VOL. XIII. Nº 6 JUNE 1928

MECCANO MAGAZINE

THE CALL OF THE MOUNTAINS

(See page 458)

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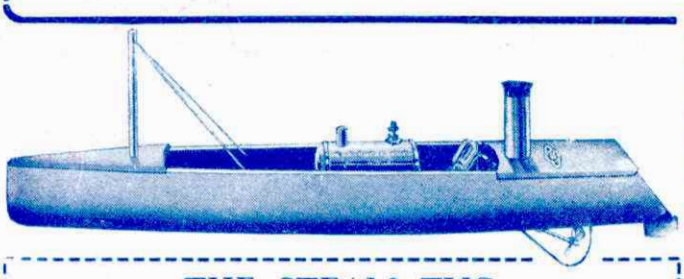
HOBBIES

YACHTS AND LAUNCHES

The Best of Their Kind found on any Yacht Pond!



Boys everywhere have hours of fun with these fine boats. They are the real thing, correctly built and balanced. The sailing boats have a fine setting of sail whilst the model launches are driven by strong steam engines of brass. All the latest improvements are found in the boats illustrated and no others carry so many advantages. The best wood, waterproof paint, strong sails and running lines, safe and speedy engines. You can be sure of them because they have the name of Hobbies behind them.

THE STEAM TUG

29½ ins. long. 4¼ in. beam.

A sturdy little boat at a reasonable price. With strong, safe brass engine, collapsible mast and funnel, and well finished hull in bright enamel ... ...

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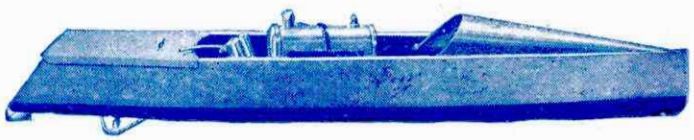

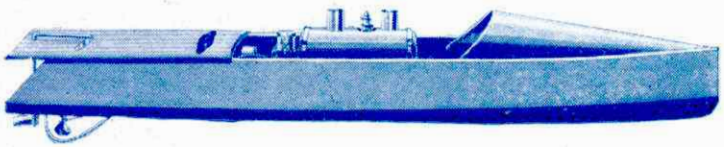

"MISS AMERICA"

26½ ins. long.
4½ ins. beam.

The most popular launch and found on every yacht pond. Cannot leak or overturn. Strong brass engine with safety boiler. Runs 25 minutes at one filling. Two colour hull and hood. Lamp, filler and instructions supplied with each boat in a strong box... ... ...

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A wonderful model with super heated engine to drive hard and steady for half an hour. The engine easily detachable for driving indoor models. Safety valve. Non-spill lamp. Beautifully finished. In wooden box with filler, measure, and full instructions ... ...

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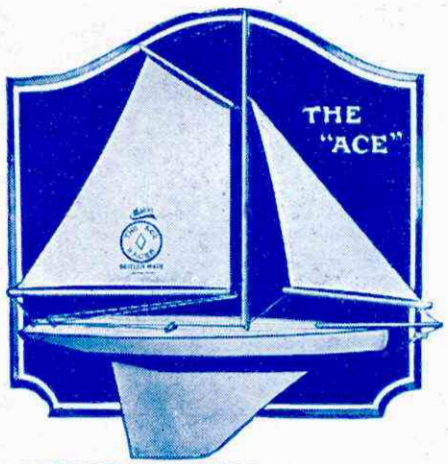
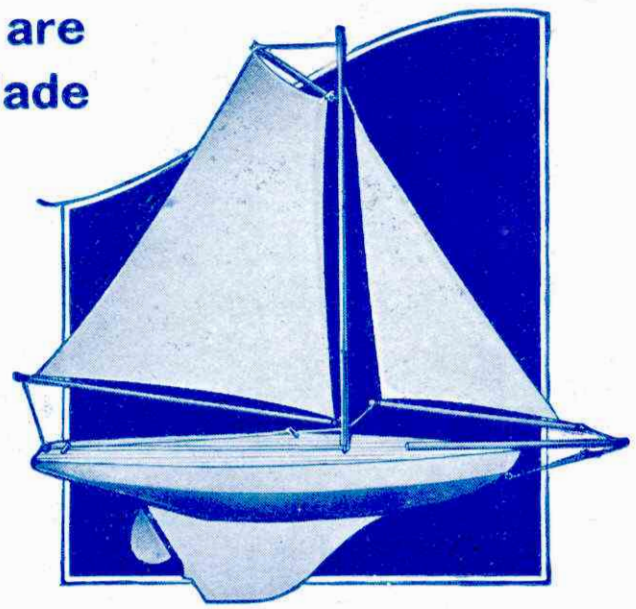


All Boats are British Made



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NEXT MONTH: WRIGHT "WHIRLWIND" AERO-ENGINE. PUBLISHING DAY: 30th JUNE.

MECCANO MAGAZINE

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Vol. XIII. No. 6
June, 1928

With the Editor

The Pleasure of Work

It is strange that some people only appreciate the value of work by thinking of the payment they are to receive for the time they have expended. They make this the most important thing in their lives and they never seem to ask themselves "What am I going to do, and why?" Their question is more often "What am I going to get, and how can I get more?" Some of the best work in the world has been accomplished with no hope of a pecuniary reward, and many an instance of this could be given in art, science and literature—which at the best of times are ill-paid callings except for a chosen few.

Money is not all that thinking people look for as a result of their work. They realise that of far greater importance than payment is the fact that work should interest and give pleasure whilst one is engaged in it. This does not mean to say that we should find pleasure in every detail of our work for, of course, there is drudgery in all work. But in the main, our work should be our pleasure, for it not only enables us to live but also it makes our life. When we make plans about our work we are really making plans for our life. When the time comes to choose your work I hope that you will endeavour to choose some occupation in which you will be able to keep before you all the beautiful things of life—one that will help to add richness to your mind and quality to your attainments.

Remember that life is really a great game—not unlike a game of tennis. You are served with a ball and you return it. If you are a good player the ball may be returned again and again, until at last either yourself or your opponent scores. If you lose a game, do not be disheartened but make up your mind to win the next, and persevere until you have won the set. In real life, responsibilities will descend upon your shoulders and you will have to make decisions and stand by them. Some decisions will be right, others will be wrong, but whether success or failure comes to you it should be your endeavour to continue the game and to profit through the experience you encounter. While at school you play hard and enjoy it because of the work you put into it, and later in life you should remember to mix enough play with your work to make it enjoyable. The choice of a career that will enable you to do this is therefore of the first importance, and I am arranging to publish a series of articles, which will commence in the near future, that I hope will help those of my readers who are still at school in the choice of a career.

The Mystery of the Thunderstorm

From the earliest days of man's sojourn upon the Earth the thunderstorm must have been one of the most familiar and impressive of all natural phenomena, and we are told that at the present time some 16,000,000 thunderstorms occur every year. It is surprising, therefore, that we do not know more about these awe-inspiring upheavals. It was not until Benjamin Franklin made his celebrated experiment 200 years ago that the power behind the thunderstorm was identified with electricity, and even to-day we do not know how this is produced, although its place of origin has been discovered.

In 1909 one of our greatest weather experts made the discovery that, when a drop of water breaks up into smaller drops, each of the latter becomes positively charged with electricity, while the surrounding air acquires a negative charge. If large numbers of drops of water in a cloud break up into smaller drops, a sufficiently large electrical charge may be accumulated to bring about a lightning charge in exactly the same manner as a spark is produced by an electrical machine. A thunder cloud is a huge billowing mass that may be as much as five miles in height, and within it the air is in continuous movement up and down, carrying drops of water along with it. Thunderstorms occur when there is an ascending current of air, and in this country they are most prevalent in the early summer because then such currents are most frequent.

The warm air from the ground rises into the colder air above and the moisture it contains is condensed into drops, which commence to fall. Some of the drops break up and become electrified, and are then carried back up into the cloud by the ascending air current. As these drops are now positively charged they repel each other, but in spite of this repulsion many of them are brought by the wind into violent contact so that they unite to form larger drops. These drops again fall, are again broken up into droplets, and again carried up into the clouds, and the process continues until sufficient electricity has accumulated to bring about a discharge, either between the cloud and the Earth or between one cloud and another. An interesting point is that, as the rain in a thunderstorm carries down with it positive electricity, the upper surface of the cloud is negatively charged.

The large drops that are such a familiar sight at the beginning of a thunderstorm are simply those that have not broken up into drops sufficiently small to be carried up again by the ascending current of air. Large drops fall more rapidly than small drops, and it has been calculated that a drop of water 1/5 in. in diameter falls at the rate of 24 ft. per second. If the upward wind is blowing at this rate, all drops of water less than 1/5 in. in diameter will therefore be blown back, or at least prevented from falling, so that only the larger drops reach the ground.

A Romance of Minute Measurement

The death has been announced of Professor Theodore W. Richards, who was Professor of Chemistry in the famous Harvard University in America for many years. His name may not be familiar to most of my readers, for it is not associated with any striking or wonderful discovery. It is not given to all scientists or engineers to make their names famous by a single great achievement, but the work of those who labour steadily for years in accumulating information is equally valuable, for it is often the knowledge acquired by them that makes spectacular achievements possible. Professor Richards did quiet work of this kind. He spent the greater part of his life in devising methods for measuring densities and atomic weights with the utmost accuracy.

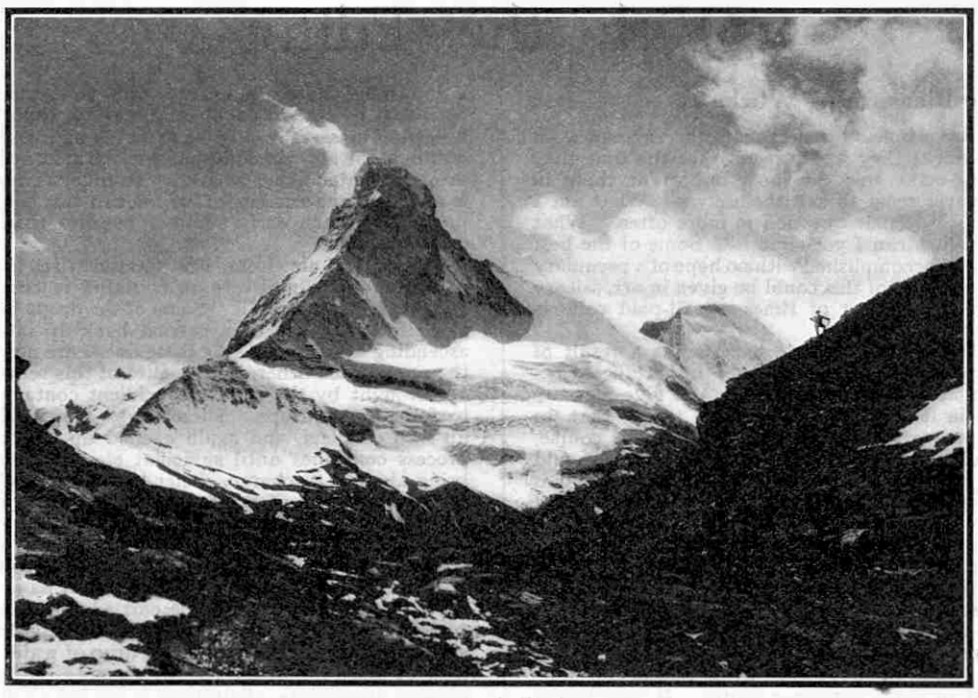
This work does not sound very exciting, but by an interesting turn in affairs it suddenly became of outstanding importance. About 14 years ago a suspicion arose that there were two different materials masquerading as lead. Both were dull grey metals, and they responded to all ordinary tests in exactly the same manner. They were, in fact, twins, with the possibility that one was slightly denser and had a higher atomic weight than the other.

Thus the final test of the suspicion rested on exact measurements of the type that Professor Richards had made himself familiar with by a lifetime of patient practice. It transpired that the difference in the densities of the two kinds of lead was only about half of one per cent, but the skilful hands of Richards separated the pure lead in each of its forms. With extraordinarily delicate balances and other instruments that he had devised, he made measurements that definitely proved the existence of twin forms of lead that could not be distinguished by any other means.

The Call of the Mountains

Triumphs and Tragedies of Alpine Climbing

THE great mountain ranges of the world have existed much as they are now for countless centuries, but the love of mountains for their own sake appears to be a comparatively modern development. The ancient writers, when they refer to mountains at all, do so usually in terms of fear, a noteworthy exception to this being the writers of certain portions of the Old Testament, who show something like appreciation for their mountain ranges. The Romans undoubtedly regarded mountains, and in particular the Alps, as nothing more than a serious obstacle to the extension of their conquests, while the Greeks seemed to have looked upon mountains merely as convenient places in which to house their gods!



The Matterhorn. The conquest of which cost the lives of four men

The crossing of a mountain range in those early days was undoubtedly a great adventure, and it is difficult to over-estimate the courage and physical strength and endurance of the men who first traversed the passes of the world's great ranges. Hannibal's historic crossing of the Alps, for instance, was a tremendous undertaking for that period. We do not know by which pass he went, but in any case the difficulties must have been enormous. We are told that Hannibal and his army advanced under fierce attack from the natives, who "slipt away at night every one to his owne harbour." The transport animals included elephants, who "were ever readie and anone to run upon their noses, and the snow being once with the gate of so many people and beasts upon it fretted and thawed, they were fain to go upon the bare yce underneeth and in the slabberie snow-broth as it relented and melted about their heeles."

It is not necessary to be a mountaineer in order to appreciate the grandeur of the great white peaks towering skyward. The views seen by the Alpine climber high up on the side of some great mountain have a beauty and fascination of their own, but it is only the observer in the valley below who can take in the beauty of a mountain as a whole. The real thrill of the mountains, however, comes only to those who climb. Once the fascination of climbing has gripped a man it never leaves him, and he returns to the attack year after year until his physical strength is no longer adequate for the task.

It is probable that no sport is equal to mountaineering in the variety of demands it makes upon its devotees. Mr. Arnold Lunn, in his interesting little book, "*The Alps*," says: "The art of mountaineering is half physical and half mental. He who can justly claim the name of mountaineer must possess the power to lead up rocks and snow, and to cut steps in ice. This is the physical side of the business. It is important; but the charm of mountaineering is largely intellectual. The mental equipment of the mountaineer involves an exhaustive knowledge of one of the most ruthless aspects of nature. . . . The mountaineer must understand the secrets of snow, rock and ice. He must be able to tell at a glance whether a snow slope is dangerous or a snow bridge likely to collapse. He must be able to move with certainty and safety on a rock face, whether it is composed of reliable or brittle and dangerous rock. All this involves knowledge which is born of experience and the power to apply experience. Every new peak is a problem for the intellect."

A striking photograph of the Aletsch Glacier giving an excellent idea of the appearance of this gigantic river of ice

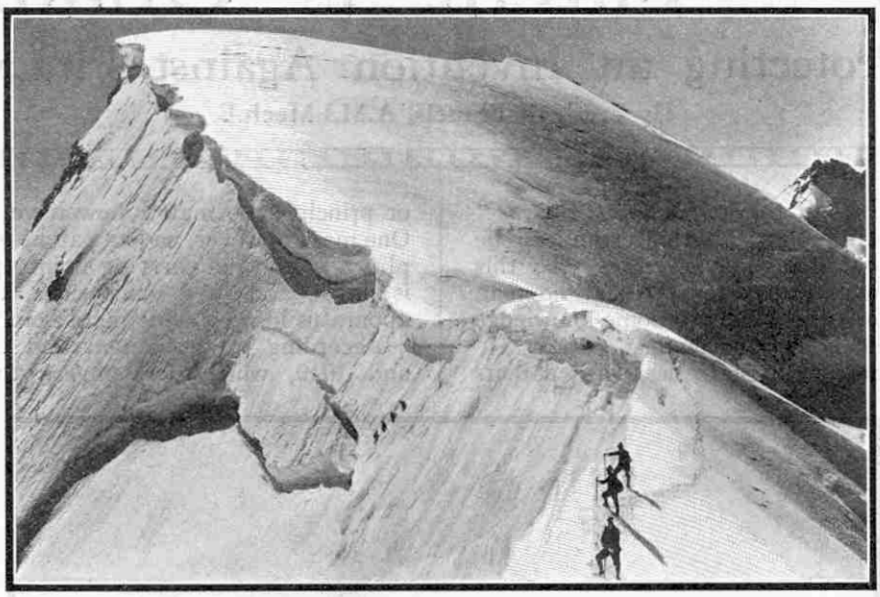
The great peaks of the Alps have been conquered one by one at the expense of incredible exertion and the loss of many valuable lives. The most tragic story of all is that of the conquest of the Matterhorn by Edward Whymper and his six companions, followed by disaster that was literally appalling in its suddenness.

Whymper had made several attempts to climb the Matterhorn but without success. In the summer of 1865 he prepared for a final effort, and his arrangements were hastened by the information that an Italian party were about to tackle the peak. On 13th June Whymper left Zermat with Lord Francis Douglas, Charles Hudson, and Mr. Hadow. With them they had as guides the famous Michel Croz, and

Peter Taugwalder and his son. All were experienced mountaineers with the exception of Hadow, a young fellow of 19 who had left Harrow only a short time previously.

Nothing of particular note occurred on the upward climb, although now and again Hadow had to be assisted over the more difficult places, and in due course they reached the summit and the Matterhorn was conquered.

After a short rest the party prepared to descend. They were roped together, but the order was rather strange, for Croz, as the most experienced and skilful member should, in the ordinary course of things, have come last, whereas actually he led. Croz was followed in order by Hadow, Hudson, Douglas, Peter Taugwalder, and Taugwalder junior. Whymper was sketching while the party was being arranged and afterwards he tied himself to young Taugwalder and brought up the rear. A little later, at the request of Douglas, Whymper tied himself to old Taugwalder. Young Peter Taugwalder now held the responsible position of last man down. Apparently Hadow began to feel the strain, and presently Croz turned round and took hold of Hadow's feet and placed them one by one into their proper footholds. He then turned to continue the descent when suddenly Hadow slipped.



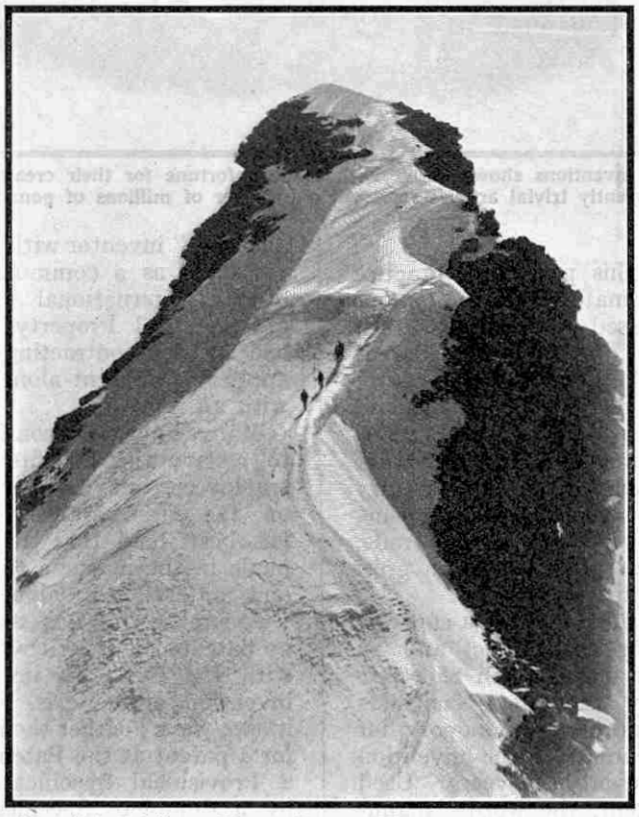
Nearing the summit. A striking photograph showing the solemn grandeur of a snow-clad peak. Note the steep ascent that is being made by the four climbers in the centre of the picture

Describing the subsequent happenings Whymper says:—"I heard one startled exclamation from Croz and then saw him and Mr. Hadow flying downward; in another moment Hudson was dragged from his steps and Lord Francis Douglas immediately after him. All this was the work of a moment. Immediately we heard Croz's exclamation, old Peter and I planted ourselves as firmly as the rocks would permit; the rope was taut between us, and the jerk came on us both as on one man. We held; but the rope broke midway between Taugwalder and Lord Francis Douglas. For a few seconds, we saw our unfortunate companions sliding downwards on their backs, and spreading out their hands endeavouring to save themselves. They passed from our sight uninjured, disappeared one by one, and then fell from precipice to precipice on to the Matterhorngletscher below, a distance of nearly 4,000 ft. in height. From the moment the rope broke, it was impossible to help them."

The suddenness of the event petrified Whymper and the two guides. For half an hour they remained on the spot absolutely motionless, and the guides cried like children and appeared to be utterly unnerved. Presently they recovered sufficient courage to continue the descent and ultimately arrived at Zermat where they aroused the village. A search party immediately set out and reached the plateau at the top of the glacier. There they found the bodies of Croz, Hadow and Hudson, but the body of Lord Francis Douglas has never been found to this day.

This tragedy caused a tremendous amount of discussion throughout the civilised world and produced a most extraordinary crop of rumours. It was asserted by many people that the rope did not break but was cut by Taugwalder, but there does not appear to be the slightest foundation for this accusation. As a matter of fact, if the rope had held, the fall of Croz and Hadow would have been checked and the tragedy would almost certainly have been averted. There is one very curious thing that Whymper tells us in his account of the disaster and this does not appear capable of any explanation. The party were provided with three ropes, and the one that was used in the descent was the weakest of the three and had only been intended for use as a reserve.

Taugwalder subsequently left for America, but afterwards returned to his native Zermat where he died about five years ago at the age of 81.



The "Sattel" on Monte Rosa, with a party of climbers descending in brilliant sunshine

Mountaineering is not for everybody, however, and there are many of us who, like Mr. Hilaire Belloc, refuse to climb for fear of "slipping down." For such folk there is ample enjoyment in walking among the mountains and such walks will often provide quite satisfactory thrills. The charms of wandering among the Swiss mountains are wonderfully described by Mr. William Le Queux in his notes on "Wengen," and particularly fine is his description of an ice avalanche.

"Few people have been close to an ice avalanche and witnessed the ice edge of a gigantic glacier of countless ages break away and fall with thunder over a precipice, the great ice boulders bounding from rock to rock down thousands of feet until they become pulverised and, like white powder, stream down out of the ravines into the valley below. The sight of a great ice avalanche is one of the most awe-inspiring scenes in the world, hundreds of thousands of tons of the remains of the ice age breaking from the edge of the dangerous glaciers to be hurled into space with irresistible force, carrying everything before it."

Spring is the best time for walking in Switzerland. To traverse the plains and valleys in May and June is to pass through an interminable orchard and flower garden in full blossom. Switzerland's wild flowers are proverbial and in Spring they run riot.

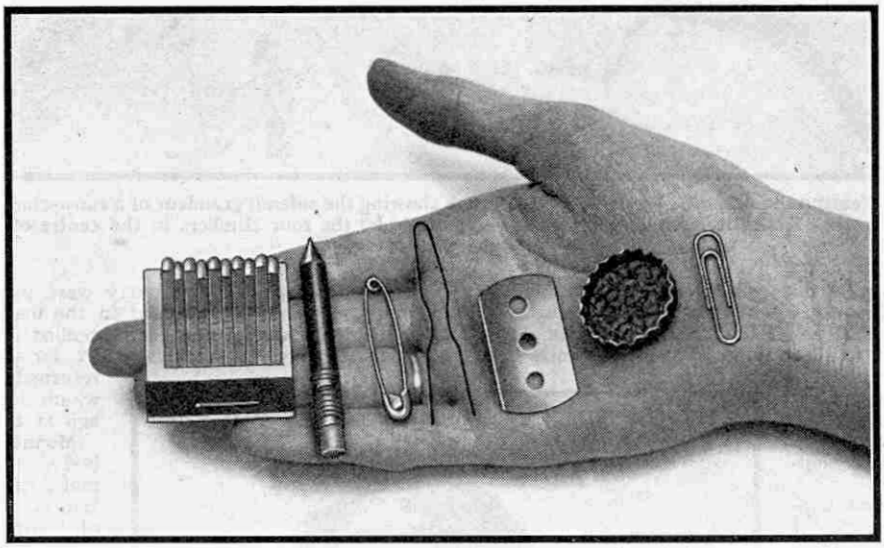
How a Patent is Obtained:

Protecting an Invention Against Piracy

By E. Lloyd Francis, A.M.I.Mech.E.

IN the March 1926 issue of the "*Meccano Magazine*" Dr. Hele-Shaw pointed out that no man can be an engineer without being an inventor. To this observation the author ventures to add that no man ought to be an inventor without having some knowledge of how to protect his inventions against piracy.

It would scarcely be consistent to deal with patents without touching briefly on the history of patent law. Although a few privileges or monopolies for certain industries are said to have been granted by Edward III, Letters Patent for Inventions originated in the reign of James I. The monopoly system was largely practised and greatly abused by the Tudor monarchs, and ultimately a great outcry was raised against the granting of monopolies, particularly when they related to the bare necessities of life.



The seven inventions shown above each made a fortune for their creators. These apparently trivial articles represent a turnover of millions of pounds

It was for the abolition of this pernicious practice of granting monopolies indiscriminately that the famous Statute of Monopolies was passed in the year 1624. The sixth section of the Statute limited Letters Patent to "the sole working and making of any manner of new manufactures within this realm to the true and first inventor and inventors of such manufactures, which others at the time of making such Letters Patent and Grant, shall not use, so that they be not contrary to the law nor mischievous to the State by raising the price of commodities at home or hurt of trade, or generally inconvenient." Out of that section grew the gigantic patent system of this country.

A patent may be defined, for simplicity, as a contract between the State (representing the public) and an inventor, whereby in return for introduction of a *new* manufacture into this country the State contracts to give to the inventor a conditional monopoly for the sole making, using and vending of the invention for a limited period, which at present is 16 years. Used to denote the subject of a patent, the word "manufacture" comprehends a product, apparatus for making the product, or the method or process used in making the product. The word also includes improvements to a known product, apparatus, or method or process.

Obviously one cannot have a patent for a bare idea or principle, no matter how novel or useful it may be. One may, however, have a patent for an idea or principle plus a method of carrying it into practice. If the idea is novel, and very meritorious, the simplicity of the apparatus in no way detracts from the value of a patent.

According to the Patent and Designs Acts of 1907 and 1919, which now govern the patent system of this country, an application for a patent may be made by any person claiming to be the "true and first" inventor of an invention, and whether alone or jointly with another person or persons, who need not be a joint inventor or inventors. Aliens, women and children may all become patentees, and an invention made abroad may be communicated to a person resident in this country, who then legally becomes the "true and first" inventor with full power to apply for a patent.

Except as a communicatee or under the provisions of the International Convention for the Protection of Industrial Property, of which this country forms one of the contracting states, a company may not apply for a patent alone, although it may do so jointly with an inventor.

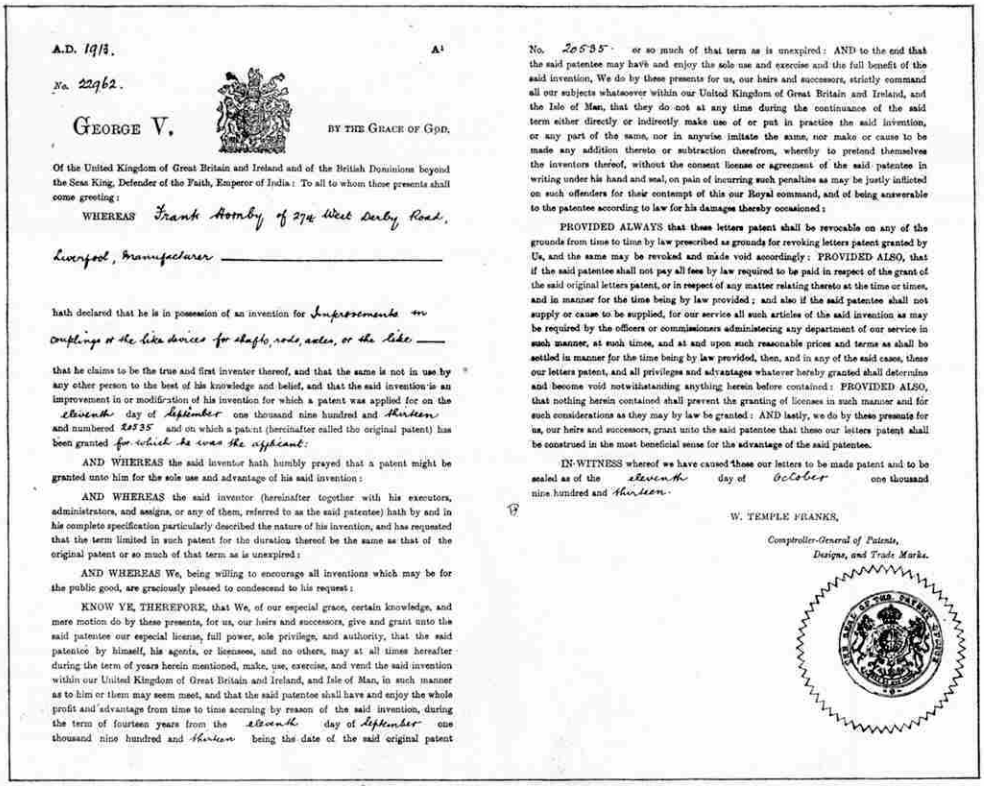
Many employers consider themselves legally entitled to receive the benefits of inventions made by their employees, but whether they are so entitled depends on the circumstances of each individual case. It has been held that an invention of a servant, even made in the master's time and with the master's tools and material, can alone be patented by the servant.

Assuming one has made an invention, how can it be patented? In order to fulfil his part of the contract with the State an inventor must disclose what his invention actually is. The disclosure may be made in two ways; either the inventor may file an application for a patent at the Patent Office and accompany it with a Provisional Specification, which must be followed by a Complete Specification within a limited period (nine months, or ten months with the payment of an extension fee), or the application may be accompanied by a Complete Specification in the first instance.

There is an essential difference between the two specifications. A Provisional Specification need only

describe the nature of the invention, while not only the nature but also the manner in which the invention is to be carried into effect must be described in the Complete Specification. Thus is the patentee prevented from keeping the "tricks of the trade" to himself.

The Provisional Specification is frequently made use of when the nature of the invention is such that further experiments or tests have to be made before it is perfected in detail. The inventor may have settled the nature of the invention in his own mind but may not have had sufficient time to make conclusive experiments, while, nevertheless, he may still wish to have his invention protected. After the filing of the Provisional Specification, the invention may be made public or tests may be carried out quite openly without fear of the subsequent patent being invalidated by reason of its having been published before the date of application.



A.D. 1913. A¹

No. 22962.

GEORGE V. BY THE GRACE OF GOD,

Of the United Kingdom of Great Britain and Ireland and of the British Dominions beyond the Seas King, Defender of the Faith, Emperor of India: To all to whom these presents shall come greeting:

WHEREAS Frank Hornby of 274 West Derby Road, Liverpool, Manufacturer

hath declared that he is in possession of an invention for Improvements in couplings or the like devices for shafts, rods, axles, or the like

that he claims to be the true and first inventor thereof, and that the same is not in use by any other person to the best of his knowledge and belief, and that the said invention is an improvement in or modification of his invention for which a patent was applied for on the eleventh day of September one thousand nine hundred and thirteen and numbered 20535 and on which a patent (hereinafter called the original patent) has been granted for which he was the applicant:

AND WHEREAS the said inventor hath humbly prayed that a patent might be granted unto him for the sole use and advantage of his said invention:

AND WHEREAS the said inventor (hereinafter together with his executors, administrators, and assigns, or any of them, referred to as the said patentee) hath by and in his complete specification particularly described the nature of his invention, and has requested that the term limited in such patent for the duration thereof be the same as that of the original patent or so much of that term as is unexpired:

AND WHEREAS We, being willing to encourage all inventions which may be for the public good, are graciously pleased to condescend to his request:

KNOW YE, THEREFORE, that We, of our especial grace, certain knowledge, and mere motion do by these presents, for us, our heirs and successors, give and grant unto the said patentee our especial license, full power, sole privilege, and authority, that the said patentee by himself, his agents, or licensees, and no others, may at all times hereafter during the term of years herein mentioned, make, use, exercise, and vend the said invention within our United Kingdom of Great Britain and Ireland, and Isle of Man, in such manner as to him or them may seem meet, and that the said patentee shall have and enjoy the whole profit and advantage from time to time accruing by reason of the said invention, during the term of fourteen years from the eleventh day of September one thousand nine hundred and thirteen being the date of the said original patent

No. 20535 or so much of that term as is unexpired: AND to the end that the said patentee may have and enjoy the sole use and exercise and the full benefit of the said invention, We do by these presents for us, our heirs and successors, strictly command all our subjects whatsoever within our United Kingdom of Great Britain and Ireland, and the Isle of Man, that they do not at any time during the continuance of the said term either directly or indirectly make use of or put in practice the said invention, or any part of the same, nor in anywise imitate the same, nor make or cause to be made any addition thereto or subtraction therefrom, whereby to pretend themselves the inventors thereof, without the consent license or agreement of the said patentee in writing under his hand and seal, on pain of incurring such penalties as may be justly inflicted on such offenders for their contempt of this our Royal command, and of being answerable to the patentee according to law for his damages thereby occasioned:

PROVIDED ALWAYS that these letters patent shall be revocable on any of the grounds from time to time by law prescribed as grounds for revoking letters patent granted by Us, and the same may be revoked and made void accordingly: PROVIDED ALSO, that if the said patentee shall not pay all fees by law required to be paid in respect of the grant of the said original letters patent, or in respect of any matter relating thereto at the time or times, and in manner for the time being by law provided; and also if the said patentee shall not supply or cause to be supplied, for our service all such articles of the said invention as may be required by the officers or commissioners administering any department of our service in such manner, at such times, and at and upon such reasonable prices and terms as shall be settled in manner for the time being by law provided, then, and in any of the said cases, these our letters patent, and all privileges and advantages whatever hereby granted shall determine and become void notwithstanding anything herein before contained: PROVIDED ALSO, that nothing herein contained shall prevent the granting of licenses in such manner and for such considerations as they may by law be granted: AND lastly, we do by these presents for us, our heirs and successors, grant unto the said patentee that these our letters patent shall be construed in the most beneficial sense for the advantage of the said patentee.

IN WITNESS whereof we have caused these our letters to be made patent and to be sealed as of the eleventh day of October one thousand nine hundred and thirteen.

W. TEMPLE FRANKS,

Comptroller-General of Patents, Designs, and Trade Marks.

The much-prized document—the sealed letters patent, as granted to an inventor—which may bring him fame and fortune—or may not!

The Complete Specification, on the other hand, is generally filed with the application when the inventor is quite satisfied that nothing of any value will be gained by continuing his tests, or when experiments need not be made which would necessarily have to be carried out in public. The Complete Specification, as already stated, must not only describe the nature of the invention, but also the manner in which it is to be carried into practice; and when the invention is such as to require illustration for its proper understanding, drawings must be filed with the specification and they then form part of the latter.

The Complete Specification has the further function of letting the public know what it is for which the inventor seeks his monopoly, and the applicant is therefore required to state in the Complete Specification what he considers to be new in his invention or, to put the matter in another way, what he is able and willing to give to the public in return for his monopoly. This disclosure is made by means of one or more claims, with which a Complete Specification must conclude.

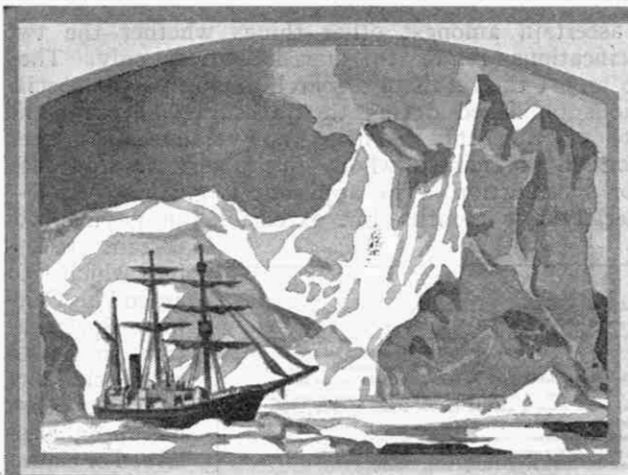
All British Patent Specifications are filed at the Patent Office, which is divided into three main departments dealing respectively with patents, trade marks and designs. The Patents' branch has a skilled technical staff who examine each application carefully to ascertain amongst other things whether the two specifications relate to one invention only. They also report the result of a search among patent specifications published during the preceding 50 years and state whether the invention now claimed has been described or claimed wholly or in part, in any such prior specification. The applicant is given a period—generally two months, but extensible on payment of certain fees—in which to amend his Complete Specification so as to avoid claiming anything that has been described or claimed previously.

Provided no hitch occurs the Complete Specification is accepted in due course by the Comptroller of Patents, but even then the applicant has not obtained his patent and is not yet in a position to proceed against infringers. The acceptance is advertised in a weekly journal published by the Patent Office and entitled "*Illustrated Official Journal (Patents)*," and during the two months following the date of this advertisement the grant of the patent may be opposed by any competent person. If necessary the Comptroller hears the evidence of the opposing parties and decides in favour of one or other.

Finally, when the period of opposition has expired, the patent may be sealed on payment of a sealing fee. Then at last the applicant has really been granted a patent and he can now proceed against all infringers.

Although valuable inventions are usually eagerly sought after by large firms, and in many cases are produced in their research laboratories, there is still room for the traditional lone worker even although he may not have a full range of costly apparatus at his command. One recent instance of this is the success of J. L. Baird, the well-known inventor of a system of television, whose early experiments were carried on with comparatively crude home-made apparatus.

It is a fact that inventors are born and not made, even in this mechanical age, and a glance around will disclose many fields where they may exercise their ingenuity. These range from finding methods of utilizing the power of the tides or inventing an internal combustion turbine, down to devising an electric toaster that will cut off the current before the toast begins to burn! Fortunes await those inventors who can supply these wants.



EXPLORING THE ARCTIC

Famous Explorers and their Attempts to Reach the Pole.

XX.—THE POLE AT LAST! PEARY'S TRIUMPH

NANSEN'S daring attempt to reach the Pole by a journey across the rough surface of the frozen ocean was followed a few years later by an Italian attempt, which only failed after an exhausting struggle in which Cagni, the leader of the expedition, advanced nearly 24 miles farther than the famous Norwegian. To get 24 miles nearer the Pole seems a very poor reward for the months of work necessary in order to achieve it, but it was quite sufficient to give the "farthest north" record to the Italian, who held it for six years.

Cagni approached the Pole from Franz Josef Land, and in the meantime another man, the most persistent of all Pole hunters, was making desperate efforts to reach it from the opposite side. This was Peary, the only man who has ever succeeded in taking a party on foot to the "top of the world," this feat being accomplished on the last of seven determined efforts.

Robert E. Peary was an American civil engineer, born in 1856. He spent some years as an assistant engineer in Nicaragua, where the construction of a canal to connect the Atlantic and the Pacific was contemplated. If this canal had been completed it would have been 170 miles in length, but only 28 miles of this would have involved any excavation, as a river and a large lake made the rest of the work comparatively easy. Work was actually begun, but was abandoned in favour of the Panama scheme that was brought to a successful conclusion by Colonel Gorgas. It is by no means impossible that increase of traffic between the two oceans may lead eventually to the construction of the Nicaraguan waterway suspended 25 years ago.

Sunny days in Greenland. Eskimos outside their "tupik," or summer tent made of skins

Peary's thoughts were turned towards the Arctic by a brief summer excursion that he made to Greenland. It is curious how strangely the far north attracts some men. Markham, who established a farthest north record for Great Britain, spent practically all his spare time in the Arctic for years before he took part in a regular exploring expedition; while men like Amundsen, Stefansson, and Wilkins, the Australian who recently flew from Alaska over the Polar Sea to Spitzbergen, seem to be far more at home there than in more genial climes.

Following on his first taste of the north, Peary settled in Greenland in 1891 with the object of making a thorough exploration of its northern shores. Undeterred by a serious accident in which his leg was broken, he landed in Whale Sound, an offshoot of Smith Sound, where he built a hut in which to spend the winter. In the following summer he and a companion made an amazing journey of 1,200 miles over the ice cap to the northern shores of Greenland and back again, a great exploring feat.

Nansen's journey across Greenland, which had created such a sensation some years previously, was made much farther south, where the land is only 250 miles in width. Peary's journey was thus far more remarkable. The strain of the constant travelling over the snowy wastes, where no landmarks were visible, must have been tremendous. Storms and fogs seemed to provide the only break in the monotony of the journey. In grey, cloudy weather—and it must be remembered that most of the journey was made high up among the clouds—no difference in appearance could be detected between the snow-covered land and the sky, with the strange result that, in Peary's own words, "my feet and snow-shoes were sharp and clear as silhouettes and I was sensible of contact with snow at every step, yet as far as my eyes gave me evidence to the contrary, I was walking upon nothing. The space between my snow-shoes was equally as light as the zenith."

Still stranger experiences awaited the travellers at the end of their outward journey. During their descent from the ice cap to the north shore they were startled to hear the hum of a bee! Soon they found themselves in a valley where grasses and alpine flowers grew, hares were running about and even herds of musk-oxen browsed. This was an astonishing discovery, for the land to which they had come was the nearest to the Pole ever reached.

At the time when he reached the valley Peary's dogs were on the point of giving out, and he was faced with the prospect of a journey back to his winter quarters on short rations, with the very unpleasant possibility of never arriving there. The amazing discovery of musk-oxen was indeed very fortunate, and Peary must have thought that the unexpected meat was the finest that he had ever tasted. He visited this Arctic oasis on later expeditions, and the discovery of musk-oxen again saved his life on more than

one occasion. The memory of the days of hardship and hunger that he then endured while searching for game always remained with him and he never raised his rifle to shoot at a herd without the feeling that his life depended upon the accuracy of his aim.

The animal that turned up so unexpectedly in the north of Greenland is undoubtedly one of the most remarkable in existence. Thousands of years ago the musk-ox ranged throughout the greater part of Europe and Northern Asia, but it is now limited to the Arctic regions in the north of America. The full-grown animal is about the size of a Highland bull, but its hairy muzzle more nearly resembles that of a sheep. Thick hide and long hair give it ample protection from cold. It lives on the lichen, moss and grass that grow in astonishing profusion in view of the low temperatures met with in those high latitudes.

Musk-oxen are social in their habits, a herd being led by an old male. They move slowly, exhausting the pasture in one place before moving to another, and are somewhat easily dealt with by hunters. When threatened by men and dogs, a herd rounds up with tails together and heads outward, while the leader stays outside the ring and charges the dogs. When he is shot another animal steps out to take his place, and so on. The hunter always aims at a spot under the shoulder, as the animal's skull is so thick that to aim at the head is a waste of ammunition.

The Arctic is by no means so devoid of animal life as the stories of the explorers of a century ago, and even later, would suggest. Game does not occur in quantities sufficient to maintain expeditions as large as that of Franklin, which numbered more than a hundred men, but small parties are quite able to live on the country, a practice followed particularly by Peary and Stefansson. On one occasion Peary had caribou steak for supper one evening, bear steak the next, and on the third the delicious flesh of the musk-ox—all freshly killed meat, and this on the northern shore of Grant Land, about 1,000 miles farther north than the scenes of the Franklin search! Stefansson was even more daring in his reliance on his ability to find and shoot caribou or musk-oxen on land, or to kill seals when travelling over the sea ice. On his long sledge journeys he refused to haul large quantities of what he contemptuously termed "groceries." Yet he was able to make journeys of enormous length—in comparison with which the famous sledge expeditions of McClintock seem mere holiday jaunts—and to return to his base as strong and as healthy as when he started.

Robert E. Peary, the first man to reach the North Pole. He had made six unsuccessful attempts and was 53 years of age when he at last attained his object

Peary's life in the Arctic brought him into intimate contact with an isolated group of Eskimos, about 250 in number, who live on the shores of Greenland north of Cape York, the principal settlement being Etah. These unspoiled children of nature, or savages as they would usually be termed, maintain a precarious living by hunting. Seals, walrus, reindeer and fish are sufficiently plentiful to provide them with meat, oil for their lamps and skins for clothing.

They live in "igloos," rude huts of stone and earth, which they abandon in summertime in favour of "tupiks," or skin tents. It is only when travelling that they make use of the world-famed snow houses. The stone igloos are permanent habitations. They are entered through tunnels, the floor level being below ground. At one end is a platform, usually formed of flat stones. This is covered with grass and upon it are strewn the sealskins and deerskins that serve as mattresses and blankets. An oil lamp is kept burning continuously and makes the interior of the hut so warm that very little clothing is worn indoors.

Peary became very friendly with the members of the scattered tribe and on occasion found it necessary to live with them. He grew to like and appreciate them, in spite of the dirt and the decidedly insanitary conditions of their dwellings. Their strength and endurance, combined with their skill in hunting and in managing dogs, made them of immense value to him, and by timely gifts of wood, hatchets, knives and guns he secured from them faithful service and at the same time made life easier for them. Whenever he steamed north on his Polar attempts he found no difficulty in persuading some of them to accompany him, or in obtaining dogs from them.

When Peary started out on his last attempt in the summer of 1907 he was accompanied by 49 Eskimos and not less than 246 dogs. Among the Eskimos were several women who proved very useful in sewing skins into winter garments. A winter camp was established at Cape Sheridan, a little north of the position where Nares established the headquarters of the British expedition in 1875, and preparations were immediately made to transport sledges and supplies to Cape Columbia, the northernmost point of Grant Land, about 90 miles away. A regular sledging route around the coast was established and kept open by the constant passage of men and dogs. At the same time parties were sent out hunting for musk-oxen and caribou, fresh meat being essential for the prevention of scurvy.

Bear-hunting occasionally provided exciting interludes. If a bear was sighted during a journey everything on the sledges was immediately dumped and away after the animal went the dogs at top speed dragging the sledges behind them. On approaching the bear the dogs were released to pursue him in earnest. By a process of biting at his heels and then retreating swiftly when he turned round to strike at them they hindered his progress sufficiently to allow the leaders to come up and shoot him. Before the introduction of guns among them the Eskimos hunted and killed bears with no more formidable weapons than spears with heads of walrus bone. In those days a good bear-dog was a priceless possession but many good dogs and over-daring Eskimos were killed in the fierce and protracted struggles that almost invariably took place.

The middle of February, 1908, was the time chosen for departure on the march northward. An earlier start would have meant travelling under the very trying conditions of perpetual darkness and very low temperatures, while to leave it until later in the season would have involved returning in the warmest part of the year, when leads of open water might prove hazardous.

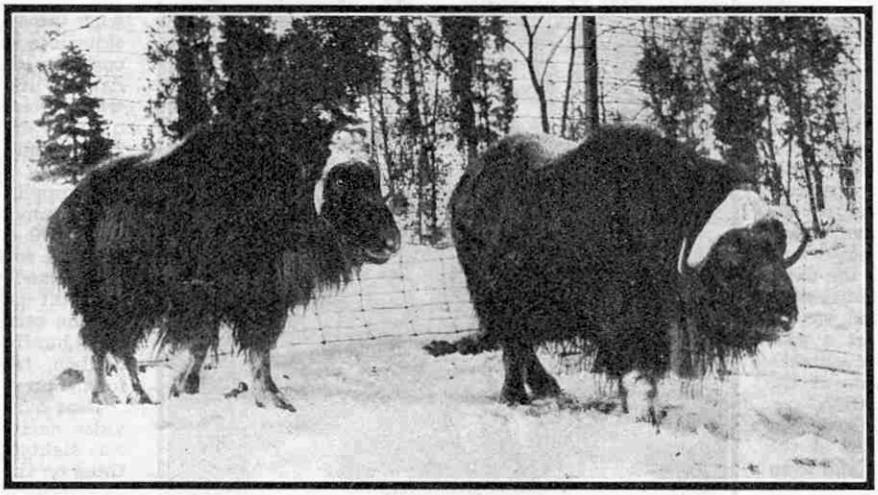
The journey over the ice was made in sections. The party was divided into divisions each consisting of one white man and several Eskimos, and it had been arranged that each division in turn, except that of the leader himself, should pioneer the way over the rough surface before returning to the base. This meant that over most of the journey of 470 miles Peary's own party would be travelling under comparatively easy circumstances, and thus would be in a good condition for a great final effort.

The ice was not unusually rough, but it was often necessary to use a pickaxe to hew a way through the pressure ridges, or to lift the 500 lb. sledges almost bodily over the hummocks. It is of interest to note that the greater part of the ice met with on the "frozen" Polar Ocean is not formed by the freezing of the sea at all, but originates in the glaciers of Greenland and Grant Land. This ice may be anything from 20 ft. to 100 ft. in thickness, and the wind and tides crush the floes together and pile the ice into great ridges that are often a quarter of a mile in width.

Over this thick roughened ice the sledges were forced northward. When leads were encountered they were crossed on detached

fragments of the floe used as ferry-boats. Delay at one lead before this method could be adopted was so prolonged that some of the Eskimos lost their nerve. They complained of ailments that Peary knew to be imaginary, and he immediately sent them back to land. In all probability they had become convinced that "*Tornarsuk*" was abroad. "*Tornarsuk*" is the greatest of the many evil spirits of whom the Eskimos live in dread, and is generally held responsible when anything goes wrong with them. Even a sudden outbreak of barking and howling among the dogs is attributed to him, and the men then run out to crack their whips or fire off their rifles to scare him away. Peary remarks that when he was suddenly aroused from sleep by such noises he did not think that mutiny had broken out or that the men were fighting—it was only an indication that "*Tornarsuk*" had ridden by on the wind.

On the march an Eskimo would suddenly stop to listen, and then inform his comrades that "*Tornarsuk*" had spoken to him. Peary was always careful not to offend the Eskimos' religious feelings and would receive the message in a respectful manner. Even in the wild excitement of a bear chase, "*Tornarsuk*" would make his presence felt. One bear hunted in Grant Land did not stop in the usual way when the dogs reached him, but kept on travelling. This was a sure proof that the terrible "*Tornarsuk*" himself was in the animal, and the prospect of slaying the great devil excited the Eskimos greatly. A prolonged argument took place afterwards on the question of where "*Tornarsuk*" had gone to when the bear was killed!



Courtesy] [Canadian Government

Musk-oxen, the strange animals with muzzles like those of sheep, which Peary found browsing in the far north of Greenland, within 500 miles of the Pole

When the timorous Eskimos had been sent back, and it became possible to cross the lead, the remainder of the party pushed on.

As each supporting division fulfilled its mission of transporting supplies and easing the way for the party intended to reach the Pole, it returned south, until at last the day came when Captain Bartlett was due to return with the last of them. Bartlett was a Newfoundland whaler captain who had been Peary's right-hand man on several expeditions. Before returning, he had the pleasure of reaching a latitude higher than that of any other explorer with the exception of Peary himself, and the knowledge that in all probability his leader would reach the goal in a few more marches.

The final spurt went according to plan and on 6th April, 1908, Peary's little squad stood on a spot that was certainly within five miles of the North Pole. At the Pole it is impossible to fix position with absolute accuracy by observations of the Sun owing to the low altitude of the Sun and the consequent smallness of the angle to be measured. In order to be absolutely sure of having reached the Pole Peary therefore traversed the ice in various directions within a circle 10 miles in diameter, the centre of which was the spot indicated by his observations. At some moment during these marches he had passed over, or very near to, the point where north, south, east and west became one. Up to that time Peary was the only man who had ever changed the direction of his march from northward to southward without making any deviation from the straight line in which he travelled!

The names of the men who reached the Pole—so far the only men who have actually stood there—are worth mention. In addition to Peary there were Mathew Henson, his coloured servant, and four Eskimos named Ookeah, Ootah, Egingwah and Seegloo respectively. Henson had spent as much time within the Arctic circle as Peary himself, and had acquired all the expertness and skill of an Eskimo in sledge-driving. It seems a little strange that a man of equatorial descent should be among those who first reached the North Pole!

Thirty hours were spent at the Pole in taking observations and photographs, after which the homeward trail was struck. Everyone was pleased and exhilarated by the knowledge that the task of years had at last been accomplished, but there was always a distinct feeling of anxiety whenever thoughts of the "Big Lead" came uppermost in the minds of the explorers.

Ordinary lanes of open water occasioned no anxiety, and even the possibility of ice movements causing a lead to open right under the igloos in which they slept did not worry Peary's men unduly, for the buoyancy of the air inside their clothing would support them long enough to enable them to scramble to safety or to allow their comrades to drag them from the icy water. It was on account of the possibility of being let in for an involuntary cold plunge that Peary never used sleeping bags, as Arctic explorers usually do. He preferred to have his arms and legs free for these emergencies.

But the Big Lead is quite a different affair. For about 46 miles north of Cape Columbia the depth of the sea is only about 100 fathoms. Then it rapidly increases to 825 fathoms, while nearer the Pole the bottom could not be found by a sounding wire nearly 1,500 fathoms in length. Thus there is what is known as a continental shelf extending into the sea from Grant Land, and at the edge of this shelf a lead of open water forms very rapidly as the season advances and the weather becomes warmer, especially under the influence of the strong winds that set the ice in motion. This is the dreaded Big Lead.

In 1906 Peary was seriously delayed on his northward journey by this lead, and on his return later in the season it presented so great an obstacle that only by taking chances with thin, newly-formed ice did he manage eventually to cross it. Then starvation was avoided by the narrowest possible margin.

This time he was more fortunate. The return journey had been made easier by the absence of the strong winds that on previous occasions had driven the ice eastward and obliterated the trail, and probably the same cause was largely responsible for the unexpected absence of the Big Lead. Land was reached 16 days after leaving the Pole, and when the last sledge arrived at the foot of the glaciers of Grant Land the Eskimos yelled and danced with delight until they were completely exhausted. One of them attributed the easy return to one of two causes—either the great devil was asleep, or was having trouble with his wife!

Peary's wonderful journey was marred by one accident only. Ross Marvin, the leader of one of the supporting parties, was drowned on his return journey, probably while attempting to cross a lead on ice that had not become strong enough to bear his weight. The full story of the tragedy will never be known, for the Eskimos of his party were not present, although they saw his body floating in the lead afterwards. The superstitions of the natives led them to destroy all his belongings and to hasten away from the place where they had last seen him.

With Peary's achievement we bring our story of Arctic Exploration to a close. After years of desperate struggles by explorers of all nations the Pole had at last been reached, only to find that its geographical position was on the drifting ice of a frozen ocean. As far as is known, there is nothing permanent within hundreds of miles and the sealed tin in which Peary, following the usual custom of explorers, left a record of his visit has been carried hundreds of miles away from its original place by this time, unless it has been crushed by ice pressure.

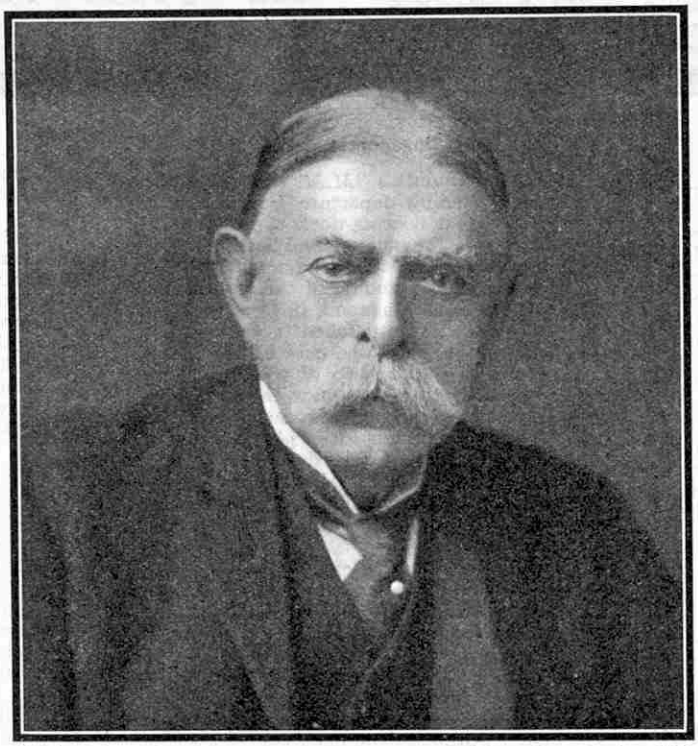
The Story of the Arctic is by no means finished and it may almost be said that it has scarcely begun, as so far the efforts of the pioneers have only served to give man a precarious footing in these icy regions. Determined and organised efforts are still necessary to give him such control over the Arctic that he may make use of its natural resources, or at least use it as a short cut in travel and communication. For these efforts, aeroplanes and dirigible balloons will be available, however, and in the next phase of the Story of the Arctic they will play a great part.

A Pioneer in Pullman Train Development

The Late Lord Dalziel of Wooler

THE death of Lord Dalziel of Wooler has removed one of the most interesting figures in the world of international travel. Lord Dalziel's greatest work in this direction was accomplished during his connection with the Pullman Car Company Ltd., of which he was chairman and managing director. He was among the first to realise the enormous possibilities of the Pullman car and he pushed forward the development of luxury travel on British railways and on the Continent to a very remarkable extent.

Among his most noteworthy introductions was that of the famous "*Southern Belle*," which was inaugurated on 1st November, 1908. At first it was confined to first-class passengers and ran only on Sundays, but later third-class carriages were added and the train ran every day. It may be remarked that the provision of third-class cars has had a great deal to do with the success of the Pullman system, for large numbers of regular travellers who are not prepared to pay first-class fare are quite willing to pay the small supplementary charge that brings them the comfort of the Pullman accommodation.



Photo] [*Lang Sims, London, S.W.*

The late Lord Dalziel of Wooler

Subsequently Lord Dalziel was instrumental in introducing Pullman cars on the South Eastern and Chatham, the Caledonian, and the London and Brighton railways. Progress was naturally interrupted during the war, but subsequently development was continued and among other famous trains there were inaugurated "*The Harrogate Pullman Limited*" and the "*Thanet Limited.*"

Readers of the "*M.M.*" will no doubt be interested to know that only a day or two before his death Lord Dalziel spent some time in examining the latest Hornby Railway Pullman Car model and expressed the greatest interest in its design and construction.

In 1919 Lord Dalziel became chairman of directors and president of the managing committee of the International Sleeping Car Company, being the first Englishman to fill that position. His tireless energy resulted in the inauguration of Pullman trains in many parts of the Continent, including the famous "*Blue Train*" between Calais and the Riviera, and later "*The Golden Arrow*" express between Calais and Paris. Still more recently he became vice-chairman of Thomas Cook & Sons Ltd., and associated companies.

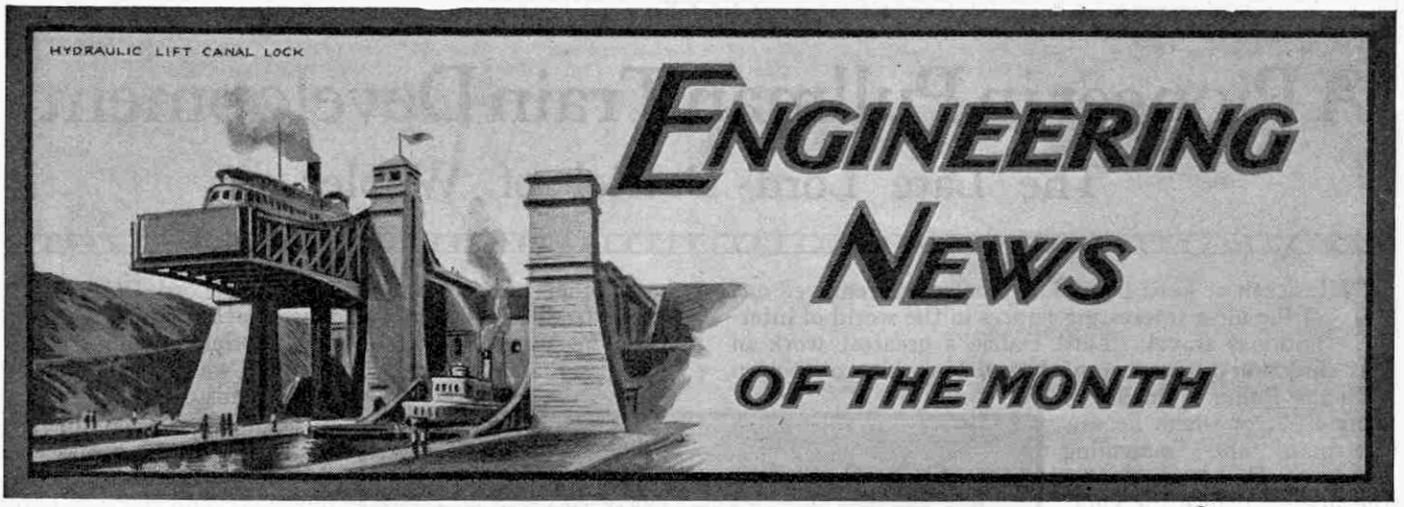
Another important step taken by Lord Dalziel was the introduction of motor cabs into London. At that time he was connected with the General Motor Cab Company and his taxi-cab scheme was regarded with great misgiving by his associates. His confidence in the ultimate success of the taxi-cab was unshakable, however, and he went to the extent of personally guaranteeing the initial capital of £250,000 that was required before the scheme could be launched effectively.

In his earlier days Lord Dalziel spent some time in the United States and there he commenced a series of great newspaper enterprises. On his return to England he established a news service between London and the principal Continental cities, and shortly afterwards founded the "*Dalziel News Agency.*" At a later period he was proprietor of the "*Evening Standard*" and the "*Pall Mall Gazette,*" but he ultimately disposed of these interests.

Lord Dalziel combined in a very exceptional degree the qualities of imagination and initiative. Once an idea had occurred to him and he had satisfied himself as to its soundness, he immediately proceeded to develop it, utilising for the purpose every possible means at his disposal, and in most cases he was entirely successful. He possessed to quite an unusual extent the quality of far-sightedness. Obstacles and difficulties in the immediate foreground did not deter him in the least, for he was able to look beyond them and to visualise ultimate success. A striking example of this ability was shown in his inauguration of a London taxi-cab service, already referred to.

Although Lord Dalziel did not take a very prominent part in public life he was a keen politician, and he represented the Brixton Division of Lambeth in the House of Commons in the Conservative interest for many years. During his Parliamentary career he took part in a number of important debates and established a reputation as an excellent speaker and a man of shrewd judgment.

Lord Dalziel was created a baronet in 1919 and a baron in 1927. He was also the recipient of several honours from Continental countries, including Italy and France.



Recalled by Wireless

As an instance of the margin allowed to British aircraft in the maintenance of their time schedules between London and Paris, a remarkable incident that occurred recently deserves recording. An air liner bound for Paris was recalled to Croydon by wireless to pick up a passenger who had arrived late. This incident is stated to be the first of its kind in British commercial aviation, and the "*Wireless World*," in commenting upon it, states that the incident opens up new possibilities in the service that wireless can render to mankind. In the present stage of hurry and scurry the latecomer finds himself better cared for than his forefathers. Even in the most leisurely period of the Victorian era to miss a train was to lose it and no amount of pious imprecation could bring it back. If the Croydon case is to be accepted as a precedent we may soon enjoy the spectacle of the "*Flying Scotsman*" backing irritably into King's Cross after being recalled by an S.O.S. at Potters Bar!

* * * *

South African Railway Omnibuses

The South African Railways Administration have brought into service a new type of railway omnibus for use in country districts, and a service operating between Kalaver and Calvinia, a distance of 92 miles, has already been opened up.

A particularly interesting feature of these buses is that they will provide separate accommodation for first-class and third-class passengers. The major portion of the accommodation naturally is given up to the third-class, in which upholstered bench seats arranged around the sides of the bus will accommodate 30 people. The central space in this compartment will be available for luggage, either of the personal or commercial type. The first-class accommodation is in the front of the bus and provides seating room for 10 passengers.

The roads in some of the districts to be served are what in England would be looked upon as mere cart tracks, and in consequence the buses are called upon to face heavy duty. Each is fitted with six wheels, which have patented hubs fitted to separate axle systems linked to a double set of springs. Thus on encountering a particularly severe obstruction the wheels will bend sideways or lift upwards, and pass over without anything other than a normal jolt.

The Singapore Floating Dock

In last month's "*M.M.*" we referred to the impending departure from the Tyne of the great floating dock to be stationed at the new Singapore naval base. Actually the dock is due to start on its 8,600-mile journey in the middle of this month, and will arrive at Singapore in October. The dock is being despatched in two portions and will be under the care of four Dutch ocean-going tugs, two of which will pull while the other two guide from the rear. The passage through the Suez Canal will be a thrilling affair for in places there will be a clearance of only three feet between the dock and the canal sides! The canal will be closed to other traffic throughout its length while the dock is being navigated through.

The new dock is capable of accommodating vessels larger than the "*Mauretania*," and is 855 ft. in length, 172 ft. in width and 75 ft. in depth. It can be submerged to lift vessels drawing not more than 70 ft. of water, and it has a lifting capacity of 50,000 tons, while its pumping plant can deal with 30 tons of water an hour. Although the dock contains 20,000 tons of steel and 3½ million rivets, it has taken only 10 months to build.

* * * *

A New Gold Coast Harbour

The development of the Gold Coast during recent years has been very rapid and particularly in regard to engineering works. A striking reminder of this progress was afforded recently by the opening of the new deep water harbour at Takoradi by Mr. J. H. Thomas, the well-known official of the National Union of Railways, who was Colonial Secretary in the Labour Government in 1924. Previously it was necessary for ocean-going vessels to lie some two miles out from shore to load and unload their cargoes which were carried to and from the ship in surf boats. The new harbour enables large ships drawing up to 30 ft. of water to come alongside the quays, thus enormously facilitating the handling of cargo. This harbour is the only one of its kind in 1,300 miles of coast line.

As another instance of the growth of Gold Coast transport facilities it may be mentioned that since the harbour was first planned over 240 miles of railway and 4,000 miles of motor routes have been added to the Colony's trade routes.

Canada's Mineral Output

A prominent mining engineer, addressing a meeting in Montreal recently, said that Canada had just made a "nice start as a mineral producing country!"

According to Government figures, the production in 1927 was a record. Gold production amounted to 1,825,421 fine ounces valued at 7½ million pounds. Silver production was 22,210,936 fine ounces, nickel 66,435,799 lb., copper 150,223,717 lb., and lead 308,742,526 lb. The total value of the year's mineral production was but little short of £50,000,000.

* * * *

A Running Motor Sleigh

Extremely good results are said to have attended the trials of a new Russian motor sleigh. The machine has an extremely light body and is driven by an air-cooled engine developing 20 h.p. In front are fitted two runners and at the rear two caterpillar drives of specially light construction so as to exert only a small pressure on the snow. On friable snow a speed of 20½ m.p.h. was reached, and it is stated that the sleigh is capable of good performances under the most difficult conditions over forest paths, up steep hills and in loose snow.

In the types at present being built accommodation is afforded for three persons and a luggage boot is placed in the rear. Fully loaded the whole sleigh weighs only 14 cwt.

* * * *

The World's Motor Speed Record

Captain Malcolm Campbell's world's motor speed record of 206.9 m.p.h., set up on the Daytona Beach course on 19th February last, as described in the May "*M.M.*," has already been broken. On 22nd April, Mr. Ray Keech set up a record of 207.5 m.p.h. on a special 36-cylinder triplex racing car, fitted with three 12-cylinder aeroplane engines, one in front and two in the rear of the car, designed to develop 1,500 h.p.

This new record also was made at Daytona, and the speed recorded was the average of four runs, two in each direction along the beach. On another run it is claimed that a speed of 220 m.p.h. was attained, but this speed was not recorded as the electric timing device failed to act.

Both Captain Malcolm Campbell and Major Segrave, the latter of whom held the record smashed by Captain Campbell, have announced their intention of attempting to regain the record for Britain.

Protecting Oil Tanks from Lightning

As a consequence of the disastrous fires that took place two years ago in California through large oil storage reservoirs being struck by lightning, investigations have been carried out to discover the best means of affording protection from electric storms in future, and after tests with model reservoirs the Shell, Associated and Union Oil Companies have adopted certain recommendations.

Wherever possible in future, all-metal tanks with walls sufficiently thick to provide ample conduction of currents from direct strokes, and in good contact at all points to prevent sparking, are to be employed. Where the use of metal is not practicable, conducting poles, approximately 140 ft. in height, equipped with a metal wire cage to which all neighbouring metal is connected, are to be erected. The cage will be placed 14 ft. above the surface of the reservoir and connected directly with an earth wire buried in the trench around the reservoir. The space in the reservoir between the top of the tank and the level of the oil is to be filled by an inert gas instead of air.

Another system of protection is based on the principle of equalising the charge between the cloud and earth as rapidly as it is formed. Barbed wire stretched as nearly as possible parallel with the earth's surface is carried on steel towers ranging from 80 to 95 ft. in height and spaced from 300 to 400 ft. apart. Direct earth connection to water-bearing strata is made from each tower.

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Motor Cycles Licensed

Recently published tables compiled from returns by the Licensing and Registration Authorities of England, Wales and Scotland, show that at the end of September last 681,410 motor cycles were licensed for use in the British Isles. At the end of September 1926 the figure was 636,971.

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A Motor Bus Tour of Britain

To demonstrate the reliability of the modern omnibus, an A.D.C. motor bus was recently despatched on a tour of Great Britain. It carried a load equivalent to 37 passengers and covered 1,800 miles in six days. The route taken was from London to Land's End, from there to Inverness and thence to Aberdeen, Newcastle and down the east coast to London. On the outward run the bus ascended Shap Fell, a 16-mile continuous climb, at an average speed of 26 m.p.h.

* * * *

Floating Dock for New Zealand

The Harbour Board of Wellington, N.Z. are proposing to add a floating dock to their existing equipment. Plans have been prepared for a new structure of the self-docking type with a lifting power of 15,000 tons, an overall length of 560 ft. and an overall width of 115 ft. The dock will be able to accommodate vessels drawing not more than 24 ft. and provision is to be made for future lengthening to 620 ft.

Interesting Reclamation Work in Spain

An interesting reclamation undertaking is being pushed forward in the delta of the Guidalquivir in Seville, Spain, with the object of draining marshland and bringing it into cultivation. The work is being carried out by a Spanish company with British backing. Already some 300 miles of narrow gauge railway and 40 miles of road have been constructed and two zones of 3,000 acres each have already been brought under the plough.

It is anticipated that some 7,000 acres of the best irrigated land will be available for cotton growing. A notable feature of the work is that the company will not cease its activities with the mere reclamation of the land. It proposes to allocate farms to suitable tenants and to aid these tenants as may be necessary during the early years of their operations. It is expected, too, that eventually half a million will find a means of livelihood on this land from which the sea is being ejected.

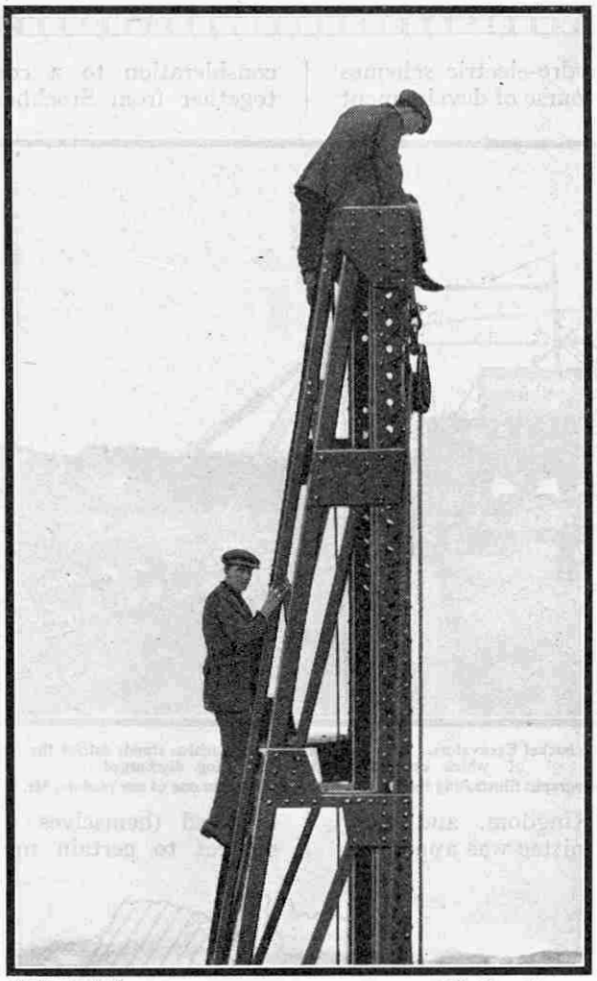

Photo courtesy] [*Hastings Observer*

Engineers engaged on large constructional work need clear heads and steady nerves. A slip would be fatal for the men shown in our photograph erecting an 80-ton pile-driver at Hastings

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The Australian Commonwealth Line

After several years' operation at a heavy loss, the Australian Government have sold their Commonwealth line of steamships to Lord Kylsant, the Chairman of the White Star Line. The sum involved, it is stated, is £1,900,000.

Trolley Buses at Hastings

A new type of electric trolley bus has recently been put into service at Hastings. Each of the vehicles is of the six-wheel two-decker type, affording accommodation for 57 passengers, and is driven by a 60 h.p. motor. Owing to the hilly district over which the buses have to operate, each vehicle has been fitted with a triple braking system, electric, hand and pneumatic.

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The World's Largest Water Tunnel

A splendid instance of engineering accuracy was displayed recently when the two sections of the tunnel that is being bored between Loch Laggan and Loch Treig, in connection with the Lochaber hydro-electric scheme for the British Aluminium Company, were linked up. The boring of this tunnel has been going on from two ends for over 18 months and when the workmen "holed through," 12 miles away from their bases, it was found that they were within 1 in. of true centre. The Lochaber hydro-electric scheme was described in detail in the "*M.M.*" of April and July, 1927.

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Broadcasting Finance

The growth of broadcasting in Britain is excellently illustrated by reference to the payments made to the British Broadcasting Corporation by the Post Office. For the current year, ending March, 1929, it is anticipated that the payment will amount to £880,000, out of which the B.B.C. have to maintain their apparatus, stations and staff, and to pay for programmes. At the end of February last there were 2,451,051 licenses in existence, and the number is being increased at the rate of 1,000 per day.

From the revenue that the Post Office receive from wireless licenses they first deduct 12½ per cent. for the cost of collection. Of the balance, 90 per cent. of the income from the first million licenses, 80 per cent. from the second million and 70 per cent. from each succeeding million is turned over to the broadcasting authorities.

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Motor-Driven Pleasure Yachts

The modern tendency to instal oil engines in ocean-going ships is shown in several new private yachts that are being built in German yards for American owners. Most of these vessels are to be fitted with engines of the Diesel type. As an example we may mention the "*Savarona*" which will be driven by twin screw Diesel machinery developing 3,000 b.h.p. This vessel, which is being built for a Philadelphian banker, is 294 ft. in length with a beam of 38 ft. 3 in. and will be capable of developing a speed of 16 knots.

* * * *

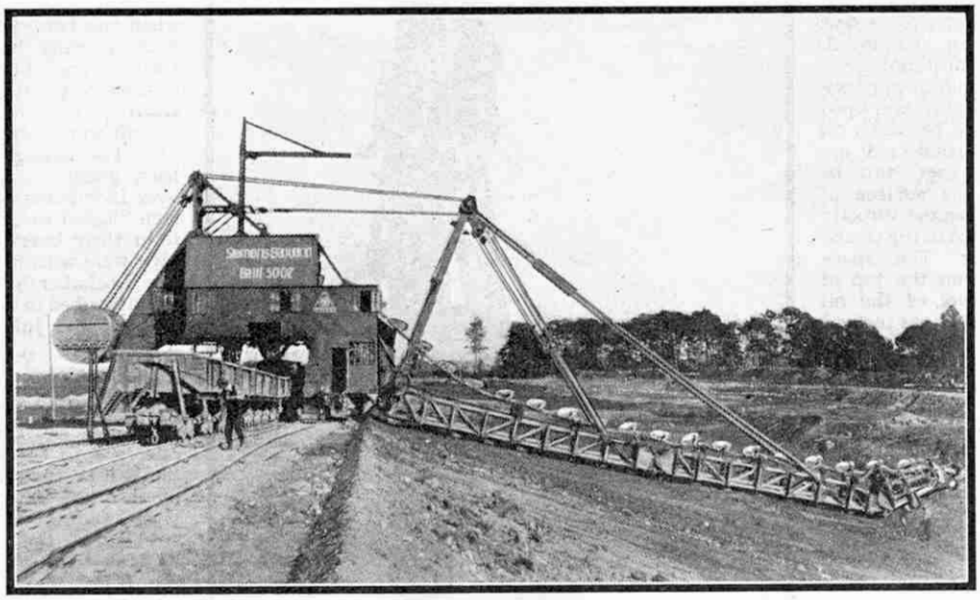
The Canada-Australia Beam Service

It is announced by the Canadian Marconi Company that the new beam wireless service between Canada and Australia will be opened for commercial working in the near future. A long series of exhaustive tests to ensure perfect working is now approaching completion.

Harnessing the River Shannon

Hydro-Electric Scheme to Supply Southern Ireland

ONE of the most interesting hydro-electric schemes of the present day is now in course of development in the Irish Free State. This scheme involves the harnessing of the River Shannon, and has for its ultimate object the generation of electric current on a scale sufficient to meet the lighting and power requirements of the whole of Southern Ireland.



One of the electric multiple bucket Excavators. Note how the massive machine stands astride the soil train, into one truck of which excavated material is being discharged

For this and the other photographs illustrating the article, we are indebted to one of our readers, Mr. E. C. Pearce of Limerick

As long ago as 1918 the Board of Trade appointed a committee to investigate and report upon the water power resources of the United Kingdom, and their industrial possibilities. A sub-committee was appointed to deal with this matter in respect to Ireland, and its report was submitted in December 1920. No practical developments followed however, probably owing to the political unrest prevailing. In 1924 the subject was revived by a German firm, Messrs. Siemens-Schuckert, who proposed the electrification of the entire Irish Free State from a single hydro-electric power station, to be erected on the River Shannon near Limerick. They offered to carry out the necessary investigations and to submit a definite scheme for the consideration of experts to be chosen by the Free State Government. This proposal was favourably received and the Government invited the firm to carry out a comprehensive survey and to furnish plans, estimates and all necessary information. The report was received by the Free State Government in September 1924, and was passed for consideration to a committee of four experts called together from Stockholm, Zurich and Christiania.

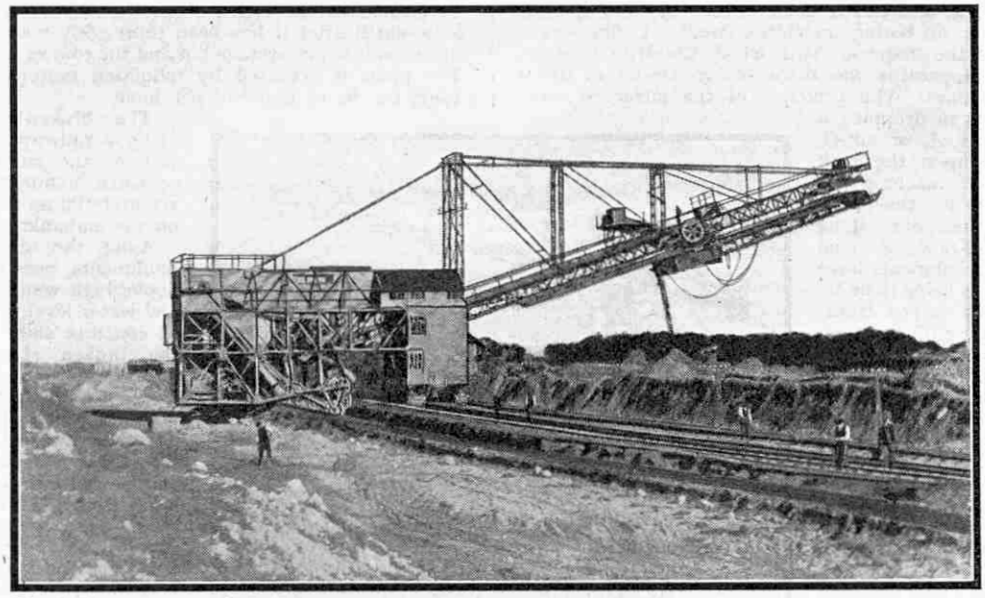
During the following two months the committee of experts carried out a detailed survey of the River Shannon, and of many of the towns and villages which the German scheme proposed to supply with electric power. When these surveys had been completed, the committee gave long and careful consideration to the various engineering problems involved, and ultimately reported themselves to be in favour of the project, subject to certain modifications. On receipt of this report the Irish Government introduced a bill empowering them to proceed with the scheme. Considerable opposition was encountered, but ultimately a bill was passed and a contract with Siemens-Schuckert was signed in August 1925.

Map showing the main transmission lines of the Shannon Power Distribution Scheme

Between Killaloe, a small town at the southern end of Lough Derg and Limerick, the River Shannon in its progress towards the sea, falls about 100 ft. The Shannon Power Scheme is utilising this fall by constructing a huge dam across the river at a point between Killaloe and O'Brien's Bridge. This will divert the water through an intake weir into an artificial channel or "head-race" canal, being excavated across the country to Ardnacrusha, a village three miles north of Limerick.

At Ardnacrusha the canal terminates at a sluice house adjoining a hydro-electric power station, both of the latter now

being in course of construction. In passing through the machinery of the sluice house the water will be led downward a depth approximating to the natural fall that is effected by the Shannon during its course from the weir to the vicinity of the sluice house. When released from the power station the water drawn from the head-race canal will pass into a second and lower channel known as the "tail-race" canal. This canal will return the water to the river Shannon at Parteen Lax, below St. Thomas' Island.

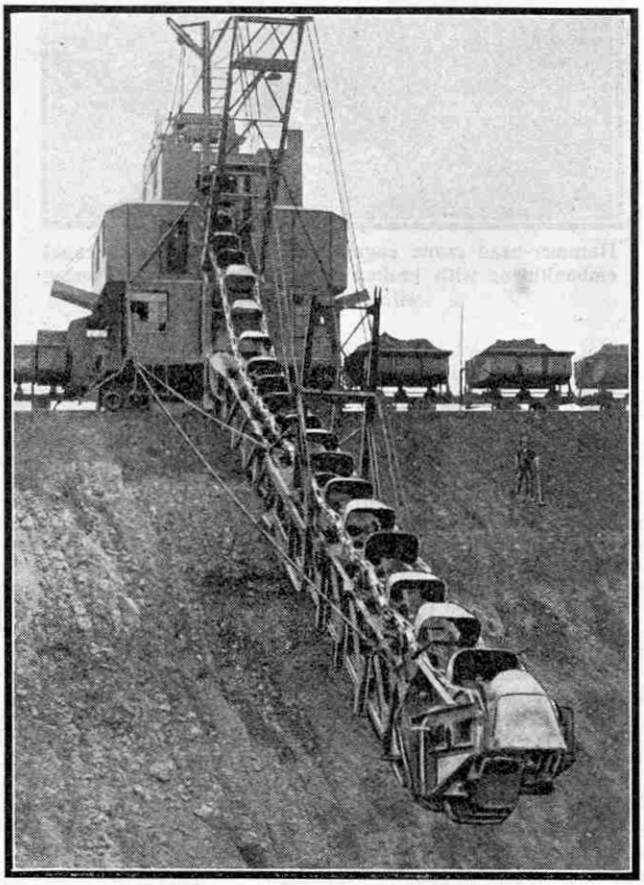


Electric Transporter at work building up one of the canal embankments. To the left of the running track is shown the trench out of which loose earth to feed the conveyors is being excavated

When the contract for the Shannon undertaking had been signed, an electric derrick crane and two movable oil engine cranes were immediately erected at Limerick Harbour to provide adequate facilities for receiving the plant and transporting it to the various building sites. The huge collection of material that in due course arrived from Germany included no less than 76 locomotives. Daimler tractors were employed to haul the specially constructed trailers upon which these engines were conveyed from the harbour to the railway tracks laid down at the sites. The whole of the machinery in use for the civil engineering work was transported from Germany by the contractors.

The peaceful country village of Ardnacrusha quickly became a centre of great activity. Two camps, one to accommodate 750 Irish workmen and one for German workmen, were erected in the vicinity, and included concrete huts large enough to house 90 men, and smaller premises of wood. Electric light was provided throughout and large stoves were installed for heating during the winter months. Extensive engineering repair shops, including welding and tool-making departments, and also a smithy, were built, and a large store room was erected to hold a comprehensive stock of parts for every kind of German machine utilised.

A temporary electric power station was constructed and nine Diesel engines, giving a total output of 4,180 h.p. were installed. Each engine is directly coupled to a three-phase alternator, operating at 400 volts. From the station a 17,000-volt line was carried across country to the place selected for damming the river — a point near Clonlara, about two miles above the village of O'Brien's Bridge. Camps for the workmen to be employed in the locality were built at these two places. The camps were not as large as those at Ardnacrusha, but were similarly equipped and had good recreation facilities. At O'Brien's Bridge the contractors took over an old disused mill and equipped it with central heating to render it habitable.



A Steam-driven Excavator at work upon the head-race canal

Work on the Shannon scheme proper was commenced in September 1925, when a start was made with the excavation of the head-race canal. Leaving a short natural barrier of earth at the point where the waters of the Shannon are to be deflected, the canal is being cut from the western bank of the river in a general south-westerly direction to Ardnacrusha, following as closely as possible the contour of the hills situated to the west of O'Brien's Bridge. Excavation is proceeding simultaneously from the other end also, and the head-race is now more than half completed.

Six multiple bucket excavators of German manufacture, each capable of removing 13,243 cu. ft. of soil per hour, are engaged in scooping out this channel. They are operated by three-phase motors designed for a pressure of 3,000 volts, and supplied with current by means of a cable running parallel

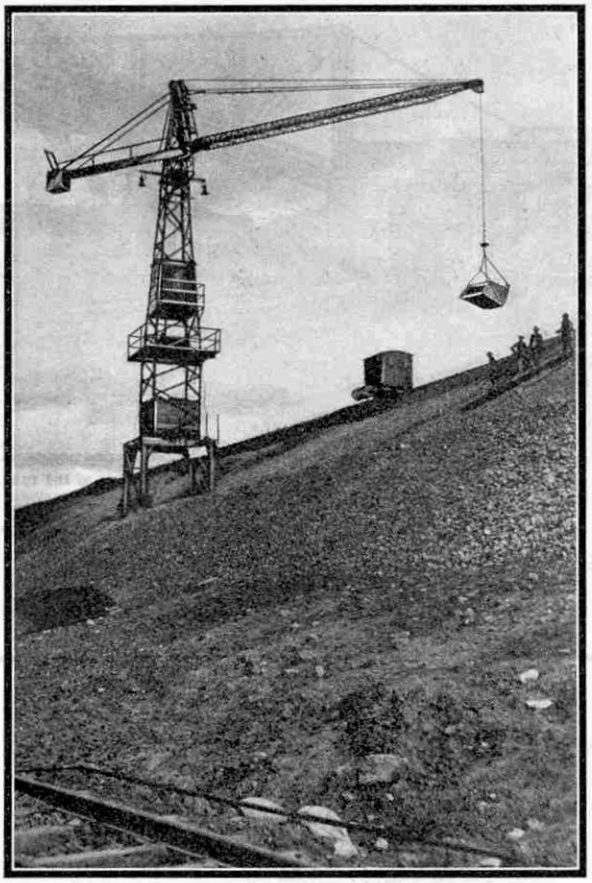
with the excavator track. As excavation progresses the rail track used by the mechanical excavators and "soil" trains is moved forward, a ponderous track relaying machine being employed for the purpose. The gearing by which the existing track (including sleepers) is lifted from one place and lowered elsewhere is operated by hand.

The excavation of the head-race canal involves the removal of 392,386 yds. of rock, and this is being effected by boring and blasting. Compressed air-boring machines were at first employed, but owing to the frequency with which the drills became locked this type of apparatus was discarded in favour of drop hammer boring machines. The principle of the latter is very primitive and consists in dropping a raised heavy boring tool, or chisel, at regular intervals upon the rock below. This class of machine has proved very effective for the work.

Excavation is only necessary along a portion of the head-race, as along most of the route embankments have to be built up. This is being done by the aid of electrically driven transporters, one of which we illustrate on page 469. These interesting giants carry at the rear a double chain of buckets which can be raised or lowered according to the depth of the cut required. Soil trains empty loose earth into a trench behind the transporters, from where material is collected by the buckets and elevated and shot into a storage hopper somewhat resembling a huge funnel. The hopper then delivers it on to the lower end of a long conveyor belt extending half-way along a fixed jib or boom inclined upward at an angle of 20°.

A short arm also equipped with a conveyor belt is slung beneath the main boom and by ingenious mechanism can be slid up and down the latter, while the belt of the undercarriage can also be driven in either direction. By means of this the material elevated by bucket to the upper conveyor belt can be deposited close in at the base of the transporter, or at any point out to the end of the main boom—a range of movement amounting to about 130 ft.

The height from which the material is dropped helps to pound it together and thus render the bank more solid. When an embankment has been built up in this manner to the required height, it is allowed time to settle, after which the slopes and crest are dressed manually, and a covering of soil is then laid on by the transporters to a depth of about 8 in. The tops of the embankments are approximately 10 ft. in width.



Hammer-head crane engaged in facing head-race canal embankment with broken stone, prior to final covering with concrete slabs

Adequate steps are being taken to ensure that the canal is made watertight, and where the soil of the inner slopes and the canal bed is deficient in this respect, a layer of clay 2 ft. in thickness is being added on the surface.

The bed and the inner slopes of the head-race canal are protected from the eroding effect of water by means of a layer of broken stone, roughly 16 in. in thickness. The stone used for this purpose is obtained in the vicinity of Clonlara and also from limestone strata intercepted by the canal excavations. A small stone-crushing plant at Clonlara deals with the stone obtained in that locality, but the bulk of the broken stone used for dressing the faces of the head-race canal, and in preparing the huge quantities of concrete and road material used in connection with the scheme, is dealt with by the large stone-crushing and washing plants erected near Ardnacrusha.

The excavated material is loaded into trucks, which are then elevated by means of a winch to a platform above the crushing plant. One side of the truck is then opened by a workman and the material is precipitated on to a vibrating receptacle, or feeder, from where it is jerked into the first of a series of automatic crushers, being conveyed on wide endless belts from one crusher to the next. The aperture of the first crusher is roughly 36 in. by 48 in., that of the next two 12 in. by 26 in. and of the last 16 in. by 30 in. In passing through the series the material is reduced to coarse and fine aggregate and ultimately sand.

When crushed the material is conveyed upon a couple of belts up to two washing drums in which are perforated screws that carry the stones through a stream of water and free them from all loose earth. The larger sized material then falls down a chute into rail trucks and is ready for conveyance to the head-race canal. Perforated drums called "grading sieves" receive and sift the loose earth after it has been thoroughly washed, and deposit the fine sand into one storage bin and the coarser material into another. The plant is actuated by induction motors and can deal with 1,765 cu. ft. of material per hour.

The broken stone is conveyed along a railway track laid along the bed of the canal, and electrically operated hammer-head cranes carry the material up to where it is required on the embankment.

Along the inner face of the embankments, over the area from 3¾ ft. above high water level to 1 ft. below low water level, a covering composed of concrete slabs is being laid over the broken stone to protect the banks from the erosive action of waves set up by the wind or passing vessels, for the head-race will be a navigable channel. When completed this canal will be 103 ft. in width at the bottom, and roughly 295 ft. in width at water level. The gradient of the outer or landside slopes of the canal varies between 1 : 3 and 1 : 5, while the inner slopes vary between 1 : 2 and 1 : 3, these degrees of slope having been proved to give excellent stability. By the time the canal is completed, roughly 159,000,000 cu. ft. of earth and almost 10,600,000 cu. ft. of rock will have been removed.

The 7½-mile route of the canal crosses several roads and streams, and also intercepts the river Blackwater, a tributary of the Shannon. Usually the Blackwater is a modest, peaceful stream, but during the rainy season it becomes a raging torrent, and on this account special attention has been paid to it by the Shannon engineers. In April 1926 the construction was commenced of a huge concrete culvert to convey the Blackwater beneath the canal, and by July of the same year the work was sufficiently advanced for the stream to be diverted to its new course. A caterpillar-mounted steam shovel was used for effecting the necessary excavation and 310,000 cu. ft. of earth were removed by this means. About 130,000 cu. ft. of concrete and reinforced concrete were used in building up the culvert.

Where the canal intercepts roads the latter are being carried over the canal by means of artistic reinforced concrete arch bridges, while small streams crossing the canal route are conducted underneath by means of culverts of simple construction.

The weir to deflect the waters of the Shannon into the head-race will raise the water level of that section of the river above O'Brien's Bridge by 24.8 ft. and of Lough Derg by more than 3 ft. This huge natural reservoir will play a very important part in the working of the Shannon scheme, for it is calculated that during the winter enough water can be stored up here to maintain a satisfactory flow into the head-race canal throughout a dry summer.

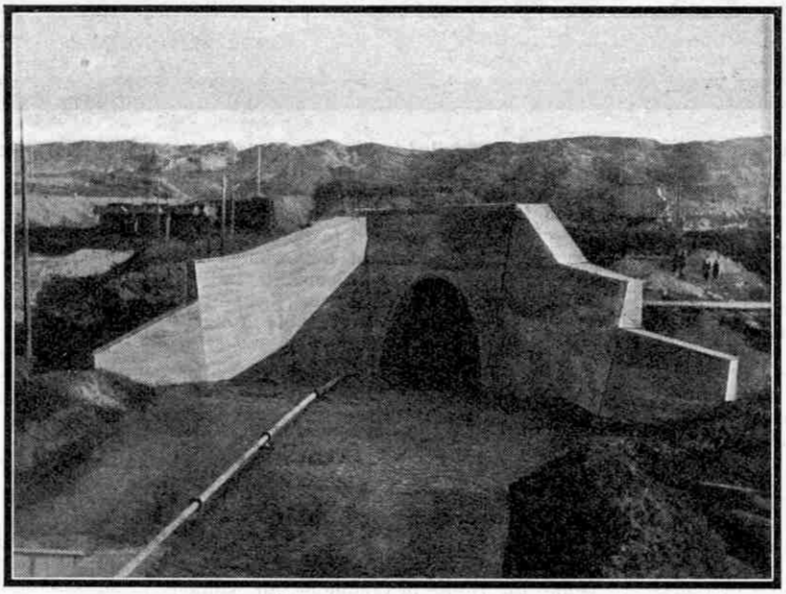
It is important that the river should be kept open for navigation until the new road through the head-race is available, and the weir is therefore being constructed in two parts. Two grab excavators mounted upon pontoons are engaged in clearing the loose earth from the rock upon which the dam is being built, and a diver is employed to ascertain when the clearance of an area being worked is complete. Holes are then bored in the rock and the upright beams forming the outer walls of the coffer-dams are inserted. When the cofferdams, consisting of sheet piling, are completed, the water enclosed is drawn off and in the dry bed thus provided the weir is built up.

The major portion of the weir is of concrete, but the upper part is composed of watertight clay. Six openings, each equipped with a

sluice gate, are provided in the structure to allow of the passage of surplus water when the river is in flood. The sluices comprising the end pairs will each be fitted with a steel-roller gate 59 ft. in width and 9 ft. in depth, while the two central openings, which are somewhat lower than the others, will be provided with double-roller gates, each 33¾ ft. in width by 11½ ft. in depth. The weir will be surmounted by a covered gangway housing the machinery for hoisting the gates, which it will be possible to operate either by hand or electrically. The weir is being provided with a fish pass at the end opposite to the head-race canal. Granite-faced spillway basins will be built in the river below the weir to prevent erosion of the latter.

The intake building across the head of the head-race canal is being built upon rock of similar formation to that supporting the Shannon weir. Excavation work in connection with the foundation of the intake building was carried out in an open bed, partly by hand and partly by means of a mechanical excavator. When completed the intake building will have three openings each 82 ft. in width and will be provided with steel sluice gates similar to those of the Shannon weir. By means of these gates the influx of water into the head-race canal can be cut off when necessary.

A huge cable crane completely spans the river Shannon at the site of the weir and intake building, and has been erected to facilitate the speedy transport of materials. Between the end sluices of the intake building and the canal embankment, at the side farthest from the river, facilities are being provided for vessels to enter or leave the head-race canal, by way of a special passage separated by a rock wall from the wide expanse of water forming the approach to the intake building.



The Blackwater culvert looking south. The unfinished mound in the background will be the southern bank of the canal

In order to reduce the velocity of the water approaching the sluice house at Ardnacrusha, the head-race canal is being made considerably wider as it nears that point. Vessels passing along this canal toward the sluice house will pass from the head-race to the tail-race channel by means of two end-to-end locks, which are separated from the canal by a thick stone wall. In passing through the locks vessels will negotiate the drop of 100 ft. from the level of the head-race canal to that of the tail-race canal. The tail-race canal that will receive the water when it passes from the power house, and will return it to the Shannon, is about 1½ miles in length and will have a bottom width of 72 ft. Most of the excavation for the foundation of the power house and the tail-race canal is through rock, and it is calculated that in respect of these two items nearly 785,000 cu. yds. of this material will have to be removed.

The construction of the concrete sluice house and the power station is being pushed forward day and night. The concrete is compounded in two mixing machines situated side by side and mounted at one end of a cable crane. Each machine can make 35 cu. ft. of concrete every three minutes. The raw materials are lifted in hoppers up to the machines by means of an elevator, and the finished product is discharged into a skip large enough to hold the contents of both mixers. The loaded skip is then conveyed by the overhead cable to the required site, lowered and discharged. The concrete mixers and the hoisting and travelling gear are all electrically operated. The steel towers supporting the cable are 131 ft. in height and move along parallel rails, thus greatly increasing the area over which the skips can serve.

In the sluice house will be a screen 303 ft. in length and equipped with a mechanical cleaner. The water from the head-race will pass through this screen, and from there into pressure pipes 108 ft. in length, there being one pipe to each of the six Francis type turbines to be installed. Electrically operated sluices will govern the amount of flow through each pipe. The turbines will be fitted with spiral water inlets and will have vertical shafts linked directly to the generator shafts.

The generators will be of the vertical closed type, generating current at 10,500 volts, and each having an output of 30,000 kV-a. The transformers to be installed will be fitted with automatic detectors and alarms to call attention to any excess heat that may develop.

From the hydro-electric power station at Ardnacrusha which, as already stated, is close to Limerick, high tension overhead cables will distribute power to various parts of the Irish Free State. The two systems of main transmission lines will be carried on towers 23 ft. in height, and will extend from Ardnacrusha to Cork and Dublin respectively. Power will be transmitted along these lines at a pressure of 110 kV. Transmission stations are being erected at Ardnacrusha, Cork and Dublin, and from them power will be sent out at 38 kV. over a network of lines linking up various places within the Free State. When the scheme is fully developed a sub-station at Maryborough will also supply power to the 38 kV. lines. Subsidiary transmission stations will be built at various places on the 38 kV. system and the current there stepped-down to 10 kV.

The Shannon scheme is being carried out in three stages—an initial development of the plant to the extent of 90,000 h.p., a subsequent extension of the capacity to 180,000 h.p., and finally the provision of increased facilities for water storage. The work now in hand represents the first stage, and when complete will provide power, under normal conditions, to the extent of 288,000,000 units annually. It is calculated that even during the driest of summers 153,000,000 units of power will be available, and it is anticipated that the result will be to stimulate commercial development throughout the Irish Free State.

Can You Solve These?

Puzzle No. 1. *Contributed by C. H. Thomas, Purley.*

A man was sent the following message by a secret society:—"Book passage America. Ship called 'Ajax' reported leaving eleven to-morrow. Hasty and necessary death if you refuse." What was the name of the secret society?

* * * *

Puzzle No. 2. *Contributed by S. E. Seneviratne, Kandy, Ceylon.*

One day a customer went into a grocer's store to buy 2 lb. of flour. The grocer had mislaid all his weights, save one of 40 lb. He dashed this on the ground and broke it into four pieces of unequal weight. By a strange chance, with these pieces he was able to weigh up any even weight from 1 lb. to 40 lb. Assuming that the 40 lbs. weight broke into pieces each an exact weight in lbs., what was the weight of each piece?

* * * *

Puzzle No. 3.

A coal merchant, wishing to weigh a big load of coal, found that the platform of his scales was too short to accommodate the whole of the four-wheeled wagon in which the coal was loaded. He already knew the exact weight of the wagon and he decided to obtain the complete loaded weight by weighing first with the rear wheels on the platform and then with the front wheels on. He thought that in so doing he would obtain the correct total figure. Was his idea correct?

* * * *

Puzzle No. 4. *Contributed by I. P. Simpson, Ulverston.*

I have no head and a tail I lack,
But oft have arms, and legs, and back.
I inhabit the palace, the tavern, the cot,
And it is a beggarly place where I am not;
Though a monarch were present (I tell you no fable),
I still should be placed at the head of the table.
What am I?

The solutions will appear next month.

Refuelling Airships at Sea

An interesting experiment, bordering on the spectacular, has been carried out by the U.S. aircraft carrier "*Saratoga*" and the U.S. airship "*Los Angeles*" at sea. While both ships were proceeding at a fair speed the airship descended over the "*Saratoga*" until the crew of the latter were able to pick up lines dropped from the airship and haul it down to the deck. Thus moored, the two ships travelled together for a little distance, and subsequently "*Los Angeles*" took off once more and returned to its depot at Lakehurst, New Jersey.

The experiment was carried out to determine whether refuelling could be carried out with safety at sea, and it is claimed in the United States that the success of the attempt proves that it will be possible to extend considerably the operating radius of airships. In commenting upon the experiment, "*The Engineer*" points out that a single refuelling has very little value as regards the extension of the radius action. If an airship has sufficient fuel capacity to enable it to fly to and return from a point, say 1,000 miles from its base, then with two refuellings from a tender stationed 2,000 miles from the base it would just be able to reach and return from a point 3,000 miles away. In other words, with two refuellings the effective radius of action would be trebled. With one refuelling the extension of the radius of action would depend upon how near to the objective the tender could be placed for the carrying out of the refuelling operations. It could only be doubled by placing the tender within gun range of the objective.

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A Curious Controversy

The aeroplane in which the brothers Orville and Wilbur Wright made the first flight on a power-driven heavier-than-air flying machine, on 17th December, 1903, is to be housed in the British Museum. It was intended that this should have been sent to England several years ago, but negotiations to secure the interesting relic for America intervened and caused delay.

The explanation of the remarkable fact that the British Museum should be the final resting place of an American machine is explained by the controversy between Mr. Orville Wright and the Smithsonian Institution at Washington. The Smithsonian collection includes the machine built by Professor S. P. Langley, who endeavoured to drive a full-sized aeroplane by steam on 8th December, 1903. The machine just failed to fly. In 1914 certain of Langley's admirers withdrew the machine from the Smithsonian Institution, fitted it with a modern aero engine and air-screw, and succeeded in making it fly. On the strength of that performance the machine was officially described by the Smithsonian Institution as "the first heavier-than-air machine capable of carrying a man in free flight."

One sympathises with Mr. Orville Wright's refusal to accept the accuracy of that description, and as the authorities decline to alter the description, the British Museum is to house the machine that achieved the historic 12 seconds' flight.

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Air Minister on Aviation Costs

In his recent speech on the air estimates before the House of Commons, Sir Samuel Hoare gave a very complete resumé of the operations of British aircraft throughout the world. He stated that the time when civil aviation would no longer require subsidising was almost in sight, the running costs per ton mile having been reduced from 4/2 in 1922 to 1/10 with the three-engined machines now used by Imperial Airways. Progress could be maintained only by the introduction of new types of machines and engines at comparatively short intervals but, unfortunately, the existing agreement with Imperial Airways afforded neither the time nor the money to effect these improvements. Consequently a new agreement was under discussion.

The introduction of new machines, said Sir Samuel, was also effecting economies in the Royal Air Force, and in the estimates £200,000 less was required this year for spares than was the case last year. On the other hand, the Air Ministry were calling for an increased sum to be spent on aircraft and engines, the actual figure for 1928 being £6,000,000 as compared with £3,000,000 in 1922. Most of the new machines bought would be of metal construction, and seven types of all-metal machines would come into general use in the course of the year. Considerable developments were anticipated in the use of flying boats.

Sir Samuel's disclosure that the airships R100 and R101, which are to carry out their flying tests in the summer and autumn of this year, could have been built in one year, was particularly interesting. In order to eliminate any avoidable risk some three years have been spent on research and experiment in connection with these vessels.

Pilot's Remarkable Escape from Death

A flying officer of the R.A.F. had a remarkable escape from death recently. He was flying over Essex in a Siskin machine, when the map he was examining fell to the floor of the cockpit. In order to retrieve it he found it necessary to unstrap his belt, and while he was bending down the machine turned completely over and he was thrown out. Fortunately he had the presence of mind to pull the ring of his parachute apparatus as he fell, and he made a safe landing.

* * * *

The World's Air Speed Record

Although no official announcement has been made, it is understood that a further British attempt will be made shortly by Flight Lieut. D. A. Greig, the newly appointed commander of the high speed flight, to lower the world's air speed record of 318.3 m.p.h. set up by Major di Bernardi, the famous Italian pilot, on a Fiat Macchi seaplane.

Subsequent to the late Flight Lieut. S. M. Kinkead's crash while preparing to attack the record for Britain, it was revealed that in one of his trial flights at Calshot Kinkead found that his air speed indicator was registering 330 miles per hour, although he was flying only at a very slight angle on to the 3 km. speed course. This particular instrument actually was reading on the slow side. There is every reason to believe that the Supermarine-Napier seaplane is capable of a speed of approximately 340 m.p.h.

* * * *

British Bid for Long-Distance Record

It has been rumoured during the past few weeks that the Air Ministry have decided to make a further attempt this year to break the world's non-stop flight record. According to an Air Ministry statement the story is not without foundation, but on the other hand it is premature. The position is that an aeroplane is being built with the object of making exhaustive tests to determine how long an engine will actually run in air under normal flying conditions. The machine that is being built is of the type that might be expected to beat the present time duration record, but the question of a long-distance flight will not be considered until the proposed tests have been completed satisfactorily.

* * * *

A Stinson monoplane fitted with a 200 h.p. Wright-Whirlwind engine recently set up a new world's duration record by remaining in the air for 53 hours 36 mins.

The Trans-Atlantic Flight

The first successful aeroplane crossing of the North Atlantic from East to West was accomplished in April by Captain H. Koehl and Baron von Huhnefeld, two German pilots, who were accompanied by Commandant Fitzmaurice of the Irish Free State Air Service. The machine flown was a Junkers all-metal monoplane fitted with a Junkers engine developing 310 h.p. The machine is known as the "*Bremen*," and has a wing span of 58 ft. and an overall length of 34 ft. It is of the same type as the Junkers machine that set up a duration record of 53 hrs. 23 mins. last year.

The airmen left the Irish Free State Aerodrome at Baldonnel with New York as their objective, but after favourable conditions for the first half of the flight the machine ran into fog and adverse winds that blew it off its course, until eventually the aviators were forced down to take refuge on Greenly Island, a lonely outpost off the Quebec coast. The aviators at one time were seriously apprehensive of their chances and realised only too well how fortunate they were to make land.

The narrow margin by which this feat was accomplished has brought into prominence the question of the desirability of introducing legislation forbidding unauthorised persons to attempt the trans-Atlantic flight. The British attitude is still that a person's life is his own, and that the Government have no jurisdiction over those who wish to commit suicide outside territorial limits. The Japanese Government method is somewhat better, for it resolutely declines to allow pilots to sacrifice their lives unnecessarily. It is reported that three separate Japanese efforts to make an east to west crossing of the Pacific from Tokio to Seattle will be made this summer. There were many applications for the post of pilot to each of these expeditions and in order to eliminate the unsuitable a unique test was introduced. All intending applicants were made to walk around a marked circle on an aerodrome for 50 hours without sleep or rest, and were compelled to take their food while walking. It is not surprising to learn that only ten applicants succeeded in surviving this ordeal!

* * * *

"Moths" for New Zealand Light Aeroplane Clubs

The New Zealand Government have decided to purchase eight D.H. Moths. Four of these will be loaned to the recently formed Light Aeroplane Clubs at Auckland and Christchurch, each of which will receive two machines. The other four machines are to be attached to the New Zealand Air Force at Christchurch for training purposes.

Naming Service Air Machines

The R.A.F. shortly are to introduce a new system of naming that will indicate immediately the class to which any particular aeroplane belongs. Under this system all machines will be given an individual name, just as in the case of naval ships, but the name of each machine of a particular type will commence with the same initial letter. Thus those machines whose names begin with the letter "A" possibly will belong to a night bombing type; the letter "B" may be taken to represent land single-seater fighters, and so on. It is not intended to alter the names of any existing aircraft.

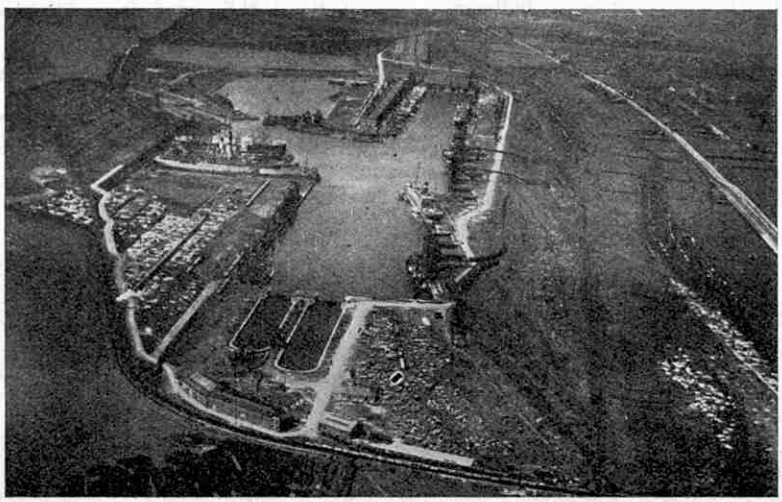
* * * *

Three New Records

Toward the end of April, Captain H. S. Broad, flying a D.H. Moth, succeeded in establishing three new world's air records. These were the 100 kilometre air record carrying 1,000 kilograms (approximately a ton); the 500 km. record for the same weight and the 500 km. record carrying 500 kilos. The first record was previously held by a Frenchman at 153 m.p.h. Captain Broad's actual speed for this distance was 162.3 m.p.h. The second record, held by Czechoslovakia at 142 m.p.h., was increased to 158½ m.p.h. which is also the new figure for the third record. These feats were accomplished by Captain Broad while flying over a course between Stag Lane aerodrome and Reading. Actually Captain Broad was in the air for two minutes under two hours, and he maintained an average speed of 158½ m.p.h.

There are now five air records to the credit of Great Britain. In addition to the three mentioned above, Capt. Broad holds the 100 km. light aeroplane speed record, while the 100 km. unlimited speed record was set up by Flight Lieut. Webster in the course of his winning flight for the Schneider Trophy.

From the Air



Courtesy [*L.N.E.R.*

An aerial view of the King George Dock at Hull. Owned by the L.N.E.R., it is the centre of the Hull wool trade. There are ten other docks in the system, the total enclosed water area being 232 acres. The total length of the quays is 14 miles, these being served by nearly 300 miles of standard gauge railway track

Across the Pole by Air

Captain G. H. Wilkins, the well-known Polar explorer, and Mr. C. B. Nielson, recently made a flight across the Polar Sea from Point Barrow, Alaska, to Spitzbergen, with the object of endeavouring to locate land in the Polar Sea. The course followed did not take Captain Wilkins across the Pole itself, a route that had already been traversed by Amundsen in the "*Norge*," but enabled him to see the mountains of Grant Land and the most northerly peak of Greenland. The route chosen passed over or near the elusive Crocker Land that Peary "discovered," and which has not been seen again. Although this course was adhered to closely, no trace of land was seen.

The flight was made on a Lockheed-Vega monoplane, with a Wright "Whirlwind" 225 h.p. engine. At the outset considerable difficulty was experienced in taking off, and some four or five attempts were necessary. Once in the air, however, the conditions were comparatively favourable, and the 2,200 miles separating the two points were covered in 21½ hours' flying time.

* * *

A Great World Flight

With their arrival at Le Bourget, Paris, recently, Captain Costes and Lieutenant Lebrix, the two famous French pilots, completed what is certainly the greatest flight made up to the present day. In the course of a 36,000-mile tour completed in 338 flying hours, they have flown completely round the world—except for the crossing of the Pacific—and from one end of America to the other.

The outstanding individual feats in this brilliant accomplishment were the non-stop flight of 2,658 miles from Paris to St. Louis, West Africa; the non-stop crossing of the South Atlantic from St. Louis to Natal, Brazil, and the Tokio-Paris homeward stretch, 10,500 miles, flown in six days. In the course of their travels the airmen have encountered every possible type of weather and have overcome every obstacle without mechanical difficulties. Throughout the flight the same Hispano-Suiza engine was used in a Breguet machine.

* * * *

The remarkable growth of civil aviation in Germany is made clear by the summer timetable of the Luft-Hansa combine. Every German town of any importance is connected with the system and the company's machines will fly daily over routes totalling in length 40,000 miles.

* * * *

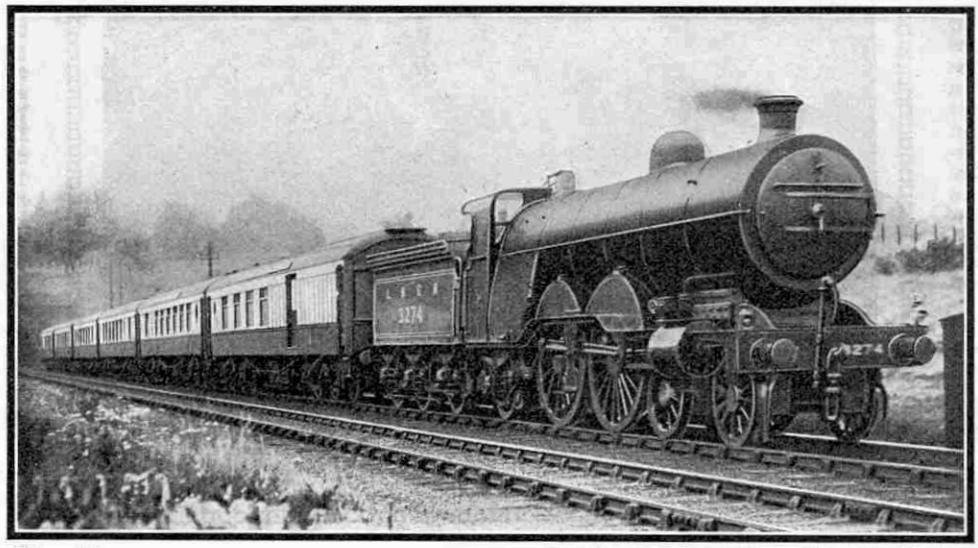
Two new airships, each 787 ft. in length and with a cruising range of 11,200 miles, are to be built for the U.S. Navy. Each will accommodate five aeroplanes.

FAMOUS TRAINS: XVIII.

The "*Queen of Scots*," L.N.E.R.

By Cecil J. Allen, M.Inst.T., etc.

GRADUALLY the Pullman car is spreading its influence over the continent of Europe. One day it may come into use as universally on this side of the Atlantic as it is in the United States and Canada, where every long-distance express without exception carries its Pullman equipment. On the American continent, however, the distinction is merely between "Pullmans" and ordinary "coaches," there being no class distinctions corresponding to our first and third, and the European first, second and third classes. But already you can start a Pullman journey up in Scotland, and finish it halfway across Europe. Pullman dining cars are at your service over L.M.S. lines between Inverness, Aberdeen, Oban and Glasgow; the "*Queen of Scots*" of the L.N.E.R. will bring you luxuriously through from Glasgow and Edinburgh to King's Cross in London; you can continue from there by the Southern Railway Pullman boat express to Dover and on from Calais to Paris by the famous "*Golden Arrow*"; whence all-Pullman trains will run you to Brussels and to Amsterdam in the north, Biarritz and the Spanish frontier or the spa of Vichy in the south, the French Riviera in the south-east, and elsewhere. The European Pullman car undoubtedly has come to stay.



Photograph [*Railway Photographs, Liverpool*

Up Leeds and Harrogate Pullman, emerging from Hadley Wood Tunnel

It was on the Great Eastern Railway, during the *régime* of its American General Manager—Sir Henry Thornton—that the Pullman car was first introduced to London and North Eastern metals. But the kind of traffic conveyed in the Eastern Counties was not quite "Pullman" enough in character to make a success of the Pullman workings, and apart from the Pullman cars on the Harwich Continental services, the number of passengers using the cars was not sufficient to justify their continuance. In casting about for a suitable way in which to use the Pullmans the London and North Eastern officials bethought them of the famous spa at Harrogate, and it was decided to assemble a number of the cars into a complete Pullman train and run it between King's Cross and Harrogate as a *train-de-luxe*. Leeds and Bradford were to benefit by making the train non-stop between London and Leeds, and by the working of two of the cars through beyond Leeds to Bradford.

The experiment was an immediate success. The "*Harrogate Pullman*" thus came into being, and the palatial train of umber and cream cars became a familiar sight on the Great Northern main line. Shortly after this the working of the train was extended to Newcastle.

Another all-Pullman service that was tried did not work so well. A "*Sheffield Pullman*" was put on, coming up in the morning non-stop from Sheffield to King's Cross and returning in the evening. Later on this train was diverted via Nottingham, and run from there over the Great Central route into Sheffield, whence it was extended to Manchester; but still the public were shy of patronising it. Once again an alteration was made, by which the "*Harrogate Pullman*" was also affected. Leeds and Bradford were cut out of the latter train's itinerary, and it was accelerated to run non-stop over the 198¾ miles between King's Cross and Harrogate—at that time the longest non-stop journey on the L.N.E.R. system.

This alteration took the "*Harrogate Pullman*" over a section of the L.M.S. lines, from Shaftholme Junction, just north of Doncaster to Knottingley, after which followed some most tortuous travelling with many curves and severe slowings, not to mention steep gradients, past Ferrybridge, Burton Salmon, Church Fenton and Tadcaster up to Harrogate. As compared with the 165 minutes allowed the train to passing Doncaster, 156 miles from King's Cross, the difficulties of the next 42¾ miles entailed an allowance of no less than 58 minutes, and 3 minutes less on the up journey. Needless to say, the up time of 3 hours, 40 minutes thus instituted on the up working between Harrogate and King's Cross was by far the fastest ever known between the Yorkshire spa and London. An extension of the journey at the northward end was brought into force at the same time, a Pullman train of the L.N.E.R. for the first time crossing the Border and bringing up in the capital city of Edinburgh. To celebrate this change the name was changed to the "*Harrogate and Edinburgh Pullman.*"

But what about Leeds and Bradford? From this time forward they had their own independent service. The Sheffield train was diverted to Leeds instead, leaving London just ahead of the Edinburgh train, the two departures from London being at 11.10 and 11.20 a.m. To give a quicker service to Bradford, the "*West Riding Pullman,*" as this new train was called, stopped first at Wakefield, instead of Leeds, and from Wakefield two Pullmans were run direct to Bradford and from there on to Halifax, so that four important West Riding cities thus came into possession of their own express Pullman service to and from London. In each case, too, the times instituted to and from London were considerably faster than those by any other train, either of the L.N.E. or the L.M.S. companies, so that the passenger obtained exceptional speed as well as exceptional comfort in exchange for the supplementary Pullman fare demanded.

And now, from the beginning of last month, a new and very important rearrangement of the two trains has taken place. The only drawback has been the slowing of the best time from London to Harrogate by 17 minutes, and the best time up by 19 minutes. But by way of compensation Leeds has now two Pullman expresses daily in each direction to and from town in the splendid time of 3 hours 25 minutes, two of them non-stop and the other two calling at Wakefield. Harrogate similarly has two four-hour Pullmans both ways to and from London daily, while Leeds and the West Riding also get a through Pullman service to Scotland.

The down Scottish Pullman express—which has now changed its title from "*Harrogate and Edinburgh Pullman*" to the more alluring "*Queen of Scots Pullman*"—splits the difference between 11.10 and 11.20 a.m. by leaving at 11.15 a.m., and runs direct

to Leeds and thence to Harrogate. North of Harrogate, by omitting the Ripon and Berwick stops, and by some speeding-up, the *"Queen of Scots"* is brought into Edinburgh at the same time of 7.35 p.m. as before, after which it is run forward to Glasgow. On the return journey it leaves Glasgow at 10.5 a.m., and Edinburgh at 11.15 a.m.—a much more convenient time than the early hour of 8.30 a.m.—and runs into King's Cross, by the same route, at exactly the same time as the north-bound *"Queen of Scots"* makes Edinburgh.

Meanwhile the *"West Riding Pullman"* is altered on its down journey from the morning to the afternoon, leaving London at 4.45 p.m. and arriving at Leeds at 8.16 p.m., after which it is run forward to Harrogate. Thus Harrogate and Leeds have now a morning and evening Pullman service both ways. Another advantage of this rearrangement is that it enables one train to do the return "West Riding" trip each day, arriving at King's Cross at 3 p.m. and going down at 4.45 p.m.

The up "West Riding," in order to maintain a time of 3 hours, 25 minutes from Leeds to King's Cross, inclusive of a stop at Wakefield to attach the Halifax and Bradford portion, is now booked to make the fastest long-distance run on the L. N. E. R. system, covering the 175.7 miles between Wakefield and King's Cross in 183 minutes, at an average speed of 57.6 miles an hour. But the fastest intermediate average is kept up by the down Pullmans, which are both booked to cover the 138¼ miles from Hatfield to Doncaster in 140 minutes. When allowance is made for the severe slowing through Peterborough, this timing entails an average rate of over 60 miles an hour for this long distance.

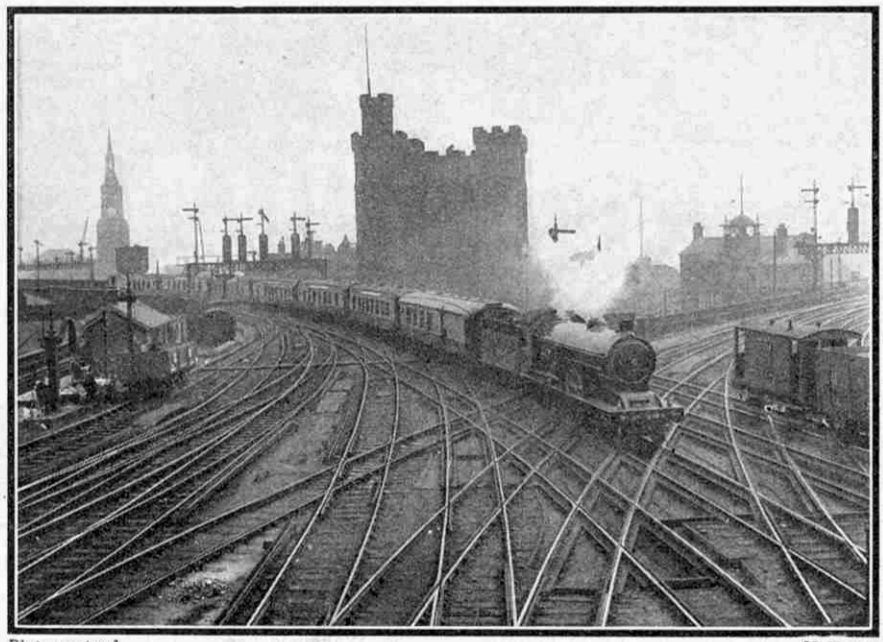


Photo courtesy] *[L.N.E.R.*

The *"Queen of Scots"* "Pullman" Car Express entering Central Station, Newcastle-on-Tyne. It is hauled by N.E. Class "Z" three-cylinder 4–4–2 engine No. 733. The train is passing over the special layout assembled from Hadfield's Manganese Steel Crossings.

Several types of locomotives have been tried on these high-speed journeys, including both the large four-cylinder "Valour" class 4-6-0's and the "Director" 4-4-0's of the Great Central section; but the most successful results, both as regards time-keeping and economy in fuel consumption, have been achieved by those wonderful Great Northern "Atlantics." Though the type has been in existence now for over a quarter of a century, these remarkable machines, like Peter Pan, seem strongly disinclined to "grow up." I have recorded runs behind them when time has been kept with loads that would not disgrace the best efforts of a "Pacific." On these "Pullman" turns, where speed rather than load is the chief consideration, the "Atlantics" have a splendid reputation; indeed, by the efforts of the capable and enthusiastic "link" of drivers to whom their working has been entrusted, they have probably the best punctuality record of all express trains on the L.N.E.R. On several occasions time lost by circumstances not under the driver's control has been regained in an exceptional fashion, as, for example, when on a recent trip, slacks for engineering works caused the up express to be 13 minutes late in passing Peterborough, after which the remaining 76½ miles to town were covered in the extraordinary time of 68 minutes, and the train reached London on time!

When Mr. H. A. Ivatt built his pioneer "Atlantics" for the Great Northern Railway, in 1898, they were the first engines of this wheel arrangement to be introduced into the country. His earliest batch had small boilers, but in 1902 there appeared No. 251—now No. 3251—provided with a boiler 5 ft. 6 in. in diameter, which was quite a monstrous size at that time. The outstanding characteristic of No. 251 was the mating of this big boiler to what were, in those days, exceptionally small cylinders. Mr. Ivatt, having proclaimed his opinion that the measure of a locomotive's success was its "capacity to boil water," put his convictions to the test in this revolutionary machine, which flouted many of the locomotive ideas of the period. Express trains at that time were mostly hauled by 4-4-0 engines with small boilers and large cylinders, which had to be worked very hard—or "thrashed," as it is called in locomotive circles—when on fast train duties, with a correspondingly bad effect on the bill for fuel and maintenance. Not so No. 251, with a great boiler and her wide firebox—another innovation—spread out across the frames to the maximum width of the engine. Since then all the "Atlantics" have been fitted with superheaters, and their cylinders have been enlarged in diameter from 18¾ in. to 20 in., but the short stroke of 24 in. remains, and in every other respect the locomotives are practically as first built.

There are two unusual engines of the class, however, which frequently take their turn in the Pullman "link." One is No. 3279, which Mr. Ivatt rebuilt experimentally with four cylinders instead of two. This engine is easily recognisable as the only L. N. E. R. "Atlantic" with outside Walschaerts valve-motion, and there are certain other external differences in the framing above the coupled wheels. Then there is the still more interesting No. 4419, which has been fitted with an American "booster" engine, driving the small pair of wheels under the cab. This ingenious mechanism consists of a small two-cylinder engine, supplied with steam direct from the boiler—by means of a rather unsightly pipe running along the side of the boiler above the wheels—which gives the locomotive valuable assistance at the moment of starting. As soon as the train gets into speed the driver is able to cut out the booster engine completely by means of a gear, the action of which corresponds to the free wheel clutch of a bicycle. The engine then proceeds in the normal manner.

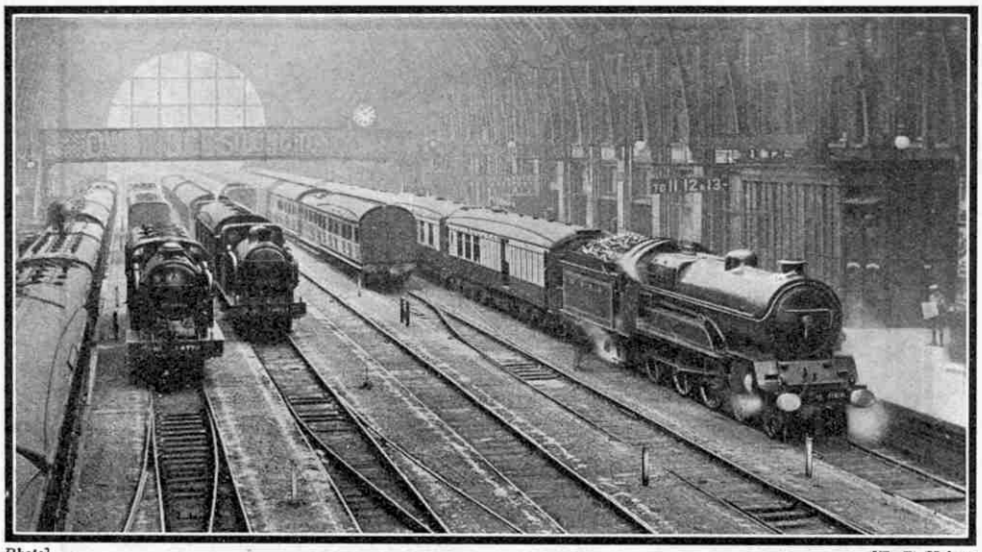
The idea is to give a "boost" at starting, when it is most wanted, and then to cut out the booster cylinders, so that they may not prove a drain on the boiler steam supply, nor oppose frictional resistance at high speeds. By successful remodelling, the booster engine on No. 4419 has been arranged so that it can be cut in and out at speeds as high as 25 miles an hour or so, which makes it available on steep gradients as well as at starting. No. 4419 is also recognisable as being the only "Atlantic" to boast a large cab, with high roof and side-windows.

The maximum load laid down for the Pullman workings, on account of their high booked speeds, is one of eight cars, which makes a total of a little over 330 tons. You may wonder why the "Pacific" engines are not employed on such important trains, especially as by their use loads might be increased; but there are one or two weak bridges between Doncaster and Leeds, and until they have been replaced the "Pacifics" are barred. But in all probability a "Pacific" will be awaiting us at Leeds, to take us forward on our journey from there.

The usual formation of the train on leaving King's Cross is a third-class Pullman brake coach next the engine; then a couple of third-class cars, followed by two palatial first-class cars furnished with comfortable arm-chairs and beautifully decorated internally; then one more third-class car, and a third-class brake car bringing up the rear. One of the special features of these all-Pullman trains is that the passenger's meals are brought to him, no matter where he sits, from two or three kitchens strategically disposed throughout the train, instead of his being compelled to leave his seat and repair to the restaurant car. This arrangement, of course, entails a considerably larger train-staff than is carried on any ordinary express, but it is part and parcel of the luxury travel

that is associated with the name " Pullman." Most of the cars are carried on eight wheels, a new type of 4-wheeled bogie having replaced the previous 6-wheeled standard, but even the 8-wheeled cars turn the scale at 40 tons.

We have travelled previously over a great part of the route, both on the north-bound journey with the " *Flying Scotsman* " and also coming south on the " *Aberdonian*," but new readers will welcome a recapitulation of the features of the journey. So far as concerns the first non-stop spin, from London to Leeds, the worst gradient occurs in the initial 1½ miles out of King's Cross, which not only rise at between 1 in 105 and 110, but also through a couple of tunnels where the rails are always greasy with moisture, so that the engines incline to " slip." Once through Holloway, however, all is plain sailing, and some six minutes after starting we are passing Finsbury Park at 40 miles an hour or so, rapidly accelerating. Five miles from the start, at Wood Green, we have nearly reached the mile-a-minute rate, but here there begins a rise for nearly eight miles at 1 in 200, to Potter's Bar, up the major part of which the speed will drop to between 40 and 45 an hour. The engine is not being hurried, as the timetable gives a fairly generous allowance of 25 minutes for the first 17¾ miles to Hatfield. Tunnels are a constantly recurring feature of this first section of the journey, there being no less than nine in the 24 miles from King's Cross to the summit point of the " Northern Heights," at Woolmer Green, between Welwyn and Knebworth. Welwyn Viaduct, across the Mimram Valley, is another noteworthy engineering achievement, with its 40 arches at a maximum height of 100 ft. above the valley.



Photo] [*F. R. Hebron*

The " *Queen of Scots* " about to leave King's Cross. 4-cylinder G.C. type engine No. 6164 " *Earl Beatty* "

From Hatfield to Peterborough the timetable allows 56 minutes for the 58¾ miles, and of this distance the 27 miles from Hitchin to Huntingdon are booked to be covered in 24 minutes, at an average of 67½ m.p.h. It is quite possible that we shall cut this time and attain a speed of 80 miles per hour or over on the tempting downhill stretch past Three Counties and Arlesey. Water is taken from the troughs at Langley, near Stevenage, and the next opportunity is not until Werrington Junction, some three miles beyond Peterborough. The sharp curve through Peterborough Station entails a reduction of speed to 15 or 20 miles an hour. For the next 29 miles to Grantham the time allowed is 33 minutes because, after a level stretch past Tallington to Essendine, the engine has to climb for 12 miles to the summit at Stoke Box, largely up grades of 1 in 200 and 1 in 178. Stoke is exactly 100 miles from King's Cross, and with its 420 ft. of altitude is the highest point on the route, south of Leeds.

More " galloping " now lies ahead. Threading the short Stoke Tunnel, we are through Grantham five minutes later, having taken 114 minutes over the 105½ miles from London. The next 50½ miles to Doncaster must be covered in 51 minutes, including the short climbs over the summits at Markham, beyond Tuxford, and Piper's Wood, after Bawtry. On this stretch we take water twice, from troughs in the Trent Valley, beyond Newark, and at Scrooby, the village distinguished by having been the home of the " Pilgrim Fathers " before their departure for America. Two interesting railway features on this section are the level crossings at Newark and Retford over the L.M.S. and L.N.E. (Great Central Section) Nottingham to Lincoln and Sheffield to Grimsby lines. As the old Midland Company was the first in the field in the former case, the L.M.S. signal-box controls the crossing, and it is diverting to think that the L.M.S. signalman there has it in his power to hold up the non-stop Edinburgh flight of the rival company's " *Flying Scotsman*," though it is to be trusted that he will not exercise his rights !

At Doncaster we slow for the second time, in order to leave the East Coast main line for the West Riding direction. Between here and Leeds there are some heavy grades. From Adwick to beyond South Elmsall (160-165 miles) the rise is at 1 in 440-200, but after that it steepens to 1 in 150, to a summit near Nostell. A swift descent then brings us through Sandal to Wakefield, where another severe slack is made. There is now a five-mile climb ahead, mostly at 1 in 100, to Ardsley, the highest point on this section, after which we drop at 1 in 100 into Beeston, and run slowly through Holbeck into the Central Station at Leeds. For the 19¾ miles from Doncaster to Wakefield 22 minutes are allowed, but the difficult 11 miles of the Wakefield-Leeds stretch require 18 minutes, making 205 minutes for the 185¾-mile run of our " Atlantic " from King's Cross.

As at Wellington Station of the L.M.S. in Leeds, so here at Central our train is now reversed, and we shall pass our engine for the north-bound run just as we are running in. It may be one of the " Z " class three-cylinder " Atlantics " of the North Eastern Area, but in all probability it is a " Pacific," for whom our 300-ton train, gradients notwithstanding, is but a feather-weight. A very slow start has to be made. Immediately after leaving Leeds Central, at 2.45 p.m., we diverge sharply to the right and run down to Geldard Junction, whence for a short distance we must seek the hospitality of L.M.S. metals—the Midland main line from Leeds to Carlisle, just beyond Holbeck—in order to get on to the L.N.E. line for Arthington. Past Headingley and Horsforth we climb at 1 in 100 for five miles, rising from an altitude of 115 to 391 ft. in the first 6¼ miles out of Leeds. This is the preliminary to the gloomy portal of Bramhope Tunnel—with its 2¼ miles of length, the second longest bore on the L.N.E.R.—down through which, on a falling grade of 1 in 94 for three miles, we hurry to Arthington, 218 ft. above sea-level. Then comes a climb of 3¾ miles at 1 in 195, followed, after a brief respite through Pannal, by ¾-mile at 1 in 114 to Crimple Junction, where we pass at a snail's pace around a curve of extraordinary sharpness on to Crimple Viaduct, and a mile at 1 in 91 up to the 400 ft. altitude of Harrogate. It is small wonder that this 18-mile stretch needs half-an-hour for its negotiation. Harrogate is reached at 3.15 p.m., 4 hours after leaving London.

Leaving at 3.20 p.m., we have in the next nine miles to drop all but 300 ft., first for 1½ miles as steeply as 1 in 66, and for three miles from Wormald Green at 1 in 133, so that 14 minutes prove ample for the 11½ miles from Harrogate to passing Ripon. A level run onward brings us to Northallerton, where we rise to rejoin, at reduced speed, the East Coast main line, which we left at Shaftholme Junction, 58 miles farther south. It is interesting

Leading Dimensions of Great Northern "Atlantic" Express Locomotives, L.N.E.R.

Cylinders, diameter	20 in.
,, stroke	24 in.
Driving Wheels, diameter	6 ft. 8 in.
Heating Surface, Tubes	1,910 sq. ft.
,, Firebox	143 ,,
,, Superheater	343 ,,
,, Total	2,396 ,,
Firegrate Area	31 ,,
Working Steam Pressure, per sq. in.	180 lb.
Tractive Effort (at 85 per cent. Wkg. Press.)	18,360 lb.
Adhesion Weight	36 tons
Total Engine Weight	69½ ,,
Water Capacity of Tender	3,500 gals.
Coal ,, ,,	6½ tons
Weight of Engine and Tender, in working order	112½ ,,
Length of Engine and Tender, overall	57 ft. 10 in.

to note that our detour has added only 11 miles to the journey.

Water is taken from Wiske Moor troughs, just beyond Northallerton, and at 4.7 p.m. we reach Darlington, the 39½ miles from Harrogate having taken 47 minutes. Two minutes suffice at Darlington, during which time the astonishing contrast may be noted between the "Pacific"-hauled Pullman express of 1928 and little "*Locomotion No. 1*" of the 1825 Stockton and Darlington Railway, mounted on his pedestal in the station. After this follows the difficult 36½ miles to Newcastle, with its sharp ups-and-downs, some quite steep, like the 1 in 150-163 from Croxdale to near Durham. Reduced speed may be necessary at one or two points where colliery subsidences are giving trouble, and a very severe slack is made over Durham Viaduct, Darlington to Newcastle requires 48 minutes, and we arrive there at three minutes before 5 o'clock.

During the seven-minute halt our engine is probably changed for another "Pacific," and at 5.4 p.m. we set out on the second non-stop stage of the journey, which exceeds 100 miles in length. It is over the 106½ miles to Drem, north of the Border, where connection is made to the golfing resort of North Berwick. The time allowance of 124 minutes entails an average rate of just over 50 miles an hour, over what is a fairly easy course. The worst ascents are the eight miles, mostly at 1 in 200-224, to Cramlington, shortly after the start; the 3¾ miles up at 1 in 170 from Alnmouth; and then nearly six miles up at 1 in 190 along the sea-cliffs past Berwick, during the course of which we make our way across the famous Royal Border Bridge, 90 ft. above the waters of the Tweed. Beyond the last-mentioned rise there is an eight-mile bank, largely at 1 in 200, leading up to Grant's House summit, 391 ft. above the sea.

Then comes the severe descent—4½ miles at 1 in 96, known as Cockburnspath Bank, which is the terror of drivers of heavy up trains. Here speed will be moderated. The highest speeds over this section will be attained, probably, between Christon Bank and Chathill, and near Beal, where quite probably our maximum rate may reach 70 to 75 miles an hour. After Cockburnspath comes Dunbar, and fairly easy undulations on to Edinburgh. The Drem stop is but brief, and at round about 7.30 we are crossing the complicated switches and crossings at Portobello, preparatory to running up the final 1 in 78 through Calton Hill Tunnel into the Waverley Station. The time of arrival is 7.35 p.m.

At Edinburgh we exchange our "Pacific," possibly for one of the big "Director" 4-4-0 engines, but probably for one of the new "Shires." Our run to Glasgow is a singularly easy one. By careful planning those who engineered the original Edinburgh-Glasgow Railway managed to preserve, as far as the Northern suburbs of Glasgow, a course that is to all intents and purposes perfectly flat throughout. This is in striking contrast to the tremendous grades of the rival L.M.S. route, which takes a location further to the south.

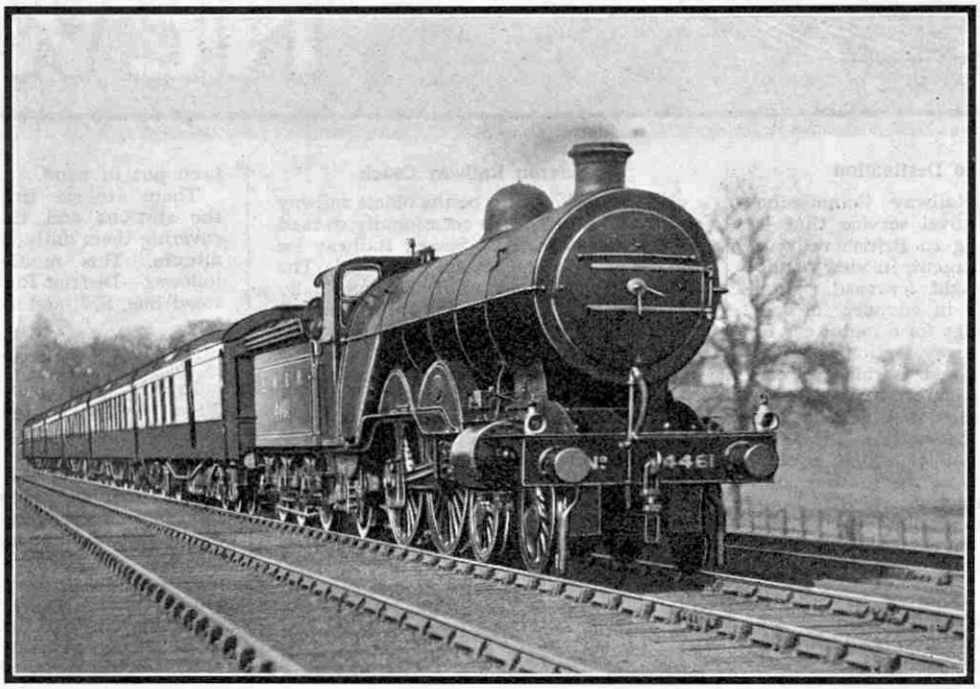


Photo [*Railway Photographs, Liverpool*

A recent photograph of the up "*Queen of Scots*" near Hadley Wood. Engine No. 4461

Leaving Edinburgh at 7.42 p.m., our engine maintains across Scotland an average rate of round about 60 miles an hour, and despite a stop at Falkirk, and a couple of slowings for colliery pitfalls, we approach Cowlairs, 46 miles from Waverley, at about 8.38 or 8.39 p.m. The ample margin left for the last 1¼ miles is on account of the precipitous drop at 1 in 42 through the tunnels into Queen Street terminus, which has to be taken at the most cautious speed. Until well into the present century, descending trains were all provided with special "brake-trucks," for additional brake-power, and outward-bound trains were pulled to the summit of the bank by wire ropes, but bank engines now perform the latter duty, and the former precaution is abolished.

So, at a quarter to nine in the evening, having covered 451 miles from King's Cross, the "*Queen of Scots*" stops in Queen Street Station, Glasgow, her beautiful cars imparting an unusual touch of brightness to that deep-lying and dingy terminus. We have taken part in the longest continuous Pullman journey that these islands afford, and a considerably longer spell of travelling than 9½ hours in such palatial conditions would hardly have tired us.

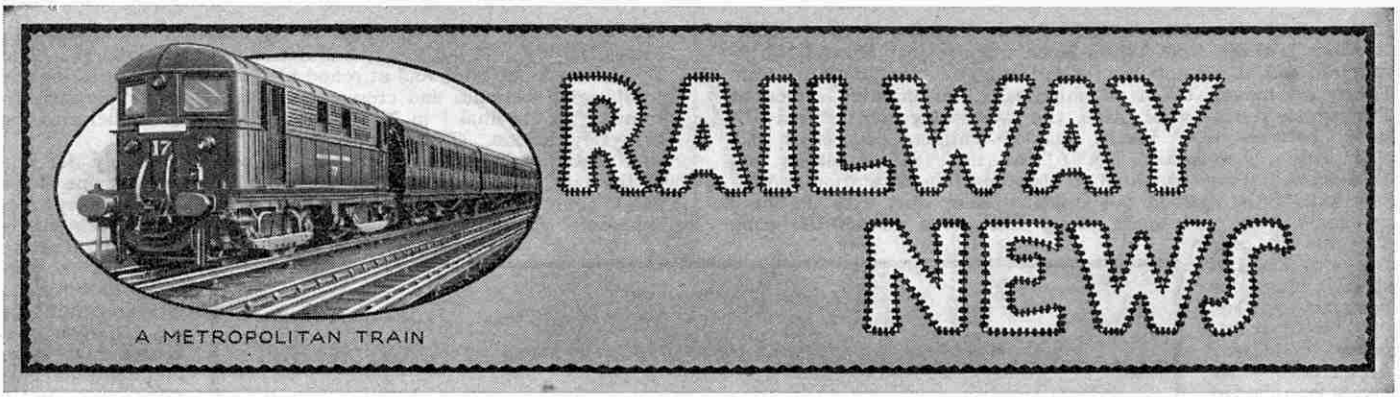
L.M.S. New Standard Colour Scheme

It is announced that the L.M.S. have now definitely adopted a colour scheme for their locomotives. The first-class passenger tender locomotives (Royal Scot 4–6–0s, Standard Compound 4–4–0s of Midland design, "Claughton" and "Prince of Wales" of the Western Division and also late L. & Y. "Hughes" 4–6–0 four-cylinder types) will continue to be painted L.M.S. lake, but will carry the engine numbers on the cab panels and the letters "L.M.S." on the sides of the tenders. The same method of displaying lettering and numbering will apply to all other engines, but passenger locomotives of all other classes will be painted black with red lines, and goods engines plain black. The honour of wearing the smart Midland lake livery now rests with a very select few, a fact that will doubtless give many L.M.S. enthusiasts considerable disappointment.

Prior to the grouping in 1923, the locomotives of Great Britain were renowned, not only on account of their efficiency as machines, but because of the numerous bright and attractive liveries that they wore. Green has always been the favourite colour. It was used mainly by the Great Central, Great Northern, Great Western, Highland, South Eastern & Chatham and the London & South Western Companies, each railway having a distinctive shade of its own. Khaki was used by the North British Company, while a very similar colour distinguished the London, Brighton and South Coast engines. The Caledonian were renowned for their rich royal blue.

Now these varying colours have disappeared, and although green still remains the most popular, there are only three shades in use in the country. The L.N.E.R., G.W.R., and S.R., have all adopted it as standard for their express passenger engines. The L.N.E.R. are using a lighter green than any in use before, while the G.W. retain their old colour scheme throughout and the Southern favour a dark L.S.W. olive colour.

The only other bright colour retained after the grouping was that of the L.M.S. This company retained the old Midland scheme, using a warm lake in the case of passenger engines, but placing the L.M.S. crest on the cab panels instead of that of the Midland Railway, and the number of the engine in yellow figures on the tender sides. Now even this fine and distinctive red is to disappear partially. All the famous engines of the '999' Class will be black, though many old North Western enthusiasts will be pleased to see the popular "George V's" and "Precursor's" appearing again in their original black and red.



From Home to Destination

The Tasmanian Railway Commission have introduced a novel service that is particularly interesting to British railway enthusiasts at this moment, in view of the railway companies' fight for road rights. Passengers who book in advance in Tasmania may now arrange for a motor car to take them to the railway station to commence their journey, and for another car to meet them at the end of their railway journey and take them to their destination. When booking, the passenger is provided with two coupons, one of which is surrendered on commencing the journey and the other at its completion. The railway companies allow a shilling for every coupon that the motor car owner returns to the company.

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The four new marshalling sidings at Exmouth Junction have now been brought into use and the marshalling yard itself is now complete.

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British Permanent Way

British railways spend approximately 13½ million pounds per annum on repairs and renewals of permanent way. To carry out that work nearly 59,000 men are employed, not including some 8,900 men of a supervisory grade.

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Automatic Brakes

One of the problems that faced the railway companies when the grouping system came into operation was the unification of the braking systems. Certain of the lines taken over were operated on the Westinghouse system and others on the vacuum. The Southern Railway was probably the most fortunately placed, for two of the three companies that formed the group had vacuum brakes as standard, and it was a comparatively simple matter to change the Brighton section locomotives and rolling stock over from the Westinghouse system.

On the L.N.E.R. there was greater difficulty in reaching a decision as to the standard brake to be adopted. The Great Eastern, North Eastern, North British and Great North of Scotland lines were fitted with Westinghouse brakes, this meaning that practically one half of the 3,500 locomotives and 20,400 coaches taken over by the L.N.E.R. had to be converted either to Westinghouse or to vacuum operation. In addition, there were 1,100 engines and 4,700 coaches fitted with both brakes.

It has been decided now that the vacuum brake shall be the standard and the Westinghouse is to be withdrawn.

A Veteran Railway Coach

What is believed to be the oldest railway coach still in service is occasionally worked on the Kent and East Sussex Railway for the use of the Manager and Engineer. The coach was built in 1848 and originally formed part of a royal train of three saloon coaches built for the use of Queen Victoria.

A correspondent in the "*Railway Magazine*," giving particulars of the coach, states that "later it became a royal saloon on the L. & S.W.R. and worked between London and Portsmouth, going also to Windsor. In 1890 it was sold to the Plymouth, Devonport and South West Junction Railway and ran between Callington and Bere Alston. It was then transferred to its present owners—then, of course, the Rother Valley Railway. Fortunately, it is in an excellent state of preservation, due to the very careful handling it has received, and when not in use it is kept in a shed. There is a door in the centre of each side. The vehicle is divided into two compartments, each containing two sofas and a table. The upholstery is grey with walnut panelling, while the exterior is painted thus: under framing, black; coach work, brown, with yellow lining and lettering; roof, white. It is fitted with the continuous brake, and steam heating; lighting is by gas."

One of the other two coaches that formed the train is still to be seen on the Shropshire and Montgomery Light Railway.

* * * *

More "Garratts" for New Zealand

The most powerful "Garratt" engines ever built for the 3 ft. 6 in. gauge have been ordered from Messrs. Beyer Peacock & Company by the New Zealand Government Railways. There will be three of the engines, each having a tractive effort of over 51,000 lb. at 75 per cent. boiler pressure. They will have the 4–6–2 + 2–6–4 wheel arrangement and will be three-cylindered. The grate area will be 58 sq. ft. and a mechanical stoker is to be installed. This is the first instance of a mechanical stoker being fitted to a British-built articulated locomotive. The diameter of the coupled wheels will be 4 ft. 9 in., the engine being intended for main line passenger express working over a ruling gradient of 1 in 40.

* * * *

Charing Cross Underground Traffic

The recent extensions of the underground lines serving the Charing Cross stations have so increased the traffic that over 35,000,000 passengers are using the stations each year. The number is growing rapidly, and improvements to provide facilities for the speedy handling of any number up to 50,000,000, have been put in hand.

There are six tracks passing through the stations and the number of trains covering them daily is 2,744, or over two a minute. This number is made up as follows:—District Railway, 1,096; Hampstead line, 877, and Bakerloo, 771.

* * * *

Spanish Railway Electrification

In a note in our April "*Engineering News*" we referred to a remarkable scheme for the improvement of public services that was recently introduced by the Spanish Minister of Public Works. In addition to the points outlined in our report, we learn that a committee is now completing a three months' investigation into the advisability of electrifying certain of the mountain sections of the Spanish railways, and also parts of the more intensely covered Catalan system. The total length of track involved in the proposed scheme amounts to 1,200 miles, and the Minister has allocated £10,000,000 for the work.

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An exceptionally quick run was made recently by an "Atlantic" type locomotive, No. 728, on the L.N.E.R. service between Edinburgh and Leeds. The engine, with a 213-ton train behind it, left Thirsk on time and arrived at York seven minutes ahead of schedule, having covered the 22½ miles at an approximate speed of 73 m.p.h.

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Canadian Railways Operating Figures

The report of the Canadian Bureau of Statistics for the year 1926 has recently been issued. The figures covering railway operations are of particular interest and disclose that of the total track operated in Canada, 40,353 miles, the Canadian Pacific Railway covers 14,004 and the Canadian National Railways, 20,860 miles. Freight trains carried a total of 122,476,822 tons, the total mileage for this class of train being 65,827,862 miles. The total number of passengers during the year was 42,686,166 and the mileage covered by passenger trains was 47,645,714 miles. During the year 439½ miles of new track were opened for operation.

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L.N.E.R. Shires

Names have now been allotted to certain of the new L.N.E.R. "Shire" 4–4–0 engines, as follows:—236 "*Lancashire*"; 245 "*Lincolnshire*"; 246 "*Morayshire*"; 249 "*Aberdeenshire*"; 250 "*Perthshire*"; 264 "*Stirlingshire*"; 265 "*Lanarkshire*"; 266 "*Forfarshire*"; 270 "*Fifeshire*"; 277 "*Berwickshire*"; 281 "*Dumbartonshire*"; 306 "*Roxburghshire.*"

French Railway Electrification

Rapid progress is being made with the electrification of the French railways, particularly in the area known as the Midi among the Pyrenees on the Spanish border. Over 480 miles of line in this district already have been electrified and other schemes are going rapidly forward.

The Midi Railway is by no means alone in the progress it has made. In several areas a gradually expanding network of electrified line is being thrown out. The lines along the Rhone Valley are already supplied with power from the French Alps; three electrified main lines radiate from St. Etienne, and the main line from St. Etienne to Lyons is shortly to be taken in hand. The Paris-Orleans line is complete between Paris, Orleans, Vierzon, Aguzon, and extensions are now being made to Limoges, Brive and Soulliac. The Paris-Orleans scheme is particularly important, for subsequently it will provide a first class electrified line down the centre of France from Paris to Toulouse.

These schemes are made possible only by the vigorous use of the exceptional water facilities that France possesses. In the Pyrenees there are already six main hydro-electric power stations and in each of the many valleys in this mountain system small stations have sprung up. The output of the six main stations is 170,000 h.p.

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A Heavy Load

One of the heaviest individual loads ever carried by railway in this country was handled recently by the L.N.E.R., when an octagonal ingot weighing 112 tons was conveyed from Sheffield to Openshaw, Manchester. The ingot was 11 ft. 11 in. in length, 7 ft. 9 in. in diameter at one end and 7 ft. 5 in. in diameter at the other end. It was loaded on to two 60-ton six-wheeled bogie armour-plate wagons fitted with a cradle, and by this arrangement the weight was distributed so that the axle load in no case exceeded 14 tons 6 cwt.

* * * *

Canadian Railway Traffic Records

The official Government statistics of steam railway operation in Canada show that the year 1927 was a record in every direction. Mileage worked, traffic carried, staffs, all showed big increases. Compared with the mileage of 39,077 operated in 1926, last year shows a gain of 350 miles of track, for there were 39,427 miles in operation. Tonnage carried increased from 119,494,165 tons in 1926 to 121,616,686 tons, this increase being largely in grain and forest products. The number of fare-paying passengers showed a slight decrease from 40,536,162 to 39,381,565, but the number of employees increased from 132,695 to 165,368.

Pullman Cars on British Railways

In response to many requests we give below, by courtesy of the Pullman Car Co., a list of the Pullman Cars at present operating on British Railways. Those marked with a star are first-class brake composite coaches.

Southern Railway:—Albert Victor, Alberta*, Belgravia, Bessborough, Cleopatra, Devonshire, Duchess of Albany, Duchess of Connaught, Duchess of Fife, Duchess of Norfolk, Empress, Grosvenor, Louise, Majestic, Myrtle, Pavilion, Princess Ena, Princess Helen, Princess Margaret, Princess Mary, Princess Patricia, Verona*, Vivienne, Waldemar, Octavia, Rosamund, Fingall, Rainbow, Plato, Corunna, Florence, Savona, Sorrento, Valencia, Clementina, Emerald, Regina, Sapphire, Palermo, Cosmo Bonsor, Alicante, Glencoe, Hibernia, Leghorn, Orpheus, Scotia, Seville, Ruby, Mimosa, Daphne, Topaz, Hawthorn, Stella, Tulip, Dorothy, Thistle, Hilda, Venus, Dora, Albatross, Mabel, Constance, Diana, Dolphin, Falcon, Figaro, Cadiz, Malaga, Monaco, Neptune, Sunbeam, Sylvia, Calais, Milan, Padua, Palmyra, Portia, Rosalind, Anaconda, Ermine, Coral, Elmira, Formosa, Maid of Kent, Aurora*, Flora*, Juno*, Montana*, Argus, Marjorie, Sappho, Medusa, Pauline, Camilla, Latona, Madeline, Pomona, Theodora, Barbara, Cassandra, Rosemary, Prince, Princess, Viking. Third Class numbered 1 to 26 inclusive and 30 to 36 inclusive.

London & North Eastern Railway:—Fortuna, Irene, Iolanthe, Cambria*, Catania*, Geraldine, Albion, Ansonia*, Aurelia, Arcadia*, Corsair, Cynthia, Alexandria, Marcelle, Sybil, Kathleen, Third Class 40 to 49, 52 to 58, and 65/6, inclusive.

London Midland & Scottish Railway:—Duchess of Gordon, Fair Maid of Perth, Flora Macdonald, Lass O'Gowrie, Mary Beaton, Mary Hamilton, Mary Seaton, Annie Laurie, Helen Macgregor, Maid of Morven, Lady Nairne, Bonny Jean, Meg Dods, Lass O'Ballochmyle, Mauchline Belle, Mary Carmichael.

Metro. Rly.:—Mayflower, Galatea.

Great Southern Railways (Ireland):—Third Class Nos. 100 to 103 inclusive.

Not allocated:—Penelope, Philomel, Zenobia, Minerva, Cecilia, Chloria, Niobe, Leona. Third Class 80.

The World's Fastest Train

France now claims the record for the fastest scheduled train in the world. This runs over the Paris-Orleans electrified line between Paris and Vierzon, a distance of 127 miles, at an average speed of over 60 m.p.h.

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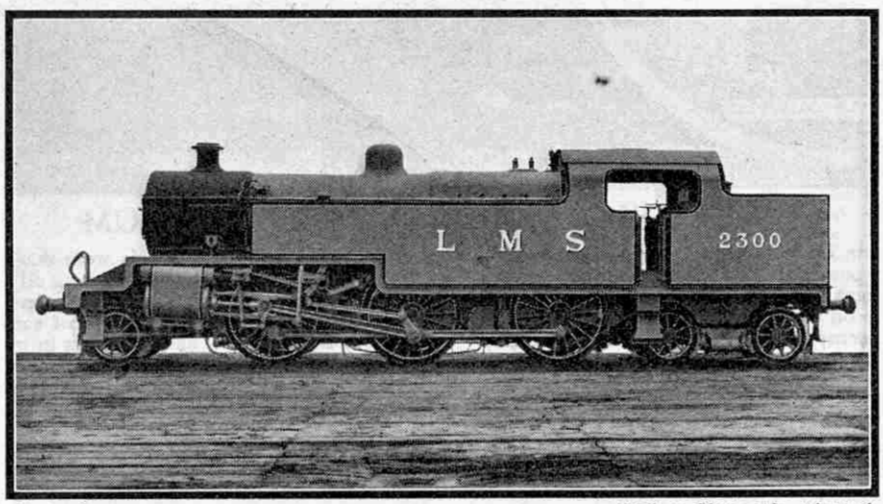
Railway Station Gardens

In Britain we point with pride to many of our railway stations that possess gardens maintained and stocked by the staffs of the individual stations. Realising the pleasure that such gardens give to travellers, the British railway companies encourage the staffs' activities by presenting prizes for annual competition. But Victoria, Australia, carries the practice much further. Twenty-three years ago the Victorian Railways Commissioners embarked on a big scheme for beautifying all the waste pieces of railway property adjoining their stations and other buildings. An official nursery was established, and that now sends out 40,000 trees, apart from plants, each year to every part of the railway system. The cultivation and maintenance of each station's garden is carried out by the local staff and prizes are given each year for the best-kept garden.



Courtesy] [*Railway Photographs, Liverpool*

Side view of one of the new L.M.S. 2–6–4 tank locomotives. As mentioned last month, the numbers of these run from 2300 to 2324 and the locomotives are being built at Derby

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Operations are shortly to commence on the construction of a 1,600-mile railway linking up the Persian Gulf and the Caspian Sea. The work is to be carried out by a combine composed of British, American, German and French companies.

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The Problem of Line Subsidences

One of the most trying problems presented to railway engineers is that of dealing with line subsidences in the colliery districts. For example, the bridge carrying the Hull and Barnsley line of the L.N.E.R. over the L.M.S. line at Pudworth has settled to such an extent, due to colliery workings, that the headway for the L.M.S. line has been severely curtailed. It will be necessary to raise the girders of the bridge to restore the original clearance. The bridge is of the continuous lattice girder type, 182 ft. in length, and weighs 300 tons. The work will be taken in hand shortly and must be carried out without stopping the traffic either over or under the bridge.

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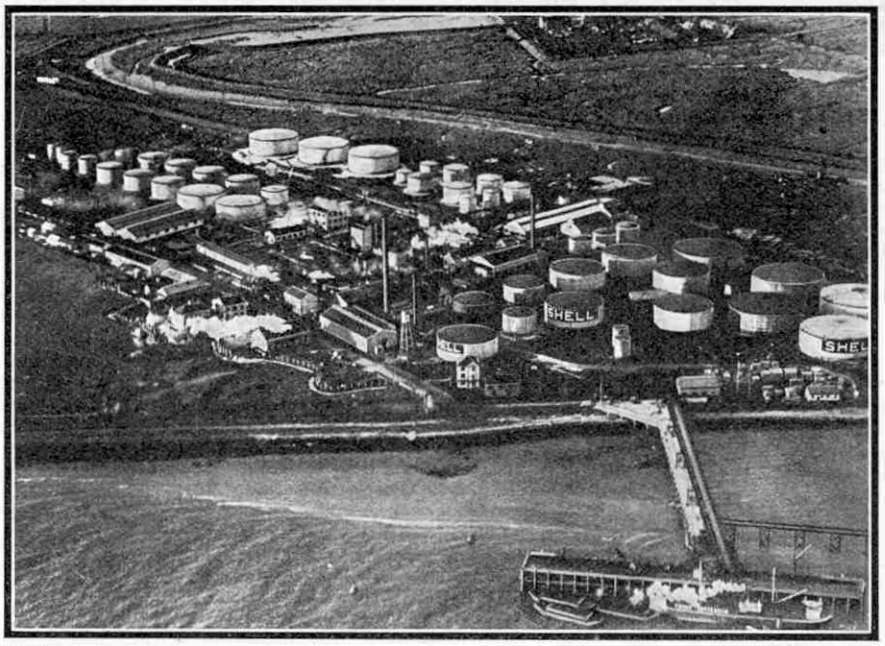
In expert railway circles recently there has been considerable discussion aroused by a proposal to experiment with an elevated super-speed train composed of cigar-shaped coaches and driven by a propeller actuated by a Diesel engine. Such a train, it is stated, would be capable of attaining a speed of 200 m.p.h.

V.—REFINING THE CRUDE PETROLEUM

THE crude oil that shoots up voluntarily from an oil-well or is drawn forth by powerful pumping machinery varies considerably in different oilfields in the proportions of sand and water it contains. The oil that is obtained from the wells of Mexico, for instance, is accompanied by a very small quantity of water and sand, while in some of the oil-bearing districts as much as 50 per cent. of the outflow is made up of these two impurities.

The sumps and field storage tanks to which the oil is led as it leaves the well, as described last month, rid it of a considerable proportion of this useless matter, and the liquid that is piped to the refinery generally contains only some two per cent. of impurities. At the refinery this remaining small percentage is eliminated and the pure crude petroleum is chemically separated into its several constituents.

The refining processes are numerous and intricate, and vary somewhat according to whether paraffin or asphaltic oil is being treated. As explained in the February "*M.M.*," these two different crude oils yield a number of distinctive by-products, and the treatment suitable for paraffin oils is of no avail with the asphaltic liquid. The principle of petroleum refining is common to both methods of treatment, however, and in this article we will describe the refining of paraffin oil.



Courtesy [*Shell-Mex Ltd.*

Aerial view of Shell-Haven Refinery on the Thames estuary

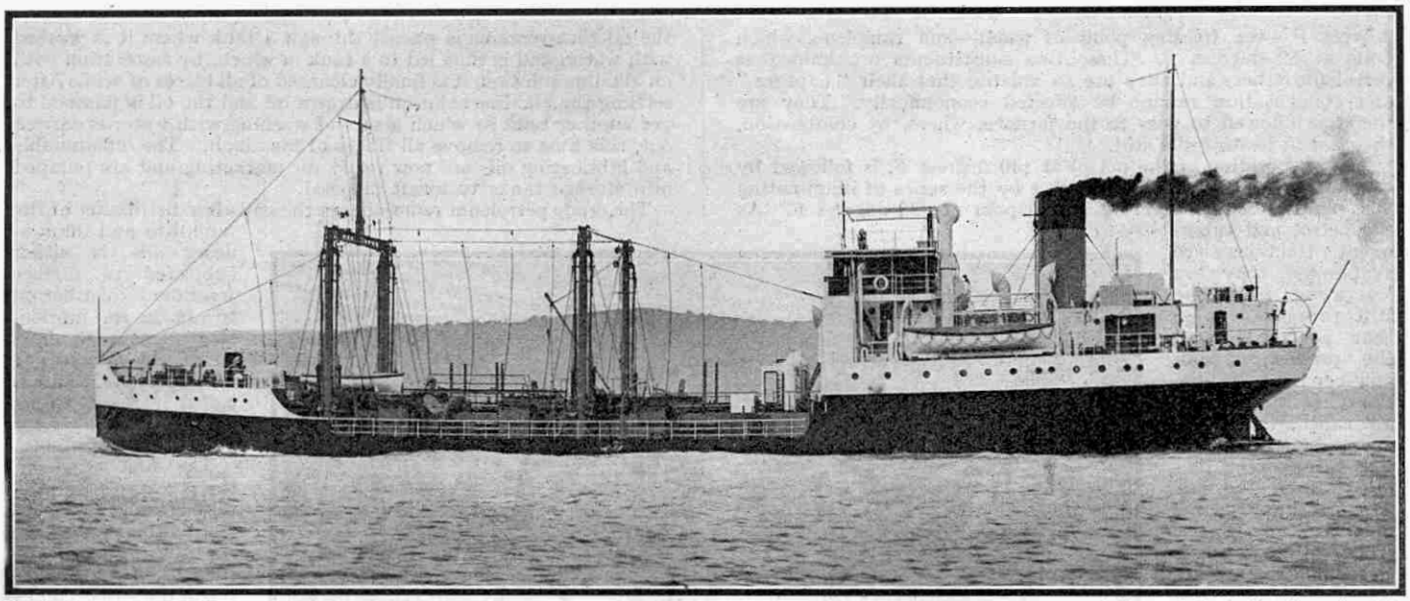
Considerable quantities of the crude petroleum obtained in Indiana and Ohio, U.S.A., contain a large proportion of sulphur. This class of oil was first discovered in Ontario, Canada, about the year 1868, but no process then known proved capable of eliminating from it the strong smelling sulphur. The odour was astonishingly penetrating and communicated itself not only to everything with which the oil came into contact but also to everything in the immediate neighbourhood. When it was found impossible to market this product in Canada several consignments were exported in the hope of establishing a foreign trade. The smell of the sulphurous cargo tainted everything on board the ships, however, and the shippers were inundated with claims for ruined merchandise and, in addition, were prosecuted for creating a dangerous nuisance. After that nobody would have anything to do with sulphur oil.

When an abundant flow of this grade of oil was tapped in Ohio some time later, great efforts were made in the United States to sell the liquid first as an illuminating oil and afterward as fuel, but without success. The producers offered handsome rewards to anyone who should find a means of satisfactorily separating the sulphur from the oil, and scientists in many countries tackled the problem. It was not until 1888, however, that a successful process was evolved, its discoverer being Dr. Herman Frasch. After three years of strenuous research Dr. Frasch discovered that the addition of metallic oxide to petroleum containing sulphur resulted in the removal of the unwanted element in the form of a compound of the metal and sulphur. Copper oxide proved to be the most suitable because the resulting copper sulphide formed separates readily as a black insoluble precipitate and can be re-converted easily into the oxide by roasting. When the oil is relieved of its sulphur by means of this process it is identical with paraffin oil and is refined as such.

As soon as the American oil producers were satisfied that a practical and economic solution of the problem had been found the Frasch process was universally adopted and it enabled the Canadian sulphur oil-wells to be revived and worked profitably. It is interesting to note that this method still remains the only efficient means of de-sulphurising oil.

The crude petroleum arriving at a refinery is accommodated in storage tanks until it is required for treatment. It is then pumped into a " pre-heater " tank, where, as the name implies, it is subjected to a preliminary heating. This is done by means of hot vapours already distilled from crude petroleum, which are en route to the condenser by way of pipes laid through the pre-heater tank. This pre-heating of the crude oil saves time and fuel in the process known as " fractional distillation," which takes place in the " still " or vat into which the liquid is next pumped. The still is heated by a furnace at the base.

Two types of still are in general use in the oil industry. One pattern is a horizontal steel cylinder of from 30 ft. to 40 ft. in length and about 13 ft. in diameter, built up of boiler plate. From two to twelve stills are erected in a row, each resting upon a brick foundation, while the brickwork extends up to about half the height of the still. The top of each still is surmounted by a dome, similar to that seen on locomotives, through which vapours pass



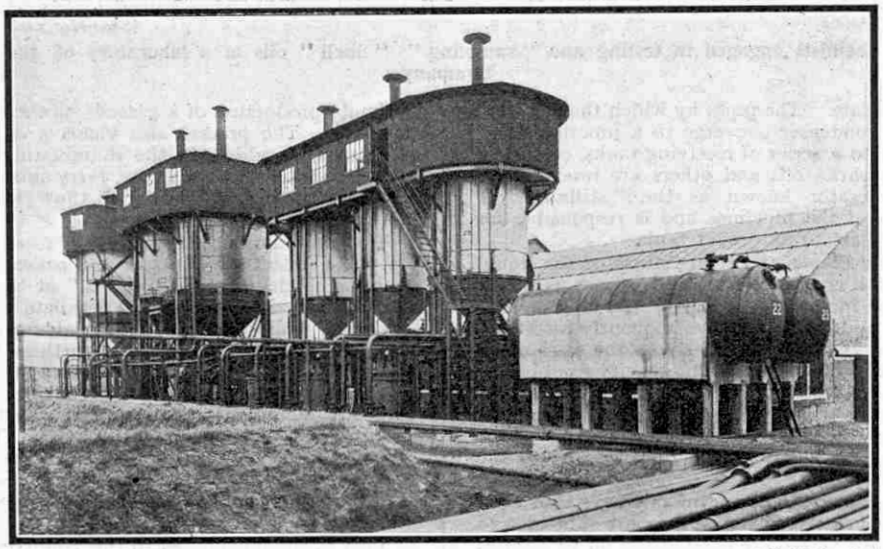
Courtesy] [*The Anglo-Saxon Petroleum Co. Ltd.*

A typical coastal oil tanker. The "*Paua*" is a vessel of 1,087 tons and trades under the flag of New Zealand between various ports of that country

from the still to the condenser. The capacity of horizontal stills varies from about 600 barrels to about 1,000 barrels of crude oil at each charge.

Vertical or "cheese-box" stills adopted at some refineries are about 9 ft. in height and approximately 30 ft. in diameter, and can receive the equivalent of 1,200 barrels at a single charge. They are mounted vertically upon a wall of brick arches and each has a double curved bottom and a domed top.

In the fractional distillation of the petroleum its constituents are vaporised successively in the order of their boiling points, liquids such as petrol naturally being vaporised before the temperature rises sufficiently high to vaporise the heavier oils used for lubrication. The process is not capable of bringing about an absolute separation of the constituents of any mixture of liquids submitted to it, however, as was explained in the "*M.M.*" for August, 1927, in an article dealing with the use of fractional distillation in treating coal tar. At the same time no other refining process is possible with petroleum, as the substances present resemble each other very closely in chemical behaviour.



Courtesy] [*Shell-Mex Ltd.*

The Agitator Plant at an Oil Refinery. Note the extensive use of corrugated iron for the inspection chambers at the top of the towers and for the adjoining outbuilding. Timber structures are strictly forbidden at all oil depots

It is usual to divide the products into three groups, known as inflammable, illuminating and lubricating oils respectively. Each group is divided into various constituents. The basis of classification is specific gravity, which rises continuously in the course of distillation. When the liquid distilling over shows a specific gravity of a certain value on testing, the distillate is diverted into a new tank. The first group consists of light oils of specific gravity varying from 0.625 to almost 0.750, and includes a range of liquids known as the naphtha series of oils, among which are petrol, benzine and benzoline. The naphthas are classified generally in three groups, the second and third consisting of oils slightly heavier than those of the preceding group. The first of these groups includes oil as used for stoves and spirit lamps. The second group includes the familiar motor spirit petrol while the oil representing the third group is utilized as a cheap substitute for turpentine in the painting, printing and dyeing industries.

The inflammable oils are also known as the paraffin or kerosene series and include all oils of a specific gravity between 0.744 and 0.820. The manner in which paraffin was first distilled from crude petroleum by an Englishman named James Young, in 1850, was described in the "*M.M.*" for February last. Although Young was the pioneer of commercial refining, he had not the distinction of being the discoverer of this valuable mineral oil, for paraffin was obtained from wood-tar 20 years previously by a German named Baron Reichenbach.

Paraffins are graded according to their colour, flash point, burning point and specific gravity. The finest paraffin is known as "water-white," while the lowest grade is of a yellow tint. The flash point of an oil is the lowest temperature at which the liquid will give off a vapour which, upon mixing with the air, proves combustible in the presence of a naked light. The burning point indicates the temperature at which the mixture would ignite and burn continuously. Both the flash point and the burning point of paraffins vary according to the grade of the oil. A temperature of 73 degrees F. was adopted by law many years ago as the safe flash point, but nowadays the majority of paraffins used have a flash point of 120 degrees F. or more. The burning point lies between 150 degrees and 300 degrees F.

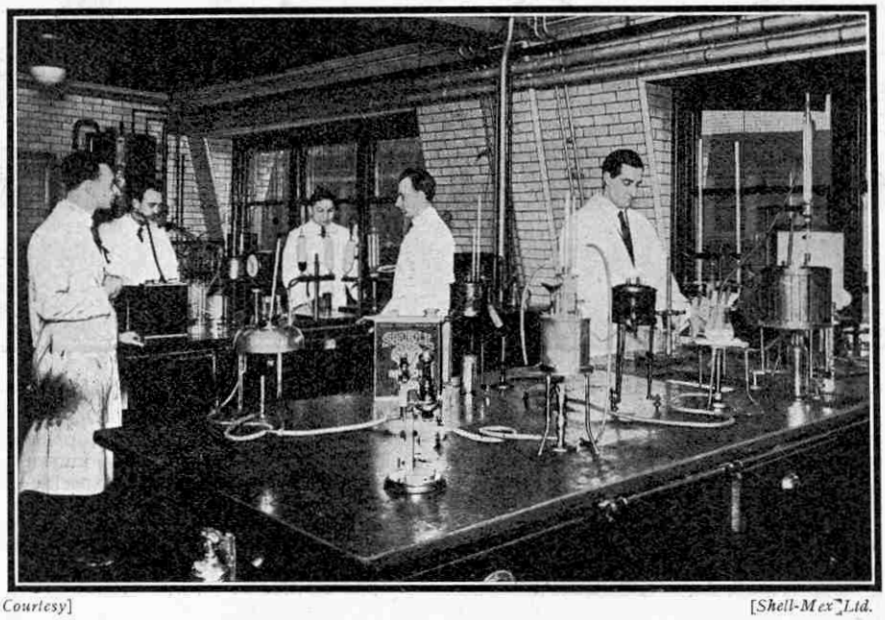
The heaviest of the illuminating oils are sometimes classed as the lightest of the lubricating oils, and vice versa. Lubricating oils, represented by the third group, are of great commercial importance and the methods of extracting them from the crude petroleum are very varied. The term is comprehensive, and covers all heavy oils, semi-solid and wax products derived from the "crude."

In petroleum refining the charge of crude oil in the still is heated up and the more volatile constituents or "fractions" soon commence to evaporate. Two of the earliest fractions to separate out are cymogene, which attains boiling point at a temperature of 32

degrees F.—the freezing point of water—and rhigolene, which boils at 62 degrees F. These two constituents are known as petroleum ether, and they are so volatile that their "capture" and condensation cannot be effected economically. They are therefore allowed to pass to the furnace, where, by combustion, they aid in heating the still.

The evaporation of the petrol at 140 degrees F. is followed by that of other naphtha oils and later by the series of illuminating oils, paraffin being converted into vapour at 338 degrees F. As the petrol and subsequent fractions are evaporated they are led away from the still through a pipe that passes through the pre-heater tank and conveys the distillate, as the vapours are called, to a condenser tank. In passing through the pre-heater tank the hot vapours impart some of their heat to the crude oil awaiting treatment. They are thus cooled and, to a proportionate extent, are condensed back into liquid. This liquidification is completed in the condenser tank, where a constant stream of cold water is directed upon the pipe.

One condenser serves a number of stills from each of which a pipe conveys the vapours to the condenser and a corresponding pipe leads off the liquefied distillate. The pipes by which the distillate is drawn away from the condenser converge to a junction point where other pipes radiate to a series of receiving tanks, certain of which are allocated to naphtha oils and others are reserved for illuminating oils. An operator known as the "stillman" is stationed at the junction of the pipelines and is responsible for diverting the flowing distillate to its proper tank.



Courtesy [*Shell-Mex Ltd.*

Chemists engaged in testing and "sampling" "Shell" oils at a laboratory of the Company

The stillman periodically checks the temperature of the liquid and instructs the fireman in charge of the still furnaces as to the necessity of slackening or increasing the fires. By means of a small instrument called a hydrometer he also frequently ascertains the specific gravity of the distillate, which shows the class of oil issuing from the condenser. When the specific gravity recorded by the hydrometer indicates that the flow is changing from the light inflammable oils to the less volatile and heavier illuminating oils, he immediately closes the valves of the pipelines leading to the naphtha tanks and opens the valves of the lines leading to the tanks reserved for illuminating oils.

When the inflammable and the illuminating oils have thus been run off into their respective receiving tanks, they are subjected to a second distillation that is effected by passing the oil to a series of stills into which super-heated steam is injected. The oil vapours that are given off are led to a condenser and the distillate is subsequently separated out and passed to another set of receiving tanks, as before. During this second distillation any fractions of oil of a specific gravity lighter than 0.800 that separate out from the parent liquid are transferred to the group of inflammable oils.

The various oils are now subjected to a purifying treatment to rid them of their unmarketable colour and of certain objectionable elements. Each fraction is pumped into one of a group of tall, cylindrical vessels with cone-shaped lower ends and known as "agitators." A proportion of sulphuric acid is introduced into each agitator and the oil and acid are thoroughly mixed by means of a strong air-blast directed downward from the top of the vessel. The violent agitation thus set up is maintained for several hours. The acid has no action on the paraffins themselves, but chemical changes occur between the acid and the impurities, with the result that by the time the air-blast is shut off the contents of the agitator have thickened considerably and darkened in colour. The thick sludge that then settles to the bottom of the agitator is later drawn off and is used in connection with the manufacture of fertilizer or treated for the recovery of the sulphuric acid.

When the sludge acid has been withdrawn from the agitator the oil that remains is passed through a tank where it is washed with water, and is then led to a tank in which, by association with an alkaline solution, it is finally cleansed of all traces of acid. After settling the alkaline solution is drawn off and the oil is pumped to yet another tank in which a second washing with water is carried out, this time to remove all traces of the alkali. The inflammable and lubricating oils are now ready for marketing and are pumped into storage tanks to await disposal.

The crude petroleum remaining in the still after distillation of the naphthas and illuminating oils is either subjected to further fractional distillation to obtain its lubricating oil content, or is treated by a process of destructive distillation called "cracking," which results in a yield of paraffin wax, etc.

The first stage in the cracking process is the slowing down of distillation by slackening the fire beneath the still. As the domed top of the still becomes cooler, the vapours ascending from the hot mass of crude oil do not pass to the condenser, but condense upon the interior of the dome and fall down into the retort, where they are again converted into vapour. This process is continued for a considerable time and results in decomposition of the oil with the ultimate production of a gaseous mixture chiefly of hydrogen and methane. The process also yields a distillate which, after condensation, is added to the illuminating oils. The residue that remains in the still is a heavy, tarry substance called "residuum." The method of slow distillation thus yields crude naphtha, crude illuminating oil and residuum.

The residuum is then transferred to a tar-still and again heated up. The resultant vapours are passed through air condensers and the condensate is "trapped" at three stages. The product drawn off at the first trap is a distillate from which paraffin wax is obtained, while the third trap yields a grade of illuminating oil. A substance intermediate between these two is obtained from the second trap. The residue is known as petroleum coke, and so thorough is the cracking process that the coke is entirely devoid of any oily ingredient. This coke is chiefly utilised in the manufacture of carbons for electric arc lights. The paraffin wax obtained from the distillate of the first trap is hardened by a freezing process and is then subjected to tremendous pressure to squeeze out of it all liquid paraffin. In this manner a heavy grade of lubricating oil is obtained from the wax.

Most of the oil shipped to this country is already refined and is transported from abroad in ocean-going vessels known as "oil tankers." These ships differ in many respects from the ordinary freight steamers, generally in having their propelling machinery situated in the stern of the vessel instead of amidships. The crew of an oil tanker are accommodated in the forecastle and the extensive centre portion of the ship is devoted entirely to oil tanks.

A longitudinal bulkhead extends the full length of the oil-tank section and divides the series of rectangular tanks into two long rows. The oil tanks vary in number from two to ten or twelve, according to the size of the tanker. They extend from the deck level of the ship down to the inner bottom, and as each tank is self-contained, a single cargo may include several different classes of spirit without there being any fear of the various spirits becoming mixed. The tank section in its entirety is isolated from the fore and aft sections of the ship by two strong bulkheads at each end and spaced about 1½ ft. apart.

When the oil industry in America was in its infancy the transporting of oil in bulk by water was tried out with river barges and proved very successful. Barges are still used for river transport in U.S.A. and the modern successors of the first oil barges are commodious craft capable of shipping up to 300 tons of oil at one time. The success of the barge exporting led to the creation of

ocean-going vessels specially designed for the shipment of oil and thus the tanker came into being. The first tanker had a carrying capacity of about 1,000 tons of oil, but now there are in daily service on the Atlantic Ocean and elsewhere vessels capable of carrying 15,500 tons—4,500,000 gallons of oil.

The loading and discharging of an oil tanker is carried out with practically no other noise than the subdued regular throb of the pumping machinery, and is in marked contrast to the noise and bustle that accompanies the handling of other types of cargo steamers. There is a complete absence of buckets, cranes, winches and dirt, and all that can be seen by any curious visitor to an oil wharf where a tanker is being loaded or discharged is one or more thick flexible steel hose-pipes connected at one end to fixed pipes on the deck of the ship and at the other end to the wharf pipelines by which the oil is conveyed to or from the adjacent storage tank farm. The pumping machinery of a large modern tanker can deal with as much as 1,200 tons of oil per hour.

The highly inflammable nature of the cargo shipped by an oil tanker has resulted in special regulations being applied to this type of freight carrier. No naked lights are allowed on board and electric current is generated in the engine room for all lighting and domestic requirements. The crew also are forbidden to smoke while there is any oil in the tanks. In addition an oil tanker always commands the right of way at sea and all other vessels give her as wide a berth as possible.

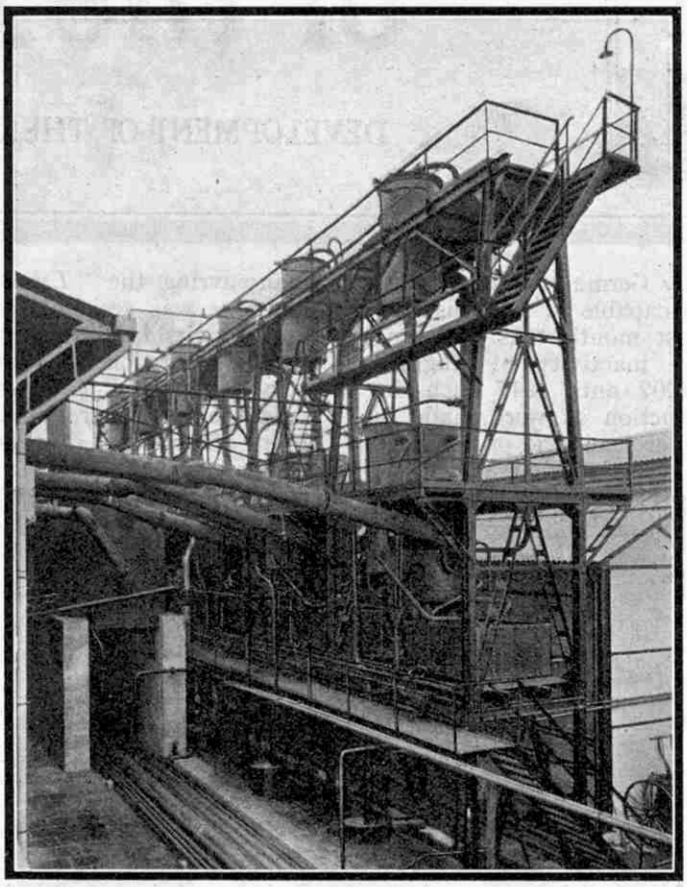
The oil is discharged from the tanker through flexible steel hose and led by way of underground pipelines to large storage tanks. It is later withdrawn from the tanks and pumped either into small coasting tankers or into railway tank wagons for dispatch to various filling installations. The special rail cars used in this country have a net capacity of from 8 to 16 tons, but in the United States huge cars with a capacity of from 30 to 50 tons are quite common. At the filling stations to which the refined oil is conveyed it is transferred through pipelines to storage tanks from which it is drawn off as required and loaded into 50-gall. and 100-gall. drums and also, in the case of motor spirit and certain grades of lubricating oils, into the 2-gall. cans that are now so familiar a feature.

In addition to the oil obtained from oil-wells a considerable quantity is derived from a kind of clay known as shale. Shale differs from ordinary clay in having a laminated structure; in other words it is in the form of very thin layers. Very extensive beds of oil shale are found in Scotland, from which a large amount of oil is extracted.

The oil derived from Scottish shale is refined on similar lines to crude petroleum. The shale is mined and the lumps are brought up in the small trucks or "hutches" of an aerial railway and conveyed to the crushing mill where they are discharged into crushing machines that reduce them to a size suitable for economic distillation. The crushed shale then falls into another series of hutches and is conveyed to the retort house. The hutches are carried upward on an endless chain until they are above the retorts, where the manipulation of a lever opens a sliding door in the floor of each truck and discharges the shale into the topmost chamber or "hopper" of a retort. The storage hopper of a modern oil shale retort accommodates nearly 9,000 lb. of crude shale, which is sufficient to keep the retort in full operation for 24 hours.

At the refinery of the Pumpherston Oil Company Limited at Breich in Scotland, the retorts are built in batteries of four. They are vertical structures about 20 ft. in height and approximately 2 ft. 6 in. in diameter at the base and they taper slightly towards the top. The lower portion is built of firebrick and the upper part of cast-iron. The retorts are heated up to 1,600 degrees F. by the burning of the hot vapours given off during distillation, which are fed into the heating chamber at the base of the retort together with the proportion of air necessary for complete combustion. This heating chamber is built completely around the retort.

The shale is fed into the retort from the storage hopper with mathematical precision and gravitates through successive zones of slowly rising temperature, its rate of movement being adjusted accurately to the temperature so that it is perfectly "cooked" in its downward journey and thus yields the maximum quantity of oil. During this process steam is injected in the base of the retort. This steam serves the two-fold purpose of maintaining the required temperature and also entering into reaction with certain materials in the shale. The resultant oil vapours are drawn off by means of exhausters and conducted into atmospheric condensers where most of the vapours condense with the steam into a liquid called ammonia water. This mixture of oil, ammonia and water is then passed into a separator tank where, owing to differences in specific gravity, the various elements separate and are drawn off individually and diverted to different receiving tanks.



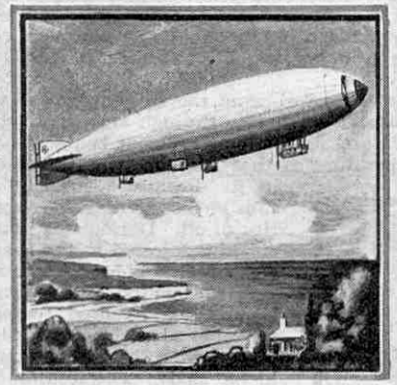
Courtesy [*Shell-Mex Ltd.*

Condensers to receive oil vapours from the Stills

The crude oil derived from the shale is transported from the receiving tank to an elevated storage tank in which it is left for about 15 hours in order that any water still present may settle to the bottom and be drawn off. When this has taken place the oil is allowed to pass by gravity to the first of a series of horizontal stills. These stills are connected in such a manner that the oil under treatment flows out of one into another, the temperature and rate of flow being carefully adjusted so that as far as possible each still supplies one product continually. Fractional distillation takes place in the stills and the naphthas and illuminating oils given off as vapours are condensed by passing them through coiled tube immersed in water and from there to separate receiving tanks. The separated constituents are then freed from impurities by chemical treatment corresponding to that already described in the distillation of petroleum.

The vapours that have not been converted into liquid form in the condensers are led off into ammonia "scrubbers" where they are thoroughly washed in order to remove any ammonia that still may be present. They are then passed to naphtha scrubbers where a further washing separates out the lighter vapours or naphthas. There still remains certain vapours that have resisted all the condensing processes and these are led away to be utilised in heating the retorts.

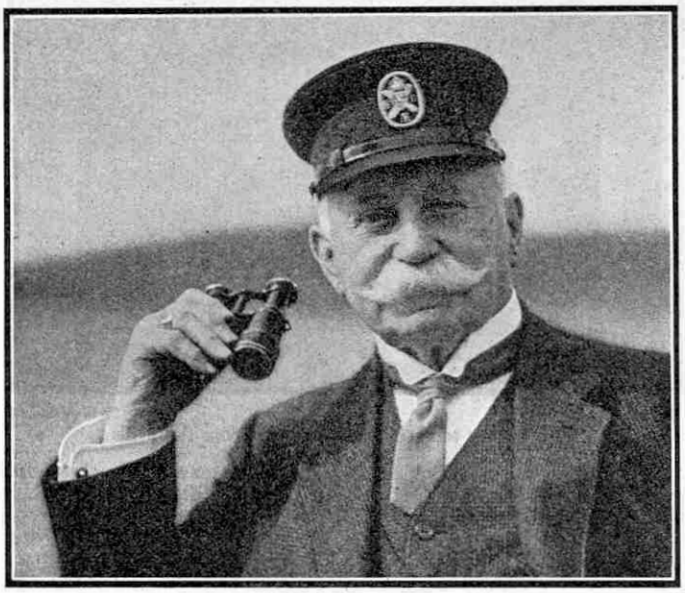
The residue of asphaltic oils is used as a flux in the treatment of the asphalt obtained from the famous Pitch Lake at Trinidad and which, in refined form, is used as a road-making material. The Pitch Lake, so named by Sir Walter Raleigh, is situated about half-a-mile inland on the island of Trinidad, and is roughly 127 acres in extent. The supply of asphalt seems to be inexhaustible for however much is removed during a period the lake resumes its original level within two days after operations. The asphalt is removed by means of pickaxes and transported in trucks to the lake-side refinery where it is heated or "boiled" sufficiently to rid it of all superfluous water. In subsequent treatment it is placed in a large tank and heated up to about 200 degrees F. while flux from petroleum stills is heated up to about 175 degrees F. in another tank. The flux is then passed slowly into the asphaltic tank where the mixture is agitated until the two ingredients become one. When cool it is ready for use in road-making.



The Conquest of the Air

DEVELOPMENT OF THE DIRIGIBLE

THE great progress made by Germany in developing a reliable rigid airship capable of long distance flights, as described last month, was in strong contrast to the comparative inactivity of England in airship matters. From 1907 until 1917 such developments in airship construction as were made in England were in favour of either semi-rigid or non-rigid airships, and were carried out mainly as experiments to determine the possibilities of airships as practicable additions to military equipment. Semi-rigid airships are non-rigid airships strengthened by the addition of a keel along the base of the envelope, or hull.



Count Zeppelin

The first British Army airship was of this type, and was built in 1907 at the Royal Aircraft establishment at Farnborough. The sausage-shaped envelope was 25 ft. in diameter and of 50,000 cu. ft. gas capacity, and the two metal bladed propellers were driven by a 40 h.p. "Antoinette" engine by means of belting. The "*N.S.1*," as the airship was called, was wrecked during a storm, and a second and larger airship of the same class was then constructed. The "*N.S.2*" was equipped with an engine of 100 h.p., and in October, 1907, made a successful flight from the hangar at Farnborough to London, in 3½ hours. Later the airship was stored away and eventually it was completely dismantled.

During the ensuing four years several small non-rigid airships were built or purchased by the British Army authorities, but they were not very successful. In 1900 the "*Morning Post*" inaugurated an airship fund and with the money subscribed purchased and presented to the British Government an airship built by Lebaudy Freres, of France. This airship was 337 ft. in length and its 150 h.p. Panhard engine enabled it to attain a speed of 36 m.p.h. The envelope had a gas capacity of 350,000 cu. ft. A special hangar was erected at Farnborough to receive the airship, which was successfully flown across the English Channel. While manœuvring the "*Lebaudy*" into its new home the envelope was accidentally torn, but this was repaired and the airship subsequently made several trial flights. At the conclusion of a later flight the airship made a very bad landing, however, and was completely wrecked.

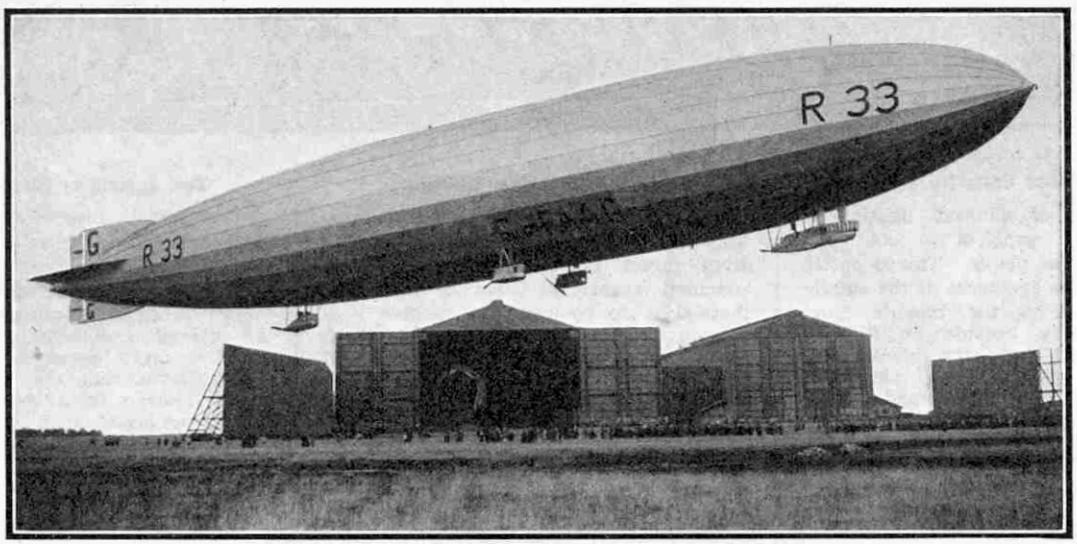
In the same year a smaller non-rigid airship that had been designed at Farnborough was completed. The envelope of this was of 75,000 cu. ft. capacity and was made by the Astra Company in Paris, but the car, with frame, was built in England. This car was of peculiar design, being flanked fore and aft by an extended framework to which the suspension ropes were connected. The car itself thus formed a central compartment and accommodated the crew and one 80 h.p. "Green" engine, driving metal propellers. The airship proved capable of attaining a speed of 28 m.p.h. but in other ways was not very satisfactory. Various alterations were carried out, including the substitution of two 45 h.p. "Iris" engines for the "Green" motor, and four-bladed wooden propellers for the metal ones. The "*Gamma*," as this airship was officially called, was in regular use until the envelope became so porous as to leak. In 1912 this envelope was replaced by a new one of 100,000 cu. ft. capacity and the airship was thus given a new lease of life.

Another British non-rigid airship that performed good work between 1910 and 1912 was the "*Beta*," a small dirigible of 35,000 cu. ft. capacity. The two twin-bladed wooden propellers were actuated by chains from a 30 h.p. "Green" motor, that was subsequently replaced by one of 100 h.p. The airship then attained a speed of 27 m.p.h. Several successful flights were carried out with the "*Beta*," including one from Farnborough to London and back.

In 1912 the "*Beta*" was practically re-built, and was fitted with a new car large enough to accommodate three persons and containing a 50 h.p. "Clerget" motor,

and a new envelope of 50,000 cu. ft. capacity. It then had a maximum speed of 35 m.p.h. and a flying range of 280 miles. After these improvements the airship was named "*Beta II*" and was considered by experts to be greatly superior to "*Beta I.*"

During 1912 the "*Delta*" was completed and put into commission. This British airship was also of the non-rigid class but was constructed on more ambitious lines than any of her predecessors. The envelope had a gas capacity of some 180,000 cu. ft. and a lifting force of 5½ tons. The "*Delta*" was capable of a maximum speed of 45 m.p.h. with a corresponding range of 350 miles, and was driven by two 100 h.p. "White" and "Poppe" engines. The car accommodated a crew of five. Like the "*Gamma*," the new airship was of streamline form and tapered considerably toward the stern. The "*Delta*" made history in several respects, wireless telegraphy experiments being successfully carried out from it on one occasion, while on another a parachute descent was safely accomplished.



The British rigid Airship R.33 ascending from Pulham Aerodrome. The streamlined form of the envelope is clearly indicated

The first rigid airship to be built in this country was constructed by Vickers Limited in 1911, to the order of the British Admiralty, and was known variously as the "*Mayfly*" and as "*Naval Airship No. 1.*" The twelve-sided envelope was 512 ft. in length and 48 ft. in diameter, and covered a lattice girder framework that was strengthened by 40 transverse frames spaced 12 ft. 6 in. apart. Inside the envelope were 17 small gas balloons representing a total of 660,000 cu. ft. of gas. The two cars slung 200 ft. beneath the envelope were built of Honduras mahogany, and each accommodated one 180 h.p. Wolseley motor. Two propellers attached to the front car were operated at 500 r.p.m. by the forward engine, through bevel gearing, while the engine in the rear car drove direct a 15 ft. propeller at 1,000 r.p.m. The "*Mayfly*" represented the expenditure of much thought and money but its career was very brief, for it was wrecked while being drawn from its hangar at Barrow-in-Furness.

British and French aeronautical experts continued to favour the non-rigid class of airship, and in 1913 the British Admiralty purchased an "Astra Torres" airship from the Astra Company, of France. Astra Torres airships are the invention of a Spanish engineer named Torres who, having unsuccessfully endeavoured to convince the Spanish Government of the merits of his invention, sought the co-operation of the Astra Company. The company decided to give Torres' invention a trial and a small dirigible of approximately 33,000 cu. ft. gas capacity was built to his design. The distinctive feature of the Astra Torres type of non-rigid airship is that practically the whole of the suspension system is arranged inside the envelope, in order to reduce to the minimum the air resistance set up by numerous external suspension ropes.

The purchased airship was 240 ft. in length and 46 ft. in diameter. It was the fastest in the world at that time, the two 200 h.p. Chenu motors being capable of developing a speed of more than 51 m.p.h. The suspended car accommodated a crew of seven. A second and slightly larger airship of the same type was purchased after the outbreak of war in 1914 and, together with the airship bought in 1913, was engaged in Channel patrol duty in connection with the transporting of troops to France.

The Zeppelin menace to our shores and the submarine menace to shipping soon made it imperative for England to equip herself with a considerable number of small airships for coastal patrol and escort duty. To meet this new demand a type of small non-rigid airship similar to the "*Delta*" was evolved. So urgent was the need for these airships that, in order to save time in constructing and assembling them, the necessary cars were obtained by removing the wings from a certain class of military aeroplane then being made in large numbers, and utilising the aeroplane bodies. The airships were officially styled the "S.S." or "Submarine Scout" class, but among the junior officers to whom they were entrusted they became known as "Blimps."

The first "Blimps" made were 143 ft. in length, and 27 ft. 9 in. in diameter at the widest part, with a gas capacity of 60,000 cu. ft. Their normal "ceiling" or flight altitude was 750 ft. but on more than one occasion a height of 6,000 ft. was attained. Various types of engines were fitted and in all cases a speed of over 50 m.p.h. was obtainable. New and improved types of "S.S." airships were produced from time to time, enabling increased speed and flying range to be attained.

The development of the non-rigid "Blimps" was followed in 1916 by the introduction of the "Coastal" class and, in 1917, of the "North Sea" type of British non-rigid airships. The "North Sea" craft were an improved edition of the "Coastal" class and were designed primarily to serve as scouts with the North Sea Fleet. These airships were designed on the Astra Torres principle, being tri-lobe in shape. They were of much stronger

(*Continued on page 499*)

A Pit Lamp that Casts No Shadows

The securing of efficient lighting is a more difficult problem in coal pits than in most other places. This is partly on account of the smallness of the candle power available in the miner's hand lamp, and partly because no diffused light is reflected from the black walls of the roads and working places. Many attempts have been made to secure improved lighting, and among the latest of these is one embodying an ingenious form of lamp glass known as the "Lumax" prismatic well glass. This glass gives a steady light all round the lamp by the simple method of cutting out the troublesome shadows of the protecting rods that are necessary in the lamp.

The outside surface of the cylindrical glass is of the ordinary smooth type, but the interior surface has vertical prism-like flutings. The rays of light from the interior do not pass straight through the lamp in the ordinary way, but strike the inner surface of the glass obliquely and are bent or refracted. The result is that some of the rays actually pass behind the protecting rods and, as these are placed very close to the glass, the shadow is practically non-existent. This is indicated in a striking manner in the two accompanying illustrations, in which is shown the remarkable change brought about by substituting the new glass for the old type in an ordinary miner's lamp.

* * * *

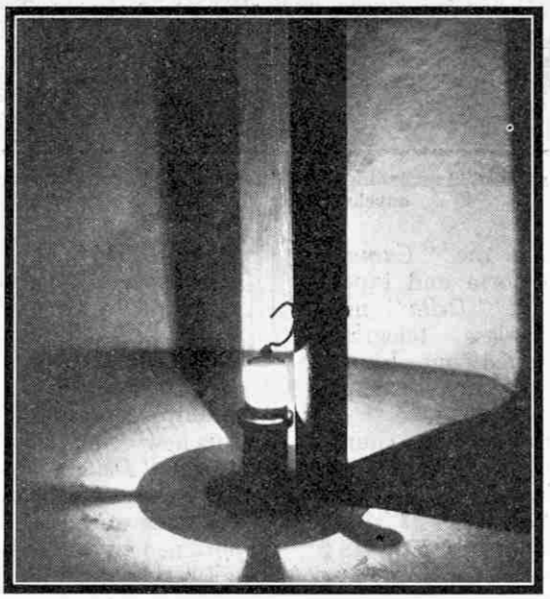
Electrified Car to Baffle Gunmen

The frequency of attacks by armed men in America on bank messengers and others carrying money has given rise to many elaborate protective schemes. Armoured motor cars with armed guards have been largely used, and now a special car body has been invented for the purpose by a Los Angeles man. In appearance this car resembles a one-man tank, except that the wheels are of the ordinary car type with puncture-proof tyres. The remainder of the car is completely sheathed in armour and bullet-proof glass, and it is surmounted by a revolving turret for a gunner armed with an automatic rifle. Finally a notice on the side, "Danger—keep distance," gives warning that the armour is electrically charged to a voltage sufficiently high to give a severe shock to anyone touching it. The whole car is under the control of the man in the turret, who has a clear view in all directions.

Interesting Wireless Inventions

An interesting method of obtaining high tension current for wireless receivers from direct current mains has been patented recently in Great Britain. The method is to connect the positive high tension terminals of the set to various points on a resistance coil, one end of which is connected to the positive terminal of the electric mains. The negative mains terminal and the negative high tension terminal are left free. It is claimed that this method of connecting mains to wireless sets avoids the hum and other undesirable effects due to current variation.

Another patent, which originates in Germany, deals with economy in low tension supply. The filament of the valve containing the new device is first heated by a battery in the usual manner and after that bombardment by positive ions maintains it at a sufficiently high temperature. In order to bring this about a grid electrode with a wide mesh is fixed in front of the filament and charged positively to an intermediate voltage. The result is that the positive ions of the gas in the valve are attracted towards the filament and keep it at a high temperature by the bombardment, the speed of the ions depending on the voltage.



Courtesy) *[Craig Ltd.*

Pit lamp fitted with ordinary glass, showing the shadows cast by the protecting rods. (Compare with illustration on next page)

Two Ingenious Electrical Fuses

The ordinary fuse wire used in electrical circuits is thoroughly reliable and efficient, but for certain purposes it does not act with quite sufficient rapidity. With the object of improving matters in this respect an interesting fuse has been introduced for use more especially with electrical apparatus that can do a great deal of damage in a short time if they become overheated.

Two flat metallic plates are included in the circuit that is to be protected and the current between them passes through a spring and a smaller plate attached to it. This third plate is soldered to one of the larger plates by an easily fusible metal and the whole is enclosed within a small tube in such a manner that the two larger plates are pulled slightly away from each other, thus placing a strain upon the spring. A short circuit or any other circumstance giving rise to overheating quickly melts the solder and the contraction of the spring results in the immediate breaking of the circuit.

Another interesting fuse provides protection against excess of current and also against a rise in temperature of the general surroundings. It may be used therefore as a guard for electric ovens and other apparatus in which electric heating to a definite maximum temperature is required. It is enclosed within a small glass tube with terminals at each end for insertion in a circuit. Inside the tube the two terminals are joined by a series arrangement that includes a length of suitable fuse wire, a helical spring to keep the wire in tension, and a short length of thick wire of an alloy that melts at a pre-arranged temperature. The temperature at which the device comes into operation may be varied within wide limits by a suitable choice of alloy.

* * * *

Amphibious Tugs

Tugs that are capable of travelling over land as well as water sound rather impossible, but they are actually in use in Ontario. These tugs are flat bottomed and are used for towing logs up lakes and rivers to the saw mills. In order to facilitate their overland progress they are fitted with iron-shod runners. On reaching land they pull themselves out of the water by means of a steel cable anchored to a tree or other solid object at one end and wound round a drum at the other.

Air as a Heat Insulator

Still air is quite a good insulator of heat and this property has been utilised recently in a practical manner. In order to obtain successful results the air is confined in thin layers to prevent the formation of convection currents, and experiments have proved that polished aluminium is the most suitable material within which to confine it. A polished material is best because it does not radiate or absorb heat so well as a roughened surface, and aluminium is specially valuable in this respect because it may be obtained in the form of extremely thin foil that will not conduct heat away in large amounts if it accidentally comes in contact with the hot material that is to be protected.

In making use of the method for insulating a steam pipe, for instance, a layer of aluminium foil is first wrapped around the pipe. Spacing rings of non-conducting material are then fitted at intervals so that a second layer of foil may be wrapped around the pipe, leaving between the two layers an air space of from 1 cm. to 2 cm. in width. Around this other layers of foil are wrapped with similar air spaces between them, the actual number depending upon the degree of heat insulation required. In dealing with joints and valves it is sufficient to wrap the foil loosely round.

One great advantage of this kind of insulation is its light weight, which works out at less than one-tenth of that involved by the more usual methods of packing. In addition, aluminium is not subject to corrosion by air and moisture, and its resistance to the action of water makes it specially valuable for the insulation of underground steam pipes.

* * * *

A Gentle Reminder

An ingenious contrivance, calculated to prevent absent-minded travellers from forgetting their hand luggage when buying their tickets, has been introduced recently at the New Union Station of the Canadian National Railways at Toronto, which was opened not long ago by the Prince of Wales. The apparatus consists of a narrow luggage rack, scarcely wide enough to hold an ordinary suitcase, fixed in front of the ticket counter at a point knee-high from the ground. While purchasing his ticket the traveller steadies his bag on this support with his knee, and if he forgets his bag and commences to move off the bag falls to the ground and draws his attention to it before it is too late.

* * * *

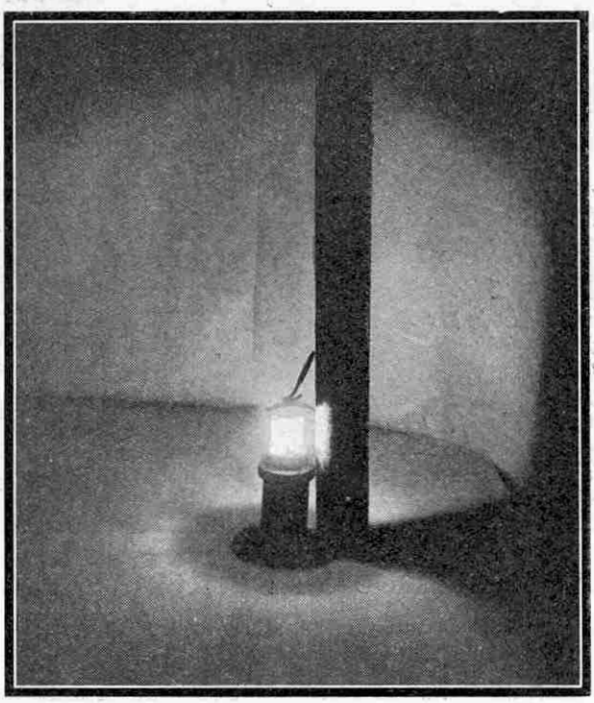
Self Switching Bell Wire

A Hungarian inventor has patented a type of flex wire for electric bells that does away with the necessity for a push button. The two wires inside the new flex are brought into contact at any point in its length merely by squeezing, and separate again immediately pressure is released. Many other useful applications of this invention are possible, one that has been suggested being for giving automatic signals of such events as the fall of rock in mines.

Invisible Light to Protect Safes

An account was given in these columns in August, 1927, of a hidden camera actuated by a secret switch that was used to obtain photographs of burglars or other unauthorised intruders. The switch was placed where it was almost certain to be touched, but in a new form of the device it may be replaced by a photo-electric cell.

A beam of light passes across the room in which the camera is placed and falls on a photo-electric cell in connection with the mechanism of the camera. When the burglar, in passing, prevents the beam from reaching the cell the camera is operated through a relay, while extinguishing the light altogether causes the camera to take pictures continuously until the film is exhausted. Safes and strongroom doors may be completely guarded by using several such beams, while the use of a cell sensitive to invisible infra-red rays will help to prevent interference of any kind.



Courtesy [*Ceag Ltd.*

Lamp fitted with "Lumax" glass, showing how the rod shadows are almost entirely eliminated (see previous page)

* * * *

A Plough that Electrifies the Soil

Among the latest agricultural inventions is an electric plough. This plough turns over the soil in the ordinary manner, but in addition it has an electric generator attached to the blades in such a manner that, to use the words of the inventor, "an electrical field is created between them, producing an effect like lightning."

The effect of this combined treatment of the soil is to kill insect pests and weeds. It is also claimed that atmospheric nitrogen is "fixed" in the soil at the same time. Nitrates and other nitrogen compounds are, of course, excellent fertilisers, and one method of making them now largely employed is by means of an electric arc in a current of air. This causes the nitrogen and oxygen to combine, and apparently the inventor claims that the same process takes place in the soil itself as it is turned over by his plough.

Rotating Lift for Garages

An ingenious lift has been invented to suit the conditions now met with in garages. The value of land and the increase in the number of cars now running in this and in other countries have between them made one-floor garages uneconomical and lifts are necessary to take the cars to the upper floors of the garages now coming into use. A lift of the ordinary kind is really unsuitable for such a purpose as any particular car wanted may be behind a number of others and in any case it often requires much manœuvring to get it into position to go on the lift.

The lift invented to avoid this is of circular design and may be moved round as well as up and down. On each floor of the garage a steel structure with one door is built round the lift proper and these doors also can be rotated. A car from the street requiring garage room is run on to the lift and carried up to the floor on which a compartment is available. The lift is then rotated until its door is opposite the empty compartment, and the steel structure is also rotated to bring the two doors together, when the car can be run off the lift. The mechanism prevents the lift from moving until the doors of the lift and of the revolving structures on each floor are locked.

The "turn lift," as this invention has been named, is said to cost only about 10 per cent. more than an ordinary fixed lift, an extra cost that is by no means excessive in view of the economy in space that will result from the better packing of cars on as many floors as necessary. The whole apparatus is electrically driven and operated.

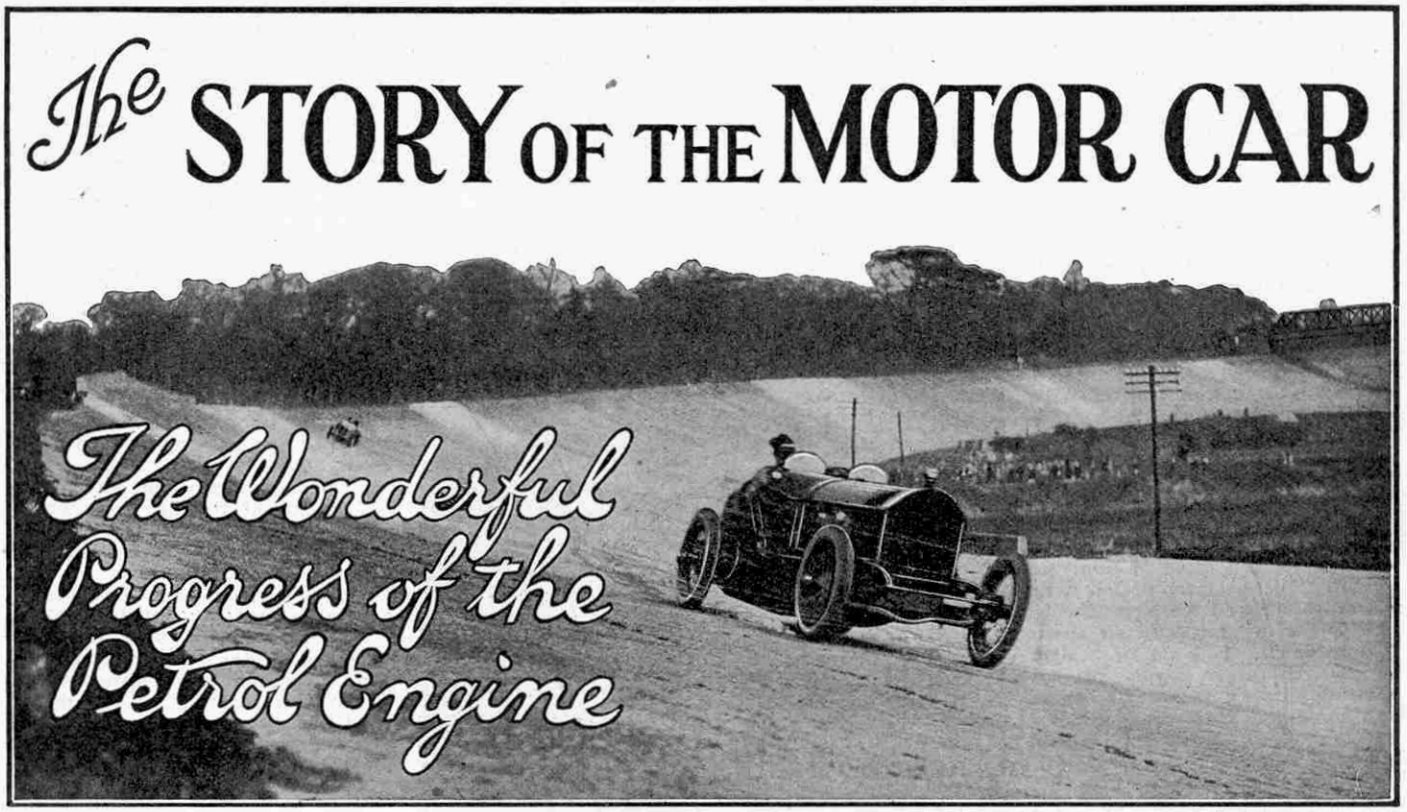
* * * *

A New Type of Cinema Screen

An interesting invention in the cinematograph world is a screen that gives the effect of depth without necessitating the employment of two lenses or anything in the nature of stereographic apparatus. A screen of white muslin is first backed with a flexible black paint to fill up the pores. On this paint millions of smooth, tiny glass particles are then fixed by means of a transparent varnish, and these particles are covered with a second layer of varnish. It will thus be seen that the surface is not flat but consists of an enormous number of spherical reflecting surfaces packed closely together, giving an appearance of depth to the screen.

The glass particles are no larger than pin heads but they bring about a great transformation, making it possible to obtain a good view of pictures from the side as well as from the front of the screen of which they form a part. If one stands at the side and very nearly in the same plane as the screen itself, it is possible to read the letters of the titles quite easily, for there is no distortion. In addition, the danger of eye strain due to flicker is greatly diminished. It has been found also that the reflecting power of the screen is very great and thus less current is needed in projectors used in conjunction with it.

The STORY OF THE MOTOR CAR



IV.—HOW ELECTRICAL METHODS MADE RELIABLE IGNITION POSSIBLE

In last month's article we described how the charge of the explosive mixture that is the source of power in the internal combustion engine is introduced into the cylinder.

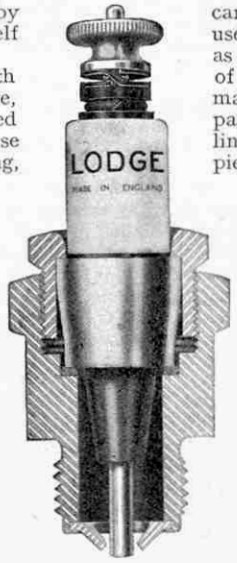
We now come to the problem of bringing about the explosions at the rate of 4,000 per minute and the two electrical methods by means of which this problem is solved.

A HISTORY of the methods of igniting the explosive mixture in an internal combustion engine would commence with the clumsy coil and primary battery used by Lenoir in the first practical engine of this kind ever made, and the porcelain or platinum tube favoured by Panhard. It would include accounts of electrical systems using primary and secondary batteries, of others using small dynamos driven by the engine, and of some that used both methods in the belief that neither was reliable in all conditions. The two methods now most widely used on motor cars would then be described—namely, ignition by magneto or by coil and accumulator—and finally would come the remarkable development whereby the mixture in a heavy oil engine is made to ignite itself with certainty at the correct moment.

In the present article it is not intended to deal with the pioneer methods of ignition, interesting as these were, but to describe methods that have been well established after long trial. These are entirely electrical, and the use of electricity has been further extended to include lighting, engine-starting, horn-blowing and windscreen-wiping.

The first of the two methods that are of importance to-day makes use of what is known as the magneto. This is a magneto-electric machine, driven by the engine, and producing high-tension current, that is current at the high voltage necessary for causing a spark to pass across the space between two terminals in the explosive mixture. The magneto is entirely self-contained, for by magnetic induction it first produces low-tension current, then transforms this into high-tension current, and finally distributes this current to the plugs in the cylinders as required. Constant attention to design has made this instrument so efficient and reliable that it has practically displaced all other methods, and its supremacy has never been seriously threatened until quite recently by the advent of reliable coil and accumulator ignition.

The low voltage current is produced in the magneto by the rotation of a coil of wire in a magnetic field. Readers of the various articles on electricity that have appeared from time to time in the "*M.M.*" will be well aware that a current is induced in a wire that cuts across the lines of force in a magnetic field. In the case of the magneto this field is provided by permanent magnets of the horse-shoe type. These are made of a special steel alloy of great hardness, which retains its magnetism for a long period, and separate pole-pieces are usually bolted on to fit closely to the armature in order to give a magnetic field in which the lines are concentrated as much as possible in the space in which the coil rotates.



Section of plug showing central electrode

The armature is a piece of metal of H-shaped cross section and rotates between the pole pieces at high speed. It carries the primary coil wound in the recesses. The material used in its construction is soft iron and in addition to acting as support for the primary coil, it serves the useful purpose of concentrating the lines of force. Experiments with magnets and iron filings on the lines of those described on page 1081 of the December "*M.M.*" prove that magnetic lines of force tend to become crowded together in any piece of soft iron placed in a magnetic field. The effect of winding the insulated coil upon a soft iron armature is therefore to bring a larger number of lines of force into the path of the rotating wire and so to produce the maximum current.

Another point worth noting is that the core of the armature is built up from thin plates or laminations instead of being made in one piece. This keeps the magnitude of stray current induced in the metal as low as possible, and thus prevents energy losses. These stray currents, which are known as eddy currents, act as a brake and interfere with the current we desire to employ.

The primary coil or winding is of comparatively thick wire and has a small number of turns. One end is connected to the armature itself while the other is taken through the hollow spindle to a fixed terminal on an important part of the magneto known as the contact breaker, which rotates with the armature. The fixed terminal is insulated and fitted with a platinum-pointed screw. Normally another platinum

point is in contact with this, the second point being carried on the arm of a rocker and pressed against the first by the action of a spring. The rocker is in electrical connection with the armature.

So long as the points are touching, the primary winding is shorted through the armature. As the contact breaker revolves, however, the points are momentarily separated at intervals, this being brought about by the action of a projection or cam on the inner surface of the casing, known as the cam ring, under which the contact breaker revolves. A fibre block on one end of the rocker is depressed when it comes into contact with the internal cam, simultaneously raising the platinum point on the other end. The spring already mentioned brings the points into contact once more immediately the fibre block has passed the cam.

As the contact between the points is made or broken, so the current in the primary coil is started or stopped, and consequently momentary currents are induced in the secondary coil wound over the primary. This is a finer wire and has a very large number of turns, with the result that the voltage of the current induced is far greater than that of the current in the primary coil and is sufficient to cause the spark to jump across the gap provided on the sparking plug.

It may be noted here that although the platinum surfaces periodically separated by the action of the cam and rocker are known technically as "points," they are in reality flat and circular. As they separate, a spark is formed between them, and if they were points the sparking would be excessive and damage would quickly result.

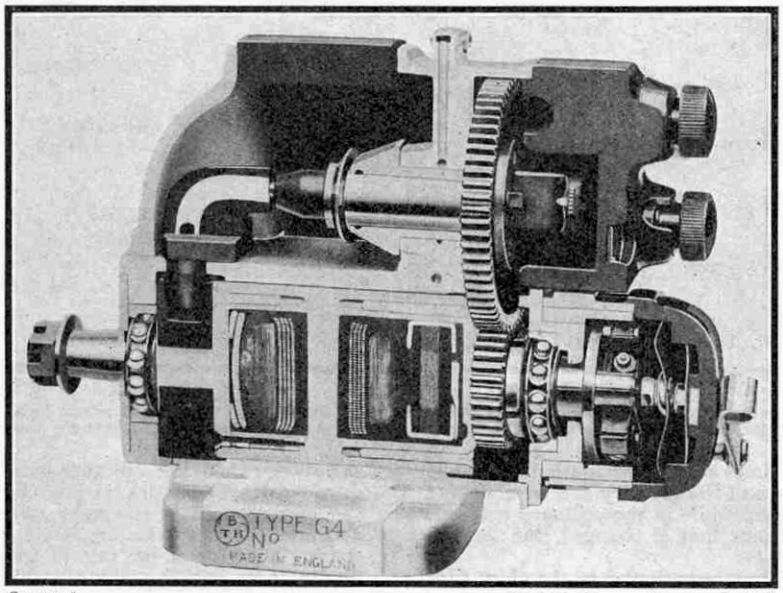
It will be seen that in principle this portion of a magneto is an induction coil. The chief difference between the two is in the rate at which the make and break is carried out. In an induction coil the current in the primary is started and stopped with great rapidity, giving practically an alternating current in the secondary coil. In the case of a four-cylinder engine, in which there are two explosions in each revolution, the number of sparks required is restricted to two per revolution, and these must pass near the ends of the compression strokes, as explained last month. Accordingly the magneto armature must be so geared to the crankshaft that the fibre block comes into contact with the cams on the casing at the required moment only. The number of cams depends on the speed at which the armature is rotating. Usually it rotates at the same speed as the crankshaft, and in that case two cams must be provided in order to break contact twice in each revolution. The two cams in this case must be exactly opposite each other.

In order to secure the best results, the primary winding should be cutting the lines of force at the greatest rate possible at the moment when the spark is required. This condition is easily satisfied by using the H-shaped armature, as it can be arranged that the recesses are at that moment in the position where the movement of the coil is at right-angles to the direction of the lines of force between the poles of the magnets.

As explained last week, some mechanism for varying the time of the spark must be incorporated. This is by no means difficult. If the casing that carries the cams is moved round a little in order that the fibre block makes contact with the cams a little earlier, then the spark will take place a little earlier during the compression stroke in the cylinder, since the magneto drive is geared to the crankshaft. The rotation required is limited and is controlled by the ignition lever in such a manner that the explosion can be made to occur at any required time.

One of the disadvantages of the magneto is that retarding the spark lessens its energy. The armature winding can only cut the lines of force at the maximum rate in one timing position, and this is usually arranged to be when the ignition is fully advanced.

The high-tension current thus induced must be supplied to the various cylinders. One end of the secondary winding in which it originates is connected to the armature and is therefore earthed, while the other end leads to an insulated brass collector ring mounted on the armature spindle. A carbon rod, or brush as it is usually called, is kept by a spring in contact with the rotating ring in order to collect the current and conduct it to the distributor. Assuming again that we are dealing with a four-cylinder engine, the distributor consists of four separate brass segments arranged in a ring on the inside of a circular body of insulating material. Each segment is connected to a terminal on the outer casing of the magneto, the terminals in turn being connected by flexible wiring to the plugs in the cylinders. A rotating brass strip in electrical connection with the collecting brush is rotated by gearing from the armature drive and makes contact with each segment in turn.



Courtesy [*British Thomson-Houston Co. Ltd.*

Sectional photograph of an ordinary type of magneto with magnets removed to reveal the interior. The position of the coils on the rotating armature is clearly seen, as are also the collecting brush and lead to the distributor.

The make and break occurs once during each contact between the rotating strip and a segment, and thus a spark is fired in each cylinder in turn. It will be noticed that the distributor shaft must be geared to rotate at half speed only, for four contacts are made and therefore four sparks will pass during each revolution. This means that there are four sparks in two revolutions of the crankshaft or one spark for each stroke of the engine.

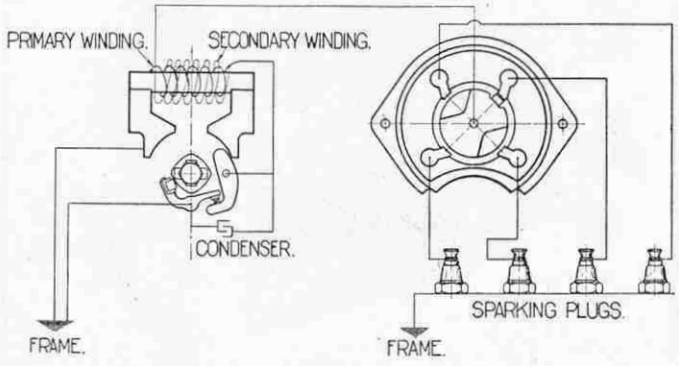


Diagram showing the primary and secondary circuits in the magneto and distributor of a four-cylinder engine

In the case of a six-cylinder engine there will be six segments in the distributor, and the distributor shaft is again driven at half the speed of the crankshaft, in order that the number of power impulses shall be six in two revolutions of the crankshaft. In order to produce six sparks in two revolutions, six interruptions must be brought about by the contact breaker in the same period. This is done by driving the armature at one-and-a-half times engine speed.

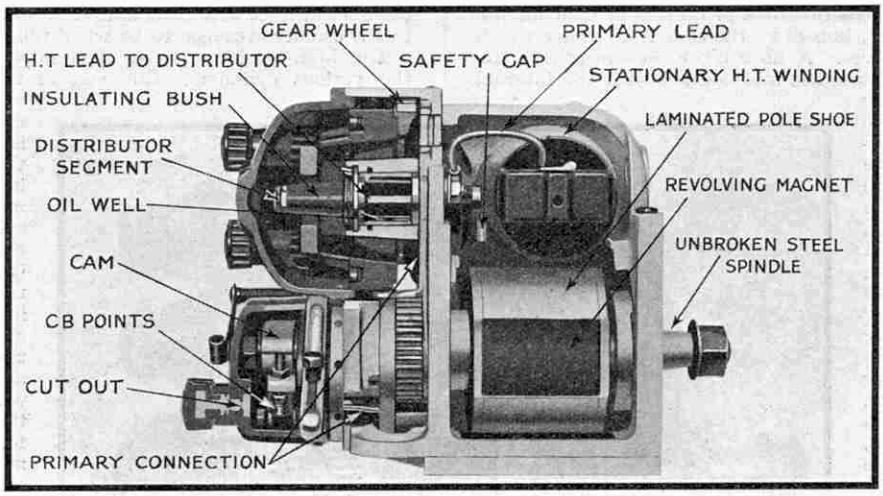
The terminals on the magneto are not connected to the plugs in the cylinders in the same order. It will be remembered from the article in the March number that the usual firing order in a four-cylinder engine is 1, 3, 4, 2, and the successive segments of the distributor therefore must be connected to the plugs in the cylinders in this order. In a six-cylinder engine the number of segments is six and the connections to the cylinders are made to give sparks in the order 1, 4, 2, 6, 3, 5, or the reverse.

When we come to deal with engines of more cylinders than six the wiring becomes complicated. In the case of an eight-cylinder engine the customary order is 1, 5, 2, 3, 8, 4, 7, 6 for a straight engine, and 1, 4 ; 3, 2 ; 4, 1 ; 2, 3 for a V-shaped engine, the numbers denoting cylinders in the right-hand and left-hand blocks alternately. Twelve cylinder engines are usually constructed in two sets of six cylinders each, and in this case the order is 1, 6; 4, 3;

2, 5; 6, 1; 3, 4; 5, 2, again alternating from right to left.

A great improvement in the magnets used to provide the field in magnetos has been made in recent years. They are now constructed of a special steel alloy containing cobalt, which can be made more strongly magnetic than ordinary steel, so that it is not necessary to make them so large as was formerly the case.

A further improvement is the introduction of what is known as the polar inductor type of magneto, in which the magnets are rotated instead of the coils. In the usual form of this instrument two magnets are pivoted on the rotating magneto spindle in such a manner that two of their four poles, one a north pole and the other south, fit closely to the laminated pole-pieces of the core of the stationary coils and produce lines of force that pass through the core. When the magnets are rotated, poles of opposite kinds pass each end of the core in succession, so that the direction of the lines of force in it is changed four times in each revolution. Current is thus produced in the windings of the primary coil by changing the direction of the lines of force, while in the ordinary magneto it is the direction of the windings that is changed, the lines of force remaining stationary.



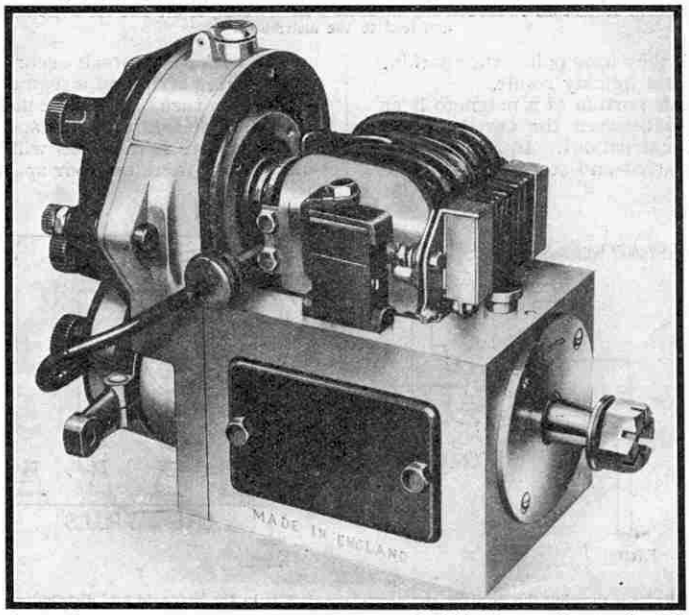
Courtesy [*S. Smith & Co. (M.A.) Ltd.*

Polar inductor type of magneto. The magnets are mounted on the magneto shaft and rotated in order to change the direction of the lines of force and thus produce current in the stationary coils seen in the illustration

In other respects the polar inductor is similar to the older type and includes primary and secondary windings, contact breaker and distributor. The contact breaker does not revolve, however, and usually current is led into the segments of the distributor across a small air-gap, thus avoiding the use of frictional contacts.

The great advantage of the polar inductor is that it gives four sparks in each revolution, whereas the ordinary type of magneto only gives two. The importance of this may be seen by considering the case of a six-cylinder engine. Six sparks are required in two revolutions of the crankshaft, and in order to obtain this number the magneto shaft must be rotated three times. Thus it is necessary to drive this shaft at 1½ times engine speed, whereas with the polar inductor the same effect may be obtained by driving it at ¾ times engine speed only. This means that a polar inductor running at 2,000 revolutions per minute will serve the same purpose as an ordinary magneto making 4,000 revolutions in the same time, a rate that is often required from a magneto in these days of high-speed engines. Wear and tear and the risk of mechanical breakdown are thus reduced when the new type of magneto is employed. A further advantage is that the high tension current is taken direct to the distributor instead of through a rotating contact, thus avoiding internal leakage troubles.

The sparking plug is the final item in the firing mechanism. In principle it is very simple. The plug body screws into an orifice in the cylinder and carries two metallic terminals, usually called electrodes. One of these is attached to the metallic body of the plug and is in electrical contact with the cylinder block, thus being earthed in the same way as one end of the secondary winding.



Courtesy [*British Thomson-Houston Co. Ltd.*

Another view of a polar inductor type of magneto, showing the stationary coils and the lead to the distributor. The rotating magnets are in the lower part of the casing

The other electrode usually takes the form of a rod passing straight through the plug, and is insulated. It is this insulated electrode that is in connection with one of the segments of the distributor. The two electrodes are placed so close together that the high voltage current is capable of bridging them by a spark.

A moment's reflection will show that the passage of the spark is all that is needed to complete a circuit for the high-tension current. Commencing with the earthed end of the secondary coil, the path may be traced through the coil to the brass collector ring and then by way of the carbon brush and distributor to the insulated electrode of the plug, while the other electrode is earthed. At the moment determined by the action of the contact breaker, therefore, a spark will flash across the terminals and the distributor ensures that this takes place in the correct cylinder.

The plug is the weakest link in this chain, and this is not surprising when the circumstances in which it must work are considered. The spark is produced by a high-tension current, the insulation of which is by no means a simple problem. In addition, the electrodes are liable to be severely corroded by hot sparks that pass at the rate of 1,000 per minute in the case of a four-cylinder engine making 2,000 revolutions per minute. The plug itself is the origin and centre of the explosion in the cylinder and is thus called upon to withstand the effects of a very high temperature. The problem of how to make reliable plugs has not been a very easy one to solve, but after years of experiment and research it may be said that the plug has outlived the bad reputation it earned in the early days of motoring, and that it is capable of an astonishing amount of hard work.

Three parts go to make up a complete plug. These are the central electrode, the insulator and the body. The body is usually made of steel and fits into a threaded opening left for it in the cylinder block. As already mentioned, it carries the earthed electrode. The other electrode is held centrally in the insulating material that intervenes between it and the body of the plug. The insulator is made either of porcelain or of mica rings clamped together. In either case the material used must be of the highest quality in order to withstand the effects of heat, and the design must be such that there is a long surface leakage path in order to make the insulation effective. Cracks developed in the material by changes in temperature result in loss of efficiency by providing paths along which leakage may take place.

The central electrode is in electrical connection with a brass terminal at the top of the plug to which the wire from the distributor is connected. As a rule the electrodes are made of nickel steel, the best material for standing up to the disintegrating effects of the spark. The distance between them must be carefully adjusted to about 20 thousandths of an inch in order to obtain the best results, and as they burn away because of the heavy sparking

between them, the gap must be reduced at frequent intervals.

To stop an engine all that is necessary is to cut off the current supply from the magneto. For this purpose an insulated strip of springy brass on the contact breaker cover is in connection with the primary winding and also with an earthing switch on the dashboard. Closing the switch renders the make and break useless and no current is induced in the high-tension winding until the switch is opened once more. Thus the process of "switching on" an engine is really one of switching off the earth connection.

Two important accessory parts of the magneto whose functions may now be explained are the safety spark gap and the condenser. The former is used to protect the armature winding. When the magneto is driven at high speeds the current generated is very powerful, particularly at the moment when the primary winding is cutting across the magnetic field at right-angles. If by any chance a high-tension wire becomes detached from one of the sparking plugs, or some other event prevents this current from taking a normal path, the probability is that the current will find its way to earth by breaking down the insulation of the winding. To prevent this from happening a safety spark gap is provided in the high-tension circuit. The points of this gap are about $\frac{3}{8}$ in. apart and one is earthed. So long as the much narrower sparking plug gap is available, the current will find its way to earth across it and will only choose the wider safety gap in the circumstances already noted.

The condenser serves the double purpose of preventing damage to the points of the contact breaker and of intensifying the sparking current. When the points begin to separate there is a tendency for the current in the primary circuit to jump across the gap, and if this were allowed the sparking that would result would eventually burn the points away.

The condenser works on principles that are now well known from wireless practice. It consists of two plates separated by air or some other non-conductor, several pairs of plates being commonly used instead of one large pair in order to save space. Such a condenser is placed across the gap, so that one set of plates is earthed while the other is connected to the primary winding. When the points separate, the current charges up the plates instead of sparking across the points. The electricity thus stored rebounds and traverses the primary in the opposite direction, this extra current intensifying the effect in the secondary coil, as this is obviously dependent on the magnitude of the current in the primary. When contact is re-made, the condenser absorbs some of the current in becoming charged once more, and thus very little effect is produced in the secondary.

The chief value of the magneto is that it gives a hot fat spark that is admirably suited to the requirements of the internal combustion engine. Its chief drawbacks are that it does not give a good spark when the engine is running at low speed, or when ignition is retarded, and that it serves no other purpose with any measurable efficiency. On that account coil ignition making use of current from accumulators is now coming into use. The ignition process is exactly like magneto ignition, except that machinery for inducing the primary current is not required. The contact breaker and the distributor remain and are driven directly or indirectly from the crankshaft in order that timing of the spark may be effected.

The re-introduction of this method is of great interest. It was used 25 or 30 years ago but fell into disrepute, mainly because of the difficulty of keeping the crude accumulators of that time in good condition. They were charged at irregular intervals and their requirements were very little understood. It was not surprising, therefore, that the introduction of a reliable self-contained mechanical unit such as the magneto resulted in the complete abandonment of messy chemical storage methods.

A remarkable picture showing the wonderful escape of C. Wilkinson in the Ulster Automobile Club's Speed Trials at Magilligan Strand, Londonderry. Mr. Wilkinson, after he had won his class race turned sharply at speed, overturning at the same time, fortunately receiving only slight injuries

To-day the position is completely changed. Continuous scientific study of accumulator construction has led to the production of types to suit all purposes. Charging is now regularly carried on with the aid of self-regulated dynamo electric machinery driven by the engine itself and practically every disadvantage that caused the substitution of the magneto has now been overcome. Battery ignition has been particularly favoured in the United States, where no less than 78 per cent. of cars were so fitted as early as 1920.

The change is not proceeding with such great rapidity in Great Britain, but the modern trend of car design seems to be in the direction of the ultimate abolition of the magneto. The coil is equal to it in general efficiency and has the great advantage that the energy of the spark is constant, being unaffected by the speed of the engine or the retarding of the ignition. A further great advantage is that coil ignition may be made part of a comprehensive electrical equipment. The applications of electricity in the modern car are of very great interest indeed and will be dealt with in a later article in this series, which will explain how it is used for starting engines as well as for providing light.

Hunting Red Deer—*(continued from page 501)*

the snow fell it was a boon companion. I fed it, and Laddie fed it, and even Dash, our dog, came to love it! Christmas came along with its joyous festivities and our dear friends would have us share it with them. But a fellow can't take a deer visiting very well, so we left Nimrod food and water, shut it up in its pen yard and shut Dash in his. When we returned home, about midnight, Laddie rushed off ahead to greet "Nimmie" as he called it. I was behind him when I heard him let out a yell of anguish and fall down on the straw of the pen-yard. I thought at first he was taken suddenly ill and I leaped in and grabbed him. He had "Nimmy's" head in his arms and he was sobbing as if his heart would break, and poor Nimmy was stone cold in death. My old eyes blurred and we sat there and wondered what had cut off its short life strand. Alas! We had overfed it and it had died from indigestion.

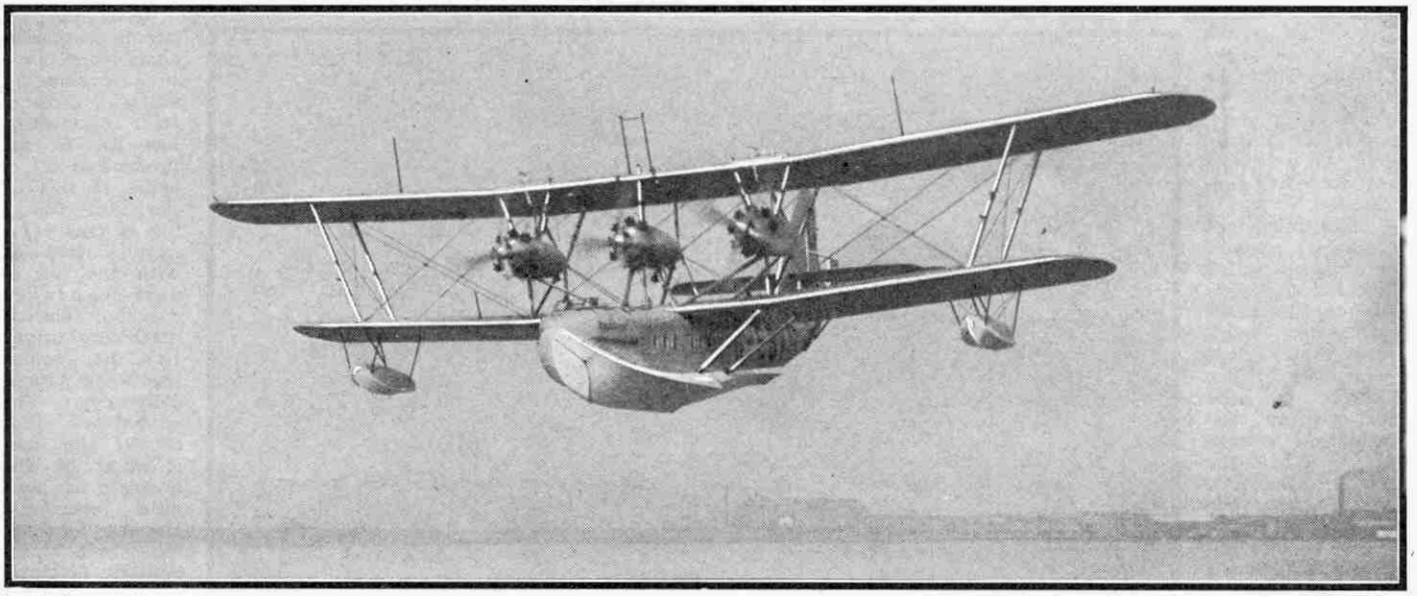
We covered the body of our pet with straw and next morning I got an Indian to take it far out to sea in his canoe and throw it into the tide. Laddie and I stood at the door and watched the canoe's wavering path across the calm water. At last there came a splash and an ominous circle in the water, and poor "Nimmy" had gone, leaving two sorrowful hearts.

* * * *

[We have to thank the Editor of the "*Canadian National Railways Magazine*" for permission to reprint the above story, and for the loan of the blocks.—EDITOR, "*M.M.*"]

Short "*Calcutta*" Boat Seaplane

A Notable Passenger Craft



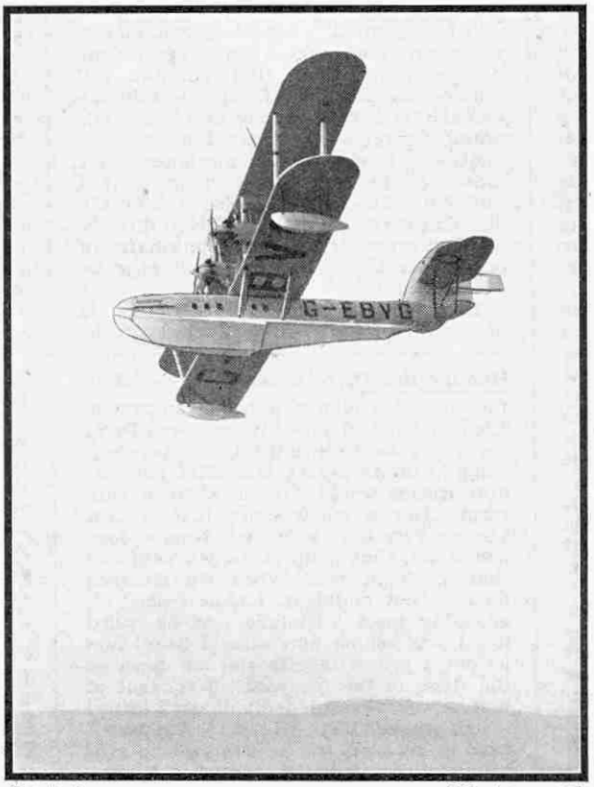
Courtesy] [*Short Bros. Ltd.*

The Short "*Calcutta*" flying boat about to alight. The photograph gives an excellent impression of the unusually graceful lines of the machine

ONE of the most interesting recent events in the aviation world was the launching at Rochester of the first British all-metal passenger flying boat. This was the Short "*Calcutta*" commercial boat seaplane built to the order of the Air Ministry for operation by Imperial Airways.

The "*Calcutta*" has many noteworthy features. The aim of the constructors has been to produce an aircraft fulfilling all modern requirements in regard to passenger accommodation combined with the securing of maximum safety. The machine is fitted with three engines, on any two of which it will fly comfortably, thus practically ruling out the possibility of a forced landing. The entire structure is of metal with the exception of the covering surfaces. Duralumin is the metal used, in conjunction with fittings of stainless steel, and the result is a sound engineering job of the greatest possible reliability.

Special attention has been paid to the water performance of the hull, the lines of which have been developed as the result of considerable research in Short Bros. testing tank, and it is claimed by the makers that the water performance attained is unequalled by any other flying boat.



Courtesy] [*Short Bros. Ltd.*

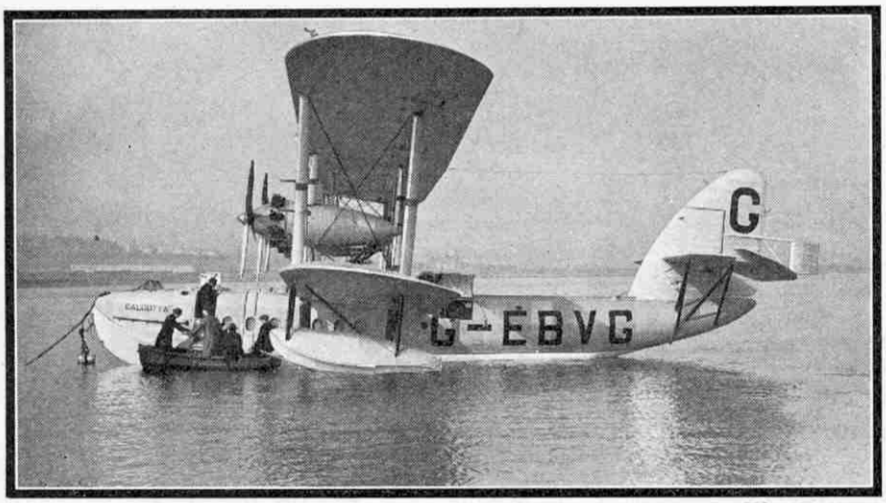
The "*Calcutta*" on a trial flight over the River Medway. The viewpoint shows clearly the underside construction

The three Bristol "Jupiter" engines each develop 485 h.p. at 2,000 r.p.m., and are mounted in line in separate nacelles between the planes and arranged as tractors. The oil tanks are situated in the nacelles and are connected up to the external oil coolers. A Bristol engine starter is installed in the centre nacelle coupled to all three engines. This starting engine has been arranged also to drive a mechanical bilge pump and the general purpose dynamo for lighting and wireless services when the main engines are not running. The petrol is carried in two tanks in the upper plane, the engines being fed entirely by gravity, and the system is so arranged that any engine can be fed from either tank.

Particular care has been taken with the design of the hull arrangements. The pilots are accommodated side by side in a roomy cockpit in the bow, from which position an excellent view is obtained in all directions. The starboard control column is made detachable so that the assistant pilot is able

to obtain access to the extreme bow for mooring purposes, a hinged hatch being provided to facilitate operations.

The second pilot, who also combines the duties of wireless operator, is provided with a compartment immediately aft of the pilot's cockpit and shut off from it by a roller blind. This compartment contains all the wireless instruments, drawers for charts, etc. Under normal atmospheric conditions the range of the wireless transmitter from the aircraft to the ground, with good readable signals, is approximately from 300 to 400 miles for telegraphy and from 200 to 250 miles for telephony. An emergency aerial is fitted on a telescopic mast attached to the upper plane for use when the boat is moored in harbour or makes a forced landing. In addition, the boat is fitted with Bellini-Tosi direction-finding apparatus.



Courtesy] [*Short Bros. Ltd.*

The "*Calcutta*" at its moorings in the Medway. This photograph gives a good idea of the enormous size of the machine in proportion to the boat and the men. The small object on the tip of the upper wing is the port side navigation light

The main passenger cabin is very roomy, being 17 ft. in length, 6 ft. 6 in. in width and 6 ft. 3 in. in height. Normally the passengers are arranged in rows of three with a gangway slightly off the centre. The comfortable upholstered seats are constructed of metal and are fitted with cushions designed to be used as lifebelts in case of emergency. In addition each seat is fitted with a convenient collapsible table.

The seats and the lower portion of the sides of the cabin are covered with antique pattern leather and the roof with a wool head-lining. The sides of the cabin are provided with large plate glass windows that ensure an excellent view for every passenger. Along the top of the cabin is fitted a duct, which carries the lighting cables and also serves as the fresh air duct. It is connected by pipes leading to the cowls fitted in the hull and the supply of fresh air is regulated by means of valves fitted on the underside of the duct. At the rear end of the cabin is a buffet in charge of a steward and complete with oil cookers and ice chest for the provision of either hot or cold refreshments. Another feature of considerable interest to passengers is that no petrol is carried anywhere in the vicinity of the hull, so that smoking can be indulged in without running any risk of setting the machine on fire.

The passengers enter the cabin through a specially designed hatch at the forward end, arranged so that they can step direct from the flying boat to the quay to which it is moored. A separate hatch is provided aft for loading luggage, so that passengers and baggage can be embarked simultaneously, thus effecting an appreciable saving in time.

The overall length of the "*Calcutta*," including the Servo rudder, is 64 ft. 9 in., and its overall height 22 ft. 3 in. The overall spans of the upper and the lower planes are respectively 93 ft. and 76 ft. 6 in. The surface area of the main planes, including ailerons, is 1,825 sq. ft. The weight of the boat when fully loaded is 20,200 lb. and its empty weight 12,600 lb., leaving 7,600 lb. available for load. Normally an allowance of 3,540 lb. is made for 15 passengers, baggage, food and water. The maximum speed of the machine at sea level is 126 m.p.h. At a cruising speed of 100 m.p.h., with a petrol supply of 320 gallons, the range is 500 miles, and this figure can be increased to 740 miles by taking on board 480 gallons of petrol, with, of course, a correspondingly smaller load. The machine is capable of climbing at 750 ft. per minute at sea level and has a service ceiling of 13,500 ft.

A specially designed beaching chassis has been built to facilitate the transporting of the "*Calcutta*" on land.

Some Engine

The talk in the grill room turned to big locomotives.

One of the guests said he believed he had seen the largest engine on record during a recent trip to Atlanta, and proceeded to describe it as follows :—

" This engine," he said, " has five acres of grate bars, four acres of netting in the smoke-box and it takes a man a day and a half to walk through the cylinders. Every time the engine exhausts, it rains for twenty minutes afterwards. There is an elevator that goes to the headlight to hoist oil and it requires five barrels to fill it. It takes two men forty-five minutes to light one signal lamp.

" They use a steam shovel to give her coal ; the tank holds twenty-seven carloads, and every time they wash the boiler it is necessary to drain the Gulf of Mexico, and transportation is held up for several days. The pony wheels are as large as an ordinary turntable and the engine house forces hold a picnic each year in the fire box. She carries 850 pounds of steam in her boiler and 360 pounds of air in her train line. She can haul 722 loads in good weather and seventy-two in bad weather. She runs from Atlanta to New Orleans, a distance of 475 miles, and makes the trip in two hours and eleven minutes.

" While the tank was being filled, one of the pumpers fell into the tank. The injector was on at the time and the enormous suction drew the poor labourer through the water main (60 inches in diameter) which led to the injector. He was discovered bobbing up and down in the water glass, and it had to be broken with a 25 pound sledge hammer to release him.

" The engineer was called to take out this locomotive, and on arrival at the roundhouse, found he only had 40 pounds of steam, and he remarked to the negro fireman as to why he could not get up steam, and the fireman said : ' Cap'n, da's the third time dat gauge has gone round and it's just started ' round again.' " —" Pennsylvania News."

New Meccano Models—(*continued from p.* 521)

upper Bracket. His head (a 1" Pulley Wheel with set-screw) is fastened to a bolt passed through the Flat Bracket that serves as his " neck."

The construction of the schoolmaster is quite clear, but it may be mentioned that the 2" Axle Rod forming his " cane " is simply pushed between the 2½" Strips representing his arms and secured in position by screwing up the ⅜" Bolt that can be seen in the illustration. By slight adjustments to the positions of the figures, the character of the scene can be changed entirely, and some very humorous effects obtained.

How the "Electric Hare" Works

The Mechanism of a Greyhound Racing Track

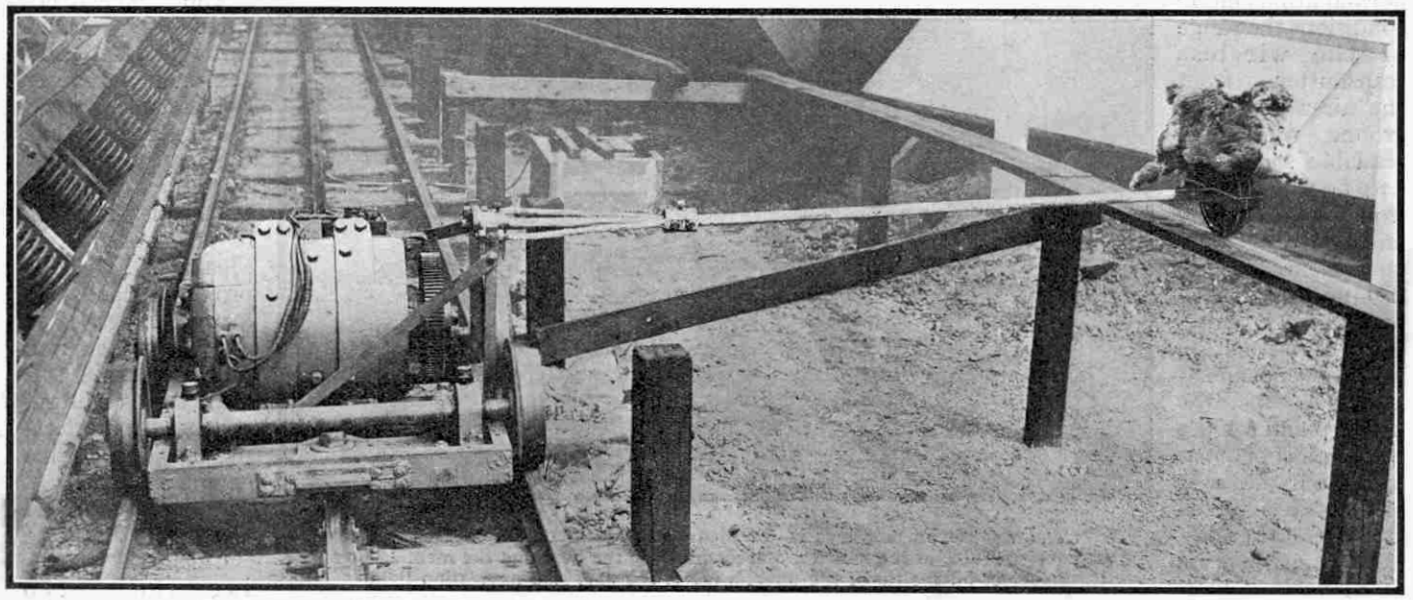


Fig. 1. The mechanism of the Electric Hare, showing the driving motor and the braking system

THE development of greyhound racing tracks throughout the country has been extraordinarily rapid and has attracted widespread interest even among those who do not attend these tracks. Many readers have written to ask exactly how the electric "hare" is propelled and controlled, and as the electrical arrangements of a greyhound track are exceedingly interesting we have decided to devote a short article to a description of one of the most up-to-date tracks—that at Stanley Track, Liverpool.

The first essential is, of course, that the "hare" shall resemble the living animal as closely as possible, and this involves concealing the mechanism by which it is propelled. A glance at Fig. 1 will explain the general arrangement. On the left of the picture is seen a four-wheeled trolley or truck running on a miniature sunken track. This track runs completely around the course and the truck is concealed from view in a timber covering known as a penthouse. On the inner side of the penthouse is a continuous opening for the projection of an arm that carries the "hare," as shown in Fig. 1. The "hare" itself is mounted on a rubber-tyred wheel which runs on a wooden insert let into the course all the way round.

The truck is driven by a 25 h.p. motor with a two-wheel drive, and the current for propelling it is collected from a centre rail by means of a mechanical spring contact or slipper fixed directly at the rear of the truck. As will be seen from Fig. 1, the centre rail is very wide in proportion to the running rails, and the object of constructing it of such massive proportions is to prevent flashing, which would be liable to upset the dogs during the race. The current is supplied by means of motor generator sets fed from a three-phase corporation supply at 230 volts. The supply from the generators is at 250 volts direct current, and it is carried to a high tower known as the control tower, which is fitted with the necessary switches, etc., to enable the operator to control the starting, stopping, and running speed of the truck and thus of the "hare."

The control tower is situated on the top of the grandstand and thus the controller has a completely uninterrupted view of the whole course. The control is carried out by means of a liquid switch, which regulates the voltage across the armature of the truck. The fields of the truck motor are excited separately by a six-volt battery. This battery is carried on the truck and is controlled by means of a small switch operated manually each time the truck is put into service for a race.

On the termination of a race it is necessary for the "hare" to disappear quickly, and for this purpose the trolley is run off the main track into a siding. There it is braked mechanically by a series of heavy springs and a "Ferodo" lining. These springs are attached to upright posts, and are seen on the extreme left thrown over into their non-operative position. When the truck runs into the track siding the springs are moved over into a vertical position so that they press hard on the wheels of the truck, thus checking it very rapidly. The distance required to bring the truck to a standstill varies from 30 ft. to 50 ft., according to the speed at which the "hare" was running at the conclusion of the race.

In front of the grandstand is the judges' box. This is in telephonic communication with the indicator tower in the centre of the track, on which are shown the results of each race and the winner's time. This tower is four sided and is lighted by twelve 150-watt lamps. Above the judges' box are two lamps, one red and the other green. If the green lamp lights up at the conclusion of a race it signifies that all is well, but

if the red lamp lights up it shows that something has gone wrong and that the judges have declared the race void.

In order to carry on racing at night the track is illuminated by fifty-one 1,000-watt lamps placed approximately a distance of 30 ft. apart. These lamps are on standards about 17 ft. in height and are shaded by large enamel shades. The grandstand is lit by twelve 300-watt lamps, which are switched out from the control tower during the race. The approaches to the stand and car parks are also lit with 200 and 300 watt lamps. In order that the "hare" may be plainly visible all the way round the track at night it carries a small red light, the current for which is taken from the truck batteries.

The track is provided with 150 kennels, each of which is lighted by a 30-watt lamp in order to enable the trainers to attend to the dogs at night. Of these kennels 100 are home kennels for the permanent housing of dogs, and 50 are racing kennels occupied by dogs that are actually to run on any particular day.

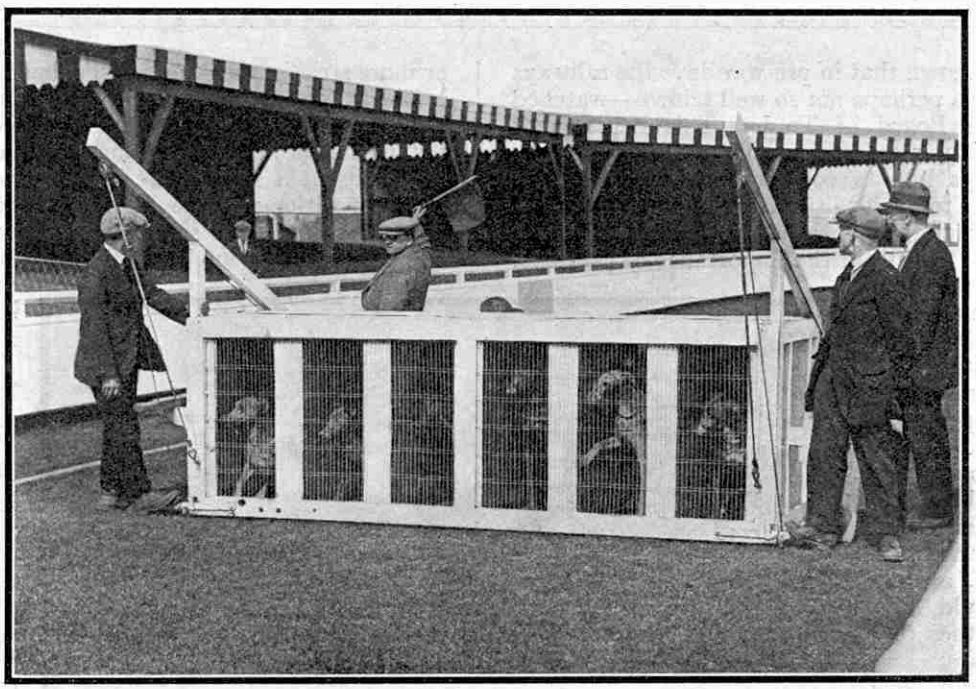


Fig. 2. The Greyhounds just about to be released from the trap

What happens in an actual race is this. The dogs that are to run are locked up in their kennels for two hours before the starting time in order that there shall be no possibility of anybody interfering with them. When the time arrives they are led out of their kennels and paraded around the track so that they can be seen by everybody. On arrival at the judges' box they are examined, particular attention being given to the correct fitting of their muzzles and blinkers, if any. They are then led to the starting trap, Fig. 2. This consists of a sort of long wooden box divided into separate compartments, and each dog is placed in one of these. The front of the compartments is covered with wire netting so that the dogs have a clear view, and it is arranged so that it can be swung outward and upward quickly, thus releasing all the dogs at exactly the same instant.

The "hare" then comes out of its den and runs completely round the track. As soon as it has passed the starting trap and is in view of the dogs, the starter's flag drops, the front of the trap is swung open, and out rush the dogs in pursuit. At the end of the race the "hare" disappears into the siding, which is situated a little way past the finishing line. The full length of the course is 525 yards.

The programmes are not confined to flat racing but are varied by the inclusion of a proportion of hurdle races. The hurdles used are 2 ft. 10 in. in height to the brushwood at the top.

It might be thought that a 25 h.p. motor was unnecessarily large to propel the "hare," but it must be remembered that this has to travel at speeds up to as much as 50 m.p.h., and must be capable of extremely rapid acceleration. Further, a breakdown of the "hare" during a race would be a very serious matter and therefore the whole of the electrical mechanism is planned on very solid lines so that it is practically impossible for anything to go wrong.

The main electrical plant that we have described was supplied by the General Electric Company of Witton, and is housed beneath the grandstand along with a workshop for the carrying out of running repairs and renewals as may be required from time to time.

It is interesting to compare modern greyhound track racing with races that were held near Hendon in 1876. In this case the artificial hare was hauled along in front of the dogs by means of a wire actuated by a windlass!

The greyhound is an extremely interesting dog from many points of view. Its origin is obscure, but most probably it came from the East. On certain Egyptian monuments are drawings that appear to prove the existence of dogs of the greyhound type some 3,000 years ago, and what are probably descendants of these early types are to be found to-day in Persia, Egypt, Arabia, and elsewhere. The name "greyhound" is also something of a mystery. The theory has been put forward that it may have originated in the prevailing colour of ancient stock but this seems extremely unlikely. Another and much more probable theory derives the name from the ancient British word "grech" or "greg," meaning a dog.

The ancestors of the greyhound must have been animals of much greater power and strength than the breed of to-day. During the period when the wolf and the stag were to be found in Ireland, the Irish Greyhound or Wolf-Dog was regularly employed in the chase of these beasts—a sport for which the modern greyhound is obviously unfitted. The Old English Greyhound also was a very powerful animal, capable of pulling down the red deer and fallow deer. Only the princes and nobles were allowed to keep these dogs and to kill one was a serious offence punishable by death.

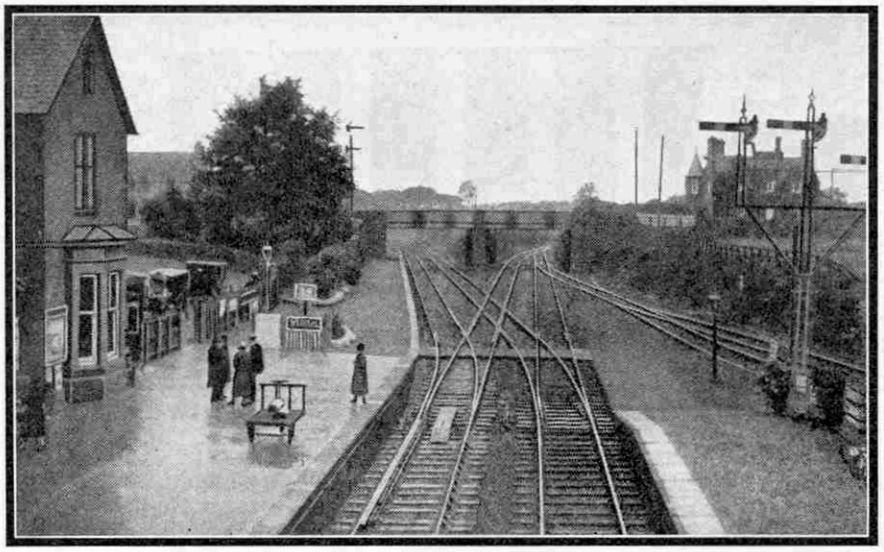
As the result of long specialisation the greyhound has entirely lost the power of scent and hunts by sight alone.

Railway Construction & Working

Some Government Regulations and Requirements

By R. D. Gauld, M. Eng., A.M.Inst. C.E.

IT is generally known that in pre-war days the railways were—in ways perhaps not so well known—watched over by the Board of Trade. This department laid down certain regulations and requirements to which all railways had to conform before they could be declared open to traffic. These requirements have been added to gradually, as the result partly of legislation and partly of growth in the importance of railways. Some of the requirements had not the backing of the law—that is to say, a railway could not be forced to comply with them. All railways did comply, however, because an accident arising out of the infringement of a regulation would have placed the railway company concerned in an awkward position. Of course, as each regulation came into being, it applied only to works constructed after that date; but if the regulation dealt with some feature of train working, such as the provision of automatic brakes, then it was expected that the railway would alter its existing practice as quickly as possible.



A Typical Junction Station: Castle Douglas (L.M.S.)

The Board of Trade had inspecting officers whose duty it was to see that the regulations and requirements were carried out, more particularly for new works, and also to inquire into accidents. These duties have now been taken over by the Ministry of Transport. As modern developments had made some of the regulations, especially those on signalling, somewhat out of date and too restrictive, new ones were issued. They form a fairly large pamphlet, and in this article we will mention a few of the more interesting of them and give some account of their origin.

The distant signals have to be located so that the heaviest and fastest train can be brought to rest between the distant signal and the next stop signal. Distant signals are to be painted yellow on the front side and are to show a yellow light at night. It was always unsatisfactory that under the old regulations a distant signal showed a red light at night and the driver could pass it. In future a driver will not have to pass a red light, when all the distant signals have been converted, but this will take some years to carry out. The yellow light was not favoured at first on account of its alleged resemblance to a white light, but a satisfactory yellow, or more strictly speaking orange, has now been obtained.

The failure of any signal apparatus must give a danger indication. This is the signal engineer's creed, and all automatic, power and ordinary signalling conforms to it. Thus, if a signal wire breaks, the arm goes to the "on" position; while in power working a failure of power results in the signals being placed "on." When the signalman is unable to see one of his signals from his box, that signal must be electrically repeated in the box. This is usually done by means of a miniature arm which shows the same indication as the large signal.

Points, unless power worked, must not be more than 350 yards from the signal box. The reason for this is that a greater length of rodding would be very hard to work, and the effect of heat and cold upon it would make the working of the points uncertain. In some places unworked points may be allowed; these are not connected to the signal box but are trailed through by the train and pushed aside as may be necessary. Of course, all facing points, that is, points that divide tracks for approaching trains, have to be worked from the cabin, and special arrangements are necessary to prevent such points being moved under a train.

One sentence in the regulations concisely sums up the whole object of a signalling installation, and is well worth quoting. It says:—"Point and signal levers to be so interlocked that the signalman shall be unable to clear a fixed signal for the movement of a train until after he has set the points in the proper position for it to pass, and bolted them as necessary; that it shall not be possible for him to clear at one and the same time any two fixed signals which may lead to a collision between two trains; and that, after having cleared the signals to allow a train to pass, he shall not be able to move any points connected with, or leading to, the line on which the train is moving, until the signal is replaced."

No station platform may be narrower than 6 ft. and at important places at least 12 ft. should be provided. Island platforms, that is platforms with a track on each side of them, must be at least 12 ft. in width on account of the fact that fast trains passing in opposite

directions are rather alarming to passengers on a narrow platform. The ends of platforms must terminate in a ramp, and not steps, in order to avoid injury to passengers inadvertently walking too far along the platform in the dark. Platforms must stand 3 ft. above rail level and no columns may be less than 6 ft. from the edge of the platform in order to reduce the risk of injury to alighting passengers. In addition, platforms must be well lighted, the station name must be clearly shown and a clock must be provided in a prominent position.

No staircase or incline may be narrower anywhere than it is at the top, in order to prevent dangerous crowding. For the same reason, handrails, a limit of steepness of one in eight for inclines, and a maximum unbroken height of 10 ft. for stairways, are demanded.

Stations must not be on a steeper grade than 1 in 260, because it is considered that on any steeper grade a vehicle is likely to start moving under gravity and wind action.

A good design for an Island Platform Station

As the result of one or two bad accidents within the last twenty years or so, it is recommended that all passenger trains should carry ambulance and breakdown equipment and be electrically lighted.

Elaborate regulations are laid down for the design of bridges and viaducts in various materials, both under and over the line. Cast-iron at one time was much used, but it is now not allowed in underbridges as it is considered unreliable.

Rails must not be less than 30 ft. in length, and for main line traffic they have to weigh at least 85 lb. per yard. The standard adopted by the railways is well ahead of these requirements, as the length is 45 ft. and the weight 95 lb. per yard. On the London, Midland and Scottish Railway the standard rail length is 60 ft.

All curves of 10 chains, that is 660 ft. radius, must have a check rail, and it is usual also to place a check rail on flatter curves than this if the speed is likely to be high. Diamond crossings, that is the arrangement produced by one track crossing over another, must not have a flatter angle than 1 in 8. The reason for this is that at flatter angles a very long gap has to be traversed by the wheels, and there is some risk of their taking the wrong side of one of the rails.

Dimensions are given to fix the minimum clearance between vehicles on the rails and fixed structures, such as platforms, goods shed doors and signal posts, after proper allowance has been made for curvature and superelevation. The most recent regulations go a good deal further than all previous issues on this subject, and for the first time notice is taken of the electrification of railways, and minimum measurements for overhead wire and conductor rail clearances are given. It is recognised, of course, that in the conversion of existing lines to electric traction the desirable clearances cannot always be obtained, and therefore they are not compulsory. Overhead wires, such as telephone wires crossing the railway in the open, must be at least 20 ft. above rail level. This is to allow for any likely amount of sag in the wires, and it will also allow a crane to work on the line without too much restriction on the movement of the jib.

The space between tracks where there are more than two, is specified, with the object of reducing the danger to men working on the tracks, and also to shunters, wagon repairers and carriage cleaners working in sidings adjoining running lines.

A good deal of attention is given to level crossings, the requirements for which depend upon the nature of the road traffic and the volume of the railway traffic. Each individual case is dealt with on its merits, but all important crossings have gates protected by signals and these signals can only be pulled off after the gates are closed across the road.

Everybody has noticed mile, half-mile and quarter-mile posts along the line, and also gradient boards, but probably not many know that it is a requirement of the Ministry of Transport that these should be provided. The reason for it is not quite clear, but these indications are quite useful to the railwayman, the mileages being essential in permanent way work.

Refuges for men to stand in have to be provided in tunnels, parapet walls of long viaducts, and in the walls of cuttings where there is only small standing room. It is to the credit of the railway companies that the provisions they make for the safety of their employees are well in advance of what is called for by the requirements of the Ministry of Transport.

The early railways were badly handicapped by the absence of efficient brakes, and it was not until the invention of the air-operated brake that much progress could be made in the direction of increased speeds and loads. Among many other important matters the Regulation of Railways Act of 1889 laid down certain requirements for continuous brakes to be provided on all passenger-carrying lines. The two most important conditions are that the brake must be instantaneous in action and capable of being applied by the engine driver and guards, and also it must be self-applying in the event of any failure in the continuity of its action. The Westinghouse and vacuum brakes both met these requirements most satisfactorily.

It used to be hinted that the Board of Trade regulations were too restrictive but under them the densest railway traffic in the world is worked with a greater degree of safety than is found in any other country.

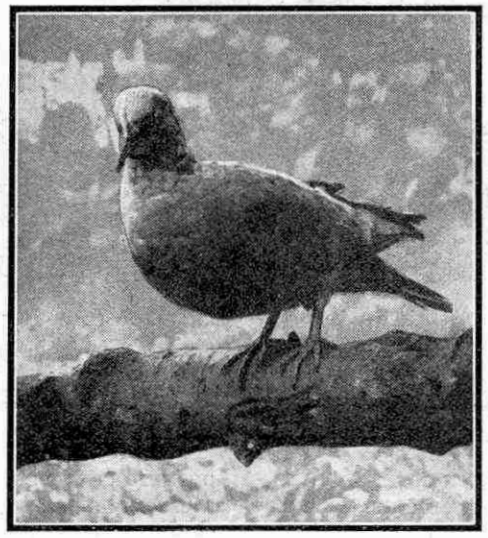
Feathered Home Makers

Some Curious Points in Bird Architecture

By Rev. F. J. Hammond

THE rapid increase in the popularity of nature study, and in particular of nature photography, has resulted in an enormous increase in our knowledge of what might be called the domestic details of bird life. At the same time there still remain unsolved mysteries. For example, we do not know exactly why each bird builds after its kind; why thrushes line their nests with mud and blackbirds do not; why chaffinches usually build such neat, artistic nests, while sparrows are careless in the extreme in their building.

Among other problems which, so far as I know, have not yet been solved, is that of exactly how different birds commence their nest-building operations. What, for instance, are the initial steps taken by, say, the swallow, or by that rough and ready builder, the wood-pigeon?



Wood-pigeon

For many years swallows nested regularly in my porch. From behind the glass of the inner doors there was every opportunity of watching the operations of the birds, and full use was made of these opportunities. I made strenuous efforts to witness the foundation laying of the nest but I never succeeded in doing so. The outer front door was never closed day or night while the swallows were about. One day the wall was bare—the next day there was a thin semicircle of foundation; but watch as I would I never saw that foundation made.

This is my problem. One may see the foundations of hundreds of nests but one never sees the birds making them. So far as I know the actual method of building remains a mystery.

During several successive years a pair of wood-pigeons nested in an elm near my bedroom window and gave me an excellent opportunity of watching their proceedings. The lady and gentleman arrived together early one morning in March. They sat side by side on the branch where the nest had always been previously and, to judge by appearances, they were earnestly discussing the site. The old nest had gone—a victim to the howling winter gales.

Nest of Thrush, showing lining of mud

It was extremely fascinating to watch the two small creatures. I have long been convinced that all animals have some actual means of conversing and communicating with one another, and this occasion provided what was to me further proof of the accuracy of my belief. These two birds alternately looked at one another and then turned their little heads towards the place where the old nest had been. Quite evidently they were talking about it. One seemed to say: "What do *you* think? Will the same place do again?" Then the other replied: "Yes, I think so; at any rate, let's chance it!"

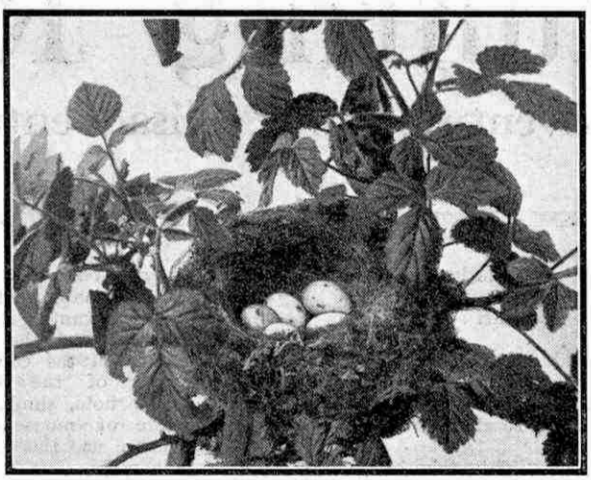
So much having been settled, the gentleman walked slowly along the branch to the site. Turning his head first one way and then the other, he deliberately inspected it, considered for a moment, and then walked back to report to his lady. Then they both walked along, and as anxiously as two humans viewed the situation for the new home from every angle and talked it all over again. And now the gentleman seemed to hesitate. "I am not sure!" said he. Then chimed in the more practical-minded lady: "Well, we can't afford to waste time—we'll try it!"

This important decision having been made, nothing remained but to set about building operations. Mr. Wood-Pigeon flew down below somewhere and returned with a small stick: Mrs. Wood-Pigeon took this from him and laid it carefully on the site. The performance reminded me strongly of the ceremonial laying of a foundation stone, as the two strutted about and bowed to each other so very solemnly. Then the husband set to work in earnest and brought stick after stick, which the lady dealt with as fast as they came. I was watching the operations through a powerful pair of binoculars but I was only able to note that the husband seemed to confine himself to fetching the building materials while the lady carried out the actual building. I could see that she stood in the centre revolving in a circle as she adjusted her materials, but I never succeeded in seeing exactly how she interlaced the pieces. There was evidently much hard work in the affair for the placing in position of each piece was accompanied by rapid twistings and turnings.

I was greatly disappointed later to find that all this labour had been thrown away. What went wrong I do not know, but something must have caused the birds to change their minds, for after getting on well

with the nest they abandoned it and built a home in another part of my orchard where, I am glad to say, they safely reared a family.

There are many curious features about nests that are not easy to explain, except on the supposition that birds vary as much in intelligence and energy as human beings. For example, even among birds that are notoriously clumsy and careless in their domestic architecture one finds every now and again a nest that obviously has been constructed with care and real skill. On the other hand one may find occasionally really disgraceful-looking nests built by birds, such as the chaffinch, whose nests usually are models of symmetry and neatness. Another curious point is that a pair of birds will sometimes labour for quite a long period to build a nest in a position where it is utterly impossible to secure stability. Repeated disasters appear to have no effect, for the birds immediately start all over again on their hopeless task.



The neat artistic nest of the Chaffinch

As a general rule birds take a fair amount of trouble to make their homes inconspicuous to passers-by, human or otherwise. It is all the more strange, therefore, to find occasional nests placed in such positions that it is almost impossible to miss seeing them. In such a case it is difficult to avoid speculating upon whether the birds that built the nest were of lower intelligence than the average, and therefore did not realise the danger, or whether for some reason or other, which the faculties of the human observer were not capable of appreciating, the site had some advantage that outweighed the obvious drawbacks.

Conquest of the Air—(*contd. from page* 485)

construction and capable of more extensive range than the largest of the "Blimps." They were 262 ft. in length, 55 ft. in diameter, and of 360,000 cu. ft. gas capacity. Motive power was provided by two 275 h.p. Rolls-Royce "Falcon" engines, giving a speed of 60 m.p.h. Each airship carried a crew of ten. These dirigibles were often engaged in continuous duty for 24 hours and on one occasion during September, 1918, "*North Sea Airship No.* 11" achieved a record of 100 hours 50 minutes continuous flight, covering a distance of approximately 4,000 miles during that period.

While England was concentrating on non-rigid airships, Germany was likewise showing her faith in airships of the rigid class and was building Zeppelins as speedily as possible. At the close of 1914 two Zeppelin factories were in full operation, one at Berlin and the other at Friedrichshafen. Each factory was capable of producing two Zeppelin airships per month.

The practicability of rigid airships was demonstrated to England in the course of the Zeppelin bombing raids on our coastal towns. During the first two years of the Great War several of the German airships suffered defeat at the hands of the British airmen but such dirigibles were completely destroyed by the home force or by the raiders themselves. During a Zeppelin raid on the night of 24th September, 1916, however, a German airship No. L33 was damaged by gun-fire and forced to earth near Colchester. Before alighting from the airship the crew set fire to it, but only the outer cover and gas bag were destroyed before the conflagration was successfully extinguished. The structure of the airship was practically undamaged, and provided British engineers and designers with a long desired opportunity of making a detailed study of Zeppelin construction. This airship was one of the first in which the Zeppelin designers adopted the streamline form instead of the uniform cylindrical shape of their earlier airships.

The British Admiralty authorities were at that time responsible for all British airship design, construction and operation, and they adopted the streamline form of envelope for the rigid airships subsequently designed. These airships were far from being merely a close copy of the captured Zeppelin as, although the British designers embodied in their plans the good points of the German airship, they also introduced many modifications to improve upon its design and construction. The Great War was well advanced when the British rigid airships became available for service, and several of them were only partially completed when hostilities ceased.

The first of these rigid airships to attract public attention was the R.34 which achieved fame comparatively early in her career by making a successful trip across the Atlantic and back again in July 1919. This airship was built to Admiralty design by William Beardmore & Company Limited at Inchinnan, near Glasgow. The polygonal framework of duralumin girders provided compartments for 18 small gasbags. Four cars, each approximately 30 ft. in length, were slung beneath the huge hull, the fore and aft cars being situated on the centre line of the airship and the remaining pair amidships, one on each side. Five 250 h.p. 12-cylinder Coatalen "Maori IV" Sunbeam engines provided the motive power. The navigating compartment containing the various instruments was embodied in the foremost car. The four propellers were formidable affairs and consisted of one 19 ft. 6 in. in diameter and three 17 ft. 6 in. in diameter.

(*To be continued*)

Bound Volumes of the "*M.M.*"

In response to a large number of requests for back copies of the "*Meccano Magazine*" we beg to announce that all Magazines prior to December 1923 are out of print. Each of the 1924 issues is available, but only the May, June, July, September and December issues of 1925 are in stock. All of the 1926 and 1927 issues are available with the exception of January and February 1926.

Copies of back issues will be sent, post free, price 3d. for issues prior to 1925, 4d. for the issues of 1925 and 1926, with the exception of the December numbers. The December issues, 1925 and 1926, and all the issues of 1927, 8d. The number of copies is very limited and early application should be made.

We can supply a limited number of bound volumes of the "*M.M.*" at the following prices (carriage paid). January-December 1924, in one volume 10/-. July-December 1926, price 8/3. January-June 1927, 9/6. July-December 1927, 9/6.

Binding the "*M.M.*"

As announced last month, we have made arrangements with Messrs. O. H. Bateman & Co., of 13, North John Street, Liverpool, to supply a special "*Meccano Magazine*" binding case and also to bind readers' Magazines when required. *These cases take six issues only and two are therefore necessary to bind a full year's Magazines.*

Cases Only. The binding cases, which cost 3/6 each (post free), are supplied in what is known as "quarter Basil, full cloth." That is to say three-quarters of the sides are dark crimson cloth and the back and a quarter of the sides are dark crimson leather. The case is tastefully embossed in gold with the name "*Meccano Magazine*" on the front and on the back is the name and volume number. As mentioned above, the case takes six "*M.M.'s*"

Cases and Binding. These binding cases are supplied so that readers may have their magazines bound locally, but where desired Messrs. O. H. Bateman & Co. will bind "*Meccano Magazines*" at a charge of 6/6, including the case, which takes six Magazines, and also return carriage. The covers of the Magazines may be included or omitted as required, but in the absence of any instructions to the contrary they will be included.

Readers desiring to have their Magazines bound need only make a strong parcel of them, include a note of their name and address together with the necessary remittance, and send the parcel direct to Messrs. O. H. Bateman & Co., 13, North John Street, Liverpool, by parcel post, carriage paid. We understand that at present about two weeks are required to bind the volumes.

Hunting Red Deer

Adventures and Misadventures in the Forests of

By Bonnycast

"LOOK OUT!" we heard a voice yell in the darkness outside the caravan. Then came a tremendous bump and a crash, and voices enquiring "Are you hurt? . . . Where are you . . . ?"

We grabbed some clothes, got the flashlights and fell out of the camp car, where we had been sleeping beside the Bathurst Road. We saw first a dead deer and then a car resting sedately on the grass, without a single wheel under it! Next we saw three dark forms of men sitting in the hedge!

"I saw the deer just for a second in the headlights, then bump! We hit it and out we went," said one of the men. "Yes, we were going a good clip, because we are off for a deer hunt. . . . Oh! not as fast as 40—perhaps we were doing 30! . . . You're right—it was a bit dark to be slipping along so fast, but the road was good and everything all right until that blamed deer tried to slip across in front. It's dead I guess—I hit it fair on the side!"

The deer was certainly dead, and the car was dead too—that is until four new wheels could be fitted at a garage. The three men were torn and battered, but luckily without a bone broken. Having made sure of this, we all sat down in the solemn darkness, lit "fags" and had a midnight roadside meal. Our visitors were but boys, and by the law of chance one or more should have been killed, but they just laughed it off. They tumbled into our car when daylight came and went along to a "car doctor." When we left them at the town, that was the last we saw of them.

The Red Deer are Good Swimmers

No wonder they hit a deer. The tracks of these Virginia deer, or "red deer" as we call them, were to be seen on every road in the province this fall. We were parked at the time to hunt the northern part. On the way up, near Oak Point, we saw a beautiful doe come out of the spruce woods, trot across the bog, and enter the Miramichi River. She daintily picked her way out over the shore sands until she felt the water up to her belly, then she launched off and swam the mile-wide river, while we timed her. There was not much tide and she made it easily in 16 minutes, slopping out on the further bank evidently not a bit tired, for she fed as soon as she came to grass. Through the telescope I could see her watch the road above the shore carefully every time a motor dashed along.

These so-called "red" or white-tailed deer are good swimmers and sometimes are seen far out at sea. We have seen them out so much as three miles from land, swimming along valiantly.

The bucks lose their horns every year in April—or sometimes in March—being thrown off so that the buck may not be armed and thereby injure the doe or delicate fawn.

I have hunted the white-tails in Canada from coast to coast, and they are the best distributed game animal in the Dominion. Nova Scotia has just taken a census of her moose—using a hundred guided during February in the deep snows—and claims some 11,000 moose, bull, calf and cows. As there are fully two deer for every moose, there must be 25,000 deer at least in that province, and more in New Brunswick. They are so prolific, indeed, that the small gardens in the back counties are eaten up by them, the pokelogans and savannahs are criss-crossed by their trails, and each morning the main high roads are arrow-pointed by their shapely hoofs.

One evening we were sitting on the shore of the river after a hard day's work with the cameras, trying for pictures of moose and deer.

"Listen!" said Laddie. "There's a doe calling far up the river."

The thin bleat of her call came down the moonlight air, clear and distinct and then we heard the sharp "*Ch-ee-ah*" of the buck. Now, the doe came along opposite to us, in the dark woods not trusting herself in the moonlight places. She called sharply "*Bar-r-r*"—a coughing, explosive kind of note. Again the call was answered, and the doe continued to thread the dark places and call until they met one another above us, through the shallow river. The calls of these deer are much clearer and sweeter than the harsh grunting bellow of the bull moose, and the cow-like squealing note of the cow moose.

The young of the whitetails have a gentle note, similar to the whining note of moose—in fact the calf moose use this note too. We were handling one this week and every time we gently prodded it to go along a desired path, it just whined and cried like a moose.

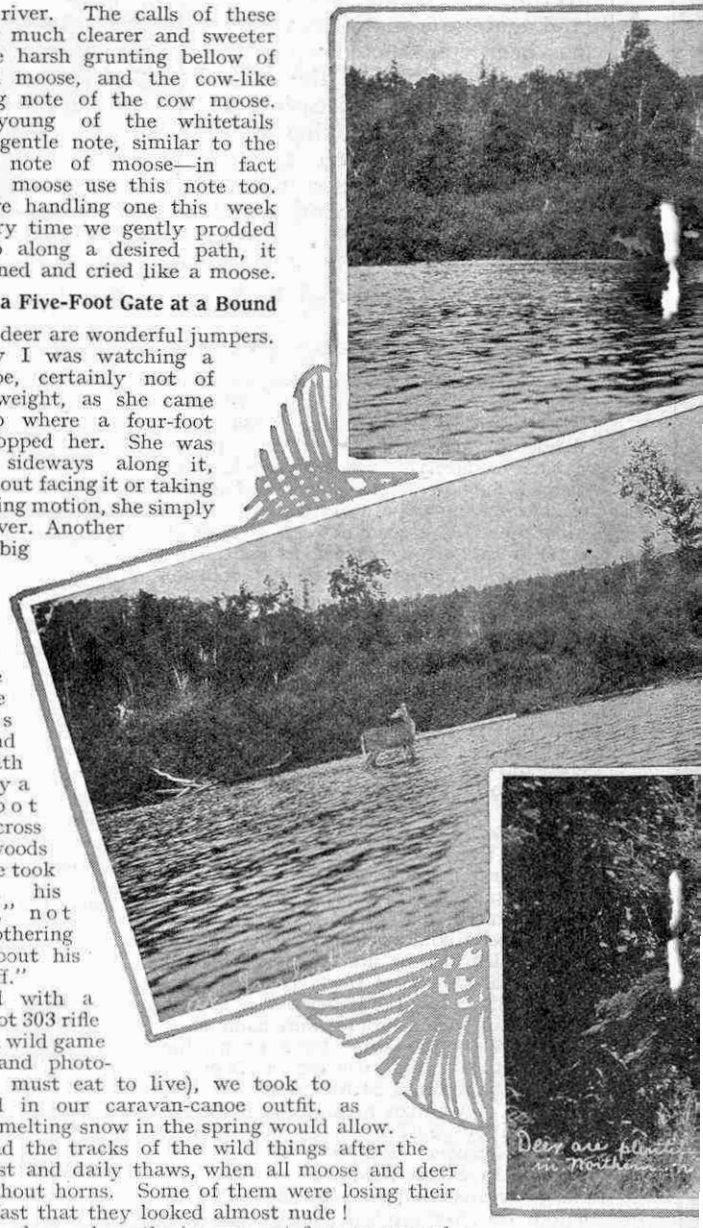
Clearing a Five-Foot Gate at a Bound

These deer are wonderful jumpers. One day I was watching a little doe, certainly not of 100 lb. weight, as she came along to where a four-foot fence stopped her. She was feeding sideways along it, and without facing it or taking any leaping motion, she simply sprang over. Another day, a big 250 lb. buck came running out of the spruce woods and found his path barred by a five-foot gate across the old woods trail. He took it "in his stride," not even bothering a bit about his "take off."

Armed with a single shot 303 rifle (for even wild game writers and photographers must eat to live), we took to the field in our caravan-canoe outfit, as early as melting snow in the spring would allow. We found the tracks of the wild things after the hard frost and daily thaws, when all moose and deer were without horns. Some of them were losing their hair so fast that they looked almost nude!

In one place, where the ice was yet firm on a pond, a buck had tried to cross and had fallen down. Out ran a doe and down she sprawled too. Even though they were wild with fright at the men's approach, they could not regain their feet. A lumberman kindly dragged them off the ice to the snow crust and away they went, like the wind.

We found that the deep snow was fatal, here as everywhere to the deer family. The young ones—and often the adults also—broke through the crust, with the result that their long legs held them prisoners. In this predicament the unfortunate creatures are of course absolutely helpless, so much so, indeed, that a common bob-cat could come up and kill one with impunity.

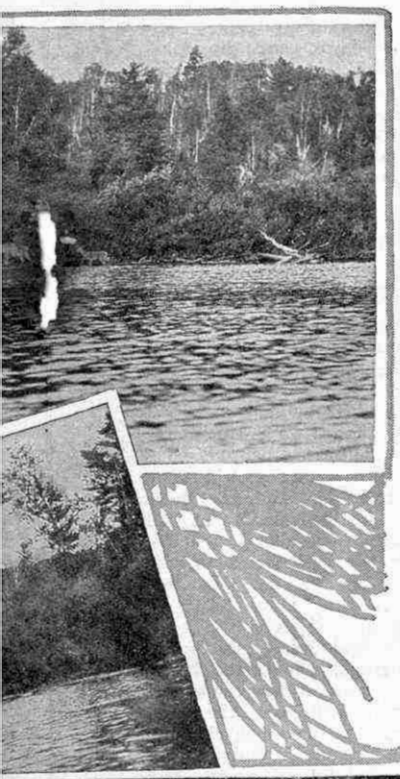


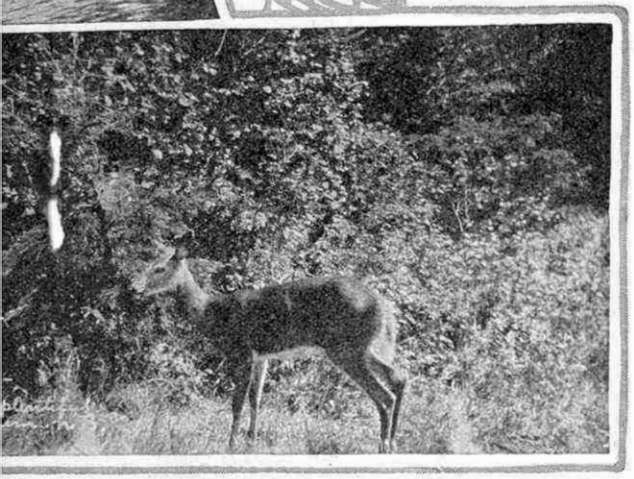
The red deer at home. P
Brunswick. (Top) A doe
startled by the photograph

er with a Camera

s of New Brunswick after Nimble "Whitetails"

nycastle Dale





home. Photographs of the graceful "Whitetail" taken in the forests of New op) A doe and fawn snapped near a lumber camp at Imhoff. (Centre) A doe photographer. (Bottom) Young deer have little fear of people before the hunting season opens

Tracking the Deer in the Snow

We saw one place where a bear had dragged out a calf moose and eaten it. It was remarkable to see the strength a bear displayed in dragging away this big calf moose. The body weighed fully 300 lbs. yet after he had killed it with one bat of his great paw, he easily dragged it through the stumps, upsetting one of the big spruces in doing so. Then he went on down the river bank, across the ice and up the bank on the other side. There, a trapper saw him and set a big steel trap, and next morning hungry Bruin raved at the end of the cruel-toothed jaws.

I think it quite feasible, from what we know of the red deer, for a farmer trapper or hunter to build a pen of a hundred square feet of good fencing in the woods. Here he could put some salt and a bit of food, and by having a trip door in the fence, connected with some tempting bait, easily catch many deer alive and uninjured.

It is after the first fall of snow that the easy tracking is done, for then they hang out a trail for the hunter to follow. Although we found tracks of the great host of deer living in the woods in the fall from Chatham to Newcastle, up the Bartibog and along the great woods road to Bathurst, we did not set out with the idea that even with this great number of deer about a hunter can run right into one immediately. At the first crack of a branch or the rattle of a pebble, every deer within sound becomes as hidden as a rabbit. The tall, lithe creatures can sneak past almost within sight and never make a sound or show a sign.

A deer feeding along the edge of a river "freezes" instantly to statue-like stillness at the sight of our canoe, or the slightest sound of our carefully-placed feet. But let a kingfisher, after its prey suddenly fall into the river with a tremendous "thwack," right in front of it, the deer does not cease its feeding or even raise its head. Nor does it take alarm when the loud quack and swift flapping of black duck comes from the creek mouth. A flock of mergansers can fly beating the water with their wings and driving the small fish into the shallows where the deer feeds, but the deer will simply glance at them "out of the corner of its eye" without raising its head. Neither does the hoot of an owl or the sharp whistling cry of an eagle disturb it. Among Nature's many sounds nothing save the crash of a falling tree seems to alarm it.

The Glory of a Canadian Autumn

There is nothing to equal Canada in the glorious autumn, with the gorgeous colour effects—the flaming of the Maples and the golden glitter of the birches. When our canoe rounds a bend and glides out of the dark spruces into the sunlight, we are compelled to clap a hand over our eyes to hide it all, for the brilliance of the scene is really painful to the eye. Then we come to the "falls" or shallow rapids, where every broken ripple and splash sends out a fiery red reflection of the woods. The river gleams with all shades of scarlet, darting off into deep cardinals and flashing out innumerable golden yellows. No wonder that those who have not actually seen, will not believe a faithfully-painted Canadian autumn scene!

On this prolific river, in July when the myriad "No-see-ums" eat us alive, it is a common sight to see many moose and deer in all parts of the rivers, driven there to escape the fierce bites of the greater flies, "Spot-wings." The hunters, who come out simply for venison to the guide camps along the Nipisiguit Geteagouche, Chaslo, Casaguet or Pokemoncge Rivers, cannot for a minute imagine what it is like in summer, when tens of thousands of flies attack both the wild animals and their photographers. During many nights in July, on the banks of these rivers, we could not sleep a moment, for we have not been able to find a cloth as fine as cheesecloth that will let air through and at the same time not let in a host of these biting torments!

The one sad part of it all to the deer lover is the way the nimble little white-spotted fawns worm themselves into our hearts until we love them above any pet we raise—yes, even more than our own faithful dogs.

Rescuing a Fawn from Indian Dogs

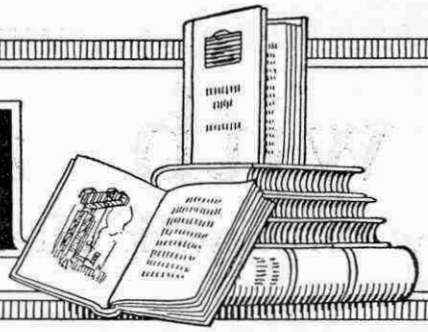
Once we took the young of a deer, just after it had lost its spots and was in its reddish grey coat, right out of the mouths of a baying, yelping, frothing pack of Indian hounds. Laddie and I were seated on the shore at the mouth of a river. Some Indians camping near-by had some hounds—lean, great-toothed, hungry-looking creatures—which we had watched carefully every time they got to rearward of our twitching legs! This day, as we sat there glorying in the red and scarlet of the forest scene, we heard a yelp, then another, and soon a pack of dogs came along in full cry. Ahead of them, leaping along for its life, came a six months' old fawn—a tiny mouse-coloured thing, that fled like a bounding shadow in and out of pools, over logs, through banks of bracken, frost-seared now to a warm brown tint. Over a great fallen spruce the fawn leaped, and into the river. The hounds splashed after it.

Into the canoe we jumped and off we paddled, might and main, down the current after the pursuers and the pursued. The dogs, with a final burst of cry, fell right upon the crouching half-sinking fawn and down it went beneath them. Their fury and greed kept it there until we arrived. Laddie put me into the midst of the turmoil, and with my paddle I indiscriminately whacked the head of every mongrel I could see. Soon I had them dismayed and leaping away on every side, and then the poor half-drowned but unharmed fawn rose to the surface. The dogs closed in again with a howl of victory when they saw it, but I changed that howl into a wail of agony with my goodly ash blade and off they went yelping to another tune.

I drew the poor thing into the craft, emptied some water out of its lungs, wrapped it up and took it home to our camp. In a few hours it followed us like a shadow, crying the moment we left it alone. We christened it "Nimrod" and before

(*Continued on page 491*)

Books to Read



Readers frequently write asking if we can recommend books that are both of interest and of use. On these pages we review books that will specially appeal to readers of the "M.M." We do not actually supply these books, which may be obtained either through any bookseller or direct from the publishers.—EDITOR.

"The Book of the Railway"

By J. R. HIND (Collins' Clear-Type Press. 6/-)

Popular books on railways have appeared so rapidly during the past few years that it seems almost impossible for a writer to break new ground. The historical side of railways must, of course, follow the beaten track, and one can scarcely expect to come across anything new. Having dismissed this aspect of the matter, however, Mr. Hind begins to deal with railway working, and he does so in an exceedingly interesting manner. The chapter on working a station, for instance, is excellent, and so also is his description of the operation and control of goods traffic. Signalling methods, and the abnormal measures that must be taken in times of fog, snow or breakdown are also dealt with, and the construction and maintenance of the permanent way is carefully explained.

The author then passes on to survey the railways of the world and although, owing to limitations of space, his descriptions are necessarily brief, they are sufficient to give an excellent idea of the conditions that prevail in different parts of the Empire, on the Continent, and in the United States.

The book is provided with some 250 illustrations. These have been well selected with a view to helping out the text, but unfortunately the reproduction leaves something to be desired. There are also 20 plates in colour.

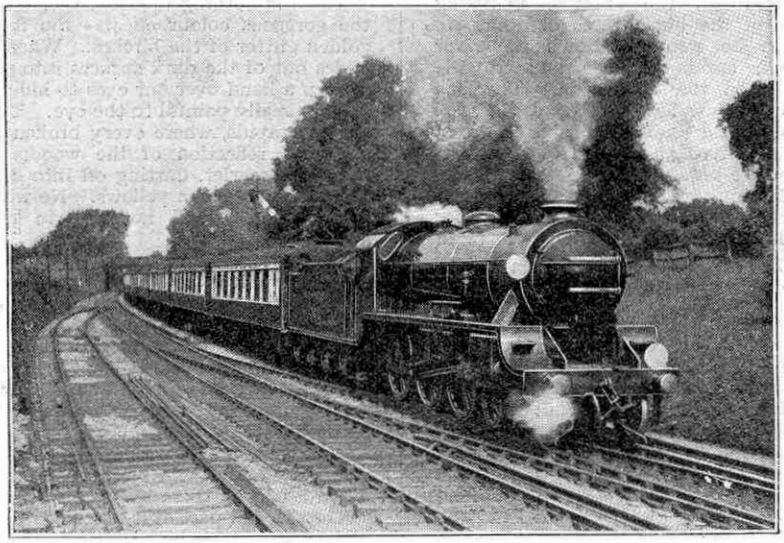
* * * *

"Engineering Science"

By W. WARD (Arnold. 3/-)

The ground covered by this book is approximately that usually given under the heading of Engineering Science in a first year senior course. Its arrangement and treatment of the subject differs from existing text-books, however, and the author has endeavoured to avoid, as far as possible, academic language, in view of the fact that he realises many of his readers may not have had a great deal of preparation in mathematics and general science. The introduction of formulæ is avoided in the hope that readers may be induced to think out things for themselves and so come to realise better the ideas that formulæ often obscure.

The book includes chapters on Force; Speed; Machines and Efficiency; Power; Steam and Other Engines. The final chapter deals with the triangle of forces, an important subject to which some attention has been given in the Complete Meccano Manual (See Model No. 736). Whilst the book is essentially one for engineering students, there is much that will be of interest to our mechanically-inclined readers, who will no doubt find Meccano of considerable service in working out some of the experiments suggested.



Victoria-Dover Continental Pullman Express (from "The Book of the Railway")

* * * *

"A Naturalist at the Poles"

By R. N. RUDMOSE BROWN (Seeley Service & Co. 25/-)

Those readers who have followed our series of articles on Arctic Exploration, will be interested to read this book, although the locality of the exploration work is mainly in the Antarctic, the book dealing with the adventures of Dr. W. S. Bruce in the polar regions. Dr. Bruce not only held a remarkable record in the number of expeditions that he either led or accompanied, but he was also acknowledged to be the highest authority on polar exploration. It was only his natural shyness and intense dislike of publicity that prevented him from becoming one of the outstanding personalities of his generation.

In his Preface, the author of the book, Dr. R. N. Rudmose Brown (who was a member of several expeditions both in the north and the south) points out the great value of polar exploration. Speaking of the work done by certain polar ships, Dr. Bruce once said "they have been more truly treasure ships than the gold-bearing galleons of Spain." To lift the veil from the unknown and to add to human knowledge in the belief that all knowledge is of value, was the aim of Dr. Bruce in all his polar voyages. His varied experiences from pole to pole are those of a singularly adventurous life, and the accounts of the voyages are written largely from his unpublished diaries.

If ever our readers should have a conversation with an Antarctic explorer, let them remember that they should not ask him "How many bears did you shoot?" No amount of telling seems to convince people that there are no bears in the Antarctic. Indeed, there are no mammals at all except seals and whales, and the only ferocious animal is the sea leopard, which may reach 14 ft. in length. It is a beast of prey and feeds mainly on penguins, which it chases with great agility under the water and on the ice. Penguins, of course, abound, and bears would thrive wonderfully on them, but strange to say they have never reached these regions.

The enormous number of penguins is mentioned in the chapter dealing with spring at the South Orkneys. The birds began to return to this district in October, first as stragglers then in a steady stream. "They passed the ship in thousands, one might safely say millions, all heading for their favourite rookeries. A conservative estimate of the penguins on the rookeries on Laurie Island was five millions—no mean population for a tiny island measuring 30 square miles, of which 90 per cent. is glacier ice."

Endless interest is to be found in studying the habits of the penguins in their mating, nest-building and caring for the eggs. When courting, the males are terribly conceited, and are always ready to quarrel. The noise of a penguin rookery is said to remind one very forcibly of the shrill chatter that arises at a crowded reception or "at home," where a hundred voices are raised at the same time and discordancy is the predominant note! Penguins are a valuable source of fresh food to explorers when meat becomes scarce during the winter. In one of the expeditions mentioned in this book, the men brought thousands of eggs to the ship on sledges. The average daily consumption was 15 per head, not counting

raw eggs eaten on the rookeries. Hundreds of eggs were stored away for future use, and a couple of thousand were put in cold store in a pit in the nearest glacier for use the following winter!

* * * *

"The Terror of the Seas"

By PERCY F. WESTERMAN (Ward Lock. 3/6)

How dangerous a pirate a submarine would make if handled by unscrupulous yet skilful men, is shown in this story, which reminds one in many ways, of Jules Verne's "*Twenty Thousand Leagues Under the Sea.*"

The inventor of the death-ray, a Professor who has just perfected his invention and has not yet parted with the secret, is made prisoner by this submarine, while his athletic and daring son shares his fate. The secrets and happenings of the underground lair of the submarine, where the workshops and headquarters of the gang are hidden, are calculated to give the reader the "creeps" in real earnest!

To counteract the effect of the murdering submarine crew, there are brave sea Captains and a British "mystery ship" with a jolly Commander, who can be the bluff Captain of a tramp or the austere Commander of a warship, as necessity may require. How the efforts of warships of several nations are thwarted time after time in their efforts to rid the sea of this submarine terror, and how she finally meets her doom, makes "*The Terror of the Seas*" as good a sea yarn as we have read for a long time.

* * * *

"Romances of the Wild"

By H. MORTIMER BATTEN, F.Z.S. (Blackie. 5/-)

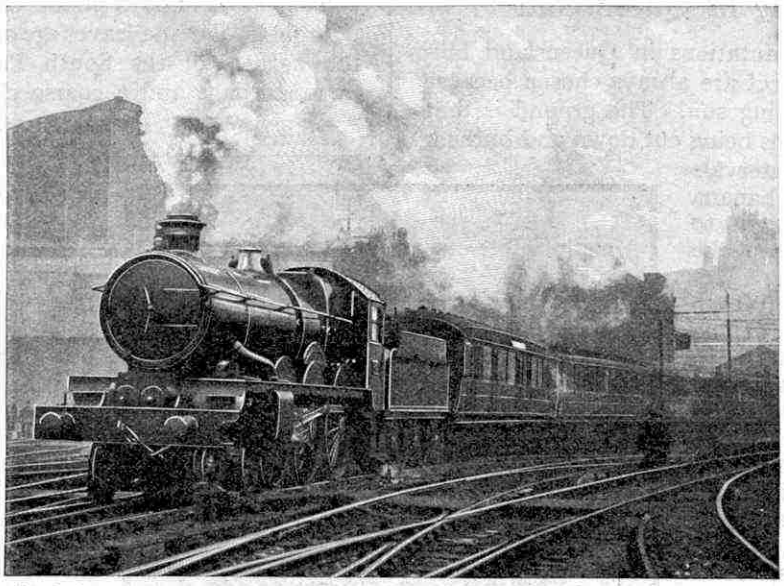
In this book Mr. Mortimer Batten, already well known as a writer on natural history subjects, gives us some more of his characteristic stories of wild animals. From these stories we realise that the woods and hills are full of romance and that the truth of wild nature is far stranger than its fiction. We gather that the denizens of our woods and hills have much in common with ourselves—they have their loves; their sorrows and their ambitions. The ways of our dumb friends are so widely different from our own ways, however, that we may not even comprehend the meaning of the things we see. As an instance, the author mentions what is regarded as the blind stupidity of sheep by which the rest follow where one goes. In thinking of this we lose sight of the fact that the law of "follow-my-leader" is one of the oldest and wisest laws that govern the lives of birds and beasts. It is the result of thousands of years of weeding out and grafting in, and the sheep that does not blindly follow its leader is the fool of the fold, which in the wild would be the first to fall.

Mr. Mortimer Batten has seen and knows all the creatures of which he writes. He takes no liberties with their habits, beyond the introduction of a plot around which to weave the fabric of a story. He gives us stories of Negeet the badger and her adventures in the underworld; the Waif of Prairie Hollows; the Coming of the Curlews; the Gentleman Hobo; Kings of the Infinite; Whitefoot of the Deadland Trail; Banska the Grizzly, and others. The death leap of the hounds in the story of Fireflank, the fox-cub, is a fine piece of writing:—

"The single rock in mid-stream was covered with snow to-day, but beneath the snow was a coat of ice. . . Fireflank leapt and landed, light as a thistleseed, buoyant as a russet leaf of autumn, landed and fled on towards the rocks of his secure home. The hounds did not falter . . . and they, too, leapt for the pointed rock in mid-stream. Instantly the first lost his foothold, clawed desperately for a moment, but was caught by the tide and whirled away, uttering the cry of a dog which knows itself doomed. Unwaveringly, fearlessly, the second also leapt, gained a footing, slithered back, clawed to the top, slithered over into the current, lashing the water into foam. And it too was drawn over the brink of the fall, to be shattered lifeless among the rocks . . . to become the sport of the waves. . . Long after darkness had fallen, the voice of a man could be heard along the river bank calling, calling for his dogs . . . the snow had covered all signs, yet he could guess what had happened. . . He knew that his dogs had been decoyed to their doom, he knew that he would never see them again, yet far into the night he searched. And when at length he turned his steps wearily homewards he heard from the heart of Garolgome Wood a mocking 'yap-yap,' which told him that he and his dogs were the sport of the wild creatures they had designed to kill."

Such occurrences as these make one wonder whether the natural cunning of the fox is not really of a higher order than is usually ascribed to it.

The book is charmingly illustrated by the well-known artist, Mr. Warwick Reynolds, who always portrays the creatures of the wild so faithfully.



Courtesy [*G.W.R.*

G.W.R. "*Pendennis Castle*" leaving King's Cross (from "The Book of the Railway" reviewed on the previous page)

"The Hunted Piccaninnies"

By W. M. FLEMING (Dent. 6/-)

The two young sons of pioneer parents who are searching for new land on which to settle, stray from their wagons and are lost in the Australian bush where white men had not before penetrated. The wicked medicine man, Dirribandi, of the Mundooey tribe who inhabit this region, is anxious to get rid of three little piccaninnies. Under the pretence that it will not rain until the piccaninnies are killed, they are allowed a day and a night in which to travel and then Dirribandi and his three little nephews set out to track and kill them. The piccaninnies elude their pursuers for a while and bump into the white boys—to their mutual astonishment. The five are lost and in peril from surrounding tribes—for the piccaninnies are in enemy territory—and together they hunt and live as best they may, for as Joe put it: "They know how to get a feed and we don't, so I think we had better stick to them!"

Many and varied are the things the little black fellows teach Joe and Dick—they learn how to catch small animals and wild ducks; how to find wild honey, and a dozen other things to keep them alive. The pursuers soon discover the tracks of the piccaninnies, but fortunately the river floods the surrounding country, and the little black boys with their white chums remain in temporary safety on a piece of rising land converted by the floods into an island. The adventures of the boys when the flood subsides are thrilling indeed, for they fall in with hostile warriors, live in terror for days, and all have to use their wits to frustrate the plans of their enemies.

The story is delightfully different from the general run of boys' stories, and in addition to being excellent reading there is much useful knowledge stored therein. The reader learns much about how the blacks live and hunt and incidentally will have a chuckle over the incaution of the white boys when stalking their dinner—which causes them to give the alarm to their prey and so they go dinnerless! The book is pleasingly illustrated with finely tinted coloured plates.

Interesting New Books

We hope to deal with the undermentioned books in an early issue.

"WHITE'S SELBORNE FOR BOYS AND GIRLS" *by* Marcus Woodward (Blackwell)

"THE STORY OF THE HIVE" *by* Canning Williams (Black)

"THE LAND OF MAGELLAN" *by* W. S. Barclay (Methuen)

"SHELL LIFE" *by* E. Step (Fredk. Warne)

"HEROES OF MODERN ADVENTURE" *by* Tiltman & Bridges (Harrap)

"THE HARVEST OF THE WOODS" *by* E. Step (Jarrolds)

"ROVERS AND STAY-AT-HOME" *by* M. Edwin (Dent & Sons Ltd.)

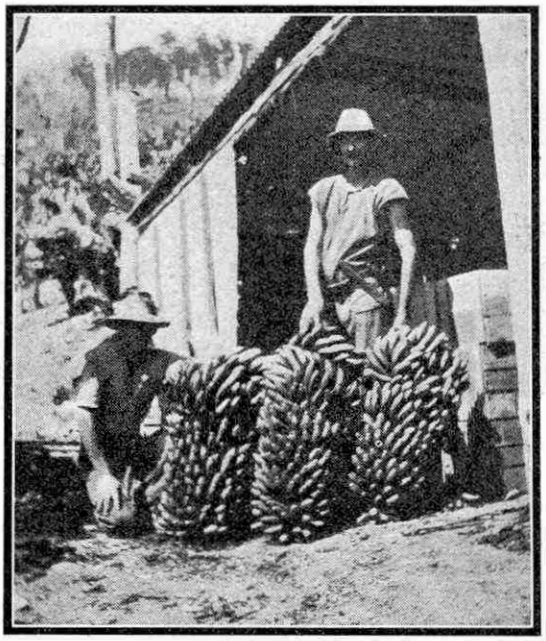
"THE JUNGLE SPIES" *by* Tom Bevan (Collins)

Banana Growing in Queensland

As sites for banana plantations in Queensland hill-sites with an easterly aspect are always chosen because the palms need the morning sun. The ground is first cleared, all trees and shrubs being cut down and burned. Holes are then dug at intervals of 12 ft. to receive the banana suckers. When these begin to grow, men with hoes keep the ground clear from weeds.

The palm grows from 10 ft. to 20 ft. in height, and has drooping leaves from 6 ft. to 10 ft. in length. The true stem is underground, but there is a stalk, often a foot or more in diameter at the base, made up of the sheathing bases of the leaves. This protects the flowering stem as it pushes its way upward. First a long "bud" appears, composed of tightly overlapping purple scales, each of which protects a cluster of true flowers. The lower clusters wither and die and only the upper ones are fertilized and bear fruit.

The bananas grow round the fruit stem in ridges called "hands." A standard-sized bunch averages nine hands, with 10 to 15 bananas a hand. When the fruit is young it points downward, but when nearing maturity it bends upward and into the stem. Each plant produces a single bunch within 12 or 18 months after planting. The palm is then cut down, but in the meantime shoots or suckers from the underground stem have been growing to replace it.



Bananas grown in Queensland. Our reader, Norman Burgess, and his father, with some fine bunches

Bananas for the markets are seldom allowed to ripen on the palm, but are cut while green. The tree-ripened fruit matures so quickly that the skin cracks and insects get in and spoil the fruit. This is unfortunate, for bananas ripened on the palm have a superior flavour.

The bunches are carried to the packing sheds, and the "hands" are cut off and graded, bananas less than 5 in. in length being thrown away. They are then packed in cases, each banana being packed singly. A case will hold two or three bunches. When packed they are placed aboard a special fruit train and conveyed to market, where they bring from 14/- to 30/- per case.

There are nearly 70 known species of bananas but only three or four are grown in Queensland. They are the *"Cavendish," "Sugar"* and *"Lady Finger"* bananas, while the plantain is also grown. This is a very similar plant, the fruit of which grows nearly 2 ft. in length and is used for cooking. The plantain is the chief food of natives in the tropics, taking the place of potatoes. Banana leaves are also of value, being used by the natives of the South Pacific Islands for making mats, cordage and a coarse cloth.

N. BURGESS (Tweed R., N.S.W.)

Reconstructing a Roadway

A short time ago, the roadway of one of the busiest thoroughfares of St. Leonards-on-Sea was entirely reconstructed by an interesting method. A giant pile-driver of a new design was erected. This operated in a similar way to a steam hammer, the hammer being positively driven instead of being hauled up and released, as is the case with most pile drivers. By this method from 15 to 20 blows were struck in a minute, thus greatly accelerating operations.

The piles were made in two halves with a spiral core inside to keep them about an inch apart, and were then covered with a steel casing. When a pile had been driven about 40 ft. into the ground, so that it rested on a bed of rock, the core inside was relaxed and the pile collapsed inward, thus enabling it to be withdrawn, leaving the steel casing intact in the ground. Concrete was then poured into the casing, and when hardened formed a strong ferro-concrete pile.

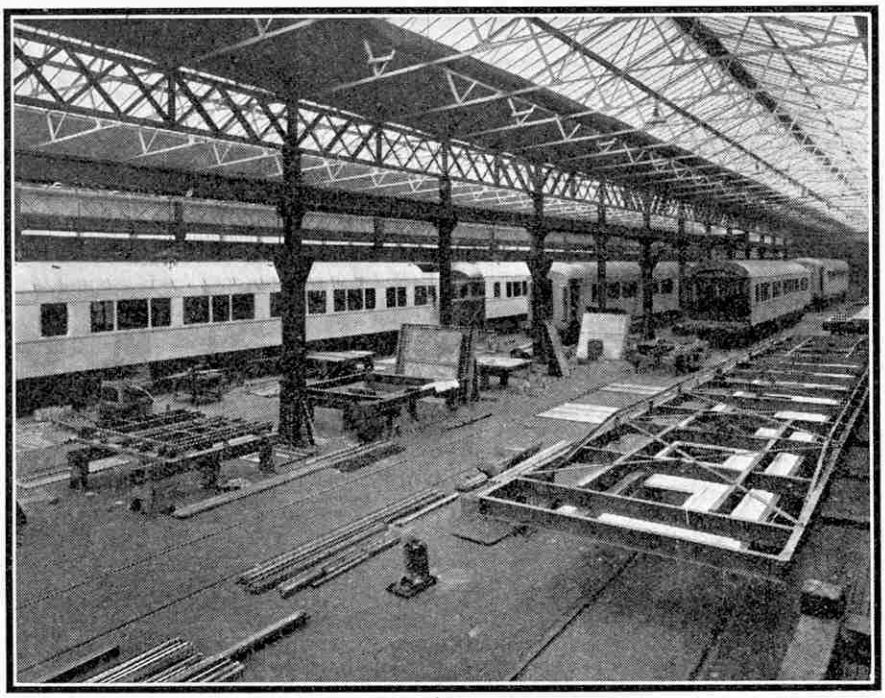
The piles having been driven in in two rows, all the old wooden blocks forming the surface of the road were removed, revealing a layer of concrete about 9 in. in thickness. In this, narrow trenches were cut by means of pneumatic drills. The trenches ran from pile to pile both along and across the road, thus enclosing squares of concrete about 20 ft. square. When the trenches were completed, wire girders were laid in them and concrete was run in and left to set. Then the old concrete enclosed by the trenches was removed and the girders were joined in both directions by long steel rods. After this operation was complete, fresh concrete was run all over the road and then smoothed out to form a level surface on which the new wooden blocks were laid.

The advantage of this new method of road-making is that the girders and the struts joining them form a springy surface for heavy traffic, which otherwise would be liable to cause the earth underneath to subside. A strong road bed has been rendered necessary by the enormous increase in the quantity of traffic passing over the road. L. LACEY (St. Leonards-on-Sea).

Where All-Steel Wagons are Made

Along with a number of others I recently paid a most interesting visit to the works of a large firm in Leeds who manufacture all-steel wagons, carriage underframes and bogies for railways in all parts of the world.

We first visited the offices where I was specially interested in the Works Office with its charts showing the progress of work, weekly expenditure on power, wages, etc. Then we passed on to the Plate Mills where white hot steel ingots weighing seven or eight tons are "cogged," that is they are passed backward and forward between rollers until they are reduced to about eight inches in thickness. Immediately they are cut by huge shears into smaller slabs and are reheated in furnaces, to be rolled into plates by another set of rolls. Both sets of rolls are driven by a 500 h.p. steam engine which can be reversed with amazing swiftness.



Courtesy] **Building Steel Railway Coaches** [Leeds Forge Co. Ltd.

Passing on to the Shearing and Pressing Department, we saw the electrically-driven shears and punches that cut the plates—only a portion of which are made in the Plate Mill—into the shapes required. The sheared plates are then heated in furnaces using producer gas and pressed in hydraulic presses to make wagon, underframe and bogie parts. These pressed steel components are used instead of the channels, angles, etc., that are employed in making the built-up type of bogie or underframe.

We followed the pressed parts to the Constructional Machinery Department where they are ground to size by high-speed emery wheels and drilled for bolts and rivets. We then saw the parts being put together and fastened temporarily in the Erecting and Riveting Shop. Subsequently the erected parts are riveted by pneumatic hammers and hydraulic machines. We saw several complete wagons here, and these being of all-steel construction looked quite different from the majority of British wagons. Rolling stock for overseas is sent in parts, the smaller details being packed in boxes and crates.

We visited the Foundry where cast iron articles are made and then passed on to the Smithy, which appears to vie with the Riveting Department in making as much noise as possible! Smith's hammers, hydraulic hammers, roaring oil furnaces and screeching drop stamps all contribute to the general pandemonium. We were really glad to escape to the Machinery Department where castings and forgings are dealt with by numerous lathes and broaching, drilling, planing, milling, slotting and grinding machines. This completed our tour of the works which, although short, gave us an interesting illustration of modern methods and large-scale production.

W. HARDY (Headingley, Leeds).

The Lowestoft Swing Bridge

While on a visit to Lowestoft I made friends with an official on the Swing Bridge and was allowed to visit the control house. The bridge is operated by hydraulic power, the water being obtained from the harbour.

When a vessel is about to pass, the bridge is cleared and the barriers are run across. The controller, by means of a lever, tilts the span, which is on a pivot at the centre, so that the near end is about 6 in. above the street level and the far end the same distance below it. He then, by means of another lever, removes the blocks on which the near end rests, and the raising lever is then reversed and the bridge tilted the other way. The span is swung by means of a third lever that admits water into a cylinder beneath the span. The water forces out a piston, which draws a cable with it and by means of a series of pulleys pulls the bridge round.

This being done, the controller pulls down a knob that protrudes from the bottom of a metal box on the wall and pushes over the arm of a rheostat, thus switching on power to an electric motor that drives a pump and pumps water into a tank at the end of the building. This tank descends while the power is being used, and so long as the pump is working it continues to descend when the bridge is stationary.

By this time the ship will have passed and water is now admitted into a second cylinder that acts in the same manner as the first, except that it pulls the span round into its original position. When it reaches its place the power is shut off, and the bridge is tilted so that its near side is raised. The blocks are run into place, the bridge is lowered on to them, and the barriers are then run back and the bridge is once more open to traffic.

The pump is still working, however, and the tank continues to rise until it strikes a bar pivoted in the centre. This end of the bar is carried upward and the other end consequently goes downward, pulling with it a wire that passes over two pulleys and is attached to the end of the rod bearing the starting knob. Thus, when the tank reaches a certain point, it automatically cuts off the current and stops the motor, and a few seconds later the rheostat arm flies back of its own accord.

S. GREGORY (Leicester).

The Flettner Rudder

Clearly Explained by a Working Meccano Model

By H. F. Lane

In last month's "M.M." Mr. Lane explained the underlying principles of the Flettner Rudder, and referred to the installation of the actual gear in vessels of various types. Below he describes a remarkable Meccano model that demonstrates the action of the Flettner Rudder in a clear and extremely interesting manner. With the exception of a length of brass tubing, which may be obtained for a few pence from most metal merchants, the model is constructed entirely from standard Meccano parts.

BEFORE commencing to describe the Meccano model it will be necessary to study the manner in which the operating cams on the rudder head actuate the secondary rudder. This should be clear on reference to the diagrams shown in Figs. 1 to 4. In order to make the drawings easier to follow, one of the cams and its corresponding roller have been shaded in each drawing. The roller 6 on one end of the rocker arm 4 runs round the periphery of the cam 1, and the roller 7 runs on the cam 2.

It will be remembered from last month's description of the rudder mechanism that the quartermaster's wheel is connected to the cams 1 and 2, which turn about a pivot as a single unit, and the rocker arm 4 is connected to the secondary rudder. In Figs. 1 and 2 the quartermaster's wheel, and therefore the cams 1 and 2, are in the "midships" position. In Fig. 1 main and secondary rudder are in the normal position and the vessel moves straight ahead.

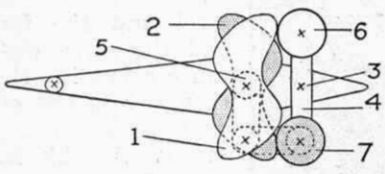


Fig. 1

In Fig. 2 the main rudder has been deflected 30 degrees by external forces, and consequently the rocker pivot 3 has been carried round this amount relative to the cams 1 and 2. Owing to the design of the cams, this movement has the effect of angling the rocker arm 30 degrees relative to the main rudder, and the movement of the rocker arm, transmitted by links and cranks to the operating shaft 5 that passes down through the hollow rudder stock, angles the secondary rudder 30 degrees relative to the main rudder, or 60 degrees relative to the fore and aft line of the ship, thereby producing an increased unbalanced pressure tending to return the main rudder to the midships position. As the main returns, the angle between rocker and main reverts to its original setting, so that, as the main reaches the midships position the system is once more in equilibrium.

The cams are so designed that a critical point occurs in the angling every 45 degrees. Since the relative angle between the secondary and main is a direct function of the relative angle between the centre line of the cams and the main, a deflection of the main of 45 degrees will cause the mean position of the secondary to be deflected 45 degrees relative to the fore and aft lines of the ship, and a further deflection of the secondary of 45 degrees relative to its mean position. Thus the total deflection of the secondary rudder is 90 degrees relative to the fore and aft lines of the ship. In other words, the secondary is now at right-angles to the direction of the stream, and exerts a maximum effect trying to return the main.

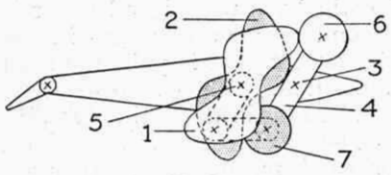


Fig. 3

By studying Fig. 2 it will be seen that if the main rudder is deflected more than 45 degrees the rollers pass their critical points on the cams, and therefore the angle of the rocking arm relative to the main is diminished. Consequently the secondary's angle relative to the main is reduced by an amount equal to the angle of deflection of the main, relative to the ship, in excess of 45 degrees. Thus the secondary is maintained at right-angles to the stream and continues to exert a maximum turning moment.

The above deflections are far larger than could occur in practice. They have been discussed in order to demonstrate the principles more clearly.

The fulfilment of the conditions laid down in paragraph (c) (2) in last month's "*M.M.*" is carried out in the following manner. Suppose that the engines are put astern while the rudder is normal, as in Fig. 1. Though the ship will still carry her headway for some minutes, the powerful sucking effect of the propeller will reverse the direction of the stream in the vicinity of the rudder. Since it is this stream that steers the ship, the rudder must adjust itself at once to the new conditions without waiting until the ship herself has gathered stern way.

Theoretically, if the whole system were in stable equilibrium beforehand, the main rudder would remain in the original position under these new conditions, but in unstable equilibrium. In practice this position could not be maintained more than a few seconds, but to enable the rudder to take up its new position still more quickly, the quartermaster is instructed that whenever the engines are reversed—either from "ahead" to "astern" or vice versa—he is immediately, without further orders, to put full helm (whether starboard or port is immaterial) on the secondary rudder, thereby producing the unbalanced pressure needed to give the main its initial start from its position of unstable equilibrium. Once started, the main continues to swing round, and as soon as the main indicator records 45 degrees, or even before, the quartermaster centres the secondary and leaves the cams to maintain automatically the secondary rudder normal to the stream exerting the maximum precessing couple.

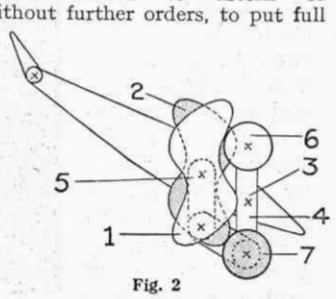


Fig. 2

So far we have considered the ship only on a straight course, which the quartermaster maintains by small helm angles, sometimes to port, sometimes to starboard, as in ordinary power-operated steering gear. In order that a ship may answer her helm effectively under any circumstances, the conditions laid down in paragraphs (a) and (b) (1) must be fulfilled satisfactorily.

Suppose, for example, that the officer of the watch has ordered "starboard 30." The quartermaster spins his wheel the requisite amount, thereby angling the cams 1 and 2 30 degrees in a clockwise direction (see Fig. 3). This causes the rocker 4 to move through a similar amount, causing the secondary rudder to angle 30 degrees in an anti-clockwise direction relative to the main. The resultant reaction of the stream of water impingeing on the angled secondary causes the main rudder to precess in a clockwise direction, thus turning the ship to port. But as the main rudder turns it carries with it the rocker pivot 3. This makes the rocker rollers 5 and 6 "hunt" their original positions on the periphery of the cams, thereby diminishing the angle of the secondary until a position of equilibrium is finally found wherein the small amount of deflection remaining is just sufficient to meet the unbalanced pressure acting on the main due to its deflection.

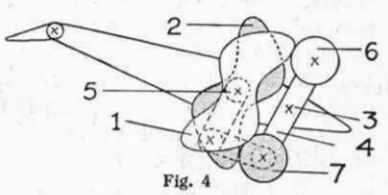


Fig. 4

This is indicated in Fig. 4 where the cams have been angled 30 degrees and the main has precessed 20 degrees, leaving 10 degrees on the secondary to hold it in the position at which equilibrium is assumed to occur. It should be noted that the cam—or control—indicator on the bridge is calibrated to allow for this. Thus, assuming the above ratios to be correct and the officer of the watch to have ordered starboard 20 degrees the quartermaster would spin his wheel until starboard 20 shows on the cam indicator, though to affect this he would actually angle the cams 30 degrees. As a result, with the ship turning in calm water and no wind, starboard 20 should appear on the main indicator, but even if the main indicator swings to 25, drops to 15, and finally settles at, say, 22 the quartermaster disregards it, secure in the knowledge that the sensitive control

is creating a consistent starboard 20 effect throughout.

The effort of the main to keep in step with the cams is no less sensitive when they are angled than when they are amidships. Considering Fig. 3 as a deflection of the main rudder by external forces from the position shown in Fig. 4, the motion of the rocker pivot relative to the cams has increased the secondary angle, and created the precessing couple. A similar but opposite effect occurs when the main suffers deflection in the reverse direction.

The actual rudder proportions determined from a long series of experiments are: area of secondary to area of main rudder, 1 : 8; area of main before stock to area of main abaft stock, 1 : 2.35; and greatest breadth of main (at stock) 1 : 6.6 of its length. These proportions are reproduced very closely in the Meccano model.

The secondary exerts, of course, a small turning moment in the direction opposite to that in which the main rudder is operating. This actually works out at about 2/13th of the whole moment exerted by the main rudder, leaving 11/13th to steer the ship, and therefore is inappreciable.

Construction of the Model

The construction of the model should be commenced by making the main rudder. Both sides of the rudder are similar and are composed of two $5\frac{1}{2}'' \times 3\frac{1}{2}''$ Flat Plates 1, a $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flat Plate 2, and a $2\frac{1}{2}'' \times 2\frac{1}{2}''$ Flat Plate 3 (Fig. 6). The latter overlaps the upper $5\frac{1}{2}'' \times 3\frac{1}{2}''$ Flat Plate by two holes. The leading edges of the Plates 1 and 2 are carefully bent so as to preserve the steam-line section, as also are the projecting portions of the $2\frac{1}{2}'' \times 2\frac{1}{2}''$ Plates 3.

The two halves of the rudder are spaced apart at top and bottom by Flat Girders, a $3\frac{1}{2}''$ Flat Girder being used for the top, and a $4\frac{1}{2}''$ Flat Girder for the bottom. Both Flat Girders are secured to the Plates by $\frac{1}{2}'' \times \frac{1}{2}''$ Angle Brackets.

The secondary rudder, or Flettner "fin," is composed of two pairs of $2\frac{1}{2}''$ Flat Girders 4, which are bolted at their trailing edges one on each side of a $5\frac{1}{2}''$ Strip that gives rigidity to the whole. The leading edges of the Flat Girders are prised apart and pushed on to four Couplings arranged on an 8" Rod 5. Ordinary bolts are used to secure the Flat Girders to the Couplings, one Washer being placed on each bolt between the Couplings and Girders. The top end of the Rod 5 is journalled in the Coupling 5a and the lower end in a 1" Triangular Plate bolted to the $4\frac{1}{2}''$ Flat Girder forming the bottom of the rudder.

The stock 6 consists of a $7\frac{1}{2}''$ length of $\frac{3}{8}''$ inside diameter brass tubing, which can be obtained for a few pence from most metal merchants. It is drilled at certain points to enable it to be attached to the Couplings 7 and 8.

A bolt is passed completely through a hole in the stock 6 and then inserted in a diametrically opposed hole so that its shank projects outside the stock 6. The bolt is then screwed home in the threaded bore of the Coupling 7, a nut being placed on the shank of the bolt and locked against the tube to prevent the bolt working loose. The Octagonal Coupling 8 is also secured to the stock by a bolt.

The control shaft consists of an $11\frac{1}{2}''$ Rod 9, which passes down through the centre of the stock 6, and is journalled near its bottom end in the Octagonal Coupling 8. The motion of the Rod 9 is transmitted to the secondary rudder via the $\frac{7}{8}''$ Bevels 10 and the $\frac{3}{4}''$ Contrate Wheel and $\frac{1}{2}''$ Pinion 11. The 3" Rod carrying one of the $\frac{7}{8}''$ Bevels and the $\frac{1}{2}''$ Pinion is journalled in Couplings that are fixed to the side Plates 2 by $\frac{3}{8}''$ Bolts. It is necessary to place one Washer on each of the $\frac{3}{8}''$ Bolts between the Couplings and the side Plates in order to obtain the correct spacing.

The method of fixing these two Couplings applies also to the Coupling 7. The Octagonal Coupling 8 is secured between the Plates 2 by $\frac{1}{2}''$ Bolts passed through the Plates and inserted in the sides of the Coupling. Five Washers should be placed on each bolt to space the Coupling centrally in the rudder.

When the two halves of the rudder are fitted together, the leading edges of the Plates 1 and 2 and the trailing edges of the $2\frac{1}{2}'' \times 2\frac{1}{2}''$ Flat Plates 3 are drawn together by means of $\frac{3}{8}''$ Bolts. This gives a correct streamline section to the main rudder.

The roller bearing 12 consists essentially of four $\frac{1}{2}''$ fast Pulleys mounted loosely on $\frac{3}{4}''$ Bolts. Each of these bolts is inserted in one of the four centre holes of a Wheel Flange. A second Wheel Flange, which forms the top cover of the bearing, is secured in place by nuts on the ends of the bolts (see Fig. 5). The $\frac{1}{2}''$ Pulleys bear on the rudder stock and so maintain it in the correct vertical position. The complete roller bearing unit is fixed to the horizontal $12\frac{1}{2}''$ Angle Girders of the frame by two of the $\frac{3}{4}''$ Bolts carrying the $\frac{1}{2}''$ Pulleys.

In order to eliminate the specially shaped cam plates that would be necessary with an orthodox model of the Flettner rudder, a very simple device is employed. It is in the form of a double sun-and-planet gear contained in the operating head.

The operating head (see Fig. 7) consists of two Hub Discs spaced

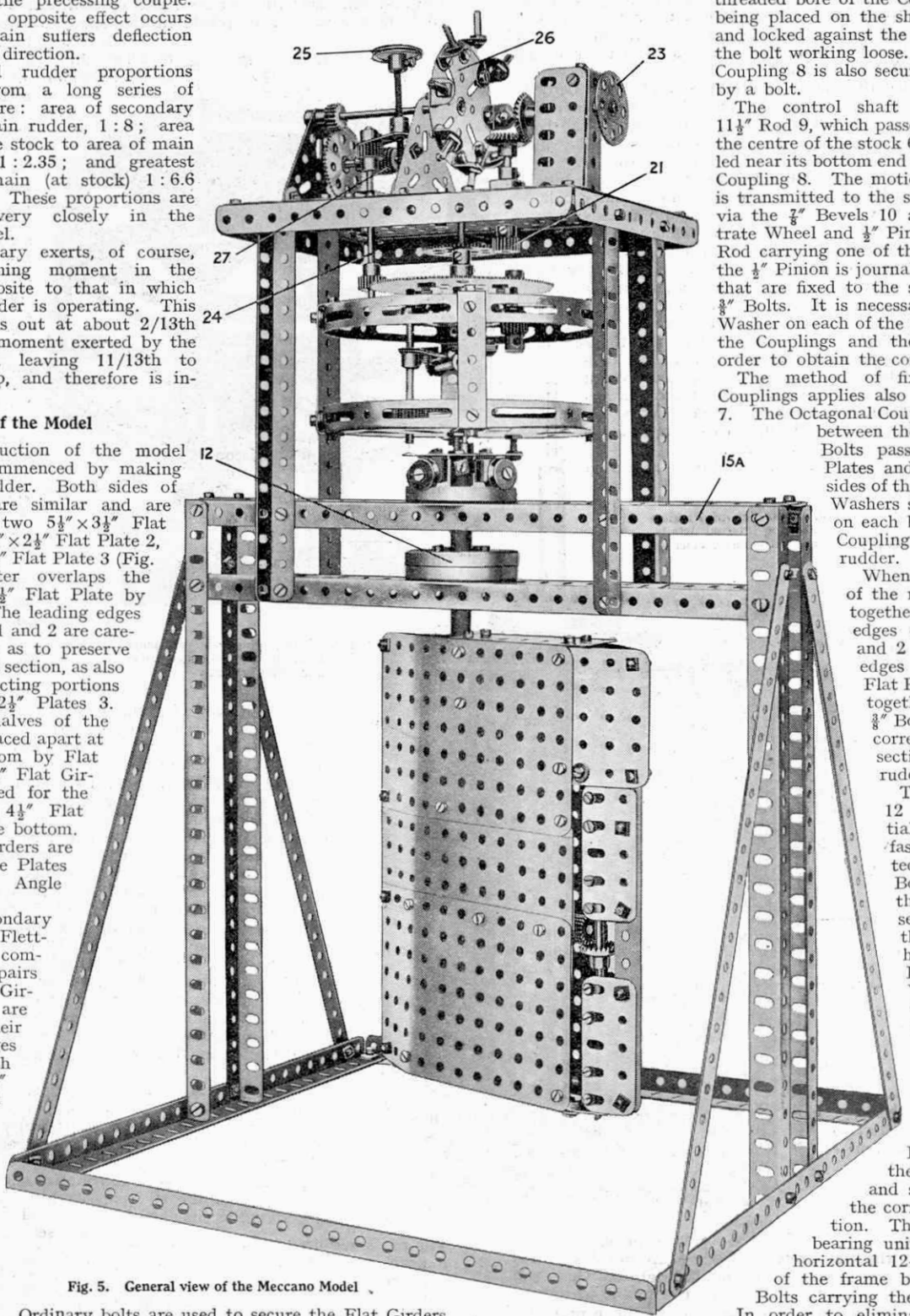


Fig. 5. General view of the Meccano Model

apart by a number of $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips, and is secured rigidly by a number of $\frac{1}{2}''$ bolts, in the manner shown, to a Face Plate 13 that forms the upper half of the top roller bearing unit. Each $\frac{1}{2}''$ loose Pulley forming a roller of the bearing is journalled on a $\frac{3}{8}''$ Bolt that is held in a Threaded Boss 14. In order that the $\frac{1}{2}''$ Pulleys shall not come into contact with the underside of the Face Plate 13, the Threaded Bosses 14 are packed away from the latter by two Washers on each of their retaining bolts. The $\frac{1}{2}''$ Pulleys normally ride on the edge of the Wheel Flange 15, but they are shown raised free of this guide so that their arrangement may be seen more clearly.

The Wheel Flange 15 is bolted to the two $12\frac{1}{2}''$ Angle Girders 15a of the demonstration frame (Fig. 5). Thus the two roller bearing units 12 and 15 serve to retain the rudder in the best possible manner, the bearing 12 taking up the side play and the bearing 15 taking the direct weight of the rudder.

The top of the rudder stock 6 is secured rigidly to the boss of the Face Plate 13 (see Figs. 5 and 7) by an ordinary bolt, which is passed through a hole in the stock and screwed into the set-screw hole of the Face Plate. A nut is used to prevent the bolt touching the control shaft 9, which must revolve freely within the boss of the Face Plate. It will now be realised that the whole of the operating head rotates as one with the main rudder, and that the control shaft is quite free to turn independently of the stock and operating head.

The 50-teeth Gear Wheel 16 is secured to the top of the control shaft 9, and meshes with a $\frac{3}{4}''$ Pinion fixed to a 3" Rod that is journalled in holes in the top and bottom Hub Discs. On the same Rod is a Crank 17, which has its arm prolonged to two inches between centres by a 2" Strip bolted to it. The 3" Rod 18 has a 57-teeth Gear Wheel 19 secured to its lower end.

The Gear 19 is in mesh with the $\frac{1}{2}''$ Pinion mounted on a short Rod that is journalled in the upper Hub Disc and in one of the holes of the 3" Gear Wheel 20. A Crank 21 is attached to this Rod and is connected to the Crank 17 by means of a 2" Rod that is mounted pivotally on the Cranks by means of Collars, ordinary bolts being passed through the end holes of the Cranks 17 and 21 and inserted in the set-screw holes of the Collars. It will be observed that the Crank 21 is equipped with a Flat Bracket, the round hole of which coincides with the elongated hole of the Crank and forms a bearing for the bolt secured to the connecting rod.

A 57-teeth Gear secured to the upper end of the Rod 18 is in mesh with a $\frac{1}{2}''$ Pinion 21 (Fig. 5), which is mounted on a short Rod carried in a foot-step bearing consisting of a Double Bent Strip bolted to one of the $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flat Plates that represent the "deck." As will be seen, the short Rod carries at its upper extremity a $\frac{7}{8}''$ Bevel that meshes with a second Bevel actuated by the steering wheel 23. To ensure that the 57-teeth Gear and the Pinion 21 (Fig. 5) engage correctly, it is advisable to journal the top end of the Rod 18 in one of the holes of the Flat Plates comprising the "deck." The $3\frac{1}{2}''$ Gear 20 is attached to the upper Hub Disc by $\frac{1}{2}''$ Bolts in a similar way to the Face Plate 13.

Rotation of the Bush Wheel 23 causes the Gear 19 (Fig. 7) to be operated via the $\frac{7}{8}''$ Bevels and the $\frac{1}{2}''$ Pinion 21 (Fig. 5) meshing with the 57-teeth Gear on the Rod 18. Thus the Crank 21 (Fig. 7) is caused to rotate, and with it the second Crank 17, which operates the control shaft 9 through the medium of the 50-teeth Gear 16.

As a result of the angle thus set on the secondary rudder, the main precesses to a new position, but in so doing carries round with it the two vertical shafts mounted in the Hub Discs. Since the 57-teeth Gear 19 is at rest, this motion causes the $\frac{1}{2}''$ Pinion that meshes with it to rotate in the opposite direction to that in which it was turned originally, thereby diminishing the angle of the secondary until equilibrium is found.

Similarly, if external deflection takes place on the main after the latter has been placed in any position the secondary rudder automatically alters its angle, because the Pinion actuating the Crank 21 (Fig. 7) travels round the stationary Gear Wheel 19. The turning moment exerted by the secondary then restores the main to whatever angle of helm had been set previously. When the main rudder arrives at its former position it will be found that the secondary rudder is also in its original position.

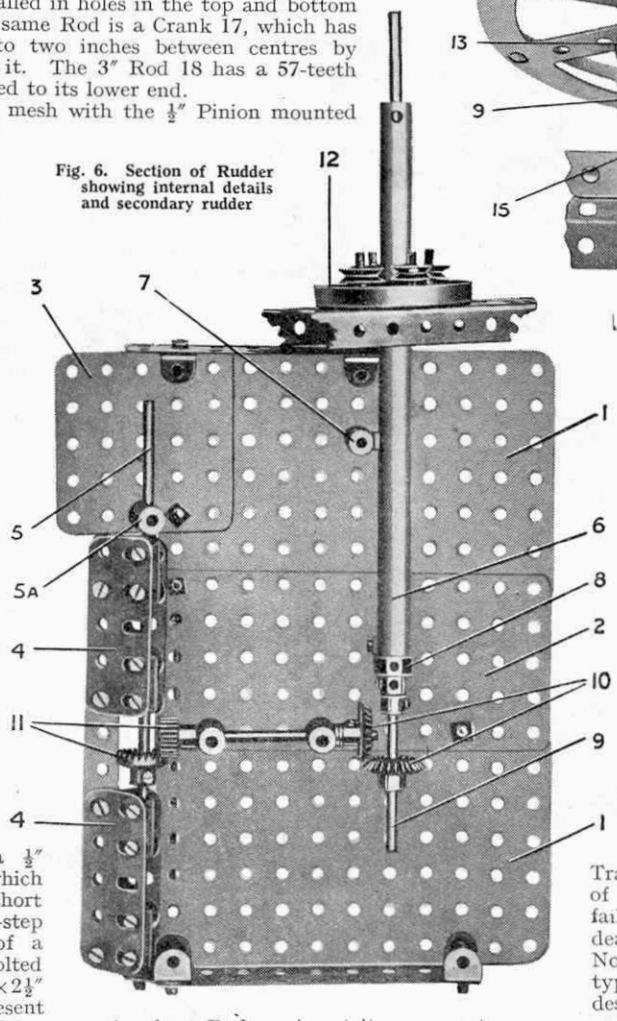


Fig. 6. Section of Rudder showing internal details and secondary rudder

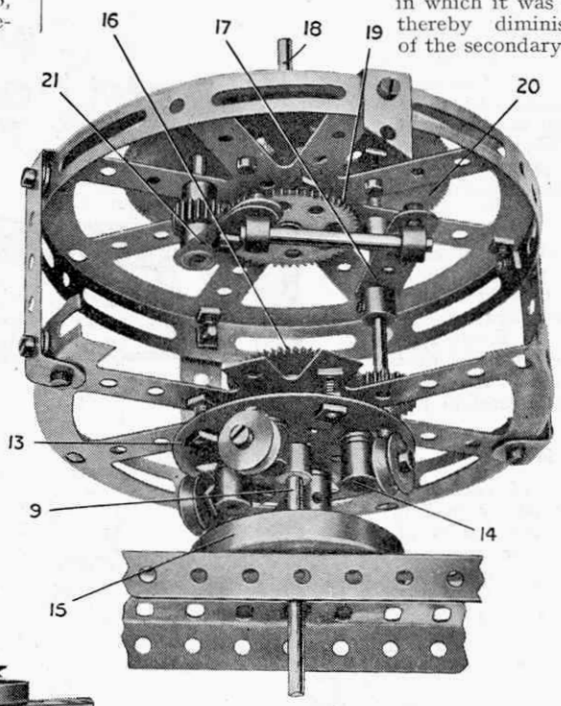


Fig. 7. Operating head of Rudder, showing control mechanism and roller bearings

It is necessary for the Crank 21, which has to turn complete circles, to be shorter than the Crank 17, in order that the latter shall never be at a dead point. At the same time, the control shaft and operating shaft 18 must turn through equal angles. The arrangement given here provides for these angles being equal with sufficient accuracy up to 30 degrees or 40 degrees on either side of the mean position—i.e., for controlling the main rudder when on a steady course, or for setting the maximum helm angle that can be applied by the quartermaster.

To render the rudder controllable by the emergency hand steering gear (Fig. 5) the 1" fast Pulley 25 on the end of the $3\frac{1}{2}''$ Threaded Rod is rotated until the $\frac{1}{2}''$ Pinion on the end of the $3\frac{1}{2}''$ Rod 24 is brought into engagement with the $3\frac{1}{2}''$ Gear Wheel 20.

The $\frac{1}{2}''$ Pinion near the upper end of the Rod 25 is brought simultaneously into mesh with the Worm 27, so that when the hand steering wheel 26 is turned, the Gear 20 is moved and with it the main rudder.

As stated in last month's article, the Board of Trade regulations provide that a ship must be capable of control by hand in the event of the mechanical gear failing. The subject of emergency hand steering gear was dealt with more fully in another article (see "*M.M.*" for November, 1926), and a Meccano demonstration model of a typical arrangement for steering a ship by hand was described in detail in that article.

The parts required to build the Meccano Model are as follows:—

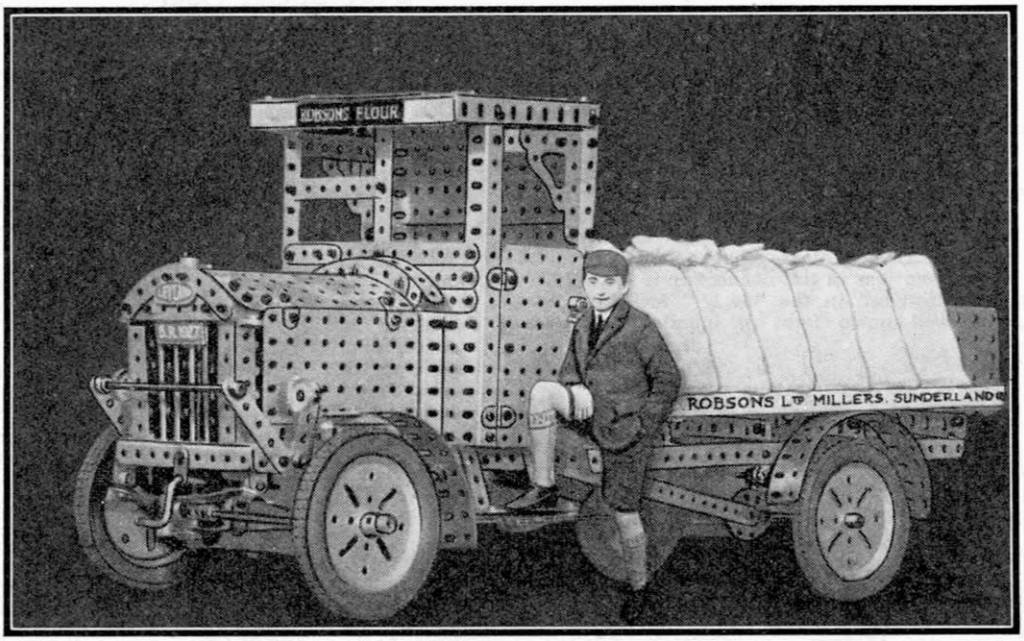
4 of No.	1	1 of No.	14	1 of No.	27	5 of No.	48A	1 of No.	77		
1 " "	2	3 " "	16	3 " "	27A	4 " "	52A	1 " "	80A		
1 " "	6	3 " "	16B	1 " "	27B	10 " "	59	1 " "	103C		
2 " "	6A	4 " "	17	1 " "	29	2 " "	62	1 " "	103D		
12 " "	8	1 " "	18A	4 " "	30	1 " "	62A	6 " "	103F		
4 " "	8A	1 " "	22	1 " "	32	8 " "	63	4 " "	111		
2 " "	8B	4 " "	23	112 " "	37	1 " "	63A	8 " "	111A		
2 " "	9	4 " "	23A	20 " "	37A	4 " "	64	28 " "	111C		
1 " "	10	1 " "	24	50 " "	38	5 " "	70	8 " "	115		
2 " "	11	1 " "	25	2 " "	45	2 " "	72	2 " "	118		
18 " "	12	6 " "	26	1 " "	46	2 " "	76	3 " "	137		
1 " "	13			1 brass tube as specified							

A Realistic Meccano Motor Lorry

Built by an "*M.M.*" Reader

THE motor lorry shown on this page might easily be mistaken for a full-sized vehicle, the outside of which had been painted to resemble gigantic Meccano parts. It is an actual Meccano model, however, and the illustration is merely an ingenious example of "fake" photography. The designer and constructor of the lorry, J. W. Vipond of Sunderland, obtained for his work an award in a recent "*M.M.*" Model-building Competition and prizes in two shows held a short time ago in Co. Durham. One of the shows was held at Seaham Harbour, where he obtained First Prize and in the other, which took place at Shildon, he secured a silver medal.

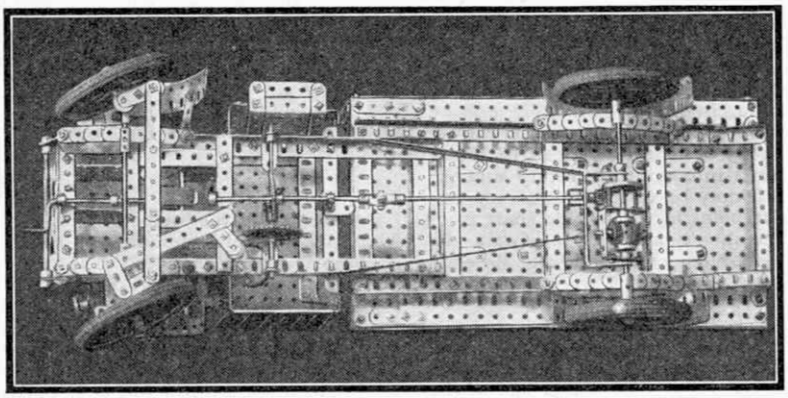
The realistic illustration was obtained, of course, by superimposing a separate photograph of the constructor upon a photograph of the lorry. The final print, prepared from the paste-up, gives the illusion of a Meccano boy (of somewhat sturdy proportions!) standing with one foot on the step (seemingly a full 18" high) of the Meccano lorry.



This is not a scene from Meccanoland, nor yet the production of a "super" Meccano Outfit. The photographs of J. W. Vipond and his model motor lorry have been "faked" so that the designer appears to be standing with one foot upon his handiwork

Quite apart from the novelty of the photograph, the model should prove of great interest to our readers. In every detail it is an almost perfect reproduction of the outward appearance of the actual vehicle. It has a hinged door (complete with catch), a hinged bonnet, lamps, starting handle, etc., and the bars of the radiator are convincingly represented by Axle Rods. The inscriptions on the sides and front of the lorry, together with its Dunlop tyres and the miniature sacks with which it is loaded, give a final touch of realism to its appearance.

In the lower illustration we show a view of the underside of the model. It will be seen that the mechanism is of a very simple and straightforward design. The drive from the Electric Motor is transmitted via a short Sprocket Chain drive and a Worm gear to a 57-teeth Gear Wheel secured to the propeller shaft. The latter incorporates a Universal Coupling, which maintains a uniform transmission of power to the rear axle whilst allowing for movements in the back axle caused by irregularities in the road surface.



This is an underside view of the model motor lorry. Note the arrangement of the drive transmission, rear springs, and novel steering gear

The steering gear is somewhat unorthodox, for it consists chiefly of Strips and Cranks, which are actuated directly by a Crank secured to the end of the steering column. This arrangement has, as it stands, two distinct disadvantages. The first is that it is not of the Ackermann type, i.e., the road wheels do not turn through unequal angles in order to compensate for the difference in radius of the arcs described by the front wheels in rounding a corner.

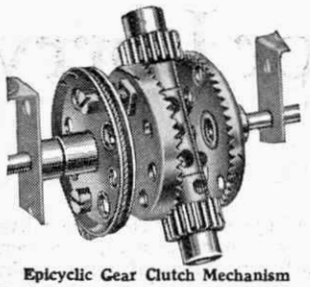
The steering gear may easily be converted to the Ackermann system, however, by altering the positions of the two Cranks secured to the stub axles, so that they lie at obtuse angles to the front wheels instead of right-angles, and shortening the tie-rod that joins them.

The second disadvantage of the steering mechanism is that no reduction gearing is introduced in the connections between the steering column and the stub axles, with the consequence that the front wheels are turned to their fullest extent by only a fraction of a revolution of the steering wheel. A slight movement of the latter would thus cause too great a deviation in the road wheels, and steering would be difficult and dangerous.

A differential similar to that described under detail No. 251 in the Standard Mechanisms Manual is embodied in the model, and torque rods are represented by two Strips bolted to the differential frame and to the side members of the chassis.

Vipond's main object in building the model was to reproduce the original as closely as possible in appearance, and most of our readers will agree that he has fully attained his end. From the point of view of the model engineering enthusiast, however, the mechanism offers scope for improvement and additions. We are of the opinion that the reproduction of mechanical essentials is quite as important as the perfection of external details, and the size of the builder's outfit permitting, an effort should be made to reproduce at least the more important features of the actual mechanism.

The addition of a clutch, gear box, and braking system similar to those used in the new Meccano chassis would result in a reproduction of the real thing of which even an experienced engineer might well be proud.



Epicyclic Gear Clutch Mechanism

Suggestions Section

Edited by "Spanner"

(123)—"Wobble Shaft" Variable Speed Gear

(Harold W. Turner, Hastings, New Zealand)

THE interesting model shown in Fig. 123 is of a new and very ingenious type of infinitely variable speed gear. It is known as "wobble shaft" transmission, owing to the curious motion of the principal part of the mechanism.

It is a recognised fact that the ordinary type of gear box, with sliding gears, is very far from the ideal form of drive transmission, and for some years past there have been many and varied attempts to devise a really efficient and practical gear box that will provide a speed ratio capable of very fine variation and that at the same time will eliminate the necessity of engaging toothed wheels. One of the best known inventions in this connection is the P.I.V. Gear, which was fully described in the *"M.M."* for May and June, 1927. Another well-known form of infinitely variable speed gear is the torque converter, a Meccano model of which is illustrated and described in the Standard Mechanisms Manual (detail No. 254, Section XIII).

The construction of these devices in Meccano is very instructive. Moreover, when completed, they may be incorporated in all kinds of models and some extremely interesting results thereby obtained. The principle embodied in the wobble-shaft transmission has not been applied previously to a Meccano model.

The most important feature of the mechanism is a shaft that is actuated by some form of motor in such a way that one of its ends describes a circular path. The other end of the shaft is attached by means of a universal joint to a fixed point; hence the diameter of the circular path described by the shaft varies from a maximum at one end to zero at the fixed end. If some convenient means can be found to convert this circular movement into ordinary rotary motion, then the speed of the driven shaft may be varied within very fine limits according to the particular point in the wobble shaft from which the drive is taken. The means adopted to obtain the required result will be perfectly clear on reference to the Meccano model.

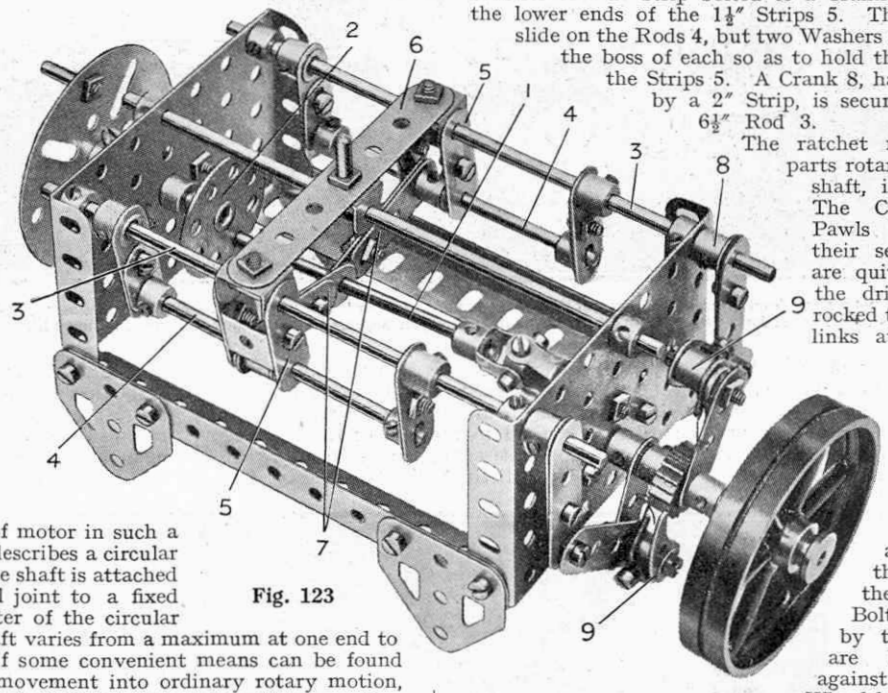


Fig. 123

Construction of the Model

The 4½" Axle Rod 1, which forms the wobble shaft, is secured at one end to a Universal Coupling that is fixed to a Threaded Pin bolted on the end 3½"×2½" Flanged Plate. The other end of the Rod 1 is inserted in one of the holes of a Bush Wheel 2. This Bush Wheel 2 is secured to the driving shaft, which in the model is journalled in a reinforced bearing consisting of a Double Bent Strip bolted to the 3½"×2½" Flanged Plate. By rotating the hand wheel secured to this Rod the end of the wobble shaft 1 inserted in the Bush Wheel is caused to describe a circular motion. The shaft itself does not rotate of course. Two 6½" Axle Rods 3 should now be journalled in the Flanged Plates and held in position by Collars and set-screws, as shown. Two Cranks are secured to each Rod, and each pair of Cranks carries a 3½" Rod 4 in their end holes. The bearings for the Rods 4 in the Crank arms are reinforced by Flat Brackets bolted to the Cranks.

The 1½" Strips 5 are free to slide on the Rods 3 and 4, and are bolted together in pairs by means of Double Brackets. All the Strips 5 are moved simultaneously to and fro by means of the 3½" Strip 6, each end of which is bolted to further Double Brackets held between the ends of the Strips 5. The handle provided at the centre of the Strip 6 consists of a Threaded Pin, the shank of which is employed to secure another Double Bracket which slides upon a further 6½" Axle Rod. This Rod serves merely as a guide.

Each link 7 connecting the Rods 4 and the wobble shaft 1 consists of a 2" Strip bolted to a Crank that is placed between the lower ends of the 1½" Strips 5. These Cranks are free to slide on the Rods 4, but two Washers should be placed against the boss of each so as to hold them in position between the Strips 5. A Crank 8, having its arm prolonged by a 2" Strip, is secured at one end of each 6½" Rod 3.

The ratchet mechanism, which imparts rotary motion to the driven shaft, is shown fairly clearly. The Cranks on which the Pawls 9 are mounted have their set-screws removed and are quite free to move about the driven shaft. They are rocked to and fro by connecting links attached to the Cranks 8. The connecting links consist of 2" Strips pivotally attached by bolts and nuts (see Standard Mechanism No. 263) to the end holes of the 2" Strips bolted to the Cranks 8, and their other ends are mounted loosely on the ¾" Bolts carrying the Pawls 9. Each ¾" Bolt is secured to its Crank by two nuts. The Pawls are held in engagement against the teeth of the Ratchet Wheel by pieces of Spring Cord connected to the centre holes of the Cranks and to the Pawls.

A Flywheel is mounted on the driven shaft in order to obtain steady rotary motion. The inner end of the driven shaft is journalled in a Double Bent Strip bolted to the Flanged Plate. Another bearing for this shaft should be placed in front of the Flywheel (this bearing has been removed from the illustration).

When the 3" Strip 6 is pushed towards the Bush Wheel end of the model—where the motion of the wobble shaft 1 is at a maximum—the maximum throw will be imparted via the links 7 to the Rod 4, and the resulting motion of the Cranks 8 imparts a maximum throw to the Pawls operating the Ratchet Wheel. Consequently the driven shaft will revolve at its highest speed. If the Strip 6 is moved in the opposite direction—that is, towards the Universal Joint—the throw of the links 7 decreases and the speed of the driven shaft falls.

The neutral position is obtained by sliding the links 7 as closely as possible to the Universal Joint. In this position the throw imparted to the links 7 is insufficient to rotate the Ratchet Wheel.

(124)—A Meccano Desk Agenda

(P. B. Brown, Godalming, Surrey)

From time to time we have described in the Magazine many articles built with Meccano parts that may be put to really practical use, and the desk agenda, or memo. pad, illustrated in Fig. 124 is the latest addition to the list. It is possible that some "*M.M.*" readers will welcome this model as a means to induce Father to provide further new parts (on the desk in his den, or at his office, the Meccano agenda will be of great value to him !) Others will probably find many uses for it themselves. We should like to recommend it especially to all hard-working Club secretaries !

The device consists principally of two Meccano Wood Rollers mounted on 4½" Axle Rods journalled in the frame in the positions shown. The Rollers are secured to the Rods by means of Collars having ordinary bolts inserted in place of their grub screws. The Collars are inserted in the recesses in the ends of the Rollers and secured to the Rods so that their bolts lie in the grooves specially cut for the purpose.

A long narrow strip of paper, specially prepared for the purpose by cutting strips and pasting them end to end, is wound round the Roller 2 and its other end is attached to the Roller 1. In order to transfer the paper from one Roller to the other, the 4½" Rods are rotated simultaneously by means of two Flanged Wheels, secured one on each Rod and on opposite sides of the model.

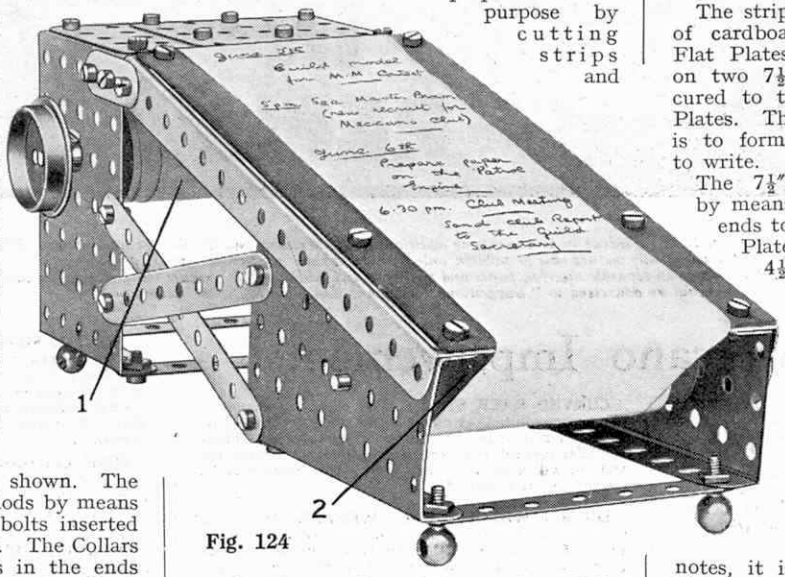


Fig. 124

The strip of paper passes over a sheet of cardboard, bolted to two 5½"×3½" Flat Plates, which, in turn, are placed on two 7½" Angle Girders that are secured to the upper sides of the Sector Plates. The purpose of the cardboard is to form a smooth surface on which to write.

The 7½" Angle Girders are secured by means of 1½" Strips at their upper ends to the upright 3½"×2½" Flanged Plates in which is journalled the 4½" Rod carrying the Roller 1. Four Handrail Supports secured underneath the frame at each corner form legs on which the agenda stands firmly. Handrail Supports are very useful for this purpose, for their rounded surfaces allow the model to be placed upon highly polished furniture without fear of scratching.

When the exposed strip of paper becomes filled with notes, it is only necessary to turn the Rollers to bring a further supply of paper into position.

Miscellaneous Suggestions

Under this heading "Spanner" replies to readers who submit interesting suggestions regarding new Meccano models or movements that he is unable to deal with more fully elsewhere. On occasion he offers comments and technical criticisms that, he trusts, will be accepted in the same spirit of mutual help in which they are advanced.

(M.18). Meccano Radiators.—"*M.M.*" readers are constantly devising realistic radiators for use in Meccano model motor cars. R. Musgreave, of Wakefield, tells us that he uses a small piece of copper gauze or perforated zinc of the kind used for meat safes, etc. This is attached to a suitable framework built up from Meccano Strips, and the complete radiator looks very well indeed.

(M.19). Improved Gear Change.—A useful gear-changing device is suggested by S. Hobday, of Windsor. It consists principally of a Threaded Crank mounted on a Threaded Rod of convenient length. The sliding Rod carrying the change gears is passed through the slotted hole in the end of the Threaded Crank and is fitted with a Collar on each side of the Crank. On rotation of the Threaded Rod, the Crank is caused to travel to and fro along its length, carrying with it the sliding Rod and thereby effecting the gear changes. One advantage of this device is that, once set in the desired position, the gears cannot be moved out of engagement through vibration, etc.

(M.20). Drip-feed Lubrication.—There are many instances where the moving parts of a model require constant lubrication, and for this purpose the drip-feed lubricator suggested by T. Smith (Woodley) is eminently suitable. Briefly, it consists of a small funnel, of the kind that is sold with model steam engines, secured in position above the part requiring lubrication, and a strand or two of round lamp wick threaded through the funnel, so that the end rests on the part to be oiled. The funnel is then filled and the oil allowed to soak through the wick.

(125)—Worssman's Silent Feed

(Kenneth Brooks, Sale, Cheshire)

There are many examples in engineering practice where ratchet mechanism is employed to impart intermittent rotary motion to a shaft, and such mechanism has frequently been reproduced in Meccano. By arranging two or more ratchets to work alternately on a single shaft, a series of impulses may be imparted so as to produce a comparatively smooth and continuous rotary motion. An example of this form of gearing is included in the "wobble-shaft" transmission gear described on the opposite page.

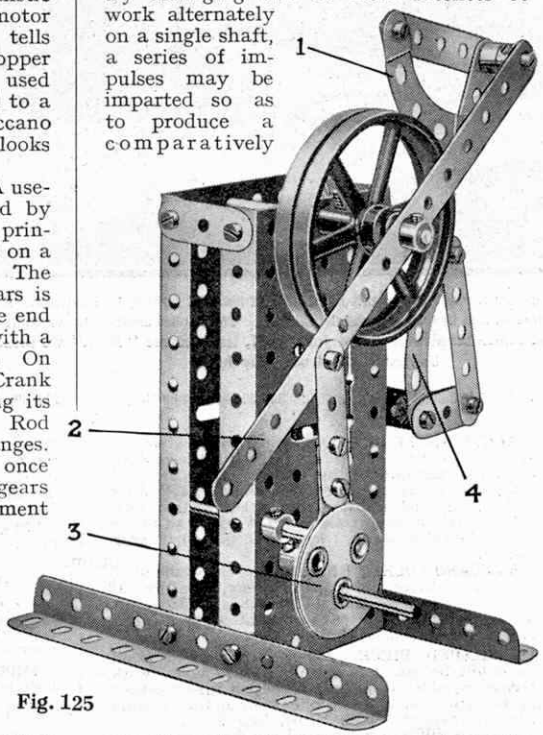


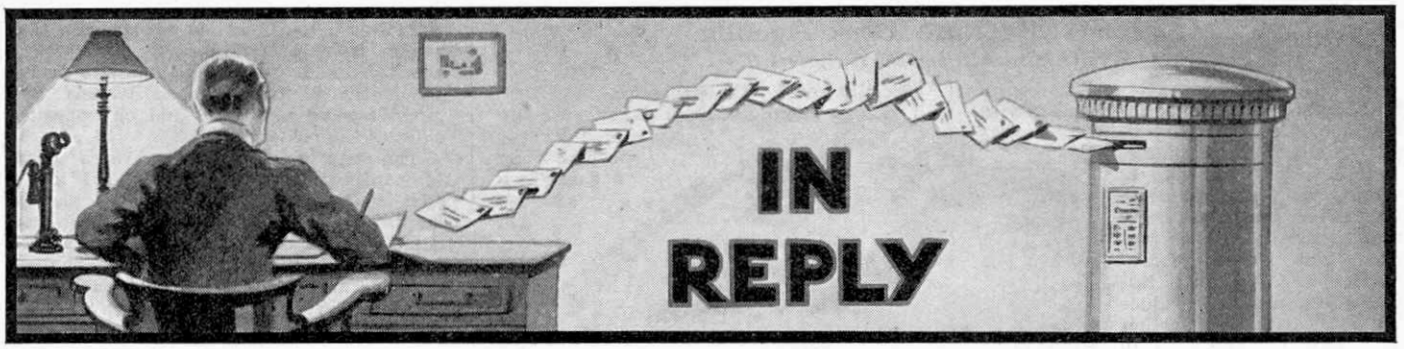
Fig. 125

In practice the teeth of the pawls and ratchets are subjected to excessive wear, and any device that tends to reduce this is very welcome. The amount of wear in the Worssman silent feed, which dispenses with the ordinary type of pawl and toothed ratchets while obtaining the same results, is practically negligible. It forms an excellent substitute for the ordinary ratchet motion when a light drive is required.

A Meccano model of this interesting mechanism is shown in Fig. 125. As will be seen the mechanism is extremely simple and there is doubtless many ways in which it can be used in conjunction with Meccano models. The Flywheel is secured to a 3½" Axle Rod that is journalled in the Upright Flanged Plates, and the 7½" Strip 2 is mounted pivotally on the Rod. The 2½" small radius Curved Strip 1, which corresponds to the pawl in the orthodox ratchet mechanism, has a 2½" Strip bolted to one of its ends and a 1½" Strip bolted to the other. The cam unit so formed is attached to the end of the 7½" Strip 2 by means of a ¾" Bolt, which is secured to the unit by two nuts. Two Collars should be placed on the bolt between the cam and the Strip 2.

The Strip 2 is rocked about its pivot on the Rod of the Flywheel by the Eccentric 3, to which it is connected by a 2" Strip. This Strip is attached pivotally to the Strip 2, and the motion imparted to the Flywheel can be modified by altering its point of attachment.

The second cam unit is identical in construction to the first, but is attached pivotally to a 1"×1" Angle Bracket that is bolted to the flanges of the upright Plates. When the shaft carrying the Eccentric is set in motion the Flywheel is rotated intermittently by the Curved Strip 1, which when moving in one direction rides freely over the Flywheel but in the reverse direction grips the milled groove that is cut in the circumference of the Flywheel. The object of the Curved Strip 4 is merely to prevent the Flywheel moving backward when the Curved Strip 1 is making its return stroke.



In these columns we reply to suggestions regarding improvements or additions to the Meccano and Hornby Train systems. We receive many hundreds of such suggestions every week, and consequently we are able to publish only ideas that show particular interest or ingenuity. Suggestions submitted for consideration in this section must be written on separate sheets of paper and the name and address of the sender must appear on each sheet used. Envelopes should be addressed to "Suggestions," Meccano Ltd., Binns Road, Liverpool.

Suggested Meccano Improvements

2½" PULLEY WHEELS.—We are afraid that little use could be found for these parts, and therefore we do not consider their manufacture desirable. (*Reply to F. Gerarde, Bristol*).

NEW TYPE ROD.—We note that you consider a suitable addition to the system would be a rod having a portion of its length keyed. We are keeping your idea before us for future reference. (*Reply to L. J. Larking, Weymouth*).

COVERING FABRIC.—Such substances as cloth and leather are unsuitable for inclusion in the system. (*Reply to Charles Daye, London, E.9*).

2" RUBBER RING.—We cannot see that a 2" rubber ring would be of much use to the Meccano system, as the 2" Dunlop Tyre or the 3" Rubber Ring (part No. 142) fulfils practically all its uses. (*Reply to W. C. Whitelow, Leeds*).

THINNER WASHERS.—We are unable to see any reason for decreasing the thickness of the existing Washers, but further suggestions regarding this matter would be appreciated. (*Reply to G. Stokes, Whitchurch*).

NEW SPROCKET CHAIN.—We were interested to note that you consider that a Sprocket Chain of double width would be useful in the Meccano System. Your idea is worthy of consideration and will be filed for future reference. (*Reply to J. E. Parker, Kensington, W.*).

NEW RESISTANCE CONTROLLER. — A variable high-resistance would no doubt be useful in certain experiments with Meccano electrical apparatus. It could also be used to control the speed of the Electric Motor. Your idea will receive further attention. (*Reply to C. R. Fowler, Adelaide*).

SOUND BOXES.—These articles cannot be introduced into the system for very few uses could be found for them. (*Reply to J. S. Fariner, Wanstead, E.11*).

CONICAL PIECE.—We note that you suggest a conical-shaped piece for fastening over the 2" and 3" Pulley Wheels, thus forming a disc wheel. Your idea is interesting but is impracticable as the part would serve no useful purpose. (*Reply to D. Healey, Sheffield*).

THREADED STRIP COUPLING.—An accessory of this type is not suitable, we consider, as its uses are covered already by existing parts. (*Reply to C. R. Fairhurst, Glasgow*).

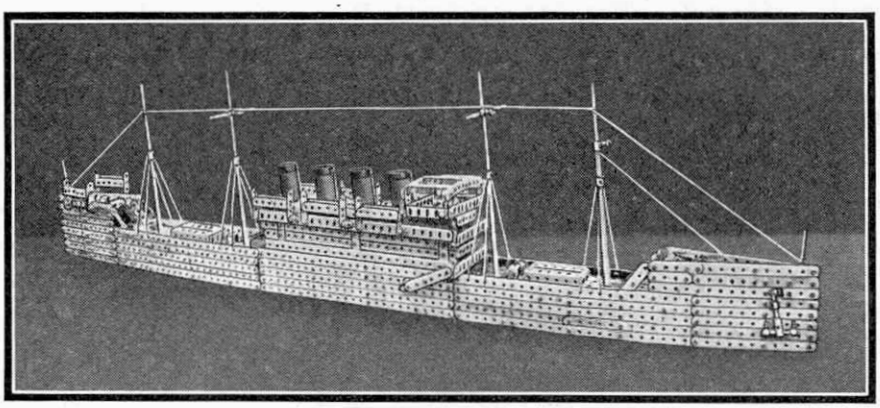
INSULATING KNOBS.—It would be difficult to find many uses for such parts. In conjunction with the 6 B.A. Screws they would certainly form a neat terminal, but the existing metal terminal is, we think, quite sufficient. (*Reply to J. J. Hooks, Market Drayton*).

MINIATURE LIFEBELTS.—These articles cannot be introduced as Meccano parts, for apart from their ornamental value they would have little use. (*Reply to C. Grey, Southall*).

CURVED RACK STRIPS.—We were interested in your suggestion that curved rack strips, serrated on their inner surfaces, should be manufactured. These would enable internal-teeth gear wheels to be built up, and we will keep your idea before us. (*Reply to V. Thompson, Woodhall Spa*).

DOUBLE-WIDTH GEAR WHEELS.—We note that you are in favour of the introduction of double-width 57-teeth and 50-teeth Gear Wheels. These would no doubt be very useful in the construction of gear boxes, etc., and we will keep your suggestion in mind. (*Reply to D. Garnett, Bournemouth*).

A WELL-PROPORTIONED MODEL LINER



Our illustration is of a fine model Cunard liner built by Harold Roden, of Upton, Birkenhead. Roden, who is 9 years of age, is quite an expert in this branch of model-building. The model clearly shows what excellent work he can turn out. It will be remembered that in the July, 1927, issue of the "M.M." we illustrated a model battleship constructed by him.

ACUTE ANGLE GEARING.—Gear wheels giving an acute and obtuse angle drive are not, we consider, a suitable addition to the system. There are very few instances where an acute or obtuse angle drive is required, and in these cases the existing Gear Wheels, used in conjunction with Worms, can nearly always be substituted. (*Reply to D. Garnett, Bournemouth*).

MECCANO POCKET KNIFE.—A pocket-knife fitted with screwdriver, Meccano spanner, etc., would be a very useful addition to the model-builder's kit, and we will give your idea further attention. (*Reply to G. D. Taylor, Stoke Mandeville*).

H-SHAPED PIECE.—An H-shaped piece would no doubt be useful in certain constructional work, but we consider that its introduction is unnecessary as this article can quite easily be built up from existing Strips. (*Reply to T. W. Moore, New York*).

IMPROVED CLOCKWORK MOTOR.—We doubt whether any improvement would result from fitting the Clockwork Motor with a screwed winding shaft, in place of the keyed one now fitted. It would certainly enable Couplings, Threaded Bosses, etc., to be used as winding keys, but we do not consider that this method of winding the Motor would be very efficient. (*Reply to R. Hastings, Madrid*).

SPECIAL SWITCHES.—It would be contrary to our usual practice to manufacture special switches. We feel sure most Meccano boys prefer to construct such accessories for themselves, or, alternatively special switches may easily be purchased from any electrical dealer. (*Reply to J. Macdonald, Alloa, Scotland*).

CONE CLUTCH.—The question of introducing a cone clutch has received our attention for some time past and we hope in the near future to give a definite announcement concerning this matter. (*Reply to C. P. Collins, Chester; D. Robinson, Hull; and others*).

IMPROVED 6" CIRCULAR PLATES.—We were interested in your suggestion that a series of slots should be cut in the 6" diam. Circular Plate (part No. 146). This would no doubt increase the adaptability of the part and your idea will receive further attention. (*Reply to Tomiso d'Arosse, Vicenza, Italy*).

BASE PLATES.—As has been stated previously in these pages, we are not in favour of introducing large perforated Plates to act as bases for large Meccano models. Where such plates are required they can be built up from a number of existing Plates or, alternatively, a wooden baseboard can be used. (*Reply to F. French, Newcastle-on-Tyne*).

S.B.C. BULB HOLDERS.—We are not in favour of your suggestion that small bayonet cap bulb holders would be suitable additions to the system. The existing miniature Edison screw holders will be found quite suitable in practically all Meccano models. (*Reply to J. Young, Exeter*).

NEW GEAR WHEEL.—We note that you advocate the introduction of a gear wheel having curved teeth so that it may gear with the existing Worm Wheel. Your idea is interesting in principle, but little advantage would accrue from the introduction of this type of wheel. (*Reply to F. C. Jones, Ipswich*).

SPECIAL PLIERS.—We agree that small-nosed pliers would be most useful additions to the system and possibly we will be able to introduce these pliers in the future. (*Reply to L. W. J. James, Glasgow, S.2*).

1"×1" DOUBLE ANGLE STRIP.—A Strip of this type would be quite useful although it can, of course, be built up from existing parts. We shall consider your suggestion. (*Reply to D. Healey, Sheffield*).

IMPROVED SCREWDRIVER.—We were particularly interested in your suggestion that a short length of the side of the blade of the existing screw-driver should be ground so that it may slip into the slot in the bolt-heads. This would allow the screwdriver to be used in awkward places and we will give careful consideration to your suggestion. (*Reply to R. H. Roberts, Rhyl*).

FRET-SAW BLADES.—We are of the opinion that special blades are unnecessary additions as these articles can quite easily be obtained elsewhere. (*Reply to W. E. Foster, Walsall*).

Suggested Hornby Train Improvements

STEAM COACHES.—We agree that this method of dealing with light passenger traffic is becoming quite popular on actual railways, though we are afraid that for the time being we cannot introduce "*Sentinel*" coaches into our system. (*Reply to J. V. McGann, Fermoy, Co. Cork*).

NEW CORRIDOR TENDER.—Although the tender of the "*Flying Scotsman*" is now fitted with a corridor to enable the engine crew to be changed en route, we do not consider that there would be any advantage to be gained by including similar corridors in our models. (*Reply to J. Summers, Stroud Green, N.4, and J. M. Miller, Alloa, N.B.*).

"GARRATT" ARTICULATED ENGINE.—As has often been stated in these pages before, we think that the price of a model "*Garratt*" articulated locomotive would be far too high for it to be popular. (*Reply to E. Hastings-Smith, Maidenhead*).

ELECTRICAL LEVEL CROSSING.—We agree that an electrical level crossing would be very attractive and of really practical utility. The introduction of a crossing of this type will be carefully considered. (*Reply to G. L. Short, Walmer, Kent*).

COLOUR LIGHT SIGNALS.—We are afraid that it is not practicable to introduce colour light signals. Their operation would necessarily be complicated and they would be very costly to manufacture. We doubt also whether they would be very popular among Hornby train enthusiasts. (*Reply to Ronald Murray, Auckland, N.Z.*).

MODEL HOARDING.—There is no doubt that model hoardings add considerably to the interest of a layout and they may be introduced to the Hornby System later. In the meantime such hoardings are very simple to make and suitable advertisements to cover them may be cut from various magazines. (*Reply to B. G. H. Preston, Birmingham, and R. F. Glover, Cambridge*).

TAIL LAMP FOR GUARD'S VAN.—We will give your suggestion consideration, as we agree that a guard's van would look more realistic carrying a tail lamp. (*Reply to M. B. Andrews, Doncaster*).

SNOW PLOUGHS.—We are afraid that the snow-plough, although designed to work correctly, would not be able to clear sand or any other similar substance from a Hornby track. In any case we would not advise any enthusiast who values his rolling stock and the mechanism in his locomotive to try experiments of the kind you suggest. (*Reply to L. Winder, Kingstown*).

DESTINATION BOARDS FOR LOCOMOTIVES.—We do not think that destination boards such as those used on the Great Eastern section of the L.N.E.R. would be at all in great demand owing to their limited use in actual railway practice. (*Reply to G. Judd, London, E.7*).

CAST WHEELS.—We have been experimenting with coaches fitted with cast wheels and we are satisfied that these improve the running considerably. We intend therefore to introduce such wheels to some of our rolling stock. (*Reply to R. H. Jacobs, Osterley Park*).

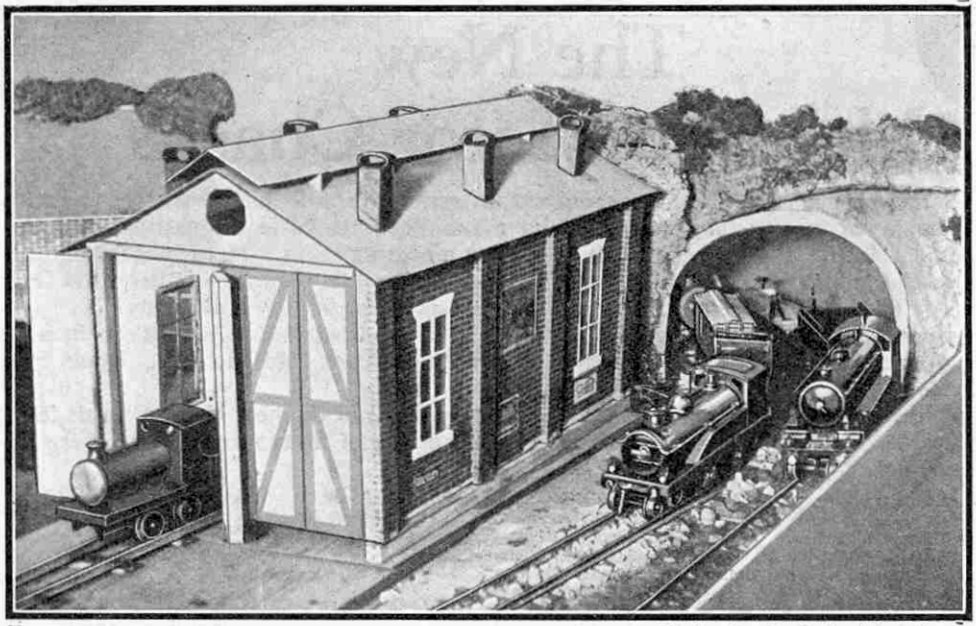
DUMMY AXLE BOXES.—Dummy axle boxes would no doubt considerably improve our rolling stock. As a matter of fact we are experimenting with a coach fitted with these and if we decide to introduce them an announcement will be made in due course. (*Reply to W. Fisher, Edinburgh*).

SIGNAL GANTRY.—In response to very large numbers of requests we have decided to introduce a signal gantry which we hope will be available shortly. (*Reply to B. W. Darnell, Taunton*).

SPRING BUFFERS.—We receive many suggestions from time to time for spring buffers to be fitted to our rolling stock. We do not see that such buffers would be of any practical utility and in fact we think they might introduce complications. In any case if we fitted such buffers to our wagons and coaches the price would have to be appreciably increased. (*Reply to B. Everard, Ulceby*).

No. 2 HORNBY WAGON.—We are interested in your suggestion for a larger wagon than the one we have at present and preferably a wagon fitted with bogies. We think that a wagon of this type might prove very popular and we are filing your suggestion for further consideration. (*Reply to Tony Garner, Edinburgh*).

FILLING IN AN AWKWARD CORNER



Our photograph shows an engine shed and a tunnel constructed by a Bradford reader, Mr. Arthur Schofield. The engine shed not only helps to fill an awkward corner but is also of real practical use in giving a finished appearance to the line and for housing the locomotives when not in use, so as to keep them free from dust.

The Hornby track is made to look more realistic by means of the ballast, which is composed of chicken grit. It has been found that a well-ballasted track gives better results in locomotive running, and that heavier loads can be hauled by the same engine over tracks thus treated. The rocky appearance of the hillside in the background is produced by the ingenious use of crumpled brown paper over which have been scattered here and there small pieces of moss. Very realistic scenic effects may be produced in this manner with the simplest materials.

WATER TROUGHS.—Water troughs would in our opinion be absolutely out of place in a Hornby railway. They could not serve any useful purpose as our locomotives do not require water and the tenders are not fitted with water scoops. We are afraid also that the use of such troughs would result in splashing water in all directions which would not meet with the approval of the domestic authorities! (*Reply to John Bevan, Mitcham*).

OIL TANKS FOR TENDERS.—We quite understand why you would like us to introduce tenders fitted with oil tanks, but we are afraid that your suggestion is impracticable. We cannot agree with you that oil burning locomotives are coming into fashion in this country, although they were very useful during the recent prolonged coal strike. (*Reply to J. A. Marnott, London, S.W.*).

OUTSIDE CYLINDERS ON No. 2 TANKS.—At present we do not contemplate fitting our No. 2 Tanks with outside cylinders. (*Reply to J. Tapworth, Welwyn*).

PLATELAYERS' HUT.—It is possible that a platelayers' hut will be added to the Hornby accessories before long. In the meantime you will be interested to know that we hope shortly to introduce a watchman's hut together with a brazier which should add greatly to the realistic appearance of any layout. (*Reply to K. Garrard, Guernsey*).

CROSSOVERS FOR CONTROL.—Crossovers fitted for control no doubt have considerable possibilities and we are filing your suggestion for further consideration and experiment. (*H. Evans, Salford, Nr. Bristol*).

SCALE MODEL SPRINGS FOR ROLLING STOCK.—We quite realise that perfectly smooth running would result if we fitted scale model laminated springs to the bogies of our Pullman cars. Nevertheless, the price of a bogie of this kind would be as great as the cost of a complete Pullman Car at present. We think you will agree that it would not be worth while making the alteration. (*Reply to James Betts, Guildford*).

HAMMERHEAD CRANE.—We do not propose to manufacture special cranes of the hammerhead and other large types for use with Hornby railways. There should be no difficulty in building with Meccano any cranes that may be required. (*Reply to J. A. Ratcliffe, Erith, Kent*).

CLOCKWORK IN BREAKDOWN VAN AND CRANE.—Your suggestion for the fitting of clockwork mechanism in our breakdown van is interesting but we do not think that it would result in any practical advantage. The price of a van so fitted would evidently be much higher and without the corresponding increase in utility. (*Reply to B. H. Briggs, Wilmslow*).

"BLINKERS" on HORNBY ENGINES.—Smoke deflectors are useful on certain actual engines but they would be out of place on Hornby engines and certainly would not improve their appearance. In any case, so far as we know, "blinkers" are used only on the Southern Railway on their "King Arthur" type locomotives. (*Reply to E. Creasey, Felixstowe*).

BLACK SMOKEBOX.—You will be interested to hear that the smokebox of Hornby engines are now coloured black in accordance with actual railway practice. (*Reply to W. Parker, Renishaw, near Chesterfield, and others*).

JUNCTION PLATFORM.—So far we have had very small demand for a platform of the type you suggest. Such a platform would be costly and also would be cumbersome and only suitable for large layouts of certain types. We believe that the platforms we already manufacture are adequate for the great majority of layouts. (*Reply to J. Gill, Dursley, Glos.*).

VACUUM BRAKE PIPES.—The buffer beams of Hornby trains would no doubt look more realistic if vacuum brake pipes were included. Your suggestion is quite interesting and we shall give it careful attention. (*Reply to N. Fisher, Grange, Edinburgh*).

MOTOR CAR TRUCK.—We shall give this type of wagon careful consideration when we make the next additions to our range of rolling stock. We think you are right that a truck of this kind would be very popular. (*Reply to D. P. Post, Redhill, Surrey*).

PRIVATELY-OWNED WAGONS.—We are constantly receiving suggestions that we should introduce privately-owned wagons into the Hornby system. Nevertheless, privately-owned wagons that are familiar to boys of a certain district are usually absolutely unknown to boys of another, and it would be impossible to manufacture a sufficient variety of wagons to satisfy all enthusiasts. (*Reply to John Busler, Bletchley, Bucks., and J. Ure, Tunbridge Wells*).

SIX-WHEELED WAGONS.—We agree that six-wheeled wagons would be very popular, especially in the case of model 20-ton brakes, and we will give your idea careful attention. (*Reply to R. Bompas-Smith, Manchester*).

COLMAN'S MUSTARD VAN.—You are doubtless aware that we once manufactured a Colman's Mustard Van and that it did not prove sufficiently popular to warrant our continuing doing so. We have had no call for vans of this kind recently. (*Reply to R. Rowlands, Liverpool*).

"One of the New Super Models"

The New Meccano Motor Chassis

Hundreds of letters are reaching us daily from enthusiastic boys who have seen the new Meccano Motor Chassis Model displayed in the shops and who have examined its perfect construction.

This splendid Model is a triumph of Meccano model-building. It is accurately constructed on correct principles and includes all the important details of automobile practice—Differential Gear, Ackermann Steering, Gear Box (3-speed and reverse), Internal Expanding Rear Wheel Brakes, etc.

Full instructions for building the model, with illustrations in half-tone, are given in an 8-page folder, which may be obtained from your dealer, price 3d., or direct from Meccano Ltd., Binns Road, Liverpool, price 3d. post free.

The undermentioned Meccano dealers have purchased models of the new Motor Chassis for demonstration purposes. Every Meccano boy who is within easy distance of any of these stores should make a point of seeing these splendid models.

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Altrincham. Harry Brown, 1, Moss Lane.
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Dumfries. Robert Elder, 44, English Street.
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Elland. C. H. Carter, Bridge End P.O.
Exeter. Exeter Cycle Works, 174, Sidwell Street.
Falkirk. Alexanders Stores, 150, High Street.
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Newcastle-under-Lyne. W. Hill, 4, Red Lion Square.
,, L. C. Kendrick, 82, George Street.
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Wakefield. The Eagle Press, Wood Street.
Warrington. Warrington Co-op. Soc. Ltd.
Wath-on-Dearne. Wm. Walton, High Street.
Whitchurch. R. E. Jones, 30, Watergate Street.
Woodford Green. W. Jackson, 56 & 58, High Road.

MECCANO LIMITED **Binns Road** **LIVERPOOL**

Electricity Applied to Meccano

VIII—Electric Bell; Relay; Lamp Standard; Ammeter

These articles are intended to draw every Meccano boy's attention to the numerous fascinating uses to which the Meccano electrical parts may be put. The first two articles of the series dealt with the elementary principles of electricity, and subsequent articles described various Meccano switches, a coil-winding machine, a Meccano electric telegraph system, electro-magnets, a galvanometer, motors, an electric locomotive, and other simple apparatus. Below we deal with a Meccano bell and other instruments that can be put to practical use. All these models are constructed from a few ordinary Meccano parts used in conjunction with the special electric accessories.

OF all electrical instruments the electric bell must be one of the most familiar to Meccano boys. The majority of houses to-day are fitted with a complete system of electric bells, which for reliability, simplicity of working, and convenience, far surpass the antiquated wire-actuated bells. Their simplicity and cheapness of operation is remarkable, especially when one takes into consideration the many valuable services that they perform.

We feel sure that all "*M.M.*" readers will desire to make the practical Meccano electric bell that is illustrated in Fig. 1. When completed it may be installed in the house and used for many different purposes. It is a very useful model.

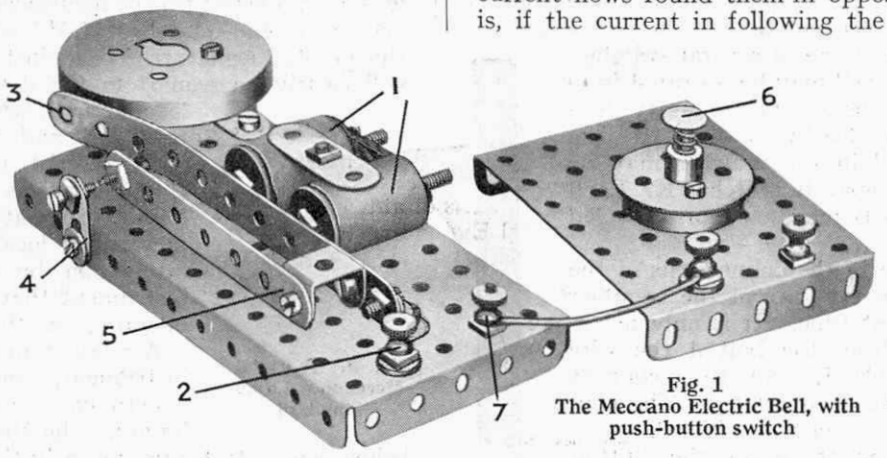


Fig. 1
The Meccano Electric Bell, with push-button switch

Meccano Electric Bell

The construction of the model should be commenced by winding to capacity the two Bobbins of the magnet with 26 S.W.G. insulated wire. Each of the completed Bobbins 1 is mounted on a Pole Piece that is bolted to two 1½" Strips, which are placed one upon the other to form a yoke or connecting piece. This magnet is identical to that described in the article in this series which appeared in the March "*M.M.*" The coils are covered with brown paper, which enhances their appearance and protects the insulation of the wire, and are clamped in position on the 5½"×2½" Flanged Plate by means of a 1" Threaded Rod secured to the Plate by two nuts. The upper end of this Threaded Rod passes through a 1½" Strip and a third nut placed on the Rod clamps the Strip firmly down upon the coils.

A wire from one of the coils is attached to a 6 B.A. Bolt that is insulated from the base Plate by an Insulating Bush and Washer and carries the terminal 2. The second wire from the same coil is secured to one wire of the other coil, and the remaining wire of the latter is attached to the 6 B.A. Bolt 4. This bolt is insulated from the base Plate in the usual manner and carries a Flat Bracket, in the upper hole of which is secured a Meccano Silver-tipped Contact Screw. A second Contact Screw is bolted to a 3½" Strip 5 that, in turn, is attached by means of a Double Bracket to a 5½" Strip 3.

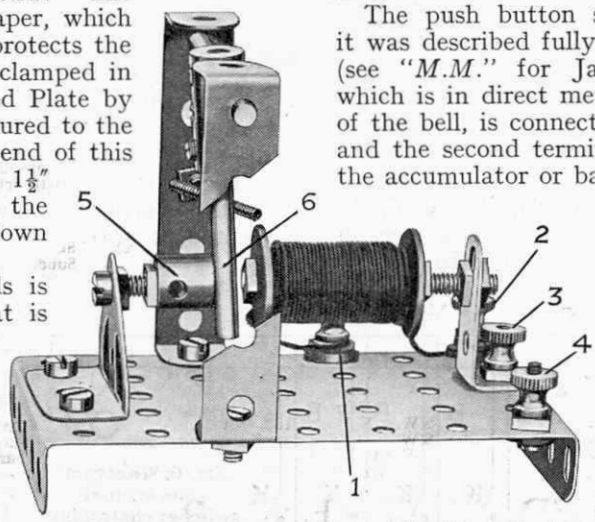


Fig. 2. The Meccano Relay. (Part of the Strip in the foreground has been cut away to disclose the inner details)

The coils 1 should be connected together so that the current flows round them in opposite directions. That is, if the current in following the turns of wire passes round one coil in a clockwise direction, the ends of the wires should be so connected that the current passes round the second coil in an anti-clockwise direction. This method of connecting the coils gives a north polarity to one end of one coil and a south polarity to the corresponding end of the second coil, and adds to the efficiency of the model.

The 5½" Strip 3 serves as a combined armature and hammer, and is attached rigidly at one end to the Flanged Plate by a ½"×½" Angle Bracket in such a manner that it is in close proximity to the pole faces of the magnet 1.

The gong consists of a Wheel Flange secured to a ½" Reversed Angle Bracket, which, in turn, is bolted to the 5½"×2½" Flanged Plate. The Wheel Flange is quite effective, but if it can be substituted by an actual bell much better results will be obtained, of course.

The push button switch needs no comment, since it was described fully in the third article of this series (see "*M.M.*" for January, 1928). The terminal 7, which is in direct metallic contact with the base Plate of the bell, is connected to one terminal of the switch, and the second terminal of the switch is connected to the accumulator or battery. The second wire from the accumulator is attached to the terminal 2 of the bell.

When the button 6 of the switch is depressed the circuit is completed and the current flows through the switch and through the frame of the bell to the Silver-tipped Contact Screw mounted on the Flat Bracket 4. From there it passes through the coils and back to the accumulator via the terminal 2. The current flowing through the coils 1 causes

the Pole Pieces to attract the armature 3, and the end of the latter strikes the bell. As soon as the armature is attracted in this way, however, the Contact Screws are drawn apart and the circuit is broken. Consequently the coils are de-energised and the armature 3 flies back to its former position. But in doing so it brings the Contact Screws together once more and closes the gap in the circuit, and the cycle of operations is then repeated. The movements of the armature are very rapid, and produce a continuous ringing of the bell for so long as the push 6 is depressed. This type of bell is known as a "trembler," since the armature trembles, or vibrates.

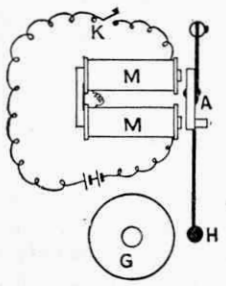


Fig. 3. Diagram of connections for single-beat bell

Control by Several Switches

It is quite a simple matter to arrange the connections so that the bell may be rung by closing any one of several switches. In this way the same bell may be operated from various parts of a house. The necessary connections are shown clearly in Fig. 5. The electric bell indicated in the drawing may be controlled from four separate switches K. Each pair of branch wires B may, of course, be led into different rooms.

A simple alteration in the connections of the Meccano bell will convert it from the trembler type to the single-beat type. It is only necessary to disconnect from the bolt 4 the wire attached to the coils 1, and to reconnect the wire direct to the accumulator. The connections will then be as shown in Fig. 3.

With this arrangement, when the button (K in Fig. 3) is pressed the current passes directly to the magnet M, which attracts the armature A. The end H of the latter produces a single beat on the bell G, for the magnet will hold the armature against the ends of the Pole Pieces as long as the button K is pressed. To sound the bell a second time the button must first be released and then pressed down again.

It will be obvious that the number of strokes or beats given by the bell is absolutely under the control of the operator. For this reason the single-stroke bell is of considerable value for signalling purposes. It is used exclusively on British railways in communicating from one signal box to another.

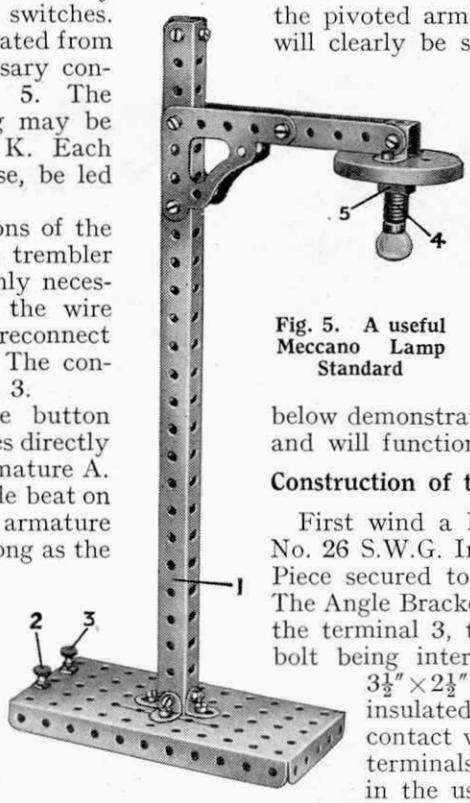


Fig. 5. A useful Meccano Lamp Standard

Functions of a Relay

If a current flows through a long length of wire in order to work an instrument—such as a telegraph sounder—situated at a distance from the operating point, it becomes comparatively weak because of the resistance in the wire through which it passes. Hence, if an ordinary circuit is used, the battery power will have to be increased in accordance with the distance through which the current is required to flow. There is a better method of getting over this difficulty, however. It is to employ two small batteries in conjunction with a relay, in place of one very large battery. The function of the relay is to bring into action, on receipt of the weak current flowing through the "line wire" from the battery at the sending station, the secondary, or local, battery that operates the sounder or other instrument. The necessary connections for an arrangement of this kind are shown diagramatically in Fig. 4.

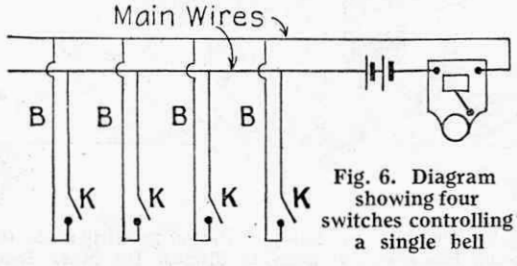


Fig. 6. Diagram showing four switches controlling a single bell

The relay consists essentially of a magnet (M in the drawing), having a large number of turns of wire, and a pivoted armature AP. The switch K is situated at the operating end, and when it is closed it causes current to flow round the magnet. The magnetic effect of the incoming current is thereby enhanced—in accordance with the ampere-turn law mentioned in the "Electricity" article in the March *"M.M."*—sufficiently to move the pivoted armature AP against the contact CP. As will clearly be seen from the diagram, this closes the local circuit, which contains the battery BB and the instrument that it is desired to work. Therefore the relay has enabled the weak "line" current to control the more powerful "local" current, and the latter can be used to operate an instrument that could not have been operated by the weak line current.

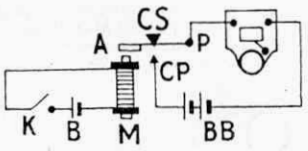


Fig. 4. Diagram showing connections for operation of Bell by Relay

A relay is an extremely interesting instrument, and many instructive experiments can be carried out with its aid. The Meccano relay described below demonstrates very clearly the principles involved, and will function well on an extremely small current.

Construction of the Meccano Relay

First wind a Meccano Bobbin to full capacity with No. 26 S.W.G. Insulated Wire, and mount it on a Pole Piece secured to a 1"×½" Angle Bracket (see Fig. 2). The Angle Bracket is secured to the 6 B.A. Bolt carrying the terminal 3, the Insulating Bush or Washer on the bolt being interposed between the Bracket and the 3½"×2½" Flanged Plate. The Bracket is thus insulated from the Plate and yet in electrical contact with the shank of the terminal 3. The terminals 1 and 2 are insulated from the Plate in the usual manner, and the two ends of the magnet winding are connected to them. The remaining terminal 4 is in metallic contact with the Plate, for reasons that will become apparent later.

The moving armature 6 consists of a 1½" Rod mounted in the longitudinal bore of a Coupling that, in turn, is secured to a transverse Rod journalled in the upright 2½"×½" Double Angle Strips. Part of one of these Strips is cut away in the illustration to disclose the mechanism of the relay.

The movement of the armature is limited by an adjustable stop, which consists of a Threaded Boss 5 mounted on a ¾" Bolt. The latter is secured rigidly to a Trunnion. By altering the position of the Boss 5 on the shank of the ¾"

Bolt, the gap between the armature 6 and the Pole Piece may be modified to suit different conditions of working. The smallest gap possible should be used as this makes the instrument sensitive to the effect of very weak currents. When the correct gap has been ascertained the Threaded Boss may be locked on the shank of the ¾" Bolt by a nut. A short length of Spring Cord attached by a nut and bolt to one of the upright 2½"×½" Double Angle Strips normally holds the armature 6 against the stop 5.

The line battery, which may consist of a single small dry cell, is connected to the terminals 1 and 2 of the relay, and a switch should be included at a convenient operating position in the circuit. The local circuit containing the bell (or other instrument that it is desired to work) and the local battery, which may be a Meccano 4-volt Accumulator, is connected to the terminals 3 and 4 of the relay.

When the switch in the line circuit is closed, a weak current flows through the coil of the relay and energises it. This causes the armature 6 to be attracted to the Pole Piece, which is secured to the 1"×½" Angle Bracket that is in electrical contact with the terminal 3, and as soon as contact is effected, the local circuit is completed. The current from the Accumulator flows from the terminal 3 along the Pole Piece and armature 6 and back through the frame of the model to the terminal 4. When the line current ceases the magnet no longer holds the armature and the latter flies back under the action of the Spring Cord, thus breaking the local circuit.

The Meccano electric bell and relay form a most interesting combination from which much pleasure and instruction may be derived.

Meccano Lamp Standard

The Meccano lamp standard illustrated in Fig. 5 will make an effective addition to a model railway. A few of these accessories placed about the station " yard " lend a touch of realism to any layout. Also, we have no doubt that many Meccano boys make a habit of reading in bed—especially the "*M.M.*" It is a practice that generally ought not to be encouraged, of course. Nevertheless, we must say that for a bedside reading lamp the Meccano standard is eminently suitable.

The upright is composed of two 12½" Angle Girders 1 joined together at the top and bottom by ½"×½" Angle Brackets so as to form a square column. The Girders are secured to the 5½"×2½" Flanged Plate by four ½"×½" Angle Brackets placed one on each side of the column.

The Meccano Lamp Holder 4 is secured to the Double Bent Strip 5 by means of a 6 B.A. Bolt, which, with its head inside the lamp holder, is passed through the centre hole in the Double Bent Strip. An Insulating Bush is placed on the shank of the bolt to insulate it from the Strip, and the bolt is secured in place by a nut, which is used also to secure a short length of insulated wire. This wire is led down the centre of the vertical column, under the base Plate, and is attached to the bolt of the terminal 3, which is insulated from the Plate in the usual manner. The terminal 2 is in direct metallic contact with the model.

The Double Bent Strip carrying the lamp holder is bolted to a Wheel Flange, which serves as a reflector, and to a second Double Bent Strip that is secured between the ends of the 5½" Strips projecting horizontally from the vertical 12½" Angle Girders 1. The wires from the Accumulator are connected to the terminals 2 and 3. The lamp is earthed by way of the Holder 4, which is in metallic contact with the Double Bent Strip 5.

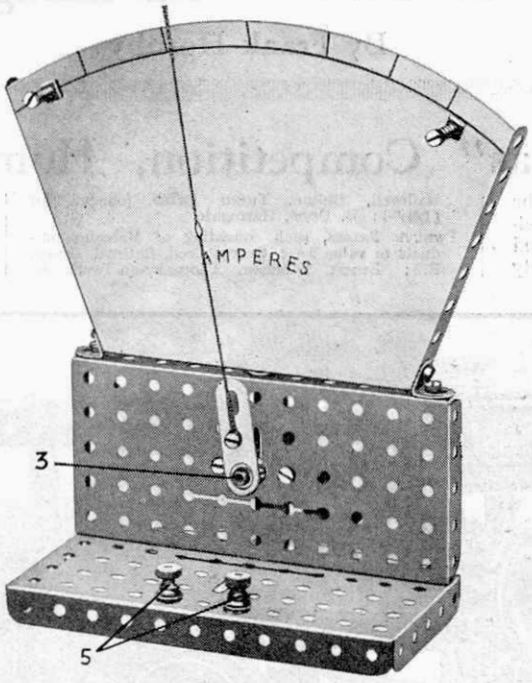


Fig. 7. A practical Hot Wire Ammeter (front view)

Meccano Hot Wire Ammeter

An ammeter is an essential part of the young experimenter's equipment. With its aid he can discover many interesting points in regard to the behaviour of an electric current in any particular circuit. For instance, it is not generally realised that the current is the same in all parts of a circuit; a high resistance and one of lower value connected in series would both have the same number of amperes flowing through them. Perhaps the most interesting use to which an ammeter may be put, is to connect it in series with the Meccano 4-volt Electric Motor. By altering or removing the load on the Motor the current consumed will be seen to vary from a minimum when the motor is running " light "—that is, with no load—to a maximum when the motor is running under its greatest load.

In order to enable Meccano boys to carry out interesting experiments of this kind, we have designed a hot wire ammeter that, with the exception of a short length of fine copper wire, may be made entirely from Meccano parts. The model will work excellently if connected in series with the Meccano 4-volt Motor and Accumulator. It may be useful to explain here that to connect the ammeter " in series," a wire is taken from the Accumulator to one of the terminals 5 of the ammeter. The second terminal of the model is connected to a terminal of the Motor, and the other Motor terminal is connected to the remaining terminal of the Accumulator.

Fig. 7 is a general view of the Meccano Ammeter, and Fig. 8 is a view of the reverse side. The most important part of the model is the length of resistance wire 1 (Fig. 8), termed the " hot wire," which is stretched tightly between the 6 B.A. Bolts 2. These two bolts are attached to and insulated from the 5½"×2½" Flanged Plate forming the base of the model. Each is connected by a short length of wire to an insulated terminal 5 on the front of the model (Fig. 7). A Collar having an ordinary set-screw substituted for its grub-screw is secured on the 1½" Rod 3, which is journalled in the upright 5½"×2½" Flanged Plate and also in a 2½"×½" Double Angle Strip. A short length of fine copper wire attached to the set-screw of the Collar is taken round the Rod 3 several times and then secured to the centre of the wire 1. The 25-gramme Weight 4 is bolted to a Crank that is secured on the Rod 3. The Crank should normally be in a horizontal position so that the weight pulls against the wire 1. The Crank carrying the pointer (which consists of a Loom Heald, part No. 101) is next attached to the front end of the Rod 3 so that the pointer rests lightly against one of the ¾" Bolts at the end of the scale.

When the current flows through the resistance wire 1, the latter becomes hot and expands. Since the weight 4 maintains the wire 1 in a constant state of tension, any slackening of the latter must result in a downward movement of the weight 4, and this movement causes the pointer to commence to travel across the scale. When the current decreases the wire 1 contracts, or tightens, in cooling, and thereby pulls the weight 4 in an upward direction and causes the pointer to move back again across the scale.

If possible the scale should be calibrated with the aid of a standard ammeter, otherwise purely arbitrary divisions will have to be used. The principle employed in the model described is used actually in many well-known makes of ammeter. It is employed mostly in instruments designed for use with alternating current work.

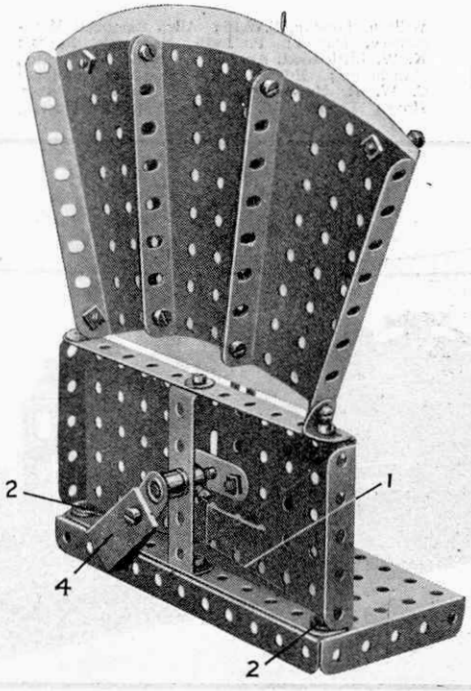


Fig. 8. Rear view of the Meccano Ammeter

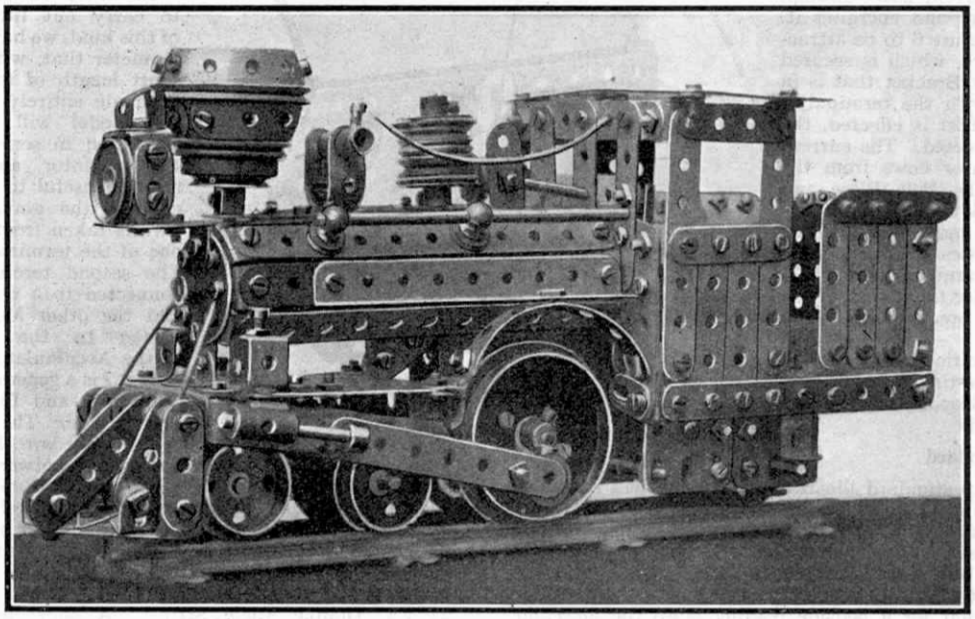
Results of Meccano Model-Building Contests

By Frank Hornby

"Christmas" Competition, Home Sections

DURING the last few months the number of entries in each Model-building Competition has increased steadily. Nevertheless, I was agreeably surprised to find, on looking through the entries in the "Christmas" Contest, that the maximum number for any previous contest had been almost doubled! Moreover, the quality of the entries shows no signs of deterioration. Indeed, the models are of a still higher standard, as regards both design and construction.

The following list gives the names of the prize-winners in the "Home" Sections of this contest:—



A fine model by Albert Holmes, of an old South American locomotive

Section A.

FIRST AND SECOND PRIZES combined and divided between the following two competitors, each receiving cheque to value £2/12/6: E. A. Jeffs, Colesbill, and R. A. Pearse, Kingston-on-Thames, Surrey. THIRD PRIZE (cheque for £1/1/-): Dr. A. P. Day, Sandown, I.O.W.

TWELVE PRIZES, each consisting of Meccano products to the value of 5/-: H. A. A. and R. M. A. Hankey, Limpsfield, Surrey; D. F. Mallalieu, Ashton-under-Lyne; W. F. Taylor, Buxton; H. A. Garrett, Ipswich; C. Coysh, East Sheen; L. Lacey, St. Leonards-on-Sea; R. R. Green, Thornton Heath; E. W. Fielder, London, S.W.19; Eric Whalley, Blackburn; William Goodwin, Eccles; Leslie Hope, Weston-Super-Mare; R. J. Webb, Wallasey.

SPECIAL COMMENDATION (Certificate of Merit and Meccano Standard Mechanism Manual): Allen Ives, Huddersfield; George Elson Tonge, Farnworth; S. D. Steele, Beckenham; D. Corser, Shifnal; J. Sharp, Haywards Heath; H. L. Edwards, Cheltenham; C. C. M. Giffin, Letchworth; W. F. Waddington, Newcastle-on-Tyne; W. O. Minnitt, Patricroft; C. R. Sawyers, London, S.E.1; H. Evans, Wallasey; S. G. Sheppard, Catford, S.E.6; R. S. Weaver, Prestwich; L. T. Harris, Enfield.

Section B.

FIRST PRIZE (cheque for £3/3/-): Albert Holmes, Gorton. SECOND PRIZE (cheque for £2/2/-): H. C. Stevens, Halliwell, Bolton. THIRD PRIZE (cheque for £1/1/-): B. Unné, Harrogate.

TWELVE PRIZES, each consisting of Meccano products to value 5/-: George Cecil, Bethnal Green, E.2; Ernest Tyreman, Thornaby-on-Tees; G. Willson, London, S.W.16; Allen Campbell Montgomery, Dublin; P. Lyth, Newcastle, Staffs.; K. W. Littlewood, Armley, Leeds; Curtis Swann, Manchester; Edgar Bell, Felixstowe, Suffolk; C. W. R. Mundy, Southsea; Kelso S. Oliver, Hove; Leonard W. Parsons, Midsomer Norton, near Bath; R. J. Bromley, Kew Gardens, Surrey.

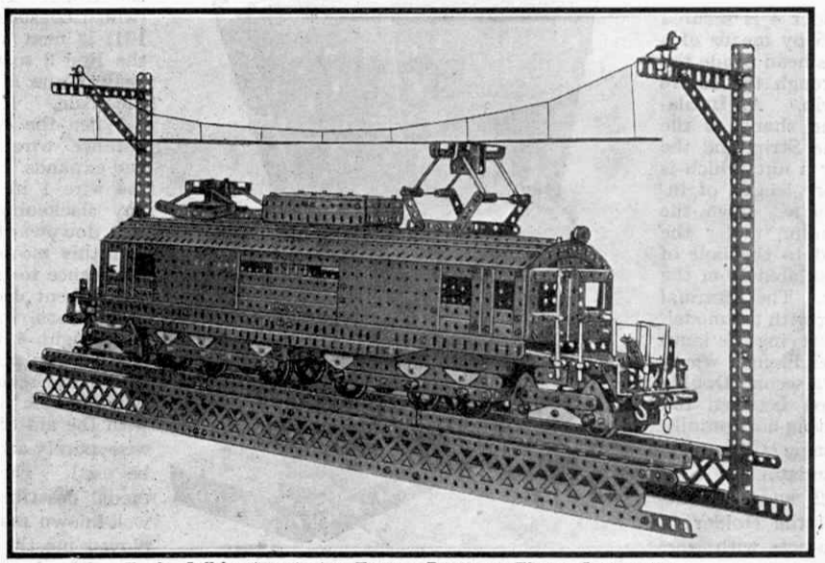
SPECIAL COMMENDATION (Certificates of Merit and Standard Mechanisms Manual): Fred Dowie, London, S.E.15; E. C. Redfern, Cobham; R. H. Bamford, Uttoxeter; L. M. Allen, Pangbourne, Berks; P. A. Wood, Oldham; H. F. White, Grantham; A. W. Campbell, Gosport; G. Resker, Walthamstow, E.17; Patrick James, Surbiton, Surrey; John C. Mears, Westcliff-on-Sea; Fred Dunkley, Northampton; Jack and Sandy Grieve, St. Andrews.

Section C.

FIRST PRIZE (Meccano products to the value of £2/2/-): A. Jones, Moss Side, Manchester. SECOND PRIZE (Meccano products to value of £1/1/-): Cyril Walker, Nottingham. THIRD PRIZE (Meccano products to the value of 10/6): Jack Hunter, Beeston, Leeds.

TWELVE PRIZES, each consisting of Meccano products to the value of 5/-): George Shepherd, Barnsley; George Meiklejohn, Burntisland, Fife; G. Stevens, London, S.E.4; A. Harris, Godalming; R. Sigurdson, Clacton-on-Sea; James H. Rothwell, Bankside, Bacup; J.N. Bailey, Kingston Hill, Surrey; P. Chamberlin, Kensington, W.5; Frank Buckler, London, N.13; Alec E. Bores, Colchester; H. Hiscott, Ilford, Essex; T. J. Hobbs, Rubery, Birmingham.

SPECIAL COMMENDATION (Certificates of Merit and Standard Mechanism Manual): H. F. Bower, Brockley, S.E.4; Margaret Wynn, Manchester; R. J. Wood, Oldham; Frank Gant, Southsea; R. A. Hodgkin, Oxford; Harry Stoyle, Lichfield, Staffs.; Denis H. Jones, Scarboro'; J. Harris, Ross-on-Wye; J. C. Salter, Bristol; G. P. Neilan, New Seakam, S.O.; W. R. Burton, Ashford; Lionel D. Carter, Corsham, Wilts.; M. O. Coulter, Newport; Eric J. Scarre, Darlington; John Warren-David, Milford Haven; C. G. Bethune, Litherland; Albert Blackburn, Kelvedon; G. K. Benn, Grantham.



E. A. Jeffs' prize-winning Express Passenger Electric Locomotive

A considerable number of Certificates of Merit will be awarded to competitors in addition to those listed.

As stated above, the First and Second Prizes in Section A have been divided equally between R. A. Pearse and E. A. Jeffs. The Competition judges decided that the models submitted by these

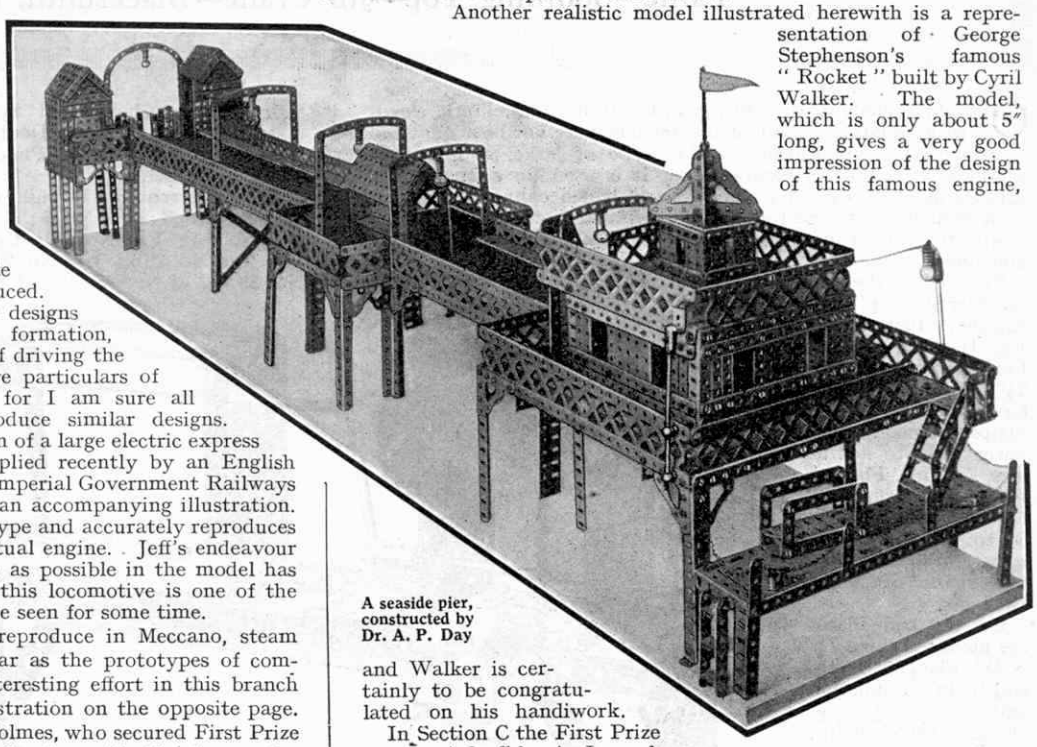
competitors were of equal merit.

Pearce's entry comprises a most interesting variation of the standard Meccanograph. Apparently, in spite of the enormous number of entries in the recent special Meccanograph Competition, the alternative methods of construction of the Meccanograph are not yet exhausted. Pearce has arranged his model so that the table is given an eccentric, or epicyclic, motion; in addition to turning round on its own axis, the table moves in a circular path. The mechanism rotating the table is in the form of sun-and-planet gear. Meccano boys who are conversant with the working of the Meccanograph will be able to imagine the many new and intricate designs that can be reproduced when the table is worked in this way.

The specimen designs produced by the machine are remarkable, and I do not think that anything quite like them has before been produced. The most interesting feature of the designs is, of course, the peculiar elliptic formation, which is due to the novel method of driving the table. I hope in the future to give particulars of Pearce's improved Meccanograph, for I am sure all Meccano boys will wish to reproduce similar designs.

E. A. Jeffs' model is a reproduction of a large electric express passenger locomotive that was supplied recently by an English firm of locomotive engineers to the Imperial Government Railways of Japan. This model is shown in an accompanying illustration. As will be seen, it is of the 4–6–6–4 type and accurately reproduces most of the details found in the actual engine. Jeff's endeavour to include as many realistic details as possible in the model has certainly been rewarded. I think this locomotive is one of the finest models of the kind that I have seen for some time.

Although a difficult subject to reproduce in Meccano, steam locomotives were again very popular as the prototypes of competition entries. A remarkably interesting effort in this branch of engineering is shown in the illustration on the opposite page. The model, which was built by A. Holmes, who secured First Prize in Section B, represents the old Southern Pacific locomotive that was illustrated in the October, 1927, issue of the *"M.M."* Those readers who are able to do so should refer to that issue and compare the Meccano model with the photograph. I think they will then agree that, although built on a very small scale, the model bears a striking resemblance to its prototype. Holmes is guilty of bending one or two Strips in constructing his model—a practice that I do not altogether advocate—but he must be forgiven, for the final result of his work fully justifies the means employed.



A seaside pier, constructed by Dr. A. P. Day

The principal features of the model are the smoke stack, warning bell, and cowcatcher, which have all been reproduced most skilfully. The operating cord with which the driver actuates the bell consists of a length of Spring Cord, and the bell itself is represented by a ½" fast Pulley attached to a Collar. A Clockwork Motor is built into the framework and the engine is capable of running under its own power on gauge 0 rails. The driving axle is journalled in the side plates of the Motor.

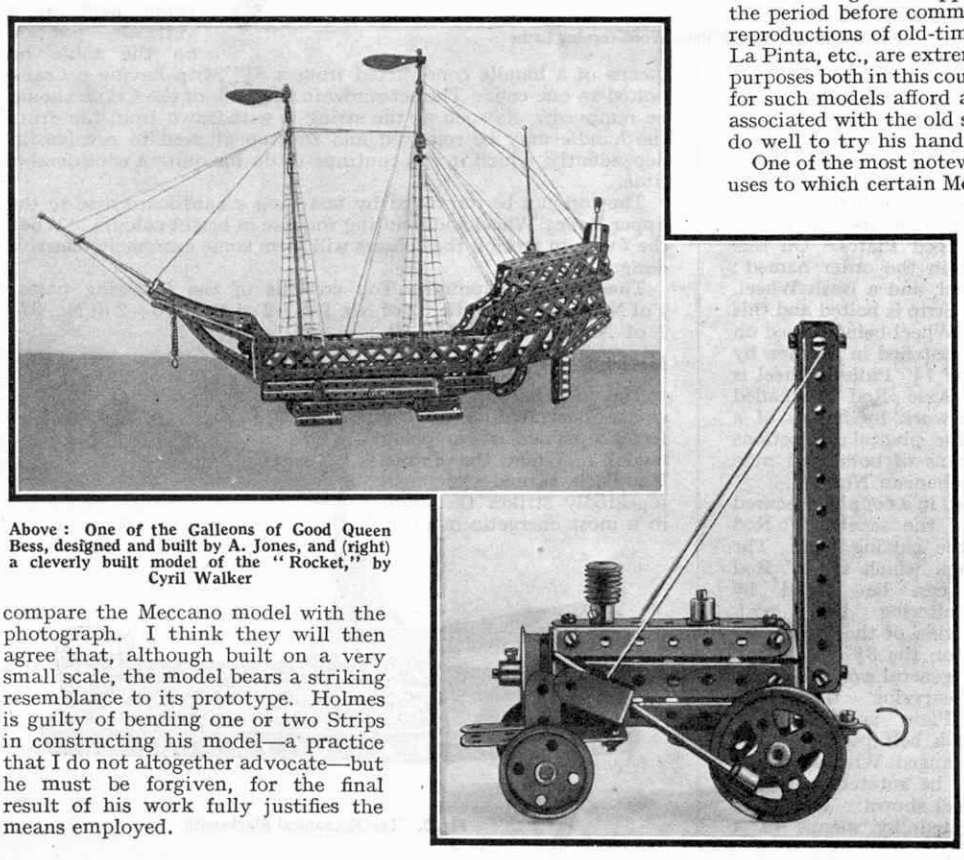
Another realistic model illustrated herewith is a representation of George Stephenson's famous "Rocket" built by Cyril Walker. The model, which is only about 5" long, gives a very good impression of the design of this famous engine, and Walker is certainly to be congratulated on his handiwork.

In Section C the First Prize was carried off by A. Jones for a model of an ancient galleon. The design of the model has been carefully thought out, and I should imagine that Jones must have studied the general appearance and construction of the vessels of the period before commencing to construct his model. Miniature reproductions of old-time sailing vessels, such as the Santa Maria, La Pinta, etc., are extremely popular for instructive and decorative purposes both in this country and in America. This is only natural, for such models afford a picturesque link with the romantic times associated with the old sailing vessels. Every Meccano boy would do well to try his hand at this form of model-building.

One of the most noteworthy features of Jones' model is the novel uses to which certain Meccano parts have been put. For example, the use of Propeller Blades as pennants and a Worm Wheel as a stern lantern is particularly interesting. A decorative effect is given by the use of Braced Girders along the sides of the hull.

Generally speaking, models of buildings and similar structures that contain no working parts do not possess the same fascination as a model that may be set in motion. The miniature sea-side pier that Dr. A. P. Day has constructed entirely from Meccano parts is an exception, however. Besides being of very original design the model is exceedingly well built and contains all the familiar details of the typical pleasure pier. The photograph reproduced on this page gives a good idea of the realism of the model and I expect it will remind many *"M.M."* readers that the holidays will soon be here. Such little details as the turnstiles at the head of the pier, the pay-boxes, and the electric light fittings, all help to make the model a really interesting example of Meccano construction.

Another noteworthy entry was a model motor cycle combination built by H. C. Stevens. It is evident that Stevens is familiar with all (*Continued on page 544*)



Above: One of the Galleons of Good Queen Bess, designed and built by A. Jones, and (right) a cleverly built model of the "Rocket," by Cyril Walker

New Meccano Models

Lathe—Spinning Top—Jib Crane—Blacksmith, etc.

OUR first model this month is in the form of an elliptic wood-turning lathe. Some of our readers may not be acquainted with the application of this type of lathe, and it may therefore be useful to mention that it is used for shaping such articles as chair legs and similar parts which cannot be shaped with ordinary slide-rest tools. The elliptical motion of the cutter is effected by means of special mechanism incorporated in the machine.

The bed of the model consists of two 12½″ Angle Girders held together by 5½″×2½″ Flanged Plates (see Fig. 1). The stand is formed from two 3½″×2½″ Flanged Plates having four 2½″ Curved Strips fastened to their lower ends to act as legs. The Flanged Plates are braced by four 3½″ Strips fastened to the bed of the lathe and to the Plates by means of Angle Brackets.

On the bed Plates are mounted three 2½″×3½″ Flanged Plates which, in conjunction with two 3½″ × ½″ Double Angle Strips, form the main bearings of the lathe. For the sake of rigidity the upper ends of the Double Angle Strips and one of the Flanged Plates are braced at the top by 4½″ Strips, and the second pair of Flanged Plates are braced in a similar manner by 2½″ Strips. A 5½″ Axle Rod is held in place by means of Collars in one of the Flanged Plates and in the frame work formed by a 2½″ Strip bolted between the 3½″ Double Angle Strips.

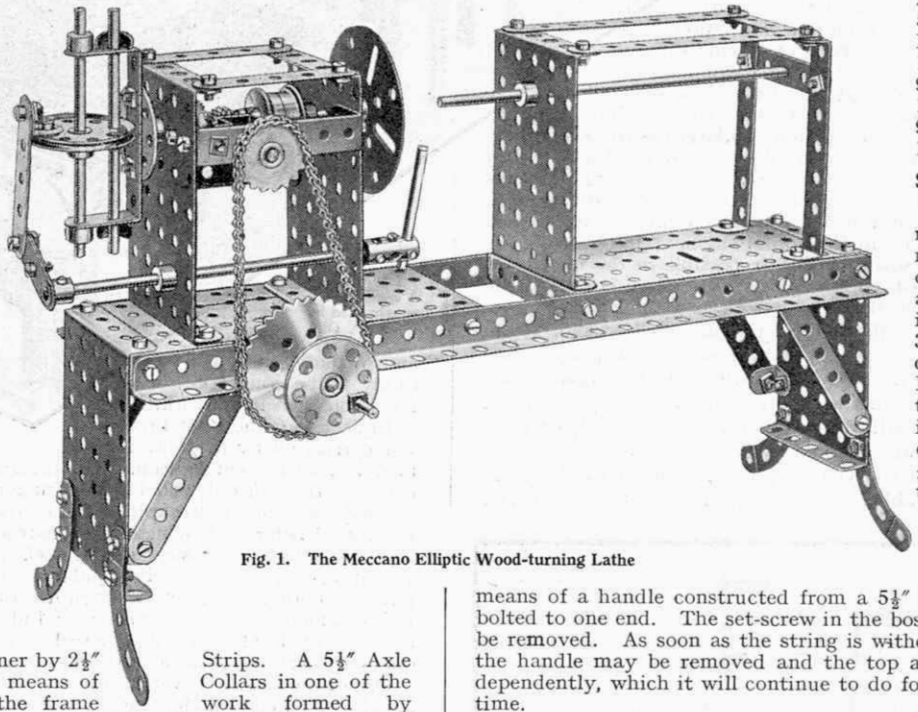


Fig. 1. The Meccano Elliptic Wood-turning Lathe

The shaft carrying the Face Plate consists of a 3½″ Rod journalled in the second pair of Flanged Plates. On this Rod the following components are placed in the order named: two ¾″ Flanged Wheels, a ¾″ Contrate Wheel, and a Bush Wheel. To the Bush Wheel a 2½″×1″ Double Angle Strip is bolted and this carries two 3½″ Rods, a 1½″ Pulley Wheel being placed on the Rods before the latter are fastened in position by Collars and Spring Clips. The 1½″ Pulley Wheel is connected to another 5″ Axle Rod journalled horizontally in the framework by means of a Crank and a 2½″ Strip, the pivotal connections being formed by means of bolts and nuts as in Standard Mechanism No. 263.

A 2″ Rod mounted in a coupling secured to the end of the second 5″ Rod represents the cutting tool. The arc through which the 2″ Rod moves can be varied by altering the position of the 1½″ Pulley on the 3½″ Rod. For general work the shaft carrying the Face Plate is driven by means of a belt passing round the ¾″ Flanged Wheels, and it may also be rotated from the hand wheel shown. The latter is connected by means of a short Sprocket Chain to a 1″ Sprocket Wheel that is secured to a 2″ Axle Rod journalled in a Double Bent Strip at right angles to the Face Plate shaft. A ½″ Pinion on its end engages with the ¾″ Contrate Wheel.

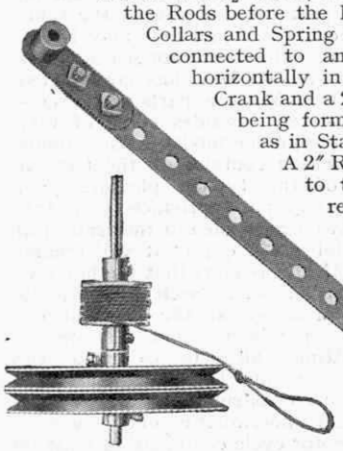


Fig. 2. Spinning Top, with starting cord in position

The parts required to build this model are as follows: 2 of No. 2a; 4 of No. 3; 5 of No. 5; 1 of No. 6a; 2 of No. 8; 4 of No. 12; 1 of No. 14; 1 of No. 15; 1 of No. 15a; 3 of No. 16; 2 of No. 17; 2 of No. 20b; 1 of No. 21; 1 of No. 24; 1 of No. 26; 1 of No. 29; 2 of No. 35; 52 of No. 37; 1 of No. 45; 2 of No. 46; 2 of No. 48d; 2 of No. 52; 5 of No. 53; 7 of No. 59; 1 of No. 62; 1 of No. 63; 4 of No. 90; 12″ of No. 94; 1 of No. 95; 1 of No. 96; 1 of No. 109; 1 of No. 115.

Spinning Top

This is a very simple model that will provide much amusement for one's younger brothers and sisters. The top itself consists of two 3″ Pulley Wheels secured to a 3½″ Axle Rod. To start the top, a length of cord is wound round the drum formed from two ¾″ Flanged Wheels and then pulled sharply, the top meanwhile being held in a vertical position on the table by means of a handle constructed from a 5½″ Strip having a Crank bolted to one end. The set-screw in the boss of the Crank should be removed. As soon as the string is withdrawn from the drum the handle may be removed and the top allowed to revolve independently, which it will continue to do for quite a considerable time.

The top can be improved by fastening a cardboard disc to the upper Pulley Wheel and painting the disc in bright colours. When the top is in motion the colours will form some extremely effective designs.

The Meccano Spinning Top consists of the following parts: 1 of No. 2; 1 of No. 16; 2 of No. 19b; 2 of No. 20b; 1 of No. 37; 1 of No. 40; 1 of No. 62.

Mechanical Blacksmith

The Mechanical Blacksmith illustrated in Fig. 3 forms a particularly amusing model. When the Crank Handle is turned the smith repeatedly strikes the anvil in a most energetic manner.

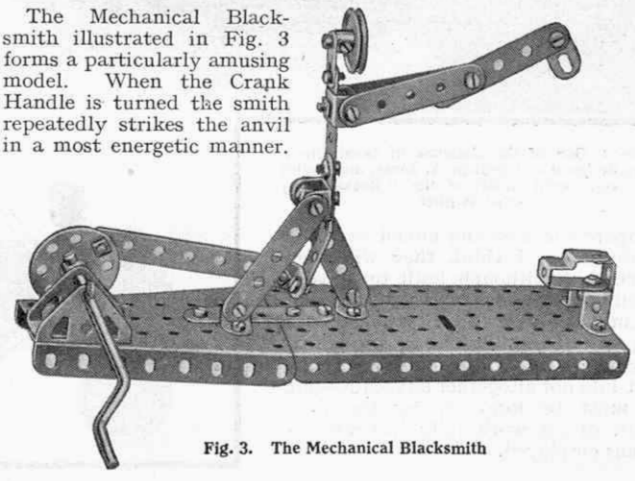


Fig. 3. The Mechanical Blacksmith

The base of the model is constructed from a $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate and a Sector Plate fastened together by means of a $2\frac{1}{2}''$ Strip. The smith's body consists of two $2\frac{1}{2}''$ Strips overlapped two holes and bolted together. His head is formed from a 1" Fast Pulley secured to his "neck" (a Flat Bracket) by a $\frac{3}{8}''$ Bolt, the shank of which is gripped by the set-screw in the Pulley. His legs are fastened to the base by means of Angle Brackets and are attached pivotally by bolts and lock nuts (see Standard Mechanism No. 263) to a Double Bracket secured to his body.

An Angle Bracket bolted to the smith is connected to the Bush Wheel on the Crank Handle by means of a $3\frac{1}{2}''$ Strip pivoted at each end by a bolt and two nuts (Standard Mechanism No. 263). The Crank Handle is journalled in a pair of Trunnions bolted to the Sector Plate and is prevented from sliding longitudinally by a Spring Clip.

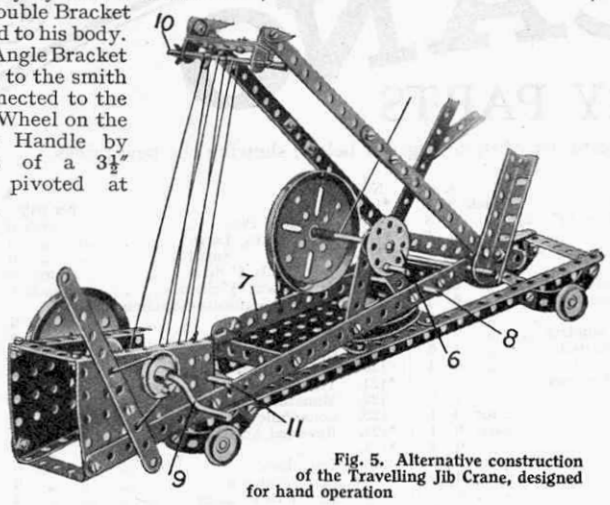


Fig. 5. Alternative construction of the Travelling Jib Crane, designed for hand operation

The anvil consists of two $\frac{1}{2}''$ Reversed Angle Brackets, a Cranked Bent Strip, and a Double Bracket bolted together in the manner shown and secured to one end of the base. On turning the Crank Handle the connecting Strip causes the smith to rock to and fro on his legs, so delivering a series of blows on the anvil with his hammer.

The parts required to build the Mechanical Blacksmith are as follows: 1 of No. 3; 8 of No. 5; 2 of No. 10; 2 of No. 11; 5 of No. 12; 1 of No. 19s; 1 of No. 22; 1 of No. 24; 1 of No. 35; 26 of No. 37; 4 of No. 37a; 1 of No. 44; 1 of No. 52; 1 of No. 54; 1 of No. 111c; 2 of No. 125; 2 of No. 126a.

Travelling Jib Crane

The crane shown in Fig. 4 is a most interesting model to build and when completed its operation will afford endless fun. It is shown equipped with an Electric Motor, which operates the hoisting mechanism, but if a Motor is not available and it is desired to operate the model entirely by hand, the alternative construction shown in Fig. 5 should be followed. The crane is mounted on wheels, is capable of swivelling upon its travelling base, and is equipped with hoisting and luffing motions.

As shown in Fig. 4 the travelling base of the model consists of two $12\frac{1}{2}''$ Angle Girders spaced apart at their ends by $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips and at the centre by two $3\frac{1}{2}''$ Strips. The 3" Pulley Wheel 1, which is bolted to the swivelling structure, rests upon a similar wheel bolted to the $3\frac{1}{2}''$ Strips in the centre of the travelling base. A short Rod secured in the boss of the Pulley 1 is free to rotate in the boss of the lower 3" Pulley, and the base and swivelling structure are held together by means of a Collar or Pulley Wheel, etc., fastened to the lower end of this Rod.

The construction of the jib, which is built up from Strips and Angle Girders, is shown clearly in the illustration. One end of the hoisting cord is attached to the Double Bracket bolted in the head of the jib, and the cord is then led round the $\frac{1}{2}''$ loose Pulley Wheel in the pulley block (which consists of two $1\frac{1}{2}''$ Strips bolted one on each side of the Hook), over the 1" Pulley in the head of the jib, and so down to the hoisting shaft. The latter consists of a 3" Axle Rod journalled in a $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip bolted to the Motor, and is driven from the armature spindle of the Motor via two separate belt drives.

The jib is luffed by operating the Crank Handle 3, the cord from which passes round the Axle Rod 4 on the jib, then round the Rod 5 in the base, back round the Rod 4, and is secured finally to a Flat Bracket mounted on the Rod 5. It will be noticed that Washers and Spring Clips are placed on the Rods 4 and 5 to prevent the cord becoming entangled.

If the construction shown in Fig. 5 is adopted it should be noted that the hoisting cord is operated by the hand wheel 6, the shaft of which is controlled by a cord and lever brake. The brake lever 7 pivots about the Rod 8 and the cord tied to it passes round a 3" Pulley Wheel on the hoisting shaft.

The luffing of the jib is effected by means of the Crank Handle 9. In this case the operating cord passes from the Crank Handle round the Rod 10, then round Rod 11, back round Rod 10, again over Rod 11, and once more round Rod 10. The end is secured to one of the Sector Plates that forms a bearing for the Crank Handle 9. It will be observed that a greater leverage is obtained from this arrangement than in that illustrated in Fig. 4. Of course, either method may be adopted to suit individual requirements.

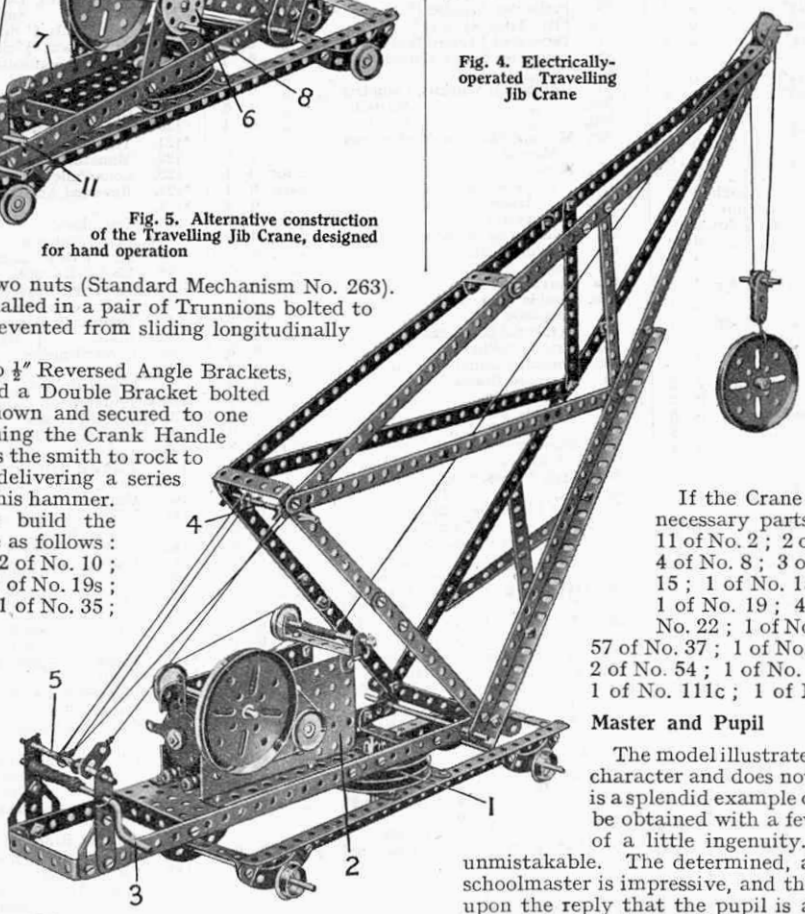


Fig. 4. Electrically-operated Travelling Jib Crane

The parts required to build the electrically-operated crane shown in Fig. 4 are: 10 of No. 1; 9 of No. 2; 2 of No. 3; 2 of No. 5; 2 of No. 6a; 4 of No. 8; 1 of No. 10; 1 of No. 11; 2 of No. 12; 2 of No. 15; 1 of No. 15a; 2 of No. 16; 1 of No. 17; 2 of No. 18a; 1 of No. 19; 4 of No. 19b; 4 of No. 20; 4 of No. 22; 1 of No. 23; 1 of No. 24; 14 of No. 35; 60 of No. 37; 6 of No. 37a; 14 of No. 38; 1 of No. 48; 7 of No. 48a; 1 of No. 52; 1 of No. 57; 4 of No. 90a; 5 of No. 111c; 2 of No. 126a; 1 Electric Motor.

If the Crane is built as shown in Fig. 5 the necessary parts are as follows: 10 of No. 1; 11 of No. 2; 2 of No. 3; 6 of No. 5; 2 of No. 6a; 4 of No. 8; 3 of No. 10; 1 of No. 11; 1 of No. 15; 1 of No. 15a; 5 of No. 16; 2 of No. 18a; 1 of No. 19; 4 of No. 19b; 4 of No. 20; 4 of No. 22; 1 of No. 23; 1 of No. 24; 12 of No. 35; 57 of No. 37; 1 of No. 48; 7 of No. 48a; 1 of No. 52; 2 of No. 54; 1 of No. 57; 1 of No. 62; 4 of No. 90a; 1 of No. 111c; 1 of No. 115.

Master and Pupil

The model illustrated in Fig. 6 is of a purely amusing character and does not contain any working parts. It is a splendid example of the remarkable effects that can be obtained with a few Meccano parts by the exercise of a little ingenuity. The subject of the model is unmistakable. The determined, almost ferocious, attitude of the schoolmaster is impressive, and there is no doubt that much hangs upon the reply that the pupil is about to give to a question put by the master.

It is not clear whether the student is seated upon a low chair or form, or whether he has collapsed on the floor owing to the stress and strain of the moment. In any case, it can be seen from the illustration that he is attached to the Flanged Plate that forms the base of the model by means of two Angle Brackets secured by a single bolt to the $2\frac{1}{2}''$ Strip representing his body. The $2\frac{1}{2}''$ Strips that form his legs are bolted to the

(*Continued on page* 493)

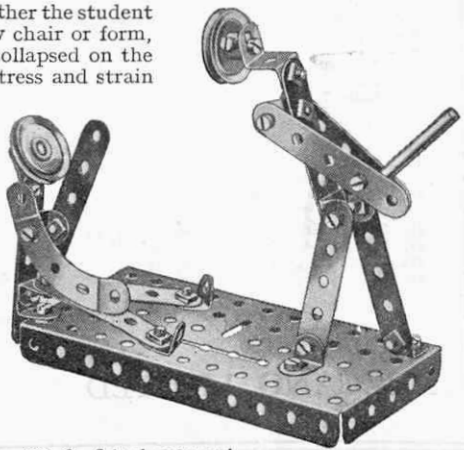


Fig. 6. Schoolmaster and Pupil; a critical moment

MECCANO

ACCESSORY PARTS

There are now 251 parts in the Meccano system and a complete list of these is given below, showing the new prices.

Perforated Strips

No.			s.	d.
1.	12½″	½ doz.	1	0
1a.	9½″	„	0	9
1b.	7½″	„	0	8
2.	5½″	„	0	6
2a.	4½″	„	0	5
3.	3½″	½ doz.	0	4
4.	3″	„	0	3
5.	2½″	„	0	3
6.	2″	„	0	3
6a.	1½″	„	0	3

Angle Girders

7.	24½″	each	0	8
7a.	18½″	„	0	6
8.	12½″	½ doz.	1	9
8a.	9½″	„	1	3
8b.	7½″	„	1	2
9.	5½″	„	1	0
*10.	Flat Brackets			
*11.	Double Brackets		each	0 1
*12.	Angle Brackets, ½″×½″		doz.	0 3
*12a.	„ „	1″×1″	½ doz.	0 4
*12b.	„ „	1″×½″	„	0 3
9a.	4½″	½ doz.	0	10
9b.	3½″	„	0	8
9c.	3″	„	0	8
9d.	2½″	„	0	7
9e.	2″	„	0	6
9f.	1½″	„	0	6

Axle Rods

13.	11½″	each	0	2
13a.	8″	„	0	2
14.	6½″	„	0	1
15.	5″	„	0	1
15a.	4½″	2 for	0	1
16.	3½″	„	0	1
16a.	2½″	2 for	0	1
16b.	3″	„	0	1
17.	2″	3 for	0	1
18a.	1½″	„	0	1
18b.	1″	„	0	1

19.	Crank Handles, Large	each	0 2
19s.	„ Small	„	0 2
19a.	Wheels, 3″ diam., with set screws	„	0 6
20.	Flanged Wheels, 1½″ diam.	„	0 5
20b.	„ „ ¾″	„	0 4

Pulley Wheels

19b.	3″ dia. with centre boss and set screw	„	0 7
19c.	6″ „ „ „ „ „	„	2 0
20a.	2″ „ „ „ „ „	„	0 5
21.	1½″ „ „ „ „ „	„	0 4
22.	1″ „ „ „ „ „	„	0 3
23a.	½″ „ „ „ „ „	„	0 3
22a.	1″ „ without „ „ „	„	0 2
23.	½″ „ „ „ „ „	„	0 2
24.	Bush Wheels	„	0 4
25.	Pinion Wheels, ½″ diam.	„	0 6
25a.	„ „ ¾″ „ Double width face	„	0 8
26.	„ „ ½″ „	„	0 4
26a.	„ „ ½″ „ Double width face	„	0 6

Gear Wheels

27.	50 teeth to gear with ½″ pinion	„	0 6
27a.	57 „ „ „ ½″ „	„	0 6
27b.	133 „ „ „ ½″ „ (3½ dia.)	„	1 3
28.	Contrate Wheels, 1½″ diam.	„	0 9
29.	„ „ ¾″ „	„	0 6
30.	Bevel Gears, ½″, 26 teeth	„	0 9
30a.	„ „ ½″, 16 „ *Can only be*	„	0 6
30c.	„ „ 1½″, 48 „ *used together*	„	1 6
31.	Gear Wheels, 1″, 38 teeth	„	1 0
32.	Worm Wheels	„	0 5
34.	Spanners	„	0 2
34b.	Box Spanners	„	0 4
35.	Spring Clips	per box (doz.)	0 3
36.	Screw Drivers	each	0 3
36a.	„ „ Extra Long	„	0 6
36b.	„ „ Special	„	1 0
37.	Nuts and Bolts, 7/32″	per box (doz.)	0 6
37a.	Nuts	„	0 3
37b.	Bolts, 7/32″	„	0 3
*38.	Washers	„	0 1
40.	Hanks of Cord	2 for	0 3
41.	Propeller Blades	per pair	0 4
43.	Springs	each	0 2
*44.	Cranked Bent Strips	„	0 1
45.	Double Bent Strips	„	0 1

Double Angle Strips

46.	2½″×1″	½ doz.	0	6
47.	2½″×1½″	„	0	9
47a.	3″ ×1½″	„	0	10
48.	1½″ × ½″	„	0	4
48a.	2½″×½″	½ doz.	0	5
48b.	3½″×½″	„	0	6
48c.	4½″×½″	„	0	9
48d.	5½″×½″	„	0	9

No.			s.	d.
50a.	Eye Pieces, with boss	each	0	4
52.	Perforated Flanged Plates, 5½″×2½″	„	0	5
52a.	Flat Plates, 5½″×3½″	„	0	5
53.	Perforated Flanged Plates, 3½″×2½″	„	0	3
53a.	Flat Plates, 4½″×2½″	„	0	3
54.	Perforated Flanged Sector Plates	„	0	3
55.	Perforated Strips, slotted, 5½″ long	„	0	2
55a.	„ „ „ 2″ „	„	0	1
56.	Instruction Manuals, Complete	„	2	6
56a.	„ „ No. 0-3	„	1	0
56b.	„ „ No. 0	„	0	4
56c.	Meccano Standard Mechanisms Manual	„	1	0
57.	Hooks	2 for	0	1
57a.	„ (Scientific)	each	0	1
57b.	„ Loaded	„	0	3
58.	Spring Cord	per length	0	9
59.	Collars with Set Screws	2 for	0	3
61.	Windmill Sails	4 for	0	6
62.	Cranks	each	0	3
62a.	Threaded Cranks	„	0	4
62b.	Double Arm Crank	„	0	3
63.	Couplings	„	0	6
63a.	Octagonal Couplings	„	0	8
63b.	Strip Couplings	„	0	8
63c.	Threaded Couplings	„	0	6
64.	Threaded Bosses	„	0	2
65.	Centre Forks	„	0	1
66.	Weights, 50 grammes	„	1	0
67.	„ 25 „	„	0	5
68.	Woodscrews, ½″	doz.	0	3
69.	Set Screws	„	0	3
69a.	Grub Screws, 5/32″	„	0	4
69b.	„ „ 7/32″	„	0	5
70.	Flat Plates, 5½″×2½″	each	0	4
72.	„ „ 2½″×2½″	„	0	2
76.	Triangular Plates, 2½″	„	0	2
77.	„ „ 1″	„	0	1

Screwed Rods

78.	11½″	each	0	6
79.	8″	„	0	5
79a.	6″	„	0	4
80.	5″	„	0	3
89.	5½″ Curved Strips, 10″ radius	„	0	2
89a.	3″ „ „ cranked, 1½″ radius, 4 to circle	„	0	2
90.	2½″ „ „ 2⅜ radius	„	0	1
90a.	2½″ „ „ cranked, 1⅜″ radius, 4 to circle	„	0	1
80a.	3½″	each	0	3
80b.	4½″	„	0	3
81.	2″	„	0	2
82.	1″	„	0	1

Sprocket Wheels

94.	Sprocket Chain	per 40″ length	0	6
*95.	2″	each	0	5
*95a.	1½″	„	0	4
*95b.	3″	„	0	6
*96.	1″	each	0	3
*96a.	¾″	„	0	3

Braced Girders

97.	3½″	½ doz.	0	9
97a.	3″	„	0	8
98.	2½″	„	0	8
99.	12½″	„	2	6
99a.	9½″	½ doz.	2	0
99b.	7½″	„	2	0
100.	5½″	„	1	0
100a.	4½″	„	0	10
101.	Healds, for looms	doz.	0	9
102.	Single Bent Strips	each	0	1

Flat Girders

103.	5½″	½ doz.	0	10
103a.	9½″	„	1	2
103b.	12½″	„	1	3
103c.	4½″	„	0	9
103d.	3½″	„	0	7
103e.	3″	½ doz.	0	6
103f.	2½″	„	0	5
103g.	2″	„	0	4
103h.	1½″	„	0	4
103k.	7½″	„	1	0
*104.	Shuttles, for looms	each	7	6
105.	Reed Hooks, for looms	„	0	4
106.	Wood Rollers	„	1	6
106a	Sand Rollers	„	1	9
107.	Tables for Designing Machines	„	1	6
108.	Architraves	„	0	2
109.	Face Plates, 2½″ diam.	„	0	4
110.	Rack Strips, 3½″	„	0	2
111.	Bolts, ¾″	2 for	0	1
111a.	„ ½″	3 for	0	1
111c.	„ ⅜″	doz.	0	3
113.	Girder Frames	each	0	3

No.			s.	d.
*114.	Hinges	per pair	0	4
115.	Threaded Pins	each	0	2
*116.	Fork Pieces, Large	„	0	3
116a.	„ „ Small	„	0	3
117.	Steel Balls, ⅜″ diam.	doz.	0	6
118.	Hub Discs, 5½″ diam.	each	1	3
119.	Channel Segments (8 to circle, 11½″ diam.)	„	0	4
120.	Buffers	„	0	2
120a.	Spring Buffers	per pair	0	8
120b.	Compression Springs	each	0	1
*121.	Train Couplings	„	0	2
122.	Miniature Loaded Sacks	„	0	2
123.	Cone Pulleys	„	1	3
*124.	Reversed Angle Brackets, 1″	½ doz.	0	4
*125.	„ „ „ ½″	„	0	3
126.	Trunnions	each	0	2
126a.	Flat Trunnions	„	0	1
127.	Simple Bell Cranks	„	0	1
128.	Boss Bell Cranks	„	0	3
*129.	Rack Segments, 3″ diam.	„	0	5
*130.	Triple Throw Eccentrics	„	1	0
131.	Dredger Buckets	½ doz.	1	0
132.	Flywheels, 2½″ diam.	each	2	0
133	Corner Brackets	„	0	1
*134.	Crank Shafts, 1″ stroke	„	0	2
135.	Theodolite Protractors	„	0	3
136.	Handrail Supports	„	0	3
137.	Wheel Flanges	„	0	3
138.	Ship's Funnels	„	0	3
138a.	„ „ Cunard type	„	0	9
139.	Flanged Brackets (right)	„	0	2
139a.	„ „ (left)	„	0	2
140.	Universal Couplings	„	0	10
141.	Wire Lines (for suspending clock weights)	„	0	9
142.	Rubber Rings, 3″ diam.	„	0	3
142a.	Dunlop Tyre to fit 2″ diam. rim	„	0	4
142b.	„ „ „ 3″ „	„	0	6
143.	Circular Girders, 5½″ diam.	„	1	0
144.	Dog Clutches	„	0	6
145.	Circular Strips, 7″ diam. over all	„	0	9
146.	„ Plates, 6″ „	„	1	0
*147.	Pawls, with pivot bolt and nuts	„	0	3
*147a.	Pawls	„	0	2
*147b.	Pivot Bolt with 2 nuts	„	0	2
148.	Ratchet Wheels	„	0	6
149.	Collecting Shoes, for Electric Locos	„	1	6
150.	Crane Grabs	„	0	7
151.	Pulley Blocks, Single Sheave	„	0	8
152.	„ „ Two „	„	0	9
153.	„ „ Three „	„	1	0
*154a.	Corner Angle Brackets, ½″ right hand	½ doz.	0	6
*154b.	„ „ „ ½″ left „	„	0	6
155.	Rubber Rings, ¼″ diam.	each	0	1
*156.	Pointers, 2½″ over all, with boss	„	0	4
157.	Fans, 2″ diam.	„	0	4
158a.	Signal Arms, Home	„	0	5
158b.	„ „ Distant	„	0	5
*159.	Circular Saws	„	1	0
160.	Channel Bearings, 1½″×1″×½″	„	0	2
162.	Boiler, complete with ends	„	1	0
162a.	Boiler ends	„	0	3
163.	Sleeve Pieces	pair	0	6
164.	Chimney Adaptor	each	0	2
165.	Swivel Bearings	„	0	6
166.	End „	„	0	3
167.	Geared Roller Bearings	„	20	0
167a.	Roller Races, geared, 192 teeth	„	4	6
167b.	Ring Frames for Rollers	„	3	0
167c.	Pinions for Roller Bearings, 16 teeth	„	1	0
168.	Ball Bearings, 4″ diam.	„	3	0
168a.	Ball Races, flanged	„	0	6
168b.	„ „ geared	„	0	9
168c.	Ball Casings, complete with balls	„	1	9
169.	Digger Buckets	„	2	0
*170.	Eccentrics, ½″ throw	„	0	9

Ask your dealer for a copy of the complete illustrated list of Meccano Accessory parts and keep it by you for reference.

* These parts are available with nickel finish only.

MECCANO LIMITED BINNS ROAD LIVERPOOL

June Meccano Model-Building Contest

SIXTY-THREE SPLENDID PRIZES TO BE WON

EVERY Meccano boy who likes to build up models from his own ideas—(there must be very few who do not prefer this method to copying the illustrations in the Instructions Manual)—should enter the special Model-building Competitions that are announced in these pages every month. Each competition is run separately and there is no reason why any competitor who enters regularly should not receive prizes in several contests.

The contests are organised with a view to encouraging "*M.M.*" readers to exercise their ingenuity and to build bigger and better models. By their aid we are able to bring the work of keen model-builders to the notice of hundreds of thousands of their fellow Meccano boys.

As soon as an "*M.M.*" reader has built an entirely new model or has produced a greatly improved version of any model that has been described in the Meccano literature, his work is eligible for entry in any one of the model-building competitions announced each month.

THE PRIZES

The Prizes to be awarded in Sections A and C are as follows:—

First Prize: Cheque for three guineas.
Second Prize: Cheque for two guineas.
Third Prize: Cheque for one guinea.
Six prizes, each consisting of Meccano Double Headphones, or Meccano Crystal Receiving Set.
Twelve prizes, each consisting of a Meccano Single Telephone Receiver.

The Prizes in Section B are as follows:—

First Prize, Meccano products to value two guineas.
Second Prize: Meccano products to value one guinea.
Third Prize: Meccano Double Headphones, or Crystal Receiver.
Six Prizes, each consisting of a Meccano Single Telephone Receiver.
Twelve Prizes, each consisting of a Complete Instructions Manual.

A limited number of Certificates of Merit and complimentary copies of "Meccano Standard Mechanisms" Manuals will be awarded in each Section.

Hints to Competitors

There should be no dearth of ideas for new models; to the boy who keeps his eyes open new suggestions will present themselves every day. Give your imaginative powers full rein, put forward your best creative effort, and your success in the competition is certain.

Any number of parts may be used in the models submitted, but do not make the mistake of thinking that because you have only a No. 00 Outfit you naturally stand a poorer chance of winning a prize than a competitor who has a No. 7 Outfit. It is not necessarily the most complicated models that carry off the awards. Originality of ideas and neatness of construction are, in the judges' opinion, the most important factors that lead to success. Similarly, do not think that because you are not as old as another competitor you do not stand such a good chance of success. In this competition, as in all Meccano competitions, the age of the competitor is specially considered when the prizes are being awarded.

The best plan is to send a photograph of your model, of course, but if you cannot manage to obtain a good photograph a clear drawing will do as well. Neither photographs or drawings need be your own work, but the model itself must be the result of your own unaided efforts. Whether you send a photograph or a drawing you should state what your model is and mention any points of particular interest. If there are any details in your model that are not very clear, you should write out the necessary explanation, using one side of the paper only, and send it along with the photograph or drawing.

Important Instructions

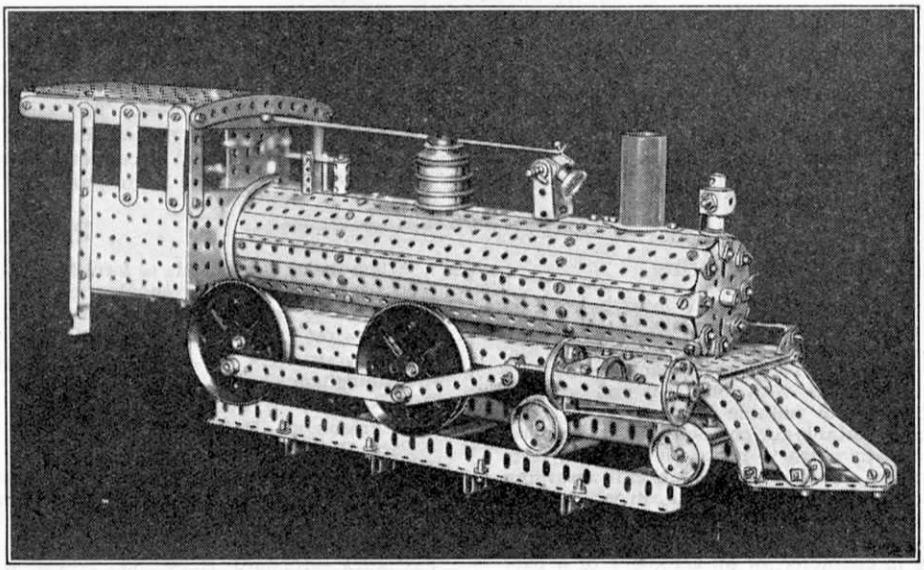
The competition will be divided into three different Sections, as follows:—Section A, for competitors residing in the British Isles and over 14 years of age. Section B, for competitors residing in the British Isles and under 14 years of age. Section C, for competitors of all ages residing overseas.

Read the following instructions and regulations carefully and make sure you have observed every condition of entry before sending in your work:—

Do not send the actual model. Your photographs or drawings, if unsuccessful, will be returned providing that a stamped addressed envelope of the necessary size is enclosed with your entry. Prize-winning photographs become the property of Meccano Ltd.

Your name and address must appear on the back of each photograph or sheet of paper used, together with your age, name of the competition ("June" Model-building Competition) and the Section in which the model is entered. Address the envelope "June" Model Competition, Meccano Ltd., Binns Road, Liverpool.

Closing date for Sections A and B; 31st July, 1928. For Section C; 31st October, 1928.



This excellent model of a South African Locomotive secured a prize in a recent Model-building Competition

With the Secretary

Model Admired by 100,000 People

I have often referred in these columns to the importance of seizing every opportunity that may arise of securing publicity. The exhibition of models at some public function is particularly valuable in this respect, a well-constructed model of some well-known object making a far greater appeal than any amount of description or explanation.

A striking instance of the value of this has now come to my notice from the Clifton M.C., Johannesburg. H. Jacobsen, the secretary of this club, constructed a model of the 8-cylinder La Salle car that was worthy of comparison with the many fine models that have already been produced by members of this club. Previously these have attracted notice on such occasions as their periodical exhibitions only, but it seems that a representative of the South African agents for the La Salle car had seen this particular model and had promptly asked its constructor for permission to place it on exhibition in the motor section of the great Rand Agricultural Show.

This show is the greatest event of the year in the Transvaal. Some idea of its importance may be gathered from the fact that there was an attendance of considerably more than 100,000 people during the week in which it remained open. The majority of the visitors saw the Meccano model displayed on the La Salle stand, where it proved such a great attraction that it afterwards appeared on the films of the Show exhibited in the local picture houses, and secured special reference in the Johannesburg newspapers, one of which said that for design, construction and fidelity it was worthy of the highest praise.

The effect of this publicity is undoubtedly all to the good from the point of view of the Clifton M.C., and the Leader has already written to inform me that it has helped them considerably and that they feel that the club is now more firmly established than ever.

Meccano Club Leaders

No. 34. Mr. B. Gilbey

The Newcastle-on-Tyne M.C. has been in existence since 1925 and our photograph shows the energetic Leader, Mr. B. Gilbey, who has been at the helm since that date. Members recently have concentrated on building models of the splendid bridge now being erected across the Tyne

A Model Aeroplane Meeting

A very interesting hobby for the summer months is the construction of model aeroplanes. This can readily be carried on as a club affair, for models of varying degrees of complexity and difficulty can be made, ranging from simple machines of thin card to more elaborate aeroplanes, with longerons and spars of wood strip, and plane covering of suitable fabric

The hobby is particularly suitable for competitions, as summer is the best time of the year in which to make the practical tests of flying ability that must be the chief consideration in awarding prizes. Ordinary open competitions may be run, in which competitors are asked to enter aeroplanes designed and constructed by themselves from any material, but others in which the materials to be used are restricted in character, or an aeroplane of a particular design is to be made, will provide great scope for ingenuity. It is a good plan, for instance, to hold a competition for aeroplanes constructed from a set of component parts such as are advertised in the pages of the *"M.M."*

In deciding on the merits of the entries in any competition, marks should be awarded for good workmanship and ingenious methods of construction, while if the competition is an open one the merits of the design must be taken into account. First consideration must be given to airworthiness however. An open space free from accidental air currents is required in order to carry out tests of this, and if possible aeroplane meetings should be held in conjunction with a country excursion. In addition, it will almost certainly be found that the proceedings will be lengthy, as the members are sure to be so interested in the winning models that they will want to see them in operation repeatedly, and ample time should therefore be allowed.

A Saturday afternoon excursion would probably provide the most suitable opportunity for the trials, but the excursion should not involve travelling to any great distance, as the fragile models are liable to come to grief if not carefully handled. Each entrant should be allowed three trials in which to demonstrate the stability and range of his machine in the air. A competition of this kind is sure to arouse great interest, and the actual trials are bound to be highly enjoyable if carried out in the manner suggested.

* * * *

The information was given on this page in the April *"M.M."* that an attempt was being made to form a club at Newton-le-Willows, Yorkshire. This was an unfortunate error that arose from a mistaken address. The club referred to is being formed at Hawick and Roberton, Scotland, and a corrected announcement appears in the list of proposed Clubs given this month.

Proposed Clubs

Attempts are being made to form Meccano Clubs in the following places and boys interested should communicate with the promoters, whose names and addresses are given below :—

ASCOT.—Joseph Bell, King Edward Road, Ascot, Berks.

BIRMINGHAM.—T. F. Bowen, 30, Russell Road, Moseley, Birmingham.

BIRMINGHAM.—H. Coulson, 254, Long Acre, Nechells, Birmingham.

BOURNEMOUTH.—R. B. Grice, " Pinewood," Fernside Road, Tolbot Park, Bournemouth.

DEVIZES.—Stewart Phipps, Dunkirk, Devizes.

HAWICK AND ROBERTON.—Harry Scott, Harden, Hawick, Scotland.

HUDDERSFIELD.—P. W. Robson, Middle House, High Flatts, Nr. Huddersfield.

TASMANIA.—Richard Hope, 35, Trevallyn Terrace, Launceston, Tasmania.

CLUB NOTES

Herne Bay Meccano and Hobbies M.C.—A memory building contest was arranged, and aroused great interest, the first prize for accuracy being divided between Masters Latchford, Joy and Beale. Games Tournaments have been conducted during the past session, the meeting at which the final matches were contested being enlivened by sealed number and flying dart competitions. A Senior Section has been organised for the older members of the club. While remaining an essential part of the club and working in conjunction with it, the Section arranges its own programmes and is run by a separate committee. Club roll: 43. *Secretary*: C. W. Russell, 4, Clifton Villas, Herne Bay.

Derby M.C.—Has had a very successful session, a notable event of which was a Hobbies Exhibition, at which members were complimented by visitors on the high standard of the exhibition. Evenings devoted to Five-minute Lectures have proved a popular feature, among the subjects being "*The Royal Scot*," "*The Modern Battleship*," "*The Atlantic Cable*" and "*The Latest Braking Action*." A Lecture on "*The Working of a Naval Gun*," given by Mr. Green, was greatly appreciated. Other interesting talks were given on "*How to Spend a Cheap Holiday in France*," and "*Shakespeare's Country*," the latter being given by the secretary, and illustrated by lantern slides lent by the G.W.R. A Games Week has been held, during which an exciting Hand-ball Game was played between teams representing the "House of Meccano" and the "House of Hornby." Club roll: 28. *Secretary*: W. P. Smith, 435, Uttoxeter Road, Derby.

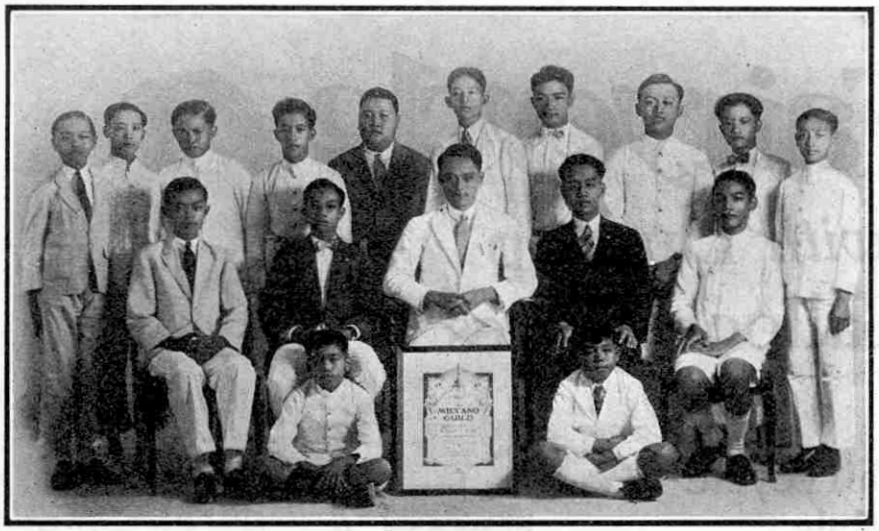
Chelmsford M.C.—Has become affiliated with the Guild and is making splendid progress. At present Model-building is the most important feature in the syllabus and many very interesting and well-designed models have been produced. New members will be made very welcome and particulars may be had from the secretary. Club roll: 12. *Secretary*: Miss G. F. Flexman, Saracen's Head Hotel, High Street, Chelmsford.

Woolwich and Plumstead M.C.—This newly-established club is making splendid progress, and a large and airy Club Room has been secured at a reasonable rent. Meetings are held every Friday and last about 2½ hours. After business has been disposed of the time is divided equally between Model-building or a Lecture, and Games. The club now possesses a Table Tennis Set; two sets each of Draughts and Dominoes; and a Chess Set, the donor of which has volunteered his services as instructor. A visit to the local Power Station has been arranged and many outings have been planned for Saturday afternoons. It is hoped to secure a good Cricket pitch in time to organise a team, and the secretary will be glad to hear from anyone who is able to help in this matter. Club roll: 30. *Secretary*: Stanley E. Weller, 22, Woodhurst Road, Plumstead, S.E.18.

Teignmouth Congregational M.C.—Is now in a flourishing condition and an excellent leader has been secured in Mr. C. I. Bowerman. Two evenings a month are devoted to Fretwork. A novel monthly competition has been arranged in connection with this hobby, the winner being the member who has broken the least number of blades during the month! Reckless sawing is now severely avoided. Club roll: 20. *Secretary*: Donald Ford, 16, Higher Brook Street, Teignmouth.

Wyggeston Grammar School (Leicester) M.C.—Has just completed a most successful session, interesting features of which were visits to large works and papers prepared and read by members. A lecture on De Havilland aeroplanes, illustrated by slides on loan from the Company, proved such a success that the Leader repeated it before the School Engineering Society. The session concluded with the finest Exhibition yet held. It is a rule of the club that every member must produce a Model on this occasion and the large number of Models on view showed excellence in both design and construction. The Exhibition was held on the school "Open Day," of which it was a most attractive feature. Visitors assisted in the award of prizes by voting for the three Models they considered best. Club roll: 79. *Secretary*: Master J. R. Crowe, Wyggeston Grammar School, Leicester.

Singapore Chinese M.C.



This club was affiliated in September 1927 and is in a flourishing condition. The sectional idea has been adopted and the rivalry between the three sections formed is very keen. Activities are many and varied, including social meetings and interesting excursions to rubber plantations, and the club owes much to the enthusiasm of the President and Leader, Mr. Choo Teck Hong, and the secretary, Mr. Chia Boon Hoe

Hastings Central M.C.—The Club Exhibition was a great success. The models displayed were of a very high standard and included a Sunbeam Car, Electric Loco, and High-speed Ship-coaler, which attracted much attention. The Hornby Train layout, on which a regular service was maintained throughout the evening, proved very fascinating to visitors. Club roll: 42. *Secretary*: W. V. Veness, 9, Earl Street, Hastings.

Morison Memorial (Clydebank) M.C.—The club's first Annual Exhibition and Concert was a huge success. Round three sides of the hall were arranged benches on which models were displayed, with members in attendance to set them in motion and explain the action. An Electric Railway attracted much attention. A Concert was included in the programme and the Meccano play "*Nonsense Nana*" was presented. A song entitled "*3 M.C. Calling*," specially written for the club by Miss Dobbie, was rendered with great success. The audience included several members from Victoria M.C. *Secretary*: George Gerrard, 53, Montrose Street, Clydebank.

Norbury M.C.—Devoted much time during last session to keenly contested Model-building Competitions and Hornby Train Nights. A visit to Pascall's Sweet Factory proved to be of extraordinary interest, and members are now building models of the wonderful machines that they inspected. Club roll: 26. *Secretary*: L. V. Ricards, 45, Wharfedale Gardens, Thornton Heath, Surrey.

Pinxton M.C.—The Model Engineering Exhibition held last session was an outstanding success. The opening ceremony was performed by Mr. Spencer, Managing Director of Pinxton Collieries Ltd., and Mr. P. F. Day took the chair. The Exhibition remained open for five days and many excellent models were displayed, including interesting miners' lamps and models of mining machinery lent by Pinxton Collieries Ltd., in addition to models made by the members. The first three prizes were awarded to a Model Colliery, a Horizontal Steam Engine, and a Crane. Professor Baltied gave a very interesting lantern Lecture on "*How Metals Get Tired*." *Secretary*: S. Winfield, 118, Park Lane, Pinxton, Nr. Nottingham.

Ilfracombe M.C.—The Carpentry Section is making splendid progress and many good models have been made. The club has a Hornby track running round the room. On Hornby Nights as many members as possible bring their trains and the line is as busy as a real railway on a Bank Holiday! A special Model Railway Section is to be established, to meet on a separate day. The Exhibition was a great success and the models displayed were of very high standard. Side-shows of various kinds were arranged, in one of which visitors were invited to drop a penny to cover a threepenny bit placed at the bottom of a bowl of water. Only two visitors succeeded! The proceeds of the Exhibition amounted to more than £5. At a Parents' Night an interesting feature was a race for models of Motor Cars made by the members. Club roll: 35. *Secretary*: R. Trawin, 33, Victoria Road, Ilfracombe.

Victoria Council School (Leeds) M.C.—Model-building has been the most popular feature recently. A particularly interesting innovation has been the introduction of a Novelty Night. Members each bring a certain specified number of Meccano parts and the Leader then selects a model to be built, using only these parts, and marks are awarded for the most original models completed in the time allowed. At one meeting the Leader demonstrated a Meccanograph model and members were greatly fascinated by the wonderful manner in which it produced designs. Club roll: 16. *Secretary*: Rodney Clayton, The Cottage, Osmondthorpe, Leeds.

Whitgift Middle School M.C.—Last session began with a competition for Models built during the school holidays, the winning models being a Crane and a Warehouse. Model-building Nights are the great attraction, and to stimulate interest still further it has been decided to purchase some of the larger and more expensive Meccano parts out of club funds and to lend them to members. Club roll: 26. *Secretary*: F. T. Brockes, 14, Addiscombe Court Road, East Croydon.

Galashiels M.C.—In the latest Model-building Contest the prizes were won by a Motor Car, a Windmill and a Motor Bus. These models were exhibited in the shop window of the local Meccano dealer and attracted great attention. A Sale of Work and Exhibition was held at the end of April, at which the takings amounted to £41 19s. A friend presented a medal, which was won by a model of Chair-o-planes constructed by a 10-year old member. In addition, a local gentleman lent a Meccano Loom designed and made by himself when he was a boy. Club roll: 18. *Secretary*: D. Richmond, 58, St. John Street, Galashiels.

A New and Imposing Model!

The Dunlop Pneumatic Balloon Tyres, $12\frac{1}{2}'' \times 2\frac{1}{4}''$, fitted to this latest No. 8 Fairycycle give the machine a striking appearance and increased comfort in riding, making it comparable with the buoyancy and luxury of a big car.

The Model 8 Fairycycle is also fitted with ball bearings throughout, spring saddle, upturned handlebars with brake working on the nickel plated rims, tyre pump, stand and carrier, etc. Price **£4:7:6**

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REGD. TRADE MARK.

The No. 8 Fairycycle

REGD TRADE MARK

with Dunlop Balloon Tyres

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FAIRYCYCLE No 8
(REGD. TRADE MARK.)

Other Fairycycle Models

No. 1, with tangent spoke wheels, $\frac{1}{2}''$ ribbed tyres, stand and carrier	39/6
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No. 3, De Luxe Model, as Model 2 but with ball bearing wheels, $\frac{1}{2}''$ ribbed tyres	59/6
No. 4, Super Fairycycle as Model 3 but with ball bearings throughout and spring saddle	65/-
No. 6, Senior Model with 16" wheels, $\frac{1}{2}''$ ribbed tyres, ball bearings throughout	70/-
No. 7, as Model 6, but with pneumatic tyres	75/-

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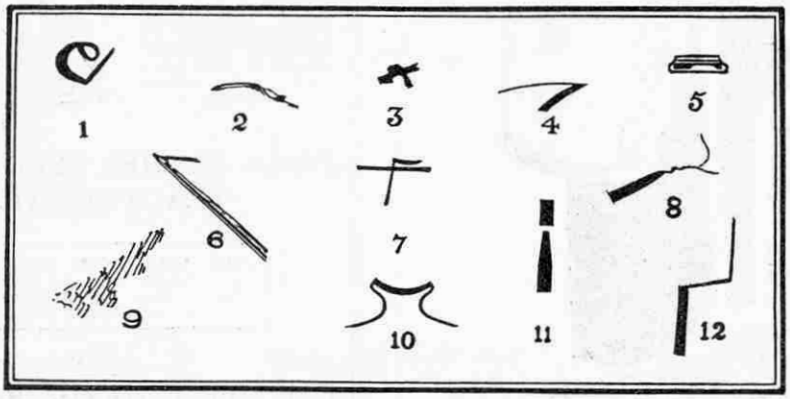
Competition Page

From Which Advertisements Are These Taken?

Meccano boys are famous for the keenness of their eyes. Probably that is the reason for the popularity of competitions in which sharp eyes play a prominent part. Invariably the number of entries for "Sharp Eyes" contests is considerably greater than for any other form of competition and we are asked for more! It is because of that we have no hesitation in setting this month another sharp eyes puzzle of a type that has proved very popular in the press generally recently, and which first appeared in the *"M.M."* over a year ago.



In the accompanying picture there are 12 peculiar little sketches. Actually each of them is a fragment cut from an advertisement that appeared in our last month's issue, and readers are asked to identify the advertisements from which the pieces have been taken. In the first place it must be explained that each of the fragments is exactly the same size as it appeared originally, but it is not necessarily reproduced in exactly the same position; that is, some of the pieces are upside down and others are inclined to one side or the other.

In this type of contest readers are entitled to call in the assistance of their brothers and sisters, father and mother, uncles, aunts and friends. There is no restriction at all!

Solutions must be submitted in the form of lists numbered to correspond with the number shown against each fragment, and the solution must give the advertiser's name and the exact point on the advertisement from which the fragment is cut. Prizes of Meccano or Hornby Train goods, to be chosen by the winners, to the value of £1/1/-, 15/-, 10/6 and 5/- respectively, will be awarded to the senders of the four most accurate solutions in order of merit. In addition, there will be a number of consolation prizes. In the event of a tie for any of the prizes, the award will be given to the entry that shows the neatest or most novel arrangement.

Entries must be addressed to "Advertisement Fragments, Meccano Magazine, Binns Road, Liverpool," and must reach this office not later than the 30th June. Overseas closing date, 29th September.

34th Photographic Contest

Throughout the long winter months our photographic readers have contained themselves with patience, but with the return of sunny spring days and the longer hours of daylight a marked restlessness has manifested itself, and a photographic competition must be held to provide an outlet for the new enthusiasm.

To give our country and town readers an opportunity of competing on level terms in this contest we have decided to set two sections. These are "A Farm Scene" and 'A Park Scene." Any reader who wishes to do so may compete in either or both of these sections.

Prizes of photographic or Meccano goods, to be selected by the winners, to the value of 10/6 and 5/- respectively, are offered to the senders of the best and second best photographs in each of the two classes into which the two sections of the competition are divided, A for those aged 16 and over, B for those under 16.

Intending competitors are reminded that it is always desirable to give a special title to their photographs. Often enough a title serves to cast a ray of light upon the subject of an apparently commonplace photograph and lifts it from the rut. Every print submitted must bear the name, address and age of the sender, who should also state whether the work is his or her own throughout. All photographs submitted must have been exposed by the senders but the finishing may have been done by a professional. All other matters being equal, preference will be given to prints that are entirely the work of the competitor.

Entries must be addressed to "34th Photographic Competition, Meccano Magazine, Binns Road, Liverpool," and sent to reach this office not later than 30th June. Overseas closing date, 29th Sept.

COMPETITION RESULTS

Second Stomachion Competition.—The standard of the entries to this competition, if anything, was slightly higher than that of the similar contest organised in our Christmas, 1927, number. That, of course, may be accounted for by the additional experience of the competitors, but it is interesting nevertheless to note that no one who gained a prize in that first competition has been successful in the present competition. That is all to the good and will inspire the unsuccessful to redouble the intensity of their efforts with a view to future success.

The awards were as follows:—

1. F. W. Jones (Birmingham); 2. J. Rodriguez (Maida Vale, W.9); 3. E. Hannan (Warrington); 4. W. Davies (Manchester). Consolation Prizes: H. Dean (Altrincham); H. Ewing (Co. Donegal); W. Finch (Birmingham); R. P. Lester (Streetly); J. W. Rowan (Belfast); R. W. Schofield (Glasgow).

OVERSEAS RESULTS

Aeronames.—1. E. Smith (Montreal, Quebec). 2. A. F. Setro (Vancouver, B.C.). 3. C. Galdes (Valletta, Malta). Consolation Prizes: Lam Bew Weng (Malacca, S.S.); Lam Seck Weng (Malacca, S.S.).

Canadian Essay.—The remarkable feature of this competition was the wide knowledge of Canadian matters displayed by New Zealand readers. It would be interesting to learn the real reason for this, for we do not anticipate for one moment that there is something in N.Z. air that makes a boy desperately keen on geography. Whatever the reason we congratulate N.Z. on scooping the principal prize pool.

The list of prize-winners is as appended:—

First Prizes: Section A, J. Hyde (Matakohe, N.Z.); Section B, M. Wysocki (Marton, N.Z.). Second Prizes: Section A, M. M. Reader (Palmerston North, N.Z.); Section B, T. MacLachlan (Otago, N.Z.). Consolation Prizes: G. Milne (Queensland, Australia); U. Mohan Rao (Madras); A. Wilson (Auckland, N.Z.); N. Thomas (Christ Church, N.Z.); J. Kelly (Ontario).

Xmas Stomachion Contest.—Our Overseas readers lacked nothing in comparison with boys nearer home when it came to tackling Stomachion problems. Many splendid entries were submitted. Unfortunately, space precludes a detailed review. The winners' names are as follows:—1. H. W. Turner (Hastings, N.Z.); 2. D. A. Walker (Temuka, N.Z.); 3. G. K. Choksi (Karachi); 4. E. Holder (Trinidad, B.W.I.).

January Sharp Eyes.—So many Overseas readers succeeded in giving a completely accurate solution that we have had to resort to our usual practice of awarding the prizes to the senders of the most novel and neatest of the completely accurate solutions.

The solution to this competition which, it will be recalled, was announced in the January Magazine, is as follows:—

1, Diamond Stamp Packet; 2, O Pusher Monoplanes (F. J. Mee); 3, Force; 4, Wormar Drip Feed; 5, Veeder Cyclometer; 6, Warne's Book of Games; 7, Fyfe & Gray's Stamps; 8, Sutcliffe's Model Warships; 9, R. Wylie Hill & Co.; 10, Pathé Baby Ciné; 11, Hull's Locomotives; 12, Lines Bros. "Rolls-Royce" No. 9; 13, Hamley's Hand Lamp Magic Lantern; 14, Daisy Air Rifle; 15, Electric Questioner; 16, Tractor Monoplane (Patent Model Mfrs.); 17, Amber & Wright's Stamp Album; 18, Graves' Cycles.

The awards are as follows:—

1. L. G. Mauger (Cranbrook, W. Australia); 2. D. Black (N.S.W., Australia); 3. R. Clouston (Gisborne, N.Z.); 4. B. Mayses (Prospect, Adelaide). Consolation Prizes: A. Gamman (Hastings, N.Z.); J. Lister (Transvaal, S.A.); J. Sharpley (Hawkes Bay, N.Z.); R. C. Taylor (Pretoria, S.A.); H. W. Turner (Hastings, N.Z.); J. Van Maanen (Utrecht O, Holland).

THE STAMPS OF BRITISH SOUTH AFRICA

THE young collector who wishes to specialise in the stamps of a portion of the British Empire that will not impose too great a strain upon his pocket, may do much worse than decide upon the stamps of the Union of South Africa. Here he finds a stamp issuing country whose earliest issues date back for only one generation but yet provide quite a big field to explore.

Up to 1910 the four colonies that comprise the Union, Cape Colony, Transvaal, Orange Free State, and Natal, were self-contained. Each had its own government and customs barriers marked the frontiers. Towards the end of the last century the leading statesmen of the colonies, realising that the interests of all four were mutual, began to strive hard for unity. After prolonged and strenuous efforts they succeeded. On 20th September, 1909, was passed the South Africa Act by which the self-governing colonies became united on 31st May, 1910, in a legislative union under one government, under the name of the Union of South Africa. The occasion was proclaimed a public holiday and was marked by the issue of a commemorative postage stamp of the denomination of 2½d.

This stamp, the first issued by the Union Government, was in Prussian blue on white paper, the four colonies being represented by the four shields at the corners. It was used for a considerable period after union but not less than 14 million copies were destroyed by the Government in 1920.

Temporarily the four colonies continued to use their own stamps for denominations other than 2½d., but in January, 1911, competitive designs were invited for a permanent issue. It was stipulated that the designs must include the King's head and crown; the words "Union of South Africa"; the denomination in figures; and the words "Postage" and "Postzegel." The design adopted was the familiar King's head in profile enclosed in an oval with a small fleur-de-lys in the upper corners and denomination in the lower corners. The watermark was a springbok's head.

This design was introduced on 1st September, 1913, and two types were used in the 14 different denominations ranging from 1d. to £1. The second type varies from the first in one important detail only—the two small labels between the price tablets are blank save for light shading. In the first type, used for the ½d., 1d. and 1½d. values, these labels bear the inscription *Revenue—Inkomst.* "Inkomst" is "High Dutch" for "revenue." The oval surrounding the King's head, as the stamp illustrated here shows, was surmounted in both types by the Imperial Crown, bordered by the name of the Union in English and Dutch and supported by tablets inscribed *Postage—Postzegel.* Type 1 is illustrated on this page.

In March, 1925, an Air Post Service was inaugurated. South African Defence Force aeroplanes were used to convey mail matter between Cape Town and Durban, via Oudtshoorn, Port Elizabeth and East London, and special air-mail stamps were used to frank the letters carried. The stamp gave a fairly large representation of an aeroplane in flight, and apart from this and the price tablets bears only the inscription South Africa—Air Post, Suidafrika—Lugpost. The service operated for only three months when, owing to lack of support, it was withdrawn, and with it the stamps were withdrawn also. The word "Lugpost" is Afrikaans, and this was the first occasion on which Afrikaans spelling was used on a Union stamp issue.

In 1922 the Government invited new designs for a general issue, the conditions being that each must include a design, pictorial or otherwise, definitely associated with the Union of South Africa; the words "Union of South Africa" and "Unie van Suidafrika"; the denomination in figures and the words "Postage" or "Posseel."

Subsequently the designs that are in general use to-day were adopted. The outstanding feature of the issue is the bi-lingual arrangement by which alternate stamps in each value except the 4d. are printed in English and Afrikaans. The arrangement is clearly shown in the illustrations of the pairs of the ½d. and 1d. values that appear on page 531.

The most popular stamp of the series from the philatelist standpoint is the 4d. triangular, for it is a reproduction of the earliest South African stamps, the Cape triangulars. As we have just said, this value does not follow the general plan of alternating the English and Afrikaans inscriptions on each sheet of stamps, and in this case each sheet is printed in one language only. The 4d. value differs from the rest of the issue also in that it is imperforate, just as the Cape triangulars.

The first stamps of the set to make their appearance were the ½d., 1d., 4d. and 6d. denominations. With the 4d. we have already dealt. The design of the ½d. stamp shows a springbok's head surmounted by a tablet bearing the name "South Africa" or "Suidafrika." The value tablet appears immediately below the head and is surrounded with laurel wreaths. Across the bottom of the stamp there is another tablet bearing the inscription "Postage Revenue" or "Posseel Inkomste."

The 1d. stamp shows the ship of Van Riebeek entering Table Bay. Van Riebeek was the first Governor of the settlement that the Dutch East India Company established at Table Bay for the refreshment of its fleets on their passages to and from Holland and the east. It is from this settlement that the present great Dutch population of South Africa have descended. Here again the value tablet appears in the centre at the bottom of the stamp with the country's name and the Postage—Revenue inscriptions respectively at the top and the bottom in English and Afrikaans on alternate stamps.

The design used for the 6d. stamp shows an orange tree in fruit. This is, of course, a tribute to the Orange Free State and as a matter of fact the design of the tree follows closely that of the early stamps of the Orange River Colony. Subsequently the remaining values of the issue, the 2d., 3d., 1/–, 2/6, 5/–, and 10/– denominations, made their appearance.

(*Continued on page* 531)

SPECIAL STAMP PACKET (ASK FOR NO. 2.)

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Look at this amazing gift boys! Contains large handsome **PORTUGAL Independence** mint pictorial, beautifully engraved (cat. 6d.); pictorial **GREECE** (ship in canal) mint; **CONGO**; **BULGARIA** (palace) mint; **GABOON** (Spearman); sets **Bavaria**; **U.S.A.**; **French Cols.**; **Perf. Gauge**, etc. Over 60 UNUSED. This superb gift absolutely FREE. Cheap and interesting approvals.

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From my second advertisement in your paper I obtained about one hundred and twenty replies—including thirty-two from abroad. I shall have no hesitation in coming to you again next season. S.H.C.

We have received quite a number of orders for our apparatus this morning as a result of your advertisement. P. & T.Ltd.

FREE 10 different Pictorial GUATEMALA

to genuine applicants for approvals enclosing 1½d. for postage. (Abroad 4d.)

Horace Miller & Co., Whitstable.

N. BORNEO PACKET FREE

A grand packet of **25 Different Stamps,** containing a very fine 3c. pictorial **North Borneo, Italian Somaliland** pictorial unused, **Cilicia** scarce, **Dominican Republic** bi-coloured, **Montenegro** unused, **Ruanda Urundi** surcharged on **Belgium Congo, Cuba** telegraph, **Jhind** Indian Native State, **Algeria** pictorial, **Monaco** unused, **Wallis and Futuna Isles, Mauritania, Madagascar,** etc., etc., free to all asking to see my famous Approval Sheets and enclosing **2d. for Posting and Packing (Abroad 3d.)**

S. HAMMOND, 2, CHESHAM FIELDS, BURY.
Stamp Collections, etc., purchased.

STAMP PERFORATION GAUGE

Stamp collectors will find this card extremely useful in enabling them instantly to find the size of perforation of any stamp. Price 1d. (post free) from the Editor, *"M.M."*

MECCANO WRITING PADS

These Writing Pads are just the thing to use when writing to your friends, for the special notepaper shows at once that you are a Meccano boy.

The pads are supplied in two sizes, each consisting of 50 printed sheets of tinted bank paper with cover. Prices—Large, 1/- each (post free); Small, 6d. each (post free), from Meccano Ltd., Binns Road, Liverpool.

PACKET. 30 good class **ZOOLOGICAL** stamps only—giraffes, elephants, lions, tigers, birds, etc. **BORNEO** (rhinoceros), **NEWFOUNDLAND** (caribou), **IRAQ** (winged bull). These first three stamps alone are usually sold at nearly twice the price I am asking for the packet. **UKRAINE, GUATEMALA, POLAND, VOLTA** (dromedary), **SILESIA, MOZAMBIQUE, SUDAN** (camel), **WALLACE Is.** (bird of paradise), **NYASSA, TCHAD** (leopard), and many other fine stamps, Price 4½d.

In addition, all purchasers of the Packet asking for approval sheets and sending 1½d. postage will be presented with two splendid sets—**8 MALAY** (tigers) usually sold at 10d. and **12 HUNGARY** (Turul—the mystic bird of the Magyars) catalogued 1/-. Send addresses of stamp collecting friends and receive an extra set free.

H. C. WATKINS (M. DEPT.), GRANVILLE ROAD, BARNET

Stamp Collecting—(*continued from page 529*)

The design of the 2d. stamp is very pleasing. It shows the Union Buildings at Pretoria, in which the administrative offices of the Government services are located. The buildings cost £1,500,000 and took five years to build. They are situated on the slopes of a hill, Meintjes Kop, and they command a superb view of Pretoria. Encircling these buildings and forming a strange commentary upon this happy outcome of unified effort is a ring of forts and blockhouses, reminiscent of warfare, but now in ruins. This stamp therefore is of special South African interest.

Every South African is acquainted with that charming homestead known as "*Groot Schuur*," forming the subject of the 3d. postage stamp. "*Groot Schuur*" means "Big Barn." It was built by and became the home of that commanding figure Cecil John Rhodes, one time Prime Minister of Cape Colony, but more widely known as the founder of Rhodesia. He became the dominant personality in the great corporation known as the De Beers Diamond Mining Company. Many who do not know the enthralling history of this Bishop Stortford boy know of his foundation of Rhodes' Scholarships. For many years "*Groot Schuur*" was his headquarters. Situated on the slopes of Devil's Peak in the Cape Peninsula, and built in the old Dutch style in surroundings of unexampled beauty, it surveys Table Bay and False Bay from its peninsular eminence. Near by is the famous Rhodes monument with its statue of "*Physical Energy*." Nestling in the pine trees adjoining the estate is the cottage home of Sir Leander Starr Jameson who, like Rhodes, became Prime Minister of Cape Colony, but who achieved much more prominence as the leader of the venture known as the Jameson Raid.

"*Groot Schuur*" is now a national possession. This princely home, linked in association with the names of many famous South Africans—Botha, Smuts, Hertzog and others—became the property of the people for the use of their Prime Ministers by the express wish of Rhodes.

The shilling value shows a pair of gnus racing side by side, while the 2/6 and 5/- values are reminiscent of the early days of transport in South Africa. They show respectively an ox wagon inspanned, that is with its string of oxen hauling the wagon across the veldt, and an ox wagon outspanned, that is, with its oxen detached and bivouacked for a halt. Much of South Africa's most interesting history is bound up in the adventures of those who trekked the country in ox-wagons. To these early settlers their wagon was not only a means of transport, it was a home and often enough a fortress! Even to-day, in spite of the growth of railway and motor transport, the ox-wagon is still the only practicable means of transporting heavy goods in many parts of the country. The 10/- value shows a striking view of Cape Town and Table Bay.

It is perhaps remarkable that, throughout the whole series, there is no reference to South Africa's greatest industries, gold and diamond mining. Gold and diamonds represented no less than 63 per cent. of the export trade of South Africa for the year ended December, 1926, and the value represented more than half the world's production. Probably the Union Postal Authorities will introduce the subject in a subsequent issue.

No reference to the stamps of the Union of South Africa would be complete without mention of the former German Colony known as South West Africa. Subsequent to the Great War the administration of this colony was taken over by the Union, and Union stamps overprinted were introduced for postal use. Here again alternate inscriptions in English and Afrikaans were used. The King's head stamps were overprinted in two horizontal lines 14 mm. apart, inscribed respectively South-West Africa and Zuid-West Afrika, the word "Africa" in each case appearing on the second line. Subsequently the word "Zuid-West" was transformed to one word.

Similar overprints are found on the new pictorial stamps. Here the inscriptions run vertically and the Dutch "Z" gives place to "S" and the final "T" disappears from Zuid-West. In an article of this length it is impossible to go into minute or even complete details of the slightly varying types of overprint, but the indications given will afford a general guide to the would-be specialist collector.

We are indebted to Stanley Gibbons Limited for the courtesy of the loan of the stamps from which the illustrations appearing with this article have been prepared.

As we go to press we learn that the 4d. triangular stamp, illustrated on the previous page, and to which reference is made in the course of this article, is to be withdrawn in favour of a new rectangular pictorial issue. Unofficially it is stated that the imperforate condition of the stamps has caused considerable annoyance to the postal staffs who have been required to cut up the sheets of stamps before individual stamps could be issued to the public. Details of the new design have not yet been made public but will be announced shortly.

Stamp Gossip

The Navarino Commemoratives

The Greek issue to commemorate the centenary of the great naval fight at the Bay of Navarino on 20th October, 1827, recently made its appearance. It consists of three designs, showing the Bay of Navarino, the great sea fight in progress, and Admiral Sir Edward Codrington, the Commander of the British Fleet, on the 1.50, 4 and 5 drachma values, respectively.

A brief account of the circumstances is of interest. Actually the trouble that caused the fight dated back to 1821. At that time Turkey dominated Greece but a revolution in another part of the Near East caused the Turkish Army of Occupation to be withdrawn, and Greece immediately made a bid to recover her independence. The Turks fought hard to retain their mastery and in the ensuing warfare appalling massacres were perpetrated by both sides. Eventually the three great European powers, France, Great Britain and Russia, decided to put a stop to the trouble, and intervened on the side of Greece.

The English and French Mediterranean Fleets were despatched post-haste to Navarino Bay, and on arrival the Allied forces, reinforced by a Russian squadron, entered the harbour with all guns loaded and decks cleared for action, in order that they might have a closer control over affairs. Peace was still the objective, however, but it was not to be. The commander of one of the British frigates, the "*Dartmouth*," discovered that his vessel was lying to the windward of a Turkish fireship, and realising his precarious position, he sent a boat to move the fireship further on. This action the Turks interpreted as a declaration of hostilities. In a few moments fire was opened and quickly every ship in the harbour became engaged. Before night fell the Turkish Fleet was wiped out and the independence of Greece assured.

Other than the establishment of Greek independence of Turkish control, the Battle of Navarino has two interesting claims to fame. It is stated that more decorations were awarded in connection with this fight than for any previous sea fight in British history! Also it was the last battle of any magnitude in which wooden battleships took part.

HELPING HIMSELF

They were entertaining a visitor at dinner, and when the sweet was being eaten little Johnnie said: "Won't you have another piece of apple tart, Mr. Hobbs?"

The visitor laughed. "Well, Johnnie," he said, "since you are so polite, I believe I will have some more."

"Good!" said Johnnie. "Now, mother, remember your promise. You said that if it was necessary to cut into the second tart I could have another piece."

* * * *

Vast clouds of smoke and big tongues of flame began to issue from the top windows of a house. A man ran over to it and pressed the electric bell. The door was opened by a woman who suffered from deafness.

"Madam, your house is on fire!" exclaimed the man.

"What's that?"

"Your house is on fire!" he repeated.

"What's that? House on fire? Oh, is that all?"

"Well," replied the man, aghast, "that's all I can think of at the moment."

* * * *

Officer (referring to member of the crew who has been picked up after being in the water three-quarters of an hour): "Is he all right?"

Sailor: "Yessir—'cept that 'e seems to 'ave lorst 'is sense of 'umour."—*"Punch."*

* * * *

CANNY

The Secretary: "A gentleman has called for an interview. He wishes you to tell him the secret of your wonderful success in life, sir."

Millionaire: "H'm. Is he a journalist or a detective?"

* * * *

Doctor: "You certainly look better. You must have followed my advice and had a change."

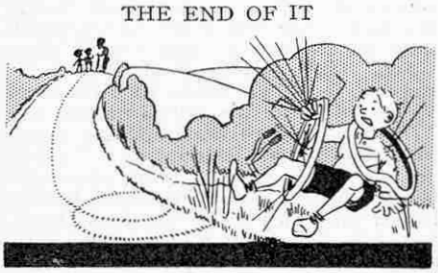
Former Patient: "Yes, I did."

Doctor: "Ah, where did you go?"

Former Patient: "I went to another doctor."

* * * *

THE END OF IT



Two boys were teaching another youngster to ride a bicycle. After getting him safely into the saddle they gave him a push and off he went down a hill.

Some time passed, but there was no sign of the cyclist, so the two went in search of him. Meeting an old lady, they inquired if she had seen a boy on a bicycle.

"Indeed, no," was the answer. "I have seen no one except a boy sitting in a ditch mending umbrellas!"

* * * *

BOOTED AND SPURRED

"Are you the plumber?"

"Yes, mum."

"Well, be careful about your work; all my floors are highly polished and in excellent condition."

"Oh, don't worry about me, mum. I won't slip: I've got nails in me boots."

CARELESS

Coming into the dining-room the old lady found her grandson bending over the cat and carefully examining it.

"What are you looking at the cat like that for, Johnny?" she inquired curiously.

The little boy glanced up quickly, whilst the sleeping cat went on purring contentedly before the fire.

"Oh, Grandma," he cried, "the pussy cat has gone to sleep and left its engine running!"

PATENTLY PALPABLE PIFFLE

People who perpetrate poetry are peripatetic, potty and
Prolix.
Progressive papers upon
Pistons, Pontoons, Propellers and Pumps are
Predominantly preferable to
Pestilent
Perpetual, pernicious and
Preposterous
Poems, persistently postulating im-
Possible prodigies of
Perfect, precocious, privileged and profound
Protoplasm;
Presuming pungent, puzzling
Possibilities
Perceived only by pythonic persons possessing
Primeval, prognostic, profitable
Propensities for
Persistent prolific patience
Piltering,
Perfidious poets perplex pioneers of pilular
Properties,
Prove puissant purloiners of
Proverbs,
Proceleusmatic prophecies,
Praiseworthy puns.
Pestilent
Pessimists propose to
Petrify, pulverize, and painfully
Punish all
Purblind polyglotic poets who
Pollute
Praiseworthy paper by perverting
Politics and
Practising pragmatical panic-producing
Prosody, while
Pathetically pawning pens and
Pencils to
Provide pullets, pies, pancakes and
Pure
Proteins. Personally I
Prefer playing with powerful, practical
Pit Paraphernalia and
Pacific
Pianos to polishing off
Polyonymous
Popular poems.

HIS INCREASE

Junior Clerk: "I should like a small increase in my salary, sir, please."

Merchant: "I don't see my way clear to do that, but I can do the same thing in another way. You are aware, of course, that time is money?"

Junior Clerk: "Yes, sir."

Merchant: "Well, hereafter you can work until six instead of leaving at five."

EASY

Lawyer (for the defence): "I do not think he broke into the house; he just inserted his arm. Now, his arm is not him, so I fail to see how you can punish him."

Judge: "Very well, we will sentence his arm to twelve years' hard."

Prisoner (screwing off his cork arm): "Righto, m'lud! Here y'are. Cheerio!"

* * * *

"Why, dad, this is roast beef!" exclaimed Willie at dinner one evening, when a guest was present.

"Of course," said his mother. "What of that?"

"Why, you told mother this morning that you were going to bring an old mutton-head home for dinner this evening!"

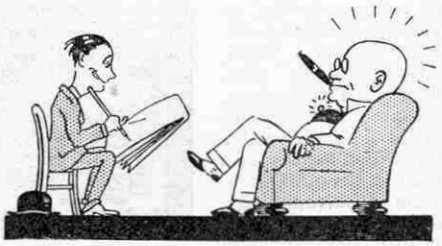
* * * *

Juryman: "I want to be excused, my Lord. I owe £25 to a man, and as he is leaving town to-day for some years, I want to catch him before he gets to the train, and pay him the money."

Judge: "You are excused. I don't want anybody on the jury who can lie like that!"

* * * *

SUCCESS



Reporter: "And have any of your boyish ambitions been realised, sir?"

Self-made Millionaire: "Yes, when I was a lad and mother used to cut my hair, I often wished that I were bald."

* * * *

"Why do artists sign their names at the bottom of their pictures?"

"So that you can tell which way to look at them.

* * * *

"I say, dad, I'm going to buy you a nice new pipe for your birthday."

"But I have a new one."

"You had, dad; I've just broken it."

* * * *

Angry Gent.: "How dare you? What do you mean by putting your hand in my pocket?"

Thief: "Excuse me, sir; I am so absent-minded. I used to have a pair of trousers exactly like yours."

* * * *

Old Gent.: "Are you kind to dumb animals?"

Boy: "Not 'arf. Only the other day I let my dog through the gate so as he could chase our neighbour's cat."

* * * *

Tramp: "Gi' us a copper, guv'nor."

Swell: "It seems to me you are in want of manners, not money."

Tramp: "I asked for what I thought yer had most of, boss."

* * * *

STREAKY BACON

An Irishman who had a pig fed it to repletion one day and starved it the next. On being asked his reason for doing so, he replied:

"Och, sure, an' isn't it that I like to have bacon with a strake of fat an' a strake of lane?"

* * * *

Little Freddie had difficulty in understanding fractions. His teacher explained at great length that the fractional parts of a whole totalled that whole. When she thought she had driven home the explanation, she asked Freddie whether he would rather have a whole apple or two halves, expecting him to answer that two halves were the same.

He replied, "Two halves."

"Why would you prefer two halves?" she asked.

"Because then I could see if the apple was bad inside!"

NOT TRYING

It was at a street railway crossing that a diminutive engine was struggling to push an enormous line of trucks into the nearby siding. As truck after truck crawled past, the little knot of pedestrians became more restive. At last the engine snorted up, putting its last ounce of power into its job, and one old lady, pointing to the driver and fireman leaning out of their cab windows, exclaimed to her companion: "Just look at them! Us waiting to cross more than five minutes, and them lolling there not trying!"

* * * *

A negro taxi-driver, charged with running a man down was told by the presiding judge that, when in danger of hitting some person, he should "zigzag his car."

"I did zigzag, your honour," answered the negro, "but dat man was zigzagging too, an' he zigged so much faster dan I could zag, dat it just nacherly give me swimmin' in the head, and dat's how I come to hit him."

* * * *

"Is there a word in the English language that contains all the vowels?"

"Unquestionably."

"What is it?"

"I've just told you."

* * * *

A little boy in a city school refused to sew, thinking it beneath the dignity of a ten-year-old man.

"George Washington sewed," said the principal, taking it for granted that a soldier must; "and do you consider yourself better than George Washington?"

"I don't know; time will tell," said the boy seriously.

* * * *

Motor Salesman (after lengthy explanation to countryman): "Now I've gone over this car thoroughly with you; I've shown you every cam and shaft, and I'd like to have your order. But is there still anything you don't understand?

Countryman "Yes, what makes it go?"

* * * *

An accident had happened in one of those excellent houses that are being built by the thousand at the present time. The tenant decided to call on his landlord and explain the matter.

"An accident, you say?" stormed the landlord. "What happened? Come, be quite frank."

"I am afraid I shall have to have a new front door and —" began the thoroughly frightened man, when the landlord shouted:

"New front door! Whatever do you mean? New front door! Why, man, it's a new house and you've only been in it a week." "Yes, I know," replied the tenant. "But you see, I tied my dog to the front door knob. A cat went by, and now we haven't got a front door."

* * * *

"Why do you not deal with me now?" asked a butcher of a woman who had formerly visited his shop regularly.

"Well," was the reply, "the last piece of meat I had from you was so tough that I could have soled my boots with it."

"Then why did you not do it?" asked the nettled butcher.

"Because I could get no tacks that would go through it."

* * * *

"There must be a lot of golfers in our building."

"Why so?"

"The other morning I was standing in the rear of the elevator and called 'Four,' and everybody in the elevator ducked."

* * * *

Little girl (to grandfather): "Grandpa, why don't you grow hair on your head?"

Grandpa: "Well, why doesn't grass grow on a busy street?"

Little Girl: "Oh, I see; it can't get up through the wood blocks."

* * * *

PROPERLY STUNG

Sandy bought two tickets for a raffle and won a £500 motor car. His friends rushed up to his house to congratulate him, but found him looking miserable as could be.

"Why, mon, what's the matter wi ye?" they asked.

"It's that second ticket. Why I ever bought it I canna imagine."

* * * *

Customer: "I'm tired of your eggs. Every one of them seems to have a chicken inside."

Sharp Boy: "Try these, sir, they haven't. They're ducks' eggs, sir."

LET ME DREAM AGAIN

Customer: "You sold me a car about a week ago."

Salesman: "Yes sir, how do you like it?"

Customer: "I want you to repeat everything you said about the car again. I'm getting discouraged."

* * * *

Child: "May I have a dark supper to-night?"

Mother: "What do you mean, dear?"

Child: "You gave me a light supper last night and I didn't like it at all."

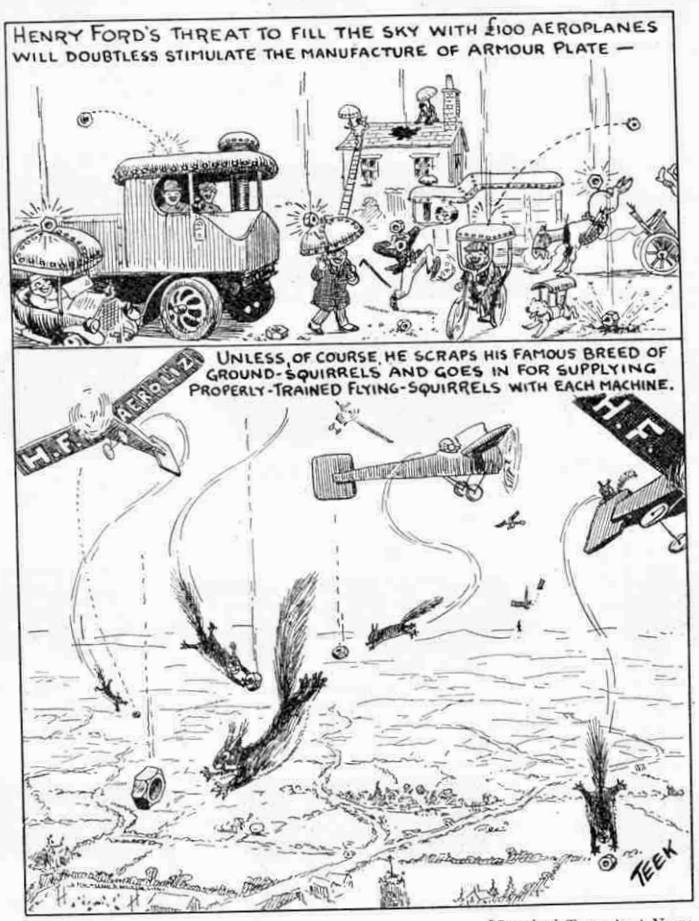
* * * *

"Are you sure that I shall recover?" an anxious patient once asked a physician. "I've heard that doctors sometimes give a wrong diagnosis and have treated patients for pneumonia who afterwards died of typhoid fever."

"You've been woefully misinformed," replied the medico, indignantly. "If I treat a man for pneumonia he dies of pneumonia."

* * * *

A "KNUTTY" PROBLEM



Courtesy [*Sentinel Transport News*

The editor was dying, but when the doctor bent over him, placed his ear on his breast, and said, "Poor man! Circulation almost gone," he sat up and shouted: "You're another! We have the largest circulation in the country!"

* * * *

SCHOOL BOY "HOWLER"

"The Kodak is the Bible of the Mohammedans."

* * * *

NO CRITIC

The Poet: "Dash it—I can't find that sonnet anywhere. Eustace must have thrown it into the fire."

His Wife: "Don't be absurd, Algernon. The child can't read."

* * * *

A balloonist, having lost his bearings, descended within a few feet of the ground and called out to a man in a field:—

"Hi, my man, can you tell me where I am?"

"Why, you chump," shouted the man, "you're in a balloon."

* * * *

The lady in the Mersey Railway was shocked. "Bobby," she said severely, "Why don't you get up and give your father your seat? Doesn't it pain you to see him reaching for a strap?"

"Not in a train," said Bobby.

OVERWORKED

Fred: "You're awfully hoarse this morning, Teddie. What have you been doing?"

Ted: "I was in some amateur theatricals last night."

Fred: "Playing lead, I suppose?"

Ted: "No, old chap. I was the prompter."

* * * *

A clever foreign pianist had been engaged as accompanist to an amateur singer, whose ambitions were higher than her musical ability. The lady had been flat nearly all through her songs, and at last the pianist lost his temper.

"Madam," he said politely, "it is of no use. I gif up der chob. I blay der black keys, I blay der white keys, and always you sing in der cracks."

* * * *

Mistress: "Why are you taking the goldfish out of their water?"

Biddy: "Sure, ma'am, and didn't ye tell me to feed them on dry bread!"

* * * *

Lessons in school had been proceeding for about an hour, when a boy took an apple from his pocket and began to eat it.

The teacher saw him. "Go out into the school-yard and finish your meal," he said, sarcastically. To his surprise, the boy quietly rose and moved to the door. Then he turned.

"Please, sir," he said, "can me little brother come too, 'cos 'alf of it is his?"

* * * *

A great meeting was in progress, and the hall was crowded. An M.P. entered, and as he wished to get up to the platform he tapped a man on the shoulder and exclaimed: "Make way, please," but the man stood still.

"Do you know who I am?" cried the enraged M.P. "I am a representative of the people!"

"Yah," growled the other, "but we are the bloomin' people!"

* * * *

Little Willie had gone to bring the new kittens in. His mother hearing a shrill meowing called out: "Don't hurt the kittens, Willie."

"Oh no," said Willie, "I'm carrying them very carefully by the stems!"

* * * *

Policeman (who has just picked up a two-shilling piece, to tramp laying claim to it): "But how can you prove that it belongs to you?"

Tramp: "Why, guv'nor, you can see for yourself I've got a hole in me pocket."

* * * *

Murphy (trying to take a rise out of Sandy): "Hullo, Sandy; still at it? What do you think you're digging out that hole for?"

Sandy: "Aw, mon, pinch yersel. I'm not digging out the hole. A'm digging out the dirt, and leaving the hole."

* * * *

A Kildare porter put up a notice which read: "The nine-thirty train won't go to-night till ten o'clock, and there won't be no last train to-night."—(Model Railway News).

* * * *

"I've got a railroad radio."

"A railroad radio?"

"Yes, it whistles at every station."

* * * *

Mother: "I don't want Billie to see his birthday present before morning. Where shall I hide it?"

Father: "I should think the safest place would be the bathroom."

* * * *

A FISHY BUSINESS!

Mrs. Pouter: "If you really caught all these fish, how is it that Mrs. Jones saw you in the fishmonger's half an hour ago?"

Mr. P.: "Because I had caught so many I had to sell him some, or I'd never have got home."

* * * *

Ned: "We'll be friends until the end."

Ted: "Lend me ten shillings then."

Ned: "That's the end."

* * * *

Customer: "Say, waiter, I ordered strawberry shortcake. Where are the strawberries?"

Waiter: "That's what it's short of, sir."

* * * *

Visitor: "How does the land lie out this way?"

Native: "It ain't the land that lies, it's the land agents."

* * * *

Phil: "Did they have a decent conjuror at the entertainment last night?"

Bill: "Rather, top-hole! I lent him a dud shilling, and he gave me back a good 'un afterwards."

BRITISH AND GUARANTEED

ROLLING STOCK

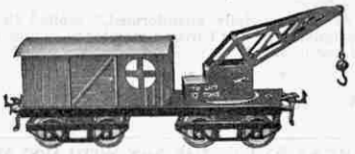
Gauge 0 — Hornby Series — Gauge 0

SEND FOR COMPLETE ILLUSTRATED LIST

Below we illustrate 35 pieces of Rolling Stock of various types. These form part of the big range of components included in the Hornby Series. All Hornby Rolling Stock is modelled on realistic lines and is beautifully finished in colours. Each piece is available with either L.M.S., L.N.E.R. or G.W. lettering. Ask your dealer to show you the full range.

***HORNBY WAGON**
As supplied with all Hornby Goods Sets.
Price 2/6

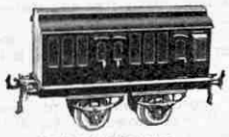
***BRAKE VAN**
Finished in grey, with opening doors. Price 3/6



***BREAKDOWN VAN AND CRANE**
Beautifully coloured in grey and black, with opening doors. Suitable for 2-ft. radius rails only ... ... Price 6/3

***BRAKE VAN**
Finished in grey, with opening doors. Price 3/6

***HOPPER WAGON**
Mechanically unloaded. Finished in grey and black ... Price 4/-

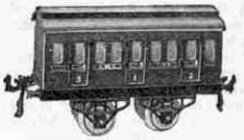


***GUARD'S VAN**
Realistic design, fitted each side with opening doors. Price 3/6

WAGON
French type. Lettered Nord. Highly finished in colours. Price 3/3

***No. 2 LUMBER WAGON**
Fitted with bolsters and stanchions for log transport. Suitable for 2-ft. radius rails only. Price 4/-

MOTOR SPIRIT TANK WAGON "B.P."
Finished in Yellow. Price 2/6



***HORNBY PASSENGER COACH**
As supplied with No. 0 and No. 1 Passenger Sets and No. 2 Tank Passenger Sets. Price 3/6

PETROL TANK WAGON "PRATTS"
Finished in green. Price 2/6

***MILK TRAFFIC VAN**
Fitted with sliding door, complete with milk cans. Price 3/6

***No. 2 LUGGAGE VAN**
Finished in blue and green. Fitted with double doors. Suitable for 2-ft. radius rails only ... Price 5/9

***No. 1 CATTLE TRUCK**
Fitted with sliding door. Very realistic design. Price 3/6

PETROL TANK WAGON "SHELL"
Finished in red. Price 2/6

JACOB'S BISCUIT VAN
Finished in grey and black, with opening doors. Price 3/6

CARR'S BISCUIT VAN
Finished in dark blue, with opening doors. Price 3/6

***No. 2 TIMBER WAGON**
Beautifully enamelled in green. Suitable for 2-ft. radius rails only ... ... Price 3/6

SECCOTINE WAGON
Beautifully finished in blue, with opening doors. Price 4/-

CRAWFORD'S BISCUIT VAN
Finished in red, with opening doors. Price 3/6

***CRANE TRUCK**
Finished in grey and black ... Price 3/6

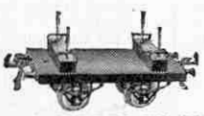
***No. 1 LUGGAGE VAN**
With opening doors. Price 3/6

***No. 2 CATTLE TRUCK**
Splendid model fitted with double doors. Suitable for 2-ft. radius rails only ... ... Price 5/9

***GUNPOWDER VAN**
Finished in red, with opening doors. Price 3/9

***GAS CYLINDER WAGON**
Finished in red, lettered gold. Price 2/6

***SNOW PLOUGH**
With revolving plough driven from front axle. Price 5/6



***No. 1 LUMBER WAGON**
Fitted with bolsters and stanchions for log transport. Price 2/-

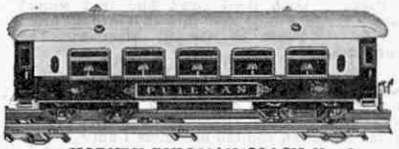
***TROLLEY WAGON**
Finished in grey and red. Suitable for 2-ft. radius rails only ... Price 5/6

No. 1 TIMBER WAGON
Beautifully enamelled in green. Price 1/9

BRAKE VAN
French Type. Lettered Nord. Beautifully finished in colours. Opening doors. Price 4/-

SIDE TIPPING WAGON
Excellent design and finish. Price 2/6

***CEMENT WAGON**
Finished in grey and black. Price 3/-



HORNBY PULLMAN COACH No. 3
As supplied with No. 3 Train Sets. Price 16/6

Lettered L.M.S., L.N.E.R. or G.W.

***REFRIGERATOR VAN**
Enamelled in white, with opening doors. Price 3/9

ROTARY TIPPING WAGON
Finished in grey and green. Price 3/-

STATIONS AND ACCESSORIES

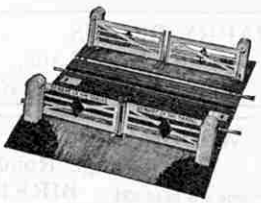
Hornby Series

The Hornby System consists of a comprehensive range of Stations, Platforms and Accessories with which the most elaborate model Railway Terminus or Goods Yard may be constructed. Every item is exceptionally well designed and is carefully modelled on its prototype in real life. A selection of the various components included in the Hornby Series of Stations and Accessories is illustrated below.

RAILWAY STATION No. 2. Excellent model, well designed and finished. Constructed in three sections which are detachable. Dimensions: Length 2-ft. 9-in., breadth 6-in., height 7-in. ... ... Price **10/-**

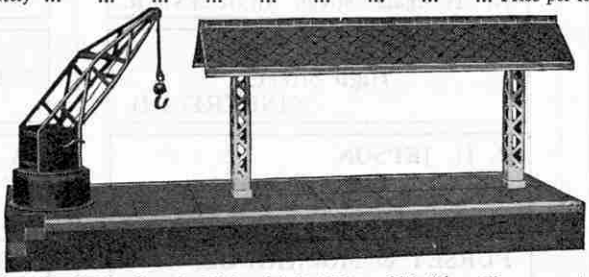
PASSENGER PLATFORM. Length 16½-in., width 3-in. This platform may be connected to the main station or used separately. The interlocking device at each end enables a number of these platforms to be joined together ... ... Price **3/6**

White paled fencing as supplied with the Passenger Platform may also be purchased separately ... ... Price per length **6d.**



LEVEL CROSSING No. 2 Beautifully designed in colours. Measures 11½ × 7½-in. with Gauge 0 rails in position. Price **5/-**

SIGNAL CABIN No. 2 Dimensions: Height 6½-in., Width 3½-in., Length 6½-in. Finished in colours and lettered "Windsor." Roof and back open to allow a signal lever frame to be fitted inside cabin, if desired, and operated ... Price **6/6**

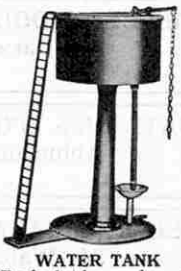


GOODS PLATFORM. Length 16½-in., height 6½-in., width 6-in. The crane at the end of the platform revolves on its base. It is enamelled in bright red and is fitted with a crank and ratchet mechanism for controlling the load. The remainder of the platform and shelter is coloured in green, blue and white ... ... Price **10/-**

ISLAND PLATFORM. Length 32½-in., height 6½-in., width 3-in. The ramps at either end are detachable, and if desired the platform may be connected to the main station. Attractively coloured in green, blue and white ... ... Price **7/6**

Ramps similar to those fitted to the Island Platform may be purchased separately. Price **9d.** each.

TELEGRAPH POLE Price per pair **3/6**

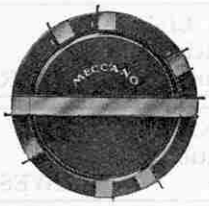


WATER TANK Brightly coloured. Stands 8½-in. high. Fitted with flexible tube and valve lever. Price **6/6**

LOADING GAUGE Price **1/9**

TUNNEL Realistic and finished in colours ... Price **7/6**

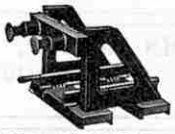
WAYSIDE STATION No. 1. A well-made model, richly finished in colours. By placing one or more of these Stations at intervals along the track, and using the Windsor Railway Station as the main terminus, a very realistic effect is given to a miniature lay-out. Dimensions: Length 16½-in., width 6-in., height 9-in. ... ... Price **5/-**



TURN-TABLE No.1 **2/6**
„ No.2 **4/-**

LAMP STANDARD No. 1 (SINGLE) A 4-volt bulb may be fitted into the globe. Price **3/-**

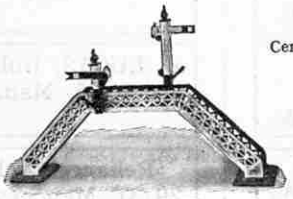
SIGNAL No.2 "Home" or "Distant." Price **2/6**



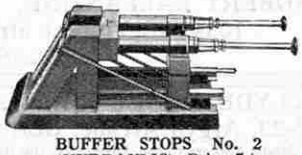
BUFFER STOPS No. 1 (SPRING) Price **1/-**

VIADUCT. Price **7/-**
ELECTRICAL VIADUCT. Price **8/-**
Centre Section for Viaduct. Price **4/6**
Centre Section for Electrical Viaduct. Price **5/-**

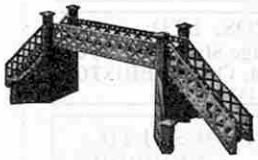
LAMP STANDARD No. 2 (DOUBLE) Four-volt bulbs may be fitted into the globes. Price **4/-**



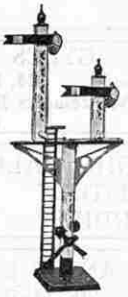
FOOTBRIDGE
No. 1. Without Signals ... „ **3/6**
No. 2. With detachable Signals Price **6/-**
Signals only ... ... per pair **2/9**



BUFFER STOPS No. 2 (HYDRAULIC) Price **5/-**



LATTICE GIRDER BRIDGE Constructional type. Strong and well proportioned. Price **9/6**



JUNCTION SIGNAL Signal arms operated by levers at base. Very realistic model standing 14-in. in height. Price **5/6**

PLATFORM ACCESSORIES No. 1. Miniature Luggage. Price per set **1/6**

PLATFORM ACCESSORIES No. 3. Platform Machines, etc. Price per set **1/6**

PLATFORM ACCESSORIES No. 2. Milk Cans and Truck. Price per set **1/6**

Manufactured by MECCANO LIMITED, BINNS ROAD, LIVERPOOL

Meccano & Hornby Train Supplies

All the dealers whose advertisements appear on this page carry full stocks of Meccano Outfits, Accessory Outfits and Meccano parts, Hornby Trains and Hornby Train Accessories all the year round. The names are arranged in alphabetical order of town.

HARRY BROWN,
1, Moss Lane,
ALTRINCHAM.

J. WOODHALL,
256, Grange Road,
'Phone : B'head 621 BIRKENHEAD.

HOBBIES LTD.,
9a, High Street,
BIRMINGHAM.

MERCER'S DOLLS' HOSPITAL,
68, Darwen Street,
BLACKBURN.

BATESON'S SPORTS DEPOT,
Abingdon Street,
BLACKPOOL.

SELLEN'S BAZAAR,
54, Waterloo Road,
BLACKPOOL, S.S.

J. MORRIS, F.C.O.,
70, Knowsley Street,
Tel. 1074 BOLTON.

BROWN, MUFF & CO. LTD.,
BRADFORD.

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68, London Road,
BRIGHTON.

JOHN TAYLOR,
28, Preston Street,
Tel. : Brighton 957 BRIGHTON.

BRISTOL TOY EXCHANGE,
92b, Whiteladies Road,
Clifton, BRISTOL.

GYLES BROS. LTD.,
Tel. 2888 24, Bridge Street, BRISTOL.
188, Whiteladies Road, Clifton, BRISTOL.
Tel. 143

JOHN HALL (TOOLS) LTD.,
BRISTOL. NEWPORT.
CARDIFF. SWANSEA.

SALANSON LTD.,
20, High Street, BRISTOL.
4, High Street, CARDIFF.

SAM TAYLOR,
Silver Street,
Tel. 320 BURY.

HAROLD HUNT,
38, Spring Gardens,
Tel. 202 BUXTON.

HOBBIES LTD.,
385½, Yonge Street, Toronto 2,
CANADA.

PANTOYS LTD.,
Tel. 3561
The Promenade, CHELTENHAM SPA.
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High Street,
CINDERFORD.

R. H. JEPSON,
1, Cross Cheaping,
COVENTRY.

PURSEY & MOCKRIDGE,
The Sports Outfitters,
Tel. Dartford 173 DARTFORD.

HENRY WHALLEY,
195, Duckworth Street,
DARWEN.

RATCLIFFES TOYERIES,
19, Osmaston Road,
DERBY.

JAMES L. DIXON,
14, Suffolk Street,
Tel. Dublin 1528 (off Grafton St.), DUBLIN.

DIXON'S
41, High Street,
DUNDEE.

BASSETT-LOWKE LTD.,
5, Frederick Street,
EDINBURGH.

ROBERT BALLANTINE,
103½, St. Vincent Street,
GLASGOW.

CLYDE MODEL DOCKYARD,
22-23, Argyll Arcade, GLASGOW.
Model Makers to the Admiralty, the Railway Coys., etc.

HOBBIES LTD.,
326, Argyle Street,
GLASGOW.

FLETCHER'S TOYLAND,
77, Deardengate, HASLINGDEN.
Grand Building, RAWTENSTALL.

H. POULTON, Toyland,
75 & 77, High Street,
HOUNSLOW, Middlesex.

GAMLEYS,
The Hove Hornby Train Store,
78, Church Road, HOVE.

HAMMOND'S LTD.,
Paragon Square,
HULL.

WALKER'S EMPORIUM,
25-9, Inglis St., and 11-13, New Market,
INVERNESS.

W. J. S. CARPENTER,
13 & 15, Queen Victoria Street,
LEEDS.

HOBBIES LTD.,
89a, Woodhouse Lane,
LEEDS.

PEARSON & DENHAM (PHOTO) LTD., 6, Bond Street,
LEEDS.

A. WRIGHT, The Garage,
200/2, Dewsbury Road,
Tel. 22719 LEEDS.

ROBOTHAM'S LIMITED,
"Baby's Kingdom,"
Tel. 4809 Belvoir St., LEICESTER.

LLOYD & SONS LTD.,
2, Station Street,
LEWES.

BYCROFTS EMPORIUM,
366, High Street,
LINCOLN.

C. LUCAS, Hobbies Depôt,
35, Manchester Street,
LIVERPOOL.

Reliance Cycle & Motor Co.,
29/31, Manchester St., Liverpool.
Argyle & Conway Sts., Birkenhead.

The ARUNDEL CYCLE & SPORTS STORE, 52, Church Road,
Upper Norwood, LONDON, S.E.19.

DEMPSEY & CO.,
69, South Side, CLAPHAM,
'Phone : Brixton 3022 LONDON, S.W.4.

Meccano & Hornby Train Supplies

The thirty-one dealers whose advertisements appear on this page carry full stocks of Meccano Outfits, Accessory Outfits and Meccano parts, Hornby Trains and Hornby Train Accessories all the year round. The names are arranged in alphabetical order of town.

HOBBIES LTD.,
65, New Oxford Street,
Tel. Mus. 1656 LONDON, W.C.

HOBBIES LTD.,
147, Bishopsgate,
Tel. London Wall 7350 LONDON, E.C.

HOBBIES LTD.,
79, Walworth Road,
Tel. Central 2457 LONDON, S.E.

LEDWITH BROS.,
42 & 44, Walworth Road,
Nr. ELEPHANT AND CASTLE, LONDON, S.E.17.

PERCIVAL & CO.,
140, High Street,
Tel. Wstw. 0120 WALTHAMSTOW, E.17.

F. R. POTTER & SON,
43, Market Place,
LOUGHBOROUGH.

H. G. PARTRIDGE & CO.,
10, Chapel Street,
Tel. 234 LUTON.

BARRS, Children's Paradise,
49, Deansgate,
Telephone 165 City MANCHESTER.

A. FRANKS LTD.,
95 & 97, Deansgate, MANCHESTER.
90, Bradshawgate, BOLTON.

HENRY'S Toy & Game Stores,
22, King Street,
Tel. 3004 Central MANCHESTER.

HOBBIES LTD.,
10a, Piccadilly,
MANCHESTER.

A. INMAN, MANCHESTER.
105, Lapwing Lane, Didsbury. Tel. 1518.
179, Dickenson Rd., Rusholme. Tel. 2241.

JOHN NESBITT LTD.,
42, Market Street,
MANCHESTER.

H. WILES LTD.,
124, Market Street,
MANCHESTER.

R. SCUPHAM & SONS,
35, Linthorpe Road,
MIDDLESBROUGH.

WILLIAM OLLIFF,
13, Grainger Street West,
NEWCASTLE-ON-TYNE.

BEECROFT & SONS,
16, Pelham Street,
NOTTINGHAM.

J. R. NORRIS,
Photographic Dealer,
9, Pelham Street, NOTTINGHAM.

C. HORSBURGH,
12, High Street,
PAISLEY.

JANES & ADAMS,
13, The Promenade,
And Branches. PALMERS GREEN.

DEAN & HOLT,
78, Yorkshire Street,
ROCHDALE.

A. E. HAIG,
16, Northenden Road,
SALE, CHESHIRE.

HOBBIES LTD.,
214, West Street,
SHEFFIELD.

THE REDGATE CO.
(SHEFFIELD) LTD.,
Tel. 22806 Moorhead, SHEFFIELD.

SHEFFIELD PHOTO COMPANY,
6, Norfolk Row (Fargate),
'Phone 23891 SHEFFIELD.

WILSON, GUMPERT & CO. LTD.,
57, Fargate,
Tel. 20489 SHEFFIELD.

BIRMINGHAM & COVENTRY
CYCLE CO., 140 & 151, Above Bar,
SOUTHAMPTON.

HOBBIES LTD.,
25, Bernard Street,
SOUTHAMPTON.

S. T. SIMPSON & SON,
589-595, Lord Street,
Tel. 4998 SOUTHPORT.

H. W. GINN,
The London Motor, Cycle & Sports Co.,
Tel. 252 Staines 106, High St., STAINES.

E. M. COLLINS,
12, Lower Castle Street,
TRALEE.

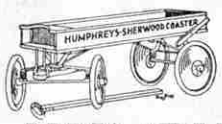
ROLLER SKATES

Spring is here and **outdoor sports** are now in **full swing.**
Roller Skating provides the **ideal exercise** for growing **boys** and **girls.**
Modern Roads seem almost specially built for youthful skaters. **Our Skates** are of the **very best** and our **prices** are **right. Send for a pair now.**
You will be delighted with them.

No. 3 with Threaded Clamps and Case-hardened Steel Wheels ... 5/- pair
No. 5 with Best Ball-Bearing Wheels 10/- ,,
No. 6 with Best Ball-Bearing Wheels and Block Heels, as illustrated ... 11/- ,,

Postage and Packing 1/-. Colonies and Abroad 5/-

Bateson's Sports Depôt, Blackpool



42'6
CARRIAGE PAID

HUMPHREYS
Sherwood Coaster

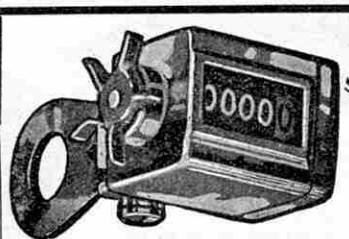
WILL CARRY A TON

Disc Wheels. Roller Bearings. Solid Rubber Tyres. Coil Spring Shock Absorbers.

Write for illustrated list.

HUMPHREYS,
Meccano and Hornby Train Depot,
Next Grove Arcade,
WALLASEY VILLAGE CHESHIRE

We have no hesitation in asserting that our clients are convinced that your Magazine is one of the best pullers in which they advertise. B.D. & Co. Ltd.



A VEEDER

CYCLOMETER FITTED TO YOUR BICYCLE TELLS YOU:
How far you have been.
Distance from one place to another.
Service your tyres give you.
Number of miles to destination.
Distance travelled, etc.

Make your riding doubly interesting. Its accuracy has been endorsed by all the best authorities and the experience of your fathers for 30 years.

Insist upon a genuine Veeder—see the name thereon.

Made in Two Models:
Regular 6/6, Trip 15/-.
F. E. DICKINSON,
St. Andrew's House, Holborn Circus, E.C.1.

READERS' SALES

(*Rate:* 1*d. per word, min.* 1/-)

L.M.C. Tank Loco, Gauge 0. Used once. As new. 38/- or nearest.—Beardwell, 21, Falmer Road, Enfield, Middlesex.

Exchange. Home Cinematograph complete (two Machines and Films) for good Kettledrum, or sell 10/-.—Davies, 21, Boreham Road, Warminster.

Cigarette Cards, Sets and Odds: Lists—Thornton, 159, Grosvenor Road, Wavertree, Liverpool.

Racing Yacht for Sale. Cost 27/6. Accept 12/6. Moore, 26, Thornby Road, Clapton, E.5.

Cigarette Cards, 50 assorted 6d. Sets 25, 5d., 50, 9d. Three Albums 9d. each.—Hunter, 20, Ramshill Road, Scarborough.

Primus 4-volt Electric Motor. Nearly new, 5/6. Magic Lantern, with Slides, good condition, 3/-. Diana Air Gun, 3/-. R. J. Thompson, 15, Orford Hill, Norwich.

Bargains! List, 1½d. Exchange Stamps with Overseas readers. Enclose 3d. stamps.—Garrett, "Brithdir," Marlpit Lane, Coulsdon, Surrey, England.

Sale. Good General Stamp Collection. Lightly mounted. Guaranteed catalogued at over 95/-. Price 30/- or best offer. Particulars—Stott, 19, Oak Street, Shaw, Lancashire.

For Sale. Three Wooden Trucks, Carriage, Dining Saloon, Engine. Over 70/- new. Gauge 0. Scarcely used. What offers?—R. E. Jones, Ferox Hall, Tonbridge.

Miss America Launch with Exhaust Pipe, 9/6. Cinematograph, 4/-. Both perfect. 43 "Boy's Magazines." 60 "Gems." 60 "Nelson Lee's." (New). First offers secure.—Page, 11, Tivoli Road, West Norwood, London.

Model Electric Light Plant, cost 38/6. Accept 20/-. Cinematograph with Acetyline Lamp. Cost 15/-. Accept 7/6. Wireless Headphones. Cost 15/-. Accept 7/6.—Lane, 157, Osborne Road, Brighton.

Sale. "Scout," Nos. 956 to 1038. Offers?—Adams, 71, Neath Road, Plymouth.

0 Gauge Tinplate Rails and Points. Stamp.—Pratt, 3, Crescent Road, Ipswich.

10,000 Cigarette Cards for sale, including sets. What offers?—Write Boston, 105, Tufnell Park Road, M.7.

For Sale. "Meccano Magazines," March 1922–March 1927 (August, December 1924 missing). "Locomotive News," May 1921–September 1923. "Railway Magazines," February 1920–June 1928. Best offer.—F. Mitchell, 127, Newbold Road, Chesterfield.

Sale. Bassett-Lowke Steam Engine and Tender, 2–6–0, Gauge 0. Price 50/-. Cost £5/5/-. Apply Roberts, 17, Swinton Place, Bradford, Yorkshire.

2 complete sets Stuart launch parts. Copper Boilers 8/- each, absolute bargains.—Box 601.

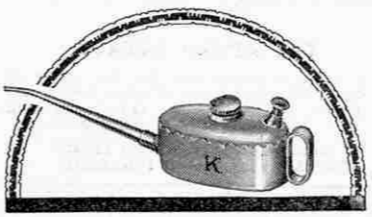
Model-building Contest Results—

(*Continued from page* 519)

the details of the actual machine, for he has taken care to see that his model is of the very latest design. The machine incorporates a saddle tank, spring-mounted seats, carrier fitted with tool bag, twin exhaust, and spring forks, etc. The sidecar is of a well-proportioned design and is complete with wind screen and side lamp. Unfortunately the model is not equipped with a driving unit, but no doubt one of the Meccano Motors could be included by making slight alterations to the existing design.

B. Unné has chosen as the subject for his model the swing road bridge at Newcastle-on-Tyne. The pivoted portion of the actual bridge is mounted on an embankment in the centre of the river. At each side of the river the road is carried forward slightly over the edges of the banks and rests on stone masonry. The rotation of the bridge is effected by a steam plant located on the central embankment. The structure lends itself readily to reproduction in Meccano, and Unné has produced a very realistic model.

This Month's Special Articles



A Perfect Miniature "K" Type Oil-Can

All Meccano and Hornby Train enthusiasts will be interested to know that we have introduced a miniature "K" type oilcan for use in oiling Meccano models, Hornby Trains, etc. The oil is ejected drop by drop by depressing the valve, as in the full-sized model, and in all other respects the oiler is perfect in every detail. It is made for us by Messrs. Joseph Kaye & Sons Ltd., of Leeds, the largest manufacturers of this class of goods in the world. Exhibited on our stand at the British Industries Fair, it was the subject of considerable attention. One of the oilcans has recently been sent to H.R.H. the Prince of Wales, and a gracious letter of acknowledgment has been received expressing H.R.H.'s admiration of the beautiful lines and perfect finish of this model.

Every Meccano model-builder and miniature railway enthusiast should add one of these oilcans to his equipment. They may be obtained from any Meccano dealer (price 3/6) or direct from Meccano Ltd., Liverpool (price 3/8 post free).

MECCANO LTD.
BINNS ROAD
LIVERPOOL

MECCANO MAGAZINE

Registered at G.P.O., London, for transmission by Canadian Magazine Post.

EDITORIAL AND ADVERTISING OFFICES:—
BINNS ROAD, LIVERPOOL.

Telegrams: "Meccano, Liverpool."

Publication Date. The "*M.M.*" is published on the 1st of each month and may be ordered from any Meccano dealer, or from any bookstall or newsagent, price 6d. per copy. It will be mailed direct from this office, 4/- for six issues and 8/- for twelve issues.

To Contributors. The Editor will consider articles and photographs of general interest and payment will be made for those published. Whilst every care will be taken of articles, etc., submitted, the Editor cannot accept responsibility for any loss or damage. A stamped addressed envelope of the requisite size should be sent where the contribution is to be returned if unacceptable.

Advertisements

Readers' Sales and Wants. Private advertisements (i.e., not trade) are charged 1d. per word, minimum 1/-. Cash with order. Editorial and Advertising matters should not be dealt with on the same sheet of paper (see important notice five lines below).

Small Advertisements. 1/- per line (average seven words to the line), or 10/- per inch (average 12 lines to the inch). Cash with order (see important notice below).

Advertisers are asked to note that private advertisements of goods manufactured by Meccano Limited cannot be accepted.

Display. Quotations for space bookings, and latest circulation figures, will be sent on request.

Press Day, etc. Copy should be sent as early in the month as possible for insertion in following issue. We usually close for press on or before 10th of each month for following issue. Half-tone blocks up to 100 screen.

Proofs of advertisements will be sent when possible for space bookings of not less than half-an-inch.

Voucher Copies. Sent free to advertisers booking two inches or over. Other advertisers desiring vouchers should add 8d. to their remittance and should order voucher copy at same time.

Remittances. Postal Orders and Cheques should be made payable to Meccano Ltd.

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The Readers' Sales and Wants column is reserved for advertisements dealing only with collections of stamps as a whole. A collection that is being disposed of on approval sheets, or by packets or sets, should be advertised in the small advertisement column, the rate for which is 1/- per line, average seven words to the line. Although the advertiser may not be actually conducting a stamp business, such advertisements are not to be classified under Readers' Sales and Wants.

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Readers Overseas and in foreign countries may order the *Meccano Magazine* from regular Meccano dealers, or direct from this office. The price and subscription rates are as above, except in the case of Australia, where the price is 1/- per copy (postage extra), and the subscription rates 7/- for six months and 14/- for 12 months (post free).

Overseas readers are reminded that the prices shown throughout the "*M.M.*" are those relating to the home market. Current Overseas Price Lists of Meccano Products will be mailed free on request to any of the undermentioned agencies. Prices of other goods advertised may be obtained direct from the firms concerned.

CANADA: Meccano Ltd., 45, Colborne Street, Toronto.
AUSTRALIA: E. G. Page & Co., 52, Clarence Street, Sydney, N.S.W.
NEW ZEALAND: Models Ltd., Kingston & Federal Streets, Auckland.
SOUTH AFRICA: Arthur E. Harris (P.O. Box 1199), 142, Market Street, Johannesburg.
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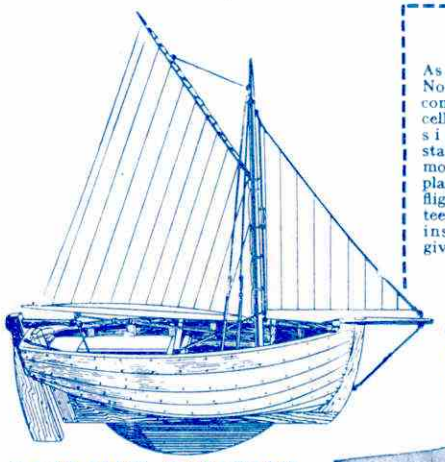

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BUILT TO SCALE

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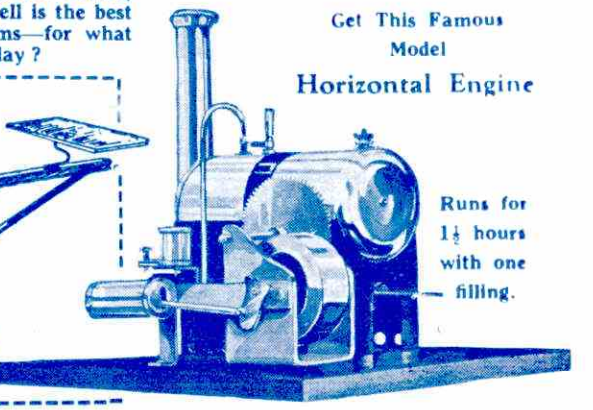

Get This Famous Model Horizontal Engine

Runs for 1½ hours with one filling.

THE ZULU BLOW GUN. The Novelty of the year. A most fascinating toy for indoors and outdoors. Harmless and instructive, complete with 6 Indoor Arrows, and 3 Outdoor Arrows, 4 Targets, Blow Gun, and Instructions. Post 9d. Price **5/11**

IT DRIVES

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- A small 4-volt dynamo.
- A large number of small models.
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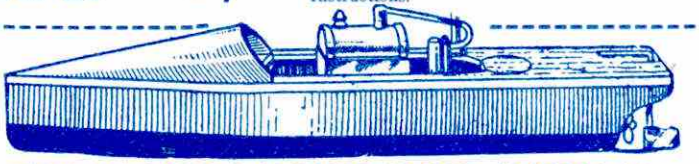

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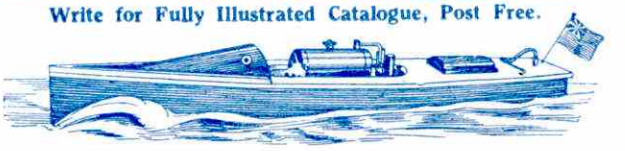

The Motor Hydroplane "MAPLE LEAF V"

The hull is constructed of selected yellow pine and has mahogany spray hood and deck fittings. Brass rudder, tiller and rack, and strong wire guard to protect the brass propeller. Enamelled in a beautiful shade of green, the hood, deck and fittings being varnished. 26 ins. long. Fitted steam engine and boiler. "Maple Leaf V" will run for 30 minutes and cover a long distance. Price **22/6**

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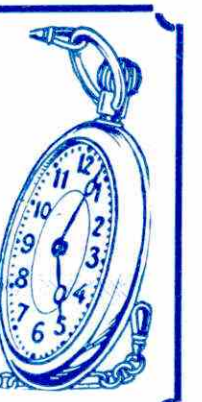

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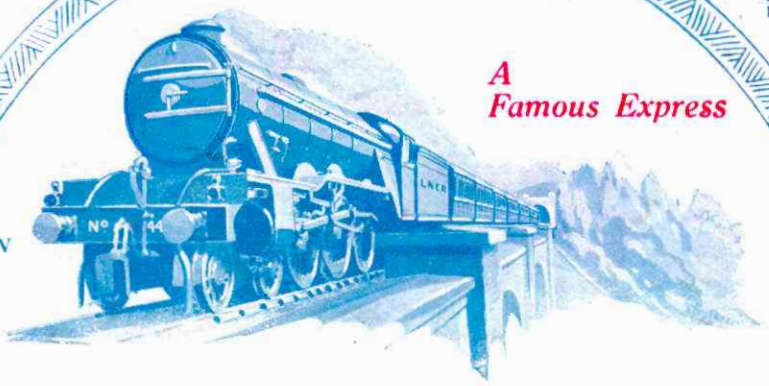

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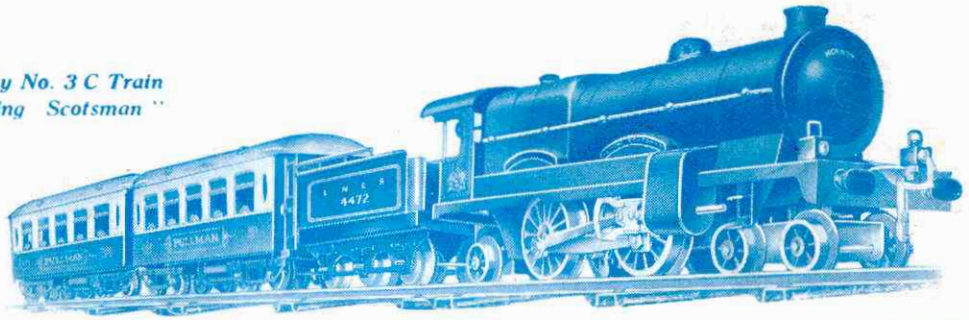

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