VOL. XIII. No. 4 APRIL 1928

MECCANO MAGAZINE

FAMOUS AMERICAN LOCOMOTIVES
(see page 282)

Now I'm off!

Here's happy hours for me at the yacht pond! I'm going to race my steam launch against the others and let my pal sail the yacht. It's great sport, costs you nothing and is perfectly safe. There are lots of other fellows at the pond with Hobbies' boats, and of course there is nothing to equal them at the price. They are not just painted pieces of wood, but properly balanced and beautifully finished boats.

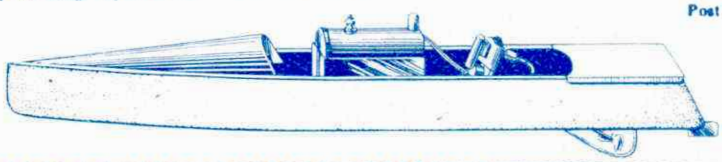
HOBBIES MODEL BOATS

PETER PAN

27¼ ins. Long. 3¾ in. Beam.

A sturdy little boat with balanced hull and strong brass engine. Fitted with safety valve and direction rudder. Full directions included.

10/6 Post 9d.

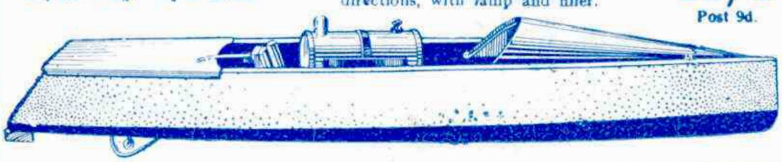


MISS AMERICA

27¼ ins Long. 4¼ in Beam.

The most popular model. Two-colour hull. Strong brass engine, oscillating type, direct drive. Boiler fitted with safety valve. Full directions, with lamp and filler.

12/6 Post 9d.

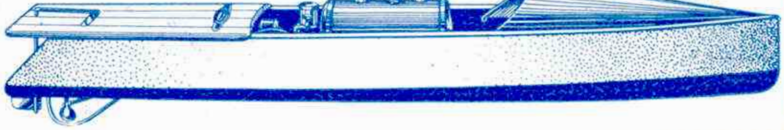


PEGGY

SUPER-HEATED.
31 ins. Long.
5¾ in. Beam.

Built like a real ship. Super-heated boiler. Large well finished hull. Double geared engine, automatic lubricator. Safety valve and big capacity boiler. Engine removable for driving models.

22/6 Post 1/3



SAILING BOATS

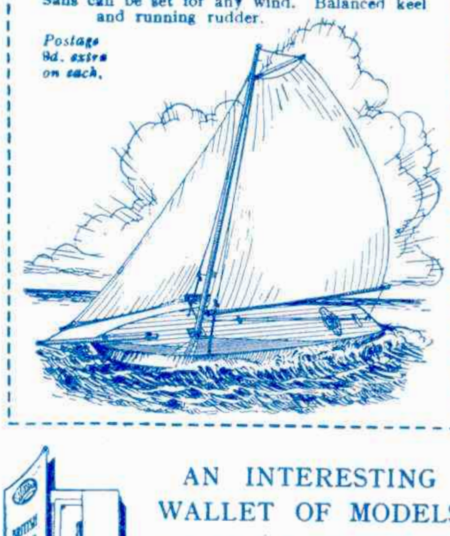
All these boats are finished in bright enamel, have detachable masts and are fitted with waterproof running lines.

The Ace 14½ in. Deck **3/6**
With solid hull finished two colours. An excellent cheap boat.

Whitewings 20½ in. Deck **8/6**
A real yacht, with hollow hull and strong sails. Weighted keel; running rudder.

The Seagull 23 in. Deck **15/-**
The best of all. Will not sink or turn over. Sails can be set for any wind. Balanced keel and running rudder.

Postage 9d. extra on each.



These boats are stocked by all first-class toyshops and stores. Ask for Hobbies and don't be put off with any others. The name behind them is your guarantee of good value.

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Here is a wallet containing illustrated leaflets of the full range of boats and of interesting stationary engines and constructor sets. It is free on application to Hobbies by addressing your envelope to Dept. 196 as below.

NEXT MONTH: AMERICA'S GREATEST FREIGHT CARRIER. READY 1st MAY. PRICE 6d.

MECCANO MAGAZINE

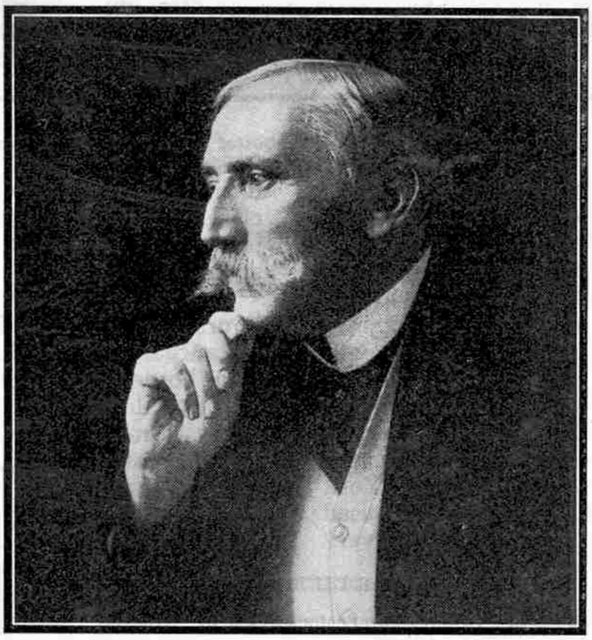
Editorial Office
Binns Road
Liverpool

Vol. XIII. No. 4
April, 1928

With the Editor

A Famous Naturalist

The recent death of Mr. Richard Kearton, F.Z.S., will be a cause of regret to all who have made acquaintance with his wonderful nature pictures, either by reading his books or by listening to his attractive lectures. He was well known to thousands of people by his success in the photography of birds and animals in their native surroundings, a sphere of work that he made particularly his own and in which he was greatly assisted by his brother, Mr. Cherry Kearton, the well-known cinematographer of wild life.



Mr. Kearton was born at Thwaite, a little village in Swaledale in the North Riding of Yorkshire. He left school early and took to farming, the family occupation. At the age of 17 he was quite an expert on sheep-farming, but while learning all that was possible of this pursuit he lost no opportunity of becoming familiar with the animal and bird life characteristic of the moorland scenery of his home. He carried with him for the rest of his life one unpleasant reminder of his eagerness in this respect. Searching for birds' nests one day, he fell from a height and broke his leg. Unfortunately the bone was not properly set and the accident left him permanently lame. This did not check his ardour nor did he allow it to prevent him from making the long and tiring excursions that were necessary in following his hobby.

While still farming at Thwaite he made the acquaintance of one of the partners in the famous publishing house now known as Cassell & Co. Ltd., and was persuaded to go to London to take up a position with the firm, writing on natural history in publications of various kinds. For more than 30 years he lived at Caterham and there became familiar with every inch of the Surrey country-side.

Kearton settled in Caterham when failing health compelled him to resign his connection with Cassell & Co., but prior to that time he had made journeys throughout the length and breadth of Great Britain and had introduced on a large scale an entirely new method in nature study. In 1892 he took a photograph of a nest with eggs in it at Enfield, and his success in several similar experiments determined him to be satisfied with nothing less than actual photographic representation of the life histories of birds and animals. The drawings previously available were often inaccurate in detail, besides giving very poor representations of the activities of birds and animals in their natural surroundings.

In order to carry out his purpose he tramped over the moors of Scotland and the north of England and haunted the lakes and broads of the eastern counties, as well as the shores of Northumberland and other places where sea-birds in enormous numbers were to be met with. His interest was so keen that with his brother he even underwent the discomfort of visiting the lonely isle of St. Kilda in the Outer Hebrides, living in a hut the floor boards of which were so rotten that they broke when walked upon. This island is a paradise for bird-lovers, and on it the Keartons found many absorbingly interesting subjects for their camera.

The task of taking photographs on the gaunt cliffs of St. Kilda and the tiny neighbouring islets was not easy, but the natives are accomplished cliff climbers and greatly assisted the equally daring photographers. The book in which Kearton describes his adventures on the island abounds with pictures showing the brothers or their native helpers standing in the most dangerous positions on the edges of tremendous cliffs, or sitting in contentment on the narrow ridge of some crag where a slight slip meant a headlong fall of hundreds of feet into the ocean below!

In order to secure a photograph of a St. Kildan catching fulmar petrels by means of a long rod with a noose at the end, for instance, the camera was taken to the edge of an awful precipice commanding a view of a ledge of rock on which the birds were sitting. The St. Kildan had a rope tied round him for safety and stealthily descended until he was as near the ledge as possible. Quietly he pushed the rod forward until the noose was just in front of the head of the selected victim, when a quick turn of the wrist passed it around the fulmar's neck. The subsequent struggles of the bird only served to tighten the fatal noose.

An interesting feature of the work of the Keartons was the use that they made of devices to prevent the victims of their camera from becoming aware of their presence. Richard Kearton was largely responsible for the invention of most of the recognised hiding contrivances now used in such work. Concealed behind a screen of boughs and leaves, he would wait patiently with his camera until the desired moment had arrived for taking a photograph, keenly observant all the while of every happening within sight and sound. He used this method for securing photographs of birds on their nests.

It was not always necessary to hide, however, as is shown by one striking passage from his book "*With Nature and a Camera*" (Cassell & Co. Ltd.). "The great secret of all field work" he says, "is the power to keep absolutely still for a prolonged period of time. I have stood like a statue in a perfectly exposed place beside a small cattle pond for half an hour on a calm summer's evening, and had five rabbits, four voles, and two or three common brown rats within a dozen yards of me fighting, feeding, swimming, and playing with the utmost unconcern, until I stirred, when they all disappeared as if by magic."

As a lecturer Kearton was always in great demand. One particularly popular feature of his lectures was his illustrations of the calls of animals and birds, whose habits he had studied so closely that he was able to give the most realistic imitations. He lectured in the chief European cities and also in America, while through his numerous books he became a well-known figure throughout the whole of the English-speaking world.

MODERN AMERICAN LOCOMOTIVES AND THEIR WORK

BY H. W. PONTIN

Photo] [*H. W. Pontin*

A Juggernaut of the railroad! No. 1432 Lima super-power 2–8–4 booster fitted locomotive, Boston and Albany Railroad, U.S.A.

THE British boy, accustomed to the sight of locomotives of graceful outline but comparatively diminutive stature, would open his eyes wide at the sight of the enormous engines employed on American railroads. Few "*M.M.*" readers will be familiar with the mechanism of American engines and doubtless a few words on their operation will prove interesting.

It is well to understand first of all that the operation of the great trunk lines of the United States has reached a point where huge freight trains and heavy passenger equipment are the everyday rule. On the New York Central Railroad, for instance, little comment is aroused when a freight train of 140 cars goes by! And every car is at least 40 ft. in length! The fast expresses such as the famous "*Twentieth Century Limited*" frequently run from New York to Chicago in several sections of from 12 to 16 Pullman cars each, and each car may be taken as 80 tons dead weight.

The "*Twentieth Century Limited*" is the most famous of American expresses and is regarded by the American boy in much the same way as the British boy looks on the "*Cornish Riviera*" express or the "*Flying Scotsman.*" It derives its name from the fact that it was first run on the opening day of the twentieth century. It runs from New York to Chicago, along a route 978 miles in length, which lies first due north from New York, up the valley of the Hudson River for 150 miles, and then swings across country until the banks of the Great Lakes are reached and hugged closely for the remainder of the run. The timing for the journey is 20 hours, showing the excellent average speed of 48.9 m.p.h.

At first sight this performance may not appear very impressive, although it is the world's fastest run for a distance of this length. There are two important points to be borne in mind, however. First, between New York and Buffalo there are nearly 30 service slacks, or one to every 15 miles. This alone is sufficient to make exceptionally fast running almost out of the question for a 900-ton train. The second point is that there is a maximum speed limit of 70 m.p.h. imposed on the train. With these points in mind it becomes obvious that only engines of exceptional power and accelerative capacity can maintain the fast schedules laid down for these great trains.

Leading Dimensions of 4–6–4 "Hudson Speed" Express Passenger Engines. New York Central Railroad

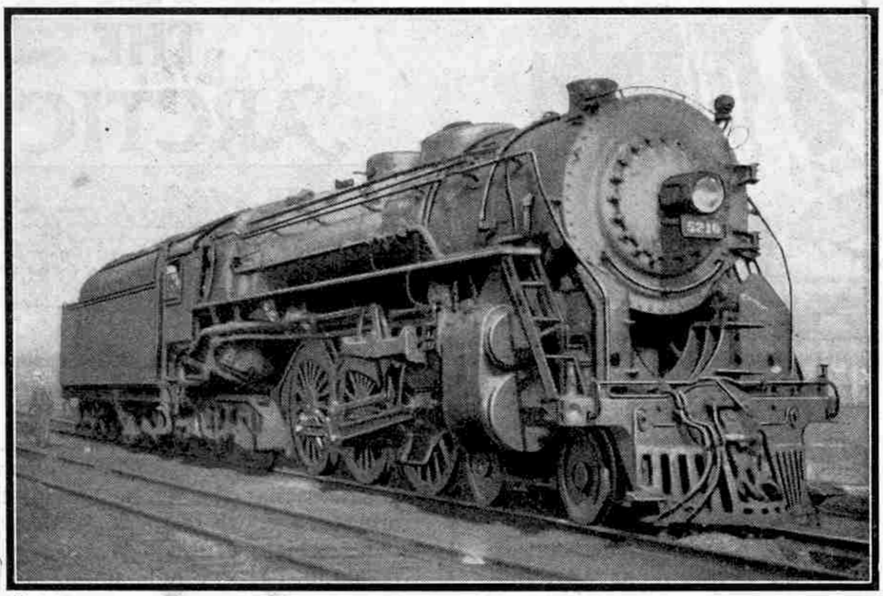
Cylinders (2) 25 in. diameter by 28 in. stroke. The entire cylinder block is cast steel. This is a saving of two tons dead weight.

Driving Wheels	79 in. dia.
Total Wheelbase	76 ft. 1½ in.
Boiler, inside diameter	82 7/16 in.
Grate Area	81.5 sq. ft.
Heating Surface—Flues	3,403 ,,
Tubes	800 ,,
Arch Tubes ...	37 ,,
Firebox	244 ,,
Superheater ...	1,951 ,,
Total	6,435 ,,
Weights in Working Order—	
On Drivers	182,000 lb.
On Heading Truck	63,500 ,,
On four wheel Trailer Truck ...	97,500 ,,
Total	343,000 ,,
Maximum Tractive Power—	
Engine	42,300 ,,
Booster	10,900 ,,

The tender is carried on two six-wheeled trucks and has capacity for 15,000 gallons of water and 21 tons of coal.

The general trend of present practice for new freight power seems to be toward the 2–8–4 Lima super-power engine, or the 4–8–2 "Mountain" type. Both these types are hauling fast freight trains with complete success every day and they may be said to represent the highest peak in modern American locomotive design. Their continuous run may be anything from 200 to 900 miles in length and this is made possible by the incorporation of all the newest devices for economical operation, with strict attention to the comfort of the crews that work the engines.

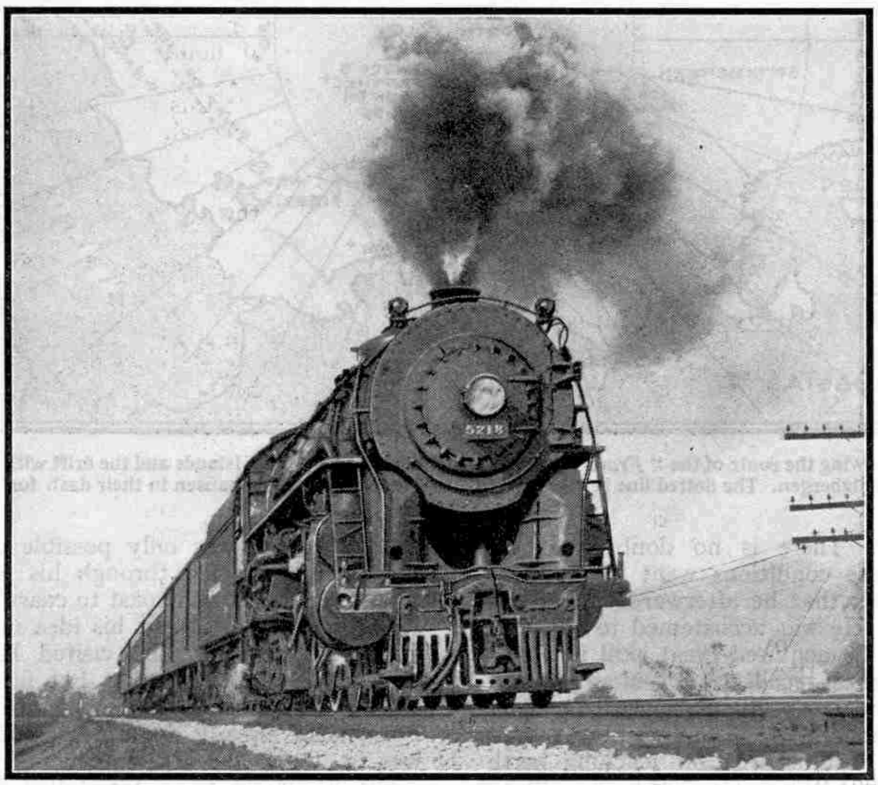
It would be impossible for one man to keep the engine properly fired by hand throughout a long run, and among the labour-saving devices is a mechanical stoker. The use of this extremely efficient apparatus allows the engine to be worked to full capacity throughout the run, and the heaviest thing the fireman handles is the oiler with which he lubricates the stoker mechanism!



Photo] [H. W. Pontin

"Hudson Speed" 4-6-4 Baltic type express locomotive No. 5210, New York Central Railroad, U.S.A.

What a change from the laborious shovel! If a peep could be taken into the firebox of one of these stoker-fired mammoths, all that would be visible would be one inch of fire over the entire grate area, and that is where the long runs come in. The mechanical stoker can place the coal more evenly and consistently than the most skilful firemen. A dirty, clinkered fire, irrespective of the length of the run, is unknown, for all that is necessary is occasional use of the steam grate-shakers. By the efficient use of the stoker poorer grades of coal may be used with the engine at the "popping" point for the entire trip.



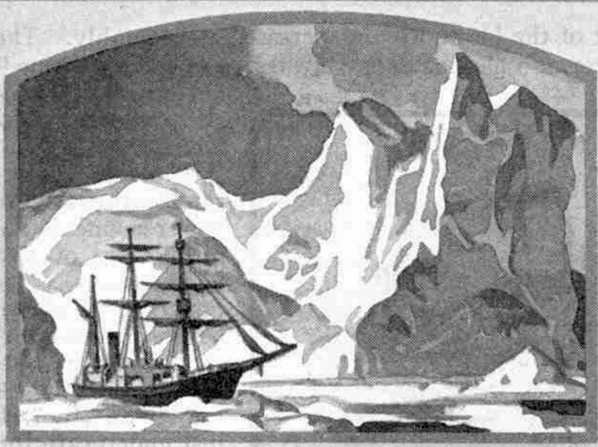
Photo] [H. W. Pontin

A vivid impression of power is given by this "ground level" view of a giant of the New York Central Railroad. "Hudson Speed" 4-6-4 locomotive No. 5218

Then there is the feed-water heater. This device pre-heats the water taken from the tender and delivers it to the boiler at a much higher temperature than the old injector could. This makes for economy in water evaporated, and therefore in coal consumption. Another appliance is the "booster," with which many "*M.M.*" readers will be familiar already, as two L.N.E.R. "Mikados" possess this equipment. It is a well-known fact that if a locomotive can start a heavy train it can haul it. That is where the booster is of such value, for by its use at the start or on heavy grades the tractive effort of the locomotive is increased considerably. The booster also eliminates largely the need for "banking" engines for passenger and freight trains.

Another important feature on the newer engines is the installation of two $8\frac{1}{2}$ in. cross compound Westinghouse air compressors. These are connected directly to the main frames, just underneath the smokebox, and in addition to charging long brake pipes they provide the air pressure for the operation of the auxiliary mechanism on the engine itself. A brief note of the uses to which the compressed air is put is all that can be given here. It controls the firedoor; it applies sand to all driving wheels; it blows the steam chime-whistle and rings the bell, and also operates the communicating signal whistle used on all passenger trains. The wet down hoses are worked by air and, last but not least, the engine is reversed and "hooked up" by a power gear using compressed air. The automatic train control appliances are common to passenger and freight engines.

Enthusiasts who have stood and watched the "*Cornish Riviera,*" the "*Royal Scot,*" or the "*Flying Scotsman*" would enjoy the sight of one of these American giants doing business at the head of a 3,000-ton freight train, or at the head of one of the fast "Limiteds." The new "Hudson Speed" type of 4-6-4 locomotives now in course of delivery to the New York Central Railroad in large numbers are a fair representation of American passenger practice. One of these, No. 5205, represented the N.Y.C. at the recent Baltimore Exhibition. (*Continued on page* 313)

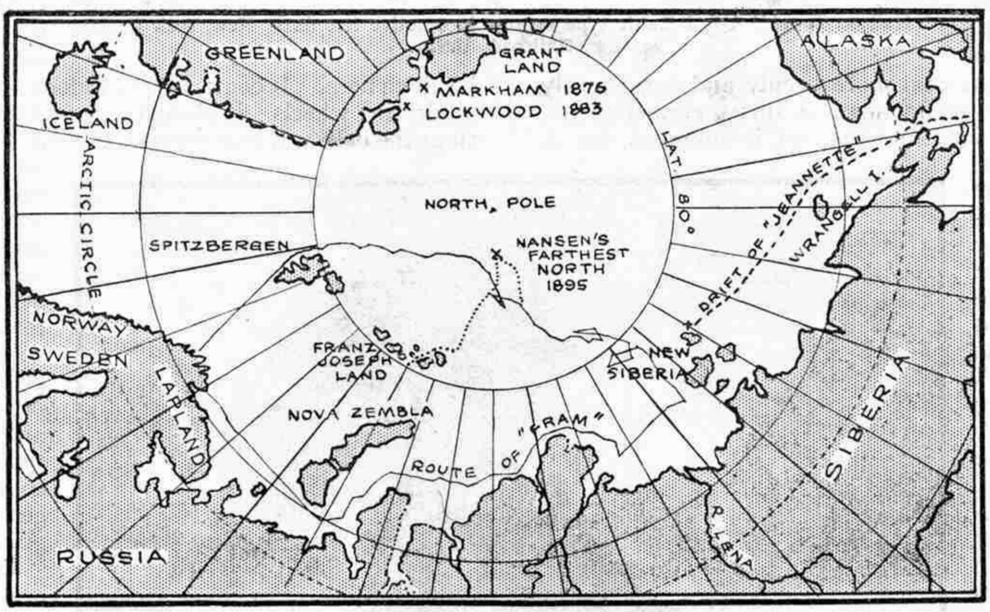


EXPLORING THE ARCTIC

Famous Explorers and their Attempts to Reach the Pole.

XVIII.—THE FIRST CROSSING OF GREENLAND

THE discovery of the ice-bound sea north of Greenland and of a practicable way to it through Kane Basin was dealt with in the last article in this series. This route was followed by later explorers with profitable results. Before giving an account of their expeditions, however, an extraordinary attempt to reach the "top of the world" by an entirely new method calls for notice. This was made by the famous Dr. Nansen, who achieved a new farthest north record almost 200 miles beyond that of Lockwood referred to last month.



Map showing the route of the "*Fram*" from Norway to the New Siberian Islands and the drift with the ice to Spitzbergen. The dotted line is the track followed by Nansen and Johansen in their dash for the Pole

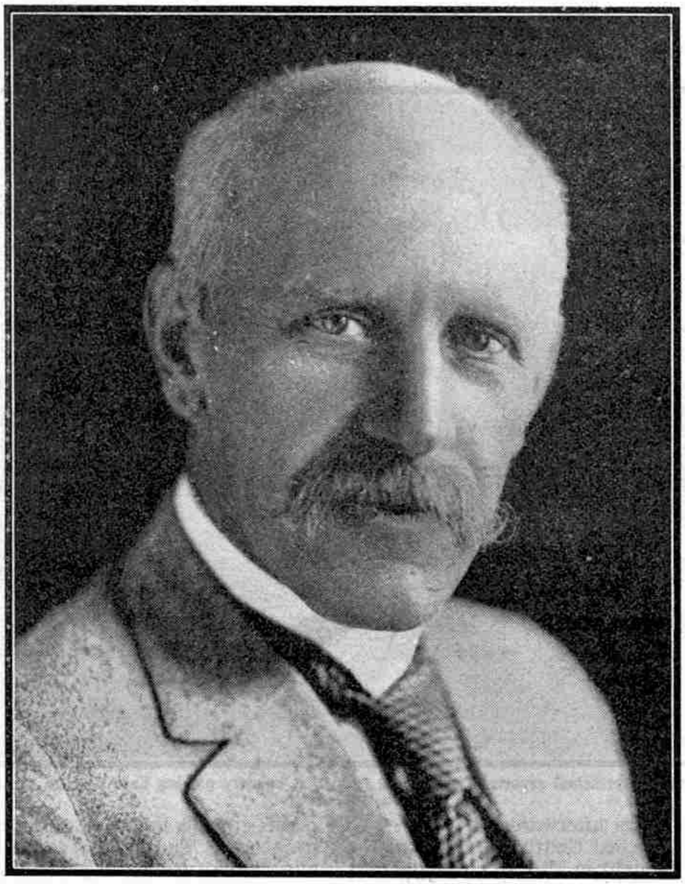
Fridtjof Nansen was born in Norway on 10th October, 1861, and spent the greater part of his youth in the country among the fiords and mountains. There is no doubt that his outdoor life under these conditions went far towards fitting him for the work that he afterwards undertook in the Arctic regions. He was accustomed to bathe in the coldest pools, and he acquired great skill in snowshoeing. One of his earliest recollections is of an attempt to run down a long and steep hill much used by older and more practised snowshoers in competitions. This ended in his running into a drift on reaching earth again after the jump, with the result that he dived into the snow headforemost and was buried to the waist. His legs remained waving in the air, and it was some time before his companions realised that he was unable to extricate himself and rescued him from incipient suffocation!

As he grew older he and his brother became accustomed to long expeditions over the mountains, either on fishing excursions or for the sheer pleasure of travel. The attraction that the Arctic regions held for him led him while still a youth to spend a summer on a sealing vessel, during which period he visited Iceland and sighted Greenland. He became unofficial bear shooter on this cruise, and in addition occupied himself profitably in the study of the seal and other forms of ocean life.

Returning home, he took up scientific work in the Bergen Museum, of which he became curator. While engaged in this work he read of an attempt to penetrate to the interior of Iceland, in which it was found that satisfactory progress on the inland ice was only possible on snow shoes, and the thought flashed through his mind that he would cross Greenland from coast to coast in the same manner. He was not able to put his idea into practice for some years, during which he visited Italy and carried on important zoological work, but finally the opportunity came. It was none too soon. The American, Robert Peary, had already made a preliminary expedition and was on the point of commencing a new journey that probably would have forestalled Nansen's and made it unnecessary.

Greenland is of interest to geologists because it reproduces conditions that existed in northern Europe during the Great Ice Age, when Russia, Scandinavia, Holland, half of Germany and a large proportion of the British Isles were covered by an immense ice sheet ending on its southern borders in great glaciers. The ice cap of Greenland had been visited by several explorers, whose attempts to cross it had failed for various reasons. They always commenced their journies from the settlements on the west coast, to which they also returned, but Nansen with characteristic boldness decided to commence on the almost uninhabited east coast and to make his way thence across the ice-bound plateau. He admitted that retreat was thus cut off, but reasoned, quite sensibly, that his plan involved only one crossing of Greenland instead of two.

When he announced his project he was regarded as a madman. One paper in Bergen inserted an advertisement of a display of snowshoeing with long jumps to be given by Nansen on the native ice of Greenland, reserved seats in the crevices, return tickets unnecessary! The Government refused any financial aid, but this was forthcoming from various sources and Nansen finally set off in 1888. With him were three other Norwegians and two Lapps. The former included Sverdrup, who took part in many later Arctic expeditions, including, as we shall see, the one that made Nansen most famous. The plan was to proceed to Iceland in a sealer and to wait for a favourable opportunity to land on the Greenland coast. To take the "*Jason*," as the sealer was called, away from the sealing ground at the most favourable season of the year would have been a very costly business and accordingly Nansen had to restrain his impatience while the vessel followed the seals.



Dr. Fridtjof Nansen

Finally on 17th July the opportunity seemed to have arrived. Between the "*Jason*" and the shore of Greenland there was a belt of drifting ice about 2½ miles in width and Nansen determined to force a passage through it in his boat. The baggage was accordingly stowed partly in this and partly in a similar boat loaned by the captain of the sealer. By about seven in the evening all was ready, and the party left the ship.

The beginning of the expedition was not exactly encouraging. In trying to get through the drifting pack the pressure of the ice became so threatening that it was necessary to pull the boats up on a floe, which was soon swept out seaward once more by a strong southerly current. For ten days they drifted on the ice, exposed at all times to the danger of being crushed. On one occasion the floe was forced out to the edge of the pack on the verge of the open sea, and if it had been crushed they would have had great difficulty in saving even one of the boats and the provisions it contained.

At last they found a way through the ice and set foot on dry land. They were far south of their intended landing place and the best of the season was gone, but without hesitation they rowed north through the belt of comparatively clear water between the pack and the shore, occasionally camping on the floes, and at all times being compelled to exert the utmost vigilance to prevent their boats from being crushed. Often it was only possible to work their way north by threading a way through narrow lanes, poling off the threatening ice floes on either side.

On the way they came across a small tribe of Eskimos who led a distinctly precarious existence on the bleak coast. After many narrow escapes from falling fragments of icebergs and from the floes through which a passage was forced, they found a suitable landing place from which to commence their adventurous journey.

A few days were then devoted to repacking the baggage on their five sledges, repairing footgear and clothes, and on other necessary preparations, and on 6th August they started, Nansen and Sverdrup pulling the largest sledge with a load of 440 lbs., the others having one sledge each with about half that weight.

The ascent was steep and the snow soft, while the rain that fell did not assist their progress. When the weather cleared, and a lower temperature hardened the snow, their chief discomfort was a burning thirst, for the only water available was that formed from ice melted by bodily heat. To obtain a few drops of this precious liquid, they filled flat pocket flasks with snow and carried them in their breast pockets.

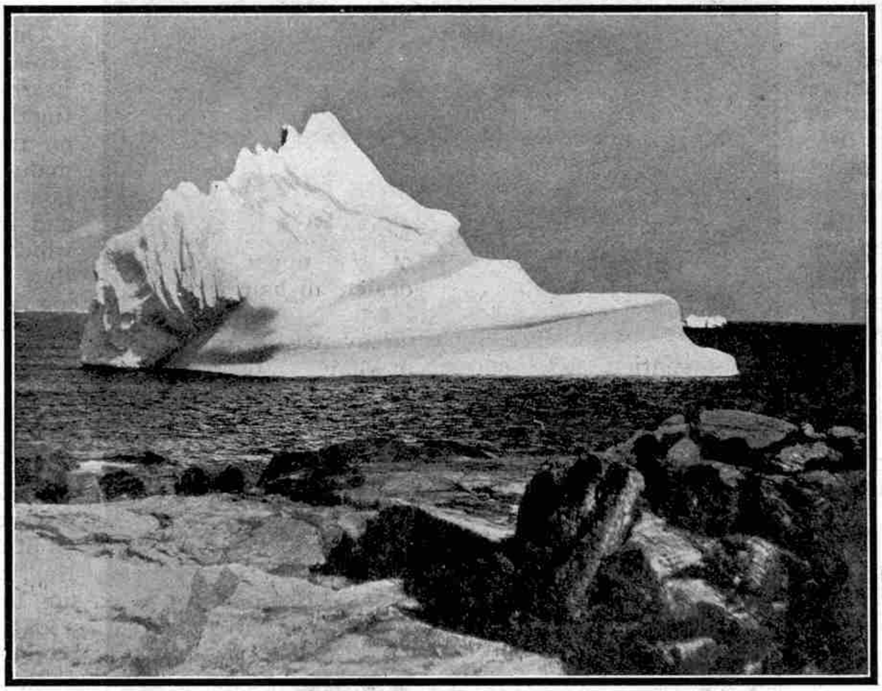
The ascent continued to be steep until a height of 6,000 ft. above sea level was reached, and as three men were often required to pull one sledge, they covered the ground several times over. Progress was so slow that Nansen changed the direction of the march towards a point on the west coast well to the south of his original destination, in order to shorten the journey.

For weeks they went on, their altitude rising and the temperature falling. At night, the thermometer fell as low as 72°F. below freezing point in the tent, and on waking the men often found hoar-frost completely surrounding their heads. Outside, their beards were liable to be frozen so fast to the wrappings about their heads that speech became very difficult. All round them was a waste of snow and ice, for they saw the last nunatak, or peak projecting through the ice, a fortnight or so after starting.

The highest point of the great ice cap was at length reached and the descent commenced. At first the slope was very gradual, and for days together they remained at a height very little below 8,860 ft., the greatest reached by them. When the downward slope became more definite they hoisted sails on the sledges and made better progress. So elated were they at their speed when this method of progression became possible, that on one occasion they continued sailing throughout the moonlit night and had narrow escapes from precipitating themselves into yawning crevices many hundred feet deep.

Pushing on towards the coast, they arrived in sight of the fiord for which they were making, and a memorable day arrived when they found water and were able to drink to repletion. The ice was now uneven and the crevices made the work terribly hard as well as dangerous. Several times one or other fell into a crevice, but the unhappy victim usually managed to get his alpenstock fixed across the gap like a horizontal bar. Nevertheless, it was remarkable that they succeeded in reaching the shore without mishap. Thus the Greenland icecap had been conquered at last.

It now remained for the explorers to reach one of the settlements and with this aim they then built a boat—if a willow-wand framework covered with sailcloth may be called a boat. Its shape was distinctly peculiar—an Eskimo who saw it afloat later reported that he had seen two men in half a boat—and it was necessary to sit very still and move with caution to prevent it from capsizing. This was by no means easy, for the thwarts were very narrow and uncomfortable to sit on, so much so in fact, that both Nansen and Sverdrup spoke very feelingly on the subject of their "half boat" many years afterwards!



One of Greenland's principal exports! An iceberg from that country passing Cape Charles in Labrador on its way south

In the boat Nansen and Sverdrup reached Godthaab and later their companions and baggage were brought in also, to conclude a memorable expedition. Unfortunately no ship was available to take the explorers back to Norway, but Eskimos in their light kayaks succeeded in delivering letters to the "*Fox*," M'Clintock's old ship, then engaged in transporting ore from mines 70 miles to the south. Nansen's success was thus known to the world before his return, and a great welcome awaited the party in Christiania in the following spring.

Nansen settled down to biological work on his return, but the Arctic was never absent from his thoughts. In all probability ambition to reach the Pole had been the cause of his journey across Greenland, an adventurous journey regarded by him as preparation for the still more hazardous enterprise. As early as 1884 the idea had occurred to him of wedging his ship in the ice to drift with it across the Polar basin, a method by which he hoped to pass within reasonable distance of the Pole itself. In 1890 he made a public announcement of his proposals.

To understand how the idea occurred to him we must go back to an Arctic tragedy of 1879. In that year an American expedition under Lieut. De Long left San Francisco in the "*Jeannette*" with the intention of seeking land supposed to exist north of the coast of Siberia. The ship proceeded through the Bering Strait, but was caught in the pack not far from Wrangel Island to drift helplessly to the north west until, two years later, it was crushed between the floes and sank at the place marked on the map by a cross. The party took to the boats, three in number, and landed on the New Siberian Islands.

In the attempt to cross the seas separating the islands from the mainland, however, one boat disappeared and was heard of no more. A second with 10 men safely reached a Russian village at the mouth of the River Lena, but De Long himself and 13 men landed on a bleak and inhospitable shore and, with two exceptions, died one by one from starvation while trying to reach the settlements. The exceptions were seamen sent in search of relief. They struggled on for weeks through drifting snow and across icy swamps, living on burned boot-soles and "tea" made from willow leaves. In one or two deserted huts they found old bones that they charred and tried to eat, and some pieces of fish so ancient and rotten that they fell to pieces when handled. They were rescued by natives after undergoing incredible hardships, but it was then too late to save De Long and the rest of the party.

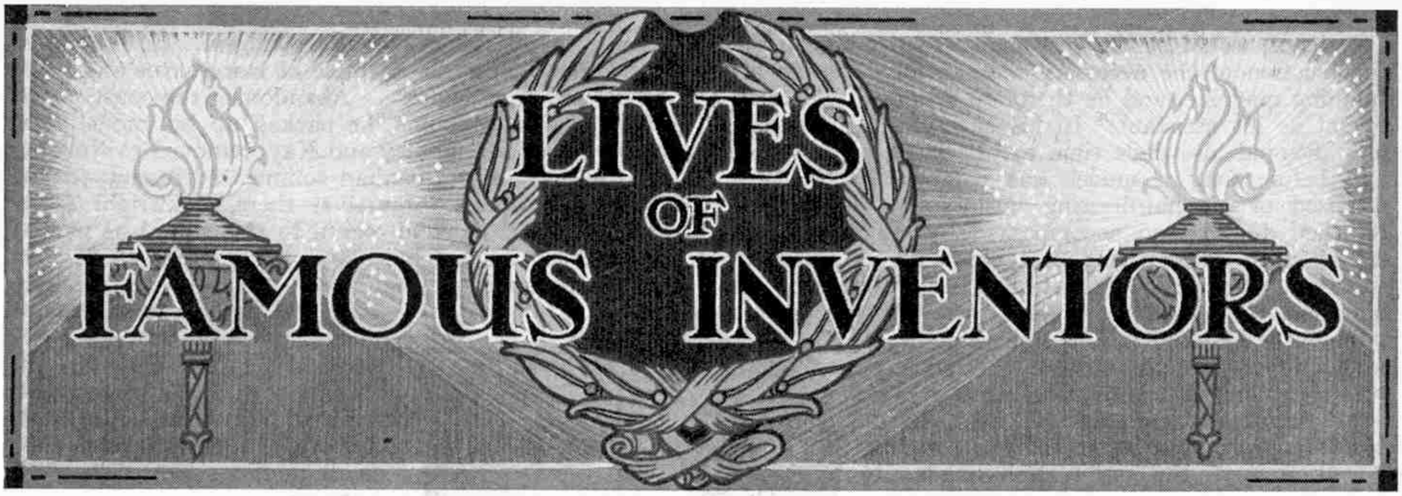
The interest of this expedition for Nansen was that three years after the sinking of the "*Jeannette*" an Eskimo discovered several articles from the ship near Godthaab in Greenland. These included a list of provisions signed by De Long, a list of the boats of the expedition and several pieces of wearing apparel marked with the names of members of the crew. These must have reached Greenland on drifting ice carried across the Polar sea by the wind or a current from the direction of Siberia. On reaching Cape Farewel they had been caught in a current known to flow up the west coast of Greenland, and finally cast ashore.

Other facts that seemed to confirm the existence of this current were known. For instance, a throwing-stick of a kind used only by the Eskimos of Alaska was also found at Godthaab, and this was even ornamented with Chinese glass beads that these Eskimos were known to obtain from Asiatics by barter. Further, no trees grow in Greenland, yet the natives of that country make great use of driftwood that on examination turns out to be chiefly Siberian larch, while an observation that casts a very interesting light on Nature's methods of seed distribution is that many plants growing in Greenland belong to a series found elsewhere only in Siberia. The seeds of the original plants in the former country must have survived a journey in cold storage across the Polar ice.

When Nansen announced his intention to follow the drift in a specially strengthened vessel with provisions for five years, his plan was received with approval in many quarters and he obtained financial support from the Norwegian Government. Many authorities prophesied disaster however. Among these was Greely, the leader of the disastrous expedition referred to in the last article of this series. Greely did not regard Nansen as a serious explorer and dismissed his crossing of Greenland as a mere piece of mountaineering. He expressed the belief that no ship built could survive the pressure of the ice floes that would be met with, even if the drift itself were possible, while in addition, he said that Nansen could not get near the Pole in his ship because it was certain that in the unknown regions land 300 miles across existed, covered with the glaciers forming the source of the heavy pack ice met with north of Greenland by the members of the Nares and Greely expeditions. It will be seen that the myth of the open Polar sea had been displaced by a new idea, which since has been proved to be equally mistaken.

Nansen proceeded steadily with his preparations in spite of the gloomy forebodings of Greely, and finally sailed in the now famous "*Fram*." This was a stout wooden vessel with rounded sides and a keel that was practically sunk in the planking and would offer no resistance to ice pressure. It was expected that the "*Fram*" would simply be lifted up when caught between two floes. The total thickness of the ship's sides was 24 in. to 28 in. of solid wood, and the inside was shored up in every possible way so that, in Nansen's words, the interior of the hold had the appearance of a "cobweb of stanchions and braces."

The "*Fram*" was rigged as a three-masted fore-and-aft schooner, with an unusually tall mainmast, but an engine was fitted also. This was of the triple expansion type, but in order to meet possible emergencies it could be used also as a compound engine or even run on one cylinder only. The sturdy *(Continued on page 326)*



XI.—SIR RICHARD ARKWRIGHT

AT the time when the Blackburn inventor James Hargreaves was perfecting his cotton "spinning jenny," described in last month's "*M.M.*," another Lancashire man, Richard Arkwright, was evolving a mechanical spinning machine of entirely different character. Arkwright's invention was one of the most important of the early contrivances that prepared the way for the marvellous high-speed textile machinery of to-day.

Richard Arkwright was born at Preston on 23rd December, 1732. He was the thirteenth child of the family, and as his parents were very poor they found it impossible to give him a proper education. An uncle taught him to read, and the rest of his meagre education he acquired by attending a local night school through the long winter evenings.

While still only a youngster Arkwright was apprenticed to the trade of a barber. When his term of apprenticeship was completed he removed to Bolton, where he rented a small room in the basement of a building in Churchgate, and there set up in business for himself. His cellar shop fronted on to the main thoroughfare and its existence was made known to the public by a sign bearing the words: "Come to the subterraneous barber. He shaves for a penny." This remarkably low charge brought him so much trade that eventually other barbers in the district were forced to reduce their price to the same level. It is said that Arkwright returned the compliment by lowering his charge to a halfpenny!

About 1761 he engaged a journeyman who was specially skilled in making wigs and, installing the new assistant in the shop, Arkwright devoted himself to the trade of an itinerant dealer in hair. At that time this was a very profitable trade, as wig makers found it difficult to procure the materials they needed with which to make up the wigs then worn by the people of the upper and middle classes. In consequence, dealers in hair were able to get very favourable prices for their goods. It has been said that Arkwright had discovered a secret dye that enabled him to supply hair of whatever colour happened to be the prevailing fashion!

Sir Richard Arkwright

As he journeyed from one Lancashire town to another and visited the different fairs frequented by men of his trade, Arkwright met people of all classes. Little is known of the events that led him to commence building cotton spinning machinery, but it is supposed that he first became interested in the subject by reason of the frequency with which it cropped up in conversations of the day. The carding machine invented by Lewis Paul and the flying shuttle evolved by John Kay were at that time just beginning to be generally adopted by mill owners, and there was much speculation among hand loom weavers as to the effect these inventions would have on their livelihood.

Arkwright had a natural liking for mechanics and the idea of spinning and weaving cloth by machinery greatly appealed to him. He began to gather information upon the subject whenever and wherever he could, and at length he became convinced that he could devise a machine that would effect great improvements in the spinning of cotton thread.

During 1769 Arkwright learnt that a clockmaker named Kay, then living at Warrington, had constructed some model rollers for a man named John Highs of Leigh, who was reported to have been engaged in devising an original roller spinning machine. Highs had used up all his available funds without succeeding in constructing a practical machine, however, and had ceased experimenting.

Arkwright realised that Kay, having had this experience, would be the very man to assist him in the construction of the necessary mechanical parts for his spinning machine, and he therefore arranged with Kay to act as his assistant. In his enthusiasm Arkwright now devoted his whole time to perfecting his machine and before long a model was completed. He then disposed of his hairdressing business in Bolton and returned to Preston accompanied by Kay, with the intention of constructing and exhibiting a full-sized spinning machine. At first he found difficulty in obtaining the necessary funds for the purpose, but after a while he became acquainted with a liquor merchant named John Smalley who undertook to finance the scheme.

Arkwright insisted that he must have absolute privacy in order to work on his invention and this stipulation made it difficult to find a suitable workroom. Eventually Smalley obtained the use of a back parlour in the Grammar School master's house in Stoneygate, at that time a quiet residential quarter. A large back garden full of gooseberry trees screened the room from the gaze of the curious, and in that parlour Arkwright and Kay set to work.

In spite of Smalley's assistance money was not too plentiful, for Arkwright had very little to spare and that only by limiting himself to the absolute necessities of life. We are told that during the Parliamentary election of March 1768, he was visited at his workroom and solicited for his vote but he declined on the grounds that "his clothing was in such a ragged state he could not for shame go up to the poll." He added adroitly that "if they would procure him a suit of clothes he would give them his vote." The canvassers were equal to the occasion and they immediately started a subscription. A suit of clothes was purchased and presented to the inventor who promptly put them on and registered his vote as promised!

In spite of all efforts the endeavours of the two men to work in secret were almost defeated. In an adjoining cottage lived two old women, evidently possessed of a good share of curiosity. They soon began to tell their neighbours of the strange noises they heard coming from the back of the schoolmaster's house. These noises, they said, were of such a droning character that they were convinced it was "the Devil tuning his bagpipes, and his favourites, Arkwright and Kay, dancing a reel!" This weird story caused consternation among the neighbours and for a while many of them were in favour of breaking into the back room to make a thorough search for "the Devil," who was supposed to be primarily responsible for the mysterious revelry!

Arkwright was fully aware that the Lancashire hand-loom weavers regarded any kind of machinery devised to speed up production as an attempt to deprive them of their means of livelihood. The rough treatment that had been given to Hargreaves and his spinning jenny indicated quite plainly to Arkwright that his own invention would meet with a similar reception when its existence became known. He therefore decided to follow the example of Hargreaves and to go before any trouble arose. Abandoning the construction of a full-sized machine, he packed up his model and, accompanied by Smalley and Kay, removed to Nottingham where Hargreaves had commenced manufacturing spinning jennies. On arrival there, Arkwright interviewed a local bank in regard to the capital he needed to establish his machine, and they agreed to provide him with sufficient funds for the purpose. Shortly after the agreement had been made, however, the bank apparently lost confidence in the invention and withdrew their financial aid. In the meantime, Arkwright had taken over small premises near Woolpack Lane and had begun the task of erecting a number of his machines. Smalley was made a partner in the concern and Kay was retained as mechanic.

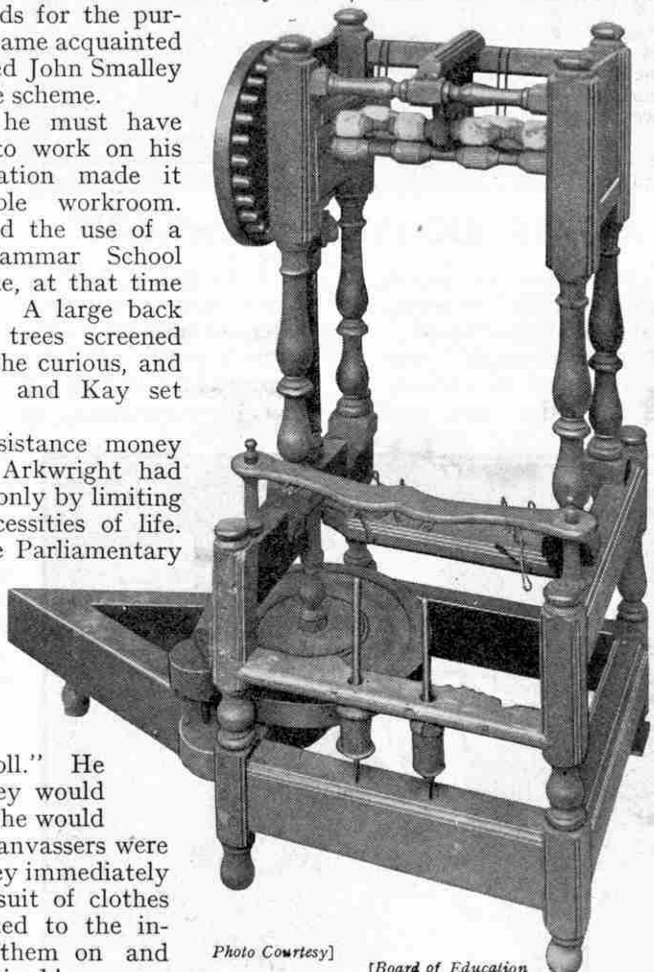


Photo Courtesy] [*Board of Education*

Arkwright's Spinning Machine, invented in 1769

The spinning machine invented by Arkwright consisted of a vertical wooden frame containing four pairs of rollers and four "fliers," in passing between which the delicate cotton threads, or "rovings," were drawn out and twisted into a strong warp thread. Each roller was made in four lengths, as shown in the accompanying illustration, so that four threads could be passed through the machine simultaneously. Each pair of rollers was so geared as to rotate faster than the preceding pair or pairs, the ratios being such that the speed of the last pair was six times as great as that of the first. The first pair of rollers did little more than compress the roving, but the second pair, revolving at a greater speed, drew out the thread to an extent that was proportionate to the increased speed of rotation. The third and fourth pair of rollers, revolving at still higher speeds, further stretched the roving.

In order to ensure that each pair of rollers obtained a satisfactory grip upon the thread as it passed between them, the upper roller was covered with leather and the lower one was fluted longitudinally. A lead weight suspended from the upper roller caused the latter to bear upon the one immediately beneath and so compress the roving. The four bobbins containing the rovings to be drawn and spun were mounted at the back of the frame, and the thread from each bobbin was passed successively through the pairs of rollers.

From the last pair of rollers each elongated thread passed through a wire guide and down to a revolving vertical spindle that carried a wooden bobbin and a device called a "flier." The flier was secured to the spindle and rotated with it, but the bobbin was free and driven separately by a twisted worsted band held at one end by the sheave of the spindle and at the other end passed round what Arkwright described as the "whirl of the bobbin." One leg of the flier bore a number of hooks, or "hecks," round one of which the thread passed on its way to the bobbin. Each revolution of the flier gave one turn of twist to the cotton. The rotating bobbin was restricted in speed by means of the band, and wound in the twisted yarn at a rate proportionate to the number of revolutions that the bobbin rotated less than the flier. For every roving spindle at the top of the machine there was a corresponding flier spindle at the foot.

Horse power was employed to operate the spinning machine. The animal was attached to a "horse wheel," and as this was turned the rotative motion imparted to it was conveyed through spur gearing to a vertical shaft carried on a wooden bracket that projected from one side of the machine. The four flier spindles were rotated by means of an endless belt, one end of which passed round a large pulley fitted at the lower end of the counter-shaft. An arrangement of crown gearing was employed to transmit the motive power to the drawing rollers.

When the bank refused to finance him any further, Arkwright took his model to Messrs. Need and Strutt, a Nottingham firm of stocking weavers, in the hope that they would recognise the possibilities of his invention and put forward some scheme for aiding him financially. His expectations were realised for Jedediah Strutt, the inventor of the stocking machines used by his company, at once appreciated the value of the spinning machine and offered to supply the necessary additional capital. A new company was then formed, the fusion giving Arkwright the full benefit of the stocking firm's resources.

His money problems being satisfactorily settled, Arkwright gave himself up enthusiastically to promoting his invention. One of his first acts was to apply for a patent for his machine, and the desired legal protection was granted in 1769. The mill was duly completed and the spinning machinery put into successful operation. The cotton yarn spun by the machines proved to be of much firmer and harder texture than that produced by hand looms or spinning jennies, and it was specially suitable for warp. So great was the prejudice of Lancashire manufacturers against Arkwright, however, that they declined to purchase his superior thread or to give it a trial.

In 1771 Arkwright and his partners erected a second and larger mill at Cromford in Derbyshire, the necessary power being obtained from the adjacent River Derwent. This adoption of water power earned for the machinery at this mill the name of "water frames," and the spun thread produced became known as "water twist." The spinning machines installed at Cromford Mill contained a larger number of spindles than those at the Nottingham factory. In 1775 Arkwright patented an improved spinning machine embodying this increased spindle capacity and also an arrangement that ensured the spun cotton yarn being wound evenly on to the bobbins.

At the time when Arkwright obtained this second patent the opposition of the Lancashire weavers to improved textile machinery once more became evident and a fresh wave of rioting spread over the country. In spite of his unpopularity among the weavers, however, Arkwright continued to make progress. More mills were erected at Cromford and the increased employment proved the means of greatly augmenting the local population. Even in the north of England where the opposition to textile machinery was much more acute mills became established under Arkwright's direction. Apart from all this, the inventor derived considerable sums of money from the sale of his machines to independent owners of small factories.

It was inevitable that sooner or later Arkwright should come into conflict with the weavers and in October, 1779, one of his mills at Chorley was raided by an infuriated mob who completely smashed up the spinning machines and burned down the buildings. Subsequently mill after mill in Lancashire was attacked and burned.

Arkwright began to have trouble also with cotton manufacturers who illegally copied his machines and this trouble became so serious that, in 1781, he took legal action against nine manufacturers for infringement of his patent rights. The first of these charges was tried in July 1781, and resulted in a verdict in favour of the defendant on the grounds that the terms of the patent specification were not sufficiently clear. In consequence of this decision against him Arkwright withdrew the remaining eight prosecutions, and instead of entering upon a prolonged and costly legal battle, made a public statement of what he considered to be his side of the case.

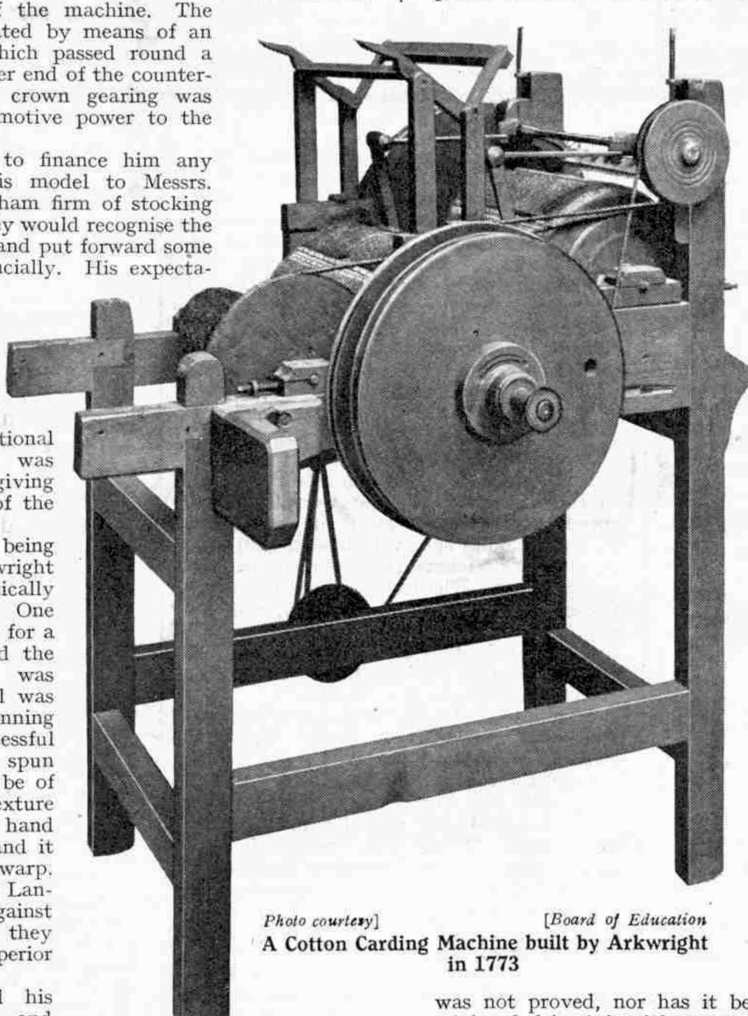


Photo courtesy] [*Board of Education*

A Cotton Carding Machine built by Arkwright in 1773

This statement was contained in a pamphlet published under the title of "The Case of Mr. Richard Arkwright and Co. in relation to Mr. Arkwright's invention of an engine for spinning cotton, etc., into yarn."

During the next few years he contented himself with quietly collecting evidence in support of the validity of his patents and in 1785 he again took legal action, this time to establish his patent of 1775. As on the previous occasion the case was judged on the question of the sufficiency or otherwise of the terms of the patent specification, and this time Arkwright succeeded in winning the day.

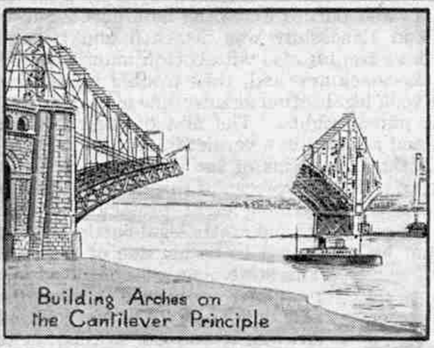
This success was the signal for more intensive opposition than before on the part of the manufacturers, and in June, 1785, they brought an action against Arkwright with a view to upsetting his claim to be the inventor of the "water frame" spinning machine. The trial lasted from nine o'clock in the morning until half-past twelve at night and created great excitement. The manufacturers intended the trial to be a fight to the finish and they put forward every possible witness they could obtain. Among those who testified against Arkwright was his former assistant Kay, who swore in the witness-box that the "water frame" spinning machine as made by Arkwright had been invented earlier by Highs of Leigh. The evidence put forward was so inconclusive that Highs' claim to be the inventor of the spinning machine was not proved, nor has it been proved since that time. This trial ended for Arkwright more adversely than before, and his patent was wholely annulled. There is little doubt, however, that he was defeated more by the overwhelming quantity of the evidence brought against him rather than by its conclusiveness.

It is an ill wind that blows no one any good, however, and the extraordinary interest in textile machinery aroused by the trial proved a splendid advertisement for Arkwright, and many millowners now sought after him. In Derby, Leicester, Worcester, Stafford, and many other places his "patents" were adopted under license by independent manufacturers, and he soon made a large fortune.

The partnership between Arkwright and Strutt was terminated during 1783, Arkwright retaining Cromford Mill while Strutt assumed sole ownership of the mill they had erected at Belper.

In 1786 Arkwright was appointed Sheriff of Derbyshire, and subsequently had the honour of presenting an address of congratulation to King George III in regard to the latter's escape from an attempt to assassinate him. In return the King bestowed a knighthood upon Arkwright in recognition of his pioneer work in raising the textile industry to a profitable and prosperous level.

Arkwright was a man of great enthusiasm and indefatigable industry and for many years he worked from four o'clock in the morning until nine o'clock at night. In spite of his great vigour, however, he suffered acutely from asthma and it was from a complication of disorders arising from this complaint that he died on 3rd August, 1792, in his sixtieth year.


Building Arches on the Cantilever Principle

Engineering News of the Month

The World's Water Power

The Geological Survey of the United States Department of the Interior have recently issued a report on their investigation into the possibilities and development of the use of hydro-electric power. At the end of 1926 water power to the extent of 33 million h.p. had been harnessed, these figures comparing with 23 million h.p. in 1920. The total potential water power of the world is estimated at 454 million h.p. Of this Europe claims 58 million, of which 13,100,000 has been developed. In North America it is estimated that a total of 66 million h.p. can be developed, and up to the end of the period mentioned 16,800,000 had been harnessed. Approximately three-quarters of the total world's increase between 1923 and 1926 took place in North America including both the United States of America and Canada. The greatest potential source of water power is Africa, and it is estimated that 190 million h.p. can be produced on that continent. Only 14,000 h.p. has yet been developed, however. South Africa and Oceania as yet have barely touched their resources.

* * * *

The Telephone Service

During last year the British G.P.O. Telephone Department used 660,000 miles of telephone wire in the erection of new and repair of old lines.

It is interesting to note that all the manholes and jointing chambers required for the underground cables were of reinforced concrete. Despite labour charges and the cost of material it has been found that reinforced concrete is cheaper than the brick structures erected in pre-war days.

* * * *

New Eastern Cable

The Eastern Telegraph Company will shortly open its new submarine telegraph cable between Lanaka, Cyprus, and Haifa. This is the first submarine cable to connect up with Palestine, which now comes on to the world's cable map. The Eastern Associated Cable Company is working on underground lines between Port Said and Suez, and when these are completed direct communication with India will be established.

* * * *

Spanish Road Reconstruction

The Spanish Minister of Public Works has commenced a vigorous campaign for the inauguration of new and improved undertakings of national importance, and included in his programme is the modernisation of 350,000 miles of roads. A start is being made on the laying out of several new motor roads, the improvement of 4,300 miles of existing roads, and the construction of 79 new road bridges. Docks, harbours, hydro-electric undertakings, reservoirs, afforestation, irrigation and railway developments all figure in the programme, the estimated total cost of which is £155,000,000.

* * * *

Vickers Steel

In Captain Malcolm Campbell's recent successful attack on the world's motor speed record, as in most of the recent record-breaking achievements on land and in the air, Vickers steel played an important part. The frame, axles and gears, the steel forgings in the gear box, and the crankshaft and connecting rod drop forgings of Captain Campbell's car are all of Vickers steel, manufactured at Vickers-Armstrongs' River Don Works.

It is interesting to note that the same steel was also used in Major Segrave's famous Sunbeam car with which he created the record now broken by Captain Campbell, and in the victorious Bentley car in the 24-hours' Grand Prix d'Endurance at Le Mans. The crankshaft and connecting rod drop forgings of the Napier " Lion " engine fitted to the Supermarine Napier S.5 that won the Schneider Trophy Race for Great Britain likewise were of Vickers steel and manufacture, as was also the crankshaft of the A.C. car with which the Hon. Victor and Mrs. Bruce averaged over 68 m.p.h. for 15,000 miles on the Montlhery course at Paris.

* * * *

Chaining up the Dome of St. Paul's !

In the course of the renovations that have been in hand during the past two or three years at St. Paul's Cathedral, stainless steel of Sheffield manufacture has been very extensively employed, and recently a big order has been placed for tie-bars to be used in bracing the masonry.

The most interesting application of stainless steel is in the strengthening of the dome. A great chain 450 ft. in length is to encircle the base of the dome and, in addition to strengthening, it will also serve to preserve its shape. The chain will weigh 30 tons and each of its links will be 15 ft. 4 in. in length and 3⅜ in. in width. The chain will be wrapped around the base of the dome four times to form four parallel lines of links.

This, by the way, is the largest stainless steel chain ever made.

The Port of Montreal

It will surprise many "*M.M.*" readers to know that Montreal, Canada's great grain port, stands either fifth or sixth in the list of the world's great sea ports. This is an amazing fact when one considers that Montreal is only open to shipping for eight months in the year and lies some 1,000 miles up from the mouth of the River St. Lawrence. It is not possible to give Montreal's true relationship to the other great ports, for the 1927 figures for Liverpool, London, Antwerp, Hamburg, and Shanghai are not yet available.

It is not in grain alone that Montreal deals, although this is its greatest traffic, 194,435,569 bushels having been handled last year, as compared with 135,897,822 in 1926. In the tonnage and number of ships cleared there was also a striking advance. Last year 7,798 ships totalling 17,322,444 tons used the harbour, these figures showing an increase of 180 and 655,120 tons respectively over 1926.

If port activity may be accepted as a reliable indication of the internal condition of a country, this advance of Montreal's power is splendid evidence of the prosperity of Canada. Montreal's own view of the future may be gauged from the increasing port development work that is in hand. New grain elevators are being built, extensions to existing structures are being put in hand to facilitate speedier handling, and most important of all is the rapid progress on the new bridge across the St. Lawrence. This will prove a vital factor in the development of the city and its surrounding areas, and will form part of a great arterial highway linking up with the United States.

* * * *

A British-Built American Liner

It is a rare privilege for an American shipowner to have his vessels built in a British yard. Particular interest attaches, therefore, to the " *Santa Maria,*" the first of two liners now approaching completion for the Grace Line of New York by the Furness Shipbuilding Company. The " *Santa Maria* " will be on her trials in the early part of this month and subsequently is to operate the Grace Line services between New York and the west coast of South America, via the Panama Canal. She is a comparatively large ship, being 486 ft. 6 in. in length with a beam of 64 ft. The gross tonnage is approximately 9,000 tons. The propelling machinery is of the twin-screw Sultzer type, each engine developing 4,000 b.h.p. In normal circumstances it is anticipated that a speed of 16½ knots will be secured.

A South Sea Loading Problem

Among the richest of the possessions that came under the dominion of the British flag after the Great War, Nauru and Ocean Island may be placed high. These South Pacific Islands, once the property of Germany, possess immense deposits of phosphates, commercially useful in many directions and valued at £4 per ton.

The development of the islands' resources presented a difficult problem. Neither possessed a harbour, and ocean-going vessels found it impossible to get in-shore to load. Transshipment from barges also involved an inevitably high bill of costs. The islands are surrounded by slowly shelving beaches running out considerable distances and at high tide these are covered only by a few feet of water. Their seaward edges are of coral and, dipping suddenly into deep water, they form a constant menace to ships lying close by. Steam must be kept up constantly to facilitate a quick getaway should nasty weather suddenly develop, not an infrequent happening among the islands.

The problem of ship loading has been solved in a very interesting manner. At Nauru are installed two immense swinging cantilever arms, each reaching out 200 ft. over the sea. Each will rotate through 180°, so that it can be secured inshore when necessary. A loading-out conveyor, capable of carrying 600 tons of phosphates per hour, is carried out on the arms and suspended over the holds of the ship lying off-shore. The supply of phosphates from the quarries to the storage bunkers on the seashore is brought down by conveyor also, and the arrangements are such that 12,000 tons are constantly on hand. Thus any ship can be provided with a cargo and loading commenced within a few minutes of its anchor being dropped.

At Ocean Island the conditions are more favourable to the construction of harbour works, and a loading jetty, 350 ft. in length, is in course of construction.

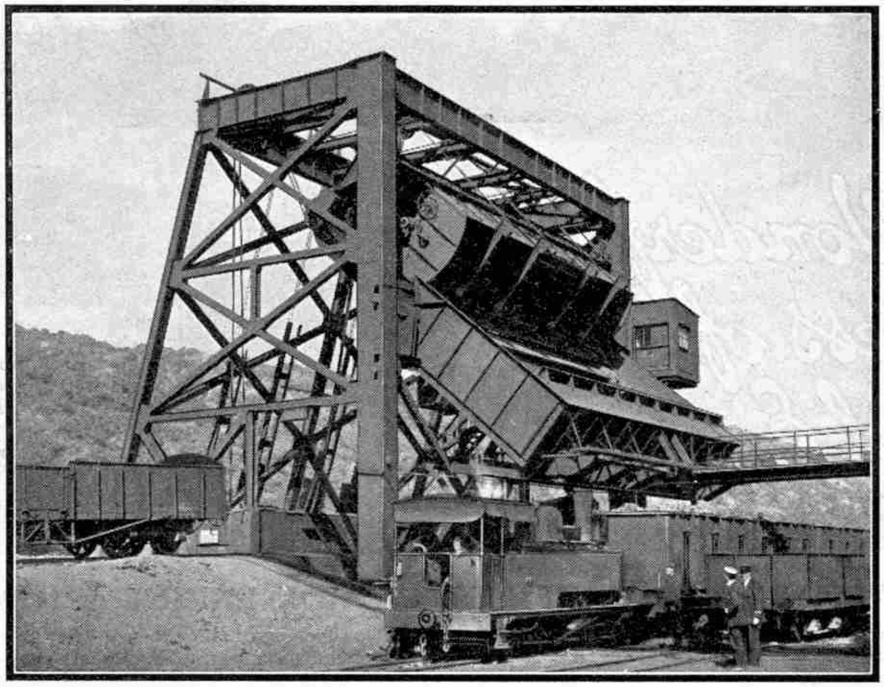
* * * *

New Avonmouth Dock

According to the programme at present laid down, the extension of the Royal Edward Dock at Avonmouth will be opened by the Prince of Wales on 23rd May. Work has been going steadily forward on the extension for over two years, and when it is finally completed an additional water area 21 acres in extent and six additional deep water berths will be available. Included among the new equipment and facilities that are being afforded in connection with the extensions is a granary capable of accommodating 20,000 tons of wheat. The estimated cost of the extensions is £2,000,000.

A New African Bridge

The bridge shortly to be constructed across the River Benue at Makurdi, approximately 290 miles inland from Port Harcourt, on the eastern section of the Nigerian Railway, will be one of the longest bridges in the whole of Africa when complete. It will comprise 13 spans with a total length of 2,584 ft. The work is being done by Sir William Arrol and Co.



Courtesy] [*South African Railways and Harbours*

An interesting Coaling Appliance at Durban, South Africa. As will be seen from our photograph the appliance lifts the coal wagon bodily

The "*Ile de France*"

The Compagnie Generale Trans-Atlantique of Paris have recently taken delivery of their new ship, the quadruple-screw liner "*Ile de France*," which has been built by the Societe de Chantiers et Ateliers de St. Nazaire (Penhoet). The new ship is the most important trans-Atlantic liner built since the War and is the largest mercantile vessel owned in France. It is somewhat larger than the "*Mauretania*," and on the list of ocean greyhounds ranks sixth in point of size, being exceeded only by the "*Olympic*," "*Aquitania*," "*Berengaria*," "*Leviathan*," and "*Majestic*."

The vessel is 791 ft. 10 in. in length, 91 ft. 10½ in. in breadth and 79 ft. 10 in. in depth. Its displacement is 40,300 tons and its turbines, of the direct-coupled type, develop 52,000 s.h.p. In its trials the "*Ile de France*" attained a speed of 24 knots, as compared with the designed speed of 23.5 knots.

* * * *

Italy's Merchant Fleet

One of the most interesting features of the shipping world within recent years has been the rapid growth of Italy as a maritime power. Within the past decade it has sprung from seventh to fourth place in point of size of commercial fleets. At the end of 1927 the Italian fleet comprised some 3,483,000 tons, as compared with Great Britain 22,074,000 tons, United States 14,670,000, and Japan 4,033,000.

The Sydney Harbour Bridge

In the "*M.M.*" for December, 1926, and January and October, 1927, we dealt extensively with the progress that was being made with the new bridge that is being built to span Sydney Harbour. Readers will be interested to know that the work is still progressing absolutely to schedule, and it is unlikely that anything now will occur to prevent the formal opening of the bridge taking place in October, 1931, at which time a British Empire Exhibition will be in progress in Sydney.

It is anticipated that the whole of the shore structures will be completed by the end of June next, and as we write the fourth of the five approach spans on the Sydney side of the harbour is being completed. The abutment towers and their pilings are well in hand and all the substructure is already in place. With the completion of the last approach span, work will commence on the throwing of the main span across the harbour. This great span, as readers will recall, will be a two-hinged arch, 1,650 ft. in length and 170 ft. above the water level at high tide.

Some idea of the huge nature of the contract Dorman, Long & Co. Ltd. are carrying out will be gathered from the fact that they found it necessary to erect a small town at Moruya to accommodate the men employed in quarrying and facing the granite required in the work and in preparing the ballast for the concrete. On the bridge and approaches over 1,200,000 bags of cement will be required, with 120,000 cu. yds. of sand and 260,000 cu. yds. of broken granite. The total weight of the steel in the bridge will be approximately 50,000 tons.

* * * *

New Naval Contracts

The Admiralty recently placed contracts for the construction of six new submarines. Vickers-Armstrongs of Barrow will build four, Cammell Lairds of Birkenhead one, and the other is to be constructed at Chatham Dockyard. The approximate cost of each will be £500,000. The vessels are to be of the new "P" class, as their names indicate: "*Perseus*," "*Poseidon*," "*Proteus*," "*Python*," "*Phœnix*" and "*Parthean*."

It is anticipated also that contracts for a flotilla leader and eight destroyers will be given out shortly. The flotilla leader will be named "*Codrington*," after the Admiral who commanded the British forces in the famous Battle of Navarino Bay. The destroyers' names will be: "*Acasta*," "*Achates*," "*Acheron*," "*Active*," "*Antelope*," "*Antony*," "*Ardent*" and "*Amazon*."

The STORY OF THE MOTOR CAR

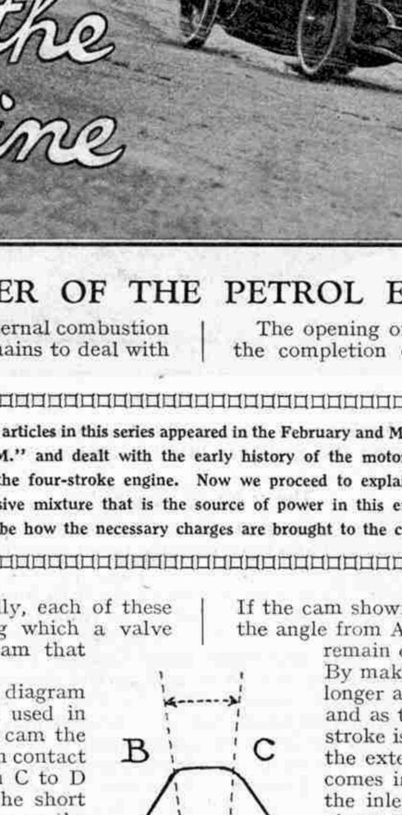
III. HOW THE POWER OF THE PETROL ENGINE IS OBTAINED

> The previous articles in this series appeared in the February and March numbers of the "M.M." and dealt with the early history of the motor car and the working of the four-stroke engine. Now we proceed to explain the nature of the explosive mixture that is the source of power in this engine, and to describe how the necessary charges are brought to the cylinder.

LAST month the course of operations in an internal combustion engine was fully explained, and it now remains to deal with the methods of supplying the necessary mixture of petrol vapour and air to the engine and of bringing about the explosion. Before dealing with these, however, further important points in connection with the actual design of valves and the timing of their action must be referred to. In previous descriptions of valve action we have simply said that the valve opens or that it closes. Naturally, each of these operations takes time, while the period during which a valve remains open depends on the design of the cam that actuates it.

The action of the cam may be realised from the diagram on this page, which shows a cam of the type used in ordinary engines. During one revolution of the cam the valve is opening while the portion from A to B is in contact with the valve stem, and closes while that from C to D is acting. It remains fully open only during the short period in which the portion from B to C is pressing on the roller, as during that period the valve is lifted to its greatest extent. A cam with a sharp point and steep sides will thus open and close a valve quickly and leave it fully open for a very short time, while the use of one with the bulge flattened will keep the valve open for a longer period.

In describing the cycle of operations in the four-stroke engine, it has been supposed that the periods of opening or closing of the valves coincide exactly with the strokes themselves. In practice this is not the case. The inlet valve, for instance, is allowed to remain open a little beyond the time required for the downward stroke of the piston. This is done to ensure that as much of the explosive mixture as possible is introduced into the cylinder, the momentum of the inward rush of gas through the valve being sufficiently great to counteract the pressure produced in the early stages of the return stroke of the piston.



Exhaust Cam showing how the timing of the lift and the period of full opening are fixed

The opening of the exhaust valve is made to commence before the completion of the explosion stroke and to continue for a little while after, that is, it remains open for a brief period during which the inlet valve is beginning to lift. In this way scavenging, or complete clearance of the products of combustion is effected.

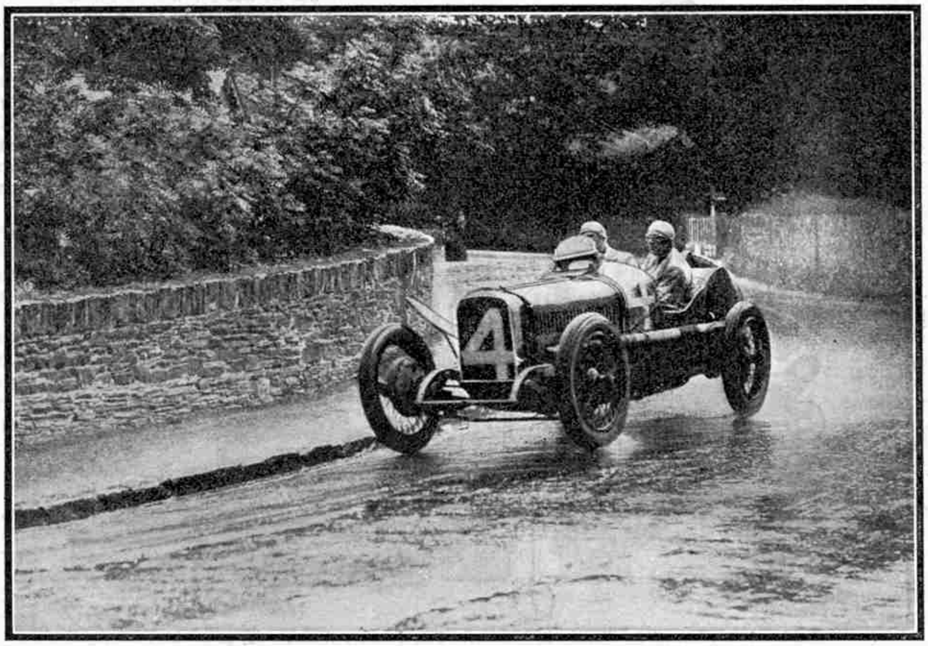
In order to cause the valves to open in the manner indicated, the position and extent of the bulge on the cam are varied. If the cam shown in the figure were used as an exhaust cam, and the angle from A to D were exactly a right-angle, the valve would remain open for the exact duration of the exhaust stroke. By making the angle larger the period of opening is made longer as required. The extension is made on both sides, and as the period of overlap with the preceding explosion stroke is greater than that with the following inlet stroke, the extension is greater on the side of the cam that first comes into contact with the valve parts. In the case of the inlet valve, we have seen that it should open at or about the beginning of the downward stroke, and continue to remain open after its completion. Accordingly, the angle from A to D is again greater than a right-angle and the bulge of the cam is extended rearward only, thus retarding slightly the closing of the valve.

It will have been realised that valve action is of great importance in a petrol engine, and it will not be surprising to learn that much care and thought have been applied to their construction and position in order to make them as efficient as possible.

Side-by-side valves were practically standard for a considerable period, and are still fitted to a very large proportion of engines. The two valves are arranged to control the ports, or openings, into two pockets on the same side of the cylinder casting, each pocket communicating separately with the cylinder space. The stems work in guides or steel bushes pressed or screwed into the cylinder casting, and are case-hardened.

The cams do not operate directly on the valve stems. Intervening tappets are provided and these often have roller ends to prevent friction and wear at the points in contact with the cams. It will be noticed, too, that the cams only lift the valves positively, afterwards merely leaving them free to return to their seats at the correct moment. To ensure that this return will take place smartly, springs are used. These are of the spiral type, enclosing the valve stem. The lower end rests on a collar held in position on the valve stem by a cotter passing through a slot in the stem, while the upper end presses on the cylinder casting. Thus the cam lifts the valve against the compression of the spring, and the latter operates to close it immediately the pressure of the cam relaxes.

There is an interesting difference between inlet and exhaust valves. Their stems must necessarily pass through the openings by which the explosive mixture enters or the burned gases leave. The inlet valve is kept cool in this manner, but the stem of the exhaust valve is exposed to the action of corroding gases at a very high temperature. This results in corrosion of the stems, or "pitting," as it is usually called, the name being given on account of the surface appearance presented by the stems, while the high temperature ruins the temper and hardness of the metal, and may eventually lead to breakage of the valve.



Major Segrave, driving a "Sunbeam," taking Braddon Bridge in an International Tourist Trophy Car Race at the Isle of Man

The manufacture of an exhaust valve that will stand up to its work has not proved very easy. Nowadays special steels containing as much as 25 per cent. of nickel or tungsten are used, whereas 3 per cent. nickel steel is quite satisfactory for inlet valves. Pitting may also take place on the exhaust valve seating and on the face or part of the valve that rests on it. Much of the efficiency of an internal combustion engine depends on a perfect fit between these two, and as pitting causes leaks with a lowering of the all-important compression, it is necessary from time to time to grind the planes of contact perfectly smooth with the aid of fine carborundum.

The shape of the cylinder head in engines with side-by-side valves is not ideal by any means. Great improvements in this respect may be made by using overhead valves, or valves that are inverted and placed in the cylinder head above the piston. To operate these the cams lift push rods attached at their upper ends to pivoted rockers that depress the valves to open them. Another method that is growing in favour is the use of an overhead camshaft, the drive being taken to it through an intermediate vertical shaft by means of bevel or worm gearing. In this case there are no heavy push rods to be lifted each time a valve opens.

In engines that are fitted with overhead valves there are no side pockets in which quantities of unused gas or products of combustion may hide. The space for the mixture is compact and the maximum power of the explosion is developed and transformed into useful work.

One disadvantage of overhead valves is that when a valve breaks the head falls into the cylinder and considerable damage is possible. This does not occur very often now that special nickel and tungsten steels have been developed for use in making the valves, and is more likely to occur in the high-speed engines of racing cars than in those of ordinary touring cars. Nevertheless, in the engines of a few cars the exhaust valve—the one most liable to fracture—is left in the usual position, while the inlet valve is inserted over it.

So far we have been dealing with poppet valves, by far the most popular type. At various times attempts have been made to devise other types to increase efficiency and to lessen noise. The older type of poppet valve was very noisy indeed, but improvements in the design of tappets and tappet rollers have resulted in much quieter engines.

Of the various types of valves that have been tried during the last 25 years or so, only the sleeve valve is of importance to-day. The original sleeve valve engine was the invention of C. Y. Knight, and to-day is used in the Daimler, Minerva and a few other cars. Briefly, the principle is that the piston is surrounded by two concentric cylinders or sleeves of light steel, which move up and down independently of each other. Slots cut in the sleeves are brought by their movements into position to allow mixture to enter or the exhaust gases to leave the cylinder when necessary.

Thus, during the inlet stroke of the piston, the two slots on the inlet side of the sleeves must coincide with that in the cylinder wall through which the mixture enters from the inlet pipe. During the next three strokes these ports must not coincide, but during the fourth, three similar ports on the exhaust side come into line. To effect this, the two sleeves are moved independently by short connecting rods from the cam-shaft, which is driven at half speed by gearing connected to the crank-shaft.

The detachable cylinder head of the Knight engine is spherical and the plug is set centrally. The shape of the combustion chamber is therefore ideal, and a highly efficient engine is the result. In addition, the sleeve valve engine is exceedingly quiet and the noise made by the sucking action of the engine on the petrol is plainly audible even at high speeds.

There is another type of sleeve valve engine in which only one sleeve is used. In order to bring the openings in a single sleeve opposite to those in the cylinder walls at the right moment, and then only, a much more complicated type of movement is necessary. In the Burt-M'Collum engine, first used on the Argyll car of pre-war days, the ports are shaped like triangles with the upper part removed, and the sleeve is not only moved up and down as in the Knight engine, but is rotated as well. To accomplish this, a pin attached to the sleeve by a universal joint is set eccentrically on the face of a disc rotated at half speed from the crank-shaft by skew gearing. The actual path of any point on the sleeve is elliptical. It will be noticed that no springs are necessary in an engine having sleeve valves of either type, the valve always being positively placed exactly where it is needed by the form of drive adopted.

We must now pass on to deal with the explosion that is the source of power in the internal combustion engine. There are many possible fuels that may be used in a modern four-stroke engine. These include coal gas, water gas and producer gas, all of which may be used to run motor car engines, but the most suitable form of fuel for an automobile as distinct from a stationary engine is a liquid that is easily vaporized, for its storage is a comparatively simple matter.

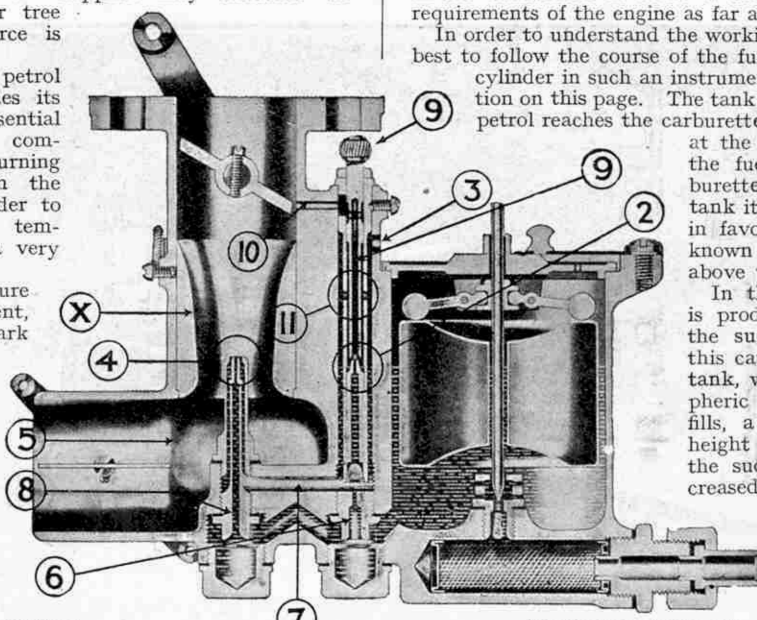
Of the liquids available, the one usually adopted is petrol, the portion of petroleum that boils at temperatures up to about 150°C. The oil that gushes out of the wells of the United States, Mexico, Persia and other places is a very complex liquid containing chiefly various hydrocarbons, or compounds of carbon and hydrogen. The simpler of these compounds have low densities and boiling points, and on distillation of the petroleum they are the first to be collected. They not only vaporize easily, but a mixture of them with air ignites readily, thus making them very suitable for motor car engines.

The heavier fractions of the petroleum distillate are paraffin or kerosene, and the still heavier oils that are used to-day in the Diesel engine. In addition, benzol obtained from coal by distillation, as described in articles in the "*M.M.*" last year, is largely used in internal combustion engines, either alone or mixed with petrol, while a fuel that may be of great value in the future is alcohol.

The power obtainable from alcohol is appreciably less than that derived from an equal weight of petrol, but this fuel has the great advantage of providing the only means at present known of making the energy of the Sun available within a reasonably short period. Coal and petrol may be regarded as forms of solar energy, but ages have been necessary to effect the transformation, and it is certain that there is a definite limit to the amount of these available. Alcohol, on the other hand, is obtained by distillation or fermentation of vegetable compounds. Thus methyl alcohol or methanol is formed when wood is distilled, while ethyl alcohol is the product of fermentation of fruit juices containing sugars. Large annual supplies may therefore be produced, while the plant or tree that is their immediate source is either unaltered or replaceable.

For complete combustion petrol requires from 14½ to 15 times its own weight of air. The essential requirement of an internal combustion engine is that the burning should spread outward from the spark with great speed in order to produce a large increase in temperature and in pressure in a very short time.

In a mass of explosive mixture in which there is no movement, the explosion started by the spark spreads out in spherical waves at a very great speed, the latter being dependent on the pressure and the strength of the mixture. The wave travels more slowly in mixtures weak in petrol and increased pressure results in increased speed of transmission of the combustion. The latter fact accounts, in part, for the great increase in efficiency brought about by compressing the mixture before firing. The gas nearest the plug, however, burns with practically no increase in pressure, as it is surrounded by an elastic cushion of unignited gas, and it has been found that even in a rich mixture the maximum pressure may not be developed until an appreciable time has elapsed.



Courtesy] [*Zenith Carburetter Co. Ltd.*

Sectional diagram of the Zenith Carburetter. Petrol enters through the gauze filter on the right and is sucked through the various jets by the rush of air entering through the wide tube on the left. The supply to the cylinders of the resulting mixture is controlled by the driver by means of the throttle above the choke tube

To the eye and ear the explosion may seem instantaneous and the actual time may appear very short when measured in seconds, but in a high-speed internal combustion engine the whole expansion stroke may take only one-fiftieth of a second, while the actual explosion must take even less time than this. This would be quite impossible were it not for the fact that the charge in the cylinder is in rapid movement when fired by the spark. Turbulence, as it is called by engineers, is a necessity as it ensures that the igniting flame reaches all portions of the charge with maximum rapidity. The practical effect of this was shown in an interesting experiment by Clerk, the inventor of a famous two-stroke engine to which we shall refer later. He arranged the valve action and spark timing of an engine in such a way that the gaseous mixture was fired after being compressed three times with the valves closed, instead of once. He thus allowed time for the initial turbulence of the mixture to be lost. The process of combustion was then found to be slow, and the action of the engine wasteful and inefficient. In practice, turbulence is secured by the rush of the mixture in entering the cylinder, and the inlet ports must be so designed that the rush is not checked in any way.

The instrument that introduces the charge to the cylinder is the well-known carburetter. In a four-cylinder engine making 2,000 revolutions per minute, there are two explosions in each revolution. This means that 4,000 charges of mixture must be delivered to the cylinder in the same period. Thus the carburetter is a very important part of the engine.

In early forms of the carburetter air was passed over the surface of petrol, and in so doing carried along with it petrol vapour. To assist in vaporizing the petrol various devices were used. In some cases wire gauze wet with the petrol was placed in the path of the air, and in others wicks were used. To-day jets are almost universal, these being supplied with petrol from a chamber in which a constant level of petrol is maintained automatically. This is known as the float chamber. A space in which the vapour is thoroughly mixed with air and a throttle to control the supply of the mixture to the cylinders complete the carburetter in its simplest outline.

In common with other features of the petrol engine the carburetter has been greatly improved, chiefly with a view to obtaining the best results under varying conditions. The petrol demands of an engine running under load and at high speed are quite different from those of one that is idling, or running slowly without load, while a mixture richer in petrol is necessary for starting a cold engine than for keeping one running after it has been thoroughly warmed up. Slow-running jets and extra air supply for running on the level are therefore often incorporated in the carburetter in order to satisfy automatically the varying requirements of the engine as far as possible.

In order to understand the working of a modern carburetter it is best to follow the course of the fuel from the storage tank to the cylinder in such an instrument as that shown in the illustration on this page. The tank may be on the dashboard, when petrol reaches the carburetter by gravity flow, or it may be at the rear of the car, in which case the fuel must be lifted to the carburetter either by air pressure in the tank itself, a method not now greatly in favour, or by the use of a device known as the "Autovac" placed above the carburetter level.

In the Autovac a partial vacuum is produced in a metal chamber by the suction of the inlet pipe, and this causes petrol to flow in from the tank, where it is subject to atmospheric pressure. As the chamber fills, a float rises until at a certain height it operates valves to shut off the suction and admit air. The increased pressure then opens a valve leading into an outer chamber, into which the petrol flows to be delivered by gravity flow to the carburetter.

On reaching the carburetter the petrol first enters the float chamber, so called because it contains a cylindrical metal vessel floating on the petrol. When petrol first enters, the float rises until the former has reached the desired level. The float then actuates toggle levers that press a needle valve on to its seat where the petrol pipe is attached to the float chamber, thus cutting off the supply. A fall in the level of the fuel, and therefore of the float, results in the opening of the needle valve to admit a further supply.

At the base of the chamber is a second pipe leading to the jet. The orifice of the latter is very slightly below the level of the petrol in the chamber, and is placed in the path of the air that is being sucked into the cylinder. The action of the air rushing past the orifice causes a fine stream of petrol to issue from the jet, the tube in the region of the jet being narrowed down to give the air an increased speed at that point in order to atomise or break up the petrol into the fine drops constituting the vapour. Above this point the tube widens again gradually and here the vapour and the air are thoroughly mixed together before passing through an opening that may be closed entirely or regulated by the driver of the car at will.

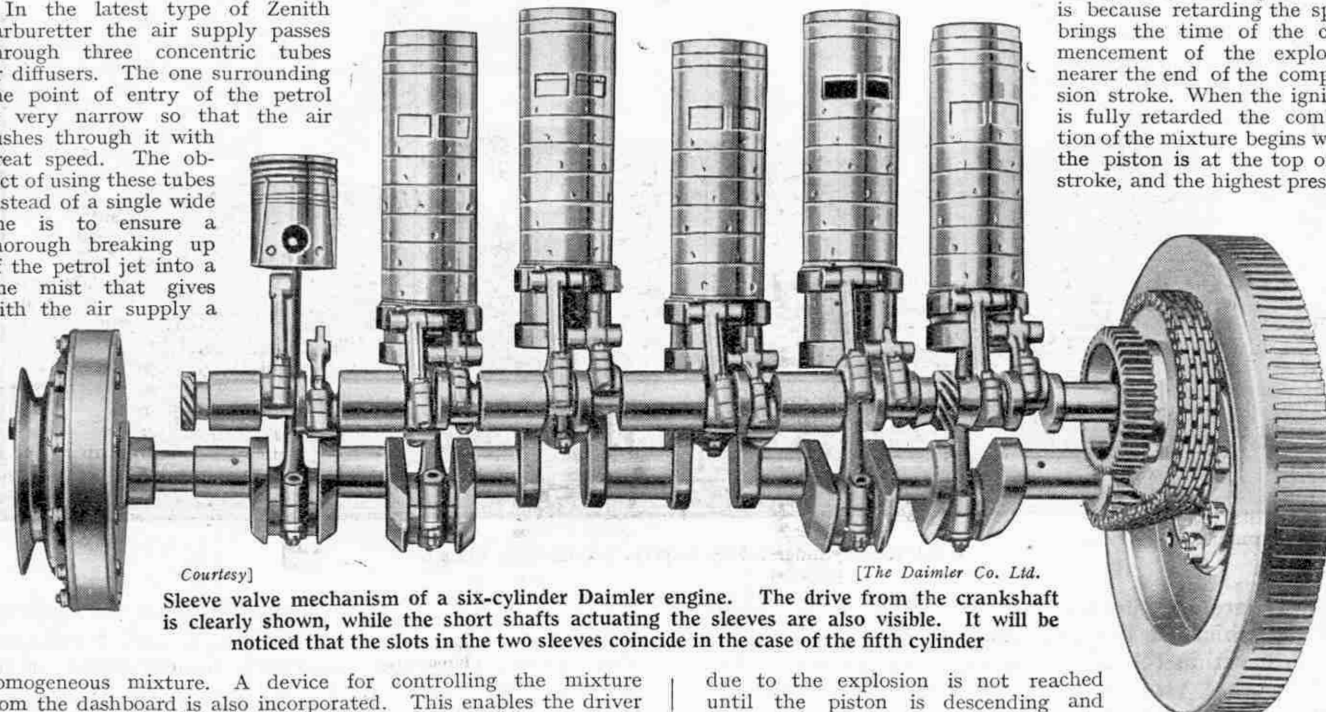
In order to make a carburetter of this type sufficiently elastic to satisfy the requirements of an engine under all conditions, other jets are added. A typical example is the Zenith carburetter shown in section on this page. In this two additional jets, known as the compensator jet and the slow-running jet, are used. The compensator jet is formed by enclosing the main jet within a slightly wider tube, as shown in the circle marked 4 on the diagram, and is supplied separately from a well, 7, that always contains a little petrol. The tube 6 through which its supply is obtained is also shown.

The supply of petrol obtained from this jet is not increased by the greater suction resulting from high speeds, as the rate of flow of petrol into the well is restricted to the volume that passes through the narrow tube 6. It will be seen that of the two jets so far considered, one tends to supply more petrol than is required at high speeds owing to the greatly increased suction, while the other tends to supply less. In this way compensation is effected, and the mixture is kept approximately correct over the whole range of engine speed.

The third or slow-running jet 2 obtains its supply from the well of the compensator jet and opens into the inlet tube at the level of the throttle. When the throttle is slightly open, the speed of the air supply passing on to the cylinders through the exceedingly narrow opening is very great, and the powerful suction set up produces a spray of petrol through the narrow slow-running jet. The supply may be controlled by means of the knob numbered 9, which alters the effective area of the jet in order to give the most economical mixture and the smallest amount of fuel necessary to keep the engine just ticking over.

Easy starting is obtained by the use of an air strangler in the air inlet. When this is closed the whole suction of the engine is concentrated on the petrol supply, thus giving a rich mixture that explodes readily even during the coldest weather. It will be noticed also that the petrol enters the float chamber through a filter tube of fine wire gauze.

In the latest type of Zenith carburetter the air supply passes through three concentric tubes or diffusers. The one surrounding the point of entry of the petrol is very narrow so that the air rushes through it with great speed. The object of using these tubes instead of a single wide one is to ensure a thorough breaking up of the petrol jet into a fine mist that gives with the air supply a homogeneous mixture. A device for controlling the mixture from the dashboard is also incorporated. This enables the driver to use a rich mixture for starting purposes.



Courtesy] [*The Daimler Co. Ltd.*

Sleeve valve mechanism of a six-cylinder Daimler engine. The drive from the crankshaft is clearly shown, while the short shafts actuating the sleeves are also visible. It will be noticed that the slots in the two sleeves coincide in the case of the fifth cylinder

Another type of carburetter uses piston throttles, which uncover different jets as they move, in order to give a total jet orifice proportionate to the requirements of the engine. In still another type a petrol jet of fixed size is used and the air supply is regulated. In one carburetter working on this principle the variations in suction of the engine cause the rise and fall of leather bellows connected to a metal cylinder that is thus made to uncover the correct proportion of the air inlet tube. A needle attached to the bellows works in a cylindrical jet and regulates the amount of petrol at the same time, thus maintaining a correct proportion between the two constituents of the mixture.

A point of some importance in the development of the power of the explosion is that the gas produced by burning must be swept out of the cylinder as far as possible. When the piston is at the top of its stroke there is still a clearance space left above it and the gas in this space cannot be got rid of in the ordinary manner. It thus remains behind to dilute the next incoming charge of gas and so reduces power output.

At one time the loss due to ineffective scavenging was so great that two extra strokes were suggested in which clean air was drawn into the cylinder and then expelled in order to carry off more of the burnt gas. In modern engines the clearance left is much smaller and scavenging is made more efficient by taking advantage of the turbulence of the incoming mixture. The small amount of burnt gas thus left in the cylinder is of very little importance.

Several other factors are concerned in the problem of obtaining the best results from the explosion of the vapour. The time at which the spark is fired in the mixture, for instance, has a very great influence on the power output of an internal combustion engine. Theoretically the explosion should take place at the moment when the piston has finished the compression stroke and is on the point of commencing the third stroke of the cycle, but theoretical requirements must be modified to suit practical conditions.

The need for modification in the present case is due to the fact that time is required for the development of the power of the explosion. As we have already seen, the time required is very small indeed, but to enable the maximum pressure to be exerted on the piston at the commencement of its downward stroke the explosion must be started a little earlier, and in practice the spark that ignites the vapour is flashed across the terminals of the sparking plug before the end of the compression stroke.

Whatever means of producing the spark is used—the chief methods will be described next month—a device for altering the time at which the spark occurs is always incorporated, and a few trials with the ignition control will demonstrate the effect of varying the time. With the engine running at a moderate speed, movement of the ignition lever from the "advanced" to the "retarded" position will result in a noticeable reduction of the speed of the engine. This is because retarding the spark brings the time of the commencement of the explosion nearer the end of the compression stroke. When the ignition is fully retarded the combustion of the mixture begins when the piston is at the top of its stroke, and the highest pressure due to the explosion is not reached until the piston is descending and the gases in the cylinder are already expanding. Much of the power of the explosion is thus wasted, as the benefit of the compression is partly lost.

It has already been suggested that in normal running the spark must be advanced. It is retarded only when starting the engine or when speed is lost in climbing a hill. As engine speed is reduced the time required for each stroke is reduced. The proportion of the stroke by which the spark must be advanced must also be reduced therefore in order to prevent the mixture from being fired too soon.

If the ignition lever is allowed to remain in the advanced position as the speed of the engine is reduced on a hill, a sharp metallic ring is often heard from the engine. This is called "pinking," the explosion being easily distinguished from a normal one by the sharper noise.

Pinking may be prevented by retarding the spark so that the charge of explosive mixture is expanding when the full force of the explosion is developed. This is wasteful as regards power, a consideration that also applies to other methods by which pinking may be prevented, and attempts have therefore been made to find a fuel with which it does not occur. A mixture of benzol and petrol is useful for this purpose while various liquids are now available, including the well-known Ethyl, that prevent pinking when added to petrol in very small proportions.

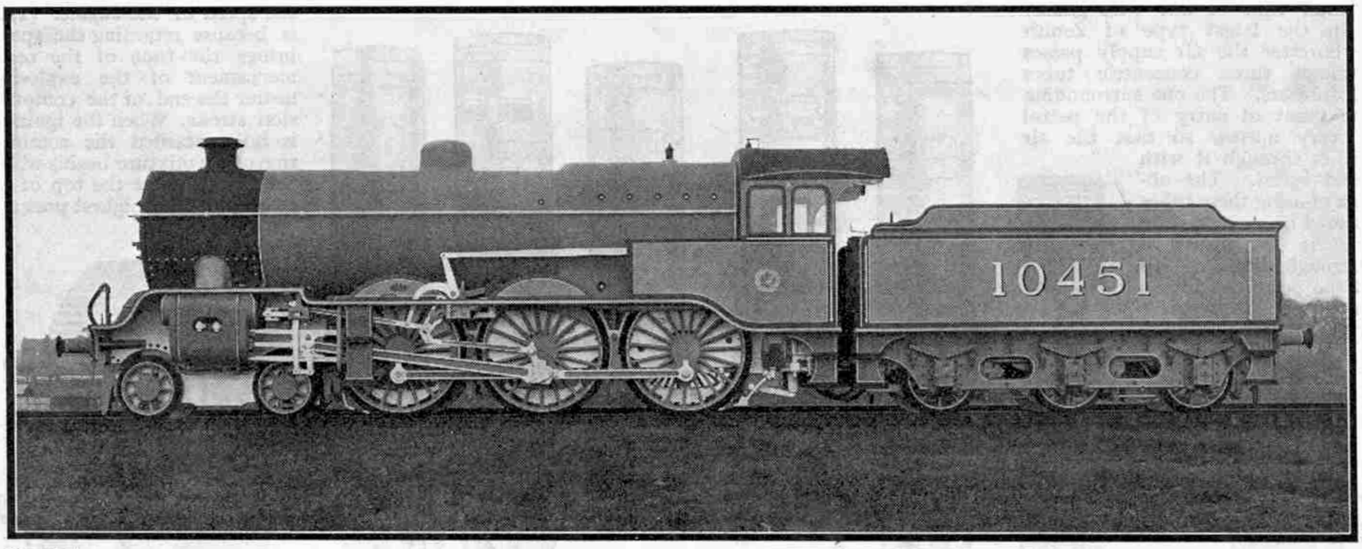
The chief constituent of Ethyl is a compound known chemically as lead ethide, the addition of only a quarter of one per cent. of which to petrol gives a reliable anti-pinking mixture. In practice even less than this is used, the proportion recommended for general use being usually only one part in 1,800 parts of petrol.

The extraordinarily small amount of this liquid that gives protection from pinking is perhaps its most remarkable feature. It is just as well that a small proportion is effective for otherwise the natural disadvantages of lead ethide might have prevented Ethyl from coming into use. In itself lead ethide is poisonous and its use in large proportions would result in the deposition of lead within the cylinder. Difficulties of this kind have now been successfully overcome and Ethyl petrol is coming into general use. We hope to give further information regarding this remarkable liquid in a later article.

FAMOUS TRAINS: XVI.

The Manchester "Club" Trains, L.M.S.

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



Courtesy] [L.M.S.

4-6-0 four-cylinder L.M.S. Express Locomotive, Class 8

SUCH are the modest dimensions of these islands on which we live that most of our biggest cities are within tolerably easy reach of the sea. The result is that very many commercial people take advantage of this accessibility by carrying on their business in their respective cities, but living at the seaside. This is a habit that the railway companies, not unnaturally, like to encourage, for it means a considerably longer journey, and therefore a proportionately higher season ticket rate, than if the same people were run merely to and from the city suburbs.

Thousands of London business men, for example, come up daily from places as far afield as Southend, Brighton, Eastbourne, Worthing, Folkestone, Margate, Ramsgate, Clacton and Walton, ranging in distance from 35 to 75 miles away, and taking in time from one to two hours on the journey in each direction. Glasgow similarly has within reach the beautiful resorts on the Firth of Clyde, and Leeds and Bradford people do not find Scarborough or Bridlington too far away. Liverpool is as nearly on the sea as makes no matter, while Birmingham, alone among the big cities, finds the sea a little too remote for residential purposes.

But it is with Manchester that we are concerned this month. The business Mancunian has a fine stretch of coast from which to choose. His favourite seaside places of residence are Blackpool, with its outlying suburbs of Lytham and St. Anne's, and Southport. Rhyl, Colwyn Bay and Llandudno also claim their share of this daily city-coast traffic, and even Morecambe and the lakeside resort of Windermere are not too distant. The whole of this traffic is dealt with at the two adjacent stations of Victoria, once the headquarters of the Lancashire and Yorkshire Railway and now of the Western "B" Division of the L.M.S. system, and Exchange, the one-time property of the late London and North Western Railway. Work is now in progress connecting the two terminals directly together, and when it is finished one of the remarkable features of the joint station will be a continuous platform of the enormous length of 2,196 ft. Woe betide the unfortunate seaside resident, in days to come, who arrives at the station at the last minute to find his coast-bound train at the opposite end of this platform from the one he expected! But we must hope that he will not do anything so foolish.

Leading Dimensions of Locomotives working L.M.S. Manchester "Club" Trains

	4-cylinder 4-6-0 Horwich type.	2-cylinder 4-6-0 "Prince" class.
Cylinders, diameter	(4) 16½ in.	(2) 20½ in.
" stroke	26 in.	26 in.
Driving Wheels, diameter	6 ft. 3 in.	6 ft. 3 in.
Heating Surface, Firebox	176 sq. ft.	133 sq. ft.
" " Tubes	1,717 "	1,440 "
" " Superheater ...	430 "	325 "
" " Total	2,323 "	1,898 "
Firegrate Area	27 "	25 "
Working Steam Pressure (per sq. in.)	180 lb.	175 lb.
Tractive Effort (at 85% Wkg. Press.)	29,470 "	21,670 "
Adhesion Weight	59.3 tons	46.2 tons
Total Engine Weight	79.1 "	66.5 "
Water Capacity of Tender	3,000 gals.	3,000 gals.
Coal " "	6 tons	6 tons
Weight of Engine and Tender (full) ...	119.1 "	106.0 "
Length " " (overall)	60 ft. 2 in.	—

Note: Dimensions of 4-cylinder 4-6-0 "Claughton" Class and Midland 3-cylinder 4-4-0 compound type have been given in previous articles of this series.

Of the two stations, Victoria is considerably the larger. Its accommodation was greatly increased early in the present century, when a new terminal portion, with 10 platforms, was added on the south side for the use of the trains to and from the Oldham, Stalybridge and Bury directions, the last-named of which are now worked electrically. There are now 17 platforms, of which 11 are terminal, and 6 are through from one end of the station to the other. A singular feature of the working is the manner in which trains to and from the east end of Exchange Station pass through the centre of Victoria, between Nos. 11 and 12 platforms, over relief tracks not provided with platforms; the same lines are used by freight trains that require to pass through Victoria.

An ingenious part of the equipment at Victoria is the overhead luggage carrier, which runs right across the station just under the roof. It is electrically worked, and the operator, who has a precarious perch below the carrier, is able, by suitable hoisting tackle, to lower his capacious luggage basket on any platform and, when it has been filled, to lift it and whisk it away to any part of the station required, without delay and with a minimum of effort.

Courtesy] [L.M.S.

Blackpool "Club" Train

Exchange station is on a much smaller scale and has only five platforms. It is No. 3 at Exchange, coupled with No. 11 at Victoria, that will ultimately make the 2,196 ft. platform, but by means of suitable cross-overs it will be able to accommodate two or three trains simultaneously. So the two stations have between them 22 platforms, and when united will make one of the largest stations in the country, though from the point of view of compactness the combination could hardly bear comparison with, say, Waterloo terminus in London.

Shortly after four o'clock in the afternoon we make our way past the Cathedral at Manchester into Exchange Station, for the departure of the first of the "club" trains. This reminds me that I have not yet explained what a "club" train is. A considerable number of years ago certain Blackpool residents formed a kind of travelling club, and requested the Lancashire and Yorkshire Railway authorities to provide them with a saloon coach in which they might travel together in a comfortably "clubbable" fashion. The railway people fell in with the idea, and the "club" saloon was duly included in the formation of the chosen Manchester-bound express in the morning, and a down evening express leaving shortly after 5 p.m.

Since then on all the chief residential expresses between Manchester and Blackpool and Manchester and Southport very fine open corridor coaches have come into use, and the trains are made up thus from end to end. Thus there is not, perhaps, the same call for the club saloon as once there was, but it is still run, and the club members are assured of privacy for their journey. The same idea has been taken up since by residents at Llandudno and at Windermere, to both of which popular resorts club saloons now run.

The actual "club" trains are the 4.30 p.m. from Exchange to Llandudno, the 5.5 p.m. from Exchange to Windermere, and the 5.10 p.m. from Victoria to Blackpool; but the 5 p.m. from Victoria to Southport and the 4.55 and 5.2 p.m. from the same station to Blackpool also have sufficient of a "club" character to be included in our survey. The collection of coast-bound expresses leaving Victoria in this 15 minutes is indeed remarkable, and still more so is the character of the passengers, as from two-thirds to four-fifths of the coaches provided on each of these trains are first-class.

The first of these expresses to be away is the 4.30 p.m. from Exchange to the North Wales coast. At one time it was timed at a rather higher speed than now, as only 48 minutes were allowed for the 40 miles between Manchester and Chester and 34 minutes for the 30 miles on to Rhyl, which, with a four-minute halt at Chester, meant 86 minutes from Manchester to Rhyl. To-day, with no stop at Chester and a one-minute halt at Prestatyn instead, the same journey needs 90 minutes. In earlier days the departure time was 4.55 p.m., but it is now 25 minutes earlier, and an additional express leaves at 4.40 p.m. for the same direction, making calls at Warrington and Chester.

For the working of the train, which consists of 10 up-to-date bogie vehicles, amply provided with lavatory accommodation but non-corridor, the engine attached was until recently one of the handy North Western "Prince of Wales" type 4-6-0's. Despite their moderate weight of 66 tons, apart from tender, the "Princes" have shown themselves capable of a great variety of passenger work, even up to and including fast and heavy passenger expresses, and their scope is best illustrated by the nickname "Maid-of-all-Work." With a load of 300 tons like this, over what is throughout an easy road, our "Prince" will experience no difficulties. Lately, however, three "Claughtons" have been transferred to Llandudno Junction for the purpose of working the train.

Soon after leaving Exchange, the Llandudno "club" train passes on to the historic Liverpool and Manchester route of 1830, now all but a century old. Until we leave it, at Earlestown Junction, the line is nearly dead level, and as we are clearing the eastern suburbs of Manchester, at Patricroft, speed should be rising above the "sixty" line. For miles now we run across the bleak spaces of the famous Chat Moss, which gave George Stephenson such untold trouble in the laying of the Liverpool and Manchester line. It was only by laying great "rafts" of interwoven hurdles, brushwood and heather over the treacherous surface, and then building up his embankment on them as a foundation, that Chat Moss was conquered.

Between Kenyon Junction and Newton-le-Willows we pass over the West Coast main line, here in a deep rock cutting, and brakes are immediately applied for Earlestown Junction, 16½ miles out, passed at 4.50 p.m. Here we curve off sharply to the left, in order to run down at 1 in 88 to join the main line just mentioned, at Winwick Junction. Our use of it will be brief, however, for after three miles into and through Warrington, we again diverge a mile beyond for the Chester line. In this last mile we rise sharply at 1 in 135 out of Warrington on to the fine four-track bridge that spans the Manchester Ship Canal, at a height sufficient to enable large sea-going vessels to pass underneath. One of the heavy expenses connected with the construction of the Ship Canal was that of providing bridges for all the railways crossing its route, including the provision of the lengthy embankments leading up to them—one of great size at Runcorn, two at Warrington, and two for the Cheshire Lines tracks near Irlam.

Courtesy] [L.M.S.

Platform 12, Manchester Victoria Station

From the Ship Canal bridge we diverge immediately to the left to join the old Chester route, and then begin to rise steadily. In the course of the ascent we cross over the route we have just left and continue mounting until we reach Halton Tunnel, which carries us through the crest of the ridge. Above the tunnel, which is just over a mile in length, runs the London-Liverpool main line of the L.M.S. From Halton the gradients are mostly falling past Frodsham, where the line is carried by a fine brick viaduct across the valley of the Weaver, and Helsby to Chester. The passage of the General Station at Chester at 5.21 p.m. is beset with sharp curves at both ends and is a slow business, but a few moments later we are gaining speed through the tunnels in "Chester Cutting," and are doing round about 60 again as we approach Sandycroft.

Once more there is a long level stretch ahead, first by the left bank of the Dee, and then along the North Wales coast. At Shotton, by the way, there is an "exchange" station with the London and North Eastern Railway, which runs overhead. Probably few people are aware that the L.N.E.R. have lines in North Wales. Originally these belonged to the Wrexham, Mold and Connah's Quay Railway, which was absorbed by the Great Central. This little section of the L.N.E.R. is completely isolated from the parent system, to which access is obtained only over the Cheshire Lines Committee's tracks. But meanwhile we are hastening on past Flint and Holywell, and at 5.52 p.m. we reach Prestatyn, having covered the 66½ miles from Exchange in 82 minutes. Over the rest of the journey we have no time to dwell. Stops are made at Rhyl, Abergele, Colwyn Bay and Llandudno Junction, and by 6.43 p.m. the Llandudno "club" train is at rest in Llandudno, 87¾ miles from Manchester.

Well before this time the Blackpool and Southport "club" trains have finished their shorter journeys. Of these the 4.55 p.m. is usually the lightest, eight corridor coaches, two of which are destined for Fleetwood, sufficing for the greater part of the year. The engine we shall probably find to be one of the fine Horwich-built four-cylinder 4–6–0's of "Class 8," many of which work on these coast services. For an engine of such power, a train of some 215 tare tons—with passengers not more than 230 tons or so—is but a featherweight, despite the difficult character of the journey. By comparison with the journey just mentioned, this one includes a number of very heavy gradients, as well as severe speed restrictions at various points.

Over the extraordinarily sinuous section of line from Manchester through Salford to the "Windsor Bridge No. 3" Junction at Pendleton we gain speed, in preparation for the stiff climb past the station bearing the singular name of "Irlams-o'-th'-Height," up to Pendlebury. This is for two miles at 1 in 99, and will bring down our speed to about 30 or 35 m.p.h. After this there follow some sharp undulations, notably a steeply-graded dip on to the troughs at Walkden, and 2 miles of falling grades also to Atherton, at between 1 in 232 and 106; but of these, owing to constant trouble with subsidences caused by colliery workings underneath, our driver is unable to take full advantage. Then comes a bad slack for the junction at Dobb's Brow, where we leave the Liverpool line and turn northward. This first 12 miles has occupied 19 minutes.

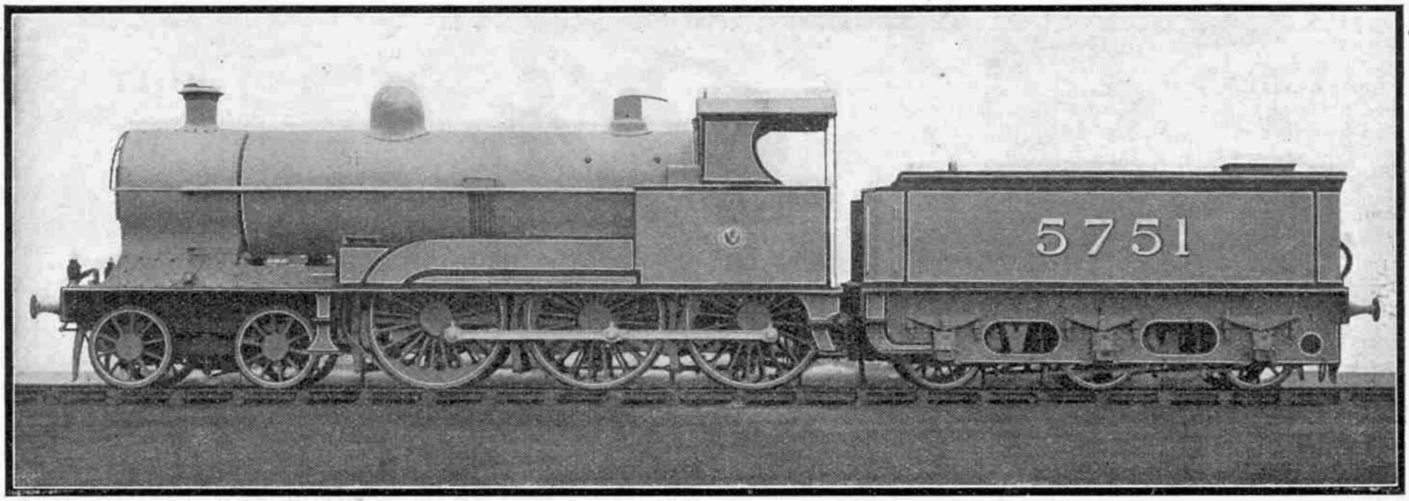
We are now running over a short spur line that carries us across to the Preston line proper, from which we diverged at Pendleton. It is presumably to ease the congestion of the latter route, which has but two tracks, that the majority of the Blackpool expresses are booked to take the much harder four-track route through Atherton. The Hilton House spur, which is tremendously steep, rising for 1½ miles at between 1 in 51 and 74, and for another three-quarter mile at 1 in 204, avoids Bolton, and brings us back to the Preston line at Blackrod, whence we run on through Chorley to a junction with the West Coast main line at Euxton. After slackening severely here, to 25 m.p.h., a few more miles of downhill running prepare us for the even worse slowing through Preston, which we pass at 20 m.p.h. in 44 minutes from leaving Victoria, 29¾ miles distant.

After the steep pull out of Preston the difficulties of our engine are at an end, as there is little in the way of grades from there on to Blackpool. After eight miles of four-track line, over which a further set of track-troughs, near Salwick, enables our engine to pick up an additional supply of water, we approach Kirkham Junction at high speed.

From here three routes are available to Blackpool, and it is interesting to note that all three are used in succession by the 4.55, 5.2 and 5.10 p.m. trains. We are to curve to the right, taking the northernmost, to the Talbot Road Station, on the north side of Blackpool. The 5.2 will take the central route, direct to Waterloo Road and from there into the Central Station. This is both the shortest in distance and the most recent in construction, but as it serves Blackpool only, and none of the outlying towns, its use (with the exception of this 5.2 p.m. express) is confined to special and excursion trains. Then comes the 5.10 p.m., which follows the southernmost route into Blackpool, curving round in a great loop to reach Lytham, Ansdell and St. Anne's on the way to Waterloo Road and Central Station.

For the 14½ miles from Preston to Poulton the 4.55 p.m. express is allowed 17 min., and we make our first stop, 44¼ miles from Manchester, 61 minutes after starting. Here the two through coaches for Fleetwood are detached from the rear, and with six coaches left we pass on to Bispham, where a brief stop is made, and Talbot Road, arriving at 6.6 p.m. We have covered a total distance of 47¼ miles, and the comparative slowness of the running must be put down to the difficulties of the route.

Between the 4.55 and 5.2 Blackpool expresses there comes the 5 p.m. Southport express. This is a considerably heavier train, the winter formation amounting to 11 open corridor coaches, often expanded in summer to 12 or 13. This also is usually



Courtesy] [L.M.S.

4-6-0 L.M.S. Express Locomotive, "Prince of Wales" Class

a "Class 8" 4-6-0 turn, but I was greatly astonished to see the train go out of Victoria the other day with a Midland 4-4-0 compound in charge. Over such gradients as those between Manchester and Wigan, this 300-ton train is a tremendous load for a compound, and I should dearly have liked to see how the engine fared on Pendlebury bank, but unfortunately time did not permit.

The Southport express follows close on the heels—or, I suppose I ought to say, the wheels!—of the 4.55 to Blackpool, passing Dobb's Brow Junction five minutes later, at 5.19 p.m.; but no reduction of speed is needed here, as the Southport train takes the straight line on to Hindley, where it diverges from the Liverpool line to the left to get through Wigan. The passage through Wigan, which is approached by extremely sharp curves, must not be made at more than 30 m.p.h. and, with such a load as this, 27 minutes from Manchester proves to be none too great an allowance for the distance of only 16½ miles. Rising grades follow to Gathurst, but after that all is plain sailing, and there is a fine straight stretch across the level marches of West Lancashire slightly in favour of the engine, which enables a speed of over 60 an hour to be maintained for some miles, especially if any time has been lost on the congested and difficult earlier stages of the run. St. Luke's, 32½ miles from Manchester, is reached in 47 minutes, and the main station at Chapel Street, ¾-mile further, at 5.51 p.m.

We now have to follow the fortunes of the 5.2 and 5.10 p.m. Blackpool trains. The former has an eight-coach formation of the very latest L.M.S. open corridor stock, and is generally hauled by a 4-4-0 Midland compound. To save clashing with the Southport train, it is taken over the right hand, or "fast" lines from Victoria to Windsor Bridge No. 3 Junction, and from there over the old main line to Preston *via* Bolton. This is a mile further than the Atherton route, but the gradients are much easier, the average of the rise from Pendleton to Bolton being about 1 in 200. The chief obstacle is the long and severe slowing through Bolton, to 20 m.p.h. The timing is very easy, however, 20 minutes being allowed to clear Bolton, 10¾ miles; 47 minutes to Preston, 30¾ miles; 71 minutes to the stop at Waterloo Road and 76 minutes to Blackpool Central.

The 5.10 p.m.—the real Blackpool "club" train—is another of heavy formation, being generally made up to 10 corridor cars and the club saloon, but expanding to 13 vehicles in the summer season. This is an almost invariable "Class 8" 4-6-0 turn of duty. Following the Southport express to Dobb's Brow Junction, which is passed at 5.30 p.m., the 5.10 carries on over the very steep Hilton House spur, pursuing the same route as the 4.55 p.m. coast-bound train to Blackrod, Chorley, Preston and Kirkham. Preston is passed at 5.57 p.m., Kirkham at 6.9 p.m.; and the first stop is made at Lytham, 43½ miles from Victoria, at 6.17 p.m. Like all the Blackpool and Southport trains, this express has been decelerated from its earlier running times. At one period Lytham was reached in the even hour from Manchester, but the much heavier corridor rolling stock now in use, with its more limited seating accommodation in proportion to weight, is doubtless in part responsible. After making stops at Ansdell, St. Anne's and Waterloo Road, the "club" train rolls into Blackpool Central at 6.40 p.m., exactly 90 minutes after starting, having covered a total distance of 51 miles.

There is now but one "club" train left to mention—the Windermere express leaving Exchange at 5.5 p.m. This express completes one of four leaving Exchange and Victoria in the 10 minutes between 4.55 and 5.5 p.m., all running to or through Preston and each one getting there by a different route. The 4.55 p.m. out of Victoria goes by Atherton, as we have seen, and the 5.2 by Bolton; the 5 p.m. Glasgow express out of Exchange takes the longest route—33 miles—through Eccles, Tyldesley and Wigan (North Western), where it is combined with the second part of the 1.30 p.m. "*Mid-day Scot*" out of Euston; while our 5.5 p.m. to Windermere, in order to get in front of the Glasgow train, takes the "Lancashire Union" line from Bickershaw to Standish, over a route which it is one of the only two passenger trains in the day to patronise, through Whelley. Another most singular fact is that this last route involves the use of over half-a-mile of London and North Eastern metals, between Strangeways East and Amberswood East Junctions. How many readers of the "*M.M.*," I wonder, know that it is possible to travel over the L.N.E.R. on the way from Manchester to Windermere?

The Windermere train provides a very easy locomotive working. It is usually entrusted to a Midland compound, but occasionally to a 4-6-0 "Prince." Four non-corridor coaches make up the formation, with the "club" saloon on the rear. The route followed is slack-infested and very heavily graded throughout to Preston, the worst pitch being at 1 in 67 up near Whelley. The 32½ miles to Preston require an allowance of 55 minutes, the Windermere train arriving just two minutes after the 5.10 p.m. Blackpool "club" train has passed through. At Preston, through Liverpool coaches are added, and after a halt of five minutes, a level run follows over the 21 miles to Lancaster, allowed 26 minutes. A brief sight of the sea is obtained at Hest Bank, and then the Windermere "club" train carries on through the important junctions of Carnforth and Oxenholme without stopping, making Kendal, 21½ miles from Lancaster, half-an-hour later. It is just 2¼ hours after leaving Manchester Exchange that the train puts in an appearance at Windermere, having travelled 83 miles. In the opposite direction it makes a faster trip, cutting off the odd quarter, and completing its journey from Windermere to Manchester in two hours.

One point that cannot fail to be noted in connection with the trains whose working is described in this article is the amazing complexity of the London, Midland and Scottish system in Lancashire. We have just seen how four expresses leave two adjacent Manchester stations for Preston within 10 minutes of each other, each one following a different course. The 5 p.m. Southport express and the 5 o'clock from Exchange to Glasgow, again, often run for considerable distances in sight of one another on their journey to or through the two neighbouring stations at Wigan. It must be remembered, however, that this complexity arises partly from the fact that two systems once independent have now been amalgamated. As is the case in many other parts of the country, had the grouping of the railways taken place at an earlier date, it is probable that many such routes, built purely for competitive purposes, would never have come into being. The money thus spent could often have been put to far better use in the doubling and improvement of previously existing lines. But these unnecessarily ramified tracks, all of which have to be staffed and maintained, constitute not the least of the problems which our great railways have to face, in their struggle towards more economical working. Possibly the necessity for strict economy in railway working may eventually lead to some of the alternative routes being closed.

Air News

Pilots Wanted for Short Service

Nearly 350 officers will be required by the Royal Air Force for flying duties during the present year under the short service commission scheme, the average rate of appointment being approximately 40 each month. Applications are accordingly invited from suitable candidates who must be between the ages of 18 and 25, well-educated and of good eyesight and physique.

Short service commissions are granted for five years' service on the active list and four in the reserve. Accepted candidates enter as pilot officers on probation and undergo training at a Flying Training School for about a year. Then they are posted to a service squadron for duty. Only a small proportion of short service officers are eventually granted permanent commissions, but facilities are available to assist the others to obtain civil employment at the end of their period of duty. Further information relative to the scheme can be obtained from the Secretary, Air Ministry, Adastral House, Kingsway, London, W.C.2.

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New Dutch Air Mail

A contract has been placed with the K.L.M. Company for the regular operation of an air mail service between Batavia and Surabaya in the Dutch East Indies. This service is to connect with the European mail-boats at Batavia, and will enable up-country residents in Samarang and Surabaya to reply to letters from Europe by the mail taken outward by the steamer that brought the inward letters. Fokker FVII-3M machines fitted with three Armstrong-Siddeley " Lynx " engines are to be employed on the service.

The K.L.M. Company are proposing also to open up a regular monthly service each way between Holland and Batavia. This is the outcome of the highly successful flight made last October by Lieut. Koppen of the Dutch Army Air Service, who flew from Amsterdam to Batavia and back in 28 days. His machine was a Fokker FVII-3M Armstrong Siddeley " Lynx " similar to those about to be used on the mail service just mentioned. These machines also will be employed on the Amsterdam-Batavia service.

"*The Aeroplane*" in commenting on this proposed new service wonders what attitude the Persian Government will take up in regard to the service. If it is permitted to use the Persian Gulf route—as Lieut. Koppen did—the Persian refusal of facilities for Imperial Airways' proposed Basra-Karachi service will assume a new aspect.

Reserve of Air Force Officers

The Air Ministry announce that openings are now available for young men to be trained as pilots in the Air Force Reserve. At least 60 candidates will be accepted if so many of the right type are forthcoming. Applicants must be of good education and physique, but need not have had any previous flying experience. They must be over 18 and under 25 years of age. The successful candidates will be granted commissions as officers of the Reserve and will be eligible for promotion to the rank of Flying Officer after 18 months' service.

The flying training is carried out at Civil Flying Schools at Edgware and Bristol, and consists of a course not exceeding three months (preferably taken continuously) during the first six months of service ; six hours' solo flying (within a maximum period of 10 days' training) during the second six months ; and 12 hours' solo flying (within a maximum period of 20 days' training) in each subsequent period of 12 months' service. When undergoing training an officer receives, generally speaking, the same pay and allowances as an officer of the same rank on the active list. In addition, an annual retaining fee of £30 is payable, subject to compliance with the regulations.

Application forms and further details can be obtained by applying to the Secretary (S.7.c.), Air Ministry, Adastral House, Kingsway, London, W.C.2.

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The Westland " Westbury "

The Westland Aircraft Works have recently completed a three-seater fighting machine that is stated to be the first of its kind. As far as general arrangement and performance are concerned the " Westbury " resembles some of the earlier twin-engined bombers. It is a biplane with two Bristol Jupiter VI engines mounted on the lower wings.

The principal dimensions of the machine are as follows :—Wing span 68 ft. ; length of fuselage 43 ft. 4⅜ in. ; height to tip of upper wing 30 ft. 9 in. ; wing area 875 sq. ft. When fully loaded the machine will carry 7,877 lb. and can attain a maximum speed of 125 miles per hour at 5,000 ft. Its maximum ceiling when working under service conditions is 21,000 ft.

There is a roomy compartment for wireless equipment, a tip-up seat for the operator and a communication passage between the front and rear cockpits. The pilot's seat is just ahead of the wings and the rear gun position just behind the wings. Below this a Lewis gun, firing below the fuselage, is mounted, and through the opening for this gun there is an entrance for the crew of the fuselage. Two types of wings have been constructed for use with the machine, one of timber framing, the other of duralumin. A gun-mounting is carried in the nose of the fuselage also.

* * * *

An Atlantic Airship Service

An announcement was recently made by Mr. Hoover, the American Secretary of Commerce, that the United States Government have arranged to co-operate with Commander C. D. Burnie, the head of the British Airship Operating Company that is building and subsequently will operate R100, in the establishment of a regular trans-Atlantic mail and passenger air service. In September of this year R100 is to make an experimental trial flight to the United States and back, and Commander Burnie has so interested President Coolidge that the United States Government have agreed to give every possible facility on the American side of the ocean. The mooring mast at the United States Naval Airship Station at Lakehurst, New Jersey, is to be at the disposal of R100 during its stay in America. Subsequently the Anglo-American company that is to be formed to operate the service will secure its own airship stations on both sides of the Atlantic. Five passenger-carrying airships will be required for the service and of these two will be built in America. It is not anticipated that there will be any difficulty in securing the sanction of the U.S. Congress to the use of airships for the purpose of mail-carrying.

* * * *

Blackpool Municipal Aerodrome

The Corporation of Blackpool are promoting a Parliamentary Bill to secure powers to acquire and maintain a municipal aerodrome.

Behind this announcement lies another chapter in the story of Blackpool's progress from a little Lancashire fishing village to its position as the premier holiday resort in the north of England. The Corporation have secured an option on a site of between 500 and 600 acres in extent and the aerodrome is to occupy the major portion of the land. A motor car racing track will surround the aerodrome and grandstands are to be built for the use of spectators. There will be complete facilities for commercial aeroplanes in addition to the proposed permanent joy-riding " stable," but the principal object of the municipal aerodrome is to add flying meetings and motor races to Blackpool's extensive list of holiday-making attractions.

Across the World in Sixteen Days

The greatest feat in the whole history of flying was accomplished recently by Mr. Bert Hinkler, who flew from London to Port Darwin, Australia, a distance of 11,000 miles, in 16 flying days. His mount was an "Avro-Avion" light aeroplane fitted with an 80 h.p. "Cirrus" engine.

The flight is the more meritorious on account of the low power of the machine and the fact that Mr. Hinkler flew alone. His day's work was not finished when he landed at his intermediate stopping places; he had then to turn to and overhaul his machine in readiness for the next day's flying. Further, the machine is nothing like as sturdy as the standard type of "Avion" machine now produced by the Avro firm. Mr. Hinkler's "Avion" was the original of the type and was produced several years ago specially for a light aeroplane competition held at Lympne. Despite its age the machine functioned perfectly throughout the flight, and a similar tribute must be paid to the engine. In a telegram to the makers, A.D.C. Aircraft Limited, the aviator declared that the machine had run perfectly throughout and that it was in as good condition as on the day when it left the test bench. Considering the fact that each day's flying amounted to almost 1,000 miles, no greater tribute could be paid to the excellence of the "Cirrus" engine.

As a piece of propaganda work for the light aeroplane, and particularly the British product, it is doubtful whether any flight could have produced so sensational an effect. Australia, Great Britain and the Empire generally have cause to be proud of Mr. Hinkler, who is an Australian by birth.

The flight was the outcome of a promise made by Mr. Hinkler to his mother some years ago that he would fly to Australia and land at her garden gate, and subsequent to the completion of the major portion of his flight he literally redeemed his promise.

The following actual timetable showing the stages in which the flight was accomplished is of great interest. The figures in brackets show the mileage between the respective starting and stopping points indicated :—

Feb. 7, London-Rome (1,100); Feb. 8, Rome-Malta (400); Feb. 9, Malta-Benghazi-Tobruk (980); Feb. 11, Tobruk-Ramleh (350); Feb. 12, Ramleh-Basra (900); Feb. 13, Basra-Jask (800); Feb. 14, Jask-Karachi (580); Feb. 15, Karachi-Cawnpore (850); Feb. 16, Cawnpore-Calcutta (650); Feb. 17, Calcutta-Rangoon (650); Feb. 18, Rangoon-Victoria Point (500); Feb. 19, Victoria Point-Singapore (720); Feb. 20, Singapore-Bandung (625); Feb. 21, Bandung-Bima (900); Feb. 22, Bima-Port Darwin (1,000).

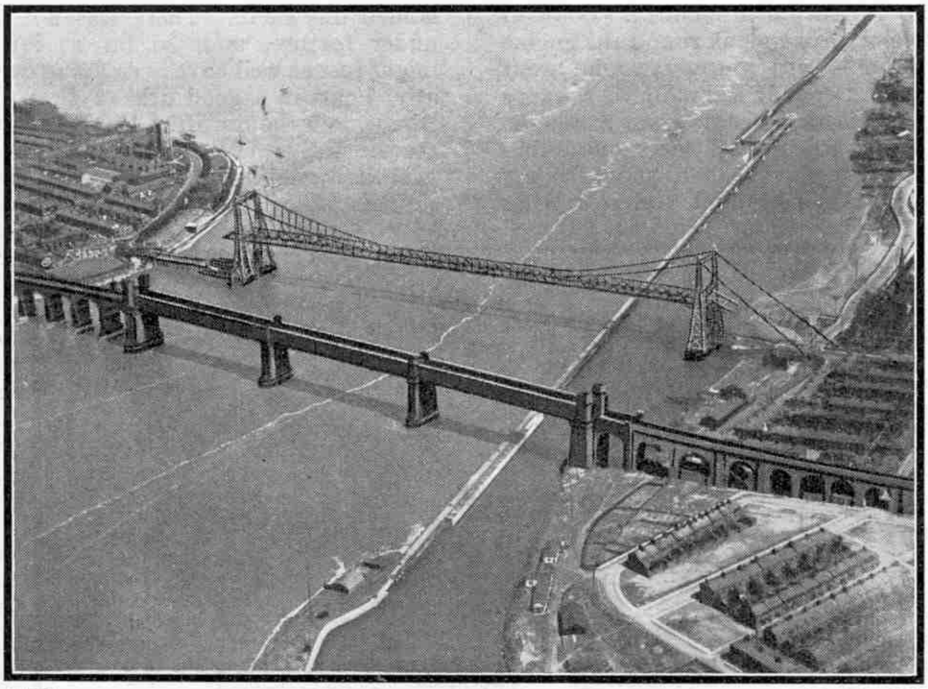
In addition to setting up a record time for the England-Australia journey, several other new records were created in the course of the flight. It was the first non-stop flight from London to Rome; the fastest flight from England to India; the longest solo flight ever made; and the longest flight on a light aeroplane.

* * * *

Sir Sefton Brancker's Official Machine

Readers who have followed the account of Air Vice-Marshal Sir Sefton Brancker's flight to India will be interested to know that the Air Ministry have recently purchased a D.H. Moth for his use in his capacity as Director of Civil Aviation. The identification marks of this aeroplane are G–EDCA, the last letters indicating "Director of Civil Aviation." The Director makes a point of flying to his engagements whenever possible.

Famous Bridges from the Air—No. 2



Photo] [*Aerofilms Ltd.*

Our recent articles on the Manchester Ship Canal lend additional interest to this striking view. Our photograph shows the L.M.S. main line Bridge and the Transporter Bridge, crossing the Manchester Ship Canal and the River Mersey. Runcorn is on the right and Widnes on the left.
The Transporter Bridge is the subject of a fine Meccano model

The D.H. 61

The newest production of the De Havilland Aircraft Company is a biplane specially designed to meet the requirements of aircraft operation in the Dominions. Its type number is D.H.61 and the first of the series was despatched a few months ago to an Australian firm of fruit preservers. Appropriately enough this machine has been christened "*Canberra.*"

The biplane is designed to accommodate from six to eight passengers. It has a wing span of 52 ft. and is 39 ft. in length. It can be equipped with floats for seaplane work or the usual type of landing gear for ordinary land operation. In the former case its fully loaded weight is 6,700 lb. and in the latter 6,200 lb. These figures are based on the actual tests of a land-type machine, but in further "61's" steps are to be taken to bring the paying load up to 6,700 lb.

A Bristol-Jupiter engine of the series VI type has been fitted to "*Canberra,*" but in subsequent machines a Jupiter series VIII geared engine will be fitted. This will give a speed ranging up to 132 m.p.h. at ground level. The petrol consumption of this engine in combination with the storage capacity of the fuel tank fitted permits a cruising range of 450 miles. A specially interesting feature of the D.H. 61 is its folding wings.

In a subsequent issue of the "*M.M.*" we hope to publish photographs and further details of this interesting machine.

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A Fast Channel Crossing

A D.H. Moth piloted by its owner, Mr. A. C. Jackaman, recently accomplished an extremely fast trip from Croydon to Le Bourget (Paris). Leaving Croydon at 11.10 a.m., the Moth landed at Le Bourget at 12.45, having made the flight at an average speed of 147 m.p.h. The petrol consumed on the flight was only 6½ gallons.

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In a forthcoming issue we hope to give a full description of the new Short-Calcutta flying boat. This is the world's largest flying boat and has been built for the Air Ministry.

FINAL INSTALMENT

My Flight to India

By Air Vice-Marshal Sir Sefton Brancker, K.C.B., A.E.C.

As mentioned last month, this historic flight to India left England on the 20th November, returning on the 17th March following, and in over four months' active work covered 18,000 miles. During that time they had not a single forced landing through a material defect and the aeroplane totalled over 200 hours in the air. We are indebted to the Editor of the "Halton Magazine" for permission to print this article in which permission Sir Sefton Brancker was pleased to accede.—EDITOR.

On our way to Delhi we flew over Gwalior and Agra, and landed at Bharatpur for lunch. Cobham wanted a couple of days to look round the engine before we faced our homeward journey, so he went straight on to the Aircraft Depot at Karachi, where every form of expert and enthusiastic assistance was available.

On the 25th February we started for home from Karachi in beautiful weather. We had hoped to get through to Bunder Abbas in one flight, but soon after starting we ran into a Shammal, or north-west wind, blowing strongly against us, with the result that, after $7\frac{3}{4}$ hours' flying, we were forced to land at Jask because we had not time to reach Bunder Abbas by daylight.

On the 26th we had an easy flight to Bushire still against a head wind, and on the following day we went to Ahwaz, where I had promised to visit the Anglo-Persian Oil Company's administrative headquarters.

On the 28th we reached Baghdad, after three hours' flying against a strong head wind. Just as we reached the aerodrome, the wind swung round 180 degrees, with the result that Cobham, not realising what had happened, landed down wind, much to the amusement of the onlookers, but without any ill-effects. I spent one day clearing up matters in Baghdad, and on the 2nd March we set out for Damascus.

To make sure of having enough petrol, in case we met further head winds, we landed to fill up at Ramadi. On leaving we took the wrong direction, and spent about three quarters of an hour looking for the track, eventually returning to Ramadi aerodrome in order to discover exactly where it was. Once found, it was perfectly easy to follow.

At Rutbah Wells we left the track ploughed up for the use of the Air Force machines flying to Egypt, and followed those left by the Nairn Motor Transport Company direct from Damascus. They ran over a wonderfully flat bit of desert where we could have landed anywhere. There was not a sign of a hill or under feature, and, so far as land-marks went, we might just as well have been flying over the sea. Personally, I put in a good deal of sleep on the way across! About four hours after leaving Ramadi we began to see the Lebanon Mountains away to our right front, and eventually landed at Rayak, the French military aerodrome, which lies between Damascus and Beyrout, where we received the usual warm and hospitable welcome typical of French aviation.

Sir Alan Cobham and (right) Sir Sefton Brancker. In the centre is seen the late A. B. Elliott, the mechanic who accompanied the flight

Our readers will remember that Elliott was killed by a sniper's bullet during a later flight

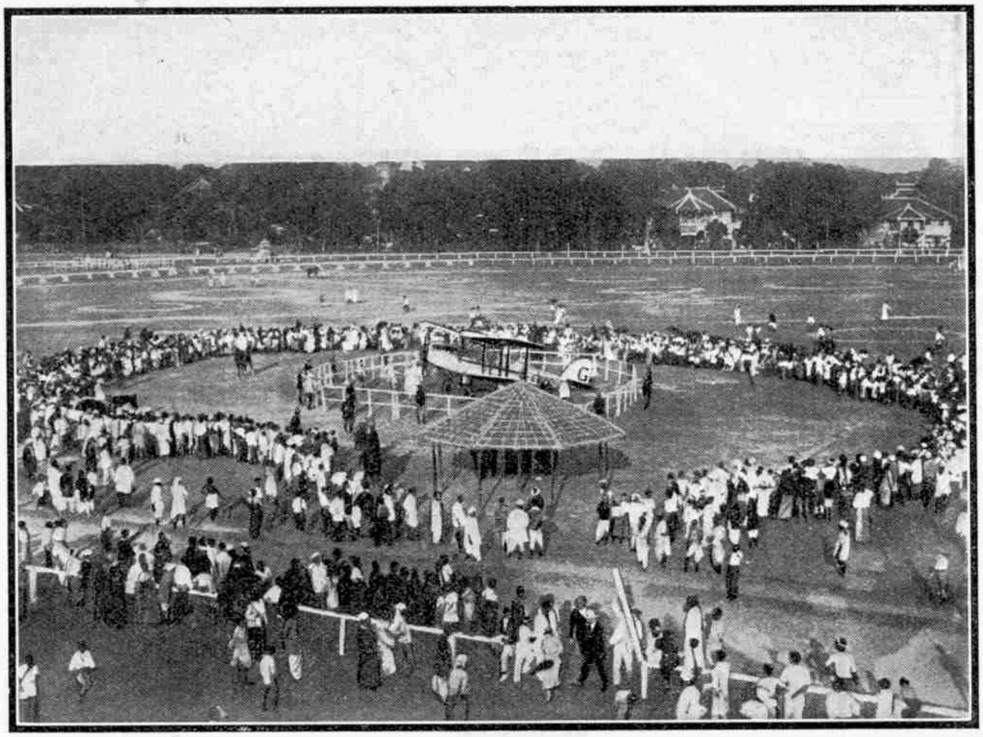
I had to stop one day in Beyrout to interview General Sarrail, the High Commissioner of French Syria. On the 4th we had an easy flight and spent the night with our hospitable friends, the French Air Force at Aleppo. On the 5th we started early and had a perfectly glorious flight over the Taurus in beautiful weather at about 8,000 ft. and it was extremely interesting, and somewhat alarming, to look down into the ravines along which we had wriggled on our outward journey.

We landed at Konia to pick up petrol and found that the Turks had everything ready for us, so that we got away in almost record time, and eventually landed at Constantinople, after a total of $8\frac{1}{4}$ hours in the air.

On the 7th we flew to Belgrade over Sofia, a non-stop flight of $6\frac{3}{4}$ hours. The present Belgrade aerodrome is a long way out of the town, and, although we landed at three o'clock in the afternoon, I had to wait a long time for a boat to take me up the Danube, and eventually arrived at Belgrade at eight in the evening. I was up at 5 a.m. to catch an early boat down the Danube, in order to reach Budapest by lunch. The weather was still perfect. We spent about four hours at Budapest, and eventually arrived at Vienna just before dark.

On the 9th we flew to Prague, and for the first time on the whole trip Cobham lost himself. Our compass had become inaccurate, as we had had no opportunity to swing it for some time, with the result that he flew down the wrong railway and, after about two hours' flying, we realized that we were lost. Eventually, we flew low to read the name of a railway station, and from that oriented ourselves and arrived in Prague just as a heavy snowstorm commenced all over the country to the south.

On the 10th and 11th it snowed heavily. We made an effort to get away each day, but on the 10th we ran into thick snow in the neighbourhood of Dresden. We were forced to turn back owing to the engine beginning to peter out, through being suffocated with snow. On the 11th we ran into impossible visibility, and had again to return. The morning of the 12th looked bad, but once more we made an effort to get away in the morning and again we were driven back by thick snow.



The aeroplane having arrived at Monkey Point, Rangoon, is "on view" on the Brigade Parade Ground

In the afternoon the weather cleared a little, so we pushed off for Strasbourg. There was a strong north wind, bringing with it heavy snowstorms, and as there was a good aerodrome at Nuremberg we considered the wisdom of coming down for the night. However, it looked a little better in front and we were anxious to get on. So, although we had no weather reports from the west, we decided to stick to it, but as we approached Stuttgart the weather got worse and worse. Again we nearly turned back to Nuremberg, but a gleam of red towards the west tempted us to hold our course. Ten minutes later there was a black wall of snowstorm in front of us, and the snow had closed in behind us; after flying round a little, it became evident that we would have to land. We were over extremely bad country—a mass of hills and woods with very few fields—but after some inspection, Cobham selected a small field on the top of a hill, and with Elliott, I and the baggage all as far back in the cabin as we could get, to avoid the chance of standing on our nose, we made a very successful landing in snow and mud in a field from which we knew it was perfectly impossible to take off again. We were just in time, for the snow closed in almost at once, and darkness fell soon after.

The local German police knew all about our coming, and helped us in every way. Three big lorries turned up at different intervals during the following day, and with every one working with a will we had the machine dismantled and transported fifty miles by road to Boblingen, near Stuttgart, by midnight. The weather was bitterly cold, and it was snowing most of the time.

The next day, 14th March, we got the dismantled machine into a shed and erected it. I cannot speak too highly of the prompt and efficient assistance we received from the German authorities. They thoroughly entered into the spirit of our desire to get to London with as little delay as possible and did everything in their power to get us into the air again quickly. On the 15th, in the morning, snow stopped us getting away, but in the afternoon matters improved a little, and in very bad visibility we slipped over the Schwarzwald and reached Strasbourg in little over an hour's flying. The French Flying Corps at Strasbourg gave us every assistance, and were much amused at the amount and variety of our baggage—they could hardly believe their eyes as we pulled out our suit cases and packages from the cabin. On the 16th the weather cleared and we had a delightful trip to Paris with a strong following wind in 2¾ hours, and on the 17th, 3¼ hours found us at Croydon, our journey ended.

Our chief object was to avoid incident and eliminate the spirit of adventure, and our sole desire was to accomplish the journey, not as an aviation feat, but as a means of carrying out certain duties and negotiations.

To sum up briefly, we covered about 18,000 miles in a little over three months of active work. We were absent from England for four months, but for more than three weeks of that I was incapacitated through sickness. During that time we did not have a single forced landing through a material defect, and only one forced landing to escape impossible weather.

During the three months we travelled on only 53 days, and we totalled just over 200 hours in the air. In spite of unusually bad weather on our way out, from Bucharest onwards to Rangoon, and from Rangoon back to Prague, we were never once delayed in starting at our pre-arranged hours owing to weather, and only on two or three occasions were we late in arriving at our destination through meeting unexpectedly strong head winds.

The only cases of engine trouble that occurred were water leaks, and with an air-cooled engine even these would be eliminated.

Generally speaking, the route between London and Rangoon is an extremely easy one for operation, the greatest bar to regularity in (*Continued on page 318*)

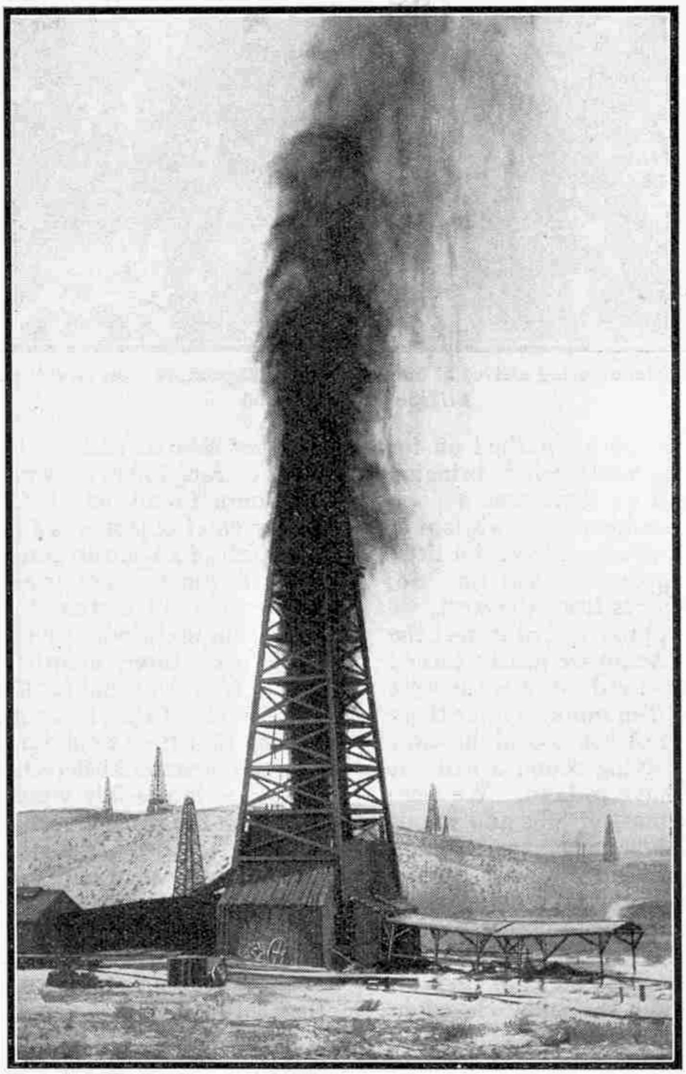
THE STORY OF OIL

III.—FAMOUS "GUSHERS" AND WELL FIRES

ALTHOUGH the exploitation of the Persian oilfield, as related last month, was not attended by any thrilling incidents, the same cannot be said of some of the oilfields in other parts of the world. Indeed, in some instances, as we shall see in the course of this article, the sinking of the first wells was as exciting as any seeker for adventure could desire.

One of the most interesting oilfields in existence is that at Summerland, near Santa Barbara, California, where a substantial stratum of oil-sand lies several hundred feet below the level of the Pacific Ocean. When it was first proposed to carry out boring operations on the Summerland coast the project excited considerable interest by reason of its originality and the necessity of excluding sea water from the wells. Operations were commenced in 1896. A low timber jetty extending seaward from the shore was erected and upon this a derrick was built some distance from the shore end. From the derrick a special hollow pipe called a "well casing" was plunged downward to the sea-bed. After a plumbing test had been made to ensure that the casing was absolutely vertical, this was secured at the top end to the floor of the derrick. The drilling equipment was then sent down within the casing, and after various adjustments actual operations were commenced.

The first well was successfully sunk and the satisfactory yield of oil obtained from it led to a boom in off-shore well-sinking at Summerland. More than 300 oil-wells were sunk there into the bed of the ocean during the ensuing four years. The wells yielded an average output of 60 barrels per day, but some of them proved comparatively short lived and more than 60 gave out during the first 3½ years in which the locality was exploited. The wells at Summerland are very shallow, and do not penetrate the ocean bed to a greater depth than 500 ft. Nevertheless, they have yielded a steady flow of oil since they were established more than a quarter of a century ago. An illustration of this oilfield appear on the next page.



A great Oil Gusher at Taft, U.S.A., emitting oil at the rate of 20,000 barrels per day

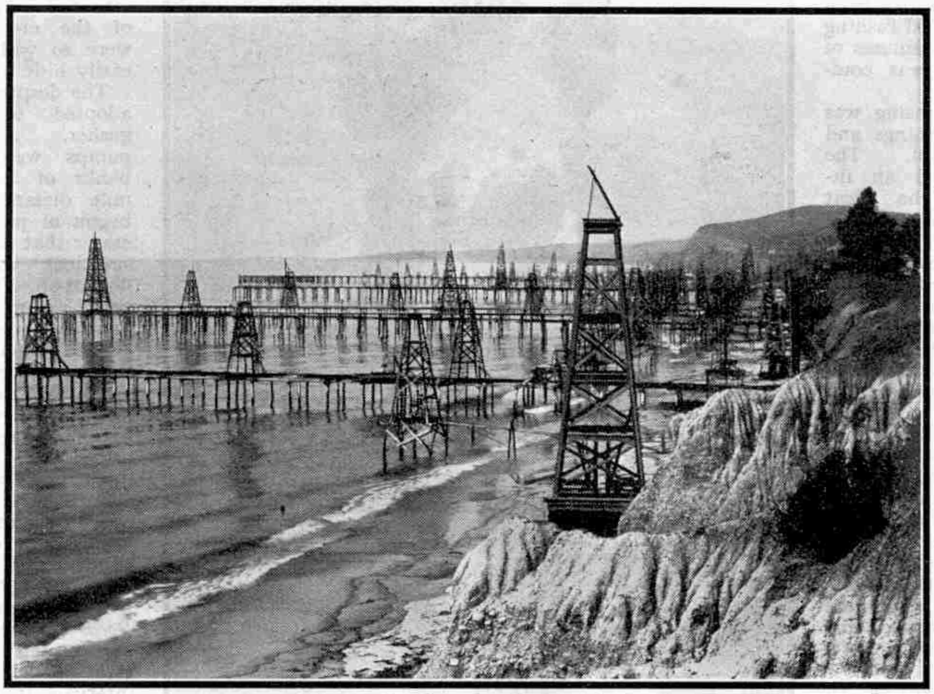
Although Australia is almost as extensive as Canada, the United States, or Europe, it is almost devoid of oil deposits. Some surface deposits were discovered in 1912, however, in eastern New Guinea, and during the War the Australian Commonwealth permitted the Anglo-Persian Oil Company to carry out boring operations there. No practical results came of the investigations, however.

A curious story is told of the manner in which oil was discovered in Egypt. It is said that a man interested in oil exploitation was one day reading the second chapter of the Book of Exodus, and was attracted by the statement in the third verse that the ark of bulrushes, made by the mother of Moses for her child, was "daubed with slime and with pitch." He then reasoned that if there was pitch in Egypt at that time there was also oil, and therefore that the oil should exist there to-day. The theory was considered worth putting to the test and later a geologist and oil expert was sent to Egypt to make investigations. He subsequently confirmed that oil existed in that country, and operations on a commercial basis were put in hand. At the present time there are three wells in operation in Egypt and the yield of oil from these is considered sufficient to justify the sinking of further wells.

When oil wells are sunk in new or little exploited country the oil often comes in in the form of a "gusher" or "spouter." During the long ages in which the oil has been accumulating below ground and saturating the subterranean sand it has been emitting gas for which there was no escape. In course of time the quantity of imprisoned gas increased to such an extent that an enormous pressure was reached. When an oil prospector drives a bore-hole into ground overlying such oil-sand he lessens the pressure of the earth upon the sand at that point, and if drilling is carried deep enough the moment arrives when this pressure becomes less than the upward thrust of the gas. Then the inevitable happens, and the gas, with a sudden roar, gushes from the borehole, forcing the oil-sand along with it and high into the air. Frequently the force of the gusher is so great as to wrench the drilling tools out of the borehole and wreck the derrick. In the comparatively brief history of the oil industry there have been several remarkable gushers, mostly in the oilfields of the American continent.

It was a gusher that established Texas as a State prolific in oil wealth. After two years of prospecting there, a Washington geologist named Captain A. Lucas selected a drilling site at Beaumont, and in 1900 erected a derrick there and commenced drilling operations. A close watch was kept upon the well and on 10th January, 1901, the drill became greatly agitated. The ominous noises that began to come up from the depths of the 6 in. diameter borehole were all the warning that the drillers required, and with one accord they "downed tools" and sprinted at top speed for safety. They were not a minute too soon, for barely had they put a safe distance between themselves and the well when the faint rumbling grew to a mighty roar. A 600 ft. length of the pipe casing emerged from the borehole with the speed of a projectile, and soared 200 ft. into the air, while the piercing shriek of the gas escaping from the well under terrific pressure became almost deafening.

A momemt later the oil arrived in full force, shooting upward in a dense unwavering column to a height of 150 ft., before spreading outward like the spray of a fountain and raining oil upon the neighbourhood. The drenching oil spray saturated the surrounding country and every ditch and hollow became an oil-bath. After several hours of terrific gushing the oil settled down to a steady flow equivalent to about 20,000 barrels per day. It should be noted that when a "day" is mentioned in connection with the output of an oil-well it refers to the complete cycle of twenty-four hours.



Pumping Oil from beneath the Pacific Ocean. Some of the derricks of the Oilfield at Summerland, California, U.S.A.

The Texas gusher was the biggest "strike" of oil that had been achieved in the United States, and it attracted thousands of visitors and numerous prospectors to the locality. For the first few days Lucas and his men permitted the gusher to flow without restraint, partly to advertise the district as a newly discovered oilfield of vast resource, and partly as a reward to the great crowds who visited the spot in the hope of seeing the gusher in full play. Each of these days of free entertainment represented a huge loss of oil, however, and steps were soon taken to bring the gusher under control.

Gangs of labourers were hurriedly engaged and the digging of wide pits, or reservoirs many feet in depth to accommodate the freely flowing oil was carried on day and night. Isolated ditches and small ponds filled with oil were linked up by roughly dug channels and their contents led to the large reservoirs. For a time the gusher kept ahead of the diggers and overflowed channels and pits as fast as these were dug. It is said that close upon 1,000,000 gallons of oil were lost before the gusher was brought under control, on the sixth day of its existence.

Sometimes a gusher will cease flowing as suddenly as it began. This characteristic has been a feature of many of the gushers in the Caucasian oil-bearing district, where, in the Bibi-Eibat oilfield, short-lived gushers from time to time have added to the excitement of exploiting the oil wealth of the locality. One of the most remarkable gushers of this oilfield occurred during 1901 in a well that had been sunk to the depth of 1,813 ft. The well was 14-in. in diameter and the massive column of oil that suddenly rushed upward at a terrific velocity attained a height of about 60 ft. before spraying outward and raining oil over a wide area. During the period in which this gusher was most active as much as 100,000 barrels of oil was obtained from it in one day! Then, after it had yielded about 2,000,000 gallons of the precious fluid, the gusher suddenly ceased to flow.

If a strong wind arises while a gusher is unrestrainedly active the oil spray is often wafted several miles before it falls to the ground. Sometimes the direction of the wind carries the spray over some town situated near the oil-well, and the town of Baku, on the Bibi-Eibat oilfield, has several times had the unpleasant experience of being visited by oil showers.

Rumania has been described as an immense oilfield and numerous wells have been sunk there. The rugged nature of the country has resulted in many of the oil-wells being situated on the slopes of hills. On several occasions gushers have come in, and when one of these occurs speedy measures have to be taken to prevent the oil from escaping. Great earthen embankments are built up on the hillside, below the well, to prevent the flood of oil from swamping villages situated in the valley far below. Often these embankments are flung up hastily and without full consideration being given to the enormous pressure that the weight of accumulating oil will impose upon them. Anxious watch, therefore, is maintained day and night until the engineers are able to establish proper accommodation for the outflow, when the contents of the temporary reservoirs can be drawn off.

The greatest menace to the well engineer is the ever-present danger of fire. Nothing is started up more easily than an oil fire. A lighted match carelessly thrown to the ground, a flash of lightning or a spark created by some fragment of flying rock hitting a derrick, may prove to be the key that unlocks a first-rate disaster.

A gusher on fire is an awesome spectacle and is best likened to a volcano in eruption, while the behaviour of the flames suggests a gigantic Bunsen burner. For the first 30 or 40 feet above the borehole the thick column of upward-rushing oil is so dense that air cannot penetrate it and combustion is thus rendered impossible. The fire therefore is kept outside, and all that can be seen is an encircling ring of blue flame where the air comes into contact with the surface of the gusher. Higher up, however, where the gusher begins to spread out and air is able to enter between the particles of oil-sand, full combustion takes place and the column of oil becomes a mass of flame.

At the top of the column the rushing oil falls away on every side like fountain spray, and the flame assumes tremendous proportions and intensity. As it glows and sparkles between the clouds of dense smoke that are emitted, the flaming column-head suggests glimpses of a vast inferno. At night the "plume" or head of a blazing gusher lights up the whole of the surrounding district and sometimes can be seen more than 100 miles out to sea, while the terrific continuous roar from the well can be heard many miles away. Sometimes a burning gusher defies all efforts to subdue it and after raging for weeks gradually burns itself out, a tragic state of affairs that results in many millions of gallons of oil being lost.

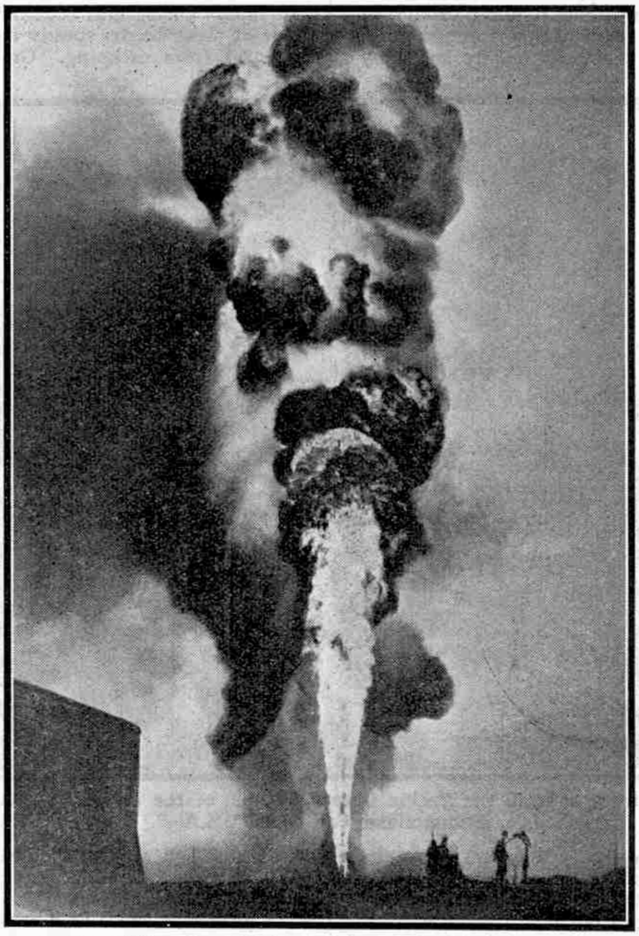
Mention was made in the February "*M.M.*" of the discovery by Lord Cowdray's engineers, in 1908, of vast oil resources underlying the northern area of the province of Vera Cruz, Mexico. Up to the time of these operations the status of Mexico as a country possessing natural oil supplies had never been established, but the terrific gusher that brought in the now famous "*Dos Bocas*" oil-well advertised Mexico as a land of remarkable promise, and a great rush of eager oil prospectors soon followed.

Drilling by means of steam-driven rotary tools had been in hand at the "*Dos Bocas*" well for a considerable time, but the hard rocky strata that had to be bored through made progress very slow. On 4th July, 1908, the drill suddenly penetrated to the underlying oil-sand and immediately gas fumes of overwhelming strength came up the borehole. This was sufficient warning to the engineers, and drilling was stopped immediately. All boiler fires were hastily drawn and the ashes drenched with water, while every light in the neighbourhood was extinguished.

The subterranean agitation in the well increased with great rapidity and in a few minutes oil gushed forth. The column rapidly increased in thickness until it was 8 in. in diameter, while the volume of the outflow attained 350 gall. per minute. The derrick was shattered to fragments and the debris completely hidden from view by the great skyward rushing oil stream. Within 20 minutes of its arrival the gusher was completely out of control.

Soon the 8-in. well casing was wrenched from its fastenings and collapsed into the well. The narrow borehole proved an insufficient outlet for the great pressure of pent-up gas and oil, and the ground around the well began to heave and subside as though under the influence of an earthquake. Wide cracks appeared in all directions, through which clouds of gas, followed by oil, rose rapidly. These crevices extended further and further from the well and ultimately some of them reached the boilers. Whether the ash-heaps were still hot in places in spite of their drenching with water will never be known, but as soon as the ground opened up beneath the boilers the gas and oil emitted from the crevices became ignited. Instantly the fire spread to the gusher and there followed one of the most appalling sights that have ever been witnessed on an oilfield.

The flames of the gusher rose to a height of 1,500 ft., while the roar and crackle soon could be heard several miles away, and dense clouds of smoke almost blotted out the daylight. At night the spectacle was even more impressive than by day, and the glow of the flaming head of the oil column illumined the dark sky over a great area. The brilliance of the conflagration was such that on several occasions ships 200 miles out to sea mistook it for the light of Tampico lighthouse.



A burning Oil-well at Taft, U.S.A. The great height of the flames can be judged by comparing them with the men to the right of the Well

Expert fire-fighters, who specialised in combating oil fires, were summoned, but one glance at the blazing gusher convinced them that the task of subduing it was beyond them. The engineers who had laboured so assiduously to bring in the well were determined not to be beaten by the fire without offering some resistance, however, and they began to devise a plan of attack.

The heat of the burning gusher was so great that it was impossible to approach within 300 ft. of the well, and it was deemed useless to attempt to extinguish the fire by the customary method of directing upon it numerous jets of steam under pressure. It was therefore decided to "cap," or stifle the well by dragging a huge specially-constructed lid over its mouth.

A convenient barrel tank was dismembered and the heaviest of its steel plates were riveted together to form a thick platform or lid. Heavy steel rails, totalling 30 tons in weight, were then fastened down upon the platform and cables to serve as drag ropes were attached. The cables were passed around the well and their free ends secured to steam winches.

Before this massive lid could be dragged over the borehole, however, the surrounding ground already badly broken by numerous fissures, suddenly caved in, and the narrow borehole became a crater 1,000 ft. in diameter, which almost immediately filled with oil.

Assistance now arrived in the form of a battalion of 450 sappers sent by the Mexican Government to render the engineers all possible aid, while another batch of men were sent by the Government to restore order among the frightened native population of the district.

The engineers now decided to drive a tunnel, having a downward slope of 45 degrees, that should reach the borehole at a point considerably below the well surface. The tunnel was not to be driven actually into the borehole but a barrier of earth was to be left which, when blasted away, would collapse into the well, thus sealing it and cutting off the supply of oil to the blazing gusher. Before this scheme was put in hand, however, further subsidences occurred at the well mouth, and the earth there gave such evidence of instability that it was considered too risky to drive a tunnel as intended. By this time many of the crevices in the ground were so wide that a man could easily hide in them.

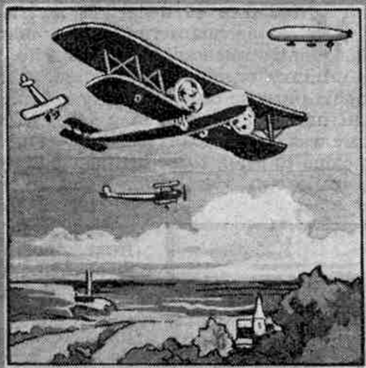
The desperate measure was now adopted of drowning-out the gusher. A series of powerful pumps were installed by the banks of a river about half-a-mile distant and the task was begun of pumping into the great crater that formed the well mouth sufficient water to drown the flow of oil. This operation had only been under way a short time, however, when the fire suddenly ceased voluntarily, owing to the supply of gas and oil petering out. Trouble was not over even now, however, for the gusher became a terrific outflow of hot salt water, and the tremendous quantity of about 70,000,000 gall. was ejected during the subsequent 24 hours. The "*Dos Bocas*" fire raged for 58 days, during which there went up in smoke more than 2,000,000 gall. of oil.

Every now and then "*Dos Bocas*" returns to life for a brief period and throws up a fountain of salt water, but in the intervals it remains a quiescent derelict oil-well, surrounded by a vast area of water.

The Mexican oilfield was the scene of another great gusher 18 months later, when the "*Potrero de Llano No. 4*" well came in. Immediately the drill entered the stratum of oil-sand the oil rushed up the borehole with such force that the gusher was quickly out of control. The outflow increased until oil was pouring forth at the rate of 5,260,000 gall., or 125,000 barrels per day. The terrible conflagration of the "*Dos Bocas*" well was still vividly remembered by the engineers of "*Potrero de Llano*," and drastic steps were taken at once to prevent any likelihood of the new well becoming ignited.

It was deemed futile to attempt immediately to "cap" the well and initial efforts were concentrated on preventing the vast quantity of oil being ejected from running to waste. A gang of 2,500 Mexicans and Indians was gathered together, 1,500 of whom were relegated to the task of excavating a vast earthen reservoir to accommodate 105,000,000 gall. of oil. The men laboured in two shifts, one during the day and one during the night. The material excavated was utilized to build up the embankments. Other men were engaged in laying two 8 in. dia. pipe-lines from the well to the reservoir. The gusher was ultimately directed through the pipe-lines and the reservoir filled with oil to a depth of 30 ft. In due course the outflow from the well was brought entirely under control and restricted to a convenient output.

Next month we shall relate how a modern oil-well is sunk and the outflow of oil is brought under control. The laying of the great pipe-lines that often extend for several hundred miles, and through which the crude oil is passed to the storage tanks of a refinery or an export depot, will also be described.

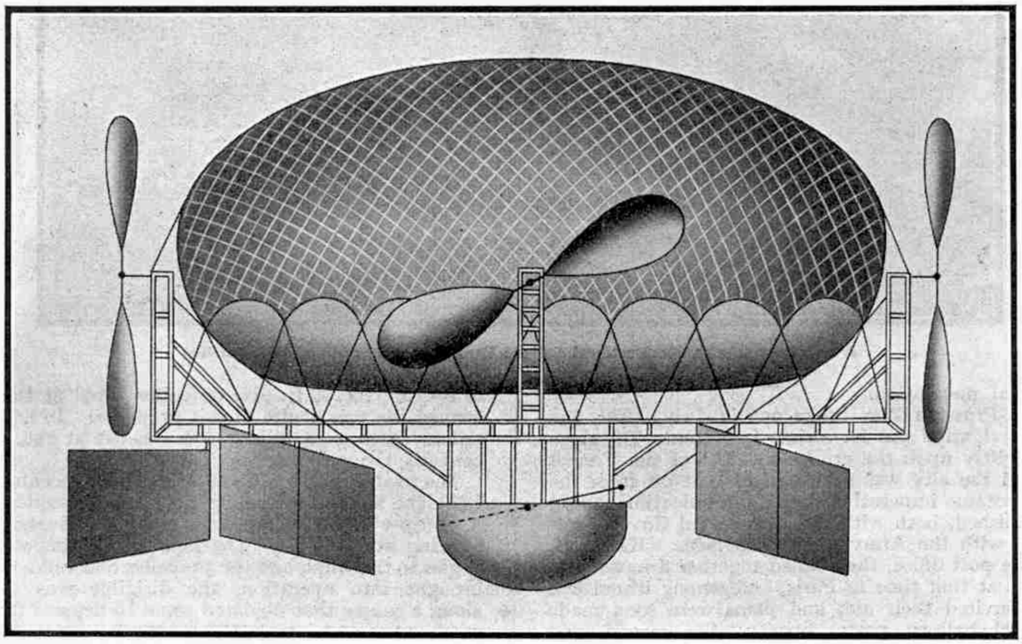


The Conquest of the Air

EARLY BALLOON ASCENTS

THE belief expressed by the French aeronaut, Nadar, in 1863, that aerial navigation could only be achieved by means of heavier-than-air machines, as mentioned last month, aroused considerable interest. Many French scientists and aeronauts disagreed with his opinion, and they propounded various theories in which balloons were utilised. One of the most interesting of these schemes was put forward in 1864 by M. David, a member of the Aerostatic and Meteorological Society, in a pamphlet he published under the title "*Solution of the Problem of Aerial Navigation.*"

The booklet described two dirigible balloons each having a sausage-shaped envelope of varnished or vulcanised lutestring. One was equipped to illustrate his theory of propulsion by sails and the other his concept of a purely mechanical aerostat. Within the envelope of the former was a smaller balloon that was connected with a reservoir of compressed air placed under the car. By mechanical means the lesser balloon could either be filled with gas or atmospheric air, according to the aeronaut's wish to ascend or descend. The outer envelope was covered in network, from the lower extremities of which was suspended a horizontal wooden framework with vertical supports fore and aft to which were attached large vertical sails. The right and left sides of the balloon each had a double-bladed propeller carried on a vertical extension of the balloon framework and connected up to the engine placed in the car. The engine was to be operated either by steam or expanded air.



Vertical Section of David's Mechanically-propelled Aerostat

A vertical sail of stretched canvas, mounted on a pivot and capable of turning to right or left, was rigged up at the prow of the aerostat, while a smaller one was placed at the stern. Further aid to navigation was provided by two horizontal sails, or slightly inclined planes, also fitted on pivots and situated one fore and one aft of the balloon car. The car was connected to the balloon framework by means of several uprights of wood or iron, and was also attached by ropes to the network covering the envelope.

David explained that the purpose of the side propellers "is to oppose the currents of the atmosphere with an equal force. They consequently turn so as to screw up against the wind. Their movements should be more or less rapid, according to the force of the wind, and should be so adjusted as to cause equilibrium." He calculated that by means of the sails the balloon could, under favourable conditions, ascend or descend without loss of gas or ballast. He admitted, however, that this simple method would only propel the balloon at a slow speed, even in calm weather.

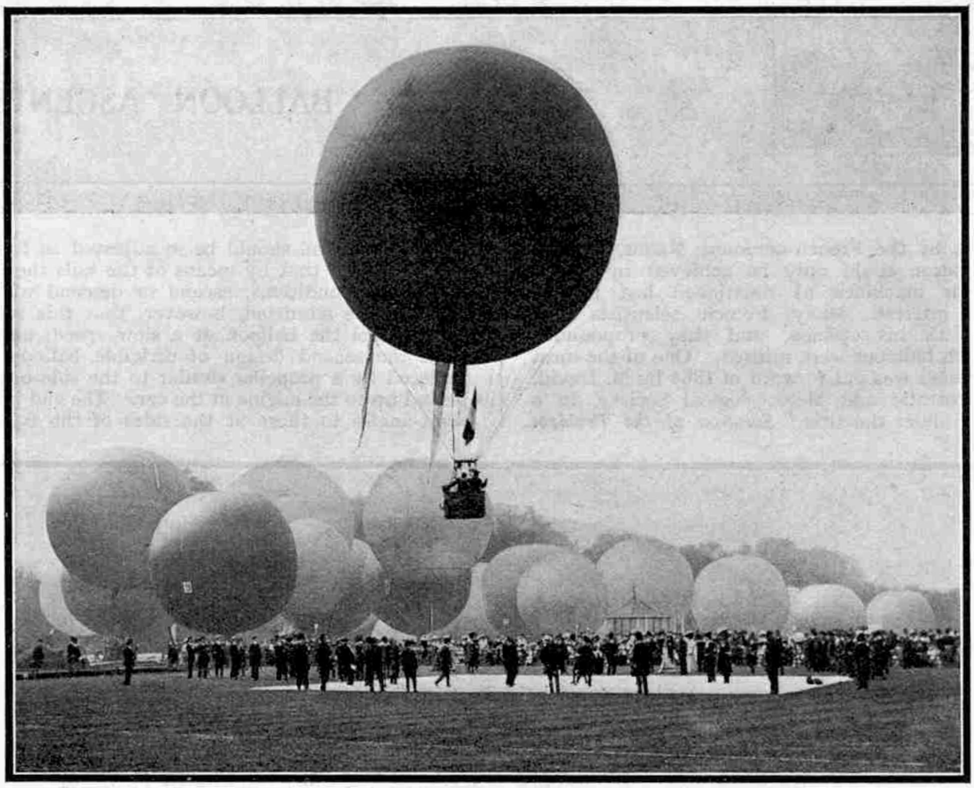
In the second design of dirigible balloon each end sail was replaced by a propeller similar to the side ones and likewise connected up to the engine in the car. The end propellers operated at right-angles to those at the sides of the balloon. Vertical sails were pivoted in front and behind the car, slung beneath the framework, while the stern sail was supplemented by a rudder.

The perfecting of a mechanically propelled airship was carried a stage further in the following year when an inventor in Germany named Paul Haenlein constructed a dirigible balloon that derived its motive power from a gas engine accommodated in the balloon car. The envelope was of cylindrical form with cone-shaped ends, and to ensure it being absolutely airtight it was lined with a thick coating of rubber and covered externally with a thinner coating of the same substance. The envelope was 164 ft. in length, 30 ft. in dia. at the cylindrical portion, and was of 85,000 cu. ft. capacity. The car was constructed of horizontal beams and was suspended beneath the envelope by means of ropes from the network. It was slung as close to the envelope as was practicable in order to add to the rigidity of the whole.

The 4-cylinder Lenoir type gas engine installed in the car was of 6 h.p., and in operation consumed 250 cu. ft. of coal gas per hour. This fuel was drawn from the balloon envelope, the air bags within the latter being proportionately inflated to remedy the shortage and so prevent deflation of the balloon. The use of coal gas added considerably to the weight of the balloon and in consequence restricted its power of ascension. In view of this fact the trial was carried out with the balloon held captive at a low altitude by numerous soldiers. The balloon attained a speed equivalent to 10¼ m.p.h., and it is unfortunate that lack of funds prevented further experiments being carried out with this promising airship. Had it been possible to use hydrogen instead of coal gas the appreciable reduction in load would have resulted in a much greater rate of travel being achieved.

Yet another device for effecting the navigation of a balloon was invented in 1866 by a Frenchman named Delamarne. He designed a cylindrical balloon equipped on each side with a triple bladed propeller, while a disc, the purpose of which was to resist the pressure of the air, was fitted to the nose of the balloon and in the rear a large rudder was provided as a further aid to navigation. The propellers were actuated by means of a shuttle operated by the aeronaut in the car.

At the test flight carried out from the Luxembourg Gardens, Paris, the balloon ascended satisfactorily but, despite its owner's energetic manipulation of the steering apparatus, it responded only to the aerial currents encountered. Delamarne subsequently carried out a further trial flight, this time from the Champs de Mars, where several historical balloon ascents had been made in the past. His attempt was witnessed by the Emperor Napoleon III and a large crowd of people. This exhibition proved more unfortunate than the previous one, however, as in the course of the balloon getting away one of the propeller blades penetrated the envelope and tore it to such an extent that repair was impossible. The flight therefore had to be abandoned. After this experience Delamarne forsook experiments in aerial navigation.



A typical scene at an International Balloon Race. The first competitor ascending

When the Franco-Prussian War broke out in July, 1870, the subject of balloon navigation was for a time forgotten. The siege of Paris followed swiftly upon the crushing defeat of the French Army at Sedan, and the city was soon entirely cut off from the outside world. It became imperative that communication should be speedily re-established, both with the Provisional Government then at Tours and with the Army in the provinces. Rampont, who was chief of the post office, then called together a number of aeronautical experts at that time in Paris, and among whom was Nadar. Rampont invited their aid, and plans were soon made for an experimental balloon postal service. Six second-hand balloons were procured and thoroughly overhauled in preparation for the venture. Great excitement prevailed among the populace when it became known that attempts were to be made to deliver despatches to their fellow countrymen beyond the besieging army.

The first attempt was made on 23rd September, 1870, when an aeronaut named Durouf ascended in one of the renovated balloons with many important despatches in the car. The balloon rose satisfactorily and descended three hours later near Evreux, having safely passed over the enemy encamped around the city. Two days later a second consignment of mail was sent off in another of the balloons, while a third left on the 29th of the same month.

All these balloons accomplished their mission without mishap and the Government then decided to establish a regular balloon postal service. Accordingly two balloon factories were built and equipped in Paris. The balloons made at these factories comprised envelopes of best varnished cambric enclosed in tarred rope network and were of 70,000 cu. ft. capacity, while each car accommodated four persons. Every balloon ordered from the factories by the Government had to be constructed and delivered within a specified time, and the manufacturer was fined £2 for each day that a balloon was overdue.

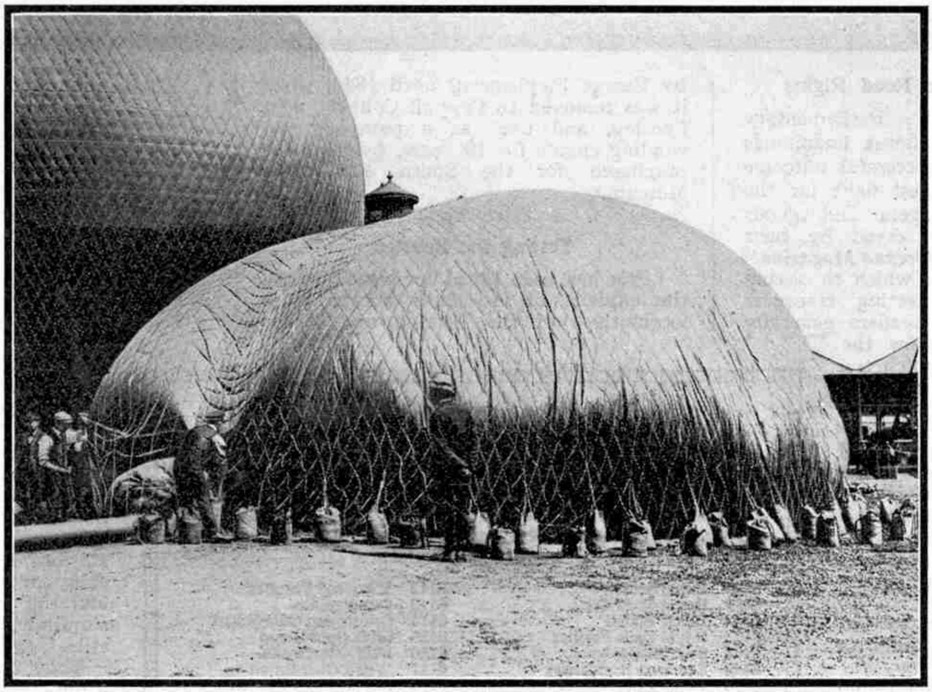
Marines were trained to operate the balloons and during the four months of the siege 66 balloons left Paris and conveyed 102 passengers out of the city. Nine tons of telegrams and letters were likewise transported. Carrier pigeons were taken by many of the balloons and were subsequently released, to fly back to Paris with messages containing military or civil information. Of the 409 pigeons employed for this purpose only 57 safely returned to the city, but as this small number brought in a total of some 100,000 messages the venture was by no means fruitless. Only five of the 66 balloons sent up came to grief, three of them falling into the hands of the enemy, while two were never heard of again.

The successful escapes by balloon from Paris reawakened interest in aerial navigation and in October 1870 Dupuy de Lome, a marine engineer who was naval architect to the French Government, received a grant of £1,600 to enable him to construct and experiment with a dirigible balloon. The completed balloon had a cigar-shaped envelope with pointed ends and was 118 ft. in length, 49 ft. in dia. at the middle, and of 122,000 cu. ft. capacity. The envelope was inflated with hydrogen gas, and an air bag operated by a pump placed in the balloon car was installed within the envelope. The car was large enough to accommodate a crew of 14 men, four of whom were to operate the 30 ft. dia. propeller fitted at the stern. Two sails formed the two blades of this propeller. In addition, a triangular sail to serve as a rudder was hoisted at the stern, immediately beneath the envelope.

The trial of the dirigible took place at Vincennes on 2nd February, 1872, the balloon ascending with a full complement of passengers. A south-westerly wind at a velocity of about 32 m.p.h., was blowing at the time. The head of the balloon was set at right angles to the wind, and the propeller and rudder being immediately brought into operation, the dirigible was successfully steered along a course that deviated some 10 degrees from the path of the wind. A speed of about six m.p.h. was maintained. Later a safe descent was effected about 90 miles from Paris. Although the dirigible of M. Dupuy de Lome did not represent any great advance on the navigable balloons of previous inventors, his flights and experiments confirmed that under moderate conditions, a lighter-than-air balloon could, by means of a screw propeller and rudder, be controlled during flight.

The utility of balloons for the purpose of scientific investigation of the upper atmosphere was by this time fully recognised and almost every year ascents for the purpose were made by various experienced aeronauts. These ascents were generally carried out only under favourable weather conditions, so that the safety of the ventures was more or less assured. Disaster overtook a small party who ascended from Paris in April, 1875, however, in a balloon called the "Zenith." Three experienced aeronauts, Gaston Tissandier, Sivek and Croce-Spinelli, were in the car. When an altitude of more than 2,000 ft. had been attained the voyagers commenced to be acutely affected by the rarefied atmosphere into which the balloon had passed. Apparently the balloon continued to ascend very rapidly, and before the aeronauts were able to make use of the bags of oxygen they had with them for such an emergency all three lost consciousness. The balloon attained a height of 27,000 ft. and after being several hours in the air it descended to earth, the car striking the ground with such force that the scientific instruments were broken. Of the three occupants, Sivel and Spinelli had died in the air from asphyxiation, but Tissandier survived the ordeal, although he was slightly injured by the car's impact with the ground. This voyage acted as a strong deterrent to future scientific expeditions by balloon.

Another aerial voyage of scientific research that ended fatally was one undertaken in this country in 1881 by a Mr. Walter Powell, Member of Parliament for Malmesbury, who, on the 10th December of that year ascended in a War Office balloon called "Saladin." Powell was accompanied by a Cheltenham gentleman and an officer of the Rifle Corps. Urged by a strong easterly wind the balloon travelled westward to Exeter where, drifting into a current of air blowing in the opposite direction, it retraced its journey as far as Bridport. As the balloon approached the town the aeronaut realised that there was a possibility of the wind carrying the balloon out to sea, and made hurried efforts to partly deflate it. The wind dragged the balloon some distance after it reached the earth, but the two passengers managed to scramble out of the car. Their departure considerably lightened the balloon, and before Powell could get out it shot up into the air again. It was carried swiftly out to sea and was never seen again, nor was anything more heard of its unfortunate occupant.



Inflating a large balloon envelope. Note the ring of loaded sand bags for holding it down as it fills with gas

Three years later two French Army engineers named Renard and Krebs attracted public attention by a torpedo-shaped dirigible balloon that they had constructed. It was 165 ft. in length and of 66,000 cu. ft. capacity. The envelope was cylindrical in shape but tapered slightly toward the rear; at the front end it was 27 ft. in dia. The car of the balloon was an extensive affair made of bamboo cane and covered externally with silk. It was 108 ft. in length, 6 ft. in height and 4½ ft. in width. A propeller constructed of wooden beams 23 ft. in length was fitted in front of the car and was operated by a 8½ h.p. motor that derived its power from an accumulator carried in the car. A large rudder was rigged up at the stern, at a height about midway between the car and the envelope. When loaded with ballast in preparation for an ascent, the balloon weighed two tons.

After a wait of two months for suitable weather an ascent was made from Meudon, on the 9th August, 1884. When the balloon was well clear of all tree-tops the propeller was started up and the speed at once increased. The rudder was also manipulated with success, and when a distance of 2½ miles had been flown the balloon was turned completely round, the curve described by this manœuvre being of roughly 160 yds. radius. In due course it arrived back at Meudon.

The valve was then opened sufficiently to permit of the envelope being slightly deflated and the balloon brought down to about 250 ft. above the ground. It was then skilfully manœuvred into a position for landing, was hauled down by means of a long guide rope thrown overboard and caught by waiting soldiers. Subsequently trials were made in winds of varying velocity, and on five out of six tests the dirigible was safely brought back to its starting point. Encouraged by the excellent results achieved with this dirigible Renard later endeavoured to construct one on a larger scale, but he was unsuccessful.

Many aeronautical inventors were turning their attention toward the perfecting of a "flying machine," and until the beginning of the present century the subject of navigable balloons was allowed to lapse. In the meantime, however, many interesting flights in ordinary balloons were carried out by various aeronauts and some of these achievements are worthy of mention.

During 1887 several attempts were made once more to cross the Channel by balloon and the feat was accomplished by an aeronaut named Morton at his third attempt. He ascended at Dover and 5½ hours later descended safely at Roon, a village about 33 miles east of Calais, having travelled through the air a distance of approximately 70 miles. The same year two French aeronauts, Mangot and L'Hoste, also attempted the feat, but when they were last seen they were some 39 miles south of the Isle of Wight. It was presumed that during the storm at that time raging in the English Channel their balloon fell into the sea and the men were drowned.

A record height for a balloon ascent was achieved in December 1894 by a scientist named Dr. A. Berson, who went up from Stassfurt, Prussia, in a hydrogen-filled balloon. The voyager afterwards related that when the balloon attained a height of 22,150 ft. he resorted to inhaling oxygen from the supply he had taken up with him. After passing through a stratum of fine snow the dirigible attained a height of 31,500 ft., 2½ hours after the commencement of the flight. The doctor then decided to return to earth, and the descent was accomplished in slightly less time than the upward journey. The dirigible safely reached the ground at a spot about 186 miles from where the ascent was made.

The following year Herr Salomon Andrée, Chief Engineer to the Swedish Post Office, created a sensation by publicly announcing that he intended to journey by balloon to the North Pole, provided he could raise the £7,000 to £8,000 necessary to cover the cost of the venture. Andrée had already visited the Arctic regions as one of the meteorologists of the Swedish Expedition in 1882, and therefore was well acquainted with the climatic conditions. His scheme was favourably received and a national subscription for his project was opened. One generous donor contributed over £3,500, while the King of Sweden also gave a large sum. When it was evident that the necessary funds would be forthcoming Andrée commenced preparations for the flight, first consulting scientists and experienced aeronauts in many countries with a view to obtaining the best all-round advice.

The balloon was built in France, the envelope being made of Chinese pongee silk as adopted for French balloons, while the car was constructed of wood and wicker work, no iron or steel being allowed lest they should influence the magnetic instruments to be used on the trip. A successful trial flight was made from Paris in May 1896, in the presence of many expert aeronauts including Col. Renard and Tissandier. Doubts were expressed by aeronauts as to the chances of the balloon remaining in the air long enough to cross the Polar seas, however, and in deference to their misgivings Andrée had the capacity of the balloon envelope increased by 300 cubic metres, bringing the total capacity up to 4,800 cubic metres. The envelope was also further strengthened with several additional coats of varnish.

The balloon was then sent to Sweden where it was got ready for the flight. The Swedish Government arranged for a gunboat to convey Andrée and his two companions and their balloon from Gothenburg to Spitzbergen. The gunboat left Gothenburg on 18th May, 1897, and was accompanied by a cargo vessel carrying the gas-producing plant and other necessary equipment.

The expedition ascended from Spitzbergen on 11th July of the same year and soon passed out of sight. Several carrier pigeons were taken in the car, for release periodically to return to Sweden with messages as to how the party were faring. *(Continued on page 331)*

Railways' Fight for Road Rights

Among experienced Parliamentary authorities opinion is almost unanimous that there will be a successful outcome of the railway companies' fight for the right to carry passengers and goods by road in the areas served by their ordinary lines. The "*Meccano Magazine*" is not a proper place in which to discuss controversial points affecting transport undertakings, but our readers generally will be interested to know the principal points upon which the companies base their petition.

In the first place it must be understood that the railway companies, in common with all other joint stock and chartered companies, are authorised by their charter of incorporation to do only certain things. If they wish to carry out any other undertaking they must secure special authority to do so. Thus special powers to own hotels and operate steamboats were necessary.

The coming of the internal combustion engine has revolutionized transport working and is the most important development since the introduction of the steam engine itself. It will be obvious that the changed circumstances thus created have seriously affected the railway companies. A great deal of their most remunerative passenger and goods traffic is now moved from place to place by road. The railway companies claim that the community as a whole cannot enjoy the full benefits of motor transport unless there is close co-ordination between road and rail operations. The second principal point the companies submit is that it is unfair for them as ratepayers to be required to contribute toward the cost of constructing and maintaining roadways, while they are debarred from the unrestricted use that is granted to their competitors.

* * * *

Two Historic Locomotives

One of the original experimental locomotives of the Liverpool and Manchester Railway, the "*Novelty*," was discovered only some 20 years ago working as a stationary engine at a works at Rainhill, the wheels having been removed. For over half a century the old warhorse had been forgotten and lost. Parts of it have since been lodged in the South Kensington Museum.

Another of the original Liverpool and Manchester engines, the "*Sanspareil*," worked on the Bolton-Leigh line (built by George Stephenson) until 1844, when it was removed to Coppull Colliery, near Chorley, and used as a pumping and winding engine for 19 years, before being purchased for the South Kensington Museum.

* * * *

Testing the Booster

Little has been heard for some time of the exploits of the three booster-fitted locomotives of the London and North Eastern Railway—the only British engines to be fitted with this contrivance, which, however, now has a considerable vogue in America and, to a smaller extent in Australia. The two large "Mikado" goods engines continue to perform good work with heavy coal trains, and the remaining booster fitted engine (Doncaster-built "Atlantic" No. 4419) has been tried on various sections after being rebuilt with reduced boiler fittings to enable it to be used on the North British section. The booster mechanism has been modified as the result of these trials. It now has a higher gear ratio and can be brought into action when the engine is travelling at higher speeds than formerly.

A recent test was made when No. 4419 was called upon to start a special train of no fewer than 18 main line carriages on a stiff gradient and sharp curve. Without the additional assistance of the booster this feat would have been quite impossible for a locomotive of the "Atlantic" type and of comparatively small dimensions, but the train was started in splendid fashion, thus demonstrating the usefulness of the auxiliary engine driving the trailing wheels. On another trial, the train was started from rest by operating the booster only. R.S.M.

"ROYAL SCOT" NAMES

By courtesy of the L.M.S. Railway we publish below the list of names chosen for allotment to the first batch of engines of the "Royal Scot" class. It will be observed that they are named after famous regiments of the British Army. This is an entirely new and decidedly novel source of engine nomenclature

6100	Royal Scot	6112	Sherwood Forester
6101	Royal Scots Grey	6113	Cameronian
6102	Black Watch	6114	Coldstream Guardsman
6103	Royal Scots Fusilier	6115	Scots Guardsman
6104	Scottish Borderer	6116	Irish Guardsman
6105	Cameron Highlander	6117	Welsh Guardsman
6106	Gordon Highlander	6118	Royal Welch Fusilier
6107	Argyll & Sutherland Highlander	6119	Lancashire Fusilier
6108	Seaforth Highlander	6120	Royal Inniskilling Fusilier
6109	Royal Engineer	6121	H.L.I.
6110	Grenadier Guardsman	6122	Royal Ulster Rifleman
6111	Royal Fusilier	6123	Royal Irish Fusilier
6124	London Scottish		

Underground "Booking" Machines

Some interesting experiments with automatic ticket issuing machines have recently been carried out on the London Underground Railways and as a result several new types of installations are being made as opportunity serves. Among these is a slot machine that will replace the noisy "pull-bar" machine, which was easily manipulated with base coins or metal discs.

The new machine not only prints, dates and issues the necessary tickets but also tests the coins submitted to it and gives correct change for sixpences or shillings. There is only one coin slot for each ticket value, and whether the correct number of pennies, 6d. or 1/- is dropped in, the ticket is delivered with any necessary change. At certain stations this machine is electrically connected to the turnstile and the act of issuing a ticket simultaneously releases the turnstile.

This machine is, in effect, a development of the passimeter booking office that now is being adopted throughout the Underground system. For this a clerk is required to take the fare, but the ticket is printed from a roll of plain paper, dated and numbered by a machine that also operates the turnstile. Another development of the passimeter is that the controlling mechanism of the lifts descending to the trains is located inside the passimeter booth. The clerk thus controls the lifts with one hand and operates the ticket issuing buttons with the other.

The whole tendency of modern booking office methods is to do away with preprinted tickets. Time is saved and greater accuracy is secured. Rush hour records taken during the past ten years show that passengers to-day pass before a booking office window at the rate of 1,000 per hour under passimeter conditions, as compared with 600 per hour under the old manual conditions.

* * * *

Tokyo's First Underground Railway

Japan for generations has been noted as the progressive eastern country. Its municipal and state enterprises have been fashioned on western lines and in many features the capital city can display more up-to-date arrangements than are to be found in the majority of western cities.

At the end of last year Tokyo's first underground railway opened for traffic. It has been laid out on the lines of the New York subway system and has been built to withstand earthquake shocks.

Britain's Largest Signal Box

Passengers on the Southern Railway recently have noticed with considerable speculation a new building that is springing up rapidly on a piece of ground between the two stations at London Bridge. This is the framework of a giant new signal cabin that is to contain 311 electrically-operated levers controlling approximately 2,000 trains a day. Men are working day and night, and the new box will be brought into operation in June next when the further extensions of the three-aspect and four-aspect colour light signalling system are to be completed and the old semaphore arms abolished.

The new cabin will be 113 ft. in length and 16 ft. in width and will have three storeys. It will contain a power-operated frame 70 ft. in length and weighing 23 tons. Incidentally it will carry out the work of five existing signal boxes containing 615 mechanical levers, which eventually will be dismantled.

This great signal cabin will control 2½ miles of track (from London Bridge to Bricklayers Arms Junction—near New Cross) containing 10 and 11 sets of metals, as well as the intricate working in the Central Section Station (11 sets of rails), the Low Level Station (four sets) and the High Level Station (six sets). All these lines will be included on a large route diagram to be erected in the cabin, on which the progress of trains on the various lines will be shown by coloured lights. The staff to be employed in the new box will consist of 16 signal men and eight signal lads. These men are now undergoing a special course of instruction in similar but smaller signal boxes in the London area to accustom them to the working of the miniature levers, barely six inches in height, that will take the place of the heavy old-fashioned levers with which they have previously worked, and to move which requires a man's whole strength. The new levers are so adjusted that the flick of a finger will move them.

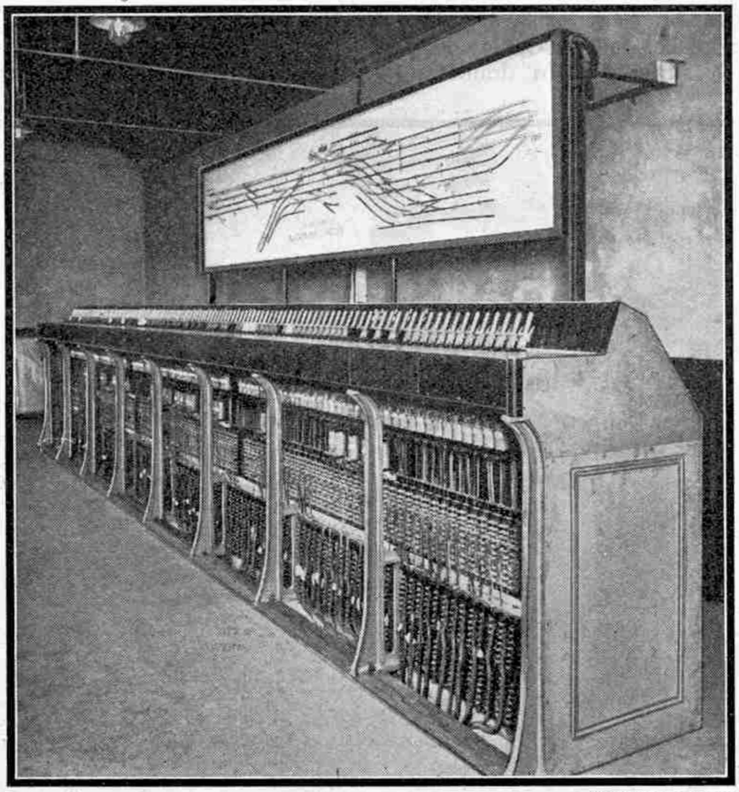
The colour-light signalling system on the Southern Railway will be extended with the opening of this box to include both the stations at London Bridge and for a considerable distance beyond, the cost of the work being £150,000.

The cabin will be the largest in Great Britain and the most up-to-date in the world. It will not be the largest in the world, for that distinction is claimed for the principal cabin at the Grand Central Terminal Station, New York City, which has on its ground floor a 400-lever frame with 360 working spaces, and on an upper floor a 360-lever frame with 294 working spaces.

Wipers for Engine Cab Windows

The L.N.E.R. are experimenting with wipers fixed to the cab windows of the famous "Pacific" engine No. 4475, "*Flying Fox.*" These wipers are somewhat similar to those used on the screens of motor cars, and they are intended to assist the driver in his observation of the line during wet or snowy weather.

New Electric Signal Cabin



Courtesy] [*Southern Railway*

Our photograph shows the inside of an electrically operated signal cabin on the Southern Railway, such as is referred to on this page. Note the miniature levers and the illuminated route diagram above the frame

Record American Railroad Run

The reception given at Washington to Colonel Lindbergh, the hero of the first 1927 Atlantic flight, was the occasion for a remarkable run on the Pennsylvania Railroad. Naturally the cinema man was prominently in the foreground at the reception, and New York picture-goers were keenly anxious to see the pictures at the earliest possible moment. Arrangements were made with the Pennsylvania Railroad for a special train to convey the films to New York and an Atlantic type passenger express engine and two steel passenger cars were detailed for the job.

The run from Washington to New York, a distance of 224½ miles, was made in 187 minutes at an average speed, excluding stops, of 74.9 m.p.h. It is claimed that 85 m.p.h. was maintained for 66½ miles and the average for the first 216 miles was 75.78 m.p.h. ! These speeds are claimed to be highest recorded by a steam locomotive over the respective distances.

High Capacity Coal Wagons

The Great Western Railway for several years past have been endeavouring to secure a wider use of 20-ton coal wagons by those traders dealing with large consignments. The economy of high capacity wagons has been emphasised time and again, and rebates on freight, weighing and tipping charges have been offered to traders as inducements to try them. It is a matter for regret that traders generally seem to be indifferent to the advantages secured by the use of the bigger wagon, but the number of users is slowly increasing, as is indicated by the fact that 1,000 of the wagons are now in use.

With these facts in mind, the introduction of 60-ton wagons on the German State Railways for hauling coal between the Silesian collieries and the gas and electricity generating stations in Berlin is of special interest. These wagons are of all-steel construction and weigh 19 tons. They have a saddle-shaped base that permits rapid discharge of the load upon the release of the side chutes, which throw the coal clear of the track upon which the wagon is standing. The depots into which these wagons work are provided with special bridge sidings running through the coal loading banks. These sidings, as the name indicates, are raised several feet above the banks and are just the width of the single track. Thus the coal falls straight on to a dump as it leaves the wagon. Two men can unload a 60-ton wagon in eight seconds, and a 1,000-ton train can be unloaded in 2½ minutes !

The economy in unloading time naturally is due to the design of the wagon, but further advantages also are possessed. In the shunting yards the larger wagon occupies only one-third of the space that would be required by the four 15-ton wagons previously needed to handle the equivalent load. This means that a train carrying 1,020 tons in 60-ton trucks would occupy a length of 190 yards only, as compared with 630 yards required by 15-ton trucks.

* * * *

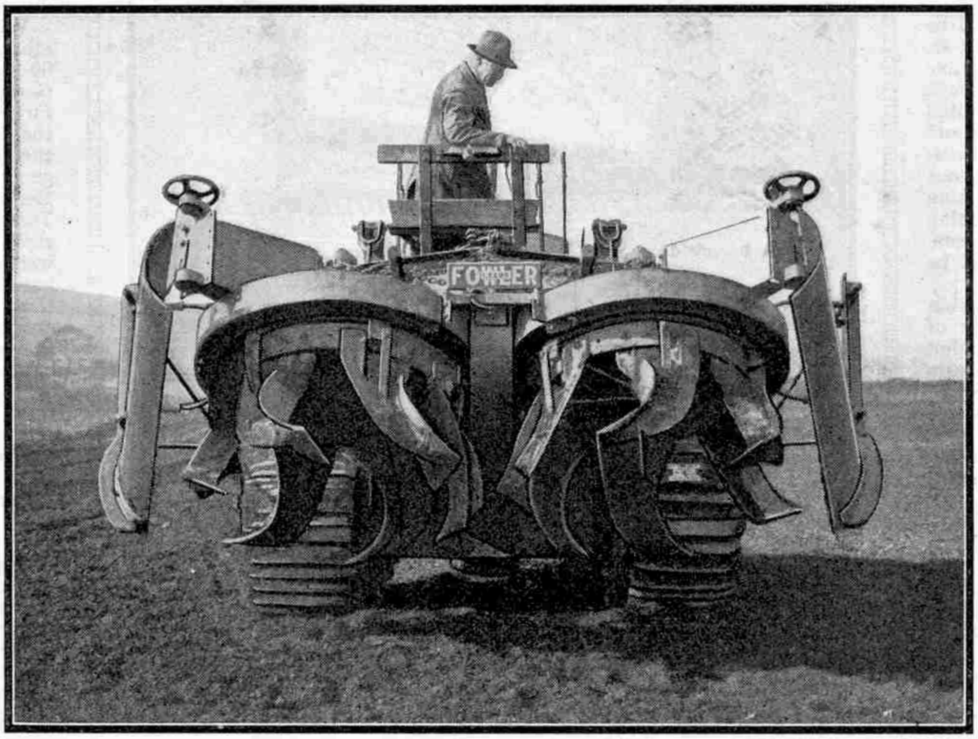
Train Number Boards

Several readers who spent their holidays in the south of England have inquired the meaning of the large number boards carried on the front of Southern Railway engines. These numbers are those given to the trains in the working time-tables distributed to signalling and other operating staffs on busy days, and are intended to enable railwaymen to identify an individual train among the many that pass through.

Plough with Huge Rotary Cutters

Interesting Machine for Sugar-Cane Plantations

PRIMITIVE man was a wanderer—not from choice but from necessity. He lived entirely upon the natural food supply that he found around him and consequently, when he had exhausted the resources of any particular place, he was obliged to move on in search of fresh supplies. No doubt at first the wandering life appeared to him to be the only existence possible, but after a while it must have occurred to him that it would be pleasanter and easier to settle in one carefully selected place. The only real difficulty was that of food supply, and by degrees, as his intelligence developed, he hit upon the idea of domesticating the animals that he needed. Subsequently there came an even bigger inspiration—that of growing his own foodstuffs instead of being dependent upon the wild products of nature.



Courtesy] [John Fowler & Co. Ltd.

Rear view of the Rotary Plough showing the Cutters at rest suspended clear of the ground

Once the idea of raising crops had become established, it would not be long before it was realised that the soil required some treatment in order to produce the best results, and thus presently there came into existence, in a primitive form, the oldest of all agricultural implements—the plough. At first probably it consisted of little more than a crook-shaped bough of a tree, with a sharp flint fastened in front. This was only capable of scratching the surface of the ground, but the idea was there.

In some primitive forms of the instrument the stick was pointed, and either hardened at the point by charring, or shod with iron. A plough of this kind, known as the caschrom, was actually in use less than 100 years ago in the islands of the outer Hebrides. A plough closely resembling the caschrom was used by the early Saxons. It was still made entirely of wood, and in shape somewhat resembled a pickaxe, one limb being held by the ploughman while the other scarified the soil as it was dragged along by two oxen. Similar ploughs were used in Egypt until quite recently.

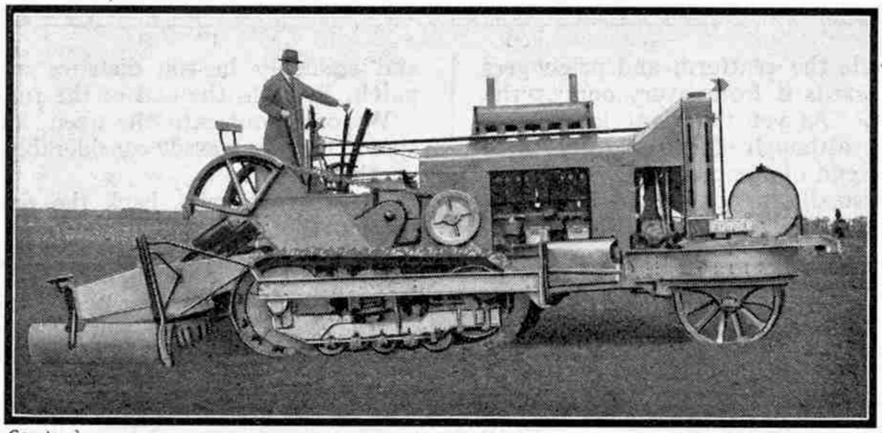
An important addition was the mould-board, a flat board fastened behind the share or cutting tool of the plough by a wooden or iron peg. Up to the time of the introduction of this accessory, the surface of the earth was merely broken up, but now the slice of earth was turned over, with the result that greater aeration of the soil and improved fertility followed. The earliest mould-board was transferred from one side of the plough to the other at the end of each furrow.

Since the invention of the mould-board various improvements have been made, leading up to the wonderfully perfect mechanically-operated plough of to-day. The modern plough is pre-eminently an implement for inverting the soil. Slice after slice of earth is cut by the steel share, and the mould-board with its beautifully calculated curve turns them over, the depth and width of the furrow being varied when necessary by adjustments of the parts of the implement. These operations are best carried out in autumn, in order that the earth may be exposed to the disintegrating action of the frosts of winter. The tilth thus produced is specially suitable for agricultural operations.

The earliest ploughs were hand operated, but oxen have been used for drawing them for ages. In more advanced countries horses came into use for the purpose, but in many parts of the world the use of oxen is still customary for economic and other reasons, in spite of the comparative slowness of these animals. Occasionally strange combinations may be seen in Eastern countries, such as a camel yoked with a bullock.

Great improvements were made in this respect at the end of last century, when the use of steam power was introduced. In the usual form of steam ploughing, the ploughshares—for a compound implement was used—were drawn across the field by a cable passing round a drum of a traction engine at one side of the field, and round a sheath on an anchor at the other side, or a drum on a second engine. Machines of this type are used in agricultural operations in many parts of the world, but have not come into general use on farms of medium size, the modern tendency being to use a motor tractor to draw the plough behind it.

A particularly interesting type of mechanical plough has been introduced recently by John Fowler & Co. Ltd., the well-known Leeds makers of agricultural machinery. In this machine two sets of rotary cutters or ploughs are arranged to turn in opposite directions on a vertical axis. These cutters break up the soil as the machine moves forward, and in consequence each section of the ground is broken up twice by the cutters in their circular path. The machine, which has been designed specially for work on sugar-cane plantations in Cuba, works to a depth of 18 inches. The working width is 10 ft. and the area that can be prepared for planting in a single day is from six to eight acres.



Courtesy] [John Fowler & Co. Ltd.

A broadside view of the Fowler Rotary Plough and Tractor. The Cutters are at work in the rear

The main frame of the machine is carried on two half tracks and a steerable front wheel, while the two rotating rings upon which the cutters are mounted at the rear are carried on a pivoted framework that can be raised clear of the ground or dropped into work as required.

The plough is driven by a 225 h.p. six-cylinder vertical petrol engine. This is arranged at the front, and from it the drive is taken to the main gear box. Two working speeds are provided on the tracks and there are two different speeds of rotation for the rotary cutters. As the cutters give four different degrees of cut as the machine moves forward, it is evident that the amount of fresh soil broken by each cutter as it revolves, depends partly upon the speed of rotation and partly on the amount of forward movement. The degree to which the soil is pulverized depends very largely on the cut, and in practice it has been found possible to produce any degree of tilth required for cultivation.

Another important factor that can be controlled by altering the shape of the cutting tools is the degree to which the subsoil is mixed with the top soil when on deep work. In many cases it is necessary to break up subsoil in order to promote drainage and thorough root development, but at the same time it is essential that the subsoil should not be brought to the surface. This can be effected by using the correct shape of rotary cutter.

For sugar-cane work the plough is fitted with two large ridging bodies in addition to the rotary cutters, so as to leave the land in ridge and furrow fully prepared for the planting of the cane. Hitherto, in preparing old cane land for re-planting, the process has consisted of ploughing, discing and harrowing before the land was ready to set up into ridge and furrow. The rotary plough will substitute for this a single operation. At the same time the tilth obtained is deeper and more thorough.

The manufacturers of this interesting plough are not yet in a position to state whether it would be practicable to extend the use of it to a shallower cultivation, but during a recent demonstration some experienced observers expressed a favourable opinion on the possibilities in this direction.

American Locomotives—*(cont. from page 283)*

They have been designed to haul fast express trains over long distances without change of engine, but the principal problem before the designers was to secure a big increase of power over the previous "Pacific" type engine, without greatly increasing the weight. The new four-wheeled trailer truck permits of a larger firebox and increases the steaming capacity of the engine without an undue increase of fuel consumption. The booster unit is geared to the rear axle.

Tour Round the World—*(cont. rom page 321)*

that the Rajputs have always been famous for the magnificent horses that they possess.

The railway by which I travelled runs along the north-west side of a range of mountains. The country further to the north west is a desert in which the climate is hot and dry during the summer and fairly cold in winter. In the northern parts hard frost is often experienced. I was told that the country to the south of the mountain range is well watered and much more fertile. The difference between the two sections into which the country is thus divided may be gauged from the fact that two crops of cereals are raised annually in the south, but only one in the north.

"Flying Scotsman"—*(continued from page 315)*

throughout, and has used up as much coal as would last a housewife four years! And we, on the footplate, have passed through the hands of 200 signalmen, and looked out for no fewer than 800 signals! Not once during the trip has it been necessary for our driver to sound an inquiring blast upon the whistle or to apply the brakes because of an adverse "distant" signal. Throughout the run, signalmen in boxes miles ahead have been busily engaged in clearing the way for us. The "*Flying Scotsman*" has the right of the road, and only in exceptional circumstances—when safe working demands it—is the train given an adverse signal.

Railway Photographs

We have received a set of photographic postcards from Messrs. Railway Photographs (13, North John Street, Liverpool) who regularly advertise in the "*M.M.*"

We feel sure that these fine postcards will be appreciated by all our readers who are interested in railways or engines. The cards received to date include photographs of the "*Royal Scot*" (both "near" and "off" sides, showing the valve mechanism), "*Flying Scotsman*," "*King George V*" and "*Lord Nelson*." There is a particularly striking upright view of the last mentioned locomotive, taken from the cab end, and it is one of the finest photographs of its kind that we have ever seen.

We are informed that a list of 24 subjects is already available—six for each of the four groups—and we understand that new titles will be added to this list each month. The series will later be extended to include Canadian, American and foreign locomotives and detailed photographs of valve-gearing, boosters, etc., are now in active preparation.

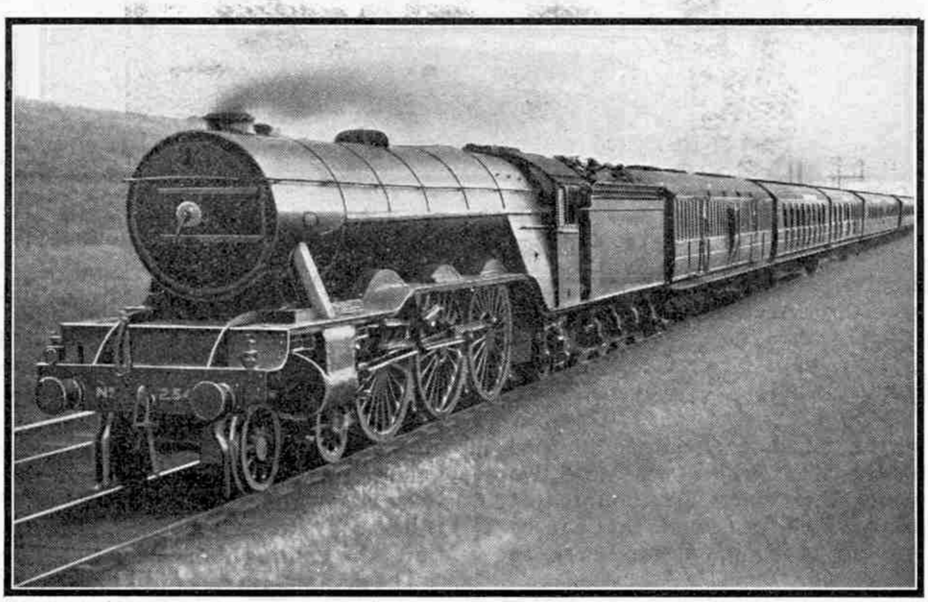
To the North with the "*Flying Scotsman*"

On the Footplate with Driver and Fireman

By R. S. Lyons

THE train is alongside the platform and passengers are streaming towards it from every one of the station entrances. As yet the giant locomotive is nowhere to be seen, although she is scarcely three minutes' walk from the end of the platform.

For over four hours a small army of workers have been busy on her at the locomotive depot. Boiler-smiths, fire-boys, fire-lighters—these and many more have had a hand in the work. The driver and fireman are not content to leave it all to them, however. They are at the depot at least an hour-and-a-half before the train is due to start—oiling, watering, and running over her to make sure she is just "right."



Photo] [F. E. Mackay

The down "*Flying Scotsman*" passing Hadley Wood. Engine No. 2543

When the signal comes to back on to the train the iron monster is ready, and she is scarcely coupled before the guard's long-drawn whistle shrills out. Fireman and driver are at once alert. Without the slightest jerk, the 120-ton monster engine, with her load behind of 500-odd tons, moves slowly forward. The "*Flying Scotsman*" is off once more, setting out on a journey that has been a feature of the L.N.E.R. for over 60 years!

Up on the engine everything is in order; there is a good head of steam, plenty of water, and the fire is burning fiercely.

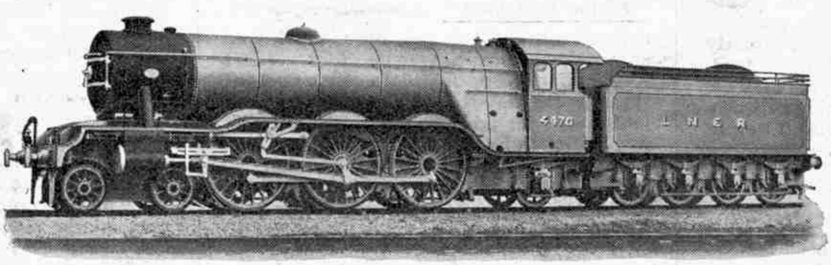
Almost as soon as we have started we are in a tunnel, nearly a third of a mile of it. The din on the footplate is almost ear-splitting. Ahead it is pitch dark, for the end of the tunnel cannot be seen. I can see neither driver nor fireman, yet they are doubtless within arm's length of me; I see only the glow of the furnace, dimmed by smoke that gets into my nostrils and throat, and threatens to choke me. And then the engine reverberates beneath my feet. She is on a bend; and suddenly in the distance appears a pale white patch, an arch, the end of the tunnel.

We come out into the open, and I notice that the speed has increased considerably. Then we are in another tunnel.

The fireman pulls back the fire-guard and a great blast of hot air strikes my face. The furnace glows dazzlingly white. He commences to shovel coal in, one shovelful to the left, one to the right, one deep into the heart.

We are out in the open once more, moving fairly fast, uphill. We roar past suburban stations, carriage sidings, and factories, our speed ever on the increase, and with monotonous regularity—every minute to be exact—the fireman tends his furnace.

I watch the driver. He is peering ahead at the signals, hand on brake in case one should be against him. But it is seldom that he has to pull up, for the track for the "*Flying Scotsman*" is kept clear for miles ahead. Yet I hope that a signal may be against us, so that I may feel the green giant quiver under the application of the brakes. At a mile a minute she can be brought to heel in fifteen seconds!



A Famous L.N.E.R. Locomotive Engine, No. 4470 "*Great Northern*"

A score or more signals confront us at a junction. I wonder which of them refer to us, for several are "down." The fireman cups his hands and bawls in my ear that those for the main line stand up high on their frames, and of these the "fish-tails" are the advance signals. The driver can pass these when they are against him, but in doing so he must slow down, for the "home" signals also probably will be against him.

I draw a deep breath and hold on tight as a double bend of track tears towards us. Without slackening we jerk and sway round, then take a mass of points that cross and recross, and race away on to other lines. How the engine keeps the metals I cannot say, but she does. The driver knows of what she is capable; he is unperturbed.

Every big station we dash through tells the fireman whether or not we are keeping to schedule. I find at Peterborough that we are two minutes in front of time; all is well. But he may say at the 100-mile signal box, which we should reach in 110 minutes or less, that we are a minute behind. Whether early or late the driver must mention the matter on his report, with the why and wherefore of the case.

At well on to 70 miles an hour we are racing towards water troughs. Although the gauges—like thick thermometers with water bobbing up and down inside—show that the boilers have plenty of water, we want more beneath the coal in the tender. A lever is pulled forward and, as we race along at the same terrific speed, we pick up 2,000 gallons in the space of a few seconds.

The "*Flying Scotsman*" thundering over a crossing, on her run to London

The fireman makes me understand above the clatter that the engine is behaving herself. Sometimes, he tells me, she is not in the best of moods, and then she needs a little gentle coaxing.

It is a fine day, which I find is fortunate. In foggy weather the journey is very trying, but snow is about the worst weather that can be encountered. With a grey sky and falling snow, it is extremely difficult to see whether the signals show the line "clear."

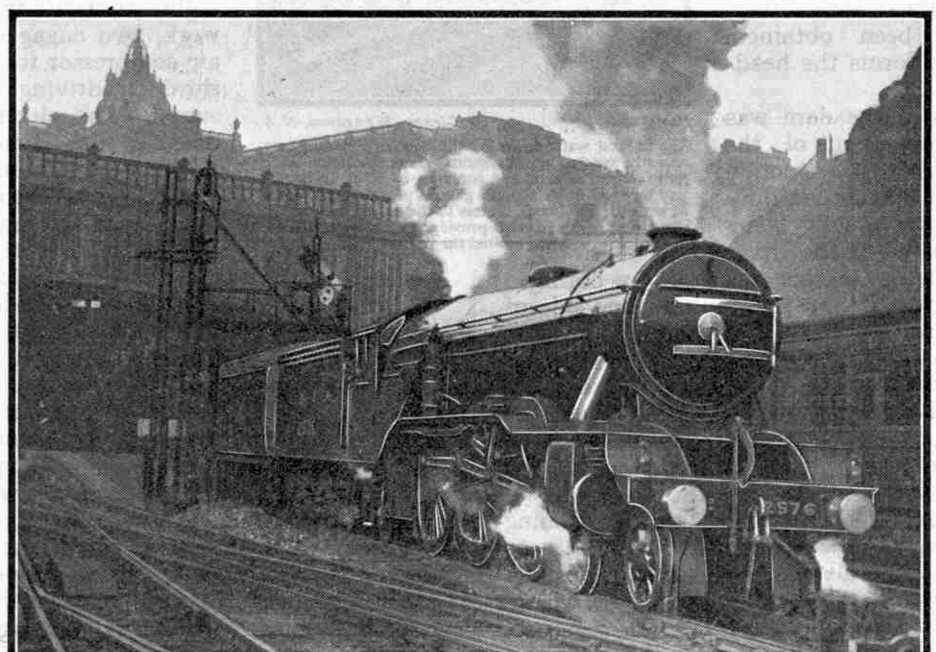
The first stop is Grantham, and here I say good-bye to fireman and driver. They have earned their rest. They will take an express back to London in an hour or so, so that they may rejoin their wives and children at night.

The wheels are tapped and then the train speeds on to York. The passengers, warm and comfortable in well-sprung coaches behind, are beginning to take lunch in the dining cars. Very different from the old days when the "*Flying Scotsman*" stopped at York for 20 minutes to allow passengers to "dine" on whatever they could obtain from the refreshment room! Experienced passengers in those days avoided the soup at York Station. It was always too hot and the uninitiated were wont to hear the cry "Take your seats, please," long before they had had an opportunity of tackling even the first course of their luncheon!

At York I have to descend from my high perch for the engine is to be changed for another 120-ton "Pacific." There is a whole string of "Pacifics" ready for the "*Flying Scotsman*" and her relief train. The new giant is in form, too. She does the 44¼ miles to Darlington in just on the same number of minutes, for the track here is ideal for speeding.

It is strange how the country has changed. There were factories at and near London, then land under cultivation, then the bricks and tall chimneys of Fletton, and more cultivated land. Now I see on either side sombre iron-works, grim-looking steelworks, and coal-mines with their smoking heaps of slag. As we near Tyneside coal-mines appear more frequently.

We have to slow down on approaching Durham because of tortuous bends, but once clear, speed again till the Tyne and Newcastle are reached. And then we race on again towards Scotland, reaching Edinburgh soon after six o'clock.



The up "*Flying Scotsman*" leaving Waverley Station, Edinburgh

The "*Flying Scotsman*" has done the journey, with five stops, at nearly 50 miles an hour

(Continued on page 31

FROM OUR READERS

These pages are reserved for articles from our readers. Contributions not exceeding 500 words in length are invited on any subject of general interest. These should be written neatly on one side of the paper only, and they may be accompanied by photographs or sketches for use as illustrations. Articles that are published will be paid for at our usual rates. Statements contained in articles submitted for these pages are accepted as being sent in good faith, but the Editor takes no responsibility for their accuracy.

Diverting a New Zealand River

The great hydro-electricity scheme now being carried out at Arapuni, on the Waikato River in the North Island of New Zealand, is the largest scheme of its kind in New Zealand and probably one of the largest in the British Empire. When the station is completed it will supply practically the whole of Auckland Province with electricity. The contract for its construction was originally let to Sir. W. G. Armstrong, Whitworth & Co. Ltd., but after a portion of the work had been carried out they made an agreement with the Public Works Department of New Zealand by which the latter undertook to finish the work.

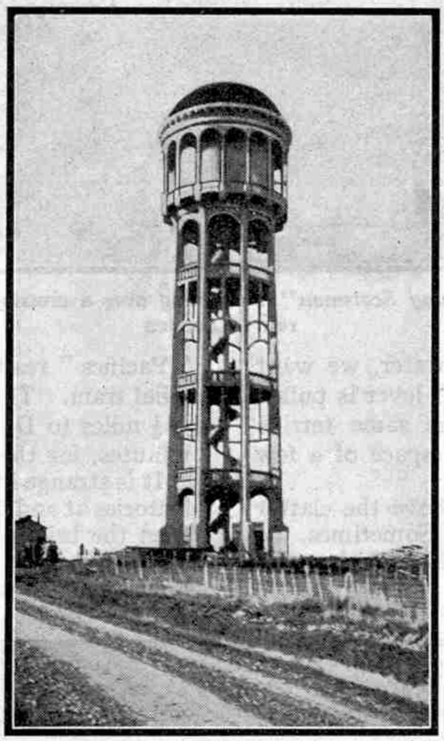
A dam was built in order to turn the river back into a former course for a few miles. The Waikato originally flowed into the Firth of Thames and it is at Arapuni that the two courses, old and new, part. From the old course the water will eventually be led by means of huge pipe lines to the turbines in the power house below the dam. By turning the water along the old river bed for a short distance a much greater fall is obtained than otherwise would have been obtained. The old course thus forms the headrace.

The construction of the dam was probably the largest item of the undertaking, though the construction of the Power house may prove difficult as the site is continually being flooded. To begin with the river bed had to be made dry. This was done by boring a huge diversion tunnel through the bank on one side of the river. The tunnel was lined with concrete and in it were fastened two huge steel gates each one foot in thickness. The intake of the tunnel is some distance above the dam and the outlet is below it. When the tunnel had been opened by blasting away the stop banks at the intake and outlet, a temporary dam was constructed between the intake and the dam site by lowering into the river huge wire baskets each containing about 8 tons of stone. The whole volume of the Waikato then poured through the diversion tunnel and the contractors proceeded with the construction of the main dam. When this was finished the temporary dam was removed, the gates in the diversion tunnel were partially closed and the water began to rise behind the dam, forming a large lake. After several weeks it reached the top of the spillway at the end of the headrace and started to go over it.

When it first raced over the spillway the water diverted by the dam followed the course planned for it and entered the old river bed in the desired place $1\frac{3}{4}$ miles away, but later it eroded the banks of the new channel so seriously that they finally gave way and allowed it to enter the old course several hundred yards higher. This is not of any great consequence provided no further erosion takes place.

When the break occurred many acres of soil disappeared in the short space of one hour and large amounts of scrub and roots fell into the new river. These were held up by screens at the Horahora hydro-electricity Station eight miles further down, where they collected in such quantity that a mat was formed across which a man could easily have walked.

K. H. MELLSOP (Pukekohe, N.Z.)



Photo] [D. Glenny, Wanganui, N.Z.

The highest water tower in the Southern Hemisphere, recently erected at Wanganui, New Zealand. It is built entirely of steel and concrete, is 165 ft. in height, and the tank holds 120,000 gallons of water, the weight of which is 530 tons. Access to the gallery around the upper part of the tower is provided by a spiral staircase winding around the central pillar

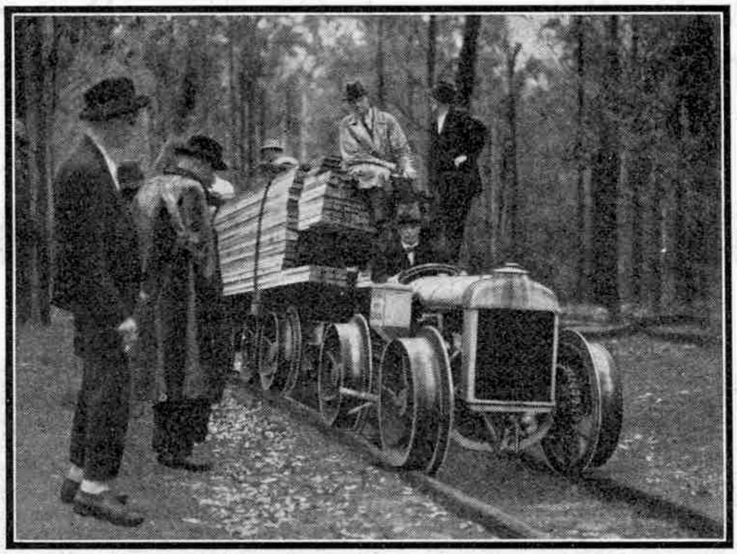
A Visit to the Lizard Lighthouse

Some time ago I had the good fortune of visiting the famous Lizard Lighthouse. First of all my guide took me to the engine room where were four big oil engines. On foggy nights three of these engines are at work, two engaged in operating the air compressor for the foghorn and a third in driving the dynamo that supplies the electric current. Incidentally this dynamo is the oldest working dynamo in England. One engine is held in reserve in case of a break down and two smaller dynamos are also available in the event of trouble. I was particularly interested in a device pointed out to me by the guide in connection with the foghorn. This consists of a brass barrel around which is wound a long strip of paper. An arm having an inked point rests on the paper and as the barrel revolves this point makes a continuous mark on the moving paper. As soon as the foghorn is started the arm commences to vibrate and thus produces a wavy line along the paper. The object of this device is to prove definitely whether the foghorn was working or not at a certain time.

I was taken next to a small room where the spare electric lamps are kept. These lamps were at least 6 in. in diameter and my guide told me they produced 9,000 candle power. Finally we climbed the steep iron stairs to the lantern room. The lantern is built upon a revolving platform floated on mercury, thus giving it a perfectly free movement. Inside the lantern were electric lamps of the type just described, and a third source of light was an acetylene burner. Only one lamp works at a time, the other two being used in case of emergency, the second electric lamp being switched on automatically if the first fails. In passing through the lenses the light is concentrated into a beam of great intensity. C. BURROWS (Redruth).

Logging in the Australian Bush

While on a tramp through the bush at Mount Macedon, 44 miles north of Melbourne, I walked one day into a clearing in which I found a large number of loggers who had just knocked off work for a meal. I was welcomed and told to sit down and "pile into the grub," which I lost no time in doing. Presently I became curious about a roaring noise and on investigation I found that it was caused by a timber chute. A mile higher up men were felling trees with axes sharper than the one that removed King Charles' head, and laying the logs in the chute for the water to carry them down to the sawmills.



Logging in the Australian Bush

While I watched, tremendous logs came down the chute at a terrific speed one after the other. As each one reached the bottom special apparatus stopped it and lifted it up to allow a double trolley to slide beneath it. On this trolley it was then hauled by steam power to a huge circular saw 7 ft. in diameter. This cut the log into quartered sections, which were subsequently trimmed to any required size by means of smaller saws. Finally the timber was removed by a tractor to sidings three miles away. I succeeded in obtaining the accompanying photograph of this operation.

I inquired what would happen if the big saw were to break, and the man in charge told me that the pieces would fly about two miles and then cut down any saplings they might strike. Possibly this was an exaggeration, but at any rate my informant spoke feelingly, for on one occasion a flying piece of one of these saws missed his head by a few inches!

While I was passing along the water chute three logs came down in quick succession. The first two got jammed in some way, and the third flew up in the air and smashed part of the mechanism for stopping the logs at the bottom of the chute. For a moment I was scared, for I thought that the flying log would land on me, but fortunately it did not.

I made the three-mile journey to the sidings with the tractor. The way led through the bush and we spotted three kangaroos and a wallaby. At the sidings a 12-ton crane lifted load after load into trucks and then the tractor-train left to return to the sawmill. I should like to have seen more of this interesting industry, but time pressed, and so I thanked my cheery companions and said goodbye. JACK JONES (Australia).

Elephant Kraal in Ceylon

When the wild elephants of Ceylon increase too greatly in numbers the Government organise what is known as an elephant kraal, into which the animals are driven and tamed. This is a very great occasion for natives and white people alike and the final stages of the capture are eagerly watched by spectators from platforms erected on high trees.

A stockade is first erected and strengthened with a solid breastwork of large tree trunks. One opening only is left, through which the elephants are subsequently to be driven into the enclosure. Hundreds of natives then set out into the forests armed with guns, firebrands and drums. When they reach the haunts of the elephants they terrify the animals by shooting, beating their drums, and waving their firebrands, and gradually drive them forward into the stockade.

The procedure adopted for subduing wild elephants in the stockade is very simple. Two tame elephants, each controlled by a native keeper, approach a wild elephant, one on each side, and gradually manœuvre him into the neighbourhood of a big tree. The keepers are accompanied by experienced noosers who, at the right moment, slip to the ground and secure the hind legs of the wild elephant with one end of a stout thong, subsequently winding the other end around the trunk of the tree. The tame elephants, who quite enter into the spirit of the game, remain at their posts for some days, after which their wild brother, now thoroughly tamed by hunger, is led out of the stockade in their company.

J. C. BARTHOLOMEUSZ (Colombo, Ceylon).

Winter Sports in Canada

Winter sports have reached a great stage of development in Canada on account of the ideal nature of the climate. Ice hockey is the national game, and it is said by many people to be the fastest game in the world. Whether this is the case or not the game is extremely exciting either to play or to watch.

Skiing has become very popular since the war, and to-day nearly every town and city has its ski club. At week-ends groups of skiers may be seen going from the towns to the surrounding country either on a "hike" or for ski jumping. Some of the more daring skiers indulge in the exciting pastime of hitching themselves behind horses or motor-cycles and the sensation of being hauled along at top speed must be really very thrilling. Ice-boating is another very popular pastime, and it may be witnessed on many of the larger lakes. Many people still love to go on snow-shoe hikes, although this sport is being displaced by skiing, which is undoubtedly more exciting. F. J. MAHER (Perth, Ontario).

My Flight to India—*(continued from page 303)*

commercial flying to-day is the crossing of mountains. On the route followed via Berlin on the way out, the only two points at which mountains are crossed are the Taurus in the south of Anatolia and the northern spurs of the Lebanon in Syria. I believe, therefore, that an aeroplane service along this route could fly with extraordinary regularity. I had anticipated that the journey might be a difficult one in places, but the nearer we came to our anticipated difficulties, the less serious they appeared. I have always maintained that travelling by air was the most comfortable form of progression, and I returned from this journey more convinced of this fact than ever.

We made several flights of over six hours non-stop, and on one occasion put in 8½ hours during the day. On every occasion I have felt just as fresh, and indeed fresher, on arrival than when I had started. The comparative silence in the D.H. 50 was remarkable—Elliott and I could converse quite easily without the engine being throttled back. I was never actually either too hot or too cold whilst in the air, and whether starting from the slush and snow of Europe or the intense heat of Rangoon, I was comfortable the moment we took-off and began to fly.

On a journey such as this one cannot afford to make mistakes, and great credit is due to Cobham for the extraordinary accuracy of all his landings and his good judgment in getting off from difficult places. Elliott probably had the hardest time of the crew, for his work began after the day's journey was over, and it was through his very close attention to the engine that we were able to avoid all forced landings through engine failure.

(The End)

Victor Hugo Travels by Train

In the early days of railways a journey by train was an adventure which many considered so fraught with danger that much courage was necessary before they would hand themselves over to the uncanny iron monster whose speed surpassed that of anything then known. Such an one was Victor Hugo, the great French author, whose name is familiar to many of you, and his description of his first train journey (which was not made until ten years after the introduction of railways) is amusing. This is what he says, as recorded in his letters:—

" Yesterday I travelled from Antwerp to Brussels, and I am now reconciled to the Railway. I left Antwerp at 4.10, and was back again at 8.15, having in the meantime had an hour and a quarter in Brussels and covered 23 French miles in all. It is a glorious feeling, which must be experienced to be appreciated. The speed is unheard of. Flowers on the wayside look like dots, or rather streaks of white or red. Nothing can be observed clearly; towns, church towers, and trees all join in one mad dance on the horizon. From time to time I saw a shadowy figure flash past the window like a streak of lightning; it was a pointsman on duty according to regulation.

" The return journey was made in the evening twilight. I was in the first coach. The blazing locomotive with its hideous noise was in front of me, throwing a powerful red glow over hill and dale as we rushed along.

" The outwards train to Brussels met ours half-way. What a terrifying experience for nervous people! Even I cannot picture anything more awful than the two fast trains passing one another, which seems to double the speed. It was impossible to distinguish anything in the other train; one could not see men or women or even the coaches in which they sat, but only bright or shadowy forms rushing past in a whirling cloud.

" It is really difficult not to believe that the Iron Horse is alive. One hears it snort, groan, and clatter; it perspires, trembles, whistles, neighs, moves slowly or rushes at a mad gallop, throwing out glowing coals and boiling water as it goes. Enormous sparks continually fly from beneath its wheels, or feet, and its breath remains suspended in the air as beautiful white vapour.

" After my arrival—it was then dark—our engine passed me in the shadow on the way to its stable. The resemblance was then complete, for in the midst of a cloud of smoke and flame I heard it groan like a tired-out horse!"

After reading this extract—from the "*L.M.S. Magazine*"—one wonders how Hugo would describe the 299-mile non-stop run with the "*Royal Scot!*"

A Well-Equipped Reading Room

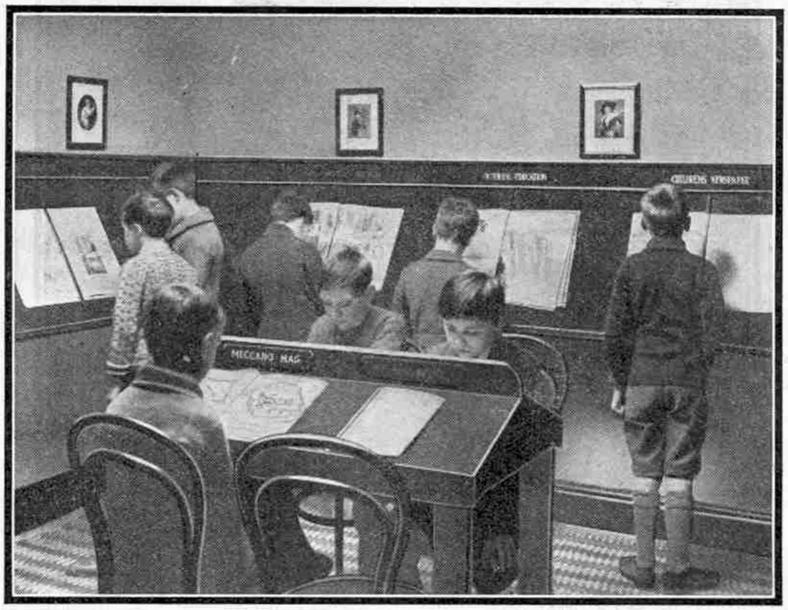


Photo courtesy] [*Blackpool Gazette & Herald Ltd.*

Many less fortunate boys will envy the scholars of Revoe Junior Boys' School, Blackpool, who have a well equipped reading room. As will be seen from the photograph, the "*M.M.*" has a place of honour, and naturally the appearance of every issue is eagerly looked for.

War on Moths!

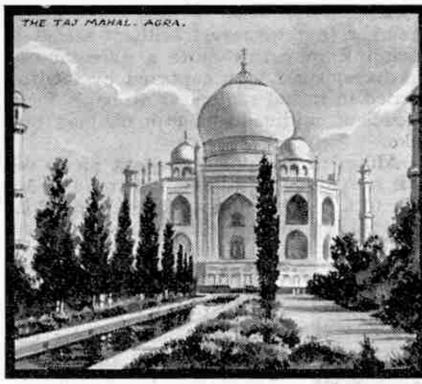
Moths, long considered the worst enemies of upholstery and the wardrobe, will be barred forever from their pastures of plush and velours if a recent adaptation of electricity becomes general. This new invention, called a " Moth-atorium " and made possible by easily regulated electric heat, aims at killing the eggs and larvae of the moth before they have a chance to start their eating activities.

The manner in which the moth does her work has always made her especially hard to combat. She deposits eggs in the upholstery of a chair or in the folds of a garment, and if the busy housewife fails to brush thoroughly this particular spot for a day or so, the tiny larvae will hatch, and immediately burrow into the fabric. Then they begin to devour the fabric, and to cut away the nap from underneath. Their tiny size and their habit of burrowing into the fabric itself, makes the finding of them almost impossible. They continue eating the fabric until they develop into the cocoon stage, and ultimately fly away as fully developed moths.

The method used in the Moth-atorium to combat these activities is simple and entirely effective. Government experiments have shown that the development of both eggs and larvae is most prolific at temperatures between 70 and 80 deg. F. A temperature of 115 deg. kills the larvae in a few minutes, while a temperature of 125 deg. will dry up the eggs in about two hours.

It is a room of ample size, located in his basement, and thoroughly insulated on all six sides by double layers of asbestos, sealed with heat resisting waterglass. The heating is accomplished by using a battery of 20 air heating units, made by the General Electric Co. of America, so distributed as to maintain an even temperature in all parts of the room. Glass windows are built into the walls, in order that the temperature may be read from the outside.

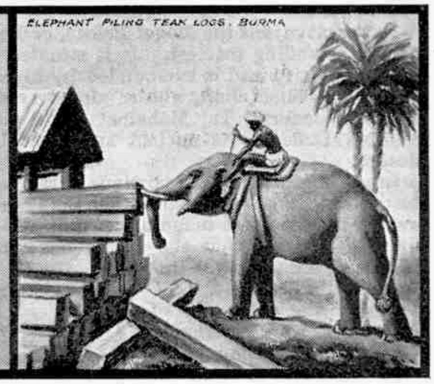
After the heat treatment the furniture is brushed thoroughly and then sprayed with a substance that is harmless and odourless but of which moth larvae can't bear the flavour, and this renders furniture immune from their ravages for at least three years.



MY TOUR ROUND THE WORLD

by

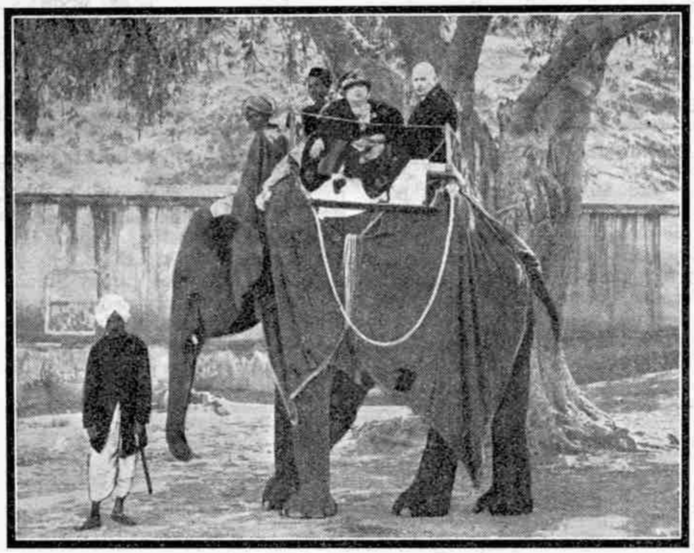
FRANK HORNBY



IX. World's Most Famous Capital. Throne Worth £6,000,000. Pink City of Jaipur. An Ancient Observatory. Teasing Alligators.

As I told you at the end of the last article in this series, I passed on from Agra to the historic city of Delhi. I was very eager to see this place, which has been closely associated in my mind for many years with the wealth and historical interest of the great Empire of which it is once more the capital. King George V held a great Durbar there in 1911, and on that occasion he announced in the magnificent palace of the Mogul emperors that it had been decided to make Delhi the capital of India in place of Calcutta, and a new city to contain a Viceregal lodge and government offices was planned to the south of the present native city.

The decision to restore Delhi to the position that it lost in 1857, when the last of the Mogul emperors was deposed, was undoubtedly a wise one. The city is centrally situated, being practically equidistant from Calcutta, Bombay and Karachi, while in addition it has an imposing history of imperial rank and splendour. The new city is the eighth of the capitals that have been built on the plains of the banks of the River Jumna. The first was Indraprasthra, and is said by the Hindus themselves to date from the 15th century B.C. Later cities were built by Hindu rulers and by their Mohammedan conquerors, and the debris of the ruins of these is estimated to cover an area of 45 square miles. Nowhere else on the face of the globe is it possible to find such a vast assemblage of ruins in a similar area.



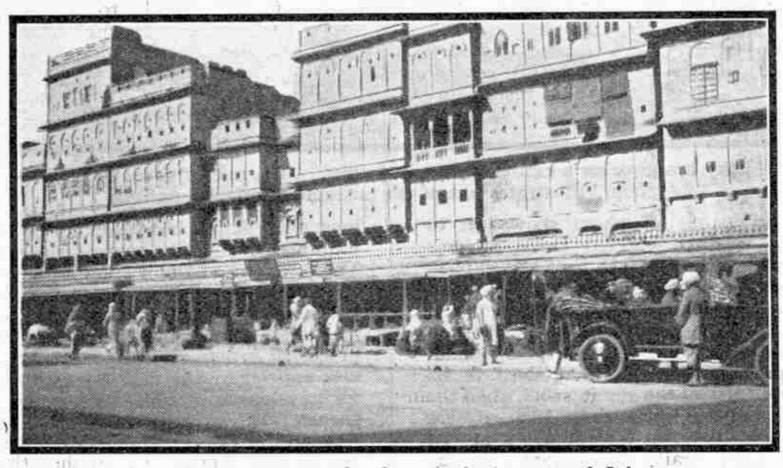
Elephant carrying visitors from Jaipur to Ambar

To us the great historical interest of Delhi lies in the outstanding part it played in the Mutiny. Lucknow, Cawnpore and other cities were no doubt of great importance, but the mutineers in general rallied on Delhi, where the last member of the Mogul dynasty was once more made into a ruling emperor. It was quickly realised by the British authorities on the spot that Delhi must be recovered before the mutiny could be completely stamped out.

To recover Delhi was not a very simple matter however. Few troops were available and at first many of these were natives of doubtful fidelity. Nevertheless, the scanty forces set free from the northern frontiers of India deliberately established themselves on a low ridge north of the city, and finally fought their way into it in spite of the thousands of fighting men, trained under British officers, who defended it.

I had not time to see all the historic and interesting sights of the city, but I managed to see a good deal of it in the course of several drives. On one of these I visited the tomb of Humayun, one of a line of Mohammedan emperors of India. In accordance with custom he chose the site of his tomb himself. On his death his widow immediately commenced work on its erection, and in it several Mogul emperors have been buried in addition to its originator. The actual tomb of Humayun is of polished white marble and occupies the place of honour in the large central chamber of the building, which itself is set in the midst of a large garden.

Off the central chamber are several smaller rooms. In one of these Bahadur Shah, the last Mohammedan emperor of India, took refuge after the capture of Delhi in 1857. Here he was found by Major Hodson, who spared the old man's life but executed his sons and nephews out of hand. This effective but oriental deed led Parliament to recall Hodson, but in the meantime he was mortally wounded in fighting near Lucknow.

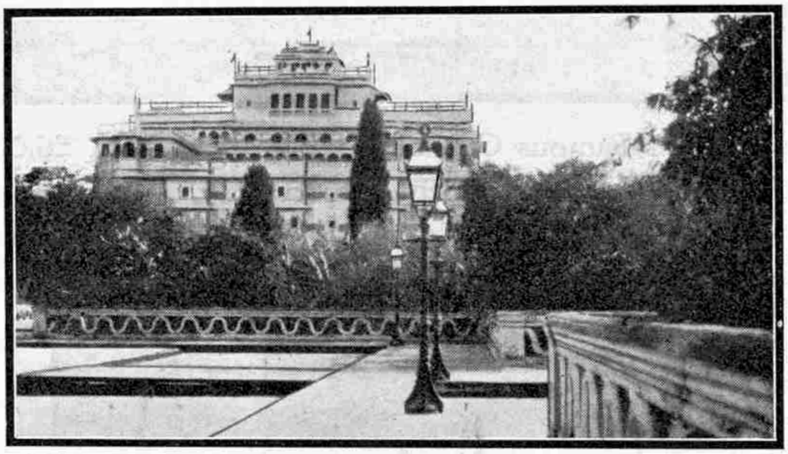


A modern motor car in the principal street of Jaipur

On my return towards Delhi a tall column attracted my eye. This proved to be one of the famous pillars erected by a Buddhist monarch named Asoka more than 2,000 years ago. Asoka conquered practically the whole of India and set up pillars at the boundaries of the Empire and in various other places, on which were inscribed edicts that he had made for the welfare of the people of his dominions. This particular pillar was removed from a distant village 600 years ago by the founder of one of the cities in this neighbourhood that have been the capitals of India. It was carefully wrapped in reeds and sheepskins and lifted on to a wagon with no fewer than 42 wheels. On this it was hauled to the River Jumna, to be transported by boat to its present position.

In the city itself the Mogul Palace, or Fort as it is usually called, is of outstanding interest. It is situated on the eastern or river side of the city and is surrounded by high walls a mile-and-a-half in length. Shahjahan, who as already mentioned was responsible for the wonderful Taj Mahal at Agra, built the palace when he restored Delhi to its ancient splendour by removing the Court thither.

In passing through the portions of the palace that have not been destroyed, it is easy to realise that the Court of the Mogul emperors was easily the most magnificent that the world has ever seen, in spite of the fact that the palace has often been looted and its treasures damaged or removed altogether. The riches at the command of these rulers were practically unlimited, and they spent their treasure lavishly in the erection and adornment of magnificent buildings. The ceiling of the Audience Chamber, for instance, was seen by Tavernier, a French traveller, who was also a jeweller and could form a reliable estimate of its value. He reported that it was made of wood stained a deep shade of crimson, richly overlaid with gold, and that it was almost covered by raised gold and silver foliage. The metal was melted down by the Mahrattas who looted Delhi in 1760.



Palace of the Maharajah of Jaipur. Note the European-looking lamps

Another wonderful ornament of the Mogul Court that has also disappeared was the Peacock Throne. It is said that Shahjahan ordered the collection of all the imperial treasure with the exception of his own personal jewels. The gems were given to a goldsmith with orders to convert them into a throne, and after seven years' work the Peacock Throne was completed. The throne itself, the three steps leading to it, and the canopy were of gold and were literally ablaze with jewels, and according to Tavernier its value was £6,000,000 sterling. It was taken away from the palace by Nadir Shah, a Persian monarch who was the last of the many great conquerors to sack Delhi.

Particular interest is excited even to-day by one of the famous jewels of the Mogul emperors. This is the Koh-i-nur, or Mound of Light, the most romantic of all diamonds, now the private property of the English Royal Family. Its early history is obscure, but Indian legends say that it was found in one of the mines near Golconda in central India more than 5,000 years ago and that it was worn by one of the heroes of the wars described in their early poetry. It passed through many hands and at length came into the possession of the Mogul emperors, one of whom showed it to Tavernier in 1665. When Nadir Shah entered Delhi he was unable to find the diamond but was finally told that the hapless descendant of Shahjahan who was then emperor had concealed it in his turban. At a ceremony a few days later the wily Persian asked the emperor to exchange turbans as a token of reconciliation and friendship, and as the latter dare not refuse he lost the diamond.

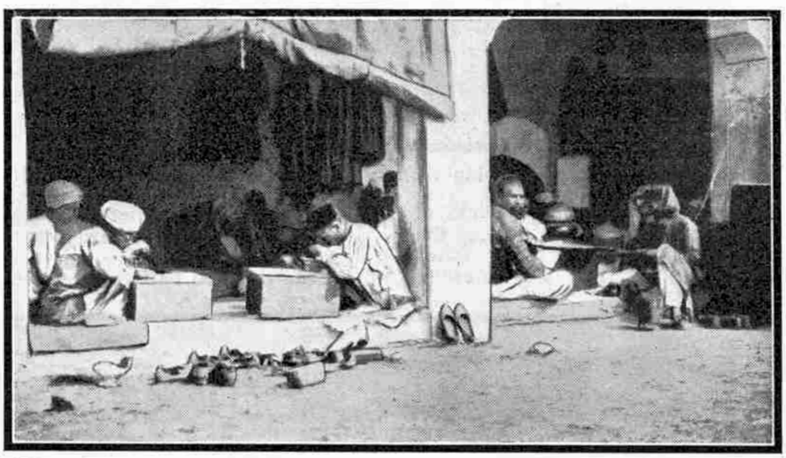
A series of misfortunes to its later possessors resulted in its passing into the possession of the ruler of the Punjab and when the British took possession of the Lahore treasury in 1840, it was presented to Queen Victoria. Twenty years later it was recut, its weight being thereby reduced from 186 to 106 carats. At the same time it lost in brilliancy and the change of shape has certainly deprived it of much of its old historical interest. Its present value is £100,000 and it is of interest to note that the stone exhibited in the Tower is a model only.

The same Audience Chamber that witnessed brilliant scenes in the great days of the Mogul Empire saw quite a different one during last century. The decrepit old man captured by Hodson in Humayun's tomb was tried in it and sentenced to banishment seven months after the jubilant mutineers had proclaimed him Emperor once more.

From the wonderful buildings of the palace I went on to see the great Mosque. This is a striking building that stands on a rocky eminence near the fort. The remarkable cupolas that adorn its roof are surmounted by glittering copper spires, and the space occupied by the worshippers at the hour of prayer is enormous in extent. The marble floor is marked off into small spaces, each just large enough for one individual. An equal space was allowed to the Emperor of India when he visited the Mosque at prayer-time.

North of the city I did not fail to visit the famous Ridge, the headquarters of the besiegers during the mutiny, and the Kashmir Gate, near which the breach carried by the storming column was made. The leader of the assaulting party was the famous General Nicholson, and a statue of this hero stands near by, while in addition a tablet marks the spot where he fell, shot through the chest, in a narrow lane skirting the wall.

Another relic of the mutiny that I saw here was the ball and cross surmounting the English church. These were riddled with shot fired during the siege. The church had a somewhat curious origin. Colonel James Skinner, an officer in the Indian Army, was dangerously wounded in one of the numerous battles of Indian warfare. While lying on the field he vowed that if he recovered he would build a church as a token of thankfulness. Fortunately he did survive, and later not only spent £10,000 upon the erection of St. James' Church near the Kashmir Gate in Delhi, but also built a Hindu temple and a Mohammedan Mosque. Two famous regiments of the Indian Army are known as "Skinner's Horse" in commemoration of this officer.



A busy brassworker's establishment in Jaipur. The pile of shoes outside the "shop" illustrates one of the customs of oriental nations

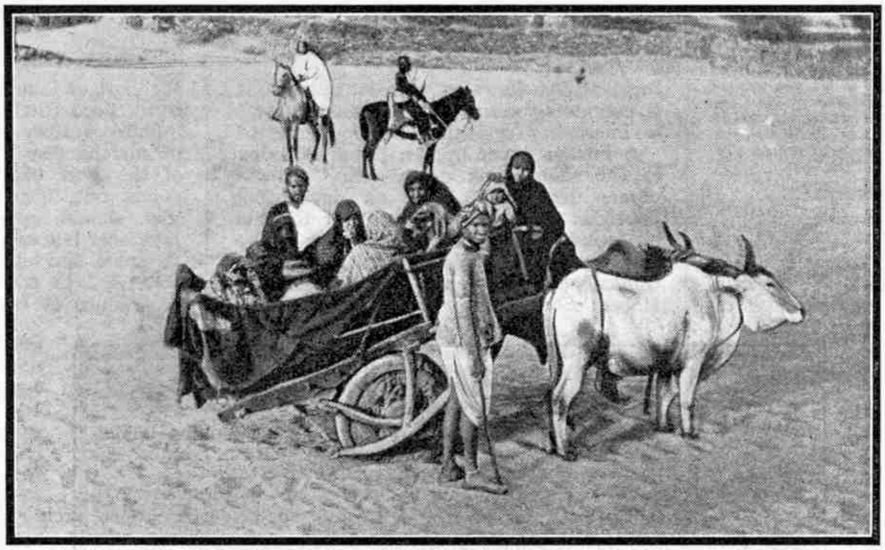
Delhi possesses one of the finest Indian streets in existence. This is known as Chandni Chauk, down which I drove when I visited the fort, as it runs to one of the two great gates of the palace. It is three-quarters-of-a-mile in length and 50 yards in breadth. An avenue of trees runs down the centre dividing it into two separate roads.

Chandni Chauk is world-famed for the skilful gold and silversmiths who have long made it the headquarters of Indian jewellery, and its unpretentious little shops contain incredible stores of precious stones. The jewellers of Delhi are specially skilful in engraving gems, and they make a speciality of jade ornaments veined with gold and set with precious stones in bird and flower designs. Hindus in general lead simple and frugal lives, but in spite of this they are very fond of costly ornament and gorgeous jewellery. This characteristic was noticed by the first European who stayed at an Indian Court for any length of time. The name of this individual was Megasthenes. He was a Greek of the time of Alexander the Great, and was at the Court of an Indian King as an ambassador as long ago as 300 B.C.

A walk through the native bazaar of practically any Indian city is very interesting indeed and Delhi is no exception. Every lane is full of people and the dust and noise are often indescribable. Bullock carts, strings of donkeys, goats and camels pass along the streets, and cows are very commonly met with. The shops are open and have a floor raised a little above the level of the street. The wares of the merchant are placed in baskets or dishes on the floor, on which also are placed the books, cash-box, and the pipe and crockery of the salesman. Both salesman and customers squat on mats on the floor, from which it will be realised that the latter constitutes practically the whole of the shop fittings!

I was very sorry to cut short my stay in Delhi, as it would have been extremely easy to find many other interesting and important places to visit, such as the famous Pillar of Victory. This was erected by an emperor who lived about the time when Magna Charta was signed in England and whose name was Kutb-ud-Din. The tower that he erected is regarded as one of the chief wonders of India. It is 238 ft. in height. Each storey has a balcony and is elaborately ornamented with carved scrolls repeating Arabic verses and recording the praises of its originator.

When finally I did leave the wonderful capital I travelled to a city that is scarcely less historic and interesting. This was Jaipur in Rajputana. On my way to it I read that "it is in Jaipur that the traveller realises the India of his dreams, full of elephants and camels, tigers, peacocks, monkeys and alligators, temples and palaces." This I discovered to be quite true, and the general impression was heightened by the blue skies and the pink walls of the buildings of this city, which is at once remarkably modern and oriental.



A happy party of travellers in a Hindu Bullock Cart at Jaipur

As I drove down the principal street two things immediately impressed me. The first was the pink colour of the buildings that I have already mentioned, and the second was that the streets are all wide and straight and cross each other at right angles. The plan of the city is, in fact, exactly like that of modern American cities where the buildings are erected in rectangular blocks.

On looking into the matter, I learned that Jaipur was only built 200 years ago. The Maharajah of Jaipur of that time was an astronomer. He became greatly dissatisfied with Ambar, his chief city, on account of its irregularity and narrow streets, the latter in places being only sufficiently wide to allow the passage of one elephant at a time. He decided therefore to build a new city, not in the midst of the hills where Ambar was situated, but out on the plains some miles away. The streets were carefully laid out in straight lines, and when the buildings were complete a migration took place from the old town to the new capital.

The pink colour has a later origin. The buildings were originally white, but a later Maharajah found this very monotonous and ordered the buildings to be colour washed, those in one street to be entirely yellow, those in a second green, and so on. Finally, pink was decided upon as the most satisfactory colour and the buildings in all streets were so tinted.

The city is quite modern in many ways. It is clean, well lighted and well regulated. Trade is organised on European lines, and altogether Jaipur is a busy and important commercial centre, well fitted to be the capital of one of the most prosperous of independent Indian states. For many of its attractions the city is indebted to its enlightened rulers, who have been faithful allies of the British for many years.

I was greatly interested in the public gardens, which cover 74 acres and are among the finest in India. Their construction was started in 1868 by the late Maharajah in order to provide work for the victims of the great famine experienced in that year. In them there is a fine collection of wild animals and rare birds, and I was particularly struck by the magnificence of the museum that stands in the grounds. This too was planned by the late Maharajah, and the foundation stone was laid by King Edward VII on his visit to India as Prince of Wales in 1876. Magnificent displays of the jewellery, pottery, china and glass-ware for which Jaipur is renowned are to be found in the museum, which also contains splendid examples of the magnificently decorated weapons and armour used by the warlike followers of former rulers.

I made a most interesting excursion to Ambar, the city in the mountains abandoned in 1728 in favour of the new city of Jaipur. The journey was over a picturesque road crowded with bullock carts, elephants, dhoolies and heavily-laden pedestrians. Arriving at a ruined gateway at the foot of the steep hill, I left the vehicle that had brought me from Jaipur and completed the journey by elephant. I have read somewhere that to enjoy riding on an elephant one must be either a Maharajah or a child. Being neither, I was not altogether sorry when, on arrival at the castle, I was able to descend from my lofty platform!

Ambar is really an amazing city even in its present ruinous state. It is situated in mountainous country and is surrounded by a wall of solid masonry that runs up hill and down dale, following its course with the utmost determination in spite of all obstacles. Within the city the buildings are erected on what appear to be cliff sides. The palace is, of course, the principal building, and is maintained in good condition although uninhabited.

I also took the opportunity of visiting the new palace of the Maharajah in Jaipur. Here I was specially interested in the observatory of Jai Singh, the astronomer ruler who built the city on mathematical lines. Jai Singh's practical knowledge and ability are shown by the fact that he issued a catalogue of the stars, together with tables giving the positions of the Sun, Moon and the chief planets, while he corrected several errors in the calendar. His instruments would seem strange to a modern astronomer. At first glance the observatory appears to be a walled-in space full of stone monuments. These are in reality the gnomons and pillars with which altitudes and other angles required by astronomers were determined in the days before telescopes were available. The collection of obsolete instruments has been restored to the condition in which it was left by Jai Singh, and is a wonderful example of an observatory in what has been termed "the stone age in astronomy."

In another portion of the palace was a small terrace with steps leading down to a pool. My guide had previously asked me for a few annas, which he had handed to a youth who now reappeared with a lump of raw meat. An attendant tied this to the end of a piece of cord and dangled it over the water, making shrill uncanny noises at the same time. Ripples presently appeared on the surface of the muddy water, and several huge forms became visible, moving slowly towards the terrace. These were alligators, fat and sleepy. Now and again one ventured to snap at the meat, which was quickly jerked back just out of reach. The game continued until the monsters were crawling up the steps, and possibilities of mistakes on their part occurred to me! I did not say anything, as my guide and the attendant, and possibly the alligators too, were enjoying the proceedings immensely. At last the bait was flung to one of the beasts, and they were left to crawl back once more to their slimy pool.

Jaipur is one of the States constituting Rajputana, the State of the Rajputs, which I traversed by railway on my way to Bombay. It is a most interesting state, as there is to be found practically all that is left of the old feudal aristocracy of India. The ruling class is composed of Rajputs, or members of the warrior caste, and they have held the castles and cities of this wide district for many centuries. Most of the stories of the Indian heroes and kings of the past describe the feats of the Rajputs from whom the Maharajahs of these states are descended. In general they are faithful allies of the British, and maintain courts of great state and magnificence.

The great mass of the people are of lower caste and include also large numbers of aborigines whose forefathers inhabited the land before the Hindus entered the country ages ago. Agriculture is the chief occupation, and I noticed a great difference between the conditions here and in the valley of the Ganges. Rajputana is much less fertile and lacks water, and on that account rice is not cultivated. Herds of camels, horses and sheep are to be seen wherever there is pasture for them, and I may note here (*Continued on page 313*)

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.

"Drawing for Beginners"

By Dorothy Furniss
(George G. Harrap & Co. Ltd. 10/6 net)

It is always interesting to come across a book that deals with an old subject in a new manner. There is no shortage of books describing the theory and practice of drawing, but this is the first book we have seen that treats the subject entirely from the point of view of a novice who possesses nothing unusual in the way of artistic ability and is unable to obtain personal tuition.

Miss Furniss—who, by the way, is the daughter of the celebrated caricaturist Harry Furniss—takes the would-be artist, puts a pencil in his hand and starts him off with the most familiar household objects. From there she leads him forward step by step, anticipating his difficulties and mistakes and showing him exactly how the various pitfalls may be avoided. The interesting descriptions of how to draw various objects are assisted by a series of extremely useful plates showing different stages of a drawing, commencing with a rough outline and gradually growing into the finished sketch.

One can scarcely imagine a more suitable book to place in the hands of beginners of any age, and it is highly probable that the author's fascinating chapters will be the means of tempting to a first effort with the pencil many who have previously maintained that they had no artistic ability.

* * * *

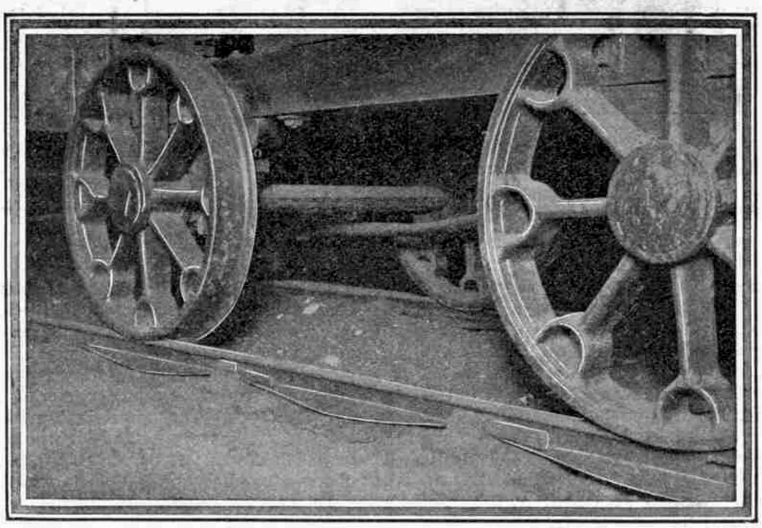
"A Century of Permanent Way"

By F. Bland, M.I.Mech.E., F.S.A.
(Edgar Allen & Co. Ltd. 10/6)

This reprint of a lantern lecture, given at the Annual Convention of the Permanent Way Institution in Sheffield, is published by Edgar Allen & Co. Ltd., Sheffield. It runs to a book of 35 pages and is a most interesting production with excellent illustrations of early joints and switches. Among other things dealt with Mr. Bland describes the various developments to which the permanent way has been subjected, and illustrates his points with numerous photographs. Incidentally, he also reveals that what is commonly termed "permanent way" is in reality anything but permanent!

A further paper by Mr. Bland included in the same book deals with "Atmospheric Railways," and an interesting appendix gives some account of the life of Joseph Locke. Locke was one of the early railway engineers and Mr. Bland thinks he "was equal to George and Robert Stephenson, or Brunel." Locke was born at Atterfield near Sheffield on the 9th August, 1805, and his chance came when George Stephenson visited Locke's father at Barnsley. As a result young William was sent to work under Stephenson at the end of 1823. He worked hard by day and studied hard at night and was so ambitious that he said he would become an M.P., which he did later. Subsequently he quarrelled with George Stephenson and there were many stern fights in later years between the two men.

Some day we may be able to tell in full story of this clever man, in the pages of the "*M.M.*" Meantime those interested in the historical side of the permanent way will be interested to know of the publication of this book."



The first railway track with stone sleepers and peculiarly-shaped rails and wheels (From "A Century of Permanent Way")

* * * *

"The Port of London"

By T. J. Owen (Port of London Authority)
(Harrison & Sons Ltd. 7/6)

This handsome volume, written by the General Manager to the Port of London Authority, deals with the history of the Port of London from Celtic and Roman times down to the creation of the Port of London Authority. In a foreword, Lord Ritchie draws attention to the infinite variety and immense quantity of merchandise that passes in and out of the Port of London every day. He points out, also, that the story is one that should appeal not only to every Londoner but to all citizens of the Empire, at home and abroad, who are so closely interested in the reception and handling of produce at London.

It is evident that the establishment of London dates back to a period long before recorded history. Its antiquity is, indeed, suggested by its name, which is derived from two Celtic words *lynn*, "a pool," and *dunn* "a fort," the indication thus being that the original settlement was fortified. Even in prehistoric times England was trading with the continent in tin, skins, and other produce, and in those days the Pool of London formed a safe anchorage for the small ships that were employed. The Roman historian Tacitus tells us that London was a place well known as a commercial centre and thronged with merchants. Although the town had been burned down by Boadicea about the time Tacitus wrote this, it was soon rebuilt, and subsequently became even more renowned.

During the Middle Ages London progressed continually, its progress mainly arising out of its trade with the continent. In Tudor times Overseas trade was developed and trade opened up with Russia and Turkey. The merchant adventurers of Queen Elizabeth's reign—such famous names as Francis Drake, Hawkins, Raleigh and Frobisher—remind us of the great importance of the port in those times. Frobisher sailed from the Thames to explore the Arctic, and Raleigh organised his expedition to Cadiz, sailing from London in 1596.

Then came the time when the docks were constructed. At first these were private ventures, the St. Catherine's, West India, East India and Millwall Docks being regarded as great engineering achievements. They were followed by the Royal Victoria Dock opened in 1855, the Royal Albert in 1880 and the King George V, the most modern dock in the port, being opened as recently as 1921.

Of the various warehouses much could be said and chapters of the book deal with the various trades—Wool, Timber, Tobacco, Meat, Wines and Spirits, Grain, Sugar, and Fruit—which make fascinating reading and all go to show the very important place that London occupies in the trade of the world in general and that of Britain in particular.

* * * *

"Sir Isaac Newton"

By S. Brodetsky, M.A.
(Methuen & Co. Ltd. 5/-)

The year 1927 marked the bicentenary anniversary of the death of Sir Isaac Newton, the greatest scientist that England has produced. The object of this book is to combine an account of this great man's life and personality with a clear and easy statement of his scientific achievements.

The importance of Newton's work is increased rather than diminished by the recent advance in physics, mathematics and astronomy. He was born in 1642 in the village of Woolsthorpe, some six miles south of Grantham, and lived in troublous times. The story of his life may be regarded as one of adventure, if for such a tale warriors are not always necessary, and if we suppose there is as much adventure in the exercise of our minds as in the exercise of our bodies.

Newton's discoveries in regard to universal gravitation, and light and colour are no doubt familiar to our readers. They formed the basis of "*Principia*" which appeared in July 1687. It was written and issued in Latin, which was the language of learning until a few generations ago.

Newton was not only a discoverer of unique power, but also an elegant exponent of his views, and his immortal "*Principia*" remains to-day one of the most original books ever written. A quiet spirit of simplicity and dignity pervades the book combined with a wonderfully sane outlook and a grandeur of conception.

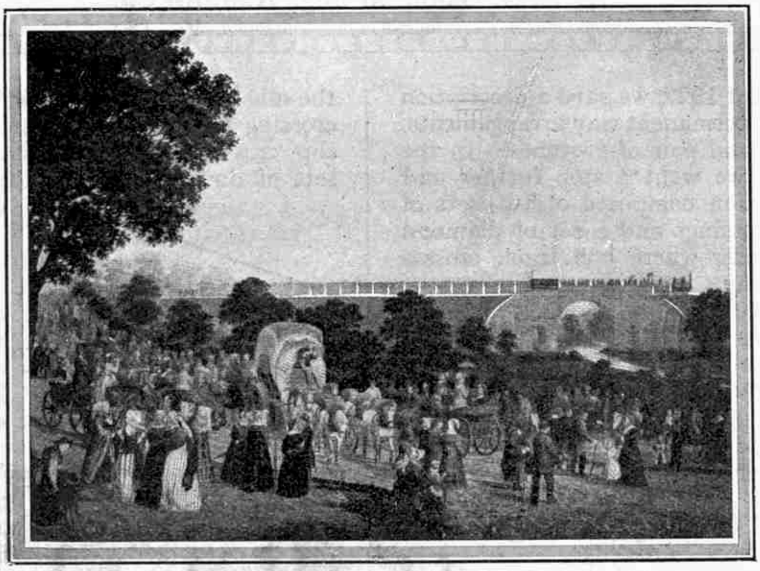
So far as Meccano boys are more particularly concerned they will remember that the fundamental laws of mechanics are formulated for the first time in Newton's volume, and it is remarkable that the problems initiated have since occupied the greatest minds of humanity of two-centuries-and-a-half. The "*Principia*" is fully discussed in the present volume, which will interest all those who study mechanics, mathematics and astronomy.

* * * *

"Yachting"

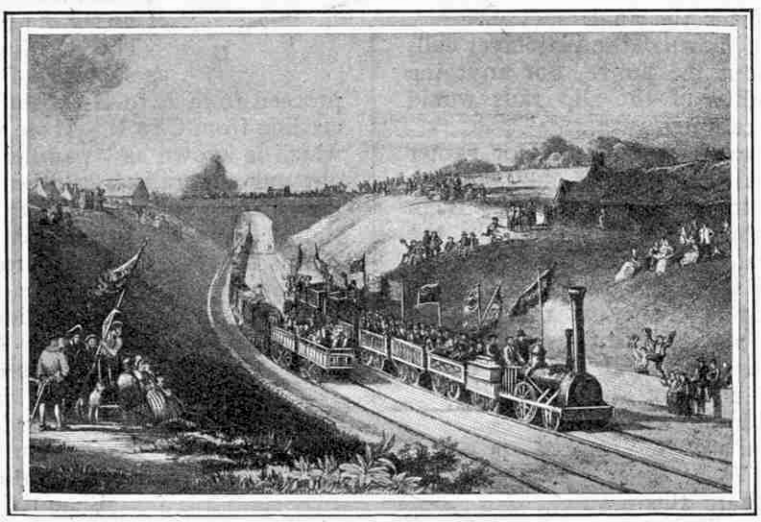
By Arthur E. Bullen and Geoffrey Prout
(Brown, Son & Ferguson Ltd., Glasgow. 7/6)

The authors are to be congratulated on having produced perhaps the best book that has yet appeared dealing with the handling of small craft from the point of view of the beginner. The first chapter gives sound advice in regard to the choice of a boat and the advantages and disadvantages of various types. Then follow useful hints on moorings and two particularly valuable chapters describing the details of a boat and her sails and rigging, and explaining in the clearest possible manner the theory and practice of sailing.



The opening of the Stockton and Darlington Railway (1825)
(From "A Century of Permanent Way")

In later sections the art of cruising is dealt with in detail and the novice will not go far wrong if he follows the advice and heeds the warnings here given, particularly in regard to the handling of a boat in bad weather. Although the authors are obviously devoted heart and soul to sail, they do not ignore the great value of the marine motor as an auxiliary, and their final chapter gives some useful advice as to the selection of a suitable motor and its handling when installed. The book is excellently illustrated by numerous sketches, which add greatly to its value.



The opening of the first Scottish Railway—the Glasgow-Garnkirk line (1831)
(From "A Century of Permanent Way")

"Goldfish Culture for Amateurs"

By H. E. Hodge & A. Derham. (Witherby. 5/-)

As we know from our correspondence many of our readers are interested in the aquarium. To such this book will be of great interest, dealing as it does with the subject of goldfish, their habits and their requirements. The book gives expert advice on the keeping of goldfish and maintaining them in a healthy condition, and it also gives instructions for their treatment in case of disease. There is a useful chapter on the setting up of an aquarium and the subjects of breeding goldfish in aquaria and ponds is also treated.

The authors point out that the average person knows very little about keeping an aquarium, with the result that of the many hundreds of thousands of goldfish that are imported into this country every year, not one in a hundred finds a worthy home. The remainder are either starved or fed on unsuitable food, are chilled by frequent changes of water or suffocated by unshaded globes kept standing in the Sun. The consequence is that the majority of these goldfish die within a short time of their purchase. With correct attention, however, goldfish will live for many years in an aquarium.

The book is well illustrated with photographs and clear line drawings in the text, and is to be recommended to all interested as a practical handbook that has long been wanted.

* * * *

"Models to Make"

By A. Duncan Stubbs. (Cassell 5/-)

This recent addition to the "Modern Boy's Library" describes simply the construction of models of all kinds of machinery. Beginning with paper models, the budding mechanic can progress to the cardboard section and then to those constructed in wood. For the more ambitious, a section is included for models in metal, followed by a more advanced collection of electrical instruments. It tells how to make about 40 working models in paper, cardboard, wood and such similar inexpensive materials.

A roundabout, aeroplane, automatic machine, submarine, periscope, pile driver, searchlight, bridges, cranes and games are amongst the designs given.

Interesting New Books

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

"The Adventures of Louis Blake" by Louis Becke (Wernier Laurie), 5/-

"Perilous Days: True Tales of Adventure" by David Masters (John Lane), 8/6

Some Notes on Permanent Way

III.—Slip Crossings and Switch Diamond Crossings

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

In the "*M.M.*" for August 1927, we gave a description of the simplest unit of permanent way arrangements, namely, the crossing and pair of switches. In the issue for November 1927, we went a step further and described the double junction composed of two sets of switches, two ordinary crossings and a set of diamond crossings, the last occurring where one track crosses completely over another. In the present article we have to introduce three variations on the simple diamond crossing, the first of which is the "slip crossing."

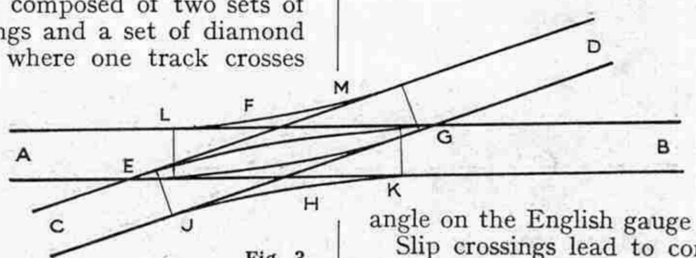


Fig. 3

In Fig. 1 we have one track A B crossing another C D at a fairly acute angle. This gives us the "diamond" E F G H, of which E and G are common crossings and F and H are "K" or "elbow" crossings.

Provided that the intersection angle is not too blunt we can insert curved rails E G and J K, with switches in pairs at E J and G K so that trains may pass from C to B or vice versa. We have now converted an ordinary diamond crossing into a "single slip crossing." The advantage is gained without the expense of any additional crossings but there is a limitation imposed by the radius of the slip rails which in turn places a limit on the angle allowable between A B and C D, while still permitting the slip arrangement. For ordinary main line work the usual value for the angle of the crossings E, F, G, H, is what the platelayer calls 1 in 8, but 1 in 7½ is about the limit. For anything blunter than this the radius of the slip rails would become too sharp for safe running.

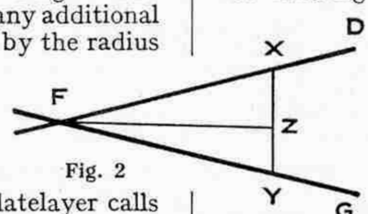


Fig. 2

Fig. 2 shows how this angle is measured or rather one of three methods. All these three methods are in use and the difference in the values given by them is quite small. The method shown is probably the commonest and it has certain advantages for calculation work. Suppose F D and F G are the gauge edges of the rails forming a crossing at F. With a 2 ft. rule we take trial measurements until we get distance X Y equal to 1 ft. exactly, the angles at X and Y being equal. Now Z being the middle point of X Y we measure F Z and find it to be, say, 7 ft. 6 in. Then the angle of crossing D F G is 1 in 7½.

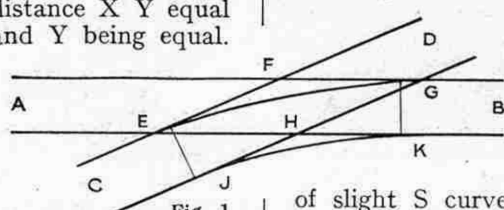


Fig. 1

We can go further than this however and insert two more slip rails between L and M and E and G, again with a pair of switches or points at each end as shown in Fig. 3. Trains now can pass from A to D or vice versa as well as from C to B and we have still only the original four crossings. The arrangement is called a "double slip crossing" or more usually a "double slip" and is very useful especially in busy termini.

Fig. 4 shows part of Amiens Street Station, Dublin. In the middle of the photograph there is seen a double slip crossing while close to the platform there is a single slip crossing. In the distance there are three more sets of double slips but they are too far away to be clear in the photograph. The angle of all these slip crossings is 1 in 7½ and with the Irish gauge of 5 ft. 3 in. the conditions for getting in good slip connections are slightly better than for the same angle on the English gauge of 4 ft. 8½ in.

Slip crossings lead to complications in the cast-iron chairs as some of the chairs have to hold four rails of which probably no two are parallel. Considerable ingenuity is required in arranging the long timbers that go right across under all the rails so that a good bearing is obtained for all the chairs.

The detail shown at A in the photograph is worth noticing. It will be seen that the wing rail of the crossing has been made continuous with the check rail for crossing B. This is a better arrangement than having them separate as they are at B and C as it gives better running owing to the continuous guidance for the wheel. The only reason for not adopting it at B and C was that it was desired to use up old material that still had some years of useful life left in it.

The disadvantage of the slip crossing as shown in Fig. 3 is that a train cannot proceed from A to D at the same time that one is proceeding from C to B. If we wish to provide this facility which is known as "parallel running" we must spread out our slip rails until the points come right outside the diamond crossing and we get the arrangement shown in Fig. 5, sometimes known as "outside slips." Trains now can use the slip roads simultaneously but the advantage will cost four more crossings together with many special chairs and timbers as the overall length of the special work has become much greater.

Now imagine the slip tracks A to D and C to B to be straightened out and parallel to one another. This will mean that tracks A to B and C to D will take the form of slight S curves and the whole arrangement gives what is called a "scissors crossover" illustrated in Fig. 6, where each line represents a track. The letters are the same as in previous diagrams. A L K B and C J M D are each called crossovers; the two put together form the scissors.

Lastly we come to the "movable" or "switch" diamond. This was introduced to overcome the difficulty caused by the fact that the Board of Trade would not allow railway diamond crossings to be fixed at a flatter angle than 1 in 8.

The reason is that the flatter the angle of intersection the longer becomes the gap between the crossing points at F and H likewise at E and G; and there is danger of a wheel taking the wrong side of the crossing especially if the check rail should happen to be badly worn. It occasionally happens, however, that a railway company finds it desirable to work in a flatter crossing for the diamond than 1 in 8. This is done by making the pointed rails at F and H movable in the same manner as a switch moves. EF and HG will be coupled together and F G and E H coupled together and all operated, of course, from the signal box. Then if a train were signalled to proceed from A to B the road would have been set previously so that the movable rails closed the gaps at F and H by moving up to the running rail. Similarly before a train could be signalled to proceed from C to D the other gaps at F and H would be closed, the first ones remaining open for the passage of the wheel flanges.

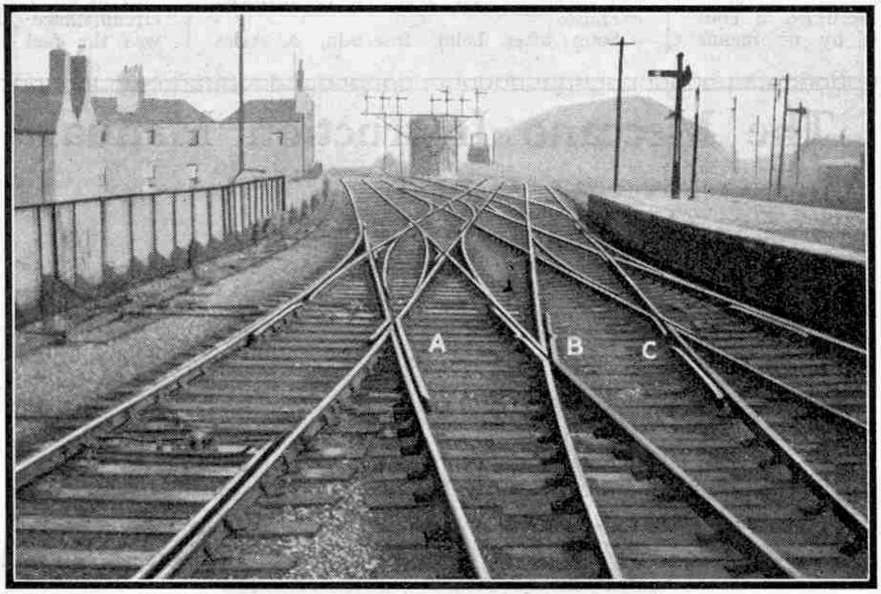


Fig. 4. Slip crossings in Amiens Street Station, Dublin

In this manner continuous rails through the diamond are secured with no danger of derailment at the "K" crossings. In this "movable" or "switch" diamond the movable rails are provided with locking arrangements just as if they were facing points. These installations are fairly expensive but there are many of them in use all over the country.

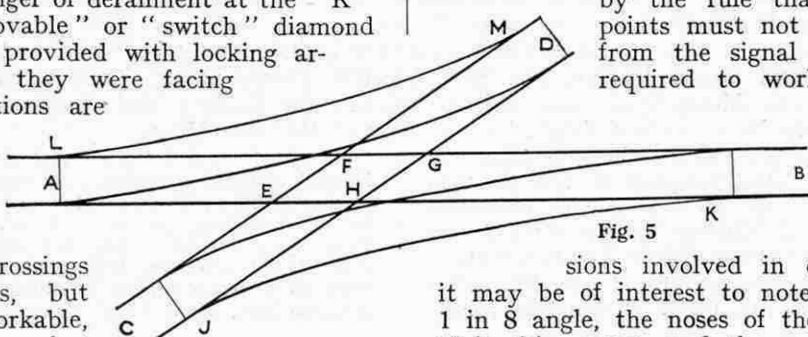


Fig. 5

One in 10 is a very usual angle for the crossings of movable diamonds, but 1 in 12 is quite workable, and the Southern Railway has at present a scheme in hand by which two sets of 1 in 12 movable diamonds are to be installed between London Bridge and New Cross. Much flatter curves in diverging from one line to another are thus possible than when the crossing angle is limited to 1 in 8, and higher speeds can therefore be allowed.

You will, of course, understand that although the sketches in this article show the main tracks straight, this has only been done for the sake of simplicity. It is best when laying out a railway to have the rails straight through the diamond crossings, but this is not always possible, and either one or both of the intersecting tracks may be curved. This, however, only affects the dimensions and does not affect the general principles we have stated.

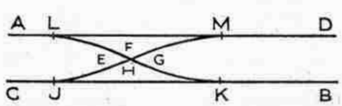


Fig. 6

In engineering work it is nearly always true that the simplest way of attaining a desired object is the best way, and permanent way engineering is no exception to the rule. For example, scissors crossovers would never be used if it was possible to get results as good by two independent crossovers following close after one another. For signalling and permanent way maintenance purposes, the two separate crossovers are best, but from the traffic point of view they usually take up more room than can be spared.

Slip crossings are seldom used so as to be facing to trains travelling along a main line, as even in the most favourable circumstances the curve of the slip rail is too sharp for anything but low speed. They are, of course, used at terminal stations where the speeds are necessarily low, but at through stations they are nearly always arranged to be trailing for normal running.

Although the signal department like to have simple trackwork to deal with so as to have plenty of room to get their fittings in, they are, of course, limited by the rule that mechanically worked points must not be more than 350 yds. from the signal box. Also the labour required to work the points increases as the length of rodding increases, and this is important at busy places.

To give you some idea of the dimensions involved in diamond crossing work it may be of interest to note that with crossings of 1 in 8 angle, the noses of the common crossings are 75 ft. 6 in. apart, and the radius of the slip rails is 464 ft. When the crossings have an angle of 1 in 7½, the noses of the common crossings are 70 ft. 9 in. apart, and the slip rails have a radius of 508 ft. These figures are based on the English gauge of 4 ft. 8½ in. and the latest British standard type of track.

It is useful to remember that British standard rails are either 45 ft. or 60 ft. in length and weigh 95 lb. per yard. Chairs are made of cast iron and weigh 46 lb. each. These are fixed on sleepers generally 8 ft. 6 in. in length and placed about 2 ft. 6 in. apart, there being 2112 of them to the mile of track.

These three sets of permanent way notes have now covered all the chief possibilities of railway track arrangement, and anything you may notice in your railway travels can be classified under one of the layouts we have described.

Exploring the Arctic—*(continued from page 286)*

little vessel was only 113 ft. in length and 34 ft. in width at the water line. Strength and warmth were the qualities that Nansen demanded, and Colin Archer, the famous boat-builder, contributed in no small measure to the success of the expedition by meeting these demands.

The journey along the Arctic coasts of Russia and Siberia occupied a considerable time, but was by no means uninteresting. On the way a number of Siberian dogs were taken on board in preparation for possible ice journeys from the ship, and every opportunity of shooting reindeer, bears, walrus and wild geese was seized. Some exciting hunts and chases ensued which on occasions were somewhat dangerous. This was the case in an encounter with a herd of walrus. When one of a number lying on the ice was shot, the rest flung themselves in the sea around the small boat containing the hunters, and bellowed and roared until the air trembled. The boat was completely hidden in spray and every moment it was expected that a walrus tusk would penetrate it or that it would be capsized in the commotion. The hunters succeeded in shooting three of the animals. Two were immediately secured with a harpoon but the third sank.

The voyage continued along the path followed by Nordenskiöld in 1878, when he made the first successful voyage to the Pacific Ocean by this North East Passage. Finally the ship was headed north, and at the end of September, 1893, was allowed to become frozen-in north west of the New Siberian Islands. The engine was dismantled, the rudder hauled up and arrangements completed for keeping a continuous record of temperatures, wind pressures, soundings and other scientific measurements.

In some ways this proved to be one of the easiest Arctic expeditions ever undertaken. Those who remained on board throughout the great drift had a comfortable home, ample food and good light, the latter being supplied from a dynamo driven by a large windmill. Exercise was obtained by walks on the ice and bear hunts. Preparations had been made to keep the men in condition by drilling them, but it turned out that each man was kept sufficiently busy throughout the whole of the voyage in one capacity or another, to avoid any necessity for recourse to artificial exercise.

Soon after being frozen-in, a series of visits by polar bears began. These animals were attracted to the ship by the smell of the dogs and the food, and in the course of their visitations many of the dogs came to an untimely end. Most of the bears paid the penalty for their daring by being shot.

Ice pressure became terrific on occasions. The grinding pressure of one floe on another piled the ice between them into huge ridges, making a noise like thunder as the ridges extended. For some time after entering the ice the pressure was greatest at the time of the spring tides, but as the ship drifted across the Polar Sea the wind seemed to be more effective in promoting ice pressure and the periods became more irregular. The "*Fram*" was fortunate enough to avoid serious damage, but on one occasion found itself in the path of an advancing ice ridge that piled ice high up over the fore-part of the ship, and created a position of some danger.

As the months went by and the ship drifted farther west than north, and that very slowly, Nansen began to feel a little uneasy about the trans-Polar current on which he had relied. Another circumstance that caused some doubt was the fact that the sea beneath the ice proved to be considerably deeper than he had expected. The greatest sounding previously obtained north of Siberia was the 80 fathoms found by De Long, but Nansen discovered that the ice in which the "*Fram*" was frozen was floating on water at least 1,000 fathoms in depth, this being the limit of his sounding wire. In fact, it seemed pretty definite that the current did not really exist and that reliance would have to be placed on the drift of the ice with the wind to carry the "*Fram*" across the Pole. Nansen never lost confidence however, for he was sure that the ship would follow the track of the driftwood and the relics of the "*Jeannette*."

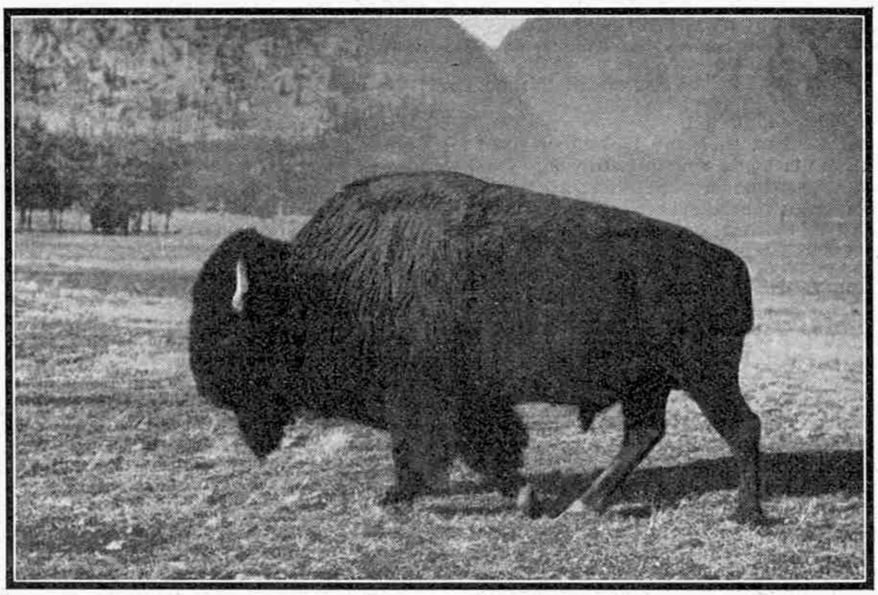
Some disappointment was naturally felt, however, when it was realised that the drift would carry the "*Fram*" only about half-way between Franz Josef Land and the Pole. This would not prevent the scientific work of the staff from being of the greatest value, but it would defeat one of Nansen's chief objects, the attainment of the Pole itself. It became necessary therefore, to adopt other means. The possibility had been foreseen, and during the first winter Nansen had kept the men busy on the construction of sledges with which to equip two men for the purpose of making a dash to the north. After careful consideration, he decided to make the attempt himself, leaving Sverdrup, his companion in the crossing of Greenland in charge of the "*Fram*."

(To be continued)

THE early history of America is inevitably associated in the minds of boys with Redskins and buffalo. Readers of almost all ages revel in the stories of the hairbreadth escapes of scouts in the forests bordering the early American settlements, and of the adventures in later years of the pioneers of the west among the buffalo and Indians of the Blackfeet, Crow and other tribes then roaming the prairies. The fact that the animal in the case is not a buffalo at all, but a bison, is of no more importance than that the Indians had nothing to do with India! The monarch of the Western prairies has an enormous hump, a thing that no real buffalo possesses; but it would ruin the romance to use any other name. To call William F. Cody 'Bison Bill" instead of "Buffalo Bill," for instance, is absolutely unthinkable!

Before the coming of the white man the buffalo grazed in the central part of North America, from the Mississippi to the Rocky Mountains and from the Mexican Gulf up to the Great Slave Lake in northern Canada. There are men still living whose memories go back to the days when the buffalo existed in such enormous numbers that hunting expeditions to procure the winter supply of meat had no difficulty in finding the animals and in slaughtering a sufficient number for all requirements.

The meat was cut up, dried in the sun and mixed into a paste with melted fat. Often a flavouring of acid berries was added, and the result was the hard compact mixture that went by the name of "pemmican." Buffalo meat in this form was the principal food of those who set out on the long and dangerous journeys through forests and across the prairies that figure so largely in frontier tales. It is not surprising that small boys whose minds are steeped in Indian lore will eat tasteless cold mutton with great relish if it is called pemmican! The veterans of the Western plains often meet at commemorative banquets and pemmican is then as greatly honoured by them as the haggis by Scots at a Burns dinner. It must be admitted, however, that in recent years the pemmican has been made from common bully beef more often than from buffalo meat.



Courtesy] *[Canadian Pacific Railway*

A Fine Buffalo Bull in Banff National Park

The name pemmican is derived from the language of the Red Indians and means "fat meat." It keeps perfectly good for years exposed to almost any weather, and in consequence it is largely used by explorers whose journeys take them far from their base of supplies. Its sustaining powers are remarkable, one pound of pemmican being considered equal to four pounds of ordinary meat.

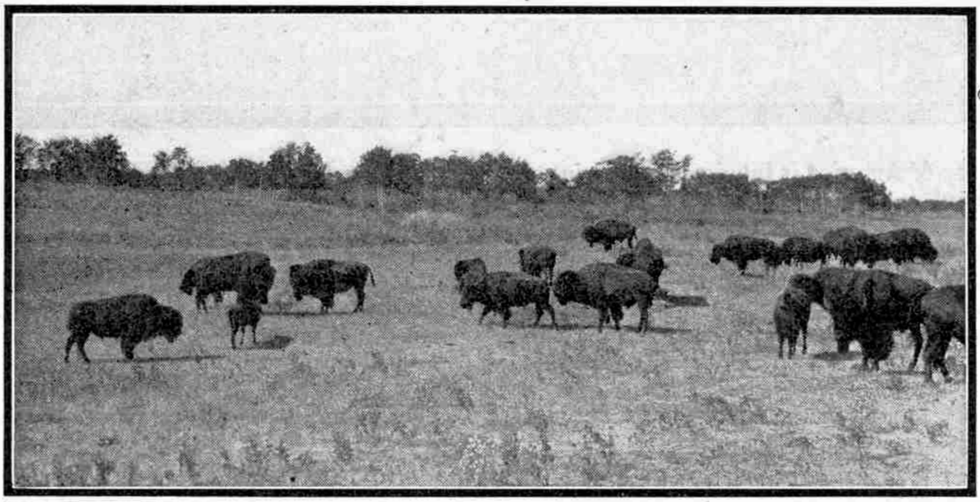
To white men the buffalo was not only a food supply but also a source of clothing upon which enormous demands were made. Buffalo robes were sold in such large numbers in the early part of last century that two or three million animals must have been killed annually to provide them. Even without this appalling slaughter their numbers must have diminished steadily as the invasion of the prairie lands by the settlers continued, for, unlike the Indians, the white men stayed on the ground and cultivated it, thus reducing the available feeding range.

The final blow came when the railroad penetrated to the west. It then became easier to transport the hides to the east, and the consequent enlargement of the market resulted in the disappearance of the buffalo in a very few years. The final slaughter began about 1870, and by 1880 the animal was practically extinct.

A small remnant of a few hundred in the wild uninhabited region near the Great Slave Lake, with a small herd in Texas and one in Yellowstone Park, were then the only buffalo remaining in North America.

Fortunately a revulsion in public feeling has not only saved this splendid animal from complete extinction, but has resulted in a surprising increase in its numbers. In 1923 there were no fewer than 11,389 buffalo in North America, and since then the numbers have continued to increase at such a rate that it has been found necessary to slaughter a certain proportion of the animals! With the exception of the wood buffalo of the Slave Lake region, all are in mild captivity. Like the remnants of the Indians, their old enemies, they are herded together in reservations in various parts of the country. There they are well protected from their enemies and supplied with food when natural sources fail.

The lot of the buffalo to-day is perhaps better than that of their ancestors. A hundred years ago it often happened that large tracts of country were devastated by fire and by plagues of grasshoppers or other insects, and then the buffalo either starved or were compelled to make a long and exhausting journey in search of fresh pasture. This cannot occur to-day. An additional safeguard is provided by the existence of many widely separated herds. The effects of a possible outbreak of disease will thus be confined to a small proportion of the entire buffalo population.



Courtesy] [*Canadian Government*

Buffalo in Buffalo Park, Wainwright, Alberta

In a sense it was only by accident that any buffalo survived at all to form a foundation for the herds now in existence. One account of the origin of the best known herd—that at Wainwright, Canada—attributes it to a romance between a Flathead Indian from the Columbia River district and a girl belonging to the tribe of the Blackfeet, a name familiar to all readers of the pioneer stories of the Western plains. The Indian, whose name was "Walking Coyote," crossed the Rockies to the Blackfeet country, met a girl, fell in love with her and married her. Too late he remembered that he had a wife at home. He also remembered that he had transgressed Flathead law by marrying a girl out of his tribe, as well as the law of the missionaries against having more than one wife.

Mrs. Coyote the second had a brain wave, however. Why not take back a few buffalo calves—then plentiful in the north-west—as a peace offering to the missionaries who were so powerful among the Flatheads, and thoughts of whom were troubling Coyote's mind? They would be so delighted by the present that all would be forgiven. Accordingly the pair set out to take four lively young buffalo over the rough tracks of the Rocky Mountains. The welcome accorded the wanderer was far from peaceful, however, and the only reward he obtained for driving those unruly calves so many weary miles was a tremendous thrashing from his fellow-tribesmen. The calves came into the possession of the Mission of St. Ignatius, and under its fostering care the buffalo prospered.

In 1884 a Montana rancher named Pablo bought ten buffalo from the mission. Until 1906 he was able to provide grazing ground for his constantly increasing herd, but at this time the United States decided to throw open the reserve for settlement and Pablo was faced with the problem of securing a new range on which his buffalo could run. At first he endeavoured to get the United States Government to purchase the animals, but failing in this he applied to the Canadian authorities for free grazing land in Canada. The Canadian Government, realising that here was an opportunity to save this interesting species for Canada, opened negotiations with Pablo, and before the general public in Canada or the United States realised it the ownership of the Pablo herd by the Dominion Government became an accomplished fact.

Other herds had been preserved also. One man in particular was so greatly interested in buffalo and bought specimens so eagerly that he became known as "Buffalo Jones." He earned this title better than did the better known Colonel Cody. The latter was named "Buffalo Bill" because of the enormous slaughter he made of the helpless animal to feed the men building the trans-continental railroad, whereas Buffalo Jones was one of the chief agents in preserving the animals from extinction.

Meanwhile the 30 head in Yellowstone Park had increased in numbers, as had also the wild wood buffalo in the north of Canada, a breed that is superior to the animals of the plains in size and vigour. The wood buffalo inhabit a heavily forested district west of the Slave River that has been their home from time immemorial, and which contains shelter and forage suited to their requirements at every season of the year. The range is interspersed with park-like meadows, swamps and lakes, and there are sandy districts several acres in extent suitable for "Wallows," for the buffalo's idea of a bath is a good roll in the sand. Salt "licks" too are plentiful. The buffalo, like many other wild animals, feels the need for salt, and invariably remains within easy distance of districts where the soil is saline.

The wood buffalo range in two herds, on what are known as the northern and the southern ranges. It is worthy of note that the animals themselves have divided each range into summer and winter feeding grounds. In order to get at the coarse grass that forms their chief food in winter the animals shovel the snow away with their nozzles and eat the green grass near the roots. In the spring they are said to eat the caribou moss that shows through the melting snow.

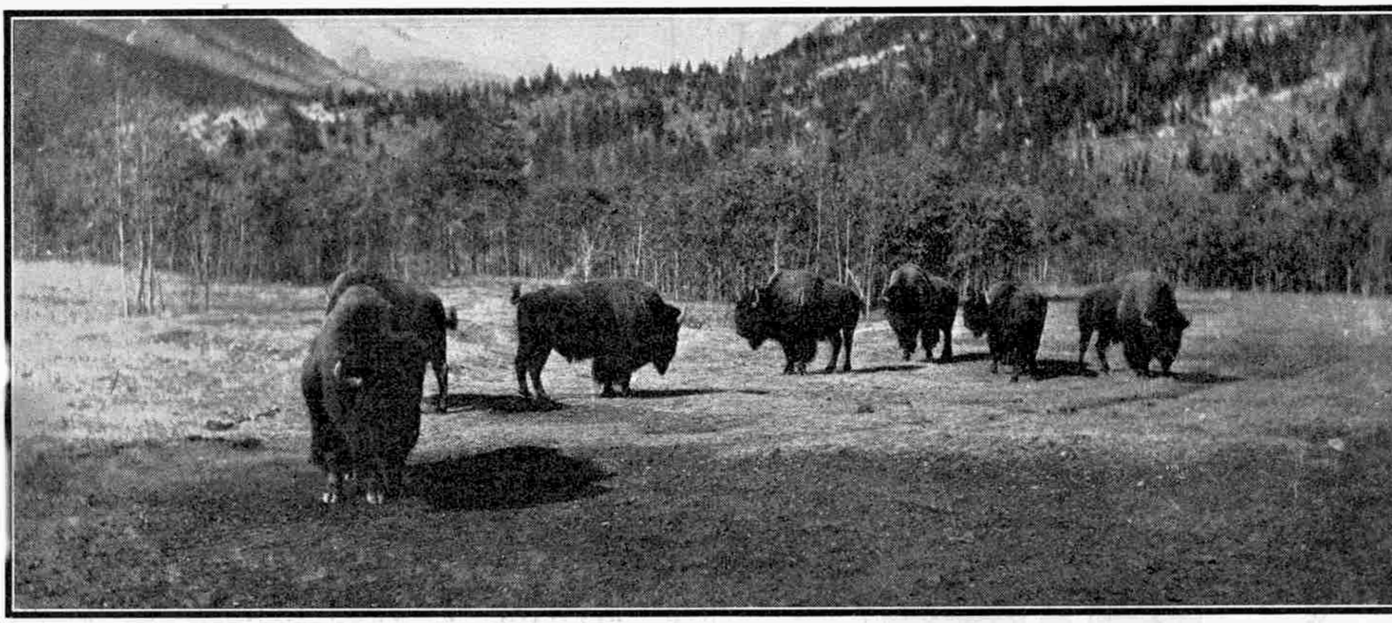
The most successful of the reservations appears to be that which owes its origin to the Flathead, "Walking Coyote." When the Canadian Government secured possession of this herd it was moved to a park at Wainwright, Alberta, on the Canadian National Railway, 127 miles east of Edmonton and 199 miles west of Saskatoon. This park comprises an area of 197·5 square miles or approximately 100,000 acres. It is the largest wild animal enclosure and contains the largest buffalo herd in the world.

The entire territory is on land particularly suited for buffalo, and there are many evidences of occupation of the region by the monarch of the plains in bygone days when he roamed over the North American continent in what were then thought to be inexhaustible numbers. About 80 per cent. of the area is open prairie, the land being rolling and containing a number of lakes, the largest of which is the half-salt Jamieson Lake. The balance of the territory is covered with light brush and poplar trees, none of which could be classed as timber. For the most part the land is unfit for cultivation, but an area containing a few square miles has been fenced off at the south-east corner for a farm to provide winter feed for the herd.

Winter quarters are fenced off from the main range and during the summer no buffalo are allowed therein. In the autumn the cows with their calves by their sides are brought into this enclosure, where they find good pasture that usually lasts for a couple of months, after which they are fed with hay and straw when the weather is severe.

A total of 748 buffalo were safely transported to the park by September, 1914. Of this number 631 were from the Pablo herd. Of the remainder, 87 were obtained from Rocky Mountains National Park, Banff, Alberta, while 30 came from what was known as the Conrad herd at Kalispiel, Montana.

The protection afforded to the buffalo in the park has resulted in an amazing increase in the size of the herd, and between 1907 and 1919 the number grew to more than 6,000. This figure is regarded as the grazing limit of the park, and in recent years a number of surplus animals have been killed every autumn. Still the herd has continued to increase until by the end of 1923 it had reached 9,000, and it was decided to reduce the numbers by



Courtesy] [*Canadian Pacific Railway*

Portion of the Buffalo Herd in the Rocky Mountains National Park, Alberta

the still more drastic method of shooting the surplus animals.

There was an interesting and unexpected sequel to this decision. The news of the intended killing was heard with delight by a large film company, then engaged in a picture of the early days in the west. The opportunity for securing a unique film was far too good to be lost and negotiations were immediately opened with the Canadian Government. As a result there was seen for perhaps the last time the stampede of a gigantic herd of buffalo before the onslaught of Indian warriors mounted on swift horses and armed with bows and arrows. No cruelty was to be involved in the operations. The Indians were only to use arrows so blunt that they would not have any effect on the hides of the animals. In order to add to the realism of the film it was necessary that some of the buffalo should be killed, but this was done by rifle shooting, the method of reducing their number originally suggested.

The Cree Indians assembled for the occasion donned their war paint and eagle feathers and entered into the spirit of the proceedings with great zest. Even old "Rattlesnake," a 68-year-old veteran, insisted on taking his place with the younger men for the ride of 25 to 30 miles with only a blanket for saddle. On the way to the scene of the stampede one chief gave a remarkable example of his prowess with his primitive weapon, shooting a rabbit while riding at breakneck speed.

The plan was to drive the buffalo through a natural defile about half a mile in width at each end and narrowing down to approximately 100 yards in the centre. A barricade of logs was erected at the narrowest part. This was camouflaged with trees to give it a natural appearance and it served as a stand for three cameras. The herd had been gathered together by cowboys some days previously and when all was ready smoke signals were lighted. The Indians immediately swooped down on the buffalo and stampeded them towards the defile. Very soon a black mass of 5,000 maddened buffalo were seen careering down on the barricade with the Redskins yelling and shouting on their flanks. The ground shook under their weight and clouds of dust blotted out the sunlight.

When the herd reached the barricade it split to avoid the obstruction, and the cameras proved to be splendidly placed for securing pictures. Other cameras on the hillsides obtained equally successful views of the events on the flanks of the herd. There the yelling Indians ran considerable risks at times. Now and again huge bulls charged their tormentors, and on one occasion a Redskin's horse unseated its rider when struck by the horns of a maddened buffalo. The Indian sprawled across the back of the bull and held fast to his leaping mount until another brave forced his pony alongside and picked up his comrade. The Crees certainly played their part well, and it was noted that old "Rattlesnake" was still "going strong" when the final pictures were taken, in spite of his 68 years!

The confusion was heightened by the continual crack of rifles. Skilled marksmen were stationed in pits protected by turf-covered steel plates and every time their rifles spoke a buffalo came to the ground, for they had been ordered to shoot to kill.

When all was over the Indians cut up and roasted some of the dead buffalo. As they squatted round their camp fire, cooking and eating luscious steaks, onlookers were reminded of the great days when the buffalo and the Indian were undisputed lords of the prairie.

The saving of the buffalo in North America was originally carried out for purely sentimental reasons but it may have far-reaching economic results. The temperament of the buffalo in general is steady and serene and he thrives in captivity much better than the majority of wild animals. He is a good food animal but the meat is inclined to be lean and tough. A cross between the buffalo and the domestic cow, however, known as the cattalo, gives promise of being a very valuable addition to the food stocks of the world. These animals are splendid grazers and like the buffalo are able to thrive on comparatively bare pasture. During the winter they graze through the snow and no matter how severe the weather they do not require to be fed as do domestic cattle. The rapidly increasing herds of buffalo thus may yet prove of value economically.

Some indication of the vigour of the national herd at Wainwright is given by the fact that 1,634 surplus animals were moved in the summer of 1926 to the wood buffalo reserve in the North. Selected young animals were cut out of the main herd and placed in separate corrals. They were then branded and transferred to loading corrals, from which they were placed on the train and started on the 800 mile land and water journey to their new home. From Edmonton the train proceeded over the Alberta and Great Waterways railway as far as Fort McMurray, where they were detrained. Specially constructed scows, or flat-bottomed boats of light draught, awaited them there, on which they were loaded and taken down the Clearwater River to the Athabaska, down that river and thence down the Rocher and Slave Rivers to their new quarters.

The experiment proved successful, the newcomers settling down well under the leadership of the wood buffalo. It was therefore repeated in 1926 and 1927, in which years a total of 2,951 animals were liberated in the northern range. This has proved the most satisfactory method of keeping down the numbers at Wainwright.

Despite the depletion in numbers of the herd, a further decrease was deemed necessary, and accordingly a slaughter contract for 2,000 more animals was let and carried out in the winter of 1926-27. The meat, hides, heads and other marketable products were disposed of on the general public market. Although these measures of reduction have been regularly conducted, the herd still numbers about 6,000, and all danger of the disappearance of the characteristic animal of the North American continent seems to be past.

The number of animals in the buffalo reserves of Canada now amounts to 11,000 or 12,000. In addition it may be noted that other animals find shelter at Wainwright, including moose, elk, mule-deer, and a few antelopes and yaks. The yaks are ox-like animals with long hair, coming from the arid plateaux of Central Asia. They resemble the buffalo in having humps, and attempts are being made to settle herds of them in Alaska. These various animals are being made the subject of experiments under the direction of the Canadian agricultural authorities, and some of the crosses between them and domestic cattle may become valuable in time.

Conquest of the Air—*(cont. from page 309)*

Great interest in the flight had been aroused in many countries beside Sweden and news was anxiously awaited. Those who doubted the staying power of the balloon pointed out that in its flight over Danoe Island, across the North Pole and to known land at the "other side," the balloon would have to travel 1,200 miles.

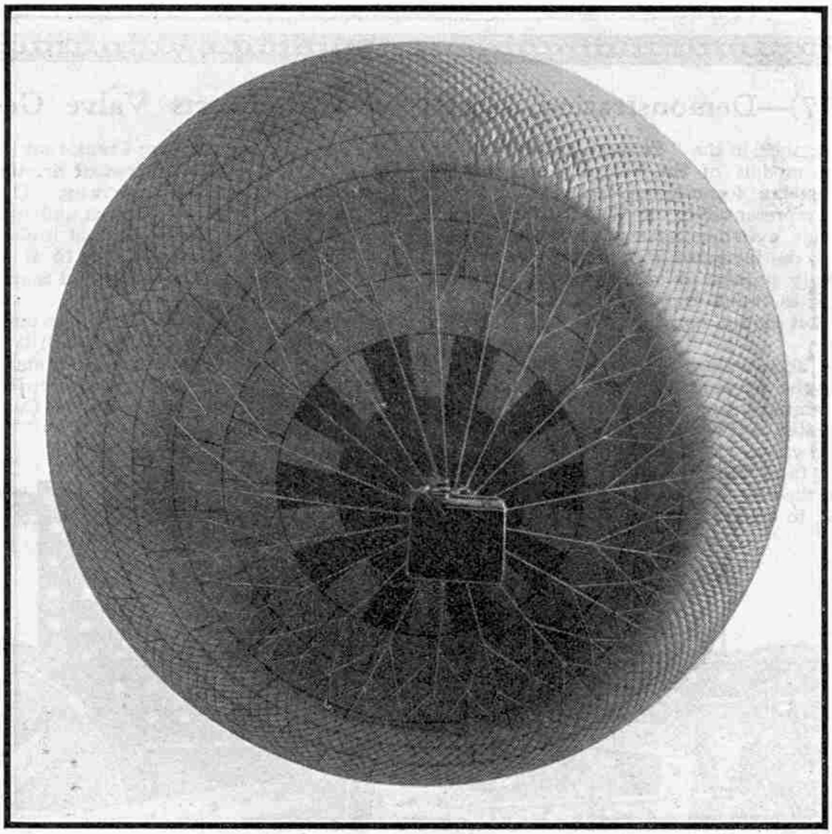
After several weeks had passed without news from the expedition, one of Andrée's pigeons returned bearing a message dated 13th July, 1897, and stating that all was well with the party. However, the latitude and longitude given in the note indicated that during the first 46 hours of the flight the balloon had only travelled about 187 miles. That was the first and last news of the expedition ever received and after a long time all hope that the adventurers had not perished in the Arctic wastes was given up.

In the same year an Austrian engineer named Schwarz built the first aluminium dirigible balloon. This was constructed under the auspices of the German Government, and was 134 ft. in length, 46 ft. in height and 42 ft. in width. The body comprised a lattice framework built up of aluminium tubes overlaid with aluminium sheeting 8/100 of an inch in thickness. An aluminium car was slung beneath the rigid envelope and carried a benzine 10/12 h.p. motor that operated four propellers, two for vertical movement of the dirigible and two for horizontal movement. The designing and building of this dirigible occupied four years and roughly £10,000 was expended on the work.

The task of inflating the dirigible occupied two days. A silk bag as large as the aluminium envelope was inserted into the latter and was then slowly filled with hydrogen. As the silk bag expanded it expelled the air from the envelope, and when this operation was completed the gas was permitted to escape from the bag into the envelope proper. The bag was then torn to pieces and pulled out of the dirigible.

A strong wind was blowing at the time when the airship ascended from the Tempelhofer Field, with one engineer aboard. It rose very rapidly to a height of 82 ft. but after remaining stationary for a few minutes at that height it commenced to fall swiftly. The unfortunate engineer had quickly found that he was unable alone to navigate the airship and, becoming frightened, opened the valve. There were no safety devices for checking the fall of the craft and therefore it sped downward with increasing velocity. Just before it struck the ground with a terrific impact the man jumped out of the car and escaped with only slight injuries, but the dirigible was completely wrecked.

During 1898 an Englishman named John M. Bacon, destined to be associated with many balloon flights of scientific interest, commenced making aerial voyages in his own balloon. His daughter accompanied him on one of his early flights, during which the balloon passed over London, Hertfordshire and Cambridgeshire. As dusk came on it was decided to conclude the trip, and a newly reaped cornfield was selected as a landing place.



A striking photograph of one of the entrants in the Balloon Race at Ranelagh, 7th July, 1906

As the balloon sank to earth it encountered a stiff breeze, however, while the grapnel proved unable to penetrate the ground, which had been hardened by weeks of drought.

"A stunning crash announced our arrival on terra firma," recorded Bacon's daughter later, "and then, the wind catching the flapping, half-empty silk, there ensued a very pretty steeplechase over the harvest-fields. Neatly piled corn-sheaves flew in all directions, panting and perspiring labourers in full cry were left far behind. The race was exciting and fatiguing, for the car was dragging all over on its side and it needed much holding on to prevent being jerked out of the basket. There was not much time left for reflection in our hurried progress; nevertheless the thought was in all our minds that we were speeding towards a deep cutting of the Great Northern Railway. . . ."

When only about 50 yds. from the cutting the balloon fouled some telegraph wires and its progress was stayed. "Our steeplechase terminated, I recall, in close proximity to a donkey. This animal alone of all the occupants of the fields we passed over held his ground. Horses and sheep and cattle bolted wildly at our approach, man himself evinced the maddest excitement, but the donkey stood firm and made no sign or sound. Only after a long half-hour, when the wreckage was at last cleared away and hoisted into a wagon, did the situation seem to dawn upon him, and uplifting voice and tail he brayed and brayed and brayed!"

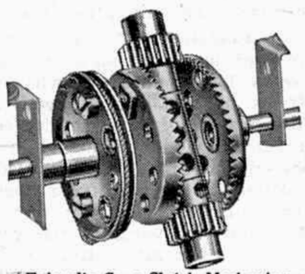
During August of the same year Bacon's balloon was utilised to carry out the first experiment in wireless telegraphy ever made from a land station to an aerostat in the air. An interesting account of the incident relates that:—

"A lofty pole in the field at Newbury, whence the balloon was to ascend, carried one of the necessary long vertical wires, while the other wire was run up the rigging of the balloon to the top of the silk. The transmitting apparatus was considered too heavy to bear aloft, and the aeronauts contented themselves with carrying the small "receiver," being thus able only to receive and not to transmit the wireless messages. The result proved a signal success. The day was perfect, the sky flecked with summer clouds, behind which the balloon became presently hidden from view . . . there in the car between them the delicate bell of the little apparatus they carried continued to tinkle forth the messages which Mr. Maskelyne, in the field now ten or twelve miles away, was still flashing to them across empty space."

Several times during his life Bacon conducted parties on aerial voyages on the occasion of solar eclipses or meteoric displays. One such voyage which almost terminated fatally was made on the night of 16th November, 1899, from the grounds of Newbury gas-works. The party ascended to obtain views of a great shower of meteors known as the "*Leonids*," which appears at intervals of 33 years. The balloon rose upwards through dense mist, and ballast had to be discharged at intervals to prevent it from sinking. Presently daylight came and with it the Sun. As the envelope slowly dried and warmed the balloon began to climb and the last bag of ballast was discharged in a vain effort to descend.

The cloud bank beneath the aerostat completely cut off all sight of the earth. Sometimes during the long hours in which the party sailed slowly through the clear upper air the sound of voices ascended to them, and later they were horrified to hear the swish of waves. After what seemed an interminable period a rift in the clouds enabled one of the party to sight a church spire. The valve of the balloon was then hastily opened and a safe descent made near Neath.

(To be continued)



Epicyclic Gear Clutch Mechanism

Suggestions Section

Edited by "Spanner"

(117)—Demonstration Model of Walschaerts Valve Gear

PREVIOUSLY we have described in the "Suggestions Section" Meccano demonstration models of Stephenson's and Joy's valve mechanisms for steam locomotives, and this month we illustrate an interesting representation of Walschaerts valve gear, as applied to an outside cylinder locomotive having four coupled wheels. This gear is the invention of a Belgian engineer and it has become increasingly popular in recent years. Under certain working conditions it is found to possess an advantage over other valve gears in that it gives a constant lead at all points of "cut-off."

Another advantage is its accessibility, for it may easily be mounted on the outside of the locomotive wheels and frames. For this reason it is usually employed on outside cylinder engines and especially on engines fitted with three or more cylinders.

The movement of the piston valves 1 is derived from two sources, namely, the combining lever 2 (a 3½" Strip), and a Crank 7 attached to the end of the crank pin in the rear driving wheel. The combining lever is connected to the crosshead by a 1½" Strip 4, which is bolted rigidly to an Angle Bracket that, in turn, is secured to the Strip Coupling forming the crosshead, and its other end is pivoted to the valve spindle 5 by means of an ordinary Meccano bolt passed through the lever and inserted in a Collar. The bolt serves in place of the Grub Screw to secure this Collar to the spindle 5.

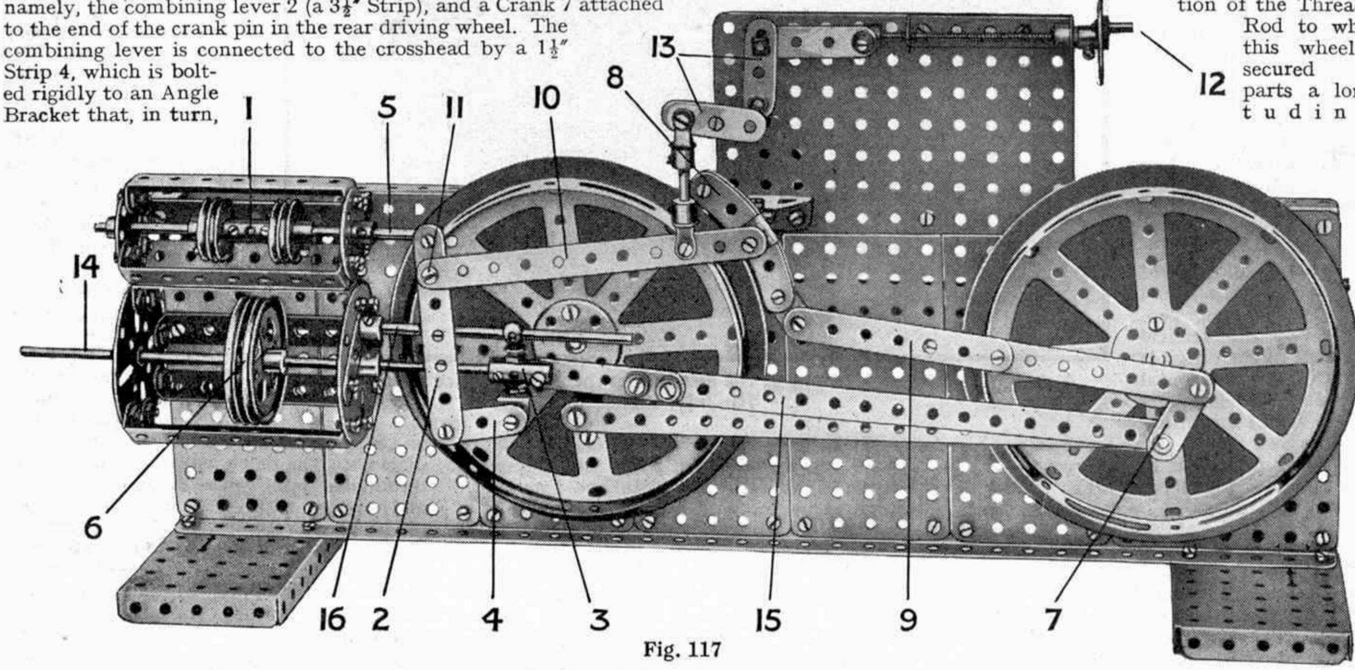


Fig. 117

The expansion link 8 consists of two 2½" large radius Curved Strips joined at their ends by ⅜" Bolts. Two nuts are placed on each bolt between the Strips so that the latter are spaced about ¼" apart. The inner Curved Strip is pivoted at its centre hole by a bolt and two nuts (see Standard Mechanism No. 262) to an Angle Bracket bolted to a Trunnion that, in turn, is bolted to the frame of the model. The expansion link is rocked about its pivot by means of the eccentric rod 9, which consists of 4½" and 3½" Strips overlapped three holes.

The eccentric rod is operated by the Crank 7, which is secured to the crank pin of the driving wheel at such an angle that its end moves in a circular path about the driving axle. It should be explained here that the crank pin consists of a 1" Rod gripped in the boss of a Double-arm Crank that is bolted to the driving wheel. The crank pin of the forward driving wheel consists of a Pivot Bolt mounted in the same way. The coupling rod (a 9½" Strip) is mounted on the crank pins and spaced away from the Double-arm Cranks by Washers so that it clears the flanges of the driving wheels. The connecting rod 15 is also mounted on the crank pin of the rear driving wheel and is spaced away from the coupling rod by two Washers.

The radius rod 10 is pivoted at one end to the combining lever 2 by means of the bolt 11, which is secured to the lever by two nuts (S.M. 262), and at the other end to an Eye Piece that is free to slide on the front Curved Strip of the expansion link 8. The position of the Eye Piece on the Curved Strip can be altered by turning the hand wheel 12. The rotation of the Threaded Rod to which this wheel is secured imparts a longitudinal traversing movement to a Threaded Boss that is connected by means of a 2" Strip to one of the Cranks 13. The second Crank 13 is coupled by a short Rod and two End Bearings to the radius rod 10, as shown.

The engine is in forward or reverse gear according to which side of the expansion link pivot the Eye Piece or die is placed, and the extent of the valve travel varies according to the distance of the Eye Piece from the pivot.

The proportions of the valves (represented in the model by two 1" fast Pulleys and two 1" loose Pulleys) are so designed that it is possible to move them slightly to and fro without uncovering the steam ports. This movement is known in technical language as the "lap."

The effect of outside or steam lap is to cause the valve to close the inlet port before the piston has reached the end of its stroke. A quantity of steam is therefore "cut-off" and imprisoned in the cylinder for a period before the exhaust port opens, during which period its expansive force continues to drive the piston forward.

In modern locomotive practice it is usual to admit a little steam to the cylinder just before the piston reaches the extreme end of its stroke, since this steam acts as a cushion in bringing the piston to rest at the dead point, without severe shock to the reciprocating parts. The extent of the port opening obtaining at the moment when the direction of the piston is reversed is known as the "lead."

It will now be clear that if the extent of valve travel is diminished the steam ports will remain closed for a longer period during each stroke of the piston, and only a correspondingly small amount of steam will find its way into the cylinder for each stroke of the piston. Since the extent of valve travel, as well as the reversing of the locomotive, is dependant upon the position of the die block in the expansion link, it is obvious that by moving the hand wheel 12 the engine driver is able to vary the amount of steam admitted to the cylinders and to reverse the loco at will. By skilfully adjusting the cut-off for the various conditions of working, he can effect very great economies in running costs.

A suitable hand wheel with which to operate the model should be fitted to the inner end of one of the driving wheel axles. Since there is only one coupling rod in the model, it is necessary to connect the driving axles by a length of Sprocket Chain engaging 1" Sprocket Wheels secured to the axles behind the frame. Additional supports for the axles must be built out at the rear of the frame.

The crosshead guide consists of a Handrail Support sliding on a 4½" Rod 16, which is secured in a Crank bolted to the Face Plate that forms the back cylinder cover.

(118)—Simple Friction Clutch

(W. Stanley Whitworth, Poynton, Cheshire)

The model shown in Fig. 118 is reproduced with the object of drawing Meccano boys' attention to the possibilities of frictional clutches and driving mechanisms when applied to Meccano models. It is

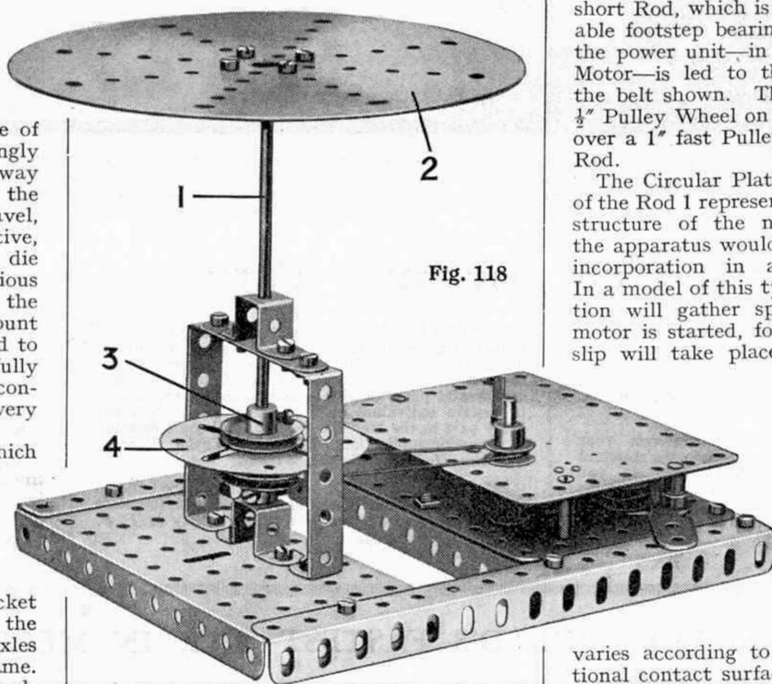


Fig. 118

only in certain types of model, of course, that the apparatus illustrated would be applicable, but it is quite possible that there are applications for it that have not occurred to the majority of Meccano boys.

The vertical Rod 1 ends at the bottom in a 1" fast Pulley Wheel 3 that rests upon a Face Plate 4. The latter is secured to a short Rod, which is journalled in any suitable footstep bearing, and the drive from the power unit—in this case a Clockwork Motor—is led to this Rod by means of the belt shown. The belt passes round a ½" Pulley Wheel on the Motor spindle and over a 1" fast Pulley on the short vertical Rod.

The Circular Plate 2 secured to the top of the Rod 1 represents the revolving superstructure of the model. As illustrated, the apparatus would lend itself readily for incorporation in a model roundabout. In a model of this type, the revolving portion will gather speed slowly when the motor is started, for a certain amount of slip will take place between the wheels 3 and 4. If the power is shut off the roundabout will continue to rotate for quite an appreciable time, and will slow down gradually and come to rest in a realistic manner.

The slip that takes place in starting or stopping varies according to the area of the frictional contact surfaces and on the weight imposed upon them. Thus, in cases where only a light driving power is necessary it might be found advisable to use a Collar in place of the 1" Pulley Wheel 3, or for heavier models better results might be obtained by using a 1½" Pulley Wheel at this point.

(119)—Two-Way Panel Switch

(R. B. Mangnall, Gosport)

The neat two-way switch shown in Fig. 119 is designed particularly for panel mounting. The mechanism may be concealed entirely behind the panel, and only the two short Rods allowed to protrude for control purposes. The switch is operated by pushing against one or other of the short Rods.

The 3½" Strip 1 is pivoted by means of bolt and lock nuts to a Trunnion 2, which is bolted to the underside of the Flat Girder. Two 1½" Rods 3 are attached pivotally near the ends of the 3½" Strip by means of ordinary bolts passed through the Strip and inserted in the threaded bore of a Collar. (The illustration shows the new type of Collar, the threaded bore of which extends from side to side, but old-style Collars may be used if desired by inserting the bolts in place of the grub screws).

Each of the two contact pieces consists of two ½" × ½" Angle Brackets attached to the Flat Girder by means of 6 B.A. Bolts 4 and insulated therefrom by Insulating Bushes and Washers. The Angle Brackets are placed one within the other and their projecting flanges are splayed apart to form a V-groove to receive the ends of the switch arm 1.

Two of the three connecting wires are secured to the contact pieces by extra nuts placed on the bolts 4. The third connection is made to the pivot bolt inserted in the Trunnion 2.

The electrical connections for the switch are similar to those illustrated by diagram on page 58 of the January 1928 "*M.M.*" A two-way switch of this type may be used for many purposes. Usually it is employed to control an electric motor or light, etc.,

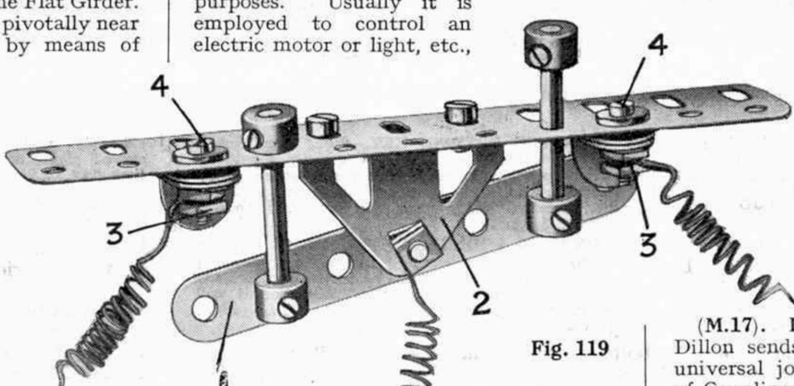


Fig. 119

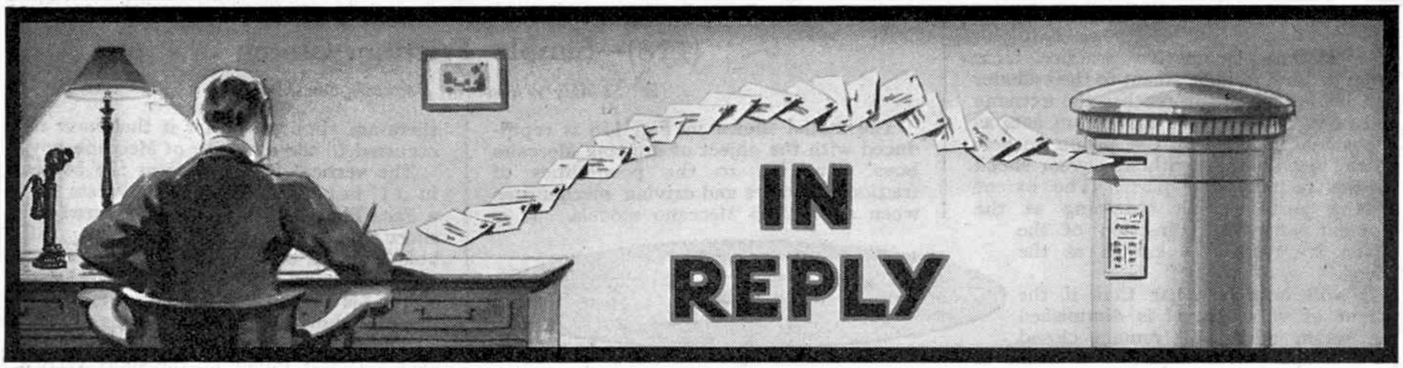
from two distinct points, two switches being employed in a special double circuit as described in the above-mentioned issue of the "*M.M.*" The switch may also be used in various wireless circuits.

Miscellaneous Suggestions

(M.15). New Gear Ratio.—Bertram S. Doff (Chorlton-cum-Hardy, Manchester) points out that if a 57-teeth Gear Wheel and a 50-teeth Gear Wheel are secured to two Axle Rods journalled in a Meccano Plate and spaced two holes diagonally apart, they will mesh properly with each other. The gear ratio so obtained is approximately 1 1/7 to 1.

(M.16). Model Aero-Engine.—Victor Lopes (Demerara, British Guiana) has built a very realistic air-cooled aero-engine from eight Worm Wheels, eight Angle Brackets and a Bush Wheel. The Angle Brackets are bolted to the Bush Wheel and the Worm Wheels are secured to the Angle Brackets and arranged radially about the Bush Wheel. This forms a very effective model.

(M.17). Built-up Universal Joint.—T. Dillon sends in a design for an efficient universal joint constructed from a series of Couplings connected by 1½" Strips and a short Rod. Although the device works perfectly, it possesses no important advantage over the special Meccano Universal Joint (part No. 140). The latter is naturally more compact, and therefore more adaptable.



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 New Meccano Parts

MECCANO POST CARDS.—Post cards printed in a similar manner to the writing pads would certainly be useful for correspondence between Meccano boys. Further attention will be given to this idea at a later date. (*Reply to G. Spellman, Harrogate, and E. Robin, Port Talbot*).

FIBRE BLOCKS.—We note with interest your suggestion that fibre blocks tapped to take the standard Meccano bolts should be manufactured. As you remark, these blocks would be useful in constructing Meccano band brakes, internal expanding brakes, etc. Consideration will be given to your idea. (*Reply to P. C. Peppietta, Birmingham*).

CURVED FLAT GIRDERS.—Few uses could be found for a curved flat girder and in cases where this part is required it can easily be built up from two Curved Strips fastened together by Flat Brackets. (*Reply to K. Light, London, N.1*).

NEW STRIP.—We are afraid that few uses could be found for a Strip having a boss fitted to each end. Such a part can, moreover, be built up from the Cranks and Strips already incorporated in the system. (*Reply to E. F. Smart, Thornton Heath*).

PIVOT BOLTS.—Your suggestion that we should manufacture a 7/32" bolt having only part of its length screwed, is quite interesting. It would certainly be possible to dispense with one of the nuts in the pivot mechanism (S.M. 263). We will keep your idea before us. (*Reply to J. W. Lowe, Rosyth*).

IMPROVED SPRINGS. — Springs manufactured with a hook at each end in place of the loop at present attached would certainly be useful in the construction of letter balances and several other models. It should not be difficult, however, to fasten hooks to the existing springs, thus obviating the need of your suggested part. (*Reply to F. Marquand, Woodville, N.Z.*)

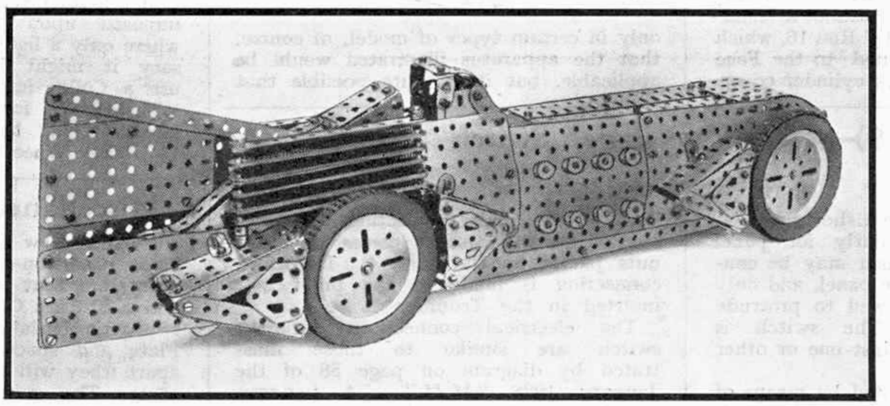
¼" PINIONS.—You will note that the bosses of Meccano gears and Pinions are ⅝" in diameter and there would therefore be some difficulty in manufacturing a ¼" Pinion. A ¼" Pinion is used, however, in the Clockwork Motor but as the boss is larger than the wheel itself, few uses could be found for it if incorporated in the Meccano system. (*Reply to J. Nicholas, Darlington*).

LONGER CHIMNEY ADAPTOR.—We do not consider there is any necessity for the manufacture of longer editions of the Chimney Adaptor (part No. 164) as where a long chimney is required two or more Sleeve Pieces (part No. 163) joined together form a very efficient substitute. (*Reply to R. Cordon, West Bridgford*).

NUMBER PLATES.—Such articles as number plates, mudguards, petrol tanks, etc., are scarcely suitable for inclusion in the Meccano System as they are not essential to the construction of models but are rather ornamental parts to give a more finished appearance to certain individual models. Our aim is to make every part in the Meccano System fulfil some function of very wide application. (*Reply to J. Taylor, Oldham; F. Price, Hull; D. Gisbert, Wigan*).

2¼" × 1½" FLAT PLATE.—Such a part can be built up easily from existing parts and we do not therefore consider its introduction advisable. (*Reply to J. P. Assenheim, Brighton*).

THE WORLD'S FASTEST CAR IN MECCANO



Captain Malcolm Campbell's success in breaking the world's speed record in his British Napier car "Bluebird" by driving at 206.95 m.p.h., must have thrilled many Meccano boys interested in motoring. The Meccano model of the car reproduced above is therefore of special interest. The model clearly shows many of the details of the rather peculiar external design, the fin fastened to the rear of the body and the Fairley surface radiators being cleverly reproduced with standard Meccano parts.

IMPROVED WINDING KEY.—Your idea that a combined winding key and box spanner should be manufactured is interesting. Any suggestions which tend to increase the adaptability of existing parts are always received with interest. (*Reply to D. H. Tomlin, Walkley, Sheffield*).

COMBINED WHEEL AND PINION.—To fasten a gear wheel on to the boss of a Pinion Wheel would be a good idea and would certainly tend to make Meccano gear boxes more compact. Your suggestion is well worthy of consideration. (*Reply to G. Lillywhite, Bentley, Hunts.*)

6" THREADED PINS.—It would be difficult to find many uses for a 6" Threaded Pin. It could certainly be used as a mast or flagstaff but these articles can easily be built up from existing parts. (*Reply to E. Moreton, Hounslow, W.*)

IMPROVED FLANGED WHEELS.—We note your suggestion that the flange of the flanged wheel (Part No. 20) should be curved, but we are afraid that the adaptability of this part would be materially affected if such an alteration were made. (*Reply to H. G. Leighton, Leeds*).

NEW WEIGHTS.—Your suggestion that we should introduce lead weights in sizes conforming with the avoirdupois system is interesting, and we will give further consideration to the idea. (*Reply to V. R. Kimm, Norwich*).

IMPROVED BOLTS.—The introduction of square-headed bolts in place of the existing cheese-headed ones would not be desirable as the speed with which models could be built up would be materially affected. (*Reply to R. G. M. Quarrie, York*).

H-SECTION GIRDERS.—We are not in favour of your suggestion regarding the introduction of H-sector Girders to the Meccano System. They would be difficult and costly to manufacture and in addition they can easily be built up from existing angle girders. (*Reply to R. Clarke, Johannesburg*).

COUPLING WITH SWIVELLING COLLAR.—It would be difficult to find many uses for your suggested new part. It is apparently intended to allow of separate rotations of two rods journalled end to end. Does not a standard coupling fulfil this requirement? (*Reply to W. J. Watson and H. Lawson, Dublin*).

SLEEVE COUPLING.—Although your suggested coupling consisting of a 3/16" diameter tube would be useful in joining two rods end to end you do not state how this tube would be fastened to the rods. Considerable difficulty would be experienced in attaching it. For this reason your suggested part appears to be impracticable. (*Reply to J. M. Gambles, S. Kensington, S.W.7, and K. R. Brooks, Sale, Cheshire*).

PLIABLE PLATES.—We note with interest your suggestion regarding pliable plates. We are not in favour of making such additions, however, as the general strength of the system would be considerably weakened. The question of introducing curved plates has occupied our attention for some time past. (*Reply to C. Burn, Wareham, Dorset*).

SINGLE ANGLE STRIP.—Where such an article is required it can easily be built up from Strips and Angle Brackets. No doubt your part would be neater, but this would hardly justify its manufacture. (*Reply to J. Stevenson, Teddingworth, Nr. Rugby, and A. H. Johnson, Tunbridge Wells*).

LARGER GIRDER FRAMES.—Little use could be found for larger editions of the Girder Frame (part No. 113) if these were manufactured. It ought to be quite a simple matter to build up large Girder Frames from existing parts. (*Reply to L. Ison, Victoria, Australia*).

IMPROVED 50-TEETH GEAR WHEEL.—It would certainly increase the adaptability of the 50-teeth gear wheel if holes were drilled around its circumference. Although this has been done in the case of the 57-teeth gear wheel, we are afraid that the diameter of the 50-teeth wheel is too small to allow this being done. (*Reply to C. R. Davies, Hull*).

Suggested Hornby Train Improvements

DOUBLE TRACK VIADUCT.—Although we quite agree that a double track viaduct would be useful, this type is not in very great demand and so we do not consider it advisable to manufacture it at the moment. (*Reply to R. Fleet, and Philip Watts, Sidcup, Kent*).

FLEXIBLE TUNNEL.—This suggestion is quite interesting and we think would be practicable. Just at present we are not contemplating the manufacture of other types of tunnel but it is very likely that we shall do so before long. (*Reply to P. Parry, Egham; J. Spencer Smith, Eton College, Windsor; and J. C. Thorne, Maidstone*).

TRAILING LAMPS FOR BRAKE VANS.—Trailing lamps would certainly add to the realism of brake vans and we are accordingly filing your suggestion for future consideration. (*Reply to C. R. Johnson, St. Albans*).

DOUBLE DECK SHEEP TRUCKS.—We quite understand that double deck sheep trucks are very popular in Australia. At the same time such trucks are practically unknown to boys in this country, and indeed in most parts of the world other than Australia. For this reason we are afraid we cannot contemplate their introduction. (*Reply to H. Hauptman, Sydney, N.S.W.*)

MINIATURE CATTLE FOR CATTLE TRUCKS.—So far as we are aware there is no great demand at present for miniature cattle for loading into trucks. If such cattle are required they can be purchased at any good class toy shop. (*Reply to P. Barkham, Redhill*).

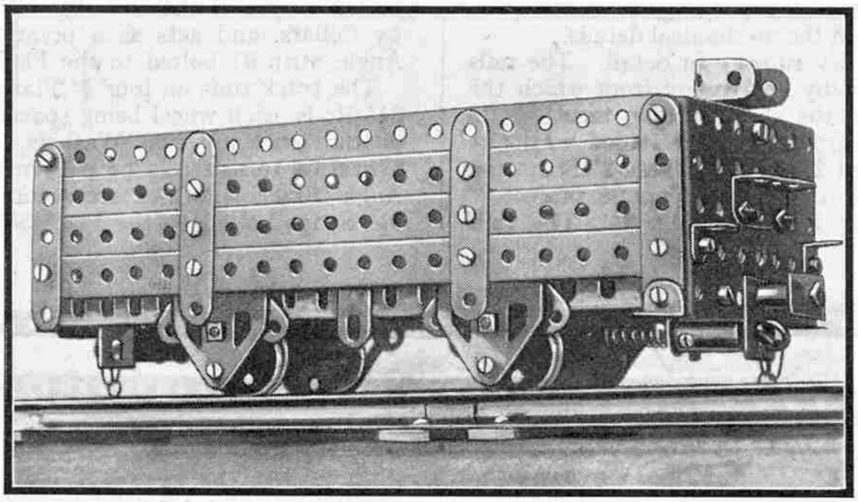
ENGINE SHED.—We are pleased to announce that a Hornby Engine Shed will shortly be available. This is being produced as the result of a widespread demand and we feel sure that it will prove a very popular feature. (*Reply to R. Rowlands and J. Harley, Liverpool; J. Sawers, Johannesburg, S.A.; and E. J. Niedermayer, Eastbourne*).

DEEP CUTTING.—We do not consider that it would be advisable to introduce deep cuttings into the system. This type of accessory can very easily be manufactured at home and we feel sure that most enthusiasts would prefer to make their own. (*Reply to Ian Banness, Staines, Middx.; P. P. Parry, Egham; and P. D. Sloman, Tonbridge*).

SMALLER LEVEL CROSSING.—We shall shortly introduce a level crossing suitable for a single branch line and we feel sure that this will be found useful in many circumstances where the double track crossing would be rather inconvenient. (*Reply to J. Trevethan, Bere Alston, S. Devon; F. Stalworthy, London, S.E.22; and B. Bulpitt, Havant, Hants.*)

"HUMP" MARSHALLING YARD.—In actual railway practice "hump" marshalling yards occupy very considerable areas. We do not think that we could reproduce such a yard in one article as it would be far too large and expensive. Enthusiasts desiring to possess one, however, can very easily purchase the various parts required and construct one for themselves on a baseboard. (*Reply to R. Gibbs, Bristol*).

A GAUGE "0" MECCANO WAGON



The above illustration of a Meccano Railway Wagon, which was built by Marcel Pauwels of Antwerp, is an excellent example of the manner in which Meccano can be utilised in the construction of rolling stock for use on Hornby railways. As may be seen from the photograph, the wagon has a most realistic appearance and includes reproductions of the most important fittings to be found on actual railway vehicles. Hornby train enthusiasts who are also the possessors of Meccano outfits would do well to remember the possibility of constructing in this manner any vehicle of a special type that may be required for some temporary purpose.

LARGER TURNTABLE.—The question of a larger turntable is now under consideration and an announcement will be made shortly. We quite agree that a turntable large enough to accommodate No. 2 and No. 3 engines and tender would be a very popular accessory. (*Reply to R. R. and R. E. Wynne, Birkdale, and D. J. Smith, Westcliff-on-Sea*).

STATION - MASTER'S HOUSE.—We would advise enthusiasts who desire a station-master's house to manufacture one for themselves out of cardboard. As there are comparatively few who require them it would hardly be worth our while to introduce them. (*Reply to R. Landcastle, Rednal*).

SINGLE POST HOME AND DISTANT SIGNALS.—A single post of this kind is now being manufactured and shortly will be on the market. (*Reply to E. Parker, London, N.W.8*).

EMBANKMENTS.—We are afraid that this suggestion is not practicable from the manufacturing point of view. Embankments are features of a model railway that are much better designed and made by each railway owner for himself, in order to satisfy his special requirements. We hope to give some useful information on this and similar matters in an early issue of the "*M M.*" (*Reply to P. Sloman, Tonbridge*).

HORNBY TERMINUS.—As the type of terminus desired varies in almost every case we feel sure that more satisfying results could be obtained by constructing terminii at home as required. (*Reply to F. A. Whitlock, Malvern Wells*).

COMPOSITE COACH.—A Pullman car composite coach is certainly very much required. We are accordingly giving the matter our careful attention. (*Reply to D. G. Smith, Westcliff-on-Sea; Kenneth Rees and Evan Powell, London, S.W.18; and Denis Rebbeck, Belfast*).

TRIPLE POINTS.—We are afraid that what you term "triple points" would be too complicated to manufacture in tin plate track unless we made them exceptionally large. The result then would be the same as that obtained by simply joining two of the existing points together. (*Reply to R. N. Walker, Liverpool*).

WIDER GAUGE RAILS.—We are afraid that there is little prospect of the introduction of rails of wider gauge. Gauge 0 has been adopted as the Hornby standard and the whole Hornby railway system is designed to suit that gauge. There is no doubt that gauge 0 is the most popular of all miniature railway gauges, and while larger gauges have various advantages their use involves certain drawbacks, one of the most important of which is the greatly increased space required for any particular layout. (*Reply to H. Easton, Wellington, N.Z.*)

NAME ON SIGNAL BOX.—This suggestion has been made on many previous occasions and we are glad to be able to state that the latest type of Hornby signal box will not bear a name. (*Reply to H. R. Wilcock, Chingford, London, E.4*).

BARREL WAGONS.—If we decide to increase the variety of our present stock of wagons, this type will have our consideration. (*Reply to H. Hauptman, Sydney, N.S.W., and George Richmond, Manchester*).

SIX-WHEELED BOGIE PULLMAN CARS.—Owing to the fact that the track and wheels used in the Hornby System are made from tinplate, we fear that six-wheeled bogies would not be as satisfactory as the present type with four wheels. (*Reply to R. H. Morrison, Edinburgh*).

BENT WIRE DOOR HANDLES.—We do not agree that door handles made from bent wire would be stronger than our present type. (*Reply to Dennis Rebbeck, Belfast*).

SPRING BUFFERS ON ROLLING STOCK.—Although the idea of spring buffers sounds attractive, we do not think that their addition to our rolling stock would have much effect beyond that of increasing the cost. We do not see any practical advantage that would result and therefore we are unlikely to adopt this suggestion. (*Reply to A. F. Ogg, Sheffield*).

NEW MILK CONTAINERS.—As stated before in these pages this matter is receiving our careful attention and before long we hope to make a further announcement. (*Reply to R. Clover, Cambridge*).

REVISED HORNBY TENDERS.—We are looking into the possibility of designing these in accordance with actual railway practice. (*Reply to P. Winston, Newton-le-Willows*).

ENGINE AND TENDER IN ONE.—We do not quite understand what you mean by suggesting this, though we would refer you to our tank engines which embody locomotive, tanks and bunker. (*Reply to A. Sharpe, Barnsley*).

SOUTHERN RAILWAY.—It has been definitely decided to introduce Southern Railway colours into the series. (*Reply to H. B. Johnson, Tonbridge, and others*).

TENDERS FILLED WITH COAL.—We agree that tenders filled with miniature pieces of coal look very attractive. At present we are not contemplating equipping our tenders in this manner, but we may do so later when the present types are re-designed. (*Reply to M. G. French, Epsom*).

CONTROL RAIL ON TURNTABLE.—We agree that this would improve the present type of turntable and so we are giving the matter our attention. (*Reply to L. Cestern, Retford, Notts.*)

ELECTRICAL LEVEL CROSSINGS.—We will consider manufacturing level crossings which can be used in conjunction with electrical layouts. (*Reply to G. W. Walsham, Grimsby*).

FRENCH PASSENGER STOCK.—The question of introducing this type of rolling stock will be considered. (*Reply to René Fer, Thames Ditton*).

MOTOR-TRAIN SET.—This kind of set would hardly be worth our while to produce. Component parts can easily be purchased and the set thus assembled where it is specially required. (*Reply to H. H. Lewis, Pontypool Rd., Mon.*)

8-WHEELED PETROL TANK.—Owing to the scarcity of this type of petrol wagon on British Railways, we do not think that a model of it would prove popular. (*Reply to George Richmond, Manchester*).

TUBE RAILWAYS.—We are afraid that the running of model tube railways would present too many difficulties to the average enthusiast. We feel sure, therefore, that they would not be in large demand. (*Reply to B. Jenkins, Cardiff*).

HORNBY "PACIFIC."—This type of locomotive entails a six-coupled mechanism, and so as previously stated in these pages, we cannot consider producing one at present. (*Reply to M. Morris, Barbage; R. Slight, Southampton; and L. Lambert, Birmingham*).

OVERHEAD ELECTRIC WIRES.—We feel confident that the centre rail system of conveying the current for miniature railways is by far the more popular owing to its considerably greater simplicity. (*Reply to R. Winter, Horsham, Sussex*).

ADDITIONAL BRAKES ON LOCOMOTIVES.—We do not propose to fit additional brakes to locomotives, as they are not required, and would only serve to increase the cost of production. (*Reply to A. C. Young, Folkstone*).

SCALE VALVE GEARS.—These would be far too delicate and costly to warrant their being fitted to our locomotives. (*Reply to C. A. Munroe, Oxford*).

WORD 'PULLMAN' ON COACHES.—At present this is certainly in the wrong place. We are about to revise the whole transfer scheme of Hornby trains. (*Reply to G. Spellman, Harrogate*).

The New Meccano Ship-Coaler

An Old Favourite in a New Form

(Concluded from last month)

LAST month we described the construction of the tower framework and the truck runway, with chute, etc. In this issue we conclude our description of the Ship-Coaler by explaining the construction of the trolley runway and the mechanical details.

Fig. 5 shows the trolley runway in detail. The rails 34, which are traversed by the trolley from which the grab is suspended, and the strengthening members 35 consist of 24½" Angle Girders, and are joined vertically at each end by a pair of 2" Strips. These 2" Strips are arranged in such a way that the Girders 35 project ¾" further from the tower than the rails 34. The rails are spaced apart by the 4½" Angle Girder 37 (the end of which projects 1") and the 3½" Flat Girder 38, while two 3½"×½" Double Angle Strips 36, 39 are bolted between the end 2" Strips.

A 1" loose Pulley Wheel 40a is mounted on a Threaded Pin secured to the Flat Girder 38, but is prevented from moving vertically by a Collar and set-screw. At the outer end of the runway a 1" Pulley Wheel 40 is fixed to a 2" Rod 41 journalled in bearings consisting of the Girder 37 and a Flat Trunnion bolted to the Double Angle Strip 36. A second 1" fast Pulley 43 similarly is secured to a 2" Rod journalled in the projecting end of the Girder 37 and a Trunnion 44 bolted to one of the pairs of 2" Strips. The 3½" Angle Girder 45 is mounted on a similar Girder bolted to the 4½" Angle Girder 37.

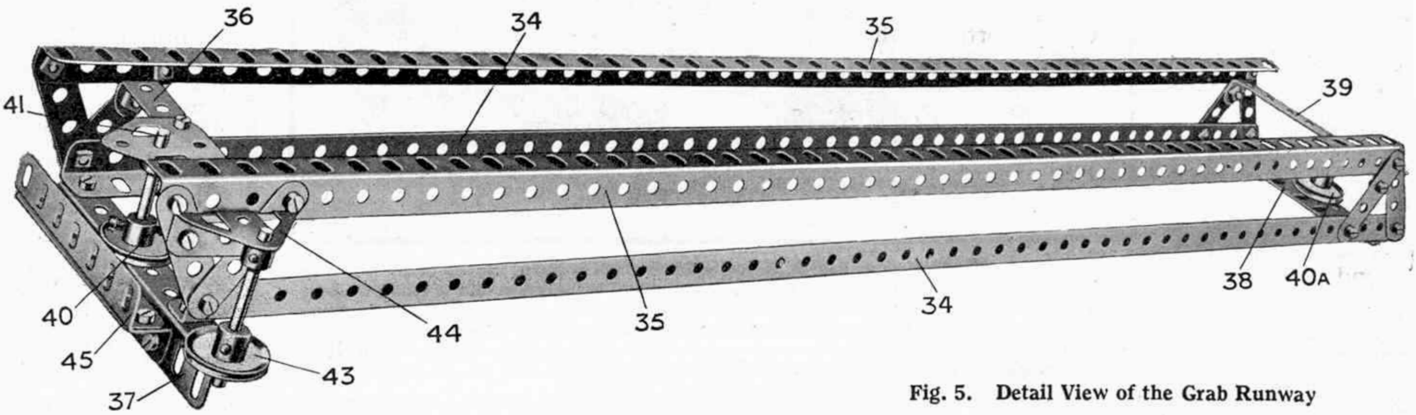


Fig. 5. Detail View of the Grab Runway

The Truck

Fig. 7 is a view of the underside of the automatically-discharging truck, which runs on the rails 18 (Fig. 4). Two 3½"×2½" Flanged Plates joined by 2½"×2½" Flat Plates form the walls of the truck, and the hinged bottom consists of a 3½"×2½" Flat Plate 58. A 3" Rod 59, journalled in Angle Brackets bolted to one of the end Plates, is retained in position by Collars, and acts as a pivot for a 2½"×1" Double Angle Strip 61 bolted to the Plate 58.

The truck runs on four ¾" Flanged Wheels secured to 3½" Rods, each wheel being spaced away from the sides of the truck by two Washers. The ½" loose Pulley Wheel 64 turns freely on a Pivot Bolt mounted in two Angle Brackets, which are secured to the ends of two 2½" Strips bolted to the Plate 58.

The Grab Trolley

The grab trolley traverses the rails 34 (Fig. 5), and from it is suspended the grab.

Two 3½" Flat Girders form the sides of the trolley (Fig. 6). They are joined by 1½"×½" Double Angle Strips 67, and their end holes form journal bearings for the 3" Axle Rods carrying the four ¾" Flanged Wheels. Two 2" Rods 69 journalled in the 3½" Flat Girders carry two 1½" Strips 72 and three pairs of ½" loose Pulley Wheels 73, 74, and 75 which are spaced apart by fixed Collars. Washers should be placed between the Pulleys 73 and 75 and the side Girders.

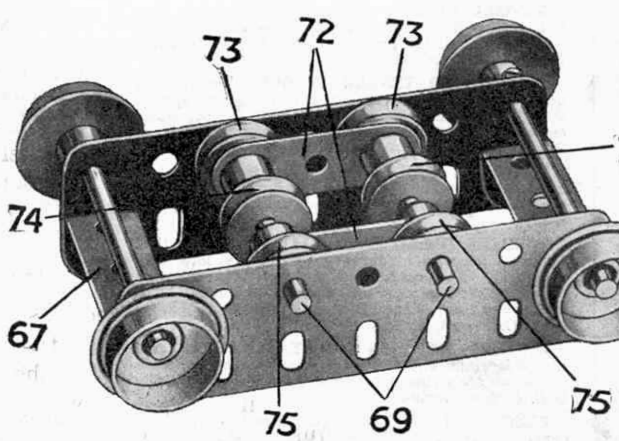


Fig. 6. The Grab Trolley

The Grab

Each jaw of the grab (Fig. 8) is composed of two 2½" Triangular Plates pivoted on a 2" Axle Rod 78 and joined by 1½"×½" Double Angle Strips 79. Four 2½" Curved Strips (small radius) are bolted to the Triangular Plates, and to these are attached the 1½" Strips 80, which are mounted pivotally on 2″ Rods 81. Four 3½″ Strips 82 also pivot about the Rods 81, and a 2½″ Rod 83 journalled through their upper ends carries two 1″ fast Pulley Wheels 86 and two ½″ loose Pulleys 84. The Rods 81 and 83 are held in position by Collars and set-screws.

Two ¾″ Flanged Wheels 85 are butted together on the Rod 78 to form a wide-grooved pulley. The Rod 78 is held in place between the Triangular Plates by Collars made fast to its ends.

Assembly of the Main Units

The two portions of the tower are united by bolting the lower ends of the Angle Girders 46 (Fig. 3) to the tops of the Girders 3 (Fig. 2). The Angle Girders 6, 6a, and the outer ends of the runway are supported by two 24½″ Angle Girders 89 (Fig. 1) bolted to the Girders 46 of the upper tower.

The grab runway is mounted pivotally on a 4½″ Axle Rod journalled in the lower holes of the 1½″ Angle Girders 57 (Fig. 3) and its outer end is supported by two ties, each consisting of a 12½″ Angle Girder and a 12½″ Strip overlapped nine holes, which connect it to the top of the tower.

The end of the 2″ Rod bearing the 1″ Pulley Wheel 28 at the inner end of the truck runway may now be passed through a hole in the Trunnion 17 (Fig. 2). A ½″ loose Pulley Wheel 87 (Fig. 1) is mounted on a 2″ Axle Rod secured in the boss of the Crank 14 (see also Fig. 2) and passes through the 1½″×½″ Double Angle Strip 33. A similar wheel 87a is supported at the inner end of the grab runway by a Collar on another 2″ Rod that is made fast in the boss of the Crank 56.

The drums on which are wound the cords for operating the grab are formed by Meccano Wood Rollers 90, 91 (part No. 106), which are gripped between Bush Wheels secured to 6½″ Axle Rods that are journalled in the 2½″ Flat Girders 52 (Fig. 3). These Rods are retained in position by means of Collars and set-screws, and carry on their ends the 1″ Sprocket Wheels 92, 93. Their other ends pass through the loops at the ends of two Springs, which are attached to the Trunnion 53 (Fig. 3) and are constantly under tension. The friction thus set up prevents the weight of the grab from unwinding the cords on the Rollers when the latter are disconnected from the driving mechanism.

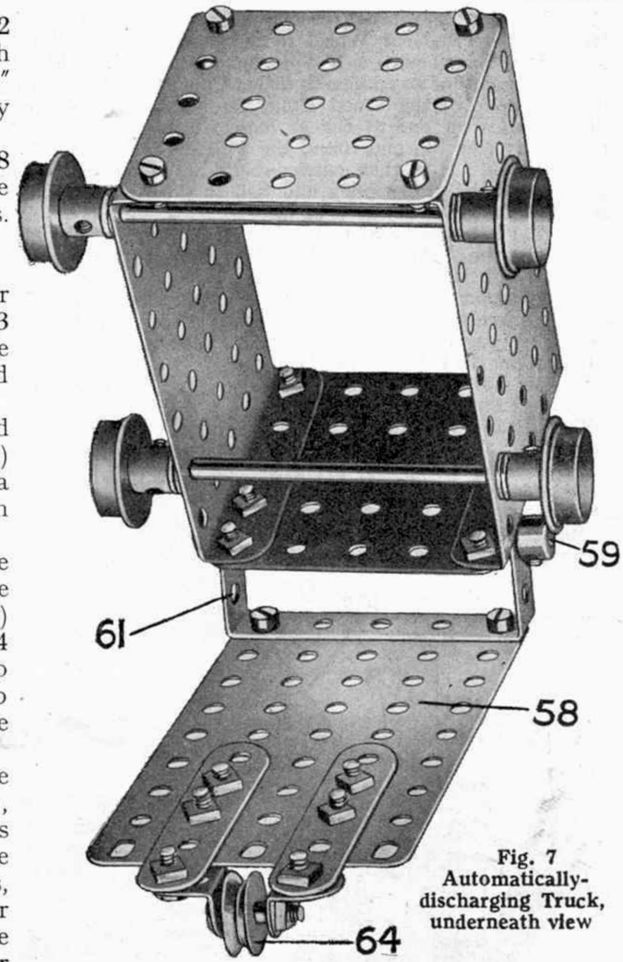


Fig. 7
Automatically-discharging Truck, underneath view

A Meccano Electric Motor should next be bolted to the Flat Plate 12 in the position shown (Fig. 1).

Transmission and Gearing

The gear box and various controls are shown in Fig. 9. The arrangement of the mechanism is as follows. A Worm Wheel secured to the armature spindle of the Electric Motor meshes with a 57-teeth Gear Wheel 96 on a 2″ Rod that is journalled in a Channel Bearing secured to the side of the Motor frame. A ⅞″ Bevel Gear, carried on the opposite end of the 2″ Rod, engages with a similar Bevel Gear, from the Rod of which the drive is led via a ¾″ Sprocket Wheel 94 to a 2″ Sprocket Wheel on the end of the 11½″ Axle Rod 95. This Rod 95 passes through the Flat Plates 7a, 10, and is provided with two ½″ Pinion Wheels 97, 98.

Three 6½″ Axle Rods 99, 100, 101 are journalled in the side Plates 7a and 10 of the gear box. The first of these carries a 57-teeth Gear Wheel to mesh with the ½″ Pinion 97, and two Sprocket Wheels that engage short Sprocket Chains, to the ends of which are tied lengths of cord.

The cords thus connected to the inner 1″ Sprocket Wheel pass round the 1″ Pulley Wheels 16, 14, 28a and 28, and are tied to opposite ends of the truck, while those from the outer Sprocket Wheel are led around the Pulleys 55, 43, 40, 56, 40a and are tied to the grab trolley. When the Rod 99 revolves, therefore, the truck and the grab trolley are simultaneously drawn inward or outward. Their positions should be so adjusted before securing that the grab trolley will come to rest in the tower immediately above the truck.

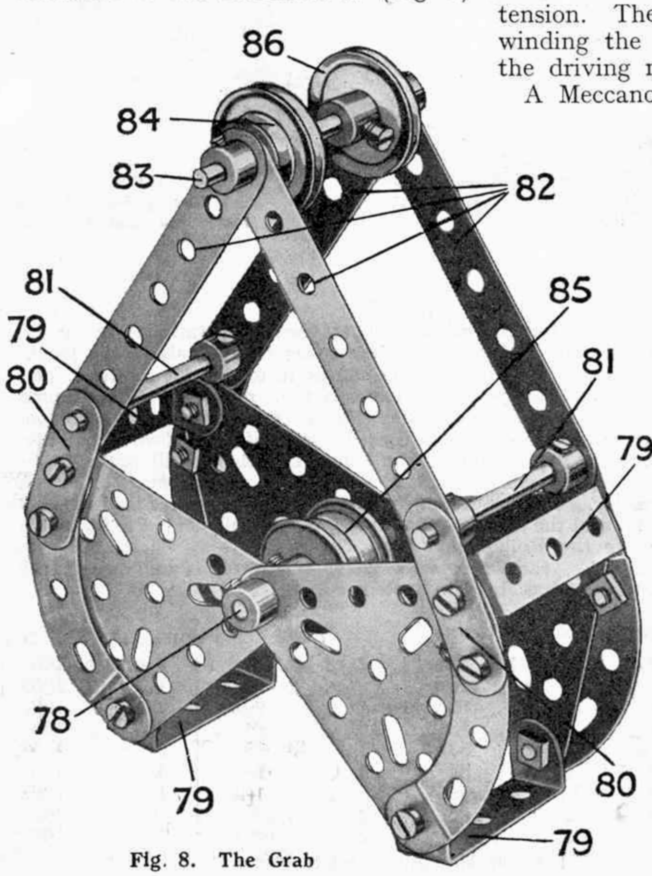


Fig. 8. The Grab

The Rod 100 is situated directly above the 11½″ Rod 95, and carries a 57-teeth Gear Wheel to mesh with the ½″ Pinion 98. It also is provided with a 1″ Sprocket Wheel 102, which is connected by means of an endless Sprocket Chain to a similar wheel 92 on the spindle of the Wood Roller 90. A cord wound on this roller passes over one of the ½″ loose Pulley Wheels 74 in the grab trolley (Fig. 6), and round the ¾″ Flanged Wheels 85 of the grab (Fig. 8). It is then carried back and over the second ½″ Pulley 74 in the grab trolley and tied to the Angle Girder 45 at the end of the grab runway (Fig. 5).

The Rod 101 bears a 57-teeth Gear Wheel that can be made to engage with the ½″ Pinion 97. It is also provided with a 1″ Sprocket Wheel, which is connected by another endless Sprocket Chain to the Sprocket Wheel 93 driving the Roller 91 (Fig. 1). This Roller is provided with two cords for raising and lowering the grab. These cords pass over the ½″ loose Pulley Wheels 73, 75 of the grab trolley, under the 1″ Pulley 84 of the grab, and back over the second pair of ½″ Pulley Wheels 73, 75, and are finally tied to the Angle Girder 45.

The Axle Rods 99, 100, 101 are all slidable in their bearings, and their movements are controlled by means of the handles 103, 104, 105, consisting of 3½″ Strips pivotally attached by means of bolts and nuts (S.M. 262) to the 1″×1″ Angle Brackets 10a (see also Fig. 2). The 3½″ Strips are connected to the sliding Rods by means of Double Brackets, which are retained in position on the Rods by Collars and pivoted to the Strips by means of bolts and lock-nuts (S.M. 263). The Gear Wheels on the Rods 99, 100, 101, can thus be brought in or out of engagement with the ½″ Pinion Wheels 97, 98 by operation of their respective handles.

The Electric Motor is controlled by a handle 106, consisting of a 2″ Rod secured in the end transverse hole of a Coupling on the extremity of an 8″ Rod 107, which is extended by a Coupling and a 2″ Rod. The latter is attached to the central starting lever of the Motor by means of an End Bearing (part No. 166).

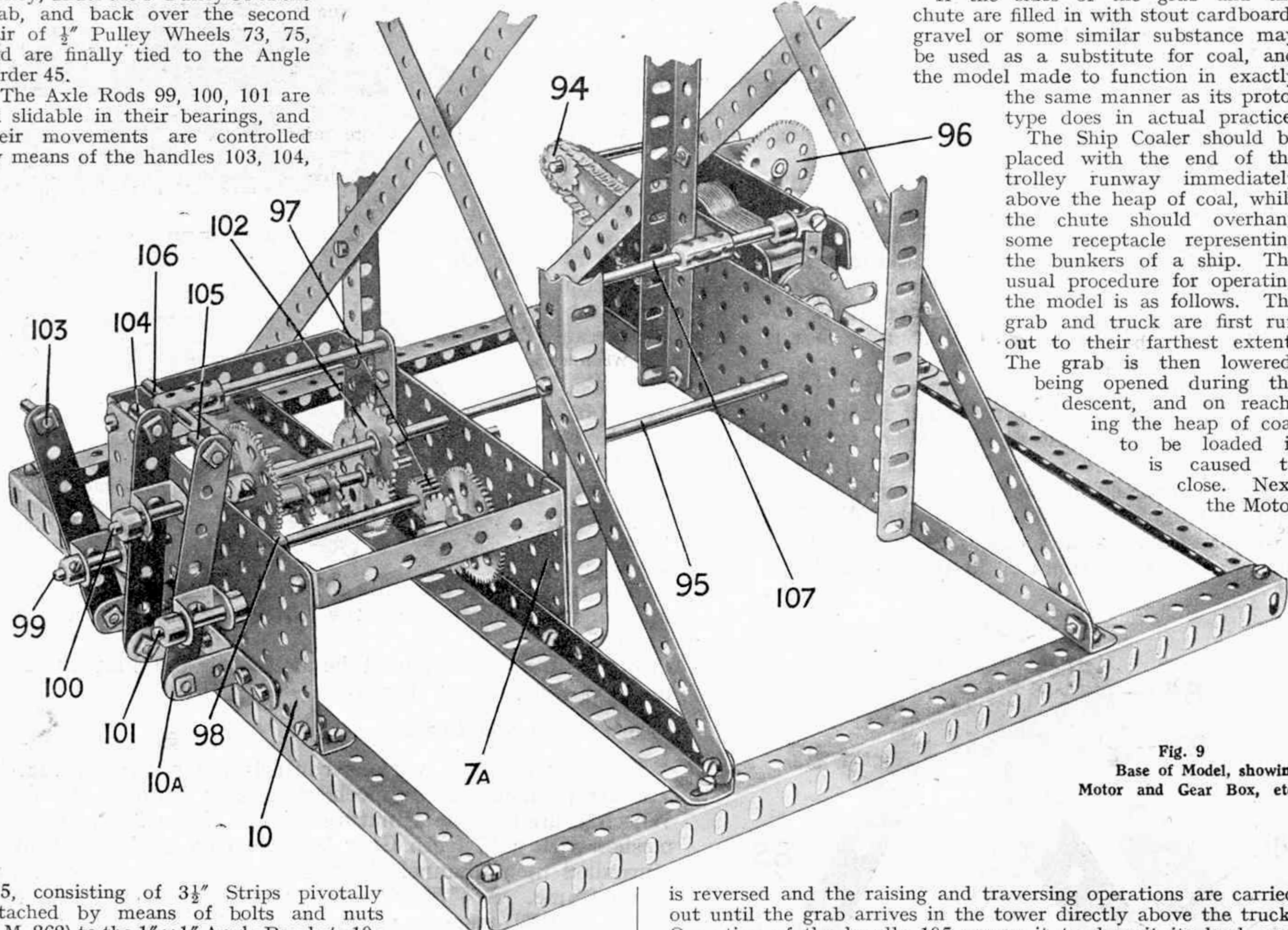


Fig. 9
Base of Model, showing Motor and Gear Box, etc.

When the handle 105 is pushed inward the grab closes if the hoisting mechanism is stationary; if the Electric Motor be reversed, the grab will open. Operation of the handle 104 causes it to be raised or lowered, but the handle 105 should be thrown at the same time in order to prevent the cord 107 from becoming slack when the grab is rising, or retarding the progress of the latter if it is descending. Care should be taken that the cords are wound on the Rollers 90, 91 in the correct directions so that all three cords 108, 109, operating the grab are either paid out or hauled in simultaneously when the handles 104, 105 are thrown together.

The handle 103, when thrown, causes both the truck and the grab trolley to travel inward or outward, according to the direction in which the Motor is running.

If the sides of the grab and the chute are filled in with stout cardboard, gravel or some similar substance may be used as a substitute for coal, and the model made to function in exactly the same manner as its prototype does in actual practice.

The Ship Coaler should be placed with the end of the trolley runway immediately above the heap of coal, while the chute should overhang some receptacle representing the bunkers of a ship. The usual procedure for operating the model is as follows. The grab and truck are first run out to their farthest extent. The grab is then lowered, being opened during the descent, and on reaching the heap of coal to be loaded it is caused to close. Next the Motor is reversed and the raising and traversing operations are carried out until the grab arrives in the tower directly above the truck. Operation of the handle 105 causes it to deposit its load, and the original outward movement is then repeated. The dipping centre rail of the truck runway (Fig. 4) presently allows the bottom of the truck to open and drop its load of coal down the chute.

A little adjustment to the completed model will probably be necessary to ensure that the different movements are timed correctly. This is effected by altering the positions of the Sprocket Chains and the cords wound on the Wood Rollers 90, 91, for which purpose the Rollers and Sprocket Wheels may be loosened on their axles, the set screws being made fast again when the mechanism has been adjusted correctly.

Parts Required to Build the Meccano Ship Coaler:

18 of No. 1	4 of No. 9	5 of No. 14	4 of No. 27A	4 of No. 48B	2 of No. 72	5 of No. 103D
2 „ „ 2	3 „ „ 9A	1 „ „ 15	2 „ „ 30	1 „ „ 48C	8 „ „ 76	1 „ „ 103E
12 „ „ 3	2 „ „ 9B	3 „ „ 16	1 „ „ 32	1 „ „ 52A	4 „ „ 90A	2 „ „ 103F
2 „ „ 4	2 „ „ 9C	2 „ „ 16A	312 „ „ 37	2 „ „ 53	15′ „ „ 94	2 „ „ 106
4 „ „ 5	2 „ „ 9F	2 „ „ 16B	6 „ „ 37A	1 „ „ 53A	1 „ „ 95	9 „ „ 115
10 „ „ 6	3 „ „ 11	12 „ „ 17	20 „ „ 38	2 „ „ 54	4 „ „ 96	4 „ „ 126
7 „ „ 6A	8 „ „ 12	2 „ „ 18A	2 „ „ 43	38 „ „ 59	3 „ „ 96A	1 „ „ 126A
12 „ „ 7	3 „ „ 12A	10 „ „ 20B	1 „ „ 46	2 „ „ 52	2 „ „ 100	1 „ „ 160
14 „ „ 8	1 „ „ 13	4 „ „ 24	8 „ „ 48	3 „ „ 70	2 „ „ 100A	1 „ „ 166
2 „ „ 8B	1 „ „ 13A	2 „ „ 26				

1 4-volt Meccano Electric Motor

Electricity Applied to Meccano

VI.—A Meccano Galvanometer and Other Models

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, and other simple apparatus. Below we describe an accurate Meccano instrument with which resistances in electrical conductors, etc., may be determined, and two simple electric Motors. All these models are constructed from a few ordinary Meccano parts used in conjunction with the special electrical accessories.

THE first model with which we shall deal this month is a galvanometer. This is of a somewhat scientific nature, but it is easy to make and much fun and interest can be obtained from its use. By building models of this type a Meccano boy will add very materially to his knowledge of electrical science, and the deeper understanding that he gains of the principles involved will enable him to build more elaborate and still more interesting electrical apparatus.

The galvanometer is used very largely in electrical work as a detector of weak electric currents, and is an invaluable instrument. The fact that a practical galvanometer may be constructed from Meccano parts is a striking tribute to the adaptability of the Meccano system. It shows that there is no exaggeration in the statement that the principles of any mechanical or electro-mechanical apparatus can be demonstrated clearly and easily with Meccano.

The Meccano Galvanometer

In essentials the model consists of a coil of fine wire having a large number of turns, in the centre of which swings a freely suspended magnetised needle. It has been pointed out in the earlier articles in this series that a coil of wire carrying a current produces a magnetic effect. When a weak current flows through the coil here used, it produces a comparatively strong magnetic field, owing to the large number of turns through which it passes, in accordance with the ampere-turns law explained last month. The magnetic field due to a current passing through the coil interacts with that of the needle, and the needle moves in an effort to balance these effects. The principle of this apparatus is employed in many types of voltmeter and ammeter, etc.

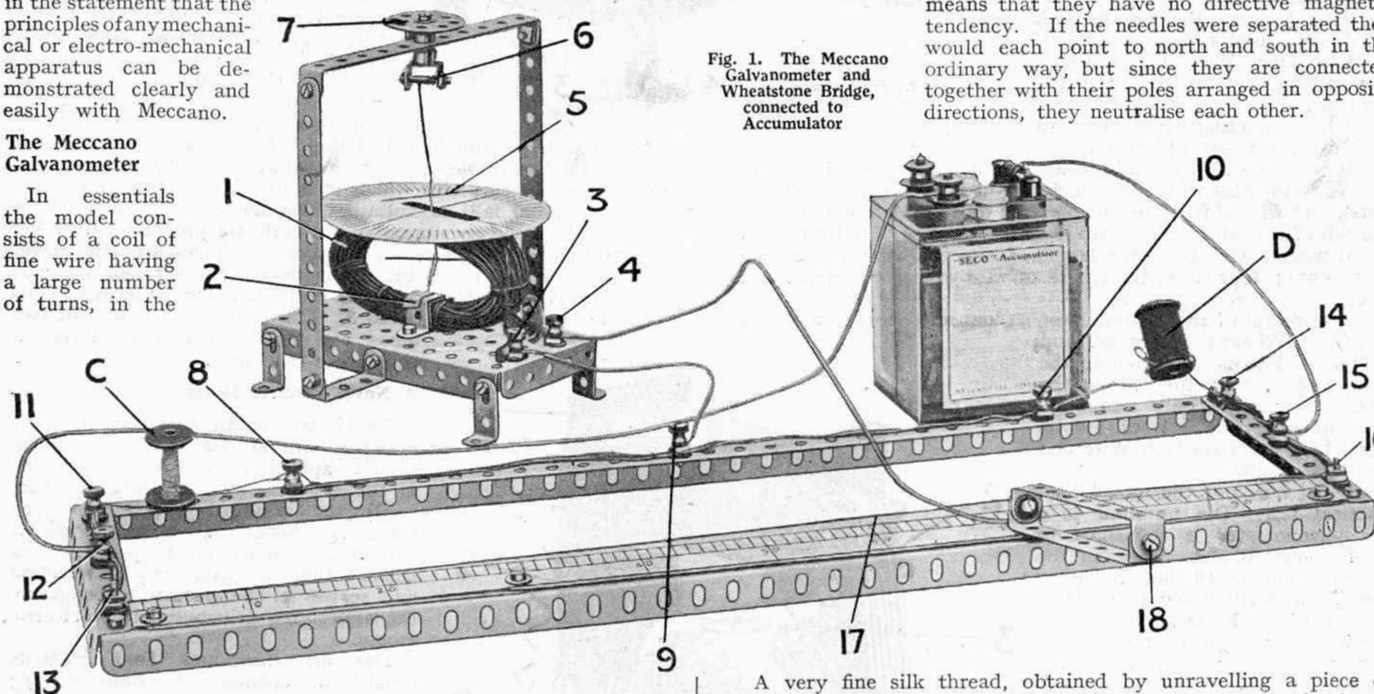


Fig. 1. The Meccano Galvanometer and Wheatstone Bridge, connected to Accumulator

Fig. 1 shows the model galvanometer connected to a Meccano Wheatstone Bridge (which is described later) and Fig. 2 is an enlarged view of it.

The coil 1 consists of approximately 70 turns of 26 S.W.G. wire. To form the coil the wire may be wound round some circular object, such as a glass tumbler, etc., and when completed it should be shaped into an ellipse, as shown. The strands of wire at the top of the coil are separated into two groups, and a space is left between the groups in which the needle support is suspended. The completed coil is bound in one or two places with thread to prevent the windings becoming disturbed, and is mounted on the $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate forming the base of the instrument. It is held in position by the Double Bent Strip 2. The two ends of the coil windings are brought to two insulated Terminals 3 and 4.

For the needles it will be necessary to magnetise two ordinary darning needles of fair size. As explained in a previous article, they may be magnetised by stroking them with one pole of an ordinary bar magnet. Note carefully which end of each needle points to the magnetic north, and mark the ends distinctly to prevent confusion. The needles are pushed halfway through a narrow strip of stout paper, as shown, with their poles in opposite positions. This means that the south pole of one needle must be on the same side of the paper strip as the north pole of the other. Two needles so arranged are described as an " astatic " pair, which means that they have no directive magnetic tendency. If the needles were separated they would each point to north and south in the ordinary way, but since they are connected together with their poles arranged in opposite directions, they neutralise each other.

A very fine silk thread, obtained by unravelling a piece of embroidery silk, is used to suspend the astatic pair, the lower needle being arranged in the centre of the coil 1. The thread is attached to a $\frac{3}{4}''$ Bolt mounted in the Fork Piece 6, which is secured by a similar bolt to the Bush Wheel 7. The latter may be rotated for the purpose of setting the needles at right angles to the longitudinal axis of the coil. To prevent the needle from swinging from side to side, the lower end of the supporting paper strip is attached to the top of the Double Bent Strip 2 by means of another short length of silk thread, which is secured to the Double Bent Strip by a piece of gummed paper.

The silk threads are secured to the paper strip by gum or glue. It is a good plan to apply a little glue to the needles to keep them in position in the paper.

It is often necessary to ascertain the resistance of a coil or a length of wire in order to find what kind of battery is necessary to produce certain effects. For instance, if a 4-volt electric motor is to be run by a current passing through long wires a 4-volt accumulator may not give sufficient current on account of the extra resistances. A knowledge of the resistance of the connecting wires used will enable the experimenter to find out definitely whether a 4-volt or a 6-volt accumulator should be used.

A simple means of finding resistances is afforded by using the galvanometer in conjunction with the next model to be described.

The apparatus represented by this model is known as a Wheatstone bridge.

A Meccano Wheatstone Bridge

The construction of the framework of the Meccano Wheatstone bridge will be obvious from the illustration (Fig. 1). The scale consists of a strip of paper or cardboard accurately divided into a hundred divisions and stuck on top of 12½″ and 5½″ Flat Girders bolted to the front 18½″ Angle Girder of the model. The three terminals 8, 9 and 10 are insulated from the frame by means of Insulating Bushes and Washers, and are connected together by four strands of 23 S.W.G. Wire. The object of using four pieces of wire is to reduce the resistance between the terminals to a minimum. For the same reason the two groups of terminals 11, 12, 13, and 14, 15, 16, are connected in a similar manner. The connecting wires are all visible in the illustration. It is necessary that all the terminals should be insulated carefully from the framework. Extra nuts are placed on the bolts beneath the terminals 13 and 16 and used to secure a length of Bare Iron Wire 17, which is stretched tightly between the two terminals.

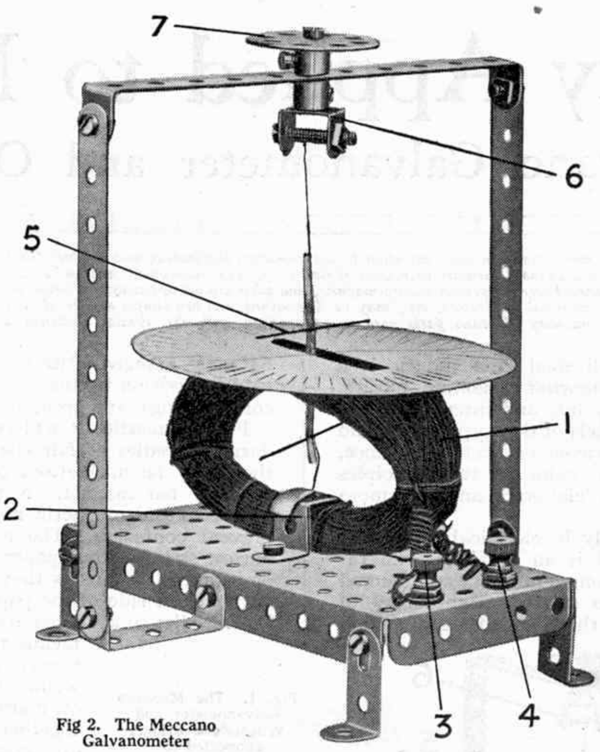


Fig 2. The Meccano Galvanometer

Before conducting experiments we shall require a set of standard resistances. For this purpose it will be necessary to obtain some No. 36 S.W.G. Single Cotton Covered Wire (this wire is not included in the Meccano Electrical parts), and wind 2 ft. 10 ins. of the wire on to a Meccano Bobbin. The coil of wire so obtained will have a resistance of half an ohm. A coil wound with twice the length of wire will have a resistance of one ohm; four times the length of wire will give 2 ohms, and so on.

One terminal of the Accumulator is connected to the terminal 12 of the Wheatstone bridge, and the terminal 15 is connected to the metal link between the cells of the Accumulator, since only two volts are required. The use of 4-volts would heat the Bare Iron Wire and affect the results.

We can now put the model to a practical test. The terminal 4 of the galvanometer is connected to the insulated 6 B.A. Screw in the end of a handle 18, and its other terminal 3 is connected to the terminal 9 of the bridge. D is a coil of wire the resistance of which we wish to discover, and C is the standard resistance coil—say of 2 ohms—inserted between the terminals 11 and 8. To make the test, the Bare Iron Wire 17 is touched with the tip of the 6 B.A. Bolt in the handle 18. The needle of the galvanometer probably will deflect and it will be necessary to touch the wire 17 opposite various points on the scale until the needle shows no appreciable deflection. When this result is obtained the bridge is said to be "in balance." If a balance cannot be obtained with the 2 ohm standard coil C, it will be necessary to try another coil of a higher or lower value.

It will be clear from Fig. 1 that the current from the Accumulator has two paths available in passing from terminal 12 to terminal 15. In one of these it passes down the straight wire 17 laid along the scale and in the other it flows through the 2 ohm resistance coil C and the coil D of unknown resistance, other resistances in this path being so small as to be of no importance.

Between the terminals 12 and 9 on the one side and 9 and 15 on the other in the second of these two paths there will be falls in voltage proportional to the resistances offered by the coils C and D, and by moving the terminal 18 along the wire 17 a point may be found dividing this wire into two portions in which the same falls in voltage occur. In other words, the point found on the wire 17 and the terminal 9 are at the same voltage and there is no electro-motive force tending to cause a current to flow from one to the other. This is indicated by the absence of movement of the galvanometer needle, as no current will then flow through the instrument. If the movable terminal 18 is brought into contact with the wire 17 at other points, current will flow through the galvanometer coil and the needle will be deflected to one side or the other.

When the point at which no current flows has been found, the resistance of the coil D may be determined by a simple calculation. As the wire 17 is of the same diameter throughout, its resistance is uniform and the proportional lengths into which it is divided by this point give the proportional falls in voltage along the wire and also in the two coils. As the resistances of the coils are proportional to the voltage falls across them, the relative resistances are also given.

If, for instance, the point giving no current through the galvanometer is 25 on the scale, the proportional resistances of coils C and D are 25 to 75, or 1 to 3. Coil C has a resistance of two ohms and thus coil D must have a resistance of six ohms.

A Novel Electric Motor

An electric motor that can be built entirely with standard Meccano parts should appeal to all Meccano boys. If the brushes, etc., are adjusted correctly the armature will rotate very rapidly, although of course the model will not produce much power. Its construction is extremely interesting and serves to demonstrate very clearly the underlying principles of the electric motor.

The armature and field magnets consist of ordinary Meccano Strips; strictly speaking these sections of the motor should consist of soft iron, but the steel Strips will serve the purpose quite well.

The construction of the model should be commenced by winding the field magnet 1. The core of this magnet consists of four 4½″ Strips laid one upon the other and pushed through two Coil Cheeks (part No. 309). The core should be wound with about 500 turns of 26 S.W.G. wire, and the completed coil may be covered with brown paper, etc., to enhance the finished appearance of the model. Each side limb of the field magnet consists of four 2½″ Strips 2 and two 2″ Strips 3 secured together by ½″

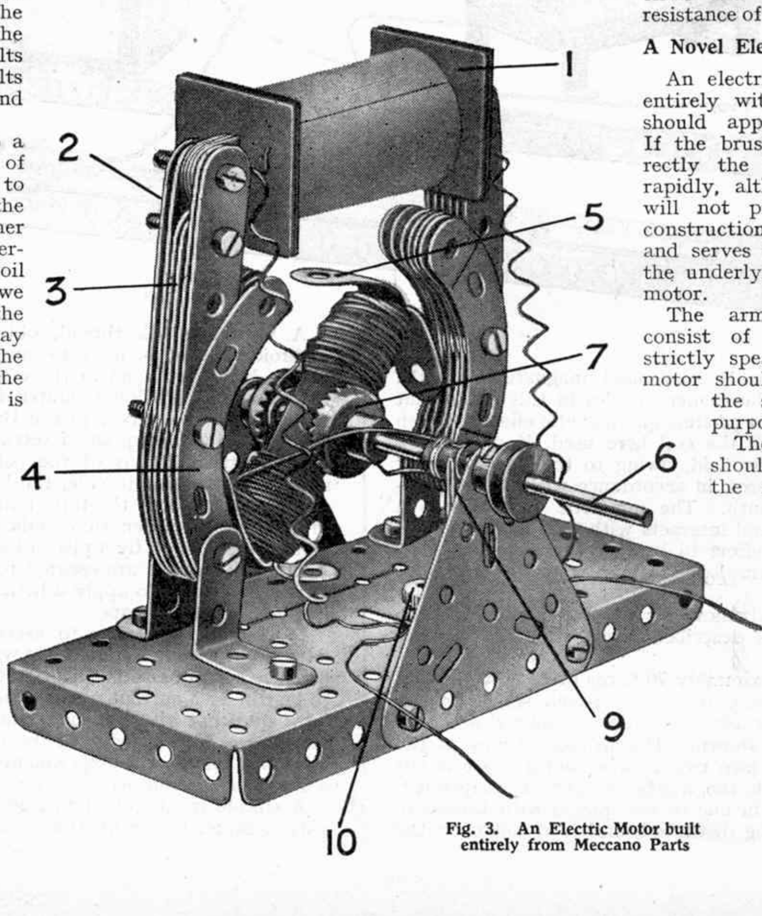


Fig. 3. An Electric Motor built entirely from Meccano Parts

Bolts. The upper ends of these Strips are spaced apart by Washers placed on the $\frac{3}{4}$" Bolts, and their lower ends are inserted between seven $2\frac{1}{2}$" small radius Curved Strips 4. The two sets of Curved Strips 4 form the tunnel in which the armature 5 rotates.

The armature consists of two $2\frac{1}{2}$" × 1" Double Angle Strips laid back to back with the $4\frac{1}{2}$" Rod 6 secured centrally between them. The Strips must be bound with adhesive tape or gummed brown paper to retain them in position and to prevent their edges from damaging the insulation of the armature winding.

The armature is wound in the following manner. Take 6 ft. of 23 S.W.G. wire and double it to find the centre. Then lay the wire diagonally across the centre of the armature so that there is an equal length on both sides. Then, using one half of the wire, wind it on to one half of the armature, and do the same with the remaining half of the wire.

Next take a strip of paper coated with gum and wind it round the armature shaft until a sleeve is formed round the Rod 6 about $\frac{1}{8}$" thick. This corresponds to the commutator. The free ends of the armature coil are now uncovered and shaped to the paper sleeve as shown in the diagram (Fig. 4). The two shaped ends of the wire form the commutator segments. One of these segments is shown at 8, the other one being on the opposite side of the paper sleeve, of course.

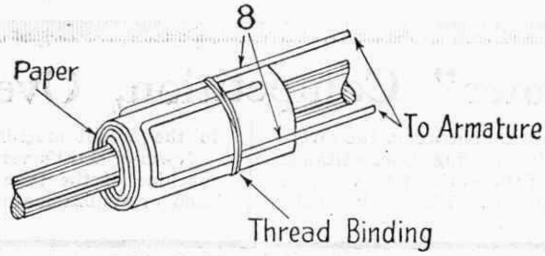


Fig. 4. Detail of Commutator of Meccano Motor

The completed armature unit is clamped in position on the Rod 6 by means of two $\frac{3}{4}$" Contrate Wheels 7, which press very tightly against the Double Angle Strips. The ends of the two Double Angle Strips are rounded as shown so that they rotate freely in the armature tunnel.

The brushes 9 consist each of a length of bare 23 gauge wire, which is doubled to increase its springiness. Each brush is connected to an insulated terminal 10, and arranged to press lightly on opposite segments of the commutator. It is very important that the armature and the segments of the commutator are in their correct relative positions.

If the motor does not run properly it may be assumed that these positions are not as they should be, and the armature must be moved round (while the armature shaft 6 and the commutator are held stationary, of course) until further trials prove the running to be satisfactory.

It only remains now to connect up the ends of the field coil 1 to two terminals 10, which are insulated from the base plate by means of Insulating Bushes and Washers. The wires from the accumulator are also attached to these terminals. Since the motor is of the two-pole type it will probably be necessary to twist the shaft 6 with the fingers to start it. If desired a switch of any convenient type can be inserted in the circuit between the terminals 10 and the accumulator.

Another Type of Motor

The Meccano Motor shown in Fig. 5 is designed on somewhat unorthodox lines and is in striking contrast to the motor described above. The novel arrangement of the armature and commutator should be noted. This is perhaps the simplest type of electric motor that can be constructed.

The combined armature and commutator 4 consists of a Face Plate to which are bolted four $5\frac{1}{2}$" Strips in the manner shown. In each of the holes in the Strips nearest the boss in the Face Plate is inserted a 6 B.A. Bolt, which forms one segment of the commutator.

Each of the two magnets 5 consists of a Meccano Bobbin wound to capacity with 26 S.W.G. wire. They are secured to the frame in the positions shown by Core Pieces. One of the wires from the lower magnet is led to one of two insulated terminals mounted in the base Plate at the rear of the model, and the other wire from this magnet is joined to one wire of the upper magnet. After the motor is erected it may be found necessary to change these connections so that each magnet 5 shall have a different polarity.

The polarity of the coils 5 may easily be determined by means of a pocket compass. If the latter is held near one of the coils one end of the compass needle will swing toward the coil. When the compass is held near the other coil the opposite end of the needle will point toward the coil, thus indicating that one coil has a North and the other a South polarity. If the needles point in the same direction in each case, the connections just described must be altered, and the wire from the lower magnet must be joined to the other wire of the upper magnet.

The remaining wire from the upper magnet is secured to the 6 B.A. Bolt 6. The brush 7, which is also attached to this bolt, consists of a short length of 23 gauge copper wire, scraped clean and bent so that it brushes lightly against the 6 B.A. Bolts forming the commutator segments. The brush should first make contact with a commutator segment when two of the armature arms are equidistant from a magnet. This point is very important, for the model will not work satisfactorily unless the brush is adjusted carefully. The gap between the magnet cores and the armature arms should be as small as possible.

The switch arm is a $3\frac{1}{2}$" Strip pivotally mounted on the $5\frac{1}{2}$" × $2\frac{1}{2}$" Flanged Plate 2 by means of a bolt and lock-nuts (see Standard Mechanism No. 262). A Flat Bracket 3 forms the switch contact. It is attached to the base Plate by a 6 B.A. Bolt and insulated therefrom by an Insulating Bush and Washer. The Flat Bracket is connected by a short length of wire passing underneath the Flanged Plate to the second insulated terminal at the rear of the model.

Path of the Current

The path of the current through the motor is as follows. From one of the terminals in the rear of the model the current passes through the wire round the lower magnet 5, then through the upper magnet to the insulated bolt 6 and brush 7. From the brush it passes to the commutator, and then through the frame of the model and the switch arm 1 to the Flat Bracket 3, and so back to the second terminal at the rear. The accumulator is connected to these terminals. In the photograph the switch is shown in the "on" position.

When the switch is on, no current will flow unless the brush 7 is in contact with one of the 6 B.A. Bolts of the commutator. Hence it may be necessary to twist the armature slightly in order to start the motor. When the brush 7 makes contact with one of the commutator bolts, the circuit is completed and the cores of the Bobbins 5 become magnetised. The armature Strips nearest the magnets will then be drawn round until they are directly opposite the magnet poles. Immediately they reach this position, however, contact with the brush is broken, the current is switched off, and the cores of the Bobbins 5 lose their magnetic power. The armature, thus set free, will "free wheel" on account of the impetus already given to it and the brush will make contact with the next 6 B.A. Bolt. The cycle of operations will then be repeated.

If enamelled parts are used in the construction of the motor, it may be found necessary to journal the armature shaft in a nickelled Strip to lower the resistance in the path of the current.

Since the circuit is completed through the armature shaft, the bearings of the latter should not be oiled, for this would increase the resistance in the path of the current and lower the efficiency and rotative speed of the motor.

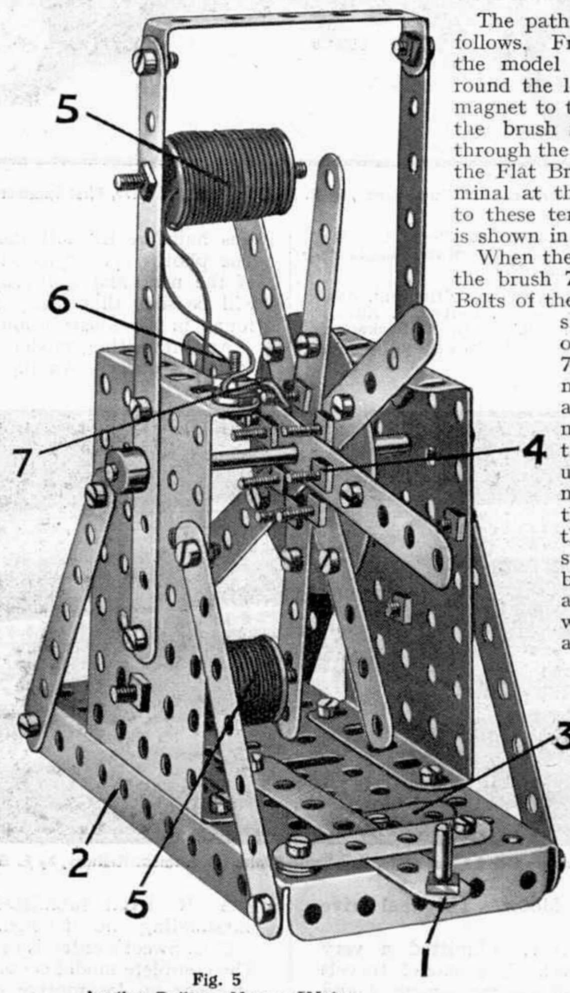


Fig. 5
Another Built-up Meccano Motor

Results of

Meccano Model-Building Contests

By Frank Hornby

"First Summer" Competition, Overseas Section

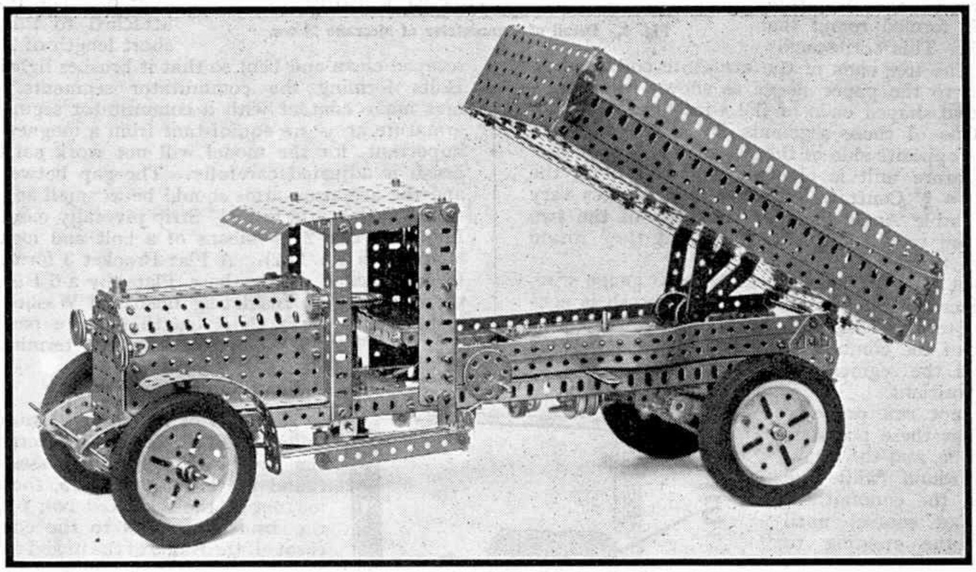
It is always very interesting to examine the entries in the Overseas Sections of the Meccano Model-building Competitions. Models are sent in from every part of the world and as a rule they exhibit a wonderful variety of subjects. The results in the Overseas Section of the First Special Summer Competition signalise a remarkable triumph for Canadian boys, for the three principal awards are carried off by boys from that country!

The following is the list of prize-winners:

First Prize (Meccano products to the value of £2 2s.): Richard D. Hiscocks, Toronto, Ontario. Second Prize (Meccano products to value of £1 1s.): J. M. Skinner, Toronto, Ontario. Third Prize (Meccano products to the value of 10/6): Norman Scott, Winnipeg, Canada.

Six Prizes, each consisting of Meccano products to the value of 5/-: E. Bull, Singleton, New South Wales; Charles C. Sweet, Banff, Alberta, Canada; A. R. Lyell, Hawthorn, Victoria, Australia; Marcel Pauwels, Antwerp, Belgium; F. Marshall, Peterborough, S.A.; J. Lincoln, Sydney, N.S.W.

Special Commendation (Certificates of Merit): W. W. Young, Claremont, Australia; Ernest Smith, Montreal, Canada; A. S. Adams, Durban, S. Africa; Lolo Cabavara, Venice; Leslie Potter, Mosman, N.S.W.; G. A. Rockwood, Colombo, Ceylon; Nat Barry, Pilgrims Rest, Transvaal; Lester Beldan, Toronto, Ontario; Kevin Langsdorf, Nobby, Queensland.



Clockwork-driven Motor Dump Lorry, by R. D. Hiscocks, First Prize, First Summer Contest)

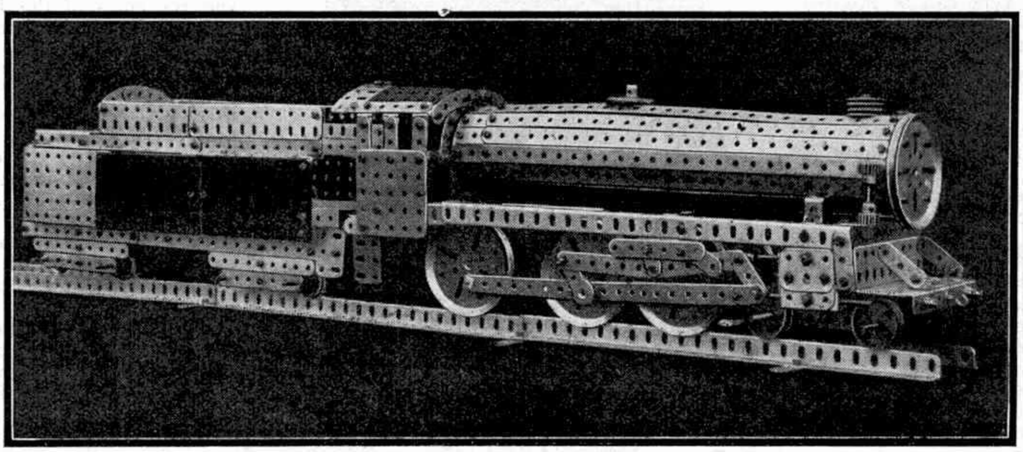
R. D. Hiscocks secured First Prize with the model tipping motor wagon illustrated on this page. Although the photograph clearly shows the external lines and details of the model, it gives little indication of the arrangement of the actual mechanism. The model contains in miniature all the essential machinery of the actual vehicle and it is driven by a Clockwork Motor. The final drive to the back axle is by Sprocket Chains.

J. M. Skinner, the Second Prize-winner, submitted a very interesting model of a mechanical shovel. The model travels on rails and is capable of carrying out all the movements found in the actual machine.

Norman Scott's very original model is in the form of a loading machine of the type used for filling railway trucks, etc., with sand or similar material. This model is reproduced at the foot of the opposite page. In operation the machine is moved by means of the Clockwork Motor until the two Face Plates are embedded in the mound of sand The Plates and the Dredger Buckets are then set in motion simultaneously and the sand is carried in the buckets to the top of the chute, down which it falls into the waiting trucks.

Among many other excellent entries, the 4–6–0 "C36" class locomotive of the New South Wales Government Railway is worthy of particular mention. This model was built by E. Bull and is based on a scale of ½" to the foot. The photograph reproduced on this page gives an excellent idea of the neat and well-proportioned appearance of the model. It will be seen that many new uses for Meccano parts have been found in the construction of the locomotive.

An interesting model of a railway truck constituted Marcel Pauwel's entry. An illustration of this truck will be found on another page in this issue, and on reference to the photograph it will be seen that, although quite a simple model, it forms an accurate representation of a type of truck in use for the transportation of coals and other minerals, etc. The model is a good example of the excellent work that can be done by using a few parts to the best possible advantage.



Meccano 4–6–0 Locomotive, New South Wales Government Railway, by E. Bull

A. R. Lyell submitted several interesting entries, the most outstanding one of which represents an electric dragline.

C. C. Sweet's entry is in the form of a "Garret" type locomotive. The complete model is over 3 ft. long and forms a pleasing example of Meccano locomotive construction.

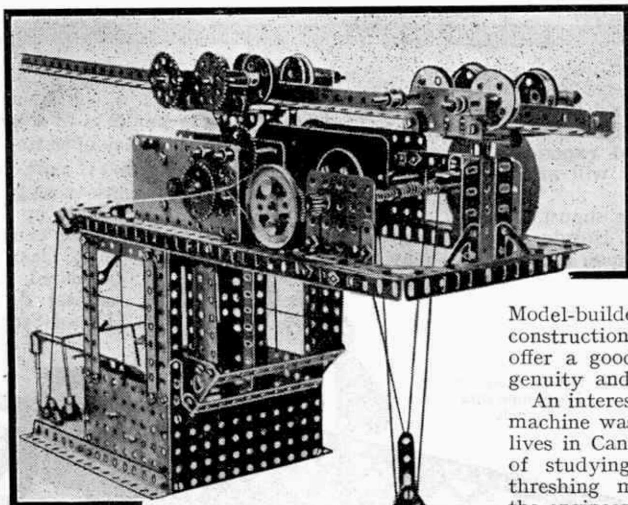
"Second Summer" Competition, Overseas Section

Many excellent models are included in the Overseas Section of the "Second Summer" Competition. Some of them are strikingly original and the majority are very neatly made and well thought out. The names of the principal prize-winners are as follows :—

FIRST PRIZE (Meccano products to the value of £2 2s.): Kenneth Angus, Napier, N.Z. SECOND PRIZE (Meccano products to value of £1 1s.): R. Earp, Edgecliff, Sydney, Australia. THIRD PRIZE (Meccano products to value 10/6): Charles Roger, Rue de Turenne, Paris.

SIX PRIZES, each of Meccano products to the value of 5/-: Hermann Jacobsen, Clifton, Johannesburg, S.A.; G. R. Merrifield, East Malvern, Victoria; J. J. Elias, Winkler, Man., Canada; Frank Stoakes, Hong Kong; George Mascull, Milford, Auckland, N.Z.; E. Smith, Rosemount, Montreal.

SPECIALLY COMMENDED (Certificate of Merit): P. Grant, Johannesburg; Jack Bratt, North Hobart, Tasmania; Norman F. Keith, Geelong, Victoria; Leslie Potter, Mosman, Sydney; Arthur Putterill, Adelaide; Alan Ryan, Kogarah, Sydney; Kenneth Downie, Carnegie, Victoria; Billy Swift, Westmount, Montreal; J. M. Skinner, Toronto, Ontario; J. P. Swain, Burwood, Sydney; E. J. Bonnici, Slima, Malta; L. J. Hardy, Victor Harbour, Australia



Monorail Electric Crane, with Friction Grip Tongs, by Charles Rogers

Kenneth Angus secured First Prize with a very elaborate model of a concrete mixing and elevating plant, of the type used in the construction of concrete buildings. In practice the machine is placed close to the building that is under construction and the sand, cement, etc., is carried to the mixer, which is in constant rotation, by means of a truck running on an inclined runway. On reaching the top of this runway the truck deposits the material into the mixer. The mixed concrete is then carried to the top of a tower by means of large buckets with collapsible bottoms, and is tipped down an adjustable chute into the correct position. The vertical tower of the model measures about four feet in height.

R. Earp's model is of a luffing and swivelling jib crane, a particularly novel feature of which is the addition of Constantinesco torque convertor mechanism, which enables the crane to lift varying loads without changing the gear ratio between the winding mechanism and the motor. Earp uses wire in place of cord on all brake drums in his model, as he finds that this eliminates binding when the brakes are in the "off" position.

Charles Roger's model, a photograph of which is reproduced on this page, is in the form of an overhead monorail crane of a type used in large foundry and locomotive shops. The crane and motor are suspended from the single rail as shown in the photograph. The various movements, such as travelling along the rail, raising and lowering the friction grip tongs, and opening and shutting the tongs, are all controlled from the operating platform suspended beneath the crane mechanism.

Amongst other models of particular interest I noticed a two-seater coupé by Hermann Jacobsen and a wheat conveyor by G. Merrifield. Jacobsen's model has a particularly realistic appearance. Amongst numerous attachments that add to the finish of the car are a spare tyre enclosed in a waterproof cover, a fold-down hood and front and rear bumpers, etc. The wheat conveyor constructed by G. Merrifield follows original lines. The wheat is carried in trucks to the base of the elevator, and there deposited. It is then conveyed to the top of the silo or storage bin by means of Dredger Buckets and dropped into it. A chute at the base of the silo allows the grain to be withdrawn into trucks when and as required.

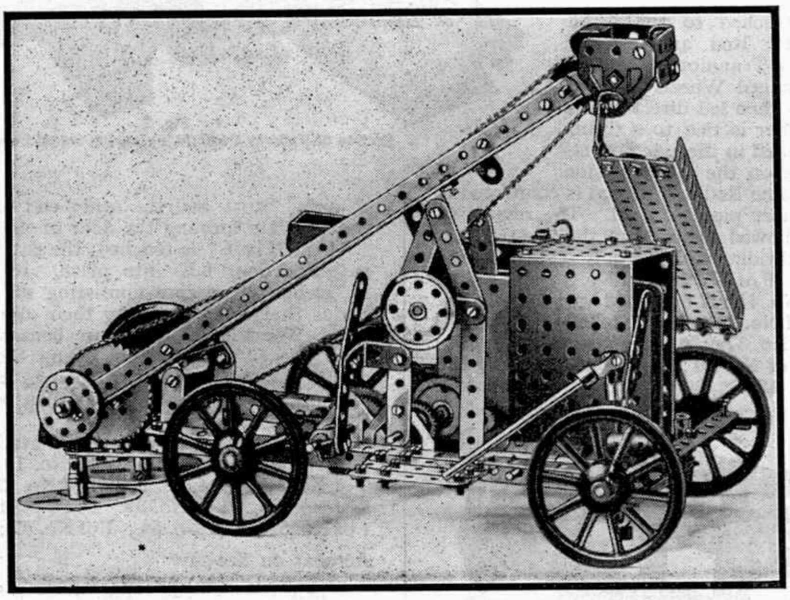
A very original model was that of a Chinese junk by Frank Stoakes, of Hong Kong. This kind of vessel forms an interesting subject for Meccano model-builders. Stoakes has represented the peculiar type of sail by means of Strips.

George Mascull chose a rather difficult subject for his model—a light cruiser—but he has succeeded in reproducing the distinctive features of this type of vessel in a very realistic manner. The particular ship on which Mascull based his model is H.M.S. "*Hawkins*." Model-builders would do well to attempt the construction of Meccano ships, for such models offer a good opportunity for the exercise of ingenuity and original ideas.

An interesting model of a binding and threshing machine was received from John Elias. As Elias lives in Canada he has had plenty of opportunity of studying the actual machine at work. A threshing machine is a wonderful example of the engineer's skill, for it cuts the wheat, threshes and sorts it entirely automatically.

The model is driven by means of a Clockwork Motor and reproduces all the movements of its prototype. The bundles of wheat are carried on a canvas belt to the "beaters," which consist of two cylinders built up from Bush Wheels and Double Angle Strips that are "studded" with a series of bolts placed with the shanks outward. When the cylinders are set in motion the spikes or bolts separate the grain from the straw. Models of this type are extremely interesting and instructive to build and are fascinating to watch in operation.

A model of the rotor-ship "*Barbara*," which was described in detail in the February, 1927, issue of the "*M.M.*," was sent in by Ernest Smith. But for the fact that the rotor cylinders are slightly out of proportion, the model is an accurate reproduction of the actual vessel.



A Bucket Loading Machine for handling sand, etc., by Norman Scott

Aeroplanes are always popular subjects for model-building competitions. Jack Bratt's model of a Blackburn "Velos" aeroplane is a particularly interesting effort. Bratt evidently took great pains in constructing an accurate scale model and his aeroplane is certainly very effective. Another interesting entry was a Meccano bacon-slicer submitted by Kenneth Downie. On turning a Crank Handle the carriage, which in practice carries the bacon, slides backward and forward in front of the slicing knife. The latter is represented by a Face Plate and is rotated when the Crank Handle is turned.

Norman Keith's entry is, I think, quite unique. It is entitled "Big Game Shooting," and comprises a group of animals, trees and figures. A hunter is shown crouching behind a tree and shooting through a shrub at an elephant. He is not having it all his own way, however, for a snake is coiled round a limb of the tree and appears to be in the act of darting towards him while, simultaneously, a tiger approaches stealthily from the rear! I fear the hunter's fate is very uncertain!

New Meccano Models

Six Interesting Subjects for Various Outfits

THIS month our examples of new Meccano models are a little more advanced than those described in the three preceding articles. They are all of straightforward construction, however, and no Meccano boy should experience difficulty in erecting them. When completed they will afford hours of fun and entertainment.

The Railway Footbridge with Signals shown in Fig. 1 may be used, of course, in conjunction with Hornby model railways. Further signals may be added, or the span of the bridge may be increased, and many other improvements may be carried out to suit individual requirements. The appearance of the model will be greatly improved if the built-up signal arms shown in the illustration are replaced by the new Meccano Signal Arms, parts Nos. 158a and 158b.

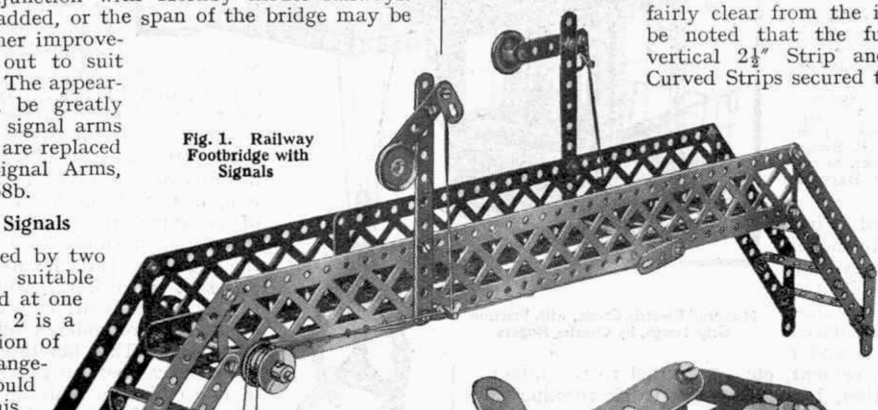


Fig. 1. Railway Footbridge with Signals

Railway Footbridge with Signals

The signals are operated by two levers mounted in a suitable framework that is secured at one end of the bridge. Fig. 2 is a detail view of this portion of the model, and the arrangement of the levers should be fairly clear from this. They are both pivotally mounted on a short Rod journalled in a Double Bracket, which is bolted to a 2½" × ½" Double Angle Strip. The latter, in turn, is secured at each end to Trunnions, and these are attached to the model by means of 1" × 1" Angle Brackets.

The operating cords are attached to the levers immediately above the pivotal Rod and are led through the spaces in one of the Trunnions, as shown in Fig. 2, and over two ¾" Flanged Wheels that act as guides. One of the cords is then led direct to the nearest signal arm, and the other is tied to a Crank that is secured to a Rod journalled in the side Girders of the bridge. Another Crank on the opposite side of the bridge is secured to the same Rod and its end is connected to the second signal arm by a short piece of cord. The remaining details of the model will be followed easily from the illustrations.

To build the Railway Footbridge with Signals, the following parts are required: 2 of No. 1; 10 of No. 2; 2 of No. 3; 8 of No. 5; 4 of No. 8; 2 of No. 10; 3 of No. 11; 2 of No. 12a; 1 of No. 15a; 1 of No. 16; 1 of No. 18a; 2 of No. 20b; 2 of No. 22; 1 of No. 24; 3 of No. 35; 60 of No. 37; 3 of No. 37a; 6 of No. 38; 7 of No. 48a; 2 of No. 62; 4 of No. 90a; 2 of No. 99; 2 of No. 100; 3 of No. 111c; 1 of No. 115; 2 of No. 126.

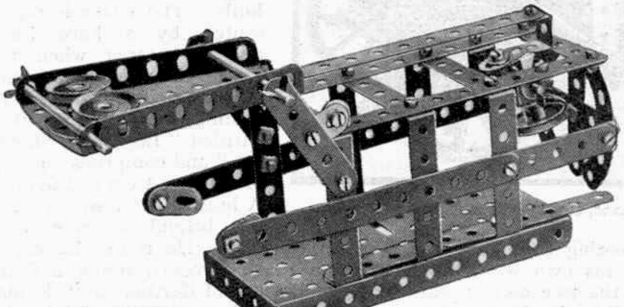


Fig. 3. Rat Trap

Rat Trap

The next model is of a very different type. We have not yet had an opportunity of testing the Meccano Rat Trap (Fig. 3), but it is quite certain that if a rat could once be tempted to touch the bait (even quite a gentle nosing would do) he would immediately be locked up!

The construction of the framework will be fairly clear from the illustration, but it should be noted that the further end consists of a vertical 2½" Strip and two 2½" small radius Curved Strips secured to a second 2½" Strip that is bolted to the side 5½" Strips by Angle Brackets. The door of the cage consists of a Sector Plate pivotally mounted near one end on a 3½" Axle Rod. The other end of the Plate is weighted by means of a Bush Wheel, two 1" fast Pulley Wheels, and a 3½" Rod.

The "bait" consists of a 1" fast Pulley and a ½" loose Pulley, suspended by means of a Hook from the centre hole of a Double Bracket. One side of this Double Bracket is bolted to a 1½" × ½" Double Angle Strip that is free to pivot upon a 2" Rod, which is journalled in two Angle Brackets secured to the 5½" Strips forming the top of the trap. The other side of the Double Bracket carries a Flat Bracket, which may be seen clearly in the illustration. This Flat Bracket forms a catch to hold a Double Bracket bolted to a 5½" Strip, and the other end of the latter is secured to the Sector Plate forming the door of the cage.

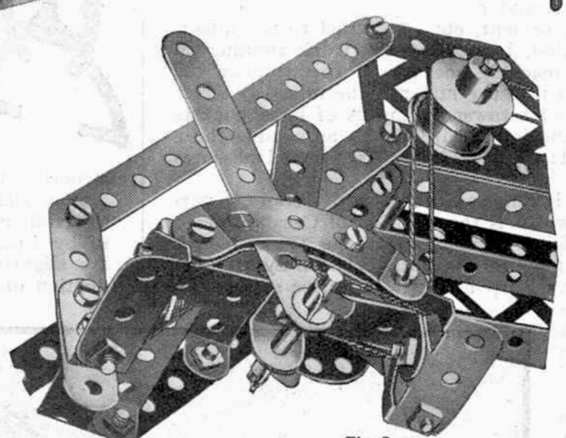


Fig. 2 Section of Railway Footbridge showing Signal Levers

If the "bait" is touched, the catch is released and the heavily-weighted door falls into place. It is prevented from reopening by means of catches consisting of Flat Brackets bolted to 5½" Strips that are secured by their extreme ends to the sides of the trap. The Flat Brackets are bent slightly so that they protrude from the 5½" Strips. In falling the door forces these Brackets and Strips outward but as soon as it has passed they spring back into position. The door can then be opened only by pulling the 5½" Strips outward.

The following parts are required to build this model: 8 of No. 2; 1 of No. 3; 9 of No. 5; 3 of No. 10; 2 of No. 11; 6 of No. 12; 2 of No. 16; 1 of No. 17; 3 of No. 22; 1 of No. 23; 1 of No. 24; 8 of No. 35; 31 of No. 37; 1 of No. 38; 1 of No. 48; 6 of No. 48a; 1 of No. 52; 1 of No. 54; 1 of No. 57; 2 of No. 90a; 3 of No. 111c.

Acrobat on See-saw

When the See-saw (Fig. 4) is set in motion the "acrobat" performs amusing antics. The rocking-beam is built up from three 12½" Strips bolted at their ends to Double Brackets, and the base of the model consists of a 5½" × 2½" Flanged Plate supported on two pairs of 5½" Strips. These Strips cross near their upper ends and form bearings for a 3½" Rod that is gripped in a Bush Wheel bolted to the side of the See-saw. One end of this Rod carries a 3″ Pulley that is connected by a crossed belt to a 1″ Pulley secured to the Crank Handle. The latter is journalled in two 2½″ Strips extending from the base 5½″×2½″ Flanged Plate. The handle should be moved to and fro to operate the model, and not actually rotated, of course.

The acrobat pivots about a 1″ Rod, which is passed through the Trunnion representing his body and journalled in the ends of two further 5½″ Strips 2. The latter are bolted to the rear pair of 5½″ Strips in the base of the model and are secured at their upper ends by a Flat Trunnion 3. The "feet" of the acrobat are bolted to the See-saw and his legs are attached by bolts and lock-nuts, so that he is free to move to and fro with the See-saw. The 1″ Pulley representing his head is secured by its set-screw to the shank of a ⅜″ Bolt that passes through his "neck" (a Flat Bracket).

The parts required to build the model are as follows:—3 of No. 1; 6 of No. 2; 4 of No. 5; 3 of No. 10; 2 of No. 11; 4 of No. 12; 2 of No. 16; 1 of No. 18a; 1 of No. 19b; 3 of No. 22; 1 of No. 24; 5 of No. 35; 32 of No. 37; 2 of No. 48a; 1 of No. 52; 1 of No. 111c; 1 of No. 126a.

Electric Elevated Crane

This is a very neat and well-proportioned model, and if a Meccano 4-volt Electric Motor is mounted as shown in the illustration, it will work splendidly. The Motor is bolted to the 3″ Pulley Wheel 6, and the latter is secured to a 3½″ Rod 5 that is journalled in two 2½″×½″ Double Angle Strips mounted between the Sector Plates in the base of the model. A Spring Clip or Collar should be mounted on the lower end of this Rod to hold the two units of the crane—the base and superstructure—together.

The 3″ Pulley Wheel 1 is driven by cord from a 1″ Pulley Wheel secured to the armature of the Motor, and a second 1″ Pulley 2 on its shaft conveys the drive to another 3″ Pulley Wheel 3 secured to the winding shaft. This arrangement of the drive is designed, of course, to reduce the speed of the Motor. The 12½″ Strips forming the jib are bolted to the front end of the Electric Motor, and are further supported by cords 4, which also are secured to the Motor. The movements of the Hook may be controlled entirely from the operating switch of the Motor.

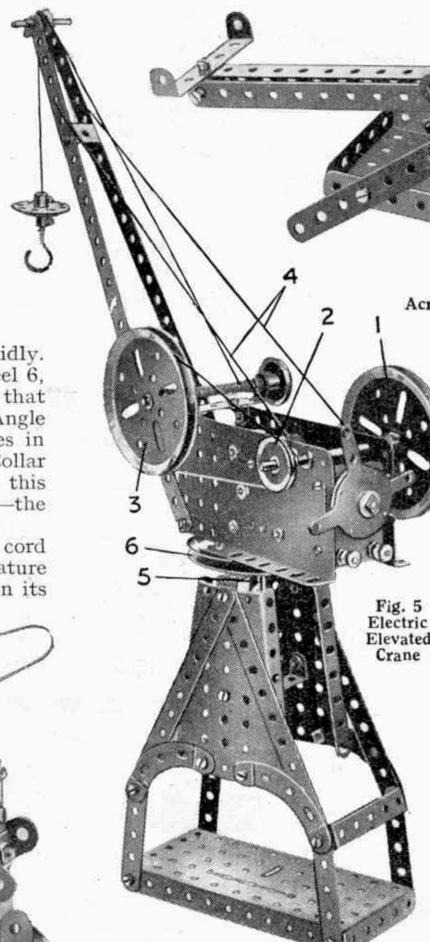


Fig. 5 Electric Elevated Crane

The parts necessary to build this model are as follows: 2 of No. 1; 4 of No. 2; 1 of No. 3; 5 of No. 5; 1 of No. 11; 1 of No. 12; 3 of No. 16; 1 of No. 18a; 3 of No. 19b; 4 of No. 22; 1 of No. 23; 1 of No. 24; 5 of No. 35; 30 of No. 37; 4 of No. 37a; 1 of No. 48; 5 of No. 48a; 1 of No. 52; 2 of No. 54; 1 of No. 57; 3 of No. 111c; 1 of No. 125; 1 of No. 126; 1 Electric Motor (4-volt).

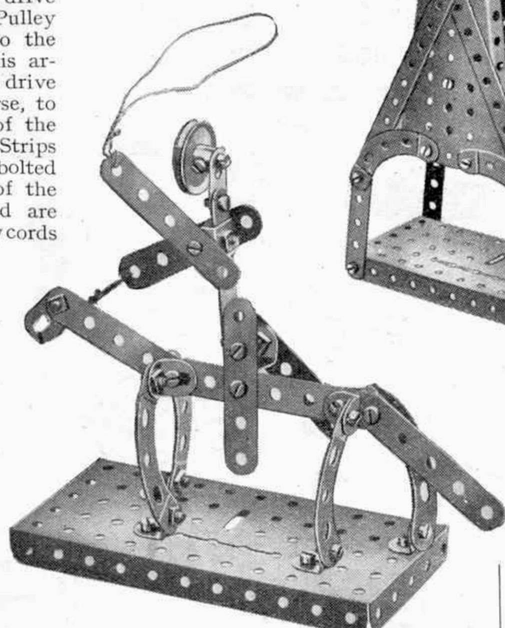


Fig. 6. Mounted Cowboy

Cowboy and Horse

The very unique model shown in Fig. 6 will, we think, appeal to all Meccano boys, because it is not only amusing but the few parts of which it consists have been used in a very ingenious manner. It is obvious that the cowboy is in the act of throwing his lasso, for which purpose he is standing up in his stirrups.

The Meccano steed has a 3½″ Strip for its body, four 2½″ small radius Curved Strips for legs, and 2½″ Strips for its neck and tail. The bolt securing one leg of the cowboy to the horse also secures a ½″ Reversed Angle Bracket. This is bolted to his other leg and the same bolt secures a Double Bracket, the centre hole of which is secured to the 2½″ Strip that forms the cowboy's body.

His lasso—and here we let Meccano boys into a secret—consists of a piece of wire bent to suitable shape; hence the appearance of arrested motion.

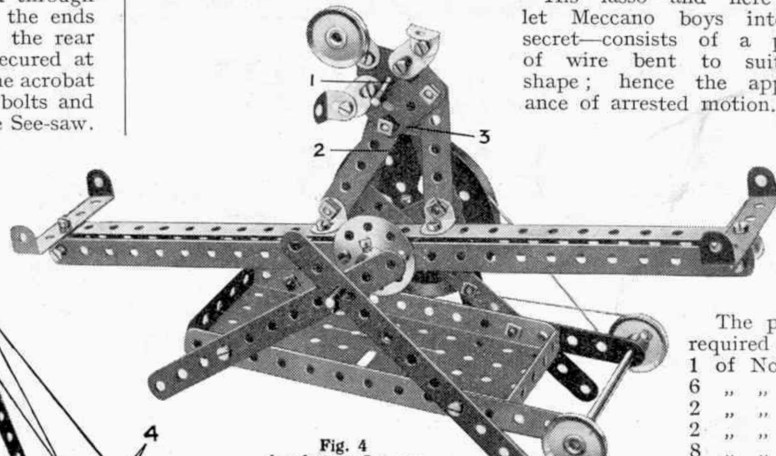


Fig. 4 Acrobat on See-saw

The parts required are:—
1 of No. 3
6 „ „ 5
2 „ „ 10
2 „ „ 11
8 „ „ 12
1 „ „ 22
24 „ „ 37
1 of No. 52; 4 of No. 90a; 1 of No. 111c; 1 of No. 125.

Beam Engine

Fig. 7 illustrates an interesting model of a Beam Engine that may be built with quite a small Outfit. The beam 2 consists of two 5½″ Strips spaced at their ends by Double Brackets and mounted on a 3½″ Rod, which is journalled in the ends of two pairs of 5½″ Strips that form the main uprights of the model.

The upper end of the connecting Strip 1 is free to pivot about a bolt that is secured by two nuts (see Standard Mechanism No. 262) to one end of the beam 2, and its other end is attached by similar means to the Bush Wheel 3. The 2½″ Strip 4 is connected by the same means to the other end of the beam 2 and to the Double Bracket 5. The latter is secured to the piston rod by means of two Spring Clips.

The cylinder is represented by two Flat Trunnions placed together to form a square and supported by a 1½″×½″ Double Angle Strip and a 2½″ Strip. A ½″ Reversed Angle Bracket forms an additional support for the piston rod. The short Rod carrying the flywheel 6 is journalled in a 2½″ Strip that is supported by the Trunnion 7, and in a Reversed Angle Bracket bolted to the 2½″ Strip.

If desired the model may be fitted with a handle consisting of a ⅜″ Bolt secured to the 3″ Pulley 6 or an Angle Bracket pivoted to the Wheel 6 by bolts and nuts (see Standard Mechanism No. 262).

The following parts are required to build the Beam Engine:—

6 of No. 2
1 „ „ 3
3 „ „ 5
3 „ „ 11
1 „ „ 12
2 „ „ 16
1 „ „ 17
1 „ „ 19b
1 „ „ 24
8 „ „ 35
20 „ „ 37
4 „ „ 37a
1 „ „ 48
1 „ „ 52
2 „ „ 125
1 „ „ 126
2 „ „ 126a

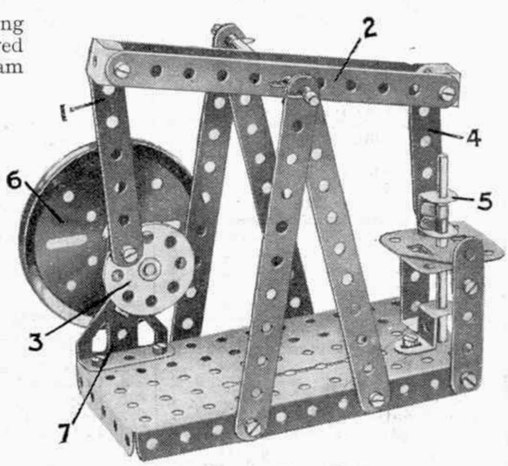


Fig. 7. Beam Engine

MECCANO ACCESSORY PARTS

REAL ENGINEERING PARTS IN MINIATURE

Meccano parts, a number of which are here illustrated, combine to form a complete miniature engineering system with which practically any movement known in mechanics may be duplicated. An additional attraction is the rich enamelling of the steel parts in red and green. Thus not only is it possible for you accurately to reproduce big engineering structures in model form, but you can also satisfy your artistic taste and introduce colour into your new Meccano models.

No.		s.	d.
3.	Perforated Strips, 3½" long ... ...½ doz	0	4
9b.	Angle Girders, 3½" long „	0	8
17.	Axle Rods, 2" long ... 3 for	0	1
19a.	Wheels, 3" diam., with set screws ... ... each	0	6
20.	Flanged Wheels, 1⅛" diam. „	0	5
	Pulley Wheels with centre boss and set screw:		
19b.	3" diam. ... ... each	0	7
19c.	6" „ ... ... „	2	0
20a.	2" „ ... ... „	0	5
21.	1½" „ ... ... „	0	4
22.	1" „ ... ... „	0	3
23a.	½" „ ... ... „	0	3
	Pulley Wheels without centre boss and set screw:		
22a.	1" diam. ... ... each	0	2
23.	½" „ ... ... „	0	2
24.	Bush Wheels ... ... „	0	4
27a.	Gear Wheels, 57 teeth to gear with ½" pinion... „	0	6
27b.	Gear Wheels, 133 teeth to gear with ½" pinion (3½" diam.) ... ... each	1	3
28.	Contrate Wheels, 1½" diam. „	0	9
29.	„ „ ¾" „ „	0	6
30.	Bevel Gears, ⅞", 26 teeth „	0	9
31.	Gear Wheels, 1", 38 teeth „	1	0
32.	Worm Wheels ... ... „	0	5
34.	Spanners ... ... „	0	2
*44.	Cranked Bent Strips ... „	0	1
45.	Double „ „ ... „	0	1
46.	Double Angle Strips, 2½" × 1" ... ... ½ doz.	0	6
53.	Perforated Flanged Plates, 3½" × 2½" ... each	0	3
55.	Perforated Strips, slotted, 5½" long ... ... „	0	2
57b.	Hooks, Loaded ... ... „	0	3
63a.	Octagonal Couplings ... „	0	8
63b.	Strip Couplings ... ... „	0	8
65.	Centre Forks ... ... „	0	1
72.	Flat Plates, 2½" × 2½" ... „	0	2
76.	Triangular Plates, 2½" each	0	2
77.	„ „ 1" „	0	1
80a.	Screwed Rods, 3½" ... „	0	3
90a.	2½" Curved Strips, cranked, 1⅜" radius, 4 to circle „	0	1
94.	Sprocket Chain, per 40" length	0	6
*95.	Sprocket Wheels, 2" diam. each	0	5
*96.	„ „ 1" „ „	0	3
99.	Braced Girders, 12½" long ½ doz.	2	6
103d.	Flat Girders, 3½" long „	0	7
109.	Face Plates, 2½" diam. each	0	4
110.	Rack Strips, 3½" ... „	0	2
113.	Girder Frames ... ... „	0	3
*116.	Fork Pieces, Large ... „	0	3
118.	Hub Discs, 5½" diam. „	1	3
119.	Channel Segments (8 to circle, 11½" diam.) ... „	0	4
120.	Buffers ... ... „	0	2
123.	Cone Pulleys ... ... „	1	3
*125.	Reversed Angle Brackets, ½" ... ... ½ doz.	0	3
126.	Trunnions ... ... each	0	2
126a.	Flat Trunnions ... ... „	0	1
128.	Boss Bell Cranks ... „	0	3
*129.	Rack Segments, 3" diam. „	0	5
*130.	Triple Throw Eccentrics „	1	0
132.	Flywheels, 2¾" diam. „	2	0
133.	Corner Brackets ... „	0	1
136.	Handrail Supports ... „	0	3
*137.	Wheel Flanges ... ... „	0	3
139.	Flanged Brackets (right) „	0	2
140.	Universal Couplings ... „	0	10
143.	Circular Girders, 5½" diam. ... ... „	1	0
144.	Dog Clutches ... ... „	0	6
145.	Circular Strips, 7" diam. over all ... ... „	0	9
146.	Circular Plates, 6" diam. „	1	0
*147.	Pawls, with pivot bolt and nuts ... ... „	0	3
148.	Ratchet Wheels ... „	0	6

IMPORTANT.—Meccano Accessory Parts will be supplied in colours unless customers ask specially for nickelled parts.

**These parts are available with nickel finish only.*

Transporter Bridge

Grand New Meccano Model-Building Competition

RADIO SETS AND 'PHONES AS PRIZES!

A NEW attraction is added to this month's Meccano Model-building Competition. The prizes include 13 Meccano Radio Crystal Receiving Sets and 30 Single Telephone Receivers. The Meccano Radio Sets and Telephones are already well known to Meccano boys and we feel sure that all "*M.M.*" readers will submit their very best work in the hope of carrying off one of these splendid prizes.

Any competitor who is awarded a prize consisting of a Radio Set or Telephone Receiver and who already possesses these items may choose in their place Meccano or Hornby Train goods to the same value, i.e., 10/6 and 4/6 respectively.

As in all previous "*M.M.*" Model-building Competitions, no entrance fees or forms are necessary. The contest is designed merely as an incentive to Meccano boys to exercise their inventive abilities, and as a means of collecting new ideas for models and movements, etc., so that these may be published from time to time for the benefit of Meccano boys all over the world. We have endeavoured to make it as simple as possible for every "*M.M.*" reader to enter the contest but it is important that the instructions printed below should be observed very carefully. If a competitor fails to do so he may spoil his chance of winning a prize.

How to Compete

When you have decided upon the subject for your model, you should copy it faithfully and neatly in standard Meccano parts and then send in photographs or clear drawings of your model, together with any descriptive matter that you consider necessary. Remember, the two key words to success are "originality" and "neatness."

Thirty Prize-winners will receive one of these Meccano Single Telephone Receivers

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.

You should send in all necessary explanations concerning your model. These should be written carefully and neatly on one side of the paper only, and they should be as concise as possible.

Try to be as original as possible in the choice of your subject. Models that really work, or that may be put to some practical use, naturally attract the attention of the judges more than models that refuse to work or fail to reproduce the movements of their prototypes. Any number of parts may be used in the model, but it should be borne in mind that a simple model of straight-forward design stands a better chance of coming out at the top of the list than a badly constructed, scrappy-looking model however complicated its mechanism may be. Good, sturdy construction will weigh heavily in the favour of any model.

It is absolutely essential that any model entered in the Competition must be your own unaided work as regards both design and construction.

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.

Important Instructions

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. It should be noted, however, that photographs of prize-winning models become the property of Meccano Ltd.

The following instructions must be followed closely:—

More than one model may be entered in the competition, but all entries from any single competitor must be sent under the same cover. No single competitor can win more than one prize; if he sends two or three models they will be considered jointly when awarding the prize.

The Meccano Crystal Receiving Set. Thirteen of these fine instruments are offered as prizes

If suitable, many prize-winning models will be included in forthcoming Instruction Manuals and other Mecacno publications, so that they may be rebuilt again and again by Meccano boys of all nationalities.

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 ("April" Model-building Competition) and the Section in which the model is entered. Address the envelope "April Competition," Meccano Ltd., Binns Road, Liverpool.

Entries for Section A and B must be received by 31st May, 1928. Closing date for Section C: 31st August, 1928.

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 a Meccano Radio 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: A Meccano Radio Crystal Receiving Set.
- 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.

"March" Competition

There is still time to enter the Model-building Competition announced in last month's "*M.M.*" Any kind of model may be submitted and the rules governing the Competition are similar to those detailed above except that in this case envelopes and photographs, etc., must be marked "March" Model-building Competition. As usual, entries will be divided into three Sections, namely, Section A for competitors residing in the British Isles and over 14 years of age, Section B for competitors in the British Isles under 14 years of age, and Section C for competitors of all ages residing overseas.

The closing dates are as follows: for Section A and B, 30th April; Section C, 31st July, 1928.

The demand for the " Meccano Book of New Models " has been so remarkably heavy that we have found it necessary to print a further and larger edition. Every keen Meccano boy who has not already secured a copy of this book should do so at once while supplies are available.

Nearly all the models, movements and new model-building ideas illustrated in the book are the direct outcome of prize-winning entries in recent competitions. They cover a wide range of interesting subjects. The Meccano Book of New Models also contains details of the best of the suggestions and ideas that have been published in the *Meccano Magazine* during recent months.

Large numbers of suggestions and bright ideas for new Meccano improvements reach us every day from Meccano boys all over the world. It is the task of our model-building department to select the best of these and to improve them as much as possible so that thousands of Meccano boys may benefit by becoming acquainted with their fellow-enthusiasts' work.

It should be understood that this book is entirely supplementary to the ordinary Instruction Manuals, and many of the models illustrated are published for the first time.

Order Your Copy Now

You may obtain a copy of the new book from your Meccano dealer, price 6d. If you have any difficulty send 7d. in stamps to us and we shall arrange to forward a copy to you immediately, post free. Address your letter as follows : " New Model Book," Meccano Ltd., Binns Road, Liverpool.

It is advisable to obtain your copy of the book as quickly as possible, as it is doubtful whether we shall print a further edition when our present stocks are exhausted.

If you have a Meccano Outfit the book of new models will enable you to obtain increased pleasure from it and you will spend many happy hours building the new models and movements that are shown. There are models of various types of Cranes, a Mechanical Shovel, a Horizontal Engine, a Biplane, an Electric Elevator, a Pit Head Gear and many others, equally interesting.

The book is composed of 24 pages contained in an attractively coloured cover on which there is a fine illustration of a super Meccano model—the Block Setting Crane.

Orders from Overseas

There is a special edition of the " Meccano Book of New Models " for Overseas. This is now ready and supplies are being sent to our agents for distribution. The price Overseas is 9d., or 10d. post free (Canada 15 cents or 17 cents post free). Readers in Australia, New Zealand, South Africa or Canada who require copies should address their orders to our agencies as detailed below.

Readers living in countries other than those mentioned should order from Meccano Ltd., Binns Road, Liverpool, sending a remittance for 10d. with their order.

AUSTRALIA.—E. G. Page & Co., 52, Clarence Street, Sydney. (P.O. Box 1832).

NEW ZEALAND.—Models Ltd., Kingston Street, Auckland. (P.O. Box 129).

SOUTH AFRICA.—Arthur E. Harris, 142, Market Street, Johannesburg. (P.O. Box 1199).

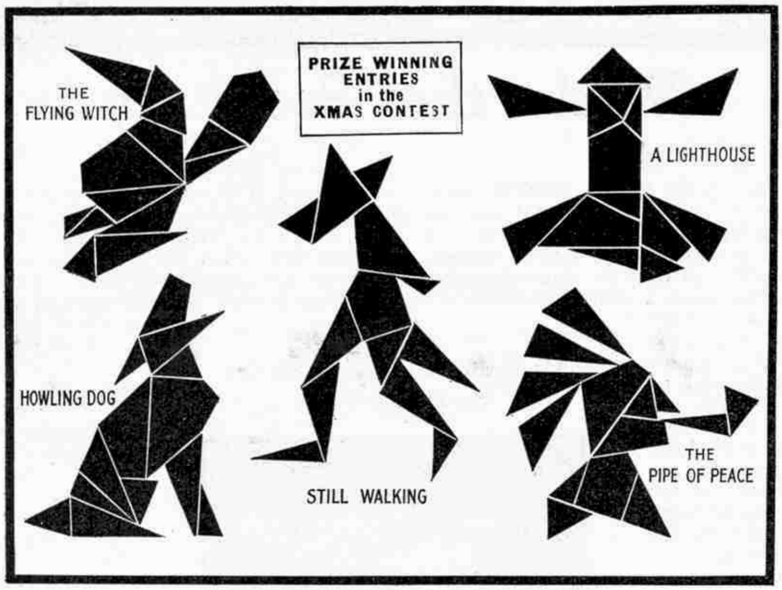
CANADA.—Meccano Ltd., 45, Colborne St., Toronto.

SEND FOR YOUR COPY TO-DAY!

Competition Page

Second Stomachion Contest

The popularity of the Christmas Stomachion Competition has been very clearly indicated by an extraordinarily large number of requests from readers calling for a repetition at an early date. Accordingly our competition this month is based once more on this amazing puzzle. Instead of calling for general entries, however, the prizes this month will be awarded to the best design of a SHIP, ANIMAL OR HUMAN FIGURE made with the 14 pieces. It is hardly necessary to add that entries that gained awards in the Christmas Contest are not eligible for this new competition.



Without doubt, quite a number of the new readers who have joined our ranks since Christmas will be wondering "what on earth is a Stomachion?" For their benefit we must explain that the Stomachion Puzzle is probably the oldest in the world. It was invented by Archimedes, the famous Greek mathematician, who lived in the 3rd century. He claimed for his puzzle that it was possible to depict any object in the world with it. The winning entries from the Christmas Competition reproduced on this page are a striking illustration of the remarkable possibilities of the puzzle, and they go far to prove the truth of Archimedes' claim.

The competition judges' comment on the winning entry is that the design is perfect. Action is shown in every line of the figure and the general attitude is completely characteristic of any well-bred dog howling in real earnest! Note particularly the angles made by the breast-bone and throat, and the set back of the ears. The picture is remarkably clever and easily gained first prize. The second prize entry, that of the witch on the broom, is of an entirely distinct type. Its execution leaves something to the imagination, but without a shadow of a doubt the author of the entry has achieved his object—that of presenting in a very novel manner a picture that is familiar to us all through the fairy tale books of our early days.

Between Felix, the Indian Chief, and the Lighthouse, there is little to choose. The competition judges declined to make a choice and bracketed the three as being of equal merit. Note particularly the "slinky" attitude given to Felix's knees. The familiar twiddling of the thumbs behind the back is achieved in a very novel manner. Note also the set of the jaw of the Indian Chief and the long hooked nose characteristic of the American Indian race. The plumes of the Indian automatically suggest themselves. The Lighthouse is clever without possessing any outstanding feature. The entrant deserves to be congratulated upon his pluck in depicting light as black, but what else could he do? His presentation of the rocks is exceptionally well done.

In passing, it should be mentioned that in the reproduction gaps have been left to show how the parts are fitted together. In certain of the originals these lines were not shown and the effect is slightly improved by their omission.

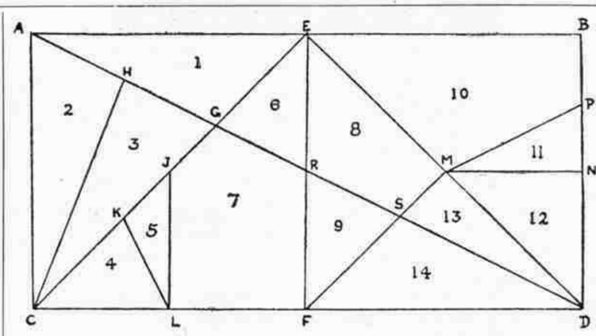
The Stomachion Puzzle is comprised of 14 pieces that are cut from a rectangle. The rectangle and full directions for cutting it up to make the individual parts are given at the bottom of the page. *It must be remembered, however, that each picture must contain the complete set of* 14 *parts. That is the one hard and fast rule.* Prizes of Meccano or Hornby Trains to the value of £1/1/–, 15/–, 10/6 and 5/– respectively, are offered to the senders of the four best entries covering the three groups mentioned. Entries must be addressed to "Stomachion Puzzle No. 2, Meccano Magazine, Binns Road, Liverpool," and must be sent to reach this office not later than 30th April. Overseas closing date, 31st July.

HOME RESULTS

The Christmas Stomachion Contest.—1. E. BALLANTINE (Londonderry) "*Howling Dog,*" 2. J. MONCRIEFF (Glasgow) "*The Flying Witch*"; 3, 4 and consolation divided between L. HOLDER (Battersea, S.W.) "*A Lighthouse*"; L. E. PARKS (Hurstpierpoint, Sussex) "*Still Walking*"; J. W. SHEPHERD (Eastbourne) "*The Pipe of Peace.*" Consolation Prizes: (the names are given in alphabetical, not merit, order), P. BREWSTER (Surrey); R. EASTWOOD (Blackburn); R. M. GIBBS (Chertsey); R. HALL (Wantage); S. LEWIS (Hull); R. O'DONNELL (Aintree, Liverpool); D. R. SHEARS (Stockport); L. G. WILKINS (Anfield, Liverpool).

Bottled Parts Competition.—1. H. S. FORTUNE (North Shields); 2. G. E. PEPPER (Dublin, S.E.5); 3. G. R. TRUMP (Bristol); 4. P. SIMONS (Lavenham). Consolation Prizes: E. GORSE (Birkdale); R. W. WHITE (Glasgow, S.2); G. C. B. LOVER (Eastbourne); F. O'CONNELL (Liverpool); A. H. BARBER (Sutton, Surrey); J. V. McGANN (Fermoy); J. SANDERSON (Freshford, Nr. Bath); J. RODRIGUEZ (Maida Vale, W.9).

24th Drawing Contest.—First Prizes: Section A, R. J. BANKS (Gillingham, Kent); Section B, J. C. MONCRIEFF (Perth). Second Prizes: Section A, R. M. CLARK (Wallasey); Section B, H. HAYES (Bradford). Consolation Prizes: W. G. NIXON (Birmingham); B. D. BAILEY (Manchester); S. HOWSON (Workington); O. A. KIMMINGS (East Acton, W.3).



The diagram above is twice as long as it is wide. The actual dimensions of the rectangle do not matter as long as this 2 to 1 relationship is preserved. Having marked the rectangle A, B, C, D, find, mark and join the centre points (E and F) of the two long sides. Then draw three diagonals; from E to C, E to D, A to D. Now mark the centre points of the diagonals EC and ED, and from those points connect up with the centre points of CF and BD. From M also connect up with F and P, the latter point being the centre point of BN. Now find the centre point (H) of the line AG, the latter point being that at which occurs the intersection of the diagonals AD and EC. Connect at H with C. One line only remains to be drawn from L to K. This line runs from L toward the point A, but is not produced beyond the diagonal EC. The pieces are now ready to be cut out and a start can be made with the game.

OVERSEAS RESULTS

Silhouettes No. 1.—In the space at our disposal this month we cannot give the original picture from which the silhouettes that were the subject of this competition were selected. This will appear next month. The awards were as follows:—1. E. HOLDER (Trinidad). 2. E. FIELD (Bethlehem, S.A.). 3. A. BYSOUTH (New South Wales). 4. D. GLASS (Brazil).

Silhouettes No. 2.—1. M. SARBY (Hawkes Bay, N.Z.); 2. J. C. RISHWORTH (Mysore State); 3. T. McLACHLAN (Dunedin, N.Z.); 4. N. F. KEITH (Victoria). Consolation Prizes: H. C. KEY (Sirajjany, E.B.Ry., India); L. WILD (Ontario); M. GLENNIE (Lytton, B.C.)

Fireworks Essay.—First Prizes: Section A, W. GRIFFITHS (Paris); Section B, T. MACFARLANE (Toronto). Second Prizes: F. JOHNSON (Durban); S. J. ROBERTS (Sydney).

November Painting Contest.—First Prizes: Section A, B. J. SMART (Adelaide); Section B, C. GALDES (Malta). Second Prizes: E. HOLDER (Trinidad); D. H. ADAMS (Sydney).

With the Secretary

How to Get New Ideas

Last month I pointed out that plans for the summer must be made in good time in order to ensure a successful outdoor session. The necessity for getting on with preparations will become even more apparent during the present month because of the great extension of daylight hours that the commencement of summer time will bring, and once more I wish to urge Leaders and secretaries who have not already done so to call the members of their clubs together in order to ascertain their wishes with regard to summer activities and to formulate plans before it is too late to give effect to them.

The possibilities are almost unlimited, ranging from camping, games and athletics to walks, excursions to places of interest and natural history outings. One or more of the various forms of activity should be possible to every club irrespective of size, and I have no doubt that many interesting ideas will be expressed by members in preliminary talks. All suggestions should be carefully discussed from every point of view, and after as many members as possible have expressed their opinions it is a good plan for the Leader to summarise the whole discussion. In doing so the size of the club and its resources, financial and otherwise, should be carefully borne in mind, although considerations of this kind should not limit the discussion in any way. In fact it is well to canvass very thoroughly every idea suggested.

Meccano Club Secretaries

No. 11. M. Younis

For the eleventh portrait in our series of Meccano Club Secretaries we travel overseas. The Student's M.C., of which M. Younis is the hard-working secretary, is an Egyptian club meeting in Cairo. It was affiliated in September 1927, and among several hobbies of the type usually pursued makes a speciality of fretwork

Competition for Clubs

In order to stimulate interest and to bring about an exchange of ideas among Meccano Clubs I have decided to run a new kind of competition. The entrants will not be individuals, as in previous competitions in the "*M.M.*," but clubs themselves, and the task set is by no means difficult. It is simply to suggest "*An Ideal Programme for the Summer Sessions.*" The collective experience and wisdom of members will be revealed in a meeting of the kind outlined above and after a suitable scheme has been decided upon, the secretary, assisted perhaps by a small committee, should forward it to me after approval by the officials and members of the club. Please note that I do not want formal essays. All that is necessary is to outline the programme and to add notes to explain any point that is otherwise left obscure.

It will be seen that the conditions have been so arranged that the size and situation of a competing club have no bearing on the competition results. What is required is not a programme to be followed by any particular club, but a programme suitable for Meccano Clubs in general, with, perhaps, suggestions for variations to suit different circumstances. In my notes in the June "*M.M.*" I shall summarise the efforts submitted, and in the same number a selection of the best entries will be published either wholly or in part.

Entries for this competition should reach me on or before 30th April. For the three best and most stimulating lists of ideas prizes of £3/3/–, £2/2/– and £1/1/– will be given, while special prizes of 10/6 will be awarded to other clubs sending in entries extracts from which are judged worthy of publication.

This is a splendid opportunity for "live" clubs to add to their resources. Plan out an interesting and comprehensive practical programme for the summer and earn with it a substantial contribution towards the expense of carrying it out or to the general funds of the club, and at the same time ensure for yourselves a successful session as a result of the thought exercised in preparation.

When we were experiencing severe snowstorms and cold weather last December and January, I constantly received cheery letters from Guild members in South Africa, Australia, and New Zealand telling me about the wonderful weather they were having. To read their stories of heat waves and bathing parties while snow was falling or cold and heavy rain beating against the window behind me almost made me decide to emigrate at once. Now we are looking forward to summer time—and they are thinking of winter programmes. On that account I propose to limit entrance to the present competition to home clubs only, and to hold a similar one later in the year for clubs in southern latitudes where summer is now practically at an end.

Proposed Clubs

Attempts are being made to form Meccano Clubs in the following places, and boys interested in becoming members should communicate with the promoters, whose names and addresses are given :—

ATHERSTONE.—Wm. Clarence Stokes, 11, Stafford Street, Atherstone, Warwickshire.

BRAINTREE.—P. Allen, "St. Edmunds," Bocking, Braintree, Essex.

BRINKWORTH.—H. Chesterman, York House, Brinkworth, Wilts.

EAST KIRKBY—R. Moore, Forest Hill, E. Kirkby, Notts.

LIVERPOOL.—R. R. Barber, 5, Fenwick Street, Liverpool.

LONDON.—Jim Dumphreys, St. Philips Vicarage, Avondale Square, London, E.1.

LONDON.—L. Hurst, 2, West Heath House, Woolwich Road, Abbey Wood, S.E.2.

MANCHESTER.—P. Chadwick, 4, Polfield Rd., Blackley, Manchester.

NEWTON-LE-WILLOWS.—Harry Scott, Aysgarth School, Newton-le-Willows, Yorks.

PETERBOROUGH.—W. V. Holloway, 153, Fletton Avenue, Peterborough.

PORTSMOUTH.—A. J. NICHOLSON, 213, Sultan Road, Buckland, Portsmouth.

RYDE.—Percy Jackson, 13, Bettesworth Road, Ryde, I.O.W.

SALE.—M. Cottrill, Lyndale, Sylvan Avenue, Sale, Cheshire.

SOUTHSEA.—K. G. BUDDEN, 40, Whitwell Road, Southsea, Hants.

STOCKPORT.—B. ROGERSON, 16, Vicarage Rd., Adswood, Stockport.

SUTTON.—G. Swain, 17, Burgess Road, Sutton, Surrey.

Victoria M.C.—The secretary gave a splendid talk on "*Piloting an Air Liner,*" which was very much enjoyed by all. A Dutch Parliament was the feature of another club night, and this caused much amusement. A Mock Trial also held was greatly enjoyed. The club's activities are many and a good attendance is maintained. Club roll: 52. *Secretary*: Henry C. Thompson, 4, Montgomerie Gardens, Glasgow.

Memorial (Hull) M.C.—The Exhibition held in January was a great success. Among many interesting models a Workshop loaned from Headquarters for the occasion attracted great attention. Much amusement was derived from a small Shocking Coil exhibited and demonstrated by one of the members. The Social Evening was voted the most enjoyable evening the club has ever had. Games played included Balloon Football and Chess, and the evening closed with an "American Supper." Club roll: 20. *Secretary*: P. Jackson, 68, Westbourne Avenue, Hull.

Liverpool M.C.—Has now secured a club-room through the kind offices of a local gentleman, and is commencing active operations once more. Intending members should communicate with the secretary, who will be pleased to give full particulars. *Secretary*: Royston Varley, 18, Lilford Avenue, Orrell Park, Liverpool.

Westbury M.C.—A visit was paid to the Electric Power Station of the First Garden City Company Limited, one of the Company's Engineers very kindly explaining everything. Meetings are well attended and the members are all very keen. Club roll: 23. *Secretary*: Eric Moye, 24, Burnell Rise, Letchworth, Herts.

Derby M.C.—The secretary reports that good progress is being made. Hornby Train Nights are popular and Model Building evenings are held frequently. Lectures by members and impromptu speeches are organised and usually prove highly successful. Club roll: 25. *Secretary*: W. P. Smith, 435, Uttoxeter Road, Derby.

Holy Trinity (Barnsbury) M.C.—Has been divided into two sections and good progress is reported. Lectures are frequently given. The Annual Club Concert is to be held on 21st April, to commence at 8 p.m. Club roll: 44. *Secretary*: F. W. Johnson, 23, Market Street, Edgware Road, Paddington, W.2.

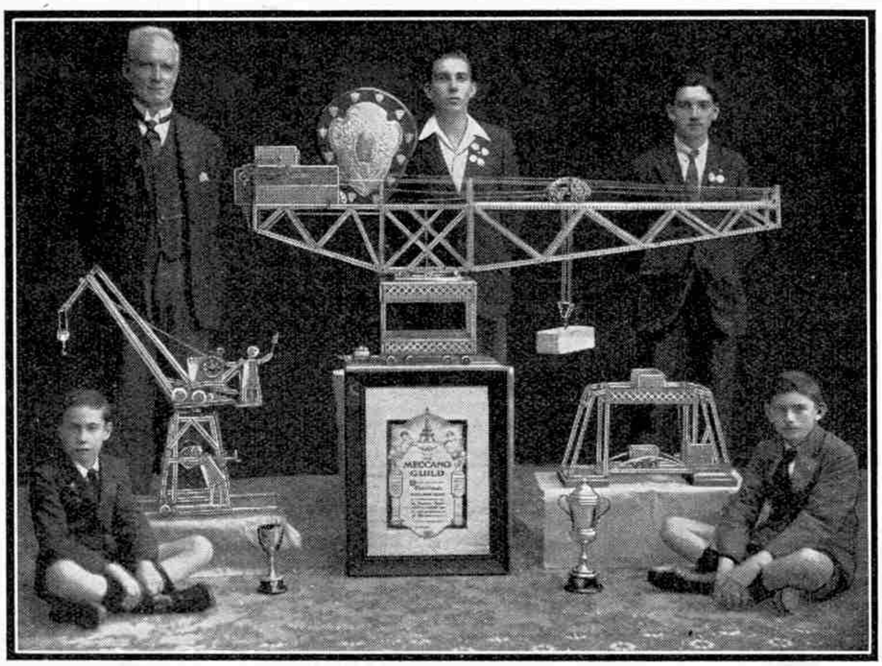
Sparkhill M.C.—Is now quite settled in the new club-room and Model Building has been recommenced. Some excellent models have been constructed, most of which are quite original. The club has an excellent library which includes many issues of the "*Meccano Magazine.*" Club roll: 14. *Secretary*: E. L. Stewart, 44, Benton Road, Sparkhill, Birmingham.

South Dublin M.C.—A most interesting syllabus is being followed and includes Model Building Competitions, Hornby Train Nights, Lectures and Mock Trials. Through the influence of Mr. A. J. Kettle, Radio Engineer, a most enjoyable visit was paid recently to the Dublin Broadcasting Station. This was the first outing of the club and the younger members especially were greatly interested. Club roll: 9. *Secretary*: Garratt M. Foley, 44, Eaton Square, Terenure, Dublin.

Bristol Grammar School M.C.—Good progress is reported and many interesting Lectures have been given by the members. A visit was paid to the works of the Bristol Aeroplane Company, two guides conducting the party and explaining everything in detail. A Hornby Night held recently proved most enjoyable. Two small parties of the club paid visits to the "*Western Daily Press*" offices and were shown the various stages in the production of a newspaper, including the publication of a special race edition. Club roll: 40. *Secretary*: S. H. Evans, 44, Belluton Road, Knowle, Bristol.

Great Baddow M.C.—At the end of each month a Games Night is held, and is always a popular feature. The membership shows a decided increase and enthusiasm is well maintained by Model Building Competitions. Club roll: 34. *Secretary*: Miss D. K. French, High Street, Great Baddow.

Observatory Meccano Club



Our photograph shows prize-winning members of the Observatory M.C., South Africa, with some of the excellent models constructed by them. On the left is Mr. G. E. Barrett, President and Leader, whose whole-hearted enthusiasm has led to the establishment of a splendid group of five clubs in and around Capetown. An account of the last Exhibition of the associated clubs, which was opened by His Excellency the Governor-General of South Africa, the Earl of Athlone, appeared in the "M.M." last January

Hooley Schools (Reigate) M.C.—Is now holding regular meetings every Monday evening at six o'clock. Several girl members have been enrolled and the secretary is hoping to enrol many new members. Model Building Nights are frequently arranged and Hornby Train Nights are popular. Many of the members have splendid layouts. Club roll: 21. *Secretary*: Miss E. Jordan, 7, South Road, Reigate, Surrey.

Middlesbrough M.C.—A visit was paid to the Stockton M.C. on the occasion of this club's Exhibition. The Annual Ghost Story Evening was very exciting and many good stories were told. The programme includes Table Tennis, Tournaments, Debates, Competitions, Hornby Evenings, and many other subjects equally interesting. The club has a splendid Magazine which is very well produced. Club roll: 52. *Secretary*: A. Bradley, 95, Deepdale Avenue, Marton Grove, Middlesbrough.

Nuneaton Grammar School M.C.—A "Sales and Exchange" evening was organised and was quite successful. A Contractors' Night aroused great interest and it is intended to hold other meetings of this kind. Club roll: 30. *Secretary*: G. Clarke, 45, Seymour Road, Nuneaton.

Lichfield Central School M.C.—A Lecture by the Leader on "*Primary and Secondary Cells*" was greatly enjoyed. The programme includes many other Model Building Competitions and interesting features and visits to various places of interest have been arranged. Club roll: 18. *Secretary*: W. H. Johnson, 58, Beacon Street, Lichfield, Staffs.

Beccles Excelsior M.C.—The club Social was a great success, over forty members being present to enjoy a good programme of games and an excellent supper. The members are very grateful to three ladies who kindly assisted with the refreshments. It has been decided to hold an Exhibition in July in connection with the Congregational Church Fete. A special model of a Riverside Wharf is to be constructed and plans are now being drawn for it. Club roll: 13. *Secretary*: B. J. Andrews, 30, Station Road, Beccles, Suffolk.

Morison Memorial M.C.—At one meeting the members were highly entertained by a ventriloquist. An Exhibition has been organised and the play "*Nonsense Nana*" has been loaned from Headquarters for this occasion. Another sketch entitled "*The Teacher and the Pupil*" is also to be given. A club choir is being formed. *Secretary*: G. Gerrard, 53, Montrose Street, Clydebank, Glasgow.

Brixton Hill M.C.—The club concluded an interesting session by a visit to the L.N.E.R. Sheds. The 10 members of the party greatly enjoyed a ride in the cab of a locomotive. The secretary is anxious to hear from anyone who will be able to assist the club by the loan of a club-room. Club roll: 12. *Secretary*: J. F. Morton, 17, Ostade Road, Brixton Hill, London, S.W.2.

Reading M.C.—Special attention is being given to summer activities which will commence in May. The programme includes visits to local places of interest, Rambles, Cycle Runs and a week-end Camp. New members will always be made very welcome and should apply to the Leader for full details. Leader: Mr. H. G. Rogers, 135, Liverpool Road, Reading.

Egypt

Student's (Cairo) M.C.—Now possesses a library, which is very popular, and a Fretwork Outfit has been purchased for club use. Lectures are given from time to time and the members take a keen interest in all activities. Music competitions are held frequently—a somewhat unusual feature of a Meccano Club—and a trip to the Citadel was recently enjoyed. Club roll: 10. *Secretary*: M. Younis, 7, El Arbein Street, Saida Zenab, Cairo, Egypt.

South Africa

Clifton M.C.—An essay competition on "How I Should Use a No. 7 Meccano Outfit" was entered into with enthusiasm and many very interesting essays were submitted. A Model-building Contest held at the beginning of the session resulted in the production of models of a very high standard, and a Lecture on the Forth Bridge delivered by the Leader was greatly enjoyed. Club roll: 33. *Secretary*: Hermann Jacobsen, 169, Loveday Street, Clifton, Johannesburg, South Africa.

This Month's Short Story

A rich and cute beauty of Bute
Wed a tailor who pressed a smart suit.
Her father objected
Much more than expected,
And booted from Bute the cute beaut.

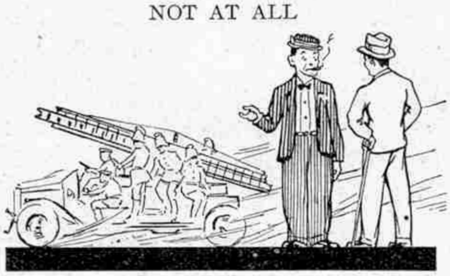
* * * *

A POET'S NONSENSE

There was an old man with a gun,
Who espied an old lady named Pheasant;
She sat on a seat in the Sun,
And he stared, and he stared—most unpleasant;
But at last, drawing near,
He made it quite clear
That he had no *intention* so rude to appear,
But was merely confused, being out with his gun,
At espying a lady named Pheasant.
—"*Stuff and Nonsense.*"

* * * *

NOT AT ALL



Yankee Visitor (who has been boasting of American hustle), as a motor escape tears past with much clanging of the bell, the firemen completing their toilet: "Say, is that one of your fire trucks? Waal, I guess that's the first bit of hustle I've seen here!"

His English Host: "Fire truck? What do you mean? That was the local window-cleaning outfit going off to a job!"—"*The Commercial Motor.*"

* * * *

"Spell chimney," said the teacher, pointing to a little girl in the front row.

"C-h-i-m-n-e-y," answered the little girl.

"Very good! Go up one," said the teacher.

"Please, miss," answered the little girl, tearfully, "I've got a clean frock on."

* * * *

James: "What sort of a dog is that you've got?"
John: "That's a sandwich dog."
James: "What kind of a dog is a sandwich dog?"
John: "One that's half-bred!"

* * * *

AN INCOMPETENT

"'Ere, young 'Erb ain't going to referee this fight. 'E can only count up to seven."—"*Passing Show.*"

* * * *

Postmaster: "What's that peculiar odour around here?"

Clerk: "Probably the dead letters, sir."

* * * *

Two men were brought before the court for fighting, and, turning to one of them, the magistrate said: "The other defendant says that you, Patrick O'Hara, started the fight."

"Sure and it's a lie, sir," replied Pat. "It was him, the spalpeen, that retaliated first."

* * * *

An Irishman who was posting a letter was told at the counter that it was over weight.

"Over what weight?" asked he.

"Over three ounces," said the clerk. "You'll have to put another stamp on it."

"Get away," said the Irishman, with a grin. "Shure, if I put another stamp on it, won't it be heavier still?"

* * * *

Old Lady to Boy Scout: "Do you do a good deed every day?"

"Oh, yes. Yesterday I visited my Aunt in the country and she was very glad. To-day I came back home, and she was very glad again."

THE LIMIT

Herbert had been taught to rise when his mother entered the room and to remain standing until she was seated or until she withdrew.

One day a boy friend came to see him. Herbert's mother came into the room where the boys were and Herbert arose. His friend did not move, so Herbert asked him to stand up.

A few minutes later mother again entered the room and Herbert jumped up, while his friend reluctantly rose to his feet.

When Herbert's mother entered the room for the third time and her son arose, the guest said, disgustedly: "I say, what do you think your mother is—the National Anthem?"

* * * *

Conductor: "Hi, Bill! The old 'bus is running backwards!"

Driver: "I can't stop her! The brakes 'ave gone."

Conductor: "'Alf a mo'. I'll change the destination boards!"

* * * *

Pompous customer: "I want two eggs poached medium soft, buttered toast not too hard, coffee not too much cream in it!"

Waiter: "Yes, sir, would you like any special design on the dishes?"

* * * *

NOT HOME-MADE

First Villager: "I saw your husband down at the station this morning, Clara."

Second Villager: "Oh, aye, he be going to town for some of this 'ere traffic jam I be reading so much of lately."

* * * *

A Lancastrian visitor in humble attire was strolling through one of London's principal shopping centres when he noticed an empty shop window. Just at that moment an assistant came to the door, and curiosity getting the upper hand of the Lancashire man he enquired: "What dost tha' sell here?" The shop assistant, thinking to take a rise out of the enquirer, replied briefly "Monkeys."

"Ah, well," returned the visitor, "tha' must have had a good sale then, there is only thee left."

* * * *

ENGAGED

Shipwrecked Sea Cook: "Oh, don't kill me, and I'll cook your Sunday joint."

Cannibal King: "Can't be did; we want you for the Sunday joint."

* * * *

"You have acted very wrongly." Thus Horace's father in the presence of Horace's mother, to Horace, discovered in the act of stealing jam.

"It may seem a small offence, Horace," he continued, "but it has for its foundations one of the prime causes of the world's unhappiness—disobedience. I am more than angry. I am grieved. I want my son to grow up a fine, strong, honourable man. I want him—" Here he stopped for breath.

Little Horace turned enthusiastically to his mother and said, "Mummy, isn't daddy interesting?"

MERELY MENTAL

Farmer: "Thought you said you had ploughed the ten-acre field?"

Ploughman: "No; I only said I was thinking about ploughing it."

Farmer: "Oh, I see. You've merely turned it over in your mind."

* * * *

"There goes a man whose hair turned perfectly white in a single month."

"Some great sorrow?"

"No. He stopped dyeing it."

* * * *

Teacher: "Why are you so late for school this morning, Billy?"

Billy: "I've got a new pair of boots, and mother forgot to cut the string."

* * * *

Johnnie: "Mother, may I play at making believe? I'm entertaining another little boy."

Mother: "Yes, dear, of course."

Johnnie: "Well, give me a piece of cake for him, please."

* * * *

Teacher: "Who was the father of the Black Prince?"

Boy: "Old King Cole."

* * * *

CRASH!

The following is a true story. Bradford Station is a terminus. An old lady boarded a train at Low Moor (a near-by station) and beckoned a porter. In a timid voice she asked, "Does this train stop at Bradford?"

"Well, missus," replied the porter, "there'll be some bump if it doesn't!"

* * * *

"Which of the parables do you like best?" said the minister to a boy in the Sunday-school.

"I like the one where somebody loafs and fishes," was the unexpected answer.

* * * *

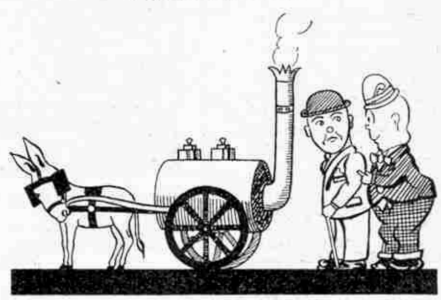
Magistrate: "What is the prisoner?"

Solicitor: "Your worship, he is a professional footballer and is the best outside-right in the team."

Magistrate: "Well, I'll change his position. He'll be left inside for seven days."

* * * *

MECHANICAL



While showing an Irish friend of mine round town, I was surprised to see him stop and stare at a chip potato cart with a chimney at the back, drawn by a donkey.

"What's the matter, Pat?" I asked.

"Well," he said, pointing to the cart, "begorra, an' I've seen some lazy donkeys, but I've never seen one wid an engine to push it."

* * * *

Teacher: "Where are elephants usually found?"

Boy: "Please, sir, they're so big they aren't often lost!"

* * * *

A farmer was trying hard to fill out a railway company's claim sheet for a cow that had been killed on the track. He came down to the last item, "Disposition of the carcase." After puzzling over the question for some time, he wrote "Kind and gentle."

* * * *

Sunday School Teacher: "Now, can any little girl or boy tell me who Job was?"

Small boy (after a moment's pause): "A doctor."

Teacher: "A doctor? Oh, dear no. Where did you read that?"

Small boy: "Please, miss, have you never heard of the patients of Job?"

THE "FISH" TRAIN

At the Anglers' Club the famous authority upon fish had been describing a catch. A meek club member interposed. "I caught something up North yesterday morning," he said, "but I don't know what YOU would call it. It was a great length . . . white and brown in colour . . . in sections, and when I caught it it hissed . . . but it was long."

"I daresay," said the authority, "it was a member of the aerius eel family."

"Very likely," assented the meek one, "but it had in the time table . . .'6.30 express Glasgow to London!'"

"The Model Railway News."

* * * *

Hank: "Where have you been all week?"

Lank: "I had clothes sickness."

Hank: "What's that?"

Lank: "My breath came in short pants and my tongue was coated."

* * * *

A kilted Highlander, playing the bagpipes, paraded up and down the street alongside a theatre queue.

"Why do they always walk up and down when they're playing?" asked a man on a passing bus.

"'Cos it's harder to 'it 'em that way!" said the conductor.

* * * *

Magnate: "Yes, I began life without shoes on my feet and now I've half a million."

Young Reporter: "Great Scot! Who cleans 'em all?"

* * *

Youth: "I'm looking for a job!"

Grocer: "Well, I like the look of you, but I can't afford more help."

Youth: "But I won't be much help, sir!"

* * *

Pat was helping a gardener on a large estate, and noticing a shallow basin containing water, inquired what it was for.

"That," said the gardener, "is a bird bath."

"Don't ye be foolin' me," grinned Pat.

"A bird bath, I tell you. Why do you doubt it?"

"Because I don't belave there's a burrd alive that can tell Saturday night from any other night!" replied Pat.

* * *

Two little girls made friends.

Said one: "Where do you live?"

"In London," replied the other.

"That's where the King and Queen live, isn't it?"

"Yes," replied the little Londoner; and then with becoming modesty, she added: "But not in our street."

* * *

Coroner: "Was this man found dead on the railroad track a total stranger?"

Witness (who has been told to be careful in his statements): "No, sor. His leg was gone intoirely. He was a partial stranger, sor."

* * * *

"Are you guilty or not guilty."

"I don't quite see," said the prisoner sadly, "why I should express an opinion and try to interfere with the jury's guessing contest!"

* * * *

ALL PRESENT

A manager of a well-known touring company wired to the manager of a small theatre to have his stage manager, stage carpenter, chief electrician, property man, and all his stage hands ready for a dress rehearsal at three.

Three hours later he had a reply: "All right—he will be there."

* * * *

Asylum Visitor: "What is that person over there in here for?"

Asylum Attendant: "He's an Aberdonian and tried to give an emetic to an automatic slot machine when he couldn't get his coin back!"

* * * *

Sunday School Teacher: "And what did David get after he fought Goliath?"

Up-to-date Kid: "Sixty per cent. of the gate receipts and a chance to meet the winner of the bout between Cain and Abel."

SAFETY LAST

Young Aeronaut: "The mater's awfully good to me. She gave me this 'plane as a Christmas present."

His Friend: "Very nice. What did your father give you?"

"Oh, he insured my life for a couple of thousand."

"John Bull."

* * * *

"Many people in church, dear?"

"Yes, quite a good attendance and a stranger among them, though I did not see him."

"How did you know then?"

"There was a pound note in the offertory bag."

* * * *

"Don't forget, Mary, that I am not at home if the gentleman is a bore."

"He is not, sir. I asked him!"

* * * *

"Hallo, Alf," cried a labourer, meeting a companion on the tramcar. "They tell me you've lost your job again."

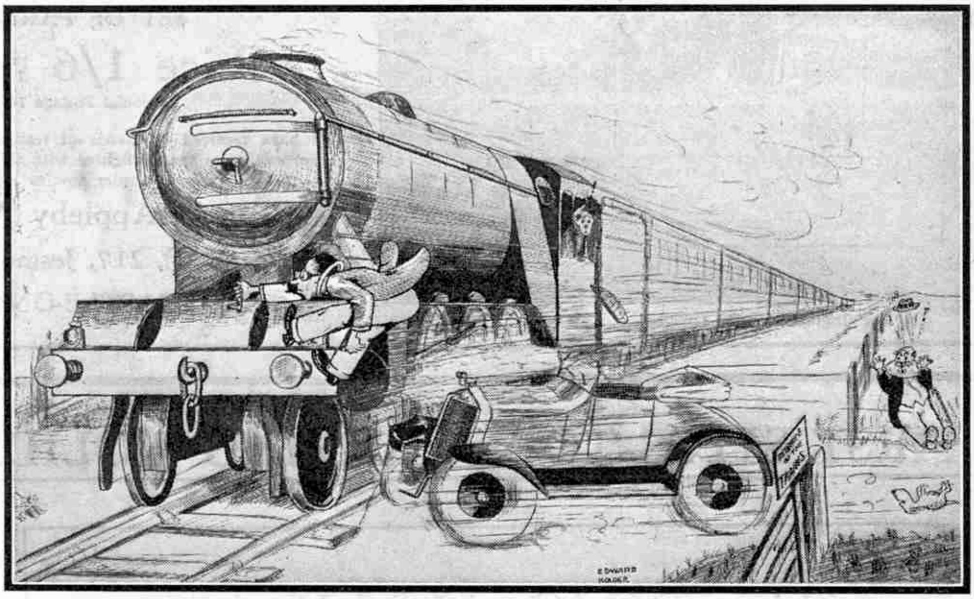
"So I have," retorted his friend. "The foreman's jealous o' me."

"Jealous?"

"Yes," said the sacked one. "You know a foreman does nothing but stand about and watch the others work?"

"I know it, Alf."

"Well, that's why he was jealous, mate," murmured Alf. "You see, somehow people would think I was the foreman!"



HE DIDN'T AUTO!

"He's quite a motor fiend, isn't he? Never seen without his car."
"But I saw him yesterday without it!"
"Is that so? Where?"
"He was clinging to the front of a locomotive with a steering wheel around his neck!"

This drawing, by E. Holder, of Trinidad, B.W.I., gained First Prize in Section A of the 23rd (*Overseas*) *Drawing Contest*

GALVANIZED JUSTICE

A man was arrested for assault and battery and brought before the judge.

Judge (to prisoner): "What is your name, occupation, and what are you charged with?"

Prisoner: "My name is Sparks. I am an electrician, and I am charged with battery."

Judge (after recovering his equilibrium): "Officer, put this guy in a dry cell."

* * * *

"I say, Pemberton, I hear the boss fired you for lying. What did you lie about?"

"Tush, tush, Gregory, for lying about an hour too long in bed every morning."

* * * *

Owner, to Jockey: "Can't you reduce some more?"

Jockey: "I haven't eaten for two weeks, and to-day I cut my finger-nails."

Owner: "Go home and shave."

* * * *

"I know where the 'lectricity comes from that lights our house," said Alice.

"Where does it come from?" queried her aunt.

"From the wall," replied Alice. "When Ma wants a light she unbuttons it."

* * * *

Schoolmistress: "Now, children, what did the Romans do for the Britons?"

Small Girl: "They civilized 'em, miss."

Schoolmistress: "And how did they do that?"

Second Small Girl: "Please, miss, they taught 'em how to fight!"

LOST—BUT FOUND

Nervous lady in ferryboat: "Are any persons ever lost in this river?"

Ferryman: "Oh, no! lady, we always find them next day."

* * * *

"I am not well, doctor."

"How do you live?"

"Like any other poor beggar—I work like a horse all day, I am always ravenous as a wolf, then I am as tired as a dog and sleep like a bear."

"You had better consult a veterinary surgeon."

* * * *

Friend: "Why do you look so sad?"

Cashier: "The auditor found a big mistake in my accounts."

Friend: "Did he report it?"

Cashier: "Report it—I had to share with him!"

* * * *

Sweet Young Thing: "I have a certificate from my doctor saying that I can't act."

Producer: "We all know that, my dear, so why worry the medical profession?"

* * * *

Teacher: "Can anybody tell me something about Henry VIII?"

Small Boy: "Yes, sir; he ironed his clothes on Anne Boleyn!"

Teacher: "Are you trying to be funny?"

Small Boy: "No, sir; it says so in my book. It says, 'Henry VIII pressed his suit on Anne Boleyn.'"

* * *

"What a nice new hat!" exclaimed his friend in admiration. "When did you get it?"

"Well," was the reply, "it was like this. I bought it first in 1919. A year later I had it cleaned, and a year after that I had a new band put on it. Then I wore it for three or four years, brushing it very carefully every morning, had it cleaned again twice, and yesterday I changed it in a restaurant."

* * *

A landlord wrote to his tenant:—

"Dear Sir,—I regret to inform you that my rent is much overdue. Will you kindly forward me a cheque?"

Came the reply:—

"Dear Sir,—I see no reason on earth why I should pay your rent. I can't pay my own!"

* * *

A cavalry officer owned a pair of breeches of excellent cut. His batman coveted the garments in question, and hoped to acquire them, especially as the breeches were old and not over clean. But the owner had other ideas. He gave them to his batman and told him to clean them thoroughly, but the soldier-servant purposely made a bad job of the cleaning.

"H'm," said the subaltern, with much displeasure, "you haven't made much of a job of this, Saunders. Have you tried ammonia?" "Yessir," said the batman eagerly, "and they fit me a fair treat."

* * * *

UNSOLICITED TESTIMONIAL

A Florida newspaper received the following communication: "Thursday I lost a gold watch which I valued very highly. Immediately I inserted an ad. in your lost-and-found column, and waited. Yesterday I went home and found the watch in the pocket of another suit. God bless your paper."

* * * *

"Er—I say, I've lent a fellow £2,000 but he hasn't given me a receipt. What shall I do?"

"Write and demand the payment of the £4,000!"

"But it was only £2,000!"

"I know—he will reply and tell you so. That will serve as your receipt."

* * * *

Indignant Householder (holding up a dead cat): "Here, constable, look what I found in my garden. What are you going to do about it?"

Constable: "Well, you know the law. If it ain't claimed in six months it's yours."

* * * *

Pat: "Lend me half-a-crown."

Mike: "Can't. I've only got two bob."

Pat: "Well, lend me that, and owe me sixpence."

BIG GAME HUNTING

STAMP collecting is usually considered to be a rather sober kind of hobby and certainly not one associated with thrills. By the aid of a little imagination, however, quite an exciting evening may be spent with stamps that depict the wild animals of the world.

The mention of big game hunting immediately suggests East Africa, which even to-day might be described as a natural zoo. It literally abounds with game of all kinds and is a real paradise to the animal lover. We should expect, therefore, to find many of these animals depicted on the country's stamps, but strange to say this is not the case. Kenya and Uganda do not show even one animal, and Tanganyika displays only a giraffe's head. This is a very disappointing state of affairs, but fortunately we have other resources.

For one of the most striking of stamps depicting animals we must go to the Federated Malay States, which provide us with a realistic portrait of a tiger. The tiger probably is the most naturally ferocious of all animals, including even the lion. As a matter of fact, the lion, if left undisturbed, is not naturally a fighter. So long as he can obtain plenty to eat he is quite a peaceable sort of person, and except when he is wounded he seldom deliberately attacks human beings. The tiger is of a much more aggressive disposition and when hungry shows no hesitation in attacking man. Although the life conditions of animals in captivity do not compare in any way with those in a wild state, it is an interesting fact that on almost every occasion when a fight has taken place in a menagerie between a lion and a tiger, the tiger has proved the victor.

At the present time the tiger is found in many parts of Asia, and we are accustomed to associate him with hot countries. It is a curious fact, therefore, that ample evidence exists to show that the tiger once roamed the Arctic Circle.

An angry tiger springing from the jungle forms the subject of the design of all the lower value Federated Malay States stamps, including the current issue. The reproduction is good and we are able to note the markings of the animal's tawny coat, the obvious strength of his limbs and his magnificent head. These stamps recall vividly the stories one has read of tiger hunting. This is conducted in three ways—shooting from elephants, which is the commonest method; driving by beaters to hunters concealed up trees; and enticing to bait during the feeding times at night, hunters being concealed in readiness near the bait.

Let us now pass on to North Borneo, another prolific hunting centre. The crocodile is the most fearsome of the creatures we shall encounter. It is found here in abundance, but it also inhabits Africa and most parts of the tropical zones, with the exception of Central America. An excellent idea of its repulsive appearance is given on the 12c. stamp of the North Borneo 1894 issue, illustrated on this page. With minor variations, the same design is used for the 12c. stamp of the 1897-1902 issue. The ugly head and jaws, with their vicious teeth, the scaly armoured back and tail, and the squat limbs, are all clearly shown as the saurian picks its way over the swamp into the river.

The crocodile will often grow to as much as 33 ft. in length. When hungry it becomes very daring and will lie in wait close to the river bank until the women of an adjacent native village come for water. When its selected victim is at the waters' edge it will dash forward with surprising agility, seize her and drag her under water.

Some of the tribes of Central Africa regard the crocodile with a superstitious horror. If a member of the tribe happens to be bitten by one of these creatures he is regarded as unclean and is immediately expelled from the tribe along with his wife and family. By way of contrast to this attitude it may be mentioned that in certain parts of India the crocodile is regarded as sacred!

The orang-outang is another interesting animal we shall meet. Translated from the Malay his name means "man of the woods," and in fact he is the original of the expression "wild man from Borneo!" The orang-outang has enormously long arms reaching almost to the ankles, a feature that is clearly shown in the illustration of the North Borneo 1897-1902 four cents issue. The stamp also shows three other apes among the trees in the background.

In Borneo also we meet the wild boar. This was once a common inhabitant of the British Isles and it is still found in many European forests. It is the original of our domestic pig, and differs only in minor details. The male boar possesses two enormous canine teeth that he is able to use to good effect when cornered. He is surprisingly agile, and our view of him on the 10c. stamp of the 1909 issue shows him charging like a living thunderbolt at an adversary. He is a game fighter and in various parts of the world boar hunting holds almost as high a place in sporting affections as fox hunting does in Britain.

We may come across also the bruang, or honey bear. He appears on the 10c. stamp of the 1897 issue and our illustration shows him up to his favourite trick—raiding a bees' honey store in the branch of a tree.

The wilds of Equatorial Africa, Liberia and the Congo call next for attention. It is not improbable that we shall encounter there a chimpanzee. This representative of the anthropoid ape is vastly different in its characteristics from the orang-outang. Unfortunately, the almost identical attitudes in which the animals are placed on the North Borneo stamp and the Liberian 5c. 1906 issue prevent the differences from being obvious to the eye. Actually the orang is made to appear more intelligent than his cousin, although he is usually considered to be of a much lower mentality.

The leopard and the panther must certainly be hunted up, and fortunately they are close at hand. We shall find the leopard in Liberia and the panther in the French Congo. They are really of the same species, for the panther is simply a black leopard. Like their cousin the puma, they are closely related to the tiger, but

(*Continued on page* 357

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VICTOR BANCROFT, MATLOCK. Good Unsorted SIAM only **1/6** per 100.

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I am in need of a good Business Slogan and I am relying on Meccano Mag. readers to provide me with one. For the best received I will present a **Collection of 3,000 Different Stamps** valued about **£15.** Closing date **May 15th, 1928. A Special Prize** has been allotted to **Overseas Readers.** Closing date, **July 31st, 1928. Special Easter Bargains: 100 Mixed British Cols. with Mint 7½d., 50 Diff. French Cols., 6d. 100 Diff., 1/3. 100 Foreign, 3d. 100 Mixed, all mine, 1½d. Paramount Stamp Hinges, 4½d. per 1,000. All postage extra.**

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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.)

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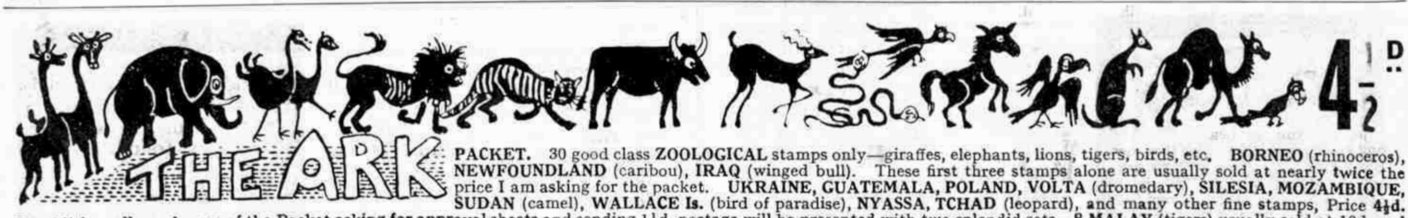


PACKET. 30 good class **ZOOLOGICAL** stamps only—giraffes, elephants, lions, tigers, birds, etc. **BORNEO** (rhinoceros), **NEWFOUNDLAND** (caribou), **IRAQ** (winged bull). These first three stamps alone are usually sold at nearly twice the price I am asking for the packet. **UKRAINE, GUATEMALA, POLAND, 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 Gossip

An Extraordinary Anachronism

In commenting upon the article in our last issue dealing with the voyages of Christopher Columbus, Mr. M. E. J. Gheury de Bray reminds us of the most extraordinary anachronism committed in the design of the St. Kitts-Nevis 1903-1918 issues. On this stamp, which is illustrated herewith, Columbus is pictured sighting land through a telescope! This in 1492, more than 100 years before the telescope was invented!

Literary Stamps

The article in our issue of December last dealing with the Don Quixote issue of Spanish Commemorative stamps does not in any way exhaust the list of stamp issues associated with literary genius. In fact it may be said that, apart from reigning monarchs and military personages, the author and the poet are best represented in the philatelic art gallery.

Poland has immortalised its great poet and patriot Slowacki; Portugal has Camoens, whose name will be familiar to our readers as the author of "*The Luciad*" mentioned in our article on the discovery of the sea route to India by Vasco da Gama, in the June issue. Vamillo Castello Branco, the Lusitanian Dickens, also has been featured on Portuguese stamps. Dante appears on an Italian issue; Pierre de Ronsard was depicted on the French 75c. stamps in 1924, and Hungary has issued three stamps paying tribute to the abilities of Maurus Jokai. Byron, the English poet, was honoured by Greece, while Bulgaria produced an excellent tribute to a British penman when in 1924 she commemorated the work of Mr. J. D. Bourchier, "*The Times*" correspondent. In the same year Bulgaria similarly honoured its national poet Vanoff. Germany recently issued a series depicting various of its literary men, including Goethe and Schiller. The portrait of Gabriele d'Annunzio, the Italian poet and patriot whose legionaries recaptured Fiume, also appears on that country's stamps.

Among all these tributes to literary people only one author has had the privilege of seeing his own portrait upon his country's stamps. This is President Masaryk, whose portrait appears upon the Czecho-Slovakian issue of 1920, while two years later, to celebrate his birthday, a further issue bearing his portrait appeared. Our illustration is of the 1920 design. Only two values were issued, 500 and 1,000 heller. The 500 h. is coloured black on a bluish ground, while the 1,000 h. is brown on buff.

Egypt

Another of the popular Egyptian Conference Commemoratives made its appearance at the end of December last. Designed to celebrate the meetings of the Statistical Congress, the series was issued in 3 values, 5, 10 and 15 milliemes, each stamp bearing a statue of the ancient Egyptian ruler, Amenhotep, who is reputed to have taken the first census of the population.

Stamp Collecting—(*continued from page* 355)

are vastly inferior in size. Our glimpse of the leopard, on the 25c. stamp of the Liberian 1921 issue, shows it perched on a tree branch apparently snarling at some other animal that has dared to come too close. The original stamp is coloured tawny yellow and black to give the natural colouring of the leopard, which is distinguished from the tiger by the markings on its coat, the dark spots being formed by incomplete rings of black, almost enclosing a bright central spot. Our panther is to be found on the 1900-1904 French Congo issue. The attitude of the animal is curiously like that of the domestic cat in a field quietly stalking an unsuspecting bird.

Unfortunately lack of space now necessitates bringing our expedition to a close. We have had little more than a brief glance at each animal, but vistas of some further pleasant excursions have been opened up. As an encouragement to readers to follow up the chase, we offer prizes of stamp packets, to the value of 10/6 and 5/- respectively, to the senders of the longest and second longest list of animals illustrated on stamps. Each reference to an animal must state the stamp on which it is to be found.

We take this opportunity of making acknowledgment to Stanley Gibbons Ltd., for their courtesy in loaning the stamps from which the illustrations used with this article and the Stamp Gossip have been prepared.

BRITISH AND GUARANTEED

ROLLING STOCK

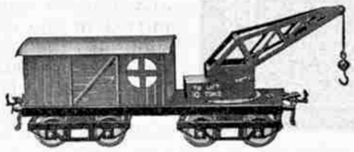
Gauge 0 — *Hornby Series* — Gauge 0

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.

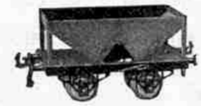
***HORNBY WAGON**
As supplied with all Hornby Goods Sets. Price 2/6

***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



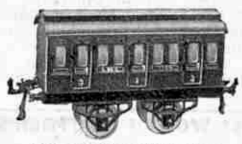
***HOPPER WAGON**
Mechanically unloaded. Finished in grey and black ... Price 4/-

***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 crimson lake, with opening doors. Price 3/6

CARR'S BISCUIT VAN
Finished in dark blue, with opening doors. Price 3/6

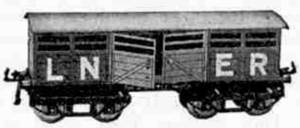
***No. 2 TIMBER WAGON**
Beautifully enamelled in green. Suitable for 2-ft. radius rails only ... ... Price 3/6

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

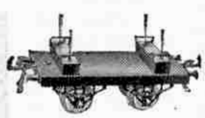


***No. 2 CATTLE TRUCK**
Splendid model fitted with double doors. Suitable for 2-ft. radius rails only ... ... Price 5/9

***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

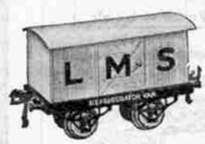
No. 1 TIMBER WAGON
Beautifully enamelled in green. Price 1/9

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/-

Manufactured by MECCANO LIMITED, BINNS ROAD, LIVERPOOL

STATIONS AND ACCESSORIES

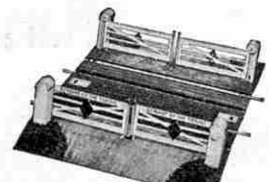
Hornby Series

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/-**

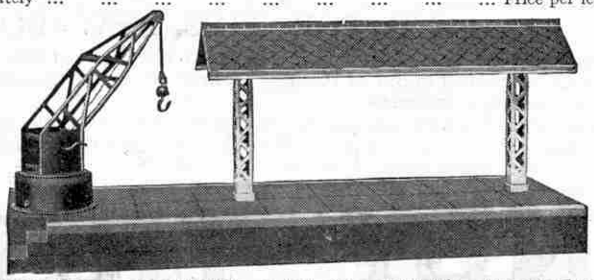
PASSENGER PLATFORM. Length 16¾-in., width 3-in. This platform may be connected to the main station or used separately. The interlocking device at each end enables a number of these platforms to be joined together ... ... Price **3/6**

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 × 7¼-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**

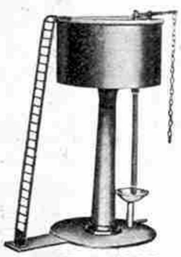


GOODS PLATFORM. Length 16¾-in., height 6¾-in., width 6-in. The crane at the end of the platform revolves on its base. It is enamelled in bright red and is fitted with a crank and ratchet mechanism for controlling the load. The remainder of the platform and shelter is coloured in green, blue and white ... ... Price **10/-**

ISLAND PLATFORM. Length 32½-in., height 6¾-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.

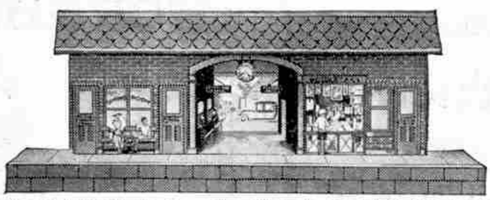
TELEGRAPH POLE
Price per pair 3/6



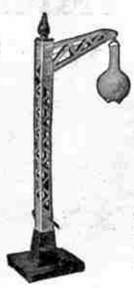
WATER TANK
Brightly coloured. Stands 8½-in. high. Fitted with flexible tube and valve lever.
Price **6/6**

LOADING GAUGE
Price **1/9**

TUNNEL
Realistic and finished in colours ... Price **7/6**



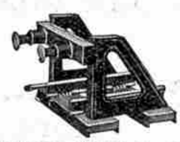
WAYSIDE STATION No. 1. A well-made model, richly finished in colours. By placing one or more of these Stations at intervals along the track, and using the Windsor Railway Station as the main terminus, a very realistic effect is given to a miniature lay-out. Dimensions: Length 16¾-in., width 6-in., height 9-in. ... ... Price **5/-**



LAMP STANDARD No. 1 (SINGLE)
A 4-volt bulb may be fitted into the globe. Price 3/-

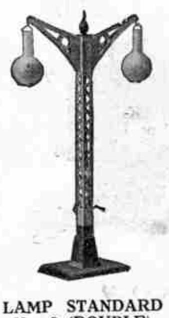
TURN-TABLE No. 1 2/6
„ **No. 2 4/-**

SIGNAL No. 2
"Home" or "Distant."
Price **2/6**

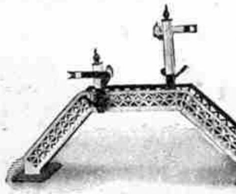


BUFFER STOPS No. 1 (SPRING)
Price **1/-**

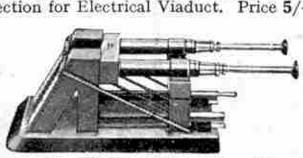
VIADUCT. Price **7/-**
ELECTRICAL VIADUCT. Price **8/-**
Centre Section for Viaduct. Price **4/6**
Centre Section for Electrical Viaduct. Price **5/-**



LAMP STANDARD No. 2 (DOUBLE)
Four-volt bulbs may be fitted into the globes.
Price **4/-**

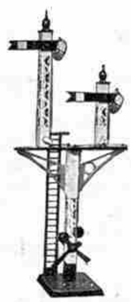


FOOTBRIDGE
No. 1. Without Signals ... „ **3/6**
No. 2. With detachable Signals Price **6/-**
Signals only ... ... per pair **2/9**



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**

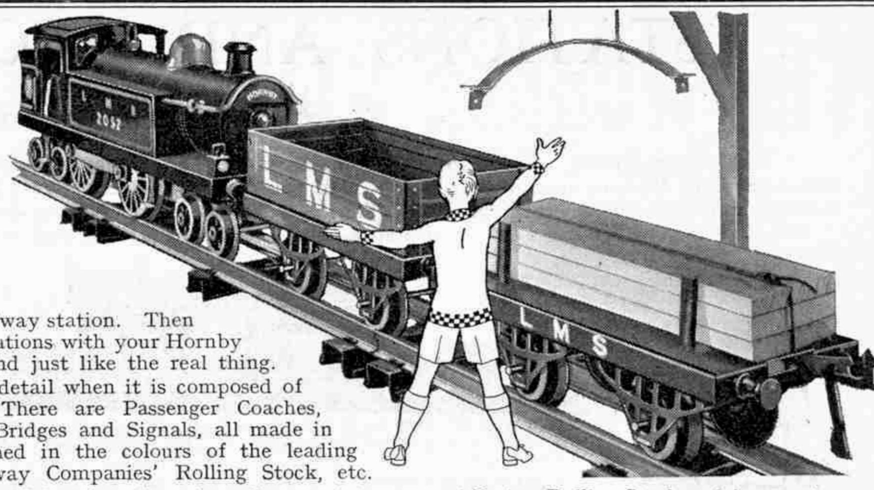
PLATFORM ACCESSORIES
No. 1. Miniature Luggage.
Price per set **1/6**

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

Shunting with a Hornby Train is fine fun



Watch a real locomotive shunting at the railway station. Then when you get home, carry out similar operations with your Hornby loco and rolling stock. It's fine fun and just like the real thing. Your miniature railway is exact in every detail when it is composed of Hornby Rolling Stock and Accessories. There are Passenger Coaches, Trucks, Wagons, Vans, Stations, Tunnels, Bridges and Signals, all made in perfect proportion and all beautifully finished in the colours of the leading British Railway Companies' Rolling Stock, etc.

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The price of the booklet is 3d. and if you cannot obtain it at your dealers it will be sent post free on receipt of 3d. in stamps. All applications should be addressed to Department AM, Meccano Ltd., Binns Road, Liverpool.

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Manufactured by MECCANO LIMITED, BINNS ROAD, LIVERPOOL

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Model Racing Yachts

and New Models of Clockwork and Electric

Motor Boats and Cabin Cruisers

from 6/6 each

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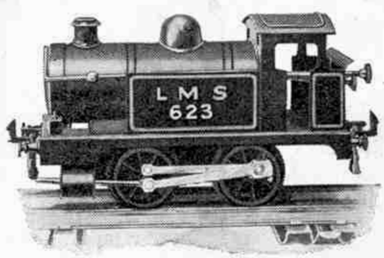
Model Makers to the Admiralty, the Railway Companies, etc.

HORNBY TANK LOCOS



HORNBY No. 1 TANK LOCO

Strong and durable loco capable of any amount of hard work; richly enamelled and highly finished; fitted with reversing gear, brake and governor.

Gauge 0, in colours to represent L.M.S., L.N.E. or G.W. Railway Companies' Locos ... ... Price 12/6

Hornby No. 1 Tank Loco, fitted for Hornby Control ... ... „ 15/-

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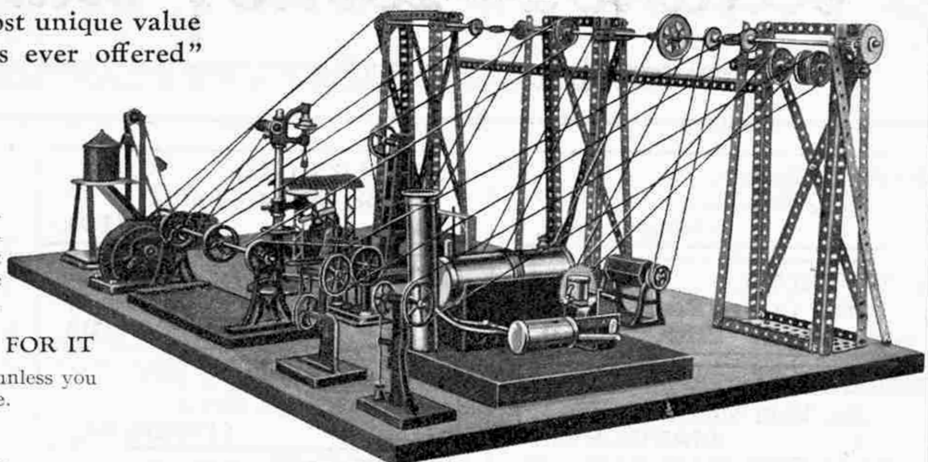
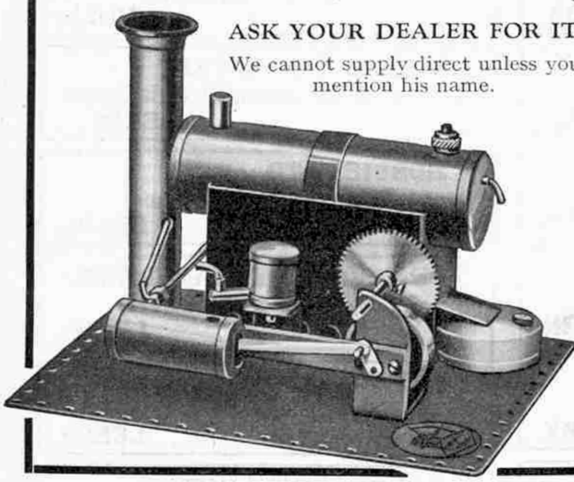
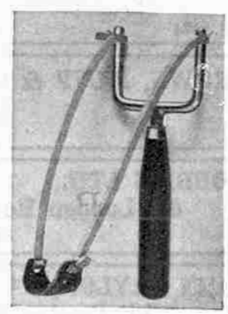
Powerful model embodying all the splendid Hornby characteristics. It is 10½" in length and is fitted at both ends with a four-wheeled bogey. Beautifully finished in colours to represent L.M.S., L.N.E. or G.W. Railway Companies' Locos, and suitably lettered. Fitted with reversing gear, brake and governor. Suitable for 2-ft. radius rails only. Price 22/6

Hornby No. 2 Tank Loco, fitted for Hornby Control ... ... „ 25/-

MECCANO LTD., 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.

HOBBIES LTD.,
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.

THOMAS JAMES & SON,
High Street,
CINDERFORD.

R. H. JEPSON,
1, Cross Cheaping,
COVENTRY.

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.

The MARVEL MART (Wm. Ross & Co.)
110, West Nile 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.

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.

HOBBIES LTD.,
65, New Oxford Street,
Tel. Mus. 1656 LONDON, W.C.

HOBBIES LTD.,
147, Bishopsgate,
Tel. London Wall 7350 LONDON, E.C.

Meccano & Hornby Train Supplies

The twenty-eight 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.,
79, Walworth Road,
Tel. Central 2457 LONDON, S.E.

W. HUMPHRYS & SON,
269/271, Rye Lane,
Estab. n 1840 PECKHAM, S.E.15.

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.

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.

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.

1/6 The Bully Boy Pea Pistol 1/6

Perfect repeating action. Fires 20 shots with force and accuracy. Bright Nickel finish as illustrated.
25 Shot—heavy model, automatic patt. 2/-
50 Shot— „ „ „ 2/6
Good supply of ammunition with each pistol.
Postage on each 3d. extra, Colonial 9d. extra.
A. Herberts (Dept. G), 27, Adys Rd., Peckham, S.E.15.

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

COMPRESSED AIR ENGINE

For driving Models, Boats, etc. Charged with compressed air with ordinary cycle pump. Great speed. Excellent value. Improved Model. Price 4/-. Post 9d. Send for Leaflet.
H. J. Mallett, Elvin Road, Dereham, Norfolk.

MODEL RAILWAY CLUB

EXHIBITION
of Members' Work
KINGSWAY HALL
KINGSWAY, W.C.1.

Wednesday, April 18th Thursday, April 19th
Friday, April 20th Saturday, April 21st
11 a.m. to 10 p.m.

Admission :

Adults, 1/2 (Including Tax) Children, 6d. (under 11)

A New Veeder!

STOUTER, STRONGER AND MORE WEATHERPROOF.

Designed to stand up and give the long and uninterrupted service demanded by modern conditions, the NEW VEEDER is the result of nearly 40 years of specialising in measuring instruments.

Made in two Models:
Regular 6/6, Trip 15/-
Write for descriptive booklet.
Sole British Agent:—
F. E. DICKINSON,
St. Andrew's House, Holborn Circus, E.C.1.

JAEGER
Pure Wool

The 1928
Jaeger "Meccano" Jersey

The 1928 Jaeger "Meccano" Jersey

is made with smaller dice effect in the borders round neck, sleeves and base. It can also now be had with Knickers (with fly opening) to match, at prices quoted below.

Jersey No. BJ105

22″	24″	26″	28″	30″ Chest
7/-	7/9	8/6	9/3	10/-

Knitted Suit No. 852

20″	22″	24″	26″
13/-	14/-	15/-	16/-

Colours :—Navy with Royal Blue and Saxe border.
Mixed Grey with Red and Saxe border.
Fawn with Navy and Saxe border.
Drab with Brown and Saxe border.
Mixed Brown with Brown and Orange border.
Saxe with Navy and Light Saxe border.

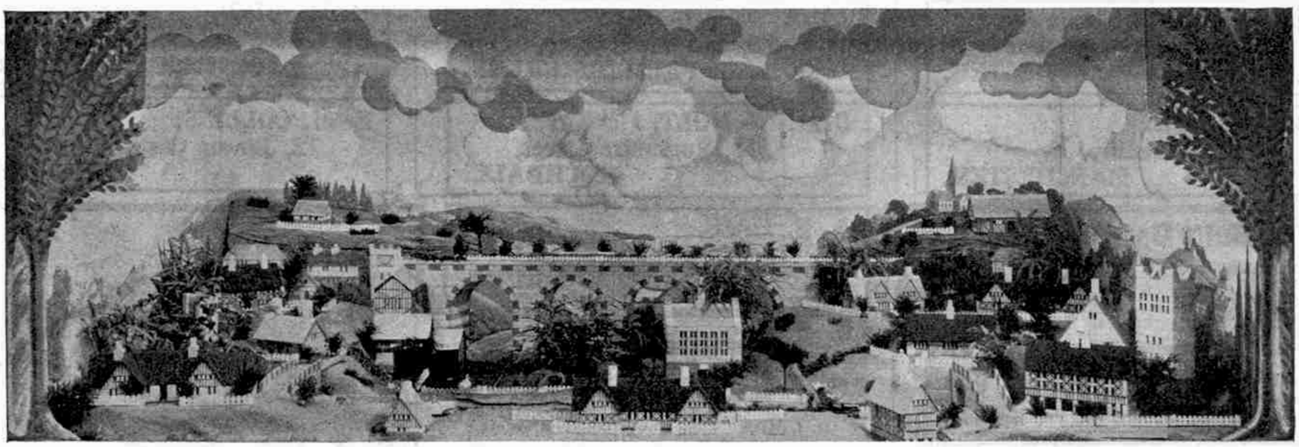
Three-quarter Hose, Turnover Tops to match

3, 4	5, 6, 7	8, 9, 10
2/9	3/3	3/9

Obtainable only from Jaeger Depots and Agents.
(Write for the address of your Local Agent).

JAEGER HEAD RETAIL DEPOT : 352/54, OXFORD ST., LONDON, W.1.
WHOLESALE & SHIPPING : 95, MILTON ST., LONDON, E.C.2.

BRANCHES : AUSTRALIA—Melbourne, 234/236, Flinders Lane. Sydney, 38/44, York Street. CANADA—Montreal, 1187, Bleury Street.

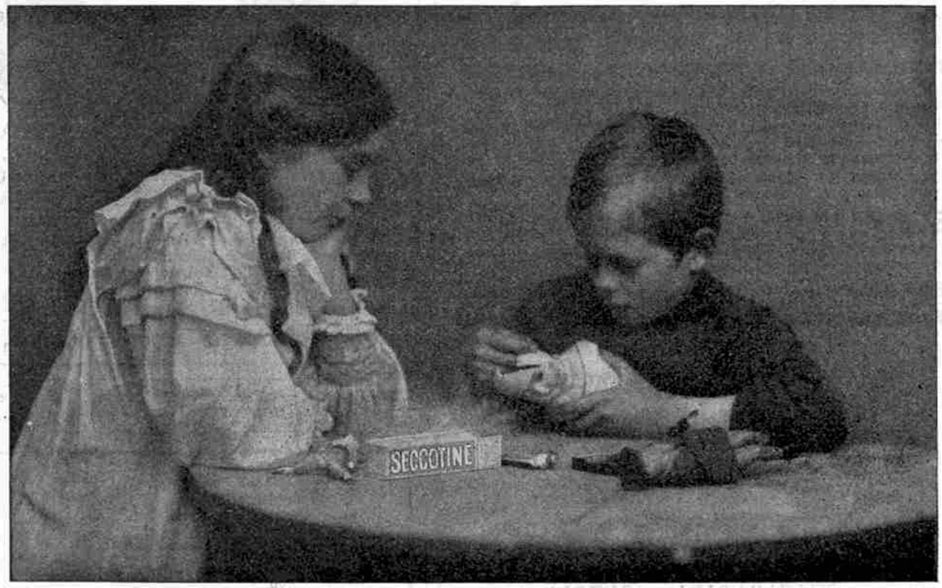


Many readers of the " Meccano Magazine " must have visited the " British Industries Fair," held at the White City, London, a month ago. Those who passed through the Toy Section of the Exhibition will have seen the original of the Scenic Display reproduced above. Railway Trains travelled at frequent intervals across the viaduct in the background, while a constant stream of motor vehicles made their way along the road at the front. The Buildings shown are built entirely with Lott's Bricks and Tudor Blocks as contained in the various Sets. Ask your Dealer to-day for full particulars, or write direct to (Dept. H2), Lott's Bricks Ltd., Watford, England.

THE MECCANO BOY KNOWS THE VALUE OF

SECCOTINE

(REGD. TRADE MARK)



WITH it he makes or mends things innumerable—Picture Frames, Models, Bats, Balls, Boats, Boxes, Bags, Books—Oh a hundred things. And then he can help his

MOTHER

She will have Chairs, Tables, Beds, Slippers, Curtains—at least fifty things. And his

SISTER

Every day in life she will bring him something to be made or mended with his wonderful SECCOTINE.

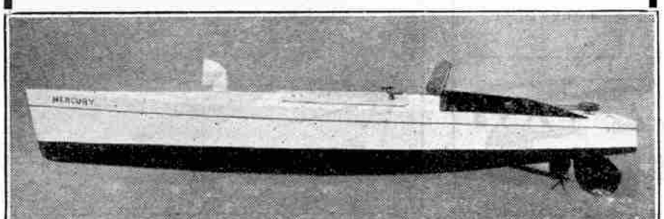
THREE SIZES AT

4½d., 6d. and 9d. per tube.

WRITE FOR A FREE BOOKLET ABOUT WHAT SECCOTINE CAN DO

McCAW, STEVENSON & ORR LTD., THE LINENHALL WORKS, BELFAST

The last word in Motor Boats!



THE Clockwork Model will run six minutes with one wind and the Electric Driven Boat over THREE HOURS with one pocket dry battery.

Don't buy a motor boat until you have seen these new Bassett-Lowke masterpieces. Length 24¾", Beam 4½". Total Weight 2 lb. 3 oz.

FULLEST DETAILS ON RECEIPT OF POSTCARD.

PRICE:

Clockwork Model - - - - 30/-

Electric Model - - - - - 35/-

(Including Dry Battery).

BASSETT-LOWKE LTD

NORTHAMPTON

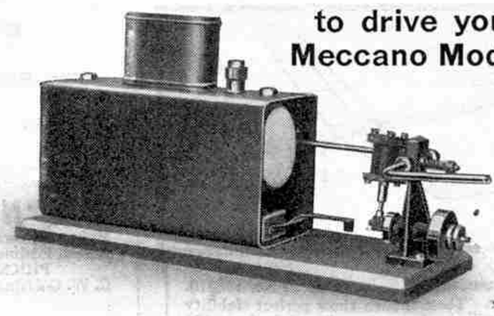
LONDON BRANCH. 112 HIGH HOLBORN, W.C.1.

MANCHESTER BRANCH. 28 CORPORATION STREET.

EDINBURGH BRANCH. 5, FREDERICK STREET.

You must have the S.T. ENGINE

to drive your Meccano Models



S.T. Engine Parts ... 5/- Finished Boiler ... 8/-

Finished Plant on Base, as illustrated ... 17/6

Post Free.

It is utterly different from the ordinary Toy Shop model engine.

In the first place you have the pleasure of building it yourself.

You need have no fear, we **guarantee** it will work when you have built it.

Secondly, like all Stuart models it is made on correct engineering lines and therefore has **Power.**

The Boiler is of Copper, brazed throughout and tested.

Send a stamp for list 12M which describes this and several other simple models, or better still a Postal Order for 6d. for our 80 page

"ENGINE CATALOGUE,"

fully illustrated and packed with interest from cover to cover.

Stuart Turner Ltd., Henley-on-Thames

HARBUTT'S PLASTICINE

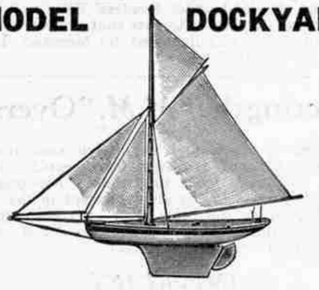
The indispensable adjunct to all users of "Meccano" Construction Sets and Miniature Railways; your little screws and small sections do not roll away and get lost the moment you put them down if you dab them on a slab of Plasticine, that alone is worth all the cost of the "Rainbow" which is only 1/- post free. There are dozens of other things you can use it for too!

Harbutt's Plasticine Ltd.

99, Bathampton, Bath

CINEMATOGRAPH FILMS, Machines, and Accessories at bargain prices. Illustrated lists post free.—Filmeries, 57, Lancaster Rd., Leytonstone, London, E.11

KENSINGTON MODEL DOCKYARD



Sailing Yachts & Fittings

HOBBIES STEAM LAUNCHES
MOTOR BOATS
HORNBY TRAINS
MECCANO OUTFITS AND PARTS
WORMAR STEAM ENGINES

Requisites for
CRICKET, TENNIS, FISHING, PHOTOGRAPHY

AIR GUNS AEROPLANES
Electric Motors & Accumulators

Send 1½d. Stamp for New List "M"

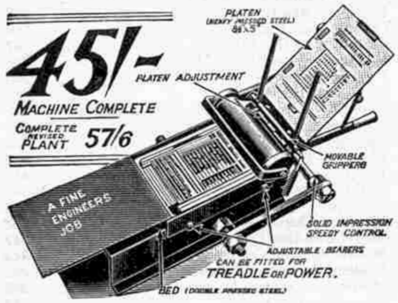
C. H. LORBERG

185, Kensington High St., London, W.8

ADANA AUTOMATIC SELF-INKING

PRINTING MACHINE

NEW ALL-STEEL SUPER-MODEL



The Machine that is Built from the experience of over 10,000 Users of the old Model.

Over 15,000 users of Adana Printing Plants, saving enormously in their own work, and hundreds making an excellent living. Government Departments, Large Printers and Big Stores are amongst the many successful owners.

Will print any matter from **Chemist's Label to an Illustrated Magazine** at a really commercial speed, including Perforating and Creasing. Simplicity to the extreme, no special skill required. Hundreds of boys producing school magazines. Real Printers' metal type, case, all complete accessories and fully illustrated instruction book included in plant. Two-coloured illustrated particulars and samples of work sent on receipt of stamp.

BUILT FOR COMMERCIAL USE.
Machines can be shipped abroad C.O.D. cash against documents in London. Goods F.O.R. Twickenham.

THE ADANA AGENCY
is a complete organization for the supply of Printing Office Equipment of every description. Controlled by most highly skilled and long experienced men of the Printing world.

(Dept. MM/5), 17, Church Street, and 34, King Street, Twickenham.

Patents for Inventions, Trade Marks: Advice Handbooks & Cons. free.—B. T. King, Regd. Patent Agent, 146a, Qn. Victoria St., London, E.C.4. 40 years' refs.

POCKET MICROSCOPES

Magnify lineally about 50 times, squares about 2,500 times. Disclose wonders of Nature invisible to naked eye. Indispensable for study of Chemistry, Botany, etc. Superior Microscope, complete with tweezers, 3 objects and 3 glass slides in case, post free **5/6.** Microscope, with 3 slides in box, post free, **2/6.**—**R. DILNOT (Dept. M),** 125, Chiswick High Road, London, W.4.

DOLLA AIR PISTOL

Heavily Nickel Plated

Blued Finish also Supplied (New Model)

An old Popular Model greatly improved making it the finest yet offered.

PRICE 5/- Postage 7d.

Darts 4/6 per gross

H. H. PARSON (Pistol Dept.), 55, Northcote Rd., S.W.11

JENNERS
PRINCES STREET, EDINBURGH
LIMITED

EDINBURGH AGENTS for MECCANO and Hornby Trains

A complete stock of all Hornby Train Accessories and Meccano Parts

JENNERS PAY CARRIAGE

Why Waste Beautiful Furs? To cure soft as wash-leather: Rabbit, Cat, Fox. Success guaranteed. Receipt 1/2. Proceeds for Foreign Missions.—Vicar, Birchover, Matlock.

Write at once for

HOBBIES BARGAIN LIST

Last day, April 21st.

IMMENSE REDUCTIONS

Motor Boats
Fretwork Sets
Fret Machines
Fretsaws
Wireless
Model Railways

C. LUCAS

Hobbies Depôt

35, Manchester St., Liverpool

READERS' SALES

(*Rate: 1d. per word, min. 1/-*)

Model Railway for Sale, Four Locos, etc. Good condition. Write—BM/VRMW, W.C.1.

For Sale. Large Cinematograph, complete with 9 large complete films. Cost £5. What offers?—E. W. Fox, 36, Argola Street, Hackney, London, E.8.

Sale. Album containing 700 different stamps. Bargain, 10/-. Also "Cassells Children's Book of Knowledge," complete, 53 parts, cost 66/3, not bound. Good condition. What offers.—Leach, 131, Abercromby, High Wycombe, Bucks.

Cigarette Cards, 100 for 6d. Stamps exchanged; your country for mine.—Langdon, Warrington Road, Ipswich, England.

1,000 Cigarette Cards. What offers?—Cridge, 81, Kingsway, East Sheen, London.

Sale. Cinematograph, Steam Engine, Primus Engineering and Complete Gauge 0 and 00 Railways. Particulars—Parlser, Moyana, Burdon Lane, Cheam.

Cigarette Cards. Sets from 2d. Lists.—Thornton, 159, Grosvenor Road, Wavertree, Liverpool.

Sale. Two Strong Locos, Straight Rails, Gauge 0, "Meccano Magazines," 1927, complete. Perfect condition. Offers?—Hudson, Havenstreet, I.W.

Sale. Tennis Racquet, 12½ oz. Cost 15/6. What offers? Excellent condition.—Pentland, 54, De Parys Avenue, Bedford.

This Month's Special Articles

Sale. Cinematograph, Oil Lamp. Complete. Slides. Seven Films. 7/-.—Gill, Halcon Corner, Taunton.

For Sale. 0 Gauge Tinplate Rails and Points. Cheap. Stamp particulars.—B. Robinson, 17, Crosscliffe Street, Manchester.

Clockwork Boat, length 20 ins., cost 13/6; Little Nipper Camera, Carrying Case, 7 Plate-holders, Postcard Printer, Accessories, good condition, cost 21/6. What offers.—Semple, 34, Alice St., Paisley, Renfrewshire.

1,200 Cigarette Cards, complete sets in twelve cloth-bound (Wills') Albums. Splendid condition. 20/-.—S. Banister, Fern Bank, Bedhampton Hill, Havant, Hants.

A Magic Lantern with 3 wick oil lamp. Cost £3/15/- new. Complete with 5 doz. slides 25/-.—Lyne, Littledean, Glos.

Sale. Cinematograph and Films. Good condition. 15/- or near offer. Miniature Railway, 10/-. Marklin Electric Railway, £3 or near offer, worth £4.—Fearnley, Red Roofs, Palace Road, East Molesey, Surrey.

Sale. "M.M.'s," Cigarette Cards, Wormar Engine, Wireless. Stamp for list.—BM/ZNSJ.

Steam Locomotive, nearly new, cost 30/-. What offers?—Boulton, "Manse," Haddenham, Cambs.

Sale. 1,350 Cigarette Cards, 9/-.—Box No. 401.

For Sale. Various Wireless Parts and Sets in Perfect Condition. Write for Particulars.—Box 403.

Two Boxes of Lott's Bricks for Sale. None Broken. Cost 23/-. What offers.—Apply Box 404.

Sale. 48 parts of "Cassells Children's Book of Knowledge," Nos. 1 to 48, not bound. Good condition. Offers.—W. Steele, 3, Ravensdale Av., College St., Long Eaton.

Sale. "M.M.'s," May 1926 to Dec. 1927, 5/6. Also 1,500 clean assorted Cigarette Cards, 7d. per 100. Album with 540 Cigarette Cards, 4/6, or lot 12/6.—Wm. G. Hamilton, 71, Gavin St., Motherwell.

Exchange Pair White Fantails for Pair of Pouter Pigeons.—Berry, Wootton, Northampton.

Ticket Printing Machine, new, 12 lbs. Type, 20/-. Cinematograph, standard size, complete, fine condition, £4. 3" Lathe 12/6. Bargains. Stamp.—120, The Avenue, Starbeck, Harrogate.

Home Cinematograph, Stamp Collection, Primus Outfit, Camera. Particulars Free.—L. J. Owen, 53, Sedgley Avenue, Nottingham.

2,000 Cigarette Cards, 8d. per hundred, post free.—Blackwell, Castle Street, Stroud, Glos.

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 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).

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.

Stamp Advertisers Please Note:—

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.

Advertisers are asked to note that private advertisements of goods manufactured by Meccano Limited cannot be accepted.

Ordering the "*M.M.*" Overseas

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).

IMPORTANT.

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: Messrs. E. G. Page & Co., 52, Clarence Street, Sydney, N.S.W.
NEW ZEALAND: Models Ltd., Kingston & Federal Streets, Auckland.
SOUTH AFRICA: Mr. A. E. Harris (P.O. Box 1199), **142,** Market Street, Johannesburg.

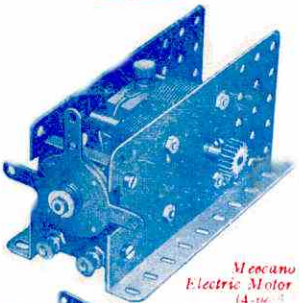
Run your Meccano models with Meccano Motors

RELIABLE – POWERFUL – SPECIALLY DESIGNED TO BUILD INTO THE MECCANO SYSTEM

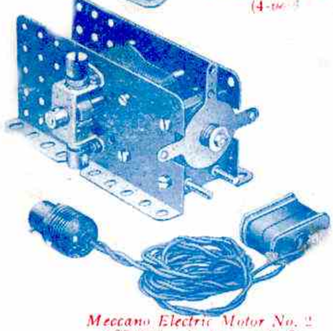
If you wish to obtain the fullest possible enjoyment from the Meccano hobby you should operate your models with a Meccano Motor. Just imagine the thrill of setting in motion your Crane, Ship Coaler, Motor Car, Windmill or any other model you build. You push over the control lever of the Motor and immediately the model commences to work in exactly the same manner as its "big brother" in real life.

All Meccano Motors are strongly made and the utmost care is taken in their manufacture to ensure that they give every satisfaction to their owners.

Particulars and prices of the Motors and Accessories are given below.



Meccano Electric Motor No. 1 (4-volt)



Meccano Electric Motor No. 2 (100-250-volt A.C. or D.C.)

MECCANO CLOCKWORK MOTOR

This is a splendid piece of mechanism, simple, powerful, reliable and free from all danger. It is fitted with starting, stopping and reversing levers, and all its movements are fully explained in the instructions that accompany it. Price 7/6

MECCANO ELECTRIC MOTOR No. 1

(4-volt)

The 4-volt Motor is specially designed to build into Meccano models. It may be run by a 4-volt accumulator or, by employing the Transformer described in the next column, from the main. Fitted with reversing motion, provided with stopping and starting controls, and the gearing is interchangeable. Price 15/6

MECCANO ELECTRIC MOTOR No. 2

(100-250-volt A.C. or D.C.)

This Electric Motor may be employed for any purpose for which a small motor is suitable, but it is specially adapted for driving Meccano models, into which it may be built. It is designed for connection with the electric light main—100-120-volts or 200-250-volts, alternating or direct. A 6 ft. length of flex, fitted with a plug for connection with the motor terminals and an adapter for connection with an ordinary lamp socket, is included. A suitable resistance is required when the motor is run with a 200-250-volt current, and this is supplied by connecting a 60-watt lamp in series with the motor. A board, on which are mounted a suitable lamp holder (lamp not included) and a switch, is provided separately. Price 32/6

Lamp board (with lamp holder and switch) Price 4/6

MECCANO RESISTANCE CONTROLLER

By employing this variable resistance the speed of the Meccano Electric Motor No. 1 (4-volt) may be regulated as desired. The controller is connected in series with the motor and accumulator, or with the motor and transformer if a transformer is used as the source of power. It will not regulate the speed of a high-voltage motor connected to the main. Price 3/6

TRANSFORMER

By means of this transformer the Meccano Electric Motor No. 1 (4-volt) may be driven from the house supply (alternating current only). It is available for all standard supply voltages, from 100 to 250 inclusive, at all standard frequencies. The supply voltage and frequency must be specified when ordering. Price 30/-

MECCANO ACCUMULATORS

These new and excellent types of accumulators have been adapted to drive the Meccano Electric Motor No. 1 (4-volt). They have remarkable recuperative powers, and will continue to supply current when nominally exhausted.

4-volt 8 amps Price 17/6 4-volt 20 amps Price 25/-

MECCANO RHEOSTAT

(For high voltage motors)

This Rheostat is for controlling the speed of the Meccano Electric Motor No. 2 or the H.V. Metropolitan Train. It may be connected to the house lighting system by means of an adapter and may be used with either alternating or direct currents ranging from 100 to 240 volts. A 60-watt lamp (not supplied) is required for use with the Rheostat. Price 18/6

Meccano Resistance Controller

Meccano Rheostat

Transformer

Meccano Clockwork Motor

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