VOL. XIX. No. 11 NOVEMBER 1934

MECCANO MAGAZINE

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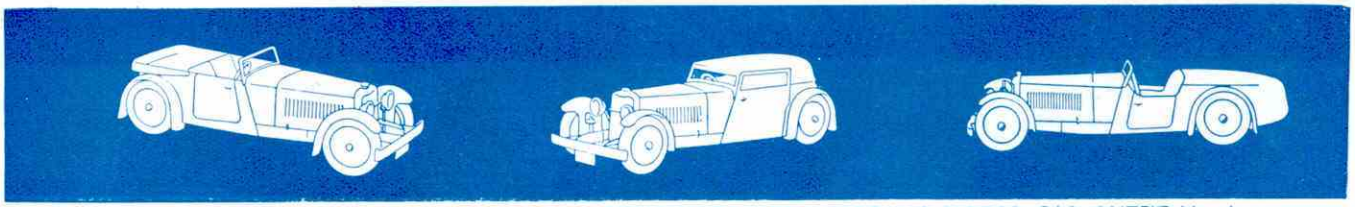
GIANT MIXER FOR MOLTEN STEEL

(see page 854)



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Perfect miniature reproductions of many different types of car can be built with these splendid Motor Car Constructor Outfits, including sports four-seaters, speed cars, sports coupés and others. All the models are driven by means of a powerful clockwork motor (included in the Outfit) giving a long, speedy and realistic run on each winding. The parts are finished in rich enamel and nickel-plate, the complete Outfits being master-pieces of miniature automobile craftsmanship.

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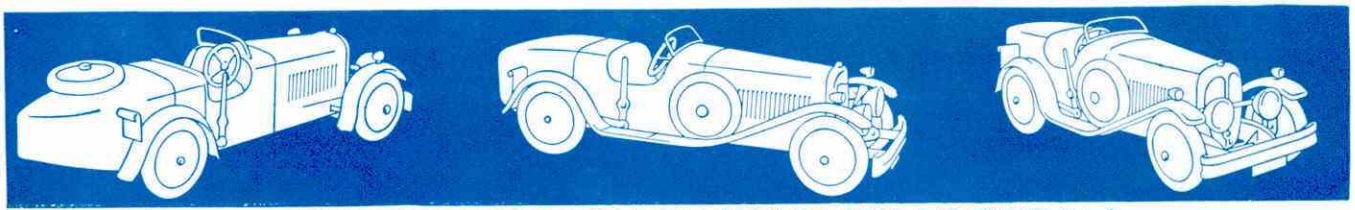
Meccano Motor Car Constructor Outfit No. 1

Meccano Motor Car Constructor Outfit No. 2



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NEXT MONTH: SPECIALLY ENLARGED CHRISTMAS ISSUE. PRICE 6d. PUBLISHED: 1st DECEMBER

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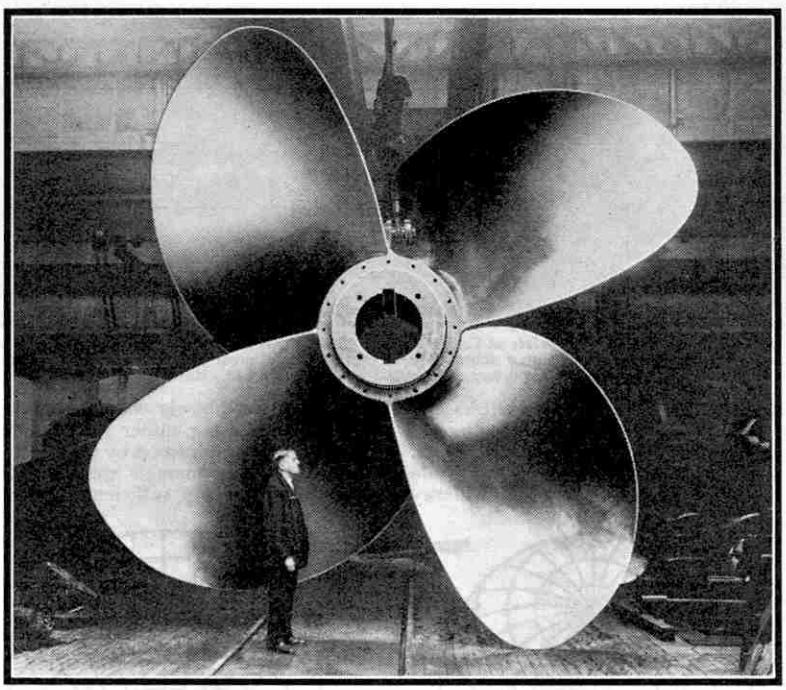
With the Editor

The "Blue Riband" of the Atlantic

The launch a few weeks ago of the Cunard-White Star liner *"Queen Mary"* has revived interest in the "Blue Riband" of the Atlantic. This was held by the Cunard Line for 49 of the 94 years that have elapsed since their first mail steamers crossed the North Atlantic, and at present is in the keeping of the Italian liner *"Rex,"* which made the crossing at an average speed of 28.92 knots.

The earliest vessels on the North Atlantic service were small, and their speed was so low that the *"Britannia,"* the first of them to commence the service, took 14 days 8 hours to complete her maiden voyage. New and larger vessels were built as the years passed. The simple engines of the earliest ships gave way to far more powerful triple-expansion compound engines, and finally to marvellously efficient turbines, with the result that the time required for the crossing was steadily reduced. From time to time other steamship companies entered into competition with the originators of the service, and the struggle for supremacy was particularly keen early in the present century when two German vessels in turn held the "Blue Riband" for nine years. The coveted honour was not regained for this country until the *"Lusitania"* and the *"Mauretania"* appeared, and the latter vessel held it unchallenged for 22 years, when it was wrested from her by the German vessel *"Bremen."* In the following year another German ship, the *"Europa,"* became the holder of the "Blue Riband," and in her turn was surpassed by the Italian *"Rex."* The *"Rex"* of course crosses the Atlantic Ocean between Gibraltar and New York. Thus the entry of this vessel into the contest for the "Blue Riband" introduces a new feature, for the courses of British and German ships engaged in the struggle lie farther north. The *"Rex's"* record crossing was made in 4 days 13 hours, and this time is in remarkable contrast to that of the *"Britannia"* 94 years ago.

In France the giant liner *"Normandie"* is now approaching completion, and when she enters the North Atlantic service in April of next year it is probable that she will surpass the record of the *"Rex."* In the Spring of 1936, however, the *"Queen Mary"* will be placed in service, and it is confidently expected that she will regain the "Blue Riband" for this country. This has more than a sentimental value, for the success of the German and Italian giants has proved that the largest and fastest vessels attract an increasingly large proportion of the available passenger traffic.



One of the four propellers of the "Queen Mary." Each of these is nearly 20 ft. in diameter and weighs 35 tons, or 10 tons more than the largest propellers previously constructed. Photograph by courtesy of J. Stone and Co. Ltd., Deptford.

The World's Greatest Motor Show

The annual Motor Show held at Olympia, London, in October is the greatest exhibition of motor cars and accessories in the world. This year's Show fully upheld the reputation of the event, for it was the largest yet held, and never before has such a magnificent display of motor vehicles been gathered under one roof. The number of makers exhibiting motor cars was 54, an increase of six on last year. Of these 31 were British, and it is very gratifying to find that their productions attracted more attention than ever from overseas buyers, as well as from those at home. The high quality of British cars is reflected in the increased number of men employed in making them. To-day there are about 100,000 more men engaged in the motor industry of this country than at this time last year, and the record sales achieved at the Exhibition encourage the belief that the number will be substantially increased in the next few months.

The Show illustrated once more the wonderful ease with which the modern motor car can be controlled, especially now that automatic gear-boxes are almost universal; but the feature that aroused most interest was streamlining. A few of the exhibits followed the American plan of streamlining throughout, which gives cars such an unfamiliar appearance that it is sometimes difficult to decide in which direction they are intended to travel! The general tendency was to streamline only the tails and wings of bodies, however, and graceful outlines suggesting speed and comfort were the result.

Our Special Christmas Number

The special Christmas issue of the *"M.M."* is greatly looked forward to every year by Meccano enthusiasts all over the world. This year it will be better than ever, and a special feature will be the presentation, with each copy, of one of the Meccano Super Model Leaflets. Each of these Leaflets describes and illustrates the construction of a splendid model of a type that should be the ambition of every Meccano boy to build.

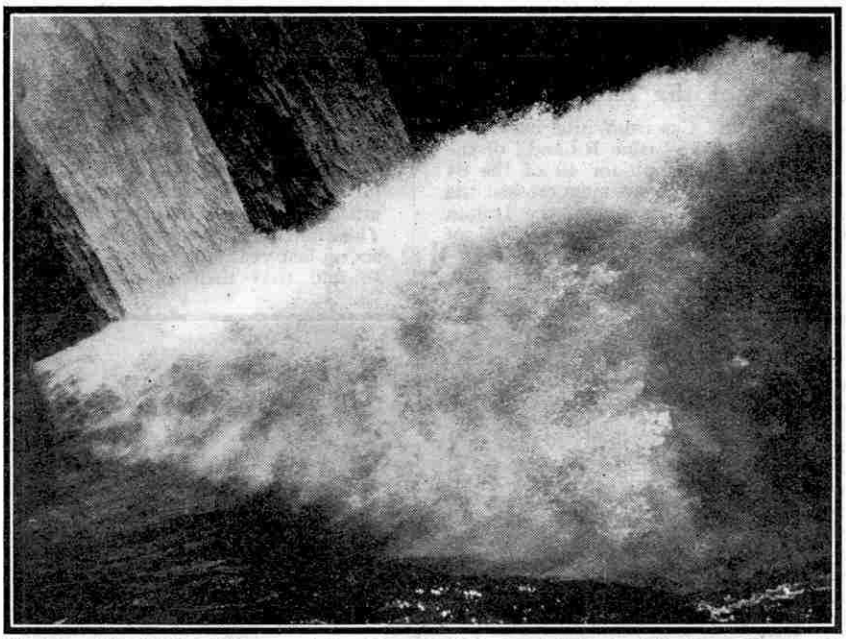
The Christmas issue, which will be published on 1st December, will be enlarged to make room for all the additional attractions now in preparation. There will be no increase in price, however, and as the demand undoubtedly will be enormous, I urge every reader not only to make sure of his copy by placing an order now with his usual dealer or newsagent, but also to tell his friends about its attractions, and to advise them to follow his example.

Taming High Speed Water Jets

Pressure Outflows that Fall Like Rain

A JET of water at high speed under great pressure is capable of exerting a surprising amount of power. Even an ordinary hose pipe attached to a domestic water supply gives a jet that seems to be almost solid when it is lightly struck with the finger, and sticks and even metal rods have been broken when used to strike larger jets produced by pressures above that of water supply mains.

Powerful jets of this kind are produced by the discharge pipes employed so largely in engineering at the outfalls of sluices or of the reservoirs formed behind huge dams, or wherever water under pressure is liberated into shallow river beds, watercourses, penstock chambers, conduit basins or ponds. These jets possess so much concentrated energy that they are capable of exerting great destructive powers, for they strike the downstream water as a solid mass and expend their energy upon a limited area. Some means of dissipating this energy must be provided, and thus we have the apparent paradox that engineers are called upon to waste power, instead of to develop it and put it to good use. The necessity for this arises from the fact that during times of flood more water enters the reservoir behind a dam than can be used for the production of power. Flooding is temporary, however, occurring only at one or two seasons in the year, and therefore it would not be worth while to instal additional machinery to generate power from the energy of the surplus water.



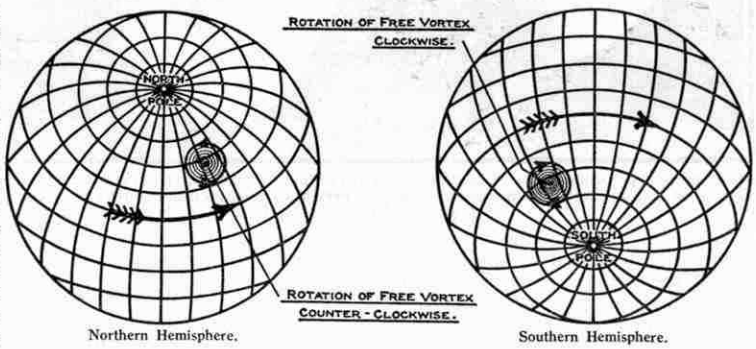
The 36 in. "Glenfield" Jet Disperser at Cray Reservoir, Swansea. It discharges 173 million gallons in 24 hours and the jet is shattered into a dense feathery mist. This and other illustrations to this article are reproduced by courtesy of Glenfield and Kennedy Ltd., Kilmarnock.

In the past the energy of such a jet of water has been dissipated chiefly by allowing it to fall into a large pond or pool, which acts as a water cushion. A pool of this kind is expensive to construct and is not altogether satisfactory in action. Even when the mass of water in it is sufficiently large to damp out a satisfactory proportion of the shock of the direct impact of the almost solid jet of water poured out on to it, the swirling currents set up are liable to damage the banks, tearing away stones and boulders that themselves become agents of destruction as they are swept away, and endangering the masonry and foundations of the dam or other structure concerned.

The problem of dealing with these destructive jets of water has recently been solved by the introduction of a singularly simple device that literally causes the jet to explode into a shower of drops that fall like rain, usually into a comparatively small pool of water placed to receive them. This device is the "Glenfield" Jet Disperser, which is made by Glenfield and Kennedy Ltd., Kilmarnock. It acts perfectly, the tremendous energy stored up in a jet of any size being absorbed by the atmosphere as the tiny drops of water fall through it; and thus both the direct impact of the jet and the erosive effect of the currents produced by its fall into a pond are completely avoided.

The "Glenfield" Jet Disperser acts by transforming the solid jet of water into what is known as a free vortex. A vortex of this kind is formed when water is allowed to escape from a vessel through a small opening in its base. One can often be seen when water flows from a wash bowl when the plug that closes the outlet is pulled up. Instead of flowing down the plug hole directly, the water then forms a kind of whirlpool flowing round the opening and passing away down its sides, leaving a vertical air column through the centre of the plug hole.

Escape whirls of this kind seem to be formed spontaneously when the head of water above the outlet is not too large, and any trifling disturbance is sufficient to produce one, which then persists without further assistance. They are produced most readily when the depth of water above the orifice is less than three times its diameter, and this explains why they are most readily seen in washbowls when most of the water has run out. When water is flowing under greater pressure than this, a free vortex can readily be formed by any means of initiating rotation, provided that there is enough space at the opening to allow the initial whirl to develop sufficient speed.



Diagrams showing why free vortices in the northern and southern hemispheres appear to rotate in opposite directions.

Free vortices have long been known in the form of smoke curls, whirlwinds, whirlpools, and surface eddies in moving streams, as well as in the escape whirls already described. A curious feature is that if they are really free, that is if the movement of the particles of which they are formed is not constrained in any way, the direction of movement in Great Britain and other places in the northern hemisphere is opposite to that of the hands of a clock, while on the opposite side of the world, in Australia, New Zealand, South Africa and South America, the rotation is clockwise. This is clearly shown in the upper illustration on the opposite page, reproduced from a photograph of an escape whirl in New Zealand. Various explanations have been given of this effect, but it is now generally recognised that it arises from the rotation of the Earth. In reality vortices in the two hemispheres are whirling round in the same sense, for each follows the rotation of the Earth itself. In the northern hemisphere an escape vortex is viewed from above, while in the southern hemisphere it is seen from below, and from the Earth's surface therefore they appear to be moving in opposite directions, as the diagram on this page shows.

The "Glenfield" Jet Disperser in its simplest form consists of a nozzle for attachment to the end of the outlet pipe through which the jet to be broken up passes. Within it are vanes that are set at an angle to give the jet a rotary motion as it passes them. This passes through the nozzle as "solid" water with an appreciable twist and immediately literally bursts into drops, for on the release of the free vortex on emerging from the nozzle every particle or filament of water continues on a course determined by its forward speed and by the tangential twist imparted to it. It is a characteristic of a free vortex that the speed of rotation of the central filaments is greater than that of those on the outside. The inner currents of the jet therefore tend to pass through the outer currents, and the released jet becomes an expanding column of interlacing filaments of fluid and is rapidly disintegrated into drops of uniformly small size.

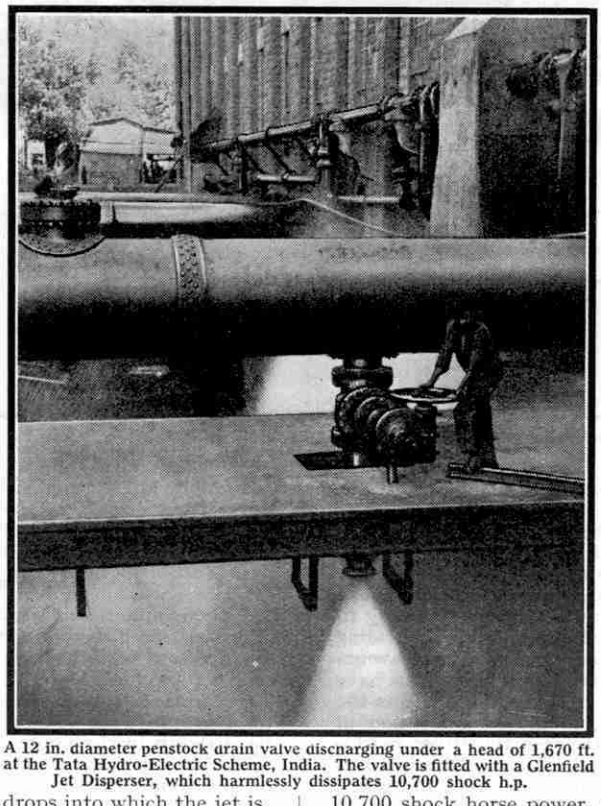
A photograph of a free vortex formed during discharge through the outlet tunnel at the Arapuni Reservoir, New Zealand. The vortex is rotating in a clockwise direction.

The tiny globules of water formed offer a very large surface to the resistance of the atmosphere, and the energy of the jet is effectively absorbed by what may be described as an air cushion of practically unlimited dimensions. No damage can be done by atmospheric disturbances set up in this manner, and the drops cushioned by the air simply fall with the speed of raindrops. They are scattered over a large area and could quite safely be allowed to fall upon a rock surface; while water into which they are discharged is free from swirling currents.

The upper photograph on the opposite page shows a 36 in. "Glenfield" Jet Disperser delivering 320 cu. ft. of water per second, under the pressure due to a head of 92 ft. No less than 1,615 shock horse power is being dissipated by this disperser, and so perfect is the disintegration of the water into drops that the discharge is deposited in a pond only 2 ft. deep without creating more than a surface disturbance! The outlet pipe is controlled by a 36 in. sluice valve, and previous to the fitting of a Jet Disperser it had never been possible to open the valve more than 6 or 7 inches. On the single occasion when the valve was opened as much as 14 in. a hole was washed in the opposite bank 80 ft. distant, over the top of a retaining wall 8 ft. high.

The illustration shows this Disperser operating under the full water head, and the gentle manner in which the finely divided jet falls on the downstream surface is clearly seen. It is of interest to notice the number of drops into which the jet is divided on issuing from the Disperser nozzle. The average diameter of the drops is about $\frac{1}{8}$ in. and about 553 million drops are formed per second! These are scattered over an area of about 1,060 sq. ft., which is about 150 times that of the solid escaping stream.

Another wide field of application of the "Glenfield" Jet Disperser is in connection with scour valves for water mains. These generally discharge into streams or open drains, and the resultant scour is often serious. The fitting of a "Glenfield" Disperser eliminates damage and allows the scour valve to be opened wide with perfect safety, whereas in many situations this is impossible without a Disperser.



A 12 in. diameter penstock drain valve discharging under a head of 1,670 ft. at the Tata Hydro-Electric Scheme, India. The valve is fitted with a Glenfield Jet Disperser, which harmlessly dissipates 10,700 shock h.p.

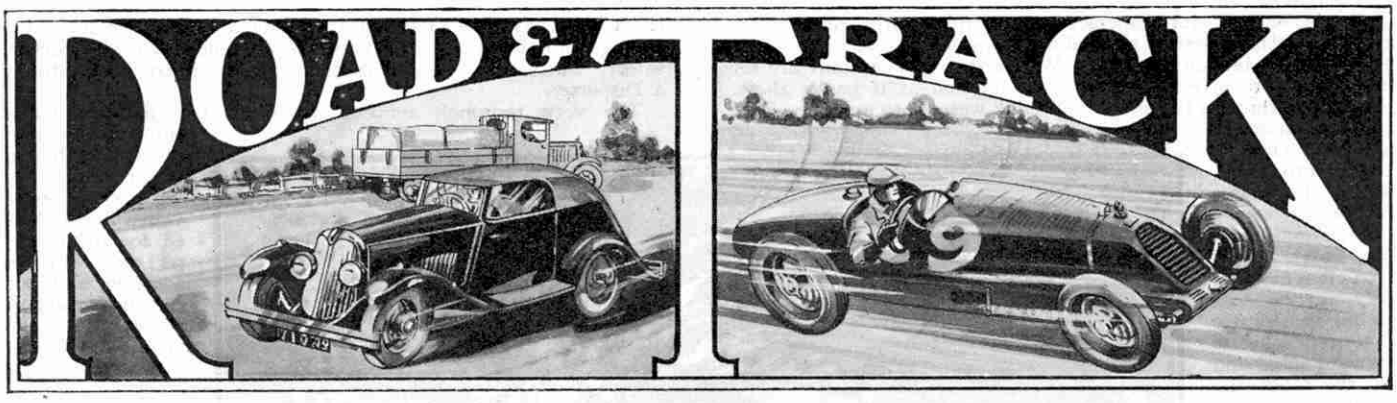
The very thorough aeration to which the dispersed jet is subjected is also of great value in improving the quality of reservoir water intended for town supplies. Where aeration, and not the dissipation of energy, is the principal object of fitting a Disperser, multiple nozzles are arranged to discharge vertically upward over a reservoir or settling pond, so that perfect aeration is obtained. This use of the device is particularly desirable in dealing with water from deep boreholes.

The Disperser nozzle can be inclined at any angle to suit particular circumstances. A vertical downward delivery requires the minimum space for the dispersed jet, and an upwardly inclined shower will occupy the maximum space, The area that would be covered by any dispersed jet travelling at a known velocity can be predicted within reasonable limits, and can be controlled by the design of the nozzle to suit requirements. This means that long narrow areas, or wide short areas, can be covered as desired.

As already pointed out, the dispersed jet from a "Glenfield" Disperser can be allowed to fall on bare rock without damage, and in some circumstances this arrangement is suitable. In others it is necessary to direct the water under control into a definite channel. A collecting pond therefore is provided, and this not only confines the discharge and limits the outflow as desired, but also reduces spraying and splashing. A deep pond is not necessary, as no water cushioning is needed, all that is required being sufficient depth to allow the discharged water to get away freely and quickly from under the escaping shower. A rough rock basin of suitable shape can be used for this purpose, though in some cases a walled pool with a low retaining dam, or weir is constructed.

One striking instance of the value of the "Glenfield" Jet Disperser is their use on penstock drain valves. There are 10 of them fitted to the 12 in. valves of this kind employed in the Tata Hydro-electric Scheme, India. These operate under a head of water 1,670 ft. and discharge vertically direct into the tail race without creating any disturbance. Each passes 63 cu. ft. per second and dissipates 10,700 shock horse power, and the lower illustration on this page shows one of them in use.

Larger nozzles, each 6 ft. in diameter, have been supplied for the Metur Cauvery Dam, also in India, discharging 1,000 cu. ft. per sec., and two giant "Glenfield" Jet Dispersers, each 8 ft. in diameter and with a capacity of 3,000 cu. ft. per sec. under a head of water 140 ft. have been constructed for use in New Zealand. Each of the units in use in New Zealand destroys over 50,000 h.p.



A New British Sports Car

A new British sports car capable of very high speeds has made its appearance. It is a supercharged 1½-litre model designed by the Squire Manufacturing Co. Ltd., of Henley-on-Thames, and is not streamlined. It is built very low and is not intended primarily for racing or for maintaining high speeds in competition work, but as a touring car for the driver who likes to have plenty of power in reserve, and to be able to corner with speed and precision. In accordance with what is now almost standard practice for speed cars, a pre-selector gear box is provided to enable gear changes to be made with the minimum of fatigue so that full advantage can be taken of the gear provided, and the car also has a hydraulic braking system. The wheels are set wide apart to increase the stability when cornering at speed.

Speed Roads for Fast Motor Travel

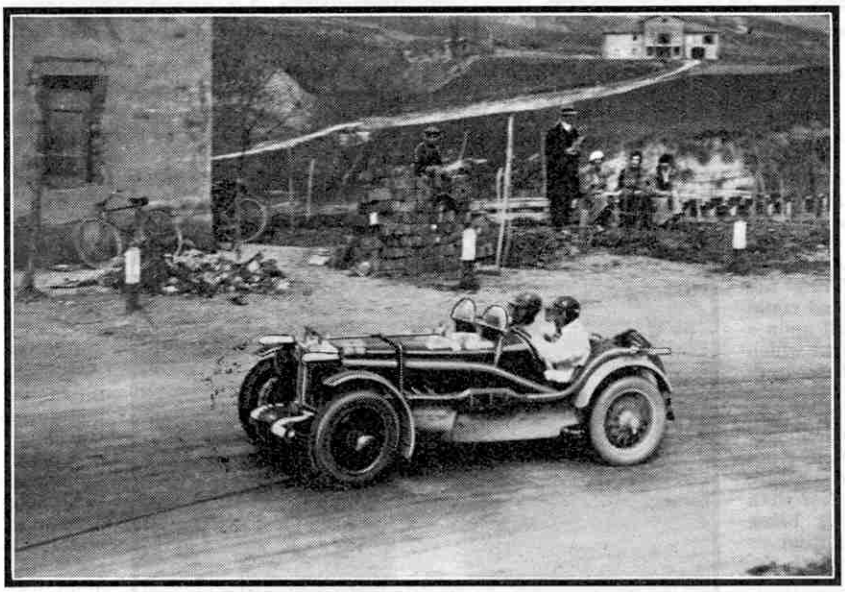
In view of the high speeds of which modern cars are capable I often wonder how long it will be before we have roads devoted solely to their use. Special roads known as "autostradu," have been built for this purpose on the Continent. They are provided with perfect surfaces and on them there are long stretches without crossings, while curves are banked as on racing tracks in order that high speeds can be maintained without risk. The construction of roads of this kind would help to reduce the alarming number of road accidents that occur daily on our roads, and a charge made for their use would help to meet the cost of making them.

When motor roads are available, motorists will be able to take full advantage of the high speeds of which modern cars are capable, and those to whom speed does not appeal or who have no reason for travelling quickly will still be able to make use of ordinary roads. Even more speedy cars will be produced and it is interesting to see how modern design is approaching the problem of providing them. Streamlining of course is prominent in these endeavours and many remarkable cars in which attention is given to this have already made their appearance. One of the most notable was the car designed by Sir Dennison Burney, a further innovation in which was the removal of the engine to the rear, the driver and his passengers sitting well in front of the rear axle. This plan is favourable to the production of a car of the "tear drop" or "pear" shape that would give very efficient streamlining and this would be the more effective in that the front wheels could be completely covered in.

A British Production Streamlined Car

The Chrysler "Airflow," which was illustrated and described in our issue for May last, was the first car to make any really revolutionary change in external appearance for many years, and its appearance has been followed by that of others, including the Singer "Airstream," claimed to be the first British production car with a streamlined body. This car is similar in outline to the Chrysler machine, having a curved front and being rather wider than normal. In spite of its unusual form, it provides spacious accommodation for four passengers. It has fluid flywheel transmission and independent springing for all four wheels.

As might be expected, experiments in streamlining have led to the design of "freak" cars, and several remarkable examples were to be seen at the Paris Motor Show held in the first week of October. Some of the streamlined bodies on view there were built so low that there was very little room for windows, and these cars promise to be death traps in the event of accident. Others were remarkable for their immense tails. The worst offender was a long two-door saloon, the tail of which is seven ft. behind the back axle, and the tapering rear section of another car on view consisted of about 20 sq. ft. of steel panelling that has to be lifted every time the petrol tank requires to be filled.



An M.G. Magnette photographed while taking part in the Italian Mille Miglia "round the houses" race. Photograph by courtesy of the M.G. Car Co. Ltd.

The Paris Show illustrated the general tendency to instal pre-selector and semi-automatic gear boxes. The Citroën front wheel model was a great attraction, and it is very gratifying to read of the excellent impression made by such British cars as the Rolls-Royce, the Bentley sports saloon and coupé, the Humbe "Pullman" and variou open two-seaters made by the Hillman and M.G. companies.

Exhibits at the British Motor Show at Olympia showed the same general tendencies as those at the Paris Show, but there was no exaggerated streamlining. A brief note on the general trend of design as exhibited at the Show is given in the Editorial page.

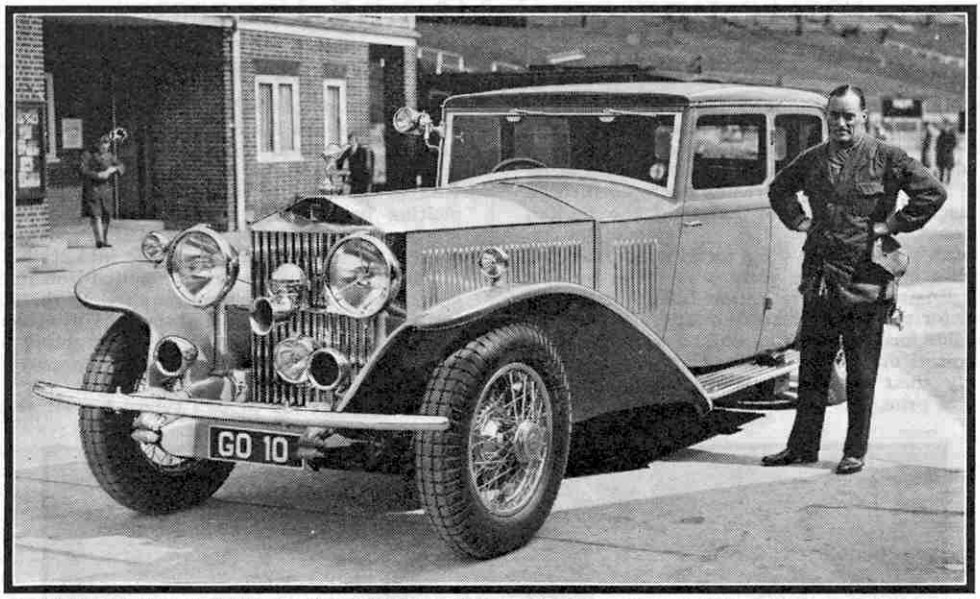
The World's Speed King

Although in recent years Great Britain has lost some of her cherished speed records, Sir Malcolm Campbell still holds the land speed record of 272.46 m.p.h., achieved in runs over a measured mile on Daytona Beach, Florida, in his famous car *"Bluebird."* This car has a Rolls-Royce engine, and it is interesting to learn that Sir Malcolm owns several Rolls-Royce cars, with one of which he is shown in the upper illustration on the next page.

Sir Malcolm has undoubtedly had the longest racing experience of any living British driver. He first took up the sport with a motor cycle and rapidly graduated to motor cars. For many years he has taken part in races on the Brooklands track and elsewhere, but has won most renown by his numerous attacks on the land speed records, made in this country, South Africa and the United States. It is well known that one of his most cherished ambitions is to be the first man to exceed a speed of 300 m.p.h. in a motor car. If he does decide to attempt this feat, it is almost certain that he will do so in the *"Bluebird."*

This Year's Racing Successes

The feature of this year's motor racing season on the Continent has been the success of the Mercédès, the German car that was prominent in earlier years of racing but has not achieved many striking successes in recent years. The revival of this famous car was marked by success in the French Grand Prix, and since then it has won practically every big Continental prize. It is not new for a single make of car to assert its supremacy throughout a racing season. The Alfa-Romeo did this last year, and previously Bentley cars won the Le Mans 24-hour race four years in succession. A new British racing car has been developed in the "E.R.A.," and it is to be hoped that next year this will prove a serious competitor to the Continental makes. I hope to publish photographs and a full description of this interesting car in an early issue of the Magazine.



Sir Malcolm Campbell, the world's most famous and successful racing motorist, with one of his Rolls-Royce cars at Brooklands. Photograph by courtesy of Rolls-Royce Ltd.

An interesting racing car also has been produced by the Triumph Company and although they do not intend to enter into a racing campaign next season, it is possible that the car then may be used for racing purposes by private owners. At present it will be sold as an ultra-performance two-seater and every one put on the market will be guaranteed to have covered a flying mile at a speed of more than 100 m.p.h. The "Dolomite," as the car is known, has a 17.85 h.p. engine that has eight cylinders, and a Wilson preselective and self-changing gear box is fitted.

Thrills at Brooklands

There were some very interesting and thrilling incidents at Brooklands during the 500-mile race of the British Racing Drivers' Club. It rained practically throughout the night before the race, and also during the greater part of the event itself, and the cars flashing round the track sent up such streams of spray that they might easily have been mistaken for motor boats! Great interest was taken in the event because of the large number of entrants capable of really high speeds, for this made passing difficult and sometimes dangerous, since at Brooklands cars travelling at speeds of more than 100 m.p.h. have to use the top of the track, which limits the available width as far as they are concerned to not more than 20 ft. The poor visibility and treacherous surface added to the troubles of drivers.

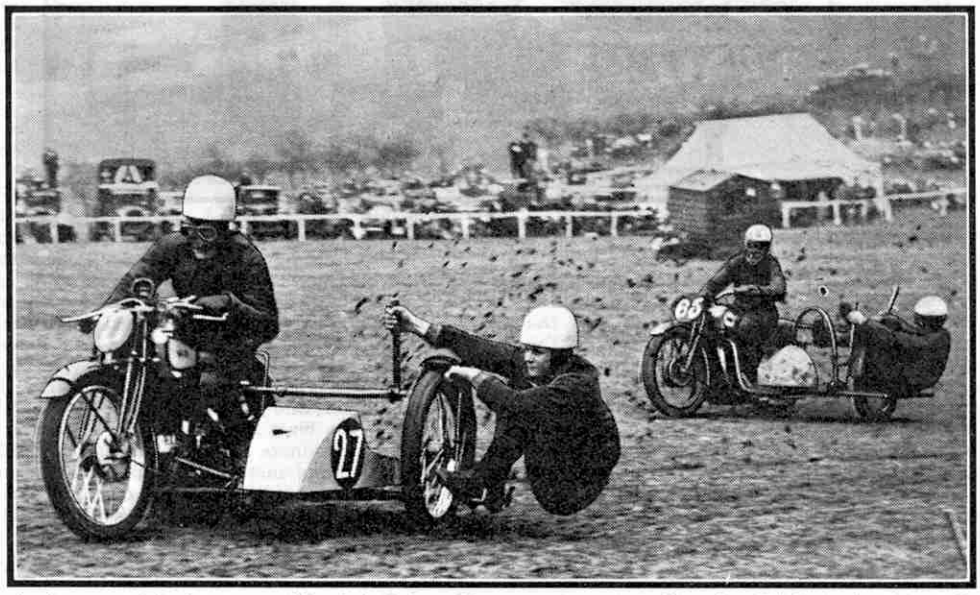
For some time before the event the favourite was J. Cobb's Napier Railton which is able to maintain an average speed of 120 m.p.h. round the track. G. Eyston's Magnette and Dixon's Riley also have lapped Brooklands at about 120 m.p.h. Of these three famous race drivers the only one to secure a place was Dixon who, in spite of being badly stung by a wasp just before the start, won at a speed of 104.8 m.p.h. A. W. K. Von der Becke and E. McClure were second in another Riley at a speed of 101.65 m.p.h. and J. D. Benjafield and A. T. G. Gardner third in an M.G. Magnette. Out of 32 starters only seven finished the race.

The Shelsley Walsh Hill Climb

A hill climbing contest almost invariably provides great excitement for the spectators, who are thrilled by the roars of the exhausts of giant cars as they race up the steep gradients of the chosen hill and make spectacular turns at the sharp corners and tortuous bends usually included. The Shelsley Walsh Autumn meeting organised by the Midland Automobile Club is no exception, for the course is 1,000 yds. in length and is marked by numerous sharp bends and an "S" curve.

This year the stiff climb was made more difficult by rain, for the course was water-logged. The presence of the two-litre E.R.A. already mentioned was a great attraction. With Raymond Mays at the wheel this car made the fastest climb of the day, the time being 44 secs., the next best being the 44 1/5 secs. accomplished by Whitney Straight in a Maserati.

What might have been a serious accident occurred to W. E. Harker, who was accelerating up the hill and approaching the "S"-bend when his throttle jammed open and the car charged the bank at full speed. Fortunately the driver was not badly hurt.



Anxious moments for the passengers! Acrobatics during a side car race at a grass track meeting. This interesting photograph was taken by one of our readers, W. M. Hunter, of London.

The E.R.A. also did well at the Donnington meeting early in October. The two-litre model successful at Shelsley Walsh was not present, but a smaller model driven by Raymond Mays won the 100-mile race for the Nuffield Trophy, at an average speed of 61.5 m.p.h. R. J. G. Seaman in an M.G. Magnette entered by Whitney Straight, was second at a speed of 59.02 m.p.h. while the third place was gained by M. B. Evans, also in an M.G. Magnette, who completed the course at an average speed of 57.06 m.p.h. The fourth place was gained by Earl Howe in a Delage.

Thrills were not absent at Donnington. In one of the earlier events two drivers touched wheels when they were fighting for a corner at high speed. One of the cars spun round and, going backwards, went right through the fence on one side of the course, while the other overturned.

Giant Storehouses for Liquid Iron

Interesting Steel-Making Processes

A MODERN steelworks is one of the most fascinating places in the world. The ruddy glare from the huge blast furnaces, the spitting and hissing of molten iron and cascades of dazzling sparks leaping from pools of white hot metal, provide a most awe-inspiring setting for the gigantic metal mixers, electrically-operated furnace charging machines, mechanical ladles for handling the molten metal, and powerful cranes.

The cover of this month's issue shows a big metal mixer installed at a Continental steelworks. This fine plant was made by The Wellman Smith Owen Engineering Corporation Ltd., London, to whom we are indebted for the cover illustration and also for that on this page. Metal mixers form an essential link between the blast furnaces and the converters or open hearth melting furnaces, and to understand properly their purpose it is necessary to know something of the general principles involved in the production of steel. Broadly speaking, the addition of carbon to iron, under certain conditions, converts the iron into steel, a metal of much wider application than cast or malleable iron, and which combines the most useful properties of both of these metals. Steel differs from iron only by the amount of carbon it contains, and may be made either by eliminating some of the carbon from iron having a large quantity of it, or by adding a proper quantity of carbon to pure iron.

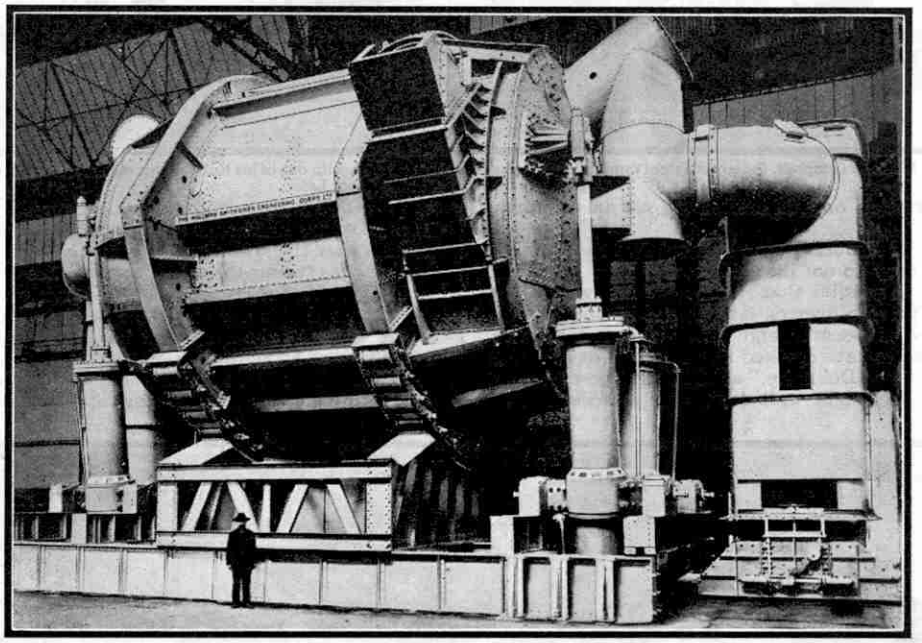
The chief methods of making steel to-day are the Bessemer and the acid and basic open hearth processes. The Bessemer process consists essentially of forcing air through molten iron and at the same time burning out the silicon, manganese, carbon and other impurities. These operations are carried out in a pear-shaped vessel called a converter, which is mounted on trunnions and is free to rotate or tip so that the molten metal can be run off. In the acid open hearth process the furnace is constructed of silica bricks, and pig iron is placed at the bottom and scrap is then added. When the mixture is melted a sample is withdrawn to test the amount of carbon, any excess of which is oxidised by adding ore. When the proportion of carbon is correct the metal and slag are drawn off into a ladle. In the basic open hearth process, magnesite bricks are used for all parts of the furnace that come in contact with the metal.

The first process in steel making is the extraction of the iron from its ore, which is done in a blast furnace. The liquid iron is run off at intervals through a special hole or vent provided in the furnace wall, and the metal flows out into a channel made in a large sloping bed of sand close to the furnace. This is known as a pig bed, and depressions or moulds are made in the sand into which the iron runs and forms "pigs," which each weigh approximately a hundredweight. In large works, however, the blast furnaces are usually worked in conjunction with the actual steel-making or refining plant, and in this case the iron from the blast furnaces is not run into pig beds, but is tapped into huge brick-lined mechanical ladles, which transport and empty the metal into the metal mixers.

In the manufacture of steel by both the Bessemer and the open hearth processes, the metal mixer is an important connecting link between the blast furnaces and the refining furnaces or converters. The metal mixer is employed as a collecting vessel or storage receptacle for molten iron, and it obviates the trouble of various qualities of iron being dealt with in the converter or melting furnace. The various tappings from the blast furnace are passed through the mixer so that a generally uniform quality of iron is collected for converting into steel.

The employment of already molten iron from the mixer reduces very considerably the time required at the converters or melting furnaces in the conversion of the iron into steel, consequently large outputs are obtained and fuel consumption in the steel furnaces is considerably less than would be the case if cold pig iron were employed.

Metal mixers are of two types, known as active and inactive. The inactive mixer usually is a cylindrical vessel with a holding capacity up to 1,500 tons of molten iron. The "Wellman" mixer shown on the cover of this issue has a capacity of 500 tons. Refining of the iron is not attempted in the inactive mixer, and the molten iron is simply poured into the vessel by means of a suitable opening situated on the top, and heat provided by producer gas, coke oven gas, or oil is applied to keep the metal in a molten state and the bath at the proper temperature.



A 1,000-ton "Wellman" Inactive type Metal Mixer installed at a Belgian steelworks. Note the massive rollers on which the Mixer is mounted so that it can be tilted to run off the molten iron. Illustration by courtesy of The Wellman Smith Owen Engineering Corporation Ltd., London.

The mixer is mounted on a massive roller track that enables it to be tilted so that the molten metal can be poured into the mechanical ladles that transport it to the converters or melting furnace. The tilting of the mixer is carried out by either electrically or hydraulically operated mechanism.

The inactive type of mixer is used particularly for the storage of hot metal received in bulk from the blast furnaces, and afterwards distributed as required to the secondary furnaces.

The active type mixer functions rather differently from the inactive mixer, and in addition to acting as a storage vessel for the iron from the blast furnace is used also as a preliminary refining furnace to eliminate some of the sulphur and silicon in the iron before the liquid metal is passed on to the open hearth furnace.

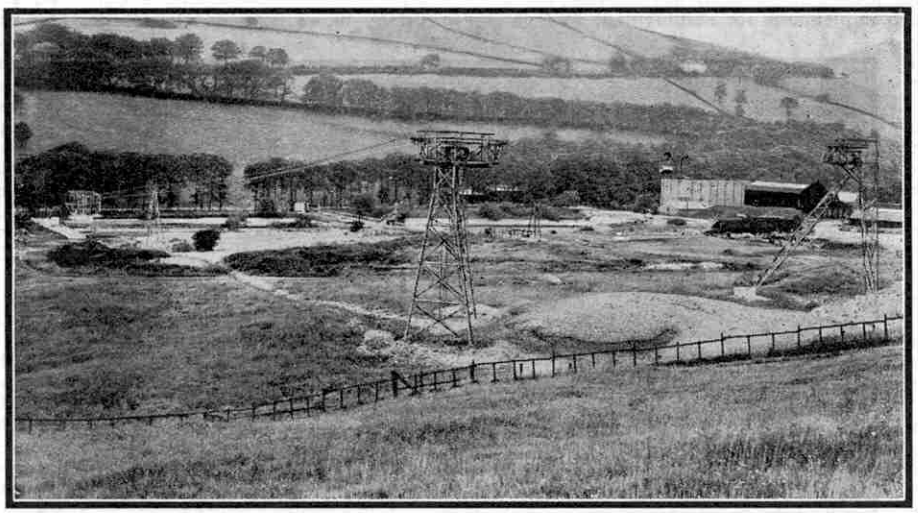
The capacity of active mixers does not exceed 600 to 700 tons, and their design differs from that of the cylindrical inactive mixer in many respects. As ore, lime, scrap, etc., have to be charged into the active mixer, it is fitted with charging doors. The mixer is arranged so that it can be tilted to facilitate pouring the metal into ladles, and slagging spouts are fitted to enable the slag to be tapped off as desired. The ports or burners of these mixers are generally mounted on travelling wheels so that they may be withdrawn from the ends of the tilting vessel to enable repairs to be carried out to the interior brickwork.

The lining of the mixer is either acid or basic according to the quality of the iron in use. Iron containing a great amount of phosphorous requires the lining to be basic or neutral, such as dolomite, magnesite, chrome, etc. Silica is used for lining acid mixers.

Handling Waste Pulp at a Paper Mill

An Interesting Drag Scraper and Ropeway

IN the manufacture of paper a large amount of refuse in the form of pulp is produced, and owing to its semi-liquid nature this material is difficult to handle and dispose of. At the paper mills of Messrs. Fletcher at Greenfield, Yorkshire, the problem has been successfully tackled by the installation of a special cable drag scraper plant working in conjunction with an aerial ropeway. The pulp, intermixed with a large quantity of water, is run into settling ponds, where it is allowed to stand and accumulate until it becomes of the consistency of stiff porridge. The material is then removed from the ponds and dumped on adjacent vacant land to make room for more. Four ponds are provided, and they are separated from each other by narrow embankments, each pond being approximately 200 ft. in length and 80 ft. in width.



The drag scraper and ropeway at Messrs. Fletchers' Paper Mills, Greenfield. The ropeway angle stations are visible in the foreground and the drag scraper in the background. Photographs on this page by courtesy of John M. Henderson and Co. Ltd., Aberdeen.

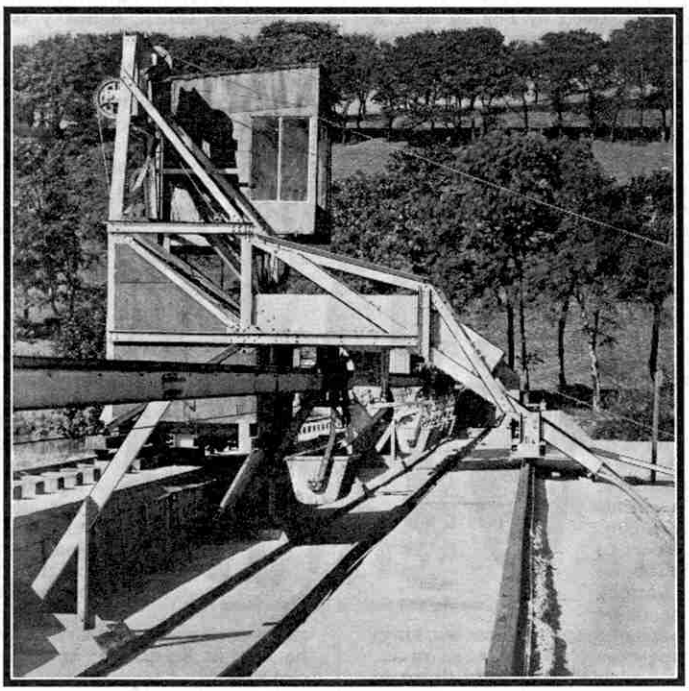
Until recently the ponds were cleared out by a scraper bucket plant and the waste was carried away in trucks, but it was found that the wagons could not get rid of the waste quickly enough. It was therefore decided to remodel the drag scraper and to provide an aerial ropeway for removing the waste material. The original plant was supplied by John M. Henderson and Co. Ltd., of Aberdeen, in conjunction with C. H. Johnson and Sons Ltd., of Manchester, and the reconstruction work was also undertaken by these firms. A general view of the remodelled plant as it now stands is shown in the upper illustration on this page.

The drag scraper consists essentially of a scoop or bucket, which is hauled backward and forward by means of wire ropes. The bucket has no bottom and is open at the front, and when travelling forward it scoops into the material to be removed and fills itself. Owing to the fact that the bucket is bottomless the load itself takes the rubbing action on the floor. When the bucket is filled it is hauled onward to a head carriage at the end of the pond and there it runs on to a metal ramp attached to the head gear that prevents the load from dropping out. The ramp rises to a height sufficient to allow the contents of the bucket to be tipped down a chute into the skips of the aerial ropeway. The scraper bucket is then hauled back by the tail or out-haul rope to get another load.

The winches for hauling the bucket backward and forward are housed in a head carriage that travels on rails laid on the central wall of the ponds, and tracks are laid at the outside ends for the tail carriages, each of which is provided with a return pulley for the out-haul rope and a heavy counterweight. At the end of the central track is a turntable by means of which the head-gear can be rotated to face either way and work on any of the ponds, all that is neccesary being to re-reeve the bucket hauling rope.

The bucket is operated by a double-drum winch mounted on the travelling head carriage, the operator's platform being raised above the winch, so that he has an uninterrupted view of the work. The winding drums can be engaged alternatively by friction clutches, and by means of automatically applied brakes a suitable tension is maintained in the rope that is being overhauled. The bucket has a capacity of $\frac{1}{2}$ cu. yd. and travels when loaded at a speed of 450 ft. per minute.

The machine is driven by a 20 B.H.P. electric motor and is capable of handling 40 tons of material per hour. Current for the motor is conveyed to the head carriage by a trailing flexible cable. Hand operated gear is provided for moving the head and tail carriages along the tracks.



The drag scraper head carriage and ramp, with a ropeway skip in position for loading.

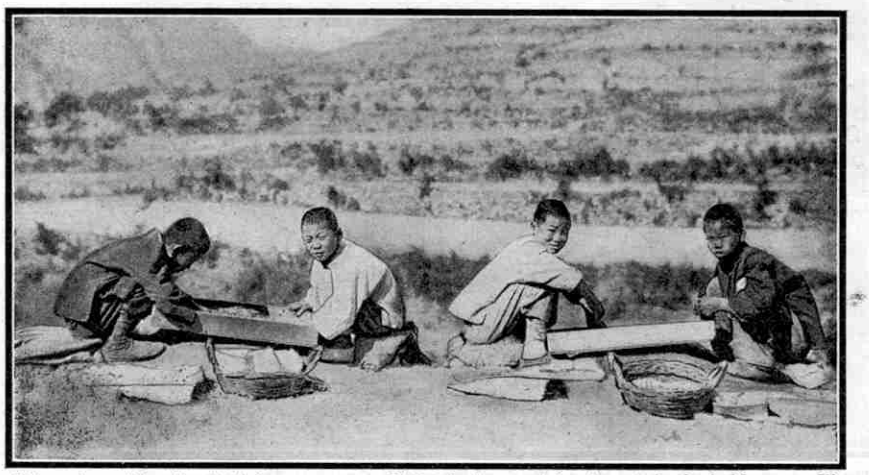
The aerial ropeway that carries the pulp from the ponds to the dumping ground is of the double rope type, and the skips pass along a loading rail at the centre of the track for the scraper head carriage. Uncoupling gear is fitted to the scraper carriage so that when a ropeway skip reaches the scraper it can be brought to rest exactly below the chute leading from the scraper ramp, down which the drag bucket discharges its load. Each skip holds $\frac{1}{2}$ cu. yd. of material, so that one load of the scraper bucket is sufficient to fill a skip. When filled the skip is again coupled to the hauling rope of the ropeway and passes on to the carrying rope.

The ropeway serves a rectangular area and passes over the waste ground where the pulp is tipped. At the far end of the tipping ground two return angle stations 60 ft. in height are placed, and the rope rises to that height at a steep inclination so as to leave plenty of room for tipping underneath. A skip tipping frame is supported on the ropeway carrying cable, and as each skip passes this frame a catch on the skip is automatically released and the skip discharges its contents, after which it passes on automatically round the angle stations and returns to the driving station.

How Man Became An Engineer

Toolmaking in the Stone Ages

MAN owes his superiority over the other creatures of the animal world to his ability to design, make and use tools to supplement the efforts of his hands. Probably he began by using sticks pulled out of bushes and clubs formed from the branches of a tree, and he may have shaped wooden implements for employment as levers. These suffered from the drawback that they were easily broken, however, and as wood is perishable, it is scarcely surprising that we have no knowledge of prehistoric tools of this kind. Their imperfections led to the search for better materials, and naturally primitive Man turned his attention to stone. One of his first tools undoubtedly was a crude hammer, consisting merely of a large piece of stone of convenient shape and size. Gradually he developed other tools for special purposes, and the relics that have been discovered show that he was ingenious in designing stone tools, and skilful in their use.

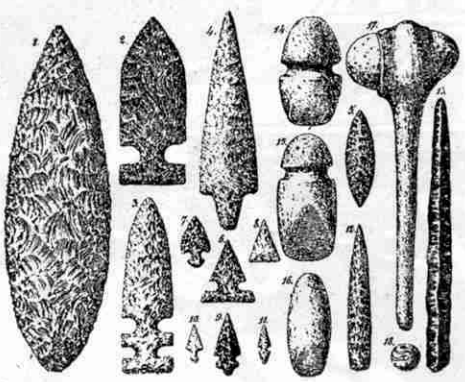


Chinese boys sifting the debris from caves near Peking in the search for stone tools of primitive man. We are indebted for our photograph to Professor G. Elliott Smith, F.R.S.

It is necessary to go to a considerable amount of trouble in order to find these ancient tools, for those that have survived have been buried in accumulations of earth, and are revealed only by careful search in river drifts and in the floors of the homes of the cave men. For instance, the crude chipped tools fashioned by Peking Man, a primitive human being who lived about a million years ago in caves in the hills near the ancient Chinese capital, were discovered only after patient sifting of the material with which the caves have been filled since he disappeared.

The stone chiefly favoured by early Man was flint, the fifth hardest substance in nature. For thousands of years he probably used the flint pebbles of river gravels and sea beaches, but eventually he discovered that the nodules in the chalk beds laid down ages ago at the bottom of the sea were better for his purpose. The chalk itself was formed from the shells of tiny shell fish that sank to the bottom of the sea when their inmates died. The water in which these creatures lived contained a certain proportion of silica in solution, and this was slowly deposited round the shells and other small objects to form the nodules of flint that to-day are to be seen in lines in the chalk cliffs or in the faces of limestone quarries, for flint, like sand and quartz, or rock crystal, is a natural form of silica.

Once he had discovered how to make use of flint for his implements and tools, primitive Man would be prepared to take a considerable amount of trouble in order to obtain good material, and no doubt he compared carefully flints from various sources. Eventually flint mines came to be worked with regularity, and the remains of many of these workings may yet be seen. There is an interesting example at Grime's Graves, in Norfolk, an ancient centre that has yielded flint right down to the present day. The three shafts of this mine passed through layers of inferior flint that were not worked, for Stone Age Man became very exacting in his requirements; but when a lower layer of good material was discovered, galleries were driven in all directions in order to give access to it. These galleries were skilfully excavated by men who used the antlers of deer for picks and the shoulder blades of animals for shovels, and the impress of a chalky thumb on the handle of a pick found in the workings is a silent reminder of one of Britain's earliest miners.



Weapons and tools of the New Stone Age.

At first, flint no doubt impressed primitive human beings mainly by its hardness, but at length they found that flakes could be chipped off by blows from another stone. This was the beginning of flint working, for the natural stones could now be shaped to make them suitable for special purposes. It is uncertain when Man first began to fashion tools in this manner instead of merely making use of any convenient pieces of flint. Certain small stones that appear to have been roughly shaped have been discovered in various localities, but it has not been decided definitely whether these really are tools of a very simple kind contrived by the earliest human beings, or whether the resemblance to Man-made implements is accidental. They have been named eoliths, a word meaning dawn stones, and a few of them were found near the remains of Piltdown Man, the earliest known inhabitant of Great Britain, who is believed to have lived about a million years ago.

The earliest form of worked stone implement that undoubtedly was the work of human hands is the hand-axe, or boucher as it is sometimes called; a heavy tool that is roughly pear-shaped and sometimes as much as 10 in. in length. It is characteristic of the river drift people, known as Chellean Man, whose remains have been found in practically all parts of the Old World; and usually it is found in association with a kind of scraper, a roughly-chipped semi-circular implement with a sharp edge. As greater skill was developed, finer and lighter hand-axes were made, their shape more nearly resembling that of the head of a lance, while the flaking was carried out in such a manner that wavy edges were given to them.

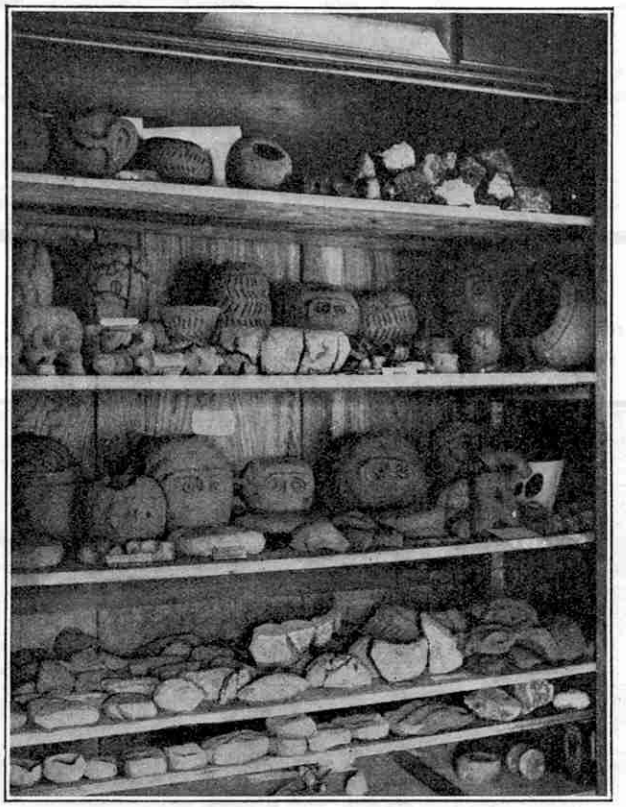
The next step in the development of flint tools came when a later race, the brutish-looking Neanderthal Men, discovered uses for the flakes chipped off when flint is struck a sharp blow. They learned how to produce flakes of various shapes and sizes, and fashioned these into tools for scraping, cutting, piercing and sawing, and also into lance heads that probably were fastened by means of thongs to wooden shafts. Neanderthal Man lived chiefly in caves, and excavations in the floors of these have brought to light not only tools such as we have described, but also the bones of many creatures now extinct, many of them showing the marks made by his stone knives, for he was a mighty hunter. The mammoth, the woolly rhinoceros, the bison, the reindeer and other cold-loving animals were his contemporaries, for the Great Ice Age had not passed away when he was in his prime; and these supplied him with his food and clothing.

After ruling the earth for a long period, probably for thousands of years, Neanderthal Man disappeared, giving way to a newcomer known to us as Aurignacian Man, from Aurignac, the name of the French village near which his remains were first discovered. Aurignacian Man was more intelligent than his predecessor, and is regarded as the earliest type of modern humanity of which we have certain knowledge. He seems to have made his way northward from an

African home, and his tools have been found in caves in almost all European countries, thus proving that his culture was widespread. In this country his delicately flaked scrapers and other tools were first unearthed in Kent's Cavern at Torquay, and they have also been dug out of the floors of caves in Derbyshire and in South Wales. They show him to have been a skilful and artistic worker. He made excellent use of flint and other stones, and even introduced entirely new materials in bone and ivory, making splendid awls and pins from the bones of horses and reindeer, and carving bone and ivory alike into beads and bangles.

Eventually Aurignacian Man was displaced by invaders who probably came from Central Asia. The newcomers are known as Solutreans. They were capable and skilful, and their settlements are recognised by the splendid workmanship shown in their flint tools, for they had effected a revolution in flint working by the discovery that flint could be flaked by pressure. This enabled them to produce beautiful implements, carefully shaped by forcing minute chips from the flakes by means of another stone or a piece of bone. For instance, their stone arrow-heads had well-developed projections for attachments to shafts, and their weapons generally were so much better than those of the Aurignacians that their supremacy is not surprising.

In their turn the Solutreans disappeared, and the Aurignacians again became prominent, perhaps emerging from the recesses of the Pyrenees and other refuges to which they had retreated on the advance of the invaders. Probably they had been unable to obtain flint in their mountain fastnesses, for their skill in working this material had deteriorated; but they had learned to make better use of bone, ivory and horn. They were provided with harpoons, that developed from simple spears into efficient weapons with two rows of barbs, and with excellent arrowheads and spear-heads, all made of bone. They were still hunters, but they had learned also to catch fish with the aid of hooks fashioned from small bones. They also made excellent bone needles, the eyelets being drilled out by means of tiny flint awls, and with these they sewed the skins of which their clothing was made. The men of this newer Aurignacian race are known to us as the Magdalenians and in their ways of life must have been similar to the Eskimos, who have claims to be regarded as their modern representatives.

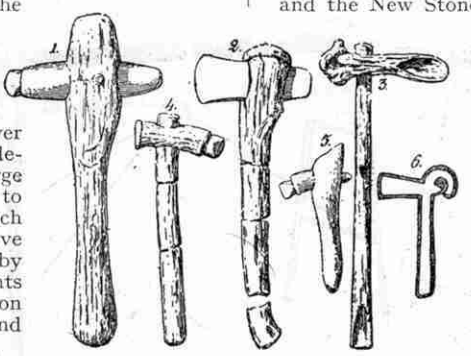


Stone implements unearthed at Glozel, France. Their origin has given rise to controversy, and it is believed that they are not genuine Stone Age relics.

As man became more intelligent and learned how to make better use of his resources he became more civilised, and what has been described as the Old Stone Age gradually gave way to the New Stone Age. The implements he made were still laboriously chipped from flint, but he became less content to make use of pebbles from river beds, and in his search for good material developed mining in the chalk districts on a large scale, the mines at Grime's Graves belonging to this Age. His tools and weapons were much finer than those of his predecessors, for he gave a sharp edge to his knives, axes and scrapers by careful flaking. Later he made his implements more efficient by grinding their cutting edges on a hard surface, and eventually the value of sand and water for this purpose was discovered.

The art of stone drilling also was introduced. Flints with holes in them occurred naturally, and wooden handles were fitted to these and securely bound by means of thongs of hide in order to convert them into axes or hammers. When suitable flints were unobtainable, holes were made by laborious chipping, but later pointed stones and pieces of stick in conjunction with sand and dust were employed for drilling. This gave much better results than chipping, for the tool was more controllable.

Another interesting feature of the New Stone Age was the introduction of the polished stone implement, for the inventive men of that age realised that their grinding processes were useful for smoothing the surfaces of their spearheads and other weapons as well as for giving them sharp edges. By this means they produced beautifully symmetrical implements that were admirably adapted for many purposes. The most typical of these is the stone axe or celt, but they made also a wide range of edged implements and weapons, including swords, hoes, knives and adzes similar in principle to tools employed at the present day.



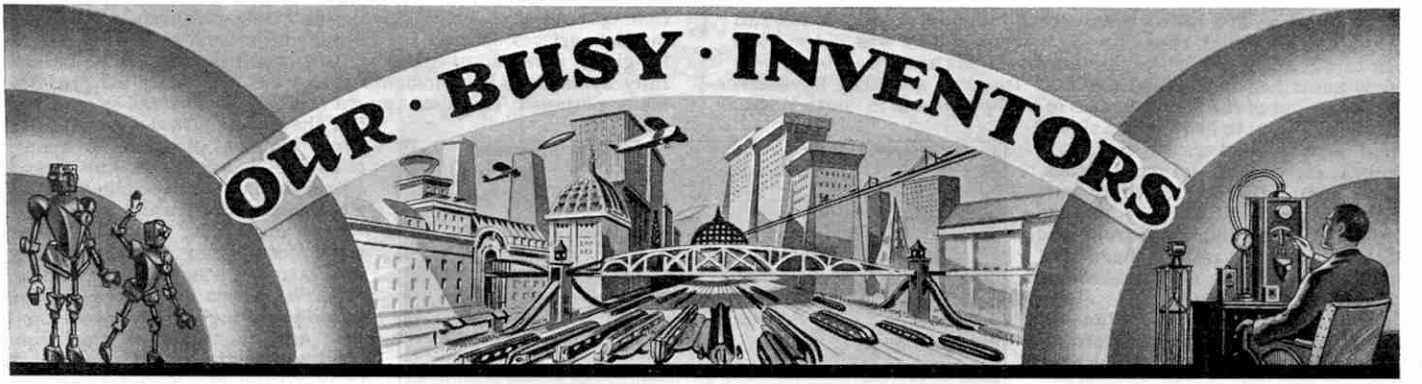
Polished stone axes characteristic of New Stone Age times.

It is interesting to find that the art of flint working, or flint knapping as it is called, is not entirely lost, for flints have been needed for various purposes throughout the Bronze and Iron Ages. For instance, they were employed in the flintlock guns that preceded modern firearms, and before the invention of matches the use of flint and steel offered the only means of obtaining fire. The industry has now fallen into decay, however, and practically the only remaining centre in which it is carried on is the village of Brandon, in Suffolk. The work of a modern flint knapper was described on page 692 of the "*M.M.*" for August, 1927. It includes the copying of prehistoric flint implements, for arrowheads, knives and spears made at Brandon are occasionally exhibited in museums that are unable to obtain genuine relics of the Stone Age, and only an expert can detect their modern origin.

The faking of flint tools and weapons is by no means unknown, and stories have been told of men who became so skilled in flint working that they were able to "find" Stone Age specimens of any required type as soon as a demand for them arose! The best means of ensuring that prehistoric relics are genuine is to see them in position during excavation, for the story of Man's development is written in the successive layers of earth and refuse that has covered his possessions, the oldest parts of the story being read in the deepest layers. The character of the remains, whether these consist of tools and weapons of the type we have described, or of pottery and other utensils, also guides experts, and every claim to the discovery of prehistoric objects is carefully tested before it is accepted.

The need for care was shown recently when astonishing finds of this kind were reported from Glozel, in France. Doubts were raised by the number and variety of the objects discovered, and by the ease with which they were unearthed. Careful examination showed that they formed an impossible mixture of "relics" of both the Old and the New Stone Ages, and the marks of metal grinding and drilling tools were found on many of them, although they were supposed to have been made long before metals were discovered. An enquiry therefore was held, experts examining the site of the discoveries in addition to the alleged remains; and it is now believed that these are not genuine products of the Stone Age.

Stone implements did not pass out of use until metal working became common, and this occurred in comparatively recent times. Bronze and copper were the first metals introduced, and it is probable that the Bronze Age began about 3000 B.C. while the Iron Age cannot be said to have commenced until 2,000 years afterwards. As Man was a thinking and inventive creature, who had already mastered fire at least 1,000,000 years ago, it will be seen that during the greater part of his dominance over the earth he has employed stone in order to overcome his enemies, both animal and human, and to supplement the efforts of his hands. It may be said that in certain parts of the earth the Stone Age has not yet come to an end. In Central Australia there are tribes living in a similar manner to that of Man's ancestors in Europe and other civilised centres centuries ago; and until explorers penetrated into their northern homes, the Eskimos of Arctic lands also lived in what were practically Stone Age conditions, for very few of them had discovered either native copper or meteoric iron.



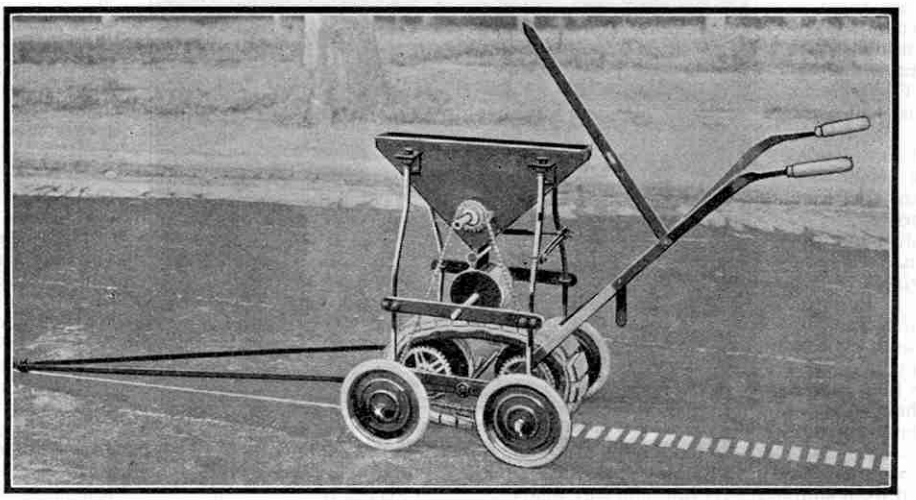
By P. A. Tent

Inventive Genius in Great Britain

In proportion to population Great Britain has more inventors than any other country in the world, and the varied character of their activities was revealed at the great Exhibition of Inventions held in October by the Institute of Patentees. When opening the Exhibition Lord Askwith, President of the Institute, remarked that inventive genius in this country has not been slow in spite of the depression, and pointed out that during the six months ending 30th June, no fewer than 19,403 applications were made for patents, an increase of about 1,000 in comparison with the previous six months. This is an encouraging contrast to the position in the United States, where the number of applications for patents in the past year was 3,000 less than in the preceding twelve months.

At previous Exhibitions Lord Askwith commented on the fact that the occupation of an inventor does not necessarily have any bearing on the products of his inventive genius. This year's exhibits have again demonstrated this, for they include a miniature greyhound racing track invented by a motor frame worker, an alarm clock produced by a medical specialist and a weather-proof deck chair contrived by a film actress.

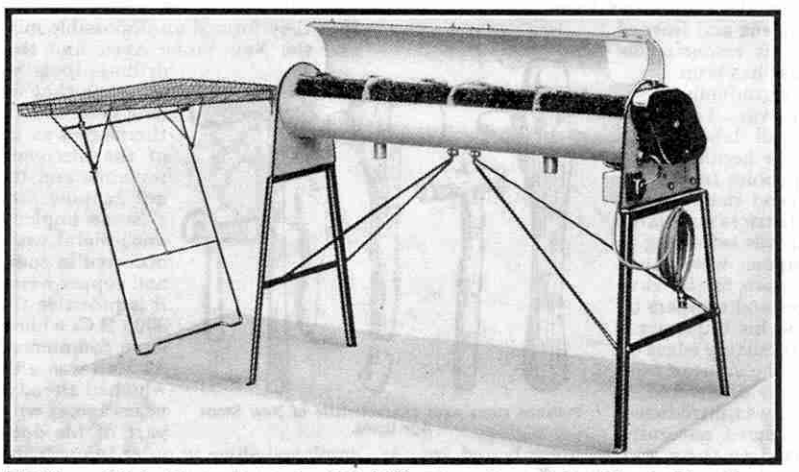
Other inventions to be seen at the Exhibition include mechanical means of cleaning windows that are awkward to reach; a device for cutting off the top of a boiled egg that only penetrates the shell and does not break up the yolk; a piano that plays colours instead of music, producing more than 1,000 different shades in any variation desired and giving continually changing colour effects that are said to be as beautiful and attractive in their own way as great music; and a door for poultry houses or similar buildings that automatically closes at dusk and opens in the morning. These and many other novel devices show that our inventors are hard at work and display ingenuity and originality in their ideas. I hope later to be able to give further details of the more attractive inventions on view, and congratulate the Institute of Patentees on the success of this year's Exhibition and on the magnificent work it is doing in encouraging those engaged in invention.



A device for painting white lines on roads with the aid of "Orolo" creeper track. It was designed by M. Capiomont, a French engineer, and our photograph is reproduced by courtesy of H. C. Slingsby, Paris.

Novel Use for Creeper Track

Since their introduction, creeper tracks have been applied to many remarkable purposes, and the upper illustration on this page shows another simple application that has been invented by M. E. Capiomont, a French engineer. This is the "Securitus" apparatus in which the "Orolo" track units of Roadless Traction Limited are employed for painting white lines on roads. The necessary paint is delivered from a container to the creeper track and this makes good contact with the surface as the apparatus is wheeled along the road. The marks produced are as good an indication to motorists and other road users as a continuous white line would be, and can be laid down with little effort and with a great saving of time. Economy also is claimed in the quantity of paint required.



The "Summit" electric egg cleaner, in which 3,000 eggs can be washed and brushed in an hour. Photograph by courtesy of Cope and Cope Ltd., Reading.

Egg Cleaning by Electricity

The second illustration on this page is an interesting reminder of the increasing extent to which machinery is now used in connection with agriculture, and of the widespread application of electricity. It shows an electric egg cleaner through which the eggs pass automatically to be brushed with hot water and finally dried. An electric motor drives the long brushes employed for cleaning the eggs and the temperature of the water in the cylindrical chamber through which these pass is raised to any desired degree by means of an electric immersion heater fitted with an independent switch. The eggs are fed in through an aperture at one end of the machine and are dry when they emerge on a wire tray at the opposite end. The machine is capable of dealing with 3,000 eggs per hour and these can be packed immediately they are delivered on the collecting tray, which is specially designed to facilitate their packing in boxes. The machine is simple to use and easily controlled, and occupies little space.

A Motor Car Testing Laboratory on Wheels

The efficiency of modern motor vehicles depends very largely on the care that is taken to provide them with the lubricants and petrol best suited to them. Petrol companies carry out experiments to decide the grade of oil and the type of fuel that is best suited to any particular make of car, and the illustration on this page shows a device that has been introduced by the Associated Oil Company, California, to enable accurate road tests to be carried out quickly and easily.

The device is set up in the rear of the car under test, the instruments and tanks for oil and fuel being mounted on an iron stand that is bolted to the floorboards. Each of the six tanks holds one and a half gallons, and petrol from any tank can be fed to the carburetter of the engine directly, or through a glass measuring vessel that contains one tenth of a gallon and is used when the consumption of fuel is being tested. The distance travelled during a trial is registered by a speedometer that is graduated to show when a thousandth of a mile has been covered, and thus the mileage obtained with any fuel can be measured with extreme accuracy.

A motor car testing laboratory that can be installed in a few hours in any make of car in order to find the best grades of oil and petrol in various climatic conditions. We are indebted to the Associated Oil Company, California, for permission to reproduce this photograph.

A car fitted with the device is literally a laboratory on wheels. In practice it is run in various conditions, ranging from high altitudes in the Californian Mountains to the heat of Death Valley, and gauges measure the temperatures of important parts of the engine and chassis. The information obtained in this manner enables the company to recommend the grades of oil and petrol to be used by the motorist on the Pacific Coast, whatever conditions of climate he may encounter, or to provide him with suitable grades if these are not already available.

Ingenious Building Devices

Among the many interesting new things to be seen at the International Building Trades Exhibition held at Olympia during September, one that seemed to me to mark a great advance was the "Turnall" building slab, manufactured by Turners Asbestos Cement Company of Manchester. This is a new building material of asbestos cement and is intended for use in the construction of flat or low pitched roofs. Slates, tiles, corrugated iron and similar materials used for roofing purposes are coverings only, placed on a structure of beams or girders that give them the necessary support. The "Turnall" slab itself is capable of carrying part of the roof load, however, for it consists of top and bottom sheets with corrugations connecting them. Thus it is virtually a continuous Warren girder, as is seen in the accompanying illustration showing a roof being constructed from slabs of this kind, and is so strong that a single slab supported on boards 5 ft. 6 in. apart can sustain a weight of more than half a ton placed in its centre. It is made in one piece and its total thickness is 2 in., the standard length and width being 6 ft. and 2 ft. 6 in. respectively. Slabs of this size can readily be handled by two men, and their use reduces the number of roof supports required.

Laying asbestos cement roofing slabs that are built like girders. Photograph by courtesy of Turners Asbestos Cement Co., Manchester.

Another interesting new material exhibited by this company was asbestos reinforced aluminium foil. This consists of asbestos paper on each side of which a thin sheet of aluminium foil is inseparably attached by means of a bitumen adhesive. The bitumen makes the sheet proof against damp and vermin, but the greatest value of the device is in maintaining an even temperature in buildings in which it is used. As most of my readers know, a bright metallic surface does not absorb heat readily and also is a poor radiator. A wall in which sheets of this kind are incorporated therefore acts as a heat insulator, retaining internal heat in cold weather, and keeping out external heat when the temperature outside is high. It is intended to be fitted behind the internal linings of walls with an air gap on each side of it, the low heat conductivity of air then adding to its effectiveness.

Aluminium is used in this interesting heat insulator because it is easily rolled into the thin sheets required and does not tarnish, and tests have proved the high efficiency of the combination of this metal with asbestos.

Lamp in Policeman's Truncheon

An interesting invention by a sergeant of the Metropolitan Police is a truncheon that incorporates a lamp. The truncheon is of the standard type and at one end is bored out in order to accommodate a battery and lamp. There is a switch on the handle, where it can be manipulated easily, and a spare bulb is carried in the other end of the truncheon. The entire lamp can be dismantled and removed quickly on unscrewing the lens.

The invention is not intended to replace the standard lamp carried by policemen, but to supplement it, and it has the advantage that a constable entering a dark building can have his truncheon ready in one hand and can use it as a lamp while having the other hand free to open doors or for any other purpose.

The inventor of this truncheon has previously distinguished himself by the production of interesting devices of various kinds, including a sand sprinkler for lorries and motor cars, that helps to prevent skids in wet weather, and a combined front and rear light designed for use on bicycles.

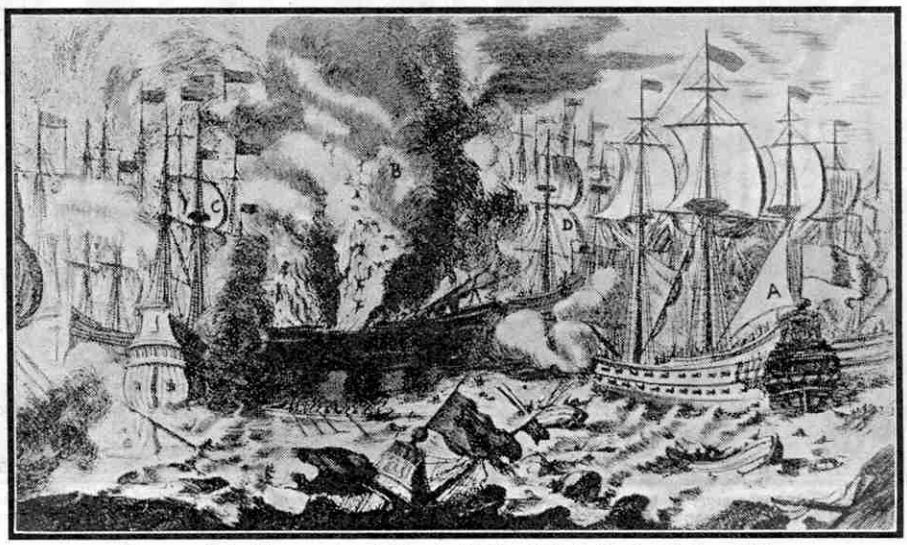
The Story of the Second Dutch War

II. The Four Days' Battle off North Foreland

By W. Coles Finch, M.I.C.E.

LAST month we related the events that led up to the Second Dutch War, and described the battle that was fought off Lowestoft on 3rd June 1665 and ended in a victory for the English fleet. The Dutch soon recovered from the shock of their defeat, and they set about re-organising their badly shattered Navy.

Admiral Tromp expected to be appointed to the chief command of the fleet, but De Ruyter arrived back from his West African exploits while the matter was still undecided, and he was given the appointment, in view of his greater experience. The two officers had never been attracted to each other, and De Ruyter's promotion further estranged them. On 11th October 1665 De Ruyter, with a fleet of 90 ships of the line, sailed from the Texel and voyaged southward until near the mouth of the Thames, where he cruised about apparently hoping to tempt the British fleet to put to sea and challenge him. No English squadrons emerged from the Channel ports, however, and about a month later he returned to Holland.



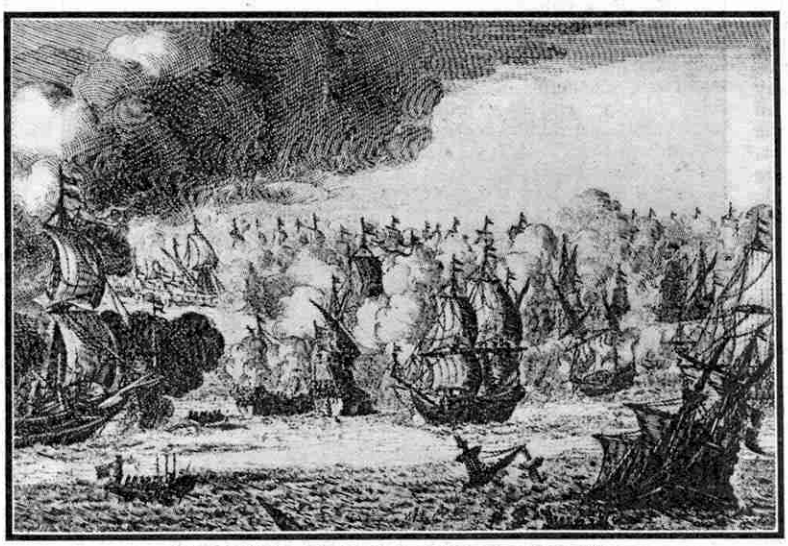
The scene during the second day of the great battle off North Foreland in June 1666.

In January 1666 France allied herself with Holland and declared war against England. The French had prepared a strong fleet of which 36 ships of the line, in addition to galleys and fireships, were at Toulon, and others were in harbour at Rochelle. The two portions of the fleet were under the chief command of Admiral De Beaufort.

In the meantime the English fleet had been repaired and its losses made good. The Duke of Albermarle was appointed to the chief command, with Prince Rupert as second. On 29th May 1666 the fleet, totalling 90 ships, anchored in the Downs, and while it was there a report reached London that the French fleet had put to sea and was on its way to unite with the Dutch fleet, which was believed to be still in harbour. The information was sent to the Duke, and Prince Rupert, in command of the White squadron, was ordered to sail at once and endeavour to intercept the French fleet in the neighbourhood of the Isle of Wight. This division reduced the Duke's force by almost one third and later seriously handicapped him, which was particularly unfortunate as the report that caused it was false. A day or so after the departure of Rupert it was learned that De Ruyter had set sail for the English coast with a powerful fleet, and Rupert was ordered to rejoin the Duke as quickly as possible. In the meantime the Duke had sailed northward on the lookout for any sign of his enemy.

The two fleets sighted each other when south of Dunkirk on the morning of 1st June. The Dutch fleet totalled 96 ships, with 4,716 guns and 22,000 men. The Duke had only 56 ships, but he did not hesitate to attack the Dutch, whose ships were strung out in a long irregular line. The English fleet advanced in a long column, a method that brought the van of the line within firing range a considerable time before the rear. It was not the best way of challenging the enemy, as the depleted English fleet needed to go into action in its entirety to strike a decisive blow at De Ruyter's large force.

During the running fight that developed many of the English ships were severely damaged by the enemy's fire, and the rough sea prevented them from using their lower or heavier guns and replying effectively. The battle had been in progress about three hours when the Duke observed that the fleets were getting close to the shallow waters of the French coast, and he ordered his ships to reverse. This evolution converted the English rear into the van, and the ships comprising it hastened to attack the Dutch centre.

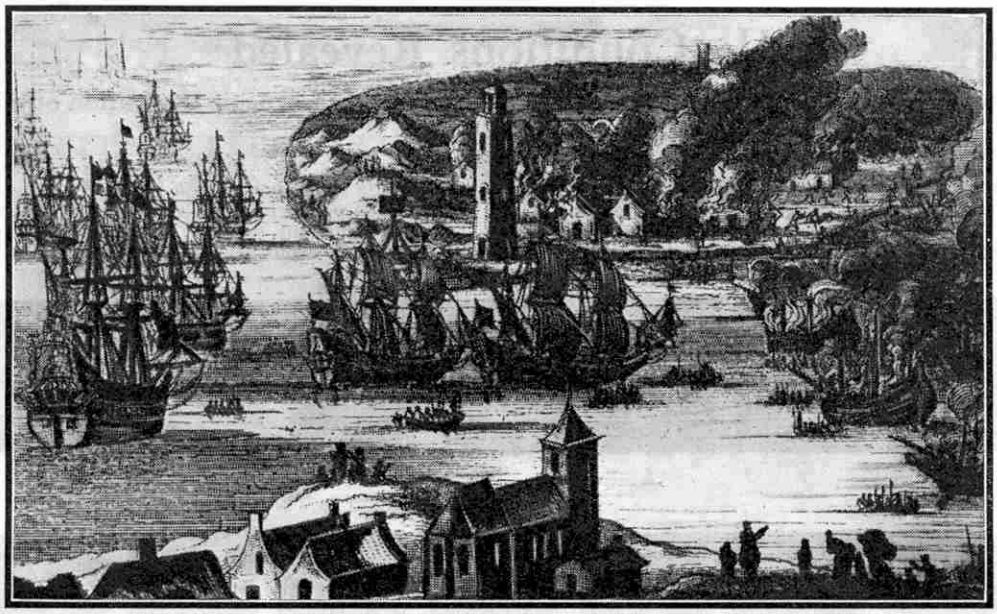


Close fighting on the fourth, and last, day of the battle.

In the confusion that followed three of the English ships became separated from the main body and were surrounded by the Dutch. One of them was the *"Swiftsure,"* commanded by Vice Admiral Berkeley, who, after making a great stand, was fatally wounded and died in his cabin while the Dutch were boarding the ship. The bravery of Berkeley won the respect of the enemy, and they embalmed his body and offered either to bury it with naval honours in Holland or to return it to England. After a desperate struggle the other two ships also fell to the enemy.

The *"Henry,"* commanded by Rear Admiral Sir John Harman, also had a gruelling time during that hectic first day of the battle, and was early disabled. A Dutch fireship grappled her on the starboard side, but a heroic lieutenant succeeded in dislodging the grappling irons and thus freeing her. A second fireship then bore down upon her and secured a hold on her port side. The *"Henry's"* sails caught fire, a panic broke out and about 50 of the crew jumped overboard, but eventually Harman restored order by drawing his sword and threatening to

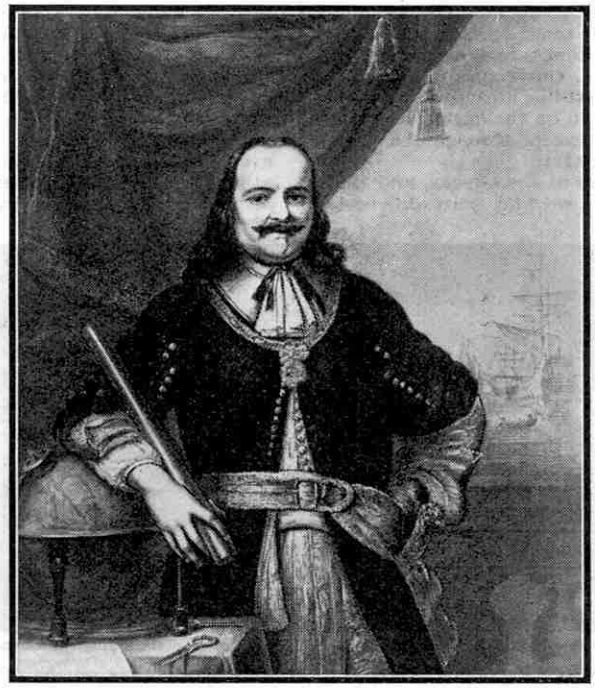
kill the next deserter. A topsail collapsed upon Harman and broke his leg, but he continued to rally his men, and when a third fireship drew near they sank her. The Dutch Admiral Evertsen then came up to the *"Henry"* and offered to spare her brave commander if he would surrender. "It has not come to that yet" replied Harman, and the next broadside from his ship killed Evertsen. Eventually the *"Henry,"* disabled but undefeated, escaped from the Dutch and reached Harwich, where she was refitted. Darkness put an end to the fighting, and the crews of both fleets spent the night in repairing their ships.



The English burning 170 Dutch merchant ships off Terschelling, Holland, on 9th August, 1666.

The battle was resumed early the next morning, when the Duke had 44 ships in action and De Ruyter about 80. The two fleets were sailing in opposite directions, and they passed and repassed each other during the day. In parts of the Dutch line the ships were so crowded together that they hampered one another in their firing. On one occasion as the leading ships of each line were almost abreast, Admiral Tromp, in command of the division then forming the Dutch rear, sailed out of the line in order to gain the advantage of the wind and bear down upon the English van. This action drew upon him the firing of many of the English ships, and his breach of discipline might have proved fatal had not De Ruyter observed his peril and hastened to his rescue. During the afternoon the Dutch fleet was reinforced by 16 ships of the line, and the English fleet retreated before the strengthened foe.

The Duke continued the retreat next day in an endeavour to avoid further close fighting until Prince Rupert's squadron could come to his assistance. This squadron came in sight about noon, and its timely arrival was greeted by cheers from the Duke's fleet, but the Dutch drew off. The Duke's ships turned to meet the newcomers, and in their haste several of them ran aground on the Galloper Sands, and the *"Royal Prince"* of 78 guns, commanded by Admiral Sir George Ayscue, stuck fast. She was immediately attacked by the Dutch, and although some English frigates hurried to defend her she surrendered before they could be of assistance. The Dutch failed to get the ship off the sandbank and therefore burned her.



Admiral De Ruyter (1607-1676).

Nightfall again ended the fighting, but next morning the English returned to the attack, and after two hours of heavy firing they broke through the Dutch centre. This was the beginning of a confusion that became general when the Dutch in turn broke through the English line. By evening the English ships were scattered over a large area, many of them were disabled and ammunition was running short. Then, at a signal from De Ruyter, his squadron, sailing almost abreast and keeping before the wind, completely broke up the English centre. The Duke gave way at this mass attack, and before he could rally his forces a thick fog descended and he retired. When the fog lifted next morning there was not an English ship to be seen, and the triumphant De Ruyter returned home with his ships gaily decked with flags.

The English losses in this long-drawn-out battle were heavy. Historians give various figures, but it is evident that 10 or 11 ships had been sunk or blown up and 11 taken to Holland as prizes, while about 2,000 men were killed or wounded and 2,300 taken prisoners. The Dutch did not lose more than six or seven ships, and their casualties totalled only 2,000 men killed or wounded, but it had taken them four days to defeat an enemy at first much weaker in numbers than themselves. In Holland the victory caused great rejoicing and a day was set aside for thanksgiving and bonfire celebrations, but in London the news of the defeat of the English, whom early reports had spoken of as the victors, cast a gloom over the city.

In this country there was much criticism of the conduct of the battle, and while the Duke, according to Pepys, the famous diarist, complained "that he never fought with worse officers in his life, not above twenty of them behaving like men," his subordinates in turn spoke bitterly of his handling of the affair. Pepys, writing on 10th June 1666, relates that "Sir G. Carteret and I walked an hour in the churchyard, under Henry the Seventh's Chapel, he being lately come from the fleet; and tells me, as I hear from everybody else, that the management in the late fight was bad, from top to bottom. . .He do, however, call the fleete's retreat on Sunday a very honourable one, and that the Duke of Albemarle did do well in it, and it would have been well if he had done it sooner, rather than venture the loss of the fleete and crown, as he must have done, if the Prince had not come."

Both the English and Dutch fleets were hurriedly repaired and re-provisioned. On 28th June De Ruyter put to sea again with a fleet of 88 ships of the line and frigates, 19 fireships and 10 small vessels. He cruised along the English coast and was still hovering about when the English fleet sailed from the Thames on 22nd July. This fleet was again commanded by the Duke of Albemarle, and consisted of 81 ships of the line and frigates and about 18 fireships. The two fleets did not get within firing range of each other until the 25th July, when another fierce battle was fought off North Foreland. The Duke's flagship *"Royal Charles"* was so severely damaged that she had to fall out of the line in order to effect immediate repairs, and the *"Henry"* had to do the same after a sharp engagement with De Ruyter's flagship *"Seven Provinces,"* during which the flagship was dismasted.

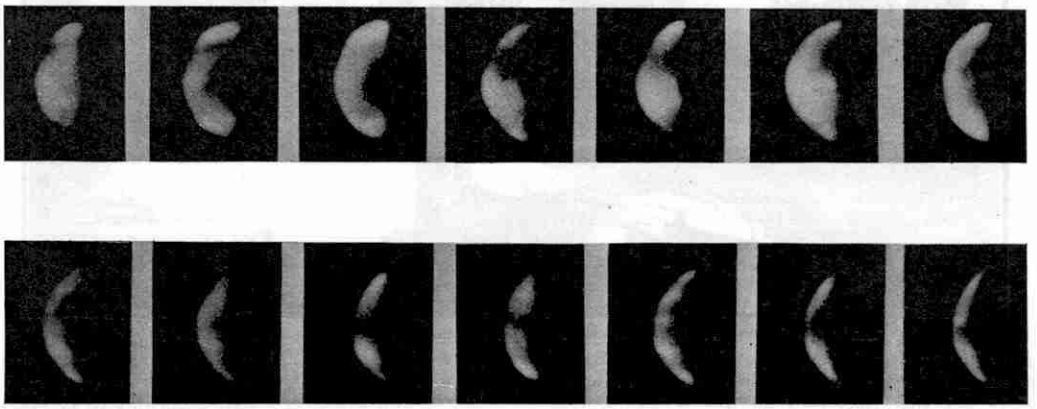
Admiral Tromp, in command of the squadron forming the rear of the Dutch line, once more allowed his zeal to outrun his discretion, and forsaking his place in the line he closed with the Blue squadron forming the English rear, which was commanded by Admiral Sir Jeremy Smith, and separated it from the remainder of the English fleet. At first Smith gave way before the attack, but later he forced Tromp to retreat; and by that time *(Continued on page 876)*

The Planets and Their Atmospheres

II—Conditions Revealed

By Dr. Walter S. Adams (Director, Mount Wilson Observatory of Carnegie Institution of Washington)

WE may now pass to a consideration of the results found for the individual planets. Beginning with Mercury, which has a mean distance from the Sun only about one-third that of the Earth, we find a planet of small mass exposed to intense heat from the Sun and, as we have already seen, always turning the same face towards it. Both visual and spectroscopic observations agree in showing that it can have no appreciable atmosphere, a conclusion that is confirmed by its appearance when observed crossing the disc of the Sun as a small black spot during one of its transits.



Ultra-violet photographs of Venus, the upper series taken in June and the lower series in July. The illustrations to this article are reproduced by courtesy of the Carnegie Institution of Washington, and were taken at the Institution's Mount Wilson Observatory.

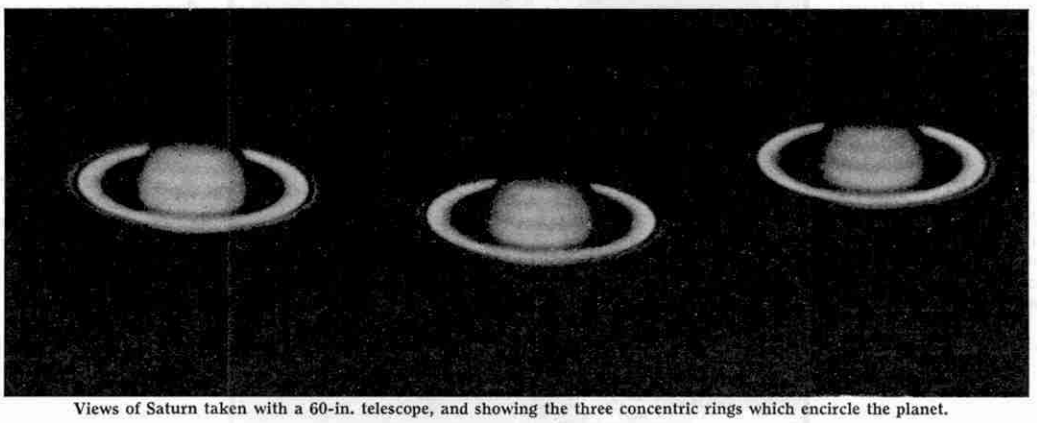
The temperature on the surface turned toward the Sun is extremely high, about 600 degrees Fahrenheit, or higher than the melting point of lead. On the side turned away from the Sun the temperature has not been measured but must be very low. The planet has certain dark permanent markings, and its surface is probably as rough as that of our Moon. Our conception of the surface of Mercury must be that of a desert-like area, intensely hot on the illuminated side and extremely cold on the dark side, with no possibility of change in its features except through the slow processes of disintegration due to temperature.

When we pass to Venus, the Hesperus of the Greeks, and the brightest of all the planets in the sky, we find quite different physical conditions. Its average distance from the Sun is nearly three - fourths that of the Earth and its mass about four-fifths as great. In many respects it is almost a twin to the Earth, having nearly the same size and density and about nine-tenths the surface gravity. An object weighing 100 pounds on the Earth would weigh 85 pounds on Venus. It has an extensive atmosphere, probably considerably less dense than that of the Earth, and is surrounded by what appears to be a perpetual layer of clouds. It is doubtful if we ever see the actual surface of Venus, the few vague markings that have been observed being quite possibly areas where the clouds have temporarily dissolved into a thick haze, much as fog dissolves over the Earth. This cloud layer unfortunately prevents us from carrying our observations of temperature and atmospheric composition to the surface of the planet, and even the rotation period of the planet is very uncertain.

Nearly all astronomers agree that, on general considerations, Venus should be better fitted than any other planet for the existence of such life as is known upon the Earth.

The next planet in order of distance from the Sun is the Earth, with its attendant satellite, the Moon. The temperature of the Moon, with no atmosphere to blanket and equalise the Sun's radiation, and with its long period of rotation, is subject to enormous variations. The surface exposed directly to the Sun's heat reaches a temperature close to that of boiling water, while that of the dark side is about 250 degrees below zero Fahrenheit.

An interesting question regarding the Earth is its telescopic appearance as seen from other planets. About half of the Earth's surface, on the average, is covered with clouds, and these would appear as conspicuous areas because of their high reflecting power. The seas and other large bodies of water would shine brilliantly when reflecting sunlight directly to the observer, but would be dark when seen at less favourable angles. Snow and ice-covered areas, varying with the seasons, would be prominent, and large forested regions, deserts, and grass land could probably be detected by their differing colours. All the surface features, however, would have to be viewed through the depth of the Earth's atmosphere, with its dust and haze and all the effects of scattering and reflection of light that it produces. The result, as Russell states, would be that an observer on Venus could hardly see objects less than 50 miles in diameter, and would have great difficulty in distinguishing permanent features because of varying clouds.

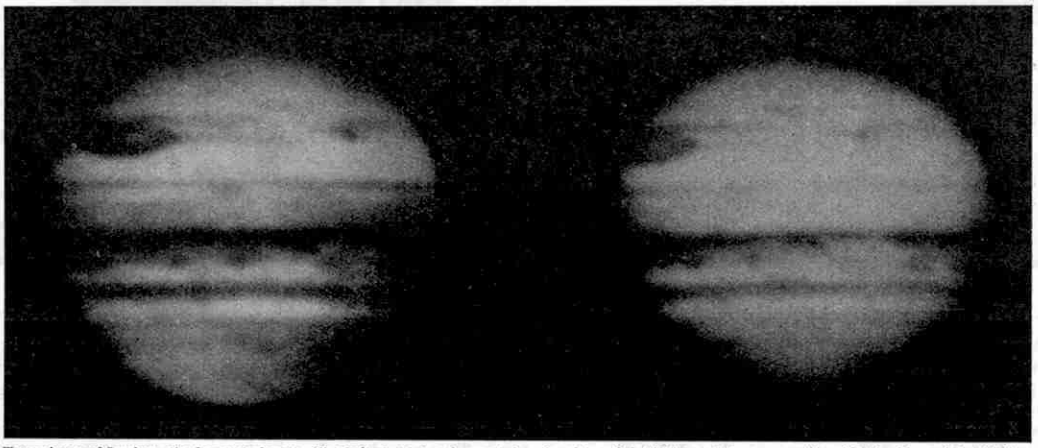


Views of Saturn taken with a 60-in. telescope, and showing the three concentric rings which encircle the planet.

The planet Mars has attracted more popular interest and has probably been observed more extensively than all the other planets combined. This is not surprising, for although it is a small planet with one-half the diameter and one-tenth the mass of the Earth, it comes nearer to the Earth than any other large planet except Venus. It has an atmosphere, although not a dense one, and unlike Venus we can observe its surface directly and find there numerous conspicuous and in some respects unique markings. The period of rotation, the Martian day, has been determined with great accuracy, and is 24 hours and 37 minutes, so nearly like our own that features on the surface of the planet are seen in closely the same position by an observer on successive nights.

The colour of the general surface of Mars is reddish, from which comes the name the ruddy planet; but nearly one-half of its surface

is covered by darker areas of a grey or dull green colour sharply bounded in many cases. At the poles of the planet are two brilliant white areas, the polar caps, which show conspicuous changes with the Martian seasons, being largest in winter and smallest in summer. The southern polar cap has been known to disappear completely towards the end of the summer season, but the northern always remains visible, although greatly diminished in size. It is difficult to conclude that these areas are not actually covered with snow or ice, although the rate of melting indicates that the deposit must be relatively thin.

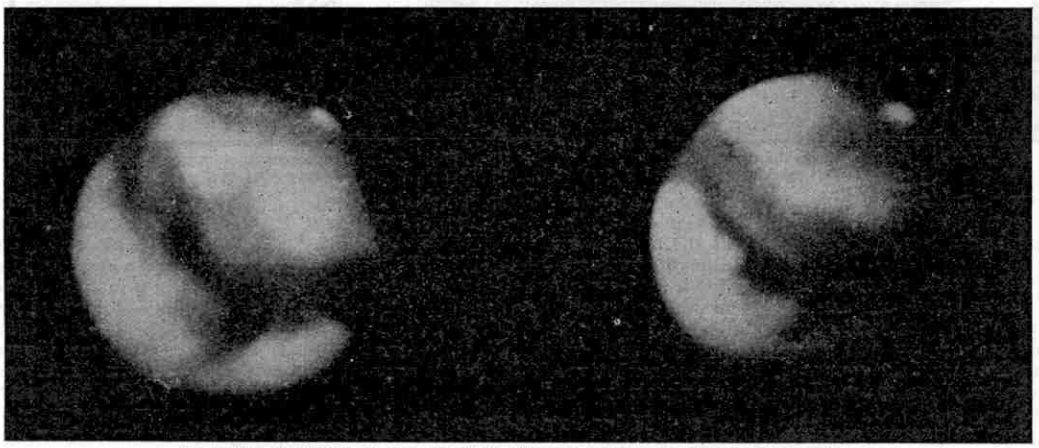


Two views of Jupiter, the largest planet. The left photograph was taken in ultra-violet light and the one on the right in blue-violet light.

Accompanying the melting of the polar caps are certain changes, which appear to be well established, in the colour of the large dark areas towards the equator of the planet. The general tendency is for these areas to become darker and more prominent in the spring season for each hemisphere, and to fade and become more yellow in the autumn of the year. Lowell and others have ascribed these changes to the presence of vegetation.

Associated with this effect is the vexed question of the canals on Mars, observed by Lowell as fine, narrow, straight markings, making a network covering much of both the dark and the reddish areas of the planet. That fine details are present on the surface of Mars that could form a basis for Lowell's observations is beyond question, but the existence of markings that can hardly be interpreted as of other than artificial origin is subject to serious doubt in view of the results of other experienced observers.

Measurements of the temperatures of Mars have led to most interesting results. When Mars is nearest the Sun the temperature of the surface exposed to the strongest solar radiation reaches about 60 degrees Fahrenheit. When Mars is farthest from the Sun this drops to about the freezing temperature. The polar caps may become extremely cold, more than 100 degrees below zero Fahrenheit. The important question of the temperature of the dark side of Mars is a difficult one to answer because of the very small area that can be observed even at the most favourable phase. The observations indicate that the temperature must be at least 40 degrees below zero, and perhaps considerably lower.



Two views of Mars taken with the 60-in. telescope, at intervals of about one month.

If we sum up conditions on Mars, we find a small planet with little water vapour and very little oxygen, whose sunlit surface in the tropics only at the most favourable times reaches temperate conditions, and during much of the time is at a freezing temperature. Every 24 hours, as the planet rotates, the surface reaches a temperature of at least 40 degrees below zero. It is clear from the observations that the atmosphere of Mars is of such low density that its shielding effect is small, and that the surface warms and cools with a rapidity far greater than that of any desert on the Earth, and only less than that of the Moon itself. Under such conditions, if we can conceive of any vegetation on Mars it would seem that it must be of a rudimentary type that requires little nourishment from the atmosphere and gives out correspondingly little oxygen. The suggestion has been made that the free oxygen that may in past ages have formed a part of the atmosphere of the planet has been exhausted in the oxidation of the surface, and the general colour of the surface is quite in keeping with this possibility.

As we pass outwards in the solar system beyond Mars we come to the zone of the asteroids, of which some 1,500 are known and many thousands doubtless exist. They are small bodies, the largest less than 500 miles in diameter, moving in independent orbits around the Sun, and far too small to retain an atmosphere. Like the Moon, they must heat quickly on the side toward the Sun and cool quickly as the Sun's heat leaves their surface. The force of gravity is so low on the smallest of these asteroids that a hypothetical man could readily throw a stone from the surface into space, and thus create an independent planet.

With the major planets Jupiter, Saturn, Uranus and Neptune, we pass to an entirely different class of physical objects. They have large masses, rotate rapidly, and are at such great distances from the Sun that they receive very little heat.

Jupiter and Saturn have extensive systems of satellites, miniature solar systems in themselves. They have dense atmospheres of great depth that prevent us from seeing down to the surfaces of the planets, if such surfaces exist, and all their markings are subject to change, although in some cases they persist for long periods. Clearly they are atmospheric phenomena and may take place on an enormous scale. The great red spot on Jupiter, for example, was 30,000 miles long and 7,000 miles wide and lasted for many years, gradually becoming rounder and smaller until it has now almost disappeared. The white spot on Saturn discovered this year at the Naval Observatory was also very large and changed its form with great rapidity.

A remarkable fact about Jupiter and Saturn, and perhaps about Uranus and Neptuue as well, is that they do not rotate as solid bodies, but more rapidly near the equator than in higher latitudes. The belted appearance of the planets, so striking in the case of Jupiter and Saturn, is probably associated with the character of their rotation.

No description of the major planets is adequate without some reference to that unique feature of the solar system, the rings of Saturn. Although of extraordinary beauty and great mathematical interest, physically they are of less importance since they possess no atmosphere. It has been shown, both by measurements of the reflected light and observations of the motions of different portions of the rings, that they consist of a swarm of little satellites, each of which follows its own orbit about the planet. The thickness of the ring is extremely small, not more than 10 miles at most; and when its plane is turned toward the Earth it is lost to sight for a few days even in the most powerful telescopes.

The latest and most distant addition to the number of known planets is Pluto. Its mean distance from the Sun is about 40 times that of the Earth, and its mass, the determination (*Cont. on page 944*)

Vacancies for R.A.F. Apprentice Clerks

The Air Ministry announce that vacancies exist in the Royal Air Force for well-educated boys, in possession of an approved first School Certificate, between the ages of 15½ and 17 years 3 months, to enter as apprentice clerks in October and January next. Entry will be by selection from among applicants with the necessary educational qualifications. Preference may be given to candidates who on entry will have attained the age of 16 years.

Detailed information regarding the apprentice clerk scheme can be obtained from the Secretary, Air Ministry (Apprentice Clerk's Department), Gwydyr House, Whitehall, London, S.W.1. Successful candidates will be required to complete 12 years on regular Air Force service after reaching the age of 18. At the age of 30 they will normally return to civil life, but a limited number may, subject to service requirements, be permitted to re-engage to complete 24 years' service qualifying for pension.

Boys entered under this scheme will normally receive 18 months' training in clerical duties, typewriting, practical office routine, and shorthand or pay and store accounting. During this period their general education will be continued under a staff of graduated teachers.

An apprentice clerk at present receives pay at the rate of 1/– a day for the first year and 1/6 a day afterwards, until he has both attained the age of 18 and successfully completed the course. Thereafter pay is at present issuable at rates commencing at from 3/– to 4/6 a day, according to the degree of success achieved at the final examination. Free board and lodgings and an allowance for uniform also are provided.

* * * *

Nearly all the machines of Railway Air Services have now been fitted with radio transmitting and receiving equipment. Several of them are provided in addition with a special "homing" apparatus.

A New Airspeed Monoplane

Two remarkable machines produced by Airspeed Ltd., the "Ferry" and the "Courier," have already been illustrated and described in the *"M.M."* Another type, known as the "Envoy," has now been produced by the same firm. This machine is very similar to the "Courier," being a low wing monoplane, but it is of the twin-engined type. The wings and fuselage are made of plywood and spruce, and the fuselage is covered with plywood, doped fabric being used for the covering of the wings.

A Keystone bomber that forms the standard equipment of many of the United States Bombardment Squadrons. The latest version of this machine has a speed of 120 m.p.h. Official photograph, U.S. Army Air Corps.

The machine is 52 ft. 4 in. in span and 34 ft. 6 in. in overall length and is fitted with two of the new "Wolseley" engines. It is capable of carrying a load of 2,233 lb., when it has a maximum speed at sea level of 170 m.p.h. and a cruising speed of 150 m.p.h. The stalling speed at full load is 63 m.p.h.

We hope to publish illustrations and a fuller description of this interesting machine in an early issue.

Flying To and From School

More and more children are now making use of Imperial Airways services to fly to and from school, and in addition to those travelling between London and the Continent, quite a number make long-distance journeys along our Empire routes. Boys or girls who are at school in England, and whose parents are at some point thousands of miles away that is served by one or other of the Empire air lines, can now fly home for the holidays in a few days. By surface transport such a journey might take weeks and, remembering that the trip both ways has to be taken into consideration, would often be impracticable.

Mail Air Route Across Canada

Plans have recently been prepared and are now being investigated by the Canadian Government for the inauguration of an air mail route across Canada. If the scheme is proceeded with, the service will be ready for operation late in 1935. The schedule provides for a west-bound aeroplane to leave Montreal at 8 p.m. every day and to reach Winnipeg in seven hours. The Pacific coast would be reached at Vancouver by noon on the following day, the total flying time being 16 hours. It has been suggested that the aeroplanes employed should have a cruising speed of about 170 m.p.h. and a maximum speed of 200 m.p.h. Mail from Toronto would link up with the airway route by a connection at North Bay or Sudbury.

If this new service is approved by the Government of Canada, it will be the fruition of work that has been in progress during the past two years in connection with the Government's unemployment relief projects. Unemployed single men have been engaged since the autumn of 1932 in preparing aerodromes and landing grounds along the line of the route, and particularly in the difficult country of Northern Ontario. Approximately 10,000 men have been steadily employed at a cost of about £500,000, but the landing fields have yet to be equipped with boundary lights, beacons, searchlights and wireless apparatus.

Glider "Trains"

Russian aeronautical engineers have recently produced a big passenger-carrying glider designed to be towed, together with a number of similar "air coaches," behind an aeroplane. The new machine is capable of carrying five people, is 59 ft. in span and weighs about 990 lb. It is estimated that the aeroplane for use with which the glider was designed will be capable of hauling a "train of the air" at an average speed of about 100 m.p.h. The gliders would be "slipped" on arrival over aerodromes.

New Wing Construction to Save Weight

A new method of wing construction that has been developed by Mr. F. Duncanson, a well-known British aeronautical engineer, is claimed to simplify the construction of aeroplane wings and also to make it possible for a great saving in weight to be made. Some idea of the success of the construction can be gained from the fact that when a wing was built on the new principle and fitted in the Blackburn "Segrave," the tare weight was reduced from 2,246 lb. to 1,971 lb. The old wing and the petrol tanks in it weighed 618 lb., while the replacement is only 358 lb. in weight. This saving in weight is being put to useful advantage by increasing the carrying capacity of the "Segrave" from a maximum of four occupants to five.

Wings built on the new Blackburn-Duncanson system are constructed around a tubular spar made of duralumin that tapers towards the wing tips and is hollow so that it can be used as a petrol tank. The principle is somewhat similar to that of the Stieger Monospar system of wing construction described in our issue for January, 1933. The tube is built up of two halves provided with special internal rings to stiffen them, while external corrugated reinforcements are also provided on top of the spar. The wing ribs are attached to the spar by rivets and angle pieces.

Unofficial Landplane Speed Record

The world speed record for landplanes was exceeded at the National Air Races held at Cleveland, in the United States, by Mr. Douglas Davis, who attained a speed of 306.215 m.p.h. The attempt on the record did not exceed the previous record by the 4.97 m.p.h. required by the National Aeronautic Association of America, and consequently it will not stand as a world record. Later on at the same meeting Mr. Davis was unfortunately killed when he lost control while cornering.

The existing world landplane record is 304.9 m.p.h., set up by J. R. Wedell in a Wedell-Williams monoplane at New Orleans on 17th February, 1934.

A Bradshaw of the Air

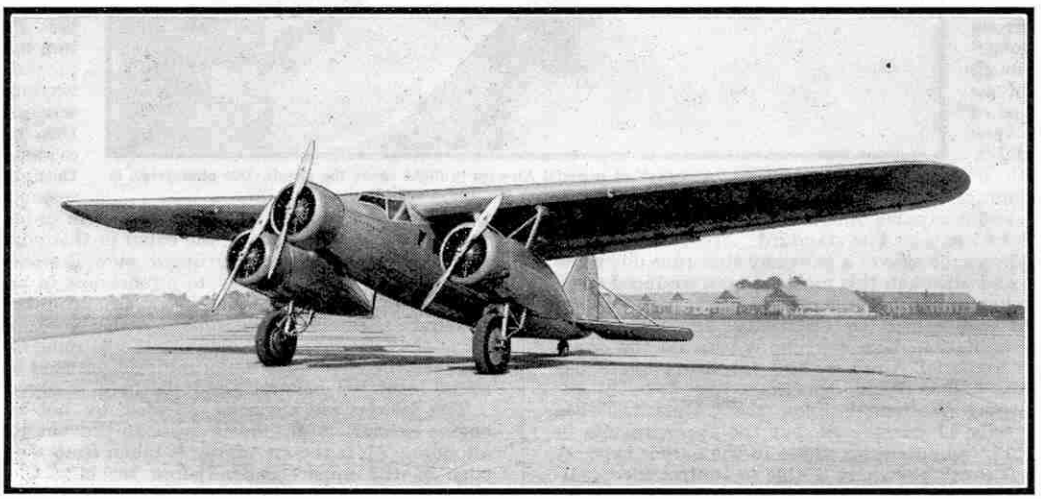
Last month the first "Bradshaw of the Air" was published. This gives full details of the entire European aerial system and other aerial systems beyond Europe, and is as accurate and complete as it is possible to make it at present. There are nearly 100 pages in the book, and all fares, schedules, departure and arrival times are given, making the volume invaluable to those who are interested in aviation.

This interesting photograph shows a D.H. "Dragon" of Provincial Airways Ltd. Photograph by courtesy of Mr. C. A. Gill.

Aeroplane that Cannot Stall or Spin

It is claimed that an aeroplane designed by M. Henri Mignet, a French experimenter, cannot stall or spin. The machine has been built and the inventor has already flown in it for more than 40 hours, and has made more than 80 take-offs.

The new machine is a biplane and is very revolutionary in design. It is not provided with ailerons or any other device to give lateral control, and the wings are staggered so much that the leading edge of the bottom one is directly below the trailing edge of the upper one. This tends to produce a "slot" effect. The front wing is hinged to act as an elevator, the aeroplane being made to climb or dive by altering its angle, and the bottom wing is used as a tailplane. There is no rudder bar, the rudder being moved by the joystick.



A three-quarter view of the Fokker FXX, which was fully described in our last month's issue. Our photograph is published by courtesy of N. V. Nederlandsche Vlietuigenfabriek.

Another Low Wing Monoplane

A machine that has a cruising speed of 150 m.p.h., a landing speed of 42 m.p.h. and a range of 700 miles on one filling of fuel, has been produced by Philips and Powis Aircraft (Reading) Ltd. The machine, which has been named the Miles "Hawk Major," is a two-seater low wing monoplane of wooden construction, and is similar in design and appearance to the Miles "Hawk." It has an entirely redesigned undercarriage, however, and is provided with powerful and highly efficient wheel brakes. A special finish that has been developed by the firm is used on the machine, and this makes the fuselage and wings much better in appearance than most motor cars. The "Hawk Major," which costs only £750, will be illustrated and described in an early issue of the *"M.M."*

French Fighter with Speed of 267 m.p.h.

Machines of the single-seater fighter type now being built at the Dewoitine factory in France have a top speed of 267 m.p.h. Other types, identical except for the fact that they use lower-powered engines, are capable of attaining speeds of 250 m.p.h. The engines employed are of the Hispano-Suiza, Lorraine, Farman and Gnôme-Rhône types.

Records for French Airwoman

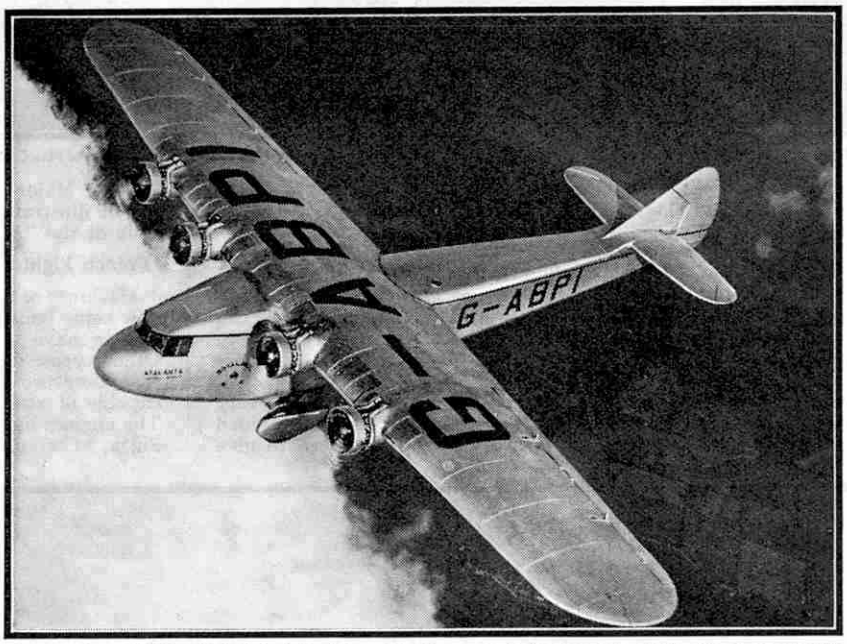
Several new records were set up at Istres, France, a short time ago by the well-known French airwoman, Mlle. Hélène Boucher, in the Caudron low wing monoplane in which the Deutsch de la Meurthe race was won this year. The most important of the records was for speed over 3 km., the new figures being 276 m.p.h.; and the womans' speed record over 100 km., which was raised to 256.2 m.p.h. The previous holder of this was Miss Amelia Earhart. An international speed record of 254.2 m.p.h. was also made. Mlle. Boucher now holds no less than seven world's records, including one for altitude in the women's category set up in August 1933 when she flew to a height of 19,359 ft. at Orly aerodrome in France.

Machines Used by Imperial Airways

Huge Air Liners combine Speed with Luxury

IN the early days of civil aviation the saving in time that could be made by means of an aeroplane was considered sufficient in itself to induce travellers to go by air. Little attention was paid to the comfort of passengers, and in cold weather it was often necessary for them to be wrapped up almost as much as if they were in the cockpit of an open machine. It was soon realised, however, that if the aeroplane were to become really popular it was necessary for air travel to be made as comfortable as any of the ordinary methods of surface transport. From that time steady progress towards comfort has been made, and in these days air liners are quite as pleasant to travel in as the first-class coaches of railway trains. The idea of comfort has been extended also to private flying, and practically all the light aeroplanes that are now produced are of the cabin type, or are provided with special covers that can be put over the cockpits to protect the occupants.

The most luxurious machines built in this country are undoubtedly those that have been designed for operation on the services of Imperial Airways. These types include the Armstrong Whitworth "Argosy" and "Atalanta," the Handley-Page "Heracles," and "Hannibal," and the Short "Scipio" and "Scylla"; and in this article we intend to give brief details of these machines, paying particular attention to the arrangements that have been made for the comfort of passengers.



An Armstrong Whitworth "Atalanta" of Imperial Airways in flight above the clouds. Our photograph is reproduced by courtesy of "The Aeroplane."

The oldest of the air liners used by Imperial Airways is the Armstrong Whitworth "Argosy," which has seen much service in all parts of the world. It is a biplane of the triple-engined type with a wing span of 90 ft. 4 in., and a length of 67 ft. It has a maximum speed of 110 m.p.h., and is capable of flying for a period of 5½ hours at a cruising speed of 95 m.p.h. The standard "Argosy" carries 20 passengers, 10 seated on each side of a gangway that runs down the centre of the cabin; and although this machine was produced some years ago the passengers are accommodated very comfortably. The cabin is heated and lighted by electricity, and there is an efficient system of ventilation. The machine is used on the cross-Channel services of Imperial Airways, and for many years has been employed on the "Silver Wing" service.

The latest Armstrong Whitworth liner, the "Atalanta," has accommodation for only 17 passengers, but the appointments in the cabin are more luxurious than are those in the earlier type. A special feature is that every passenger is able to control the condition of the air in his immediate vicinity, fresh air being led from an orifice in the nose of the machine to outlets over each passenger's seat. The amount of air coming through these outlets can be regulated by the individual passenger, who is able also to arrange for it to be heated if he desires. The stale air is sucked away through a port at the rear of the cabin. The big glass windows of the cabin are arranged so that in the event of an accident they could easily be knocked out, and in addition there are two emergency exits.

The "Atalanta" is a high-wing monoplane with a wing span of 90 ft. and a length of 71 ft. 6 in. It is the first and only monoplane of such size to be used by Imperial Airways, and has four 340 h.p. Armstrong Siddeley "Serval" radial air-cooled engines. These give the machine a maximum speed of 156 m.p.h. and a cruising speed of 125 m.p.h., the normal range being 400 miles.

The latest version of the "Atalanta" provides seating accommodation for 20 passengers in addition to a full load of freight and mail. Four Armstrong Siddeley "Jaguar" engines, each developing 400 h.p., are substituted for the "Servals," and the machine has a maximum speed of 165 m.p.h. and is able to cruise for 400 miles at a speed of 135 m.p.h.

Imperial Airways possess six machines of the "Atalanta" type, which they use on the South Africa and India and Eastern services. Two other "Atalantas" are owned by Indian Trans-Continental Airways, an associated company of Imperial Airways.

The "Heracles" and "Hannibal" types, which are also comparatively new are the biggest aeroplanes used by Imperial Airways. The two types are identical in external appearance, being biplanes with four engines, two arranged on the lower wing and two on the upper. The "Heracles," of which there are three in existence, is used on Imperial Airways European services, while the "Hannibal" type, of which there are five, was built for the Africa and India services. The European type has accommodation for 38 passengers in two cabins, while that intended for service in the East carries only 24 passengers, owing to the fact that more room is necessary for comfort in tropical countries.

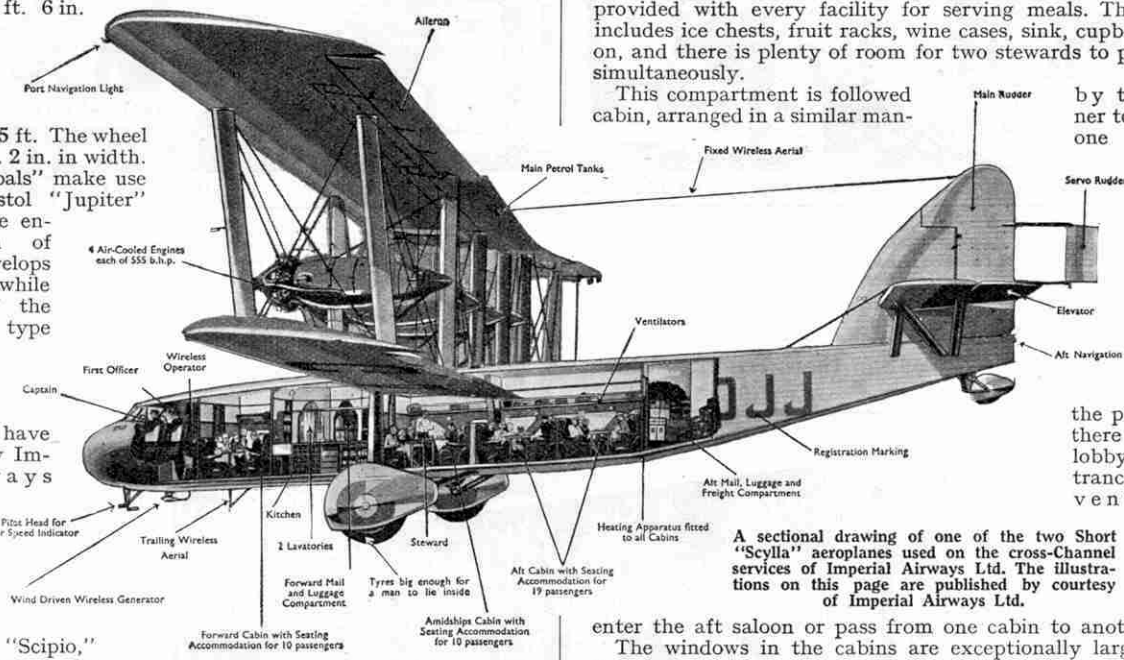
In the design of the "Heracles" and "Hannibal" types close attention has been paid to the provision of comfortable accommodation for passengers. The position of the fuselage is in itself evidence of the care and thought that has been expended in this direction, for it is situated below the planes in order to reduce engine noise in the cabin. Placing the cabin in this position also provides passengers with an uninterrupted view downward and outward, and alleviates the tendency to air-sickness of those who have not become accustomed to travelling by air. Another device that helps to reduce the noise in the saloons is the provision of a rapid metal cover that eliminates noise due to the flapping of fabric. The space between the cover and the interior decorations also is padded with sound-insulated material, and the floor is covered with carpet.

The saloons are normally warmed by hot air drawn from an engine exhaust muff, and in order to prevent the entrance of oily vapours with it the air supply is taken from a point in the leading edge of the upper plane. Before reaching the saloon it passes through a regulator in which cold air can be added in order to attain any desired temperature. The control for this is placed in the corridor between the saloon and the buffet.

The efficiency of the ventilation is also a feature of the machines. Fresh air taken from the outside of the centre slip-stream is led by pipes to the tubular members of the light luggage racks in the cabins, and diffused from these into the saloon through slots. When necessary this air can be warmed by introducing into it a part of the supply of hot air. A special regulating valve for this purpose is placed near the main hot air valve and local control is provided by means of valves fitted alongside the seats. An independent supply of fresh air is obtained from large adjustable intakes situated aft of the pilot's cabin and this is led through semi-circular ducts

arranged in the roof of each one of the saloons.

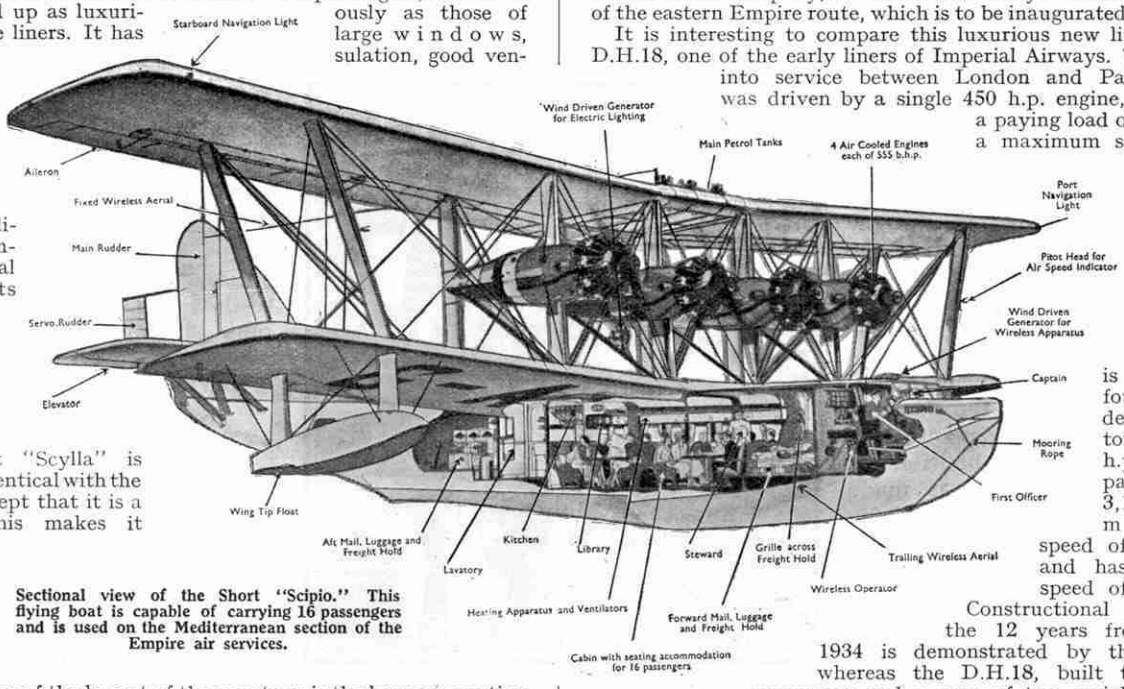
Machines of the "Heracles" and "Hannibal" types weigh 13.4 tons when fully loaded and are capable of flying at a speed of 130 m.p.h. The upper plane of each type of machine has a span of 130 ft. and a chord of 16 ft. 6 in., and the span of the lower plane is 94 ft. and it has a chord of 11 ft. 6 in. The overall length is 86 ft. 6 in. and the height with tail down is 25 ft. The wheel track is 28 ft. 2 in. in width. The "Hannibals" make use of four Bristol "Jupiter" XF MB type engines, each of which develops 555 h.p., while machines of the "Heracles" type use "Jupiters" of the XI F type.



A sectional drawing of one of the two Short "Scylla" aeroplanes used on the cross-Channel services of Imperial Airways Ltd. The illustrations on this page are published by courtesy of Imperial Airways Ltd.

Various flying boats have been used by Imperial Airways from time to time, but the standard machine now is the Short "Scipio," originally known as the Short "Kent." This machine is a biplane, and s fitted with four engines carried in nacelles slung between the wings. It is 113 ft. in span and 78 ft. 5 in. in length, and when fully loaded it weighs 14.3 tons and has a speed of 135 m.p.h. It has been developed from the "Calcutta" but is considerably larger, the span of the upper wing of the "Calcutta" being approximately the same as that of the lower one of the "Scipio." A feature of the new machine is that the planing bottom of the hull is planked with stainless steel up to a little above the water line.

The flying boat has accommodation for 16 passengers, carried in a cabin fitted up as luxuriously as those of the landplane liners. It has large windows, sound insulation, good ventilation and lighting and heating, together with adequate provision of washing facilities. The general internal arrangements of the machine can be seen in the lower illustration on this page.



Sectional view of the Short "Scipio." This flying boat is capable of carrying 16 passengers and is used on the Mediterranean section of the Empire air services.

The Short "Scylla" is practically identical with the "Scipio," except that it is a landplane. This makes it lighter, and therefore it has accommodation for 39 passengers. An unusual feature of the layout of the new type is the large proportion of the fuselage space that is occupied by the cabins. In the extreme nose is the pilots' cockpit with accommodation for the Captain, First Officer and, on long journeys, the Wireless Operator. When the machine is serving on the London to Paris route, the Captain or First Officer operates the radio set. Immediately aft of the cockpit is the forward cabin, which has seating accommodation for 10 passengers. The seats are arranged facing each other, six on one side and four on the other, and there are large tables between the seats, with a gangway down the middle.

Aft of this cabin is a large compartment with a baggage hold on the starboard side. On the port side is the kitchen, which is provided with every facility for serving meals. The equipment includes ice chests, fruit racks, wine cases, sink, cupboards, and so on, and there is plenty of room for two stewards to prepare meals simultaneously.

This compartment is followed by the middle cabin, arranged in a similar manner to the forward one and seating 10 passengers, while the aft cabin seats 19 passengers. Access to all cabins is gained by a door on the port side, and there is a small lobby at the entrance that prevents undue crowding of passengers as they enter the aft saloon or pass from one cabin to another.

The windows in the cabins are exceptionally large and allow a clear view from every seat; and in dull weather extra lighting is provided by dome lights in the roof. There are electric lamps over each table, and above the windows are racks for light parcels. The cabins are 11 ft. 9 in. in width, and the first impression on entering any of them is of their spaciousness. They are all scientifically heated and ventilated, and each passenger can control the amount of hot and cold air passing round him.

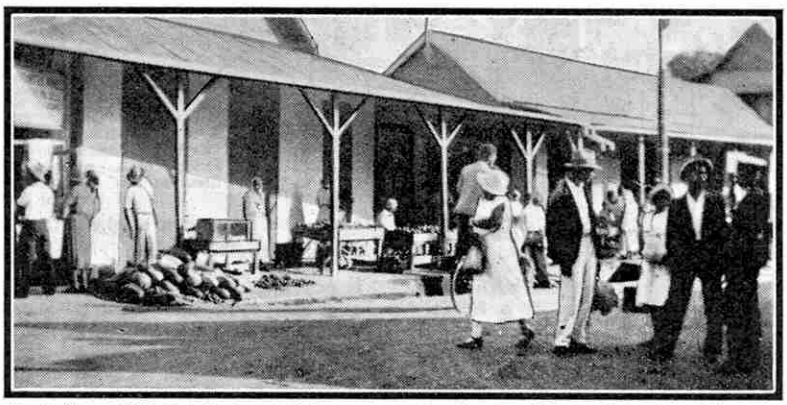
The most recent British air liner to be produced is the four-engined De Havilland "Diana." This is not yet used by Imperial Airways Ltd. but has been produced for Qantas Empire Airways, an associated company, for use on the Malaya–Australia extension of the eastern Empire route, which is to be inaugurated next month.

It is interesting to compare this luxurious new liner with the D.H.18, one of the early liners of Imperial Airways. This was put into service between London and Paris in 1922, was driven by a single 450 h.p. engine, and carried a paying load of 1,100 lb. at a maximum speed of 115 m.p.h. and a cruising speed of 95 m.p.h. In contrast to this, the modern "Diana" type of machine is driven by four engines developing a total of 800 h.p., carries a pay load of 3,147 lb. at a maximum speed of 170 m.p.h. and has a cruising speed of 145 m.p.h. Constructional progress in the 12 years from 1922 to 1934 is demonstrated by the fact that whereas the D.H.18, built to carry six passengers and a crew of two, weighed 7,200 lb., a machine of the "Diana" class, designed to carry 10 passengers and a crew of two, weighs no more than 6,350 lb. even when incorporating all the factors of structural security that are an essential factor of British air design. We hope to publish a fully illustrated article on this interesting machine in an early issue.

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.

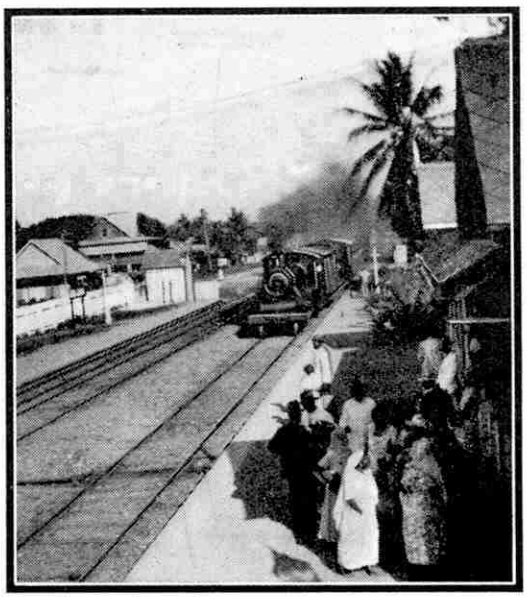
Life in a Trinidad Village

I live in the sunlit village of San Juan, Trinidad, which is four miles from Port-of-Spain, the capital of the island. Traffic on the narrow main road connecting the two places is heavy and offers interesting contrasts, for besides the usual motor cars, omnibuses and cycles, there are on it lorries laden high with bags of cocoa or bunches of bananas, and leisurely driven Indian donkey carts carrying loads of charcoal. There is also a railway station at San Juan. It is on the line between Port-of-Spain and Siparia, a distance of 51 miles that gives the longest railway journey in Trinidad; and many of the trains are hauled by imposing 4–6–0 locomotives built at Montreal, Canada.



Fruitsellers of Trinidad displaying their wares on the sidewalks. This photograph and the one below are by R. Garcia, Trinidad.

The people to be seen on the platform at San Juan station when a train is about to depart for the capital give a good idea of the cosmopolitan character of the inhabitants of "The Land of the Humming Bird," as Trinidad is called, for representatives of Europe, Asia and Africa can be distinguished. The Asiatics are East Indians, who were introduced in 1845 during the shortage of labour on the sugar plantations that followed the abolition of slavery. Their presence is made evident at times by the booming of tom-toms, a sign that East Indian marriage celebrations are in progress, and long processions of motor vehicles, in one of which is the bridegroom, resplendent in bright silk and richly decorated headgear. The cavalcade usually includes an omnibus from which drum beating and cymbal clashing echo through the countryside, and great excitement prevails among the villages on the route. A particularly attractive feature of these weddings is the dinner, to which everybody is welcome, irrespective of class, colour or creed. The guests squat on the bare ground or sit on long bamboo seats under improvised shelters, and pieces of banana leaves serve them as plates and fingers as knives and forks.



The railway station at San Juan, Trinidad, with the train from Port-of-Spain approaching.

Indian marriages are celebrated when melons and mangoes are in season. Like the Indians themselves, the mango trees originated in the East, and near the end of May are heavily laden with fast-ripening fruit. Mangoes are great favourites with all classes. There are several varieties, each with its distinctive name, shape and flavour, and they are juicy and nourishing.

Then there are water-melons, and when these are in season one wonders how there can be so many melons in any one part of the world! Negro and East Indian fruit vendors of nearly all ages line the sidewalks and at night their stalls are illuminated by crude smoky oil lamps. The flickering light creates strange effects as it plays on restless dusky faces overlooking pink slices of melon and other produce that is deep red, cream or purple in colour.

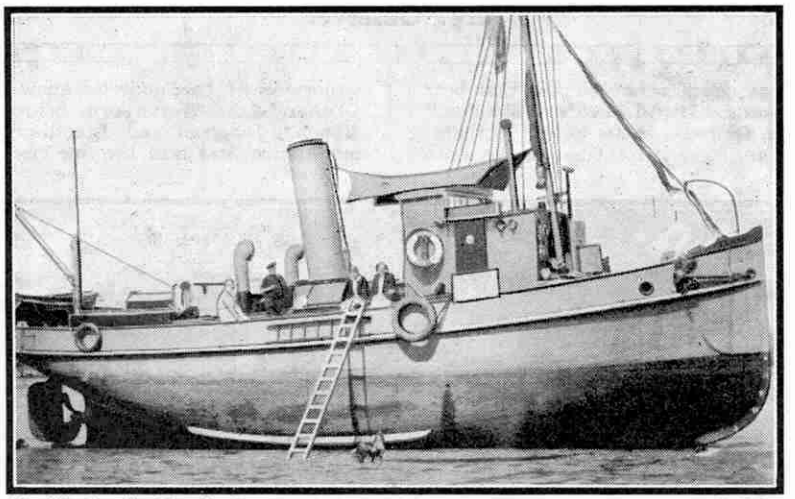
R. Garcia (Trinidad).

Forming a Cockle-Bed

When staying at Ferryside near Carmarthen during July, I was fortunate enough to be allowed a trip in the "*Feather*," a Fisheries Board steamer that patrols and inspects the fisheries between Cardiff and Cardigan and carries out certain experimental work. The "*Feather*" was formerly an Admiralty tug-boat, and was bought by the Fisheries Board and equipped with different types of fishing gear to enable her to carry out her present duties. She had been driven on to the cockle-beds at

high-tide, and at low-water 60 bags of cockles had been picked and arranged round the gunwales.

At the next high-tide, about six o'clock, we started from Ferryside. Lt. Com. Crockett, the Fishery Officer, explained to me that the cockles would be distributed around Swansea Bay. There they would breed and establish a cockle-fishery, and also would encourage fish that prey on cockles to come into the bay. The cockles would not be laid bare until the next low spring tide, and thus would be given time to breed. This scheme had previously been tried in Oxwich Bay, between Swansea and Ferryside, but the cockles had been put in shallower water and at low-tide thoughtless people had picked them and taken them away.



The "Feather," a Fisheries Board steamer, grounded on the mud at low water on the cockle-beds at Ferryside, near Carmarthen. Photograph by L. Wright, Pengam.

We reached Swansea Bay after a pleasant trip during which the cockles were constantly soaked with sea-water, and anchored near a Swansea Pilot Boat off Mumbles Pier. An entrancing view of Swansea Bay was obtained when rounding Mumbles Head, with glittering lights shining like myriads of fairy lamps against the dark background of hills beneath a cloudy sky.

We turned out early next morning and by six o'clock the *"Feather"* was steaming at quarter-speed round the bay and as close to the shore as she could get. Bag after bag of cockles was tipped over the side, and by seven o'clock, having washed down the gunwales, we were steaming at full speed again for Ferryside. Under the guidance of the coxswain of the local lifeboat, who acted as our pilot, the vessel was then carefully grounded on the cockle-beds at a suitable spot, for 40 more bags of cockles were to be taken to Swansea Bay that evening, after which the *"Feather"* would steam to Milford Haven to commence an examination of the crab and lobster fisheries of Pembrokeshire.

When the ship was high and dry I thanked her commander for his courtesy and interesting explanations, and descended to the sand, over which I made my way back to shore through the cockle-pickers and stake-nets after one of the most enjoyable trips I have ever had. L. WRIGHT (Pengam).

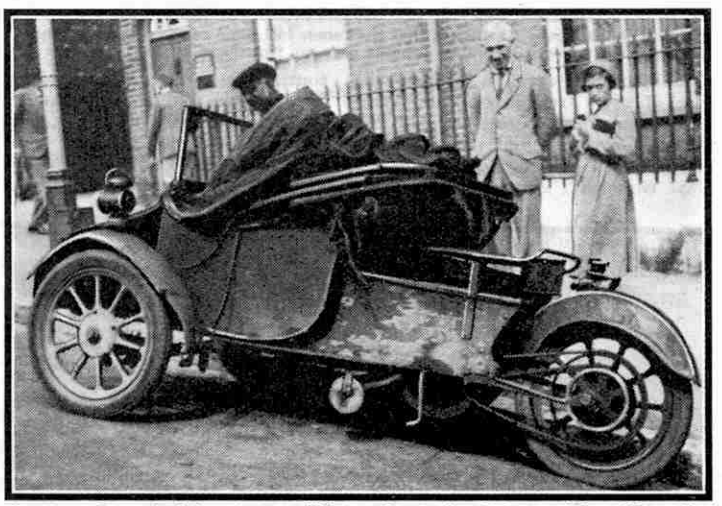
A Fight with a Barracouda

I am a cadet in the Merchant Service, and during my voyages have opportunities of seeing many interesting things in various parts of the world. Recently, while my ship was discharging cargo at Puerto Cabello, Venezuela, I witnessed a thrilling struggle between several native fishermen and a large barracouda, a tropical fish that is related to the mullets and is large and voracious. The barracouda are very daring and swim boldly round ships in harbour, snapping at the scraps thrown over the side.

While leaning over the rails on the fo'castle head one day, watching several fishermen overhauling their gear in a small boat just under our bows, I suddenly noticed a large barracouda about 5 ft. in length swimming slowly around in the crystal clear water below. A few seconds later a shout from one of the fishermen announced the fact that he also had seen the fish. One of his companions snatched up a spear about 9 ft. long, with a barbed point, and another quickly baited a line with a small fish and threw it overboard. As soon as the barracouda saw the bait it darted towards it and made a snap at it. Meanwhile the first man stood with the spear poised above his head, and suddenly he hurled it at the fish which, with a flip of its tail, eluded the missile and made off.

A few minutes later the barracouda returned to the bait. This time the spearman did not miss, and his weapon passed through the fish, to project at least a foot on the other side. A line made fast to the spear was at once hauled in and the struggle began in earnest. The water was lashed into foam by the flailing tail of the fish, but at last the combined efforts of the three men overcame their game adversary, which was lifted aboard and despatched with a wooden club.

G. FLEMING (Bradford).



A veteran three-wheeled motor car still in regular service. It is owned by a Hampshire chimney sweep. Photograph by I. Marsh, Burnham-on-Sea.

A Veteran Three-Wheeled Motor Car

The accompanying photograph shows a veteran "A.C." motor car that probably is the only one of its kind now running, for cars of this type have long since ceased to be manufactured. As the photograph shows, it is a three-wheeled vehicle. It is steered by means of a tiller and is used daily by a Hampshire chimney sweep, who is very proud of its powers and would not exchange it for a new one, since he maintains that it goes as well as any modern car! I almost agreed with him when I saw him start it up on a steep hillside, which it mounted somewhat noisily, but surely and quickly. Naturally the car has often been photographed by people interested in curious survivals of early motoring days. I. MARSH (Burnham-on-Sea).

The Railways of Switzerland

II. The Berne-Lötschberg-Simplon Route

By "Observer"

IN Switzerland not a few railway coaches may be seen that bear inscribed on their sides the words: "Bern-Lötschberg Simplon." They belong to the Bernese Alps Railway, better known, perhaps, as the Lötschberg Railway; and to journey in them over the route indicated is to have one of the most exhilarating experiences that railway travelling can anywhere provide. The scenery of the Bernese Oberland and other regions traversed by the line is of extraordinary beauty and grandeur, while the line itself is of exceptional technical interest, passing through the very heart of the Alps and including two of the three longest tunnels in the world. It is, indeed, a conspicuous masterpiece of engineering skill, and has numerous features of absorbing interest to all students of railway construction.

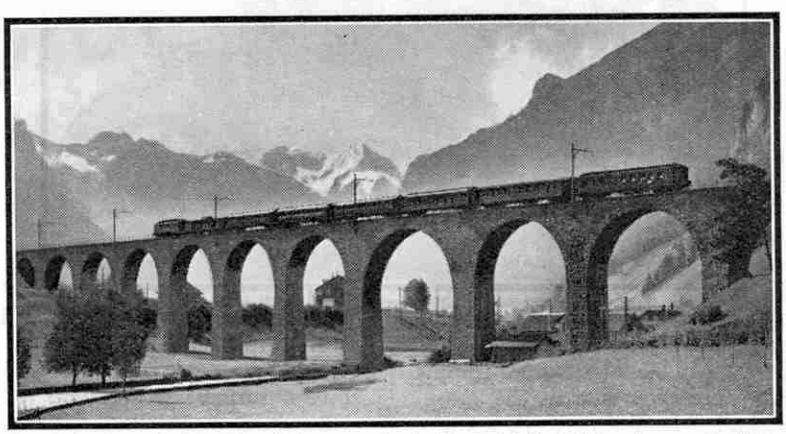
A view on the Lötschberg Railway near Kandersteg that gives some indication of the natural beauties of the route. The photographs on this page and the lower one on the opposite page are reproduced by courtesy of the Lötschberg Railway.

The Lötschberg-Simplon line is of importance, not only as providing valuable services within Switzerland, but also in forming part of one of the two great international routes that pass through that country from north to south. The other through route is known as the St. Gotthard, and it pierces the Alps by the famous tunnel of that name. A graphic description of a journey over that route by the "*St. Gotthard Pullman Express*" was given by Mr. C. J. Allen in an article published in the "*M.M.*" for March, 1928. The aim of the present article is to describe a journey over the no less remarkable Berne-Lötschberg-Simplon route.

Starting, then, from Berne, the capital of Switzerland and one of the most charming of Continental cities, the line at first has no exceptional features. It passes through beautiful pastoral country with occasional glimpses of the great mountain peaks in the far distance. In this opening stage of our journey we travel over the lines of the Swiss Federal Railways, and a smart run of 18¾ miles brings us to the quaint old city of Thun at the western end of the lovely lake that also bears that name. Here engines are changed, and the big Swiss Federal 4–6–2 electric locomotive gives place to a yet more powerful 2–6+6–2 belonging to the Lötschberg Company, on to whose lines we are about to pass.

Soon after leaving Thun the railway runs for some distance close to the edge of the lake, and we see across the blue waters a glorious panorama of the majestic snow-capped peaks of the Bernese Oberland—the Wetterhorn, Schreckhorn, Finsteraarhorn, Eiger, Mönch, Jungfrau and Blumlisalp, together with many lesser mountains. And now the line rises steadily until, 7¼ miles from Thun, we arrive at Spiez which, although only a small town, is a quite important railway junction and a delightful and convenient tourist centre. It is in fact the principal junction on the Lötschberg Railway, as in addition to the main line that goes on through Kandersteg to Brigue and Italy, there are branches that go to Interlaken where connections are given to Lucerne, Grindelwald and numerous other places, and to Zweisimmen where connection is made with the narrow gauge line to Montreaux.

The amount of traffic handled at Spiez in the busy tourist season is very considerable, and it is no uncommon sight to see the principal expresses loaded up to 500 tons and more. All the electric locomotives of the Lötschberg Company are stationed here, the most powerful being of the 2–6+6–2 type that we have noted at the head of our train. Next in power come some 2–10–2 locomotives, while for lighter trains there are smaller ones having the 2–4–4–2 wheel arrangement. At Spiez there are three signal boxes, together with an up-to-date control office in the station. Here may be observed a feature common to most stations in Switzerland—the sounding of bells on the platforms. Sometimes there is a succession of notes suggestive of church chimes, and British visitors are apt to wonder what they mean. The explanation is that these bells on the platform give similar sounds to the bells in the signal boxes, and by their distinctive notes indicate on what particular line the train that is being signalled is arriving or departing and also what is the character of the train.



A typical train on the Lötschberg Railway crossing the Kander Viaduct of 11 arches near Frutigen.

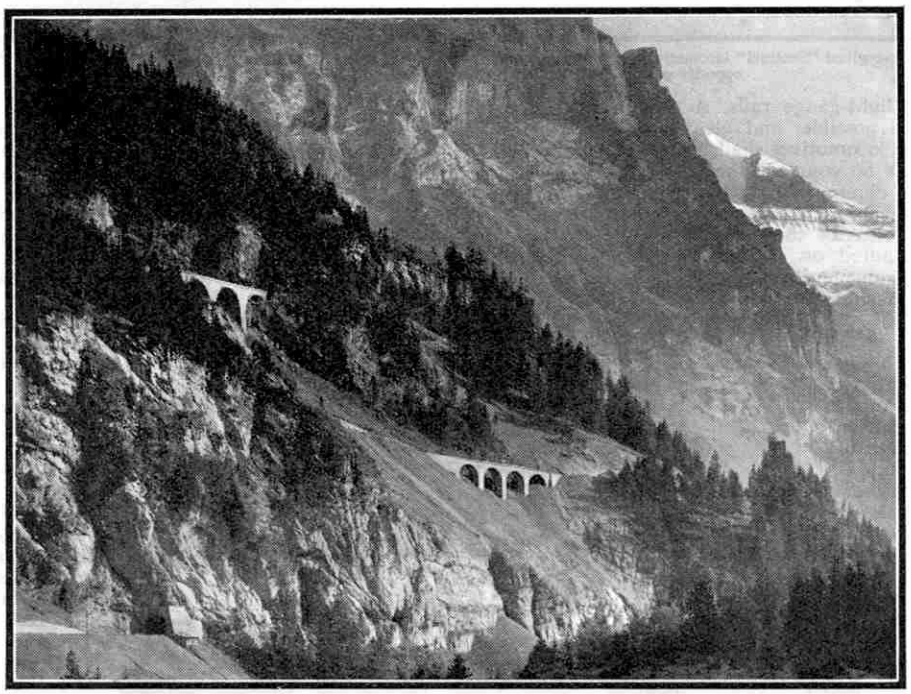
From Berne our train has consisted of 12 eight-wheeled bogie coaches, all heavy modern stock. Now four are detached for Interlaken, leaving eight to go forward over the main Lötschberg line. There is an interesting variety among these eight. First is an all-steel luggage van of the French Nord, followed by an International Sleeping Car Company's sleeper from Paris to Brigue, a

French Est 1st and 2nd composite and a Lötschberg 3rd from Paris to Milan, an Italian 1st and 2nd composite from Calais to Brindisi, an International restaurant car from Berne to Milan, and two Lötschbergs from Basle to Nice. The total load is about 300 tons, quite a light one for our locomotive, which could tackle double the weight and still keep time although there are some terrific grades to be faced.

From Spiez onward the line becomes increasingly interesting. The scenery becomes more mountainous and grand and the technical features more remarkable. After clearing Spiez the train plunges into a tunnel, and when we run into daylight again we find ourselves in the Kander valley up which we travel for a while alongside the Kander river, a mountain torrent that comes rushing and foaming down. Passing through Mulenen-Aeschi station, we see on our right the Niesen railway going sheer up the mountain side until it is lost to view in a tunnel.

The northern entrance to the Simplon Tunnel, the longest tunnel in the world. The train is entering the original bore, which was completed in 1905. Photograph by courtesy of the Swiss Federal Railways.

Calling at Frutigen we note that, although only a large village, it possesses a particularly attractive station. A little beyond Frutigen the line cuts right across the valley by a massive viaduct of 11 arches, and immediately afterwards truly mountainous grades begin and for several miles the ascent is at 1 in 37. Yet even gradients like these are not in themselves sufficient to give the rise in altitude that is necessary and presently, while still steeply ascending, the line loops round and doubles back down the valley again in the direction of Frutigen. Still mounting upward, a little later the train enters a tunnel, 1,830 yds. long, that curves round in corkscrew fashion, from which we eventually emerge, high on the mountain side, heading up the valley again. One interesting consequence of this double looping is that one particular village church is passed three times at different levels, and unless travellers know just what is happening they are apt to conclude that Swiss villages and churches are strangely alike!



Three levels of the Lötschberg Railway can be seen in this photograph. The lowest enters the tunnel on the left of the illustration, and the line climbs in successive spirals to the viaducts above.

The result of this strenuous climbing is that we arrive at the mountain resort of Kandersteg, 3,900 ft. above sea level, having surmounted no less than 1,385 ft. in 7.8 miles. After a halt of little more than a minute we proceed on our way and almost immediately enter the great Lötschberg tunnel, which has a length of 9 miles 210 yds., and thus ranks third among Alpine tunnels, being exceeded only by the St. Gotthard and the Simplon.

This colossal engineering work was begun in October 1906, and as originally planned was to have been 8¼ miles in length. Unfortunately, however, after work had proceeded for almost two years a serious disaster occurred. A dynamite charge unexpectedly opened a cleft in the deep bed of an old glacier in the Gastern Valley, and a mighty irruption of debris and mud came pouring into the heading. Of the 26 workmen who were in the tunnel at the time only one escaped alive. The rest were overwhelmed by the rush of water, earth, gravel and boulders that had been released. Within 10 minutes, 250,800 cu. ft. of material had poured into the tunnel, completely blocking it for 1,731 yds., and not stopping in its rush until it had approached to a point 1,200 yds. from the Kandersteg entrance, through which we have just passed.

This catastrophe held up operations for several months while engineers cast about for the best solution to the awkward problem that had been forced upon them. Ultimately a deviation was decided upon by which the dangerous moraine was avoided, a wide curve thereby being introduced in the course of the tunnel and over half a mile added to its length. Not until 31st March 1911 was the tunnel pierced, and rather more than two years later it was completed, the whole line being opened for traffic on 15th July, 1913.

Travelling through the long tunnel we find that the air is fresh and clean, and we can have the windows open without discomfort. In exactly 14 min. after entering the tunnel we reach the southern portal, and within a few moments we come to a stand in Goppenstein station. We are exactly on time, for although we have attained no sensational speeds we have simply played with the formidable gradients. Nowhere reaching 60 m.p.h., we have romped up 1 in 37 at over 40 m.p.h. After Goppenstein the line proceeds along the steep eastern slope of the Lötschen Valley, a wild, deep gorge with precipitous sides. We thread our way through a number of short tunnels, and presently enter a longer one from which we emerge at Hohtenn to find ourselves high on the hillside and looking across the Rhone Valley—a vast expanse that evokes a gasp of surprise.

And now we steadily descend lower and lower until on reaching the town of Brigue, where the Lötschberg Railway ends in a junction with the Swiss Federal system, we have dropped 1,766 ft. in altitude, and that without the use of loops. At times the fall has been as much as 1 in 37, and for the 16 miles from Goppenstein to Brigue the average has been 1 in 47.

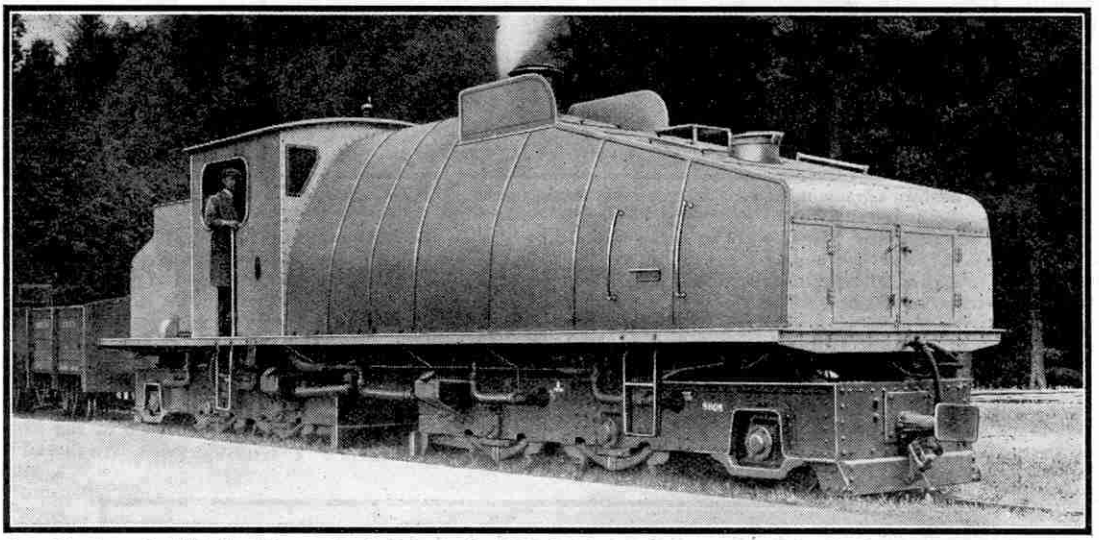
In this southern section of the line, alike in the Lötschen and Rhone Valleys, much skill and enterprise were required to construct a strong, secure line on the steep mountain sides, along narrow precipices and across the many deep ravines. Provision had to be made also against the avalanches that frequently sweep down with such destructive force. In some places tunnelling was chosen as affording the only sure protection, while in others strong barriers of masonry were erected. The extraordinary nature of the line is apparent in that it contains 21 tunnels, and 11 viaducts and bridges of more than 33 ft. span, besides numerous lesser ones. The biggest viaduct, that at Bietschthal, is 144 yds. long and on a curve of 15 chains radius. The central arch is 250 ft. above the

(Continued on page 920)

Six-Engined "Sentinel" Locomotives

Interesting Order for Columbia Railways

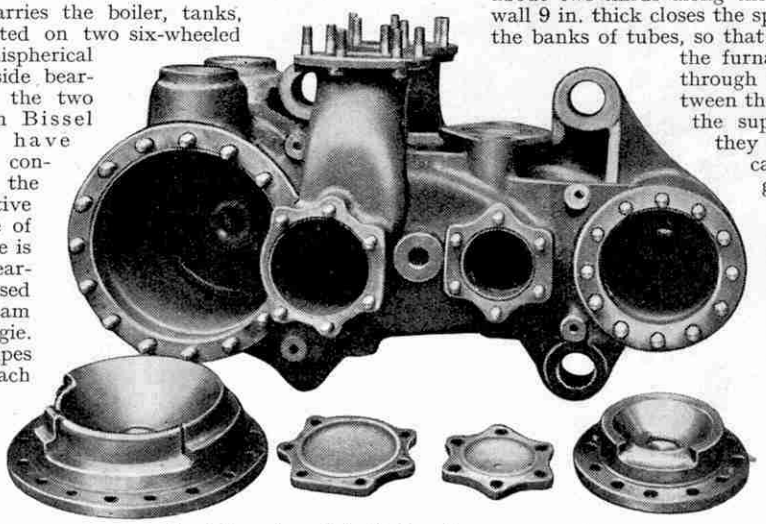
THREE locomotives that embody a number of exceptionally novel features and drastic departures from usual design, have been built recently at the Shrewsbury Works of Sentinel Waggon Works Ltd., to the order of the Société Nationale de Chemins de Fer en Colombie, South America. They are intended for heavy haulage work on a railway with steep gradients and curves of small radius, and, we understand, are to be the prototype of a range of similar locomotives on two, three and four axles.



One of the six-engined "Sentinel" locomotives built for the Société Nationale de Chemins de Fer en Colombie. Photographs on this and the opposite page by courtesy of Sentinel Waggon Works Ltd., Shrewsbury.

In the particular locomotives about to be described a six-axle arrangement was adopted because the Colombian railways are built with light-gauge rails, so that axle loadings must be kept as low as possible; and also because the severe gradients require that the locomotives shall be able to exert a high tractive effort. There are no coupled wheels or visible cylinders and valve gear, and the chimney appears to rise from the very centre of the boiler.

The main frame that carries the boiler, tanks, bunker, cab, etc., is mounted on two six-wheeled bogies by means of hemispherical pivot bearings and plain side bearings. The outer axles of the two bogies are mounted in Bissel type trucks, which have sufficient side movement, controlled by springs fitted to the trucks, to allow the locomotive to negotiate freely a curve of 87½ yards radius. Each axle is separately driven through gearing by a small totally enclosed compound expansion steam engine, mounted on the bogie. Separate flexible steam pipes with ball joints connect each engine with the main throttle valve, and allow for movements of the engine. Flexible joints are also provided in the exhaust pipes.



One of the engine cylinder blocks, with covers removed.

The boiler is of the "Woolnough" water-tube type and, compared with the ordinary smoke-tube locomotive boiler, is very short. In front of the boiler, at the leading end of the locomotive, there is space within the outer casing to accommodate a tank with a capacity of 960 gallons, and further forward still there is an air reservoir for the Westinghouse brakes, and the sanding gear equipment for the leading bogie.

Between the boiler and the tank, and to one side, there is a small platform on which a small turbo-generator is mounted to provide current for lighting purposes. A Weir feed pump, specially modified to suit the conditions, is situated in the right-hand corner of the back of the cab. Behind the cab there is a coal storage bunker with a capacity of 3 tons, and a second water tank holding 240 gallons, which is connected to the larger tank at the forward end of the locomotive by a balance pipe. The amount of water in the tanks is indicated by a gauge glass at the back of the cab. Behind the tank there is also another air reservoir for the Westinghouse equipment, and the sanding gear for the rear bogie. The Westinghouse air pump is mounted in a convenient position outside the tender on the left-hand side of the engine.

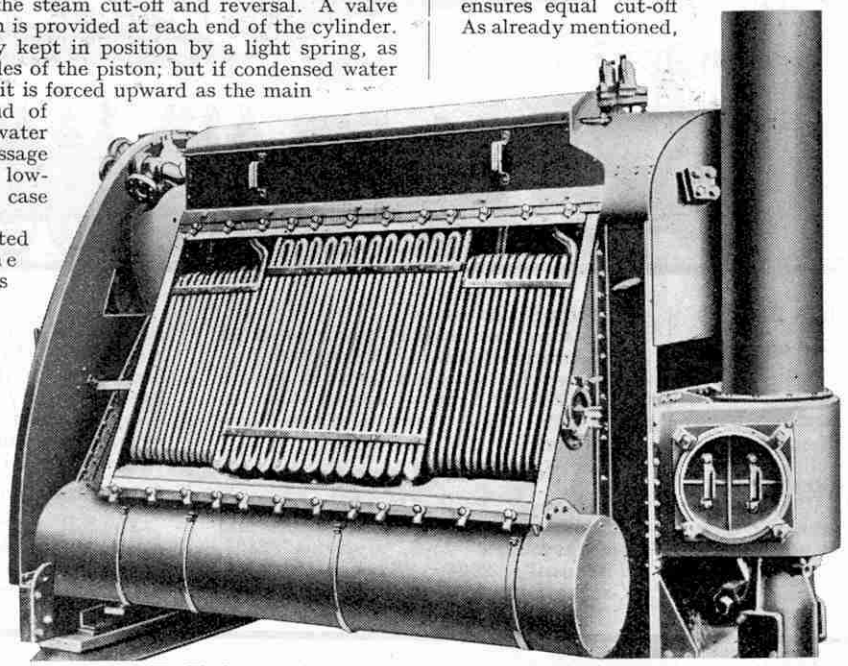
The "Woolnough" boiler has three drums, the two lower of which are disposed one on each side of the grate, and connected by banks of tubes, slightly curved and inclined at a steep angle, to a steam drum centrally placed above the grate. At a point about two-thirds along the length of the boiler a fire-brick wall 9 in. thick closes the space between the three drums and the banks of tubes, so that the products of combustion from the furnace are forced to travel outward through the tube banks. In the space between the tube banks and the boiler casing the superheater tubes are placed, and they are so situated that, while they can freely absorb heat from the gases, they also protect the boiler casing from the heat. From this space the gases, having circled around the ends of the fire-brick wall, travel back through the tube banks to the smoke-box, from which they are ejected up the chimney by the exhaust blast or the steam blower.

The air for the combustion of the fuel is drawn in through balanced louvres provided in a partition between the smoke-box and the front water tank, and passes outside the boiler casing, and within the external casing around the boiler, to the ashpan. This ensures that the boiler casing is kept cool and the combustion air preheated, so that heat that otherwise would be lost by radiation is put to good use. The balanced air louvres open proportionately to the amount of vacuum induced by the blast, and close automatically when steam is shut off.

The grates consist of two similar parts, each of which is mounted on a longitudinally arranged trunnion. Each half is operated independently from the footplate, and the arrangement allows the fire to be easily cleaned or dropped into the ashpan.

The six separate engines are of the double acting compound type with cylinders 4¼ in. and 7¼ in. dia. and a stroke of 6 in., driving a crankshaft that runs in roller bearings and carries at its centre a pinion. The pinion meshes with a gear wheel on the centre of the corresponding axle. Piston valves, which are operated by Stephenson link motion, control the steam cut-off and reversal. A valve consisting of a small piston is provided at each end of the cylinder. These valves are normally kept in position by a light spring, as the steam acts on both sides of the piston; but if condensed water is trapped in the cylinder it is forced upward as the main piston approaches the end of the cylinder, and the water escapes through a side passage to the steam chest or low-pressure receiver as the case may be.

Each engine is mounted horizontally in the bogie frame with its crank axle across the frame, and is supported at one end by the axle and at the other by a suspension link. This link is attached to the engine by a ball joint at a point slightly farther from the axle than the centre of gravity of the engine, and to the bogie frame above by a silent block rubber mounting. The result of this arrangement is that, while the engine is soundly supported, it is yet able to follow freely the movements of the axle. By far the greater part of the weight is carried by the link, and the remainder by the axle.

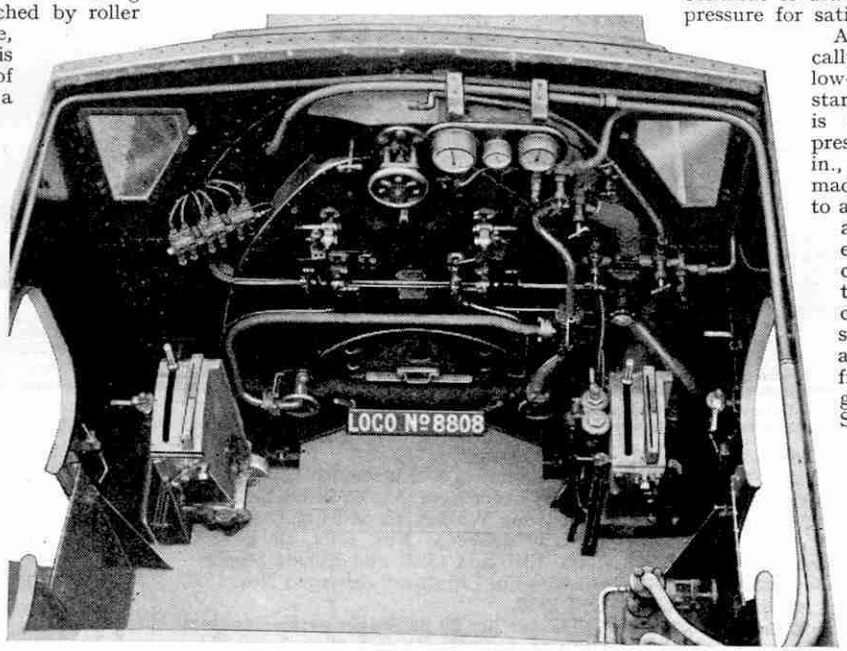


The Woolnough Boiler, opened to show arrangement of the tubes.

The whole of the motion gear and crankshaft assembly is enclosed in the crank-case, which is partly filled with oil; and therefore all the moving parts are thoroughly lubricated on the splash system. The crankshaft, to which the connecting rods and eccentrics are attached by roller bearings, is a built-up structure, and the pinion at its centre is cut and ground to form out of the solid, and forms part of a shaft to which two separate hardened and ground crankshaft pieces are keyed. Each of these pieces comprises a main bearing, crank pin, and eccentrics, and the two are identical. The pistons also are turned out of the solid, and the crossheads are of cast steel. The eccentrics are beautiful examples of high class workmanship, and are of very light and narrow section, in spite of the fact that they must be hardened and ground to take the rollers of the bearings.

The Stephenson link motion is operated by link gear from a screw-and-nut mechanism contained in a box mounted above the engine. Steam is brought to each engine from the main throttle valve through an individual pipe in which an isolating valve is placed in a position easily accessible from the track. By this means, if it should be undesirable to admit steam to any one of the engines, its isolating valve can be closed and the locomotive propelled by the remaining engines. In the unlikely event of the complete failure of an engine, it can be disconnected from its axle simply by unscrewing the large nuts on the crank-case end of the engine stanchions, so that the pinion on the engine crankshaft is taken out of mesh with the gear wheel on the axle. This operation requires only a few minutes.

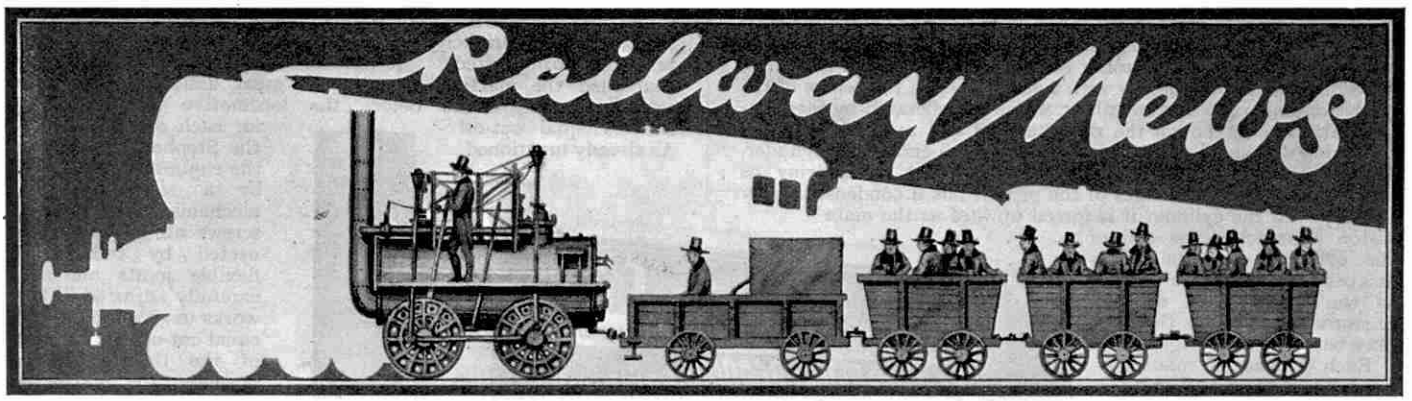
As there are six separate engines under the driver's charge, it is necessary that they should be all controlled together so that the multiplicity of driving units shall not make his task too complicated. As far as most of the controls are concerned the matter is one of no great difficulty. Accurate setting in the works before the locomotive is sent away ensures equal cut-off for each of the engines. As already mentioned, the Stephenson links on the engines are operated by a screw-and-nut mechanism, and the six screws are all interconnected by rods with flexible joints and are carefully adjusted in the works to give the desired equal cut-off. In the case of the throttle valve, however, the matter is more difficult. If, for instance, this valve were arranged to admit steam to a main chest from which all six engines drew steam, the operation of the locomotive would be unsatisfactory, for if one axle slipped on the rails the engine driving it would take all the steam and starve the others. Each engine therefore is individually controlled. The throttle valve adopted is of the poppet type, and closes on to a conical seat beneath which there is a piston-like extension that covers six ports, each admitting steam to the pipe-line of one engine. The main valve lifts about one-eighth of an inch before its piston-like extension begins to uncover the ports, so that if one axle starts to slip a throttling action will take place in the port leading to the engine concerned, and the remaining engines will continue to draw steam at an adequate pressure for satisfactory running.



A semi-plan view of the interior of the cab.

As live steam is automatically admitted to each low-pressure cylinder for starting purposes, and this is at the high working pressure of 550 lb. per sq. in., arrangements had to be made to reduce the pressure to about 140 lb. before it is admitted, and this is effected by an ingenious charging, drain, and safety valve. Two ball valves can be lifted from their seats by rods that bear against plungers operated from the screw reversing gear controlling the Stephenson motion. As a preliminary at starting the link motion is put in mid gear and the plungers are forced outward, so that the rods lift the ball valves off their seats. With the brakes "on," the regulator is opened slightly, and steam enters at the bottom of the charging valve through a reducing valve. It then passes upward and through an external pipe back through one of the ball valves, which is held open by its rod, and by a branch that has a safety valve connection to the top of the low-pressure receiver. The steam returns to the charging valve by way of the other ball valve, and finally passes to exhaust, thus warming up the engine.

When it is desired to start the locomotive the Stephenson link motion is moved to the full forward or reverse positions. In these positions of the link motion only the lower of the two ball valves is held open, and then steam at high pressure (for *(Continued on page 901)*



Winter Train Services on British Railways

The winter train services now operating on British railways show some marked improvements as compared with those of last winter. Numerous accelerations have been made, and hundreds of the additional trains that were put on for the summer traffic have been retained. On the L.M.S.R. 158 trains have been accelerated, with a total saving of 10 hrs. 18 min. per day; while on the G.W.R. the train mileage has been increased by 2,079 daily over that covered by last winter's services.

Both the famous Anglo-Scottish expresses, *"The Royal Scot"* of the L.M.S.R. and *"The Flying Scotsman"* of the L.N.E.R., are now due at Euston and King's Cross, their respective London terminal stations, at 5.40 p.m., five minutes earlier than last winter. The non-stop run of 299¼ miles from Carlisle to London, made by *"The Royal Scot,"* is the longest in the world this winter. The L.N.E.R. *"Queen of Scots"* Pullman train has been accelerated to run non-stop the 47¼ miles from Glasgow to Edinburgh, the first portion of its run, in 55 min., a gain of three minutes.

Among the many quickened services on the G.W.R. the most noteworthy is the Channel Islands Boat express, which leaves Paddington at 10.15 p.m. instead of 9.25 p.m. as formerly, an acceleration of 40 minutes. The experimental streamlined railcar services between Birmingham and South Wales are being continued.

On the L.M.S.R. considerable improvements have been made in the Scottish train services and in those operated by the company in Northern Ireland. Main line trains between Belfast and Londonderry are timed to do the journey in from 25 min. to 35 min. less than last winter. The new *"North Atlantic Express,"* between Portrush and Belfast in both directions, is continuing to run through the winter.

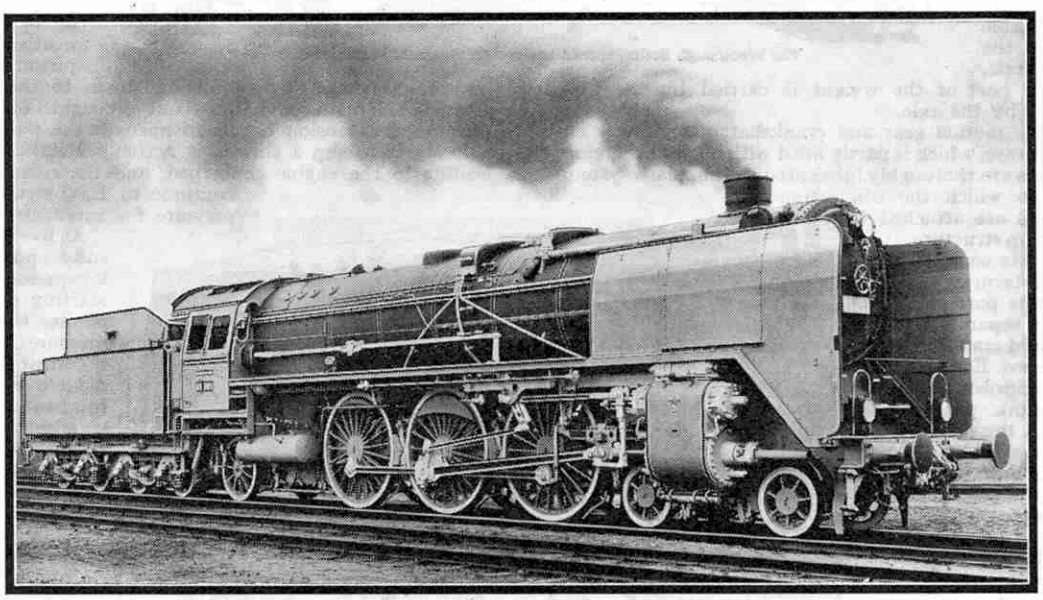
The most outstanding improvement on the Southern Railway is the speeding up of the service to North Cornwall by the *"Atlantic Coast Express"* leaving Waterloo at 11 a.m., the arrival at Padstow being 32 min. earlier than previously.

New L.N.E.R. Locomotives

The newest "Pacific" locomotives turned out from Doncaster carry numbers and names as follows:—2502, *"Hyperion"*; 2503, *"Firdaussi"*; 2504, *"Sandwich"*; 2505, *"Cameronian"*; 2506, *"Salmon Trout"*; and 2507, *"Singapore."*

Of the new 2–6–0 locomotives of the K3 class on order from outside firms, Sir W. G. Armstrong Whitworth and Co. Ltd., have recently delivered Nos. 1302, 1304, 1306, 1308, 1310 and 1324, and Robert Stephenson and Co. Ltd., have delivered Nos. 1325 and 1332.

The further 20 passenger express engines of the 4–4–0 "Hunt" class that are on order have been allotted the following numbers and names:—230, *"The Brocklesby"*; 238, *"The Burton"*; 258, *"The Cattistock"*; 274, *"The Craven"*; 279, *"The Cotswold"*; 353, *"The Derwent"*; 357, *"The Fernie"*; 359, *"The Fitzwilliam"*; 361, *"The Garth"*; 362, *"The Goathland"*; 363, *"The Grafton"*; 364, *"The Grove"*; 365, *"The Morpeth"*; 366, *"The Oakley"*; 368, *"The Puckeridge"*; 370, *"The Rufford"*; 374, *"The Sinnington"*; 375, *"The South Durham"*; 376, *"The Staintondale"*; 377, *"The Tynedale."*



Characteristic features of locomotive practice in Germany are illustrated by this large "Pacific" of the German State Railways. This was constructed by the famous firm of Fried. Krupp, A.G. of Essen, to whom we are indebted for this photograph.

Since being stationed at Haymarket shed, Edinburgh, the new 2–8–2 express locomotive No. 2001, *"Cock o' the North,"* has been working the heaviest expresses between that city and Aberdeen and giving every satisfaction. Loads of 600 tons and over have been taken without assistance and time has easily been kept.

Southern Railway Build More "Schools"

The S.R. are building 10 more "Schools" class express locomotives at Eastleigh. There are already 30 locomotives of this class in regular use, and the success achieved by these has resulted in the decision to build more. The new engines, like their predecessors, will be named after famous public schools, and the numbers and names chosen are as follows:— 930, *"Radley"*; 931, *"Kings - Wimbledon"*; 932, *" Blundells "*; 933, *"Kings-Canterbury "*; 934, *"St. Lawrence"*; 935, *" Sevenoaks "*; 936, *"Cranleigh"*; 937, *"Epsom"*; 938, *"St. Olave's"*; 939, *"Leatherhead."*

"Schools" class engines have three cylinders, weigh 110 tons, and are the most powerful 4-coupled locomotives in the country.

For experimental purposes No. 862, *"Lord Collingwood,"* a four-cylinder 4–6–0 express engine of the "Lord Nelson" class, has been fitted with a double chimney.

G.W.R. Locomotive News

New tank engines of the 0–4–2 type completed at Swindon recently are numbered 4835–9.

Several engines are now running with the newly-adopted G.W.R. monogram painted on the tender in place of the words "Great Western" that formerly appeared there.

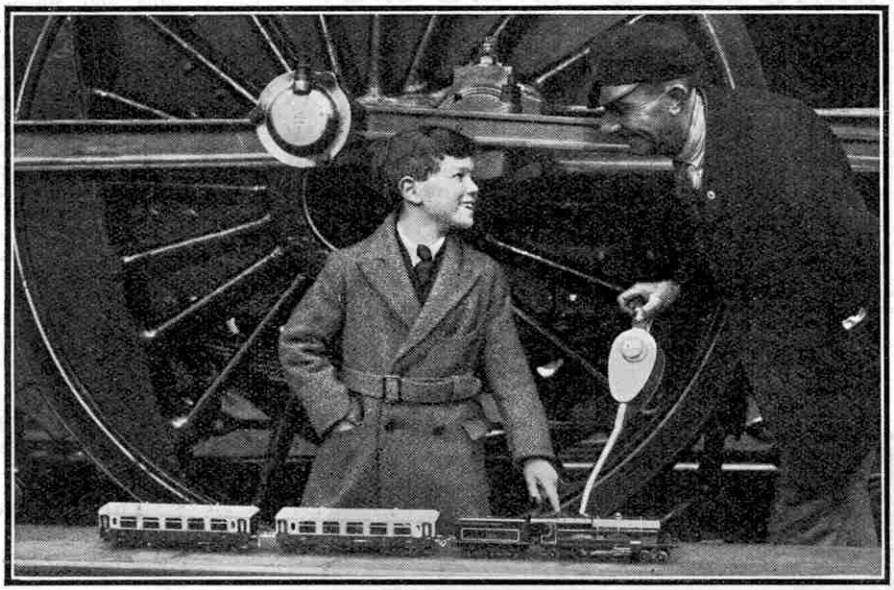
Among the numerous engines of various old types to be condemned to the scrap heap within the past few months have been two of the inside-cylindered 2–6–0 "Moguls" of the 2600 class. Their numbers were 2602 and 2607.

Further 4–6–0 Locomotives for L.M.S.R.

Crewe works have completed further 4–6–0 engines of the improved "Baby Scot" class, and these are numbered 5618 to 5627.

The Vulcan Foundry have delivered about 20 of the new standard 4–6–0 mixed-traffic locomotives of the 5020 class. During the time they are being run in these new engines are usually stationed at Crewe, and a trip that is frequently taken is from Crewe to Derby and back. Contracts have been placed for the building of 150 more of these mixed-traffic engines so that with the 70 previously ordered, there will be 220 in service by the end of next year. Of those now ordered, 100 are to be built by Sir W. G. Armstrong Whitworth and Co Ltd., and 50 by the Vulcan Foundry Ltd

Two more "Claughtons," No. 5941 and No. 5943 *"Tennyson,"* have been withdrawn for scrapping, together with two "Experiments" No. 5491, *"Prince George"* and No. 25525, *"Byzantium."*



The driver of the L.N.E.R. "Pacific" locomotive in the background of this photograph is greatly interested in a discussion on the correct manner of lubricating the locomotive of a Hornby Pullman train. Photograph reproduced by courtesy of the Editor of the "L.N.E.R. Magazine."

Brighter Railway Stations

Experiments are being made on the L.M.S.R. with a view to making railway stations brighter and more attractive. Radlett Station has been repainted in gay colours—emerald green, pale blue and orange—and made brilliant with light at night. The interior also has been made more comfortable and inviting. If the experiment is judged successful it may be extended to many other stations throughout the line.

A new standard colour-scheme also has been adopted by the L.M.S.R. for the nameboards on station platforms. These will consist in future of a board painted with a yellow ground, with the name and margins in black.

The *"Rocket"*

One of the most interesting exhibits in the Science Museum at South Kensington is the historic locomotive *"Rocket,"* which was built in 1829 by George Stephenson for the Rainhill trials that preceded the opening of the Liverpool and Manchester Railway. Its present condition is somewhat dilapidated, however, and its form considerably altered from the original design. The authorities of the Museum have now ordered from Robert Stephenson and Co. Ltd., of Darlington, a full-sized replica of *"Rocket"* as it was built at first, similar to the model supplied by that firm a few years ago to Mr. Henry Ford for placing in his extensive Mechanical Museum at Detroit. The new model is to be constructed of materials corresponding to those used in the original *"Rocket,"* which was built by the same famous firm.

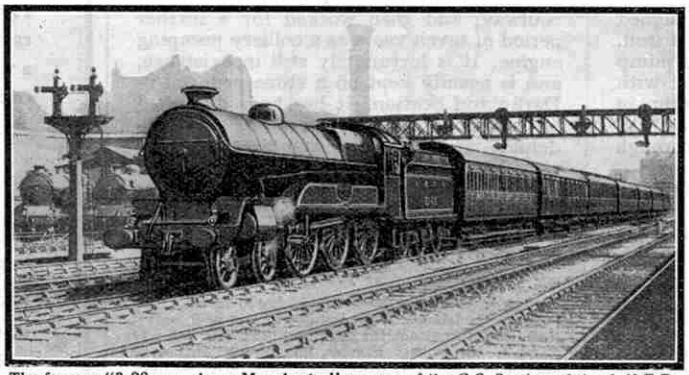
S.R. Speed Up Engine Handling

A new mechanical coaling plant and a water softening plant have just been completed and brought into use at the S.R. locomotive depot at Stewarts Lane, Battersea. The coaling plant has a capacity of 150 tons, and trucks of coal are hoisted one at a time to the receiving bin at the top of the structure, rotated axially, and the coal tipped out en masse, after which the truck is returned to the rails below. Then, as the locomotives pass below, the tenders are filled from the mechanically operated chutes in one motion.

World's Fastest Newspaper Train

The world's fastest newspaper train was introduced by the G.W.R. on 2nd October. It leaves Paddington for South Wales at 1.20 a.m. and, running non-stop to Newport, covers 133½ miles in 137 minutes, in spite of severe speed restrictions for four miles while passing through the Severn Tunnel. After Newport, where the train arrives at 3.37 a.m., it calls at Cardiff at 3.59 a.m. and principal stations to Swansea, where it is due at 5.44 a.m. The train is drawn by a locomotive of the "Castle" class, as used for the *"Cheltenham Flyer,"* the world's fastest steam train.

This is the second night newspaper express to be speeded up by the G.W.R. in the last six months.



The famous "3-20 p.m. down Manchester" express of the G.C. Section of the L.N.E.R. leaving Marylebone terminus. The engine is No. 6165, "Valour," the War memorial engine of the G.C.R. Section.

When Guards had to Pacify Passengers

Extracts from old railway Rule Books make amusing reading. For example, we learn from one issued in 1848 that it was the duty of G.W.R. superintendents to make themselves well acquainted by frequent personal intercourse with the character and conduct of every man under their orders. The superintendent's duties also required him to see that the vehicles were properly cleaned and the glasses and handles made bright, and that "the buffers pressed against each other so that they receded about an inch." In addition he had to see that every passenger had a ticket, but where a passenger held a ticket for a station short of his destination his duty included seeing that the passenger alighted at the place to which he had paid his fare, unless "being a respectable party, he could satisfy the superintendent that he had no intention of paying an improper fare."

Smoking on any part of the company's premises or trains was prohibited, and idleness or neglect of duty punishable by a fine. In the case of detention or stoppage of trains, guards were instructed to explain the cause to the passengers and "endeavour to pacify those who may be annoyed."

Film Publicity on the L.M.S.R.

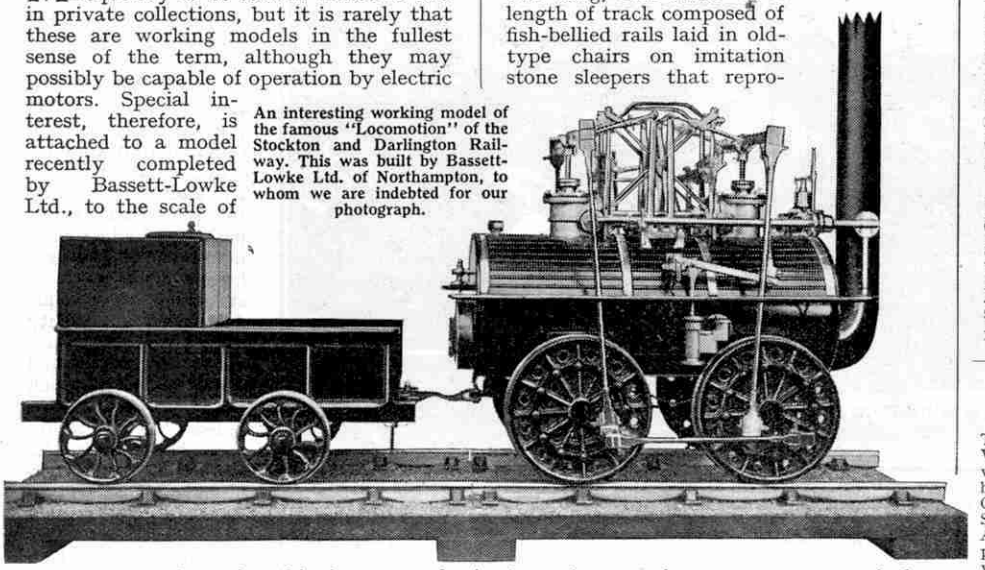
An enterprising piece of publicity work is being carried out by the L.M.S.R. in the exhibition of cinema films that have been prepared specially for showing the facilities for travel offered by that great line.

One of the films shows the passenger trains of the L.M.S.R., and some fine "shots" have been obtained of the principal expresses and, in particular, of *"The Royal Scot,"* drawn by one of the latest 4–6–2 locomotives, and also of electric and steam-drawn suburban trains in the London area. Another film, entitled *"Ships of the Narrow Seas,"* vividly portrays the L.M.S.R. Royal Mail route to Ireland.

These films are being exhibited first of all to the L.M.S.R. staff at various places throughout the system in order to make them better acquainted with the attractive services offered by the line. To accommodate the staff in charge of the cinema apparatus one of the old L.N.W.R. 42 ft. composite corridor coaches has been specially adapted. As now equipped it contains day, sleeping, and luggage compartments, and a work room where repairs can be carried out. It is probable that later the films will be given the wider publicity they well deserve, and there is sure to be keen general interest in the information they give so attractively.

An Interesting Locomotive Model

MODELS of early locomotives are frequently to be seen in museums and in private collections, but it is rarely that these are working models in the fullest sense of the term, although they may possibly be capable of operation by electric motors. Special interest, therefore, is attached to a model recently completed by Bassett-Lowke Ltd., to the scale of 1½ in. to the foot, for this is arranged as an actual working model. It represents the first locomotive of the Stockton and Darlington Railway, built in 1825 and appropriately named *"Locomotion."*



An interesting working model of the famous "Locomotion" of the Stockton and Darlington Railway. This was built by Bassett-Lowke Ltd. of Northampton, to whom we are indebted for our photograph.

The model has a copper boiler lagged with mahogany, and has the complete and intricate overhead motion of the original, connecting the two vertical cylinders on top of the boiler to the four driving wheels. This elaborate "grasshopper" gear is specially constructed for working conditions, and its components are made of nickel-plated steel. The curiously-designed driving wheels are reproduced in cast iron. The engine is complete with a feed pump worked off the motion, and is fitted with the crude pattern of chimney built up in the original of iron plates as an upward extension of the single flue passing through the boiler.

A four-wheeled tender is attached to the engine, and reproduces the actual vehicle as fitted with a rectangular sheet-iron water tank at the rear. The engine and tender together measure 3 ft. long, and stand on a length of track composed of fish-bellied rails laid in old-type chairs on imitation stone sleepers that reproduce the actual permanent way of the Stockton and Darlington Railway.

The model has been constructed to the order of Robert Stephenson and Co. Ltd., of Darlington, the firm founded in 1823 by George Stephenson in his son's name, and the actual makers of the original engine. The first works were situated at Forth Street, Newcastle-on-Tyne, and there *"Locomotion,"* the first engine of the British railway system, was built.

This remarkable pioneer was in service for 25 years on the Stockton and Darlington Railway, and then worked for a further period of seven years as a colliery pumping engine. It is fortunately still in existence, and is usually kept on a stone pedestal in Darlington Station. It has been exhibited on occasions even as far away as Philadelphia and in Paris, and actually took part in the locomotive procession during the railway centenary celebrations at Darlington in 1925. It was not then operated under steam, however, but by means of a petrol engine concealed in the tender.

Second Dutch War

—(*Continued from page 861*)

both squadrons had drifted out of sight of the main portions of the fleets. The English van and centre fought so well that by nightfall De Ruyter, lacking the support of Tromp, was in full flight. Fighting continued intermittently during the night, but adverse winds in the morning caused the English to abandon the pursuit when near the Dutch coast. The Duke was soon rejoined by Smith, who had lost touch with Tromp during the night.

The English losses consisted of only one ship of the line, two or three fireships, and a small number of men; but the Dutch lost 20 ships and 4,000 men, while their wounded totalled 3,000. Tromp was severely reproved by De Ruyter, and shortly afterwards he was dismissed from the service by the States-General, William Van Ghent, a colonel of marines, being appointed to succeed him.

The victorious English fleet sailed up the coast of Holland, capturing ships at every opportunity, and by their nearness terrifying the inhabitants of the coast towns. A deserter from the Dutch fleet informed the English that there were valuable stores and ammunition on the islands of Vlieland and Terschelling, and that about 200 richly laden merchantmen, protected only by two ships of the line, were anchored in the strait between the islands. A council of war was held, and it was decided to attack the merchant fleet. The task was given to Sir Robert Holmes, and on 9th August he approacjed the strait with nine frigates, five fireships and four ketches.

Holmes paused to station two of his largest ships of the line outside the buoys that marked the channel into the strait, to seize any ships that might escape him, and he then continued his advance. He attacked first the two Dutch ships of the line and destroyed them. The fireships were sent among the crowded merchantmen, and the air was soon thick with the smoke of many burning ships. The English seamen had received orders to destroy but to abstain from plundering, and nearly 170 of the Dutch ships were set on fire, only about 20 escaping by fleeing up a shallow creek.

Next day English seamen armed with muskets landed without opposition on the island of Terschelling, and burned Brandaris, the chief town, and numerous storehouses. An attempt to invade Vlieland was also made, but was frustrated by bad weather. The losses of the Dutch, in ships and stores, was estimated to be at least £850,000, but Holmes' lost only four or five fireships and 12 men killed or wounded. In England the affair became known as "Holmes' Bonfire."

Jerseys for Meccano Boys

Readers of the *"M.M."* have probably noticed that the Meccano boys in our advertisements and on our catalogue covers are always dressed in a special type of jersey with dice around the collar, cuffs and waist. In response to many requests, we have now made arrangements for jerseys of the special Meccano design to be made available for Meccano boys.

The jerseys are made in two styles. One is an ordinary Jersey with a turnover collar, and the other is a Pullover with a low V neck. The Jersey may be worn with a tie, and special ties to match are also being marketed. There are eight different colour schemes and all are made in a variety of sizes to suit all ages. The colours are guaranteed to be fast to light and washing.

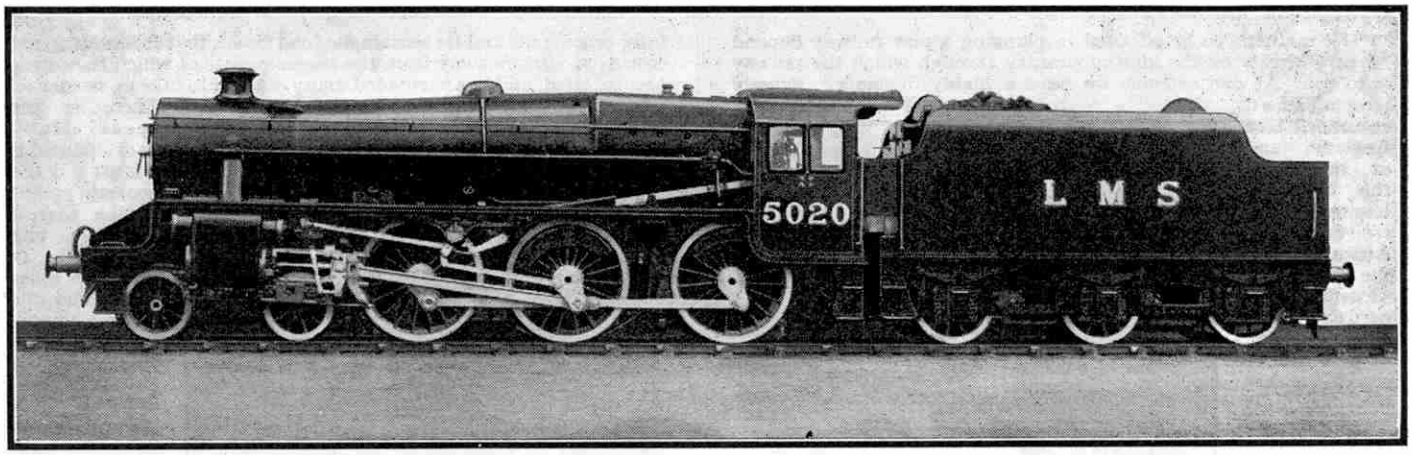
We specially recommend the Meccano Jerseys to the notice of Meccano Clubs. Club meetings will look much brighter and more "business-like" if all the members are dressed in the same colour of jersey—the one chosen by the club as its standard colour. Full particulars will be found in the advertisement on page 902.

"The Skybird" Autumn Issue

The Autumn number of "The Skybird" is now ready. This is the fourth quarterly issue and completes Volume 1. An attractive yellow cloth binder engraved with the Skybird emblem and the words "The Skybird" has been specially designed. This costs 1/3 (post free in Great Britain) and may be obtained direct from the Skybird League Headquarters, 3, Aldermanbury Avenue, London, E.C.2. A limited number of complete bound copies are available, post free 5/6. This volume constitutes an interesting record of the progress of the "Skybird" movement.

Mixed Traffic Locomotives for L.M.S.R.

New Two-Cylinder 4-6-0 Design



THE requirements of the L.M.S.R. for a "general utility" engine have led to the production of a new design of 4–6–0 locomotive that embodies all the features that have become familiar since the appointment of Mr. W. A. Stanier as Chief Mechanical Engineer. The L.M.S.R. have thus joined the S.R. and G.W.R. in recognising the merits for general traffic purposes of the 4–6–0 engine with driving wheels of medium diameter. The S.R. have several classes of this type of engine, but the G.W.R. examples, which are very numerous, all belong to the "Hall" class.

The illustration on this page, reproduced by courtesy of the L.M.S.R., shows one of the new engines built by the Vulcan Foundry Ltd., of Newton-le-Willows, and the following description will be of interest to readers.

This class is unique in that it represents the first 4–6–0 design built since the formation of the L.M.S.R. group essentially for mixed traffic working, and its ready adaptability to either passenger or goods working is shown by its traffic classification "5P5F." Previous mixed traffic locomotives have all been of the 2–6–0 or "Mogul" wheel formation, the first 244 being after the Horwich design of Mr. G. Hughes. The subsequent 40, as described in the "*M.M.*" last March, represent the modification of this design according to the ideas of Mr. W. A. Stanier, who has impressed his stamp on L.M.S.R. locomotive practice, and whose successive designs for that company all bear a remarkable "family likeness."

Thus the new mixed traffic engines greatly resemble in outward appearance the new series of "5X" passenger engines with tapered boilers illustrated and described in the "*M.M.*" last May. But instead of the three-cylinder propulsion of these engines, two cylinders only are provided in the new design, these having the same moderate diameter, 18½ in., and long stroke, 28 in., as the Stanier "Moguls." The cylinders are placed outside, as the photograph shows, and have the valve chests above accommodating piston valves with a travel of 6½ in., Walschaerts valve gear providing the necessary movement.

The cylinders are slightly inclined and are connected to the driving wheels by rods of high tensile manganese molybdenum steel of fluted section; but the side rods coupling the wheels are of plain or rectangular section. The wheel centres are steel castings with the now usual triangular rim section as on previous engines of Mr. Stanier's design, and they have the balance weights built up of steel plates riveted to the spokes, the necessary adjustments for balance being made by the addition of lead between the plates.

The coupled wheel axle-boxes are steel castings with pressed-in brasses having suitable white metal crowns. Oil grooves are provided on both sides of the crown, and the oil pads can be examined by sliding out the underkeep while the axle-box is in position. Each box is fitted with a dust shield carried on the inside face. The crown of each box has an independent oil feed from a mechanical lubricator, with the standard back-pressure valves and flexible oil pipe connections.

The laminated bearing springs for the engine and tender are made of silico manganese steel, the plates being of a ribbed section, and the fixing in the buckle of the cotter type. The spring links are of the screwed adjustable pattern.

The standard type of four-wheeled bogie supports the front end of the engine, the weight being taken through side bolsters. Bogie side check spring gear is provided to ensure smooth riding.

The boiler is similar to that of the new "5X" three-cylinder passenger engines having a tapered barrel, Belpaire fire-box, moderate degree superheater, and top-feed apparatus. The last-named is accommodated under the dome-shaped cover on the boiler barrel. The regulator valve is incorporated in the superheater header in the smoke-box. The working pressure is 225 lb. to the square inch, which is relieved by two safety valves of the Ross "pop" pattern. The boiler plates are made of 2 per cent. nickel steel with a view to strength and lightness.

A steam manifold with a main shut-off valve is provided at the top of the fire-box door plate in the cab, and to this manifold are attached valves for the vacuum brake ejector and steam brake. The sight feed lubricator to the regulator, the pressure gauge, and the train heating apparatus are also supplied from valves on the manifold, as are the two injectors for feeding the boiler and the whistle, which is of the hooter type adopted for recent L.M.S.R. locomotives.

The cab fittings generally are of the company's standard type, the drive being arranged on the left-hand side. All controls can be conveniently handled. On each side of the cab there is a tip-up seat and two sliding windows with a small hinged window outside to act as a draught-preventer for the enginemen when looking out.

The coupled wheels and the tender wheels are acted upon by the steam brake operated by the driver's vacuum brake valve. A steam ejector is used to create the vacuum when the (*Continued on page 901*)

Dimensions of New L.M.S.R. Mixed Traffic Locomotives

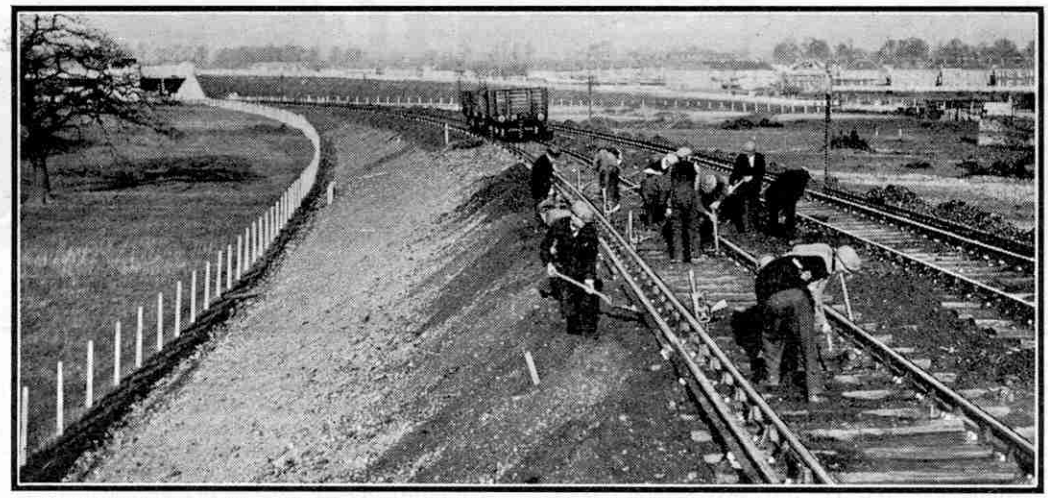
Cylinders	
Diameter	18½ in.
Stroke	28 in.
Wheels	
Bogie	3 ft. 3½ in.
Driving	6 ft. 0 in.
Heating Surface	
Tubes	1,460 sq. ft.
Fire-box	156 sq. ft.
Superheater	227.5 sq. ft.
Grate Area	27.8 sq. ft.
Working Pressure	225 lb. per sq. in.
Tractive Effort at 85 per cent. working pressure	25,455 lb.
Adhesive Weight	54 tons
Weight of engine in working order	72 tons
Weight of tender in working order	54 tons 2 cwt.
Total weight of engine and tender in working order	126 tons 2 cwt.
Coal capacity	9 tons
Water capacity	4,000 gallons
Total length of engine and tender over buffers	63 ft. 7⅞ in.

The Planning of a New Railway

From First Survey to Letting the Contracts

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

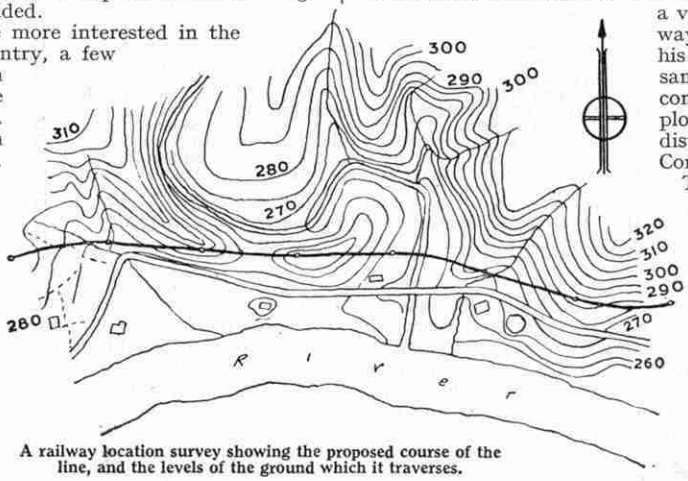
THE methods to be adopted in planning a new railway depend very largely on the kind of country through which the railway is to run. At one extreme we have a highly developed, densely populated country like England, and at the other the kind of territory found in tropical Africa, or in the centre of Australia. In an undeveloped country traffic at first will be scarce, so that the line must be built as cheaply as possible; and, as there are few centres of population, it may have to be diverted considerably out of its direct course in order to get more traffic. The ideal railway is dead straight and absolutely level, although if the rare opportunity occurs of having the line downhill for loaded wagons, the uphill traffic being chiefly empties, this leads to economical working.



Packing the sleepers up to the correct level before ballasting. The rail is held up by the jacks shown in the illustration to facilitate operations. Photograph reproduced by courtesy of the S.R.

The Australian Trans-Continental line is straight and nearly level for 300 miles, because the object of it is to connect two fairly populous areas, across what is practically a desert. The embankments and cuttings, or earthworks as they are called, are very light, and there are no sharp curves. Railways in tropical Africa are usually planned to suit the lie of the ground in order to avoid heavy construction costs, and expenses are kept down by using a narrow gauge, and steep gradients and sharp curves if tunnelling or deep excavation is thereby avoided.

As our readers probably will be more interested in the problem as found in our own country, a few words must suffice to deal with railway planning in jungle, dense forest, and unmapped country. Generally, the task will be to design a railway to join two definite places. First of all there will be a reconnaissance or exploration survey of several possible routes, and this may be not only an engineering survey, but also an economic survey, to ascertain whether such things as minerals, cattle, and vegetation of commercial value, are likely to provide traffic for the line. The various routes will then be studied carefully, and on two or three of the most promising ones trial location surveys will be made, a higher degree of accuracy in measurement being required this time, and hence taking longer. From these surveys the final route will be chosen, and on it will be made a preliminary location survey that will form the foundation for the final location survey leading to the actual setting out of the line. The difficulties of the work will be due chiefly to such things as bad climate, poisonous insects, and shortage of water supplies.



A railway location survey showing the proposed course of the line, and the levels of the ground which it traverses.

Turning now to home conditions, let us suppose that the rising and thriving township of Menton-on-Sea has, by the efforts of its enterprising Town Council, so successfully advertised its wonderfully bracing air and its amazingly good beach that it has attracted crowds of visitors away from the bigger resorts of which they have become tired, and has persuaded many of them to take up residence. There is the great drawback, however, that the nearest point of the nearest railway, the Central, is about 16 miles away, and the nearest important station, Lanchester, is 20 miles distant. If only Menton could have the railway brought to it, its prosperity is assured.

Aided by the local Press, enthusiasm for the idea becomes general in the town, and the Council is petitioned to approach the Central Railway on the subject. A Railway Sub-committee of the Council is therefore formed, the Town Clerk writes to the General Manager of the Railway to ask for the favour of an interview, and in due course that gentleman receives the sub-committee.

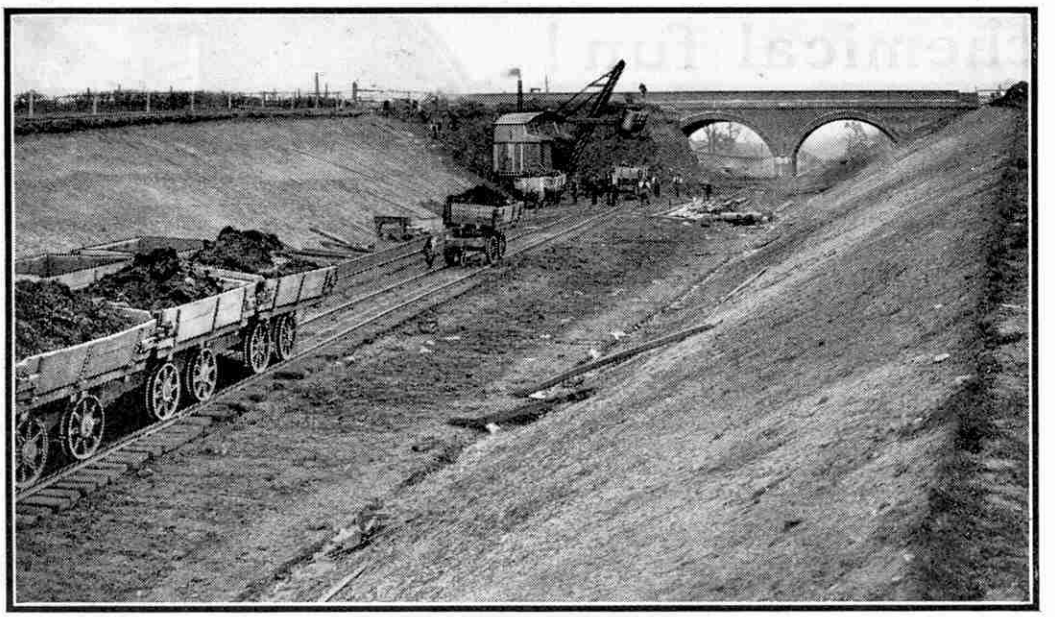
The project so far can be discussed only in very general terms, but from statistical information supplied to him, as to the population of the town, its chief industries, and so on, the Manager thinks that further enquiry is justified. It is agreed that Lancheater will be the best place to make the junction if it is decided to build the branch, and it is arranged that the Menton authorities shall canvass the district between their town and Lanchester with a view to getting support for the railway. The Manager promises to consult his Directors, so that they may sanction the setting aside of a small committee of railway officers to explore the traffic possibilities of the district; and this being done, the Committee is set up and gets to work.

Traffic possibilities turn out to be distinctly good. There are three small country towns on what would be a fairly direct route, and they have no good road connection to anywhere of importance. A fair amount of dairy farming is carried on in the area, but is somewhat restricted by poor transport. Coal is known to exist at one or two places in the district, and the seams are at no great depth. The same seams are already being worked nearer the railway, and the building of the branch is certain to lead to sinking of new shafts.

The country is a comparatively easy one from the point of view of railway building, and it is assumed that the cost for a double line will not exceed £10,000 a mile. For 20 miles this is £200,000, and at 5 per cent. interest on the money the branch must make a profit of £10,000 a year to pay its way. A rough estimate of probable traffic shows that it probably will not do this for the first few years, but is likely to do so in eight or nine years. There is, of course, also the unknown factor of the traffic it will contribute to

the rest of the line. So a report is submitted to the Directors by the Manager, recommending that a detailed scheme and estimate should be prepared. A little pressure has been put on the Menton Council who, in view of the advantages to be attained by the town, have agreed to demolish some derelict property and clear a site for the terminus, afterwards selling the site to the Railway for a nominal figure.

After discussion, the Directors agree that the expenditure is justified, and the Manager is authorised to proceed. He therefore instructs the Engineer to prepare a scheme for a railway from Lanchester to Menton, serving if possible certain named places between, and to co-operate closely with the traffic Department as to the stations, sidings, etc., required.



Forming a cutting by means of a steam navvy. The "spoil" is taken away over the temporary track in tip wagons and used to form embankments elsewhere. Photograph reproduced by courtesy of the G.W.R.

As heavy excursion trains at high speeds are expected to use the line, it is decided that the "ruling gradient," that is the steepest gradient that can occur repeatedly, shall be 1 in 176, representing a 30-ft. rise in one mile. This was used on the Great Central extension from Leicester to London. A short length as steep as 1 in 100 would be permitted if necessary, however, to save heavy expense. As the biggest engines will use the branch, the sharpest curve is to be of 20 chains radius, that is $\frac{1}{4}$ mile, a chain being 66 ft.

A set of what are called 6-inch Ordnance Sheets, or maps to a scale of 6 in. to a mile, published by the Ordnance Survey Department of the Government, are now obtained by the engineering staff, to cover the district in which the railway will lie. These sheets have on them the contours, or lines joining places of equal level, all levels being referred to what is called Ordnance Datum. A contour marked 50 is therefore at the same level whether the map shows a part of Perthshire or a part of Kent, and is 50 ft. above Ordnance Datum, called O.D.

Removing the sleepers of the temporary track to make way for the main line material. The track alongside is already laid, and the ballast has been tipped ready for spreading. Photograph reproduced by courtesy of the L.M.S.R.

By a process of trial and error, a centre line is now pencilled out on the sheets, starting from the junction point of the new railway, and using the contour lines, so that there will be as little cutting and embankment as possible, while at the same time the permissible gradient is not exceeded. This will give a series of straight lines at an angle to one another, and they must be joined by curves not sharper than the radius of 20 chains already decided as the minimum.

The sheets are now pasted together, being cut as required so that they form a roll about 18 in. wide. The line pencilled out is then walked over with the rolled map in hand, and a new line is laid down in pencil, as close to the old one as possible, but improving on it to suit the lie of the ground. An instrument called a hand level, together with a pole 5 ft. or 6 ft. long, is useful in helping to determine levels not actually given on the map. The new line is then drawn in carefully in the office with accurate curves and straight lines.

Levels are then taken along this line at definite places, such as where fences are crossed. As Parliamentary Regulations allow a deviation of 300 ft. in the country and 30 ft. in towns on either side of the centre line shown on the Parliamentary Plans, and a change of level up to 5 ft. in the country and 2 ft. in towns, it is necessary to make sure that within a 600-ft. wide strip the Ordnance sheets are correct up to date. There will usually be new buildings to be added.

The Company's legal staff now come on the scene, and reference, or give a number to, every field, enclosure, building, road or path inside this strip, with the names of the owner or lessee. The Parliamentary Plans are then prepared by tracing from the 6-inch maps, making sheets of a uniform size, each showing four miles of railway. A section is drawn under each plan, with a vertical scale of 100 ft. to 1 inch. A firm of lithographic specialists are then given the tracings, which they redraw, and reproduce in a conventional style. After proofs are corrected, the Engineer sends a quantity of the plans to the Solicitor, who sends them to the various local authorities in whose areas the railway will lie.

The section of the railway is drawn with a base line whose level must be stated with regard to Ordnance Datum. The rail level is figured on at each change of gradient, and also distances in miles and furlongs. All public roads, railways and canals crossed, and how crossed, must be shown, with span and height of bridge, and necessary raising or lowering of roads. Heights and depths of embankments and cuttings, if over 5 ft., must be marked on. Public roads crossed on the level must have levels taken on them for 200 yds. on each side of the crossing, and enlarged sections of the crossing must be shown. If the road crosses by a bridge, a section is again required with the road gradients marked. Our proposed junction at Lanchester will involve a plan and section of the existing main line for 800 yds. on each side of the junction.

An estimate of the cost of the railway is now made by the Engineer in a form prescribed by the Ministry of Transport. It sets out the quantities and costs of such things as cuttings, embankments, culverts and drains, road making, permanent (Cont. on page 901)

KEMEX OUTFITS

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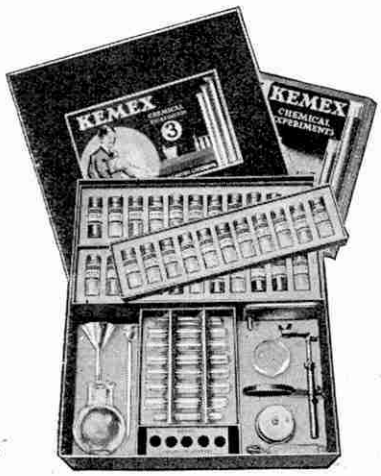

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How Ships are Measured

The Standards of Size and Capacity

IN the references to new ships that appear from time to time in the *Engineering News* and other pages of the "*M.M.*," figures of dimensions and tonnage are usually given. A certain amount of misunderstanding appears to exist in regard to some of these measurements, and the object of this article is to make matters clear by a simple explanation.

The length of a ship may be stated in two different ways. First of all there is the "overall length," sometimes written as "length O.A.," which is the maximum length of the ship between the forward and aft extremities. Then there is "length between perpendiculars," or "length b.p.," which is the length measured from the forward side of the stem post to the aft side of the stern post at the upper deck. A moment's thought will show that there is bound to be a considerable difference between these measurements, and this difference is the cause of what appear to be conflicting statements in regard to the length of any particular ship. To take an example, the overall length of the Canadian Pacific liner "*Empress of Britain*" is 760 ft. 6 in.; whereas her length between perpendiculars is only 730 ft.

A third but less important length measurement is "length on waterline," which is the length between the forward and aft extremities of the hull on the load waterline. This measurement is chiefly used in connection with vessels floating at a constant draught.

The "extreme breadth" of a ship is measured over the outside plating at the greatest breadth of the vessel. "Breadth moulded" is the greatest breadth measured over the frames.

"Depth moulded" is measured at the middle of the length of the ship from the top of the keel to the top of the upper deck beams at the side of the vessel; or in an "awning-deck" or "shelter-deck" ship, from the top of the keel to the top of the main deck beams at the side of the vessel.

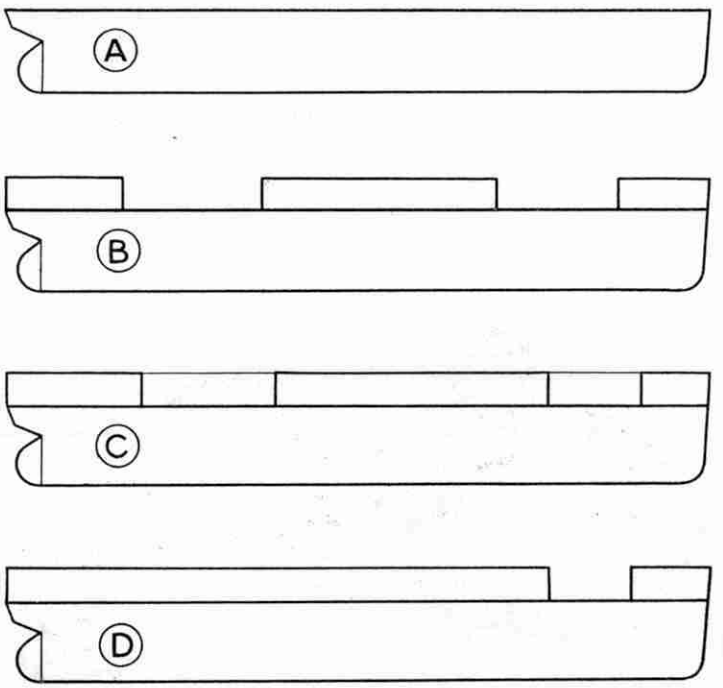
"Draught" is the depth of the submerged portion of the hull.

We have just referred to "awning-deck" and "shelter-deck" vessels. The early iron ships were of what is known as the single-deck type; that is they had one deck above the double bottom. Subsequently, in order to provide shelter, erections were built forward, amidships and aft, resulting in what is known as the "three-island" ship, with poop, bridge and forecastle. The next step was to fill in the wells between forecastle and bridge, and bridge and poop, with structures of a portable nature, primarily designed for the protection of cattle carried in the wells; and this resulted in the awning-deck type. Later the temporary filling-in structures were made permanent, producing a vessel of the shelter-deck type. In a shelter-deck ship permanent openings known as "tonnage openings" were left, which excluded that deck from being measured for tonnage as a permanently closed-in structure. The awning deck, on the other hand, was intact, and was included in the tonnage measurement. During recent years the shelter-deck vessel has been improved in regard to coverings for the tonnage openings, and has superseded the awning-deck type. A "well-decked" vessel is a development of the three-island type in which the after well only is filled in.

The tonnage of ships may be expressed in various ways, the following being the most usual.

"Gross tonnage" is the total cubic capacity of a ship measured to the tonnage deck, which is the upper deck in ships with less than three decks, and the second continuous deck from below in all other merchant ships. It includes also the capacity of all permanently closed-in structures above the tonnage deck, such as poop, bridge, and forecastle in a three-island ship. To put it in another way, the gross tonnage of a ship represents the amount of cargo it would carry if all permanently-enclosed spaces were filled, regarding cargo as measuring 100 cu. ft. to the ton.

"Net tonnage" is the gross tonnage less the tonnage of the actual space occupied by the crew and the machinery. It is upon this tonnage that pilotage dues, dock and harbour dues, light dues, etc., are based.



Structural types of ships: (a) single-deck; (b) three-island; (c) awning deck; (d) well-deck.

"Displacement tonnage" is the measure of the weight of water displaced by a vessel when afloat, and therefore is equivalent to the actual weight of the ship. This tonnage is used for the measurement of warships.

Special rules are in force for ascertaining the net tonnage upon which tolls and other charges are paid for ships passing through the Suez Canal and the Panama Canal.

Every sea-going ship of more than 15 tons sailing under the British flag must be registered; and before the issue of a registration certificate specifying the port, build, and other identification details, the ship must be surveyed by a surveyor appointed by the Board of Trade. The name of the vessel must appear on each of her bows, and her name and her port of registry on her stern. The official number that is given to a ship must be cut in the main beam, and it is interesting to note that this number remains unchanged throughout the ship's existence, no matter what changes may be made in her name or structure.

Merchant ships bear draught markings at stem and stern, the purpose of which is to indicate the amount of the ship's hull below the water at that point. The indications in British ships are in feet, each foot mark being 6 in. high. The draught marks are placed in position by the shipwright, who also "strikes in" the paint line round the hull, which corresponds to the load water line.

All British sea-going merchant ships, with a very few exceptions, are required to be marked with a loadline that indicates the limit of draught beyond which the ship should not be submerged. This regulation is designed to guard against the overloading of ships, and thus to promote safety at sea. The indications are given by means of the "disc and gridiron" markings, familiarly known as the "Plimsoll mark."

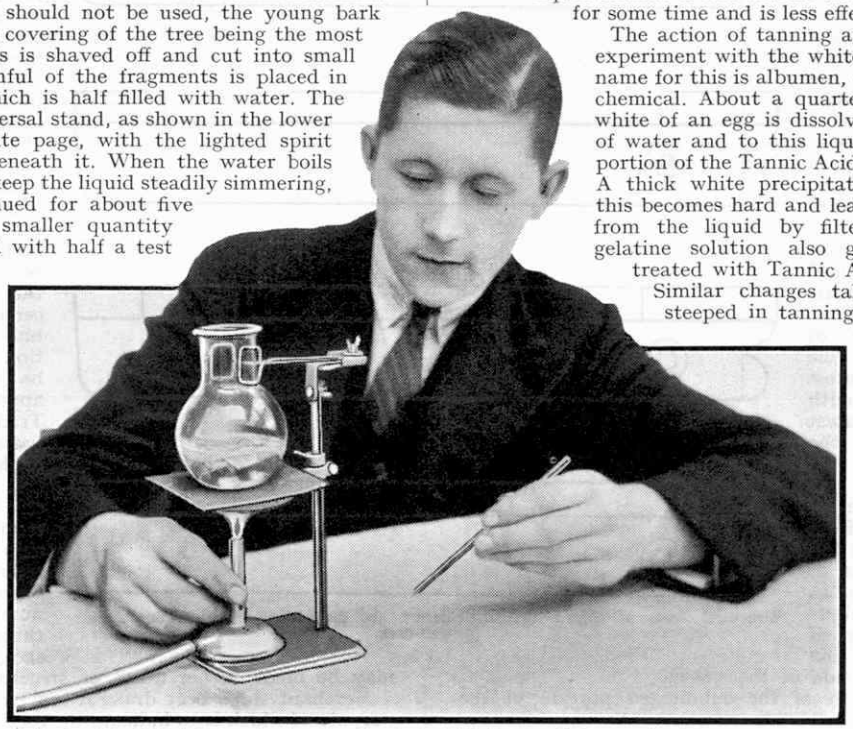
In descriptions of old ships readers may possibly come across the letters "b.o.m." in conjunction with figures expressing tonnage. These letters stand for "builders' old measurement," a method that used to be employed for measuring ship tonnage, and upon which were based the builders' charges for construction. The calculation was made in the following manner. From the vessel's length in feet between the perpendiculars three-fifths of her breadth was deducted, and the remainder multiplied by the whole breadth. The product was again multiplied by the whole breadth, and this last product divided by 94.

KEMEX EXPERIMENTS IN TANNING AND DYEING

ONE of the most interesting branches of industrial chemistry is tanning, or the preparation of leather from hides and skins. The changes that take place during this process are very complicated and are brought about by steeping the hides in liquids containing tanning extracts manufactured from vegetable sources. One of the best known tanning materials is oak bark, which for centuries has been used extensively by tanners.

An interesting series of experiments that will help to explain the chemistry of tanning can be made with oak bark and similar substances. Old oak bark should not be used, the young bark from the inner side of the covering of the tree being the most suitable. A portion of this is shaved off and cut into small pieces, and a dessertspoonful of the fragments is placed in the wide-necked flask, which is half filled with water. The flask is placed on the universal stand, as shown in the lower illustration on the opposite page, with the lighted spirit lamp or bunsen burner beneath it. When the water boils the flame is turned low to keep the liquid steadily simmering, and the heating is continued for about five minutes. Alternatively a smaller quantity of oak bark can be boiled with half a test tube full of water, the tube being held in the test tube holder, or in a folded strip of paper, with its lower end just above a small flame, and shaken gently in order to prevent violent boiling.

After the contents of the flask have cooled and the fragments of bark have settled to the bottom, a little of the extract or liquid obtained is poured off into a test tube, which may be filled to a depth of about 1 in. A solution of Iron Alum is then prepared by shaking one measure of this chemical with half a test tube full of water, and on pouring a few drops of this into the extract a deep black precipitate is obtained immediately.



Boiling a strip of silk in logwood extract in order to dye it black. The silk has previously been treated with chemicals to enable the dye to be applied effectively.

In order to explain what has happened in the experiment we have just described, one measure of Tannic Acid is dissolved in half a test tube full of water and to half of this solution a few drops of the solution of Iron Alum already prepared are added. Again a black precipitate is obtained. This is iron tannate and is exactly similar in appearance to that already obtained. The oak bark extract in fact contains tannic acid, or tannin as it is sometimes called, and this chemical is responsible for the changes that occur in tanning. The name really denotes a group of very weakly acid chemicals that are found in oak bark, and also in galls, the curious hard lumps, often resembling nuts in appearance, that form on plants where the eggs of certain insects are deposited.

It is interesting to test other barks besides that of the oak in order to find which contain tannic acid and to form an idea as to the one that is most likely to be valuable to the tanner. In all cases the hard outside bark should be stripped off before testing. Tea leaves also contain tannin. In order to test for the chemical in this source, a few tea leaves are boiled vigorously with half a test tube full of water, or they are boiled for five minutes or even more in the wide-necked flask half filled with water. The clear liquid left after the tea leaves have settled is poured into a tube and tested by the addition of a few drops of Iron Alum solution. The production of a black precipitate shows the presence of tannic acid. It must not be supposed from this experiment that tea as ordinarily made contains a large proportion of tannin. Pouring boiling water over the tea leaves and straining away the liquid formed is less drastic than boiling them with water for some time and is less effective in extracting tannin.

The action of tanning agents is best seen from an experiment with the white of an egg. The chemical name for this is albumen, which is a complex organic chemical. About a quarter of a teaspoonful of the white of an egg is dissolved in half a test tube full of water and to this liquid is added the remaining portion of the Tannic Acid solution already prepared. A thick white precipitate immediately forms and this becomes hard and leathery when it is separated from the liquid by filtering and left to dry. A gelatine solution also gives a precipitate when treated with Tannic Acid.

Similar changes take place when hides are steeped in tanning liquids, for these contain albuminous substances, that is chemicals resembling albumen or containing it. Ham rind provides a convenient subject for an experiment that forms a nearer approach to actual tanning than that with albumen itself. A small piece is freed from fat and grease and is then soaked in a solution of Tannic Acid, prepared as already explained. The action of this chemical on the albuminous substances in the rind is slow and sufficient time must be given to allow it to penetrate. This may require several days, and from time to time the rind should be carefully lifted out and washed in order to follow the changes in its appearance. Eventually it will be found to be hard and leathery.

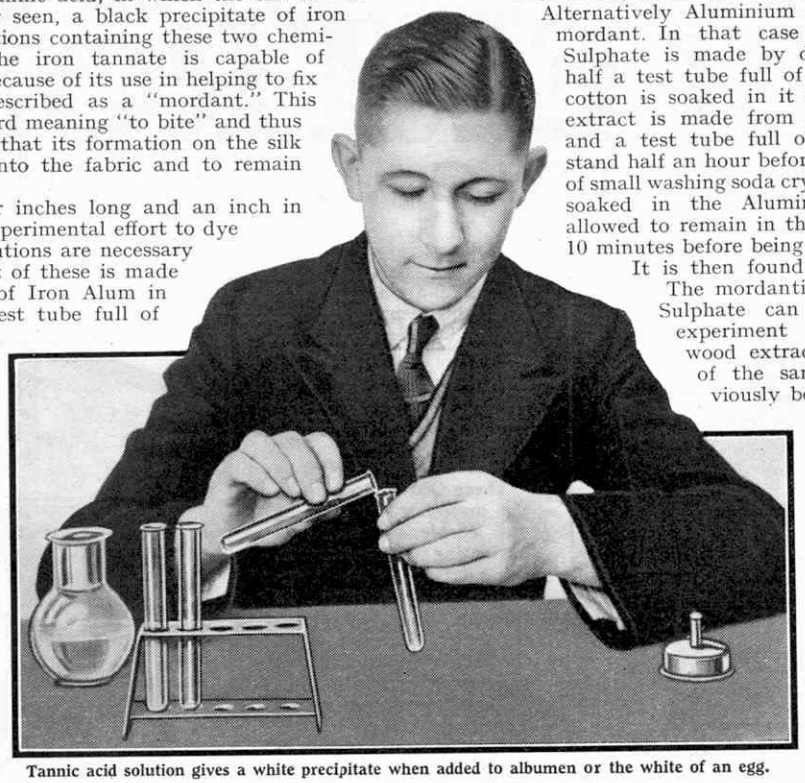
The vegetable kingdom is a great storehouse of chemicals of all kinds and certain plants and trees yield dyes or colouring matters. Wood, indigo and madder are good examples of vegetable dyes, and the colouring matter obtained from the wood of the logwood tree can be applied with good effect by the Kemex experimenter. This tree is a native of Mexico and Central America, from which countries it is exported in logs. The heartwood of the tree is the source of the dye, and is included in the range of Kemex chemicals in a convenient form for rapid extraction of the colouring matter. When it is boiled with water, a red liquid is obtained that can be used as an indicator, for with acids it becomes a striking yellow colour and it is turned blue by alkalies.

Logwood as a dye is chiefly useful for giving a good black on silk. It seems strange that so many different colours can be produced from this single material, but in all cases chemical changes are responsible, new compounds being made, or new forms of these.

produced, that show characteristic differences of colour.

In order to dye silk black it is necessary to make use of other materials in addition to the logwood, for the dye cannot be applied directly to the fabric with success. The chemicals used for this purpose are iron salts and tannic acid, in which the silk is first steeped. As we have already seen, a black precipitate of iron tannate is formed when solutions containing these two chemicals are mixed together. The iron tannate is capable of absorbing the logwood and because of its use in helping to fix the colour on the silk is described as a "mordant." This name comes from a Latin word meaning "to bite" and thus it expresses vividly the fact that its formation on the silk enables the colour to bite into the fabric and to remain firmly fixed on it.

A strip of silk about four inches long and an inch in width is convenient for an experimental effort to dye this material black. Two solutions are necessary for mordanting it. The first of these is made by dissolving six measures of Iron Alum in about three quarters of a test tube full of water and the second by dissolving an equal amount of Tannic Acid in the same quantity of liquid. When ready the two solutions are poured into basins in order to make them easily accessible. The strip of silk is steeped first in the Iron Alum solution. It is turned over in the liquid by means of the glass rod until every part of it has become thoroughly soaked, for the Iron Alum must be evenly distributed in order to obtain good results. About five minutes soaking will suffice and the strip is then stretched and hung up to dry.

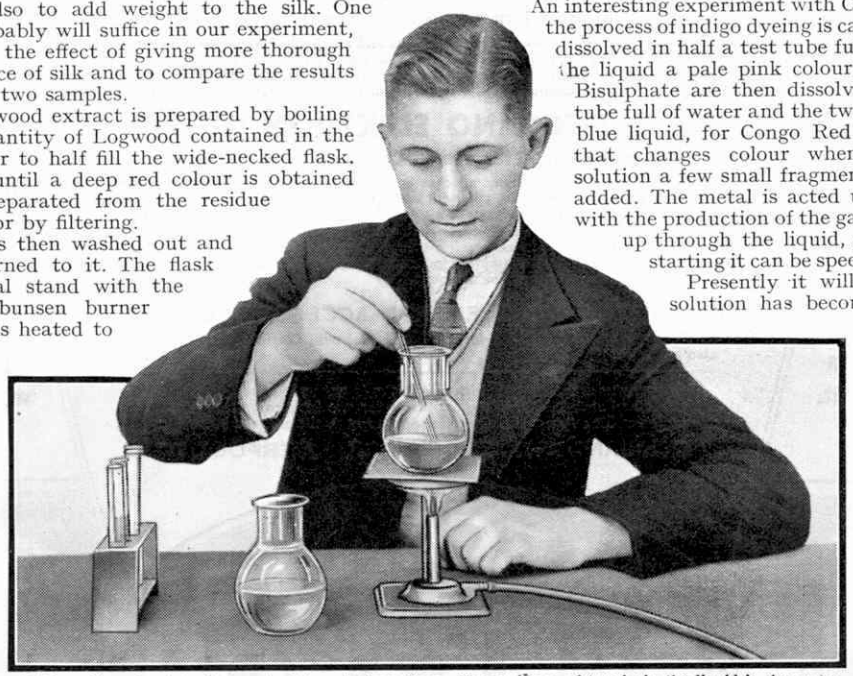


Tannic acid solution gives a white precipitate when added to albumen or the white of an egg.

Then follows a similar steeping in the Tannic Acid solution, when the black iron tannate is deposited on it, followed again by stretching and drying. In practice this process is repeated, the silk being soaked alternately in solutions of iron salts and of tannin, partly to ensure good mordanting and partly also to add weight to the silk. One soaking in each liquid probably will suffice in our experiment, but it is interesting to try the effect of giving more thorough immersions to a second piece of silk and to compare the results of the next process on the two samples.

For the final dyeing logwood extract is prepared by boiling about a quarter of the quantity of Logwood contained in the Outfit with sufficient water to half fill the wide-necked flask. The boiling is continued until a deep red colour is obtained and the liquid is then separated from the residue either by decanting it off or by filtering.

The wide-necked flask is then washed out and the logwood extract returned to it. The flask is placed on the universal stand with the lighted spirit lamp or bunsen burner under it, and the extract is heated to boiling point. The silk is then added and carefully stirred in the hot liquid. After boiling the strip of fabric in the solution in this manner for about 10 minutes, it is lifted out, dipped in cold water and wrung to expel as much liquid as possible. It is stretched and hung up to dry and will then be found to be dyed a good black colour. If the first trial is not very satisfactory, it can be repeated, varying the strengths of the solutions and the times allowed for steeping the silk in them.



Boiling chips of oak bark to extract tannin from them. The presence of tannin in the liquid is shown by adding Iron Alum solution to it, when a black precipitate is formed.

Experimenters should take care to wash their hands between operations with the different liquids in order to prevent them from becoming accidentally dyed. The glass rod used for stirring purposes also should be rinsed well under the tap before being placed in another liquid, and a further warning that will help to avoid breakages is that a glass rod is intended only for stirring purposes, and not for poking at materials placed in flasks or tubes.

A similar effect can be obtained by mordanting a piece of cotton with the same solutions and boiling it with logwood.

Alternatively Aluminium Sulphate can be used as a mordant. In that case a solution of Aluminium Sulphate is made by dissolving four measures in half a test tube full of water and a small strip of cotton is soaked in it and then dried. A logwood extract is made from four measures of Logwood and a test tube full of water, and is allowed to stand half an hour before adding about six measures of small washing soda crystals. The cotton previously soaked in the Aluminium Sulphate solution is allowed to remain in the logwood extract for about 10 minutes before being taken out, rinsed and dried. It is then found to be dyed a good black.

The mordanting effect of the Aluminium Sulphate can be demonstrated in this experiment by placing in the logwood extract a second piece of cotton of the same size that has not previously been treated with this chemical. This piece of cotton also is dyed black, but the depth of colour is much less and the dye shows a tendency to be washed out on boiling with water.

A very interesting dyestuff that cannot be applied directly to textile materials and yet does not require a mordant is indigo, the well-known blue dye that formerly was obtained exclusively from a plant grown in the East but is now manufactured from coal tar products. Indigo is a very fast dye, that is one that cannot easily be washed out of the fabric after it has been applied, and it owes its fastness largely to the fact that the peculiar method of applying it fixes it firmly in the fibres themselves.

An interesting experiment with Congo Red will explain how the process of indigo dyeing is carried on. A pinch of this is dissolved in half a test tube full of water in order to give the liquid a pale pink colour. Six measures of Sodium Bisulphate are then dissolved in a quarter of a test tube full of water and the two solutions mixed, giving a blue liquid, for Congo Red of course is an indicator that changes colour when acidified. To the blue solution a few small fragments of Granulated Zinc are added. The metal is acted upon by the acid solution with the production of the gas hydrogen, which bubbles up through the liquid, and if the action is slow in starting it can be speeded up by gently warming.

Presently it will be found that the blue solution has become colourless. A piece of filter paper or blotting paper dipped into it and then waved in the air, or left in contact with the air for some time, gradually becomes coloured, however, and the solution itself regains its colour when it is left exposed to the air in the evaporating dish or a small saucer, or is shaken in a test tube so as to bring about intimate contact of the liquid with the air.

The explanation of these results is that the hydrogen acts upon the Congo Red to form a colourless substance. Similar changes take place when indigo is treated with agents that transform it into a substance called indigo white. In actual dyeing operations fabrics are steeped thoroughly in a vat in which indigo white has been prepared and when lifted out become blue because indigo is reformed within their fibres by the action of the oxygen of the air.

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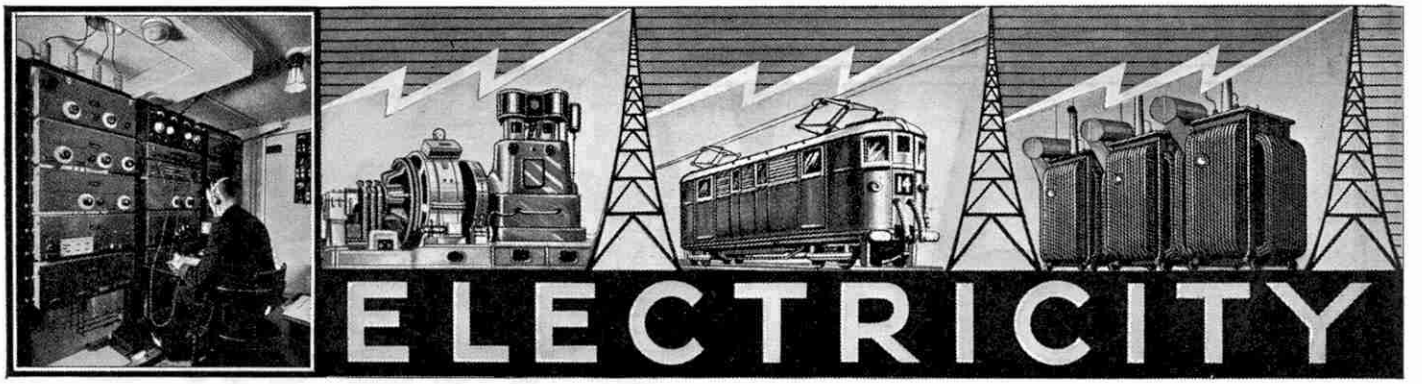
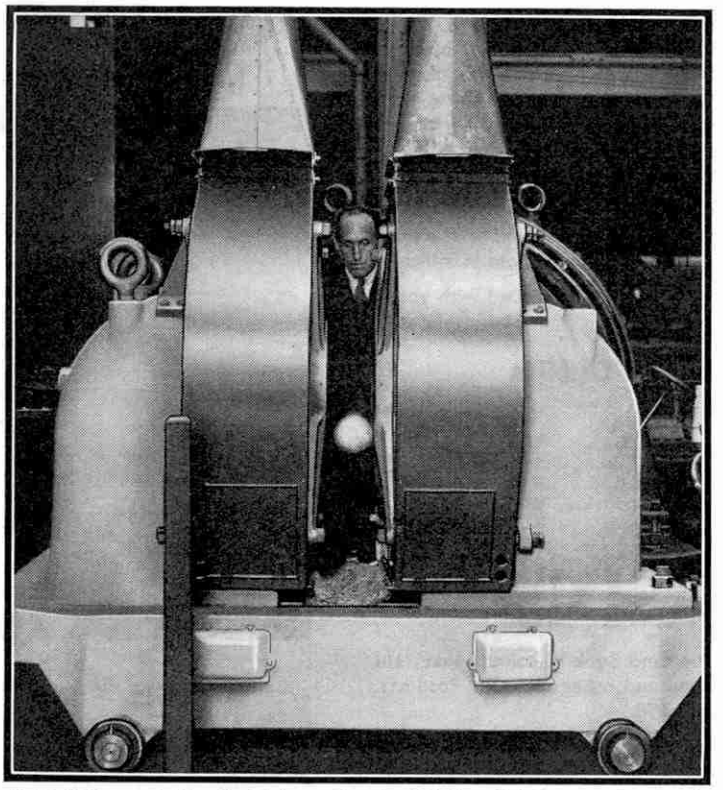


ELECTRO-MAGNETS IN INDUSTRY AND SCIENCE

A REMARKABLE variety of uses have been found for electro-magnets in industry. The principle on which the electro-magnet is based is extensively used in electrical machines, and devices of all kinds, ranging from the dynamo and the electric motor to the electric bell and alarm. Electro-magnets are used for direct lifting, and their attraction is put to good use in many different branches of industry. For most purposes they are more suitable than permanent magnets, for they can be made far more powerful than these. Their powers of attraction also are under complete control, for they are only effective when current is flowing through their windings and this can be switched on and off with great ease.

In industry the most obvious application of the electro-magnet is in the lifting of iron and steel, and magnetic cranes of various types have been developed to enable small or large masses of metal to be handled easily. Circular electro-magnets have been designed for heavy work, their working surfaces being heavily ribbed in order to enable them to grip irregular pieces of metal and to withstand rough use. A load of iron or steel brought into contact with such a magnet is lifted in a tenacious but invisible grip as soon as the current is switched on, and this grip is relaxed immediately the current is cut off when the place where the load is to be deposited is reached. For lighter duties rectangular magnets with flat surfaces are used. Their shape enables them to get a good grip on plates and other metal objects that have smooth surfaces, and they also have the advantage that two or more of them can be mounted on a spreader board in order to provide a magnetic grip at several points when dealing with thin sheets or long bars in order to prevent them being torn away.



A steel ball suspended in mid air between the poles of the largest electro-magnet ever made for experimental purposes. The magnet will be used for measurements in connection with cosmic rays. Photograph by courtesy of Metropolitan-Vickers Electrical Co. Ltd.

Electro-magnets are used for many other purposes as well as for direct lifting. Electro-magnetic separators play an important part in salvage works and destructors, where they are used to recover tins, which not only have a commercial value, but are better removed because their presence in the clinker obtained by burning the refuse decreases its value. Fixed electro-magnets of half-moon shape are used, and the refuse passes through a screen into cylinders of brass revolving inside them. The tins and other magnetic materials cling to the inside of the brass cylinder and are carried round until they pass beyond the range of the electro-magnets and are discharged into a chute, but the non-magnetic portion of the refuse passes straight on.

A similar application of the electro-magnet is used to ensure the purity of flour by removing all fragments of iron or steel from the wheat before milling. There is a double purpose in this, for in modern flour mills the wheat is ground between steel rollers, and a spark produced by a fragment of iron finding its way into the grinding machinery may cause a serious explosion and fire. The grain therefore is allowed to flow down an inclined steel plate, beneath which are powerful electro-magnets. Any fragments of iron or steel are arrested by the magnets and are pushed to one side by a scraper that passes across the collecting plate.

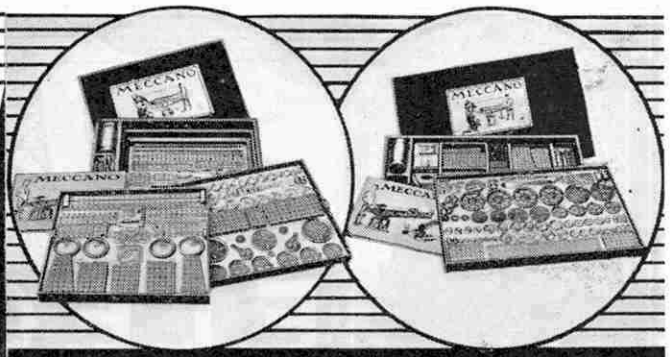
Electro-magnets play a great part also in the search for scientific knowledge, and the illustration on this page shows the largest electro-magnet ever made in this country for use in experimental work. It has been designed and built by the Metropolitan-Vickers Electrical Company Ltd., to the order of Professor Blackett, of the University of London. While there are magnets in existence that are capable of giving a more intense magnetic field over a short air gap of small area, for a short time, this magnet gives a powerful field in an air gap 15 cm. long between pole faces 25 cm. in diameter when it is working continuously at its normal rate of 6¼ kW. Further, this power can be increased to 25 kW for special purposes, and then the intensity of the magnetic field is increased by 25 per cent.

In order to obtain these intense magnetic fields 122,500 ampere turns are necessary on the normal rating and 245,000 ampere turns on the higher rating. The exciting coils are specially designed and wound in flat sections, and the heat generated in them is dissipated by air drawn through the casing that encloses them. The gap between the pole faces can be varied from zero up to 20 cm. by a screw mechanism and a switch panel is provided to enable the strength of the magnetic field between them to be varied.

The complete magnet weighs 11 tons, and is mounted on small roller wheels to enable it to be moved easily in the absence of cranes or other lifting mechanisms that are not available in the laboratory in which it is to be used. Professor Blackett will use it for measuring the deviations in magnetic fields of cosmic rays, the mysterious radiations that reach us from outer space.

Electro-magnets do not exert attractive powers in all cases, and a remarkable repulsion effect can be produced by means of one having a long laminated iron core. If an alternating current is passed through its coils, a ring of aluminium placed over the core is thrown high into the air, sometimes to a height of several feet. This repulsion is due to the induction in the aluminium ring of currents in the opposite direction to those in the coil of the electro-magnet. If the ring is forcibly held down it very quickly becomes hot.

NEW



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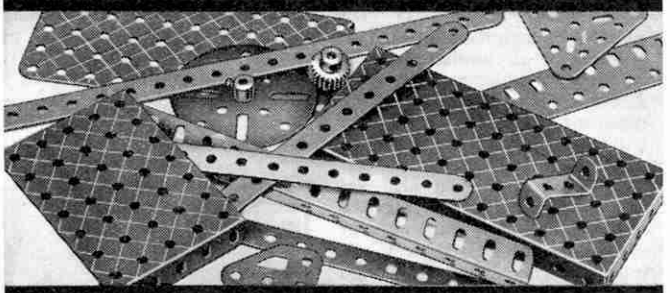

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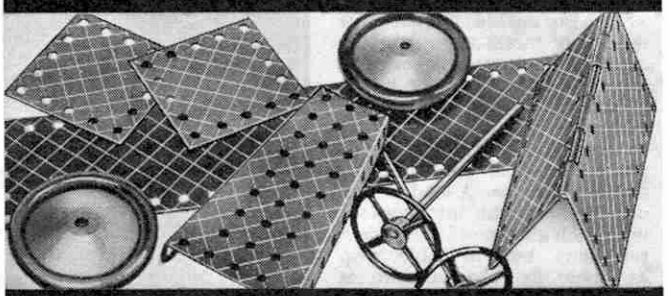

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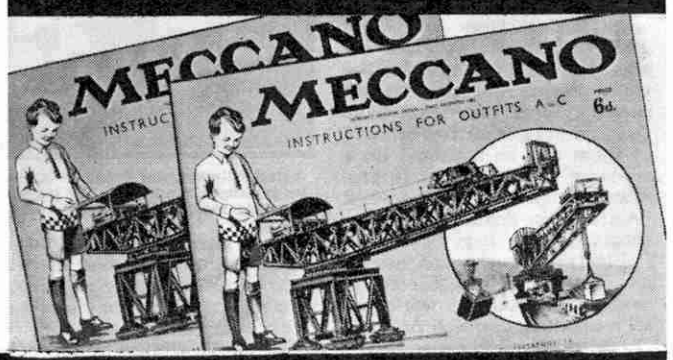

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The new MECCANO

ELEKTRON BURGLAR AND FIRE ALARMS

ELECTRIC bells are to-day almost universal, and they are employed in various ways for attracting attention or giving warnings. The Elektron Electric Bell can readily be used for purposes of this kind, and it is interesting to think out different applications for it and to devise means for putting them into effect.

The lower illustration on this page shows an interesting example in which, by the addition of an easily constructed switch, this bell can be used to give warning of the opening of a door or of any similar movement. The switch is constructed entirely from Elektron parts, which are shown mounted on a Universal Base. The switch arm consists of the Large Magnet Yoke, Part No. 1535, pivoted at one end on the 6B.A. Special Bolt, Part No. 1568, passed through the base from below. This Bolt is 1 in. long and is kept in position by means of a nut screwed tightly down on the upper surface of the Universal Base. The Ebonite Bush, Part No. 1524, is placed over it, and this is followed by a second nut. The Yoke is then fitted on and kept in position by means of another nut and a Terminal. The upper nut of the two enclosing the Yoke is only screwed down sufficiently to hold this in place, while leaving it free to turn on its pivot.

A small bolt is passed through the hole at the opposite end of the Yoke and is held by means of a nut. The nut forms the actual contact piece, and a Bell Contact Pillar is fitted as shown into one of the holes in the Universal Base in order that its point shall come into contact with the nut when the Yoke is pulled towards it by means of the piece of string shown in the illustration, which is used to actuate the device.

A switch of this kind requires a release, and a piece of Resistance Wire coiled into the form of a spring is used for this purpose. One end of this spring is hooked in position between a nut and a Terminal mounted on the top of a second 1 in. Bolt pushed upward through the middle hole at the end of the Universal Base. Over this is placed the Erinoid Sleeve 1¼ in. in length, to keep the nut and Terminal at the correct height.

One of the terminals of the Bichromate Cell is connected to the Bell Contact Pillar, and the 1 in. Bolt carrying one end of the spring release is connected to a terminal of the Elektron Electric Bell, the wires on the switch being attached underneath its base. The wiring is completed by joining the remaining terminals of the Bichromate Cell and the Bell. A pull at the string then causes the bell to ring, and this stops immediately the string is released, owing to the action of the spring.

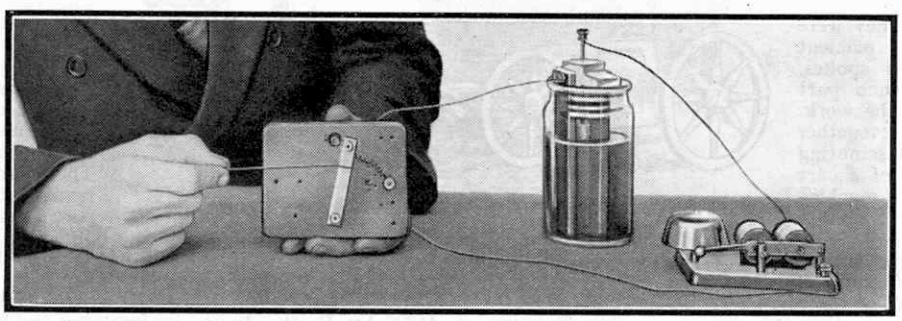
A simpler switch of this kind can be built up by simply driving nails into a wooden base in positions corresponding to those of the 1 in. Bolts and the Bell Contact Pillar. The inclusion of two or three nuts on the nail acting as pivot will lift the Large Yoke mounted on it clear of the wooden base, and electrical connection can then be made by simply twisting the bared ends of the wires round the nails.

How a fire can be made to give its own alarm. The expansion of the rod when heated closes an electrical contact that causes a bell to ring.

The spring switch can be used for indicating any movement that can be made to pull the string. For instance, suppose that it is mounted on the wall at the side of a door, with the string passing right across the door to a nail or screw on the opposite side. As soon as the door is pushed open the string is stretched and the bell rings. An alternative is to place the switch high up at the side of the door and to attach the string to a nail or screw in the top of the door itself. As the movement of the arm of the switch is limited, the fastening used should be inserted near the hinged side of the door, for otherwise the string may be pulled too far and broken, or the switch may be dragged out of position.

The switch can be made more useful by placing a second contact on the opposite side of the Large Yoke. In this case, in setting an alarm, the switch arm should be adjusted by means of the string so that it is half way between the two contacts. A pull at the string then causes the bell to ring, and a tug that breaks the string has the same effect, for the spring then pulls the arm back to the second contact. This plan enables almost invisibly fine string to be used, and burglarious entry by a window or door can readily be detected by a device of this kind.

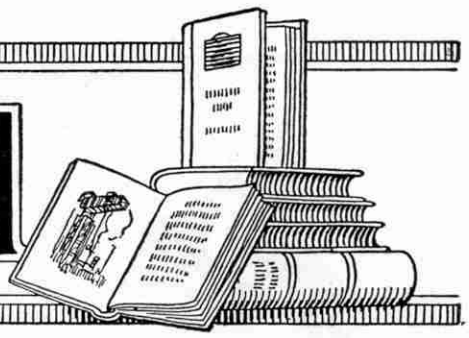
Another interesting experiment in which the Elektron Bell is used is shown in progress in our upper illustration. In this a Meccano Rod is mounted on Threaded Couplings fitted to a Flanged Plate. The rod is fixed firmly in the Coupling at its end by means of a Grub Screw, but is left free to slide backward or forward through the second Coupling, which acts only as a support. To the Flanged Plate is attached a Universal Base by means of a short Strip, and the Bell Contact Pillar is fitted at the opposite end of the Universal Base.



A switch for use with the Elektron Electric Bell to give the alarm when a door or window is opened.

The parts are so arranged that the free end of the Rod is almost in contact with the screw passing through the Contact Pillar. Terminals are placed on the Universal Base and on the Flanged Plate, and a wire beneath the Universal Base connects (*Continued on page 944*)

Books to Read



Here we review books of interest and of use to readers of the "M.M." We can supply copies of these books to readers who cannot obtain them through the usual channels. Order from Book Dept., Meccano Limited, Binns Road, Liverpool 13, adding 1/- for postage to the price. Postage on different books vary, but any balance remaining will be refunded.

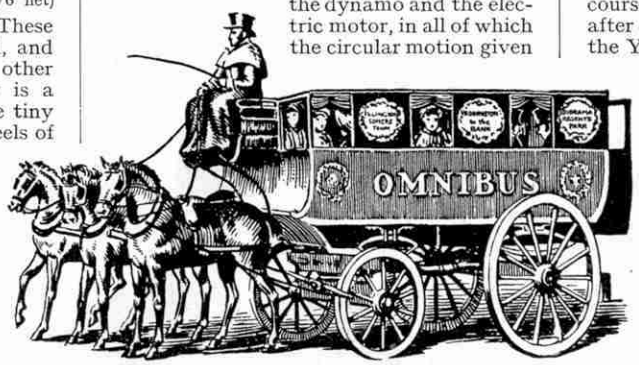
"The Story of the Wheel"

By G. M. Boumphrey. (A. C. Black Ltd. 2/6 net)

To-day the world runs on wheels. These are the basis of all transport on land, and are essential also to the potter and other craftsmen; while modern machinery is a maze of wheels of all kinds, from the tiny pinions of a watch to the giant flywheels of great engines. When and where the wheel was first used we do not know, for it is one of the primary inventions and dates from prehistoric times; but the wonderful importance that it holds in our lives gives special interest to this outline of its fascinating story through the ages.

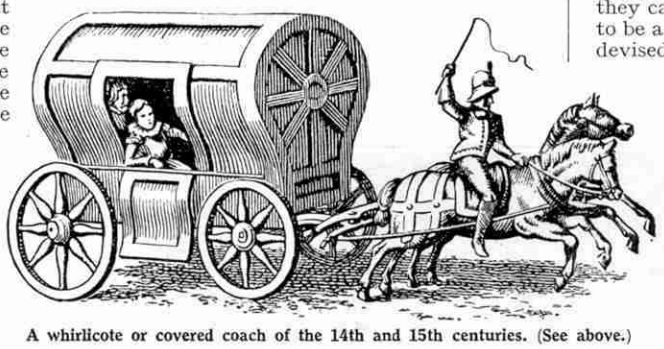
The author describes the wheel as the most brilliant of the inventions of Man, and claims that it is the only one that he thought out without any hints from nature. This claim is a bold one for, as the book itself shows, the train of thought that led to the invention of the wheel probably began with the use of rollers to enable sledges or large stones or hollowed-out tree trunks used as canoes to be moved easily over rough ground. Accidental log rolling of this kind may well have occurred in many different circumstances that revealed the advantages possessed by rollers of certain shapes, and to this extent at least Man may owe his invention of the wheel to his powers of observation. He showed his cleverness in permanently attaching to his sledge a tree trunk or some other form of roller in such a manner that it could rotate freely, and later he chopped away the middle of the roller so as to form an axle. The wheels of those early days of course were heavy and clumsy and must have been in one piece, and it was much later in the story that they were transformed into the efficient wheels of to-day, with spokes, stock, rim and tyre, each part taking up its share of the work. How these parts are put together is explained in a fascinating account of the making of a cart wheel in the days before machinery invaded the wheelwright's workshop.

In succeeding chapters the author turns to the development of the roads upon which the wheels run, and of the carriages, wagons, stage coaches and other vehicles that are mounted on wheels. The survey begins with the British chariot and the four-wheeled Roman carts, which had no swivelling device and could not turn corners easily. It rapidly brings us through the centuries to the first quaint carriages of Queen Elizabeth's day, and finally speaks of steam coaches, railways and motor cars. Other applications of the wheel are not overlooked, and we read of the transformations effected by the invention of the potter's wheel and the lathe, the introduction of the watermill and windmill, and the development of the steam engine, the dynamo and the electric motor, in all of which the circular motion given by the wheel plays so great a part.



Shillibeer's Omnibus, the first vehicle of its kind to run in London. (From "The Story of the Wheel" reviewed on this page.)

As told in the book, the story is full of human as well as technical interest, and is enlivened by many humorous and dramatic episodes, and by attractive sketches of Trevithick, Stephenson, Telford, McAdam and other inventors and innovators who were concerned in it. There are in the book 15 black and white illustrations showing interesting wheels and vehicles of different ages, and its 93 pages are packed with useful information. Another interesting application is the gyroscope, which is a wheel rotated at high speed. Such a wheel is capable of remarkable balancing feats, and is used in the gyroscopic compass and many kinds of steering mechanisms.



A whirlicote or covered coach of the 14th and 15th centuries. (See above.)

Stories of Mystery and Adventure

"The Treasure of Atil," by F. W. de Valda (Warne & Co. Ltd., 3/6), is an excellent story of a treasure hunt in the wilds of Mexico. An Englishman who sets out to study the traditions of the Yaqui Indians has the good fortune to assist one of their chiefs to escape from torture and death at the hands of a Mexican bandit, and thus gains the affection of the Indians. While among them he learns of a marvellous treasure hidden in the mountains, but illness prevents him from searching for it. He returns to England and dies, leaving to his cousin and two nephews instructions to find the treasure. In due course the three set out for Mexico where, after explanations, they are well received by the Yaquis, and set to work to hunt for the treasure. Their adventures are thrilling and varied, and conclude in a startling and unexpected manner. Captain F. A. M. Webster is not quite at his best in *"Lost City of Light"* (Warne, 3/6). The story concerns a lost city in Tibet, where have dwelt for centuries descendants of the Crusaders. It describes the attempt of three Cambridge undergraduates, one of whom is an Eastern Prince, to find the road to this city, and at the same time to trace the source of turquoise matrix that is brought by caravan to Lhasa. There is a great deal of interest in the story, and exciting incidents abound; but the extreme improbability of the plot involves the author in historical explanations that tend to become a little tedious.

"Taboo," by Major Charles Gilson (Warne, 2/–), is an African story about a mysterious "Country of the Wizard" buried in the heart of the Continent. This country is regarded with dread by the negroes over a vast area, among whom the wildest rumours of dreadful magic are prevalent. Two friends set out to solve the mystery, and after passing through appalling dangers and uncanny experiences they succeed in penetrating to the country. With the aid of natives of another tribe they capture the "Wizard," who turns out to be a white man, and break up a cleverly-devised system in which men are drugged by the "Wizard" and handed over to the chief of a neighbouring tribe to be sold into slavery. *"Led by Lawrence,"* by Gurney Slade (Warne, 2/6), introduces us to the famous "Lawrence of Arabia." The story describes the rising of the Arabs against the Turks, and their success, under the influence and remarkable skill of Lawrence, in clearing them out of Arabia. The strange and almost uncanny personality of Lawrence is well portrayed, and the description of the fighting is realistic and thoroughly exciting. From the same author comes also *"The Delta Patrol"* (Warne, 2/6), a well-written story concerning an English archæologist and his son, who pass through stirring adventures during the Egyptian rising of 1919. The archæologist is in search of the tomb of a Princess of ancient Egypt that had never been discovered, and he succeeds in finding it, practically intact, in spite of determined opposition and treachery of all kinds.

"The Incredible Adventures of Professor Branestawm"

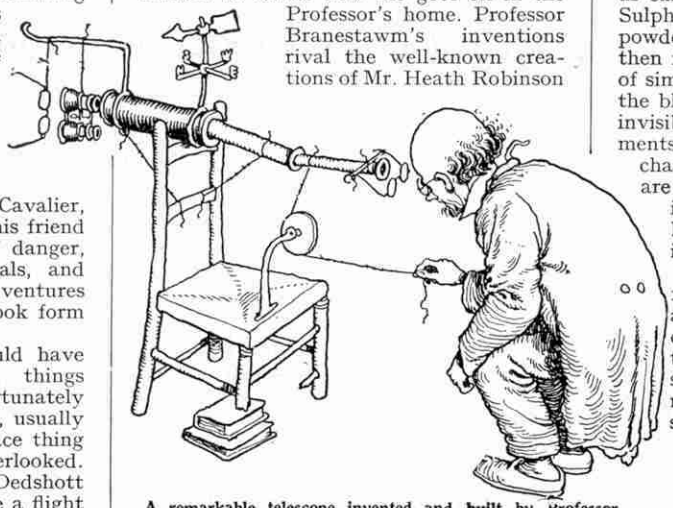
By NORMAN HUNTER. (John Lane. 6/- net)

Every reader of the "*M.M.*" must have heard of Professor Branestawm, the learned gentleman who is so busy knowing all about extraordinary things that he has no time to understand ordinary ones, for he has become one of the most popular features of the B.B.C. Children's Hour. Mrs. Flittersnoop, the faithful housekeeper who goes to stay with her sister whenever the Professor's inventions really get going, and Colonel Dedshott, the Catapult Cavalier, who is always ready to back up his friend in all his schemes in defiance of danger, are equally fascinating individuals, and the stories of the incredible adventures of the trio are as delightful in book form as when they were broadcast.

Nobody but the Professor could have invented the many wonderful things described in this book, but unfortunately all of them lead him into trouble, usually because of some little commonplace thing that he has unaccountably overlooked. We first meet him and Colonel Dedshott when they are about to undertake a flight in a wonderful machine of the Professor's own invention. They arrive in Squiglatania when a revolution is in progress in that country. The Professor showers his home-made bombs on the revolutionists and the Colonel opens fire with his deadly catapult, and after doing terrific execution the two are horrified to find that they have destroyed the wrong army! The revolutionists of course hail them with joy as allies and promptly instal them as successors to the deposed King. They reconcile themselves to the mess they have made of history by winning a battle for the side that really lost it, but things continue to go wrong. The crown is too small for the Professor and too large for the Colonel; there are only wooden soldiers for the Colonel to command; and there is no "inventory" in the Royal Palace, so that the Professor has to do his work in an uncomfortable chicken house. A new revolution then breaks out and the two are compelled to fly in the Professor's aeroplane, which falls to pieces as it lands on his lawn, where the long-suffering Mrs Flittersnoop calmly hands a cup of tea to each of the gallant adventurers.

In the subsequent stories the Professor and his friends pass through many equally ludicrous and uncomfortable moments, for which the products of the inventory are responsible. For instance, a marvellous elixir that will put life into anything it touches—except paregoric cough mixture—is accidentally upset into the waste paper basket, and the contents of this immediately become terrifyingly alive. A tremendous battle with envelopes of all sizes, bills and letters follows, and is only brought to an end when the combatants reel into a bonfire in the next door garden. The Professor is caught in a burglar trap he has installed and is brought up in Court on the charge of breaking into his own house! Serious trouble follows the invention of a clock that will go for ever without winding up, because the Professor forgets to put in a little wiggly thing to control the striking mechanism, and the clock goes on striking 13, 14, 15 and so on until hundreds of hours are struck, and the mechanism has to work so furiously to get them all in that finally it explodes.

These and other incredible stories are told with deft touches of humour that keep the reader in a constant ripple of laughter, and the fun is greatly increased by the many amusing illustrations that Mr. Heath Robinson has provided to show how the inventions work, and to help readers to realise how life goes on in the Professor's home. Professor Branestawm's inventions rival the well-known creations of Mr. Heath Robinson



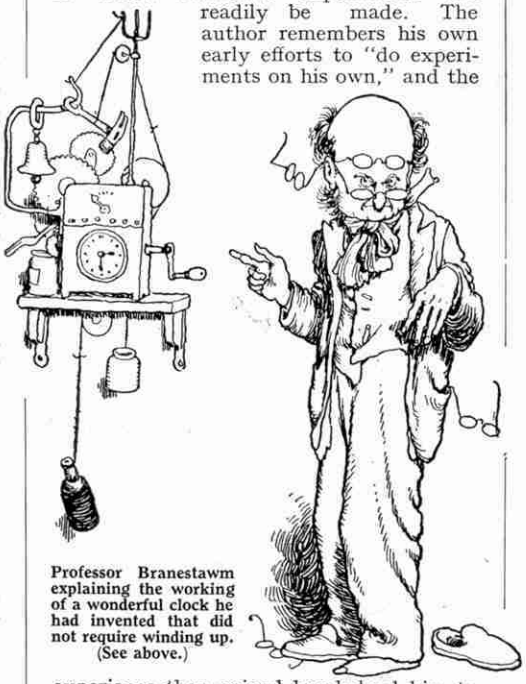
A remarkable telescope invented and built by Professor Branestawm. (From "The Incredible Adventures of Professor Branestawm" reviewed on this page.)

himself in quaintness and have provided thoroughly congenial subjects for the 76 drawings contributed by this famous artist.

"The Young Chemist"

By F. SHERWOOD TAYLOR (Nelson. 2/6 net)

There is unlimited fun in making chemical experiments, and it is not necessary to possess elaborate and costly apparatus in order to carry out fascinating work of this kind. Mr. Taylor's book is intended for boys and girls who are attracted by chemistry, and it explains how to fit up and stock a home laboratory in which attractive experiments can readily be made. The author remembers his own early efforts to "do experiments on his own," and the experience then gained has helped him to realise what is needed by his youthful successors, whether they are interested in chemistry only as a hobby or are at the outset of a chemical career.



Professor Branestawm explaining the working of a wonderful clock he had invented that did not require winding up. (See above.)

The book commences with sections dealing with the apparatus required and with its use in experiments, and then passes on to such subjects as the growth of crystals, the creation of chemical gardens, and the production of interesting gases such as carbon dioxide, oxygen, and ammonia. Sulphur, caustic soda, acids, bleaching powder, iodine and other chemicals are then introduced and their use in the making of simple fireworks, the formation of soap, the bleaching of fabrics, the production of invisible inks and brightly coloured pigments, and other attractive chemical changes, is explained. The experiments are simple, and in addition to being interesting in themselves they show how closely chemistry is concerned in our daily life.

Sections dealing with easily performed electro-chemical experiments and attractive organic chemicals complete the volume, which is illustrated by more than 50 drawings showing how apparatus is set up in readiness for the experiments described.

"The Magic Walking Stick"

By JOHN BUCHAN

(Hodder & Stoughton. 6/- net)

A story of modern magic told by Mr. Buchan might confidently be expected to provide a treat for its readers, and "*The Magic Walking Stick*" does not disappoint the highest expectations. Bill, the youthful hero of the book, buys the stick for a farthing from an old man who mysteriously disappears as soon as the stick is in the possession of its new owner. He does not discover its magic powers until he finds himself in the middle of a flood on thoughtlessly expressing a wish to that effect after turning the stick round, but his acquisition proves equal to rescuing him.

Even this adventure does not sufficiently impress Bill with the need for caution in making use of the magic powers of his stick, and several misadventures follow. One night he steals from his bed, clad only in dressing gown and pyjamas, and is whirled to a sunny beach in the Solomon Islands in response to his wish. While bathing in the warm surf he is alarmed by the sudden arrival on the scene of dark-skinned men armed with spears, and in his haste to disappear forgets to snatch up his pyjamas. When he is found shivering on the lawn of his own home he cannot explain the disappearance of these garments, and the mystery greatly perturbs his nurse!

When Bill becomes more accustomed to the powers of his magic walking stick he puts it to good use in rescuing an uncle who has been lost in the Sahara Desert in an attempt to make a record flight to Capetown and back. Next he gives himself the thrills and pleasure of exploration and is transported to an East African valley to which elephants retire to die, but his interest in the valley and in the enormous piles of ivory it contains is brought to an end by the sudden appearance on the scene of a gorilla that attacks him furiously, but is no match in speed for the magic walking stick.

Finally Bill embarks upon his greatest adventure, the rescue of Anatole, the boy heir to the throne of the Balkan Kingdom of Gracia, who is a prisoner in a lonely castle. Then comes a great blow—the magic stick disappears and the fun is over.

The story is written with all Mr. Buchan's skill and charm, and both old and young readers will be delighted with its combination of adventure, fantasy and humour.

"Penny-in-the-Slot" Weighing Machine

An Interesting New Meccano Model

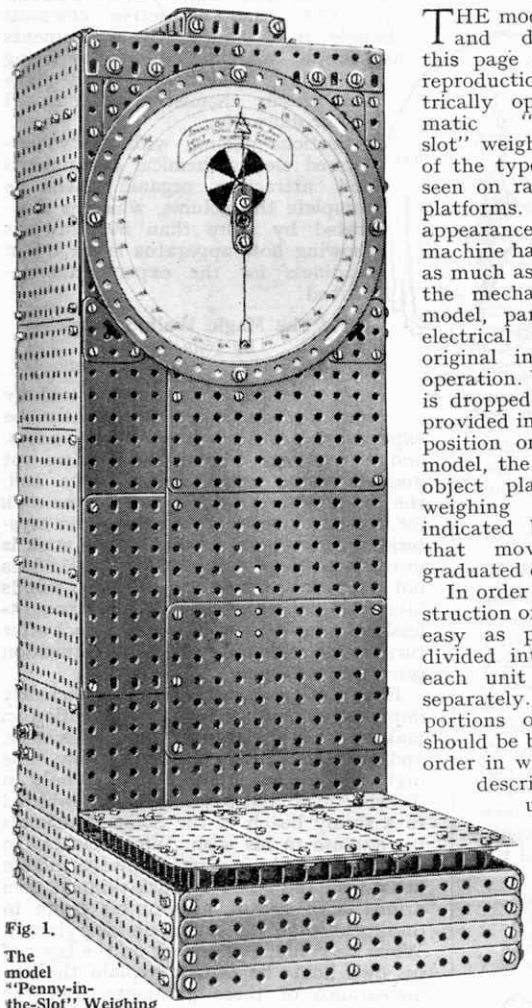


Fig. 1. The model "Penny-in-the-Slot" Weighing Machine described in this article.

THE model illustrated and described on this page is a working reproduction of an electrically operated automatic "penny-in-the-slot" weighing machine, of the type often to be seen on railway station platforms. The outward appearance of an actual machine has been copied as much as possible, but the mechanism of the model, particularly the electrical system, is original in design and operation. When a penny is dropped down a slot provided in a convenient position on top of the model, the weight of an object placed on the weighing platform is indicated by a pointer that moves over a graduated dial.

In order to make construction of the model as easy as possible it is divided into units, and each unit is described separately. The various portions of the model should be built up in the order in which they are described. The units comprise the main frame, the weight platform and its accompanying mechanism, the weight recording mechanism, electric contact maker and an Electric Motor.

Construction should commence with the framework, details of which are shown in Figs. 1 and 2, but the dial and the back of the machine should not be fitted until the mechanism has been assembled and tested.

The weight recording mechanism and the contact maker are shown in Fig. 3. The mechanism forms a complete self-contained unit and it may be assembled separately and adjusted before being built into the frame.

The gearing is placed between $2\frac{1}{2}'' \times 5\frac{1}{2}''$ Flat Plates, which are spaced at their corners by $1\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips and are fitted with four $7\frac{1}{2}''$ Angle Girders 11, by means of which the mechanism is fixed in place in the frame. Double Bent Strips bolted over the central holes of the two Flat Plates form bearings for the halves of the main spindle, one of which carries a 57-teeth Gear Wheel 1, a $\frac{1}{2}''$ Pinion 2, and a Bush Wheel 3. The Bush Wheel is fitted with a Threaded Pin 25, which points outward and engages with a $\frac{1}{2}''$ Bolt 16 that is screwed into the boss of a $\frac{1}{2}''$ Pinion 4 on the other half of the shaft. A $\frac{1}{2}'' \times \frac{1}{2}''$ Angle Bracket 5 bolted to one of the Plates forms a stop. In Fig. 3 the Threaded Pin and the $\frac{1}{2}''$ Bolt are shown near the limit of their movement. The $\frac{1}{2}''$ Pinion 4 engages a $2\frac{1}{2}''$ Gear Wheel on a $3\frac{1}{2}''$ Rod that rotates in bearings formed by 1" Corner Brackets.

The Gear Wheel 1 engages a $\frac{1}{2}''$ Pinion 7 on a Rod journalled in the $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flat Plates of the mechanism frame, and on the end of which is the small dial 8. A 57-teeth Gear Wheel on the Rod 9 meshes with the $\frac{1}{2}''$ Pinion 2, and on the same shaft as the 57-teeth Gear is a $\frac{3}{4}''$ Sprocket Wheel 10 (Fig. 2) which is spaced from the Plate by a Collar.

A solenoid consisting of a Bobbin fully wound with 26 S.W.G. S.C.C. Wire is clamped between the face of a Bush Wheel and a $1\frac{1}{2}''$ Strip by two 1" Screwed Rods. The Bush Wheel is secured on the end of a $2\frac{1}{2}''$ Rod journalled in two 7" compound strips bolted between the Angle Girders 11 (see Fig. 3). On the inner end of the Rod that supports the $2\frac{1}{2}''$ Gear Wheel is a Crank 6 pivotally attached to a Coupling by a $\frac{3}{8}''$ Bolt. A $4\frac{1}{2}''$ Rod 12 is pushed through the solenoid and one end of it is fastened in the Coupling.

A $2\frac{1}{2}''$ Rod is supported by means of a Rod Socket on top of a Double Bent Strip 13, which is secured to one of the lower $7\frac{1}{2}''$ Angle Girders 11 as shown, the Double Bent Strip being insulated from the Angle Girder by means of Insulating Washers and Bushes. The $2\frac{1}{2}''$ Rod supports a Silver Tipped Contact Screw 15 that is held in a Coupling by two Grub Screws. A Pendulum Connection 30 secured to, but insulated from, the Crank 6, makes contact with the point of the Screw 15 when the $\frac{1}{2}''$ Bolt 16 is in the normal position, that is when the Bolt is right up against the stop 5.

The constructional details of the delicately balanced spring contact maker are as follows. A $2\frac{1}{2}''$ Strip is bolted to one side of a Coupling, and two Washers are placed on the shanks of the holding Bolts to space the Strip from the Coupling and to prevent the screws from nipping the Rod 17, which is able to slide freely. The same procedure is adopted on the other side of the Coupling, with the exception that the supporting $1\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips shown are bolted in place as well. At their lower ends the $2\frac{1}{2}''$ Strips are connected by a Double Bracket, in the centre of which is an insulated Contact Screw 19. A second Contact Screw 18 has its head filed down slightly round the sides, and is held by two Grub Screws in the end of the Coupling on the Rod 17. A very weak compression spring is placed on the upper end of the Rod, and then a Face Plate, which serves as the coin table.

The amount of clearance between the Contact Screws 18 and 19 must be adjusted so that when a penny is placed on the Face Plate the weight of the coin overcomes the resistance of the spring, and the Face Plate and its Rod sink downward, thus bringing the contacts 18 and 19 together and completing the electrical circuit.

The coin for operating the machine is dropped down a

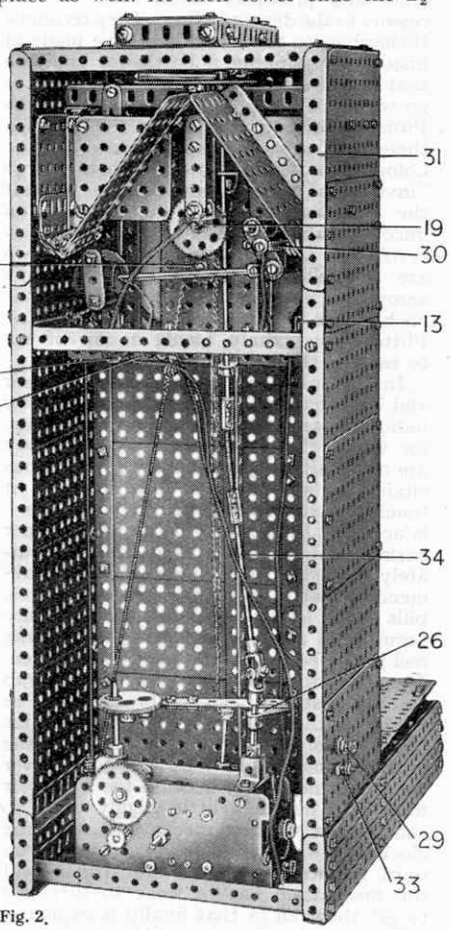


Fig. 2. The Weighing Machine with the back removed to show the layout of the mechanism and the money boxes.

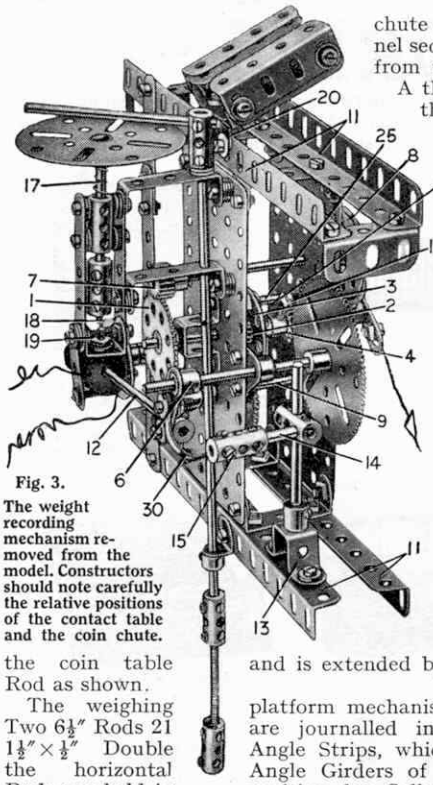


Fig. 3.
The weight recording mechanism removed from the model. Constructors should note carefully the relative positions of the contact table and the coin chute.

chute consisting of two channel section girders each made from two 2″ Angle Girders. A third 2″ Angle Girder is then bolted to one side of each channel girder, and pulled out to the limit of its elongated holes so that a slot, just wide enough to allow a penny to slide freely, is formed. The two parts of the chute are held parallel to each other by a 1½″ Flat Girder. The chute is fixed to the Angle Girder 11 (Fig. 3) by means of two Angle Brackets, one of which is numbered 20 in Fig. 3. To complete the mechanism an 8½″ Rod is pushed through a ½″×½″ Angle Bracket and the 1½″ Double Angle Strips that support the coin table and is extended by a Coupling and a 3″ Rod as shown.

The weighing platform mechanism is shown in Fig. 4. Two 6½″ Rods 21 are journalled in the upper holes of 1½″×½″ Double Angle Strips, which are bolted between the horizontal Angle Girders of the main frame. The Rods are held in position by Collars, and one of them carries two 1½″ Strips, each of which is held between two further Collars. The other Rod is fitted with two 2½″ Strips, which are fixed in position as in the case of the first Rod. The two 1½″ Strips are locknutted to 7½″ Strips, and these in turn are each locknutted to two Hinges held together in an End Bearing 22, all the connections being loose enough to allow the parts to move freely. The two 2½″ Strips are connected across their ends by a 4½″ Rod, which is linked by means of a Double Bracket to another Rod that passes through the 7½″ Strips. The Double Bracket is held in place by the ¾″ Bolt 23.

The weighing platform itself is shown in Figs 1 and 4. A 2½″×1″ Double Angle Strip is bolted 3″ from the front edge of the platform, and a 2″ Strip is attached to each of its ends. The Strips are strengthened by a 2½″×½″ Double Angle Strip as shown, and in their end holes support a 4½″ Rod. A second 2½″×1″ Double Angle Strip carries two ¾″ Bolts, which are fixed in its end holes by means of Threaded Bosses.

When the platform is in position the Rod 32 and the ¾″ Bolts rest on the 7½″ and 5½″ Strips respectively. Four 1½″×½″ Double Angle Strips, which are bolted to the underneath surface of the platform, hook over the main supporting Rods 21 of the mechanism.

A 2½″ Screwed Rod, to which a length of Sprocket Chain is attached between locknuts, is held in the boss of an End Bearing 22, and the Chain passes over a ¾″ Sprocket 10 and is joined to a length of Spring Cord. The Spring Cord is secured to a 2½″ Screwed Rod that passes through the lower girders of the frame, and is held in place by a Threaded Boss 24. When the platform is in its normal position, that is when there is no weight on it, the Threaded Pin 25 and the ½″ Bolt 16 (Fig. 3) should be right up against the stop 5.

The "penny-in-the-slot" mechanism is operated by an Electric Motor mounted in the base of the model as shown in Fig. 2. On the driving shaft of the Motor is a ¾″ Pinion, which engages a 50-teeth Gear Wheel on a secondary shaft that carries at its other end a ½″ Pinion. Through the medium of a 57-teeth Gear Wheel the ½″ Pinion drives a Worm, which meshes with a ½″ Pinion on a vertical Rod journalled in a 2½″×1″ Double Angle Strip bolted to one of the Motor side plates. At its upper end the Rod carries a Triple Throw Eccentric, and the motion imparted to the Eccentric is transmitted to a Crank 26 by means of a 3½″ Strip. The Strip is locknutted to the Crank, and the latter is supported on a Rod held vertically in a bearing unit formed by a Double Arm Crank and a Double Bent Strip. The bearing is fixed between the Motor side plates by two ½″×½″ Angle Brackets. From the vertical Rod the drive is taken through a universal transmission, consisting of a Universal Coupling at the lower end of the Rod 34 and a Flexible Coupling at the top, the latter being necessary in order to avoid fouling the Sprocket Chain of the weighing mechanism.

The electrical connections of the model are as follows. The insulated terminal 27, which is secured to a 7½″ Angle Girder held between the vertical 18½″ Angle Girders of the frame as shown in Fig. 2, is connected to one terminal of the Motor, then to the insulated contact point 19, and also to one end of the solenoid winding. The second terminal 28 is connected to the same terminal of the Motor as terminal 27, then to the other end of the solenoid winding and to the insulated Pendulum Connection 30. Finally the other terminal of the Motor is connected to the insulated Double Bent Strip 13. The Terminal 33 is in contact with the frame.

The operation of the machine is as follows. When a weight is placed on the platform the Bush Wheel carrying the Threaded Pin 25 (Fig. 3) is made to rotate by means of the Sprocket Chain. This movement in turn rotates the small coloured disc 8. The exact distance through which the Bush Wheel moves is controlled by the amount of weight on the platform. Before the dial pointer will move, however, a penny must be placed in the chute, this being necessary to bring the weight recording mechanism into operation. The penny slides down the chute and falls on to the Face Plate, thus closing the gap between the Contact Screws 18 and 19 and energising the solenoid in the manner already explained. The solenoid sucks in the Rod 12 (Fig. 3) and causes the Pinion that carries the ½″ Bolt 16 to rotate until the Bolt makes contact with the Threaded Pin 25.

When the weight is removed from the platform the pull of the Spring Cord returns the Threaded Pin and ½″ Bolt to their normal positions against the stop, and makes contact between the Pendulum Connection 30 and the Contact Screw 15, thus starting the Motor. The arm 34 then slowly rotates and pushes the penny off the platform, so disconnecting the electric circuit.

The dial can be made from thin white cardboard, gripped between two Circular Strips and fixed to the model by four ⅜″ Bolts.

Before the machine can be used to weigh objects of unknown weight the dial must be calibrated. This is a simple matter, and it is only necessary to put several known weights, say 4 oz., ½ lb., 1 lb., 1½ lb., 1¾ lb., and 2 lb. on the platform, and to mark on the dial the exact position taken up by the pointer under each load.

The parts required to build the model Automatic Weighing Machine are as follows:—8 of No. 1; 6 of No. 1b; 2 of No. 2; 1 of No. 3; 6 of No. 5; 5 of No. 6; 8 of No. 6a; 4 of No. 7a; 5 of No. 8; 12 of No. 8b; 10 of No. 9; 5 of No. 9a; 3 of No. 9b; 2 of No. 9c; 6 of No. 9d; 10 of No. 9e; 4 of No. 9f; 3 of No. 10; 6 of No. 11; 8 of No. 12; 1 of No. 13a; 2 of No. 14; 4 of No. 15a; 2 of No. 16; 4 of No. 16a; 5 of No. 16b; 2 of No. 17; 2 of No. 18a; 3 of No. 24; 1 of No. 25a; 5 of No. 26; 1 of No. 27; 3 of No. 27a; 1 of No. 27c; 1 of No. 32; 269 of No. 37; 28 of No. 37a; 80 of No. 38; 4 of No. 45; 3 of No. 46; 14 of No. 48; 2 of No. 48a; 23 of No. 52a; 8 of No. 53a; 9″ of No. 58; 42 of No. 59; 1 of No. 62; 1 of No. 62a; 2 of No. 62b; 8 of No. 63; 2 of No. 64; 11 of No. 70; 3 of No. 72; 2 of No. 81; 2 of No. 82; 15″ of No. 94; 1 of No. 96a; 2 of No. 103; 2 of No. 103f; 4 of No. 103g; 1 of No. 103h; 1 of No. 103k; 1 of No. 109; 3 of No. 111; 4 of No. 111a; 13 of No. 111c; 2 of No. 114; 1 of No. 115; 1 of No. 116a; 1 of No. 130; 4 of No. 133; 2 of No. 133a; 1 of No. 140; 2 of No. 145; 1 of No. 166; 1 of No. 172; 1 of No. 175; 1 of No. 179; 1 of No. 181; 7 of No. 182; 1 E6 Electric Motor; 3 of No. 1569; 7 of No. 1570; 7 of No. 1575; 8 of No. 1583 and 1 of No. 1586.

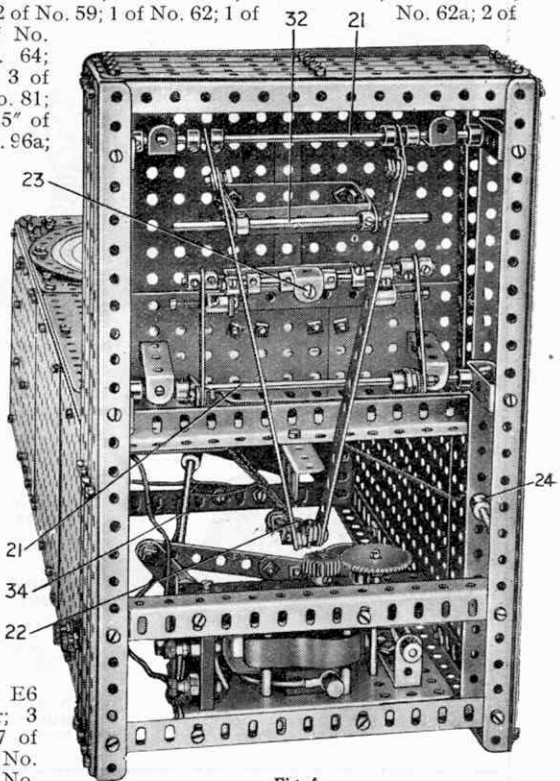
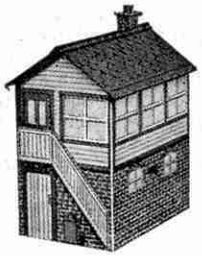


Fig. 4.
An underneath view of the weight platform operating mechanism.

Hornby Series HORNBY ACCESSORIES Gauge O

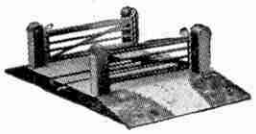
There is a splendid range of Railway Accessories in the Hornby Series, built in perfect proportion and beautifully finished. With these realistic accessories the most elaborate model railway may be constructed and operated in exactly the same manner as a real railway. A selection of Hornby Accessories is illustrated below and also on page 894. Ask your dealer to show you the full range.



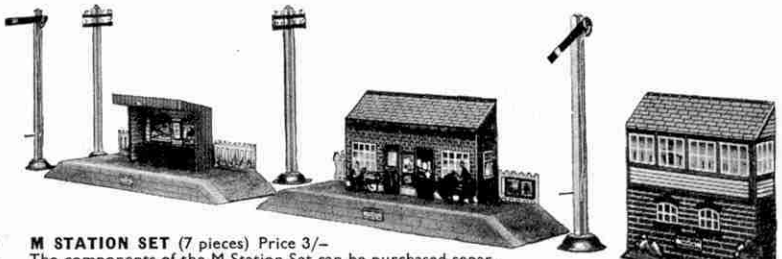
No. 1 SIGNAL CABIN
Price 2/9

STATION No. 2
Excellent model, beautifully designed. Built up in three detachable sections. Length 2 ft. 9 in., breadth 6 in., height 7 in. Price 9/6

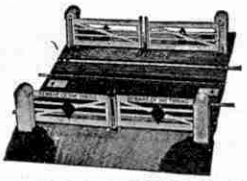
SIGNAL CABIN No. 2
Dimensions: Height 6½ in., width 3½ in., length 6½ in. Roof and back open to allow Lever Frame to be fitted inside cabin if desired.
Price 4/6



LEVEL CROSSING No. 1
Suitable for a single track only and has gauge O rails in position.
Price 2/11



M STATION SET (7 pieces) Price 3/–
The components of the M Station Set can be purchased separately as follows: M Signal Box. Price 4d.
M Signals. Price 4d. M Station. Price 1/–
M Telegraph Pole No. 1. Price 3d. M Wayside Station. Price 9d.



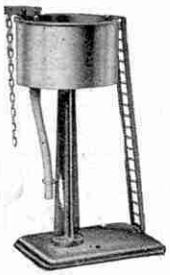
LEVEL CROSSING No. 2
Measures 13½ x 10½ in., with two tracks of gauge O rails in position.
Price 5/6

LEVEL CROSSING No. E2 (Electrical)
Similar to Level Crossing No. 2 excepting that a third rail is fitted in each of the two tracks.
Price 7/6

TUNNEL No. 0 (Straight)
Length 6 in., width 6⅛ in.
Price 1/3

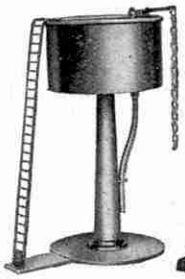
TUNNEL No. 1 (Straight)
Length 7 11/16 in. Width 6½ in. (as illustrated).
Price 1/9

TUNNEL No. 2 (Straight)
Length 15⅝ in. Width 9½ in. Price 3/6



No. 1 WATER TANK
Fitted with flexible tube and valve lever. Stands 6½ in. high.
Price 3/–

No. 1 GOODS PLATFORM
Length 13 in., height 6¾ in., width 6 in.
Price 7/6

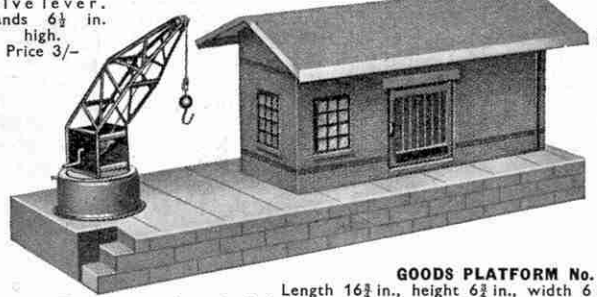


No. 2 WATER TANK
Fitted with flexible tube and valve lever. Stands 8½ in. high.
Price 5/9

CUTTING No. 4 (STRAIGHT)
This is a double cutting, mounted on a base over which the railway track is laid.
Base measurement: Length 15⅜ in., width 15 in. Price 6/–

TUNNEL No. 5
(LEFT-HAND CURVED)
(as illustrated)
This tunnel is in the form of a small hill, through which the track runs obliquely. For 2 ft. radius tracks. Base measurement: 15⅞ in. x 14⅜ in. Length of track 17¼ in. Price 6/9

TUNNEL No. 6
(RIGHT-HAND, CURVED)
Similar to No. 5 Tunnel, but with track in the reverse position. For 2 ft. radius tracks only. Base measurements 15⅞ in. x 14⅜ in. Length of track 17¼ in. Price 6/9



GOODS PLATFORM No. 2
Length 16⅜ in., height 6¾ in., width 6 in.
The crane at the end of the platform revolves on its base. Price 12/6

Two No. 1 and one No. 2 Cuttings are illustrated here.

No. 0 CUTTING
This is a Double Cutting, similar in design to but smaller than Cutting No. 4. The base measurement is 8 1/16 in. square.
Price 1/9

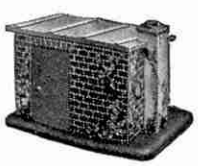
No. 1 CUTTING (End Section)
Base measurement: Length 7⅛ in., width 6 in. Price, per pair 3/–

No. 2 CUTTING
(Centre Section, Straight)
The addition of these centre sections enables a Hornby Railway Cutting to be extended to any length. They are intended to be used in conjunction with the End Sections (Cutting No. 1). Base measurement: Length 10½ in., width 6 in.
Price 2/–

No. 3 CUTTING
(Centre Section, Curved)
This is used for curved tracks in the same manner as the straight Centre Section, described above, is used for straight track. It is suitable for both 1 ft. and 2 ft. radius track. Price 2/–

LOADING GAUGE
(illustrated)
Price 2/3

M LOADING GAUGE
Price 1/–



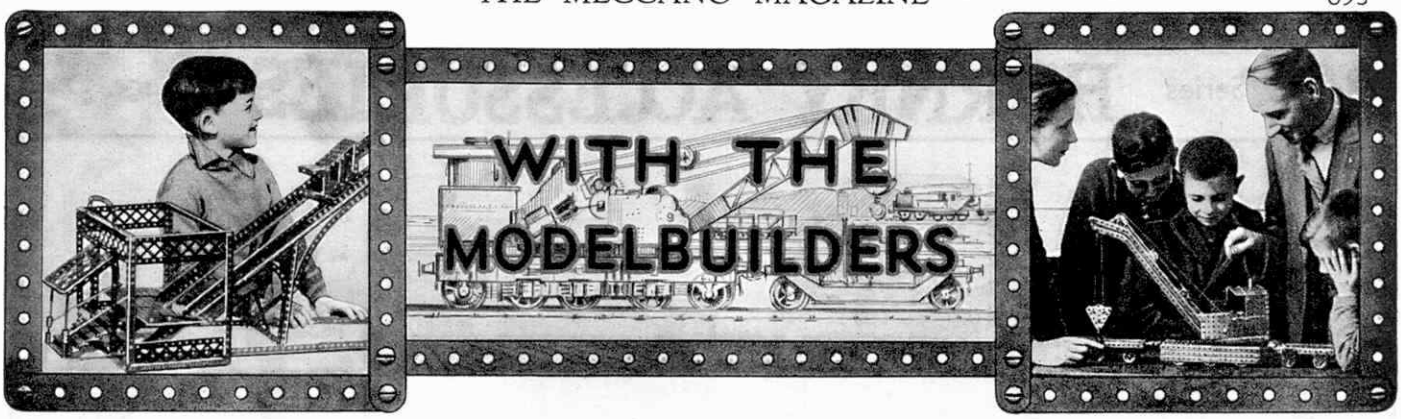
PLATELAYER'S HUT
Price 1/–

TURNTABLE No. 2
Price 3/9

TUNNEL No. 3 (Curved)
Length 13 in. Price 4/–

TUNNEL No. 4 (Curved)
(as illustrated)
Length 20 in. For 2 ft. radius tracks only. Price 4/9

VIADUCT Price 6/6 **VIADUCT** (Electrical) Price 7/6
VIADUCT Centre Section only ... ... Price 4/–
VIADUCT (Electrical) Centre Section only ... ... Price 4/6

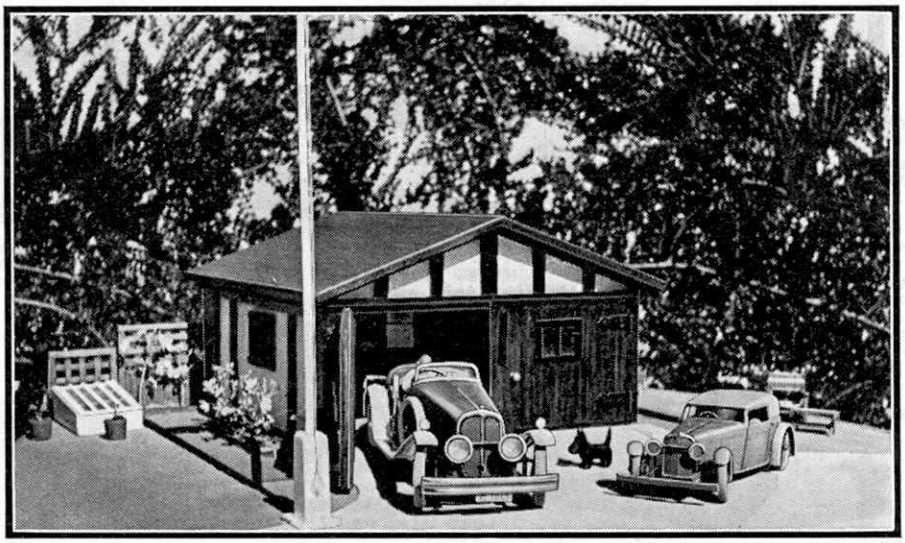


GARAGING MECCANO MOTOR CARS

The accompanying illustration shows a realistic model garage and the two cars for which it has been built. The garage has been specially designed to accommodate one No. 1 model Motor Car and one No. 2 Car, and one corner is set apart as a store room for spares and equipment. This section is accessible from outside by a door, and the parts left over from the Outfits, after building the models, are kept in it. Inside the garage, places are provided for Spanners, Drifts, Winding Keys, Oil Cans, etc., so that they are immediately available when a car takes the road or requires adjustment. Fittings include electric lighting with concealed wiring and batteries.

Outside accessories can be seen in the illustration. A miniature tap is provided for a hose connection when "washing" the cars, this being situated behind the flag pole. Imitation flower beds and lawns are laid out on the table top, and a forcing frame, flower pots, garden seat and table enhance the life-like effect.

These particulars will give readers some idea of the fun that can be had with a model garage for their cars. In this way all adjustments and alterations can be carried out in a similar manner to actual practice, and if several cars are available much fun can be had by running a racing "stable." Every Motor Car enthusiast should have a garage for his cars, and the Meccano Garage is specially made to house a No. 1 or No. 2 Outfit Model or other Car of similar size. It is attractively finished in imitation rough-cast.



The realistic garage shown above was built by Mr. H. G. Ogden, Victoria, B.C., Canada, for his son Richard who, although only 5 years old, is a keen Meccano enthusiast. The garage accommodates the two cars shown in the illustration, and provision is made for tools and the additional parts left over from the Outfits.

HEAVY DUTY BEARING

A bearing for carrying heavy loads can be made in the following manner. A Steel Ball is inserted in one end of a Socket Coupling and, at the same end, two ½" Reversed Angle Brackets are secured by ½" Bolts that are screwed into opposite tapped holes in the Coupling. Six Washers space each Reversed Angle Bracket from the Socket Coupling, and two Washers are placed between the head of each bolt and its Bracket. The Brackets are placed so that the two remaining lugs are over the Steel Ball and three Washers are placed between them before they are secured together. Two such units are required, one for each end of the shaft, and may be fitted in position on a Double Arm Crank bolted to the structure of the model.

The weight of the Rod is taken by the Steel Balls, but the Rod is held in position directly over the centres of the Balls by the Reversed Angle Brackets.

END THRUST BEARING

The device described above is also suitable for taking up the end thrust of a shaft. For such a purpose the exact spacing of the Reversed Angle Brackets is not necessary, and in fact, the ball can be retained in place by means of a single Angle Bracket secured to the Socket Coupling. The Rod would be journalled longitudinally in the Coupling, the remaining hole of which should be provided with a Collar to support the Rod. With this arrangement the end of the Rod bears against the Steel Ball and in this manner friction and wear are reduced to a minimum.

FAN WHEEL GOVERNOR

The length of run of a Clockwork Motor can be prolonged considerably by means of this speed-reducing device. A Bush Wheel is fitted with four Angle Brackets to which Dredger Buckets are secured by means of their clips. The four Buckets should each be fixed so that as the Wheel rotates, the open ends face the direction of rotation. The wheel thus formed is geared up from the Clockwork Motor to a ratio of 7 : 1 or greater as the circumstances require.

When the Dredger Buckets are rotated at speed a stage is reached when the resistance of the atmosphere on the Dredger Buckets prevents a further increase in speed. This form of governor gives a steady drive and is suitable for numerous different purposes. A similar type of governor is employed in clock striking mechanisms.

LARGE BOILERS

Models of steam engines sometimes require a larger boiler than Part No. 162, and in such cases one must be built up from separate parts.

A boiler of approximately 3¼ in. diameter can be made in the following manner. Each end is formed from a circle of 2½" small radius Curved Strips that are secured around the rim of a Face Plate. Two 5½" Strips are overlapped one hole and bolted together, and are curved to fit round the outer rim of the Curved Strips to which they are secured by Angle Brackets.

Two ends are built up in this manner and may be connected together by Strips of suitable length. To complete the circle 20 Strips will be necessary, but it is not always necessary to fill in the entire boiler. An economy can be effected by leaving the underside open.

SLIP CLUTCHES

In models fitted with automatic reversing gear that is required to operate for a long period, it often happens that the Gears do not mesh at precisely the same moment for each cycle of operations, and slight inaccuracy is likely to be increased to serious proportions after a period of operation.

Supposing for instance a model crane, to be used for demonstration purposes by a Meccano club, is fitted with an automatic reversing gear for the hoisting mechanism. The cord would be so arranged that when the load is lowered to its fullest extent there is no more cord on the winding drum which, as it continues to rotate, winds up the cord. After the load is hoisted there is a pause while the automatic reversing gear draws one Pinion out of engagement with its Contrate, and then when the second Pinion is engaged the load is lowered once again. If the Pinion disengages before the load is raised to its normal height, it will be clear that on the next wind the hook will be raised to the same extent higher than normal, and to prevent the possibilities of slight inaccuracy it is advisable to incorporate a slip clutch in the drive.

The slip clutch should consist of an ordinary friction clutch, such as is fitted to the Meccano Motor Chassis, and normally kept in engagement by means of a Compression Spring. One member of the clutch would be secured to the winding drum and the other would take up the drive from the reverse gear. The pressure exerted by the Spring would be so adjusted that under normal working, the clutch grips, but as soon as the winding drum is overloaded, as when the load reaches its maximum height, slip occurs. Thus the mechanism would be adjusted to give a slight overwind, which would be allowed for in the slip clutch, and the load would be hoisted to the same height each time.

There are numerous other applications for slip clutches, but they are especially adaptable for demonstration models that are required to operate for long periods without attention.

CARE AND MAINTENANCE OF CLOCKWORK MOTORS

We frequently receive requests for advice concerning the use of Meccano Clockwork Motors and how to prevent overwinding. There need be no fear of overwinding these Motors with any ordinary handling, but for the benefit of those boys who are naturally "heavy handed" the following method of winding will ensure that the spring is never wound too much. The Motor is allowed to run down completely and is then wound gently to its full extent and the number of turns of the key are counted. During the later stages more care should be exercised, and winding should of course cease as soon as it is felt that the key will not turn any more. Careful note should be made of the number of turns, and then in future when winding the Motor a slightly smaller number of turns should be made. Thus the spring will always be fully wound, but there will be a small margin to prevent the possibility of overwinding.

Clockwork Motors should be lubricated from time to time, and for the bearings Meccano Lubricating Oil should be used. This is of the correct consistency for the purpose and should be applied in small quantities. It is better to apply a little oil often, than much oil at infrequent intervals. The spring should receive periodical attention, and for this Meccano Graphite Grease should be used to ensure smooth running and prevent rust setting in.

The Motors should not be allowed to run down to their full extent before being put away after use. It is advisable to leave them with a few turns left in the spring. It is particularly important that the Clockwork Motors in the Nos. 1 and 2 Motor Car Outfits should not be allowed to run out completely. When running light these Motors run down very quickly. and if allowed to run completely out, damage may result to the spring.

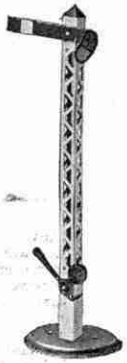
SHORTER GRUB SCREWS.—There are two lengths of Grub Screws at present included in the Meccano system, namely 5/32" and 7/32"; but even the shorter size is sometimes found too long, especially in gear-box construction. When ½" Pinions are meshed with similar Pinions, or with 57-teeth Gears that slide out of engagement on the same side as the boss, the teeth must inevitably foul the Grub Screw in the Pinion. The only remedy for this has been to file down the Grub Screw until there is sufficient clearance for the Gear teeth.

Shorter Grub Screws that fit flush with the Pinion boss can be obtained from the Collars used in the No. 2 Motor Car Constructor Outfit. These Grub Screws will be found useful for other purposes, especially in gear-boxes, and your proposal that they should be included in the standard Meccano range will receive attention. (*Reply to J. Johnson, Reading.*)

Hornby Series

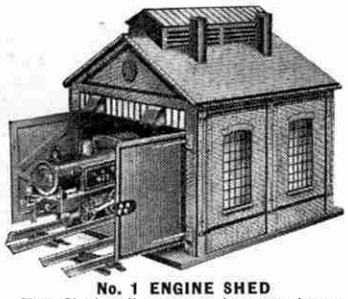
HORNBY ACCESSORIES

Gauge O



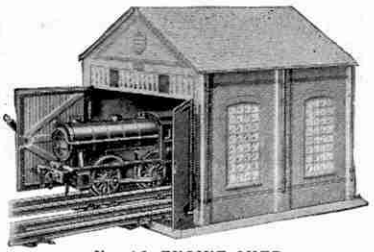
SIGNAL No. 1
"Home" or "Distant."
Price 1/–

SIGNAL No. 2
"Home" or "Distant."
Price 2/–



No. 1 ENGINE SHED
This Shed will accommodate any Locomotive and Tender with an overall length not exceeding 8¾ in. Price 15/–

No. 2 ENGINE SHED
This Shed will accommodate any Locomotive and Tender with an overall length not exceeding 17½ in. Price 22/6



No. 1A ENGINE SHED
This Shed is of the same dimensions as the No. 1 Shed, but is of simpler design, and has doors at one end only. Price 10/6

SIGNAL, DOUBLE ARM No 1.
Price 1/6

SIGNAL, DOUBLE ARM No. 2
Price 2/6

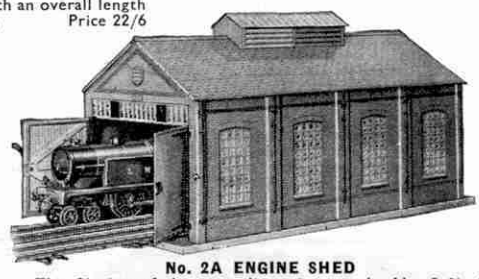
No. 1 JUNCTION SIGNAL
Price 2/9

LAMP STANDARD No. 1E
Electrical (Single as illustrated)
Price 3/6

LAMP STANDARD No. 2E
Electrical (Double)
Price 4/3

LAMP STANDARD No. 1
(Single)
Price 3/6

LAMP STANDARD No. 2
(Double, as illustrated)
Price 4/6



No. 2A ENGINE SHED
This Shed is of the same dimensions as the No. 2 Shed described above, but is of simpler design. Price 17/6

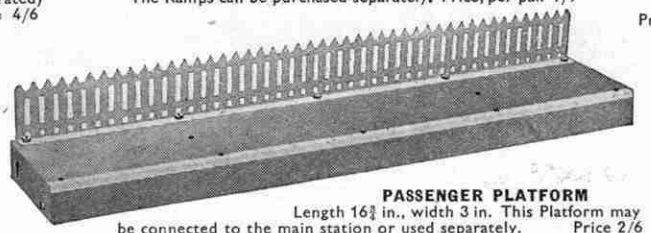
MECCANO GRAPHITE GREASE
(For Springs)
Price, per tube 6d.

ISLAND PLATFORM
Length 32½ in., height 6¾ in., width 3 in. Price 6/6
The Ramps can be purchased separately. Price, per pair 1/9

M TELEGRAPH POLE No. 2
Price 4d.

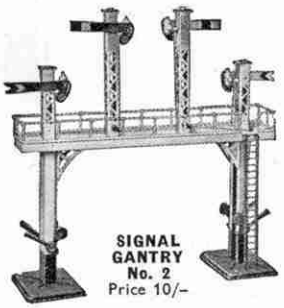
TELEGRAPH POLE
Price, per pair 3/6

No. 2 JUNCTION SIGNAL
Price 4/9

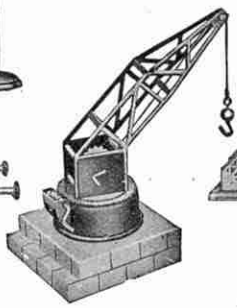


PASSENGER PLATFORM
Length 16¾ in., width 3 in. This Platform may be connected to the main station or used separately. Price 2/6
The white Paled Fencing can be purchased separately. Price, per length 6d.

SIGNAL GANTRY No. 1
Price 4/11



SIGNAL GANTRY No. 2
Price 10/–

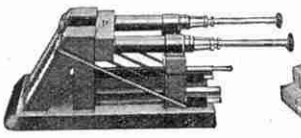


PLATFORM CRANE
Fitted with a crank handle and ratchet mechanism. Price 3/11

No. 1 FOOTBRIDGE
Without Signals. Price 2/11
No. 1A FOOTBRIDGE
Complete with Signals. Price 4/6

STATION OR FIELD HOARDING
This realistic accessory is suitable for the station platform, or for fields adjacent to the track. Price 6d.

TUNNEL (Metal)
Price 3/11

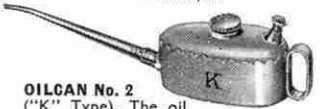


BUFFER STOPS No. 2
(Hydraulic type). Price 5/6

SHUNTER'S POLE
Price 2d.

OILCAN No 1.
Price 6d.

MECCANO LUBRICATING OIL
Price, per bottle 6d.



OILCAN No. 2
("K" Type). The oil is ejected drop by drop by depressing the valve. Polished copper. Price 3/6

All Hornby Accessories are beautifully finished in attractive colours.

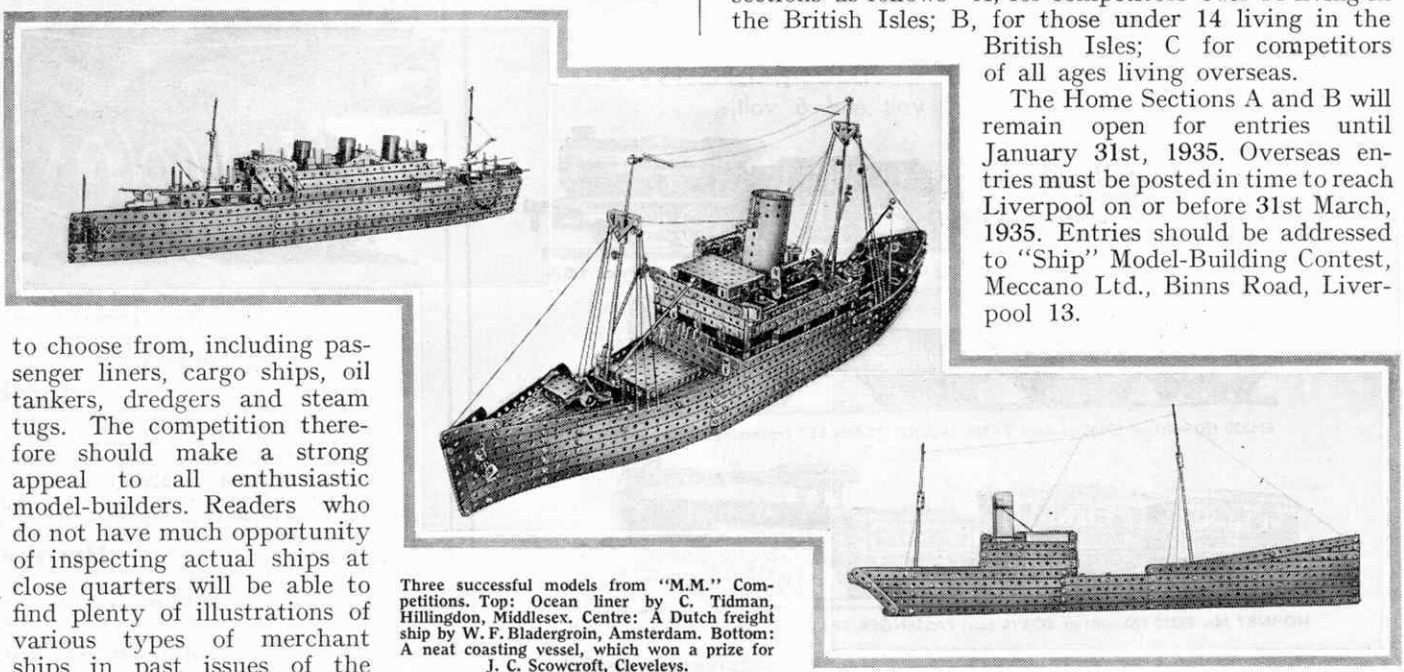
MECCANO LIMITED – BINNS ROAD – LIVERPOOL 13

Meccano Model-Building Competition

Prizes for Model Merchant Ships

This month we are organising a competition for all kinds of model merchant ships. Models of warships and naval vessels generally are not eligible. The competition is open to every owner of a Meccano Outfit, no matter what his or her age may be, and there are no entrance fees. There is no reason, therefore, why every model-builder should not make use of this chance to win a prize.

Merchant ships provide plenty of scope for model-builders, for there are so many different kinds of vessels to choose from, including passenger liners, cargo ships, oil tankers, dredgers and steam tugs. The competition therefore should make a strong appeal to all enthusiastic model-builders. Readers who do not have much opportunity of inspecting actual ships at close quarters will be able to find plenty of illustrations of various types of merchant ships in past issues of the "*M.M.*" or in the daily illustrated newspapers. We hope that every reader will send in an entry and try to win one of the fine prizes listed on this page.



Three successful models from "M.M." Competitions. Top: Ocean liner by C. Tidman, Hillingdon, Middlesex. Centre: A Dutch freight ship by W. F. Bladergroin, Amsterdam. Bottom: A neat coasting vessel, which won a prize for J. C. Scowcroft, Cleveleys.

Models should be built as closely as possible to scale, but unless the model is a large one it is wise not to include much detail. A small model will look better if it is simply constructed, particular attention being given to obtaining a realistic outline for the hull and superstructure.

All models submitted must be built by the competitor without assistance from anyone.

When the model is completed and the competitor is satisfied that nothing further can be done to improve it, the next thing is to prepare an illustration of the model. This may be either a photograph or a drawing, but it is best to send a photograph if possible. It should be clearly understood that the actual model must not be submitted, and those competitors who do not possess a camera, and cannot obtain a professional photograph, should set to work to make a neat drawing. Some of the principal prizes in past competitions have been won by competitors who submitted only drawings of their models, so that intending competitors in this contest need not be discouraged if they cannot obtain a photograph.

In order to give each competitor a fair chance, irrespective of age, the competition is divided into three sections as follows—A, for competitors over 14 living in the British Isles; B, for those under 14 living in the British Isles; C for competitors of all ages living overseas.

The Home Sections A and B will remain open for entries until January 31st, 1935. Overseas entries must be posted in time to reach Liverpool on or before 31st March, 1935. Entries should be addressed to "Ship" Model-Building Contest, Meccano Ltd., Binns Road, Liverpool 13.

Each photograph or drawing must bear the competitor's name, age and full address, and the letter (A, B or C) indicating the Section of the Contest for which he or she is eligible.

If the model contains any special features that are not shown in the photographs or drawings, it is advisable to write a short description that will make everything quite clear, and send this with the entry.

Photographs or drawings of unsuccessful models will be returned to the sender only when a stamped addressed envelope is enclosed. It should be noted, however, that photographs or drawings of prize-winning models become the property of Meccano Limited, and will not be returned.

Competitors are advised to take special care in the preparation of their photographs or drawings, for a good clear photograph or a neat drawing goes a long way towards winning the favour of the judges.

"Merchant Ship Model-Building Competition"

The Prizes

A similar and separate set of prizes will be awarded in each of the Sections, A, B and C as follows:

First Prize: Meccano or Hornby Goods value £3-3s.
Second Prize: Meccano or Hornby Goods value £2-2s.
Third Prize: Meccano or Hornby Goods value £1-1s.
Fourth Prize: Meccano or Hornby Goods value 15/-.
Five Prizes of Meccano or Hornby Goods value 5/-.
Eight Consolation Awards of Goods value 2/6.
Certificates of Merit.

Prizewinners will be allowed to choose any goods they like from current Meccano or Hornby Train price lists.

HORNBY BRITI GUARA

SAFE
SPEEDY
POWERFUL

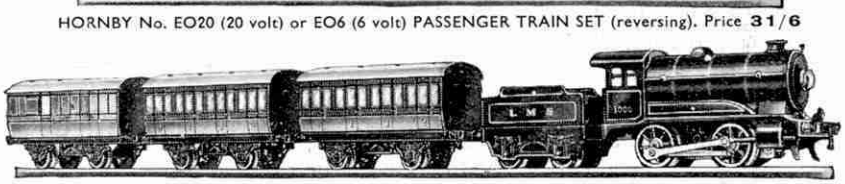
HORNBY
EPM16 SPECIAL
TANK LOCOMOTIVE
(6-volt permanent magnet type, reversing). Price **33/6**

A Selection of HORNBY ELECTRIC TRAIN SETS (20 volt and 6 volt)

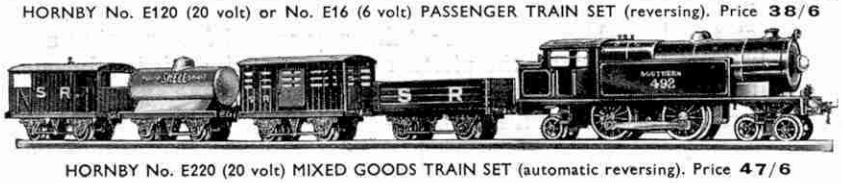
EM120 (20 volt) or EM16 (6 volt) GOODS TRAIN SET (non-reversing). Price **15/-**

EM320 (20 volt) or EM36 (6 volt) TANK GOODS TRAIN SET (reversing). Price **24/-**

HORNBY No. EO20 (20 volt) or EO6 (6 volt) PASSENGER TRAIN SET (reversing). Price **31/6**



HORNBY No. E120 (20 volt) or No. E16 (6 volt) PASSENGER TRAIN SET (reversing). Price **38/6**

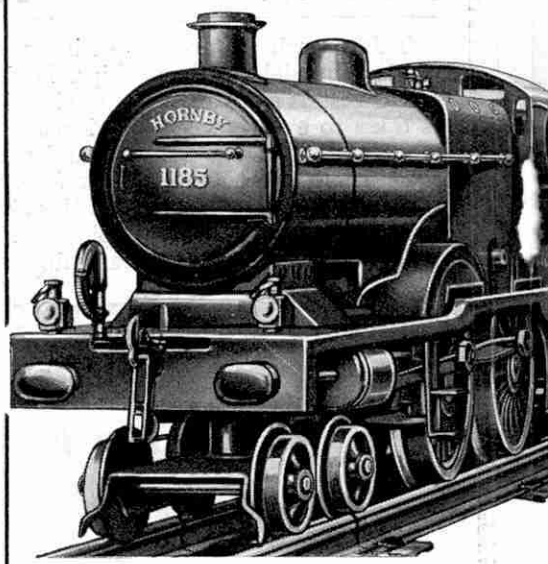


HORNBY No. E220 (20 volt) MIXED GOODS TRAIN SET (automatic reversing). Price **47/6**

HORNBY No. E320 (20 volt) RIVIERA "BLUE" TRAIN SET (automatic reversing). Price **67/6**

HORNBY No. E320 (20 volt) PULLMAN TRAIN SET (automatic reversing). Price **72/6**

ELECTRIC AND



Hornby Trains are the best that you can buy. Th
runs; the Rolling Stock is smooth running and fitte
realistic and correct in proportion. It will be a big
and can play the great game of railways. Make your ch

Hornby Elec

The Locomotives of the splendid new range of Ho
efficient motors capable of hauling heavy loads at h
Hornby Electric Locomotives can be controlled fo
lineside, The most complete control is afforded wi
automatic reversing mechanism. This enables a trai
and reversed from the lineside without touching th

Hornby Clock

Hornby Clockwork Locomotives are the long
respective types in the world. The motors fitted a
pieces of mechanism with accurately cut gears that

PRICES OF HORNBY E

20-VOLT	Price
EM120 Passenger (Non-reversing)	15/-
EM220 ,, ,, ,, ...	16/6
EM120 Goods ,, ,, ...	15/-
EM320 Tank Goods (Reversing from cab by hand)	24/-
EO20 Hornby Passenger ,, ,, ,, ,, ,,	31/6
EO20 ,, Goods ,, ,, ,, ,, ,,	31/6
E120 ,, Tank Goods ,, ,, ,, ,,	36/-
E120 ,, Goods ,, ,, ,, ,, ,,	36/-
E120 ,, Passenger ,, ,, ,, ,, ,,	38/6
AUTOMATIC REVERSING (REMOTE CONTROL)	
E120 Special Goods...	44/-
E120 ,, Passenger	48/6
E220 Mixed Goods	47/6
E220 Special Pullman	75/-
E320 Riviera "Blue"...	67/6
E320 Pullman...	72/6

PRICES OF HORNBY CL

	Price
MO Goods (Non-reversing)	4/11
MO Passenger (Non-reversing)	5/6
M1 Goods (Reversing)...	8/11
M1 Passenger (Reversing)	8/11
M2 Passenger (Reversing)	10/6
M3 Tank Goods (Reversing)	15/-
No. O Hornby Passenger (Reversing)	16/11
No. O Hornby Goods (Reversing)	17/6
No. 1 Hornby Goods (Reversing)	22/6

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MECCANO LIMITED, BIN

TISH and RANTEED TRAINS

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Hornby No. 2 Special Train Set, hauled by a true-to-type model of the L.M.S.R. "Standard Compound" class.

The Locomotives are built for heavy loads and long
itted with automatic couplings; the Accessories are
big day in your life when you have a Hornby Train
r choice now! Tell Dad it **must** be a Hornby for Xmas.

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Hornby Electric Trains are fitted with powerful and
it high speeds but always under perfect control. All
for speed, and for starting and stopping, from the
with the 20-volt locomotives which are fitted with
rain to be started and stopped, controlled for speed
the locomotive at all.

ckwork Trains

ongest-running spring-driven locomotives of their
ed are of the highest possible quality, being perfect
at ensure smooth and steady running.

ELECTRIC TRAIN SETS

	6-VOLT	Price
EM16	Passenger (Non-reversing)	15/-
EM26	,, ,, ...	16/6
EM16	Goods ,, ...	15/-
EM36	Tank Goods (Reversing from cab by hand)...	24/-
EO6	Hornby Passenger ,, ,, ,, ,, ...	31/6
EO6	,, Goods ,, ,, ,, ,, ...	31/6
E16	,, Tank Goods ,, ,, ,, ,, ...	36/-
E16	,, Goods ,, ,, ,, ,, ...	36/-
E16	Hornby Passenger ,, ,, ,, ...	38/6
E26	,, Mixed Goods ,, ,, ...	45/6
E36	,, Riviera "Blue" ,, ,, ...	65/-
E36	,, Pullman ,, ,, ...	70/-
E36	,, Metropolitan	57/6

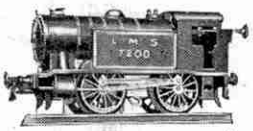
CLOCKWORK TRAIN SETS

	Price
No. 1 Hornby Tank Goods (Reversing)	22/6
No. 1 Hornby Passenger (Reversing)	25/6
No. 1 Hornby Special Goods (Reversing) ...	30/-
No. 1 Hornby Special Passenger (Reversing) ...	35/-
No. 2 Hornby Mixed Goods (Reversing)	36/-
Hornby Metropolitan C (Reversing)	42/-
No. 2 Hornby Special Pullman (Reversing) ...	65/-
No. 3C Hornby Pullman (Reversing)	62/6
No. 3C Hornby Riviera "Blue" (Reversing) ...	58/6

Hornby Electric and Hornby Clockwork Train Sets

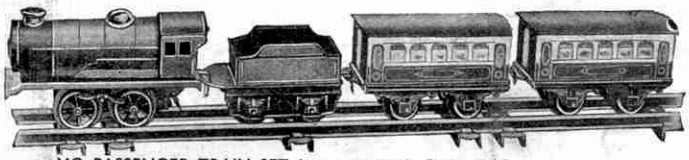
INNS ROAD, LIVERPOOL 13.

LONG RUNNING— STRONG PULLING

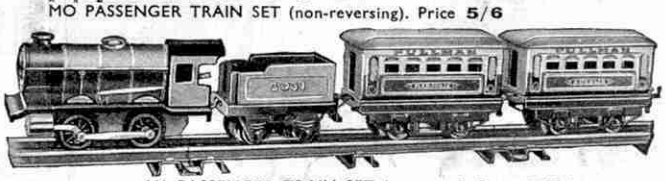


No. 1 SPECIAL TANK LOCOMOTIVE (reversing). Price **17/6**

A Selection of
HORNBY CLOCKWORK TRAIN SETS

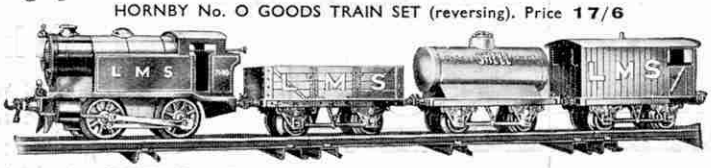


MO PASSENGER TRAIN SET (non-reversing). Price **5/6**



M1 PASSENGER TRAIN SET (reversing). Price **8/11**

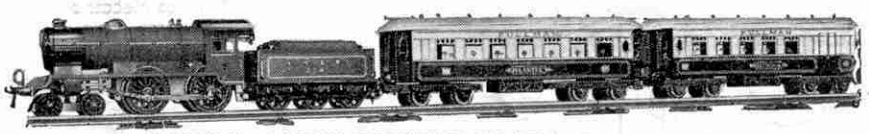
HORNBY No. O GOODS TRAIN SET (reversing). Price **17/6**



HORNBY No. 1 TANK GOODS TRAIN SET (reversing). Price **22/6**

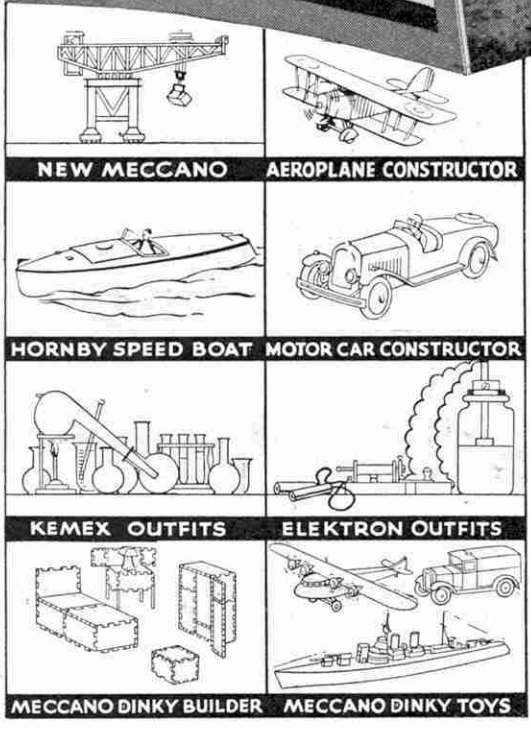
HORNBY No. 1 PASSENGER TRAIN SET (reversing). Price **25/6**

HORNBY No. 3C PULLMAN TRAIN SET (reversing). Price **62/6**



HORNBY No. 2 SPECIAL PULLMAN TRAIN SET (reversing). Price **65/-**

READY EARLY IN NOVEMBER



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Of all the wonderful Meccano catalogues that we have ever published, the new Meccano Book is the finest. It is a triumph of the printer's art and craftsmanship, consisting of 24 pages, mostly printed in full colour on best quality white art paper. The complete range of Meccano Constructor Outfits, Meccano Kemex and Elektron Outfits, Meccano Dinky Toys and the new Meccano Dinky Builder is illustrated and described in this handsome book.

We hope that every boy in the country, and especially every reader of the "Meccano Magazine," will make a point of securing a copy.

HOW TO OBTAIN THE BOOK

The Meccano Book will be ready early in November. The best way to make sure of getting a copy is to see your dealer now, asking him to reserve a copy for you. If this is not convenient, however, you can send in a remittance of 3½d., to Meccano Limited (Dept. No. 70), Binns Road, Liverpool 13, and we will arrange for a copy of the book to be forwarded, post free, immediately it is ready.

ORDER YOUR COPY TO-DAY

Published by

Meccano Limited, Binns Road, Liverpool 13

Model-Building Competition Results

By Frank Hornby

"Spring" Contest (Home Sections)

The lists of prizewinners in the Home Sections of the "Spring" Model-Building Competition are as follows:

Section A (competitors over 14)

FIRST PRIZE, Meccano or Hornby goods value £3-3s.: J. Nowlan, London, E.14. SECOND PRIZE, Goods value £2-2s.: F. Payne, Reigate. THIRD PRIZE, Goods value £1-1s.: W. Atterbury, Nelson.

EDITOR'S SPECIAL PRIZE, Goods value 15/–: H. and R. Powell, Dursley (joint entry).

FIVE PRIZES of Goods value 10/6: B. Goldsmith, B. Garwood, and L. Finch (Lowestoft (joint entry); W. Halsall, Burscough; T. Kennett, Sheerness; L. Shepherd, Middlesbrough; C. Williams, Manchester 11.

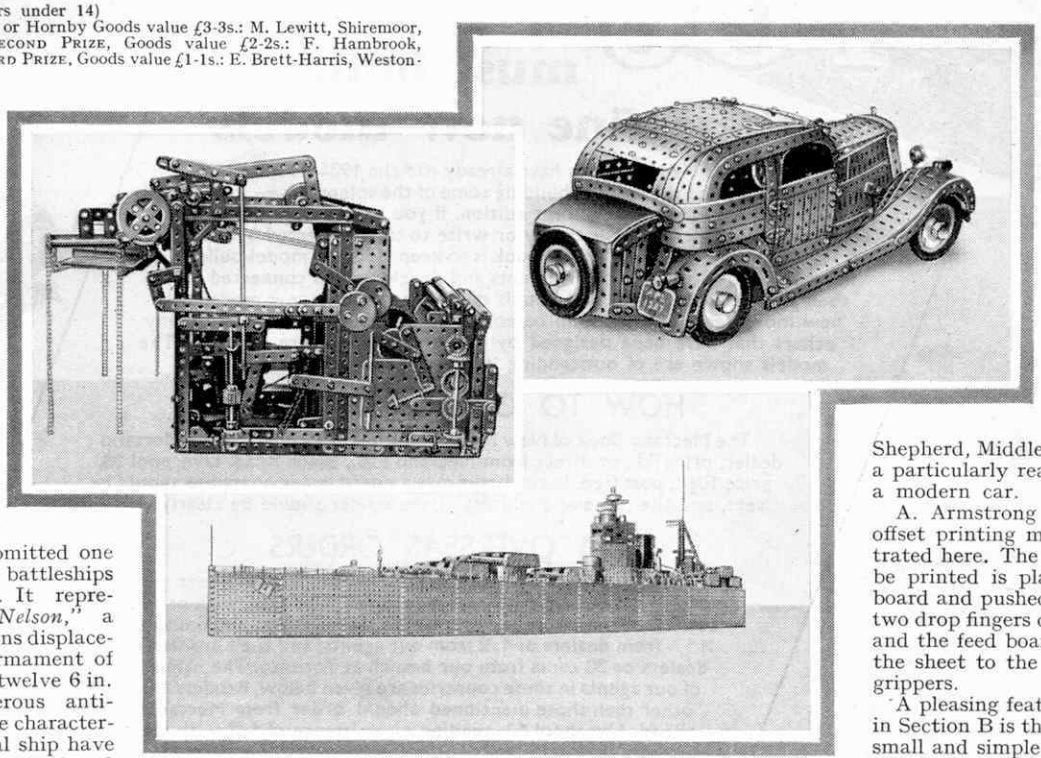
PRIZES OF GOODS value 5/–: A. Armstrong, Leicester; A. Gosman, Beckenham; R. Hilling, Ipswich; C. Malherbe, St. Heliers, Jersey; J. Matthews, Fillongley; N. Smith, Ilkeston; L. Willis, Lowestoft.

Section B (competitors under 14)

FIRST PRIZE, Meccano or Hornby Goods value £3-3s.: M. Lewitt, Shiremoor, Northumberland. SECOND PRIZE, Goods value £2-2s.: F. Hambrook, London, S.E. 6. THIRD PRIZE, Goods value £1-1s.: E. Brett-Harris, Weston-super-Mare.

FIVE PRIZES of Goods value 10/6: J. Birtill, Derby; K. Durham, Christchurch, Hants.; D. Frost, Dagenham; P. Joce, London; B. Legg, Exeter.

FIVE PRIZES of Goods value 5/–: P. Collins, Little Burstead, Essex; A. Ingle, Cleveleys, Nr. Blackpool; C. Nettle, Cheadle Hulme; E. Shapland, Exeter; J. Stone, Cambridge.



Top Right: The prizewinning saloon car built by Lawrence Shepherd, Middlesbrough. Top Left: A model rotary offset printing machine, which won a prize for A. Armstrong, Leicester. Bottom: A remarkably fine model of H.M.S. "Nelson" by J. Nowlan, London, E.14, that will be fully described in an early issue of the "M.M."

First Prize in Section A was awarded to John Nowlan, who submitted one of the best model battleships that I have seen. It represents H.M.S. *"Nelson,"* a vessel of 35,000 tons displacement, with an armament of nine 16 in. guns, twelve 6 in. guns and numerous anti-aircraft guns. The characteristics of the actual ship have been accurately reproduced in the model, and considering that the model was built from newspaper illustrations only, Mr. Nowlan may justly be proud of his success. The model is illustrated on this page, and a full description of it will appear in a future issue of the *"M.M."*

Second Prize was awarded for a working model of *"Big Ben,"* the famous clock of the Houses of Parliament. The external appearance of the clock tower is well reproduced, but it is in the mechanism itself that the most interesting and skilful work has been done. In the model the mechanism is actuated by means of two lead weights, one of which operates the time mechanism, and the other the intricate chiming gear. The hours are sounded on a deep-toned bell placed in the upper portion of the tower, and the half-hours are struck on a bell of slightly higher pitch. The general construction of the tower is good, but owing to the use of unsuitable parts, the appearance of the mechanism is rather "patchy."

Walter Atterbury won Third Prize with a weaving loom. I have examined a piece of cloth woven on the model and from the consistent texture of the material it is evident that the model is very accurately adjusted.

The picking sticks are of the underslung type, that is, they are operated from the base of the model instead of from the top, as in the standard Meccano Loom. This feature complicates the adjustment of the model, but the extra trouble involved is well repaid by the neatness and compactness and the fine quality of the cloth.

A particularly interesting constructional item is the manner in which the gear wheels and cranks are locked on their shafts in relation to each other so as to eliminate any possibility of the timing being upset. This is effected in some cases by means of a long bolt inserted in the boss of a wheel, and fitting between bolts screwed into the face of a second wheel. In other instances wheels are connected to each other by Threaded Rods. It is in the execution of small details such as these that a model-builder's capability is tested.

A special prize was awarded to H. and R. Powell jointly for a model of a "Lister" Commercial Truck. These competitors went to a great amount of trouble in preparing their entry, and I intend to make a special feature of the model in the *"M.M."* in due course.

The fine saloon car illustrated on this page is the work of L. Shepherd, Middlesbrough, and it is a particularly realistic example of a modern car.

A. Armstrong built the rotary offset printing machine also illustrated here. The sheet of paper to be printed is placed on the feed board and pushed up to lays, then two drop fingers close on the sheet, and the feed board rises and feeds the sheet to the impression roller grippers.

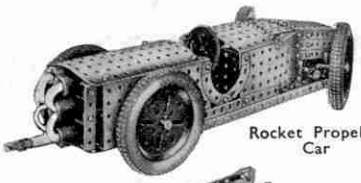
A pleasing feature of the entries in Section B is the large number of small and simple models that won prizes. Much of this success is due to the neat and careful work of the builders who, with only small Outfits at their disposal, contrived to make their models thoroughly interesting and realistic.

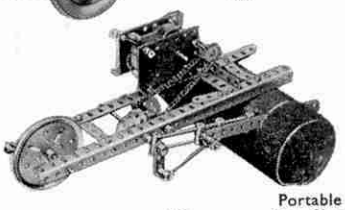
The First Prize model in this Section represents a Thornycroft six-wheeled articulated petrol tank lorry. It was built by M. Lewitt, and I understand that this is the first Meccano model-building contest he has entered. I wish to take this opportunity to congratulate him on his success and to express my hope that it will encourage him to further efforts in future *"M.M."* competitions.

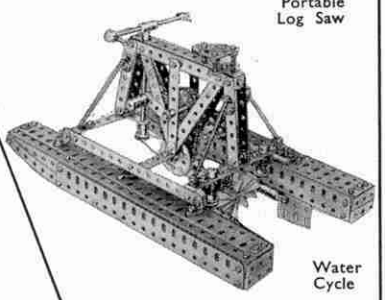
The chassis of the driving unit is sturdily built from Angle Girders and is fitted with two pairs of wheels mounted on leaf springs. Double rear driving wheels are provided and they are driven by means of a No. 1A Clockwork Motor through a two-speed gear-box and differential gear. Reverse motion is obtained by reversing the Clockwork Motor.

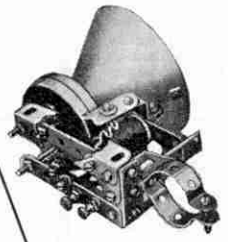
F. Hambrook, the Second Prize winner in Section B, sent a model sports car. Steering is of the Ackermann type, with the track rod in advance of the axle, a method adopted in the case of some well-known makes of racing cars. Leaf springs are fitted, and a super charger, represented by four Flanged Wheels and a Bush Wheel, is placed in a conspicuous position between the front dumb irons.

An interesting model of a travelling crane, that has a jib 6 ft. in length, won Third Prize for E. Brett-Harris.


Rocket Propelled Car


Portable Log Saw

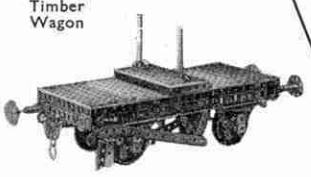

Water Cycle


Electric Horn

YOU must build these fine new models

The majority of Meccano Boys have already had the 1934 Book of New Models, and have had the thrill of building some of the splendid new models that are featured in this magnificent edition. If you have not yet had your copy see your dealer about it to-day or write to us, as directed below.

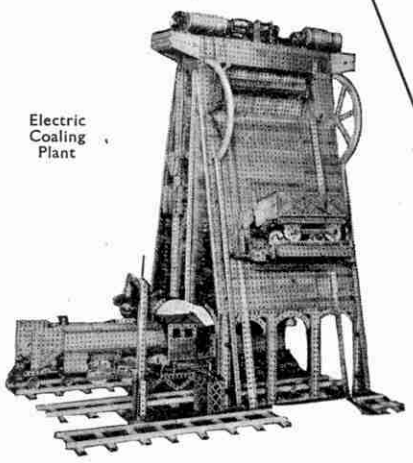
The principal object of this fine book is to keep Meccano model-builders in touch with the latest improvements and developments connected with their hobby. Illustrations and details of the best of the new models and new movements submitted in recent competitions, together with many others that have been designed by our own experts, are included. The models shown are of outstanding interest and variety.


Timber Wagon

HOW TO OBTAIN THE BOOK

The Meccano Book of New Models may be obtained from any Meccano dealer, price 9d., or direct from Meccano Ltd., Binns Road, Liverpool 13, price 10½d. post free. In the latter case a postal order or stamps should be sent, and the name and address of the sender should be clearly written.

44 Pages

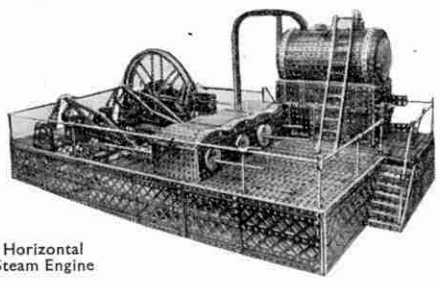

Electric Coaling Plant

OVERSEAS ORDERS

Supplies of the Meccano Book of New Models have been despatched to our colonial agents to fill orders received. The Australian price is 1/9 from dealers, or 1/11 from our agents; the New Zealand and South African price is 1/- from dealers or 1/2 from our agents; and the Canadian 25 cents from dealers or 30 cents from our branch at Toronto. The names and addresses of our agents in these countries are given below. Readers living in countries other than those mentioned should order from Meccano Limited, Binns Road, Liverpool 13, sending a remittance of 1/2 with their orders.

OVERSEAS AGENCIES

AUSTRALIA: E. G. Page & Co., 52, Clarence St., Sydney (P.O. Box 1832k).
NEW ZEALAND: Models Limited, P.O. Box 129, Auckland C1.
SOUTH AFRICA: Arthur E. Harris, 142, Market Street, Johannesburg (P.O. Box 1199).
CANADA: Meccano Ltd., 34, St. Patrick Street, Toronto.


Horizontal Steam Engine

MECCANO BOOK OF NEW MODELS 9D.

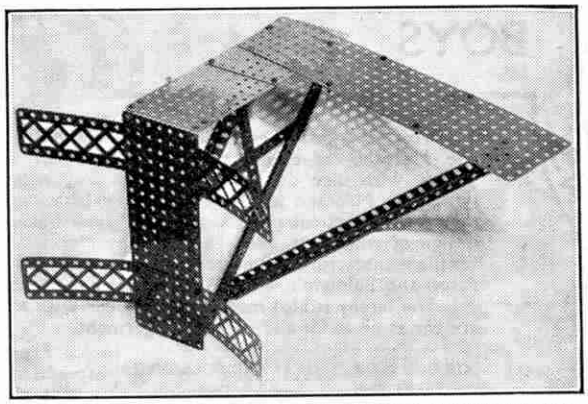
MECCANO LTD., BINNS ROAD, LIVERPOOL 13

An Ingenious Meccano Splint

Readers will be interested in another instance of the adaptability of Meccano, described by Mr. P. Maynard Heath, F.R.C.S., of Fleet, Hants, in "*The British Medical Journal*." On one occasion, having to improvise an aeroplane splint, Mr. Heath decided to make use of Meccano, and with the assistance of Mr. P. Rouquette he produced the very successful splint shown in the accompanying illustration.

The main portion of the splint consists of six 5½" × 3½" Flat Plates, two for the chest piece, two for the arm and three for the forearm. The chest and arm pieces are joined together by two 1" × 1" Angle Brackets, and their extremities are joined by two 12½" Angle Girders that in turn are braced together by two crossed 5½" Strips. A third 12½" Angle Girder supports the extremity of the forearm plate. The 12½" Angle Girders are attached to the Flat Plates by ½" × ½" Angle Girders and small wing nuts and bolts. The two chest girdles, seen at the left of the illustration, consist of two 12½" Braced Girders, and are flexible so that they can be bent round the chest.

The splint is easily adaptable for either side of the body, and to a certain extent is adjustable in size by varying the attachments of the various parts. The angle between arm and forearm pieces can also be altered.



An interesting aeroplane splint constructed in Meccano. For this illustration we are indebted to the courtesy of the Editor of "The British Medical Journal."

"Sentinel" Locos—*(Cont. from page 873)*

the throttle valve will be more fully opened) can find its way as before through the charging valve to the low pressure receiver. Since the upper ball valve is on its seating, however, the steam can go no further, and it is now that the reducing valve begins to function.

The steam pressure in the low-pressure receiver must not exceed 145 lb. per square inch, or the safety valve will lift and allow the steam to escape to exhaust. But the steam at its first entry to the charging valve may be at a pressure of 500-550 lb. per sq. in. This high pressure acts from beneath on the ball at the bottom of the reducing valve, and tends to lift it off its seat, together with the "piston" above. The area on which the steam above can act is much greater than that below, so that if the pressure beyond the valve exceeds a certain limit, actually about 140 lb. per sq. in., the "piston" is forced down and the ball valve is pushed on to its seating, preventing the admission of steam. Actually, of course, the valve maintains the ratio between the steam pressure on its two sides, so that if the pressure on the high-pressure side is less than 500-550 lb. per sq. in. the valve will close before the pressure on the other side reaches 140 lb. per sq. in.

When the locomotive is running normally with the cut-off at some earlier position, neither of the two rods is holding a bell valve off its seat, and consequently no steam finds its way via the charging valve to the low pressure receiver.

In many respects the cab arrangements are similar to those found in any ordinary locomotive, but one or two controls are differently placed. As will be seen from the accompanying illustration of the cab, there is a control pillar on each side. The lever working in a slot controls the throttle valve. Its first motion opens a pilot valve, which admits steam to the space below the main valve and puts it in balance. Behind the throttle lever and in a convenient position for the driver there is a handle controlling the reversing gear. A scale and pointer alongside the throttle lever indicates the direction of travel and the setting of the cut-off.

The flexible connecting-rods of the screw-and-nut mechanism for the Stephenson link motions have already been mentioned. These flexible shafts are linked under the footplate to a gear-box that is operated by chains from the handles on the control columns. Beside the control columns on each side there can be seen in the illustration the hand levers that control the Westinghouse brakes. The levers for the rocking grates, and the hand wheels for the soot blowers, can be seen on each side of the fire-door. The big valve on the top of the boiler is the main stop valve. The other valves control the admission of steam to the sanding gear, Westinghouse pump, injector, feed pump, etc.

The working parts of the engines are lubricated by splash from the oil in the crank-cases, while the roller bearing journals of the axles, being grease lubricated, need only very occasional attention. For cylinder lubrication a mechanical lubricator is provided. It is driven off the right intermediate wheel journal end of the trailing bogie, and forces oil under pressure into a six-feed distributor mounted in the cab.

These "Sentinel" locomotives have many interesting advantages. For instance, where several vehicles are in service and boiler inspection can be carried out on a routine basis, a complete boiler can be quickly removed from a locomotive and replaced by another. Similarly, when an engine requires overhauling it is a matter of little difficulty or expenditure of time to remove the engine and axle complete and substitute another. Further, the low axle weights, combined with the fact that the wheels and axles are in perfect running balance, reduce wear on the track, while the uniform torque gives a high factor of adhesion. The "Woolnough" boiler, it is claimed, is capable of raising steam in less than half the time that would be required for an ordinary locomotive boiler for the same power, and with a steam consumption by the compound engines of 13 lb. per B.H.P. hour it is believed that a 50 per cent. saving in fuel burned will be obtainable.

Junior Section—*(Continued from page 911)*

and at the same time to take the opportunity of clearing any dirt from the frames and bearings themselves. It is surprising what an amount of dirt can be picked up by the running gear of miniature rolling stock. Special attention should be paid to the journals or bearing portions of the axles as their oily condition tends to collect dirt.

After refitting the wheels of the various vehicles and attending to their lubrication, it will be as well to examine the couplings of the different items of rolling stock. Bent couplings should be straightened with pliers and it is essential to see that the couplings are able to swing freely on the pivots securing them to the vehicles to which they belong. The sharp curves of miniature railway systems require the couplings to move sideways when a train is passing round them. To avoid any trouble owing to undue friction, therefore, special attention should be paid to the couplings, not only the hooks but also their attendant links. In addition to being bent sideways, couplings may have become distorted in an upward or downward direction. Faults of this kind should be corrected, for to ensure that the couplings function properly under all conditions they must be in correct alignment. The straightening of couplings that are bent up or down is more difficult to carry out than in the case of those bent sideways, but using small pliers little trouble should be experienced.

Another Engineering Problem

The problem published on page 66 of the "*M.M.*" of January last attracted considerable attention, and we now give details of another similar problem. The piece of steel illustrated here measures 4" × ⅜" × 3/16" and has in its centre a shallow slot shaped as shown. The slot does not penetrate right through the metal but only about halfway, and it measures approximately ½" × ¼" × ⅛" deep. The slot was made by means of a flat file, and readers are invited to test their skill in finding the method in which the job was done. The correct solution will appear in a future issue of the "*M.M.*"

Mixed Traffic Locos—*(Continued from page 877)*

train is stationary, and a vacuum pump driven off the left-hand crosshead performs the same function while running.

Sanding apparatus of the mechanical trickle type delivers sand to the front of the leading coupled wheels and to the front and rear of the middle coupled wheels. In addition to this a de-sanding apparatus is embodied, which comes into use automatically, so that after the engine has used the sand, in the forward or reverse direction as the case may be, the rails are cleaned with hot water to prevent interference with the track circuits.

To obtain smooth riding the draw gear between engine and tender is designed with buffing spindles controlled by coiled springs. These spindles have specially designed heads that ride on an inclined plane provided on the rear engine buffer beam. The tenders fitted to these locomotives are of the new 4,000 gallon type carried on six wheels. The coal bunker, which has a capacity for nine tons of coal, has been carefully arranged so that as far as possible the coal will be self-trimming. A bunker door gives access to the coal space from the footplate, and there is ample tool box accommodation. The sides of the bunker, which are very high, are turned inward along their top edges; and this feature, in conjunction with the comparatively low rear end of the tender, gives the vehicle a remarkable and distinctive appearance.

(Continued at foot of next column

On the left-hand side of the tender is a special recess conveniently arranged to accommodate all the necessary firing irons. The tender is fitted with a water scoop, and the handles for controlling this and the tender hand brake are arranged vertically, bevel wheels transferring the motion to their respective gears.

Of these locomotives, which are to be numbered from 5000 upward, Nos. 5000 to 5019 are being built at Crewe, and 100 each by the Vulcan Foundry Ltd. and Sir W. G. Armstrong Whitworth and Co. Ltd. The first 10 of the class to be delivered by the Vulcan Foundry Ltd., Nos. 5020 to 5029, have been sent to Perth and some are sharing in the work on the Highland Section of the L.M.S.R. in place of the Highland "Clans," most of which have been transferred for duties on the Oban line.

Planning a New Railway—*(Cont. from page 879)*

way and fencing, sidings, junctions, stations, land and buildings, and signalling.

The Company's secretary now assembles the various plans and documents and hands them to the Company's Parliamentary Agents, who deposit what will be called the Menton Railway Bill at the Houses of Parliament. The last date for this in any year is 30th November, if the Bill is to be considered in the next Session.

The Bill passes through Parliament in various stages, the chief being Committee, during which it will be closely scrutinised and, if there is any opposition to it, compromise on certain parts may be necessary. However, we will suppose that, except for small amendments, our Bill has survived, so that about June it receives the Royal Assent, and becomes the Menton Railway Act, 1934.

The Engineer now gets his instructions to make the working survey. For this, the 25-in. to the mile Ordnance Sheets, or simply 25-in. sheets as they are called, are obtained, and as these show individual buildings, slight deviations of the line to avoid property can be planned on them. Of course all changes must be made inside "the limits of deviation" as already explained. Extra levels and cross sections are taken at some places to enable improvements to be schemed. After the amended line has been drawn on the 25-in. sheets, they are made into a roll as with the 6-in., and this is taken out and the line pegged out from it. Wooden pegs, 2 in. square and about 18 in. long, are put in at every chain. Every tenth one has a marker peg driven alongside it on the slant. Beginnings and ends of curves are also specially marked.

With this as a base line, a careful survey is made, going a bit wider each side than the railway fence is estimated to be, and levels are taken and a section drawn, together with cross sections where the ground is rough. This enables the working plan and section to be produced. The plan shows radii of all curves, span, width, height and description of bridges, numbers of the drawings showing bridge details, level crossings, road and stream diversions, culverts, and so on. The section shows formation level, that is, top of embankment and bottom of cutting, not rail level. Fence lines, and the tops and bottoms of slopes, are also shown on the plan.

The gradient line on the section can be varied within the limits of deviation, 5 ft. country or 2 ft. town, and a great deal of experience is necessary in fixing this. Stations should if possible be on the level, but must not be on a steeper grade than 1 in 260. Two gradients should not meet to form a dip in the tunnel or cutting, as if they do, drainage will be difficult. One main principle is to equalise the cuttings and embankments if at all possible, because if there is too much excavation it will have to be tipped to waste on land bought for the purpose, and if too little to form the embankments it will have to be dug out of land specially bought for it. Allowance has to be made also for the nature of the material and the angles of the slopes of the cuttings and embankments.

All new works such as bridges and culverts will be described above the section, at the place where they occur, in red ink, all existing details such as roads being marked in black ink.

The detailed working drawings of the separate structures, such as stations and buildings, will then be prepared, and from these the Specifications and Bills of Quantities. The former may be described as the engineering conditions that have to be fulfilled, the latter being the statement of the calculated amounts of the various materials and workmanship in the structures. When these are ready the Engineer will be in a position to let contracts for the work. The number of contracts into which the work is divided is decided, and selected firms are asked to tender for the work. The tenders are delivered sealed to the Secretary of the Company on or before a specified date. They take the form of a priced Bill of Quantities, showing what the Contractor's charges will be for the various operations. The time he requires in which to do the work is usually also an important consideration. It is possible of course that the same firm may get more than one contract. Generally, but not always, the work goes to the lowest tender.

We have now seen something of the history of the planning of a railway, from the time when a few individuals have the idea that such a thing would be desirable, up to the day when some person of note performs the ceremony of cutting the first sod. Let us hope that the optimism of the promoters will meet with its reward!

New Models for Meccano Club Exhibitions

Meccano clubs in Great Britain and other northern countries have now settled down to their indoor programmes. The meetings of established clubs are being continued on their usual lines, and provide splendid opportunities for members to show their skill and ingenuity in model-building of all kinds, and to take part in the games and other pursuits that form regular features of club work. Preparations for the Exhibitions, Socials and other events that mark the approach of the Christmas season also are well in hand, and my hopes of a record year promise to be amply fulfilled if the enthusiasm and the capacity for enjoying club life shown in all quarters is any guide.

I have prepared a revised list of models available for loan to clubs for display at Christmas and New Year Exhibitions, and shall be glad to send copies of this to secretaries. The list is comprehensive and varied, and the models themselves will be constructed in the attractive new Meccano, the blue and gold shades of which give them a strikingly handsome appearance. No Exhibition is complete without one of these splendid working models. Very little expense is incurred in including one or more of them in any display, for it is only necessary to pay the return carriage, the amount of which depends on the size of the model and in no case is more than a few shillings.

Those who wish to add a model to the attractions of their Exhibitions should let me know their requirements in good time. At least five weeks' notice is advisable, for the Meccano Model department is fully occupied with development and other work, and care also should be taken to give full details of the electric supply available in order that a suitable motor can be fitted.

Developing New Clubs

The clubs formed in recent months are making good progress and many have already secured affiliation. The success of a newly formed club depends very largely on the ability of the Leader to make every member feel at home, and to inspire him with pride in his club and the determination to make it one of the best in existence. The Leader must get to know his members and show himself thoroughly sympathetic with their aims and interested in all their activities. He can do this best by seizing every opportunity for friendly conversation with them. In his talks he should not be fussy or obtrusively friendly, but should aim at making it easy for them to give expression to their own ideas on club affairs. A genuinely friendly attitude of this kind will help to develop a club spirit that is in accordance with the aims of the Guild.

An equally important part in the success of a comparatively new club is played by the programme. This must be sufficiently attractive to sustain interest and also must be varied in order to give full scope to every member. Model-building and Model-building Contests of course must form the central feature, for these are the foundation of club work; but if there is a strong demand on the part of members for the introduction of any other hobby, steps should be taken to meet it, either by assigning a certain proportion of the meetings to the proposed addition to the programmes, or by forming a special section for those who are interested.

Meccano Club Presidents

No. 10. Mr. S. M. Mills, B.A.

Mr. S. M. Mills, B.A., is President of the Correspondence School (Wellington) M.C. This New Zealand club cannot hold meetings because its members live on lonely farms and sheep stations, but they keep in touch with headquarters by correspondence, and special Model-building Contests are arranged for them.

The Value of Games

Games should not be overlooked in club work. Table Tennis and similar games have played a great part in developing a good spirit in older organisations, and the plan I have often recommended of devoting a few minutes at the close of every meeting to a vigorous exercise of some kind has been found of great value. Lack of space often restricts activities of this kind, but this difficulty usually can be overcome by careful choice of games. For instance, there are very few club rooms that are not large enough to allow a punch ball to be fixed, or which do not afford sufficient space for friendly boxing bouts, and I strongly recommend developments of this kind to all clubs, both new and old. Leaders should always take care to exercise complete control, however, in order to prevent healthy and active fun from degenerating into anything approaching rowdyism.

Forming a Photographic Section

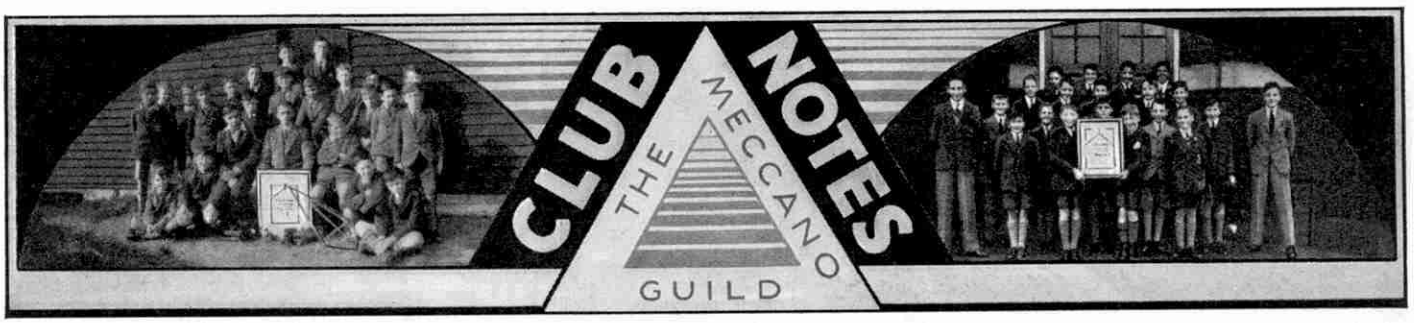
I often wonder why more is not made of photography by members of Meccano clubs. There can be no more fascinating pursuit than this, provided it is tackled in the right manner, and now that good cameras can be obtained at comparatively low cost and rapid films and plates of high quality are available, photography is no longer merely a summer pursuit and can be continued with advantage throughout the winter. There is no difficulty in forming a photographic section. The chief requirement is a keen and enthusiastic section leader who can guide members in making the necessary arrangements for developing and printing and in choosing subjects and making the necessary exposures.

Indoor photography by flashlight is a particularly interesting pursuit that could be taken up with great advantage by the members of the photographic section of a club, for the club room and the members provide excellent subjects and the results will form an admirable record of club history and development. The best photographs can be exhibited in the club room, pinned on a board or on a sheet of card suitably framed and protected by glass, or mounted in a club album.

Members of clubs in which one of these courses is followed will no doubt be willing to pay small sums for prints in which they figure or are of outstanding club interest. Money raised in this manner helps to pay the cost of films and other incidental expenses.

Proposed Clubs

AUSTRALIA—P. Bradley, 69, Woniora Road, Hurstville, N.S.W.
BIRMINGHAM—Mr. L. H. Lusk, 102, Oxford Road, Acocks Green.
BIRMINGHAM—Mr. F. D. Beels, 892, Warwick Road, Tyseley.
BRISTOL—Mr. J. F. Strachan, 40, Northumberland Road, Redland.
BRISTOL—N. E. Ricketts, 10, Belgrave Road, Clifton.
INDIA—B. Jhunjhunwala, 92, Harrison Road, Calcutta.
MAIDSTONE—Mr. L. G. Poore, Little Wrotham, Wrotham, Kent.
PERTH—G. Ashman, 11, Paddington Street, North Perth.
RHONDDA VALLEY—J. Stone, 23, Shady Road, Gelli Pentre.
SOUTH AFRICA—Mr. F. W. Wilson, 49, Parliament Street, Port Elizabeth.



Millwall Central School M.C.—Special opportunities have been given for model-building, and aeroplanes, bridges, cranes and other models constructed have been of remarkably high quality. Lantern Lectures have been given monthly and members have read papers on "*The Greenwich Subway*," "*Wonders of Wireless*" and "*Electric Welding*." Models built by members were displayed at the School Exhibition, by kind permission of the Headmaster, and with a Transporter Bridge loaned from Headquarters proved a great attraction. Many enjoyable evenings were spent playing cricket in the school grounds. Club roll: 16. *Secretary:* C. Shaw, Millwall Central School, London, E.14.

Ipswich M.C.—A very enjoyable time was spent in camp at Southwold. The club room has been repaired and decorated and is now attractive and comfortable to work in. Members are busily engaged constructing models for the Exhibition to be held in December, and the club room is described by the Leader as "a hive of industry." Club roll: 12. *Secretary:* D. Green, "Bankside," Belstead Road, Ipswich.

Dagenham M.C.—Meetings have included Cricket Matches, Cycle Runs and Swimming in addition to Model-building, which has reached a high standard. Two Exhibitions have been held, the proceedings being devoted to the August Seaside Outing, and a Camp has been organised for members of the Cycling Section. The "*Spanner*," the official organ of the club, has been improved and continues to be a popular feature of club life. Club roll: 26. *Secretary:* S. Pashley, 84, Holgate Road, Dagenham.

Worcester Y.M.C.A. M.C.—Good progress is being made and the proceedings of the club are now recorded in the local press. A visit of special interest was paid to the Generating Station at Stourport, members cycling to the Station from Worcester. The club room has been re-opened after a very successful outdoor season, and the secretary will be glad to hear from Meccano enthusiasts who wish to become members. *Secretary:* R. G. Price, Copenhagen Street, Worcester.

St. Giles' Cathedral (Edinburgh) M.C.—This is the St. George's (Edinburgh) M.C. under its new name, which has been adopted since the club took possession of club rooms in St. Giles' Hall. Members worked hard to prepare the club rooms, and particularly in laying down a permanent Hornby Railway. Competitions in Model-building and in railway working are prominent in the syllabus, and an interesting series of visits to be arranged includes an excursion to Glasgow for the Motor Show at Kelvin Hall. A Club Savings Bank has been started, chiefly to enable members to accumulate the funds required for excursions. Club roll: 140. *Secretary:* H. W. Govan, 25, South Orchard Road, Edinburgh, 4.

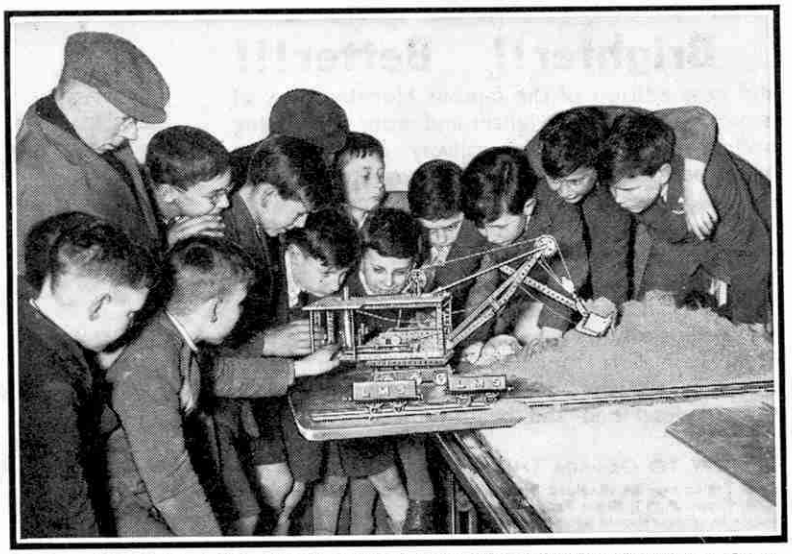
Corner House M.C.—A visit to Swindon was a great attraction to members, who were interested in the activities displayed in every department of the G.W. Railway Works. Interesting comparisons were made between "*North Star*," a locomotive built in 1837, and "*King Henry III*," one of the latest of the "King" class. Indoor meetings have included Hornby Train operations and Model-building Contests, those in which members are given a limited selection of parts with which to construct a model in a given time being especially popular. An Outing Fund has been formed to meet the expenses of excursions. Club roll: 21. *Secretary:* R. Bidmead, High Street, Corsham.

South Parade Modern School (Cleckheaton) M.C.—Affiliation has been secured. General meetings are held in the school hall, and a smaller room has been fitted with tables to enable model-building work to be carried on. Active recruiting is taking place and members are keen to make their club successful. Club roll: 6. *Secretary:* K. Walker, 12, Genge Street, Cleckheaton, Yorks.

Exeter M.C.—A group of members spent a railway holiday week, visiting Torquay, Dartmouth and other interesting places available to holders of G.W.R. unlimited travel tickets in the Exeter area, the total distance covered being nearly 400 miles. A visit was paid to Plymouth during Naval Week, when H.M.S. "*Rodney*" and other vessels were inspected, and Cycle Runs totalling over 2,000 miles also were greatly enjoyed during the outdoor season. Model-building has now been resumed on an intensive scale. Recent productions have included a representation more than 4 ft. in length of the "*Duchess of Devonshire*," a steamer recently wrecked near Sidmouth, and a model of the new Cunard-White Star liner "*Queen Mary*." Club roll: 18. Secretary: D. Legg, 25, Chute St., Exeter.

Bridgwater M.C.—A very successful Exhibition was organised by members at the local Hospital Fête. There were a large number of interested visitors, the proceeds being £2-10s., although the charges for admission were very low. The money is being devoted to the extension of the Hospital. The club was closed for the holiday weeks, but activities have recommenced and members are very keen. *Secretary:* L. R. Temple, 46, Monmouth Street, Bridgwater.

Old Charlton M.C.—Outdoor meetings were continued as long as the weather remained favourable and included Cricket, Rambles and a Mystery Cycle Race. Model-building Contests have included a particularly interesting Bridge Building Competition. A special evening was devoted to Charades and Jokes, and a talk on "*Gases*" by one of the members was illustrated by means of experiments. Club roll: 24. *Secretary:* B. Stevens, 53, Mount Street, Charlton, London, S.E.7.



Members of the St. John's School (Bridgwater) M.C., interested in operations with a Meccano Steam Shovel built by their Leader, Mr. C. J. H. Sanderson, who is seen on the left. This club was affiliated with the Guild in January of this year, and is remarkable for the high standard of the working models built by members for Exhibitions and special displays.

Sutton Valence M.C.—The club's first Exhibition arranged in connection with the School Show Day, was remarkably successful, the models and other attractions greatly interesting visitors. Prizes in the Senior and Junior Sections were kindly given by the Headmaster of the school, and the entries were judged by two of the school Managers. A Hornby Train layout attracted the younger visitors and many side shows were arranged. The effort has enabled the club to pay off the expenses incurred in formation and a balance of 10/- remains. Other events have included a visit to Chatham Dockyard, where the Leader and several members spent an entire day during Navy Week, and a Holiday Model-Building Contest. A club interest Scrap Book is being formed. Club roll: 16. *Secretary:* C. G. Ledger, Little Belringham Farm, Sutton Valence, Nr. Maidstone.

Wednesbury and District M.C.—Two large models were built by members for display in the shop window of Mr. B. Smith, President of the club. Table Tennis Contests and other games have been played, and members are now busy constructing a large model workshop for their Exhibition, and in Fretwork, Model Aeroplane construction and other activities. Club roll: 10. *Secretary:* A. L. Morgan, 17, Cobden Street, Fallings Heath, Wednesbury.

AUSTRALIA

Sydney M.C.—An extensive publicity campaign has been organised in order to secure recruits and meetings are again being held regularly. A special feature has been discussions on the best mode of running the club, and the programme has been arranged in accordance with suggestions put forward by members. *Secretary:* Mr. W. J. T. Watson, 595, Parramatta Road, West Leichhardt, Sydney, Australia.

JAMAICA

Munro College M.C.—Model-building Contests and short talks by members on different methods of forming a Hornby Train layout have formed subjects at recent meetings. Messrs. Nathan and Co., Kingston, kindly presented a Cup for competition. This was won by a fine model of a Jib Crane that aroused great interest when it was displayed in the firm's show window. Members are now busy fixing shelves round the wall of the club room to carry a Hornby Train layout. Club roll: 30. *Secretary:* A. L. Brown, Munro College, Jamaica.

NEW ZEALAND

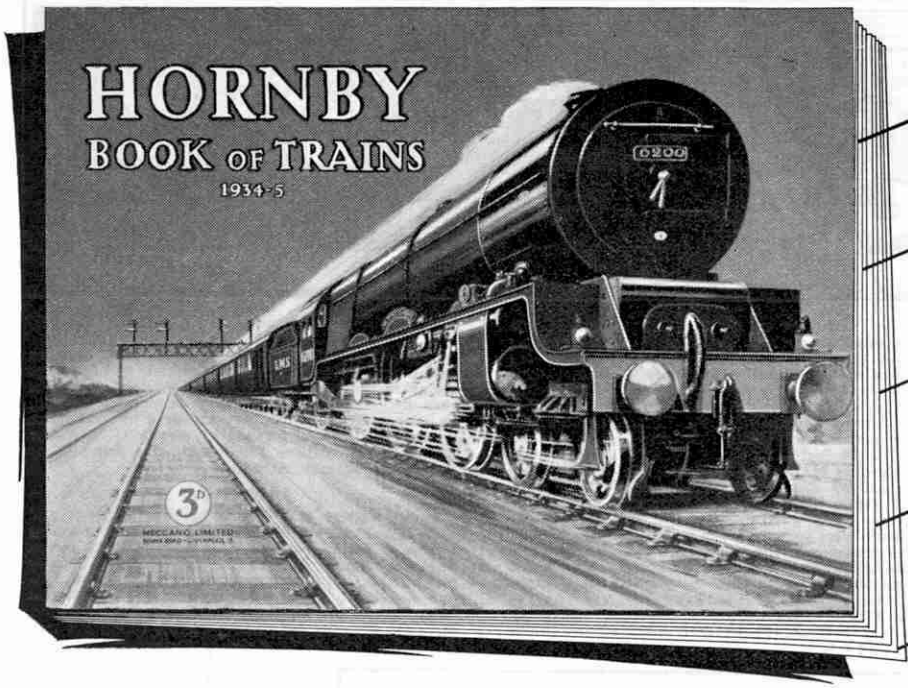
Ashburton M.C.—Keen rivalry is being shown in the construction of models for various exhibitions and in Cup Contests. A pleasing feature is the number of former members who are again taking part in club work. Considerable interest is being taken in the proposal to form a Branch of the Hornby Railway Company in association with the club, and Mr. W. Lockhard has kindly undertaken the organisation of this. Club roll: 28. *Secretary:* M. D. Templer, Bank of New South Wales, Ashburton, New Zealand.

Correspondence School (Education Department, Wellington) M.C.—Remarkable keenness is shown by the members, in spite of the fact that they are unable to meet regularly. Particularly good use is made of Model-Building Contests, photographs and drawings of entries being sent to Headquarters. The current contest is divided into two sections. In one section competitors build models of aeroplanes, motor cars, ships, bridges or any other subject they may select; and in the other, which is intended for competitors who possess small Outfits, the prize is awarded for the most ingenious model constructed with the smallest possible number of parts. An excellent entry is expected and particulars of the prize-winning models will appear in subsequent reports. *Leader:* Mr. A. G. Butchers, M.A., Correspondence School, Education Department, Wellington, New Zealand.

Wellington Boys' Institute M.C.—Members have constructed models for window displays during the school holidays, and visits have been paid to the works of Dominion Newspapers Ltd. and a Milk Depot. A framed club photograph was presented to the Leader at a special Social Evening, at which engineering stories were told and games played. Parents were invited to a display specially arranged for them at an Open Meeting. The secretary has written an attractive history of the club, and this is greatly appreciated by members. Club roll: 15. *Secretary:* E. H. Speers, 70, Cuba Street, Petone, New Zealand.

SOUTH AFRICA

Malvern M.C.—Throughout the summer meetings have been held on Monday evenings, and Saturdays have been devoted to Treasure Hunts, Football and Cycle Runs. A visit to an Exhibition of Bantu work, a Mystery Cycle Run over a difficult but interesting route of nearly 45 miles, and a Ramble to Alberton have been popular features of the recent programme. A cross country race created great excitement. The senior course was 5 miles in length, and the junior 2 miles, these events being won by J. Vivier and K. Reeves respectively. The race was followed by enjoyable talks by sectional leaders on "*Character and Body Building*," "*The Ideal Job*," "*Building a Home Museum*" and "*Delicate Machines*." Club roll: 80. *Secretary:* A. Hubbard, P.O. Box 8, Cleveland, Johannesburg, South Africa.



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The Hornby Book of Trains may be obtained from any Meccano dealer, price 3d., or direct from Meccano Ltd. (Dept. A.M.), Binns Road, Liverpool 13, price 4½d. post free. In the latter case a remittance in stamps should be sent and the name and address of the sender should be clearly written.

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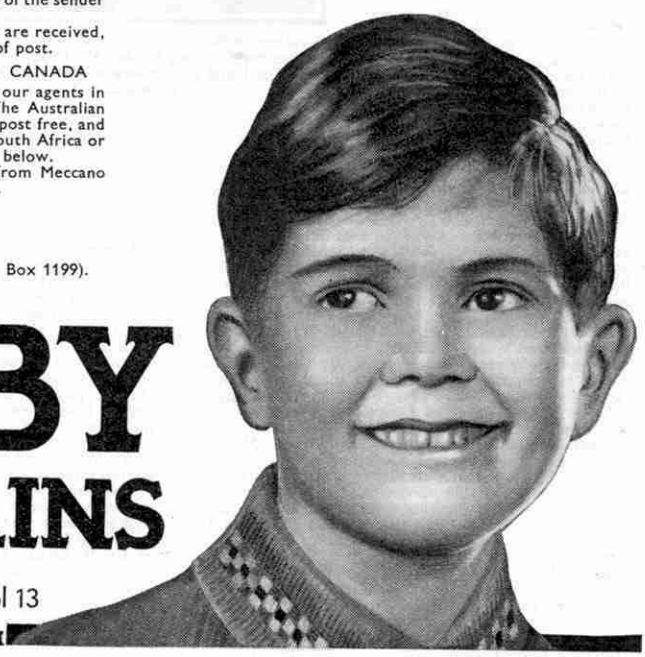

HORNBY BOOK OF TRAINS

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Branch Notes

MAIDSTONE.—An interesting feature of Branch work is the use of experimental tracks in training junior members in railway operations. Senior members look on and give advice or make suggestions for speeding up the despatch of trains. Discussions are held on topics of railway interest, members bringing interesting photographs and models for this purpose. A very instructive talk on photography was given by Mr. Corke. The practical advice he gave has enabled members to improve their railway photographic work. Secretary: W. Hills, The Orchard, Lord Romneys Hill, Maidstone.

MACCLESFIELD CENTRAL SCHOOL.—A new track of improved design has been worked out in order to provide more varied working and thus to increase the interest of track meetings. The Electrical and Aviation Sections are making good progress, and in the latter special attention is now being paid to the study of real aeroplanes. Consideration has been given to the formation of sections for aeroplane model-building, motor car model construction and other additional hobbies. Secretary: W. A. Morlidge, 4, Blagg Street, Macclesfield, Cheshire.

ELMSIDE.—Track meetings were continued during the summer, but were fewer in number owing to the many outdoor activities arranged. An interesting Debate was held on "*Are Events Foretold by the Stars.*" More new members have been secured and there is again intense traffic on the Branch track. Trains are long and heavy, double-heading often being necessary, but congested timetables are being worked with remarkable skill. Minor improvements are continually being made in order to keep the railway in good condition and to improve working methods. Secretary: D. Legg, 25, Chute Street, Exeter.

PEVERIL (MANCHESTER).—An enjoyable visit was paid to the Meccano Factory, where members were particularly interested in the working super models and the clockwork and electric train layouts displayed in the showroom. A tour of Liverpool and a trip to New Brighton followed this visit. The club room was rearranged and decorated for the opening of the winter sessions and the first task was to fit up the track on trestle tables. Tests of the pulling powers and speeds of the Branch locomotives were then undertaken in preparation for timetable working. Secretary: R. A. Owens, 18, Amherst Road, Fallowfield, Manchester, 14.

HOLYWELL (OXFORD).—Services were run on a particularly attractive garden railway, in which good use was made of natural surroundings to provide tunnels and viaducts. The track has now been transferred to the club room, and excellent train services are being run on it, special care being taken to give every member opportunities of carrying out responsible work. Secretary: J. Spicer, 28, Holywell, Oxford.

PRIORY (HIGH WYCOMBE).—The track is now double throughout except where it passes through a cupboard that has been converted into a splendid tunnel. Ample platform tracks and goods sidings are provided at the King's Cross and York termini, and an interesting feature is a variation in gradients that resembles that encountered on real railways. Good level stretches allow for high speeds at certain points and at others locomotives are called upon for hard work. Heavy trains are run on the three alternative routes provided by the extended track, and the terminal stations have been improved by covering them in and providing the usual station buildings. Secretary: J. T. Cosgrove, 54, Priory Road, High Wycombe, Bucks.

ST. GILES CATHEDRAL (EDINBURGH).—Incorporation has now been secured and members have shown great activity in erecting trestles and laying the Branch track. Senior and Junior Sections have been formed, and in each railway teams have been organised. Table Tennis, Netball and Billiards are other attractions. The Edinburgh and Leith Flint Glass Works have been visited and other attractive excursions are being planned. Secretary: H. W. Govan, 25, South Orchard Road, Edinburgh, 4.

NEW SOUTHGATE.—Meetings are being held twice weekly, and members have been greatly encouraged by incorporation. Improvements are continually being made to the layout, which is lighted throughout, and both speed testing of engines and running to timetable have been practised. A special meeting was set apart for new members, who devised timetables for track operation. Visits have been paid to the model railway of Mr. Beach, East Finchley, and to the L.N.E.R. Locomotive Sheds at King's Cross, where the vacuum-operated turntable and the coaling plant were inspected. Secretary: A. R. Wardle, 25, Limes Avenue, New Southgate, London, N.11.

A group of members of the Peveril (Manchester) Branch, No. 255. Chairman, Mr. A. Owens; Secretary, R. A. Owens. This Branch was incorporated in November, 1933, and has since pursued a practical programme of Hornby Railway operations in which every member has taken a responsible part.

AUSTRALIA

PARRAMATTA.—Several new members have been secured and all have been busy completing the Branch track. Special attention has been paid to the quality of the track and derailments due to track trouble are unknown. The finer points of railway working are now receiving attention. As the track is single, a staff system of operation is in use. This is the invention of the secretary and works perfectly. All points and signals are to be interlocked and the positions of trains on the layout will be shown by means of electric lamps. Secretary: H. H. Matthews, 27, Ross Street, Parramatta.

Branches in Course of Formation

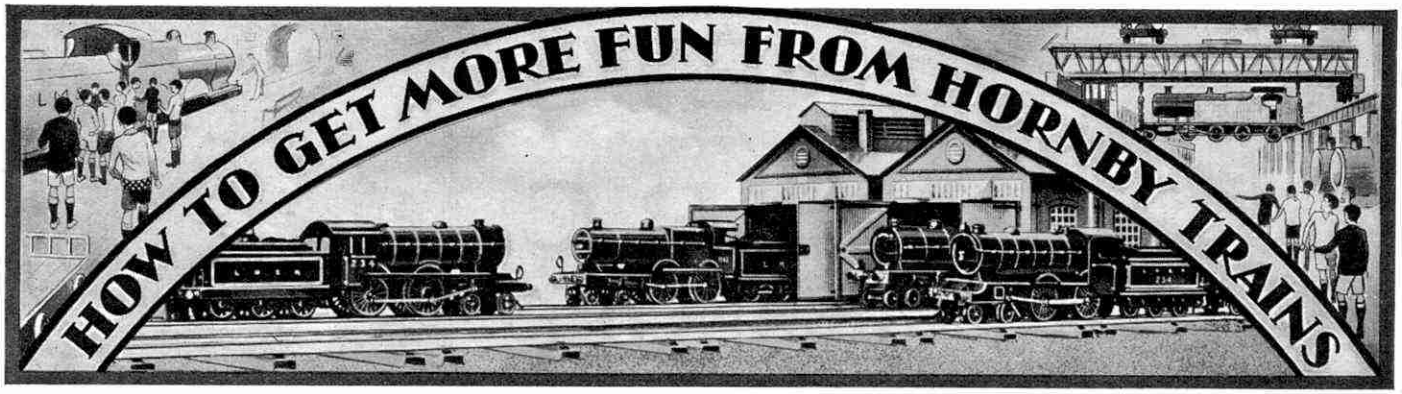
The following new Branches of the Hornby Railway Company are at present in process of formation and any boys who are interested and desirous of linking up with this unique organisation should communicate with the promoters, whose names and addresses are given here. All owners of Hornby Trains or accessories are eligible for membership and the various secretaries will be pleased to welcome all who apply.

BURY ST. EDMUND'S—D. Abel, 13, Crown Street, Bury St. Edmund's.

EAST GRINSTEAD—R. J. Symonds, Imberdene, High Grove, East Grinstead.

LANCING—J. B. Bishop, Warwick, Brighton Road, Lancing.

LONDON, N.12—D. Wicks, 39, Petworth Road, Friern Barnet, London, N.12.



LXXII.—THE INSTALLATION OF A MINIATURE RAILWAY

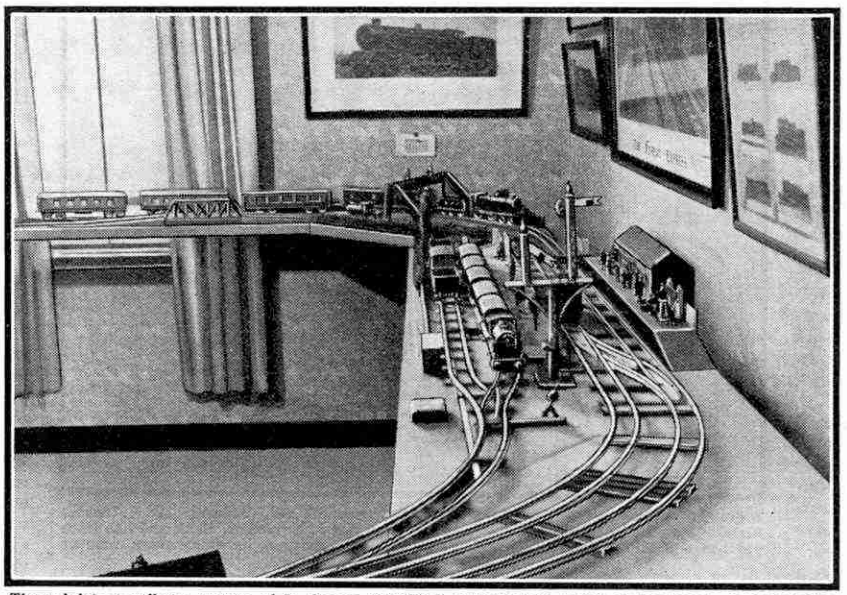
ON many occasions in these pages we have described layouts of various kinds and have dealt with suggestions for the operations that could be carried out. Some of these schemes have been developed with the idea of reproducing the services of some particular section or group, and others have dealt with more general operations without reference to any actual prototypes.

No less important than the layout itself, or the train services to be run, is the accommodation of the miniature railway and the various circumstances that will affect to a greater or less extent the character of the line. The actual installation of a miniature railway is therefore a subject that can be considered with advantage, particularly at this time when so many readers are on the point of starting a miniature system or are considering the development of one already existing.

The arrangement that gives the widest scope for the planning and laying out of a realistic system is one in which the miniature railway manager is able to secure the use of a separate room for the accommodation of his system. In that case, as a rule, space restrictions will not apply very seriously, and a railwaylike atmosphere can be imparted to the system generally and its surroundings. It is usually possible to have the line on a raised baseboard. This enables the trains to be handled far more conveniently than when they are on the floor, and enables them to be watched and appreciated better than when a more or less aerial view of them is afforded.

The method of arranging a raised base for the line varies. It is better to plan the actual layout with due regard to the shape of the room, the space available, and the services to be worked, and to make the baseboard to suit, than to erect the structure first and then find that it limits the scope of the track layout. At the same time the possibility of future extensions, which may require alterations to the baseboard, should not be overlooked.

The exact methods of construction will depend on circumstances. It may be possible to arrange for supporting brackets to be fixed to the walls of the room. This scheme is quite satisfactory if the baseboard itself is not too elaborate and heavy, and it certainly allows the floor space to be kept clear, which is a matter of importance where any boxes or other gear are to be stowed away under the railway, and for cleaning operations. A baseboard fixed in this way appears in the photograph on this page, and the neat effect of the installation is apparent.



The miniature railway system of P. James, Mansfield, arranged on a raised baseboard. An interesting railway atmosphere is created by the display on the walls of the room of various locomotive and train illustrations, a scheme that may be adopted with advantage by Hornby railway owners.

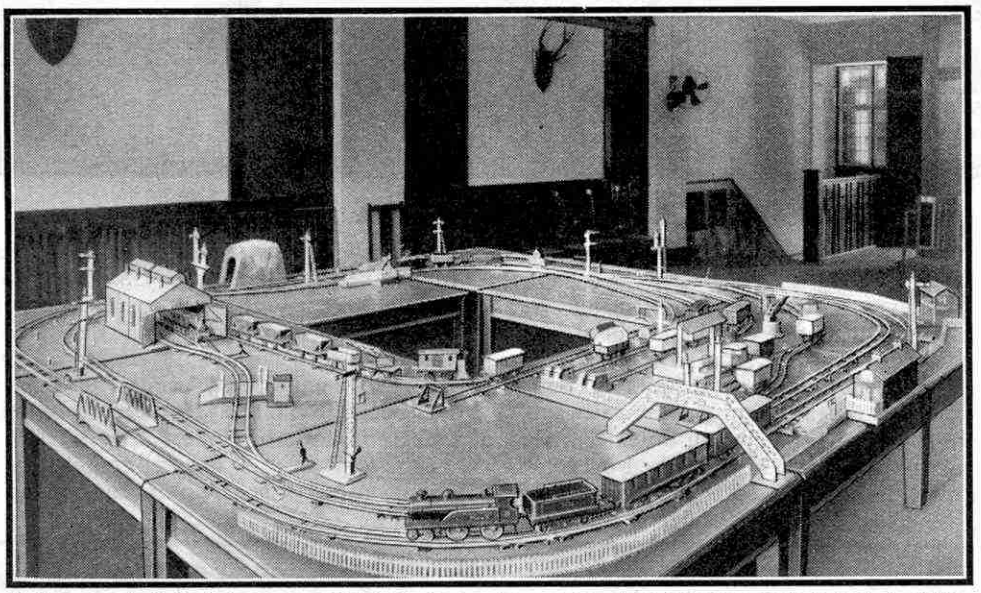
Where wall brackets cannot be arranged, it is necessary to provide vertical supports from the floor, and a favourite scheme is to make use of several trestle-type supports. This form of construction is simple, for the actual baseboard itself will be laid on top of the trestles. When no longer required, or in the event of removal, the whole of the equipment is easily dismantled.

A room set aside in this way for the accommodation of a miniature railway can be made extremely attractive, and the layout itself will be much more realistic if scenic details can be provided. The railway character of the room may be enhanced by the display of photographs or coloured plates of locomotives and trains. A diagram showing the locomotive headlamp code might be included, and would be useful to train operators and visitors alike. Working timetable arrangements and general instructions for operation, drawn up in the form of "Rules and Regulations," as suggested last month, might also be displayed. Numerous other suggestions no doubt will occur to keen enthusiasts to render the whole installation more interesting and attractive.

The upper photograph on the next page shows in an interesting manner how several tables have been brought into use to form a baseboard for a miniature railway system. This is, in a sense, a development of the familiar

method of using the dining room table when it is not required for other purposes—a stage that most miniature railways pass through in the course of their development. With the support for the model railway system thus "ready made" as it were, the model railway engineer does not have to bother about the level or the solidity of the structure, as these will be invariably satisfactory.

A point to be watched where a line is carried on a table, or indeed on any raised structure, is the provision of suitable protection to prevent a train from falling on to the floor in the event of a derailment. On the outside, more particularly of curves that are carried close to the edge of the table or baseboard, Hornby Paled Fencing may be placed and in addition to the protection thus afforded, it is most effective in appearance.



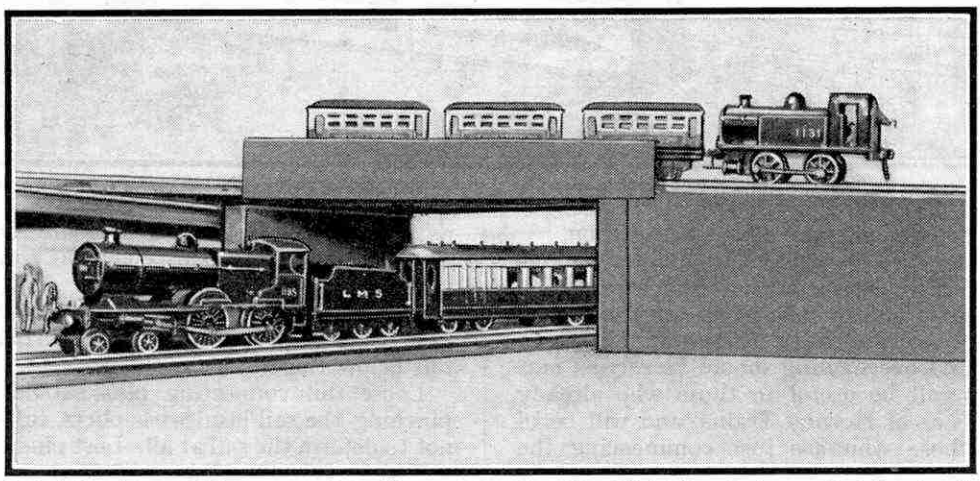
Tables are used effectively to accommodate this Hornby layout arranged by Mr. J. S. Cardosa, Kuala Lumpur. A point to notice is that a central space has been left to allow of the control of the system from the inside as well as the outside.

Where a raised baseboard, or even the use of an ordinary table, is not possible, the miniature railway engineer will have to fall back on the simplest method—that of laying his railway on the floor. This position for the line has some advantages and at the same time various definite drawbacks. Taking first the temporary layout arranged on the floor of a living room, it will probably be necessary to exercise some ingenuity in order to avoid certain difficulties. The surface of the floor itself may be satisfactory enough, but the presence of rugs or mats at different places may cause complications and upset the level of the track. If possible the model railway owner should negotiate with the domestic authorities for their temporary removal; but if unsuccessful he must plan his line to avoid such features.

Where the floor is covered all over with carpet or linoleum, no difficulty may be anticipated; but on a carpeted floor it is necessary to watch that excessive lubrication does not cause oily spots to appear, and that the use of coal or other dusty substances for wagon loads is avoided. The locomotive mechanism, and the wheels and axles of rolling stock, must be frequently examined in case any hairs from the carpet have been caught up and worked into the moving parts. They are extremely difficult to remove from remote portions of a clockwork mechanism.

Furniture is apt to be a problem, and such items as pianos or bookcases that cannot be moved must be avoided. In any case it is a good point to reduce the amount of moving to be done to a minimum, as, for one thing, it all takes time and so reduces the period available for train running. As a rule, however, it is possible to lay the main line on the floor round the outside of the table. Where it is necessary for the track to pass under such things as sideboards, which cannot be moved, imagination comes into play and transforms these into tunnels of more or less length. Suitable tunnel mouths can easily be arranged to strengthen the illusion.

Scenic effects are usually held to be impossible with temporary layouts, but the Hornby Countryside Sections provide for the first time ready-made surroundings suitable for the miniature railway that can be laid down and later removed even more easily than the rails themselves. For permanent layouts also they can be used very effectively, and they improve the appearance of the bare track to a surprising extent.

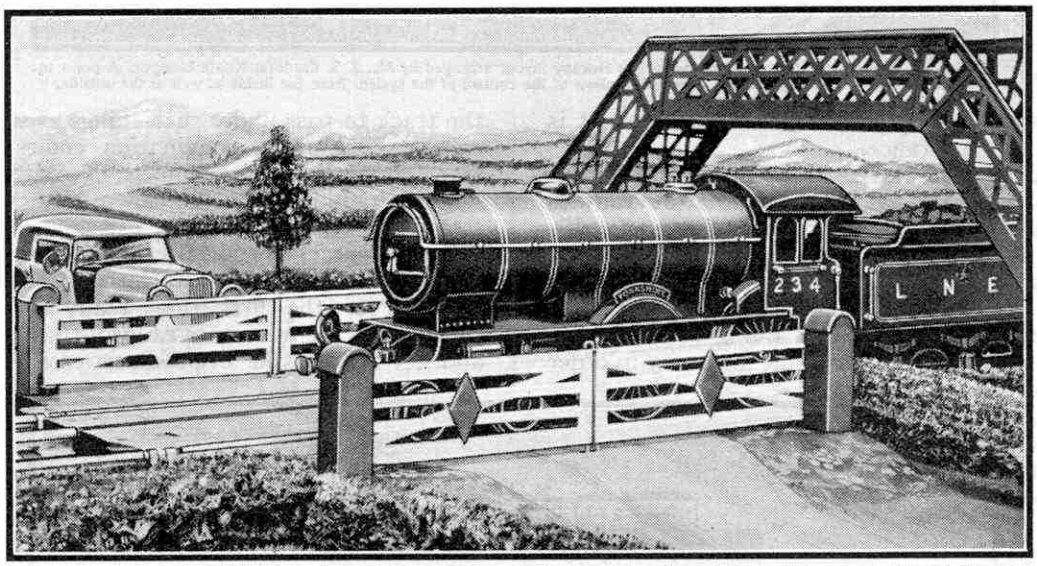


Part of the miniature L.M.S.R. system of J. W. Hague, of Ripon, Yorkshire. This is laid on the floor, and includes a branch line that ascends and crosses the main line by means of the bridge shown in the photograph.

In respect to the scenic effects and certain other features possible, the layout on the floor has distinct advantages where a spare room is set aside permanently for the railway. There is then no anxiety with regard to the space available for lineside fields and other details. The lower illustration on this page shows to some extent the possibilities of a layout on the floor. Here a branch line turns off the main track and, climbing a gradual embankment, crosses over it to reach a high-level branch terminus.

PREPARING FOR HEAVY TRAFFIC

WHILE most miniature railway owners operate their trains more or less all the year round, it is certain that more attention is given to model railways during the winter months. In the summer, fine weather and outdoor attractions cause the running of trains to assume, for the time being, second place in the interests of their owners. In the case of portable miniature railways, therefore, that have to be put away when finished with, the various components may have been packed up some time when they are suddenly required to be prepared to take part in another model railway "season." Before the usually intensive traffic of the winter can be dealt with, however, it is invariably necessary to pay some attention to the condition of the equipment so that each item may do its part in the work of the system and so ensure its satisfactory and efficient operation.



In preparing for the winter period of train running, accessories as well as the trains themselves should be examined to see that they are in proper order. Level Crossings, such as that shown in this illustration, may require a little attention to the gates.

It is a good plan to examine the different items thoroughly in order to determine how much attention or repair is necessary; and in this article we propose to give a few suggestions in regard to the best way in which this examination and overhauling should be carried out. These suggestions will be useful to those who already have some experience of Hornby Trains, and will be of interest also to those who are just commencing the hobby. There are many little points that can only be found by experience, and their discovery is made all the easier with the aid of a little practical advice.

The foundation of any railway is its track, and unless this is in sound condition the running of trains will never be smooth, and there may be constant danger of derailment. This applies as much to a gauge O track laid with Hornby Rails as to a full-size line, so before use the various rails, points and crossings should be carefully examined for any faults. Bent rails should be looked for, and if the damage in this respect is not serious, the rails will be fit for further use after the necessary straightening has been carried out. Bends along the length of the rail are usually only slight, and may be corrected with the fingers or by using a piece of wood to push the rail back into place. No hammering should be done, as this is certain to distort the rail.

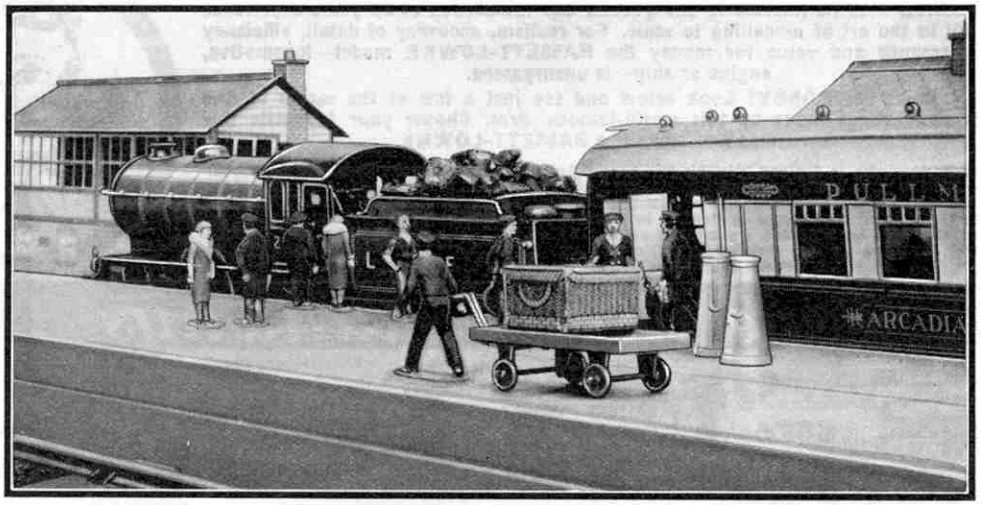
The ends of rails are apt to get bent or pushed out of shape, either from continual connecting and disconnecting of the track, or as a result of careless handling. Pliers may be necessary to correct the damage, but they must be used with judgment. Usually it is the hollow rail head that suffers, and in this case it is useful to insert a spare rail connecting pin half in and half out of the rail, as usually fitted. There are usually some loose pins of this kind among the miscellaneous equipment belonging to any miniature railway. The pin thus inserted will assist in keeping the rail head true while the pliers are used to straighten the web or vertical portion of the rail below the head.

Loose rail connecting pins should be tightened by pinching the rail head with pliers, taking care, however, not to deform the rail at all. Lost pins should be replaced, and new ones may be obtained at one penny per dozen. It is advisable also to check the gauge of the track by means of the rail gauge formed by the handle of the Hornby Locomotive winding key, or by means of the combined Rail Gauge, Screwdriver and Spanner. If the gauge portion of either of these is slid along between the rails, any tight places will be immediately revealed. The rails should be eased apart gently at such spots. Special care should be taken to detect any place where

the gauge is tight on curves, as any tightness there will have the effect of increasing considerably the resistance to the trains passing round the curves. It may even result in derailments owing to the wheels being squeezed up out of the track.

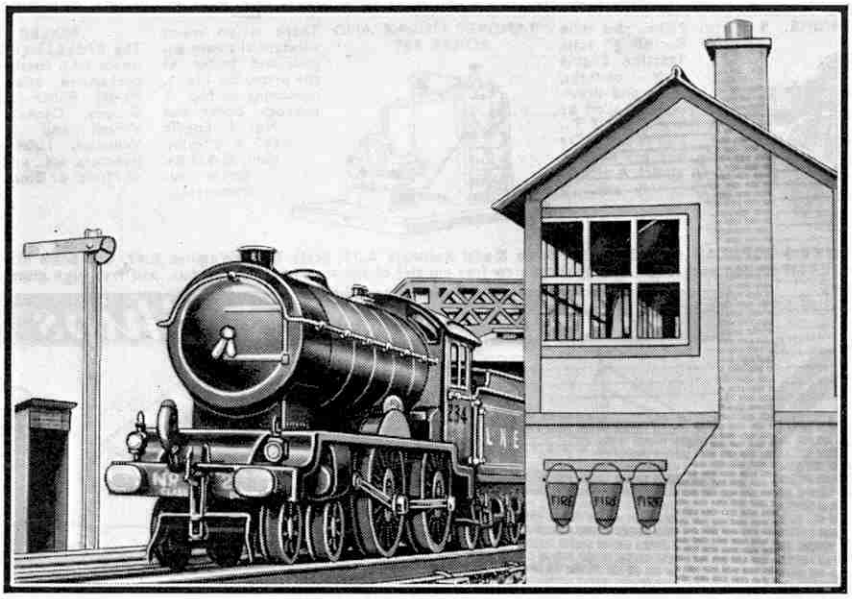
Connecting plates should be applied between the sleepers at rail joints wherever possible. They are essential in order to prevent the joints from parting, and in addition to those supplied with Train Sets and boxes of rails, they may be obtained separately at 4d. a dozen.

Occasionally it is found that rails, especially curves in new condition, when joined up by the connecting plates have a springiness that results in the sleepers not settling down quite flat. To remedy this state of affairs, each rail should be twisted over with the hands towards the centre of the circle or oval. This twisting must be done gently, a little at a time, with each rail in turn, until finally they are persuaded to settle down properly. After this operation has been performed it will be well to check the gauge of the rails again.



Miniature figures and luggage are essential to the realism of a Hornby Railway system. Their paint may require touching up in the course of the overhaul of equipment suggested in this article.

In the examination of track components, points and crossings should not be neglected. The latter can hardly get out of order to any greater extent than ordinary rails, and the same remedies therefore may be applied. The moving parts of points, however, especially the switch blades, should be examined, as they may require a little bending one way or the other to ensure that they line up at each end with the fixed rails. Even if points are inclined to be stiff it is not advisable to oil their moving parts, as it may cause them to become excessively loose. Friction here is an advantage in keeping the switch rails set correctly.



Signal Cabins, as shown here, and other buildings should not be neglected. The business-like appearance of the layout will be quite spoiled if these are shabby or damaged, so they should be carefully treated.

When the track is in order the locomotives and rolling stock should be taken in hand. As a rule after a period of storage the running of both engines and stock is apt to be somewhat sluggish. The oil used for lubrication probably will have become thick, and a certain amount of dust will have settled on the oily surfaces. To obtain free running, therefore, it is necessary to remove the old oil and the dust. Paraffin is useful for this purpose, but petrol is better still, as it evaporates quickly and leaves a clean, dry surface. In the case of locomotive mechanisms it is better that these should be removed from the housings of their locomotives. This allows the mechanism to be given a thorough washing with paraffin or petrol, whereas if it is left in the housing an oil can containing the liquid will have to be employed to reach the various remote parts. It is advisable to carry out operations involving the use of paraffin or petrol out of doors.

When the mechanism is clean and dry, its moving parts should be lightly oiled with Meccano Oil, which is of just the right consistency for the moving parts of clockwork mechanisms. It is a good scheme also to apply Meccano Graphite Grease to the spring of the mechanism. In order to do this effectively it will probably be necessary to use a small paint brush to apply the grease. On no account should a thick oil be used for the mechanisms of Hornby Clockwork Locomotives. Such oils, instead of assisting the running of a mechanism, may actually have a retarding effect owing to their heavy nature.

A point to be watched when carrying out these operations is that all wheel treads should be cleaned of the dirt that becomes rolled into them after a period of running. This is frequently due to over-oiling of the locomotives or rolling stock, with the result that the oil finds its way on to the wheels and on to the track. Dust then adheres with the result that in time a peculiar form of "mud" is found on the wheels. To obtain smooth and easy running therefore the wheel treads must be wiped perfectly clean with a rag soaked in a small quantity of petrol.

In the case of tenders and rolling stock generally where the wheels are inside the frames, it is a good plan to remove the wheels entirely for cleaning (Continued on page 901)

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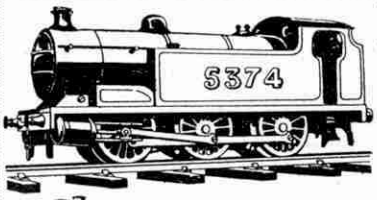

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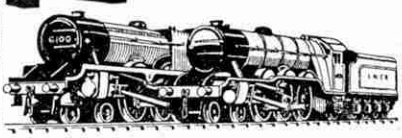

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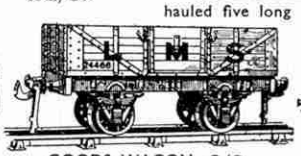

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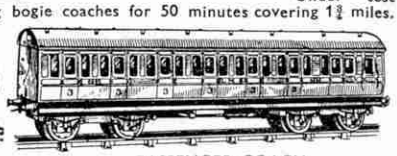

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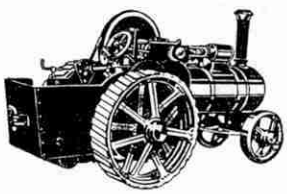

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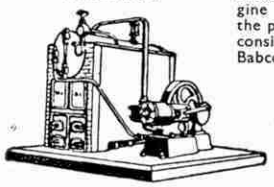

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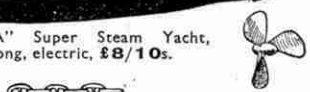

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H.R.C. COMPETITION PAGE

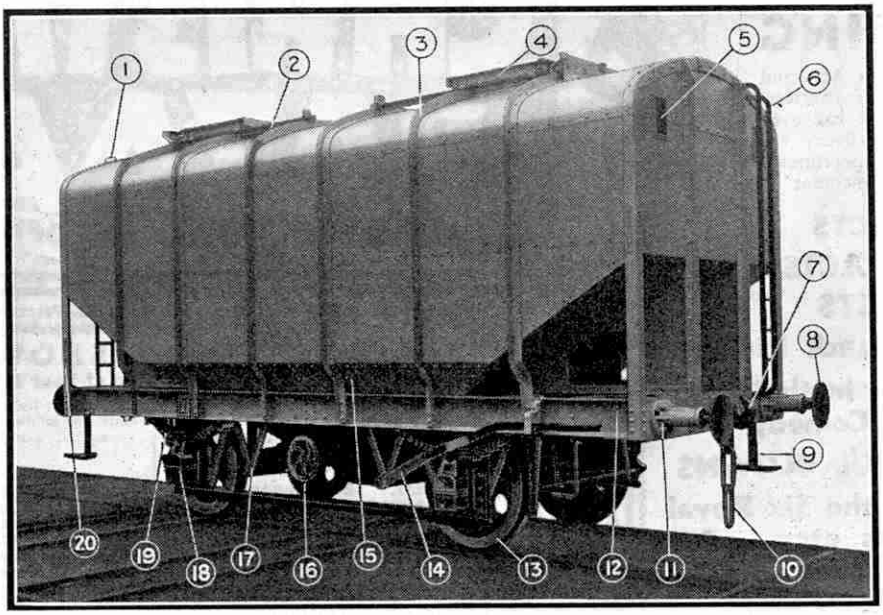
Join the Hornby Railway Company and become eligible for the competitions announced on this page.

Join the Hornby Railway Company and become eligible for the competitions announced on this page.

ROLLING STOCK CONTEST No. 3

Railway wagons and vans play a very important part in the operation of a railway, but their work is not usually regarded as being of an interesting character, and is often overlooked even by the railway enthusiast. Goods vehicles are built for a multitude of duties, and each different type therefore has a special interest of its own. In addition to the ordinary open and covered wagons there is an extraordinary variety of types, for minerals, livestock, foodstuffs, and engineering products all require vehicles specially suited to their carriage. Mineral wagons are invariably arranged for rapid unloading, and livestock traffic may require horse boxes, cattle or sheep trucks. Refrigerator, ventilated or steam-heated vans may be necessary for foodstuffs according to their nature. Engineering products range from bulky girders and so on to the more compact and more delicate motor car. It is of interest to compare the characteristics of various wagons, and to note how their general design and details are governed by their particular purposes.

We know that members of the H.R.C. are extremely keen on noticing points of this kind, and in order to give them an opportunity of exercising their skill and knowledge in such matters we present on this page *"Rolling Stock Contest No. 3."* The accompanying photograph shows a goods vehicle from which all lettering has been removed. Competitors are required to name the railway company to which the wagon belongs; to state the purpose for which such a wagon is usually employed, and to name each of the parts indicated by a number and describe briefly the function of each part. Some of the parts are common to goods stock as a class, others are peculiar to the type of vehicle illustrated.



To the senders of the four best entries received in each Section, Home and Overseas, Hornby Train goods (or Meccano products if preferred) to the value of 21/–, 15/–, 10/6 and 5/– respectively will be awarded. In the case of a tie, neatness will be the deciding factor.

Envelopes containing entries must be marked *"H.R.C. November Rolling Stock Contest No. 3,"* and posted to reach Headquarters at Meccano Ltd., Binns Road, Liverpool 13, on or before 30th November. The closing date for the Overseas Section is 28th February, 1935.

"QUESTIONS CONTEST No. 6"

This month we announce the sixth Contest in this popular series. There are 15 questions, and competitors are required to answer as many of them as they can. The answers should be given in as few words as possible. Competitors who find themselves unable to answer all the questions should nevertheless send in their entries.

(1) Why are carriage wheels tapped at the end of each journey and at intermediate stops on a long journey? (2) What is meant by automatic brake? (3) What is a motor train? (4) What is the function of a fixed distant signal? (5) What is the advantage of articulated coaches? (6) What is a wheel drop? (7) Which British railway group has no three-cylinder locomotives? (8) What railway station in Great Britain has no track and no trains, but from which railway journeys can be made? (9) Which was the last great trunk line to build a terminus in London? (10) On which sections of electric railways in this country are overhead collectors employed? (11) Which British train makes the longest non-stop journey all the year round? (12) At which station may the locomotives of all four groups be observed? (13) What locomotive wheel arrangements are referred to by the terms "Atlantic," "Mogul," "Mountain," "Decapod" and "Consolidation"? (14) Where are the highest water troughs in the world?

When answering these questions it is not necessary to go into any great detail, and provided the conditions are satisfied the shorter these are the better. The Contest will be divided into two Sections—Home and Overseas—and to the senders of the four best sets of entries received in each Section will be awarded Hornby Railway material (or Meccano products if preferred) to the value of 21/–, 15/–, 10/6 and 5/– respectively. In the event of more than one competitor sending an all correct set of answers, the awards will be made to the competitors whose entries are submitted in the neatest or most novel manner.

Envelopes must be marked *"H.R.C. November Questions Contest No. 6"* and posted to reach Headquarters at Meccano Ltd., Binns Road, Liverpool 13, on or before 30th November. Overseas closing date, 28th February.

COMPETITION RESULTS

HOME

August "Locomotive Mixture Contest."—First: R. O. Lyon (39292), Cardiff. Second: A. G. Rudd (26116), Bramhall. Third: C. E. Wrayford (6039), Moretonhampstead. Fourth: J. C. Button (10335), Crewe.

August "Railway Photographic Contest."—First: S. Garbutt (30122), Altrincham. Second: R. W. Newby (39528), London, S.W.15. Third: D. Fear (18477), Taunton. Fourth: W. F. Lever (24206), Cardiff.

August "Drawing Contest."—First: W. Dean (35099), Glasgow, S.W.1. Second: M. Vincent (8610), Pennfields, Wolverhampton. Third: H. Maasch (23994), Hove, Sussex. Fourth: I. Henderson (35356), Blyth.

OVERSEAS

May "Picture Puzzle Contest."—First and Second (Tie): W. S. Eagle (31779), Byculla, Bombay, India, and I. Brough (9112), Victoria, Australia. Third and Fourth (Tie): J. A. Rodriguez (3647), Montreal, and M. L. Morgan (22858), Cremorne, Australia.

May "Railway Photographic Contest."—First: J. McIntyre (31781), Winnipeg, Canada. Second: R. A. Wragg (7913), India. Third: A. A. Boult, Auckland. Fourth: F. D. Aria (12362), Bombay, India.

May "Drawing Contest."—First: M. Conly (24290). Maori Hill, Dunedin, New Zealand. Second: E. C. Heath (29104), West Pennant Hills, Australia. Third: W. Figgins (17726), Timaru, New Zealand.

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Saturdays, November 24th and December 1st, at 11 and 12 o'clock.
Price of admission during the above, 7d. including tax.

Monday, Dec. 3rd to Friday, Dec. 21st
Monday to Friday, at 12, 1, 2, 3, 4, 5 and 6 o'clock.
Saturday, December 8th and 15th, at 10.30, 11.30 and 12.30.
Saturday, December 22nd and Monday, December 24th, at 11, 12, 1, 2, 3, 4 and 5 o'clock.
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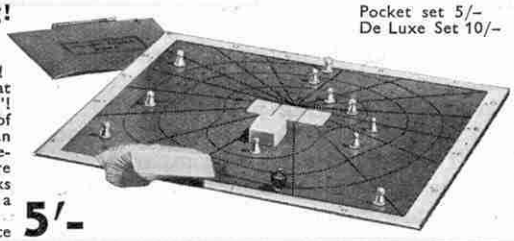

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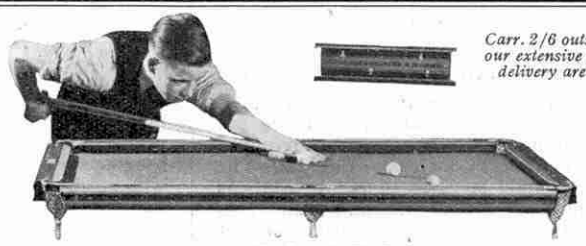

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Size of table	Length of Cue	Diam. of Ball	
3 ft.	3 ft.	1¼ in.	**19/6**
3 ft. 6 in.	3 ft.	1½ in.	23/6
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GAMAGES, HOLBORN, LONDON, E.C.1 *Telephone: Holborn 8484*

HOW HE KNEW!

"Do you think we shall have rain to-day?"

"Sure to, I'm wearing a new suit, my wife's got a new costume and hat on, and the car has just been washed down and polished."

* * * *

Optimist: "Cheer up, old chap. Every cloud has a silver lining."

Pessimist: "Maybe; but everybody hasn't got an aeroplane to go up and see it."

* * * *

"Those sweets in the window make my mouth water."

"Is that so? Here's a blotter, then."

* * * *

The small meek-looking man was seated in the tram-car and a strong-jawed woman came and stood in the gangway near him. He made a movement to get up, but the woman pushed him back into his seat. "Never mind, young fellow," she said, "I don't mind standing."

Two stops further on he tried to get up again, but the woman once more pushed him back. The same thing occurred two stops further.

"Excuse me, madam," said the meek man, desperately, at last. "Will you please let me get off at this stop. I have already gone about half-a-mile too far."

* * * *

Visitor to Barracks: "Look here, young man, are you trying to tell me that all the generals are in the private offices and that all the privates are in the general offices?"

* * * *

First Barber: "Why are you so late?"

Second Barber: "I was shaving myself and couldn't get away because I talked myself into a haircut and shampoo."

* * * *

"Why have you got two knots in your handkerchief?"

"My wife wants me to bring her some things from town, so I tied this knot in case I should forget!"

"Well, what's the other knot for?"

"The other one I tied in case I should forget what the first one was tied for!"

* * * *

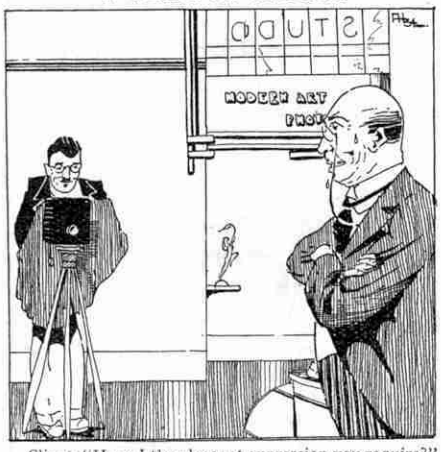
"Suppose a man married his first wife's step-sister's aunt, what relation is he to her?"

"First wife—step-aunt—er—let me see—oh! I don't know."

"Her husband, of course."

* * * *

A PAINFUL ORDEAL



Client: "Have I the pleasant expression you require?"

Photographer: "Yes, sir. Absolutely."

Client: "Then shoot quickly; it hurts my face."

* * * *

"Everybody tells me that I sing with a great deal of feeling," said Miss Smith.

"You'd show far more feeling if you didn't sing," said her candid young brother.

GROUNDS FOR COMPLAINT

Hotel Visitor (at breakfast): "Waiter, this coffee tastes remarkably funny."

Waiter: "Well, sir, it was ground only half-an-hour ago."

Visitor: "Oh, I see. And now it is mud!"

* * * *

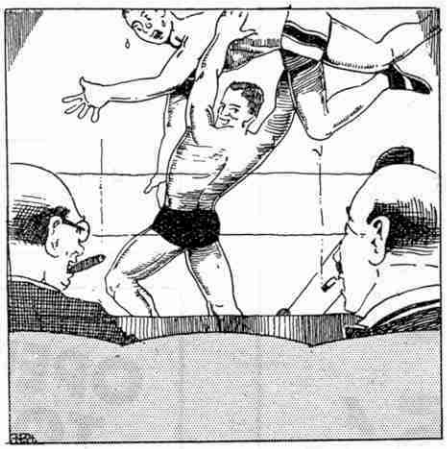
"I don't care," said the little girl who had not been invited to the party. "I'll be even with them."

"Why, what will you do"? asked her mother.

"When I grow up I'll give a great big party, and I won't invite anyone!"

* * * *

THOUGHTFUL OF HIM!



All-in Wrestler: "Excuse me, gentlemen, but is that seat between you reserved?"

* * * *

A man entered a chemist's shop hurriedly and asked for a dozen aspirin tablets.

"Do you want them put in a box, sir?" asked the assistant, as he was counting them out.

"Oh, no, certainly not," replied the customer—"I'm going to roll them home."

* * * *

Little Betty was climbing slowly upstairs, holding in one hand a plate with a piece of cake on it, for an invalid. Her father, down below, seeing the plate tilt dangerously, called out, "Keep your eye on the cake, Betty."

"My eye's no good," came the reply, "I'm keeping my thumb on it."

* * * *

The Cadger: "I ain't never 'ad a chance. No matter where I go or wot I does my unlucky number bobs up and does me in somehow."

Householder: "What's your unlucky number?"

The Cadger: "Thirteen, lady—twelve jurymen an' a judge."

* * * *

Producer: "So you think you can stand the arduous treatment of a slap-stick comedian? In our next picture you would be thrown down a thirty-foot embankment into a barrel of garbage."

Hopeful Applicant: "I think I can stand it. I was scrum half in my school Rugby team."

* * * *

"I can tell the age of a chicken by the teeth."

"But they haven't any teeth."

"No, but I have."

* * * *

The bore had outstayed his welcome and at the end of a fortnight his host thought of a sure way of getting rid of him.

"Don't you think your wife and family must be getting tired of being separated from you?" he asked the unwanted visitor.

"It never occurred to me," replied the latter; "but now you put it so nicely, I'll wire for them to come down and join us."

A TALL STORY

Teacher (to class): "What is the highest form of animal life?"

Brilliant Pupil: "The giraffe, sir."

* * * *

The Prodigy's Mother: "Of course, I know she makes little mistakes sometimes; but, you see, she plays entirely by ear."

The Prodigy's Uncle: "Unfortunately, that's the way I listen."

* * * *

"Now what's the matter?"

"I've swallowed my collar-stud!"

"Well, for once you know where it is."

* * * *

"That man would make you work till you were black in the face."

"After that, I suppose, he'd make you work like a nigger."

* * * *

Shop Detective: "I'm suspicious of that woman; she seems furtive."

Shopwalker: "Well, keep your eye on the furs."

* * * *

"Does your husband work?"

"Oh, yes. He sells toy balloons when there is a parade in town. What does your husband do?"

"My husband sells smoked glasses when there's an eclipse of the sun."

* * * *

"Why are you always running these days?"

"I'm trying to catch up with my studies!"

* * * *

The small boy who had been taken to London for a treat was very interested in an old engine at one of the stations. When he wanted to know why it was not running on railway lines, he was told that it was just a curiosity.

On returning home, the boy recounted his adventures in glowing terms. "And now I know," he said, "what killed the poor cat."

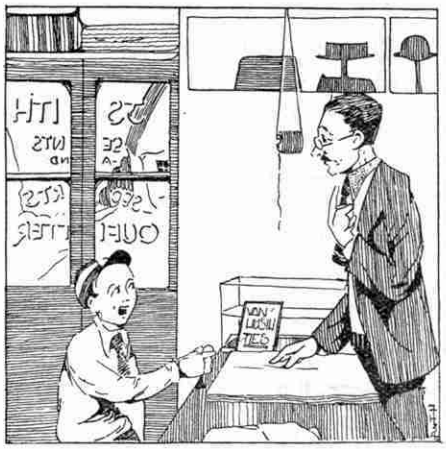
* * * *

Mrs. Brown was sewing a button on her husband's coat.

"It's a disgrace the way your tailor sews on buttons," she said to him. "Why, it's the third time I've sewn on this very button myself."

* * * *

CANDID!



Small boy: "I want a collar for my father."

Assistant: "One like mine."

Small Boy: "No, a clean one."

* * * *

"I say, old man, can you suggest anything for my complaint? I haven't closed my eyes for three nights."

"Go in for boxing. The first time I tried it my eyes were closed for a week."

WHAT IS STAMP COLLECTING?

IT would be an interesting experiment to take aside a dozen keen young stamp collectors and ask each of them the simple question: "What is stamp collecting?" It is probable that no two answers would be identical, and certainly none would suggest the mere hoarding of a quantity of pieces of coloured paper that is the non-collector's idea of the hobby. The "uninitiated" are not to be blamed for their lack of understanding. Very many of those who are said to be collecting stamps are concerned only with gathering stamps together, and having stuck them in their albums they promptly forget all about them.

This stamp symbolises the development of mail carrying in Canada. The dog team, the despatch rider, mail train, lake steamer and air mail machine, are all shown.

There is far more in stamp collecting than that. It has been called the "hobby of kings and the king of hobbies," and it is with the object of leading the "hoarders" towards the greater fun to be obtained from real stamp collecting that in this article we set out to show a few of the fascinating possibilities of the hobby.

The stamp, in its essence, is a symbol indicating that the appropriate fee has been paid for the use of the world's postal service; and philately, as stamp collecting is sometimes known, involves the study of postal services and the methods of stamp production, in addition to the simple collection and classification of stamps and study of their designs. There is an amazing amount of interest in such study, but since the young collector is more concerned with the story told by the stamp than with the study of postal services, his interest is focused on the design of his stamps. No matter where his other interests may lie, he can find some interesting means of linking them up with his stamps.

A splendid view of modern liners is shown in this view of the harbour at Antwerp.

The boy who is interested in sports and athletic pastimes, for example, will find sufficient stamps with sporting designs to keep him busily occupied throughout a long winter. The Olympic Games—the Mecca of every amateur athlete—have inspired as many stamp issues as the periodical conferences of the Universal Postal Union itself. The designs in this group tell the whole story of the early Grecian Games, the forerunners of the modern Olympiads; and provide also views of modern international sports and of peculiarly national games.

A centrepiece for an historical series. The portrait is of Columbus, discoverer of the American continent, and on the left is a view of his tiny vessel the "Santa Maria."

A sporting stamp. The view is of the parade of competitors prior to the commencement of an Olympic Games programme.

The field of engineering is covered with almost unbelievable intensity. Whether his interest lies in railways, bridge-building, electricity, radio, aviation, shipping, dock and harbour construction, or simply the field of invention, the young engineering enthusiast will find a host of stamps bearing designs that will help him to illustrate a written record of his special engineering interest.

Aviation, by reason of the enormous development of air mail services, is the best served of engineering interests. The birth and development of airships and balloons and heavier-than-air machines can be traced readily in the stamp story, and then the collector may pass to the development of internal air services, country by country. The types of aircraft in use in different countries may be shown, and in many cases the difficulties attending the operation of certain air services revealed. The air-minded boy has indeed an amazing wealth of material at his command.

This is an interesting stamp that could be included in a collection illustrating native life and customs.

The growth of ocean communication is another subject worthy of attention. The whole history of shipping development can be traced from the dugout used for river travel in the earliest days, through the galleys of ancient Rome, the Viking ships of the Norsemen, the caravels of Columbus, and the first steam auxiliary vessels, to the great liners of to-day in which ocean travel so closely resembles hotel life on land. The adventures of pioneers of navigation such as Vasco da Gama and Columbus are also recorded fully, and the collection of the complete range of stamps illustrating the voyages of these two great men alone would provide an immensely interesting task, and one that would not be too difficult.

In the field of national history the stamp collector is even better served, for with few exceptions every country has provided a record of its modern history, if only in the form of the portraits of its monarchs or presidents. In geography there are stamps illustrating the lives and habits of native peoples, and the physical features and the exploration of their countries; and art and artists, music and musicians, and social welfare work are other features of stamp designing that would repay attention. Indeed, the art of the stamp designer may be said to cover completely the whole pageant of civilisation.

The postal services of the world form a remarkably complex system by the aid of which it is possible to send a letter from one end of the civilised world to the other, with the certainty of safe delivery at its destination. The achievement of this remarkable feat takes place so regularly that most of us give it little thought, but it is of such importance that we propose to devote a special article to it in the near future. The banding together of the nations of the world into the Universal Postal Union, as the controlling body of the world's posts is known, is a romantic story. The development of postal transport is a stamp design subject that might well be used to illustrate this story. Every form of transport can be shown in the collection, from the native runner to the modern air mail. The development of the post mark is another subject that would repay attention.

This stamp could be included in an electrical engineering or inventions series. The portrait is of M. Zenobe Gramme, one of the pioneers of electrical development and inventor of the dynamo.

Stamp Gossip

and Notes on New Issues

New French Commemorative Issues

The 400th anniversary of Jacques Cartier's discovery of Canada, in connection with which a special commemorative stamp has been issued by Canada, has also been the subject of a special stamp commemoration by France. Two stamps have appeared, 75c. and 1Fr.50, both of which bear the design illustrated here, showing a portrait of Cartier and in the background the two ships that formed his fleet.

France has also marked the 25th anniversary of Bleriot's flight across the English channel. The very interesting design shown here, depicting the English and French coasts, Bleriot's machine, and his route between France and England, is used for a single stamp that is one of the most interesting French issues for many years. In modern eyes Bleriot's machine was a weird contraption of spars and wires, as the illustration shows. It was fitted with a 25 h.p. engine capable of propelling the machine at 37 miles per hour. It seems incredible that in 25 years aviation has progressed to the point where transatlantic journeys are becoming commonplace, and four-engined 1,400 h.p. machines are making the cross-channel journey between England and France to precise timetables.

The Jubilee Stamp Album

Stanley Gibbons Ltd. are constantly striving to give the young collector better and better value for his money, and the new series of Jubilee Albums that have just been prepared is very excellent value.

There are two albums in the series, both built on the same lines as the popular Improved Albums, and having page sizes measuring 8¼ in. by 6¼ in. No. 2594, priced at 2/6, has 208 pages and spaces for over 6,300 stamps. The larger size, No. 2635 has, in addition to space for over 6,300 stamps, a strong cloth cover and a special eight-page introduction illustrating rare and interesting stamps and including helpful articles on building the collection, care of stamps, foreign currencies, etc. This number is priced at 3/–.

Further details may be obtained from any stamp dealer or direct from Stanley Gibbons Ltd., 391, Strand, London, W.C.2.

U.S.A. National Parks Issue

In our September issue we gave advance descriptions of the new United States stamps that have been issued to popularise the tourist attractions of the American National Parks. Six of these stamps have now appeared, and we illustrate two of them. On the 1c., which is of upright format, there is a view in the Yosemite Park. The El Capitan mountain rises abruptly from the river towards the right half of the stamp, and the picture gives us an excellent example of the rugged beauty and grandeur that is typical of most of America's national parks.

The 2c. value gives an excellent view of the world-famous Grand Canyon in North Arizona. This stamp is specially interesting for its successful effort to depict the amazing size of this great "hole in the ground," 15 miles in length, five miles in width, and at points over a mile in depth. It will be of interest for readers to compare this view of the Grand Canyon with that of the Black Canyon published with the article *"The Hoover Dam,"* on page 99 of the February *"M.M."*

Brief details of the remaining stamps of this very beautiful series were given in the September *"M.M."* and need not be repeated. The issue is undoubtedly the most interesting that America has produced for many years, and is worthy of a place in every stamp album. We hope to show other specimens of this series in an early issue of the *"M.M."*

Gordon Commemorative Issue

The 50th anniversary of the death of General Gordon is to be marked in the Sudan by the issue of special stamps on 1st January. There will be eight, possibly nine, values, ranging from 5 mils to 50 pi, and three designs will be used. These will show (1) a bust of General Gordon; (2) a view of the Gordon Memorial College, and (3) a depiction of the scene at the commemoration service held outside Gordon's ruined palace in 1898 when Khartoum was recaptured by Lord Kitchener.

* * * *

Commencing on 1st January next Trinidad is to use the decimal system of currency instead of sterling, and the new pictorial series projected for use in the island will be denominated in cents and dollars instead of pence and shillings.

We thank Stanley Gibbons Ltd. for their courtesy in loaning the stamps from which the illustrations for our stamp pages have been made.

Italian Exhibition Stamps

Owners of Elektron Outfits among our stamp collecting readers will be specially interested in two commemorative stamps issued by Italy to mark the Exhibition of Radio Electrical Biology recently held in Venice. The design is very striking. A portrait of Luigi Galvani and a simple commemorative endorsement are the only features of a frameless stamp, the portrait and the lettering being imposed upon a plain white ground.

* * * *

This year Canada celebrates the 150th anniversary of the foundation of the Province of New Brunswick, an occasion that has been marked by the issue of a commemorative stamp.

As our illustration indicates, the design is distinctly different from any previous Canadian stamp design. The design shows, in fact, the seal of the Province, which depicts an 18th century sailing ship moored alongside a quay lined with fur stores.

"By Air—Through the Stamp Album"

By STANLEY PHILLIPS. 1/– net
(Stanley Gibbons Ltd., 391, Strand, W.C.2)

Mr Stanley Phillips is preparing a new series of stamp handbooks, to be known as the "Stanphil" stamp books, in each of which he will deal with one or another of the popular subjects depicted in stamp designs.

In this, the first of the series, Mr. Phillips presents a history of aviation based almost entirely upon the story as told in stamp designs. He traces the story of flight from the days of Icarus and Mercury, through those of Leonardo de Vinci, the Wright Brothers, and Santos Dumont, right up to modern times centring around the exploits of the Marquess di Pinedo, Kingsford-Smith and Signor Balbo. The book contains a total of 116 illustrations of stamps that bear on the story, and is completed by a short article dealing with the formation of an air collection.

Mr. Stanley Phillips, more than any other philatelic writer of to-day, has the happy knack of making his writing entertaining as well as interesting, and if this first book may be taken as a standard, the rest of the series will prove highly popular. They will do more to popularise stamp collecting than any other stamp literature we know.

Railways of Switzerland—(*Cont. from page 871*)

bed of the river and has a span of 311 ft.

The town of Brigue, with its prominent three-towered castle, lies low in the valley, and we find the atmosphere somewhat stifling after the fresh bracing air of the mountain heights over which we have passed. But we do not linger here long. Locomotives are soon changed, and in charge of another Swiss Federal 4-8-2 we enter on a further interesting stage of our journey. We rapidly gather speed, and looking out of the carriage window we see, as the train curves round, two tunnel entrances ahead with the date 1905 over the left-hand one and 1921 over the right-hand one. Into the left-hand one we plunge, and with a thrill we reflect that we are actually in the Simplon tunnel—the longest in the world!

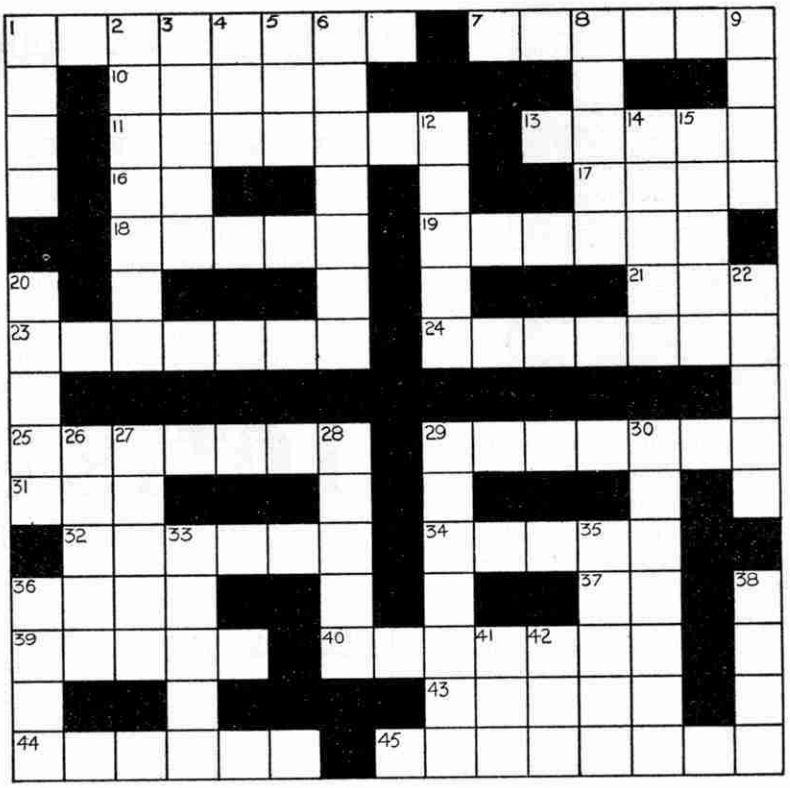
Train officials hurry along the corridors, swiftly closing all windows to keep out the heat that presently may become too oppressive, for in the centre of the tunnel we shall be as much as 7,000 ft. below the summit of the mountain above us! Italian military and customs officials also pass along the train, performing their duties, because halfway through we pass out of Switzerland into Italy, and therefore passports and luggage must be duly examined.

An efficient system of ventilation is installed in the tunnel in order to keep the air fresh. Huge electric fans are kept going by day and night and heavy iron-framed curtains are placed at the entrances to regulate the ventilation. These curtains are automatically raised by an approaching train and lowered after it has passed.

Our passage through the tunnel occupies 14 min. 25 sec., and soon after leaving it we stop at Iselle, the frontier station in Italy. Thereafter the line falls steeply, and for part of the way in a corkscrew tunnel, as it pursues its way down the deep valley, passing through typically picturesque Italian villages until the town of Domodossola is reached. Here we are at the end of the Berne-Lötschberg-Simplon route, and the Swiss Federal electric locomotive comes off and a standard 2-6-2 Italian steam locomotive comes on to work the train forward to its several destinations on the Italian State Railways.

But for us the arrival at Domodossola marks the end of our journey. We spend a pleasant hour or two exploring this old-world town and noting the many features of interest round about the railway station and extensive shunting yard. Then later we return to Switzerland, and as we travel observe afresh with ever-growing wonder the superb scenic beauties and engineering triumphs that distinguish the Berne-Lötschberg-Simplon route.

NOVEMBER CROSSWORD PUZZLE



CLUES ACROSS

1. Glaring
7. Connection
10. Aggravate
11. Storm
13. Foundation
16. Part of verb "to be"
17. Shelter
18. Oppose
19. Deplore
21. Place
23. Studies
24. True
25. Delivers
29. A Plant
31. Consume
32. A Farm
34. Sound
36. Applaud
37. Because
39. Requite
40. Extended longitudinally
43. Roman
44. Gate
45. Regretted

CLUES DOWN

1. Banner
2. Clothes
3. Birds
4. Force
5. Serpent
6. Pointed Instruments
8. Angry
9. Point of Compass
12. Ankle-bone
14. Understanding
15. Bury
20. Dazzle
22. Lacerates
26. Bird of Prey
27. Binding
28. Difficult
29. Comfort
30. In attendance
33. Separate
35. Cloth
36. Riding-whip
38. Nail
41. Circuit
42. Digested

This month's crossword puzzle will be found to follow the lines of the previous ones we have set on this page, all of which have proved remarkably successful. Every effort has been made to provide a fair and interesting puzzle, without any traps in the form of alternative solutions. The clues are all perfectly straightforward, and every word used can be found in Chambers' or any other standard dictionary. The rules that govern the solution of crossword puzzles are by now so well known that it is unnecessary to give any further explanation of the requirements of the competition.

The prizes will consist of Meccano or Hornby Train goods (to be chosen by the winners from the current catalogues) to the value of 21/–, 15/–, 10/6 and 5/– respectively, to be awarded to the senders of the four neatest or most novelly-prepared correct solutions, in order of merit. The prizes will be duplicated for the Overseas section, which is open to all readers living outside Great Britain, Ireland, and the Channel Islands.

Entries should be addressed "November Crossword Puzzle, Meccano Magazine, Binns Road, Liverpool 13," and must be sent to reach this office not later than 30th November. Overseas closing date, 28th February, 1935.

Competitors should not mutilate their magazines by cutting out the crossword illustration. Instead they should make a copy of the square on the same scale, or larger, and use that in submitting their entries for the Contest.

November Drawing Contest

As announced in our last issue, we are offering prizes throughout the winter for the best drawing or painting of any subject submitted during each month. The entries may be of any size, to suit the competitor's preference.

The entries each month will be divided into the usual two sections, A for readers aged 16 and over, B for those under 16, and prizes of Meccano products to the value of 21/– and 10/6 will be awarded for the best entries in each section.

A separate set of prizes, to be awarded in similar conditions, will be reserved in special Overseas sections for competitors living outside Great Britain, Northern Ireland, the Irish Free State and the Channel Islands.

Entries to the October competition must be addressed "November Drawing Contest, Meccano Magazine, Binns Road, Liverpool 13," and must arrive not later than 30th November. Overseas closing date, 28th February, 1935.

COMPETITION RESULTS

HOME

Slogans.—1. P. N. Tiffany (Manchester); 2. R. Andrews (Bushey); 3. S. W. Bush (Manor Park, E.12); 4. J. Stevens (Lytham).

September Photo Contest.—First Prizes: Section A, A. P. Gardner (Kettering); Section B, D. H. Warner (Richmond);. Second Prizes: Section A, E. H. Coles (Sheffield); Section B, Miss M. E. Noyes (Bishop's Stortford); Special Third: Section A, N. E. Searle (Exeter).

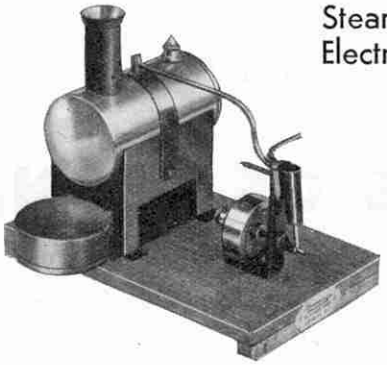
OVERSEAS

Improbabilities.—1. A. H. Randell (Vaud, Switzerland); 2. D. P. Wallace (Timaru, N.Z.); 3. J. C. P. Reade (Kopaki, N.Z.); 4. L. A. Sanh (Hong Kong).

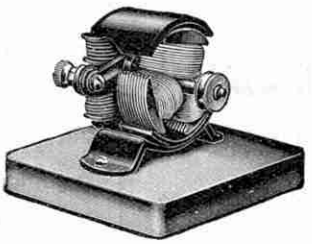
Hamleys News
Estd 1760
·HAMLEY·BROTHERS·LTD
200-202, REGENT ST., LONDON, W.1
(OUR ONLY ADDRESS)
Number Nineteen *November, 1934*

VISIT LONDON'S FINEST DISPLAY OF WORKING MODELS

Steam Engines, Electric Motors, Telephones, the latest Chemical and Electrical Sets — And don't forget to see the Model Electric Railway on the First Floor.



STATIONARY STEAM ENGINE
Fitted with safety valve, solid brass boiler, size 3½ ins. x 2 ins., turned brass fly wheel precision fit piston. Noiseless and powerful, mounted on strong polished wood base, finest value obtainable. Price **6/9**
Larger size **8/6.** Post 6d.

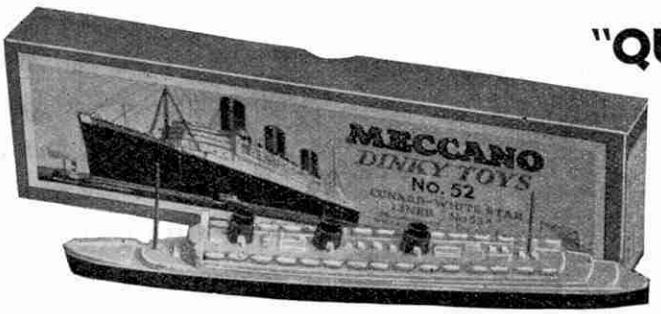


HAMLEY "REGENT" ELECTRIC MOTOR
Very powerful, high revolutions wound 2-6 volts. Perfect performance from standard 4½ volt flash lamp battery. Price (Foreign) **4/6** Post 3d.

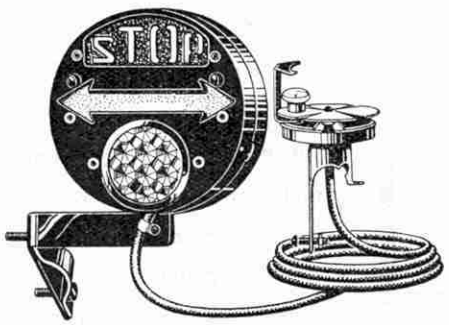
MICROSCOPE SET
Powerful lens, adjustable focus, complete with collecting jar, slides and slide covers, tweezers, dissection needle, etc. Price (Foreign) **2/9** Post 4d.

SCALE MODEL OF WORLD'S LARGEST LINER — Cunard-White Star "QUEEN MARY"

The accompanying illustration of the new Cunard-White Star liner No. 534, is an exact scale model of the liner, as she will be when finished. These are a few facts concerning the actual size of the liner: Gross tonnage 73,000; length 1,018 feet or more than three times the façade of Buckingham Palace. Passenger accommodation 1,000 first class, 1,500 tourist class, 1,000 third class. Four sets of turbines each built to develop 45,000 h.p. Probable speed, 30 knots.



Meccano Scale Model of the Giant Cunarder, "Queen Mary" (534) correct to scale and colour. Length, 6¾ ins.
Price **1/-** Post 3d.



CYCLE SIGNAL
A perfect illuminated signal of direction by means of an automatic three-way switch on the handle-bars which can readily be operated whilst applying the brakes. Fits rear fork of any cycle; operates with a standard pocket battery. Half pressure on the switch illuminates the pilot light, proving that the Direction Indicator at the rear is working. Full pressure cuts out the Pilot light to illuminate fully the Direction Signal. Battery 4½d. extra. Price **6/-** Post 6d.

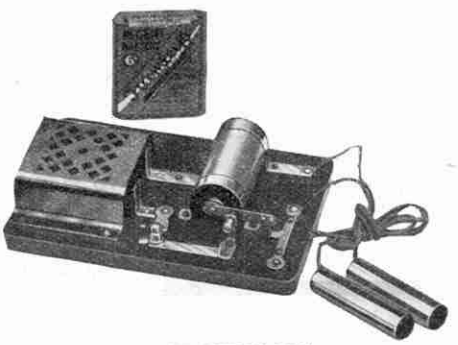
HAVE YOU JOINED THE YELMAH SOCIETY FOR YOUNG MAGICIANS. WRITE FOR PARTICULARS.

HAMLEYS EXHIBITION OF GAUGE "O" SCALE MODEL LOCOMOTIVES

The finest display of its kind in the country. The Giants of the Rail portrayed in perfect miniature. Be sure to see the:

"COCK O' THE NORTH" L.N.E.R.
10000 "HUSH-HUSH" L.N.E.R.
"PRINCESS ROYAL" L.M.S.
"LONDON SCOTTISH" L.M.S.
"GARRETT" L.M.S.
2-6-4 TANK LOCO L.M.S.
"SCHOOLS" CLASS S.R.
"LORD NELSON" S.R.

ON THE FIRST FLOOR



INDUCTION COIL
Very powerful, can be regulated, fitted "on" and "off" switch, mounted on polished wood base. Price complete with battery **5/6** Post 6d.

NOW READY. OUR NEW CHRISTMAS CATALOGUE, No. MHN.1.

The finest catalogue of Toys, Models, Games and Sports ever issued. 72 pages with large colour supplement.

POST FREE.

SECRETS of SCALE MODEL AIRCRAFT DESIGN

The first of an interesting series of articles by the well-known designer responsible for the construction of the most perfect of all scale model aeroplanes, the "FROG" and "PUSS-MOTH"

1 CHOOSING SUITABLE TYPES OF PLANE

PROBLEMS OF WING CONSTRUCTION

● The problem of designing a scale model aeroplane capable of controlled and satisfactory flight is a very different matter to designing, say, a model locomotive or motor boat. In the one case the means of propulsion, steam, clockwork or electric current, present very little difficulty; in the other the whole problem of aviation has to be tackled over again in miniature—the problem of making a heavier-than-air machine rise from the ground and fly in any desired direction.

It is clear, of course, that if you take a full-size aeroplane and scale it down exactly, with your power kept to the same ratio as your weight, you will have a true aeroplane in miniature which will behave exactly like its prototype. But there are obvious difficulties to be overcome here and the model aeroplane designer has to modify his design and meet those difficulties as best he can.

PRELIMINARY TESTS

● The first question we had to face in the early days was the choice of a type of existing aircraft which could best be reproduced as a flying scale model, for it is obvious that all machines are not equally suitable for that purpose. Indeed, it is very doubtful whether some, owing to their peculiarities of design, could be satisfactorily reproduced at all.

After many exhaustive tests we finally decided upon a modification of the High-Wing, Single-Seater type of Monoplane as our first model.

THE NEED FOR DOUBLE-SURFACE WINGS

● The efficiency of any aeroplane depends upon the relation of "lift" to "drag" in the wings. With this in mind, it was quickly realised that the single surface (or "flat") wings in general use on ordinary toy aeroplanes were quite useless for real miniature aircraft. Our first job, then, was to construct wings that would have all the scientifically correct features of the large machines and which would be light enough to meet the demands of a model 'plane.

For this an entirely new method of construction had to be evolved and, even more important, a suitable material had to be found which would embody the many properties that were required.

COMING NEXT MONTH

● In my article next month I shall tell you how we developed the double surface wing and other facts about the design of the now famous "Frog" aeroplanes, which have been so perfected that you can even "stunt" them at will. You will find illustrations of these models on the opposite page with details and prices.

FROG TRADE MARK REGD.

FROG

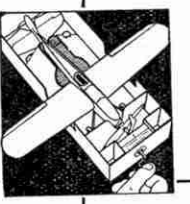
The Foremost Name in Model Aviation

"FROG" INTERCEPTOR FIGHTER

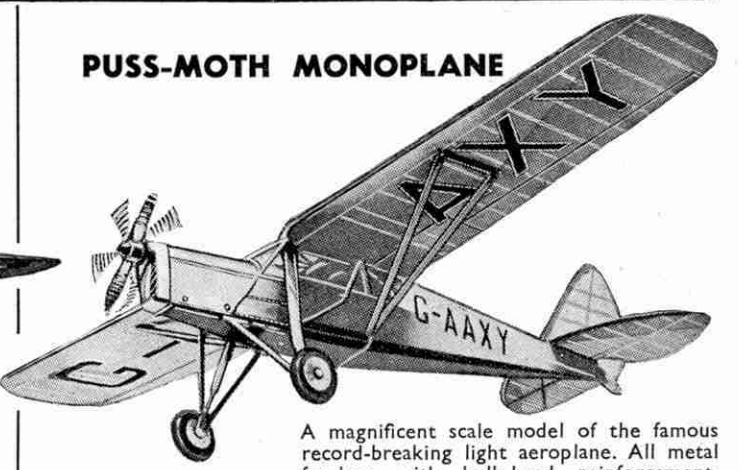
The original and now famous model. A scale model of high-speed Monoplane. Tubular construction, patented quick detachable fittings. High efficiency air-screw. A popular machine for realistic stunting. Seven models, each of handsome appearance and with the correct colours of the following nationalities: British R.A.F., France, Belgium, Holland, Italy, U.S.A. and Argentine. Price including full equipment as specified.

The "Frog" is sold complete with spare motors, lubricant and gear box oil, patent high-speed winder box and illustrated flying manual. Wing Span 11½ ins. Flies 300 ft.

7'6



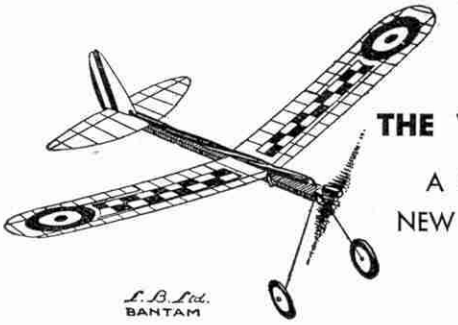
PUSS-MOTH MONOPLANE



A magnificent scale model of the famous record-breaking light aeroplane. All metal fuselage with bulk-head reinforcement, hollow wings of special design and construction. Dual motor coupled to gear box, transparent cabin and roof lights. "Frog" patent quick detachable fittings and high-speed mechanical winder. The model aeroplane "par excellence." Including full equipment as specified.

17'6

The Puss-Moth is sold complete with high-speed winder box, spare motor, insertor rod, gear box oil, elastic lubricant and illustrated flying manual. Wing Span 18 ins. Flies 600 ft.



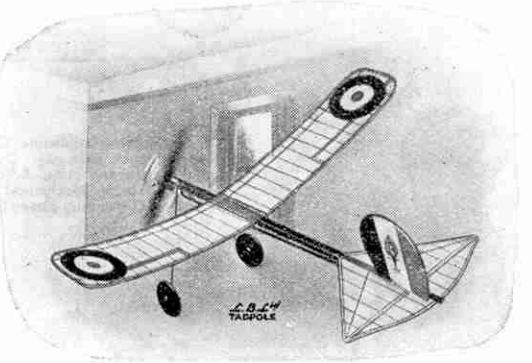
THE "BANTAM"

A SPLENDID NEW OUTDOOR FLYER

Here's a fine new model! Flies anywhere out of doors and performs remarkably well. No trouble to wind—a few turns with the special high-speed winder supplied with each model and away she goes. Will rise off ground after a short run. Wings printed in colours with the markings of a famous squadron. Sold completely assembled and equipped. Look for the distinctive "BANTAM" Box.

2'6 Price includes high-speed winder box, spare motor, lubricant and illustrated flying hints. Wing Span 9 ins. Flies 200 ft.

The Bantam is complete with high-speed winder box, spare motor and lubricant.

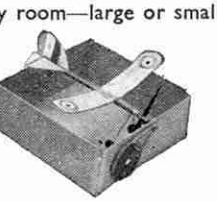


"TADPOLE" INDOOR AEROPLANE

This is *the* model for *indoor flying*. It will rise off the floor or table or even off its own box, and fly round any room—large or small. Marvellous flights—no skill required—*quickly wound with* its patented high-speed winder box as shown. Wing Span 8 ins. Duration 30 secs. Price

2'6

Complete with patent high-speed winder box and spare motor.

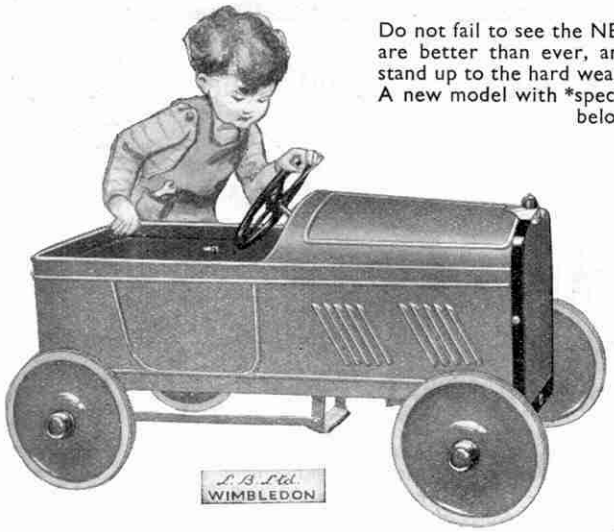


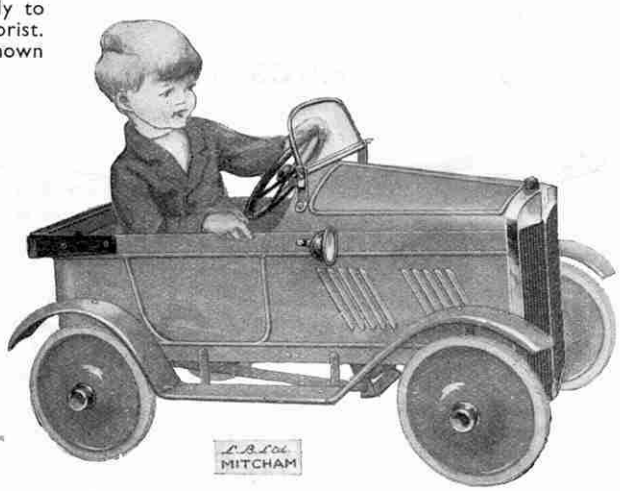
Designed and Made by International Model Aircraft Ltd., London, S.W.19

Sole Concessionaires: LINES BROTHERS LTD., TRI-ANG WORKS, LONDON, S.W.19

1935 TRI-ANG Models

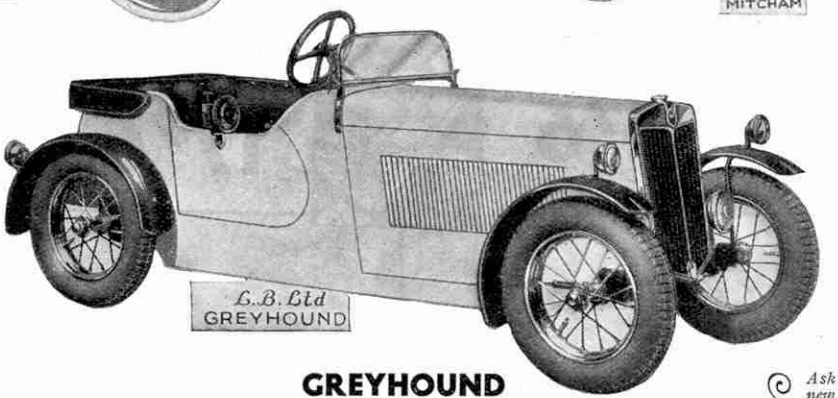
Do not fail to see the NEW TRI-ANG CARS, they are better than ever, and are built expressly to stand up to the hard wear of the juvenile motorist. A new model with *special variable gear is shown below.





WIMBLEDON

A sturdy Car with pressed steel body. Double crank drive and rubber pedals. Side opening door. Steel disc wheels and ½" White Auto Tread Tyres. Triumph type radiator. Finished in blue enamel with scarlet wheels. Length 31 ins. **17/6**



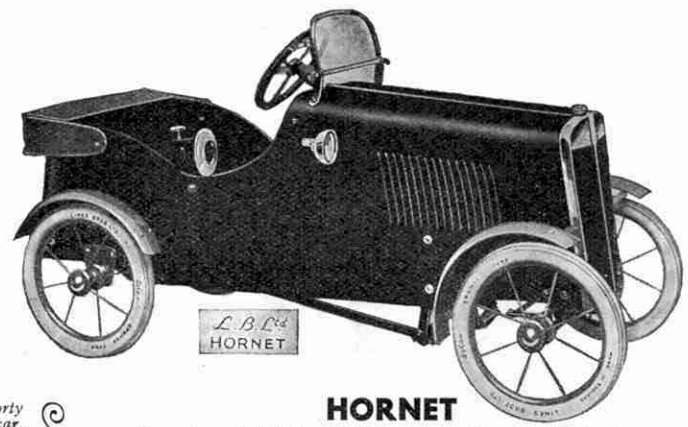
MITCHAM

A fine Car for small children. Pressed steel body with Magna type radiator. Double crank drive. Steel disc wheels, enamelled in red with ½" white auto tread tyres. Mudguards and running boards. Equipment includes adjustable windscreen, lamps, petrol and oil cans. Length 32 ins. **21/-**

GREYHOUND

A particularly handsome Car with coach-built body, double crank drive and ball bearing back axle. 2½" Dunlop pneumatic tyres. Wire wheels with chromium plated hubs and rims. Adjustable windscreen, upholstered seat and back, Mechanical horn, band-brake, Magna type radiator. Chromium plated fittings throughout. Length 63 ins. **£6-6-0**

Ask your dealer for a copy of the new TRI-ANG TOY FOLDER. Printed in full colours it shows all the popular TRI-ANG TOYS, including Cars, Dolls' Prams, Aeroplanes, etc.



*LANCHESTER

A fine new Sports Car fitted with our **special variable speed gear,** a unique and exclusive feature. All metal body enamelled in green and Steel disc wheels, plated and polished and fitted 1⅛" jointless sponge rubber tyres. Fully equipped. Length 36 ins. **47/6**

We make over forty different types of car, each of which is supreme in design, construction and finish.

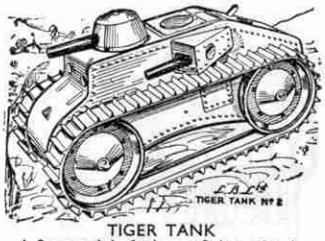
HORNET

A smart coach-built Car with Magna type radiator, mechanical horn and adjustable windscreen. Wheels fitted with 1⅛" jointless sponge rubber tyres. sports type mudguards. Double crank drive. Length 43 ins. **39/6**

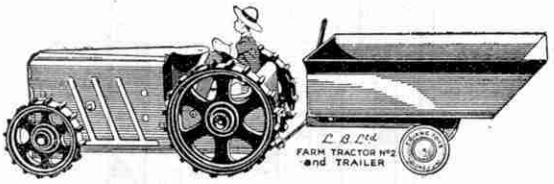
TRI-ANG TOYS ARE STOCKED BY ALL GOOD TOYSHOPS AND STORES

LINES BROS. LTD., Tri-ang Works, Morden Rd., London, S.W.19

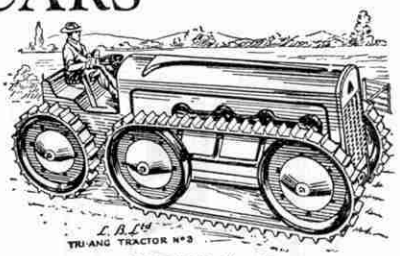
CLOCKWORK **TRI-ANG** TRACTORS TANKS, LORRIES AND CARS



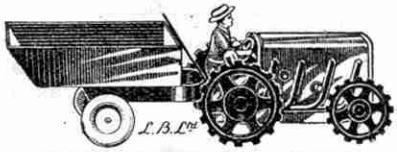
TIGER TANK
A fine model of a heavy fighting Tank. All steel construction with spring-operated gun. Extra strong clockwork. Length 10 in. **4/11**



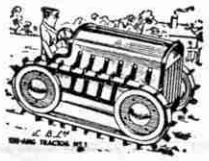
FARM TRACTOR No. 2 AND TRAILER
A powerful Tractor with steel body and heavy rubber wheels. Steel Trailer with tipping body. Overall length 17 in. Tractor only (less Trailer) 2/11 Complete **3/11**



TRACTOR No. 3C
Super-power six wheel model with forward and reverse mechanism. Steel body and wide rubber caterpillar bands. Length 12 in. **7/6**

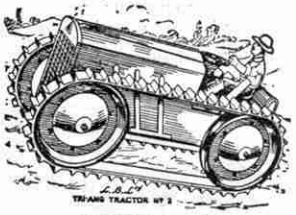


FARM TRACTOR No. 1 AND TRAILER
Well made and nicely finished. Tractor fitted good clockwork and solid rubber wheels. All steel Trailer. Overall length 10½ in. **1/-**
Tractor only (less Trailer) 9d.



NIPPY TRACTOR
A strongly made toy that climbs obstacles in a surprising way. Length 5 in. **6d.**

WHIPPET
Steel body and thick rubber bands. Good clockwork motor. Length 5 in. **6d.**



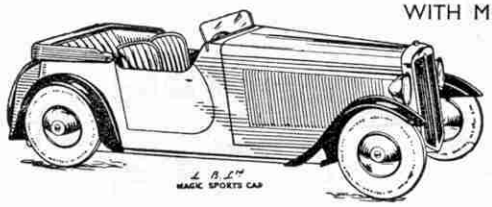
TRACTOR No. 2
A fine climbing toy with powerful clockwork motor. Steel body and rubber caterpillar bands. Length 8½ in. **2/6**

MAGIC SPORTS

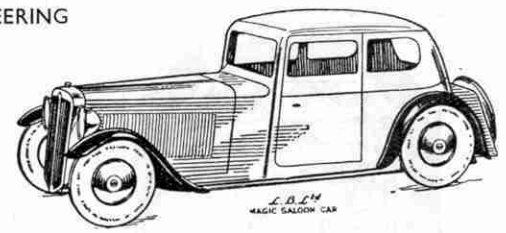
Magic Sports and Saloon Cars

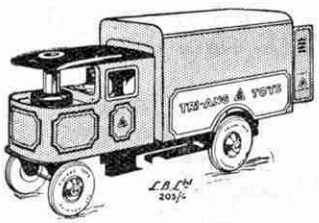
WITH MOTOR TYPE TRANSMISSION AND STEERING

MAGIC SALOON



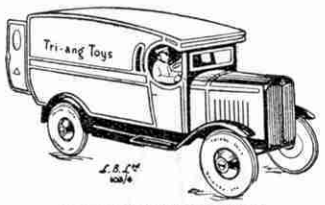
These cars are actually driven with shaft and floating crown-wheel transmission and steered from the driving seat. The steel bodies are replicas of modern automobiles and are fitted with a high speed clockwork motor with stop and start levers. Length 16 in. Either model price **10/6**
Fitted 2 electric lights 12/6





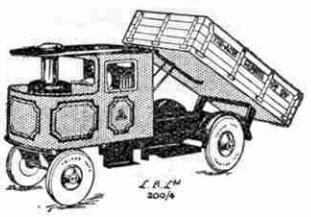
STEAM BOX VAN
Large capacity body with two doors at rear. Solid rubber wheels and strong clockwork. Length 13 in. **4/11**
Fitted Electric Light 5/11

TRAILER
A Trailer, complete with draw bar and solid rubber wheels is made to attach to any of this series. **1/11**

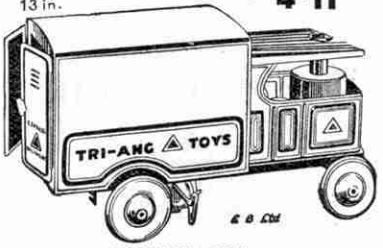


MOTOR DELIVERY VAN
A smart Motor Van nicely finished and fitted with long-running clockwork. Solid rubber wheels. Length 13 in. **4/11**

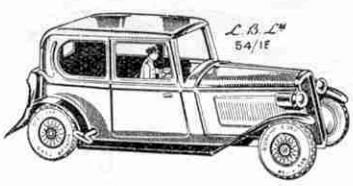
MOTOR TIPPING LORRY
Similar construction to Steam Tip Lorry but on Motor Lorry Chassis. Length 13 in. **4/11**



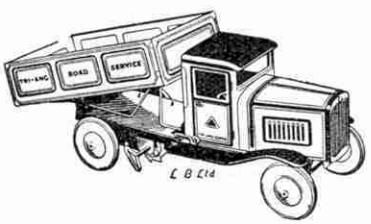
STEAM TIPPING WAGON
Well made Steam Wagon of realistic appearance. Tipping body and extra quality clockwork. Solid rubber wheels. Length 13 in. **4/11**
Fitted Electric Light 5/11



STEAM WAGON
Attractive Van with two opening doors at rear and good clockwork motor. Solid rubber wheels. Length 10 in. **1/3**



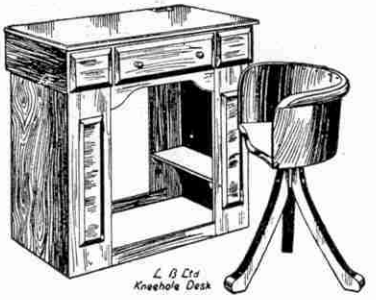
CLOCKWORK SALOON
Remarkable value in clockwork Saloon Cars. Fitted with speedy motor. Length 10½ in. **1/-**
With Electric Light 1/11



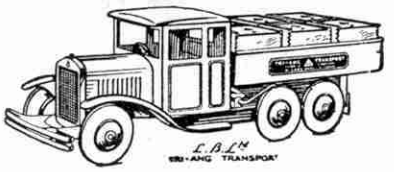
MOTOR TIP LORRY
Well made Tipping Lorry with reliable clockwork and solid rubber wheels. Length 10 in. **1/3**

Lines Bros. Ltd., London, S.W.19

START SAYING "TRI-ANG" FOR XMAS

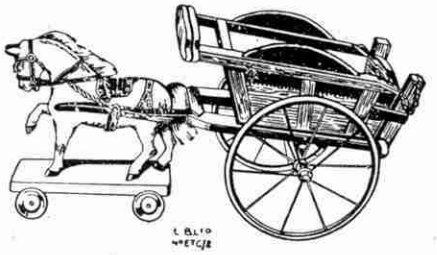


KNEEHOLE DESK No. 1
Well made kneehole desk finished in dark oak, and fitted with centre draw and inkwell. Complete with swivelling chair. Desk 24" high. **21/-**



TRI-ANG TRANSPORT SIX
Large steel tipping lorry driven by flywheel geared to rear wheels. Plated spring bumper and solid rubber tyres. Complete with six hardwood cases. **10/6**

THEATRE No. 2
Proscenium of modern design. Equipment includes electric footlights and spotlights with varicoloured discs. Roll-up velvet curtain and orchestra pit. Complete with scenery and characters for two plays. **21/-**

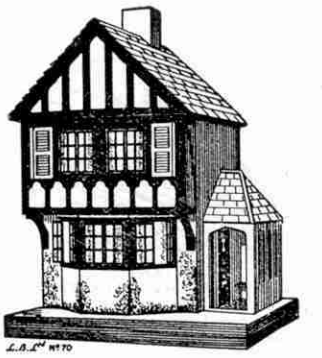


ELM CART AND HORSE No. 2
Practically unbreakable toy with varnished cart fitted with rubber tyred wheels and well made horse correctly dappled. 32" long. **29/6**
Size 1 **22/6**

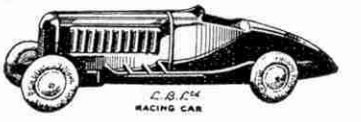
DOLL'S COT 2F
Made like a real baby's cot, with drop sides, and folding ends. Complete with spring mattress and stuffed bolster and overlay. 25" long. **17/6**
Large size, 27" long, **22/6**

COOKERY SET No. 1
Complete set of utensils for the young cook. Includes mincer, saucepan, kettle, colander, pudding basin, pie dish, rolling pin and board. Packed in an attractive box. **5/11**

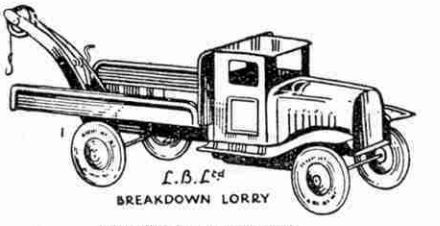
DOCK CRANES
Working model crane with chain winding gear. Swivelling cab on strong steel base. Folding legs. **1/- & 1/11**



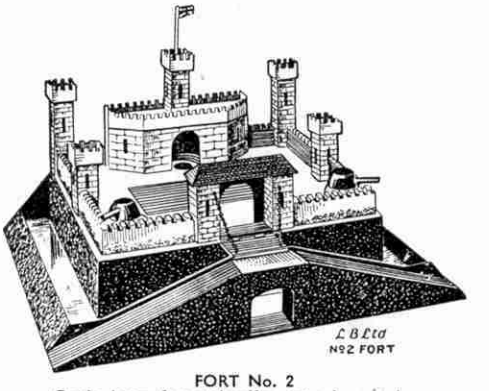
DOLL'S HOUSE No. 7D
With half-timbered front, tiled roof and porch. Two large rooms with electric light and metal framed opening windows. 27" high. **29/6**
Large model, complete with garage, **39/6**



RACING CAR
All steel racing car stream-lined body, solid rubber wheels. 10½" long. **6d. & 1/-**



BREAKDOWN LORRIES
Breakdown lorry made of heavy gauge steel with rotating jib and self-locking crank. Solid rubber wheels. **6d., 1/- & 1/11**
With elec. light, **1/9** and **2/11**



FORT No. 2
Castle design fort with self contained moat, drawbridge, ramp, two spring model cannons. Fitted elec. light. **8/11**
Other Tri-ang Forts, **4/11**, **6/11**, and **12/6**

FROM ALL GOOD TOY SHOPS AND STORES

Lines Bros. Ltd., Tri-ang Works, Morden Road, London, S.W.19

"THREE LITTLE PIGS"
MAGIC LANTERN OUTFITS
with 24 coloured picture slides from the famous WALT DISNEY Film

Magic Lantern Outfit Including electric Magic Lantern operated from a pocket battery. Gives a beautiful picture very clear and in lovely colours. Lantern is made of metal and fitted with a diffused lamp. Complete with set of 24 'Three Little Pigs" beautifully coloured picture slides and reading. **7/6**

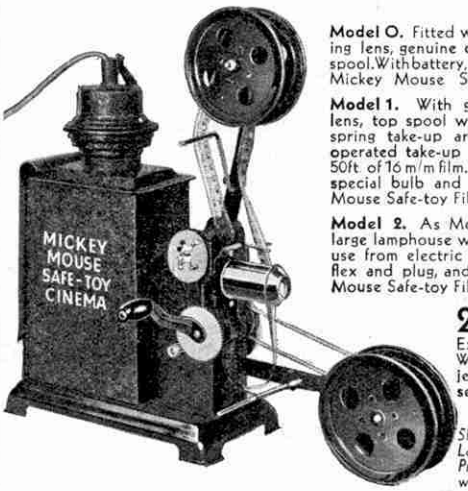
"Mickey Mouse" and "Three Little Pigs" Combined Magic Lantern Outfit. Contains complete Lantern with spare battery and lamp. Presentation set of 11 Mickey Mouse Movie stories of 8 picture slides each. Set of 24 "Three Little Pigs" coloured picture slides. All in strong dark blue fibre attache case. Packed in picture carton with showing screen on one side. **15/-**

"Three Little Pigs" Coloured Picture Slides.
Per set of 24 pictures with story printed in large type **2/6**

MICKEY MOUSE


SAFE-TOY CINEMAS

The ideal winter toy, giving a beautiful bright and clear picture. Fitted with a genuine cut-off shutter as in the expensive machines. A feature never incorporated in toy cinemas before. You will find no difficulty in operating these toy cinemas.



Model O. Fitted with good quality focusing lens, genuine cut-off shutter and top spool. With battery, bulb and three Mickey Mouse Safe-toy Films **12/6**

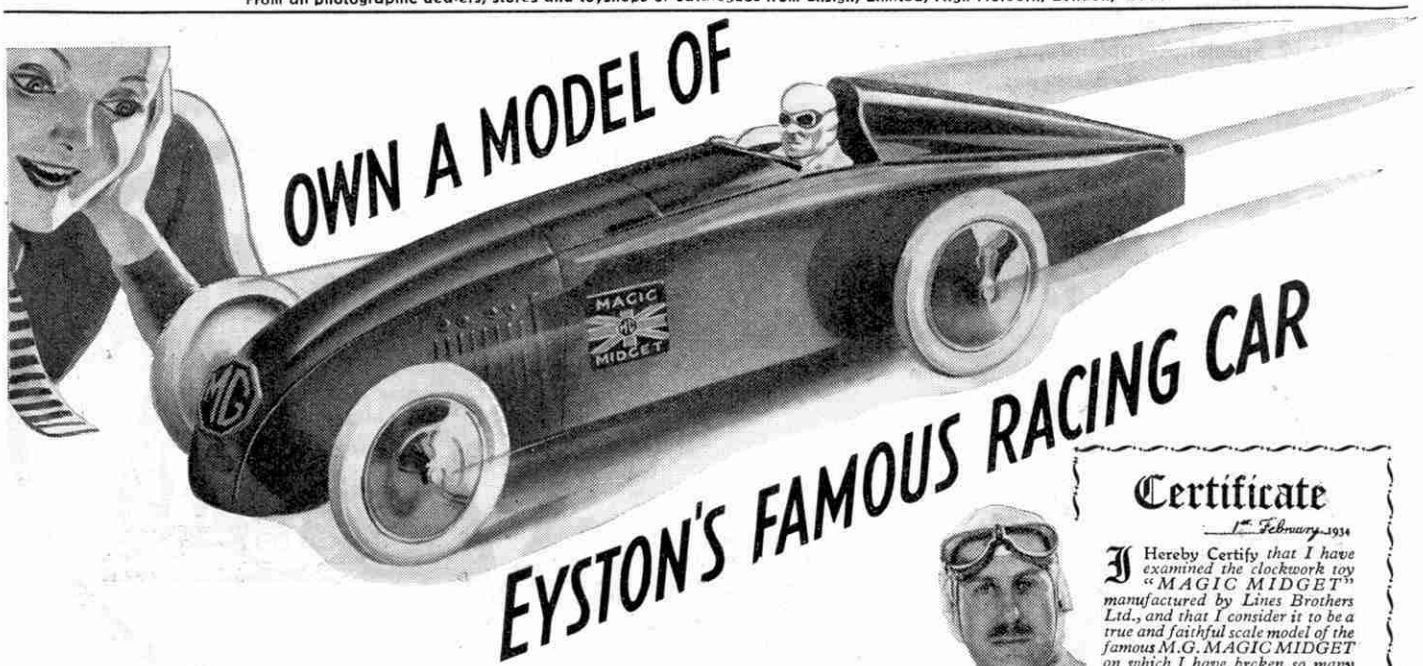
Model 1. With good quality focusing lens, top spool with rewind handle and spring take-up arm, and bottom spring operated take-up arm for running up to 50ft. of 16 m/m film. Complete with battery, special bulb and five Mickey Mouse Safe-toy Films - - - **17/6**

Model 2. As Model 1, but fitted with large lamphouse with adjustable cowl for use from electric mains. Complete with flex and plug, and five Mickey Mouse Safe-toy Films - - - **21/-**

20 MICKEY MOUSE SAFE-TOY FILMS Extracts from famous Walt Disney Films. 20 subjects in 4 series. Per series of five films **2/6** Per film **6d.**

Slides and Films British. Lanterns & Cinemas Foreign Produced by arrangement with Walt Disney Mickey Mouse Ltd.

From all photographic dealers, stores and toyshops or catalogues from Ensign, Limited, High Holborn, London, W.C.1



Certificate

1st February 1934

I Hereby Certify *that I have examined the clockwork toy "MAGIC MIDGET" manufactured by Lines Brothers Ltd., and that I consider it to be a true and faithful scale model of the famous M.G. MAGIC MIDGET on which I have broken so many baby car records and which was the first baby car to attain a speed of two miles a minute.*

(Signed) George Eyston

MAGIC MIDGET

Made by the makers of TRI-ANG TOYS under the Supervision of Capt. G. Eyston

This is a real scale model of Captain Eyston's record-breaking M.G. Magic Midget—the first Baby car to do over 120 m.p.h.: Eyston, himself, has certified it to be a perfect replica. It looks a speedy car—and it is. Try the Magic Midget out against your friends' racers.

The Magic Midget has an all-steel body with a powerful clockwork motor, rubber wheels with polished aluminium disc. Length 16 in. **Price 10/6**

See the Magic Midget at your toyshop.

LINES BROS. LTD., TRI-ANG WORKS, LONDON, S.W.19

MECCANO

AEROPLANE CONSTRUCTOR OUTFITS

Boys, Build Your Own Model Aeroplanes!

Meccano Aeroplane Constructor Outfits give boys the thrill of building their own aeroplanes. The parts contained in these Outfits enable aeroplane construction to be carried out on sound engineering lines, because they are all interchangeable on the famous Meccano principle.

The illustrated Manual of Instructions included in each Outfit shows how to build wonderful models of high and low wing Monoplanes, Biplanes, Seaplanes and other interesting machines ; in fact, models of almost every type of aircraft can be built.

All the Meccano Aeroplane Outfits in the series are available in three different colour combinations—Red and Cream, Blue and White and Green and Cream.

PRICE LIST OF MECCANO AEROPLANE OUTFITS

STANDARD SERIES.

No. O Aeroplane Constructor Outfit	**5/-**
No. O1P Aeroplane Hangar Outfit	**9/6**
No. 1 Aeroplane Constructor Outfit	**9/-**
No. 2 Aeroplane Constructor Outfit	**16/6**

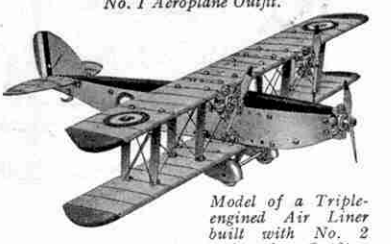
SPECIAL SERIES.

No. 1 Special Aeroplane Constructor Outfit	**15/-**
No. 2 Special Aeroplane Constructor Outfit	**25/-**

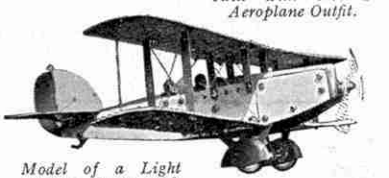
Note. The parts in the No. O and No. O1P Outfits are not intended for use with the larger Outfits.

Model of a High Wing Monoplane built with No. O Aeroplane Outfit.

Model of a Standard Light Biplane built with No. 1 Aeroplane Outfit.

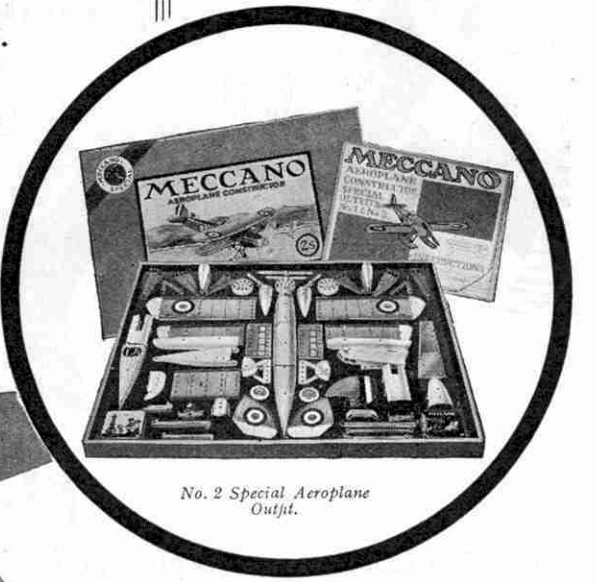


Model of a Triple-engined Air Liner built with No. 2 Aeroplane Outfit.



Model of a Light Biplane built with No. 2 Special Aeroplane Outfit.

MECCANO LTD.
BINNS ROAD
LIVERPOOL 13



No. 2 Special Aeroplane Outfit.

ASK FOR B·G·L· THIS XMAS

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Christmas is fast approaching and the time to begin your shopping list is NOW. The early shopper buys in comfort and gets the best selection. Naturally you will demand goods that are British made and you will want best value that money can buy.

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BRITISH GAMES LTD.

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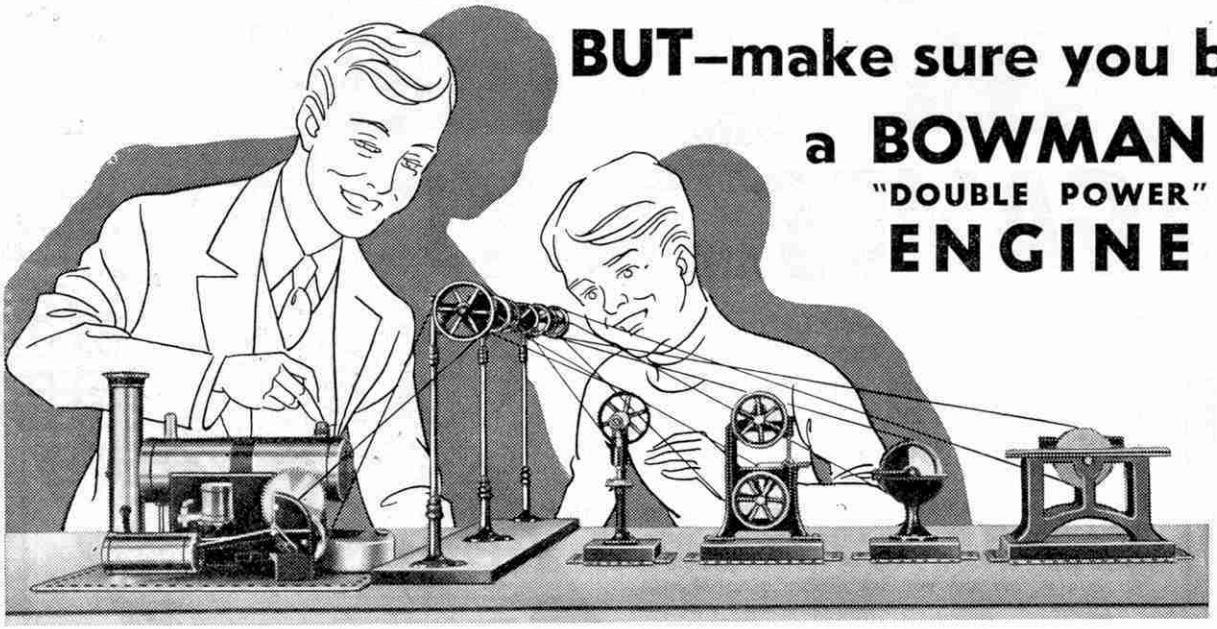
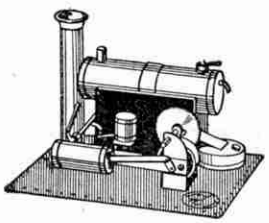
BE A REAL ENGINEER

AND DRIVE BY STEAM!

BUT–make sure you buy a BOWMAN "DOUBLE POWER" ENGINE



THE ABOVE PICTURE SHOWS STANDARD MODEL M135 DRIVING A MODEL WORKSHOP. JUST WHAT YOU WANT FOR THE LONG WINTER EVENINGS. START TO PURCHASE THEM NOW AND HAVE REAL FUN!

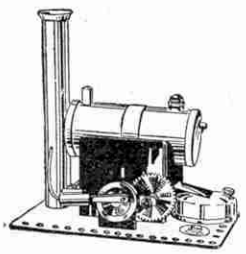


M135 illustrated. A wonderful engine, will lift 100 lbs. with suitable gearing. Solidly made of brass and steel, safety valve, drip feed lubricator. 2 speed gear, will take Meccano pulleys, sprockets, wheels, etc. Drilled metal base, Meccano pattern, by permission. PRICE **16/9** Post U.K. 1/–.

M175 illustrated. A good geared junior model. Works fairly large Meccano models. **9/–**

M180. A useful junior engine. Works small Meccano models, and will drive Dynamo No. 839. **7/6**

M158. 2 speed gear and pulleys. Runs for 25 mins. **12/6**



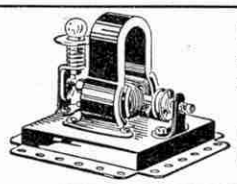
WORKING MODELS—well made reproductions.

Press No. 832	...	3/3	Circular Saw No. 833	...	3/9
Bandsaw No. 834	...	3/11	Grindstone No. 835	...	2/9

OTHER MODELS—

M122	...	27/6	M101	...	37/6
			M140	...	14/6

M130 Steam electric lighting plant, suitable for workshops, stations, etc. Gives a bright light for 40 mins. Price **21/–**

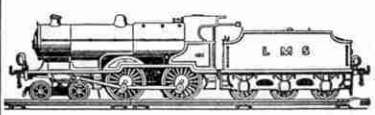


DYNAMO No. 839 illustrated, super efficient, gives bright light even with our smallest engine. Price **7/6**

MODEL 840, suitable for the larger type engine. Price **5/–**

ELECTRICAL MOTOR No. 844, 8/6 No. 845, 2/11

CHEMISTRY SETS, wonderful value ... **2/6** to **15/–**



LOCO 234, without Tender, **30/–**. Runs nearly 2 miles non-stop. Solid drawn brass boiler complete with safety valve. Exhaust through chimney. Steel frame. Length with Tender 20 ins. **TENDER 7/6**

OTHER MODELS—Loco 265, 25/– Loco 30, 21/– Loco 410, 10/6

ELECTRICAL SETS from **2/6** to **21/–**.

All models can be obtained from good Toyshops and Stores.

THE BOWMAN BOOK OF MODELS—an interesting treatise on model engineering and full details of all models—will be sent you by return of post if you send your name and address (and enclose threepence in postage stamps) to:

BOWMAN MODELS

(Dept. M.M. 28), DEREHAM, NORFOLK

YOUR OWN LABORATORY

What about asking Dad for a Lott's Chemistry Set for Christmas? Then you can have your own "Lab," and start experimenting for yourself.

Colour changes in liquids, secret inks, crystal formations, evolution of gases, fire-proofing, oxidization, dyeing, bleaching and coloured fire are a few of the subjects of the fascinating experiments you can carry out.

Lott's Chemistry Sets contain chemicals and apparatus, including flasks, test-tubes, crucibles, Bunsen burner, etc. Full instructions and explanations (by a Doctor of Science) of the processes and reactions are given.

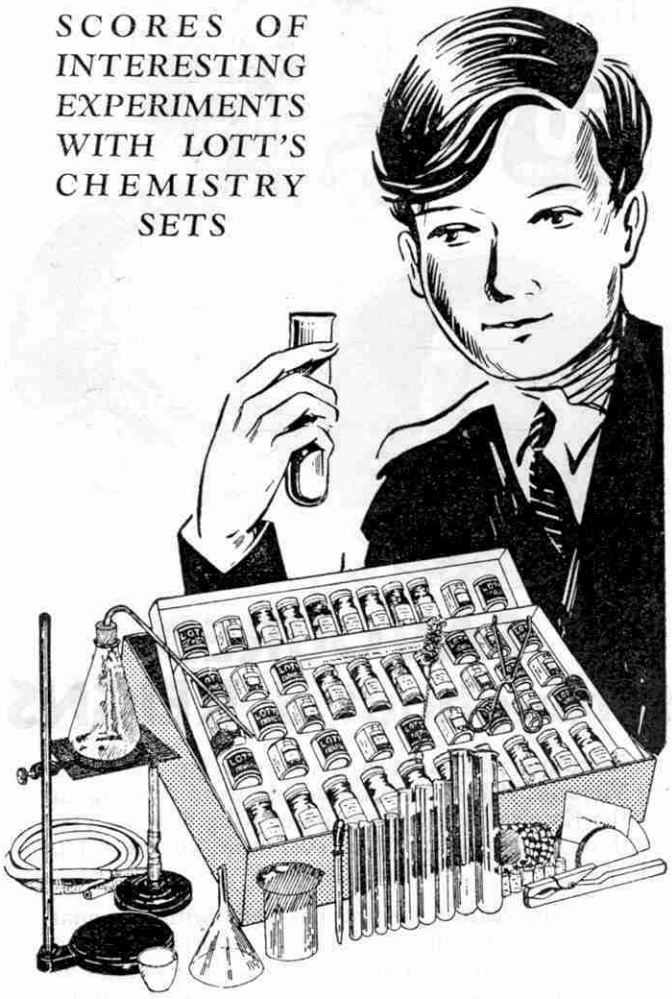
See your Dad about one NOW!

Spare Supplies of all Chemicals and apparatus can be obtained.

Complete Sets at **2/–**, **3/6**, **6/–**, **10/6**, **15/6**, and **21/–**.

Larger Students' Cabinets at **31/6**, **42/–**, **73/6** and **105/–**.

SCORES OF INTERESTING EXPERIMENTS WITH LOTT'S CHEMISTRY SETS



BOX 3. As illustrated at side. Contains 30 chemicals, Bunsen burner with rubber connecting tube, large and small test-tubes, flask with rubber cork and delivery tube, porcelain crucible, glass funnel, filter papers, litmus paper, magnesium ribbon, glass tubing, test-tube cleaning brush and Book of 131 experiments. Price **10/6**

BOX 7. In this Cabinet illustrated at side the young experimenter is provided with a really useful range of laboratory equipment. It contains 54 bottles and cartons of chemicals and the apparatus includes glass retort, retort stand with two rings, deflagrating spoon and cap, pestle and mortar, sandbath, tripod, pipe-clay triangle, glass stoppered bottles, etc., etc. Complete with full instructions and notes on the use of the apparatus. Price **42/–**

BOX 5. An especially fine set. Box 5 contains 43 chemicals and apparatus for a remarkable range of 228 experiments. The additional apparatus over and above the contents of the earlier boxes includes retort stand and ring (of great use in arranging the apparatus in a firm and convenient form), wire gauze, beaker and crucible tongs. Extra bottles of some of the chemicals most frequently used are also included. As illustrated above. Price **21/–**

LOTT'S CHEMISTRY AND ELECTRICITY SETS

Obtainable at all leading Toy Dealers and Stores

Write for Free Illustrated Lists of all Lott's Products

Dept. M.M., LOTT'S BRICKS LTD., Watford, Herts.

LOTT'S ELECTRICITY

These sets provide the equipment for performing a really remarkable range of experiments in magnetism, static and current electricity.

Box 2
Price 12/6

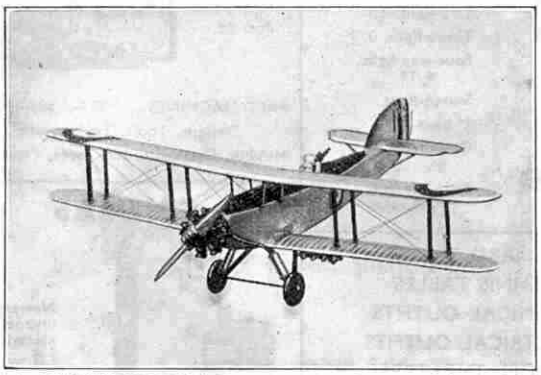
Working models and instruments such as the following can be made:

Buzzer, relay, electrically operated railway signal, traffic signal, gold-leaf electroscope, electric motor, etc., etc.

Sets at **6/–**, **12/6** and **21/–**.

SKYBIRDS

The finest series of constructive models on the market; not only are the models more accurate than anything at this price previously produced, but the range of accessories is surprisingly complete. SKYBIRDS make a most fascinating Hobby—Constructing —Painting and Photographing.



The FAIREY "GORDON." Photograph of our latest model, assembled and painted from Set No. 23, price 3/-

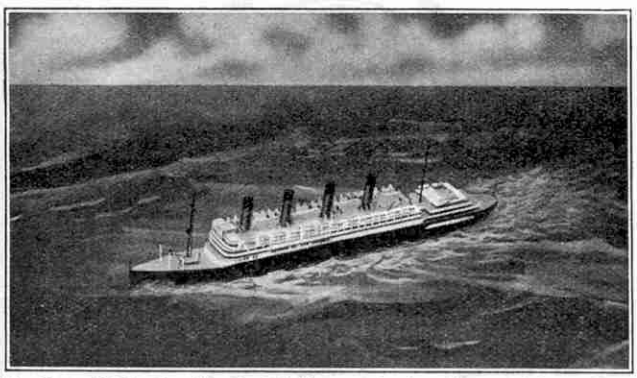
Join the Skybird League and League of Shipseries Modellers

Full Particulars on Application

SHIPSERIES

For those who have a nautical turn of mind, the SHIPSERIES 100 ft. = 1 in. constructive waterline model Ships provide an equally attractive hobby. Sets from 1/6 to 5/-. Our latest accessories include Cast metal Lightship, Lighthouse and Tug. All to same scale, price 3d. each. Submarine, Flotilla of Six, price 1/-. Rocks 4½d., 6½d., 9d. and 1/3 assorted shapes.

Ships of the Royal Navy
Ships of the Merchant Navy



The Cunard-White Star "Aquitania." Photograph of our latest model assembled and painted from Set No. 9, price 5/-

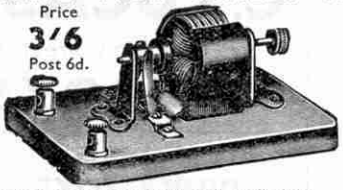
THE SKYBIRD—the official organ of the Skybird League and League of Shipseries Modellers, is an attractive little booklet published quarterly price 6d. This little book is in great demand and gives full particulars of Skybirds and Shipseries, post free Great Britain 7d. Vol. 1 bound complete, price 5/6.

For list and address of nearest agent write:

A. J. HOLLADAY & CO. LTD. (Desk B)
3, ALDERMANBURY AVENUE, LONDON, E.C.2

DRIVE YOUR MODELS THE "WILCO" WAY

Price **3/6** Post 6d.



A fine open-type Motor, will work from a 4-volt Flash Lamp Battery or Accumulator, can be supplied in parts for building yourself, with full instructions.

Price **5/9** Post 6d.

This Motor is extra powerful, and the large armature acts as a fly-wheel, causing the motor to maintain a good speed. Works from a 4-volt pocket battery or accumulator.

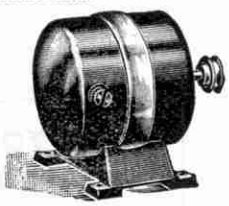
Price **12/6** Post Free.

This fine 2-6 volt Geared Motor is very powerful indeed, various speeds can be obtained by means of the five pulley wheels. Works off a 4 volt Battery, an Accumulator, or for perfect control use our Transformer.

All "WILCO" goods are obtainable from your local dealer or, in case of difficulty, direct from us. Complete Electrical Catalogue, 4d. Post Free.

Electric Motor

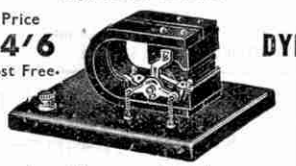
Our popular enclosed type, very speedy and smooth running. Works off a 4 volt Battery, an Accumulator, or for perfect control use our Mains Transformer. Price **7/9** Post 6d.



The "WILCO" Transformer

With speed control, reduces 200/250 vt. A.C. to 2-8 volts. Capacity 3 amperes. Ideal for driving our motors off the Electric Mains at practically no cost. Will also light bulbs for Models and Railways, etc. Price **15/6**

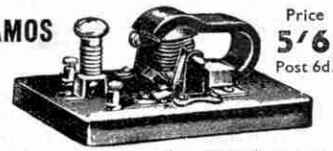
Price **14/6** Post Free.



Our best Dynamo will light up your Models or Railway with SIX 3.5 volt Bulbs easily. Base 6¼ in. x 4¼ in.

DYNAMOS

Price **5/6** Post 6d.



A strong Dynamo that will light up your Models or Railway with a 3.5 volt Bulb easily. Base 4¾ in. x 3 in.

L. WILKINSON, 8, CITY ROAD, LONDON, E.C.

Boys! Shooting with a B.S.A. Air Rifle is the sport for long evenings

Prices from **45/-** or **4/3** a month

Most fellows find that long evenings get very tiresome. A B.S.A. Air Rifle will banish the worst attack of "blues" and keep you so engrossed that time will go far too quickly.

Target practice with a B.S.A. Air Rifle is great sport. The super-accuracy enables you to do really good shooting and if you use a B.S.A. Target Holder and Pellet Catcher there will be no fear of damaged walls, etc.

B.S.A. Air Rifles make no smoke or smell and very little noise. B.S.A. Pellets ·177″ size cost only 2/3 per 1,000—37 accurate shots for one penny.

No licence is necessary to purchase if over 17 years of age, and no licence is necessary for anyone to use in the house or garden.

B.S.A. "Breakdown" Air Rifle ·177″ bore

POST THIS COUPON TO-DAY

B.S.A. Guns Ltd., 92, Armoury Road, Birmingham, 11
Send me the B.S.A. Air Rifle Leaflet

Name.....

Address.....

READERS' SALES

Wanted. Five Yellow or Red C.C.B. Segments "Brea." Will give 5/- Yellow, 2/- Red.—Pierson, 14, Dorchester Grove, London, W.4.

Sale. "M.M.'s" 1929–1934. Complete. 7/6.—Hide, "Spreakley Hollow," Parkstone, Dorset.

1,300 Different Stamps; Album, 15/- or offers.—Birkett, 40, Station Road, Wigston.

Wanted. Three eight-wheeled Bogie Wagons. Gauge O. Any make.—Woodlands, 89, District Road, Wembley, Middx.

72 "M.M.'s," Aug. 1923–Oct. 1934. Offers? List on application.—Miles, 21, Cadogan Road, Surbiton.

Wanted. Single Seater Collapsible Canvas Canoe.—J. Davies, 10, Park Lane, Roundhay, Leeds.

Sale. Pathé Kid, almost new, with unused super attachment. £2/15/- or nearest offer.—Ashley, 48, Dunster Road, West Bridgford, Notts.

Sale. 32 "M.M.'s," February 1930–December 1933. Best offers.—Kearney, Copsgrove, Leamington.

"M.M.'s," Oct. 1929–March 1934. Splendid condition. What offers?—Edwards, Newlands, Riverhead, Kent.

1,000 Stamps, Simplex Typewriter, Model Railway Station, Wireless Journals. Details on request.—Box 1101.

Rabbit Gun for Sale. Bore .41, breaks into two pieces, £1.—J. Young, 13, Wolseley St., Dundee.

Electric Model Railway, almost new, cost £8. Price £5 or offer. Write for list.—Dent, 36, Plough Lane, Purley, Surrey.

Wonderful opportunity for ambitious lad! Complete Amateur Printing Plant for sale. Two Presses, Large Stock Type and Accessories. Snip for £10, or highest offer.—Booker, 34, Springfield Road, Harrow.

Sale. 1,360 Cigarette Cards, including 14 Sets in Albums. "Meccano Magazines" for 1930-1931. Good condition. What offers?—P. Hammond, 88, London Road, Wokingham.

"Meccano Magazines," 1930, 1931, 1932, good condition, offers.—Cooper, 229, Norwich Road, Ipswich.

Cassells "Railways of the World," 3 vols. Cost 37/6, take 17/6. New condition, or exchange with cash good 9.5 mm. Projector, extra resistance.—Wilkinson, Hayle.

For Sale. Bassett-Lowke L.M.S. Compound Clockwork Loco and Tender. Good Condition. What Offers.—S. R. Allen, Good Shepherd Vicarage, 172, Dyke Road, Brighton.

PHILATELIC CORRESPONDENTS WANTED

Wanted. Australian resident stamp-collector to correspond with. Also Australian unsorted stamps.—Mullett, Salisbury Road, Bexley, Kent, England.

Wanted. Philatelic correspondent in the U.S.A.—Pyatt, 53, Lambton Road, London, N.19.

Burglar and Fire Alarms—(*Cont. from page 887*)

the Terminal on it with the Contact Pillar. On completing the wiring to the Bichromate Cell and the Elektron Electric Bell, as shown in the illustration, it will be seen that there is a complete circuit except for a short gap between the Rod and the Bell Contact Pillar.

Experimenters who have no Meccano parts can use a large knitting needle instead of the Meccano Rod, supporting it in a wooden framework with one end fixed. The Bell Contact Pillar can be fitted on the framework, and if necessary a large nail can be substituted for it. The nail and the knitting needle then are connected directly to the rest of the circuit. This arrangement is rougher than that already described, but with a little care can be made equally effective.

All is now ready for the experiment. The Rod is heated by means of the flame of a match and the bell rings after a short interval. If this does not happen the size of the gap should be reduced by means of the screw of the Contact Pillar.

The explanation of the ringing of the bell is of course that the heat of the flame causes the Rod to expand, and as it is firmly fixed at the end on the Flanged Plate, it can only become longer by extending towards the Contact Pillar. The electrical circuit is complete as soon as it has expanded sufficiently to make contact and the bell then rings.

The time required to complete the circuit depends on the size of the gap and on the rate at which the rod is heated, and it is interesting to make experiments in which the gap is varied and a spirit lamp or bunsen burner is substituted for the match. An arrangement of this kind could be used as a fire alarm.

This Month's Special Articles

MECCANO MAGAZINE

Registered at G.P.O., London, for transmission by Canadian Magazine Post.

EDITORIAL AND ADVERTISING OFFICE:—
LIVERPOOL 13, ENGLAND.

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.

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.

Advertisers are asked to note that private advertisements of goods manufactured by Meccano Limited cannot be accepted.

Small Advertisements. 1/6 per line (average seven words to the line), or 16/- per inch (average 12 lines to the inch). Cash with order.

Display. Quotations for space bookings, and latest net sale 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 6th 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 one inch 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.

Planets and Atmospheres—(*Cont. from page 863*)

of which is subject to great uncertainty, is about one-tenth that of the Earth. Receiving very little heat from the Sun, and plunged in the cold of space, this unexpected dwarf of the solar system is distinctly an object for sympathy. Unlike the giant planets that are its nearest neighbours, Pluto is too small to have reserves in its own mass upon which to rely, and it has probably lost any atmosphere it may once have had, although some remnants of nearly inert gas may still cling about it.

It is clear from this outline of some of the conclusions regarding physical conditions on the planets that only two of them, Venus and Mars, can by any stretch of the imagination be regarded as possible abodes of life. Of these Venus must, so far as we can judge, remain largely a subject for speculation. We cannot see its surface or analyse its lower atmosphere, and although the absence of oxygen in its upper atmosphere and the apparently long period of rotation are unfavourable factors, it is impossible to state definitely that life may not have developed upon it.

With Mars the case against the existence of life appears much stronger. The surface of the planet can be studied directly and the atmosphere examined throughout its entire depth. It appears like a dying world, with little or no oxygen and little water, subjected daily to great extremes of temperature as the Sun rises and sets upon its surface.

Modern theories of the origin of the system of the planets indicate that the probability of the development of such systems among the myriads of stars is very much lower than we used to believe, and that they may be relatively few in number. Similarly, as our knowledge of the planets increases, we may be led to the conclusion that quite possibly the Earth is the only planet that can at the present time support life, and so that in the universe as a whole life is a much rarer and more precious thing than we once realised.

We are indebted to the courtesy of the Carnegie Institution of Washington for the information in these articles.

MECCANO

DINKY TOYS

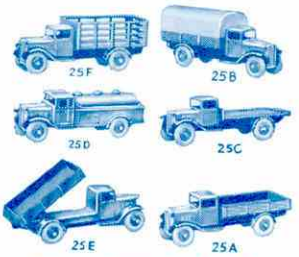
REALISTIC—STRONG—ATTRACTIVE

Meccano Dinky Toys No. 28/1

DELIVERY VANS

No. 28c	Manchester Guardian Van ...	each	6d.
No. 28f	Palethorpe's Sausage Van ...	,,	6d.
No. 28a	Hornby Train Van	,,	6d.
No. 28b	Pickford's Removals Van ...	,,	6d.
No. 28d	Oxo Van	,,	6d.
No. 28e	Ensign Cameras' Van ...	,,	6d.

Price of complete set 3/–



Meccano Dinky Toys No. 25

COMMERCIAL MOTOR VEHICLES

Fitted with rubber tyres and silver plated radiators.

No. 25a	Wagon	each	9d.
No. 25b	Covered Van	,,	9d.
No. 25c	Flat Truck	,,	9d.
No. 25d	Petrol Tank Wagon	,,	9d.
No. 25e	Tipping Wagon	,,	9d.
No. 25f	Market Gardener's Van ...	,,	9d.

Price of complete set 4/6

Meccano Dinky Toys No. 23

RACING CAR

Assorted Colours. Fitted with rubber tyres.
Price 6d. each

Meccano Dinky Toys No. 13

HALL'S DISTEMPER ADVERTISEMENT

This miniature of a well-known line-side advertisement is intended to be placed in the fields adjoining the railway track. Price 9d.

Meccano Dinky Toys No. 3

PASSENGERS

No. 3a	Woman and Child	each	3d.
No. 3b	Business Man	,,	3d.
No. 3c	Male Hiker	,,	3d.
No. 3d	Female Hiker	,,	3d.
No. 3e	Newsboy	,,	3d.
No. 3f	Woman...	,,	3d.

Price of complete set 1/6

Meccano Dinky Toys No. 52

CUNARD-WHITE STAR LINER "QUEEN MARY"

A scale model of the world's largest ocean liner Price 1/– each

Meccano Dinky Toys No. 22

MOTOR VEHICLES

No. 22a	Sports Car	each 6d.	No. 22d	Delivery Van	each 6d.
No. 22b	Sports Coupé	,, 6d.	No. 22e	Tractor ...	,, 9d.
No. 22c	Motor Truck	,, 6d.	No. 22f	Tank ...	,, 1/–

Price of complete set 3/9

Meccano Dinky Toys are the most realistic and the most attractive models in miniature ever produced.

One of the most important additions recently made is the scale model of the Cunard-White Star Liner "Queen Mary" (Meccano Dinky Toys No. 52, illustrated above). This is a magnificent model of the world's largest liner.

Many of these toys are ideal for giving the finishing touch to your model railways. You must have railwaymen to deal with your trains, and passengers to travel in them; car attendants to look after the passengers, and engineers for the maintenance of the railway and its equipment.

Then there are the miniature train sets, rail car and various other types of motor vehicle. You can have hours of fun running these on the table or on the floor.

These splendid toys can all be purchased separately at the prices shown, or they can be obtained in complete sets. Ask your dealer to show you the complete range of Meccano Dinky Toys.

Meccano Dinky Toys No. 19

MIXED GOODS TRAIN SET

No. 21a	Tank Locomotive	each	9d.
No. 21b	Wagon	,,	4d.
No. 21d	Petrol Tank Wagon	,,	6d.
No. 21e	Lumber Wagon	,,	5d.

Price of complete set 1/11

Meccano Dinky Toys No. 20

PASSENGER TRAIN SET

No. 21a	Tank Locomotive	each	9d.
No. 20a	Coaches	,,	7d.
No. 20b	Guard's Van	,,	7d.

Price of complete set 2/6

Meccano Dinky Toys No. 18

GOODS TRAIN SET

No. 21a	Tank Locomotive	each	9d.
No. 21b	Wagons	,,	4d.

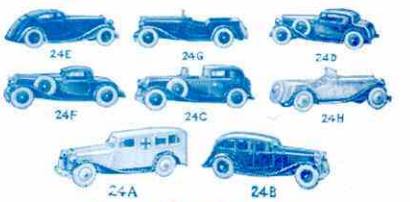
Price of complete set 1/9

Meccano Dinky Toys No. 28/2

DELIVERY VANS

No. 28g	Kodak Cameras' Van ...	each	6d.
No. 28h	Sharp's Van	,,	6d.
No. 28 l	Crawford's Biscuit Van ...	,,	6d.
No. 28m	Wakefield's Oil Van ...	,,	6d.
No. 28k	Marsh and Baxter's Van ...	,,	6d.
No. 22d	Meccano Van	,,	6d.

Price of complete set 3/–



Meccano Dinky Toys No. 24

MOTOR CARS

Fitted with rubber tyres and silver plated radiators.

No. 24a	Ambulance	each	9d.
No. 24b	Limousine	,,	9d.
No. 24c	Town Sedan	,,	1/–
No. 24d	Vogue Saloon...	,,	9d.
No. 24e	Super Streamline Saloon ...	,,	9d.
No. 24f	Sportsman's Coupé	,,	9d.
No. 24g	Sports Tourer (4 seater) ...	,,	1/–
No. 24h	Sports Tourer (2 seater) ...	,,	1/–

Price of complete set 6/6

Meccano Dinky Toys No. 2

FARMYARD ANIMALS

No. 2a	Horse each 3½d.	No. 2c	Pig each 2d.
No. 2b	Cow ,, 3½d.	No. 2d	Sheep ,, 2d.

Price of complete set 1/6

Meccano Dinky Toys No. 26

G.W.R. RAIL CAR

Assorted Colours ... ... Price 6d. each

Meccano Dinky Toys No. 5

TRAIN AND HOTEL STAFF

No. 5a	Pullman Car Conductor ...	each	3d.
No. 5b	Pullman Car Waiters ...	,,	3d.
No. 5c	Hotel Porters	,,	3d.

Price of complete set 1/3

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Boys! Hornby Trains are Real Trains

The illustration above shows Hornby No. 2 Special Train Set, hauled by a Hornby No. 2 Special Locomotive. This Locomotive is a true-to-type model of the real L.M.S.R. Standard Compound Locomotive shown in the illustration below.

A Perfect Miniature Railway

Hornby Electric and Clockwork Trains are such great favourites with boys because they enable almost every operation in real railway practice to be carried out accurately and efficiently.

Hornby Locomotives are 100 per cent. efficient. No others run so smoothly. No others pull such heavy loads.

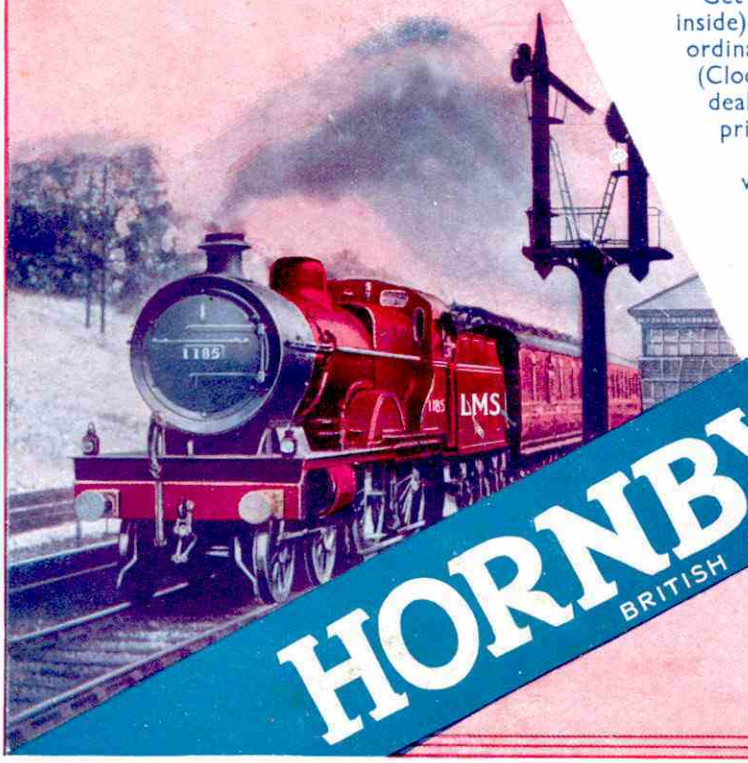
Hornby Rolling Stock is smooth-running and is fitted with automatic couplings. The range includes almost every type seen on the big railways.

Hornby Accessories are realistic and in correct proportion. They provide everything a boy could wish for to make his railway a complete representation of the real thing.

Get a copy of the Hornby Book of Trains (see page 906 inside) and make your choice now. If you prefer to have ordinary price lists you may obtain copies of Folder No. 6 (Clockwork) and Folder No. 7 (Electric) from your dealer, free of charge, or direct from Meccano Limited, price 1d. each, post free. Write to Department A.M.

This must be a Hornby Christmas for every boy who is keen on model trains!

Prices of Hornby Electric Train Sets from 15/- to 75/-
Prices of Hornby Clockwork Train Sets from 4/11 to 65/-



HORNBY TRAINS

BRITISH AND GUARANTEED

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Binns Road
LIVERPOOL
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