VOL. XVIII. No. 2

FEBRUARY 1933

MECCANO MAGAZINE

WHEN IRON FLOWS LIKE WATER

(see page 90)

6D.

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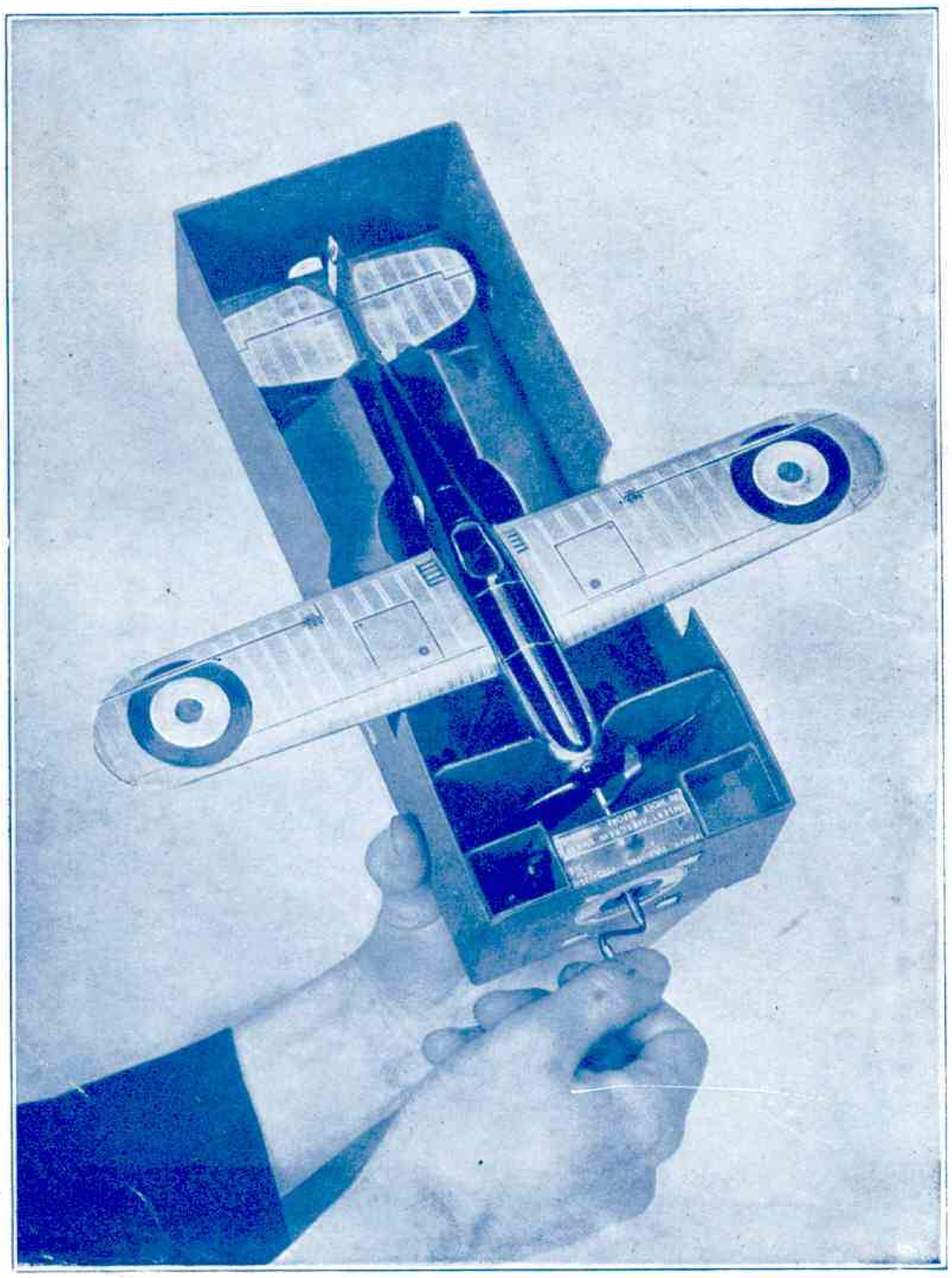

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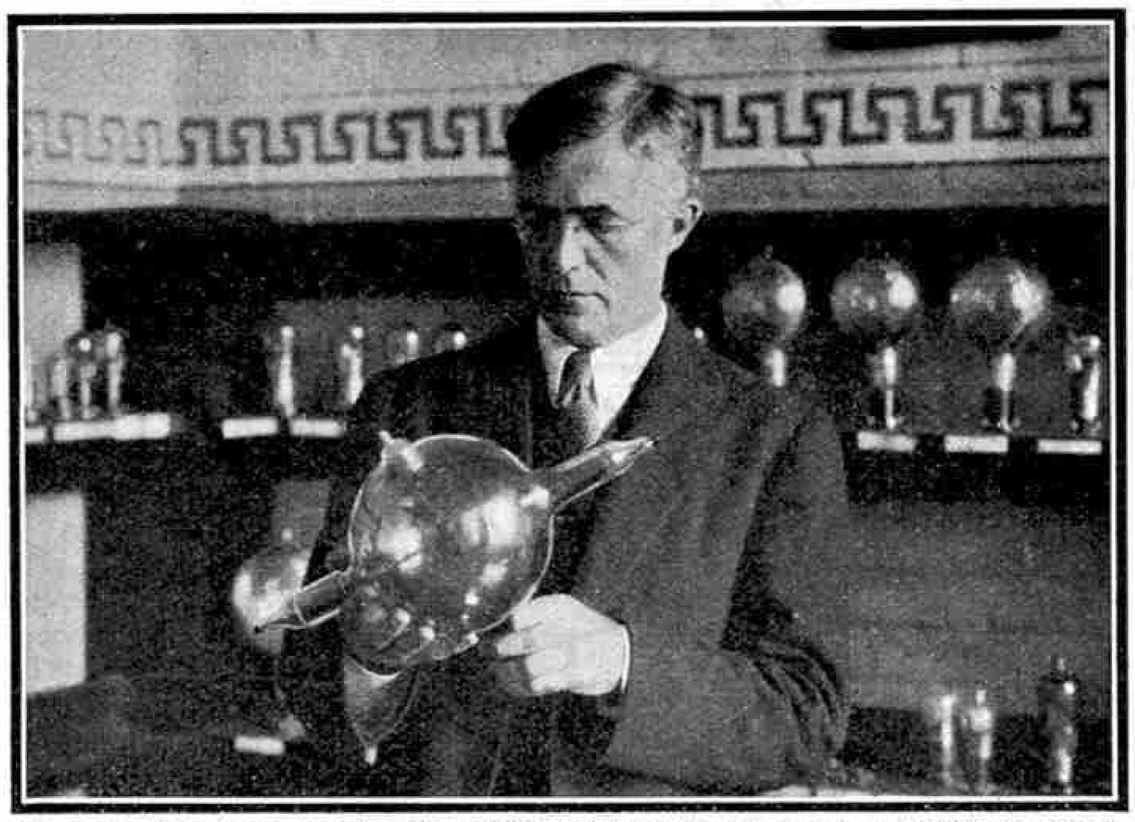
With the Editor

The Man who Halved the World's Electric Light Bill!

The Nobel Prize in chemistry, one of the greatest honours that can be gained by a chemist, was awarded last year to an American who can claim the distinction of having halved the world's electric light bill! The author of this tremendous achievement is Dr. Irving Langmuir, an Associate Director of the Research Laboratory of the General Electric Company of New York.

For many years after the invention of the electric lamp the aim of manufacturers was to create a vacuum within the glass bulb, the air being pumped out in order to prevent the glowing filament from burning away. Dr. Langmuir found that the presence of a small quantity of nitrogen or of argon, inert gases in which the filaments of electric lamps do not burn, actually reduced the consumption of current without diminishing the amount of light radiated. This discovery has had an enormous effect on the cost of the world's electric lighting. It is difficult to calculate the extent of the saving with any approach to accuracy, but it is estimated that in the United States alone the saving amounts to nearly £250,000 per night! The introduction of the gas-filled lamp provides a splendid illustration of the manner in which a laboratory experiment may change the whole course of a great industry.



Dr. Irving Langmuir, to whom the 1932 Nobel Prize for chemistry has been awarded. In our photograph, for which we are indebted to the General Electric Company of New York, Dr. Langmuir is holding a "pliotron," one of the many types of vacuum tube he has developed for radio and other electrical work.

Dr. Langmuir's experiments with vacuum tubes containing small amounts of inert gases have played a part also in the development of broadcasting and wireless communication generally, by leading to improvements in valves. In other directions his experiments may prove to be the starting points of great developments. For instance, he has produced an electric arc for use in welding metals that formerly could not be joined because, at the high temperature necessary for welding them, they combine with the oxygen of the atmosphere. Dr. Langmuir found that these metals could be protected by blowing a stream of hydrogen through the arc and directing this on to the work to be welded, in order to exclude oxygen. The introduction of hydrogen also raises the temperature.

More recently Dr. Langmuir has devoted his attention to the manner in which thin filaments of gas or liquid—some of them only an atom deep and invisible in the most powerful microscope—spread themselves over a surface. These experiments ultimately will help engineers to make better use of oil for lubrication.

The Nobel Prizes are provided from the immense fortune left by Alfred Nobel, the famous Swedish inventor and manufacturer of explosives. The awards are made annually to those, irrespective of nationality, who are judged to have made the greatest advances in various scientific and other activities. A gratifying proportion of them have been won by representatives of the British Empire, and the list for last year includes the names of two British scientists, Sir Charles Sherrington and Professor E. D. Adrian, who were jointly awarded the prize for physiology.

Shrove-tide Customs

One of the most curious and interesting annual festivals is Shrove Tuesday, which falls this year on the 28th of this month. In common with many other festivals, Shrove Tuesday was originally religious in character, and the word "shrove" is actually derived from an old Anglo-Saxon term meaning confession. Thus it is a reminder of the fact that on this day, the last before the beginning of Lent, the people in every parish throughout the kingdom were required to confess their sins. A bell was rung early in the morning to summon them to church, and although the religious origin of the holiday was later forgotten, the custom of ringing the bell long continued in many places.

At the present time Shrove Tuesday is usually associated with pancakes, and is generally known as Pancake Tuesday. Pancakes played a great part in the revelry that in former times followed confession. The fun and laughter caused by "tossing the pancakes," in order to prevent them from burning, appears to have extended beyond the kitchen, and we can see traces of ancient ceremonies in the custom still observed in Westminster School of throwing a large pancake over the bar that divides the upper from the lower school. Boys scramble for the pancake hurled into the air, the victor being the one who emerges from the struggle with the largest piece! Similar customs were formerly followed at Eton and in other public schools.

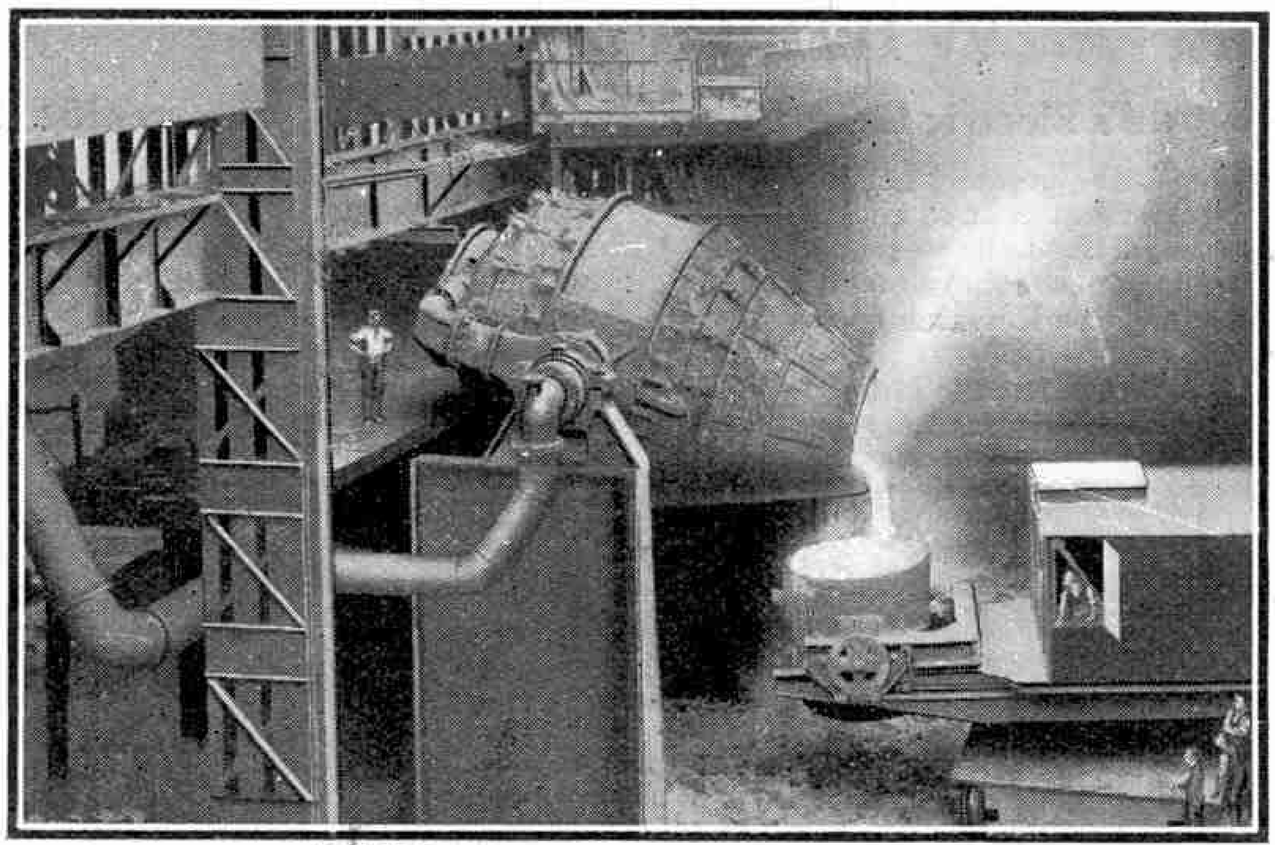
According to an old author, men formerly "ate and drank, and abandoned themselves to every kind of sportive foolery" on Shrove Tuesday. The feasting and revelry included tournaments and other combats. Men and boys dressed themselves in skins to resemble bears and wolves and roaring lions, or indulged in processions and games that occasionally degenerated into brawls and riots. These old customs have now been abandoned, but in a few places Shrovetide football is still played. This game is quite different from modern Rugby or Association football, for it is played in the streets, and those who live near the scene of the combat take the precaution to board up their doors and windows in order to prevent damage. There seems to be no limit to the number of players, and the goals are natural marks in the towns or villages in which the game is played, the ball being kicked or carried down byways and even along the beds of streams.

In Scotland "crowdie" formerly was a neverfailing dish at Shrovetide, as pancakes are in England. This was a sort of porridge, made by stirring oatmeal into a basin of hot water, and eaten with new milk. It was a favourite dish with George Stephenson, the railway pioneer. When he was living in retirement at Tapton House, near Chesterfield, he would often say, when among intimate friends, "Let's have a crowdie night." The necessary materials were immediately ordered in, and Stephenson set to work energetically to prepare the mixture.

The Making of Iron and Steel

A Romance of Molten Metal

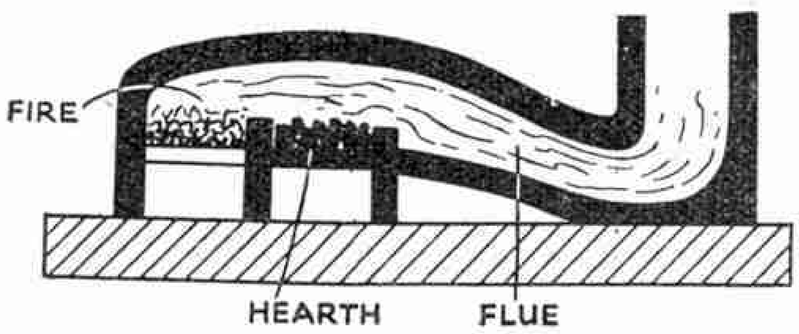
THE story of iron and steel dates back to the prehistoric period known as the Bronze Age, during which bronze, a metal composed of copper and tin, began to be employed and gradually came into general use. Bronze made possible a great advance on the stone and flint implements of the Stone Age, for it could be fashioned into a much greater variety of weapons and tools, to which a considerable degree of hardness could be given. Finally came the Iron Age, with the discovery of the art of smelting and working iron, and later of converting iron into steel. The reason why iron, although one of the most widely diffused metals, was so late in coming into general use is that it is never found in a pure state except in meteorites. Considerable skill is required to recognise the ore and then to separate the metal from the materials combined with it. The art of smelting and working iron came from the East, and it is probable that the metal was discovered by the accidental heating of a mass of ore in a fire.



Bessemer Converter pouring its molten contents into a giant ladle.

We know little about the early history of iron in Britain, but it is fairly certain that the metal was known to the natives at the time of the Roman invasion. The Romans quickly began to smelt iron on a large scale, and workings that have been discovered in several districts, such as North Yorkshire and Northamptonshire, show that these people were acquainted with certain beds of ore, of which we knew nothing until some 90 years ago. The chief iron mines worked by the Romans were in the southern counties and on the borders of Wales, and there were forges in the Forest of Dean and in South Wales, from which the metal was sent to Bristol to be made into weapons.

To trace even briefly the early history of iron in England would require many pages of the "*M.M.*," and therefore we will pass on at once to the 14th and 15th centuries. During this period the supply of English iron was not only insufficient to meet the demand, but in addition the metal was dearer and of poorer quality. As a result the English market was mainly supplied with iron from Spain and Germany. Later a revival in iron manufacture took place in Sussex, where there were large quantities of iron-stone and also an abundance of wood for smelting. This revival reached its height in Queen Elizabeth's reign when production reached such a stage that England began to export iron in the form of cannon. A startling result of this was that the Spanish ships were found to be fighting us with guns of our own manufacture. As a result of this discovery the export of iron ordnance was prohibited, although large-scale smuggling of Sussex guns to Spain continued for a long period.



Sectional diagram of a Reverberatory Furnace.

Presently people began to realise that the Sussex ironmasters were rapidly using up all the trees of the great forests, and as wood was used almost exclusively as fuel it was feared that London would be faced with a serious shortage. In 1581 an Act was passed prohibiting the conversion of wood into charcoal for the making of iron within 14 miles of the Thames. At a later period further restrictions were imposed on the use of timber, with the result that the iron industry was almost destroyed.

In 1620 Dud Dudley, son of Lord Dudley of Dudley Castle in Worcestershire, took out a patent for the smelting of iron with coal. His method was successful, but the great iron smelters, envious of the results he obtained, spread reports about the poor quality of his iron and finally forced him to abandon his efforts. After a while, however, the growing demand for iron and the decreasing supply of timber for smelting forced the ironmasters to turn to coal. Abraham Darby of Coalbrookdale in Shropshire was the first to make a financial success of smelting by coal, and he made a large fortune by casting iron pots for cooking. It is interesting to note that the first iron bridge ever erected was made at Coalbrookdale Works by a grandson of the founder. The success of Abraham Darby and of others who followed his example convinced even the most conservative ironmasters that the days of smelting by timber were over.

In the early days of iron manufacture the ore and the fuel were simply placed together in a rough furnace, sufficient heat was applied to melt the iron out of the ore, and the metal collected at the bottom of the furnace. Gradually the process was improved, notably by the use of a forced draught and the employment of certain materials, such as limestone, as "fluxes," to unite with impurities in the ore. To-day all ore is smelted in what is known as a blast furnace.

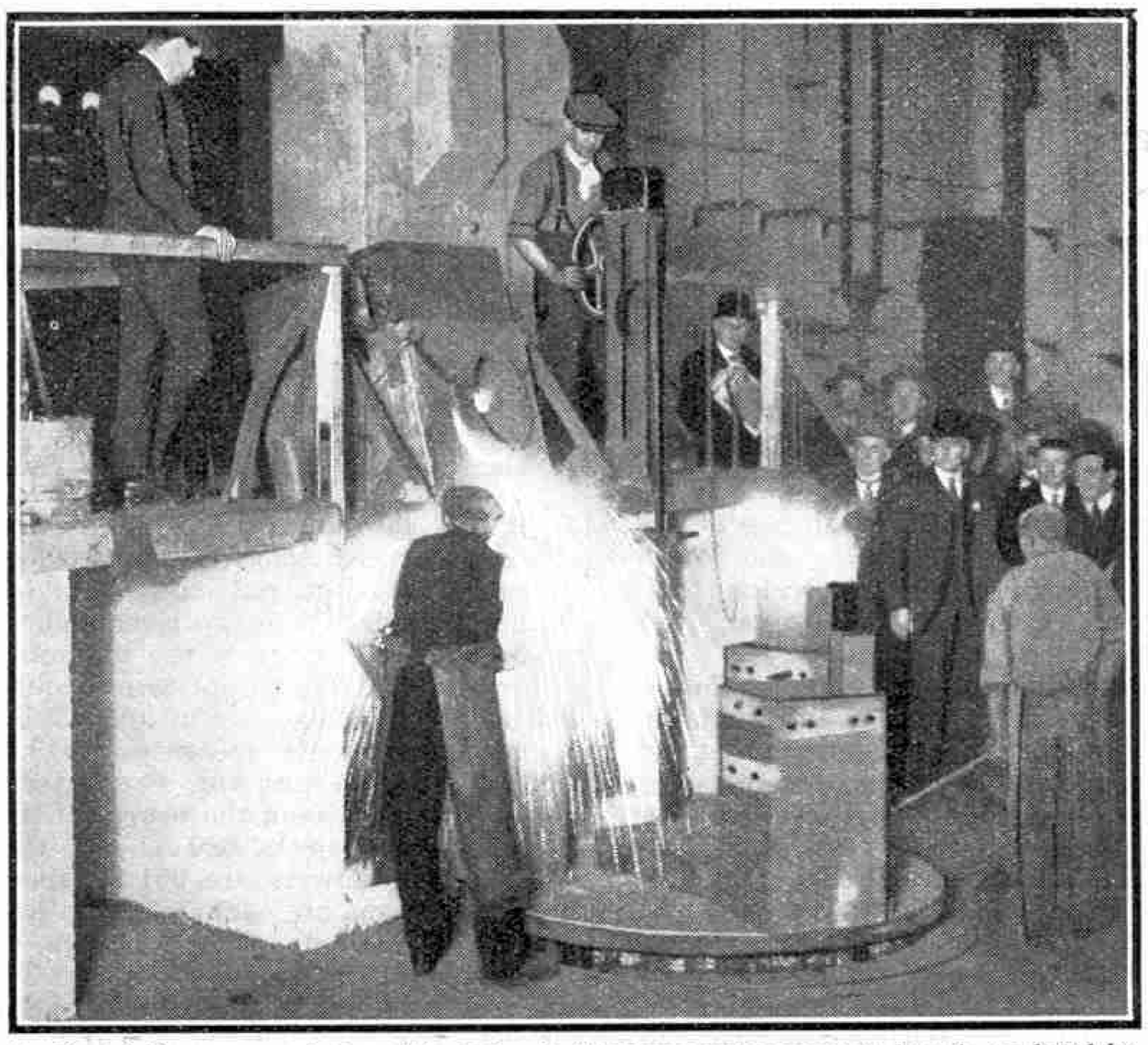
A blast furnace consists of a circular shaft in the form of two cones joined together. The lower cone, which extends about one-third the height of the furnace, is inverted and forms the "hearth." The blast pipe runs round this hearth, and nozzles named "tuyères" (pronounced twyers) pass through the walls of the hearth and provide the means by which the blast is conveyed to the interior of the furnace. The tuyères have to withstand a terrific heat, and to prevent them from melting they are surrounded by pipes through which cold water constantly circulates. Lower down the hearth are two openings, on opposite sides of the furnace, through which the slag and the molten iron respectively are drawn off. The upper cone, which forms the greater part of the furnace shaft, is upright and is closed at the top by a conical stopper known as the "bell." This stopper may be lowered to allow a charge of iron ore, limestone, or coke fuel, to be shot into the furnace. Just below the stopper there are openings in the sides of the shaft to let off the hot gases produced.

The earliest blast furnaces were open at the top and were very conspicuous objects at night with their flames flaring out and illuminating the surrounding country. After a while, however, it came to be realised that the gases escaping from the open top could be turned to good use, and about 1836 the closed top furnace came into general use. The greater part of the gases produced in a modern furnace are utilised for heating the blast, and the remainder is burned to raise steam for steam engines, or after purification used in gas engines.

The process that takes place in a blast furnace may be roughly described as getting rid of unwanted materials. Some of these are drawn off in the form of gases, as already mentioned; others mix with the limestone to form a substance known as "slag." The iron and the slag fall to the bottom of the furnace, and as the iron is the heavier it drops to the lowest level. The slag rests on the iron, mixing with it only to a very small extent, and each is drawn off through a separate opening.

The slag is taken from the furnace in a sort of huge ladle resting on a truck, and is carried to a convenient place and there tipped out. The molten iron may be run into special vessels to undergo further treatment, or it may be run into a "pig bed," a large bed of sand sloping gently away from the furnace, and in which a series of regular depressions act as moulds for the iron. If the pig iron obtained from this bed is not intended for steel-making it is used according to its quality either for making castings, or for the production of "wrought" or "malleable" iron. The higher qualities of the iron are used for making castings in the foundry. The pigs are broken to pieces and re-melted in a furnace known as a "cupola," which is really a small blast furnace, and the molten iron is then run off into the required moulds. The best castings are made from mixtures of different qualities of iron, the choice of mixture being determined by the purpose for which the casting is intended.

Wrought or malleable iron is made from the lower qualities of pig iron by a process known as "puddling." This is carried out in a "reverberatory" furnace, in which the iron and the fuel are not mixed together, but kept separate by a low wall. The flames on their way to the flue give up most of their heat to the roof of the furnace, and on account of the curved shape of this roof the heat is reverberated or reflected back on to the metal below. The floor of the hearth in which the iron is placed consists of an iron plate covered with "fettling," which is a substance such as hematite ore containing oxide of iron. Some scrap iron is put in, and the hearth is heated to a high temperature when pig iron, broken into small pieces, is introduced. When the charge has melted, the impurities in the pig iron unite with the oxygen in the fettling, slag is produced, and the iron boils vigorously. A long iron bar or "rabble" is inserted through a hole in the wall of the furnace, and the metal is thoroughly stirred in order that its impurities may be eliminated more easily. Finally the iron stiffens, and the puddler rolls it with his rabble into ball-like masses that are then removed. The iron is immediately hammered under a powerful steam hammer, during which process the slag mixed with it is expelled. Finally the iron is rolled into bars.



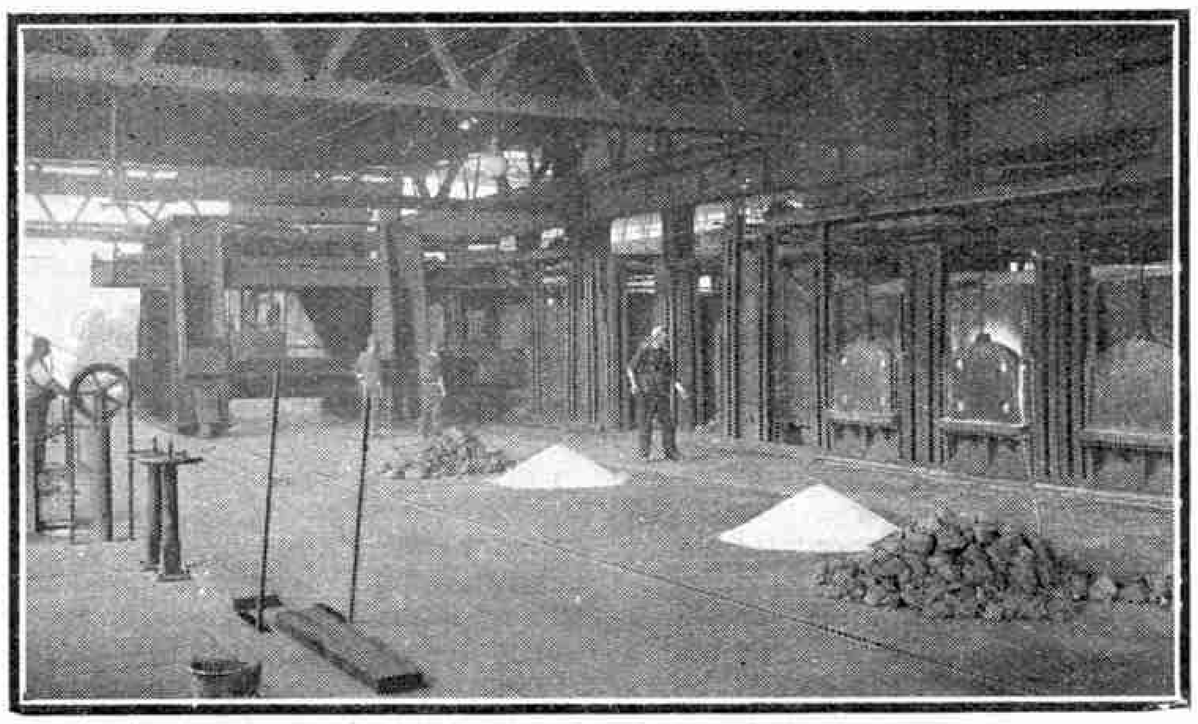
An Electric Furnace pouring crucible steel. In this Furnace the necessary heat is produced by high-frequency current.

We come now to the conversion of iron into steel. The earliest successful method was the Bessemer process introduced by Henry, afterwards Sir Henry, Bessemer in 1856. This is carried out in what is known as a "converter," which is a large vessel suspended on trunnions so that it may be swung into either a horizontal or vertical position, the swinging being controlled by hydraulic mechanism. The converter has an outer casing of malleable iron plates and an inner lining of ganister, a compact and hard variety of sandstone; or of dolomite, a mineral consisting of the carbonates of calcium and magnesium. Converters lined with ganister are limited to iron ore containing very little phosphorus; those lined with dolomite are able to deal effectively with the high-phosphorus ores that make up the greater part of the world's total ore supplies.

At the bottom of the convertor several tuyères carry the air-blast through the lining into the interior and act in a similar manner to those in a blast furnace, but in this case the blast is driven through at a much higher pressure, about 25 lb. per sq. in. The pig iron is first melted in a cupola furnace or is brought in a molten state direct from a large blast furnace; and is then poured into the convertor while this lies in a horizontal position. The blast is then turned on and the converter is swung into a vertical position that brings the metal over the tuyères, and the air-blast passes through the whole mass of metal with a loud roaring sound.

From the neck of the convertor there immediately issues a fierce flame that rapidly grows brighter and brighter until it becomes dazzling; and showers of sparks stream out, accompanied by fragments of molten slag. Presently the flame begins to drop and becomes quieter, and this indicates that the last of the carbon is burned away and that no flame-producing substance is left. The whole process is closely watched by an expert workman whose long experience enables him to tell from the various colours of the flame how matters are going on inside the converter, and at exactly the right moment he signals for the converter to be sunk down on its side, and the blast shut off. The necessary amount of molten *spiegeleisen*, a form of pig iron containing known quantities of carbon and manganese, is then added, and the whole mass of molten metal is poured into a huge bucket or ladle.

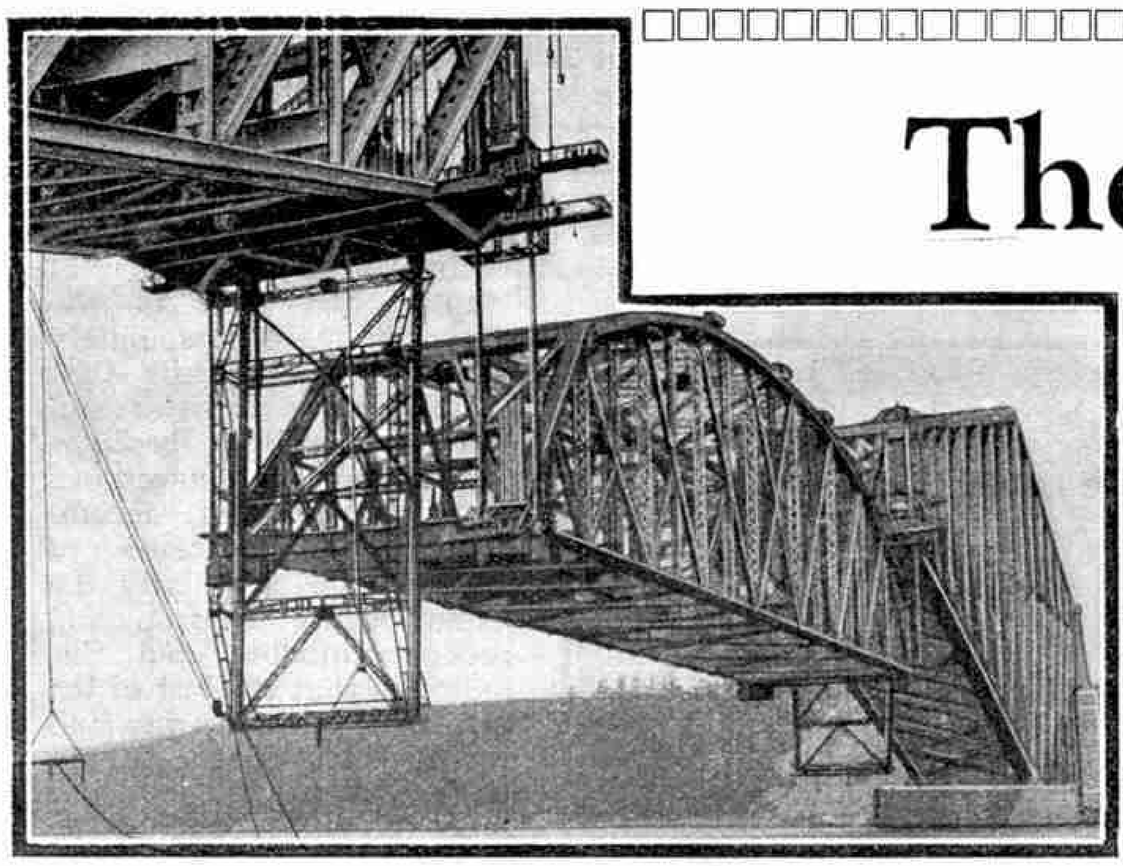
When the steel is to be used at once for making castings it is taken direct to the foundry, but otherwise it is run from the ladle into "ingot moulds." These moulds are made of cast iron, and are about 6 ft. high and 16 in. square at the top, broadening out gradually towards the bottom. They are open both top and bottom, and stand on an iron plate. The moulds are allowed to stand until the ingots, as their contents are called, have a solid shell outside, although they are still liquid inside; and the moulds are then lifted off by means of an overhead travelling crane. If the ingots are to be used immediately, each is lowered into a "soaking pit," a chamber large enough to hold an ingot easily and lined with firebrick and fitted with a lid. It is necessary to bring the ingot to a uniform temperature throughout to prevent it from being hard outside and soft inside, and in the soaking pit it gives off heat to the firebrick until the whole chamber and the ingot are at the same temperature. The ingot is then ready for the rolling mills.



A battery of Open Hearth Furnaces.

The introduction of the Bessemer process brought about a great change in the manufacture of steel. From that time the importance of malleable iron rapidly declined, and it was superseded for one purpose after another by Bessemer-made mild steel, which was of much better quality and was produced more quickly and in larger quantities than the product of the reverberatory furnace.

Huge quantities of steel are now produced by what is known as the open hearth process. This was invented in 1845 by J. M. Heath, who attempted to make steel by melting together wrought iron and pig iron. The method failed, however, because at that time it was not possible to produce sufficient heat. In 1865 a Frenchman named Martin brought out a similar but improved process, but this was not a commercial success until Sir William Siemens introduced his system of regenerative heating, by which the intense heat required for the (*Continued on page 168*)



The Story of the Quebec Bridge

1.—First Attempt ends in Disaster

THE Quebec Bridge is one of the three greatest examples of the cantilever type of bridge, the other two being the Forth Bridge in Scotland and the Blackwell's Island Bridge, New York. Of these three, the Quebec Bridge is the largest, and the story of its building is a thrilling one.

The dictionary defines the word "cantilever" as meaning a projecting bracket that supports some other object, and a simple cantilever bridge is one in which two shore arms support at their extremities a centre span. These shore arms project outward over the river in the form of huge overhanging brackets, and are known as cantilevers—hence the name given to this type of bridge. The name "cantilever" is derived from the French "cant," meaning angle, and "lever," to raise. The cantilever principle is a very old one, having been used hundreds of years ago in China, Japan and India. These early structures were, of course, very primitive, and the type developed very little until comparatively recent years.

An excellent description of the cantilever principle was given by Sir Benjamin Baker at the Royal Institution in the course of a lecture on the Forth Bridge. On this occasion the lecturer exhibited what he described as a living model of the Forth Bridge, arranged as follows :—

"Two men sitting on chairs extended their arms and supported the same by grasping sticks butting against the chairs. This represented the two double cantilevers. The central beam was represented by a short stick slung from the near hands of the two men, and the anchorages of the cantilevers by ropes extending from the other hands of the men to a couple of piles of bricks. When stresses were brought to bear on this system by a load on the central beam, the men's arms and the anchorage ropes came into tension, and the sticks and chair-legs into compression."

The great advantage of the cantilever system is that it permits the cantilever arms to be built out in pairs on each side of their towers in such a manner as to balance one another during construction, thus rendering external support unnecessary.

In the early cantilever bridges erected in Eastern countries the shore cantilevers consisted of a series of superimposed horizontal wooden beams, each successive beam projecting a little farther over the stream than the one immediately beneath it. When the gap between the two cantilevers had been reduced sufficiently by this means, it was bridged by a central beam, the ends of which rested upon the extremities of the uppermost beams of the cantilevers.

During the past 50 years the cantilever principle has been adopted for bridges constructed of metal and having spans of considerable width. The first true metal cantilever bridge was erected across the Niagara River close to the well-known suspension bridge. This cantilever bridge was opened for traffic in 1883. Two steel piers rising from the stone foundations carried cantilevers having an overall length of 395 ft., and these in turn supported a central or suspension girder 120 ft. in length. The main span, from centre to centre of the piers, was 495 ft.

Some two years later a cantilever metal bridge was constructed across the Fraser River to carry the Canadian Pacific Railway. In this case the clear span measured 315 ft. Subsequently the cantilever principle was adopted for bridges having more than one span, the additional cantilevers being built up on piers having their foundation in the river bed. The most striking example of this type of bridge is the magnificent structure that carries the London and North Eastern Railway across the Firth of Forth. The Forth Bridge has an overall length of 8,296 ft., of which the cantilever portion measures 5,349 ft. and includes three monster double cantilevers and two intervening suspended spans. The total span between the towers of the cantilevers is 1,710 ft. Each cantilever projects 680 ft. and the vertical columns composing their main towers are 361 ft. above high-water level. The suspended spans are each 350 ft. in length.

The Blackwell's Island Bridge, New York, is another striking example of the cantilever type. This bridge has a total length of 3,724 ft. and has four cantilevers built up from piers, one on each shore and the other two on the island in the river. The cantilevers are joined together without any intervening suspended spans, and in this respect the bridge differs notably from the Forth Bridge. The five spans of the Blackwell's Island Bridge are all of different lengths, the shortest being 459 ft. and the longest 1,182 ft.

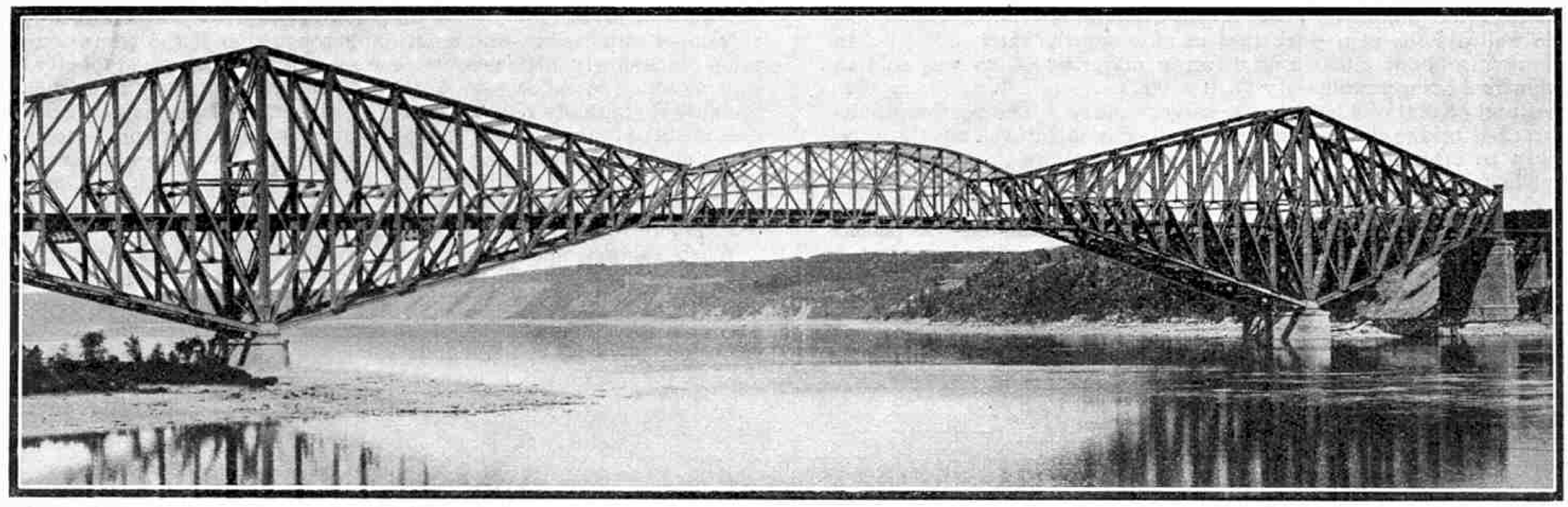
Principal Dimensions of the Quebec Bridge

Total length of bridge	3,240 ft.
Length of main span, i.e. from centre to centre of cantilever towers	1,800 ft.
Length of each anchor arm	515 ft.
Length of each cantilever span	580 ft.
Length of suspended span	640 ft.
Width of bridge from centre to centre of cantilevers	88 ft.
Clear height of steelwork above high water	150 ft.
Depth of suspended span at centre	110 ft.
Depth of cantilevers at main pier	310 ft.
Depth of main piers below high water	101 ft.
Weight of steel in bridge	66,480 tons
Quantity of masonry	106,000 cu. yds.

All the foregoing bridges, even that across the Forth, are eclipsed by the Quebec Bridge. This bridge was built to enable the provinces eastward of the St. Lawrence River to be linked up with those to the west by means of a great trans-continental railroad. The charter authorising the construction of the bridge was obtained from the Dominion Parliament in 1882. The newly-completed Forth Bridge was regarded as affording positive proof of the superiority of the cantilever bridge, and it was natural, therefore, that the engineers called into consultation proposed that the St. Lawrence should be spanned by a structure of this type. At the place selected for building the bridge the river is nearly 2,000 ft. in width, 200 ft. in depth, and flows between banks 200 ft. in height.

No definite action was taken until 1887, in which year the Quebec Bridge and Railway Company was incorporated. A design for a cantilever bridge was accepted from a New York engineer who had spent some three years over the work. Tenders were invited and ultimately the contract was awarded in 1899 to the Phœnix Bridge Company. According to the contract the bridge was to cost £2,000,000. It was to have a total length of 3,239 ft., including two anchor arms each 500 ft. in length, two cantilever spans of 562 ft. each, and a central suspended span of 675 ft. Constructed to these dimensions the bridge would have had an overall span from centre to centre of the cantilever towers of 1,800 ft., thus exceeding the span of the Forth Bridge by 90 ft. It was to be provided with a single deck 150 ft. in width, and this was to accommodate a road, two pavements and two tramway and two railway tracks.

In due course work was commenced. Among the first tasks carried out were the clearing of the shores for the erection of the approach structures, and the preparations for building the two piers in the river. In 1902 the pier nearest the south shore of the river was completed, and then commenced the great work of building



A broadside view of the Quebec Bridge, which carries the trans-continental line of the Canadian National Railways across the St. Lawrence River. This illustration gives an excellent idea of the immense length of the cantilever arms.

up the south cantilever of the bridge. Month by month the mass of steelwork rose higher and higher, and gradually projected farther out over the river. By the summer of 1907 the south anchor arm and about one third of its cantilever span had been erected, the whole extending over the river for some 200 ft.

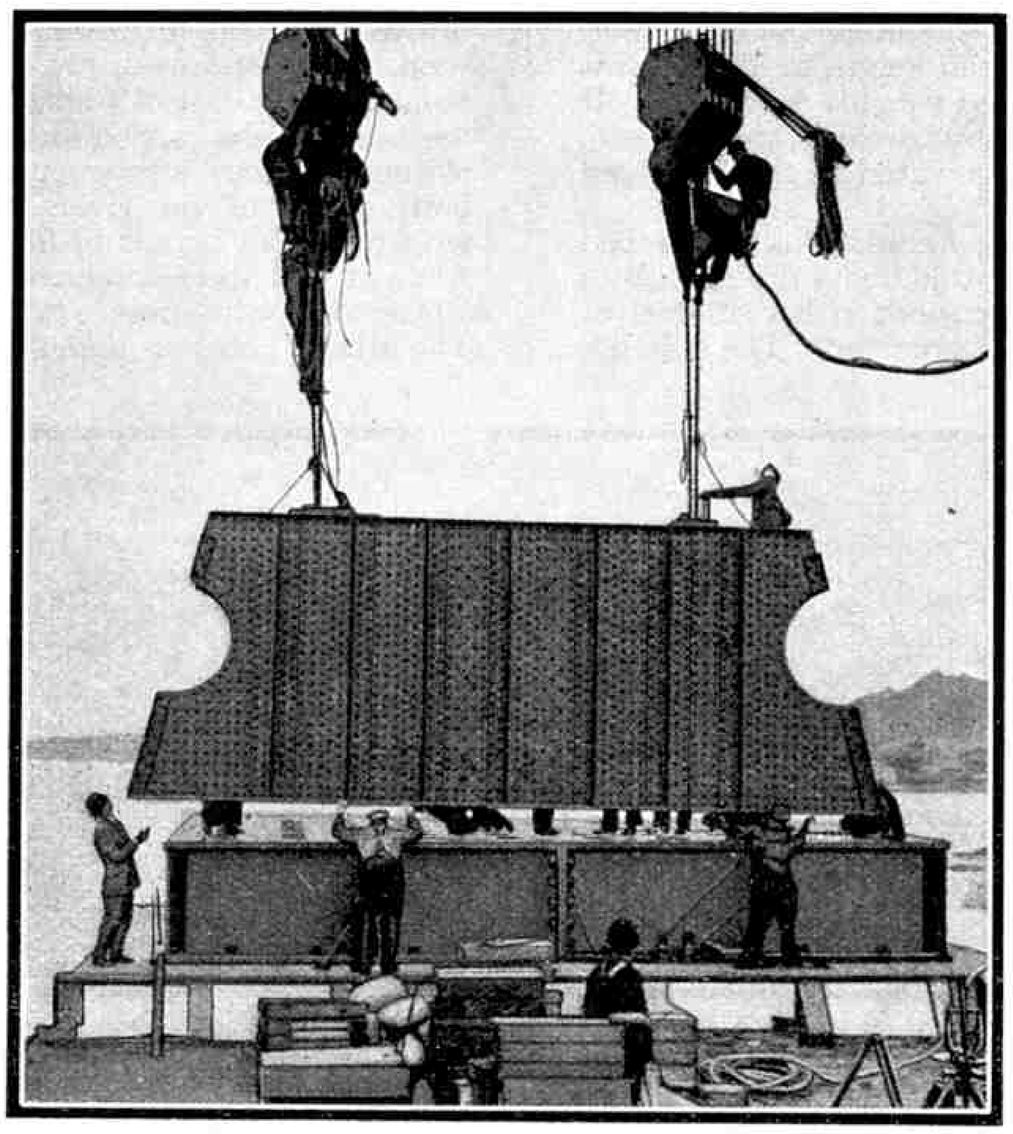
So far all had gone well, but one day an alarming incident occurred. It was noticed that the bottom or compression chords of the anchor arm were bending slightly under the tremendous strain imposed upon them. Word was sent hurriedly to the consulting engineer, no doubt in anticipation that he would order the immediate withdrawal of all workmen from the bridge until it had been minutely examined. For some unexplained reason no command to cease operations came through, however, and work went on as usual.

On 29th August 1907, came swift and terrible disaster. Shortly before work was due to cease for the day, the compression chords of the south anchor arm suddenly crumpled up. The entire cantilever rocked violently, and with a fearful crash collapsed upon its pier, carrying with it the 86 men who had been at work upon the erection at the time. It was obvious that a large number of these men must have perished, but immediate steps were taken to assist the survivors. In spite of all efforts, however, only 11 men were rescued. Of the 17,000 tons of steel contained in the structure, some 8,000 tons had fallen into the deep channel of the river, while the remainder lay astride the pier and along the bank—a gigantic mass of girders and plates 40 ft. in height, twisted and distorted almost beyond belief. Thus in a few minutes was undone the labour of three years.

This terrible catastrophe cast a gloom over the country and created utter consternation among bridge-building engineers. A searching inquiry into the cause of the disaster was instituted at once by the Government, and a Royal Commission was appointed to examine the wreckage. In due course the Commission submitted their report, in which they expressed the opinion that the accident had been due to errors in the design and building of the bridge, attributable mainly to lack of practical knowledge of how to plan and prepare for a structure on such a huge scale.

The need for improved means of communication across the St. Lawrence River still remained and was rapidly growing more acute. It was clear that, in spite of the disaster, the bridge must be built, and the Canadian Government took the matter in hand. The shareholders of the Phœnix Bridge Company were compensated for their financial loss, and the Minister of Railways and Canals appointed a Technical Board to design a new cantilever bridge. The plan ultimately put forward by the Board was on a less ambitious scale than that of the Phœnix Bridge Company. It was proposed to build a cantilever bridge 88 ft. in width and having a main central span of 1,758 ft. The reduction of roughly 50 ft. in the length of this span meant that one or both of the existing piers would have to be moved to a new position. The traffic facilities of the bridge also were reduced and consisted only of two railway tracks and two pavements.

Tenders were then invited from prominent engineering firms, and in order that the best possible design of a cantilever bridge might be secured, the Board allowed competing firms the option of tendering either for a bridge as proposed by the Board or for a structure to the firm's own design. This far-sighted policy met with general approval and no less than 35 tenders were submitted. Ultimately the Board selected a tender put forward by the St. Lawrence Bridge Company, an organisation specially formed for the occasion, and combining the interests and resources of the Canadian Bridge Company and the Dominion Bridge Company.



Workmen placing in position one of the ribs of the main shoe.

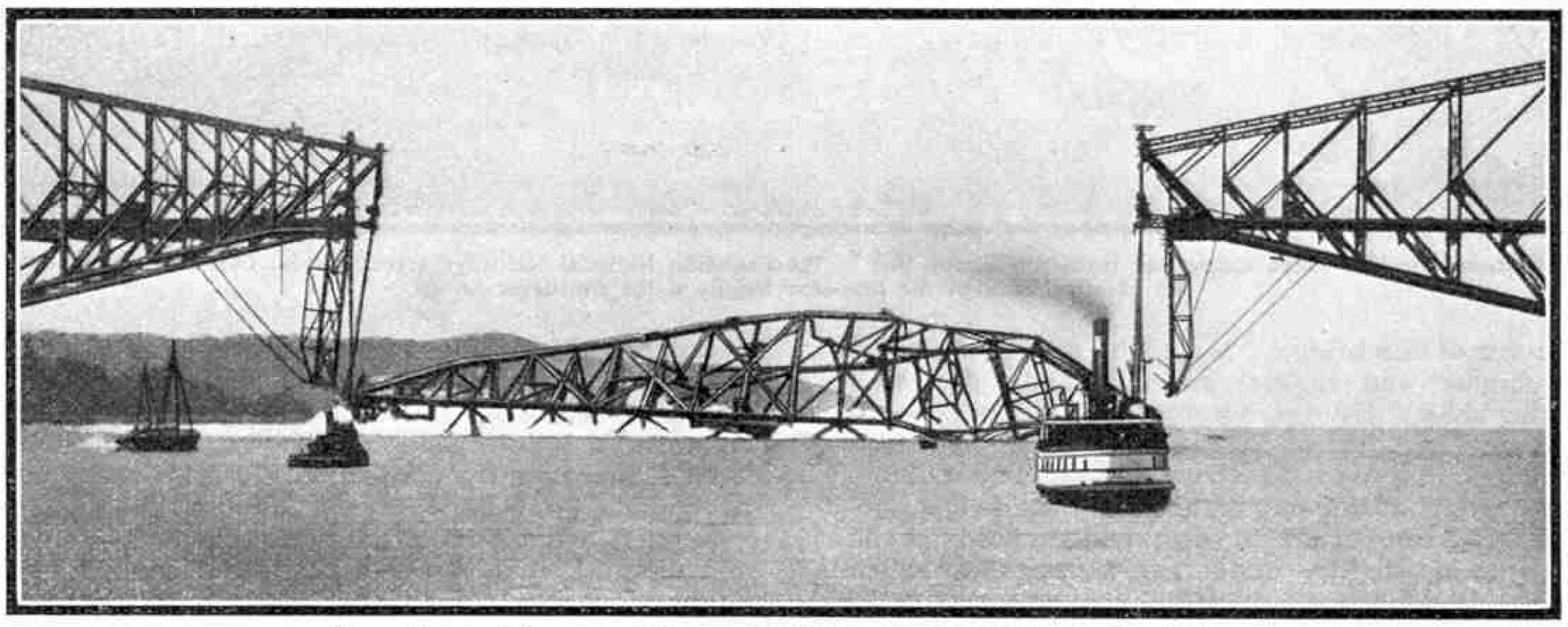
The design submitted by the St. Lawrence Bridge Company contained several features that aroused considerable interest among civil engineers. This was particularly the case in regard to the webs forming the steel bracing of the cantilevers and anchor arms, which were fashioned after the letter "K." Several advantages were claimed for this new system of girder bracing, one being that the various K trusses could be assembled without the necessity of first erecting falsework or temporary supporting members. The new idea was not adopted hastily, and it was not until the Board had considered carefully every orthodox system of girder bracing that they decided that the new method was fully as strong and reliable as any of the others, while it compared very favourably in regard to appearance.

The successful design was for a steel cantilever bridge estimated to cost £1,750,000. It was to have an overall length of 3,239 ft., comprising two approach spans 140 ft. and 269 ft. in length respectively, two anchor arms each 515 ft. in length, two cantilever arms each 580 ft. in length and a central span of 640 ft. The traffic limitations indicated in the Board's own plan were observed in the successful design, in which the side walks were shown as 5 ft. in width and the two railway tracks were placed 32½ ft. apart. One condition of the contract was that £259,000 in cash had to be deposited by the company with the Government as a guarantee of good faith, and this was accordingly done.

The task of salving as much as possible of the pile of tangled steel girders and plates that represented the former partly-built bridge was commenced by a salvage party of 25 men in December 1909. Charges of dynamite were used to break up the heavy masses of distorted steelwork lying astride the stone pier, and oxy-acetylene

torches were employed to cut up the material into portable sections. So well did the men work that in nine months they succeeded in removing about 5,000 tons of scrap material, which was sold in Montreal at approximately £2 10s. 0d. per ton. Of the sum thus realised £8,000 was paid to the salvage party. The portion of the wrecked bridge that had sunk into the channel of the river lay too deep to interfere with navigation and therefore no attempt was made to retrieve it.

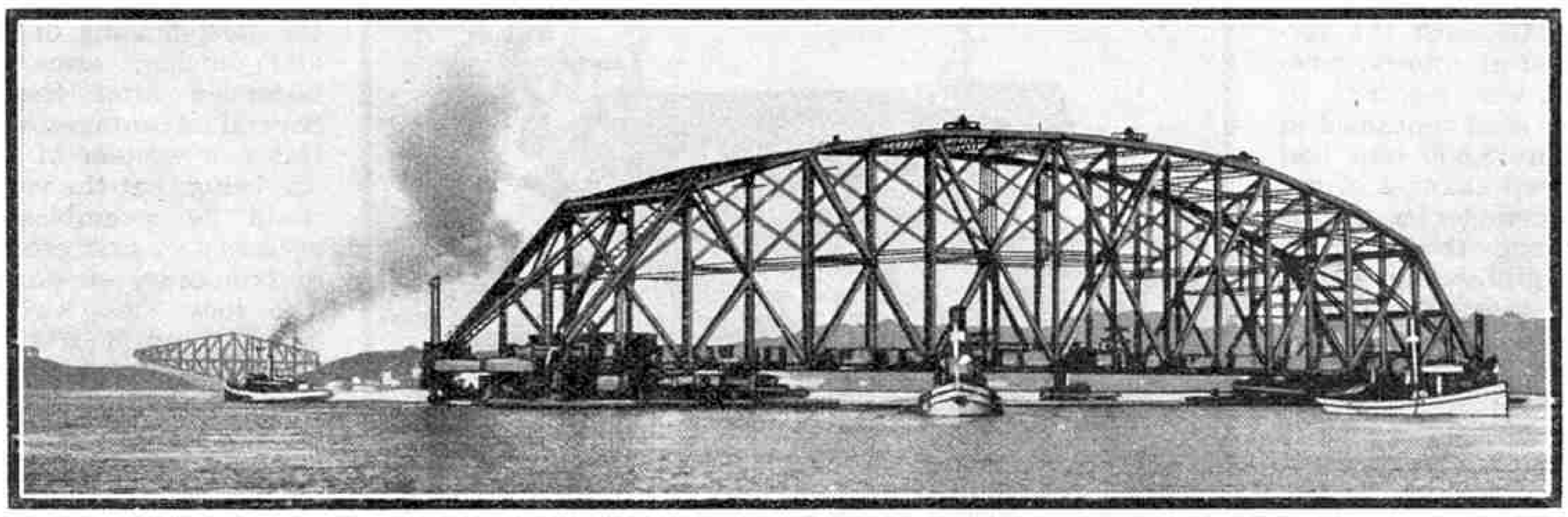
A contract in respect to the foundations for and the erection of the piers to support the approach ways and cantilevers was placed with a Canadian firm. M. P. & T. T. Davis. The two piers erected in the river by the Phœnix Bridge Company were in good condition —the south one having suffered little from the collapse upon it of the steelwork — but they were too short and unsuitably placed to be of use for the new bridge and were therefore demolished.



The collapse of the suspended span at 10.50 a.m. on the 11th September, 1916.

The new pier near the south bank of the river could not be established until the wreckage of the former bridge had been removed, but the contractors soon got to work on the construction of the pier for the north cantilever. On the north shore a large wooden building was erected in which to construct the massive caisson for the north pier. When completed this caisson had an overall length of 180 ft., was 55 ft. in width, 68 ft. in height and weighed roughly 1,600 tons. It was successfully launched and then carefully towed to the pier site, where a cavity to receive it had been excavated in the river bed by dredgers.

The caisson affords a means of sinking foundations in the bed of a river, and in principle it may be regarded as a diving bell of enormous size. It is cylindrical in shape, built either of steel or wood, and in appearance is not unlike a gasometer. The cylinder is closed at the top but open at the bottom and the latter has a sharp cutting edge of steel. When the caisson is sunk, the cutting edge beds itself evenly in the river bottom. The lower part of the caisson is rendered airtight by means of a strong partition fitted across it. The men engaged in the task of excavation work inside the chamber in an air pressure that prevents any water finding its way in below the cutting edge. As the material is excavated it is sent upward through air locks, and the caisson gradually sinks lower and lower as the work proceeds.



The suspended span, floating on the pontoon, being guided up the river.

The men employed for work in compressed air in caissons are always specially selected, as the strain is so great that only those of the finest physique are able to withstand it for long. The density of the air produces many curious effects, such as exaggerating noises to an almost alarming extent. Voices also sound harsh and quite different from their normal tones. The worst feature of all, however, is the trouble known as "Caisson Disease." The symptoms of this disease, usually intensely severe pains in the joints, are not felt in the compressed air, but make their appearance when the air pressure is reduced to normal. The mischief is caused by an excessive amount of nitrogen being absorbed by the blood.

If the process of reduction of air pressure is hurried the results are extremely unpleasant, and even dangerous; but if the transition takes place slowly, little inconvenience is felt. Frequently difficulty is experienced in making the workmen stay in the air locks while the pressure is gradually reduced and the excess of nitrogen expelled by means of the lungs. When the necessary precautions are neglected, and a man on reaching the open air is attacked by caisson disease, the only method of giving him relief is to carry him back into one of the air locks and increase the pressure again, subsequently reducing it with extreme slowness.

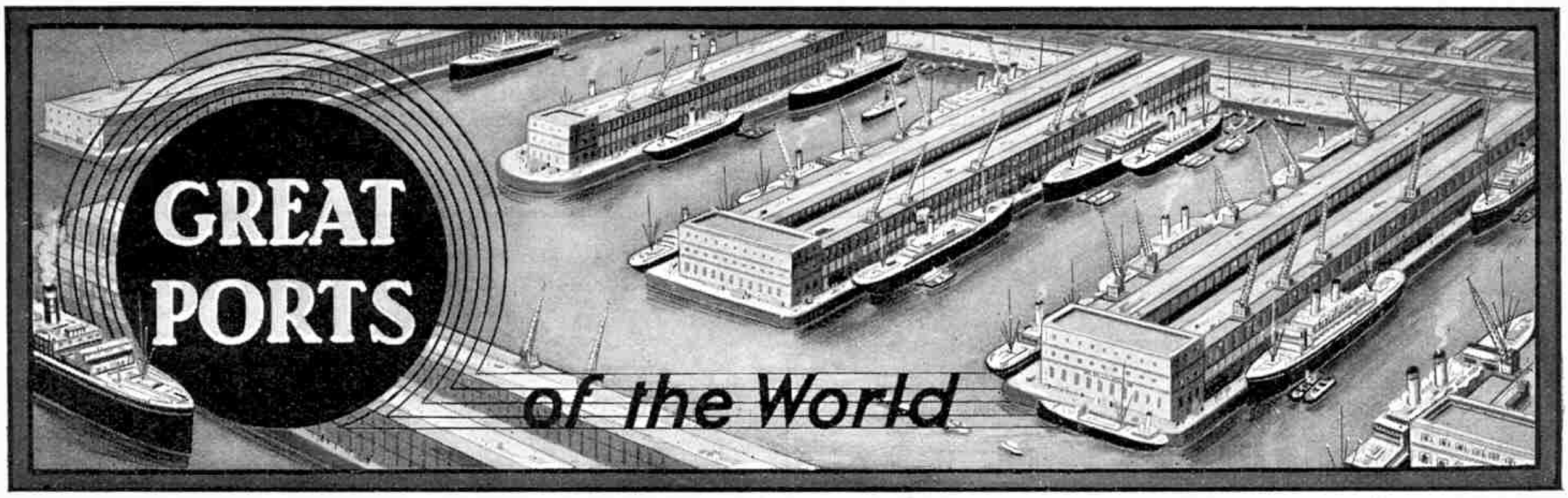
When salvage operations at the south shore were sufficiently advanced and the north pier had been completed, the equipment used in connection with the latter was dismantled, shipped across the river to the south side, and there re-erected. The caisson built for the south pier was similar to that constructed for the north pier but was somewhat smaller. Some 3,000,000 ft. of timber and 70 tons of bolts were used in constructing the two caissons.

At that time there were no engineering shops in Canada equipped to manufacture such huge steel members as those required for the bridge. Special workshops built of steel and masonry, and thoroughly equipped for the work, were therefore erected at Montreal at a cost of £260,000. In order to enable the erection of the bridge to be carried forward as speedily as possible during each working season, storage yards 500 ft. in length were laid out on both shores of the river at Quebec. Each yard was equipped with overhead cranes of 83 ft. span and 70 tons lifting capacity, while an elaborate system of railway track was laid down to enable 30-ton locomotive cranes to be used for moving the lighter materials. The utmost care was taken to ensure that the steel members manufactured for the bridge were accurately cast and fitted perfectly one to the other, so that when transported to the site and joined to the existing steelwork, only a small amount of adjustment was required.

Steel scaffolding or falsework, comprising some 8,000 tons of material, was built up to aid in the erection of the approach spans and to support the anchor arm trusses during construction. The falsework served also to support the floor system of the anchor arm until this was completed, and to carry the two skeleton towers or erection "travellers," one for each bank. Each traveller measured 210 ft. in height, 37 ft. in length and 54 ft. in width, and was surmounted by two electric travelling cranes, each having a lifting capacity of 60 tons, a transverse travel of approximately 14 ft. and a maximum working spread of 96 ft. To each of the four corner upright girders of the traveller was attached a 90 ft. boom capable of lifting 15 tons, and in addition small 7-ton auxiliary gantry cranes for handling light loads were provided. Each traveller weighed 940 tons and moved along a double set of rails, one set on each side of the runway.

The working season extended from about the end of April until the early part of December, work during the remaining months being at a standstill owing to the river being frozen over.

(To be continued).



II.—LONDON

THE earliest reliable record of London dates back to the time of the Roman invasion, when the place was already an established trading centre. The name "London" is derived from two Celtic words, "Llyn," meaning a pool or lake, and "Dun" meaning a fort. This early fort was situated on elevated land adjoining the Thames at a point where it broadened out into a lake, and it was surrounded on its other sides by marsh and forest. Here also two tributaries, the Walbrook and the Fleet, merged into the river, and together with the "pool" provided safe anchorage for the small ships of those days.

The Romans developed the fort into an important city, and made it the hub from which five important military roads radiated to various parts of the country. A stone in the Forum of Agricola was chosen as the point from which to measure distances to towns on these roads, and this stone can still be seen, although now it is in the wall of St. Swithin's Church, Cannon Street. The Romans changed the name to "Londinium," and to enhance the prestige of the city they prefaced the name with the word "Augusta." This decorative title seems to have lapsed, however, and it is merely as "Londinium" that the city is generally mentioned in old records. Like all important Roman settlements, Londinium was a walled city, and access was gained to it by three gateways, the present-day names of Ludgate, Aldersgate, and Aldgate indicating the sites of these openings. Other gateways were added at later periods. There was a strong fort at the eastern end of the wall, on the site now occupied by the White Tower of the Tower of London, and a wide ditch extended around the outside of the wall. The Roman historian Tacitus, writing about 61 A.D., described the city as "crowded with traders, and a great centre of commerce."

The 150-ton floating crane "London Mammoth" engaged on the shipment of railway coaches for South Africa. The illustrations to this article are reproduced by courtesy of the Port of London Authority.

London was further developed by the Saxons, and by the year 527 it had become the capital of the kingdom of Essex. The historian Bede described it in the 8th century as "the mart of many nations resorting to it by sea and land." Unfortunately there is no record of the nature of the foreign trade carried on at that time.

The Danish invasion, heralded by the appearance of 350 Danish ships in the Thames in the year 851, and the subsequent storming of London, led to the development of trade with the Norsemen. When Alfred the Great wrested the city from the Danes in 883 he fortified and repaired it and turned his attention to furthering its commercial interests. For many centuries ships were small and did not require much depth of water, and cargoes were dealt with while the ships were high and dry at low water, or by conveying goods between the ships and the shore in lighters. Later on there were provided small piers, known as "hithes," built of timber or stone, at which vessels could lie and discharge their inward cargoes and load the goods they had to take away. The first hithe was probably one built by Ethelred II and known as Ethelredshithe. This eventually passed into the possession of the wife of Henry I and was then re-named Queenhithe. Other hithes were built as larger ships came into use and it became necessary to discharge or load them in deeper water than the small rivers Walbrook and Fleet, but for nearly 500 years Queenhithe was the chief landing place in the port.

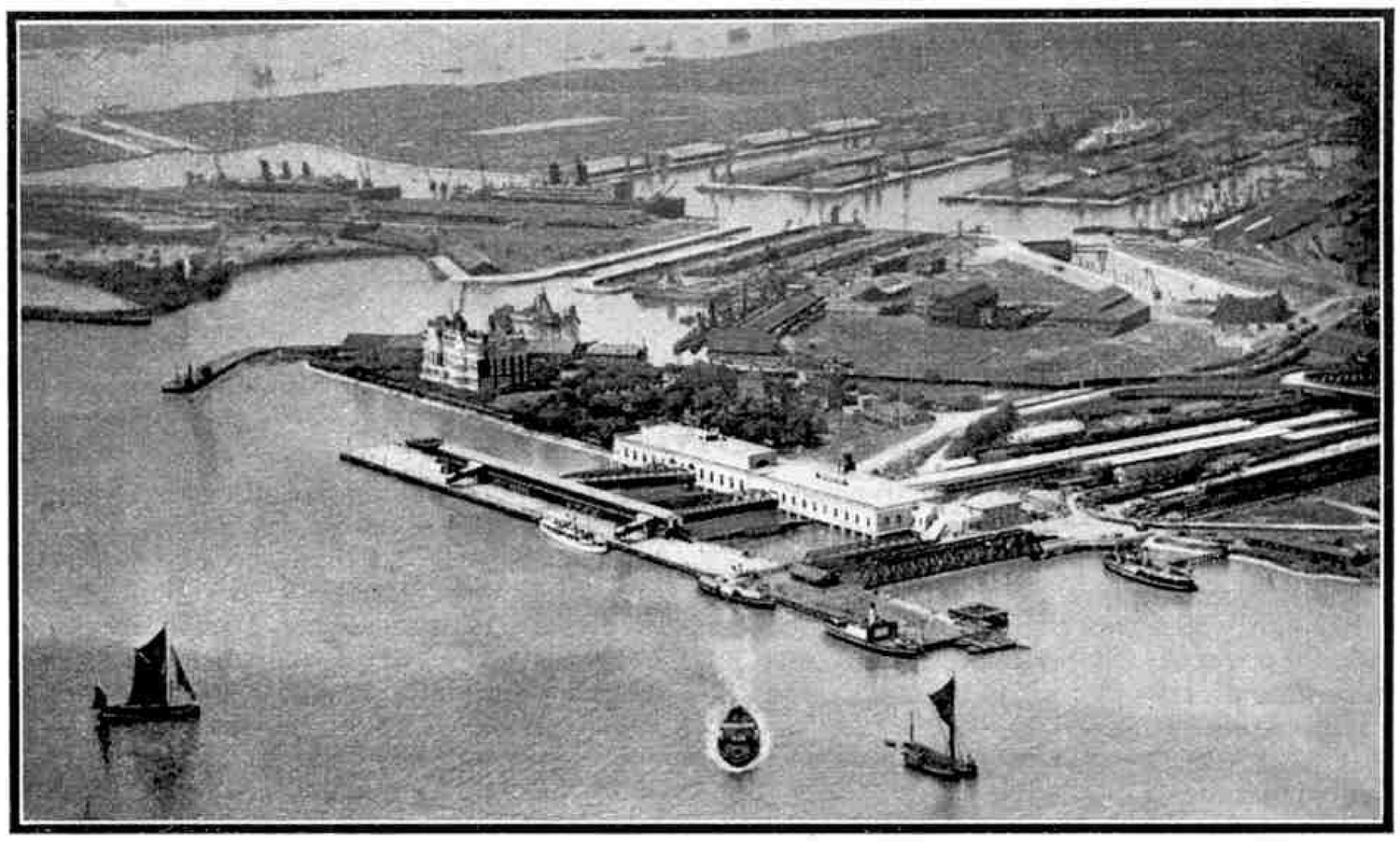
It was also during the Middle Ages that merchants began to organise themselves into powerful guilds or associations to regulate the trade of the ports. One of the most important was the association of Merchant Adventurers, who traded with Flanders, Spain, Portugal, Holland and ports in the Western Mediterranean. The most influential of these Adventurers lived in London, where they gradually gained possession of most of the foreign trade of the port. The voyages of discovery made during the 15th and 16th centuries opened up new channels of commerce and helped further to make London an international trading centre. The great extent of this trade in the time of Queen Elizabeth is shown by the fact that London contributed to the Customs revenue half of the total for the ports of the whole country.

By the closing years of the 16th century a hithe known as Billingsgate began to be more popular than Queenhithe with the London merchants. John Stow, the antiquary, who is best remembered for his valuable "*Survey of London*," relates that "this gate is now more frequented than of old time, when the Queen's hithe was used, as being appointed by the kings of this realm to be the special or only port for picking up all such kinds of merchandise brought to this city by traders and foreigners." In 1600 the famous East India Company, with headquarters in London, was formed under the authority of a Charter from Elizabeth, and eventually it became the greatest of all the English trading companies, to the great benefit of London.

The city developed so rapidly during the 16th and 17th centuries that proclamations extending the boundaries were issued from time to time, but the Great Fire that began near London Bridge on 2nd September, 1666, and lasted four days and nights, destroyed practically all the port accommodation, as well as a large part of the city. This great disaster provided an opportunity to rebuilt these areas on better lines; new and better warehouses were erected, wider streets were laid down, and houses were built of better materials. The famous architect Sir Christopher Wren, whose tercentenary was celebrated last year, re-designed and rebuilt

St. Paul's Cathedral and 63 parish churches.

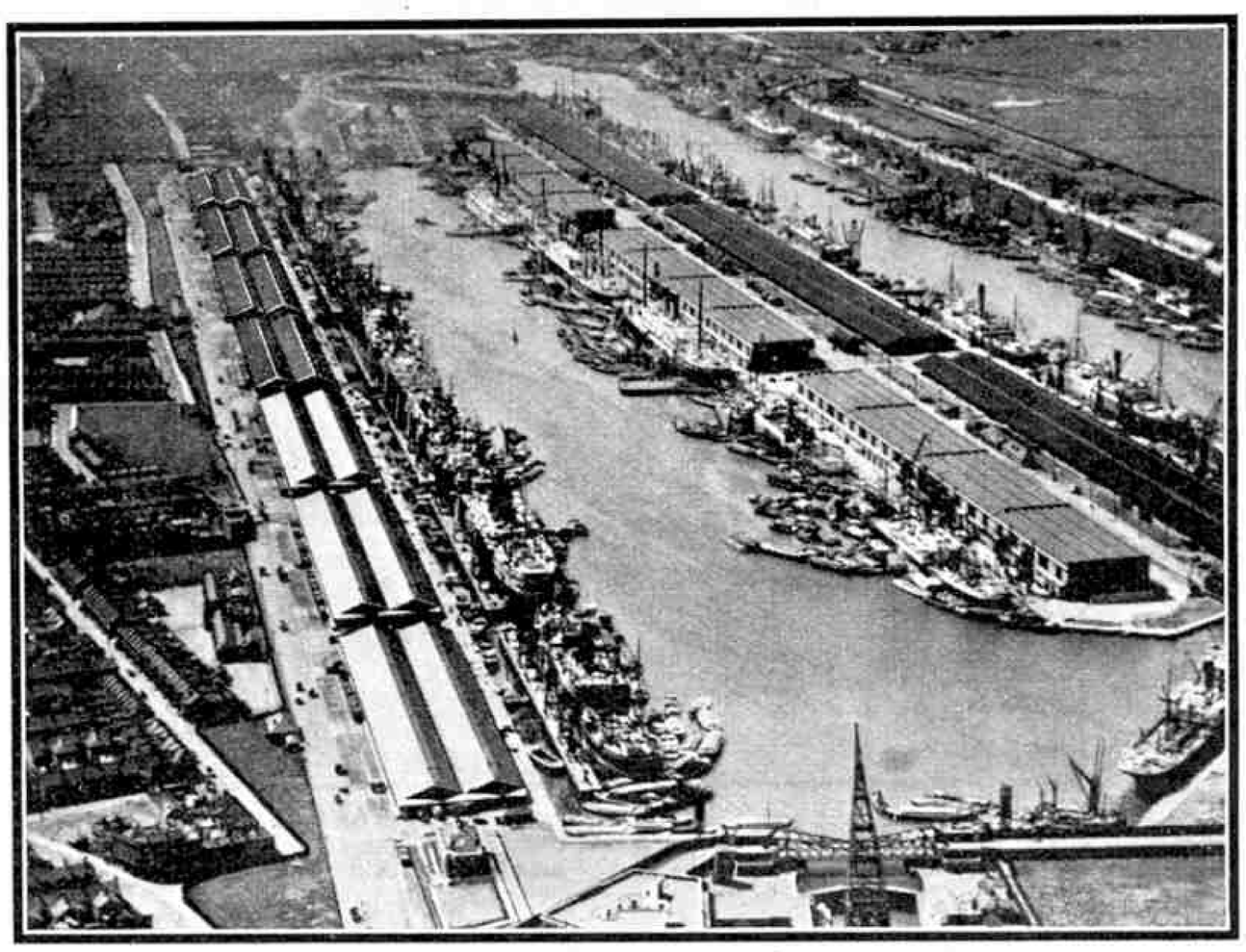
The construction in 1696 of the first wet dock was another stage forward in the development of the port of London. This dock was built at Rotherhithe and was named the Howland Wet Dock, after a family at Streatham to whom the land belonged. It was 150 ft. long and 44 ft. wide and had an area of about 10 acres. At spring tides there was a depth of 17 ft. of water over the dock sill, which was sufficient to enable third-rate ships of the Navy to use the dock. No warehouses or equipment were provided, as it was not used for the loading or unloading of ships as docks are to-day, but merely to provide safe anchorage, to ensure which trees were planted round the dock to break the force of the winds. Later on the dock was used extensively by ships engaged in the Greenland fishery and whaling trade, and it became known as the Greenland Dock. Boilers and tanks were erected on the dock to enable the whale oil to be extracted from the blubber brought by the whalers. When the Greenland whaling industry declined the dock was used for the timber trade.



Aerial view of the floating Landing Stage at Tilbury, where the passenger side of the Port of London's traffic is dealt with. In the background are the Tilbury Docks.

By 1700 London had 77 per cent. of the export and import trade of the kingdom, the exports having a total value of £5,970,000, and the imports of £7,302,700.

The trade of the port had so greatly increased by the end of the 18th century that there always existed a state of congestion of vessels in the river, owing to the insufficiency of moorings and warehousing accommodation. This unsatisfactory state of affairs hampered trade and caused great delay and inconvenience to shipowners and merchants. In addition, plundering and smuggling of goods was rife, and the activities of dock thieves reached almost incredible proportions. The public agitation that arose over these deplorable conditions culminated in a petition to Parliament in 1796, and a House of Commons Committee was appointed to investigate the trouble. Nothing of a practical nature came of this investigation, but in 1799 Parliament passed a Bill promoted by the West India merchants of London for the building of a dock on the Isle of Dogs, a bank of land that turns the river south to where Greenwich now stands, and then northward to Blackwell. This was the first dock built in the port of London for the loading and unloading of ships, and it was opened on 27th August, 1802. Other docks quickly followed, and eventually the London docks had a total water area of over 700 acres and 30 mil s of quays. In addition there were many other wharves and quays on both banks of the river.



Looking down on the King George V and Royal Victoria and Albert Docks, which have a total water area of 246 acres and form the largest sheet of enclosed dock water in the world.

These increased facilities relieved the river traffic for a time, but the continually growing trade during the early part of the 19th century, the coming of steam navigation, and the lack of proper regulations for the commerce of the port, again led to serious congestion of shipping, and complaints by shipowners and merchants. In 1857 an Act was passed under which a separate body called the Thames Conservancy was appointed to look after all matters affecting the river from Staines to Yantlet. These matters included fishing, navigation, purity of the water, and the dredging of the river as necessary; and the Conservancy was also authorised to levy tolls on ships using the river. In spite of all this, however, conditions were again unsatisfactory by the end of the 19th century. The Government recognised the importance of the port from a national standpoint, and appointed a Royal Commission to investigate the conditions. The Commission reported in June 1902 that, owing to restricted powers, the Thames Conservancy had failed adequately to maintain and improve the river. They added that the dock companies were in financial difficulties and unable to provide the funds to carry out extensions that were necessary to enable the port to deal with the large type of ships then being built. The outcome of the report was the passing in 1908 of the Port of London Act.

This Act created a new Authority or Public Trust, named the Port of London Authority, to take over and administer as one unit all the docks and the whole of the tidal portion of the river, and entrusted it with the duty of improving transport facilities. The Act did not apply to the lighting and buoying of the river, however, for this work was effectively carried out by the Corporation of Trinity House, which controls the lighthouses and buoys around the British coast. After negotiations the sum of £23,000,000 was fixed as the total purchase price of the various dock properties.

The Port of London, as defined by the area governed by the Port of London Authority, includes the whole of the tidal portion of the Thames extending from a point just below Teddington Lock in Middlesex to an imaginary line drawn from Havengore Creek in Essex to Warden Point in Kent, a distance of nearly 70 miles. The new governing body embarked upon a long programme of dock improvements and developments that included the building of new quays, sheds and refrigerating warehouses; the extension of the area of the dock systems; the construction of new wet docks, dry docks, pumping installations for increasing the depth of water in some of the docks, and floating cranes and elevators. These improvements were eventually completed at a total cost of £20,000,000.

The large dock systems owned by the Port of London Authority cover an area of 4,203 acres, with a water area totalling 722 acres, and include 45 miles of quays for the loading and discharging of goods. All these docks, with the exception of the Surrey Commercial Docks, are situated on the north bank of the river. We have no space to describe the docks in detail, but mention must be made of the King George V, and the Royal Victoria and Albert Docks. These are really one huge dock divided into three sections,

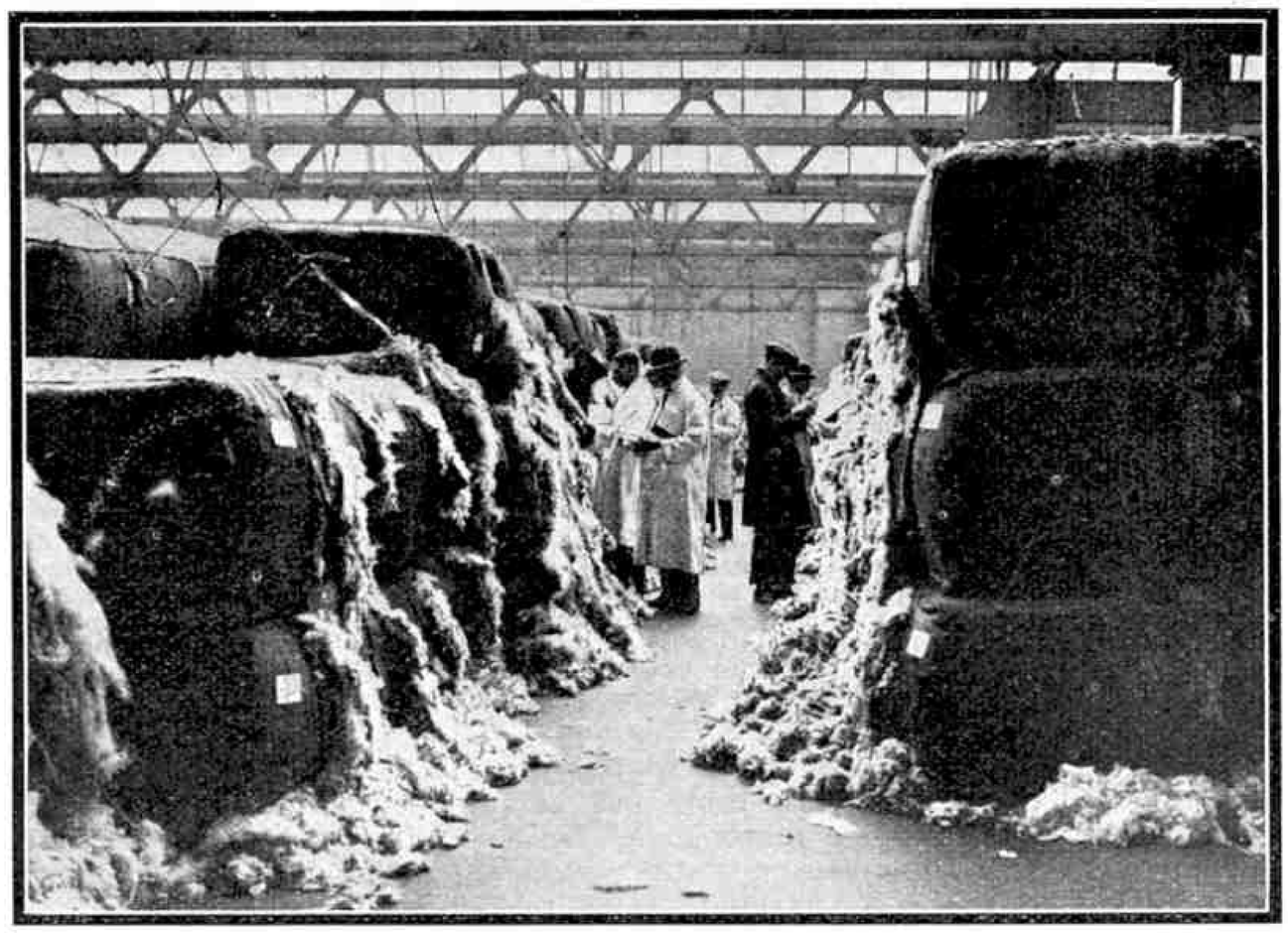
and with a total water area of 246 acres they form the largest sheet of enclosed dock water in the world. As many as 50 to 60 ships with a total displacement of 500,000 tons are sometimes discharging or loading in these docks at the same time. The King George V, which cost £4,500,000 to build, is London's most modern dock, and was opened by the King in 1921. Ships enter it by way of a fine lock 800 ft. long and 100 ft. wide.

The St. Katherine Dock is interesting historically, as it was built in 1828 on the site of the old Royal and Collegiate Church of St. Katherine by the Tower, which was the property of the Queens of England for 700 years. It is the smallest of the London docks, with a total water area of 10 acres, and is used by moderate sized vessels engaged in coastwise and Continental trading. The Tilbury Docks have recently been greatly improved, and a new main entrance lock 1,000 ft. long and 110 ft. wide, a new dry dock, and other works were completed in 1929 at a cost of over £2,500,000. They are the first docks in the Port of London on approaching from the sea and are 24 miles from the Thames estuary.

London is the ivory market of the world, and this photograph shows the Ivory Floor at London Dock, where these imports are stored.

At each dock, with the exception of the London and St. Katherine and the Surrey Commercial docks, railway lines on the quays are connected with the main railway systems of the country. No other port in the world is so well equipped with cranes and mechanical labour-saving appliances for handling general and specialised cargo. The dock equipment includes 1,345 cranes, ranging from luffing cranes with a lifting capacity up to three tons to floating cranes and derricks, the largest of which is capable of lifting up to 150 tons. Electric trucks are extensively employed on the quays for the movement of cargo to and from ships.

The commerce of London is vast and varied. About 35,000,000 tons of goods are dealt with in a year, while the Overseas trade of the port has an annual value of £505,000,000, well over one-third of the Overseas trade of the United Kingdom. Many circumstances contribute to this great volume of trade, one of the chief being that within an economic distributing area of London there is a population of nearly 20,000,000 people. London therefore absorbs enormous quantities of the foodstuffs and materials that enter the port. A great deal more is imported than is required by the immediate market at its doors, however, and thus London has become a great distributing centre for the country and one of the greatest international markets in the world.



Prospective buyers inspecting wool exhibited on a show floor at the Wool Warehouses, London Dock.

The imports come from almost every country, and the variety of the merchandise brought to the port is extraordinary, including such widely different commodities as paper, spices, hides, nitrates and mother-of-pearl shells. Among the most important of the imports are timber, grain, flour and feeding stuffs, wool, tobacco and frozen meat. About 2,000,000 tons of timber is landed in London, and the greater part of this is fir, pine and spruce from Canada, the United States and the Baltic and White Sea ports. The Surrey Commercial Docks already mentioned receive most of the imported timber. The grain, flour and feeding stuffs imported amount to about 3,000,000 tons a year. They are stored in granaries that have a total accommodation of about 60,000 tons, and the grain is transferred from the ships to the granaries by means of a fleet of floating pneumatic and bucket elevators with a total capacity of over 2,500 tons per hour. The granaries that receive the grain, flour and feeding stuffs are situated at the Millwall, Royal Victoria and Surrey Commercial Docks.

More wool is brought into London than into any other port in the world, the total amounting to about a quarter of the world's production. A great deal of it is imported from Australia, but supplies are received from South America, South Africa and all the other wool-producing countries. The wool is received in the form of bales and is stored in extensive warehouses at the London and St. Katherine Docks. The roofs are fitted with northern lights so that the wool on show may be inspected and judged in the best natural light. These warehouses have storage accommodation for 1,000,000 bales and show floor space for 60,000 bales.

Numerous quantities of Empire and foreign-grown tobacco are imported every year into London and are stored in specially constructed fire-proof warehouses equipped with cranes and lifts to facilitate the handling of the casks and bales. The stock of tobacco in the Port of London Authority's warehouses total about 50,000 tons, and its value, including Customs duty, is over £60,000,000. A good deal of this huge quantity is stored at the Royal Victoria Dock. The Port of London receives about 70 per cent. of the meat brought from abroad, and this is dealt with chiefly at the Royal Victoria and Albert Docks. The meat not required immediately is placed in extensive cold stores, but large quantities are sent to the famous Smithfield Market for sale to the London retail butchers. London has always been a great market for fruit and vegetables and the annual imports amount to about 900,000 tons. The cargoes are discharged by modern types of cranes or conveyors that lift the cases from the cool chambers of the ship and deposit them in well-equipped and airy transit sheds, where they are sorted and despatched to the various London fruit and vegetable markets.

Mention must be made of the passenger side of the Port of London's traffic. This is dealt with at Tilbury, where hundreds of thousands of passengers enter and leave the port every year, most of them by way of the Tilbury Landing Stage, a floating structure 1,142 ft. long leading to the Customs Baggage Examination Hall ashore. The largest liners can be accommodated at the stage at any state of the tide, and a system of floodlighting enables passengers to be taken aboard or disembarked equally well at night as during the day.

Every modern port catering for the largest type of ships must possess adequate facilities for the overhaul and repair of these vessels, and the Port of London is well equipped in this respect, for it possesses 10 excellent dry docks. The largest of these are the King George V and the Tilbury

(Continued on page 164)

Glass Roads

In our issue for November, 1931, we mentioned that experimental roads made of cast iron were being laid down in various parts of the country. An even more remarkable scheme has been devised by a young London inventor, Mr. George J. Ricketts, who, after 12 years of experimental work, has devised a sett made of glass.

It is agreed by road engineers that wooden blocks afford an unsatisfactory road surface owing to the great amount of water they will absorb, which makes them dangerous during wet weather. The asphalt road is suitable for heavy traffic and wears well, but it also gives rise to a great number of skids in wet weather; while the concrete road, which at first was thought to provide a solution to the problem, quickly becomes saturated. For these reasons a great amount of attention has been given recently to the possibilities of other materials for road construction, and it is possible that before very long either cast iron or glass blocks may be used to surface the main roads throughout the country.

Mr. Ricketts' glass setts are 4½ in. square and 1½ in. thick. They are fitted with special interlocking tongues, and have diamond-shaped serrations on the top in order to make them non-skid, and to provide "lanes" along which water may drain into the gutter. The blocks can be made from waste glass such as broken jam jars and window panes, and are set in bitumen. The main difficulty in the way of glass roads is the fact that they would quickly be chipped by horses' hooves. This difficulty eventually may be overcome by providing horses with rubber shoes, which is already being done in Germany. Another solution of the problem would be to prohibit horse traffic from roads paved with glass, which would also assist in speeding up traffic.

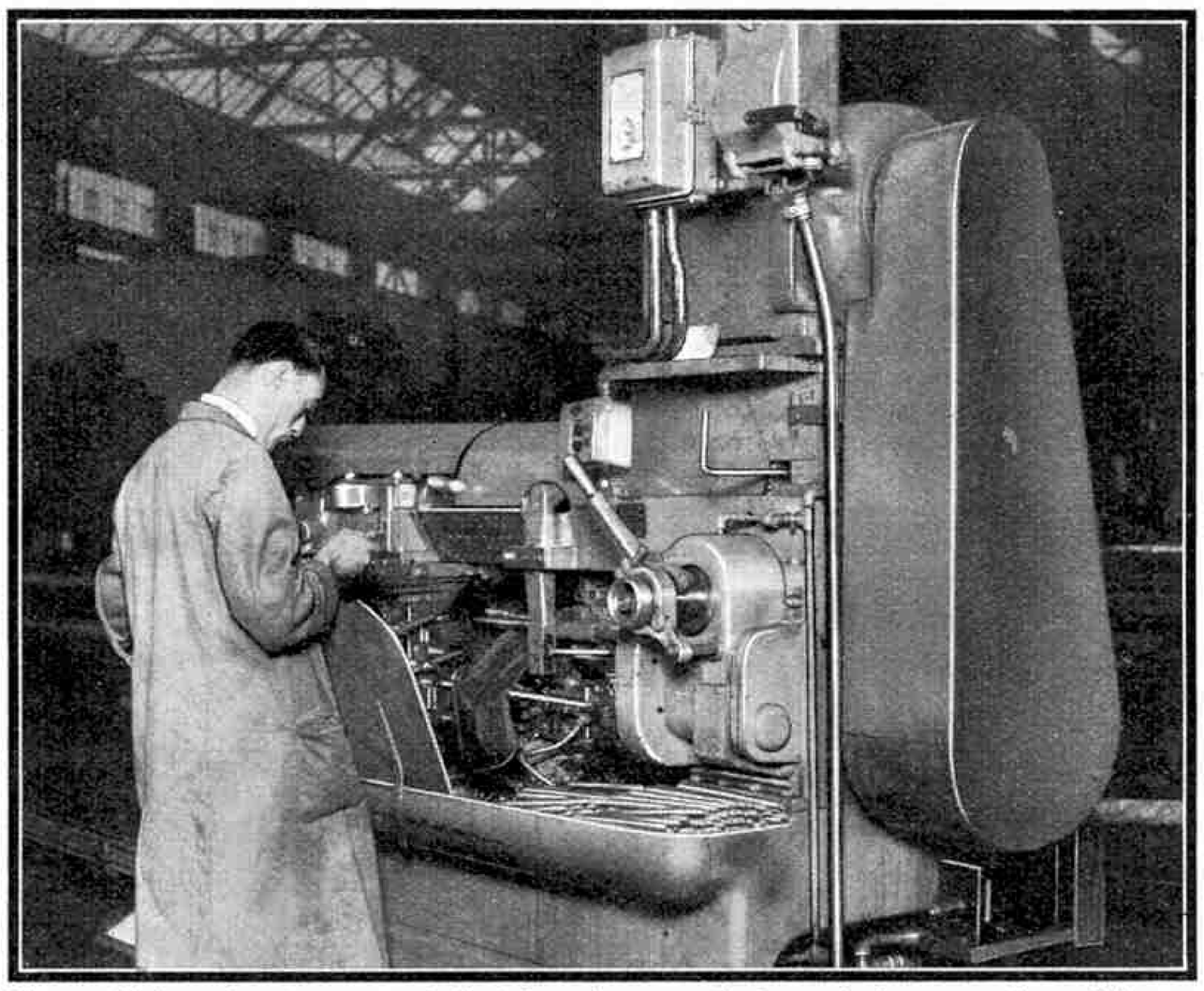
* * * *

It is interesting to note that the Tower Bridge costs the City of London a sum of £30,502 every year, while Blackfriars, London and Southwark Bridges cost only £6,324 between them.

Motoring Seven Storeys High

Plans are now being prepared for a store to be built in London which when completed will be the most remarkable shopping centre in the world, for each of its seven storeys will be provided with a roadway round it, arranged so that a motor car can drive up inclines from ground level to the top of the building. Traffic will necessarily travel in only one direction and a special route will be provided for descending motor cars.

If permission is obtained for the building to be constructed, it will be situated in Oxford Street, and will accommodate shops selling all kinds of goods. A large arcade will be constructed through the centre of the building, where there will be escalators and a number of lifts for the use of pedestrians. There will also be motor and luggage lifts. The roof will be flat and will be used for restaurants and gardens, and will be provided with an open space on which helicopters may land, while the basement will be connected with the new Marble Arch Underground Station. The building will be constructed of reinforced concrete.



The machining of water pump shafts takes place on this four-spindle automatic, and is an interesting example of a difficult machining proposition ably handled. Due to the exceptional length of the component, the main difficulty is to feed the bar stock in such a way as not to hinder production times. The automatic illustrated lives up to its name, being entirely self-feeding and completing all operations from plain bar stock to the finished job, including taper turning and the cutting of the thread. In addition to producing a well finished job, the machine gives a production of over 180 completed shafts per hour!

Sheffield's Largest Ingot

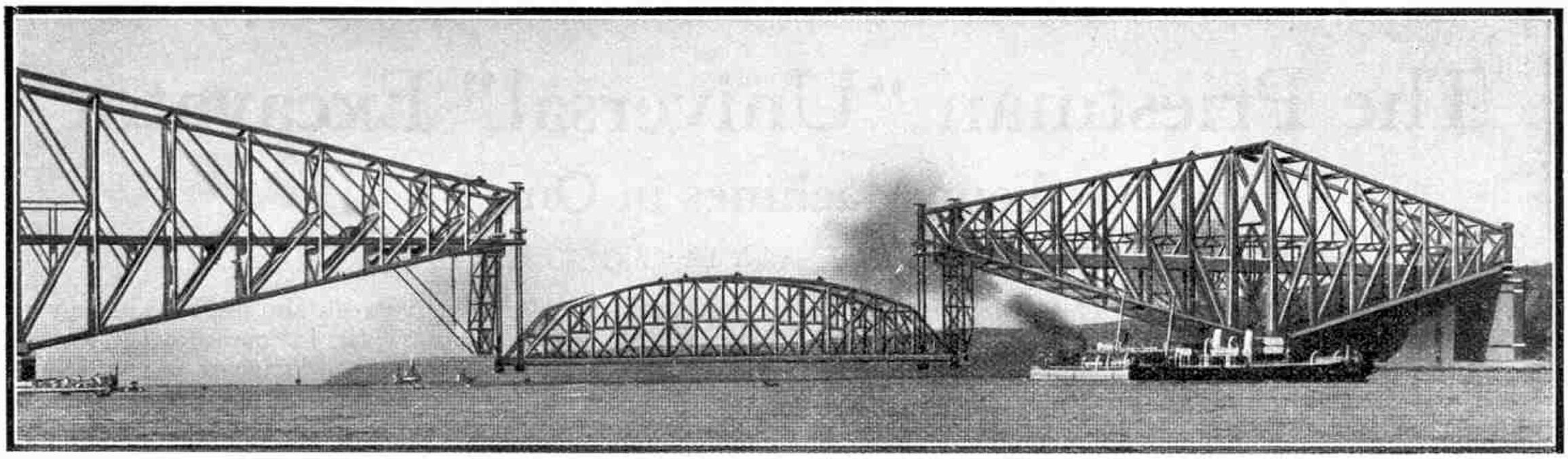
An ingot made by the English Steel Corporation, of Sheffield, was 175 tons in weight and is claimed to be the largest ingot ever cast in Sheffield. After being cast the ingot was heat-treated in an annealing furnace, and was then cropped top and bottom and had a hole punched through its centre and the internal material examined. The ingot was cast in connection with an order for a number of hollow forged boiler drums intended for service in the Fulham power station. The largest of these will be 40 ft. in length and will have an outside diameter of 5 ft. 3 in.

Periscope to Inspect Small Holes

An instrument that tests the soundness of rivet holes has been invented by a Manchester firm. The instrument, which is intended primarily for boiler makers but can be used on any riveted steel work, consists of an inverted periscope carried in a tube small enough to go inside a hole ⅞ in. in diameter. When there is any doubt about the soundness of a rivet, it is punched out and the periscope inserted, when a thorough examination may be made of all the metal in contact with the plate. The plate meanwhile is illuminated by an electric lamp, and as it is magnified seven times by the periscope, even the smallest crack will show up.

Giant Electric Motors in French Liner

The four largest electric motors ever built for any purpose will be used to propel the new French liner "*Normandie*," which was launched at St. Nazaire in October of last year. These motors are each rated at 40,000 h.p., giving the ship a total rating of 160,000 h.p. The previous record for motors was held by the two United States aircraft carriers "*Saratoga*" and "*Lexington*," both of which have eight motors, each rated at 22,500 h.p. These carriers, with a total of 180,000 h.p. each, still rank as the world's most powerful ships. The turbines on the "*Rex*," the new Italian passenger leviathan, are only capable of developing 120,000 s.h.p., or normally 100,000 s.h.p.



The suspended span of the Quebec Bridge, having been floated down the river and fixed to the hoisting chains of the cantilevers, is being hauled up into position. This photograph was taken at 10-40 a.m. on 11th September, 1916, just before the span collapsed. See special article on page 92.

New British 7,000-ton Cruiser

The new cruiser "*Orion*" was launched some time ago at Devonport Dockyard after having taken a little over a year to construct. The vessel is of the "*Leander*" class, and the launch took place two days after that of the name ship of this type. These vessels have a displacement of 7,000 tons and are provided with geared turbine propulsion machinery that has a designed output of 72,000 s.h.p. They are provided with a main armament of eight 6 in. guns.

Another recent interesting launch was made at Hebburn, the ship being a naval sloop named the "*Goncalves Zarco.*" This was built by R. & W. Hawthorn, Leslie & Co. Ltd., for the Portuguese Government, and is a vessel of 1,000 tons displacement. She is equipped with oil burners and is capable of cruising for 6,000 miles without refuelling.

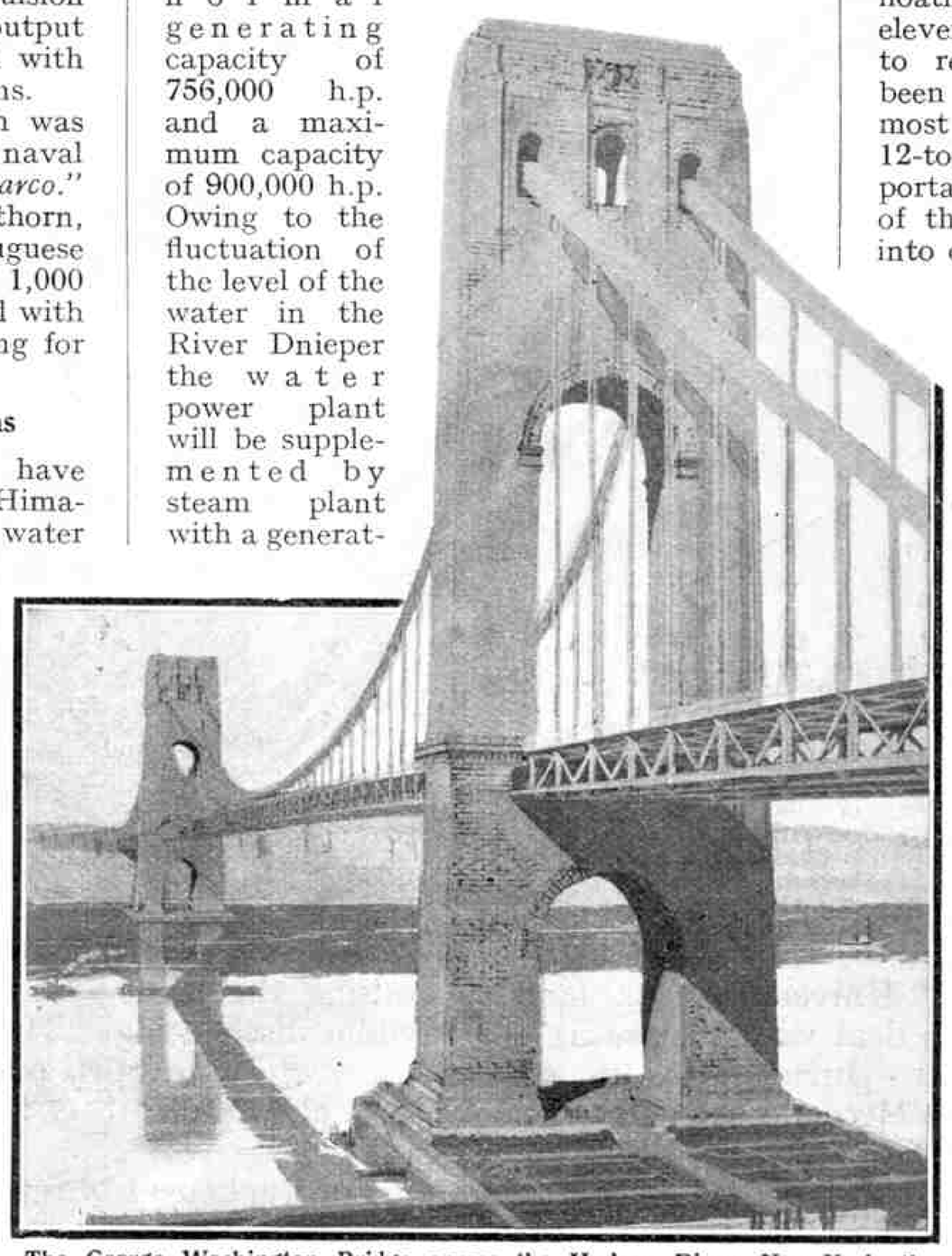
Electric Power in the Himalayas

Two interesting power stations have been installed on the slopes of the Himalayas, where they make use of the water from various streams to generate electricity. The stations are situated at altitudes of 4,000 ft. and 6,000 ft. respectively, and water for the first of the stations is obtained from two streams and carried along in a small concrete canal, or flume, where it flows at a speed of about 21 cu. ft. per second. This carries it to a forebay 740 ft. above the station, from where it travels down an 18 in. welded steel pipe to the Pelton wheels. These are two in number and are coupled directly to three-phase 50-cycle alternators that develop current at 600 k.v.a. and 6,300 volts.

The water supply for the second of the stations is obtained by means of a similar flume 4,100 ft. in length, that collects water from a third stream. The forebay is only at a vertical height of 90 ft. above the station, and the feed pipe to the station consists of a riveted steel pipe 2 ft. 6 in. in diameter, through which the water travels at a speed of 75 cu. ft. per second. This station is provided with a Francis turbine that is coupled to a 648 k.v.a. three-phase 400 volts, 50-cycle alternator, and is constructed entirely of wood. At both stations open air transformers are employed to step up the voltage of the current to 1,100 v.

Russian Hydro-Electric Scheme

In connection with the construction of the Lenin Hydro-Electric Power Station in Ukrainia, Russia, it has been necessary to build across the River Dnieper a huge dam measuring 170 ft. in height and half-a-mile in length. This station, which was originally known as the Dnieprostroi Power Plant, will have, when completed, a normal generating capacity of 756,000 h.p. and a maximum capacity of 900,000 h.p. Owing to the fluctuation of the level of the water in the River Dnieper the water power plant will be supplemented by steam plant with a generating capacity of 200,000 h.p. At present there is only one town in the immediate neighbourhood where the power generated can be utilised, but the Soviet Government are constructing a transmission line to the Donetz Basin, the most important coal mining centre in Russia, 120 miles away. According to Soviet official statements the work should be completed by the summer of 1934, but many foreign engineers consider that at least two or three more years will be required.



The George Washington Bridge across the Hudson River, New York, the longest suspension bridge in the world.

Largest Crane in South Africa

Some time ago the authorities at the Port of Durban decided to undertake a scheme for the modernisation and improvement of the harbour. In connection with this project an 80-ton crane is now to be installed at a cost of £26,000. This crane will be the largest in South Africa, the present largest being a 60-ton floating crane at Capetown. In addition, eleven 4-ton cranes have been ordered to replace hydraulic cranes that have been in service for many years, and most of these are already at work. A 12-ton electric crane and two 4-ton portal cranes for the Congella portion of the harbour area also have been put into operation.

A New Bridge Across The Severn

A scheme for the erection of a new ferro-concrete bridge across the River Severn at Newnham has been put forward by the Severn Bridge Development Company. At the site chosen the river is about 1,200 ft. in width, and it will be necessary for the bridge to have an overall length of about 1,410 ft. It will carry a roadway 20 ft. in width, flanked by footpaths 5 ft. in width, and it is estimated that the total cost will be about £250,000.

The Lochaber Power Scheme

Another stage in the completion of the Lochaber power scheme was reached some time ago when the tunnel connecting Loch Laggan and Loch Treig was broken through. The tunnel is 3¾ miles in length and is one of the most important units in the second part of the scheme. It has a total drop of 41 ft., and the point where the two halves of the tunnel met was about 1,000 ft. from the exit. The second part of the scheme includes the construction of two dams. One of these will be across the River Spean and the other will be erected at the head of Loch Treig.

A Well-Equipped Fire Engine

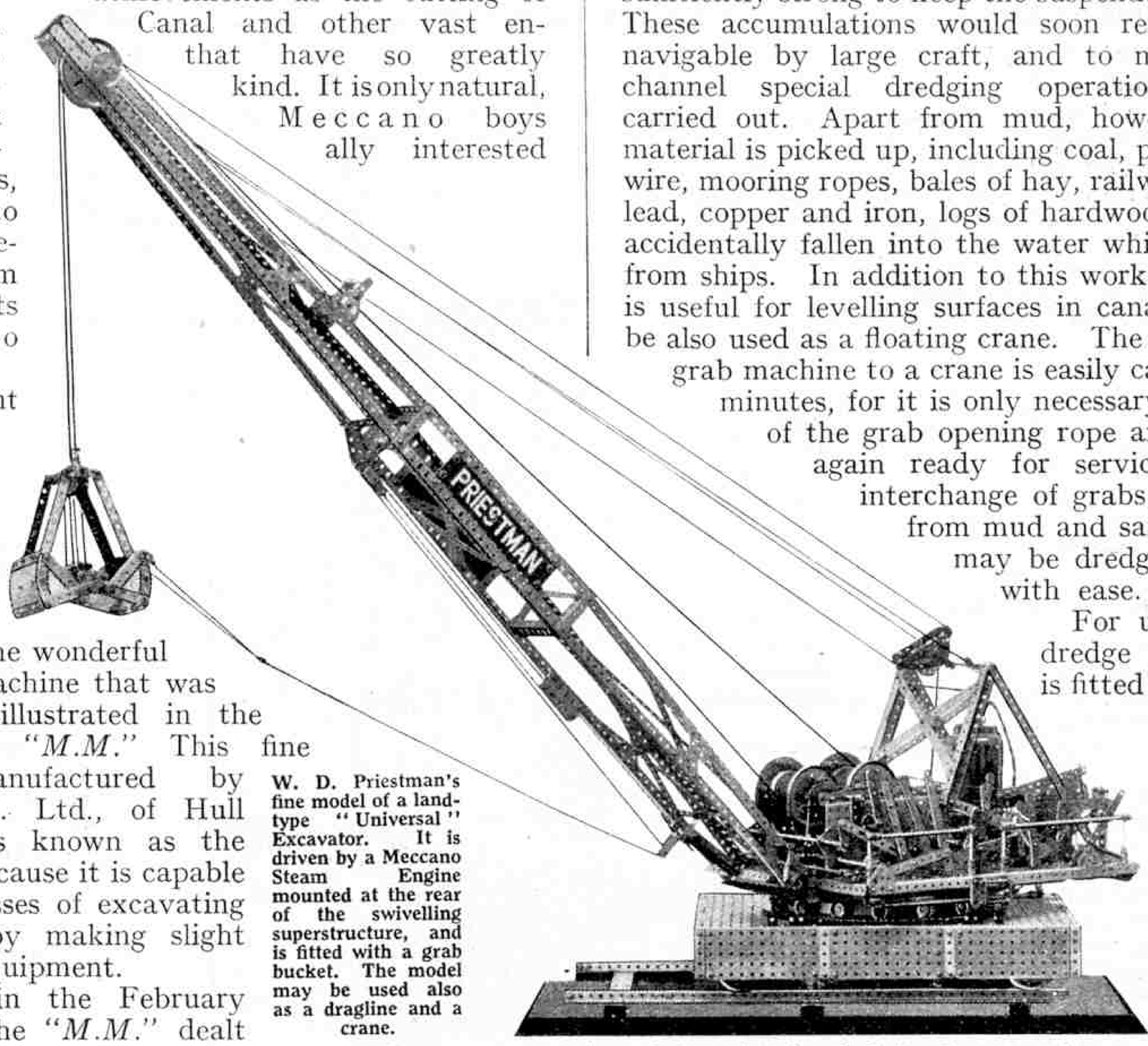
A fire engine in use at Dagenham carries practically all the equipment likely to be required by a fire brigade. This includes a chemical "foam" generator; a plant employing methyl-chloride, a new chemical extinguisher; lifting gear for raising vehicles under which people are trapped, and oxygen apparatus for entombed divers.

The Priestman "Universal" Excavator

Four Machines in One

AMONG the many thousands of ingenious machines that engineering skill has placed at man's disposal, one of the most useful is the mechanical excavator. With this machine he is able to dredge his rivers, dig cuttings for his railways, and excavate thousands of tons of material to prepare sites for the huge buildings of his cities. Appliances of this type also made possible such wonderful achievements as the cutting of the Panama Canal and other vast engineering works that have so greatly benefited mankind. It is only natural, therefore, that Meccano boys should be specially interested in these machines, for in addition to their practical usefulness they form splendid subjects for Meccano models.

Several different types of excavators have been illustrated in past issues of the "*M.M.*," and many of our readers will remember the wonderful "Universal" machine that was described and illustrated in the February 1931 "*M.M.*" This fine excavator, manufactured by Priestman Bros. Ltd., of Hull and London, is known as the "Universal" because it is capable of doing all classes of excavating work, simply by making slight alterations to equipment.



W. D. Priestman's fine model of a land-type "Universal" Excavator. It is driven by a Meccano Steam Engine mounted at the rear of the swivelling superstructure, and is fitted with a grab bucket. The model may be used also as a dragline and a crane.

The article in the February 1931 issue of the "*M.M.*" dealt with the application of the "Universal" for land working, and now we intend to deal with its use as a floating or self-propelled dredger. Incidentally we are able to illustrate also a splendid Meccano model of this machine built by W. D. Priestman, Jnr., of Hull. Priestman Bros. Ltd., have placed this model in the Hull Museum of Transport and Commerce, as a permanent demonstration of the mechanical ingenuity of this type of machine.

For use afloat the "Universal" is mounted on an undercarriage to which is bolted a cast steel roller path that in turn is bolted direct to the deck of a hopper barge, as shown in the accompanying illustrations. Several sizes of "Universals" are available, and the power may be supplied by a steam engine, an electric motor or an internal combustion engine.

One of the most interesting and useful applications of the "Universal" is that of maintaining docks, harbours and rivers free from silt and mud. This is very important and necessary work, for many of the world's largest ports are situated in the estuaries of rivers, into which every tide during its flow sweeps a vast quantity of sand and silt. Although much of this is carried out to sea again by the ebb tide, a certain proportion is always deposited at slack water when the current is not sufficiently strong to keep the suspended matter moving. These accumulations would soon render a river unnavigable by large craft, and to maintain an open channel special dredging operations are regularly carried out. Apart from mud, however, much other material is picked up, including coal, pieces of hemp and wire, mooring ropes, bales of hay, railway metals, pigs of lead, copper and iron, logs of hardwood, etc., that have accidentally fallen into the water while being unloaded from ships. In addition to this work the "Universal" is useful for levelling surfaces in canal work, and may be also used as a floating crane. The conversion from a grab machine to a crane is easily carried out in a few minutes, for it is only necessary to alter the lead of the grab opening rope and the machine is again ready for service. By a simple interchange of grabs, material ranging from mud and sand to broken rock may be dredged or transported with ease.

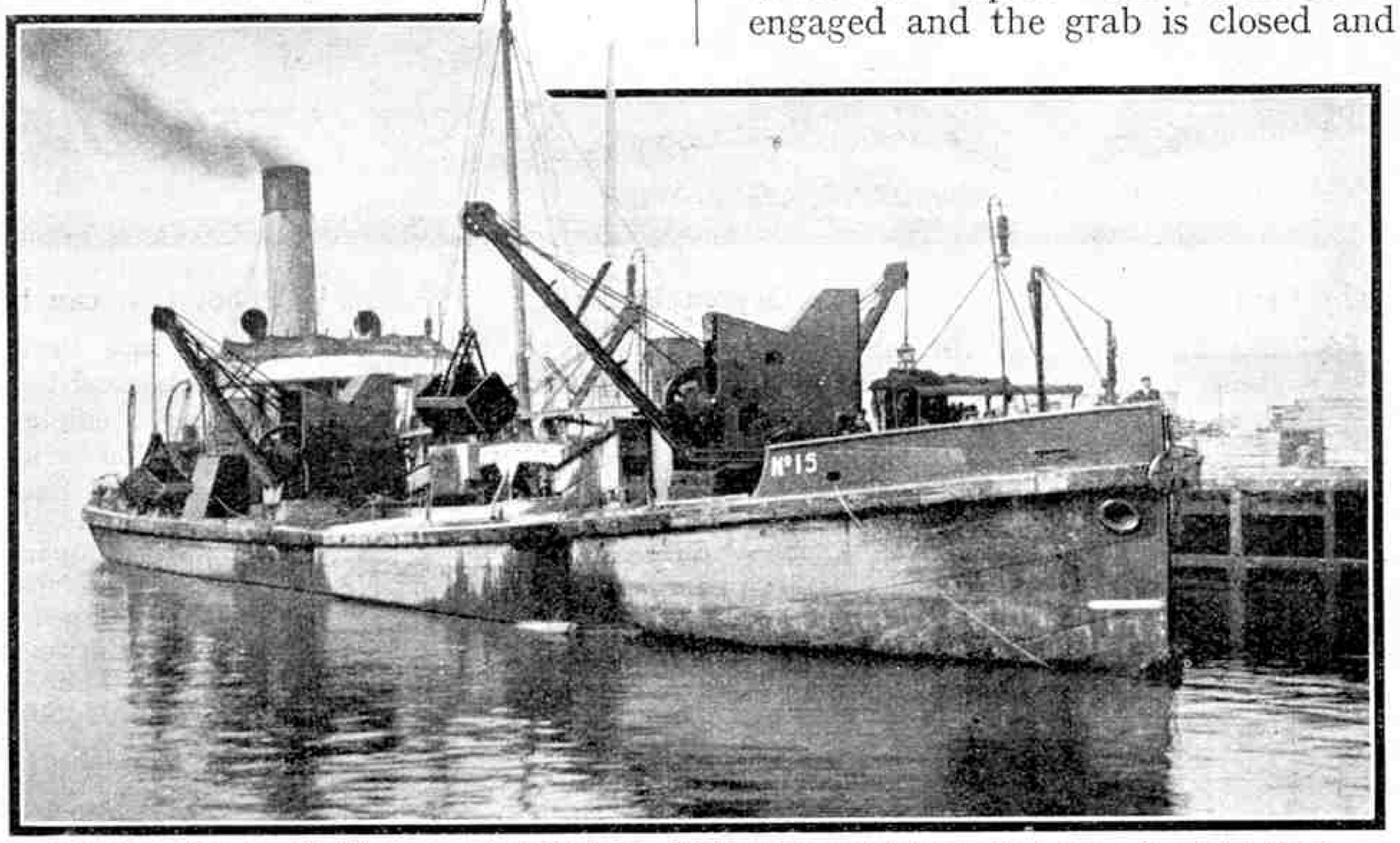
For use as a grabbing dredge the "Universal" is fitted with a double line grab, which is operated by means of two drums. Of the two ropes fitted, one is used for closing the grab when it is resting on the bottom of the river, for raising the loaded bucket to the top, and paying out while discharging. The other rope is used for holding the grab in an open position when discharging its load, and also while it is being lowered to the bottom of the river.

For the benefit of readers who did not see the previous article dealing with this machine we will describe here the most important mechanical features.

The two rope drums are mounted one behind the other, the closing and hoisting rope being attached to the rear drum, and the holding and opening rope operated by the one at the front. When the machine is working as a dragline the latter drum carries the drag rope. Both drums are driven through machine-cut steel gearing, and each is fitted with a friction clutch by which it may be engaged independently. The clutches are of the contracting band type worked by a relay system, in the operation of which a small brake band is used to

actuate a large brake band, thus giving an extremely powerful grip with an almost negligible effort on the part of the driver. In addition to the relay clutches, the closing rope drum is connected to the holding rope drum by a slipping friction device that automatically keeps the holding rope taut when the grab is being raised in the closed position. Damage that might result if the rope became slack and entangled in the mechanism is therefore avoided.

Foot-operated brakes are provided for controlling the lowering of the grab, and to allow it to be suspended in mid-air when necessary. To simplify the work of the driver the clutch levers and brake pedals are inter-connected, so that when the grab is being hoisted and reaches the maximum height desired, the application of the brakes automatically throws the clutches out of action, and the load is transferred from the clutch to the brake without any shocks whatever. Wear and tear on the machine is therefore considerably lessened.

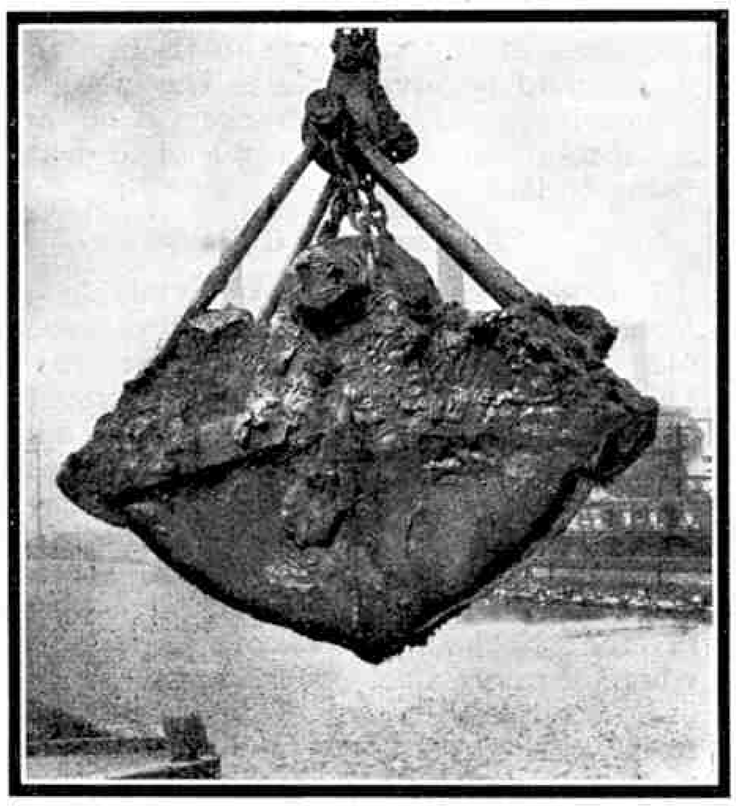


Priestman "Universals" in use as grab dredgers. Each of the grab buckets has a capacity of 70 cubic ft.

In order to reduce as far as possible any strain and fatigue on the driver, all controls are arranged close together and a comfortable seat is provided, so that the driver sits in full view of the work with all levers within easy reach.

The superstructure carrying the jib or boom is of the built-up girder type and is mounted on a roller race or slewing ring, so that it is free to slew in either direction throughout the full circle, a feature that is of considerable value in the case of short radius machines for work afloat, where the vessel may not always maintain an even keel.

The jib is sustained by several strands of wire rope, the free end of which is attached to a cast iron drum fitted with a cast steel worm and worm wheel. This gear is entirely self-sustaining, and under no circumstances can damage occur to the jib through inadvertence on the part of the operator or accidental overwinding of the drum.



An unsavoury load! The grab bucket of a Priestman Excavator being hoisted full of mud from the bed of a canal.

Two jib-head sheaves of machined cast steel bushed with gunmetal and of unusually large diameter are provided, the one for the hoisting rope having a wide tread in order to pass the rope-to-chain connection that joins the hoisting rope to the grab chain. The jib-head sheave pin is drilled and fitted with a large automatic lubricator, and a guard is provided to prevent either rope from leaving its sheave.

Except for the method of mounting already mentioned, the "Universal" for use afloat is identical with that for land work. In designing the fine model shown here W. D. Priestman has elected to mount it as a land working excavator. The model is driven from a Meccano Steam Engine, and includes slipping friction and relay clutches on the two winding drums. When the grab is on the "spoil" the clutch of one of the drums is engaged and the grab is closed and raised. Next the brakes of both drums are applied, and the crane is swivelled so that the grab is brought over the point where its contents are to be deposited. Then the hoisting drum brake is released and the grab opens. A Roller Race is used to represent the slewing ring of the actual machine.

The model, which as will be seen is mounted on rail wheels, will carry out all the movements of its prototype, and is easily converted for working as a dragline or a lifting crane by re-arranging the grab opening and closing ropes in the manner already described in connection with the actual machine. When the photograph was taken the model was equipped with a double-chain grab for working as a grab dredger.

We hope that with the aid of the details given in this and the previous article, and the accompanying illustrations, readers will be able to build successful models of this type for themselves. Those who do so are invited to send photographs of their models to this office, so that if suitable they may be illustrated in forthcoming issues of the "*M.M.*"

For the benefit of readers who did not see the article in the February, 1931 "*M.M.*," which dealt with the application of the "Universal" for land working, it may be mentioned that the alternative equipment includes three different kinds of jibs, any one of which can be fitted in a couple of hours. These jibs convert the machine into various kinds of excavators, including a trench shovel, navvy, dragline, skimmer scoop and a grab crane. The jib that is fitted when the machine is used as a dragline serves also when the machine is used as a grab excavator, and is supported on a hoist rope attached to the lifting gear at the rear of the machine. For navvy work a very strong jib is required and this is connected to the revolving frame by large cast jib feet, and is supported on a rope attached to one of the main clutch operating drums. The jib attached when the excavator is required to work as a skimmer scoop is also used to excavate deep trenches.

Tool with Many Uses

The "Eclipse" 4S Tool has been invented for the purpose of enabling a large variety of metal-working tools to be used with a single holder. The tools, which

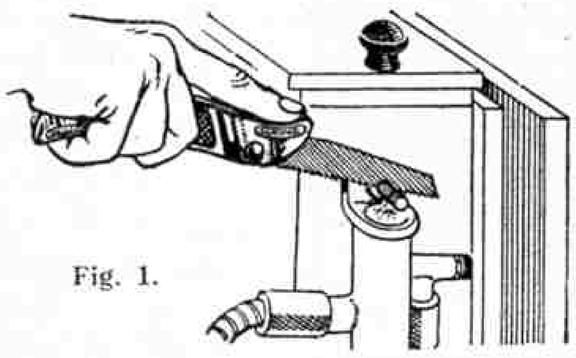


Fig. 1.

are vee-shaped at their ends, fit exactly into vee slots at the ends of the heavily nickel plated holder. These vee slots are so arranged that when the tool is fitted into one end it is in line with the holder, while at the other end it is inclined at such an angle as to allow clearance for the operator's fingers. The tool is finally secured by means of a special knurled setscrew.

The tool is packed in a metal container and will be found useful for amateur metal workers, in the tool room and the garage, and also for electrical and plumbing work. The six saw blades provided are tapered to enable them to fit into awkward corners, and they may be employed for many classes of short stroke work where a hack saw cannot be used. One of the slotting blades is specially designed for undercutting the mica of a commutator, and the others may be used for slotting screw heads, clearing out corners of blind holes, and many similar purposes.

Flat and half-round scrapers with carefully ground cutting edges are included, and the usefulness of the tool is greatly extended by the addition of a file and a slitting knife that may be employed for cutting leather belting and lead sheeting, cleaning sparking plug points, cutting out gaskets and other tasks of this kind.

The illustrations on this page show the "Eclipse" 4S Tool being used for sawing in an awkward corner (Fig. 1), cutting out a gasket (Fig. 2), slotting a broken stud (Fig. 3), and scraping a big end bearing (Fig. 4). They are reproduced by courtesy of J. Neill & Co. (Sheffield) Ltd.

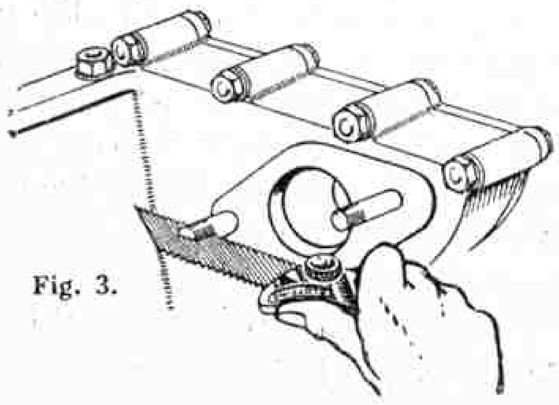


Fig. 3.

Oxygen Bricks

An invention for which it is claimed that it may save hundreds of thousands of lives in peace and war is described as "canned oxygen." It consists of a briquette in which a large quantity of the gas is absorbed or fixed. This may be stored for years without deterioration, or risk of fire or explosion, but a sharp blow raises its temperature sufficiently to cause it to give out oxygen steadily for hours at ordinary atmospheric pressure. It is said that the briquettes can be made for 6d. each, a surprisingly low cost in view of the fact that each contains as much oxygen as one of the steel cylinders now employed for storing gas under high pressure.

The invention is timely in view of the possibility of gas attacks in future wars, and it is suggested that the inhabitants of threatened towns should be provided with briquettes for use when asphyxiating gases are poured over them. The invention also could be used to supply oxygen in coal mines after disastrous explosions, when the deadly choke-damp may suffocate survivors of the catastrophe itself; and they would be invaluable to the crews of submarines and other workers who are liable to accidents that may lead to death owing to lack of air.

Armourplate Glass

Further details are now available of Armourplate glass, referred to on page 842 of the "*M.M.*" for November, 1932. This has a far greater mechanical strength than ordinary glass, for a sheet 3 in. in length and ¼ in. in thickness will support a weight of more than 3 cwt., merely bending slightly under its load. Its superiority to ordinary glass in this respect was shown in tests carried out in the National Physical Laboratory, where heavy steel balls, that shatter ordinary glass when dropped upon it from a height of 12.7 in., were unable to break a sheet of Armourplate glass unless they fell at least 10.2 ft. before striking it. A more dramatic proof of its amazing strength was given recently, when a crate containing three young elephants was suspended from a small sheet.

Armourplate glass is made from ordinary polished plate glass by subjecting it to a toughening process. When broken it forms small fragments that have no dangerous cutting edges and can be handled without risk, but it cannot be drilled or cut with a diamond, for it collapses as soon as the skin is penetrated.

Robot that can be Destroyed by a Word

It is said that the most recent robot, or mechanical man, can be destroyed by uttering a single word, the effect of the combination of sounds being to upset the delicate balance of the mechanism beyond repair. The inventor has adopted this novel plan in order to prevent it from being used for evil purposes, and he will not sell his robot or disclose the mysterious word that will shatter it.

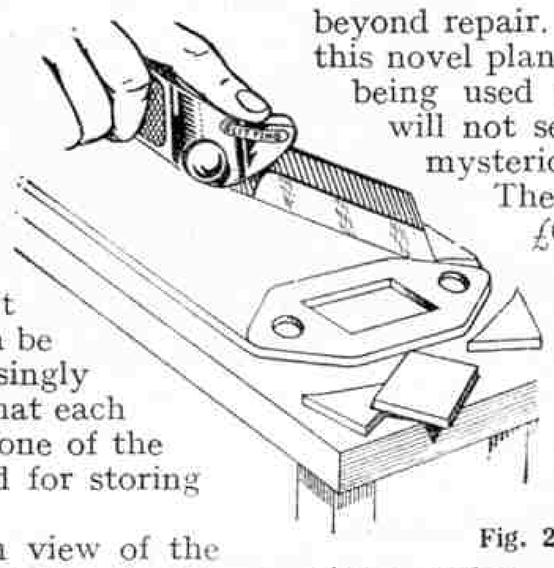


Fig. 2.

The mechanical marvel cost £6,000 to build and represents the work of 14 years. It can talk, read, stand up, wave its arms, and generally at the word of command behave in almost human fashion. If placed in a heavily-armoured tank with a machine gun it could be given orders that would enable it to destroy a regiment, and only a direct hit by a shell from a heavy gun, an unlikely contingency, could put it out of action. An army of well-trained robots of this description would be invincible and it is chiefly in order to avoid developments of this kind that the inventor keeps the control of his creation in his own hands.

A Simple Stand for Motor Cycles

A new and simple support for motor cycles has been introduced. It is known as the "Esway" stand and consists of two concentric steel tubes, the inner tube sliding inside the outer one, which is rigidly attached at each end to the frame of the cycle. When the stand is to be used, the edge of the inner tube is pressed down with the foot until it rests on the ground. A pawl on the outer tube then engages with a rack and locks the stand in position. A kick of the heel releases the pawl when necessary, and the inner tube then immediately springs back into its normal position.

The stand is easily clipped to the frame of a motor cycle and is brought into use in a second. It is equally effective on hills and on the level, and when necessary the lower end of the inner tube may be pressed into turf or soft ground in order to obtain a solid foundation.

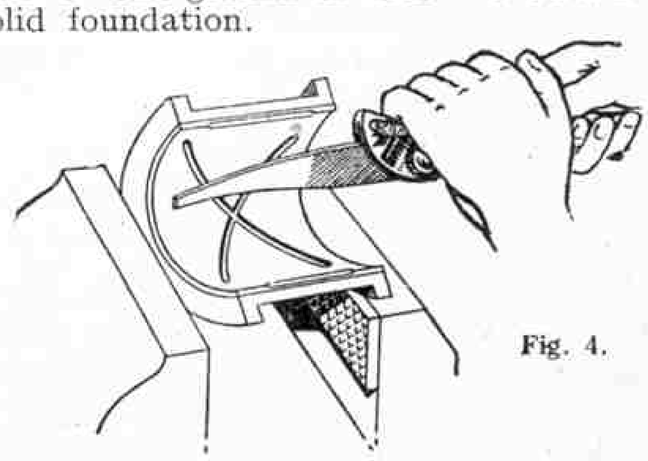


Fig. 4.

Electric Clock Without Gear Wheels

While one group of scientists have been devising electrical machinery to run at higher and yet higher speeds, another group have gone to the opposite extreme by perfecting an electric motor that revolves only twice a day. This motor has been produced in the Research Laboratories of the Westinghouse Electric Company, and there would be no difficulty in constructing one of similar type that would make only one revolution a year! The new slow-moving motor is of the synchronous type, its speed being fixed by the frequency of the alternating current employed to drive it, and it has been developed for use in the gearless clock illustrated on this page.

Ordinary clocks, whether driven by a spring or by an electric motor, make use of gear wheels to give the various hands and pointers their correct speeds. In the new clock four synchronous motors are united into one mechanism in which the only moving parts are four rotors driven directly at the required speeds. One of the four rotors makes one revolution a second, and the passage of a spot painted on it shows how each second of time is passing. Two other rotors require a minute and an hour respectively for a complete revolution, and these drive the seconds and minute hands on the face of the clock. The fourth rotor revolves once in 12 hours and its movement is transmitted to the hour hand.

The clock is silent in operation, and has a perfectly smooth motion instead of the jerky movement given to ordinary clocks and watches by the escapement mechanism employed. If the four points of wear were to be sealed in oil cups, and jewels used for bearings, a clock of this type would run for an indefinite period without attention, for regulation is automatic.

An electric clock that has no gear wheels. For our photograph we are indebted to the courtesy of the Westinghouse Electric Company.

Double-Acting Petrol Engine

The aim of one of the most recent innovations in connection with the internal combustion engine is to give a positive drive on the upward stroke of the piston as well as on the normal power downward stroke. The new engine is the equivalent of a double-acting steam engine, and has been designed by an American engineer. Its piston is longer than the usual type, and a stationary bulkhead, fitted with piston rings, divides the space within it into two portions. The bulkhead is rigidly attached to the cylinder walls and its supports do not interfere with the movement of the connecting rod.

A slot in the wall of the piston places the space above the bulkhead in connection with a valve chamber provided with inlet and exhaust valves and a sparking plug. A charge admitted to this space during one of the upward strokes of the piston is compressed by the return movement and fired at the end of the downward stroke, this driving the piston upward again. In this manner two power strokes are obtained in each cycle, instead of one as in ordinary engines using the four-stroke principle.

Car with Automatic Gear Box

An Australian inventor who is only 24 years of age has designed a gear box that enables a car to be started on a hill with a gradient of one in seven, and to be driven at speeds varying from a crawl at less than walking pace to the maximum of which the car is capable. The use of the new gear box in a road vehicle makes it as flexible as a steam locomotive, and the only controls required in addition to the throttle lever are the brake and reverse levers.

The secret of the invention is a form of transmission that provides the infinitely variable gear that has long been the ideal of all motor car engineers. A pair of centrifugal weights are mounted in a casing that forms the flywheel of the engine, and as the engine speed increases these swing outward from the shaft round which they rotate, and automatically adjust the gear ratio to suit the speed and gradient. Every possible ratio from a direct drive to one of 50 to 1 is available, and the correct gearing comes into action without intervention on the part of the driver.

A Reproducing Typewriter

A device has now been produced by means of which copies of circular letters may be automatically typed instead of being printed or reproduced by stencilling. The names and addresses and any individual details necessary may then be added by means of the same machine, thus giving the circular the personal touch that distinguishes an original letter.

The invention is a development of the principle of the player piano, for the original is not really a typed letter, but a perforated roll of paper. Holes are punched in this roll by means of a machine provided with a standard keyboard, each character being represented by a definite combination of holes in various positions. The roll is fitted into a mechanism at the back of the reproducing typewriter and the keys of the machine are depressed as it runs over a tracker bar. The compressed air required is provided by means of an electric motor of 1/6th h.p.

Automatic Change-Giving Machine

An interesting machine has been designed for the purpose of giving the correct change for any silver coin from a sixpence to a half-crown to passengers on the Underground Railways of London. This change always includes six pennies, delivered from a large drum capable of holding coppers to the value of £25, in order to enable those who arrive at stations without change to obtain tickets from automatic machines. Formerly it was necessary to install cashiers for the purpose of giving change. The machine works more quickly than a human being, however, and a trial at Oxford Circus Station has shown that its use greatly speeds up the issue of tickets at busy periods.

The machine is operated by a ¼ h.p. electric motor, and slots are provided for the insertion of half-crowns, two-shilling pieces, shillings and sixpences. The weight of the coin itself sets the mechanism in operation, and before delivering the change the machine automatically tests the thickness and weight of each coin, and even feels for the milled edges in order to make sure that counterfeits are not used. It is impossible to make use of iron and steel replicas, for a magnet would inevitably cause these to be rejected. The mechanisms delivering silver and copper coins are interlocked and pour the required change simultaneously into the bowl from which it is picked up.

The working parts of the machine are made of specially selected stainless steel in order to reduce wear. The box in which it is housed is built of sheet steel, with glass panels at the sides for inspection purposes, and the interior is illuminated so that the mechanism may be seen in action. The last coin to be inserted is brought to a position in front of the machine, where it remains on view until the next one is placed in the slot.

The lower illustration on this page, reproduced by courtesy of Brecknell, Munro and Royers Ltd., shows the change-giving machine installed at Oxford Circus Station on the London Underground Railways.

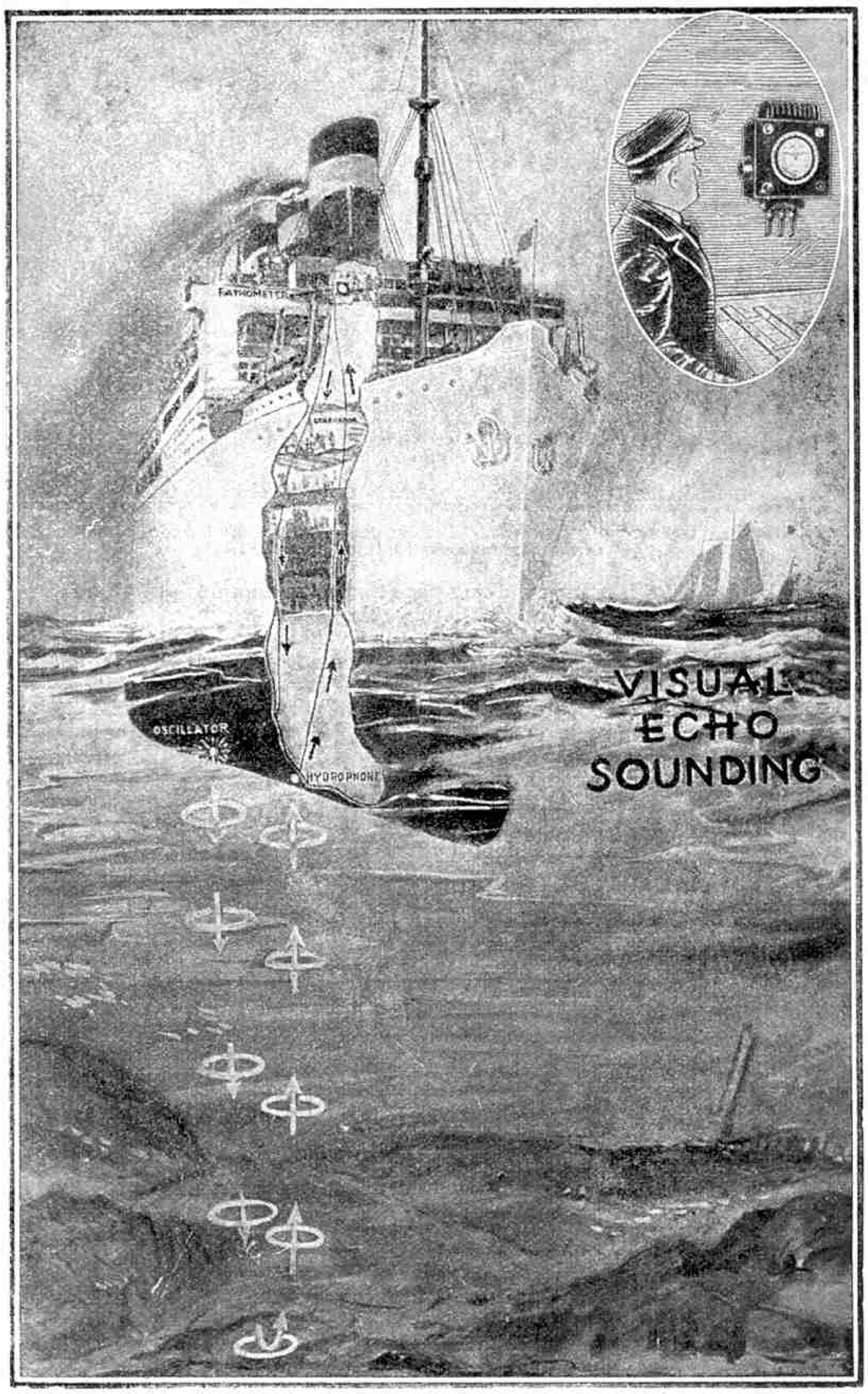
The Automatic Change-giving Machine described on this page.

Sounding the Sea by Echoes

How the Fathometer Works

THE need of a more effective method of obtaining depth-measurements has become more and more apparent with the development of modern ship designing. There are many occasions when the safety of the ship and the lives of those on board depend to a great extent upon the accurate and rapid determination of the depth of water beneath the keel. The old method of sounding, by heaving overboard a lead weight attached to a cord marked off by knots at certain intervals, is fairly efficient in a slow-moving vessel, but it is quite inadequate to provide the depth information required by a swiftly-moving steamship. Methods of sounding have been revolutionised during the past few years by the introduction of the Fathometer, which is the result of years of intensive research by the Submarine Signal Company.

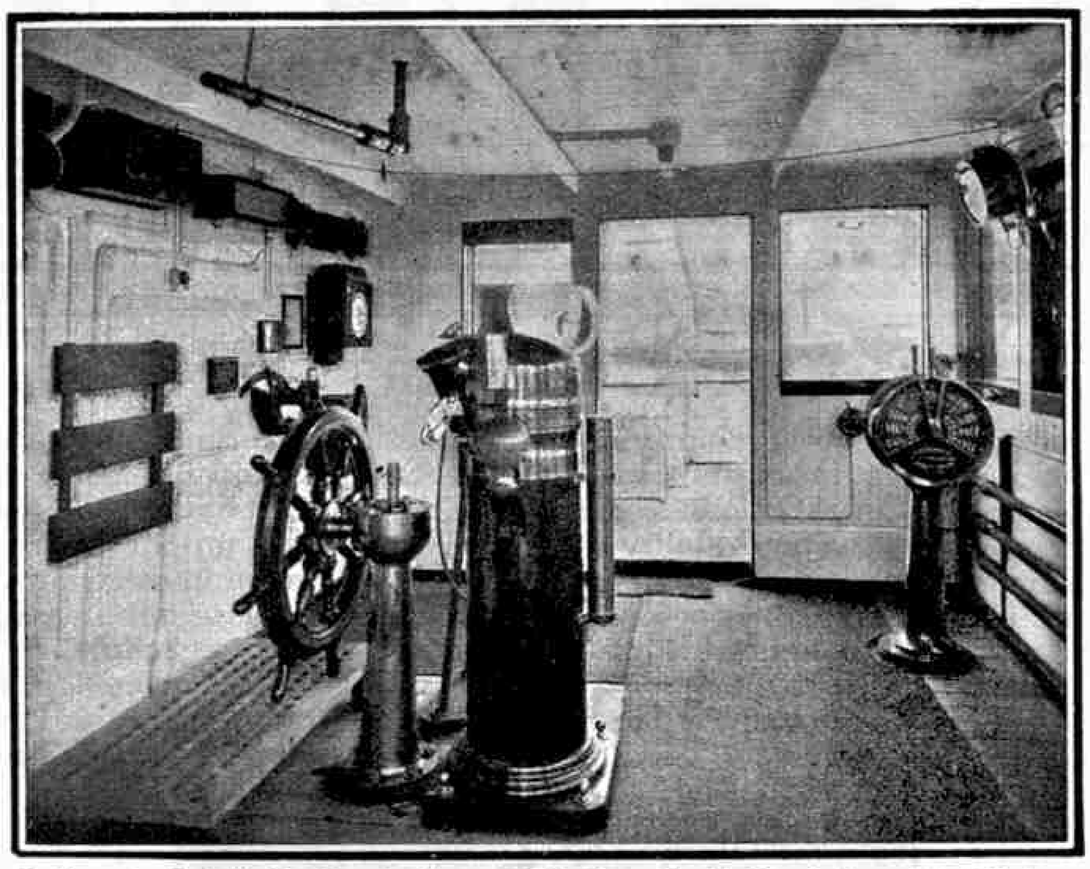
In May, 1914, on the United States Revenue Cutter "*Miami*" during International Ice Patrol off the Grand Banks of Newfoundland, Professor R. A. Fessenden of the Submarine Signal Company carried out experiments that proved the practicability of the principles that have been embodied in the Fathometer. Fessenden definitely established the facts that strong sounds produced under water would create echoes from the ocean bottom and also from icebergs, and that the time of travel of these sounds could be accurately measured, and the distance of travel thus determined. The early development work on the Fathometer resulted in the installation of this depth-sounding equipment initially on the "*Lydonia*" of the United States Coast and Geodetic Survey. The accuracy and reliability of the Fathometer were proved, and the apparatus was accepted by this branch of the U.S. Government Service as standard equipment for its survey vessels. In November, 1929, Fessenden was awarded the Scientific American Gold Medal by the American Museum of Safety for his various inventions for promoting safety at sea. The Fathometer, which was included among these inventions, was considered by a committee of experts to be the outstanding achievement in the field of marine safety. The International Conference on Safety of Life at Sea held in London in 1929 recommended that all maritime nations should encourage the use of echo depth-sounding apparatus.



The Fathometer for Visual Echo Sounding. The black arrows indicate electrical impulses, and the white arrows and rings indicate sound waves. (Inset) Watching the depth indications on the clock-like dial. The illustrations to this article are reproduced by courtesy of the Submarine Signal Company (London) Ltd.

The Fathometer has increased enormously the value to the navigator of soundings as used for the navigation of a ship. It eliminates the labour and inaccuracy of previous sounding methods, and supplies depth-measurements directly and instantly to the navigator, without either slowing down the vessel, or requiring the employment of members of the crew, as with other types of sounding gear. Modern ship design presents great difficulties for the operation of types of sounding apparatus requiring heavy sinkers. Further, sounding machines are usually placed aft, and in their use involve the hazard of losing or damaging their gear by the fouling of the line with the propellers or hull when soundings are required in rough weather. The

risks of stranding increase with the increase of a vessel's speed, and more frequent and rapid soundings are necessary in order that a high degree of navigating efficiency may be maintained. The Fathometer is now recognised as a thoroughly efficient sounding equipment, and is being included in the specifications of many vessels at present building or planned.



Fathometer installed in the wheelhouse of the Canadian National steamship "Prince Henry." The instrument is seen just beyond the wheel.

The principle on which the Fathometer echo-sounding apparatus operates consists in the measurement of the time interval between the production of a sound under water and the return of its echo from the sea bottom. As sound is transmitted through water at a uniform speed of approximately 4,900 ft. per second, the measured interval in seconds multiplied by 4,900 and divided by two represents the depth in feet, for obviously the sound has travelled during the interval down to the sea bottom and back again to the ship.

The Fathometer indicator, which is usually placed in the chart room of a vessel, controls the sending of a sound from an electric oscillator fitted in a suitable position inside the ship near the keel. This sound travels from the bottom of the vessel, strikes the ocean floor, and is reflected upward, where it is received by a hydrophone fitted inside the vessel at a certain distance from the oscillator. This sound echo creates an electrical pulsation which, at the instant it is received, is automatically translated into a visual indication of depth on the Fathometer dial. The navigator turns the switch on the indicator, and depth is promptly indicated on the dial. As long as the equipment is left in operation it will indicate the depth continuously at the rate of more than 20 soundings per minute, which is in marked contrast to the many minutes required to obtain a single sounding with former methods.

The Fathometer indicator shown in the accompanying diagram consists essentially of a disc mounted on the end of a shaft and driven by a small constant-speed motor equipped with a governor. The motor is started by closing the line switch A and turning the Fathometer switch B. Mounted behind a radial slot in the disc is a neon tube C, and in front of the disc is a circular scale graduated in fathoms and lying just outside the path of the slot in front of the neon tube. A cam on the revolving shaft opens an electrical contact D, thus allowing the oscillator E to operate at the moment when the neon tube is at the top of the scale. The oscillator produces a sound of short duration.

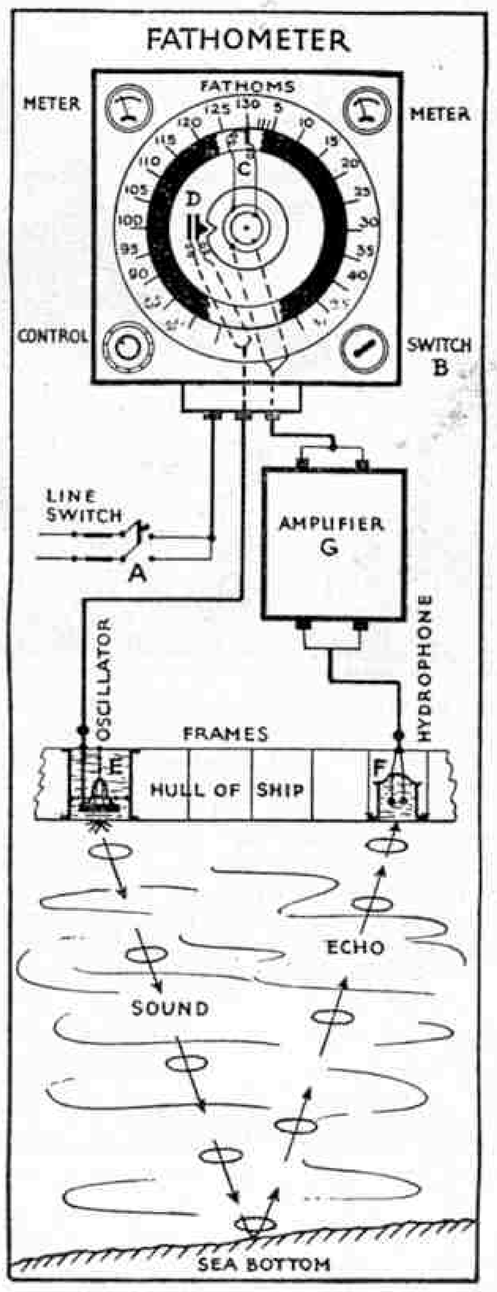


Diagram illustrating the principle on which the Fathometer works.

The sound echo returning from the sea bottom is picked up by the hydrophone F, and a voltage is generated in the hydrophone circuit. This voltage is transmitted through the amplifier G, causing a flash of light in the neon tube C, which by this time has travelled part of the way round the Fathometer dial. The flash of light acts like a luminous pointer and indicates the depth at that instant. The disc on which the neon tube is mounted makes several revolutions per minute, and light flashes of the neon tube, indicating depth, follow each other in rapid succession. If the bottom is level the flashes will appear at the same point on the dial; but where the bottom is irregular they will vary in position in accordance with the contour of the bottom.

The Fathometer installation is started and stopped by a switch button, and the adjustments for the taking of soundings are similar to those required by a radio receiver. Once the speed of the motor is regulated, the operation is entirely automatic, depth indications on the clock-like dial being given continuously.

The Fathometer has been applied with remarkable success to the fishing industry. It is of great importance to trawlers, for it actively assists them in locating fish. It enables soundings to be made regularly in rough weather, when it is difficult or even impossible to stop the vessel in order to obtain lead soundings; and it eliminates the danger of injury or loss of life during such operations. It minimises wear and tear of nets and loss of trawls by giving instant warning of variations in the contour of the ocean bed, and it enables fishing operations to be continued in fog when the usual buoys are useless. By means of Fathometer indications the area of fishing grounds can be accurately determined, and when fishing proves good at a given depth in a certain location, the automatic indications make it easy to return over the same ground for successive hauls.

The introduction of the Fathometer is the latest stage in the remarkable revolution brought about in sea fishing by modern discoveries and inventions. The capture of fish by line and net is certainly one of the world's oldest industries, but up to the 19th century the methods employed in it had changed little from those practised at the dawn of history. Then came the invention of the trawl net, which was first introduced in Ramsgate fishing boats in 1815, and the adoption of steam power in fishing craft in 1879. Since that time the beam-trawl has given place to the otter-trawl, and efficient methods of refrigeration and insulation have been developed. Echo-sounding by means of Fathometer indications brings up to date the equipment of a modern first-class trawler, which already includes apparatus for wireless telegraphy and direction-finding.

XXXIX.—AN ARTIST

CAREERS in art cover a very wide field, ranging from sculpture and the painting of pictures to designing in crafts and industry. No one can make a success of an artistic career in any of these branches unless he possesses great natural ability, but in addition a long and severe training is essential, and only those who are prepared to work hard and to give their whole minds to the task of developing their powers should think of adopting this profession.

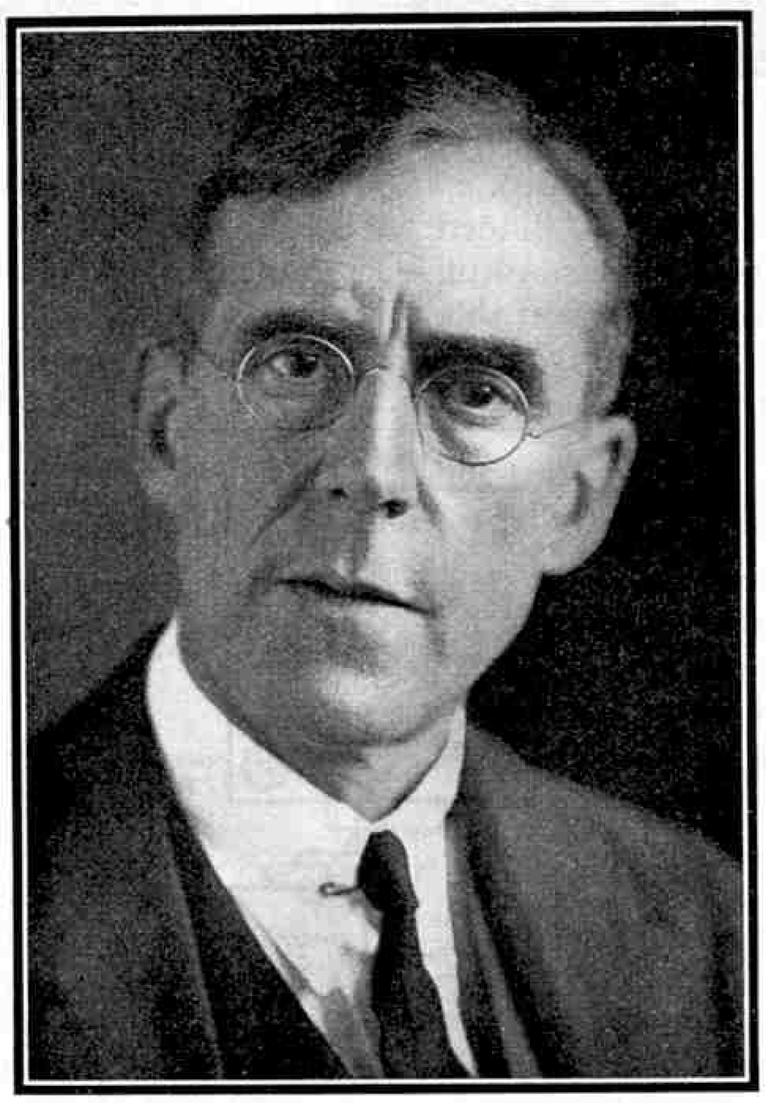
A boy who possesses drawing ability and is attracted by the prospect of an artistic career should try to develop his talent while at school, and if a choice of subjects is available he should certainly include drawing and painting in his course. To-day drawing forms a part of the syllabus in schools of all kinds, in many of which pupils are prepared for the examinations of the Royal Drawing Society; and Art may be taken as a subject in the Leaving Certificate or Matriculation examination.

Too much stress should not be laid on drawing and on artistic work generally at this early period, however, for a wide range of general knowledge is as essential in an artistic career as in any other. In the meantime the advice of competent observers on the possibility of success in an artistic career should be obtained, and if a favourable verdict is confirmed by the results of any examinations taken, application may be made for admission to a School of Art. The Principal of such a school invariably interviews applicants and bases his judgment on their ability to profit by the training given on samples of their work. He is therefore in a position to advise on the best course to pursue and on the likelihood of a successful career.

Although artistic abilities may take many different forms, and individuality counts heavily in the long run, specialisation at too early a stage is not advisable. For this reason students take a general course during their early years at an Art School. The preliminary course is followed by one specially planned for advanced students in the particular branch of art in which they are interested, and this is usually designed as a preparation for a diploma or certificate.

Art Schools of high reputation are to be found in many provincial centres as well as in London. These provide complete courses of training under well-qualified teachers, and the subjects taught include not only drawing, painting, sculpture and designing, but also the allied decorative arts necessary for those who intend to apply their abilities in industry and commerce.

As an example we may take the Liverpool School of Art, a representative provincial institution. At this school artistic occupations are divided into four types and training is given in each. The first includes painting, sculpture, etching, engraving and book illustration, which are regarded as constituting the fine arts. Attention is given also to artistic crafts, such as metal-working, wood-carving, leather working, the making of jewellery, lithography and enamelling; and those interested in industrial and commercial art may take courses in general design, interior decoration, poster and advertisement work, fashion drawing and the design of furniture. In addition, special training is provided for students who intend to take up the teaching of art, either in Schools of Art or in public and secondary schools in which drawing and art forms an important part of the curriculum. Similar courses are given in other provincial schools of the same standing. Many of these have also departments of architecture, or are closely associated with a School of Architecture, and thus practically every phase of art in modern life is covered.



Mr. Walter W. Russell, R.A., A.R.W.A., is Keeper of the Royal Academy Schools of Art, where he supervises the work of students in the Painting School. He received his training at the Westminster School of Art under Professor Frederick Brown. His works include figure compositions in the open and costume pictures, but in recent years he has concentrated on portraiture. He is represented in the collections at the Tate Gallery, London, the Walker Art Gallery, Liverpool, and most of the important galleries in this country, and also in Australia, South Africa and Ireland.

A student who has passed successfully through a regular course of instruction and training at a recognised School of Art may obtain more advanced training at such institutions as the Royal Academy Schools and the Royal College of Art, both in London, or may succeed in winning a scholarship tenable at the British School of Art at Rome. Many provincial Art Schools and Colleges offer scholarships that enable students to continue their training at one of the two London institutions, and to win one of these, or an award that qualifies for a course at Rome, is the aim of students who are interested chiefly in painting, sculpture and architecture.

The Royal Academy Schools of Painting, Sculpture and Architecture are associated with the Royal Academy, the select body of the most famous of British artists and architects. No fees are required, but applicants for admission must submit specimens of their work, together with a form of recommendation signed by a person "of known respectability," to use the phrase on the form itself. Students who have been awarded Travelling Studentships or Maintenance Scholarships from other Art Schools are not required to show their credentials, and applicants who are able to produce a certificate of proficiency from certain institutions in which architectural education is given also are admitted without the necessity of submitting specimens of their work. Those who are successful in securing admission are on probation for a period not exceeding three months, and if their work is satisfactory they are recognised as students and complete a regular course of training.

Students who do not hold scholarships or exhibitions are required to submit drawings and other work, and to pass an entrance test, before they are admitted to the Royal College of Art. If their qualifications are sufficiently high to enable them to gain admission, they follow courses in one of the five schools into which the institution is divided, architecture, designing, drawing and painting, engraving and sculpture. The courses ordinarily occupy three years, and the Diploma of Associateship of the Royal College, A.R.C.A., is granted to those who complete the training and pass prescribed tests. A further activity of the Royal College is the training of students who intend to become art teachers, Associateship of the College being the chief recognised qualification for posts of this kind. The fee for a complete session is 30 guineas.

A third famous School of Art in London is the Slade School of Drawing, Painting and Sculpture. This forms part of University College, one of the constituent colleges of London University, and provides full courses in all branches of art and architecture,

including their history. The University of London grants a diploma in fine arts to those who satisfactorily complete a recognised course of not less than three sessions, and this is accepted as a qualifying diploma for teachers in Art Schools. The fee for a session at the Slade School is 28 guineas.

The course to be followed by a student who has completed his studies will depend on the branch of art in which he is specially interested. Those who have studied landscape or figure painting, portraiture or sculpture, aim at producing works for sale to private collectors or to galleries. The rewards in the early stages of a career of this kind are often meagre, and it may be several years before an artist becomes sufficiently well known to receive commissions or command high fees for his works.

The position in regard to commercial and industrial art is different. Here a wide field is open, ranging from the industries, such as textile or pottery manufacture, in which design plays a great part, to commercial art work, including the production of illustrations for newspapers, periodicals and catalogues, posters and advertisements of all kinds. In many cases work of this kind is carried out in studios that form part of the organisation of the firm, whether this is of an industrial character, or is an advertising agency or a commercial concern.

It is important to bear in mind that in order to succeed in industrial art work more than artistic taste is needed. This may be realised from a consideration of the textile industry. The designer of any fabric must be familiar with the technical details of weaving, for otherwise he would be unable to present his work in a form that would be practicable and readily appreciated. Similar considerations apply to commercial art in relation to advertising in its many branches, for the artist must be able to produce selling ideas as well as striking designs and pictures.

A word may be said in regard to prospects. There are no regular scales of pay in commercial and industrial art, but artists and designers who show originality and ability may rise to high positions with good salaries. Careers of this kind are highly individual in character, however, and the measure of success depends entirely on the ability of the artist and designer himself.

Scenes in the Liverpool School of Art. Above and left, students at work in a life class. Below, classes in modelling and sculpture (left) and designing in industry (right). Photographs by courtesy of Mr. A. P. Huggill, A.R.C.A., Lond., A.R.E., Principal of the School.

Boys who possess drawing ability and promise to develop skill in design, and who cannot for various reasons take full time day courses at a School of Art, may follow a different plan. This is to secure a post in the studio of a firm engaged in an industry in which design plays a great part, or to join the staff of an advertising agency, or of some other organisation in which art and design are of importance. There they may obtain practical training in the work they desire to do. Although at first they may be called upon to carry out comparatively menial tasks, they will be transferred to more congenial work if they show promise, and will then be able to give their abilities full play. A boy who is ambitious would combine practical activities of this kind with evening study at the local Art School or at home, in order to qualify for the highest posts in his chosen profession.

Many crafts offer good openings for trained designers. For instance, design plays a great part in the production of jewellery, furniture, stained glass and many forms of metal work. Courses for those who intend to specialise in crafts of this kind are arranged at most Art Schools, and the study of design also may be combined with work in a commercial studio, as in other branches of applied art. Another application of art design is the production of fashion drawings. These may be merely representations of existing designs, or may be suggestions for actual production; but in each case the work is of a highly specialised character, and may be very remunerative to those who show great aptitude.

The teaching of art calls for special consideration. In order to qualify for this work, it is necessary to supplement a course of art training with one in the principles of teaching. There are three qualifications for an art master of the highest grade. One of these is the Teaching Certificate of the Royal College of Art. This is granted to the student who has completed his course for the Diploma of the Royal College, and has then passed an examination in the principles of teaching and school management. The remaining qualifications are the Board of Education Art Master's Certificate and Art Teaching Certificate. These are open to students of recognised Schools of Art throughout the country, and special courses are usually arranged to enable those interested to sit for the necessary examinations. All three qualifications are regarded as equivalent to degrees and entitle their holders to receive the pay of a graduate on the Burnham scale.

Art masters have organised a special body, known as The National Society of Art Masters, to look after their interests generally, and part of its work is to arrange qualifying examinations for teachers of art. The certificates granted to successful candidates are special qualifications for teaching in elementary schools, and include the School Drawing Certificate and a higher qualification that is known as the Further School Drawing Certificate. In addition, the Society holds examinations of a more advanced character for teachers in secondary and similar schools, while a special series of tests covers the arts and crafts that are of practical value in general education. Full details of these examinations may be obtained from the Secretary of the Society, the address of which is 29, Gordon Square, London, W.C.1.

In dealing with the four chief types into which we have divided art occupations, we have been unable to refer to every field in which an artist may specialise. This is impossible in a general article, now that art is no longer thought to include only painting and sculpture, and its importance in ordinary daily life, as well as in industry, is becoming increasingly recognised. Consequently more artistic tastes have become desirable in many occupations, some of which formerly were regarded as almost entirely mechanical in character in spite of the obvious dependence of the products concerned on form and colour for their successful marketing.

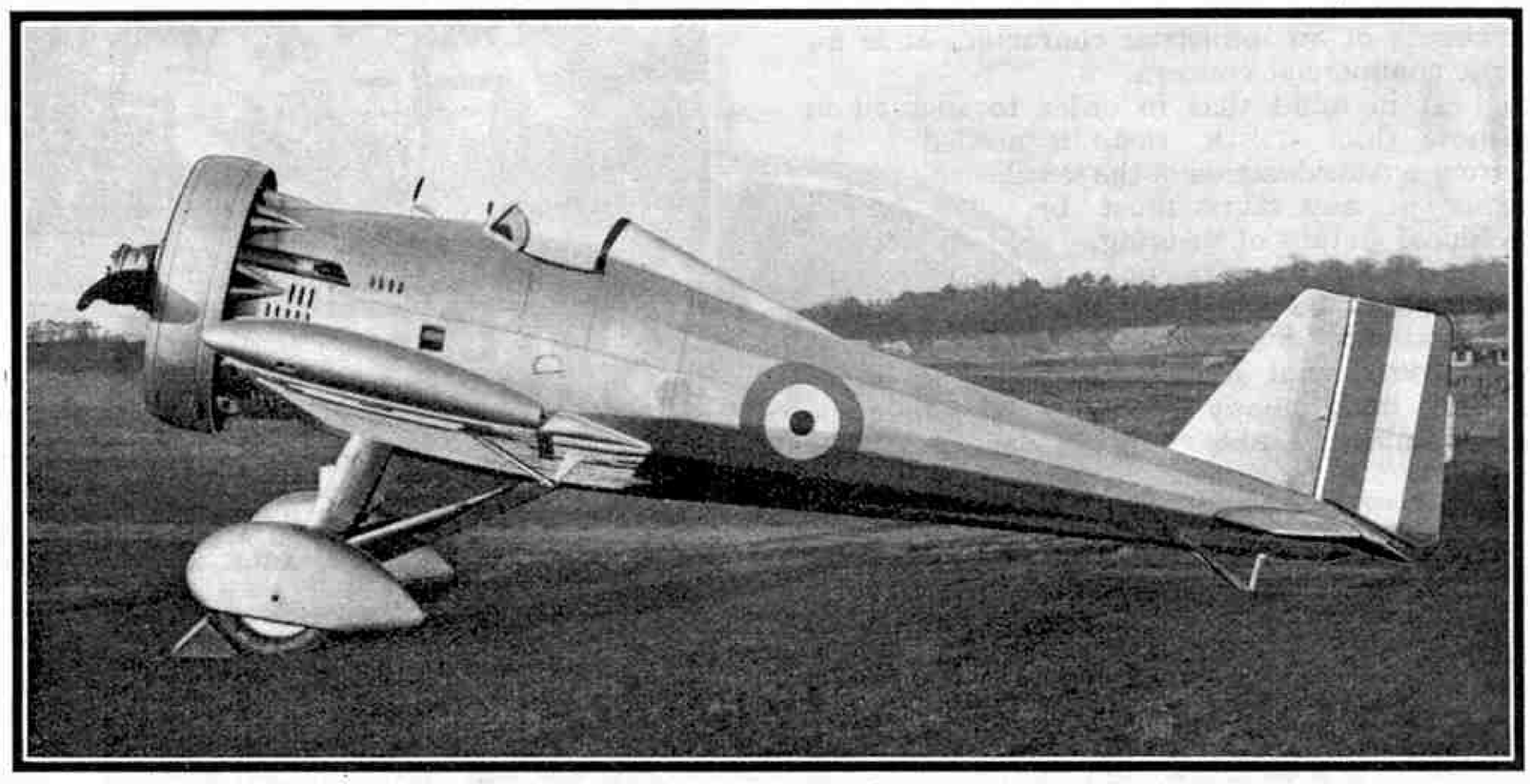
One of the results of this change of outlook has been a greater interest in art training for those engaged in various trades. For instance, boys and young men who have taken up printing, bookbinding, cabinet-making, wood-carving, painting and decorating and similar work may now attend special courses arranged for them at many provincial Art Schools. There they may combine practical training in the essentials of their trade with a study of drawing, ornament and designing that will help them to improve their grasp of underlying principles and also will enable those with artistic gifts to make the best use of them in their special branch of activity.

Art training of this kind is particularly valuable to those engaged in process work, the development of which has enabled the finest products of the artist to be reproduced in correct form and with remarkable faithfulness in regard to colour. Process work is chiefly employed in reproducing photographs, now so largely used as illustrations in books and periodicals, as well as in advertisements and similar work, and the introduction of three-colour and four-colour printing opened a new and interesting field to the commercial artist. The preparation of the blocks by means of which his designs are reproduced is highly skilled work that calls for a certain proportion of artistic knowledge in order to ensure satisfactory results, and this branch of work is sure to become increasingly important.

British Aircraft Developments

V.—Modern Low Wing Monoplanes

IN the "*Air News*" pages of the "*M.M.*" we have frequently drawn attention to the rapid increase in popularity of the low wing monoplane during the last few years. This type of machine has been for many years popular on the Continent, the most famous exponent of the type probably being the Junkers firm, for all the aircraft built by this company are low wing monoplanes. In England, however, the biplane has been the more popular machine up to the last two or three years, when monoplanes of various types have been rapidly overhauling it in public esteem.



Side view of the Vickers "Jockey" interceptor fighter, showing the excellent streamlining. The shape of the wing and ailerons tips is particularly interesting. For this photograph we are indebted to Vickers (Aviation) Ltd.

There are now many low wing monoplanes constructed in England. One, the General "Monospar," was described at length in our last month's issue, and other well-known examples include the Avro "Avian Monoplane," the de Havilland Interceptor Fighter, the Fairey Night Bomber, the Hendy 302, the Spartan Cruiser, the Vickers "Jockey" Interceptor Fighter, and the Westland Interceptor machine. In this article we deal with the main features of the three latest British low wing monoplanes in the list, the Fairey Night Bomber, the Spartan Cruiser and the Vickers "Jockey."

The Spartan Cruiser about to land. This aeroplane carries five passengers and is capable of travelling at a speed of 135 m.p.h. We reproduce this photograph, and the lower one on the opposite page, by permission of the Spartan Aircraft Ltd.

The most unusual of these three machines is the Fairey Night Bomber, for the carrying of heavy loads has always been thought to be essentially a task for the biplane. The machine also possesses the distinction of being probably the largest low wing monoplane yet constructed in this country.

The Fairey Night Bomber is a low wing cantilever monoplane equipped with two Rolls-Royce "Kestrel 111.S" engines, each developing 526 h.p. The machine has a span of over 100 ft. and when fully loaded is more than 8½ tons in weight. It is capable of carrying out bombing raids at high speed, and in its design particular attention has been paid to the problem of defending the machine against hostile aircraft.

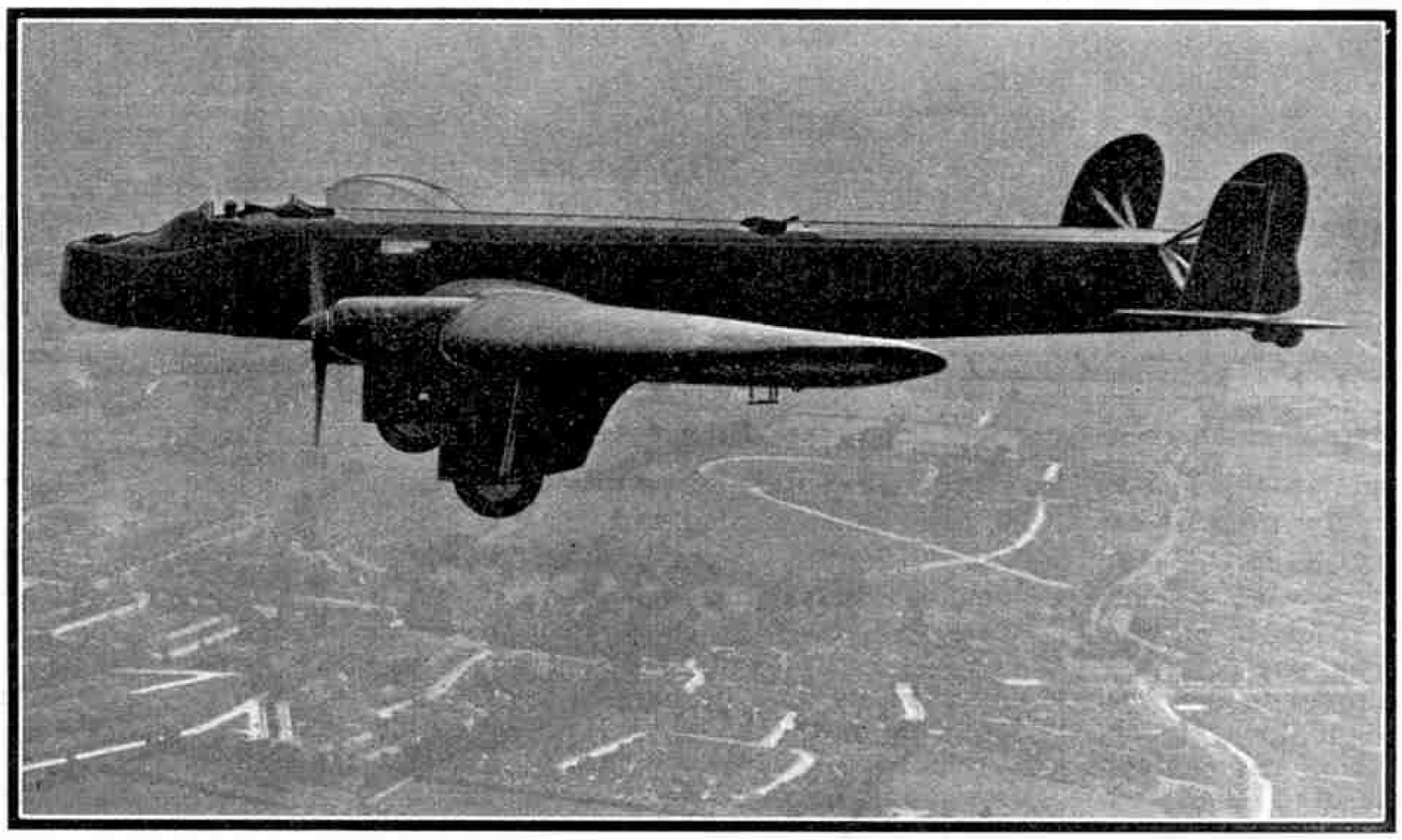
The ability to perform many and varied duties with the same machine is typical of service aircraft, and the Fairey Night Bomber is no exception to this rule. It has been designed to exceed, in various particulars, the specification required by the Air Ministry. Thus it can operate with a bigger load, while extra petrol tanks are fitted so that the range is more than the type requirements. In carrying out bombing duties, four men will normally be accommodated, but the fuselage is big enough to take between 15 and 20 men if the aeroplane should be required for service as a troop carrier. Provision is made for any kind of bomb to be carried on racks inside the wing.

The machine has been designed with a very efficiently streamlined shape, and its absolute "cleanness" has enabled it to have a high top speed, while the thick cantilever wing makes possible efficient long range cruising and high altitude flying. The machine takes off easily and lands very slowly, essential features for night flying aircraft that might be called upon to work on full load from small aerodromes.

Owing to the large size of the wing, the full bomb load is housed without any artificial increase in thickness or alteration in the profile. The engine nacelles also give

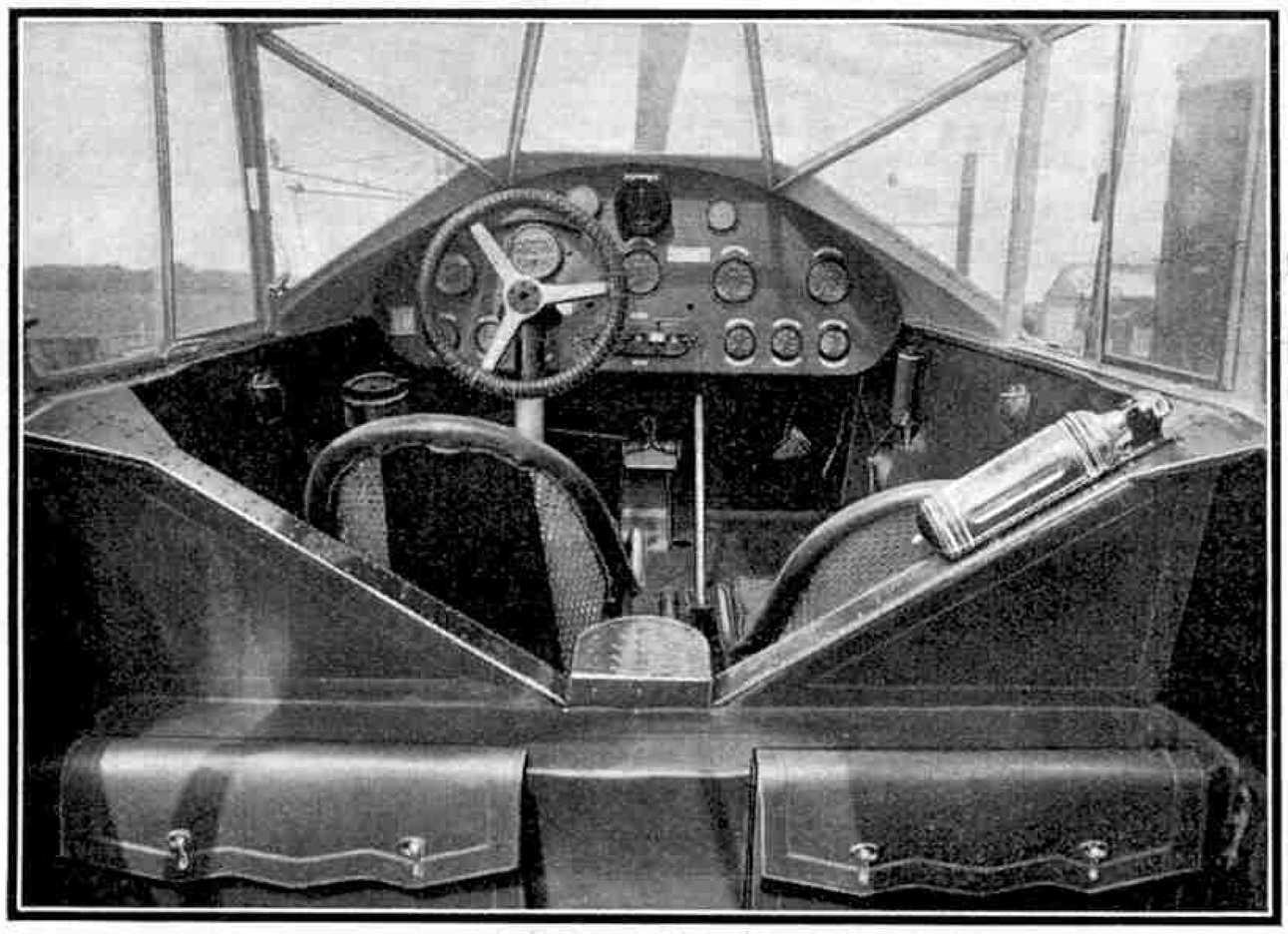
no increase in the frontal area of the machine, while the radiators give very little extra drag as they are the same width as the chassis fairing in front of which they are placed. There is no external bracing to the wing structure, and only one diagonal strut on each side to brace the chassis.

The primary structure is of steel, but extensive use has been made of duralumin for the secondary structure. The wing and the fuselage are covered with fabric, and the wing is built in sections to facilitate transportation and assembly.



The Fairey Long Range Bomber in flight. This huge machine, which is provided with five cockpits, can also be used as a troop carrier. A front view of the Fairey Night Bomber appears on page 111 of this issue. Photograph by courtesy of the Fairey Aviation Company Ltd.

As already mentioned, the problem of defence has been carefully considered, and there is perfect communication between all members of the crew, a walk-way from end to end of the aeroplane being provided to enable members to change places quickly, or to replace one another in the event of casualties. As night fighting consists chiefly of individual attacks at close range, the gun cockpit has been placed at the rear end of the fuselage, right behind the empennage or tail unit. This position was chosen in preference to relying on guns above and below the fuselage just behind the wing, because the gunner is nearer his target in a tail turret, and he does not have to worry about the possibility of shooting away the tail structure which may not be clearly discernible in the dark. All the guns fitted have wide arcs of fire and there are no blind spots until within a few feet of the machine. The centre gunner can fire downward so that even when an aeroplane is below the fuselage it is in the field of fire. In order to increase the aerodynamic cleanness of the machine, all guns are stowed away when not in use, but are arranged so that they can be instantly brought into action when required. As the aeroplane is on the Air Ministry's Secret List, performance figures are not yet available for publication.



Interior of the cockpit of the Spartan Cruiser. The pilot's position is in the left side and one of the passengers sits in the right hand seat, the remaining four passengers all being accommodated in the cabin. Another photograph of this machine is published on page 111.

The Spartan "Cruiser" is very different from the Fairey machine, for it is a triple-engined cabin monoplane capable of seating six people. It has been designed purely for civil use, particularly for the operation of feeder air services and for air taxi work, and fills the long-felt want for a machine mid-way between a light private type and a large commercial air liner.

The "Cruiser" possesses a number of structural features similar to those of the Saro range of flying boats, which were described in our issue for May 1931. It is fitted with three de Havilland "Gipsy III" inverted engines, and when equipped for passenger work carries five passengers and a pilot. This represents 72 h.p. for each paying passenger, which is not excessive, considering the good performance of the machine. When in service as a freight carrier a pay load of 1,000 lb. may be carried for journeys lasting up to six hours and within a cruising range of about 700 miles. For shorter journeys the pay load may be increased. For instance, with sufficient fuel on board for a four-hour flight, five passengers and 400 lb. of luggage may be carried. The machine is capable of maintaining flight with any one engine out of action.

The fuselage is of metal construction throughout, and follows closely in principle, although not of course in actual shape, the hulls of the Saro flying boats. A series of light frames gives the fuselage its transverse sections, while the planking or covering is of "Alclad," stiffened by longitudinal corrugations. If the fuselage should be damaged it is not difficult to carry out repairs, as beaten work is unnecessary for any part. The wing is of all-wood construction covered with fabric, and the wing cover is fixed and stiffened near the fuselage to form a walk-way to the cabin door for use when entering or leaving.

The fuselage is wide enough to allow seats to be placed along the sides of the cabin, with a gangway down the centre. Four of the seats are placed between the wing spars, while an unusual feature is that the fifth passenger is seated next to the pilot, in front of the leading edge of the wing. The windows in the side of the cabin are of Triplex glass, and those in the (Continued on page 154)

Another D.H. Aeroplane

A new de Havilland machine has satisfactorily completed its preliminary test flights. This is known as the D.H. 84, and is a twin-engined biplane of wooden construction, employing engines of the D.H. "Gipsy Major" type, one mounted on each lower wing. In order to increase the accessibility, and to obtain as much natural cooling as possible, the engines are carried in front of the leading edge, and do not actually rest on the wings. The petrol tanks are built in the wings behind each engine and are provided with streamlined fairings reaching back from the engines. It is estimated that the machine will have a cruising speed of about 110 m.p.h.

The new machine will be available in two types, one for civil purposes, capable of carrying six passengers and provided with an extra large luggage compartment, and the other for military use. Several of both types already have been ordered, and the first of the military ones to be completed are to be sent to Iraq. The type is known as D.H. "Dragon."

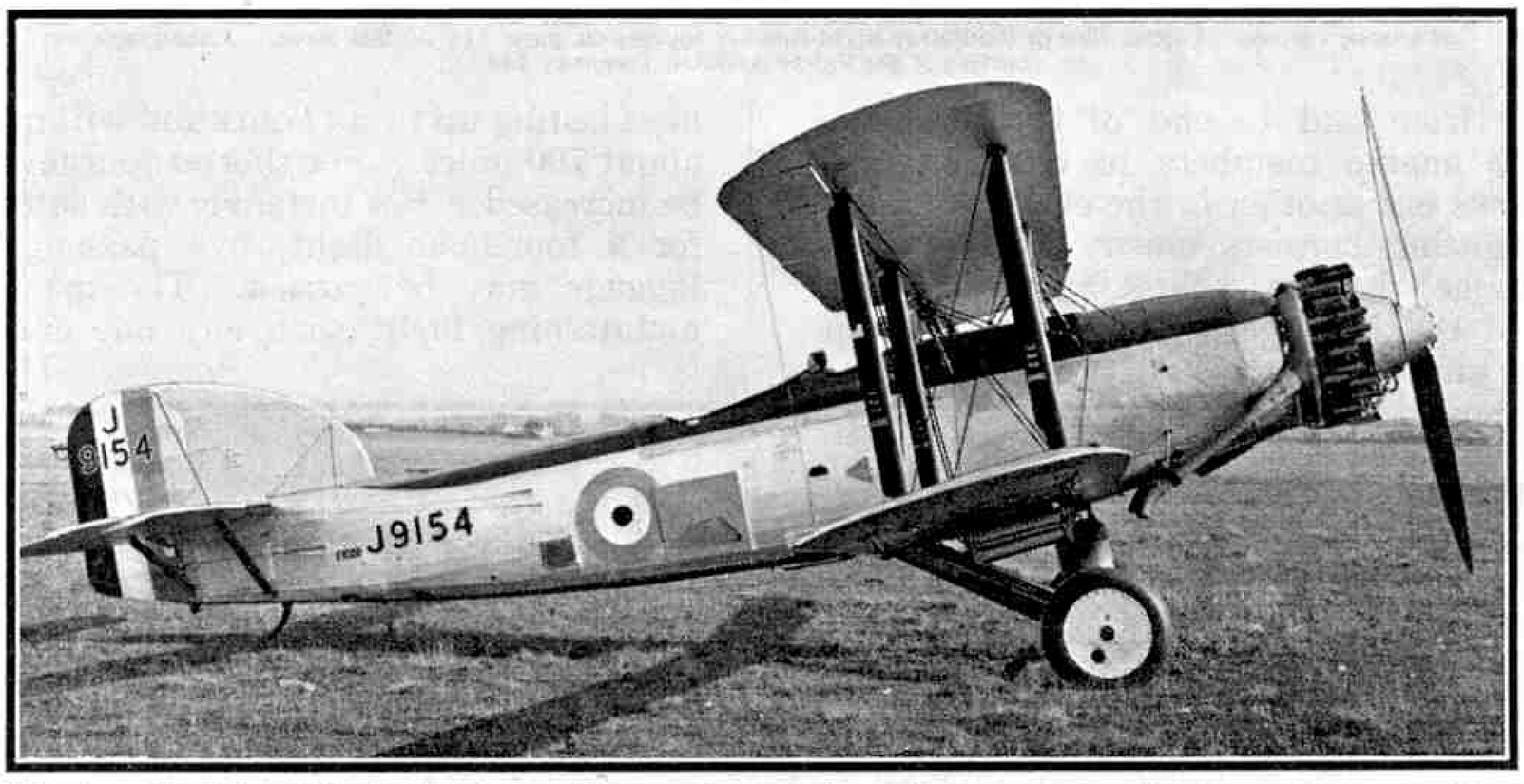
Engines for the New Zeppelin

It has been decided that four Diesel engines each developing 1,000 h.p. are to be used in the new Zeppelin, L.Z. 129, that is now being built at Friedrichshafen. The particular type to be used is not yet known. Two leading German aero engine firms are building engines, and both these types will be subjected to tests by the constructors of the airship.

It is thought that the use of the Diesel engine will enable a considerable saving to be made in fuel consumption, and this, combined with the cheapness of the oil, should reduce operation costs by a great amount. In addition, the smaller tanks needed to carry the fuel would enable the pay load to be increased. On a flight from Europe to South America it is probable that an extra 500 kgs. could be carried.

A Steam Driven Aeroplane

Work on an aeroplane driven by steam is now being carried out by the Great Lakes Aircraft Corporation of Cleveland, Ohio. The machine is equipped with a water-tube boiler in the fuselage, working at very high pressure, heat being provided by a liquid fuel furnace. Superheated steam from the boiler is carried to twin turbines placed in the wings, and the airscrews are connected to these turbines through reduction gearing. The exhaust from the turbines is carried to condensers placed in the wings where it is cooled by air directed by air scoops; and it is then fed back by high pressure pumps into the boiler.



Side view of the Fairey "Gordon." This machine is the latest version of the famous Fairey 111F General Purpose machine, fitted with an air-cooled engine. We are indebted to the Fairey Aviation Co. Ltd., for this photograph.

Flying Over Mount Everest

An interesting project for securing photographs of the summit of Mount Everest, and of the country in the immediate vicinity of this mountain, is now receiving the attention of a British Expedition. The expedition is to be organised by scientific and geographical interests, and the Marquess of Clydesdale, who will be accompanied by an experienced photographer, has consented to pilot the machine. It will be necessary for the aeroplane in which the flight is made to be provided with special oxygen breathing apparatus as the summit of Mount Everest is 29,002 ft. in height. The support of the Air Ministry has been gained for the venture, and the Maharajah of Nepal has given his consent for landings to be made in his country.

Air Transport and Iraq Pipeline

In the "*Engineering News*" on page 831 of our issue for November 1932, we gave brief details of the new pipeline connecting the oil wells of Iraq with Palestine and Syria, that is now being constructed. In the laying down of the pipe one of the chief problems met with was that of transport, but this difficulty has been solved by means of aeroplanes, the company carrying out the work having acquired two machines from Imperial Airways.

The two aeroplanes on the service are the "*Apollo*," an Avro X monoplane, and a D.H.50, and they are being maintained by Imperial Airways, who have also supplied the pilots for them. The aeroplanes are particularly useful for enabling field managers to carry out their duties, which consist of the superintending of large fleets of land motor vehicles used in the haulage of pipes, provisions and stores; and they are also proving valuable in carrying out surveying work.

Internal Air Ferries

An experimental air service between Bristol and Cardiff was operated during the summer of last year and proved so satisfactory that a regular service between the cities has been inaugurated. At present two trips are made each way every day. The journey takes about 20 minutes and the fare charges are 12/6 single and 22/6 return. The service is operated by a D.H. "Fox Moth," and several "Puss Moths" are available as reserves.

Another British air service that is operating regularly and on an economical basis is that between Shoreham, Portsmouth and Ryde in the Isle of Wight. This service is carried out with aeroplanes of the General "Monospar" and Westland "Wessex" types, and has been run since September last year, although the section between Portsmouth and Ryde was put into service before this.

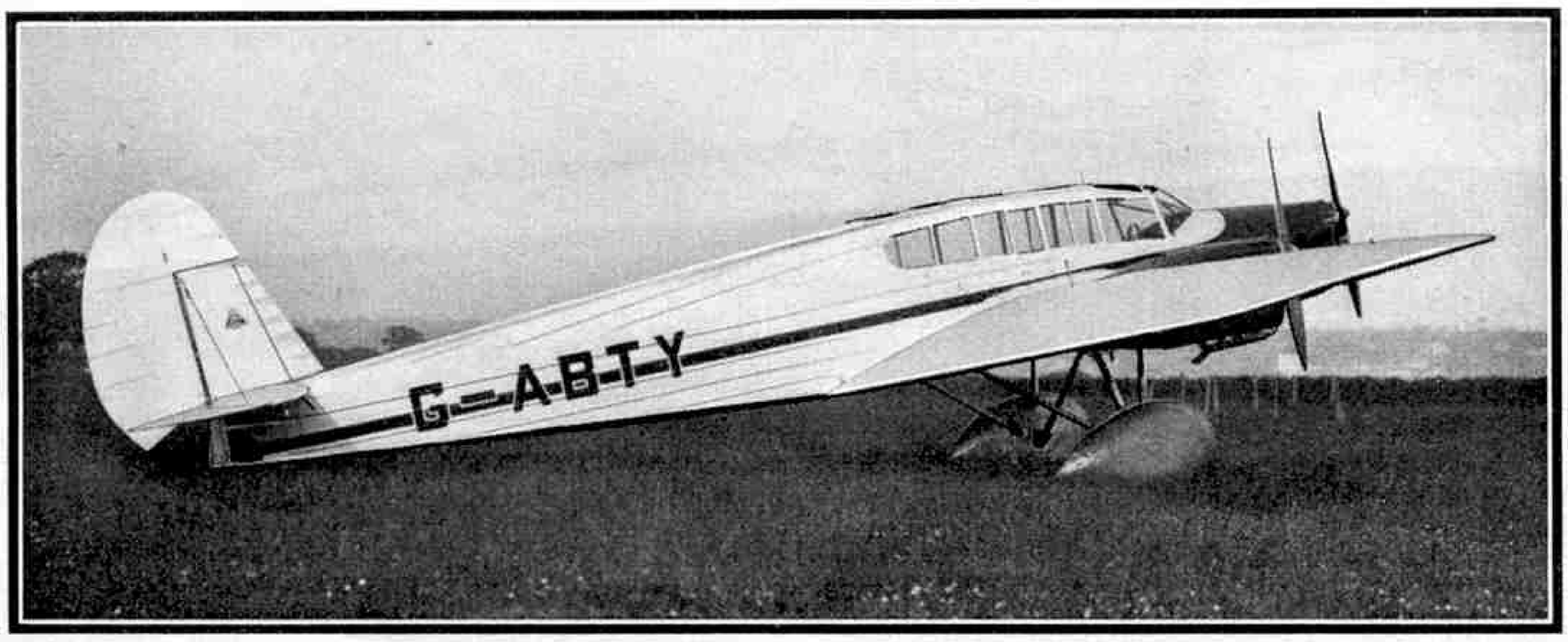
"Feeder" Services for Imperial Airways

"Feeder" air services are now being operated in conjunction with both the Indian and the African Empire air mail services. That on the England-India route consists of an extension from Karachi to Bombay and Madras, which covers a distance of about 1,000 miles and is operated by the Tata Company. It makes it possible for mails to be sent from London to Bombay in seven days and to Madras in eight days. The postage to both places is 8d. for the first half ounce and 7d. for each additional half ounce. All letters intended to be sent on the service must be superscribed "By Air in India."

There are several feeder air services operating in conjunction with the African air mail route, extending the benefit of the air mail service over areas of hundreds of miles. For instance, the coastal feeder route, operated by Wilson Airways, links up Dar-es-Salaam and other towns in Tanganyika Territory with the Imperial Airways route at Nairobi, connections being provided with both northward and southward Cairo-Capetown services. Another valuable air link extends for approximately 200 miles from Kisumu, on the main transafrican line, across the shores of Lake Victoria by way of Jinja, Torroro and Eldoret to Entebbe.

Farther south along the main route is another feeder line, the purpose of which is to effect air connections with the Belgian Congo. This line operates between Broken Hill and Elizabethville, headquarters of the Katanga province, and it is also proposed to extend a further link into the Central Congo at Luluabourg which, since the institution of the Benguella railway, has been the southern terminus of air services in the Congo. The postal rate for a half-ounce letter from England to Elizabethville is 1/3, and for postcards 7d. The time taken in transit is nine days, which is a great saving over the ordinary post.

More than 1,000 miles of auxiliary air-lines, serving districts far removed from the main route, are represented by these Nairobi-Dar-es-Salaam, Kisumu-Entebbe, and Broken Hill-Luluabourg services, and other plans that should prove equally valuable are now actively in hand.



Three-quarter rear view of the triple-engined Spartan Cruiser. For other photographs, and descriptions, both of this machine and the one illustrated below, see page 108.

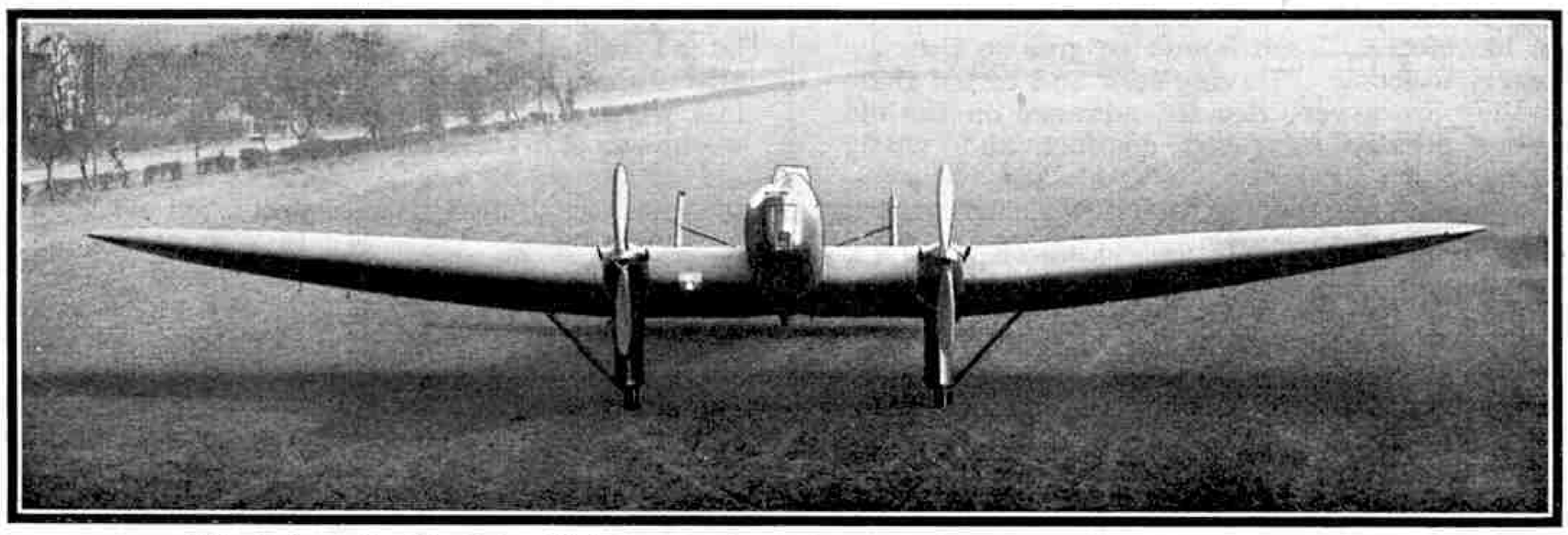
Changes in "Do.X"-Type Flying Boats

Three flying boats of the Dornier Do.X type have now been constructed, two having been built for Italy. All of these are similar in design, but the next one to be built will differ in a number of ways. The most important alteration will be that the 12 engines mounted in tandem above the wing in the existing types, will be carried inside the wing in the new one. It is thought that this alteration, while in no way detracting from the efficiency of the engines, will considerably increase the maximum speed of the flying boat, even if engines of the same power are employed. Other constructional improvements are expected to reduce the weight of the boat by several tons, which will enable a greater pay load to be carried.

The Prince's New Machine

The Prince of Wales has ordered for his own private use a new Vickers "Viastra" aeroplane. The machine is similar to that illustrated and described on page 678 of our issue for September 1932, but it is provided with more powerful engines, making use of two Bristol "Pegasus" engines, similar to those used by Flt. Lt. Uwins when he broke the world's altitude record.

The Prince's machine will be one of the largest and fastest private aeroplanes in the country, for it will be capable of carrying 14 people including the two pilots. Normally the "Viastra" is capable of obtaining a maximum speed of 127 m.p.h. and of cruising at 103 m.p.h., but the new engines should make it possible for still higher speeds to be attained. The aeroplane is to be equipped with a powerful wireless outfit.



This photograph of the Fairey Night Bomber shows the extremely small frontal area of the machine.

Powerful Aircraft Auxiliary Set

With the increase in size of aeroplanes and flying boats it has become necessary for an auxiliary pumping and generating set to be produced. A set of this kind is required to supply electricity, and compressed air for starting the main engines, for pumping fuel and oil into the tanks when refuelling, and for pumping out bilge water. A set made by the A.B.C. Motors Ltd. does all these five tasks, and is capable of doing four of them at the same time. In spite of this the set is only 30 in. in length, 16 in. in height, 19½ in. in width and 102 lb. in weight. The power plant for the set is a 4 h.p. four-stroke two-cylinder horizontally-opposed engine, running at a constant speed of 4,000 r.p.m. The generator, which has an output of 50 amps at 12 volts, is mounted directly above the engine and is designed so that it acts as a flywheel.

A Flying Tube!

A very unusual type of aeroplane has been built in Italy by the Caproni Works to the design of an Italian inventor. The machine is provided with a fat tubular fuselage open at both ends, in which the engine is housed, the pilot being accommodated in a cockpit secured to the top. The aeroplane, which has normal wings, is 46 ft. 9 in. in span, and 1,763 lb. in gross weight. An interesting feature is that a British D.H. "Gipsy III" engine developing 120 h.p., is employed.

It is claimed that the method of construction adopted in this aeroplane greatly reduces head resistance and increases the stability. We hope shortly to publish photographs and a description.

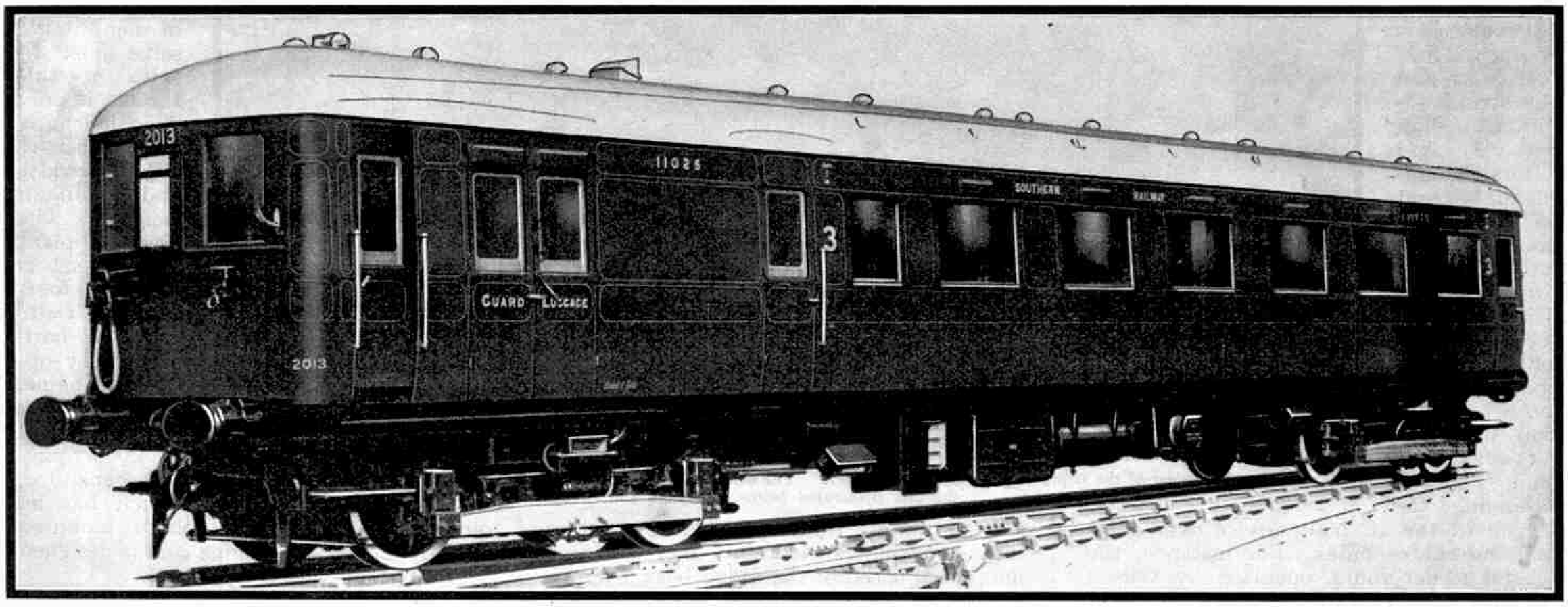
Powered Glider for Cheap Flying

An interesting machine that has been designed by Mr. C. H. Lowe-Wylde is an attempt to provide a sporting machine suitable for those who cannot afford to operate an ordinary light aeroplane. The new machine is called a "planette," and is really a powered glider, consisting of the well-known B.A.C. VII glider fitted with a 600 c.c. Douglas Model G. engine. This small machine gives all the thrills of flying and is exceedingly cheap to operate; and we hope to include photographs and further details is an early issue of the "*Meccano Magazine*."

London-Brighton Electric Expresses

New Era in Railway Travel

By "Observer"



THE opening on 1st January of the Southern Railway's electrified extension to Brighton and Worthing was an event of outstanding importance in British railway history. In the various electrification schemes carried out previously only local suburban lines had been dealt with; now a great step forward has been taken and main line express electric services have been put into operation. The event is important in itself and also in the influence it will have in promoting other schemes of main line electrification.

Although, as a railway enthusiast, my own interest has centred chiefly in the steam locomotive, I am bound to give to the new electric services a hearty welcome. Having seen and tested them I freely admit that they are a very decided advance on the old steam services, giving greatly increased comfort and vastly improved facilities.

To be properly appreciated, the new trains must be seen and their performances observed in actual practice. Readers of the "*M.M.*" have been kept fully informed of the Southern Railway's great scheme. They have been told about the new rolling stock that was building and the remarkable schedules that were being planned. I myself have read about these things and written about them, too. Yet when I examined the new timetables, saw the new coaches, and tested the new trains in service, I felt that the half had not been told.

The photograph above of a third class motor coach, for which, with the others illustrating this article, we are indebted to the Southern Railway, shows the clean lines and up-to-date character of the latest Southern electric rolling stock. The provision of ample window space, both for passengers and staff, is a feature.

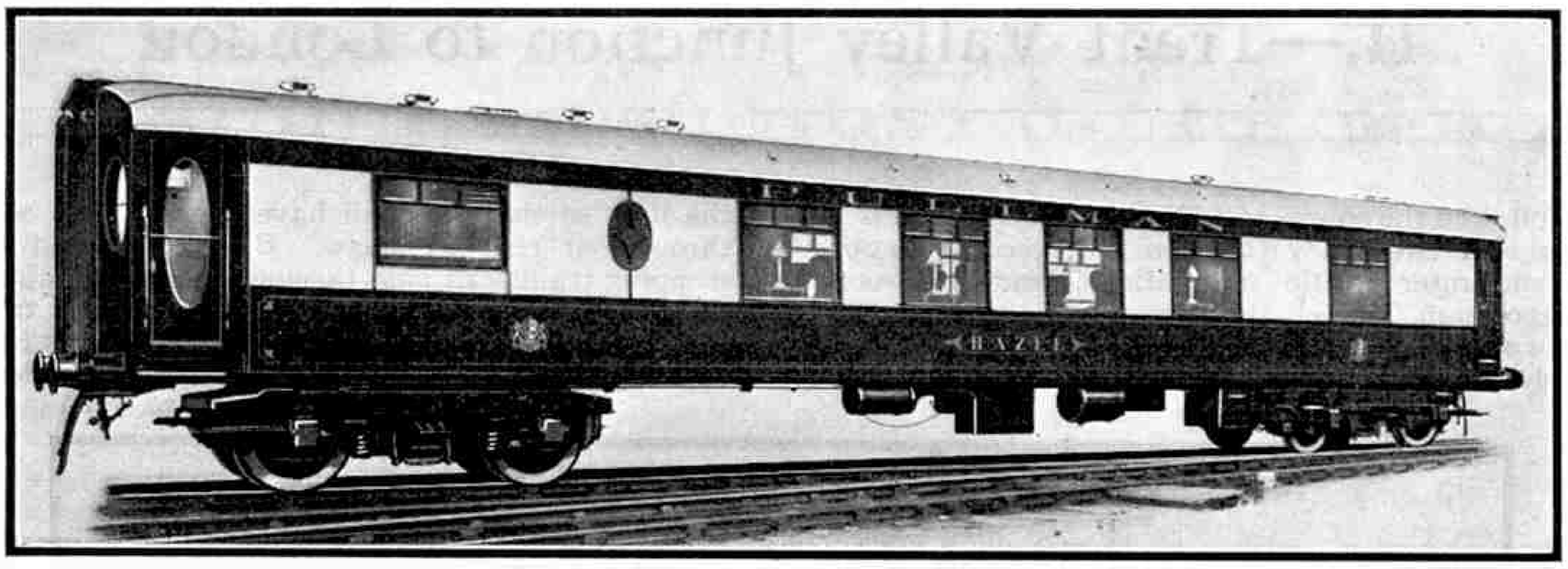
A study of the new timetables shows how generous is the service provided. Here, for instance, is a typical hour's trains in the down direction. At the hour a non-stop express leaves Victoria and runs to Brighton (50.9 miles), in 60 min. Also at the hour a semi-fast train starts from London Bridge and, making six calls en route, gets to Brighton in 74 min. At 10 past the hour a semi-fast leaves Victoria for Haywards Heath. At 18 past the hour there is a stopping train from London Bridge to Brighton. At 25 past the Victoria-Worthing express leaves and has calls at East Croydon, Haywards Heath, Hove and Shoreham. At 28 min. past there is a semi-fast, and at 46 past, a stopping train, from Victoria to Brighton. That is a fair sample of what goes on the whole day through, with additional trains during the morning and evening rush hours and at mid-day on Saturday. The last train each day is a non-stop express from Victoria, which leaves at 12 midnight and arrives at Brighton at 1 a.m. In less than four hours the next day's services begin!

By the kindness of the Southern Railway I inspected the specimen new trains that were on view at Victoria prior to the opening of the new extension. It was a pleasant task that brought a succession of surprises. When I saw the third-class coaches I could but describe them as "first-class." With their ample accommodation, bright interiors and tasteful and comfortable upholstery, I felt that one could hardly wish for anything better. But when I went on and viewed a real first-class compartment I realised that here was luxury indeed. Its seats were so restful and its woodwork, lighting and other appointments so alluring, that I then asked myself whether a Pullman could offer anything that would be worth the extra charged. When I entered the Pullman car, however, I found that it certainly could. A little later I walked through the superb coaches of the "*Southern Belle*" all-Pullman train, and then I was convinced that here was the last word in comfortable travel, and that this was in truth the world's most luxurious train. These spacious cars are just drawing-rooms on wheels. Their walls are decorated with choice inlaid woods. In some cases pictures are made of the inlaid work, while in others framed pictures hang on the walls. The floors are covered with rubber and rich carpets. Electric heaters automatically maintain an even temperature, and a wonderful system of ventilation ensures constant fresh air without any draughts. The kitchens have the very latest electrical equipment. Three new train sets have been specially built for working the "*Southern Belle*," at a cost of £35,000 each; so they ought to be good, and they are good.

For the ordinary express services, six-coach units, each composed of five corridor coaches and one composite (1st and 3rd class) Pullman car are employed, and during the rush hours two such units are combined to form a 12-coach train. For the semi-fast services four-coach units are used. All have been designed to give a maximum of comfort.

It should be noted, however, that the upholstery, lighting and heating arrangements, and other internal appointments, are by no means the only, or even the chief, result of all the thought and labour that have been expended to make the new trains as perfect as possible. By endless research and experiment the engineers of the "Southern" have worked to secure steadiness and silence in running, even at the highest speeds. To obtain the precisely correct springing demanded almost innumerable tests. I have chatted with some of the engineers, and they have told me of their rough and even alarming experiences as they tried some of the older coaches at high speeds. By patient experiment they discovered defects and learned how to remedy them, and they have made all who travel in the new coaches their debtors.

It is good to note, too, that in the new trains, the comfort of the train staff has been considered. The motor-man's cab has been conveniently fitted with a seat, plate-glass window, windscreen wiper, electric heater and a "dead-man's handle" that at once shuts off power if he should happen to let it go. In the guard's compartment a comfortable chair is provided, and a table, behind which is a large, sloping mirror. The mirror is not fitted for the guard to look at himself in, but to act as part of a periscope and give him a clear view of the line and signals ahead. This has been done because the new coaches are so wide that no projecting side windows can be allowed. The new device is—as I saw for myself—quite as effective and much more comfortable.



One of the new all-steel Pullmans running on the Brighton electrified services. In addition to their luxurious internal appointments special springing arrangements ensure smooth travel at the highest speeds.

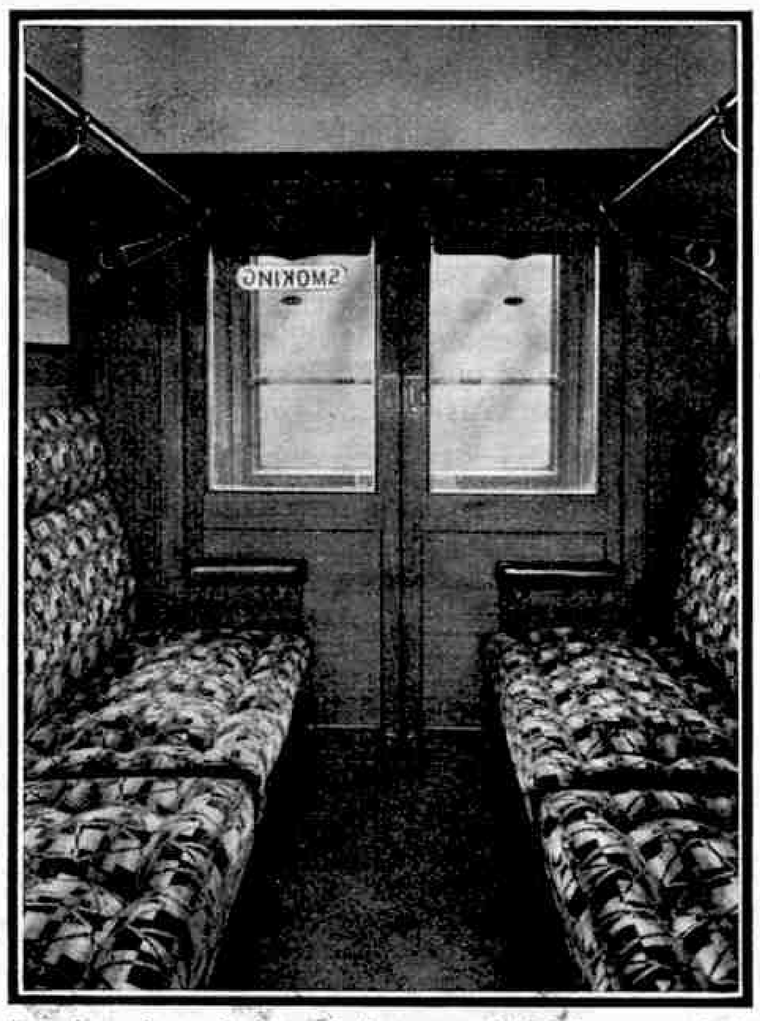
Having seen the new trains I went away possessed by a keen desire to travel in them at the earliest opportunity. Accordingly on the morning of Monday, 2nd January, I made my way to Victoria in time to catch the 11 a.m. "*Southern Belle.*" What a beauty she looked as she stood at the platform! And yet how substantial, too, for her 10 coaches (two sets), including passengers, totalled to almost 500 tons. Each motor coach weighs 62 tons and the others average over 40 tons each. I chose to travel in the first-class car "*Audrey.*" Going on board I sank into a sumptuous armchair and surveyed the delightful productions of artistic design and deft craftsmanship that surrounded me. The only disquieting reflection was that my journey would last for but one brief hour!

A few seconds after 11 o'clock the "right away" signal was given, and, moving very gently at first, we glided down the long platform. Just outside Victoria we passed one of the "King Arthur" engines that formerly worked the old steam-drawn "*Southern Belle.*" Now it had lost that honourable employment. If it could have spoken, what would it have said as the new train, propelled by a mighty rival power, ran triumphantly past? The "*Golden Arrow*" Continental Pullman express, which also leaves Victoria at 11 a.m., had got away a little in advance of us, but we steadily overhauled it, although the massi e "Lord Nelson" locomotive at its head was puffing heavily and exerting its full powers as it breasted the bank that rises immediately outside Victoria station. Our own running was quite restrained in the early stages, and for the 1.3 miles to Battersea Park we took 3 min. 15 sec. Clapham Junction (2.7 miles) was passed in 5 min. 5 sec. and Wandsworth Common (4.1 miles) in 7 min. 40 sec., or 10 sec. more than the schedule allows to the next station—Balham. Now, however, we were running well. To Thornton Heath (8.7 miles) exactly 12 min. were taken, and by Windmill Bridge Junction (10 miles) we had a few seconds in hand on the schedule allowance of 14 min. But here, unfortunately, we found signals against us, and slowing more and more, we were presently brought to a standstill in East Croydon Station. In 20 sec. we were away again, but could proceed only with caution through South Croydon; and before reaching Purley Oaks we were stopped again. Within 10 sec. we were moving once more, but the result of these delays was that to Coulsdon North (15 miles) we took 25 min. 40 sec. instead of the 20 min. booked. At 11.30 a.m. when half our time had gone, we were in Merstham tunnel and had covered 18 miles—little more than a third of our total distance. Were we going to keep time? It looked decidedly doubtful.

But now the road ahead was clear and grades were favourable. Down the 1 in 264 speed rose rapidly until 75 m.p.h., the designed maximum, was reached, and, still accelerating, between Earlswood and Horley 80 m.p.h. was touched. Indeed, the 4.1 miles between those places were run off in 3 min. 10 sec., which yields an average little short of 80 m.p.h. Up the 6-mile bank beyond Horley our speed receded until, on passing the summit before plunging into Balcombe tunnel, it had dropped into the fifties. Down the slopes beyond it quickly rose again, 80 m.p.h. was touched once more, and the 3.9 miles from Balcombe to Haywards Heath were done in a second or two under 3 min. The 19 miles from Earlswood to Wivelsfield, including six miles uphill, mostly at 1 in 264, were covered in 15 min. 25 sec.—an average speed of 73.6 m.p.h.! Such figures demonstrate convincingly the fleetness of the new electric "*Southern Belle.*"

The happy consequence of this speeding was that by Keymer Junction (41.1 miles), passed at reduced speed, we were a full minute within the scheduled 49 min. With time in hand, the closing stages were taken easily, and a slow approach was made to the terminus at Brighton where we finally stopped 35 sec. early!

The run had been full of interest and was all too quickly over. During the swiftest running, while not neglecting my timing, I had regaled myself with delicious coffee and rich fruit cake—just the sort of fare that every Hornby and Meccano boy would relish! Pullman catering is of the best.



Interior view of one of the new third-class coaches. The high standard of comfort in these vehicles is remarkable, as is evident from the photograph.

At Brighton the day was sunny, with a fresh breeze blowing and a fine sea running, and I found a walk along the front splendidly invigorating. Later I returned to London by one of the ordinary non-stop expresses and made another extremely comfortable journey. Our highest speed—between Three Bridges and Horley—was slightly over 70 m.p.h. A succession of checks made us 3½ min. late at Victoria.

If space permitted there are many more wonderful things that I might describe in telling the story of this great scheme of electrification. At Three Bridges, for instance, there is the Central Control Station where the man in charge seems to have at his command powers even more amazing than those of the magicians of old. The whole vast system, with all its trains and appliances, is under his sway, and exceedingly intricate are the instruments he operates. Then at Brighton the big new signal box is simply brimming with marvellous things. Within the box itself there are actually 115 miles of signal wire, 10 miles of telephone wire, and no less than 13,346 electrical contacts! Another piece of magic is that as daylight fades the electric lights in the signal box are switched on automatically by means of a "Radiovisor" Lighting Control.

A very modern thing at Brighton is the huge shed where the electric train coaches go to rest out of working hours and also to be cleaned. It is 800 ft. long and can accommodate 116 coaches. The equipment for cleaning is remarkably rapid and efficient in action, vacuum cleaners doing much of the work inside the coaches. Electrically operated rotary brushes, and mops, comprising thousands of strips of cloth, together with a profusion of water, cleanse the outside as the coaches pass slowly through a little tunnel. Almost everything is done by ingenious mechanical devices and little is left for the hand of man to do.

Truly we are living in a wonderful age, and the Southern Railway and its able officers and staff are in the very forefront of progress. In a difficult time they have dared to go forward with this colossal scheme, which has cost close upon £3,000,000. They have inaugurated a new era in railway transport.

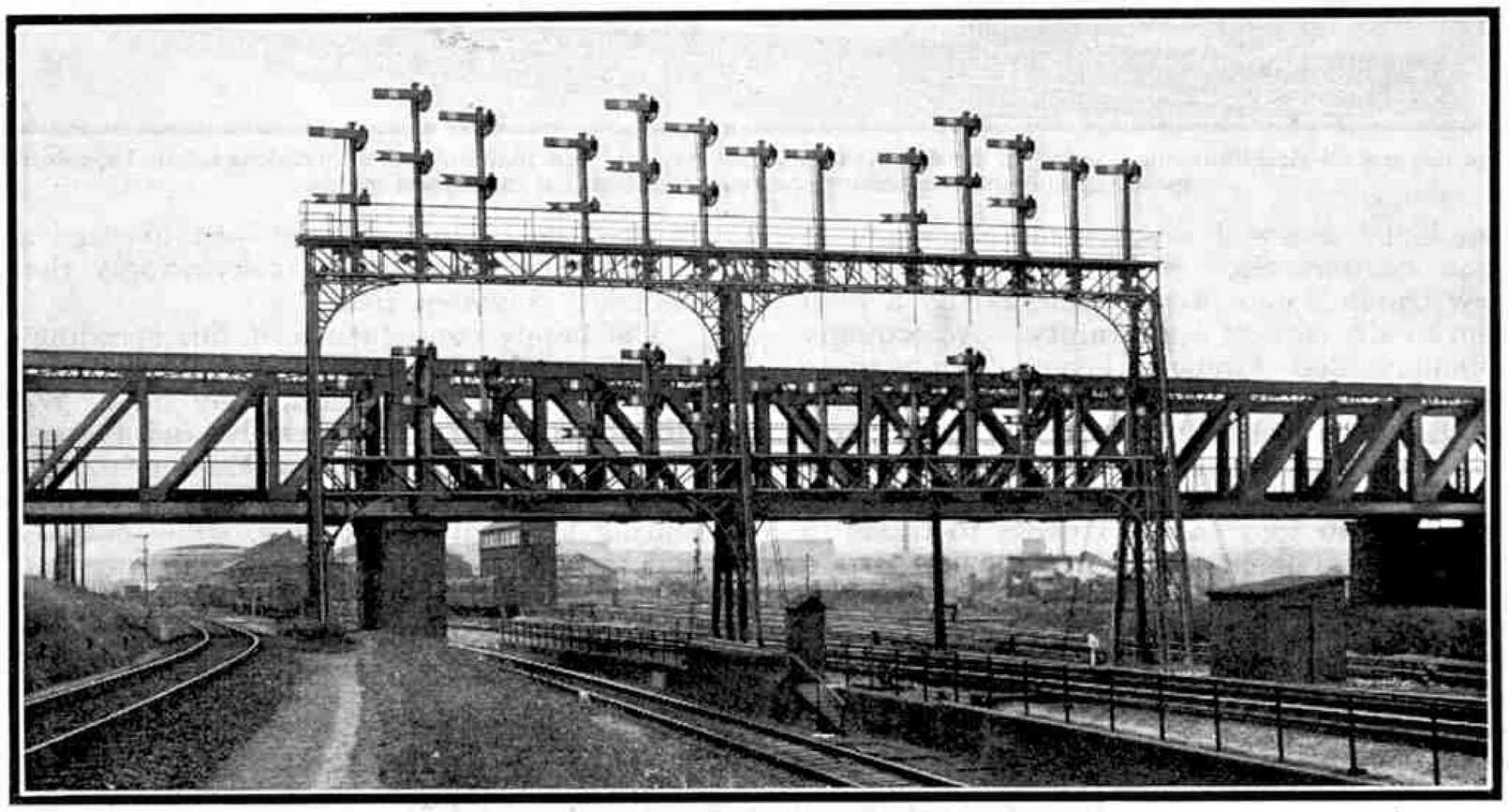
"The Merseyside Express"

II.—Trent Valley Junction to London

LAST month we followed the course of "*The Merseyside Express*" from Liverpool to Trent Valley Junction. Proceeding on our journey we encounter gentle undulations, and are soon enveloped in Shugborough Tunnel, the ornamental entrance to which is well known. We cross the Trent and Mersey Canal before reaching Colwich, where a line from the Potteries joins up with us. It is over this route, through Stoke-on-Trent, Macclesfield and Stockport, that certain of the Manchester expresses pass, and the route thus followed is the shortest between London and Manchester.

Soon the town of Rugeley is seen on our right, with the tower of its dismantled church standing in the foreground. After Armitage, the next station, we shall see on our right the three spires of Lichfield Cathedral. After passing through Lichfield Station there is nothing particular of note until Tamworth is reached. This is a large open station, through which we shall probably pass at a good speed, as a drop of 1 in 86 brings us to it, 110 miles from London. As we enter Tamworth with a characteristic blast from the shrill whistle of our locomotive, we cross the boundary from Staffordshire into Warwickshire. The Midland line from Derby to Birmingham crosses over us here, and the Midland station is actually situated just above us. A great deal of mail matter is exchanged at this station between the two routes, and a special chute is provided to facilitate its handling from the higher to the low level. Soon on the right we pass two coal mines. The first is Tamworth Colliery, and the second Pooley Hall Pit, and their presence is advertised by numerous coal wagons bearing their names.

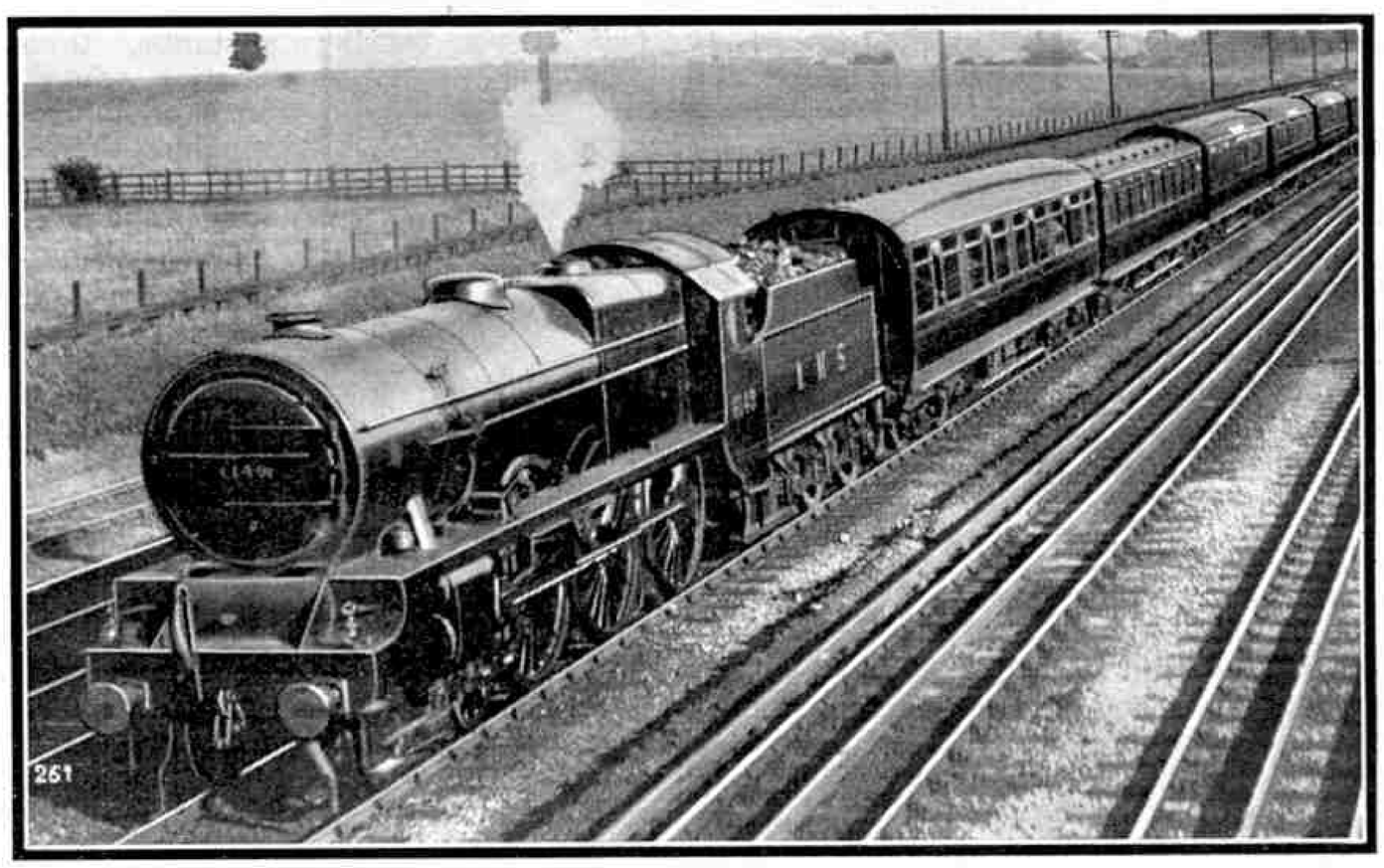
Leaving Tamworth behind, Polesworth and Atherstone are passed, and at 11.57 we run through Nuneaton, 97¾ miles from Liverpool and about half-way to our destination. Extensive sidings are seen here, and a shunting hump is a feature. We now run through Bulkington, Shilton and Brinklow, over yet another set of troughs after Newbold Box, and then approach Rugby. The famous British Thomson-Houston electrical works are situated here, and are quite close to the line, so that we shall have a good view of them as we pass through at reduced speed. By means of avoiding lines, non-stopping trains can pass through the station although other trains may be drawn up at the platforms. Several trains may be dealt with at once, and yet leave the station without interfering with one another, by means of scissors crossovers connecting the through and platform lines. Rugby, with its quarter-mile long platforms with their palatial housing of glass, and its spacious and dignified arrangement of premises, is one of the pleasantest stations in the country.



The well-known signal gantry south of Rugby, that has 44 arms. The bridge behind it carries the L.N.E.R. (G.C. Section) main line from Marylebone to Leicester over the L.M.S.R. Photograph by courtesy of the L.M.S.R.

South of Rugby we run under the main line of the former Great Central Railway, now L.N.E.R. property, which is carried over us by a fine bridge of diagonal truss construction. Immediately south of this bridge is the well-known signal gantry spanning our track, upon which 44 semaphores are mounted. We now pass the Government wireless station with its massive masts each 820 ft. high. These are on our left, or on the up side of the line. Many travellers assume that these belong to the B.B.C. Daventry broadcasting station, but this is not the case, and the masts at Daventry will be seen later on our right.

Passing over Oxford Canal we enter Kilsby Tunnel, so called after the village on the hill through which it passes. This is the tunnel that caused such a great deal of trouble in the building of the London and Birmingham line. It is 2,426 yds. long, and cost £300,000 to construct owing to the tremendous difficulties occasioned by flooding, of which the trial borings had given no warning. After Welton Station we fall in with the Grand Junction Canal, of which we shall continue to have frequent glimpses on both sides of the line until we are on the outskirts of London. Just after we cross it four wireless masts appear on our right. These are at the B.B.C. Daventry Station, two of them being 500 ft. high and the other two 325 ft.



The down "Merseyside Express" near Kenton, hauled by three-cylinder 4-6-0 locomotive No. 6149, "Lady of the Lake." The electrified "New Line" referred to in this article is visible on the right. Photograph by Railway Photographs, Liverpool.

Over gentle grades we speed onward, and before passing Blisworth commence the ascent at 1 in 320 to Roade. Here the alternative route through Northampton that left us at Rugby

rejoins our line. As frequently happened in the early days of railways, the people of Northampton wanted to have nothing to do with the railway. Therefore the London and Birmingham line that had been planned to run through Northampton was diverted, with the result that the town has now to be content with its situation on a loop line.

We run briskly down through the remarkably deep Roade cutting through treacherous shale, past Castlethorpe and then its troughs. Before reaching Bletchley, which we are due to pass at 12.44, we pass the L.M.S.R. carriage works at Wolverton on our right. The original main line passed right through the works, but a deviation was made many years ago in order to avoid the inconvenience. Here, too, were situated the locomotive works of the Southern Division of the L.N.W.R., but locomotive building was concentrated at Crewe during the '70s. We are now over 140 miles from Liverpool and just over 50 miles from Euston.

A view of some of the complicated junctions in the neighbourhood of Camden. Great use is made of flying and burrowing junctions to avoid the conflicting of different kinds of traffic.

From Bletchley, which is the junction for the Oxford and Cambridge branches, up to Tring, there is a rising gradient, gentle at first at 1 in 660. The last six miles of the distance are at an incline of 1 in 333, however, and we may expect our speed to drop somewhat, probably to a little over 50 m.p.h. at the summit. From the deep cutting by means of which the evenness of the gradient was preserved we enter Tring Station and start on the down grade of 1 in 330. We now have a downward run practically into Euston, and the quickening of the rhythmic wheel beats tells us that we are gathering speed. Our driver now has the chance to make up any time that may have been lost previously in the run, and anything up to 75 m.p.h. or even more, may be expected as we go through Boxmoor, King's Langley and Watford.

Immediately before Boxmoor there is on the down side of the line an unusual feature in the resting place of a highwayman near a chestnut tree. There are two stones about 6 ft. apart, forming the head and foot stones of the grave of Robert Snooks, who was hanged there on 11th March, 1802. We are soon threading Watford (Old) Tunnel, through which the main lines pass, the local tracks separating from us slightly and being carried in the shorter bore of Watford (New) Tunnel.

The entrance to Euston Station, which may justly be described as "The Gateway to the North." This dates from the days of the London and Birmingham Railway, and was erected in 1837. For the photographs on this page we are indebted to the courtesy of the L.M.S.R.

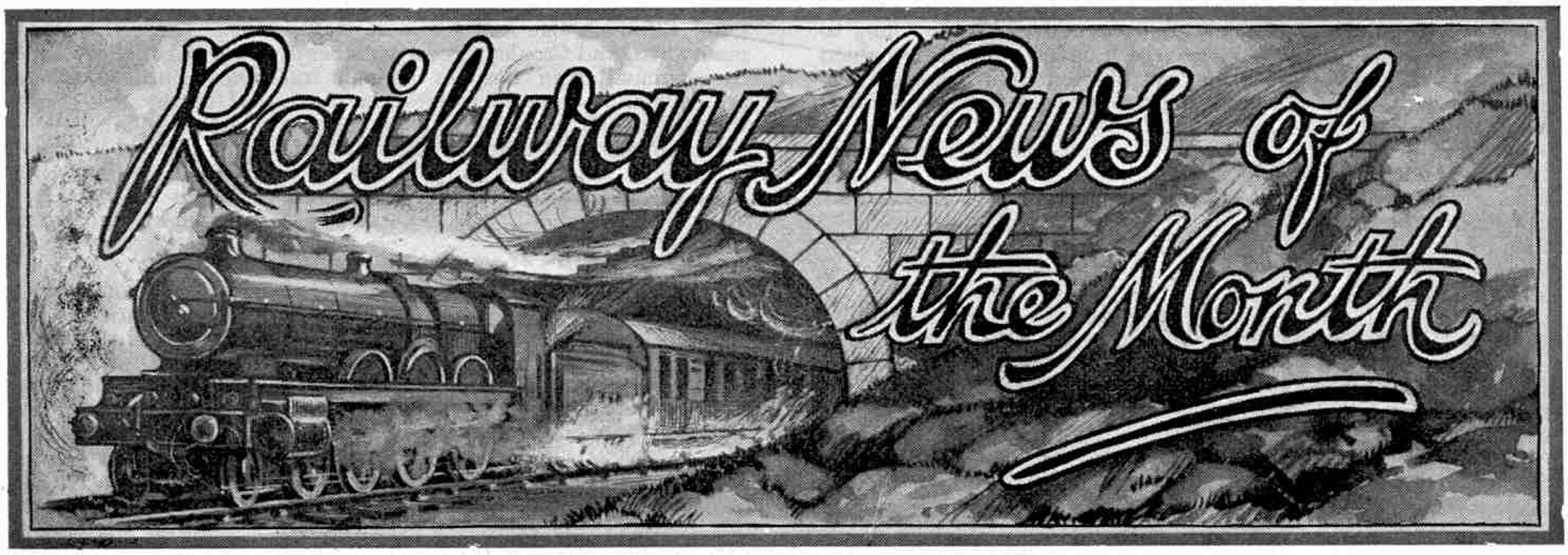
Watford, which became a junction in 1858 when the branch line to St. Albans was opened, is the start of the electrified suburban area. This fact does not impede the progress of main line trains, however, for additional tracks, making a total of six with the main and local lines, are provided for the electric services. The New Line, as the electrified tracks are usually called—although they were completed and available for steam trains 20 years ago—sweeps away to the right to Watford High Street Station, which is off the main line and for local traffic only. There the Rickmansworth and Croxley Green branches diverge, and the New Line curves round again to rejoin the main tracks near Bushey. There are several features of interest in the layout of the New Line, which we shall be able to notice as we proceed.

Skimming over Bushey Troughs we rapidly pass Pinner; Harrow, where we see the famous hill with the church on top; then Kenton, where we notice one of the substations for supplying the electric lines immediately before we dash under the bridge carrying the Metropolitan Railway. L.N.E.R. expresses that are routed over the Metropolitan also pass over the bridge, and a few miles farther on, near Wembley, we again cross the path of L.N.E.R. trains. This time it is the line between Neasden and Northolt, joining at the latter with the G.W.R. line from Old Oak, and forming as far as Ashendon Junction the G.W. and G.C. Joint line as it used to be called. We now pass under a gantry on which several semaphores attain a great height, probably for sighting purposes, owing to the L.N.E.R. bridge running across in front of it. It is a coincidence that here, as at Rugby, a bridge carrying L.N.E.R. trains and a large gantry on the L.M.S.R. system are close together.

In our headlong dash we shall have passed several of the sprightly suburban electric trains that run between Watford and Euston, and the city terminus of Broad Street also. There are, in addition, electric services between Watford and the "Bakerloo" section of the London Electric Railways. These are necessarily maintained by trains of "Tube" pattern, and the low appearance of these alongside the standard size trains of the L.M.S.R. is very striking.

From Wembley to Willesden we pass a remarkable array of sidings, in which a multitude of goods wagons and many locomotives are to be seen. Immediately after Wembley the New Line—which has kept us in close company since Watford and at approximately the same level, diverges slightly, descending the while, and then passes under the main line and sidings, finally emerging well over on the up side by the power house at Stonebridge Park, the presence of which is advertised by its two tall chimneys. Towards Willesden the New Line comes nearer to us again, but its tracks are accommodated in a separate station at a lower level.

We ease now from the rapid pace at which we have travelled down from Tring, and pass under a line that provides a connection from the Midland at Brent Sidings, Cricklewood, with the Southern Railway, by means of the North and South Western Junction line. If we are quick we shall be able to (Continued on page 154)



Diesel-Electric Traction on Railways

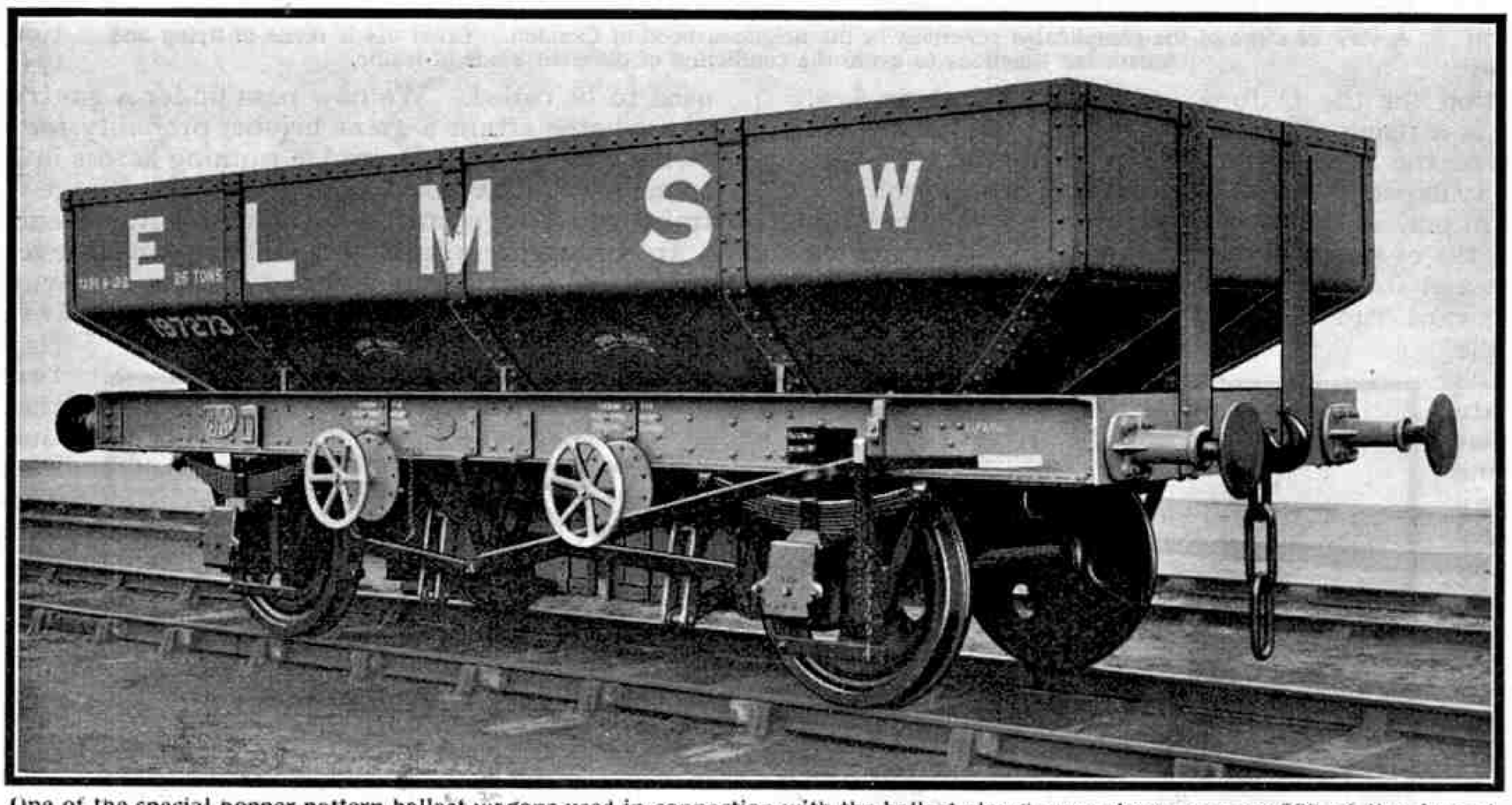
It has become increasingly evident of late that Diesel traction on the railways has come and has come to stay. By means of the Diesel engine crude oils can be used for propulsion at very low cost. For railway purposes, the Diesel engine usually drives a dynamo by which electricity is generated, the current being used through electric motors to propel the car or train. During the 20 years that have passed since the first 1,000 h.p. Sulzer locomotive was built, continuous investigation and experiment have been carried on, with the result that the Diesel engine has now been made an efficient and reliable power unit. Large numbers of Sulzer-engined main-line Diesel vehicles, varying in size from 200 h.p. to 1,700 h.p., are operating successfully in many parts of the world.

Early last year Sir W. G. Armstrong Whitworth and Co. Ltd. built a Diesel-electric rail car to which the name "*Tyneside Venturer*" was given. Its Diesel engine of the Armstrong-Sulzer type is of 250 h.p. and the car has accommodation for 60 passengers and is capable of a maximum speed of 65 m.p.h. In addition, it can run with one trailing coach on the steepest grades and with two trailing coaches on level routes. It thus makes a two or three car train with seating for 140 to 150, or 220 to 240 passengers. The control is automatic and is fitted with a "dead-man's handle," the operation being similar to that of an ordinary electric train. After preliminary trials, the car was put into regular service in the Tyneside area of the L.N.E.R., and the results have been so satisfactory that after 7½ months working, it has been purchased by the Company.

Another similar motor coach, "*Lady Hamilton*," has some excellent runs to its credit, including one from King's Cross to Newcastle-on-Tyne in a total running time, excluding stops, of 5 hours 38 min. for the 268½ miles, after preliminary runs between King's Cross and Hertford.

Of much greater power are some Diesel units that Armstrong-Whitworths have recently constructed for the Buenos Ayres Great Southern Railway in South America. These are known as "mobile power houses," and have a horse-power of no less than 1,700. Each unit is made up of two articulated units, each of which runs on two four-wheeled bogies and carries an 850 h.p. eight-cylinder Diesel generating set with cooling equipment, fuel tanks, etc. The train on which the 1,700 h.p. unit operates is made up of eight 80-foot coaches with a seating capacity of 1,000 passengers. Current is supplied to the electric motors on the axles of the unit and on the bogies of the carriages, so that the train is propelled and controlled in the same way as an ordinary electric multiple-unit train. The train can be driven from either end, and running round at terminals is thus eliminated. A speed of 70 m.p.h. can be attained.

A great advantage of these power units is that their range extends beyond that of electric locomotives of the ordinary type.



One of the special hopper pattern ballast wagons used in connection with the ballast plough vans shown on page 599 of the August, 1932, "M.M." Ballast is discharged through the openings in the bottom of the wagons, and the ploughs spread it as required. Photograph by courtesy of the L.M.S.R.

G.W.R. Locomotive News

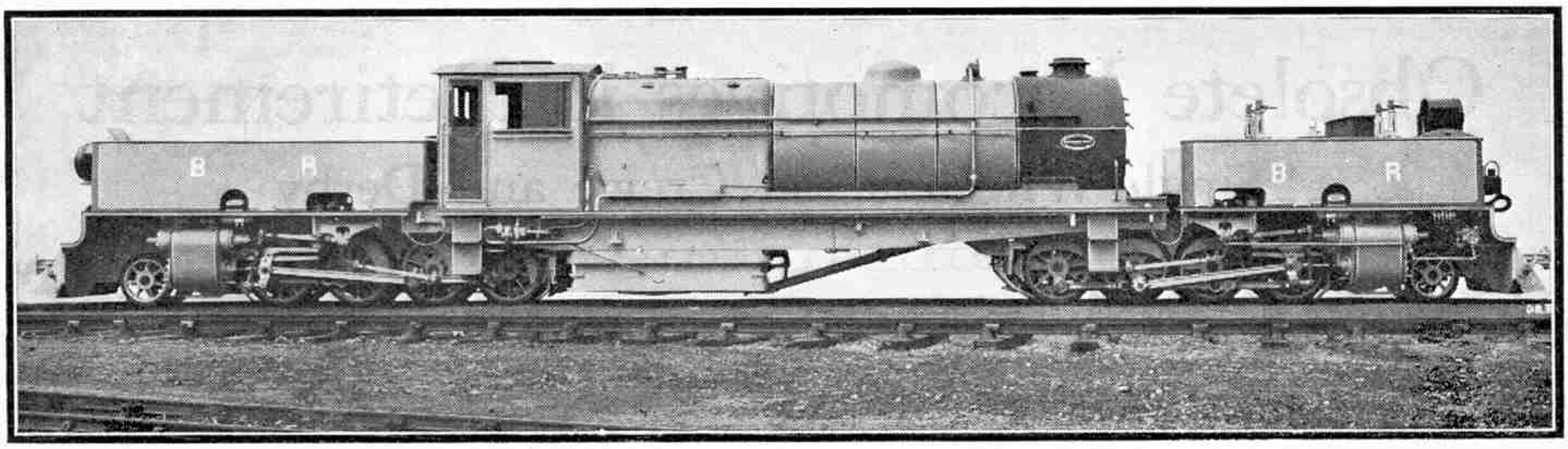
Ten more of the standard 2-6-2 tank engines of the "6100" class are now building at Swindon and will be numbered 6150 to 6159.

The new 0-4-2 tanks of the "4800" class are showing themselves smart little engines in service. Although generally similar to the older engines of this type, they have been fitted with many modern improvements in detail. Their cabs are roomy and well lighted, with large windows; and additional protection is provided for the enginemen by means of sliding cab side extensions. The dimensions of these engines are quite modest, the coupled wheels being 5 ft. 2 in. in diameter and the cylinders (inside) 16 in. diameter and 24 in. stroke. The total heating surface is 953 sq. ft. and the grate area 12.8 sq. ft. The weight in working order is 41 tons 6 cwt. A further 20 of these engines are to be built and will be numbered 4810 to 4829.

Two of the 4-6-0 locomotives of the "Star" class—No. 4006 "*Red Star*" and No. 4011 "*Knight of the Garter*"—have been withdrawn for scrapping.

The Railwayman's Guide

Every contingency on the railway is provided for in the new Rule Book which has just been issued to nearly 600,000 railwaymen. In it the driver, guard, signalman, porter or other grade of railwayman finds his course of action clearly set out. It is his rule of life when on duty and his standby in emergency, for the 240 rules contained in it cover every aspect of the safe and efficient working of the railway, whether in clear weather, fog or snow, and have to be rigidly observed by all railway employees.



New Tank Engines for L.M.S.R.

Additional 4–4–0 passenger engines of Class 2 have been built at Crewe and are numbered 694 to 698. A new series of mixed-traffic 2–6–0 " Mogul " engines is in hand at Crewe. Although conforming generally to the former engines of this class, the new engines have several important modifications in accordance with the ideas of Mr. W. A. Stanier, the present Chief Mechanical Engineer. Of the new locomotives of this class, those numbered 13235 to 13241 have already been put into service.

Derby works have turned out some more 2–6–2 tank engines, which are numbered 15565 to 15569. Ten 0–4–4 tank engines are now under construction at Derby, and will be given the numbers 6400 to 6409.

Five 0–4–0 shunting engines with saddle tanks have been built for the L.M.S.R. by Kitson and Co. Ltd. of Leeds. They have wheels of 3 ft. 10 in diameter and a wheelbase of 7 ft. 6 in. The cylinders are outside and have a diameter of 15½ in. and a stroke of 20 in. They have slide-valves and Stephenson's gear. The heating surface totals 665.5 sq .ft. ; the grate area is 11.7 sq. ft. ; and the boiler pressure 160 lb. per sq. in. The saddle tank carries 800 gall. of water and the bunker one ton of coal. The weight in working order is 33 tons and the tractive effort 14,200 lb. One of the engines is equipped with a patent smoke eliminator. By means of a cleverly contrived system, a quantity of steam from the boiler, mixed with air, is injected into the fire-box in such a manner that it combines with the gases liberated from the coal and secures perfect combustion. In the tests so far made this apparatus has been very effective.

C.N.R. Buys New Equipment

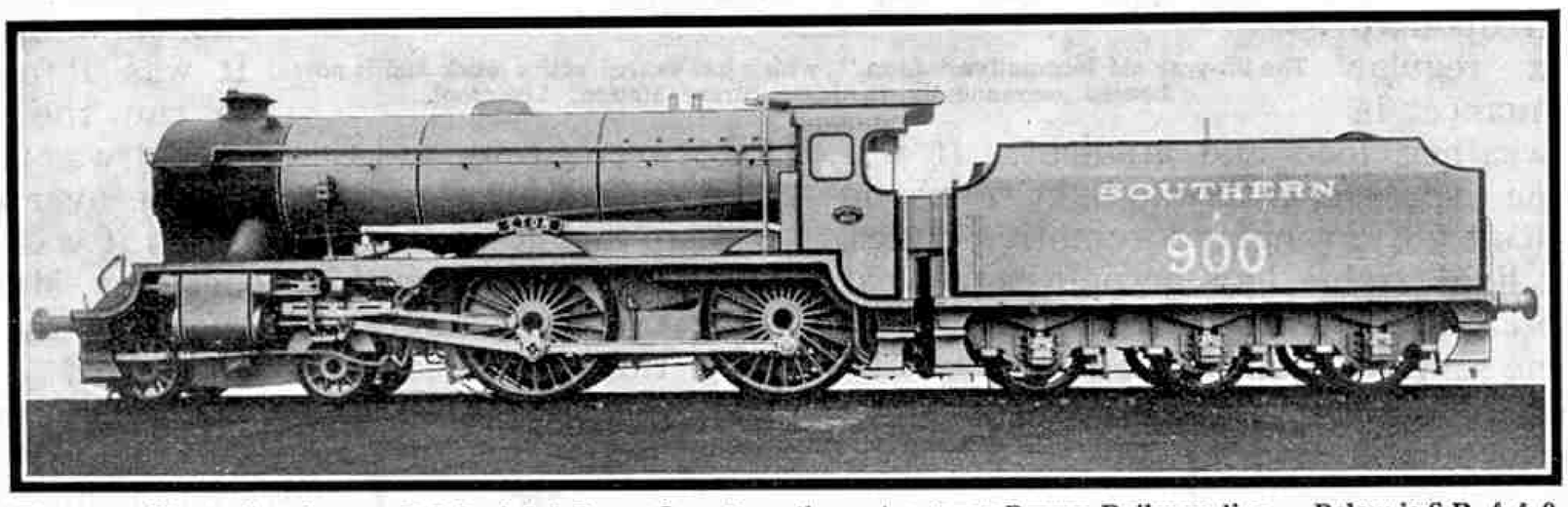
An order for 500 all-steel gondola type railway cars has been placed in Nova Scotia by the Canadian National Railways. The cars will represent the largest class of rolling stock of the kind yet built in Canada and will call for the making of 10,000 tons of soft steel, which in turn, for every ton of steel, will require the consumption of two tons of Nova Scotian coal. The gondola cars will have a capacity of 70 tons.

S.R. " School " Locomotives

Work has proceeded slowly at Eastleigh on the new lot of 3-cylinder 4–4–0 express engines of the " School " class and the first of them is only now in traffic. Its number is 910 and its name " *Merchant Taylors.*" For the other 19 engines of this class that are on order, the following names—all of well-known Schools—have been chosen :—" *Dover* " ; " *Downside* " ; " *Christ's Hospital* " ; " *Eastbourne* " ; " *Brighton* " ; " *Whitgift* " ; " *Hurstpierpoint* " ; " *Ardingly* " ; " *Harrow* " ; " *Rugby* " ; " *Shrewsbury* " ; " *Marlborough* " ; " *Uppingham* " ; " *Haileybury* " ; " *Cheltenham* " ; " *Repton* " ; " *Clifton* " ; " *Stowe* " and " *Malvern.*"

Ashford works have built some more 2-cylinder 2–6–0 locomotives of the " N " class. They are numbered 1402-9.

Mr. J. Clayton (personal assistant to the Chief Mechanical Engineer) stated recently that the depression in trade had affected the Southern Railway in that the building of the further 20 new " School " class engines had been postponed, while a projected eight-coupled goods engine had never developed beyond the drawing board stage.



The upper illustration shows a 2-8-0 : 0-8-2 Beyer-Garratt on the metre gauge Burma Railways line. Below is S.R. 4-4-0 locomotive " Eton," of the " School " class. The first of 20 additional engines of this class has been completed at Eastleigh and has been named " Merchant Taylors."

" *Flying Scotsman* " Driver Retires

Mr. William Barnes, one of the foremost engine-drivers of the L.N.E.R., retired on 31st December last, after 41½ years of railway service. During the past two summers he shared in driving the " *Flying Scotsman* " on its non-stop runs of 393 miles between King's Cross and Edinburgh. For 5½ years he drove the Pullman expresses between Leeds and King's Cross, and on one occasion, when time needed to be made up, covered the 76¼ miles from Peterborough to London in 68 min. In bidding farewell to his life on the footplate, Mr. Barnes declared : " I have enjoyed every minute of it. It is a glorious adventure."

A German Record Run

Another triumph for Diesel-electric traction was achieved in a record run made recently by a twin rail car between Berlin and Hamburg on the German State Railways, when the 178 miles were covered in 142 min., an average of 75 m.p.h. The maximum attained was 91 m.p.h. The rail car consists of two units, in each of which a 410 h.p. Maybach Diesel engine is mounted. It is streamlined and has accommodation for 102 passengers. If further tests prove equally successful, the car will be put into regular service during the coming summer.

Petrol Locomotives for Bermuda

As greater power is required for the newly-opened railway in Bermuda, two van-type petrol locomotives of 300 h.p. each have just been built at Preston. They are of an entirely new design and are intended to haul loads of 90 tons on the Bermuda railway. Each locomotive has two independent petrol engines with self-changing gear which is electro - pneumatically controlled. Trial runs were made by the new locomotives with trailer cars on the Longridge branch of the L.M.S.R. before being shipped to Bermuda.

G.W.R. Programme for 1933

The G.W.R. have planned to carry out a considerable amount of new work during the present year. It will include the building of 121 locomotives of various types, 151 coaches, including 70 third-class corridor coaches, and 36 brake and milk vans. In the course of permanent way relaying over 100,000 steel sleepers of British manufacture will be used. The programme also provides for extensive alterations to improve various stations, running lines, signalling, and siding accommodation.

Larger Boilers for L.N.E.R. 4-6-0 Engines

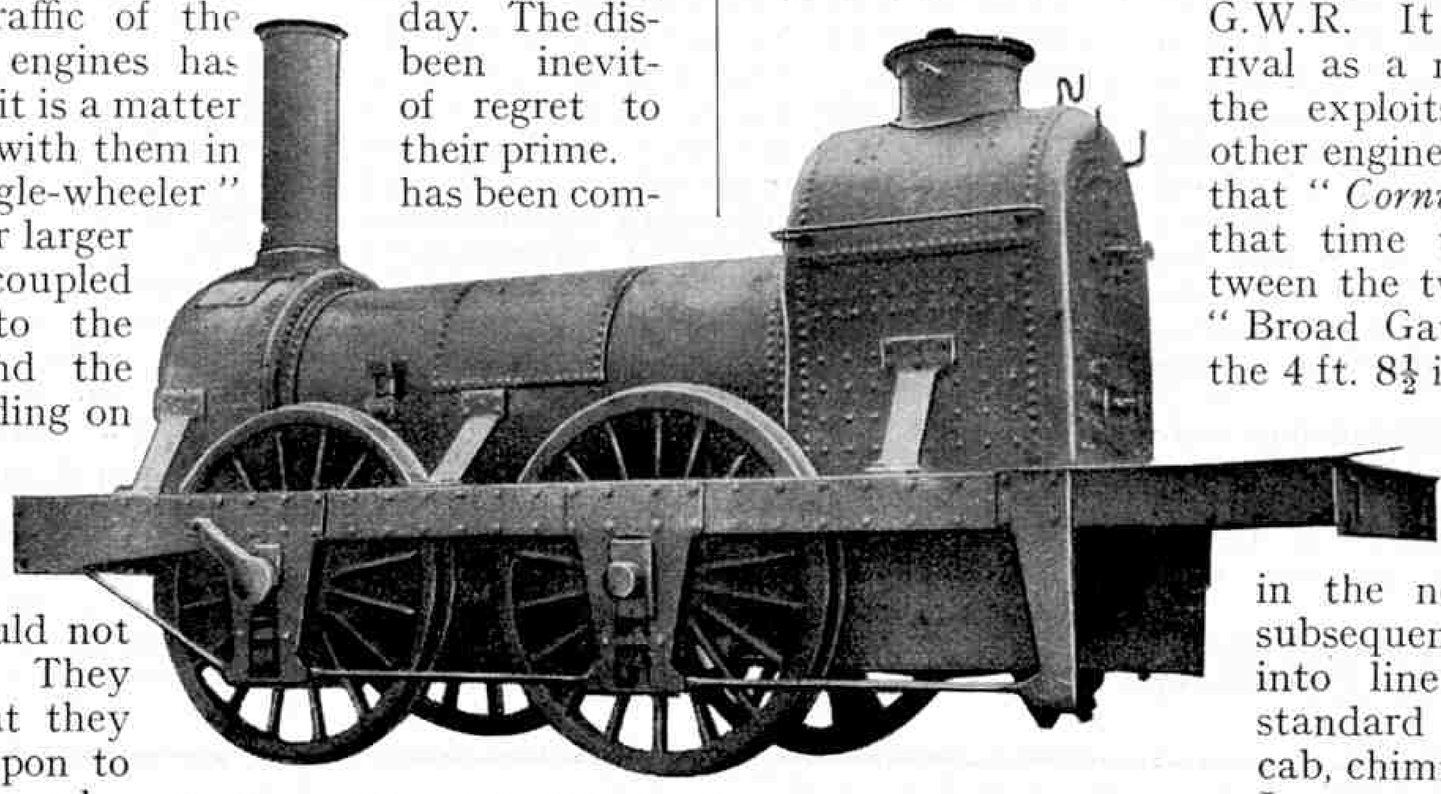
Another 4–6–0 engine of the " B12 " class—No. 8578—has been fitted with an enlarged boiler. The rebuilt engines are doing remarkably well in service and it is stated that all the engines of the class will receive larger boilers when they are in need of heavy repairs.

Obsolete Locomotives in Retirement

"Single-Wheelers" at Crewe and Derby

ON the occasion of the Railway Pageant held in Liverpool in September, 1930, thousands of people examined with curiosity and interest the examples of "single-wheeler" locomotives shown in the accompanying photographs. To older railway enthusiasts the reappearance in public of these engines served as a reminder of the time, some 30 or more years ago, when the "single" was widely used for hauling the fast main-line traffic of the day. The disappearance of these engines has been inevitable, but nevertheless it is a matter of regret to all who were familiar with them in their prime.

The graceful "single-wheeler" has been compelled to make way for larger and more powerful coupled locomotives owing to the increase of loads and the impossibility of providing on a single axle sufficient adhesion weight to deal with them. This is not to say that these engines could not tackle heavy trains. They did so frequently, but they could not be relied upon to keep time as a regular economical performance in all conditions of weather, load and gradient. It was impossible to confine them exclusively to light trains, on account of the difficulty of arranging locomotive duties, and the fact that light trains had become somewhat rare; and therefore they gradually disappeared from service, though some survived until fairly recently.



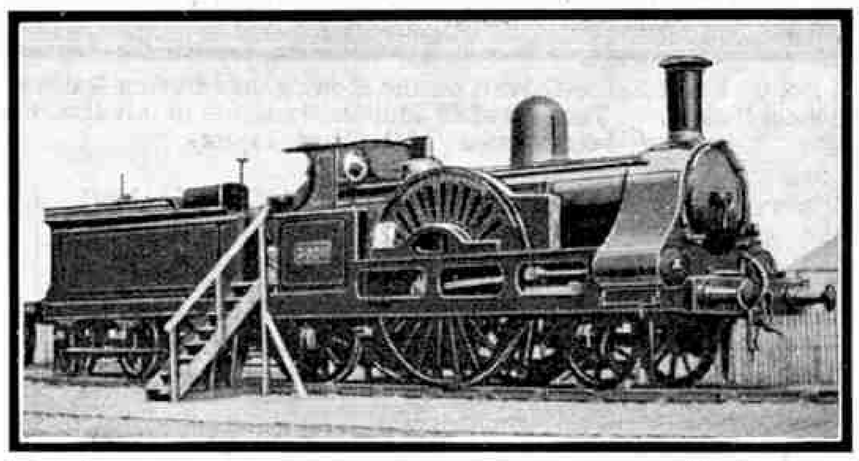
The 95-year old locomotive "Lion" which has ceased active work and is now housed permanently in Lime Street Station, Liverpool.

It is a pity that a number of the more famous locomotives of this type that have gone to the scrap heap could not have been preserved for the interest and admiration of a later generation. Fortunately, however, in these days our railways appear to be taking more interest in the preservation of famous locomotives, with the happy result that a few notable veterans have been spared from the derelict road.

One of our illustrations shows what is probably the best known of all "single-wheelers," the famous "*Cornwall*" of the L.N.W.R.; and it is indeed fortunate that it has been allowed to retire instead of being broken up. This locomotive was constructed in 1847 to the designs of Francis Trevithick, who was then Chief Mechanical Engineer at Crewe. When first built it did not exhibit the pleasing lines that it now possesses, for the boiler was placed below the driving axle. At that time it was an accepted idea that safety could only be secured with a very low centre of gravity. Therefore as "*Cornwall*" had driving wheels with a diameter of 8 ft. 6 in. it was considered necessary to place the boiler in this position in order to make the locomotive safe for the high speeds that it was expected to attain.

In this state it was exhibited at the Great Exhibition of 1851, and among other locomotives shown at the same time was the famous "*Lord of the Isles*" of the G.W.R. It was in order to rival as a narrow gauge engine the exploits of this and the other engines on the broad gauge that "*Cornwall*" was built. At that time the competition between the two systems, the 7 ft. "Broad Gauge" of Brunel and the 4 ft. 8½ in. "Narrow Gauge" was very keen.

In 1858 "*Cornwall*" was fitted with a new boiler in the normal position, and subsequently it was brought into line with Mr. Webb's standard practice as regards cab, chimney and other details. It was at one time employed to run the "Limited Mail" between Crewe and Carlisle, but was not a suitable type of engine for the difficult route over the Grayrigg and Shap inclines. In later years it was employed on fast expresses between Liverpool and Manchester, and it became exceedingly well known to the travelling public on that busy section of main line.



Photo] [*D. D. Porter*

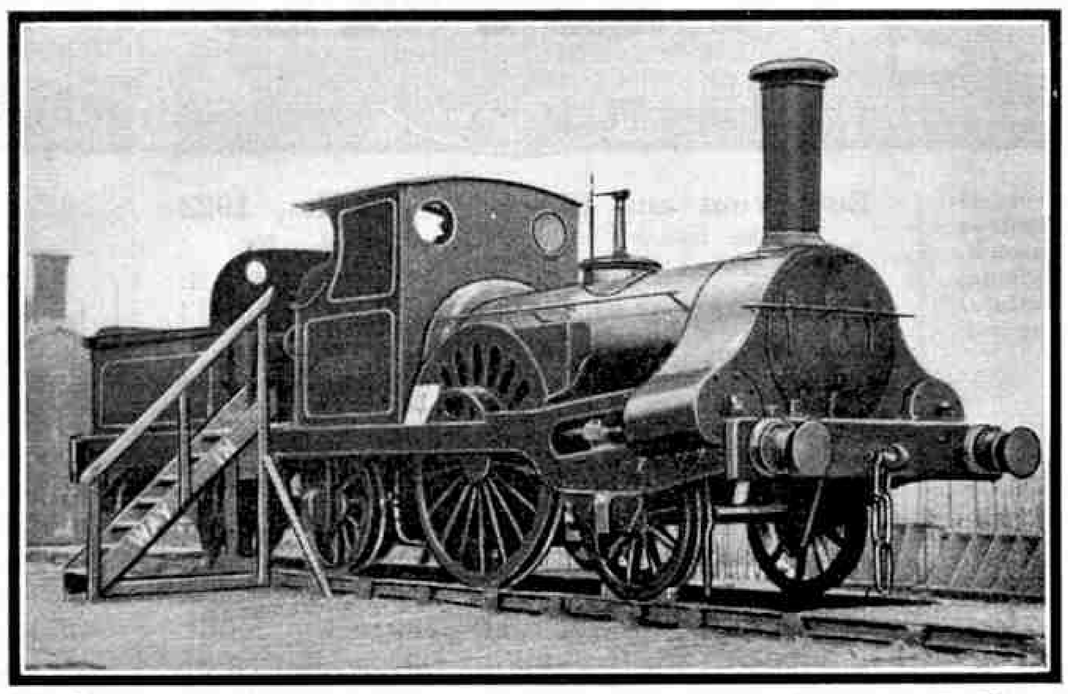
The famous "Cornwall," remarkable for having the largest driving wheels in the world. This engine was built in 1847, and until 1858 the boiler was slung below the driving axle. "Cornwall" was in service until 1905 and was then kept at Crewe until 1911, when it reappeared as an inspection engine, and was thus employed until a few years ago.

Finally, "*Cornwall*" was withdrawn from service in 1905, having covered a mileage estimated at 928,838, for no definite record exists of its work prior to 1858. After some years' retirement it was overhauled and attached to the Chief Mechanical Engineer's saloon, and it was employed on this duty until comparatively recently. An attempt was made to employ it on motor-train service, but this did not meet with much success. It is now kept in the paint shop at Crewe Works, together with another "single-wheeler" "*Columbine*," which also was exhibited at the Liverpool Pageant, and appears in one of our illustrations.

"*Columbine*" was the first engine to be built at Crewe, and was brought out by Trevithick in 1845. It was in main-line service until 1879 when it was transferred to departmental duties and bore the inscription "*Engineer Bangor*." In 1902 it was taken out of traffic and installed in the paint shop at Crewe, thus being the first

L.N.W.R. locomotive to be preserved. It belonged to what was known as the Allan "Crewe" class, Allan being Locomotive Superintendent under Trevithick. Many engines were built to this and the generally similar four-coupled goods design for other railways, notably in Scotland, where the type was very popular with the Caledonian and the Highland railways and their constituent companies.

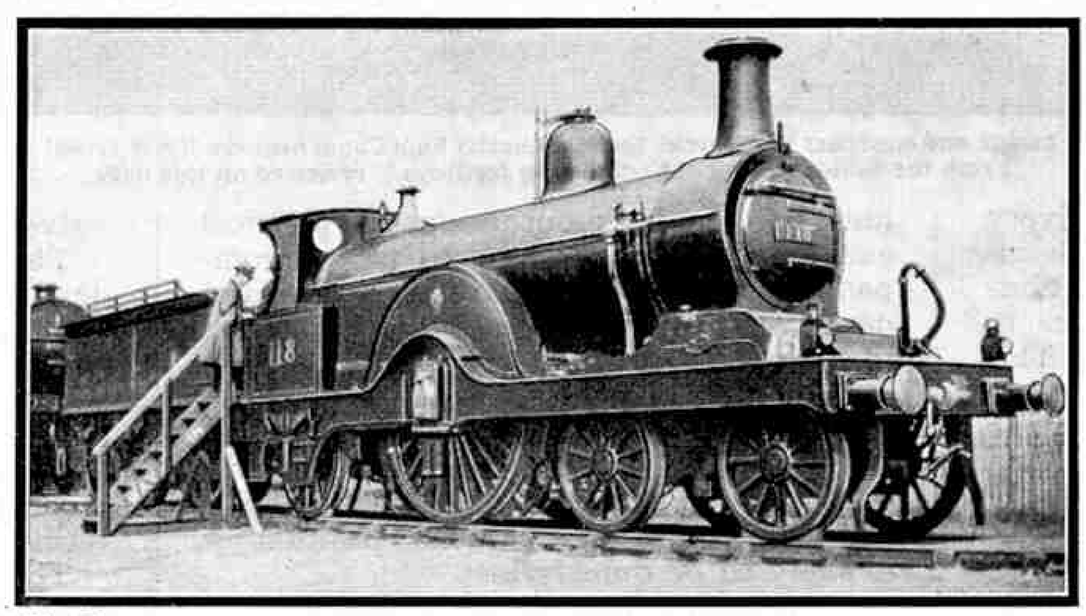
There are several locomotives now kept in retirement at Derby, the locomotive headquarters of the former Midland Railway. Among these is M.R. No. 118, which also is illustrated. This engine is one of the famous "single-wheelers" designed by Mr. S. W. Johnson, and was built at Derby in 1897; but the earliest members of the same general class had appeared some 10 years previously. Their construction followed a series of interesting experiments with power sanding apparatus devised by Mr. Holt of the Midland Railway at Derby, and from this the widely-used steam sanding gear of the present day has been derived.



Photo] [*D. D. Young*

The old L.N.W.R. single-wheeler "Columbine," the first engine to be constructed at Crewe Works. The somewhat ugly cab and the weatherboard on the tender were not included in the original design, but were fitted in later years. The engine was used on inspection duties from 1879 to 1902 and has since then been preserved at Crewe as a specimen of an early type of locomotive.

Altogether 95 locomotives of this type were built at Derby, and they were employed on express passenger duties for many years. They gave consistently good results, and in addition were economical in fuel consumption—so much so that during the coal strike of 1912 they were all set to work again on the principal trains on the Midland Railway. One of these engines bearing the name "*Princess of Wales*" was shown at the Paris Exhibition of 1900, and was awarded the Grand Prix. They were extremely popular with the enginemen, to whom they were known as "Spinners," owing to their free-running qualities. A speed of 90 m.p.h. was recorded behind one of them, and as pilot engines they have induced many a sluggish train engine to show its paces. The last duties of many of them were on the system of the Cheshire Lines Committee, where they worked the Midland section trains between Liverpool Central and Cheadle Heath. The Cheshire Lines system saw also the last of the 4–2–2 "single-wheelers" of the Great Central Railway, originally designed by Mr. H. Pollitt for service on the main line to London, when the former Manchester, Sheffield and Lincolnshire Railway pushed its way southward.



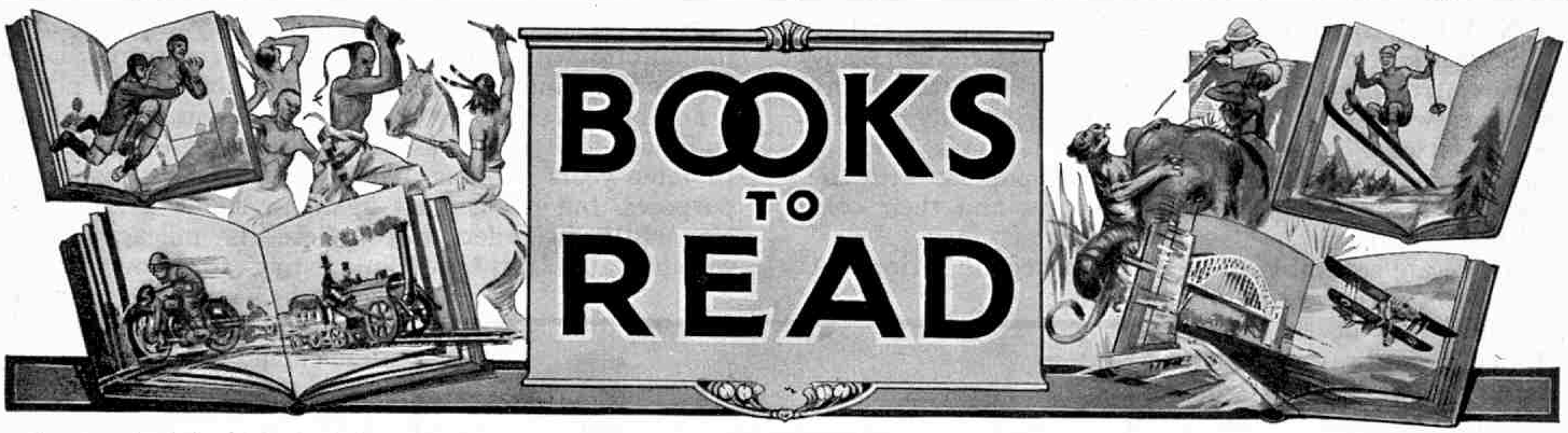
Photo] [*D. D. Porter*

No. 118 of the Midland Railway, one of a famous class of 4-2-2 locomotives. These engines were used for many years on the fast expresses, and were known as the "Spinners" owing to their free running.

The only "single-wheeler" of the 4–2–2 type that belonged to a Scottish railway is still in active service on the L.M.S.R. between Perth and Dundee. This is the famous No. 123 of the Caledonian Railway, the only member of its class. It was designed and built by Neilson and Company in 1886, and shown at the Edinburgh Exhibition of that year; and was then taken over by the Caledonian Railway and modified to conform with the practice of that company's Locomotive Superintendent, Mr. D. Drummond. It played a notable part in the "Race to Edinburgh" in 1888, and has done much useful work in main-line traffic. In later years it was employed solely for inspection purposes, but it is now again in traffic as L.M.S.R. No. 14010 in order to complete its mileage before withdrawal. It is very interesting to know that it was decided last year by the L.M.S.R. to allow this fine engine to rest in honourable retirement when its days of service are over. Apart from its distinctive career as Scotland's only 4–2–2 locomotive, No. 14010 is notable as the last "single-wheeler" to work regularly on a main line in the British Isles.

At Swindon is kept an interesting G.W.R. 7 ft. gauge locomotive "*North Star*." It was originally constructed for the 5 ft. 6 in. gauge of the New Orleans Railway, but was acquired instead in 1837 by the G.W.R. It was rebuilt in 1854 to conform with later Swindon practice, and ran till December, 1870. It was then kept at Swindon, but unfortunately in 1906 it was dismembered. In 1925 the G.W.R. authorities felt that some effort should be made to construct at least a replica of it in its original state. Fortunately some of the chief parts were brought to light, and one of the padded leather buffers was actually in use as a music stool! As reconstructed, the engine was an object of great interest at the Darlington Centenary Celebrations in 1925, and two years later it was sent over to its original destination—America—together with the famous "*King George V*," to take part in the "Fair of the Iron Horse." In 1930 it was exhibited at Liverpool with the engines mentioned previously.

The year that "*North Star*" ceased work saw the appearance on the G.N.R. of the first of a class of engines that was to become world-famous. This was the 4–2–2 "Stirling" "eight-footer" No. 1, which luckily is still in existence, though of course long since retired. As time went on detail improvements and modifications were made in subsequent members of the class, but until the end of the century they performed the greater part of the fast main line work. No. 1 was withdrawn from service in September, 1907; and in 1910 it was shown at the Franco-British Exhibition, though not in working condition. Restored to working order it ran under steam at Darlington in 1925 and is now housed in the Railway Museum at York, with other veteran L.N.E.R. locomotives, the G.W.R. "*City of Truro*" and the L.B.S.C. "*Gladstone*."



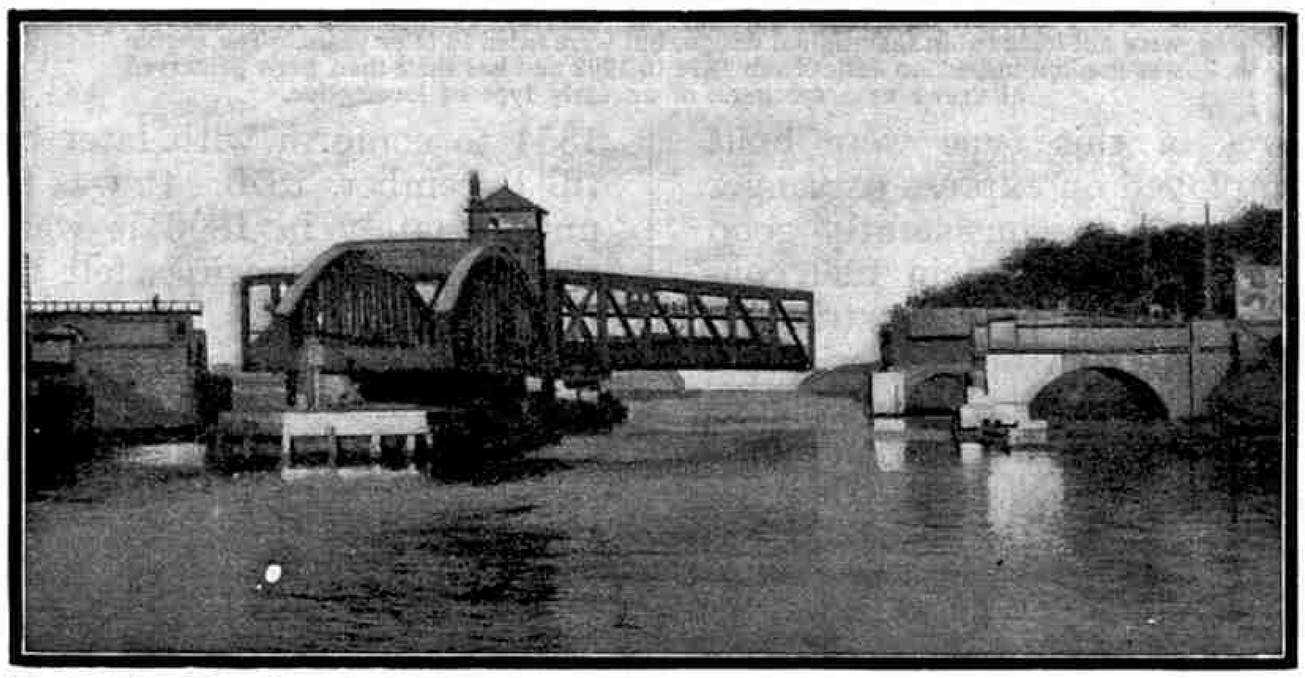
Here we review books of interest and of use to readers of the "M.M." We can supply copies of these books to readers who cannot obtain them through the usual channels. Order from Book Dept., Meccano Limited, Old Swan, Liverpool, adding 1/- for postage to the Price. Postages on different books vary, but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

"Engineering for Boys"

By Ellison Hawks (T. Nelson & Sons. 6/- net)

During the past year large numbers of readers have written to ask where they could obtain a copy of the Editor's book "*Engineering for Boys,*" and we have regretfully had to tell them that the book was out of print. The existence of a widespread demand for the book has induced the publishers to reprint it, and it now can be obtained from all booksellers.

We are sure that this will be good news to many "*M.M.*" readers. The book is unique in covering practically the whole range of engineering activities in a non-technical and interesting style. Ancient Engineering, Power, the Invention of the Steam Engine, Turbines, Railways, Breakwaters, Docks and Harbours, Lighthouses, Tunnels, Ships, Canals, Road-making, Bridge-building and Famous Bridges are described in a fascinating manner that will specially appeal to Meccano engineers. Every one of the 389 pages is packed with information, and 63 half-tone illustrations printed on art paper and 140 figures in the text make everything clear. This book should take a prominent place in the private library of every Meccano boy. J. H. M.



The swing bridge and aqueduct that carries the Manchester Ship Canal over the River Irwell at Barton. From the Editor's Book "Engineering for Boys," reviewed on this page.

"The Whispering Joss"

By Major Charles Gilson (Cassell & Co. Ltd. 2/6 net)

Chinese bandits, with their gruesome threats of removing the ears of their captives, have been prominent in the news recently, and thus Major Gilson's latest story comes at an opportune time. It concerns the adventures of Eric Monkhouse and his friend Captain Crouch, a hard-bitten old sea-dog. In rescuing an Englishman, who is being held for ransom, the two fall foul of Tong-lu, the "Yellow Death," as cruel and sinister a pirate as ever sailed the China Seas. A treasure is at stake, and the pursuit of it brings them all to England where, after many thrills, Tong-lu is finally brought to book in the dungeon of an ancient castle. This is a thrilling tale of mystery and adventure that will be greatly appreciated by its readers.

Boy Scout and Girl Guide Diaries, 1933

(Brown, Son & Ferguson Ltd. Each 1/- net)

These well-known diaries are now in their 25th year of publication, and the 1933 editions are remarkable for the amount of useful information that has been packed into them.

The Boy Scout's Diary may be described as a complete record of the Scouting world, and will be of value to Wolf Cubs, Scouts, Rover Scouts, Patrol Leaders and Scoutmasters alike. It will be appreciated also by boys who do not take part in the Scout movement, for it explains the mysteries of knots, signs and signals; gives practical hints on camping; outlines useful physical exercises; describes how to plot a compass course and to follow a trail; and deals with many other fascinating topics of a similar type that are of the greatest interest to all.

The Girl Guide Diary is equally comprehensive. The diaries would be greatly improved by placing the pencil inside the cover; in its present position it is likely to be quickly lost.

"Pirates 'Gainst Their Will"

By G. G. Jackson (Sampson, Low & Co. 2/6 net)

Among the 18th century pirates who, from their headquarters in Madagascar, preyed on merchantmen crossing the Indian Ocean, Plantain was one of the most fascinating, and Mr. Jackson's story centres round him. The youthful heroes pass through many adventures and narrowly escape hanging while serving under him, but finally they return safely to their homes in England with enough gold and diamonds to restore the family fortunes. The story is pleasantly written on conventional lines, but it is sadly lacking in the real thrills and excitement without which no pirate story can be regarded as satisfactory.

"Everyman's Wireless"

By C. L. Boltz (Harrap. 7/6 net)

The author of this book is a practical teacher of his subject, and his experience in this capacity has enabled him to produce a splendid introduction to wireless. He goes more deeply into the mysteries of the science than is usual in introductory books, but writes so clearly that those who read his book will not only have a better appreciation of the manner in which wireless sets work, but also will be able to undertake the intelligent construction of receiving sets.

After an explanation of the elements of electricity the author ventures to introduce sufficient mathematics to enable readers untrained in this subject to follow the formulæ that he develops later when dealing with transformers, condensers and valves. These preliminary chapters are followed by an account of the nature of alternating currents and wireless waves, and this in turn is succeeded by descriptions of crystals and valves, and of their use in wireless receivers. The section on valves is particularly valuable, for it deals fully with recent developments such as pentodes and screened-grid and variable mu valves, and with their special uses.

The remainder of the book is devoted to a description of telephones and loud speakers, eliminators and battery chargers, and the construction of various types of receivers. A short section is included on television and talking films, and there is a chapter on the discovery of faults in addition to useful appendices giving explanations of wireless terms and abbreviations.

The book is freely illustrated by means of diagrams that will assist readers to follow the clear and lucid explanations given by the author, and may be recommended to all who wish to have a more thorough understanding of wireless.

"Phil Acton's Promise"

By Ronald Tuckwell (A. H. Stockwell Ltd. 2/6 net)

A boy's promise to his father to keep out of fights brings him unpopularity and contempt among his school mates, and his life becomes a misery. The school is engaged in a desperate struggle for an ice hockey championship, but although the hero is a wonderful goal getter he is barred from the team. Finally, after a series of lost matches, the sports coach insists on the boy being played, and he wins the critical match for his school amidst ringing cheers.

"The Splendid Book of Inventions"
"The Splendid Book of Motors"

By G. G. Jackson (Sampson, Low. 2/6 each net)

Every boy is interested in inventions, but we fear that many of those who turn to Mr. Jackson's book for information will be disappointed. The author has tried to deal with so many inventions that he has not left himself sufficient space for each one, so that his descriptions are sketchy and often completely inadequate. This extreme compression robs the various chapters of the attractiveness they should possess with such interesting subjects.

The value of the book as a guide to the enquiring boy is reduced still further by careless statements. For instance, the author draws a clear distinction between the floating dock and the dry dock, and yet a full-page illustration of the "*Majestic*" in the floating dock at Southampton is labelled "'*Majestic*' in dry dock." In the same chapter appears the remarkable statement that "if twenty years ago Liverpool had gone to the expense of building a 950 feet graving dock, the port to-day would find nothing bigger than a 700 foot liner to fill it." This would lead readers to believe that Liverpool has no graving dock capable of accommodating the largest modern liners, whereas it actually possesses in the Gladstone Graving Dock the largest of its kind in Europe, 1,050 ft. in length and 120 ft. in width. This dock was opened by the King as long ago as 1913, and has found useful employment in dealing with much larger vessels than those regularly using the port. Elsewhere the author, in speaking of racing motor cars, makes the remarkable assertion that "aluminium alone has made many of the great records possible"; and it is interesting to hear of a single splice being sufficient for the repair of seven submarine cables. There should be a law preventing authors who make such careless statements as these from publishing their books. They make a mountain of extra work for those Editors whose mail bags are already filled to capacity.

"*The Splendid Book of Motors*" may appeal to the small boy who is beginning to be really interested in motor vehicles. In common with the book just referred to, it suffers from incompleteness. For instance, in one of the best chapters in the book, that dealing with the 100-ton lorry of M.R.S. Ltd., there is no mention of the wonderful trailer used for transporting huge girders through the heart of London, a spectacular feat that was described in the "*M.M.*" in March of last year. In this chapter the author gives three different versions of the name of the firm owning the lorry—*and all three are wrong!*

"Barkworth's Last Year"

By John Mowbray (Cassell & Co. Ltd. 1/6 net)

The author evidently knows his public school thoroughly, and also has a gift for clean-cut characterisation and the ability to tell a good story in convincing style. Barkworth's last year at Northborough should have been his happiest, for he was successful at both cricket and football, and was not too bad at his books. Trouble arose, however, through an unjust accusation that caused his guardian to remove him suddenly to far less pleasant surroundings. The strange happenings that vindicated the boy and brought him back to school provide a tale full of incident.

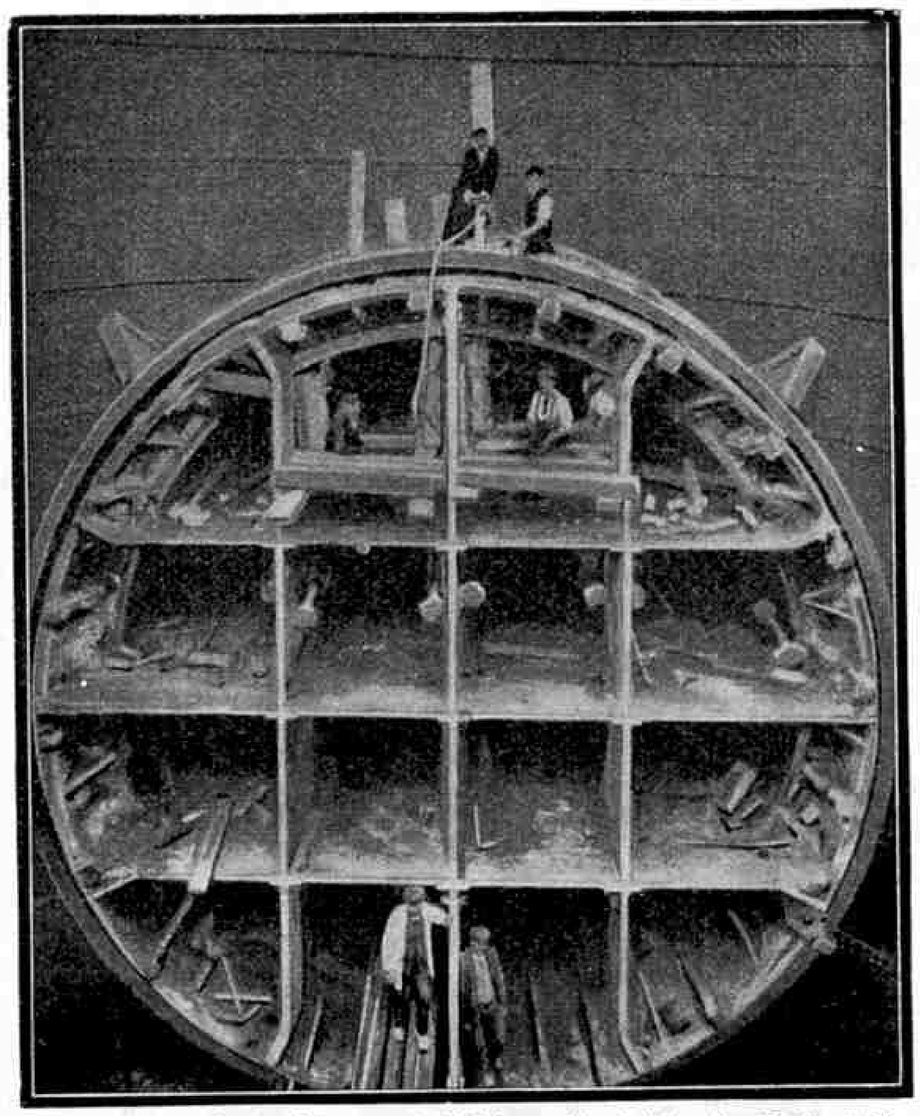
"The Bully of Boiling Creek"

By T. C. Bridges

"The Joker of Dormitory D"

By T. H. Scott
(Warne & Co. Ltd. 1/- net)

"*The Bully of Boiling Creek*" is an exciting story of the adventures of two Canadian boys who have obtained salmon fishing rights in a river in British Columbia. They find their schemes faced with ruin on account of a dam built by a bully of a man who owns land higher up the river, his object being to lower the water in the river to such an extent that the salmon cannot come up from the sea. The description of the way in which this diabolical plan is brought to nothing is full of interest and excitement, and makes a first-class yarn.



Sectional view of one of the great shields used in driving the Rotherhithe Tunnel under the River Thames. From "Engineering for Boys" reviewed on the previous page.

"*The Joker of Dormitory D*" is a rather unusual school story. A curious situation arises from the efforts of the boys of the dormitory to discover why one of their number, who was known to have received a pound note from home, had not invited them to a feed in the local village. To tell what the hero did with the note would spoil the story, which is quite a good one.

"The Looted Gold"

By J. F. C. Westerman
(Ward, Lock & Co. Ltd. 3/6 net)

Here is a story that will appeal to all boys who love adventure and are interested in aircraft. A wonderful airship, making use of a new gas of remarkable lifting power, has been built by a man with a grudge against the world, for the object of international piracy. His immediate object is the seizure of an enormous store of gold accumulated in a recently-discovered African goldfield. The pirate succeeds in obtaining a large amount of this gold, but then discovers that British aircraft are coming in pursuit of him. In the attempt to escape he flies southward, but is overtaken, and a fierce fight follows in which two of the British aircraft are destroyed by means of a new and deadly bomb projector. The pirate vessel ultimately meets her fate in the Antarctic. The story can be thoroughly recommended for its interest.

"100 Best Tricks"

By J. C. Cannell (Hutchinson & Co. Ltd. 2/6 net)

Mr. J. C. Cannell, who is Vice-President of the Magicians' Club, sets out in this book to explain in non-technical language a series of interesting and baffling tricks that can be performed easily by the average person. The tricks are very varied, and include a particularly interesting collection of tricks with cards. The explanations are clear and simple, and are assisted by numerous diagrams. The book is excellent value for half-a-crown and should appeal to all amateur magicians.

"Holding Their Own"

By F. A. M. Webster (3/6 net)

"Kidnapping From Downways"

By A. L. Haydon (2/6 net)
(Warne & Co. Ltd.)

In "*Holding Their Own*" Captain Webster is on ground that he knows well. The scene of the story is East Africa before the War, and is mainly concerned with a native rising organised by a weird secret society known as the Nabingi, or Expellers, whose object is to drive every white man out of Africa. The story opens with a native attack on two homesteads, one owned by an Englishman and the other by a German. Both of these men are away at the time, and the attack results in the murder of the German's wife, and the capture of his son, together with the Englishman's wife, son and daughter. The captured whites are taken by the Nabingi to their secret stronghold, a city built at the summit of a great mountain, to be sacrificed as an offering to their god; but eventually they are rescued after desperate fighting and many exciting incidents. No boy will read without a thrill the description of how the giant Zulu Umbelazi, with his axe, "Groan Maker," held a stairway in the temple of the secret city against a horde of Nabingi warriors. This is probably the best story that Captain Webster has written.

"*Kidnapped From Downways*" is a good story concerned with the adventures of a boy who possesses a mysterious Chinese amulet. The secret of this amulet is known to an unscrupulous Chinaman, who determines to use the boy as a means of extracting money from a wealthy merchant at Hong Kong. The hero is kidnapped from his Sussex school, taken by aeroplane to the coast, and forced on board a small steamship, the crew of which are all in the Chinaman's pay. After an adventurous voyage to China, the hero learns the secret of the charm.

Interesting New Books

The undermentioned books, recently published, will be reviewed in a future issue.

The Splendid Book of Railways
by W. H. Boulton. (Sampson, Low, 2/6)
The Splendid Book of Achievements
by G. Gibbard Jackson (Sampson, Low, 2/6)
The Splendid Book of Stamps
by Stanley Phillips (Sampson, Low, 2/6)
Ciphergrams
by Herbert O. Yardley. (Hutchinson & Co., 2/6)
In Great Waters
by Keble Chatterton. (Warne & Co. Ltd., 2/-)
Adventurers of the Air
by Keble Chatterton. (Warne & Co. Ltd., 2/-)
Pleasure Book for Boys
(Warne & Co. Ltd., 2/6)
The Golden City
by J. Sherwen Robson. (Stockwell Ltd., 6/-)
Frozen Hope
by S. M. Toyne. (Stockwell Ltd., 6/-)
The Wonder Book of Electricity
(Ward, Lock, 5/-)

FROM OUR READERS

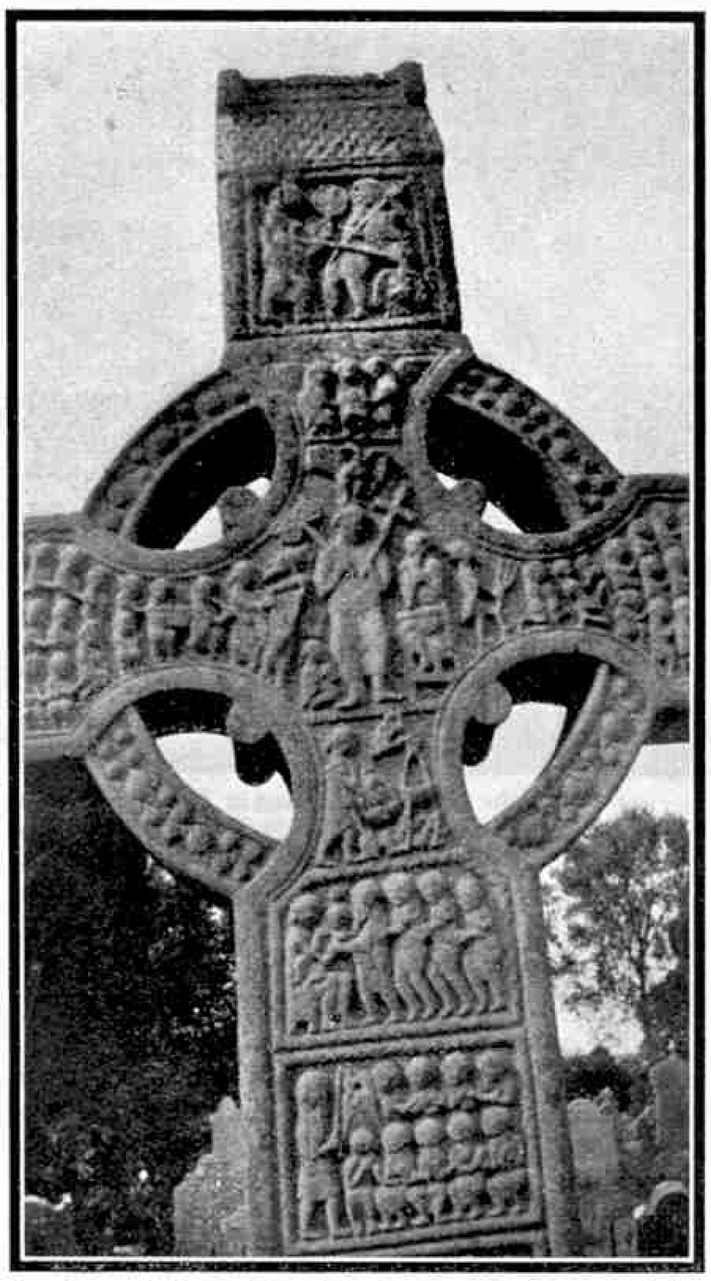
These pages are reserved for articles from our readers. Contributions not exceeding 500 words in length are invited on any subject of general interest. These should be written neatly on one side of the paper only, and they may be accompanied by photographs or sketches for use as illustrations. Articles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

An Historic Irish Valley

Last summer I had the pleasure of visiting the valley of the Boyne, beginning my tour at Drogheda, which stands near the mouth of the river. Drogheda is a fine old town, famous for its storming by the Parliamentarian troops in 1649. Portions of its ancient walls may still be seen, but only one of the gates remains. This is the St. Lawrence Gate, a massively-built stone structure that is in a splendid state of preservation.

Many years ago there stood near Drogheda a monastery founded about 500 A.D. by St. Buite, from whose names have been derived those of the River Boyne and Monasterboice, as the site of the monastery is called. A few walls, a round tower and three large crosses now remain to show visitors where the once prosperous monastery stood. The round tower is 110 ft. in height and probably was formerly much higher. It is 51 ft. in diameter at its base, and was built about 900 A.D. as a bell tower and also as a place of refuge against marauding Norsemen.

Monasterboice is chiefly famous for its three crosses, erected in the 10th century. That of Muiredach is the best preserved, and is about 16 ft. in height and decorated with carvings of a religious type. The Last Judgment is represented in the centre. On the right hand of the Judge are the just, with their faces turned towards him, and on his left the unjust are being driven away by the devil, who is armed with a three-pronged fork. In other panels various Bible scenes are illustrated, including the Adoration of the Holy Child by the wise men, and John the Baptist preaching in the wilderness. Of the remaining crosses one is plain and the second is covered with lichen.



The top of the Muiredach Cross at Monasterboice, in the valley of the Boyne. Photograph by C. H. Lees, Bristol.

Other interesting ruins in the Boyne valley are those of the ancient Abbey of Mellifont, founded in 1139 by a follower of St. Bernard. Little now remains of the Abbey, for parts of it were demolished about 100 years ago in order to furnish building material for a mill erected not far away. The Chapter House is the most perfectly preserved section. It has a very fine floor of old glazed tiles and a wonderful north window, and carved stones from the ancient buildings are stored in it. In places the bases of the pillars of the Abbey itself may be seen. These are very broad, showing that the ceiling must have been high and some authorities believe its height to have been 150 ft. C. H. LEES (Bristol).

Viking Ships in Oslo

While I was in Oslo, the capital of Norway, a short time ago, I saw the remains of three ancient Viking ships preserved in the Folk Museum. The most interesting of these is one discovered in 1903 at Oseberg, for it is believed to have been used by a queen more than 1,100 years ago, and eventually to have become her tomb. The place where it was unearthed is on the banks of a stream and is about 2½ miles from the coast and 50 ft. above sea level. Stones had been piled over the ship to form a burial mound, and when found it was covered with peat. The vessel was fairly well preserved, although some of her timbers had been crushed by pressure; and little difficulty was experienced in restoring her to her original form for exhibition in the Museum.

The burial chamber of the queen was immediately behind the mainmast. Two of her bondwomen were buried with her, all three bodies being laid on well furnished beds. In the fore part of the ship were four sledges, an elaborately-carved four-wheel wagon, more beds, and a large amount of ship's gear. The bodies of 15 horses, four dogs and an ox also were found, and a curious feature was the presence of two hand-looms in the queen's burial chamber.

The Oseberg ship was of comparatively shallow draught and probably was used for cruising in coastal waters. Her keel is made of oak, with cross pieces to which oak planks are nailed, and these were caulked with cattle-hair. She is about 71 ft. in length and her greatest width is 17 ft. Her prow is beautifully carved to represent a serpent with glowing eyes, and her mast of pine originally must have been about 45 ft. in height. There are holes for 15 oars on each side of the vessel, and she was steered by means of an additional oar thrust into the water near the stern and on the starboard side.

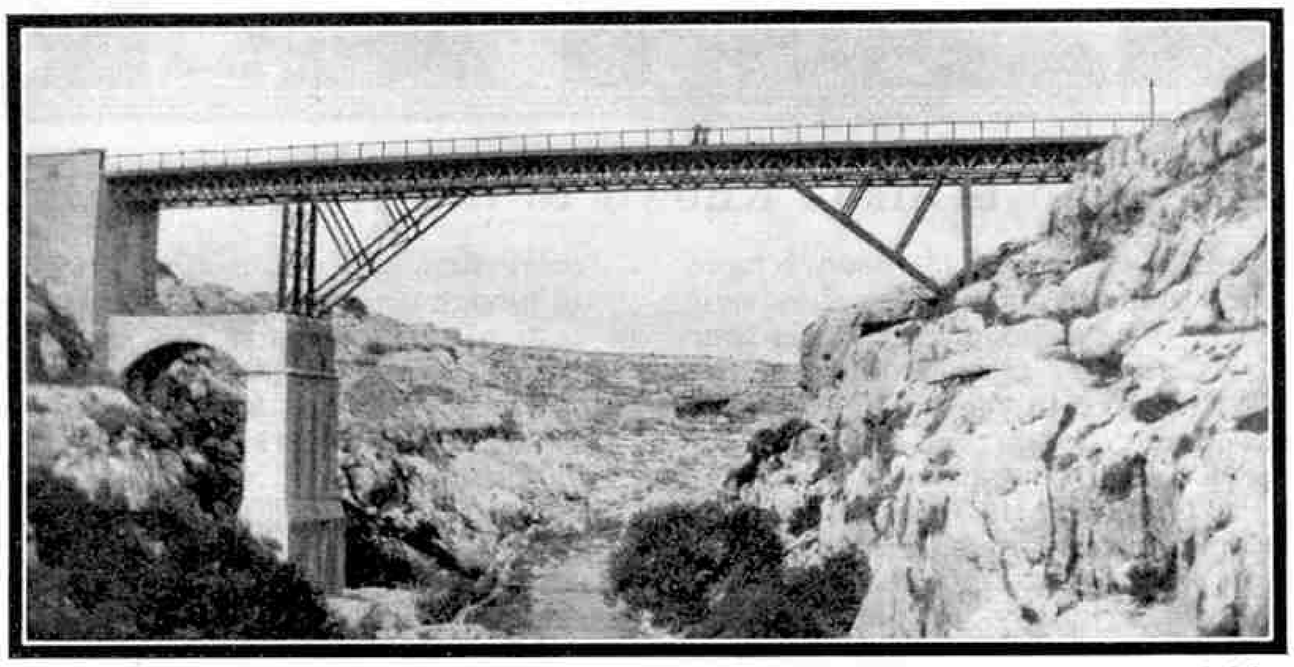
The other two Viking ships I saw were larger than the Oseberg ship, but not as well preserved. One of them certainly took part in Viking raids overseas, and later while crossing the North Sea in stormy mood in a modern liner I learned to appreciate the skill and hardihood of the ancient Norwegian mariners who boldly put out to sea in their small and frail vessels.

D. P. PEARSON (Torquay).

A Crumbling Span of Steel

"Wied il Ghasel," as Honey Vale is called by the Maltese, is a long deep ravine in a limestone ridge near Musta, a large village in the heart of the island. A turbulent stream runs at the bottom of the ravine after the winter rains, and some of the water in it is stored in a great reservoir, built in Honey Vale itself, from which part of the Maltese water supply is taken.

In 1910 it was decided to build a road from Musta to the military stations on the north-west coast of the island, and the steel girder bridge shown in the accompanying photograph was erected across Honey Vale as part of this scheme. The bridge was completed in the early years of the War, and then tractors, motor lorries and gun carriages began to clatter along its steel roadway.



The steel girder bridge across Honey Vale, Malta. The steelwork has been badly corroded by brine-laden winds and the structure is now closed to wheeled traffic. It will soon be closed to foot passengers and then demolished. Photograph by C. J. Mallia, Malta.

To-day wheeled traffic is not allowed to cross the structure, for the agents of corrosion have been remorselessly at work and the bridge is slowly crumbling. It is believed that it was too hurriedly painted when first built, and the light coatings then applied cracked and peeled off, leaving the steel exposed to the brine-laden winds that blow up the valley from the sea in summer. The bridge will soon be closed to foot traffic, and eventually demolished, and I have hastened to obtain a photograph while the structure still stands. C. J. MALLIA (Malta).

Wine Making in Provence

During a recent holiday I stayed with Provencal friends in an old world chateau in the Rhone Valley, and was thrilled to learn that I was expected to assist in picking grapes in preparation for wine making. The fruit must be gathered immediately it is ripe, and it is the custom for all available hands to work in the vineyards during the gathering season. Every day for a week therefore we were out among the vines early in the morning, stooping over them for hours as we searched carefully among their trailing shoots in order to ensure gathering every bunch.

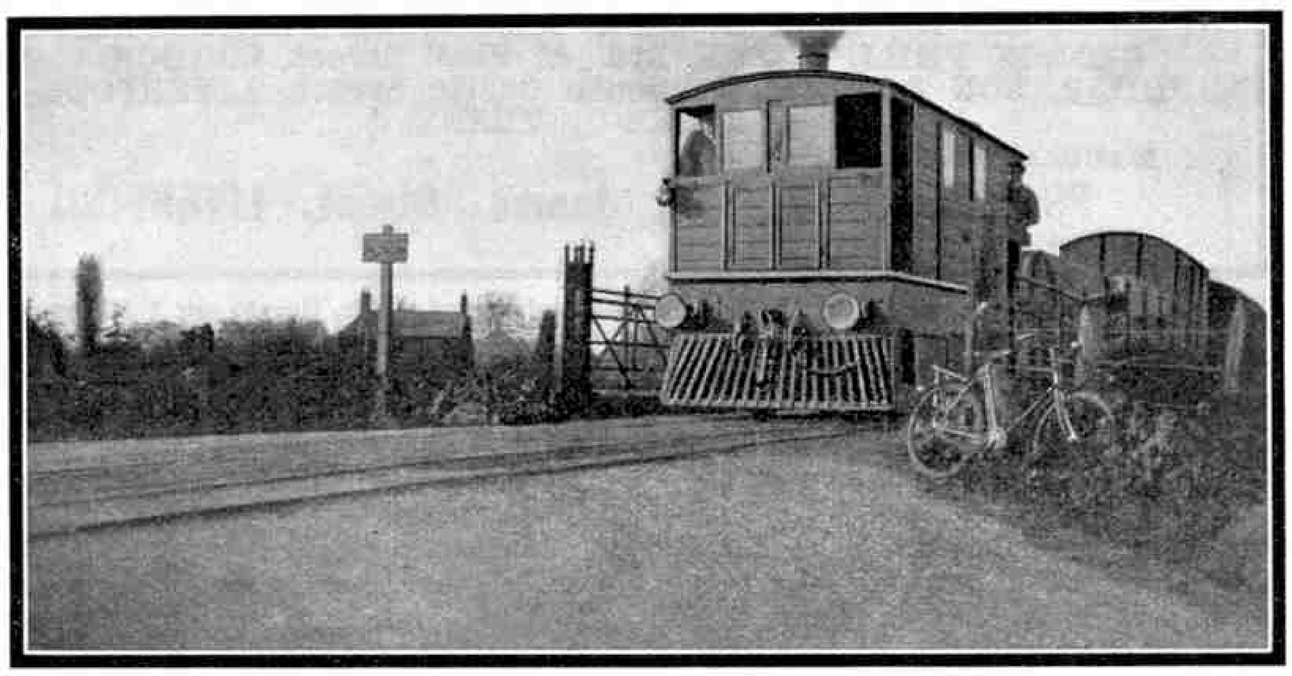
As the grapes were cut they were placed in baskets laid out at intervals along the lines of vines. The scene was picturesque and full of colour, for the pickers wore large hats and gaily coloured shawls, and some of the spreading vines were taking on their brilliant autumn tints. The baskets were rapidly filled with the luscious fruit and piled in carts for despatch to the pressing room.

When picking ended wine making began. The grapes were crushed in stone vats, the juice running through filters in the floors of these vessels and being pumped into barrels, in which it was left about a fortnight or three weeks to ferment. During this process the liquor bubbled so noisily, owing to the generation of carbon dioxide, that an unwary visitor might have been deluded into the belief that it was boiling! From time to time the progress of the fermentation was tested, and when complete the wine was drawn off into bottles. B. COTTON (Ampthill).

British Locomotive with Cow-catcher

Upwell is a large village on the borders of Cambridgeshire and Norfolk, consisting chiefly of one tremendously long street, in the middle of which runs a river. Although quiet at ordinary times, the village is the scene of great activity in the summer, for it is in a large fruit-growing and agricultural area, and hundreds of heavily-laden vehicles of all types then pass along its street.

Upwell is not on a main railway line, but is connected to the L.N.E.R. at Wisbech by a steam tramway of standard gauge. This tramway runs through the streets and at the side of a main road that is crossed on the level in several places. There are no protecting gates at the crossings, and drivers ring bells as warnings that their trains are approaching.

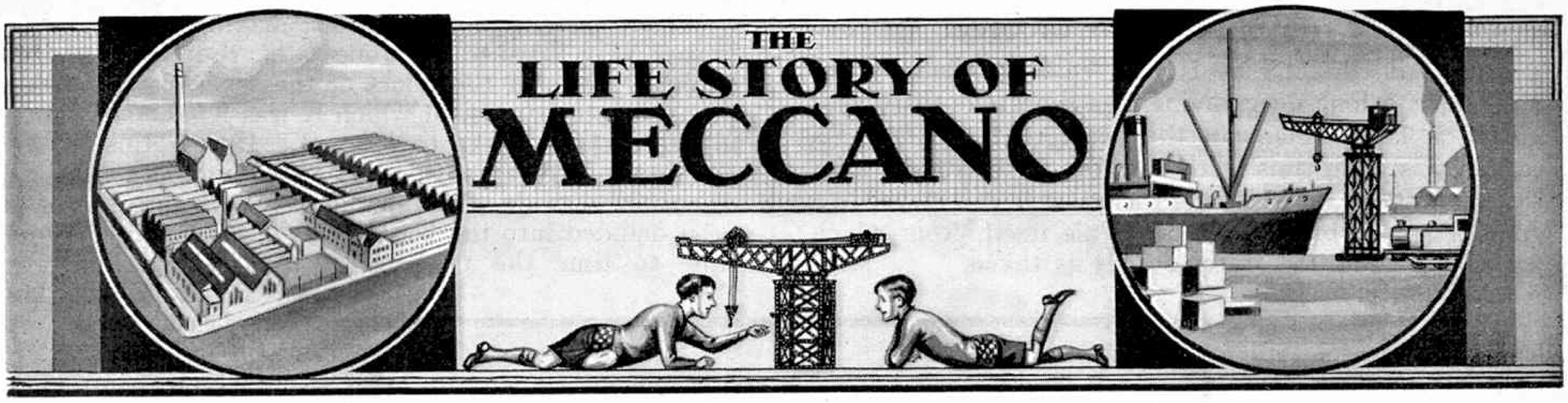


A British locomotive with a cow-catcher. This locomotive is hauling a train on the Upwell-Wisbech tramway. Photograph by L. S. Boulton, Upwell.

The engines of this tramway are of an unusual type. In general appearance they resemble ordinary goods brake vans, but the wheels and motion are entirely enclosed and a cow-catcher is provided at each end. Only goods trains are run, and they are usually made up of about 30 wagons, but more are attached during the busy fruit season. Their speed is about 10 m.p.h., and it is interesting to watch them threading their way down the winding street alongside omnibuses and motor lorries.

The tramway has a terminal station at Upwell, where there is an extensive goods yard. It is a great boon to the fruit farmers of the district, for it enables them to send their produce to be sold in large centres, or to be canned at Wisbech.

Formerly a passenger service was run on the tramway. The train consisted of from five to eight four-wheeled coaches and it was stopped in the street when would-be passengers hailed the driver. The coming of the motor omnibuses resulted in the withdrawal of the service. L. S. BOULTON (Upwell).



XIII.—How Meccano is Made Known to the World. By Frank Hornby

IN the preceding chapters of the Life Story of Meccano I have told my readers of the invention of Meccano and the subsequent introduction of Hornby Trains. I have taken them on a tour of the Meccano factory in order that they may understand the amazing amount of skilled work that goes to the making of even the simplest accessory in the Meccano system; and I have recounted also something of the service side of our activities, explaining how the Magazine, the Meccano Guild and the Hornby Railway Company are conducted to help Meccano and Hornby Train enthusiasts to secure the greatest possible fun from their hobbies.

It is one thing to have created a wonderful toy, but quite another thing to ensure that the world shall know about it and recognise its merits. In this article, therefore, I propose to tell my readers something of the work of our Advertising Department, on which rests the responsibility of making known to boys in all parts of the world the latest developments in Meccano and Hornby Trains, and the enjoyment they may obtain from these wonderful toys.

The work of the Department covers an enormous range, but it may be divided roughly into three main sections. The first is concerned with the planning and preparation of our world-wide advertising in newspapers and periodicals. The second is occupied with the designing of catalogues and other printed lists that are issued in response to enquiries arising from the press advertising; and the third deals with the production of window display material, lantern slides and special printed matter to help Meccano dealers to create local interest in Meccano products. That is a bare outline of a task that keeps a staff of 50 working at high pressure throughout the year.

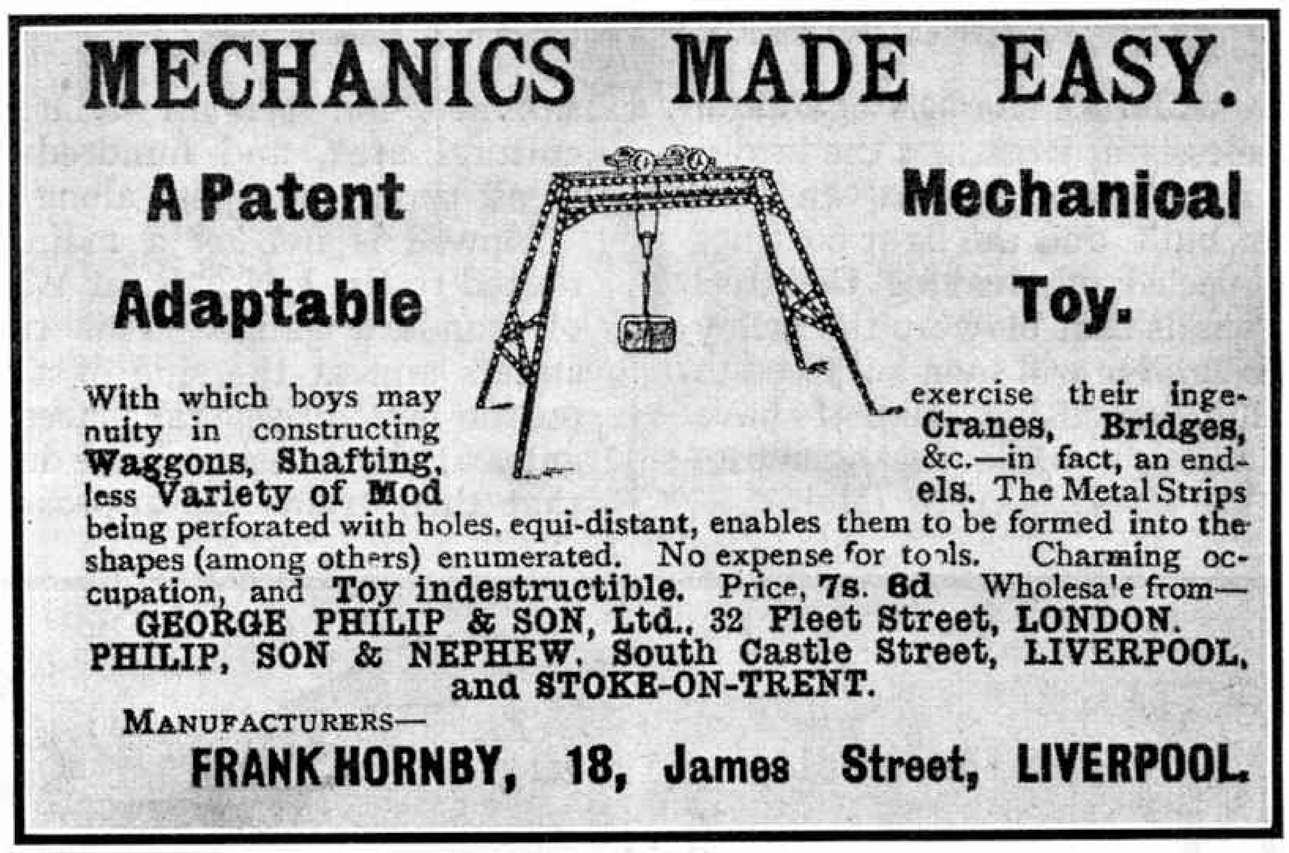
This planning ahead that is so essential to the smooth conduct of our present-day overseas campaigns is in striking contrast with the easy-going methods of the past. As early as March and April of each year the dates for the overseas Christmas campaigns have been finally settled and the preparation of the individual advertisements put in hand.

Before this advertising is ready for issue it has to be prepared in 16 different languages! An immense amount of painstaking work is involved, for the translation of the copy calls for not only a perfect knowledge of each country's language, but also for a sympathetic understanding of the characteristics of each country. For this reason the translations made by our Foreign Department, both for the advertisements, and for the catalogues to which I shall refer later, are submitted to our agents in the various countries for consideration in the light of their close local knowledge.

The "heavy artillery" of our press advertising campaigns is of course concentrated on the Christmas season. In the British Isles, during the two months preceding last Christmas, we used for our announcements some 80 newspapers, magazines and periodicals, covering a reader population of from 11 to 12 millions. The campaign increased in intensity until the peak was reached about 10 days before Christmas, when the buying season was at its height. Simultaneously similar advertising was appearing in more than 200 publications throughout the Empire overseas and in foreign countries. In Belgium and Holland, where the principal festival of the year is St. Nicholas, falling on 6th December, the main advertising campaign is conducted during November.

These strenuous activities are the culminating points of many months of hard work. In the early part of the year, at conferences held between our advertising agents and ourselves, the broad lines of the campaigns are settled, the illustrations to be used in the advertisements are selected, the special selling points to be stressed are discussed, and the total amount of money to be spent is decided.

After the conference decisions have been made there is an immense amount of routine work to be put in hand. The actual sums to be spent in individual publications, the size of the spaces, and the positions and dates of appearance of the advertisements have to be settled. Then follows the designing and preparing of the actual advertisements, a task of many complications. An advertisement issued to the public reading a high-class monthly magazine must be different from one designed to appeal to the readers of a boy's weekly "thriller." The outlook of a Swiss boy living among mountains and snow is different from that of a boy living in the backwoods of Australia; and in framing our advertisements we must provide for all these differing characteristics. The fact that we are able to do this without having to resort to elaborate variations provides an interesting demonstration of the universal appeal of Meccano products. Working models and moving trains have a language that is understood throughout the whole world of boyhood.



This is a reproduction of one of the earliest advertisements issued by Mr. Hornby for "Mechanics Made Easy," under which name Meccano first appeared.

Each succeeding advertisement that appears in the daily press or in magazines presents an interesting aspect of the particular product dealt with, and thus there is unfolded gradually a complete picture of the delights of Meccano and Hornby Trains. Every publication is used several times, some of them more frequently than others, in order to drive home our points. The national daily papers, with their huge circulations but short reading life, must be used most frequently to ensure that our message shall live in their readers' minds.

While the details of the reading matter, known as the "copy," are being settled, the art work for the illustrations is in hand. Photographs of all the items to be featured are made; and from these are produced half-tone and line blocks in a wide range of sizes. When these are ready it is possible to proceed with the preparation of the "layouts," which are representations of the finished advertisements specially drawn up for the guidance of the printers, showing the positions of the illustrations and of the "copy," and the sizes and styles of type to be used.

It is exceedingly interesting to look back on the remarkable expansion of our advertising. In the early days of Meccano when, as "Mechanics Made Easy," the product was struggling to secure a foothold, I considered a quarter-page advertisement in the "*Strand Magazine*" to be the height of speculation. I had faith

in the future of Meccano, however, and I made a point of allocating each year a definite percentage of the sales revenue for the purpose of advertising. That policy has never been abandoned, and thus as sales have increased the volume of advertising has grown accordingly. The great spaces we use to-day, the half and whole pages in the daily and Sunday newspapers, costing up to £1,700 for a single insertion, are in fact less a speculation than the early two-inch single column and quarter-page spaces, costing perhaps £5 each.

The growth in the size of the spaces occupied has been accompanied by remarkable developments in the style of presentation. In the early days, as the winter season approached and we thought it desirable to prepare some advertising, we searched our stock of blocks for those most suited to the size of space in mind, placed the illustration in the middle of the space, strung together a few explanatory words, added a price or two and the name and address, and hoped for the best! To-day every illustration in our advertising is specially planned to bring out clearly the special point to be made in the advertisement; and every word is considered to make sure that it is the best to use in that place to secure the effective presentation of our message.

The bulk of our advertising in each country is standardised, and thus it is only necessary to make one typesetting of each advertisement, from which a series of matrices is prepared for distribution among the various publishers. A matrix is a papier-mache impression obtained direct from the blocks and type under heavy pressure, and is supplied in place of copy and blocks. The despatch of a set of matrices for the series of advertisements to each of the 200-odd publications employed is an easier and less expensive operation than the forwarding of a similar number of sets of blocks and copy. Apart from the saving in blockmaking and postal costs, there is the important advantage that the possibility is eliminated of mistakes creeping into the advertisements when set.

Meccano advertising literature is printed in 16 different languages. The above illustrations show two folder covers. The one on the left is printed in Russian and the one on the right in Chinese. These illustrations show how curious some of these advertisements appear to British eyes.

On arrival at the publishers' printing offices, the matrix is placed in a casting box and molten metal poured over it. As soon as the metal is cool the matrix is stripped away, and the resulting casting, known as a stereotype, provides a perfect reproduction of the original blocks and typesetting in a form ready for printing.

So much for the main press campaign. In addition to this the advertising department prepares each year many thousands of advertisements for use by dealers in their local publications. These cannot be standardised, for the requirements of each dealer are different; and consequently separate layouts, copy and sets of blocks are issued. In order to cope with the requirements of this side of the work a floating stock of nearly 10,000 blocks is maintained!

The advertising campaign is designed to awaken interest in our products, but as it is impossible to feature anything like a full range of them in the actual advertisements, it is necessary to provide complete lists in the form of catalogues for leisurely consideration. The public are urged to secure a copy of one or other of these catalogues, either by direct enquiry from a Meccano dealer or by postal application to us. We prefer the first course for several reasons. It brings the public immediately into contact with the products themselves, and provides the dealer with an opportunity to amplify verbally the brief catalogue descriptions.

Nevertheless a big percentage of enquiries reach us direct, the number growing rapidly as the advertising campaign intensifies. At its height several thousands of applications reach us each day, and a large special staff has to be engaged to cope with the work of opening the letters, noting any cash enclosed, checking the "keys"—to which I refer later—and finally sorting the letters in bundles to accord with the particular catalogue to be sent in reply.

As most of my readers know, we ask boys who apply for literature to send us the names and addresses of three of their chums. To each of these chums a special booklet is sent, and thus practically every application involves the dispatch of four replies. It may be imagined how much work is involved in preparing the literature ready for dispatch, inserting this in the envelopes, and finally addressing these ready for dispatch.

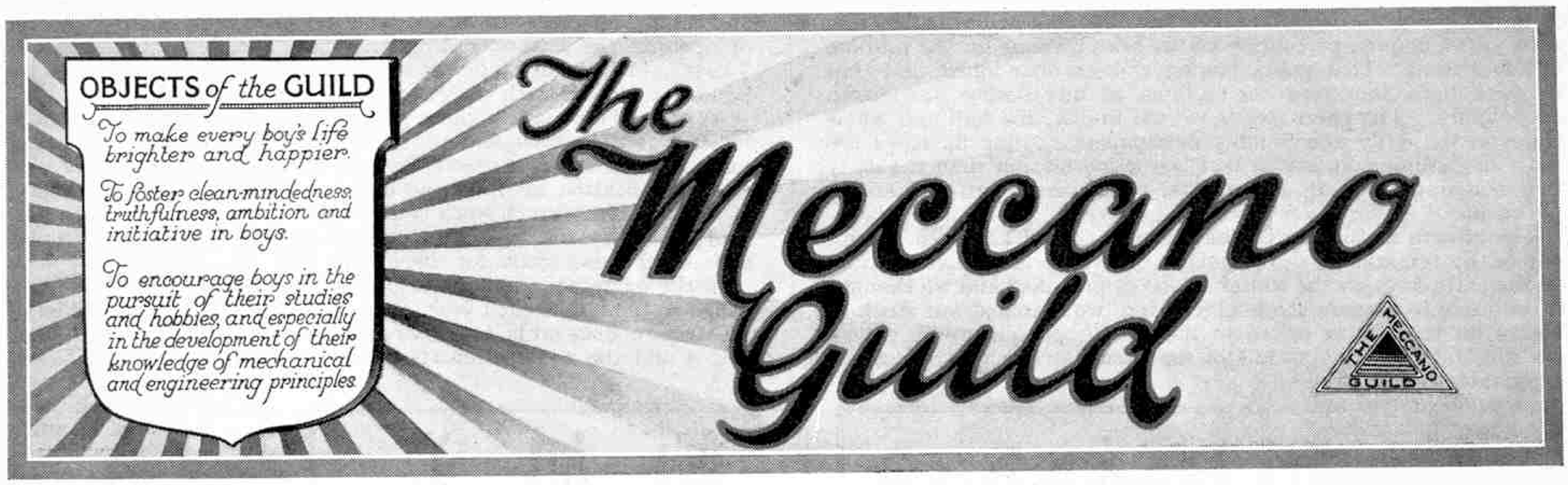
In the aggregate, millions of pieces of advertising literature are issued to the public each year, either direct or through our dealers. This figure disregards the instruction manuals packed with the outfits and the advertisements in the Meccano Magazine. These two items alone account for one-and-a-half million pieces of "after sale" service literature.

The provision of complete advertisements and of catalogues does not end our dealer-aid service. In addition the dealers are supplied with display material—showcards, window transparencies, streamers, price tickets, background screens and lantern slides—to assist in the creation of attractive window displays. We are fortunate in that our products themselves can be used to make a more appealing window display than any spectacular but lifeless card or wooden set-piece. Working models focus attention far more effectively, and the building of Meccano display models is therefore as much a part of our publicity work as the press advertising. I dealt with the work of the Model Building Department in my last article.

In order to secure the maximum efficiency from the sum allotted to advertising it is essential that we should know whether or not each item of expenditure is creating a satisfactory return. Various means are available for checking the results from press advertising, but we mainly use what is known as the "key" method, which is generally recognised as one of the most effective. The "key" consists of a Department number inserted in the address at the foot of each advertisement, as for example:—"Meccano Ltd., Dept. 29, Old Swan, Liverpool." Every newspaper or periodical used has its own particular number, and thus when the replies come in it is an easy matter to sort them out according to these numbers, and so ascertain how many are to be credited to each publication. At the end of the campaign the replies under each number are totalled up and their relationship to the amount spent in each publication is examined and recorded. These records are extremely useful when the time arrives for planning the subsequent season's campaign, for they clearly show the "pulling power" of the various publications used during the past season, and thus enable us to decide which to use again.

Every year, at the end of February, the world-famous British Industries Fair is held, in two sections running simultaneously at London and at Birmingham. Merchants and trade buyers from almost every country in the world attend the Fair in order to examine the most recent developments in the wide range of British industries. At the London section of the Fair one of the most interesting features is the display provided by the toy industry, and here the Meccano stand is always prominent. At this stand advertising literature in many languages is distributed to buyers from foreign countries, and experts are present to deal with all enquiries as they come along. The 1933 Fair opens on the 20th of this month, and I hope that all readers who are able to do so will inspect the Meccano stand at the White City.

THE END].



The Best Kind of Fun

Now that the work of the winter sessions is in full swing, reports from clubs make interesting reading, and recently I have been struck with the evidence given in them, and in the cheerful letters from Leaders that so often accompany them, of the great delight that members take in their association with this section of the Guild work. As soon as a club is established it becomes a centre in which Meccano boys obtain the best kind of fun—that of developing their hobbies in congenial surroundings and with companions of similar tastes to themselves.

Other boys join in the fun as soon as they realise its possibilities, and this was strikingly demonstrated in connection with a club Exhibition held a short time ago. There was a large attendance of interested visitors, and the Leader has written to tell me that he and his colleagues were inundated with enquiries from boys who were fascinated by the wonderful display of models that had been arranged for the occasion, and greatly impressed by the fun and happiness of club life. In another case a new member enjoyed himself so thoroughly at his first meeting that next week he brought three friends to share the pleasure with him !

Variety in Hobbies and Games

The remarkable variety that has been developed in the programmes of Meccano clubs shows how keen members are. Realising that boys' tastes differ widely, and that it is unwise to restrict their activities in any way, Leaders have taken care to widen their resources as much as possible. Meccano Model-building of course remains a central feature of every programme, for this is the hobby that brings the members together ; but many other hobbies have been introduced, and proceedings have been further brightened by means of indoor games such as table tennis—a great favourite in all clubs—midget golf, table cricket and bagatelle.

I have often pointed out that a few minutes spent in games forms an ideal conclusion to a meeting, but games that involve running about should not form part of the programme of a club if there is any likelihood that the noise or bustle will annoy other people. Before introducing them a Leader therefore should consider the position of the club room carefully, and even if this is suitable in every way, he should take care to maintain a firm hand in order that proceedings may be conducted in an orderly manner. Failure to give attention to these points might give a false impression that members are unruly. It is not necessary to enforce any strict and formal discipline, of course, and the best means of dealing with a problem of this kind is to explain matters thoroughly to members in order that they may realise the importance of order.

Rewarding Good Work

This month I give the names of members of Meccano Clubs who have been awarded Merit Medallions during last year. This is a representative list, and its extent is evidence of the enthusiasm with which Meccano boys pursue their hobby and join in the Guild and club movements.

Although the list is impressive, I scarcely think that sufficient use is yet made of Merit Medallions, and I hope that new ground will be broken during 1933 by the presentation of this award to members of clubs not previously represented in the annual list. In every club two Merit Medallions are available each session for presentation in recognition of any form of good work on behalf of the club, and nominations are made by Leaders themselves, who are in close contact with members and are able to judge their enthusiasm and energy. It is an excellent plan to forward recommendations as early as possible towards the close of a session in which an Exhibition or Concert is being held, for then the Medallions may be presented publicly, and the pleasure of those who receive them is enhanced when their good work is recognised in this manner. I shall look forward to greater activity in this respect during 1933 than in any previous year and hope that my next annual list of awards of Merit Medallions will be a record one.

Merit Medallions Awarded in 1932

ASHTON-IN-MAKERFIELD—H. H. Crook. ATTENBOROUGH—C. Bishop, D. Walford. BARTON-ON-HUMBER—C. Clark, R. Smith. ST. EDMUNDSBURY (Bury St. Edmunds)—R. Boniwell, K. Copeland. MALLOW (Cork)—D. Hickey, J. Lenihan. CROYDON HIGH SCHOOL—R. Blackstone, D. Kent. DAGENHAM—R. Mullins, G. E. Pashley, L. Plumb, E. Waite. ESTON—L. Kerridge. ST. PETER & ST. JOHN'S (Exeter)—G. Brown, R. Ellis, C. Glade, K. Pim, M. G. Searle, P. Stevens, V. White, R. Yeo. GREAT BADDOW—C. Digby, C. Kennock. WEALDSTONE METHODIST (Harrow)—E. Barlow, D. Johnson. HARWICH—R. Hammond, F. Nicholls, A. Ware. REGENT STREET SELECTIVE SCHOOL (Heywood)—A. Griffiths. KENDAL—A. Brown, W. Chambers, A. Nelson. KINGS LYNN—A. S. W. Horn. LONDON (Harlesden Methodist) L. Rallison. (Holy Trinity, Barnsbury)—A. Dines, E. George, H. Stevens, A. Wickes. (Old Charlton)—B. Stevens. (Stamford Hill)—S. Goldberg, A. Goodman, Sidney Grovic, H. Marks, D. Weitzman, A. Wexler. (Welcome, Woolwich)—F. J. E. Broomfield. MAIDSTONE—W. Hills, P. E. Hinton. MIDDLESBROUGH—C. Elder, W. Matthews. SID VALE (Sidmouth)—P. Finch, R. Sweetapple. SOUTH CROYDON & PURLEY—J. Harris. ST. COLUMBAS (Sunderland)—H. Bellenie, J. Boreham, N. Cartwright, W. Johnson, D. Ferguson, R. Allen. GORSE HILL BAPTIST (Swindon)—S. Green. WEMBLEY—E. Burns, P. Worne. ST. PETER'S (Wolverhampton)—R. F. Mann.

OVERSEAS CLUB MEMBERS

AUSTRALIA—SYDNEY—F. Batten, H. McFarlan, E. Jones, W. J. Marshall, K. Rowe, W. J. T. Watson ; UNLEY—J. B. Edge. FRANCE—CALAIS—J. Oyez, J. Revel ; CASABLANCA—M. Sarrand ; CLICHY, SEINE—P. Pinguet ; MULHOUSE—A. Bernard ; SOREZE, TARN—J. Seguier. INDIA—RANJIT—A. Singh. NEW ZEALAND—ASHBURTON—E. Furby, J. Loftus ; CHRISTCHURCH—F. Brown, A. Carpinter. SOUTH AFRICA—MALVERN—F. Paynter, Miss D. Workman ; OBSERVATORY—H. Campbell, F. McClement ; TURFFONTEIN—J. J. Pienaar.

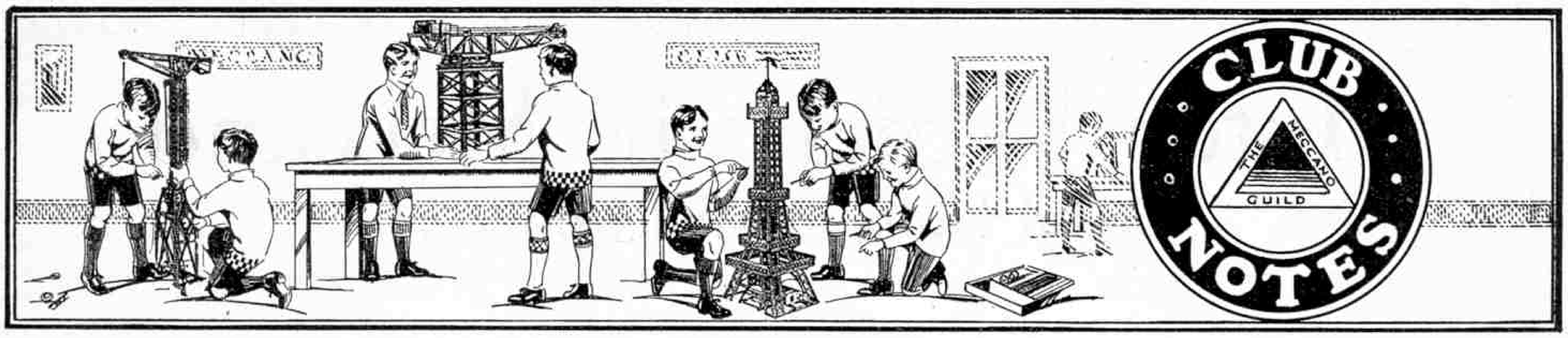
* * * * *

An Autumn Exhibition has been arranged by the Sydney (Australia) M.C. in association with the Sydney Branch of the H.R.C. This will be held on Saturday, 21st April, in the club rooms, 23a, Barker Street, Lewisham, N.S.W. Proceedings commence at 3.0 p.m., and admission is by silver coin. A special display of models is being arranged for this Exhibition, at which an extensive Hornby Train layout, incorporating a realistic system of automatic colour light signals, also will be on view, and a cordial invitation is extended to the Meccano and Hornby Train enthusiasts of Sydney and district.

Proposed Clubs

Attempts are being made to establish Meccano Clubs in the following places, and boys interested in becoming members should communicate with the promoters whose names and addresses are given below :—

BELGIUM—Mr. N. Asseloos, Pensionnat Athenee Royal, 12, Boulevard Rogier, Ostand.
CROWBOROUGH—E. Taylor, Fir Bank, Hurtis Hill.
MARSTON—R. Copperwheat, Lower Shelton.
NEW ZEALAND—R. Williams, 14, Tay Street, Oamaru.



Anderson Baptist (Reading) M.C.—The First Annual Exhibition was very successful, the models shown being highly attractive to visitors. The sideshows included a Meccanograph, a Shooting Gallery and an Electric Train. All were well patronised, particularly the Electric Train, which was set in operation by means of a switch operated by pennies. A profit of £2 4s. 1d. was made, and with this a Meccano Outfit has been purchased. Club roll: 19. *Secretary:* R. E. Hoffler, 27, Pitcroft Avenue, Reading.

Braintree High School M.C.—A Model-building Competition for Armoured Cars or Tanks attracted excellent entries, some of the Tanks readily climbing over an irregular pile of books. A Debate was held on the motion "*That Road Transport is Better Than Rail,*" the speakers putting forward their views in a ery challenging manner. A Talk on "*Magnetism*" was given by a senior member, and junior members have contributed a series of Lecturettes on "*Boats.*" An interesting scheme has been arranged for the Annual Exhibition. Models of Looms and other machines employed in the manufacture of artificial silk are to be displayed and these have been designed and constructed by members. Club roll: 24. *Secretary:* M. K. Miles, 1, Wordsworth Road, Bocking, Braintree.

Dagenham M.C.—Meetings have included Model-building Nights, Mock Trials, and a Court of Enquiry on an imaginary railway accident in addition to Lectures and Talks. A Broadcasting Show has been held, an amplifier and loud speaker in the club room being connected with a microphone outside. This created great fun at the enjoyable party held shortly after Christmas. Club roll: 25. *Secretary:* S. Pashley, 84, Holgate Road, Dagenham.

Fulstow Junior M.C.—Members are keenly interested in indoor games, the wide range available including Table Cricket, Midget Golf, Bagatelle and Table Tennis. In a thrilling outdoor run members trailed two of their number who marked out their course by means of arrows made of twigs, the "hares" being caught within sight of home. Model-building continues with unabated enthusiasm, and a Lantern Lecture on "*London*" has been given, slides being kindly loaned by the L.M.S.R. Club roll: 17. *Secretary:* J. C. Phillips, P.O. Fulstow, North Thoresby, S.O. Lincs.

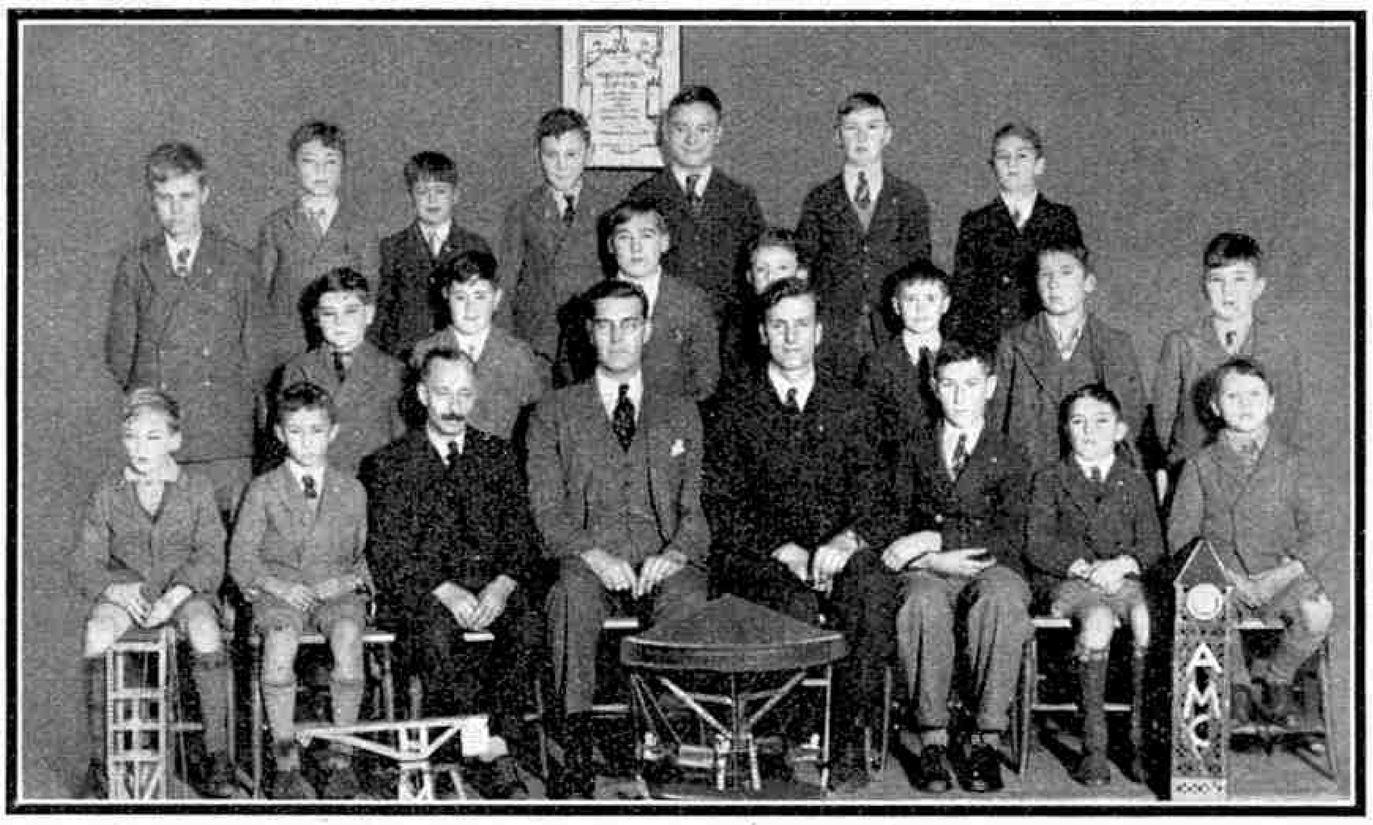
Gorse Hill Baptist M.C.—Special attention is given to variety at meetings. Model-building Contests are arranged every month in addition to Games Nights and Hornby Train Evenings. Marks are being awarded in Competitions and prizes will be presented to those who earn most marks during the session. Club roll: 19. *Secretary:* C. P. Culley, 5, Ipswich Street, Swindon.

Greenock Academy M.C.—A feature of the club room is an enlarged reproduction of the photograph of members on the "Cobbler" that appeared in the "*M.M.*" recently. Visits have been made to a tin printing works and to Renfrew Aerodrome. In the club room Lantern Lectures have been given on the construction of London Tube Railways and other attractive subjects. Members have been very busy with the construction of super-models for the Exhibition. Club roll: 64. *Secretary:* D. M. R. Steel, 25, Margaret Street, Greenock.

Wallington County School M.C.—Members meet weekly for two hours immediately after school. They are chiefly interested in Model-building and in various Contests have built Cranes, Motor Cars, Battleships and a Searchlight. In a special Contest, which was kindly judged by the Headmaster of the School, members were allowed to use any 40 Meccano parts and 30 Nuts and Bolts. Great ingenuity was shown in overcoming difficulties due to the restrictions, the winning model being an Autogiro. The Hornby Train section is building an extensive layout with two terminal stations and a full equipment of signals and other accessories. Club roll: 16. *Secretary:* E. J. Cheeseman, 38, Wordsworth Road, Wallington.

Abington (Northampton) M.C.—At all meetings members submit models to be judged by the Assistant Leader. Indoor games and Amateur Theatricals are other activities, and an excellent debate was held on the question: "*Is Fox Hunting Good for the Country?*" A splendid account of the club and its work appeared in the local newspaper, together with an excellent photograph of members with models constructed by them. Club roll: 29. *Secretary:* S. Cocking, 4, King Edward Road, Northampton.

Maidstone M.C.—An Exhibition held in conjunction with the Maidstone Branch of the H.R.C. was opened by Mr. S. B. Fletcher, who expressed great appreciation of the value of members' work. Models were judged by Mr. P. H. Prior, President of the club, prizes being awarded to the makers of Pithead Gear, a Tar Stone Conveyor and a Truck Emptying Machine, these being original in design and well constructed. Club roll: 15. *Secretary:* I. Elbourn, 91, Old Tovil Road, Maidstone.



A group of members of the Anderson Baptist Church (Reading) M.C. with a few of the models built for their First Annual Exhibition. Mr. F. Wilson, President, and Mr. J. Hewett, Leader, are in the centre of the front row, and R. E. Hoffler, Secretary, is on the right of the Leader. The club was affiliated in January, 1932, and the varied and attractive programme of Model-building and other hobbies arranged by the energetic officials is effective in maintaining the active interest and enthusiasm of members.

Plymouth M.C.—A lecture on "*Hints on Model Making*" has been given by Mr. W. Rose, a famous model-maker, who built a model ship during his lecture while explaining every detail of its construction. A scale model of "*Miss England III*" made by Mr. Rose was awarded to the member who contributed the best model ship to the Annual Exhibition. Members constructed a large number of excellent models for the Exhibition. Club roll: 57. *Secretary:* G. Symons, 6, Holland Road, Peverell, Plymouth.

St. James' (West Streatham) M.C.—Lantern Lectures on "*The Railways of Great Britain*" and "*Bournville*" have been given. Model-building Evenings have included a Contractors' Night and various Competitions. A special display was prepared for the Church Bazaar, at which many articles made by the Fretwork Section were sold. Club roll: 30. *Secretary:* C. Mizen, 64, Fallsbrook Road, Streatham, S.W.16.

Regent Street (Heywood) M.C.—A very successful Exhibition and Concert attracted many visitors, who were greatly interested in the Gymnastic Display and the Boxing Match included. Lantern Lectures play a great part in the programme and these have included talks on "*The Peaks of Derbyshire*" by Mr. T. P. Lunt, B.Sc., President of the club, and "*London*" by Mr. G. N. Chaplin, Leader. Club roll: 92. *Secretary:* W. Jones, 123, Lynden Lea, Bury Street, Heywood.

Whitstable M.C.—Meetings are thoroughly enjoyed by members, who have installed a Wireless Set and arranged to have tea in the club room in order that they may spend long evenings there. Model-building activities usually take the form of Competitions, and other Contests also are arranged regularly. A small Dance Band has been formed and its performance adds greatly to the pleasure of membership. Club roll: 12. *Secretary:* L. Dale, "Maycott," 77, Albert Street, Whitstable.

AUSTRALIA

Sydney M.C.—Mr. A. Lord, President of the club, kindly invited members to his home, where he showed them his remarkable super-models, including a Spinning Mule that was awarded a prize in the £500 International Model-building Contest. At the club's successful Exhibition, this and other models awarded prizes in this Contest were on view. The total number of models displayed was 83. Other attractions included a Hornby Train layout, and nearly 400 visitors were present. Club roll: 32. *Secretary:* W. J. T. Watson, 595, Parramatta Road, Leichhardt, New South Wales.

CANADA

Westmount (Montreal) M.C.—Meetings are held regularly in the Westmount Y.M.C.A. on Fridays after school hours. Model-building Competitions and Model Aeroplane Nights have been held, and other meetings have been devoted to lectures on "*Electricity*" and "*Photography,*" and to short-wave wireless work. Members are interested in the Cinematograph and the Gramophone and are about to produce a talking film. The Automatic Telephone Exchange and the Montreal Tramway Workshops have been visited, and members greatly enjoyed a Sleigh Drive followed by a "Brown Bread and Bean" Supper. Club roll: 15. *Secretary:* F. Thompson, 695, Grosvenor Av., Westmount.

NEW ZEALAND

Ashburton M.C.—At an Open Night, held to celebrate the club's third birthday, models built by members were judged by visitors. A Hornby Train layout was a great attraction and refreshments helped to make an enjoyable evening. Model-building has been very actively pursued, and welcome visits have been paid to the club by members of the Christchurch and Geraldine clubs. Club roll: 50. *Secretary:* M. D. Templer, Bank of New South Wales, Ashburton.

Sumner M.C.—The standard of Model-building is higher than it was a year ago and the improvement is attributed to the practice of bringing models built at home for criticism by the Leader. In a specially attractive Competition, models of farm implements were required from entrants. Members are interested in joint working with other clubs in Christchurch and district, and have taken part in visits and picnics arranged for the combined clubs. Club roll: 15. *Secretary:* A. Carpinter, 10, Clark Street, Sumner, Christchurch.

NORWAY

Sandefjord M.C.—Model-building Evenings are remarkable for the keen discussions by members of the merits of models constructed. T. Jacobsen, secretary of the club, built a special model of the Quebec Bridge, and in an interesting talk compared it with its original. Stamp Collecting Evenings also have been held, and at one of these, Mr. H. R. Sorensen, Leader of the club, gave a talk on "*Norwegian Stamps.*" Club roll: 6. *Secretary:* T. Jacobsen, Box 38, Sandefjord.

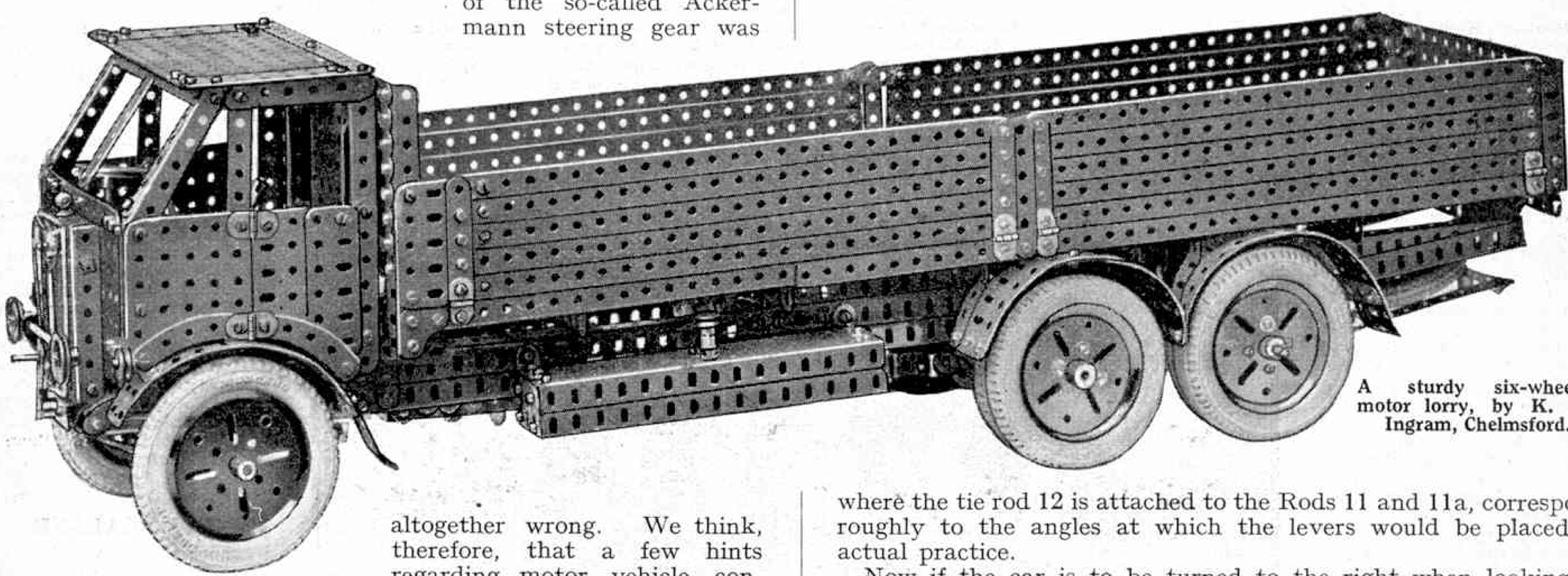
SOUTH AFRICA

Turffontein M.C.—Many special models were built for an Open Night organised by the Malvern M.C. and also for the display by the Transvaal Meccano Clubs Union at the "*Johannesburg Star*" Exhibition referred to in last month's Guild pages. In an interesting Competition members were asked to identify specimens of ten different metals. An excellent Lecture by Mr. J. J. Pienaar, Leader of the club, explained how transformers are made, and the secretary has given special talks on Stamps, one of his subjects being "*Triangular and Air Mail Stamps.*" A welcome visitor at one meeting was Mr. O. Roberts, formerly Leader of the club, who explained the aims of the Union of clubs in the Transvaal. Club roll: 8. *Secretary:* K. Tanner, 146, Ferreira Street, Kenilworth, Johannesburg.

Motor Vehicles in Meccano

Useful Hints to Model-Builders

A LARGE proportion of the models entered in Meccano Competitions represent motor vehicles, and they range from high-powered streamlined racing cars and luxurious limousines to heavy six-wheeled articulated goods lorries. Usually the bodywork is beautifully built, but the mechanical details of the chassis often are not so well designed as they might be. For example, several cases have come to our notice recently in which the construction of the so-called Ackermann steering gear was altogether wrong. We think, therefore, that a few hints regarding motor vehicle construction in Meccano will be welcomed by the majority of model-builders.



A sturdy six-wheeled motor lorry, by K. W. Ingram, Chelmsford.

The part of a car chassis on which even the most experienced model-builders often go wrong is the steering mechanism. The standard type of gear fitted to actual motor cars is known as the "Ackermann" gear. We often receive models from constructors who say that their cars are fitted with "Ackermann" gear, but on examination we find that the steering arrangement of the model bears little resemblance to this ingenious mechanism. As a matter of fact Ackermann steering gear can be reproduced with remarkable fidelity in Meccano, and it is therefore all the more surprising that so few constructors are able to assemble it correctly. With the object of clearing up the confusion that exists on this point we will describe and illustrate the Ackermann gear very fully, so that constructors can copy it in their future models.

As most readers will be aware, when a car turns a corner the near side wheels describe a sharper curve than the outer wheels, so that the front wheels have different angularities. Therefore, for the wheels to turn the corner with the least possible friction on the road surface, each must be situated at a tangent to the circle in which it is moving. As both wheels cannot lie at their respective tangents and at the same time remain parallel to each other, it becomes necessary to incorporate in the steering gear some method by means of which a greater angle can be given to the wheel that is nearest to the centre of the circle, no matter whether the car be turning to right or left. This object is achieved by the Ackermann steering gear.

In actual practice, the gear consists essentially of two short levers rigidly connected to the stub axles, and projecting either backward or forward. These levers lie at a slightly obtuse angle to the stub axles, the correct angle being arrived at by fixing the levers so that their centre lines, if produced, would meet on the centre line of the car. The exact meeting place varies according to the size of the car and length of the levers, but as a rule it is found to be just in front of the back axle. The levers are connected one to the other by a tie rod.

In Meccano practice a slightly different method is adopted, the arrangement being as shown in Fig. 2. Short Rods 11 and 11a are secured just behind the stub axles and arranged to protrude backward. They are connected together by a longer Rod 12, and it will be seen that the imaginary lines AB, CD, drawn through the pivotal mountings of the stub axles and through the points where the tie rod 12 is attached to the Rods 11 and 11a, correspond roughly to the angles at which the levers would be placed in actual practice.

Now if the car is to be turned to the right when looking at the gearing as in the drawing, the road wheel on the stub axle 13 must be deflected in that direction, and the imaginary lever AB will be moved through a certain number of degrees to the left. In so doing it pushes the lever corresponding to CD in our sketch in the same direction, but owing to the difference in angularity between the two levers, lever CD, and therefore the road wheel attached to its stub axle 13a, moves through a lesser number of degrees. If the car moves to the left exactly the opposite occurs, the lever CD moving the lever AB.

This arrangement of the linkage therefore fulfils the essential requirements of the Ackermann steering gear, that is, it imparts a greater angular movement to the inner road wheel when the car turns a corner.

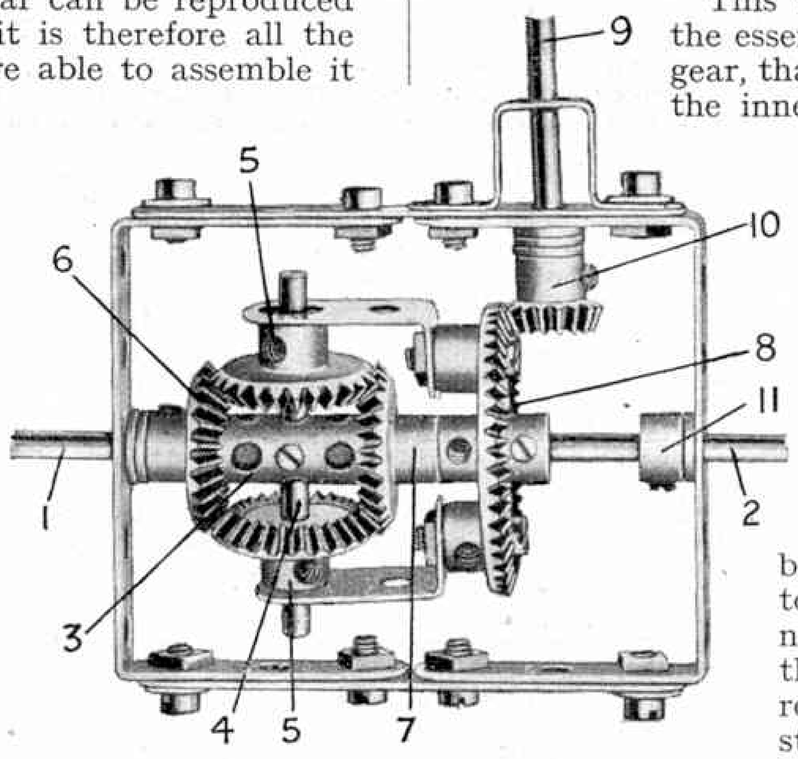


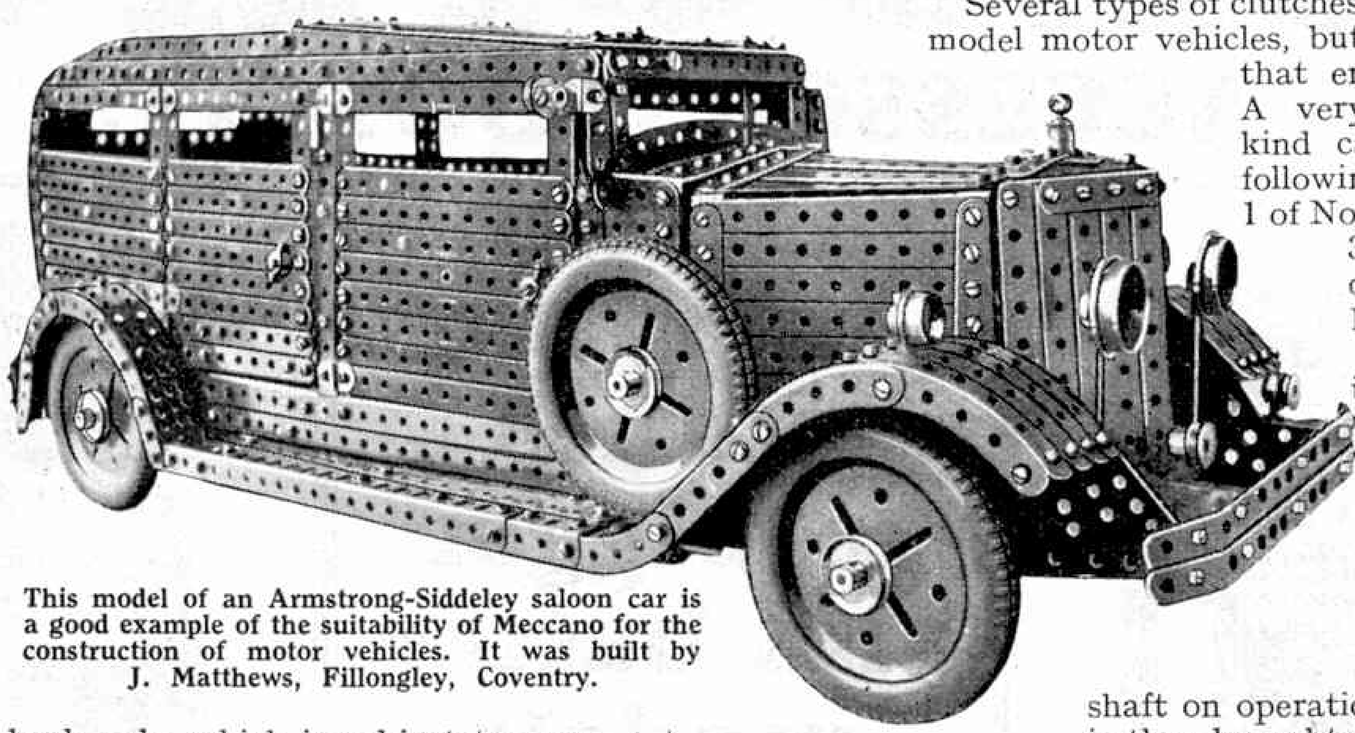
Fig. 1. Meccano differential mechanism suitable for incorporation in all kinds of model motor vehicles.

In building model motor vehicles many constructors omit the very important torque rods, which are quite easy to reproduce from standard Meccano parts. The torque rods are intended to counteract the stresses, strains and twisting effort set up by the propeller shaft, which carries the transmission from the gear-box to the back axle. If the transmission is effected by a small bevel on the propeller shaft engaging a second and larger bevel on the back axle, then, when the engine rotates, the small bevel on the propeller shaft will endeavour to rotate the bevel on the back axle. This naturally is somewhat difficult to move, and therefore the small bevel will tend to travel round the large bevel, while the latter remains stationary. This state of affairs might possibly result in a broken propeller shaft or broken springs, owing to the twisting movement imparted to the back axle casing; and it is to counteract these strains that motor vehicles are fitted with torque rods. Usually the propeller shaft is enclosed in what is known as a torque tube, which not only forms a torque reaction resistance, but also receives the forward thrust of the back axle.

In Meccano models simple torque rods can be made from Strips secured to the ends of a Double Angle Strip. These Strips should taper together at their free ends, and then be secured to a Collar by means of an ordinary bolt inserted in place of the grub screw.

The Collar is pivoted on a second bolt that is inserted in the grub screw hole of a second Collar capable of turning about a Pivot Bolt secured to a suitable girder in the frame of the chassis.

Another important item in model motor car engineering is the mechanism incorporated in the back axle to allow the outer driven road wheel to rotate at a higher speed than the inner road wheel when the car turns a corner, and yet at the same time allow the drive to be transmitted evenly and continuously to each wheel. The mechanism that fulfils these functions is known as a "differential" or "balance" gear. In some cars, especially in heavy commercial vehicles, the differential is incorporated in a secondary shaft journalled in the main frame and connected at each end to one of the road wheels by means of chain or belt drive. The object of this is to reduce to a minimum the weight of the back axle, which is subject to a continuous series of road shocks when in motion.



This model of an Armstrong-Siddeley saloon car is a good example of the suitability of Meccano for the construction of motor vehicles. It was built by J. Matthews, Fillongley, Coventry.

In the standard Meccano model Motor Chassis (Instruction Leaflet No. 1), the differential forms part of the back axle unit and the principle on which the mechanism operates should be clear from Fig. 1 and the following description.

The back axle shaft is in two sections, 1 and 2. Section 1 consists of a 3″ Rod and section 2 of a 4½″ Rod and a 2″ Rod connected end to end by a Coupling as shown. The inner ends of the shafts 1 and 2 are journalled in opposite ends of a Coupling 3, in the centre transverse hole of which is secured a 2″ Rod 4 that serves to carry the two ⅞″ Bevel Gears 5. The set-screws of these Bevels are removed so that they are free to turn about the 2″ Rod. They engage with two similar Bevels 6 and 7 secured to the shafts 1 and 2 respectively.

The outer ends of the 2″ Rod carrying the Bevels 5 are passed through the elongated holes of 1″ × ½″ Angle Brackets. The latter are secured rigidly by means of ½″ Bolts to opposite holes in the 1½″ Bevel Gear 8, and are spaced from it by means of Collars placed on the bolts between the Brackets and the Bevel Gear. This Bevel Gear is free to revolve independently about the axle shaft 2, its set-screw having been removed.

The propeller shaft consists of a 3½″ Rod 9, one end of which is secured in a Universal Joint. The other end, after passing through a Double Bent Strip and the side of the differential frame, is secured in the ½″ Bevel Gear 10, which engages with the 1½″ Bevel Gear 8. Two Collars 11 are secured to the shafts 1 and 2 in the positions shown to maintain the various gears in correct alignment and to prevent the gears 8 and 10 from slipping or binding against each other. A Washer is placed between the outer Collar 11 and the Double Angle Strip forming the end of the differential frame, and two Washers are placed against the boss of the ⅞″ Bevel Gear 6.

Everything should operate smoothly and easily when the shafts 1 and 2 are twisted between thumb and finger, whether simultaneously and in the same direction, or separately and in opposite directions.

If one of the road wheels revolves at a greater speed than the other, the Bevel Gears 5 begin to rotate and so adjust the difference in speed between the Bevel Gears 6 and 7. If the vehicle is running in a perfectly straight course the axles 1 and 2 and Bevel Gears 5, 6 and 7 must all rotate as one unit, since the road wheels are travelling at the same speed. This type of differential is suitable for all kinds of model motor vehicles.

Several types of clutches are available to builders of model motor vehicles, but the most popular type is that employing a friction drive. A very efficient clutch of this kind can be built up from the following parts: 2 of No. 12; 1 of No. 20; 1 of No. 22; 2 of No. 37a; 2 of No. 111c; 1 of No. 120b; 1 of No. 155; 1 of No. 165.

The Rubber Ring is fitted in the groove of the 1″ Pulley, which is secured to the engine shaft and forms the male portion of the clutch. The other clutch member is the 1⅛″ Flanged Wheel. This is arranged to move to and fro on the gear-box shaft on operation of the clutch pedal, and is thus brought into or out of contact with the Rubber Ring, which is driven continuously from the engine. This type of clutch is incorporated in the standard Meccano Motor Chassis, and full constructional details and illustrations of the unit are contained in Special Instruction Leaflet No. 1.

No difficulty should be experienced in building a suitable gear-box for a model from the splendid assortment of gears that form so valuable a feature of the Meccano model - building system. There are indeed very few gear designs that cannot successfully be imitated in a Meccano motor car, and the wide range of ratios afforded by the various sizes of gears available makes the building of a gear-box a task full of interest and endless possibilities for experiment. In connection with the gear-box, part No. 144, Dog Clutch, will sometimes be found useful, although in a very small model its large size will prohibit its use. The Standard Mechanisms Manual will be found very helpful in designing gear-boxes.

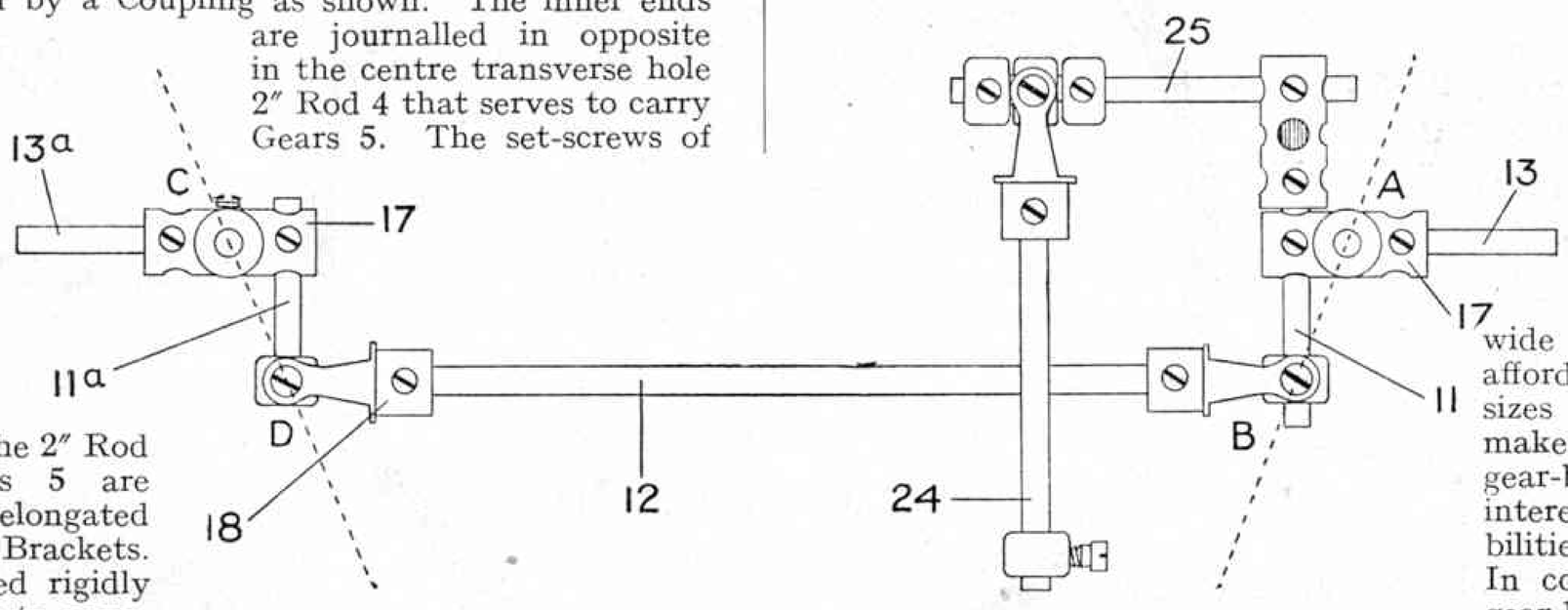
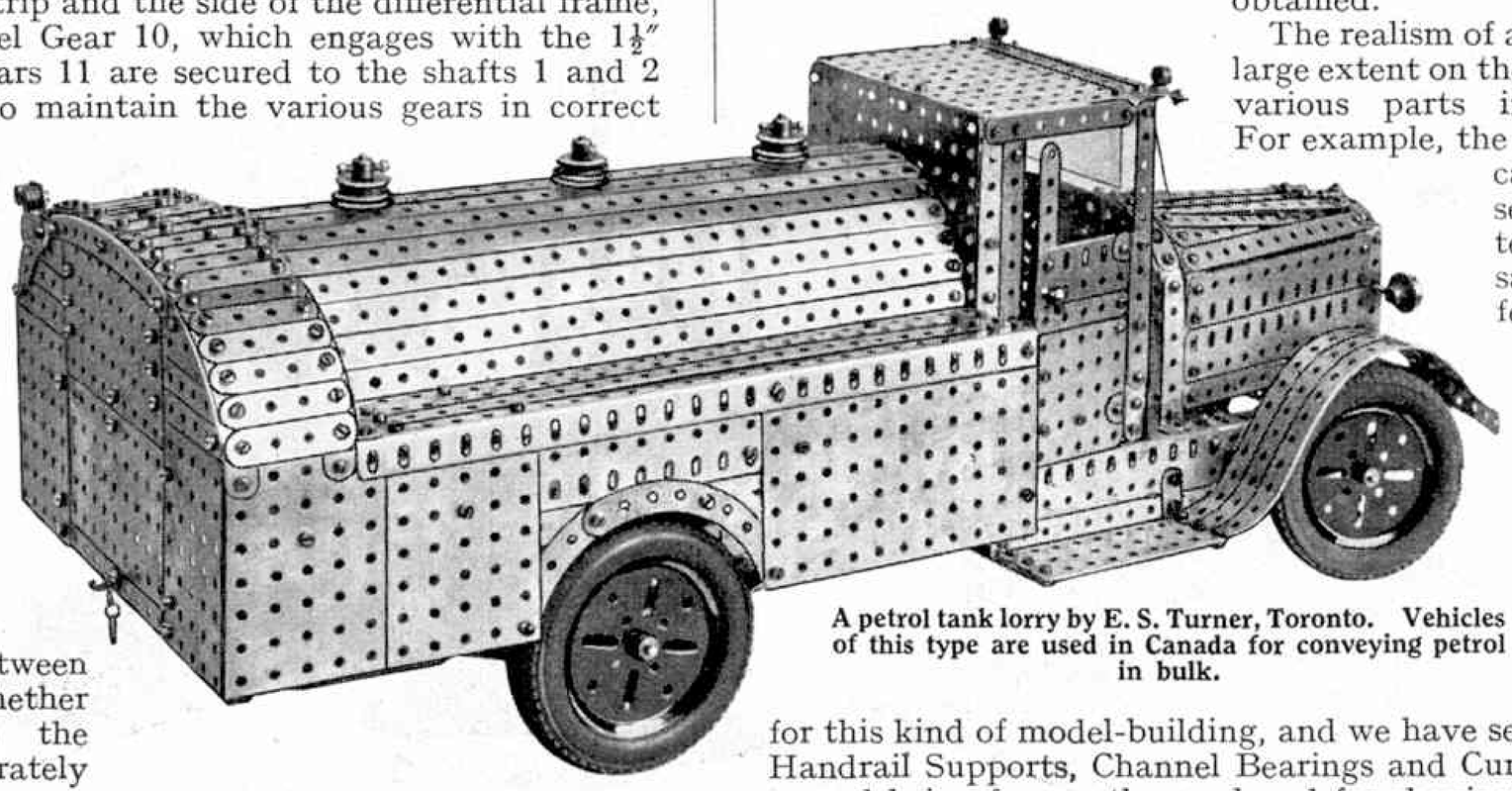


Fig. 2. Plan of Ackermann type steering mechanism.

So far as the bodywork of a model motor vehicle is concerned, little need be said, for as will be seen from the fine models on this and the opposite page, really wonderful results can easily be obtained.

The realism of a model depends to a large extent on the judicious use of the various parts incorporated in it. For example, the Pawl (part No. 147) can be used to represent the familiar pattern door handles on saloon cars, with perfect results. The Fan (part No. 157) also is valuable for use in this type of work, for it can be used with excellent effect as a radiator cooling fan.



A petrol tank lorry by E. S. Turner, Toronto. Vehicles of this type are used in Canada for conveying petrol in bulk.

Many of the newer Meccano parts are particularly well suited for this kind of model-building, and we have seen good use made of Handrail Supports, Channel Bearings and Curved Strips, the last-named being frequently employed for shaping the wing edges and moulding the contours of saloon bodies. Other parts useful in this kind of work are the Meccano Dunlop Tyres.

MECCANO

ACCESSORY OUTFITS

Meccano Accessory Outfit No. 2a

are the stepping stones to bigger and better models

Meccano Accessory Outfit No. 3a

BOYS,
think of the hundreds of additional models you could build if you converted your present Outfit into the one next higher by means of an Accessory Outfit. Maybe you would be able to build some of the fine examples illustrated below, or even bigger ones than these. Meccano Accessory Outfits connect all the main Outfits from No. 00 to No. 7. A No. 00 may be converted into a No. 0 by adding to it a No. 00a Accessory Outfit—a No. 0a would then convert it into a No. 1, and so on.
Get the Accessory Outfit you require to-day—and have more fun!

MECCANO LIMITED
Old Swan, Liverpool

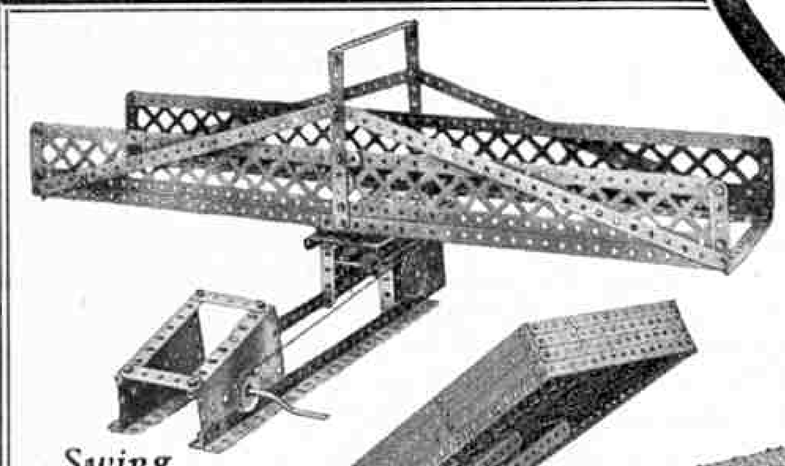
Price List of
Meccano Accessory Outfits

No. X1a converts a No. X1 Outfit into a No. X2	1/-
No. 00a converts a No. 00 Outfit into a No. 0	1/6
No. 0a converts a No. 0 Outfit into a No. 1	5/6
No. 1a converts a No. 1 Outfit into a No. 2	7/
No. 2a converts a No. 2 Outfit into a No. 3	12/6

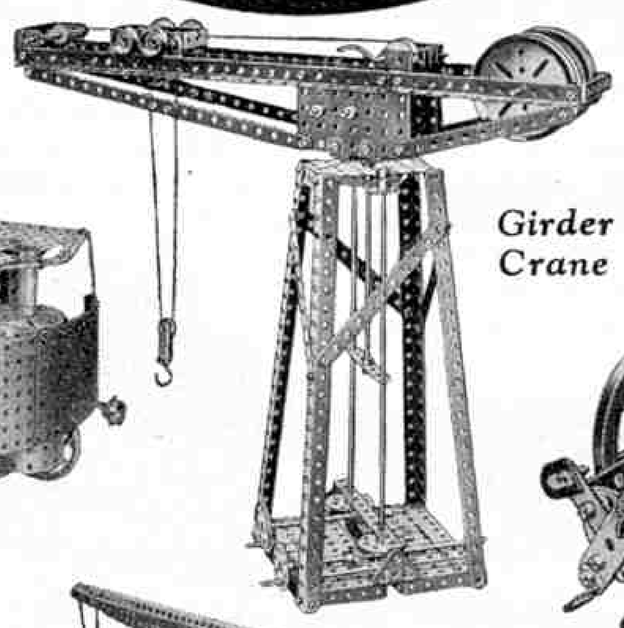
Price List of
Meccano Accessory Outfits

No. 3a converts a No. 3 Outfit into a No. 4	26/-
No. 4a converts a No. 4 Outfit into a No. 5	17/6
No. 5a* converts a No. 5 Outfit into a No. 6	55/-
No. 6a† converts a No. 6 Outfit into a No. 7	235/-

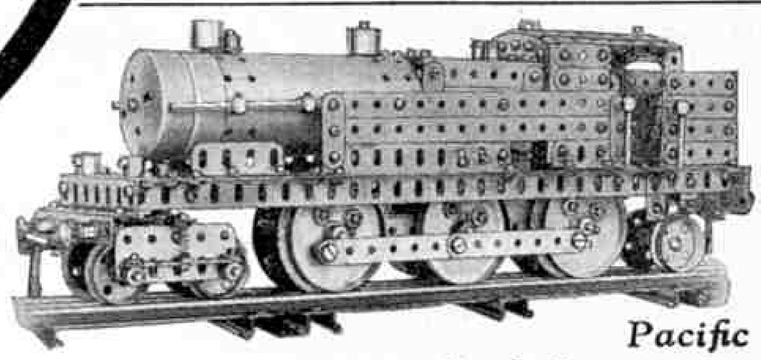
* Carton. † Enamelled cabinet.



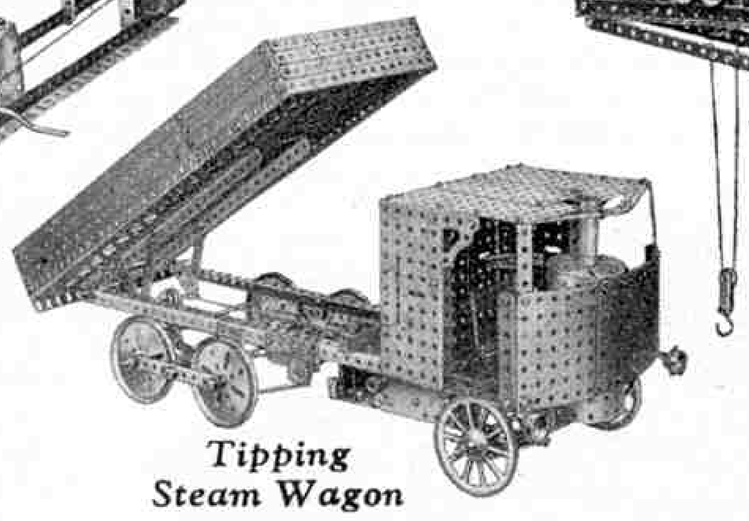
Swing Bridge



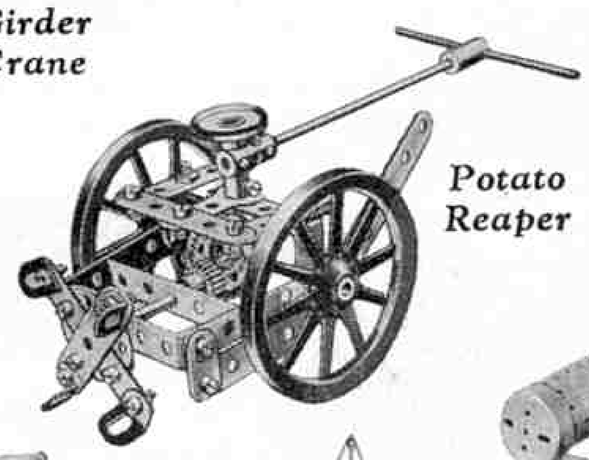
Girder Crane



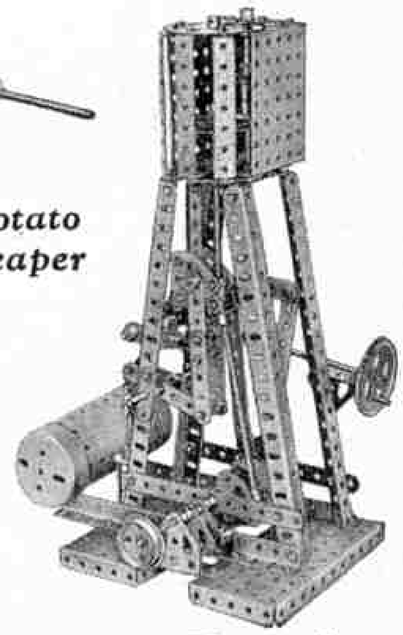
Pacific Tank Locomotive



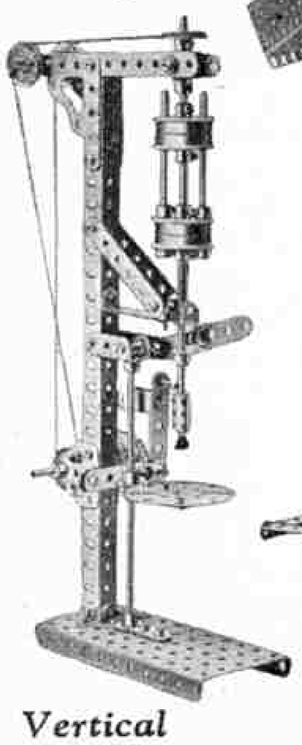
Tipping Steam Wagon



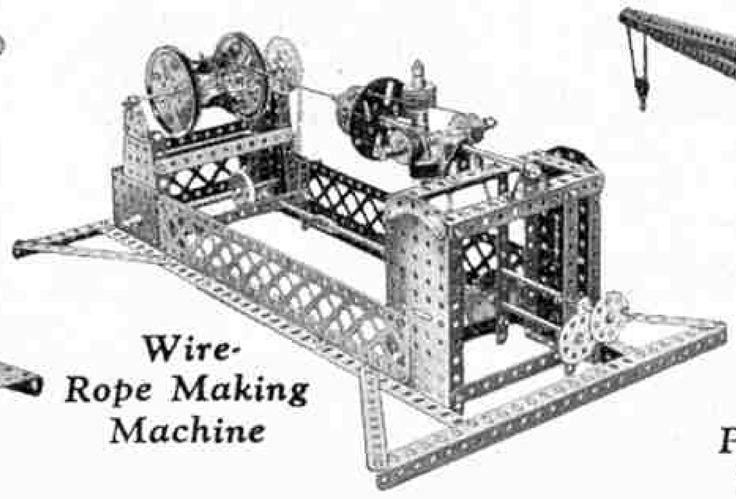
Potato Reaper



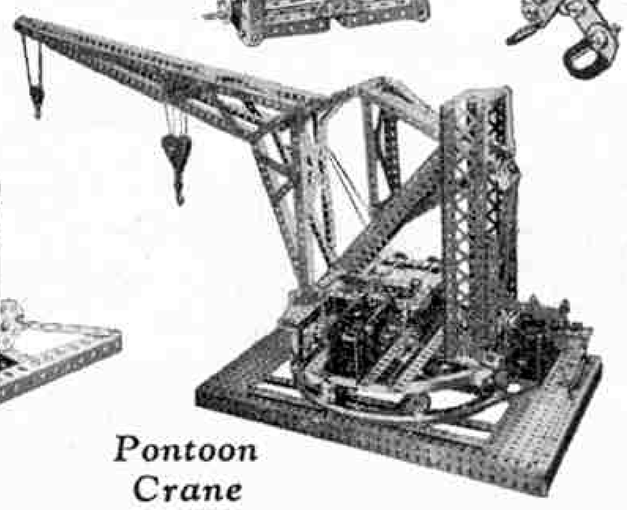
Vertical Marine Engine



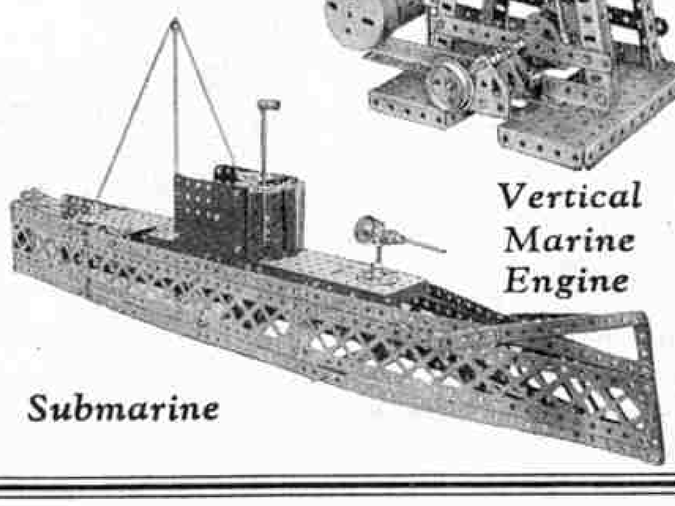
Vertical Drill



Wire-Rope Making Machine



Pontoon Crane



Submarine

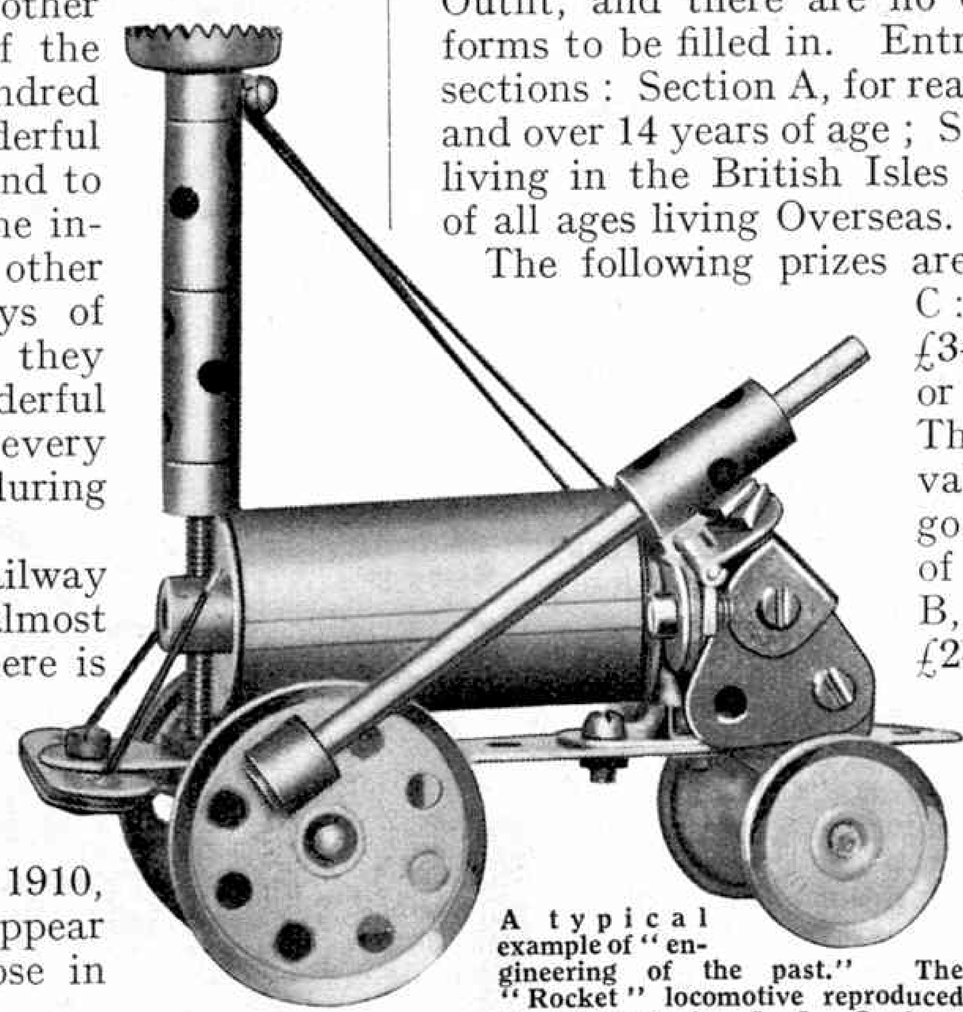
Meccano Model-Building Contest

"Engineering of the Past"

While it is interesting to look into the future and try to visualise what the world will be like 100 years hence, it is also interesting to look back over the years gone by and to compare the commonplace sights of other days with those of to-day. Most of the changes brought about in the last hundred years have been due to the wonderful ingenuity of engineers and scientists, and to the progress that has been made in the invention of labour-saving machines and other mechanical devices. If Meccano boys of to-day could see the world of 1833 they would readily appreciate the wonderful progress that has been made in every branch of engineering and science during the present century.

In some directions, particularly in railway engineering, developments have been almost revolutionary, with the result that there is a vast difference between a modern railway engine and its forerunner of 100 years ago ! The motor car of 1933 is very different, both in appearance and efficiency, from the motor car of 1910, while machine tools of 50 years ago appear very crude when compared with those in use to-day.

Many of these old relics of engineering make splendid prototypes for Meccano models, and therefore we have decided to organise a competition in which only models representing obsolete engineering subjects may be entered. The "*Rocket*" engine, shown on this page is an example of the kind of model suitable for entry. Other eligible subjects are flying machines of 20 years ago, paddle steamships, penny-farthing bicycles, old type lathes or other machine tools, and in fact any engineering structure or appliance that nowadays is considered old fashioned and out of date.



A typical example of "engineering of the past." The "Rocket" locomotive reproduced in Meccano by J. L. Gardner, Trowbridge, Wilts.

The Contest is open to every owner of a Meccano Outfit, and there are no entrance fees to be paid or forms to be filled in. Entries will be divided into three sections : Section A, for readers living in the British Isles and over 14 years of age ; Section B, for readers under 14 living in the British Isles ; and Section C for readers of all ages living Overseas.

The following prizes are offered in Sections A and C :—First Prize, Cheque for £3-3s. Second Prize, Meccano or Hornby goods value £2-2s. Third Prize, Meccano goods value £1-1s. Five Prizes of goods value 10/6. Five Prizes of goods value 5/–. Section B, First Prize, Cheque for £2-2s. Second Prize, goods value £1-1s. Third Prize, goods value 10/6. Ten Prizes of Meccano goods value 5/–.

The prizes will be awarded for the most interesting and best built models received.

Entries should be addressed :—" Engineering of the Past " Contest, Meccano Ltd., Binns Road, Old Swan, Liverpool.

Actual models must not be sent. It is only necessary to submit either clear photographs, or, if this is not possible, good drawings of the models, together with a brief but concise explanation of their chief features.

The closing dates are :—Sections A and B, 31st March, 1933 ; Section C, 31st May, 1933.

Aeroplane Constructor Outfit Building Contest

The first competition for models built from the Meccano Aeroplane Constructor Outfits, which was announced in the "*M.M.*" for September 1932, met with a splendid response, and this month we are arranging a second Contest of a similar type. To enter the competition it is only necessary to build a model of an aeroplane. This may be a monoplane, biplane, seaplane, autogiro, or any other form of aircraft, and should as far as possible be a reproduction of some well-known make of machine. The model must be constructed entirely from Meccano Aeroplane Constructor parts ; ordinary Meccano parts must not be used. If desired two or more models may be entered, but no competitor will be awarded more than one prize. Models must be the work of the competitors themselves, without assistance from anyone.

Actual models must not be sent ; a photograph or a good drawing is all that is required. Entries must bear the competitor's age, name and address.

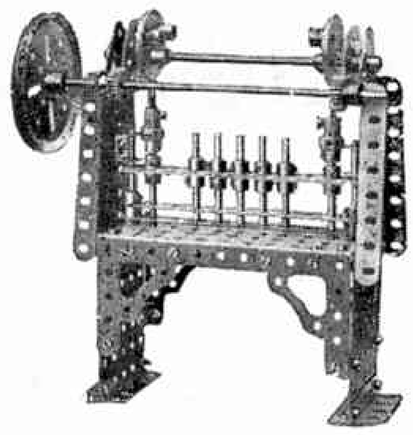
Entries will be divided into three sections as follows :—Section A, for those living in the British Isles and over 12 years of age ; Section B, for those living in the British Isles and under 12 ; Section C, for competitors of all ages living Overseas. In each Section a separate set of prizes will be awarded for the models that are the best built, and which show novel applications for the parts.

Entries must be addressed to " Aeroplane Constructor Contest," Meccano Ltd., Old Swan, Liverpool. Closing dates : Sections A and B, 31st March, 1933 ; Section C, 31st May, 1933.

Prizes for Aeroplane Contest

The following Prizes will be awarded in Sections A and C :—
First Prize, Cheque for £3-3s.
Second Prize, Meccano or Aeroplane Constructor parts value £2-2s.
Third Prize, Meccano or Aeroplane Constructor parts value £1-1s.
Six Prizes of Meccano or Aeroplane Constructor parts value 5/–.

The Prizes to be awarded in Section B are :—
First Prize, Cheque for £2-2s.
Second Prize, Meccano or Aeroplane Constructor parts value £1-1s.
Third Prize, Meccano or Aeroplane Constructor parts value 10/6.
Six Prizes of Meccano or Aeroplane Constructor parts value 5/–.



Suggestions Section

Edited by "Spanner"

(277)—Brake for Winding Gear

(G. F. Pell, Chesterfield)

In Fig. 277 is shown a type of external contracting brake that is used to a large extent in colliery winding engines. On account of the large diameter of the brake drum, and the large braking surface, a powerful braking effect is obtained by only light pressure on a foot pedal.

Two 7½″ Angle Girders are bolted to a 5½″ × 2½″ Flanged Plate, and to each of these two 3½″ Strips are secured to form bearings for a 2½″ Axle Rod carrying the brake drum. The drum consists of three 4″ diameter Circular Plates spaced apart by two Washers on each securing bolt. The two outer Plates carry Bush Wheels, and in order to place the wheels in correct alignment a Rod should be inserted in their bosses before tightening up the bolts that secure the Plates together.

Four 3½″ Strips 5 are pivoted to the 7½″ Angle Girders and at the upper ends of these the brake shoes are pivoted. Each shoe is formed by fixing three 2½″ large radius Curved Strips together for each side, and joining the two sides by Double Brackets. It is the Double Brackets that come into contact with the Circular Plates when the brake is applied. Two 1″ Screwed Rods are fixed at the centre of each shoe and pass through the upper ends of the Strips 5, to be retained in place by lock-nuts. As may be seen from the illustration, the right-hand shoe is provided with 1″ Corner Brackets at each end, and between each pair of Brackets is a Collar. The bolts holding the Collars grip the Rods that are connected to the other shoe. The other ends of the Rods also carry Collars that are pivoted in the end holes of 2″ Strips. These Strips are attached to Corner Brackets pivoted at 4 to the brake shoe.

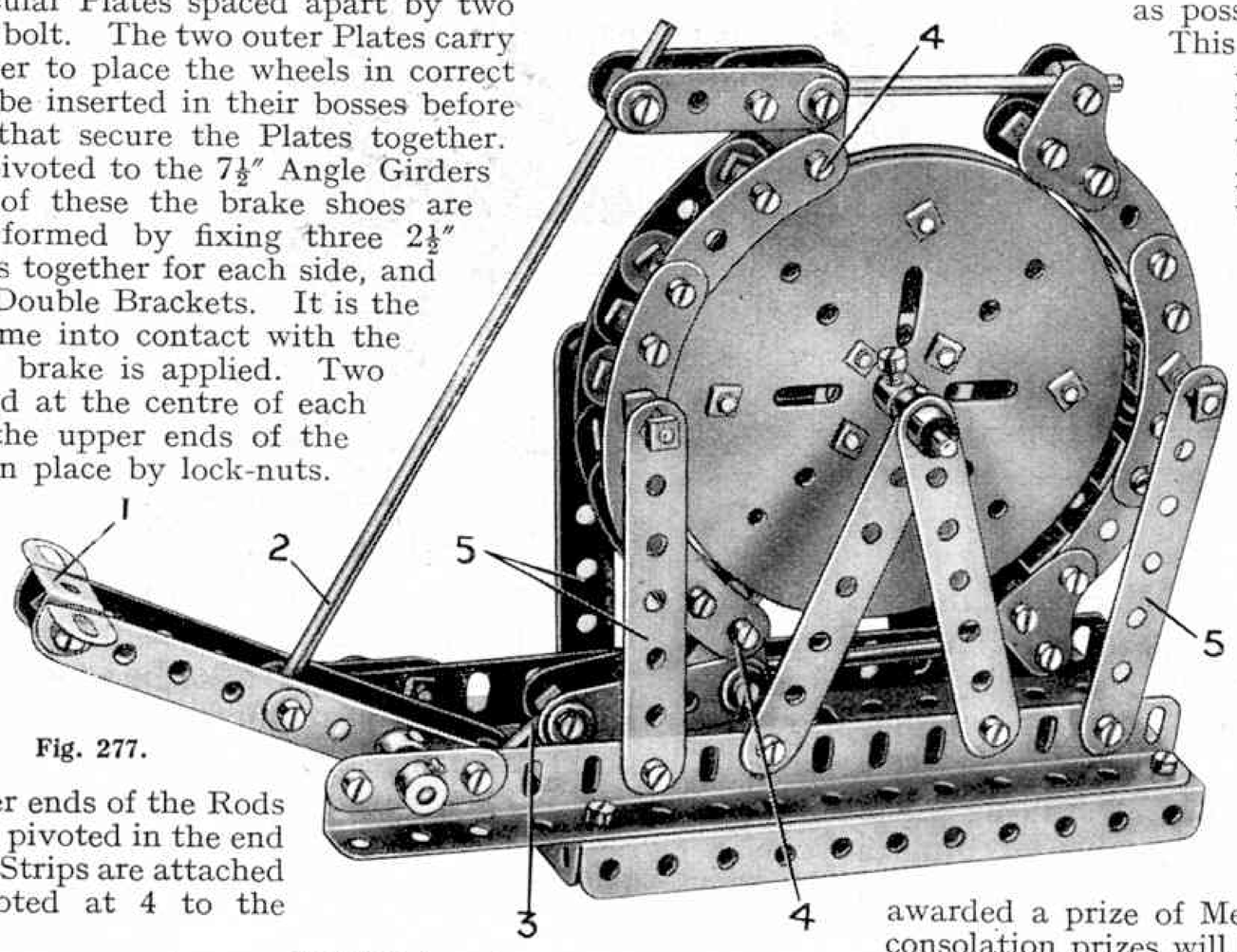


Fig. 277.

The two 7½″ Angle Girders carry at one end 1½″ Strips that cover the elongated holes, and provide bearings for the Rod carrying the operating lever. The latter is made from two 4½″ Strips fitted at one end with a Double Bracket 1 and two Angle Brackets to form a foot pedal. The Strips are pivoted in the third hole from the opposite end and are held in place by Collars. At the end of the Strips a Collar is pivoted, and carries the Axle Rod 3, which is held in a further Collar at the end of the lower pair of 2″ Strips. The Rod 2 is held in a similar manner to the upper pair of 2″ Strips and its lower end is pivoted 1½″ from the pivot of the operating lever.

When the pedal 1 is depressed the Rod 2 is drawn downward and the Rod 3 is pushed up. This movement draws the pairs of 2″ Strips together and the left-hand brake shoe is pushed forward on the drum, at the same time that the second shoe is pulled over by the connecting rods at the top and bottom. The pressure exerted on the pedal 1 is increased considerably by the lever action, so that the shoes can be made to grip the drum tightly and render it immovable.

The illustration shows only the essential working parts of the brake. If used in a model colliery engine the winding drum would be mounted on the same rod as the Circular Plates. A Boiler may be used for the drum, and one of the Ends may be bolted direct to one of the 4″ Plates. To prevent the Boiler from slipping the End should be bolted to it, this being possible with the improved parts which are provided with four perforations in the rim. A built-up drum may be made by bolting Double Angle Strips between the Circular Plates and a Face Plate.

"Suggestions" Voting Contest

This year we are again organising a voting competition for the best suggestion published during the past twelve months. Previous voting contests have always aroused a great deal of interest among "*M.M.*" readers, and the number of entries received speaks for their popularity. The voting competitions are also very helpful to "Spanner," as they show the type of suggestion that appeals to the greatest number of readers. He is then able to cater for their requirements as far as possible.

This Contest is on similar lines to previous Contests. All that is necessary is for competitors to write down on a post card the numbers of the four suggestions that they consider the best published during 1932. The suggestion considered best should head the list, with the next best second, and so on for the third and fourth. It is not necessary for the full title to be given, the number of the suggestion being all that is required, together with the full name and address of the competitor.

A record will be kept of every vote received, and at the close of the Contest these will be totalled up to find out which four items have received the greatest number of votes. The competitor whose list corresponds with the list of suggestions so obtained will be awarded a prize of Meccano Parts value £1-1s., and 12 consolation prizes will be awarded to the entries nearest correct, in order of merit. If no competitor submits an entry corresponding exactly with the final result, the first prize will go to the sender of the nearest correct.

The prizes will be duplicated for competitors residing Overseas, and all entries received in this section will be treated quite separately from the Home Section. Thus it is possible for an entirely different set of suggestions to be voted best in this Section.

A prize of Meccano Parts value 10/6 will be awarded to the sender of the suggestion that is voted best in each or both sections, and those who submitted the other contributions appearing in the final result of the voting will be awarded consolation prizes.

Post cards must be addressed to "Suggestions" Voting Contest, Meccano Ltd., Binns Road, Old Swan, Liverpool. Entries in the Home Section must reach us not later than the 28th February, 1933, and Overseas entries must be posted to reach us not later than the 29th April, 1933.

(278)—A Neat Crank

(F. Hardy, Shrewsbury)

A useful crank can be made from Flat Brackets and an Eye Piece, and on account of its neatness it can be put to a number of uses where parts No. 62 and 62b would occupy a little too much space. The web consists of three Flat Brackets forced into an Eye Piece which forms a boss. The Rod carrying this passes through the Flat Brackets to hold them in place. The elongated holes of the Flat Brackets allow for strokes of slightly varying lengths.

(279)—A Compact Three-Speed Gear-Box

(J. Ridgway, Stockton-on-Tees)

The three-speed and reverse gear-box illustrated in Fig. 279 is of particular interest on account of its extreme compactness. It is in fact probably the smallest gear-box that can be built with Meccano to give three forward speeds and reverse.

The frame is made by securing two 3″ Angle Girders to a Flat Girder and placing two 1″ × 1″ Angle Brackets at each end of the channel girder so formed. The Brackets are each spaced from the Angle Girders by means of a Flat Bracket placed underneath. This is necessary for the Pinions 3 and 8 to mesh correctly. The driving shaft 1 carries a 1″ Pulley forming one of the clutch members, and also a ¾″ Pinion 3 and a ½″ Pinion.

The end of the Rod is inserted in the bore of the ½″ Pinion 4 that is carried on a separate Rod 2 from which the final drive is taken. The latter Rod carries also a ¾″ Pinion and Collar. The sliding layshaft is a 4½″ Rod on which are a ½″ Pinion 5, a ¾″ Pinion 6 and a ½″ Pinion 7. A ½″ Pinion 8 is carried on a ¾″ Bolt screwed into the transverse bore of a Threaded Boss and locked by means of a Grub Screw screwed into the opposite end of the bore. The Threaded Boss is rigidly attached to the gear-box frame by a ½″ Bolt 9, but is spaced by a Collar and two Washers.

The movement of the sliding shaft is controlled by a ⅜″ Bolt 10, the head of which fits between the bosses of the Pinions 6 and 7. The Bolt is fixed in a Collar on the end of a 3″ Rod forming the gear change lever, and pivoted to a 1″ Triangular Plate by a further Collar secured in place on the Rod by its Grub Screw, and carrying also a bolt whose shank passes through one of the holes in the Triangular Plate. The Bolt is locked in position by a nut to allow the Rod to pivot freely.

As shown in Fig. 279, first forward speed is in engagement, the drive passing through the ½″ Pinion on the driving shaft 1 to the ¾″ Pinion 6 on the layshaft. The ½″ Pinion 7 engages the ¾″ Pinion on the driven shaft so that there are two stages of reduction gearing between driving and driven Rods. By sliding the layshaft to the right the Pinion 7 disengages, but Pinion 6 remains in engagement with its ½″ Pinion and at the same time meshes with Pinion 4. This gives a straight through drive. Further movement of the sliding Rod brings into engagement Pinions 3 and 5, and 6 and 4, in this case providing two step-up stages for top gear. Reverse gear is obtained when the rod is slid over to the extreme left, and the drive then goes through Pinions 3 and 8—which are in constant mesh—to Pinion 6, and Pinion 7 engages the ¾″ Pinion.

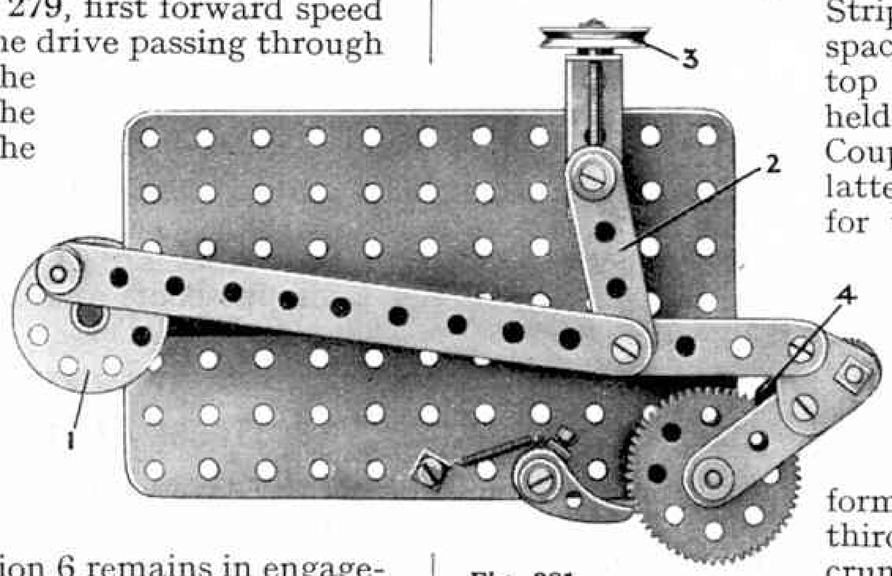


Fig. 281.

(280)—Device to Increase Crank Stroke

(F. Warner, Capetown, S.A.)

This ingenious mechanism gives a stroke almost double the length of the actual crank stroke. It is employed in certain air compressors, one of the advantages of the arrangement being the saving of space made possible by the use of a smaller crankcase than would be necessary with the full size of crank.

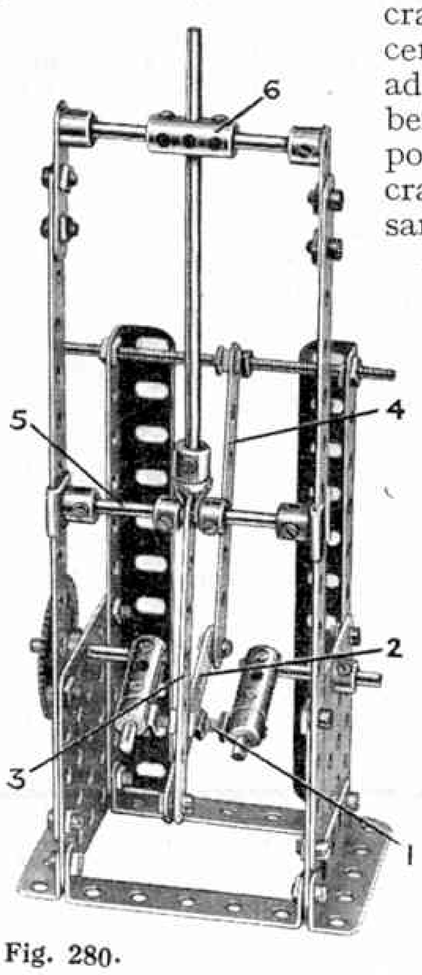


Fig. 280.

A suitable frame is built up from two 2½″ × 2½″ Flat Plates spaced apart by 2½″ × ½″ Double Angle Strips. Two 5½″ Angle Girders are placed vertically at one side of the Flat Plates and at the other side is a pair of 7½″ Strips. In fitting these, care should be taken to see that they are quite straight, as even a slight bend will impair smooth running. They should also be placed parallel for the same reason.

The crankshaft is built up from two 1½″ Rods, and on the inner end of each is a Coupling placed transversely and carrying a 1″ Rod. These two Rods are provided with Collars that are connected by a 1″ Screwed Rod 1. It is necessary to fit the Collars on the Screwed Rod before placing them in position. The crankshaft assembly will be quite clear on reference to Fig. 280.

The 2½″ Strip 2 is pivoted at its centre hole on the Rod 1, and is held in place by lock-nuts on each side. One end of the Strip is pivoted to a 3½″ Strip 4, the upper extremity of which is held loosely on the Screwed Rod connecting the vertical 5½″ Angle Girders. For the connecting rod a 3½″ Strip 3 is used, and a 2½″ Rod 5 is passed through its end hole. The Strip is placed in the fork of an End Bearing and is centred on the Rod by two Collars. Eye Pieces are fixed one at each end of the Rod and these slide up and down on the 7½″ Strips. The Strips are spaced apart at the top by two 1″ Rods held in Cranks and a Coupling 6. The latter forms a guide for the reciprocating Rod that is held in the End Bearing at the end of the connecting rod 3.

The Strip 2 forms a lever of the third order, the fulcrum of which is located at the lower extremity of the Strip 4. As the crankshaft is rotated its movement is imparted to the Strip 2, and since the pivot for the connecting rod is double the distance of the Rod 1 from the fulcrum, it travels twice the distance, and thus doubles the crank stroke. This extra movement, however, is obtained at the sacrifice of power, but the connecting rod moves at twice the speed of the crank.

(281)—Variable Ratchet Feed

(S. Croston, Belfast)

The necessity sometimes arises to adjust the feed of a ratchet without stopping the driving mechanism, and an ingenious arrangement for carrying this out is shown in Fig. 281. The Bush Wheel 1 forms the driving crank that imparts reciprocating motion to the 5½″ Strip forming the connecting rod. The end of this Strip is connected to two pivoted links, one of which is attached by a bolt and lock-nuts to a 1″ Triangular Plate at the end of the 2″ Strip swinging about the Rod that carries the 57-teeth Gear. The Strip is spaced from the Gear by two Washers, and at its other end is a Pivot Bolt carrying a Pawl 4 that is held in constant engagement with the Gear Wheel by a length of Spring Cord. A second Pawl prevents backward movement of the Gear.

The 2″ Strip 2 is pivoted on a Bolt that is screwed into the end hole of a Threaded Boss and locked by a nut. The Threaded Boss is carried on a 2″ Screwed Rod, the upper end of which is fitted with a handwheel 3. By operating this wheel the position of the link 2 can be varied, and when the Threaded Boss is at the lower end of its Screwed Rod the maximum movement is imparted to the swinging Strip carrying a Pawl 4, which causes the 57-teeth Gear to move through a corresponding distance. As the link 2 is raised the movement of the connecting rod is partially absorbed by the two 2″ Strips, and the movement of the Pawl is decreased until it reaches its minimum when the Threaded Boss carrying the link 2 reaches the end of its travel.

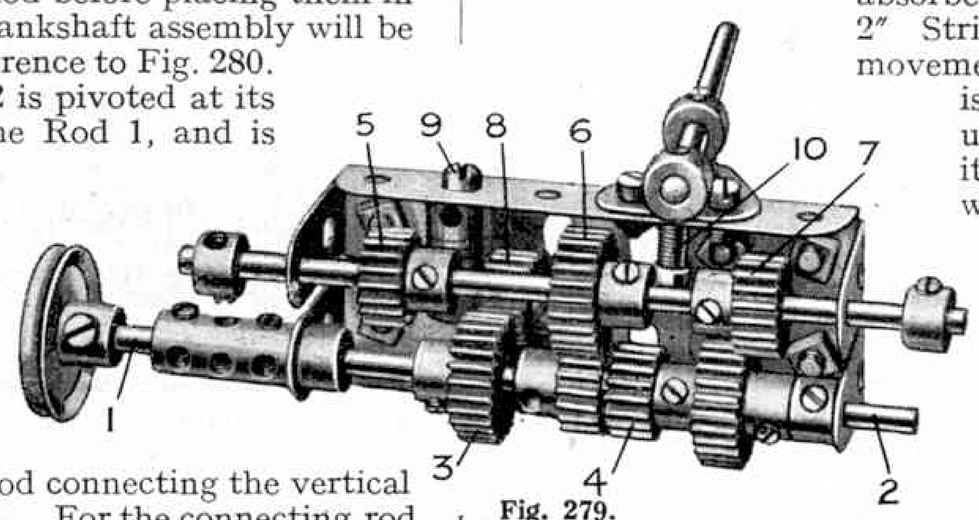


Fig. 279.

If very fine adjustments of feed are required a larger Gear should be substituted for a 57-teeth Gear at present used. The reason for this is obvious, as at present the smallest variation it is possible to obtain is 1/57th of a revolution, that is the movement through one tooth of the Gear. By using a 2½″ or 3½″ Gear adjustments as fine as 1/95th or 1/133rd can be made.

Miscellaneous Suggestions

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

(M.156.) Compact Free-wheel.—G. Green (Purley) suggests the use of the Anchoring Spring for Meccano Cord (Part No. 176) for a free-wheel device. The Spring is mounted on the Rod carrying the Gear that is to "free-wheel," and an Angle Bracket is bolted to the Gear in such a manner that its other hole fits over the loop of the Spring. When rotating one way the Gear tends to unwind the coil of the Spring, and the latter does not grip the Rod; but when rotated the other way the coil firmly grips the Rod and imparts a positive drive. No doubt certain uses will be found for this device, but its application is limited on account of the excessive friction.

Model-Building Contest Results

By Frank Hornby

"Warships" Competition (Home and Overseas Sections)

The full lists of awards that have been made in the Home and Overseas Sections of the "Warships" Model-building Competition are as follows :—

Section A (competitors over 14 years of age).

FIRST PRIZE, Meccano or Hornby goods value £3-3s.: C. J. and M. D. Keates (joint entry), London, S.E.21. SECOND PRIZE, goods value £2-2s.: J. Hooper, Tonbridge, Kent. THIRD PRIZE, goods value £1-1s.: Rev. J. B. Pim, Plymouth.

PRIZES of goods value 5/-: H. Newton, Pontefract; G. King, London, S.W.17; M. and P. Waterkeyn (joint entry), Spinkhill, Sheffield; R. Storrar, Letham Ladybank, Fifeshire; C. Williams, Manchester; H. Bourne, Scunthorpe; H. Fisher, Leith, Scotland; N. Beach, London, S.W.17; E. Butling, Liverpool.

PRIZES of "*Famous Trains*" by C. J. Allen: G. Osbon, Hove; A. Parker, Burton-on-Trent; W. Hudson, Weymouth; H. Lee, Wetherby, Yorks.; D. Epworth, Edinburgh; K. Murby, Cheltenham; P. Erskine-Tulloch, Old Oxted, Surrey; M. McDonald, Dublin; G. Ford, Bognor Regis, Sussex; R. Wilson, Letham Ladybank, Fifeshire; L. Gelle, Cardiff; L. Thomson, London, S.W.

CERTIFICATES OF MERIT: F. Shephard, Luton; A. Reid, Edinburgh; H. Allinson, Middlesbrough; N. Woodward, Middlesbrough; C. Spencer, Warsash, Hants.; K. Wells, Newport, I.O.W.

Section B (for competitors under 14).

FIRST PRIZE, Meccano or Hornby goods to the value of £2-2s.: Eric Smith, Gillingham. SECOND PRIZE, goods value £1-1s.: John Caldicott, Edinburgh. THIRD PRIZE, goods value 10/6: F. Newton, Stockport.

PRIZES of goods value 5/-: R. Lamming, Edgware, Middx.; J. Merson, Stockton-on-Tees; S. Wright, Gillingham; J. Gammon, Guildford; D. Grove, Wavertree, Liverpool; R. Benn, Grantham.

PRIZES of Meccano Engineer's Pocket Books: E. Camden, Exeter; J. Gibson, Dundee; J. Coe, London, S.W.12; D. Potter, Belfast; T. Ashton, Hoole, Chester; E. Mead, London, S.E.18; C. Sprang, Barnet; J. Macken, Bromley, Kent; A. Irvine, Kirriemuir, Angus; N. Beck, Wyke Regis, Weymouth; P. Stern, Dartmouth; A. Greenhalgh, Leicester.

Section C (competitors of all ages living Overseas).

FIRST PRIZE, Meccano or Hornby goods value £3-3s.: A. Wallace, Vancouver, B.C. SECOND PRIZE, goods value £2-2s.: E. Cauchi, Sliema, Malta. THIRD PRIZE, goods value £1-1s.: J. Anglada Roca, Barcelona.

SIX PRIZES of goods value 5/-: M. Yearsley, Floriana, Malta; H. and J. v. d. Ploeg (joint entry), Delft, Holland; W. Moore, Toronto; J. Buchanan, Vancouver, B.C.; J. Barber-Starkey, Victoria, B.C.; D. Martin, Hawkes Bay, N.Z.

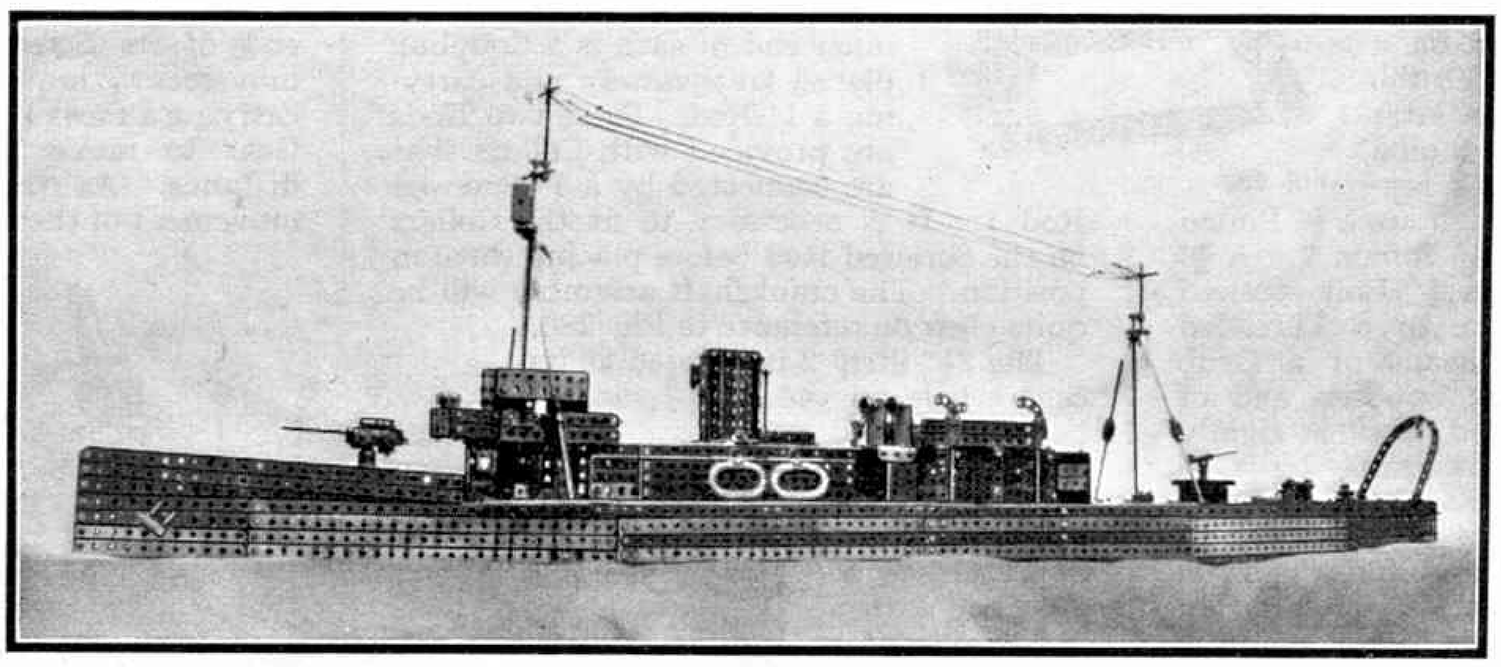
MECCANO ENGINEER'S POCKET BOOKS: M. Atapattu, Colombo; A. Fell, Hokianga, N.Z.; R. Anderson, Rangoon; S. Kurlawala, Bombay; C. Humm, Geraldine, N.Z.; R. Cain, Durban; W. Jones, Christchurch, N.Z.; A. Brandwyk, Rotterdam; C. Wood, Nelson, N.Z.; J. Traynor, Dublin; O. W. Martin and F. S. Marquand (joint entry), Woodville, N.Z.; D. Bannerman, Vancouver, B.C.; D. Ambler, Waikato, N.Z.

In entering this Contest competitors were invited to submit models of any kind of naval craft, and although the majority of entries feature actual fighting vessels, a good proportion represent auxiliary craft such as aeroplane carriers, steam pinnaces and minesweepers. It is an entry of the latter type that won the First Prize in Section A. The model is a really beautiful reproduction of H.M.S. "*Newark*," a minesweeper of 810 tons, and is built to a scale of ¼" to 1'. It incorporates revolving and elevating 4" guns, searchlights, mine-sweeping gear and winch, forward and after capstans, anchors with cables, cable stoppers and chain lead, and wireless aerial. The model is shown in the accompanying illustration, and it will be seen that its proportions are well worked out and that the construction is solid without being unduly cumbersome. The judges consider this model to be the best in Section A because it combines originality, sturdy construction resulting from correct use of Meccano parts, and a wealth of detail that supplies a realistic appearance. The model is the joint work of C. J. and M. D. Keates, London, S.E.21.

E. Smith, Gillingham, sent a model of a destroyer, whose chief claims to distinction are its neatness and a fair amount of well-proportioned detail, features that result in a very pleasing model. There is little that need be commented upon as the model is built on orthodox lines and does not represent any particular vessel.

Many ingenious methods of constructing torpedo tubes and guns are to be seen among the models entered in this Contest. One boy made torpedo tubes from two Sleeve Pieces joined together by a 3½" Strip and then covered with paper. This competitor won First Prize in the Overseas Section, his model being a scale reproduction of a three-funnelled destroyer. Strips, bolted to a girder-built framework, are used for the hull, which is approximately 30" in length and carries fore and aft guns, and two torpedo tubes mounted behind the funnels.

The Overseas Section is distinguished by a splendid model of a submarine constructed by J. A. Roca, Barcelona. It is undoubtedly a very fine piece of work, but unfortunately many of the parts used have been mutilated by bending.



This model of H.M.S. "Newark," a minesweeper of 810 tons, won First Prize in Section A for C. J. and M. D. Keates, London, S.E.21. Its success is due entirely to good construction, which is particularly noticeable in the bridge and deck fittings.

H.M.S. "*York*" formed the subject of the model sent by J. Hooper, Tonbridge. A striking feature of the actual vessel is its broad fore-funnel, and this is represented in the model by two Boilers, one of which is slightly opened out and bolted to the other. The massive superstructure is built up from Flanged Sector Plates and Boiler Ends, and the fore gun turrets are composed of Double Bent Strips and Strips, the roofs of the turrets being represented by Flat Plates.

The Rev. J. Pim's model is a very ingenious effort to produce a complete working model of a destroyer. It incorporates twin propellers driven by a Meccano Clockwork Motor controlled from the bridge, a rudder controlled from the chart house, three guns that train and elevate, life-boats slung on davits that actually work, and two triple torpedo tubes. The model is a splendid attempt to crowd a lot of working mechanism into a small space, and it is unfortunate that the construction of the hull is not so neat as it might be. It is only fair to mention, however, that the hull is moulded on correct ship-building principles, by the use of graded bulkhead frames.

A model torpedo boat destroyer that embodies most of the important constructional features of H.M.S. "*Vanquisher*" was sent by J. Caldicott, Edinburgh. There is a searchlight platform placed between the torpedo tubes aft of the funnel, flagstaffs made from 2" Screwed Rods, life-boats and davits, and a capstan formed from a loose Pulley and a Collar.

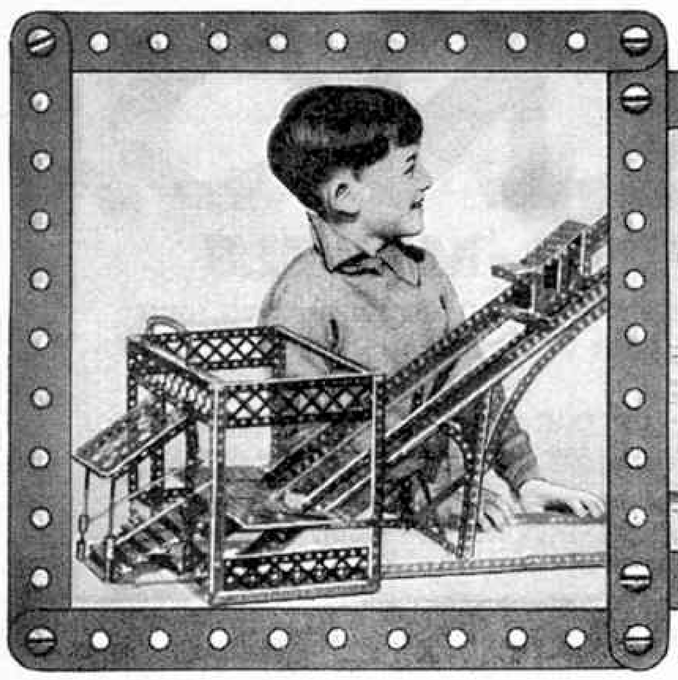
July "Lynx-Eye" Contest (Overseas Section)

Several competitors succeeded in solving correctly each of the puzzle pictures that formed the subject of this Contest and in accordance with the rules the prizes were awarded in rotation to the first correct entries examined. The list of prize-winners is as follows :

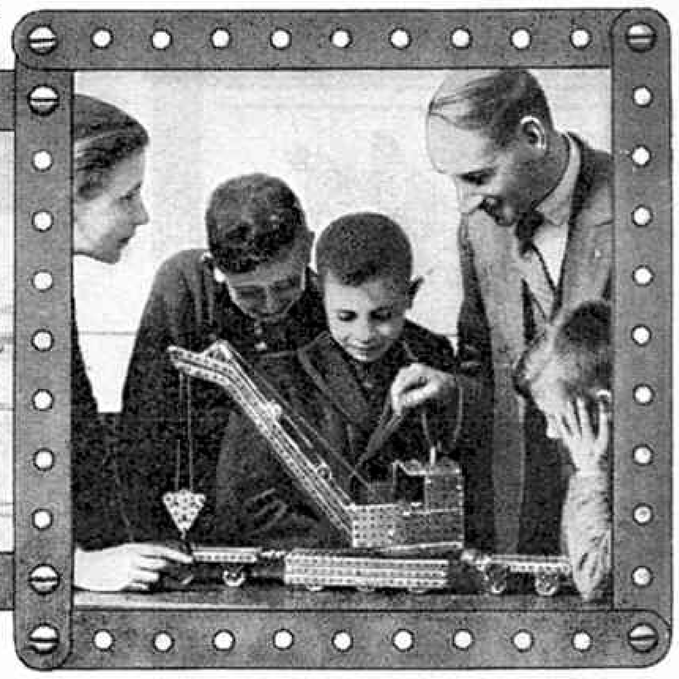
FIRST PRIZE, Meccano or Hornby goods value £2-2s.: C. McCain, Sydney, N.S.W. SECOND PRIZE, goods value £1-1s.: J. Gnanadurai, Trichinopoly, India. THIRD PRIZE, goods value 10/6: G. Gnanadurai, Trichinopoly.

TEN PRIZES of goods value 5/-: A. Khandwalla, Karachi; J. Rousseau, Ottawa; A. Waheed Pasha, Qila Sheikhupura, India; M. Abdul Wahid, Mysore, India; R. Walton, Sydney, N.S.W.; R. Taylor, Toronto; A. Abdulrahim, Karachi; D. Atkinson, Yalwal, Australia; N. Gulamabbas, Bombay; D. Maver, Brooklyn, S. Africa.

TEN PRIZES of "*Famous Trains*" by C. J. Allen: C. Williams, Brisbane; W. Ellington, Capetown; F. Little, Christchurch, N.Z.; S. Porter, Buenos Aires; E. Pfingst, Toobeah, Australia; S. Bernstein, Capetown; R. Inch, Montreal; R. Atkinson, Punchbowl, Australia; J. Coates, Verdun; C. Wood, Nelson, N.Z.



WITH THE MODELBUILDERS



ORNAMENTAL USES FOR MECCANO

Although the primary function of Meccano is to form a complete engineering system in miniature, model-builders should not lose sight of the fact that many of the parts have distinct ornamental value, and may be used in the construction of practical and artistic articles for the home. The enamel and lacquer finishes with which the parts are treated give them all a very handsome appearance, but certain units, on account of their shape, lend themselves specially to ornamental work. Among these the Braced Girders, Architraves, Flanged Brackets and Girder Frames are outstanding. The perforated lattice formation of the Braced Girders gives them a particularly attractive appearance, and all kinds of artistic structures may be built up with the aid of these parts.

An example of the use of the Braced Girders is in the casework of the Meccano Grandfather Clock (see Super Model Instruction Leaflet No. 14a). The case enclosing the mechanism of the Clock is built almost entirely from Braced Girders and the complete effect of these parts, in their bright green enamel finish, is very striking indeed. Meccano Architraves (Part No. 108) are also used in the construction of the portion of the case that encloses the dial.

Many novel and attractive ornamental effects can be obtained by using Meccano Aero parts in conjunction with standard parts, and we illustrate on this page a novel "book-end" built up in this way. When assembled the book-end looks particularly attractive and it is just the thing for the model-building enthusiast's "den."

The frame of the book-end consists of a $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flat Plate and two $5\frac{1}{2}'' \times 3\frac{1}{2}''$ Flat Plates are bolted to this. A third $5\frac{1}{2}'' \times 3\frac{1}{2}''$ Flat Plate is next fixed to the Flat Plates already in position, to form a back plate to which the ornamental aeroplane is secured. The projecting portion of the fuselage of the model aeroplane consists of two Aero Fuselage Side Front sections (Parts No. P16) that are held to the back plate by means of four Angle Brackets. The side sections are held together at the front by means of two Double Brackets, a Small Radial Engine (P43) being bolted to the upper Double Bracket. A Propeller mounted on the Engine is held in place by means of two lock-nuts. A $1\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip is secured between the upper pair of Angle Brackets, and this Double Angle Strip carries three 3″ Strips that form the top of the fuselage. These Strips are arranged so that they just fill in the space formed by the Fuselage Side sections.

The Landing Wheels (P53) are mounted on a $2\frac{1}{2}''$ Axle Rod, and each Wheel is fitted with a Rubber Tyre (P44). Two Aero Collars, P52, are placed on the Axle, and these Collars are secured to a pair of Propeller Brackets (P56) bolted together back-to-back by means of two Nuts and two Bolts. The bolts are first of all screwed home so that the Collars are locked on the $2\frac{1}{2}''$ Axle, and the nuts on the shanks of the bolts are then rotated so that the Propeller Brackets are also made rigid. An Angle Bracket is next fixed to the upper right-hand Propeller Bracket and this Bracket is in turn secured to the back plate between the sides of the fuselage by means of a bolt and nut.

The wing of the aeroplane consists of two Small Main Planes (one right and one left-hand, Nos. P3 and P4), overlapped and bolted together. The wing is supported above the fuselage by means of two Straight Interplane Struts (P28). To add a true "aeronautical" touch to the book-end, a small Identification Disc (Part No. P102) is bolted to the Flanged Plate in the position shown in the illustration. In assembling the back plate of the book-end, the Meccano Aeroplane Bolts (Part No. 537b) should be used, the Bolts being arranged so that their domed heads project on the outside. In this way there will be no possibility of the books being scratched.

MECCANO AEROPLANE HANGAR

All owners of Meccano Aeroplane Constructor Outfits will be interested in the Meccano Aeroplane Hangar. In actual practice, a hangar forms an important unit of aerodrome equipment protecting aeroplanes, when not in use, from damage due to wind, rain, etc.

In many ways a hangar is just as important in Meccano model aeronautics as it is in actual practice, and the Meccano Hangar therefore will be found a very welcome addition. Many model-builders, after assembling a model of a new type of aeroplane with their Sets, prefer not to dismantle it immediately, as they may wish to carry out further experiments when time allows. If the model is left lying about the room it is liable to be damaged, and in any case it becomes dirty and dusty. By making use of the Meccano Hangar the possibility of any trouble of this kind is avoided. After a new model has been built and experimented with it may be placed in the Hangar and the doors closed so that it cannot possibly be damaged or soiled in any way. Apart from the practical utility of the Hangar, the additional realism that the unit gives to a Meccano "Aerodrome" is very great. By arranging several models of different types of aircraft around the Hangar a remarkably true-to-life airport scene may be formed.

The Hangar is particularly roomy and will accommodate two No. 2 Aeroplane models with ease. The walls of the Hangar are given a realistic cream pebble-dash finish, while the roof is coloured in brilliant red enamel. The double sliding doors are finished in green and add a very realistic touch to the complete Hangar. The Hangar measures $29\frac{1}{8}'' \times 22'' \times 12\frac{3}{4}''$.

COUPLING SPRING CORD

Adaptability is an outstanding feature of the Meccano system, and all the parts possess this useful quality to a greater or smaller extent. The Meccano Spring Cord is a good example of the varied uses to which the parts may be put, as it is possible to employ the Cord for many purposes quite apart from its original function.

The Cord may be used as a driving belt, as a light tension spring, as a bowden cable and for oil-feed pipes, etc. When employed for many of these purposes it is necessary to couple together the ends of a length, and as some model-builders are not quite clear on this subject we are including a few notes.

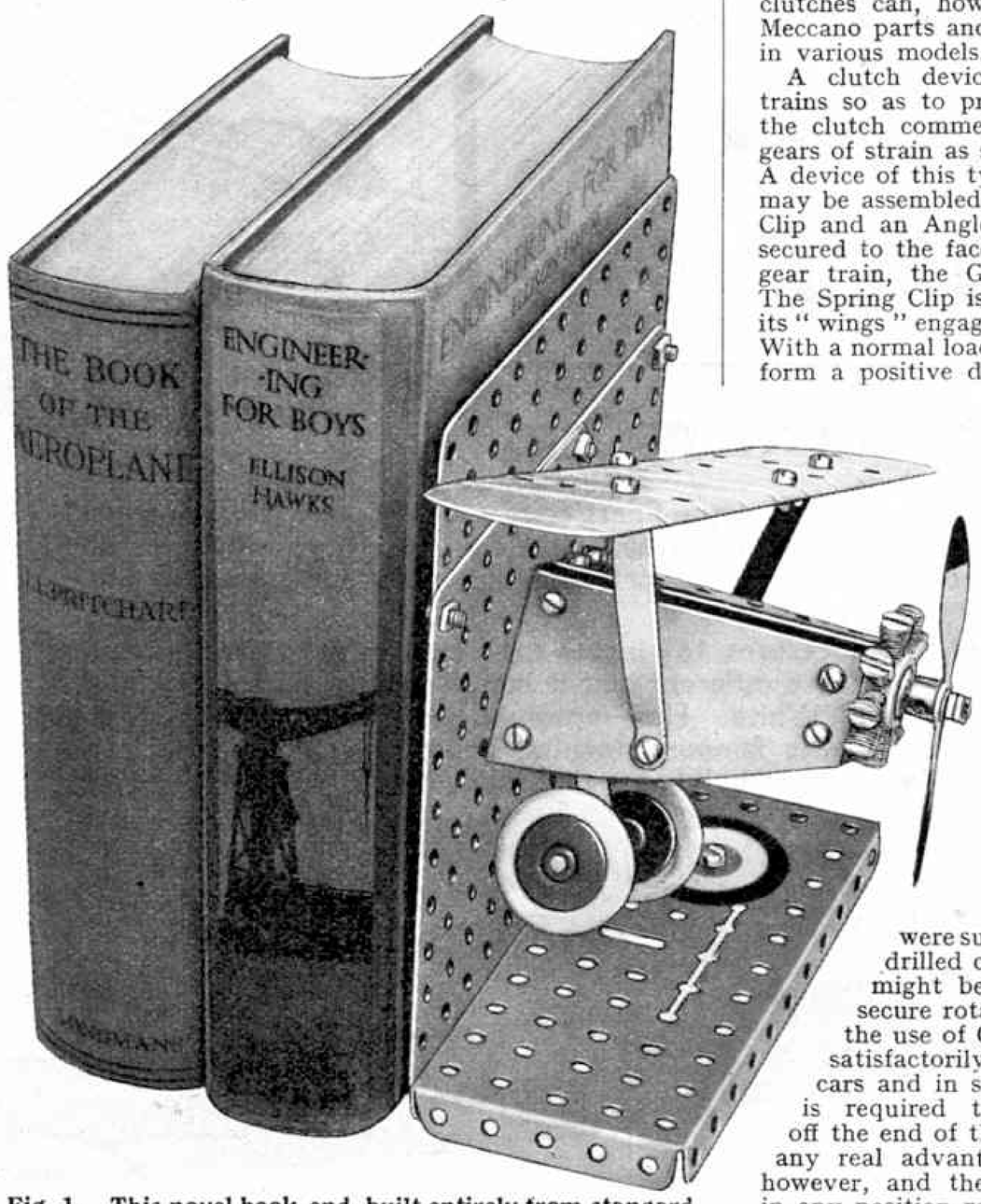


Fig. 1. This novel book-end, built entirely from standard Meccano and Aero Constructor parts, is both useful and ornamental.

The Meccano Spring Cord, part No. 58, is supplied in 40″ lengths, and it must be cut up to the required sizes by means of a pair of cutting pliers. If such pliers are not available, the cord can be severed by using the blade of a Screwdriver as a "cold chisel." In order to couple the ends of a length of Spring Cord together to form an endless belt, a Coupling Screw, No. 58a, is threaded into one end of the Cord, the threads of the Screw engaging with the inside turns of the wire forming the Cord. Three turns of the Screw are sufficient to hold it in place. The free end of the Cord is then twisted in an opposite direction three times, and the end applied to the projecting portion of the Coupling Screw. The Cord is twisted on to the Screw, three complete turns again being necessary. In this manner the twist that was imparted to the Cord is removed and a neat and efficient join is formed.

It should be noted that although the Cord may be joined effectively in the above manner, it is impossible to disconnect the end of the Cord by reversing the twisting action. In order to sever the connection it is necessary to draw out the turns of the Spring Cord from the threads of the Coupling Screw, and this is best done with a pair of fine nosed pliers.

The foregoing instructions deal with the joining of the Cord when used on an endless transmission belt. When the Cord is employed as a light tension spring, however, the Spring Cord Coupling Hook, No. 58b, should be used. The Hook is provided with a threaded shank by means of which it can be inserted in the end of a length of Cord.

AN INTERESTING CLUTCH DEVICE

When a clutch is mentioned in connection with Meccano engineering, most model-builders immediately think of the friction-disc pattern clutch that is used in the Meccano Motor Chassis. Several other types of clutches can, however, be assembled from standard Meccano parts and constructors will find these useful in various models.

A clutch device is sometimes required in gear trains so as to prevent damage due to overloading, the clutch commencing to slip and thus relieve the gears of strain as soon as the load becomes excessive. A device of this type, that is both neat and effective may be assembled from no other parts than a Spring Clip and an Angle Bracket! The Angle Bracket is secured to the face of one of the Gear Wheels in the gear train, the Gear itself being free on the Rod. The Spring Clip is placed on the Rod so that one of its "wings" engages with the lug of the Angle Bracket. With a normal load the Angle Bracket and Spring Clip form a positive drive. When the load becomes excessive, however, the Spring Clip commences to slip around the Axle.

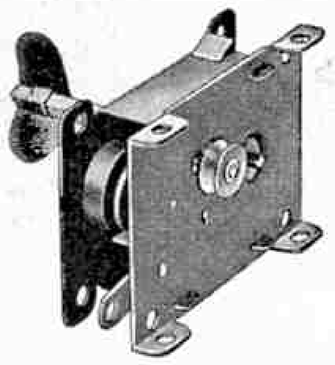
MOTOR HOOD. Your suggestion that a hood should be produced for fitting to models built with the Meccano Motor Car Constructor presents interesting possibilities. The addition of a folding hood would necessitate several modifications to the dash section, but the interest and realism that would result would no doubt compensate for these alterations. We shall certainly keep your idea before us. (*Reply to W. L. Butler, Chertsey.*)

SPECIAL RODS. If Rods were supplied having a small transverse hole drilled close to each end so that a split pin might be inserted, it would be possible to secure rotating members on the rods without the use of Collars. The idea might be applied satisfactorily to the Stub Axles of model motor cars and in similar cases where a wheel or gear is required to rotate freely without slipping off the end of the axle. The idea does not possess any real advantage over Collars or Spring Clips, however, and these parts may of course be fitted in any position required, whereas the hole and split pin system has limited adaptability. (*Reply to G. Page, York.*)

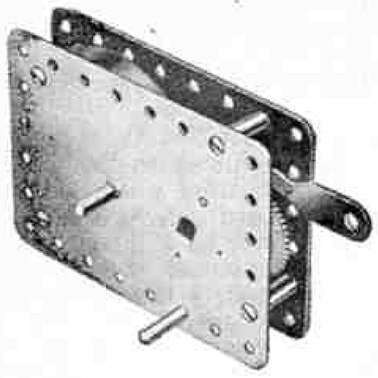
MECCANO

POWER UNITS—FOR DRIVING MODELS

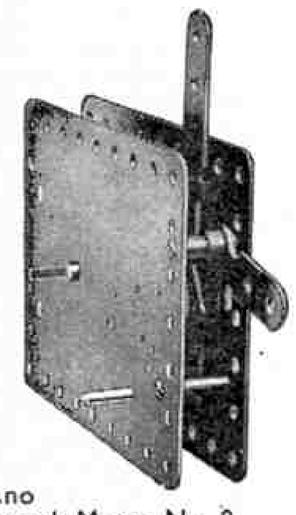
In order to obtain the greatest possible enjoyment from the Meccano hobby, the models must be set to work by means of one of the Meccano power units. Each of these units has side plates and base pierced with the standard Meccano equidistant holes.



Meccano X Series Clockwork Motor



Meccano Clockwork Motor No. 1



Meccano Clockwork Motor No. 2

MECCANO X SERIES CLOCKWORK MOTOR
A fine motor specially designed to drive models made with the new X Series parts. It is non-reversing. Price **2/6**

MECCANO CLOCKWORK MOTOR No. 1
A long running motor fitted with a brake lever. It is non-reversing ... ... Price **5/-**

MECCANO CLOCKWORK MOTOR No. 1a
This motor is similar to the No. 1 Motor, but it has reversing motion ... ... Price **7/6**

MECCANO CLOCKWORK MOTOR No. 2
This is a reversing motor of super quality ... Price **10/-**

MECCANO ELECTRIC MOTOR No. E1 (6-Volt)
A highly efficient non-reversing motor that gives excellent service ... ... Price **7/6**

MECCANO ELECTRIC MOTOR No. E6 (6-Volt)
This motor is fitted with reversing motion and has starting and stopping control ... ... Price **15/6**

MECCANO ELECTRIC MOTOR No. E20a (20-Volt)
A fine non-reversing motor, having greater power than the 6-volt motors ... ... Price **16/6**

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This is similar to the E20A Motor, but has reversing motion ... ... Price **18/6**

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This is an exceptionally powerful and reliable steam engine ... ... Price **25/-**

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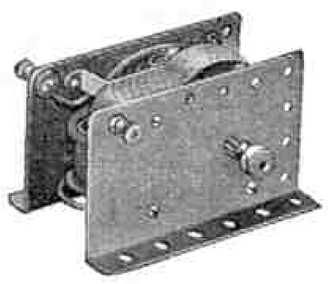
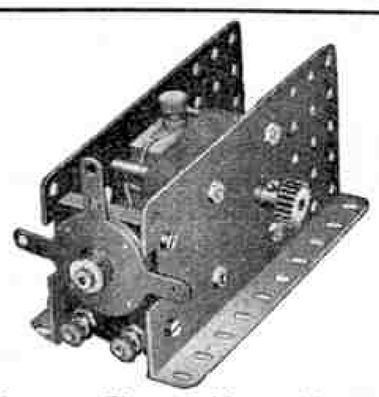


Meccano Electric Motor No. E1



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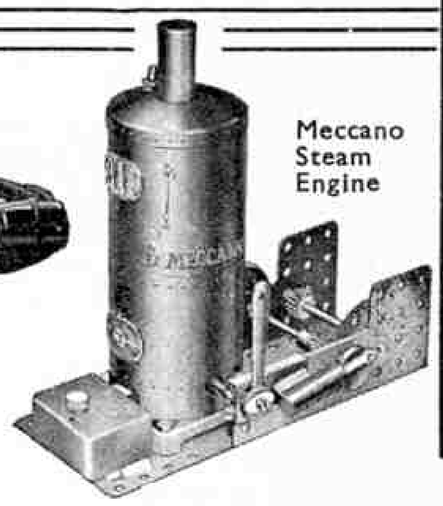
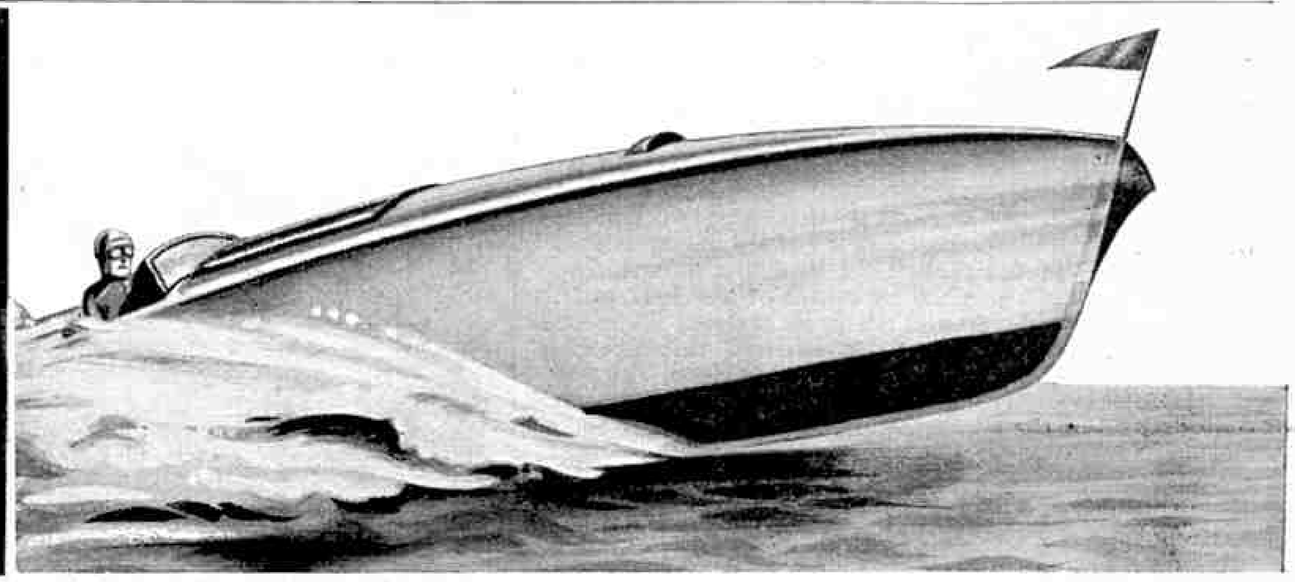
Transformer No. T20



Meccano Steam Engine

HORNBY SPEED BOAT



500 feet on one winding!

Boys ! The Hornby Speed Boat is the finest craft you ever saw, with speed and endurance written in every inch of her stream-lined hull. On one winding of the powerful clockwork motor she races away for a distance of 500 feet, smoothly riding the waves, just as real speed boats do.

The Hornby Speed Boat measures 16½ inches from bow to stern and 3½ inches in beam. She is available in three different colour combinations—Green and Ivory, Red and Cream, and Blue and White. Her motor is designed and made on the same lines as the motors of the famous Hornby Trains. She is a perfectly constructed model, with water-tight bulkheads that make her absolutely seaworthy and unsinkable.

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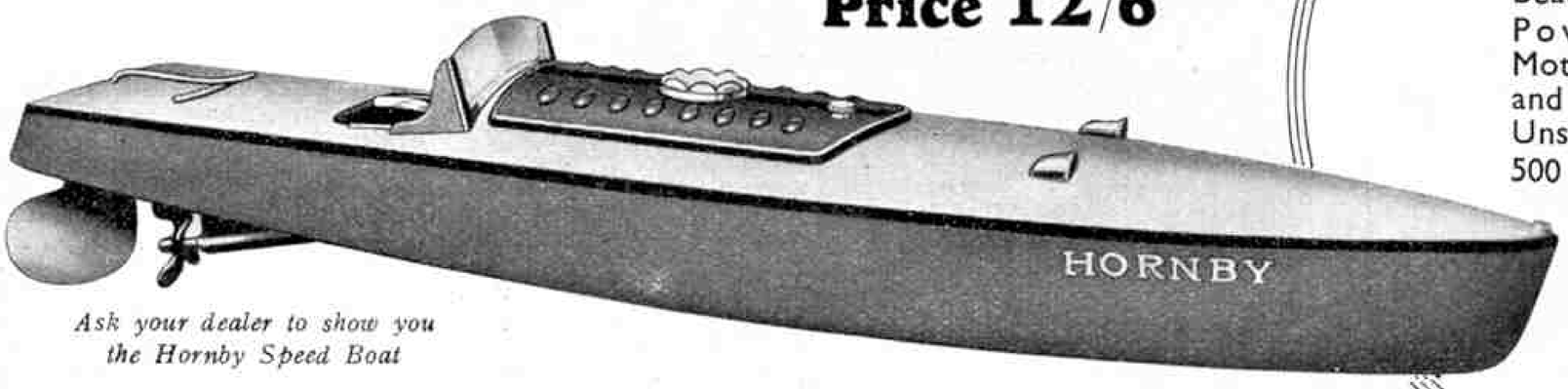

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SPECIAL FEATURES OF THE HORNBY SPEED BOAT

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Branch Notes

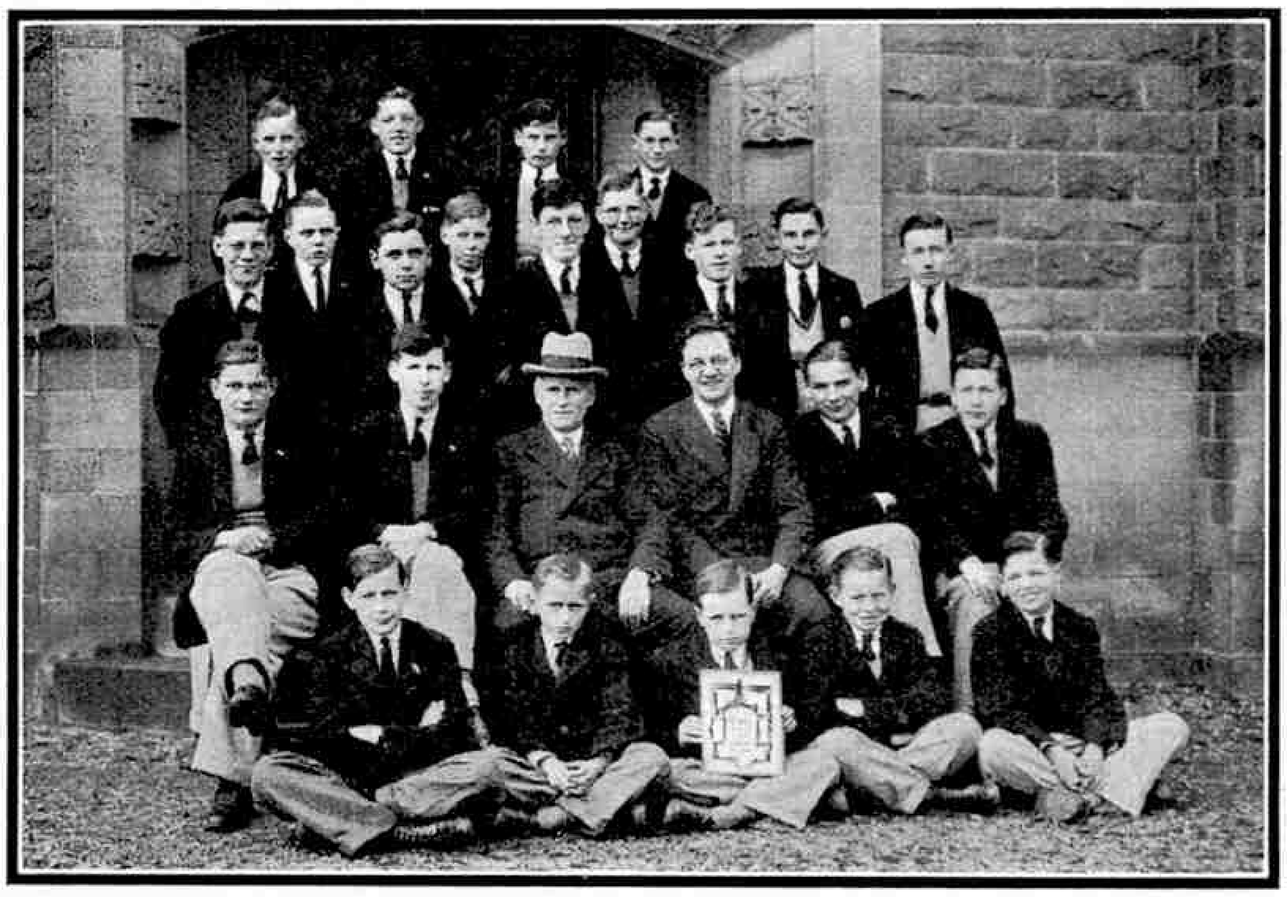
LOUGHBOROUGH GRAMMAR SCHOOL.—Regular track meetings have been held and interest has been added to them by the inclusion of Hornby Lamp Standards, an excellent effect being produced when the layout is illuminated. A special section for younger boys is to be formed in order to allow senior members to carry on more advanced train working. Secretary: D. R. Pullinger, The School House, Loughborough.

ST. JOHN'S SCHOOL (LEATHERHEAD).—There has been a revival of interest among members and many recruits have strengthened the Branch. Canon Downs, formerly Headmaster of the School, now Dean of Bocking, has kindly presented Hornby Train material to the Branch. Members are now planning a suitable permanent track, and several layouts have already been tried. An Engineering Department has been formed, the members of which keep track and rolling stock in good order, and effect any necessary repairs. Secretary: F. K. Chase, St. John's School, Leatherhead.

WIMBORNE GRAMMAR SCHOOL.—The work of fitting stations on the Branch layout with electric light has been pushed forward, and Binns Road Station is now well lighted. Other improvements have included the elimination of an awkward curve, and the erection of two chutes in Lime Street Goods Yard, one for coaling purposes and the other for loading gravel. Timetable working has been very satisfactory, passenger and goods trains being worked in with each other, exactly as on real railways. The library has been re-organised and extended, and books are issued at the close of every track meeting. Secretary: J. K. Bennett, 120, Newington Causeway, London, S.E.1.

ST. ALBANS.—A larger hall has been secured and interesting track meetings are now being held on the more extensive layout operated. The appearance of the track has been greatly improved by the addition of signals fitted with electric lights by one of the members. Visitors at one of the meetings were greatly interested in the working of passenger and goods trains. A keen debate was held on "*Road v. Rail.*" A library is to be formed. Secretary: S. Eagleton, 20, Cornwall Road, St. Albans.

PORTSMOUTH NORTH END.—Members keenly debated the most suitable type of signals and decided that semaphores were most serviceable. The layout has been re-signalled, the electric lights of the correct colour being controlled by means of a central switchboard. The layout is sufficiently extensive to enable four trains to be run at the same time, while others are being loaded or unloaded. Locomotives take their turn on duty and return to the shed in realistic railway style for coaling and inspection. Secretary: C. Mortby, 35, Beresford Road, North End, Portsmouth.



Our photograph shows a group of members of the Pannal Ash College, Branch No. 222; Chairman, Mr. R. A. C. Kayser, Secretary, P. D. Beckett. The Branch was incorporated in March, 1932. The splendid layout formed has been given a realistic appearance by the skilful use of scenic effects and is being steadily enlarged. An interesting feature is an insurance scheme, members paying a small premium to ensure their railway stock against damage by derailment or other accident.

BIRSTALL (LEICESTER).—The Branch has now received its Certificate of Incorporation, which has been framed and hung up in the track room. The track has been extended by the provision of an engine siding, and very satisfactory operations are carried out on it. Derailments and other accidents are made the subject of careful enquiries before a special committee. A visit was made to the Syston Goods Yard. Secretary: G. B. Gibson, 49, Front Street, Birstall, Leicester.

HEATH MOUNT.—Work on the track continues, the trestles having now been completed and the top planking placed in position. Many useful hints were obtained on a visit to a model railway in Manchester, which was thoroughly enjoyed. The secretary will be pleased to hear from Hornby Train enthusiasts who would like to join. Secretary: Mr. J. O. Battersby, Kingswood, Manchester Road, Fairfield, Manchester.

AUSTRALIA

PARRAMATTA.—At present only a Senior Section has been formed. Members are keen on correct operation and are concentrating on the construction of a layout that resembles actual practice as much as possible. This layout is open to the inspection of any Hornby Train enthusiast or reader of the "*M.M.*," and those interested should write to the Secretary: H. H. Matthews, 27, Ross Street, Parramatta, N.S.W.

NEW ZEALAND

MANAWATU.—The Branch now meets at the home of one of the members where a permanent track has been laid down. An incline has been included in the layout and interesting experiments are made with banking engines that are slipped on reaching the summit. Each track meeting is devoted to the operation of either passenger or goods trains, and smooth running in accordance with a pre-arranged timetable is usually attained. Cycle runs to places of railway interest are arranged in order to increase the Branch collection of railway snaps. Secretary: R. Hall, 110, Albert Street, Palmerston N.

Proposed Branches

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 extend a warm welcome to all who send in their applications.

LEIGH-ON-SEA—Kenneth G. Cross, Knowle Villa, 129, Southsea Avenue.

ST. ANDREWS—Andrew Philp, "St. Ronans," Hepburn Gardens.

Branches Recently Incorporated

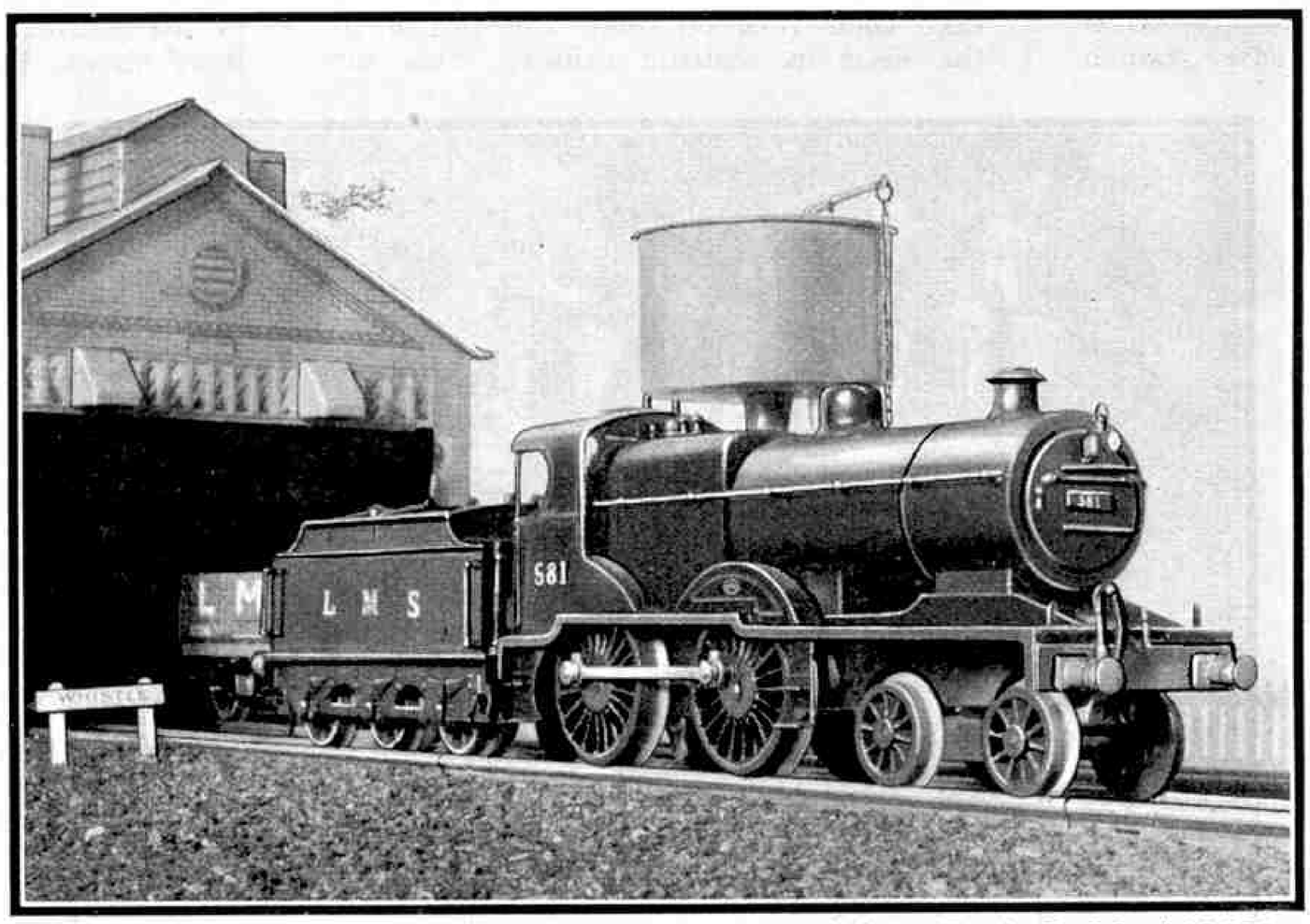
237. WATERLOO-SEAFORTH GRAMMAR SCHOOL—Mr. H. H. Howells, Willow Bank, Brows Lane, Formby.
238. HOLYWELL (OXFORD)—Mrs. M. Weatherall, 29, Holywell, Oxford.
239. 1ST BIRKENHEAD—Mr. D. A. Miller, 7, Ben Nevis Road, Prenton.

A Realistic Rebuilt Hornby Locomotive

Striking Development from Standard Model

LARGE numbers of suggestions are regularly submitted by readers in regard to improvements and additions to the Hornby Series. Locomotives and rolling stock are the most popular items dealt with, and the manufacture of additional engines and vehicles of all kinds is proposed by enthusiastic model railway owners. The wishes of the majority are followed as far as possible, but for various reasons there are limits to the range of locomotives and coaches that can be offered. Sometimes it is possible to adapt to new purposes certain items that are already available, and schemes of this kind are frequently described in the Hornby Train "In Reply" page. The scheme outlined in this article should therefore be of interest to model railway engineers generally, and to followers of the L.M.S.R. in particular.

The plan is to take advantage of the general similarity of the L.M.S.R. Standard Compound and "2P" class 4-4-0s, and convert a Hornby L.M.S.R. No. 2 Special into one of the latter. It may be done quite successfully, as the photographs show, and an interesting comparison may be made between the miniature and an actual "2P" locomotive in the illustrations. None of the essential work is really difficult, and it is not actually necessary to do the job in such detail as described, as the mere removal of the outside cylinders and the repainting of the engine and tender will give sufficient effect for many model railway operators.



A miniature locomotive representing an L.M.S.R. "2P" 4-4-0, rebuilt from a Hornby No. 2 Special L.M.S.R Locomotive as described in this article.

First of all the mechanism is removed from the housing of the No. 2 Special, and the bogie also is detached. This enables us to get at the riveted-over portions of the spigots securing the cylinders. These are filed away, and the lugs holding the slide-bar brackets to the main frames are turned back and the cylinders removed carefully so as not to damage the frames. The triangular covers on the footplate at the sides of the smoke-box saddle are then taken off. In this state the engine may be considered complete enough to represent, except for the number, either a present-day standard "2P" locomotive, although these are black, or perhaps a class "2" engine of the former Midland Railway.

If the complete conversion is to be carried out, the next part of the work is to cut two pieces of tinplate for the frames alongside the smoke-box saddle. These are filed up to shape and soldered on. The frames could be cut from cardboard if preferred, and fixed with Seccotine. These frames sloping from the smoke-box saddle down to the buffer beam give the real engine a very characteristic and solid appearance, and should be fitted if at all possible. A metal number plate is then fixed in the centre of the smoke-box door, though here again thin card stuck on will do equally well.

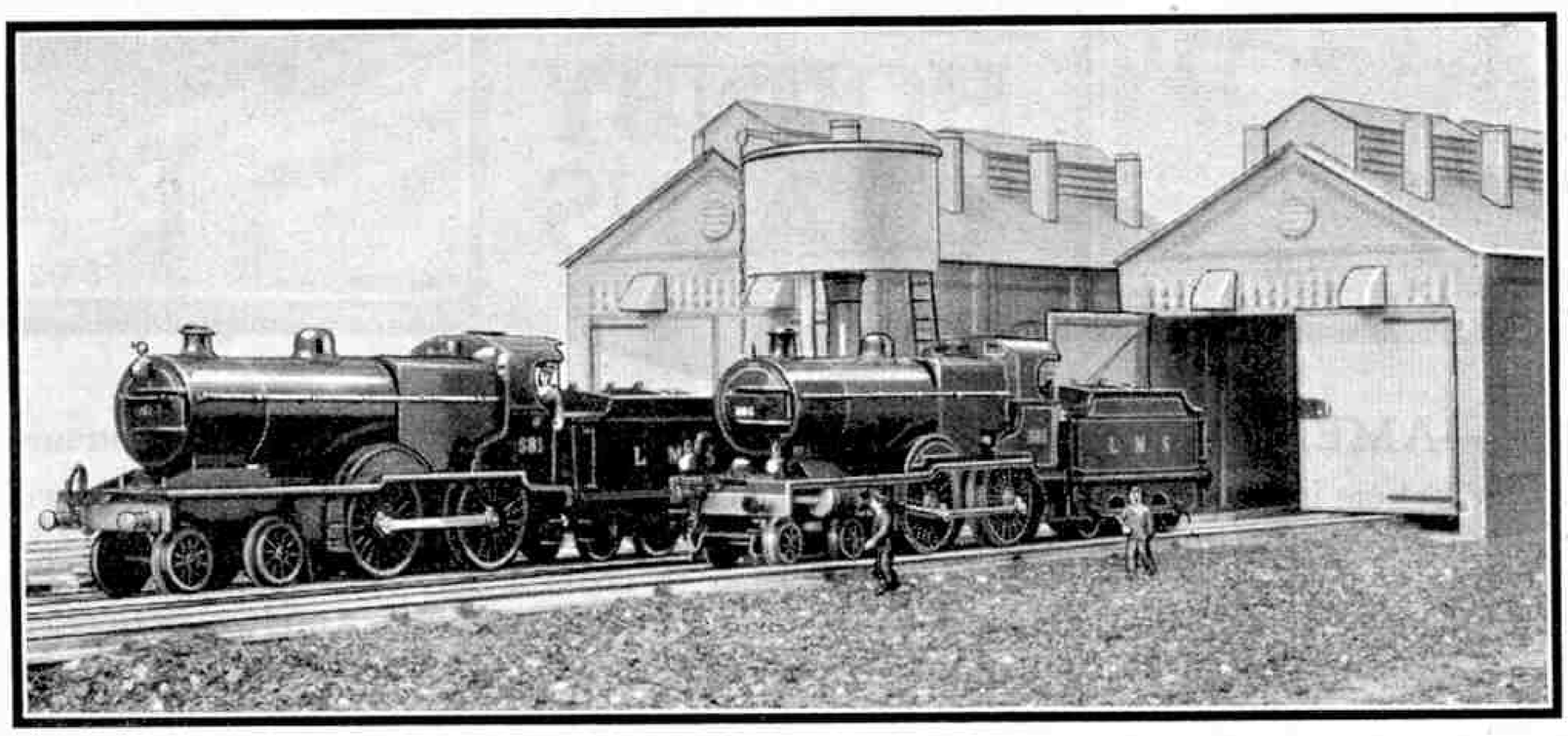
If the chimney has been at all damaged the smoke-box door may be removed to allow the number plate to be fitted easily, the opportunity being taken to attend to the chimney, which may be trimmed up, with the aid of a file and emery paper, to represent as far as possible the standard fitting of a "2P" locomotive. The holes left by the removal of the cylinders from the frames are closed by fitting a small metal plate inside each frame and filling up the holes with solder. Another scheme would be to cut thin card to the same contour as the metal frames, and glue or Seccotine the parts in position.

The next part of the work is the fitting of larger bogie wheels, and the necessary enlargement of the half-round openings in the frames to allow the bogie wheels to swing under them on curves. Any reader who is lucky enough to possess a lathe will be interested to hear that the wheels shown are actually Hornby Snow Plough wheels which, when machined up, are very useful for large bogies. Alternatively the driving wheels of MO locomotives might be employed for the same purpose. Many readers will be content with the bogies already fitted to the engine, however, but it will be agreed that a very realistic appearance is given to the locomotive by the use of the larger wheels.

This completes the mechanical part of the job. The engine should now be cleaned down, and if the surface of the enamel on it and the tender is fairly good, it is simply well sand-papered instead of being scraped or boiled off. All dust is now removed from the housing and tender, and a coat of black paint carefully applied all over, except for the whistle and the buffers and buffer beam. A very suitable paint to use is that known as "cylinder black," intended for motor-cycle use,

and obtainable at most garages and cycle stores. This should be smoothed down when dry and a second coat applied and given time to harden thoroughly.

The buffer beams and stocks of the buffers are next picked out in vermilion, and the necessary lining on the tender and cab sides, splashers, the front end of the boiler barrel and the rear end of the fire-box is carried out in the same colour. Careful measurement of the initials and numbers should be made before the job is started, and the required figures painted on in the correct positions. A small oval plate may be painted on the driving wheel splashers to represent the maker's plate. Minute letters "L.M.S." may be included in it, yellow paint being used. A black line running round the edge of the buffer beams completes the job, except for the small white figures on the smoke-box number plate. When all is dry, varnish may be applied to the boiler, fire-box, splashers, cab and tender sides, but the inside of the latter, the footplates, cab roof and smoke-box may be left in the natural dull state of the black paint. This gives a most realistic and workmanlike appearance to the engine.

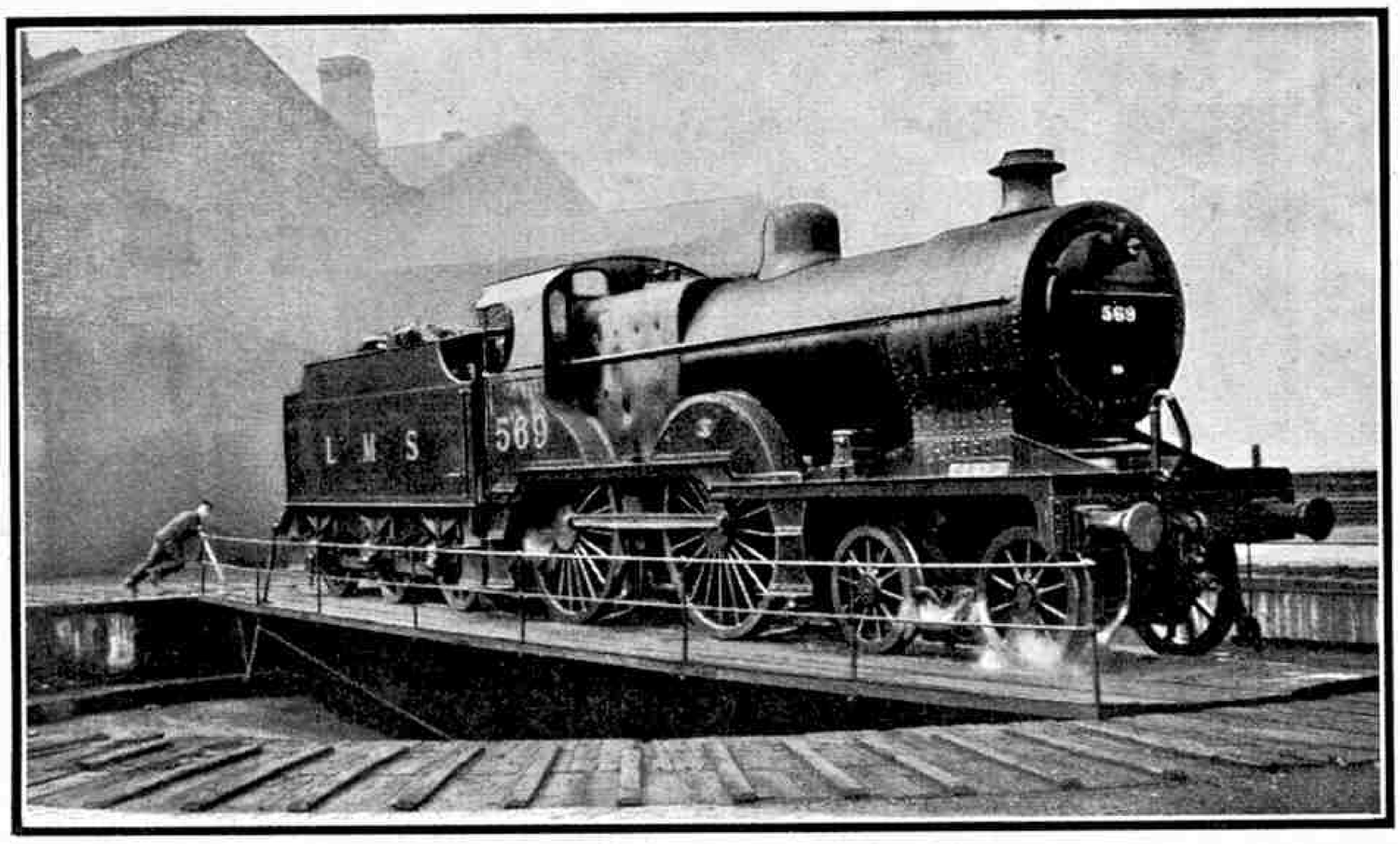


An interesting illustration showing the "2P" locomotive and a No. 2 Special together.

Before replacement the mechanism should be thoroughly washed in petrol and allowed to dry, and the wheels and mechanism side plates given a coat of black. The bogie wheels should be painted, care being taken to keep the wheel treads in all cases clear of paint, as its presence hinders running considerably and does not look realistic.

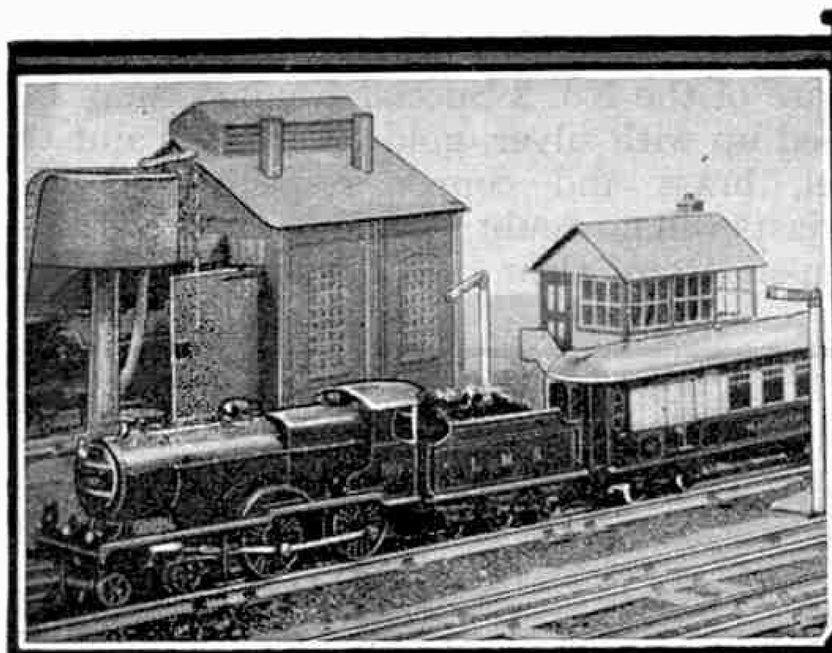
A realistic step is to paint the inside of the cab in the manner followed on the real engines when turned out of the shops. The fire-box back and the floor of the cab should be left black, but the sides of the cab, the spectacle plate and the roof should be buff-coloured. In addition, the centre portion of the cab roof is white, the whole effect being very smart and the cab generally having a light appearance inside. The miniature engine has the advantage over its prototype that it will retain this fresh appearance for a long period. The different fittings that are cast integrally with the fire-box back—a notable feature of the No. 2 Special Engines, may be suitably touched up with silver, gold or bronze paint to represent steel, brass and copper respectively. Ingenious enthusiasts will no doubt be able to apply various additional refinements of their own devising.

The engine as thus rebuilt will be found a most useful member of the locomotive stud, and capable of taking turns on the hardest trains. As a pilot engine too it will look very effecttive in front of a Compound, this combination of locomotives classes being strikingly realistic. Whereas the Compound has outside cylinders, the 2P Locomotive reproduces the inside-cylinder style of the old Hornby No. 2 Locomotive, and thus belongs to the traditional British type of 4–4–0, of which the S.R. No. 2 Special of the L1 class is now the only representative in the Hornby Series. The choice of numbers available is a wide one, as the series of standard "2P" locomotives on the L.M.S.R. now runs from 563 to 698.

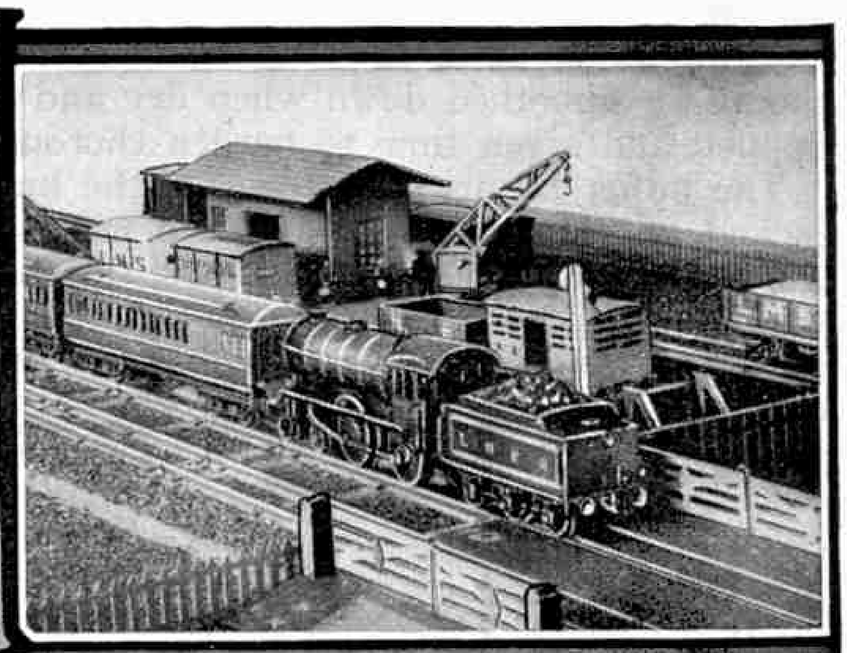


An actual "2P" class engine of the L.M.S.R. An interesting comparison may be made between this and the miniature locomotive shown on the opposite page.

Just as a miniature locomotive rebuilt in this manner has a special interest attached to it, so the development of the actual "2P" locomotives is quite a fascinating story. About twenty-five years ago numerous 4–4–0 locomotives that had been in use for some time on the Midland Railway were provided with new and larger boilers. They had been built with large cylinders in accordance with the practice then in vogue, but with only moderate-sized boilers; so that as a result of this rebuilding they became more efficient and certainly more modern-looking engines. With the introduction of superheating and its adoption on the Midland system the rebuilding process went a step further, and the engines thus treated were made to form a more or less consistent class. Their success with trains of suitable weights caused the design to be adapted to suit group conditions. The standard engines are used on subsidiary services in Scotland, and on the Western and Central Sections in addition to the Midland.

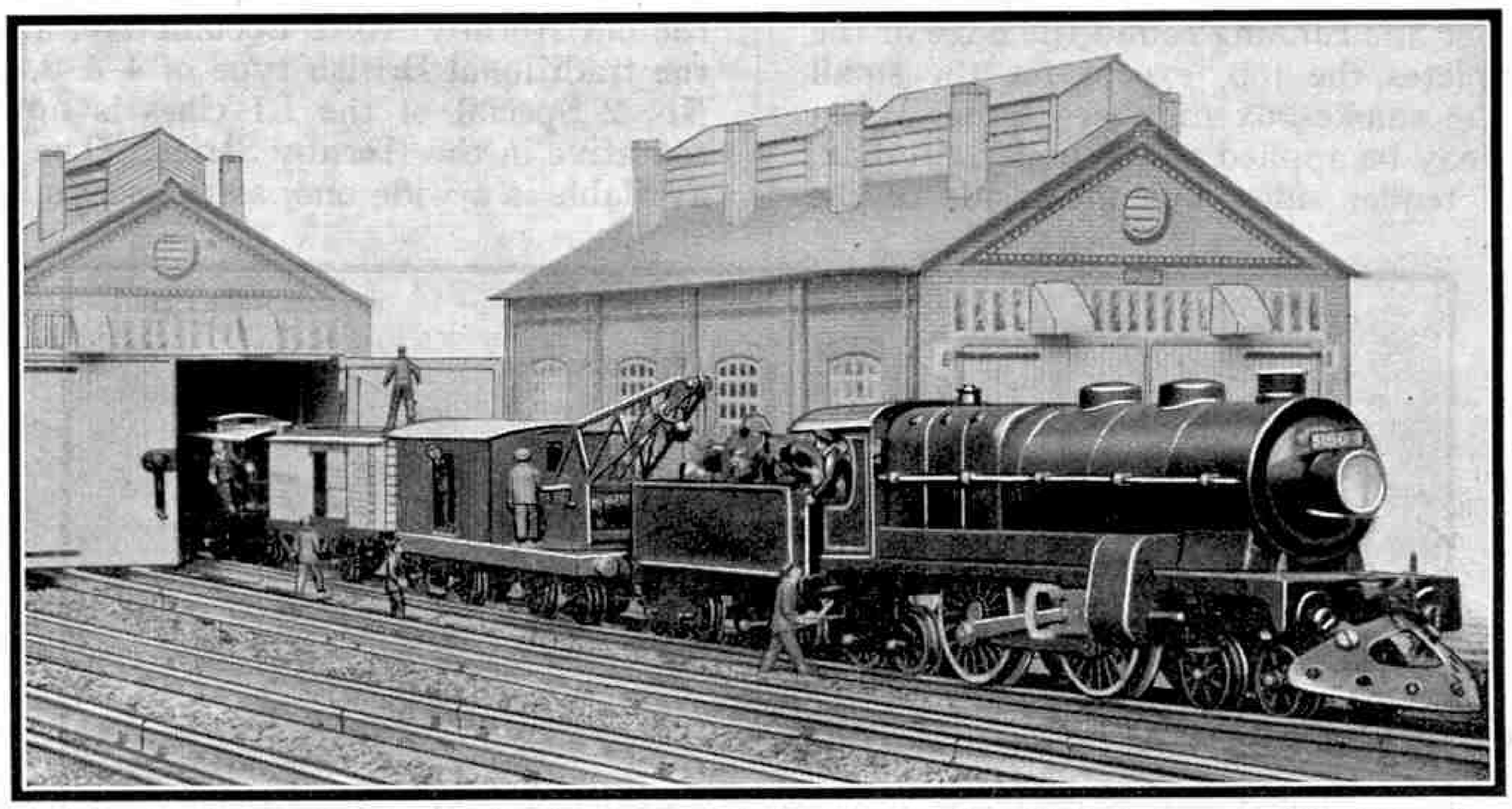


HOW TO GET MORE FUN FROM HORNBY TRAINS



LII.—AMERICAN TRAINS ON HORNBY LAYOUTS *(continued)*

FOLLOWING up the article in these pages last month, we intend to devote further attention to American-type layouts. Readers will be aware that on most American railways the trains keep to the right on double track sections, and the locomotive driver, or "engineer" as he is called, is posted on the right-hand side of the cab. This is a point to be remembered when planning a layout of this description. Thus left-hand crossover points, which are usually trailing points on English layouts, become facing points where American conditions are reproduced. As a result of this right-hand running, signals are arranged with their semaphores the reverse way from those in this country; that is, pointing to the right, away from the track when viewed from the engine. The M Series Signals lend themselves to use as American pattern upper-quadrant signals, this effect being gained by turning the arm over from its normal position and adjusting the operating wire, if necessary, to suit. They look curious at first sight to those accustomed to British signalling standards, but their realistic effect from an American point of view is very pleasing. This was evident from the illustrations appearing last month, in two of which M Signals were adapted as American upper-quadrants.



An interesting view on a Hornby American-type layout. The breakdown or "wreck" train composed of Breakdown Van and Crane, Box Car and Caboose is being hastily prepared for a trip down the line.

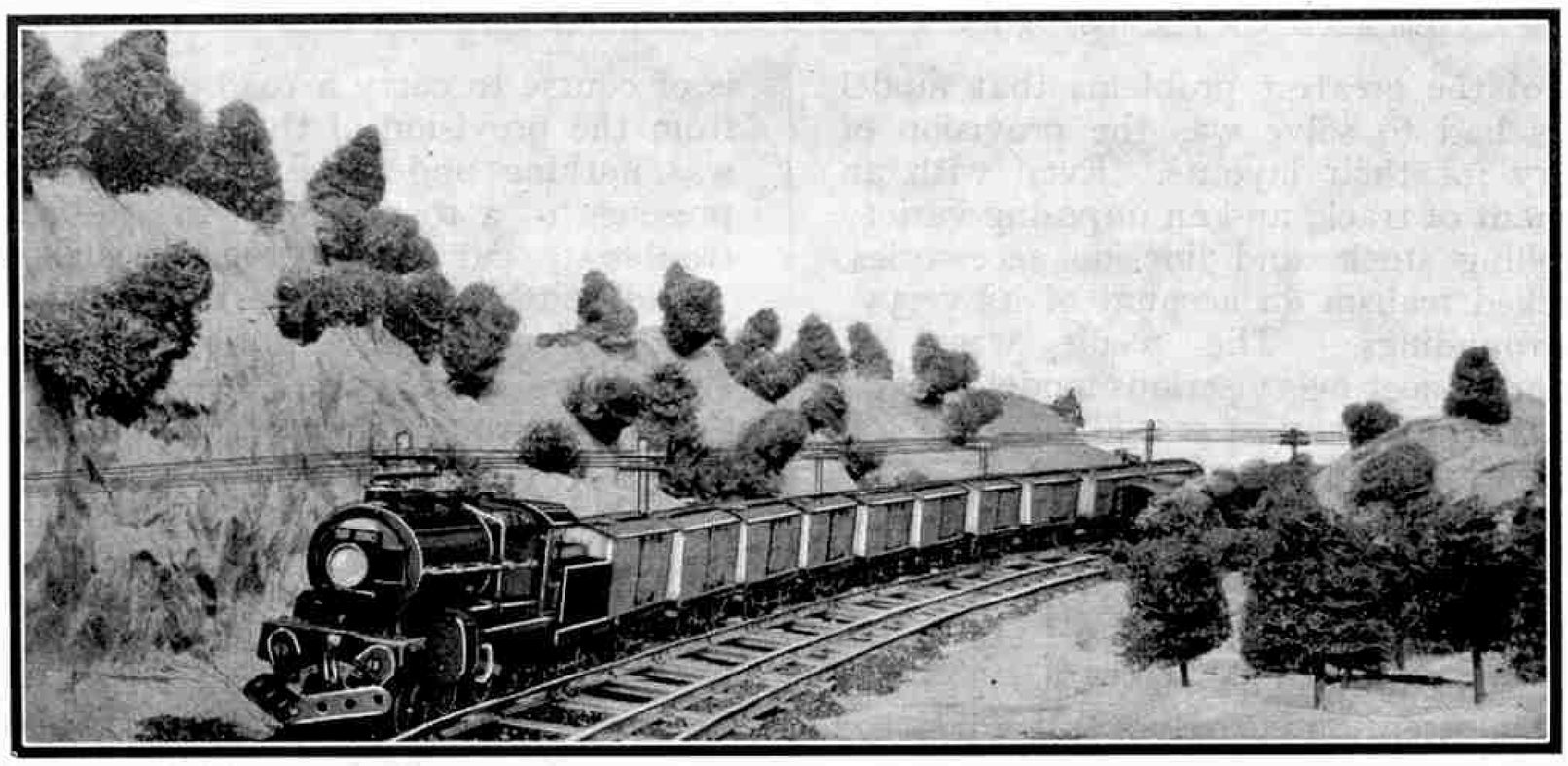
The fact that a great deal of American mileage is single track is of considerable advantage in miniature, for it allows of a certain amount of simplification of the equipment. It necessitates of course careful arrangement of the train schedules, while passing loops should be provided where they are most likely to be useful. The crossing of the trains in the correct manner so as to observe the previously arranged working schemes adds to the interest of operation. The capacity of passing loops should be such as to accommodate easily any long freight train that may arrive. When a train exceeds the capacity of the loop, the operators will have to exercise their ingenuity, particularly if a "Pullman Limited" is to cross a detained freight.

Freight traffic in America is operated under different conditions from those obtaining in this country. In that land of big distances the concentration of loads into a few huge trains is the usual practice; and this, and the physical characteristics of the various routes traversed, has caused the evolution of the enormous locomotives in use for such traffic. Centre couplers of automatic type, and the fact that the trains are air-braked throughout, make the handling of big loads possible. Some idea of the tonnage involved will have been gained by those who read in the "*M.M.*" in September last year about the 2–10–2 Canadian National "4100" class dealing with trains of 150 cars weighing 14,500 tons!

Probably the most common vehicle in use in American freight service is the box car, or as we should call it here, covered wagon or van. These are used in great numbers for general freight service, in which they may cover prodigious mileages in operating from their own systems practically all over the continent. The Box Car of the Hornby Series is an interesting vehicle, and embodies numerous characteristics of its prototype. The vertical boards, sliding doors and peaked roof are typical, and give a definitely American character to the train of which the Box Car forms a part. Owing to the large number of such vehicles in use, and the transferring that takes place between different systems, it is necessary for equipment to conform to certain standards. Various details, dimensions and other information therefore appear on the side of the Car for the benefit of those concerned, regarding the couplers, brake equipment and other fittings. This feature on the miniature Box

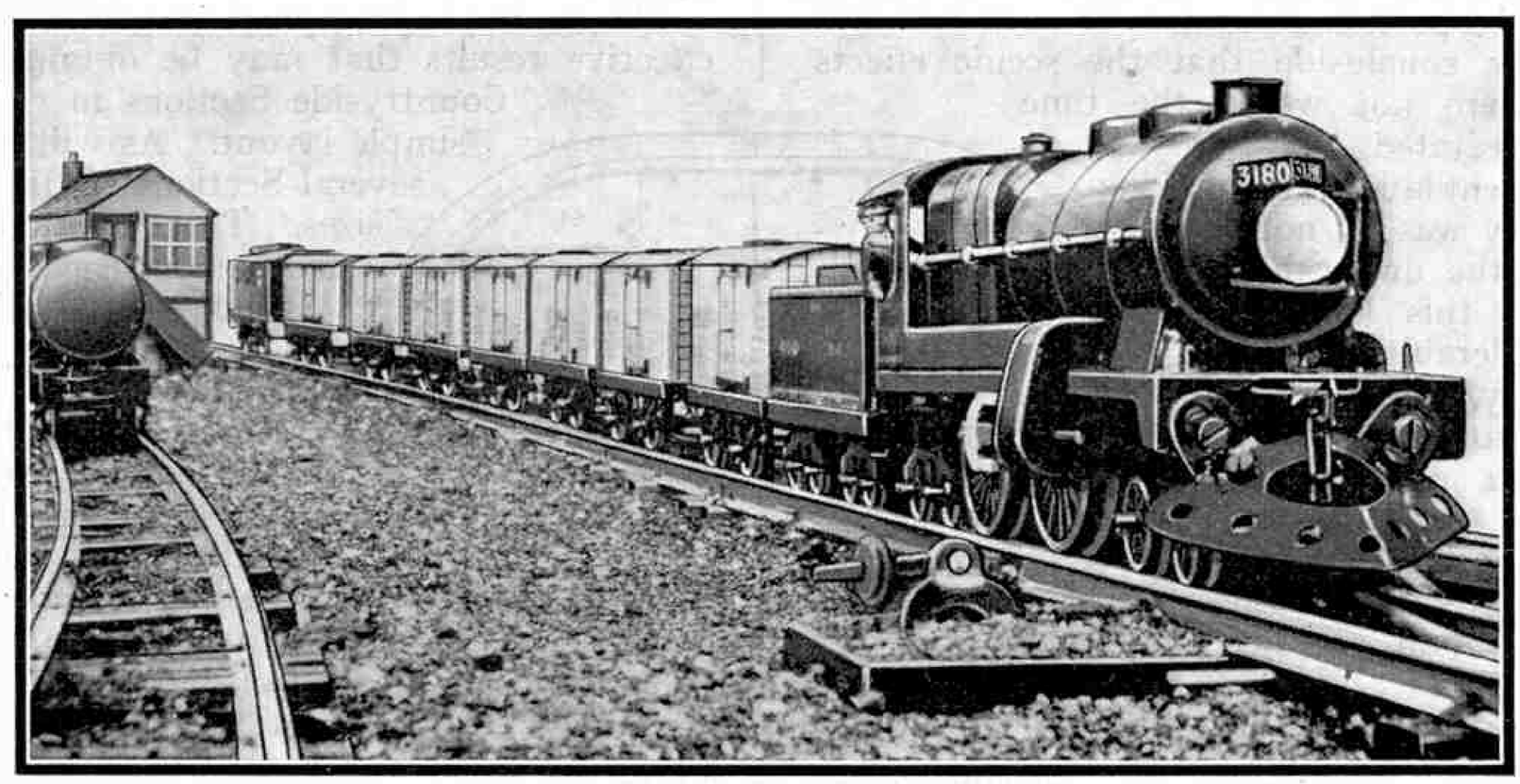
Car adds considerably to the effectiveness of the model.

In a similar manner the Tank Car is marked with details as to its equipment and capacity. Trains composed exclusively of tank cars cover long distances in America carrying oil in bulk, for it is necessary to transport the oil to the refineries and thence to the distributors as quickly as possible. The Hornby vehicle reproduces very well the characteristics of the American tank car, even to the typically squat shape of the big "dome" or filler on the top of the tank. It is finished and lettered in detail to represent one of the fleet of the Union Tank Car Company, which operates large numbers of cars.



A "preference freight" train in miniature. It is made up of Hornby Box Cars; and the footways along the roofs of these, together with the dummy brake wheels, give them a very realistic appearance.

Both the Box Car and the Tank Car may be employed in complete or "solid" trains, or they may form part of mixed freight trains for general purposes. "Preference" freight trains carrying fruit or similar perishables are run in large numbers in America, the facilities in certain cases depending upon the seasons for different commodities. General goods are now extensively handled on preference schedules, "*The Blue Streak*" of the St. Louis and Southwestern Railroad, from St. Louis to Texarkana and Shreveport, and the "*Speed Witch*" of the Pennsylvania Railroad, from Baltimore to Boston, being good examples. American railroad companies believe in the advertising value of named trains, and the titles of these two examples illustrate this. The term "preference" freight indicates that such a train will take precedence over ordinary freight trains when schedules and crossing arrangements on single line sections are being made out. The Hornby "preference" freight may therefore be made up entirely of Box Cars, or if desired some of the No. 2 Luggage Vans may be used, according to the equipment of the line.



A freight train ready to leave the yard. It is composed of Hornby Box Cars, for such vehicles are commonly used for miscellaneous traffic. Some Tank Wagons can be seen in the siding on the left.

Whatever type of freight train is run, from a "preference" or "hot shot," as trains on fast schedules are known, to an ordinary slow coal "drag," it is necessary to have a caboose. This is the equivalent across the Atlantic of the English goods brake van, and the Hornby Caboose is a very good representation of the actual thing. The caboose forms the quarters of the "conductor" and brakemen, except the head-end brakeman, who rides in the engine cab. For observation purposes there is a kind of raised hatch called a cupola, or "crow's nest" by the men, much after the style of the "birdcage" roofs on the old South Eastern and Chatham and some Continental railway vans. In addition observation platforms are provided at the ends, and there are ladders for the use of the trainmen when they have to climb on to the roof and proceed along the train to set the hand brakes when particularly severe slopes are to be negotiated. This practice explains the narrow footway or "deck" running along the top of the Box Car and also the vertical brake column and hand wheel at one end of the vehicle. The work of the train crew of an American freight is not without thrills, particularly in winter, as may well be imagined.

Mechanical equipment is largely employed in connection with loading and unloading, grain elevators and coaling plant being familiar features on most American yard and terminal layouts. These of course offer splendid opportunities for the use of Meccano models of such equipment, while cranes of all kinds are always useful. For handling coal traffic the Hornby Hopper Wagon is the nearest approach to the American "gondola" car, which is mostly used for such work. The capacity of this type of vehicle is frequently round about 100 tons, so that it does not take many "loads" to make up a weighty train. In spite of this, however, enormous coal "drags" are handled by American lines, and their reproduction on a Hornby layout will not be without interest. The Virginian system is well known for the tonnage dealt with, and is also interesting in that numerous electric locomotives are employed on this traffic. Thus the Hornby electric-type engines of the Swiss or LE2/20 patterns could quite well

(*Continued on page 154*)

Scenic Effects for Miniature Railways

The Hornby Countryside Sections

IN the past one of the greatest problems that model railway owners had to solve was the provision of suitable scenery for their layouts. Even with an elaborate arrangement of track, and an imposing variety of locomotives, rolling stock, and lineside accessories, the layout still lacked realism on account of its very un-railwaylike surroundings. The result was that sooner or later almost every serious model railway enthusiast tried his hand at providing some kind of scenic background for his layout. In the case of permanent layouts this was not such a difficult task, because so long as the required effect was produced, it did not matter much how it was obtained. Thus the railway owner could concentrate his attention entirely on results, using any material and any constructional methods that occurred to him.

The case was very different with temporary layouts that had to be laid down as required and put away again after use. Here it was necessary that the scenery should be of such a nature that it could be quickly laid out or packed away, and of sufficient strength to stand the wear and tear involved. Every item of this kind added to a temporary layout increased the time and trouble taken in handling it, and the result was that a large proportion of owners of such railways soon came to the conclusion that the scenic effects they produced were not worth the time and trouble necessitated.

Even on permanent layouts the making of effective scenery was by no means easy, and unless the owner had a special liking for this kind of work, and a considerable amount of artistic ability, the scenic results were apt to be so crude as to defeat their purpose. A boy not gifted in this direction was thus seriously handicapped unless he had a chum from whom he could obtain the necessary expert assistance.

The model railway scenic problem has now been solved to a very large extent by the introduction of the Hornby Countryside Sections, which provide model railway owners for the first time with realistic scenery in a ready-made form suitable for any layout of 2 ft. radius. These attractive accessories open up entirely new ground in miniature railway working, for they make it possible to place even the simplest temporary layouts in suitable surroundings.

As an example of the manner in which the Countryside Sections have simplified the provision of realistic lineside effects, let us consider a layout incorporating a level crossing at a suitable point. The purpose of the crossing is of course to carry a road over the railway, but apart from the provision of the Hornby Level Crossing there was nothing under the old conditions to indicate the presence of a road, unless the railway owner took the trouble to cut strips of cardboard of suitable length and width, and to give these a more or less realistic surface with sand or other similar substance. As an alternative, for those with the necessary ability, the cardboard roads might be painted; but in any case the effective reproduction of hedges and trees was far from easy.

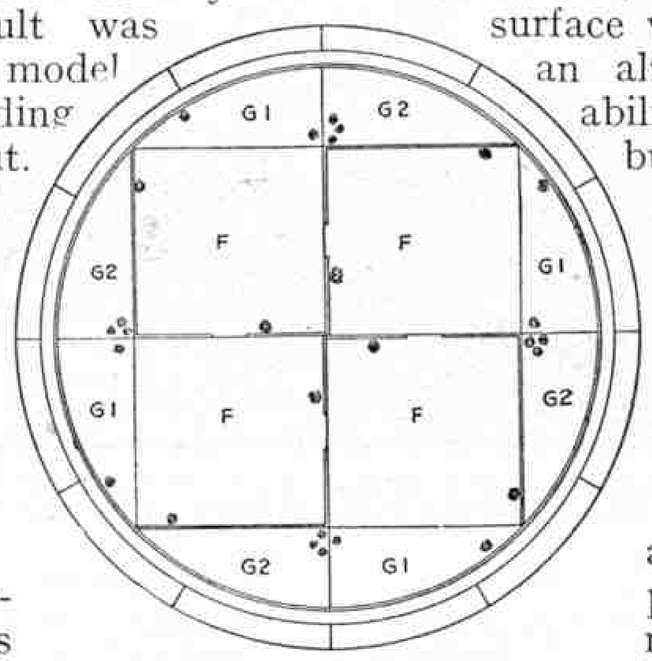


Fig. 1
Countryside Sections: 4F, 4G1, 4G2.
Rails (2′ Radius) 12 curves.

The position has been completely changed by the introduction of the Countryside Sections. A model railway owner decides that a level crossing is to be a feature of his layout conveniently near a model station. The Hornby No. 1 Level Crossing is duly installed, and is ready for the trains; and the road problem is solved in the simplest possible manner by means of a "Road Section H" applied to the crossing, the end of the section being slipped under the slope leading up to the crossing gates. The result is to give the level crossing a surprising amount of life-like realism. The Road Section is bounded by very natural hedges and trees, and on each side of it there is a typical five-barred gate to lead into the fields alongside.

The accompanying photograph shows the remarkably effective results that may be obtained by the use of Countryside Sections in conjunction with a simple layout. As will be seen, there are several Sections of different shapes and sizes. These Sections bear a definite relation to each other and to the track, so that the complete uniformity of the Hornby System is maintained.

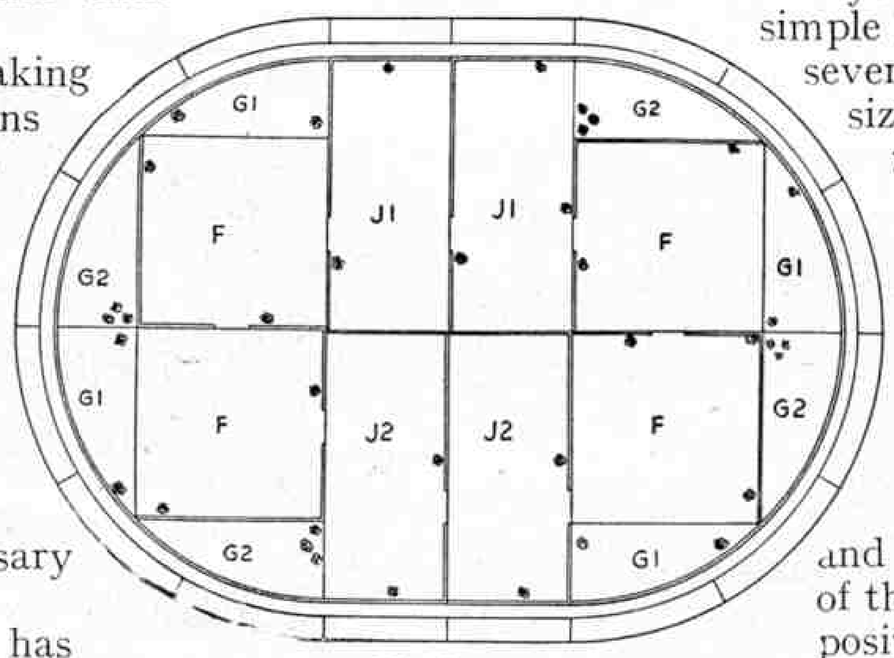
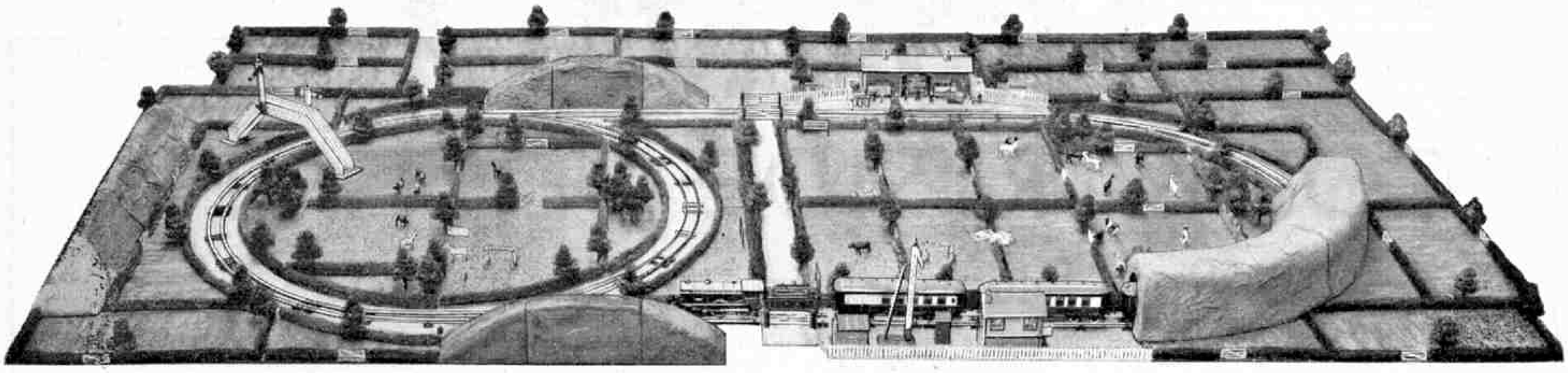


Fig. 2
Countryside Sections: 4F, 4G1, 4G2, 2J1, 2J2.
Rails (2′ Radius) 12 curves, 4 straights.

Fig. 1 shows how the Countryside Sections are applied to the simplest of all layouts, the plain circle. The inner side of the track is bounded by Sections G1 and G2, arranged to follow the contour of the rails. When these Sections are in position there is a space left in the centre that is exactly filled by four square F Sections. The striking result obtained from even this simple arrangement is well shown in the photograph on the next page.

By dividing our circle into two halves and connecting these by straight rails, an oval track is produced as shown in Fig. 2. The centre of this layout is filled by Countryside Sections J1 and J2. It will be noticed that the shorter sides of these Sections are the same length as a Hornby straight rail, so that as many Sections are required inside the track as there are straight rails laid in between the halves of the circle.

Where it is desired to use level crossings, as in the



This interesting photograph shows the realistic possibilities of the Countryside Sections on a Hornby railway layout consisting of an oval main line with an inner circle. The effective arrangement of the fields and roadway in conjunction with the Level Crossings and the Station is particularly striking.

photograph on this page, the necessary roadway is provided by means of the specially finished Section H. This is only half the width of the J1 and J2 Sections already mentioned, and therefore it agrees exactly with the length of the Hornby No. 1 Level Crossing, which is equal to a half-rail. Field-type Sections of this size, J3, are also available, so that the addition of a straight half-rail to the layout causes no trouble.

The outer edges of the track of the layout may be bounded by scenery in a similar manner to the inner edges. Specially curved Sections L1 and L2, and M1 and M2 are available, and the straight parts of the track may be edged with Sections J1 and J2, or J3. The use of these Sections round a layout is well shown in the photograph, and the principle of their application is made clear in Fig. 3.

In this we see that the L and M Sections provide a continuous border to the track, opposite to and corresponding with the G Sections on the inside. Their relation to the other pieces is such that where an L and an M Section are placed together, their total length corresponds to that of a J Section. This is shown by the arrangement of Sections of these types at the top and the bottom of the diagram. Other J Sections are laid in on the four corners of the layout, and fill the spaces there in a satisfactory manner.

Although the Countryside Sections are turned out to standard shapes and sizes, there is ample scope for devising schemes to add to the variety of effects. For instance, a number of J or J1 Sections may be arranged with their blank edges next to the track and Hornby Paled Fencing added to complete the effect, the separate trees available for this Fencing being fixed in place. This will give a very trim appearance to the edge of the railway property. Another scheme that has quite a picturesque effect consists of arranging a road to run alongside the track for some distance, possibly connecting with another road leading to a level crossing. For further variation the effect of larger fields may be produced by laying together the long blank edges of the J1 and J2 Sections, the area enclosed thus being doubled.

Many other interesting schemes will quickly suggest themselves to Hornby Railway owners, such as the removal of trees or gates here and there to prevent the Sections from looking too much alike. The trees are easily detached from their sockets, and the gates can be lifted off their hinges.

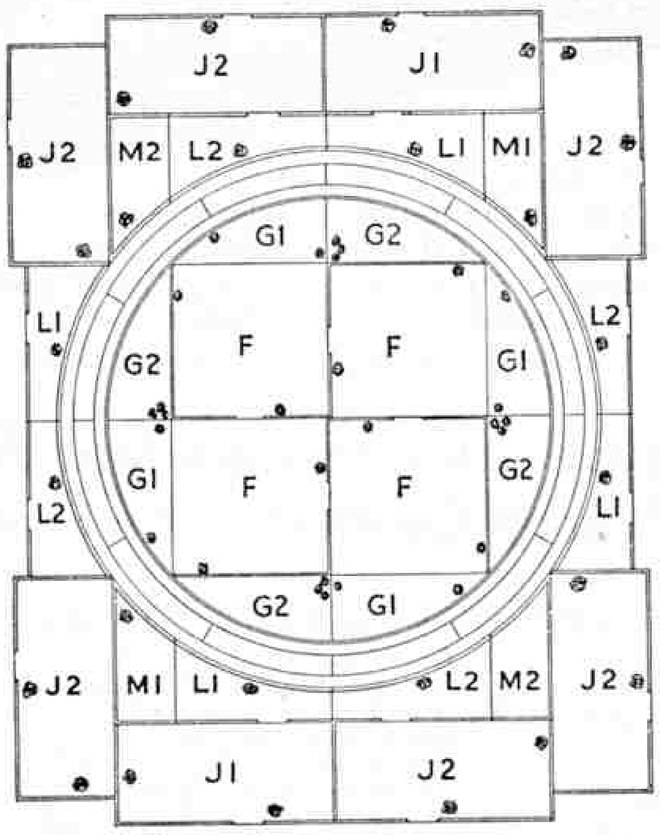


Fig. 3
Countryside Sections : 4F, 4G1, 4G2, 2J1, 6J2, 4L1, 4L2, 2M1, 2M2.
Rails (2′ Radius). 12 curves.

The Countryside Sections, with their fields, hedges, trees and gates, are thoroughly realistic, but their interest may be still further increased by inserting at various suitable points miniature figures, such as the passengers of Modelled Miniatures No. 3, and the Hornby miniature animals—cows, sheep, horses and pigs—of Modelled Miniatures No. 2, obtainable from any Meccano dealer. The two " hikers " look well passing along the road or crossing any of the fields ; and a particularly interesting scheme may be arranged by grouping a number of figures at a level crossing as if ready to pass through the gates as soon as these are opened when the train has gone by. The various passengers in their waiting attitudes look extremely effective in such an arrangement.

Considerable variety may be attained by using the miniature animals in different ways. They may be simply placed in the fields as if grazing, or they may be shown being driven through one or other of the various gateways from one field to another, or from a field out into and along the road. To represent the man in charge of them, an effective figure is one of the fitters included in the Engineering Staff, Modelled Miniatures No. 4, for these figures are wearing brown overalls that look quite suitable for drovers. A miniature cattle pen might be arranged as suggested in the "*M.M.*" for August last, and the animals could be taken along the road to this and there loaded into Hornby Cattle Wagons.

On permanent layouts the Countryside Sections may be fixed in position by means of fine wire nails. These nails are easily withdrawn, so that when any alteration or extension of the layout takes place the Sections can be quickly rearranged in accordance with the new scheme. For temporary layouts the Countryside Sections are particularly suitable, for they can be laid down and taken up as quickly as the track itself.

The photograph reproduced on this page shows the splendid results that may be obtained by the use of the Countryside Sections, and indicates some of the new possibilities opened up to any ingenious model railway enthusiast. The fabric Cuttings and Tunnels blend in well with the Countryside Sections and give a very natural effect to the whole scheme. The Fencing in the foreground, too, is useful material for almost any type of layout. It may be employed either with or without the trees that are supplied with it for attachment by means of special clips.

HORNBY

Hornby Series
For 2-ft. radius layouts only.

Copyright.
Provisional Patent
No. 4655/32.

COUNTRYSIDE SECTIONS

Real Scenery for your Railway!

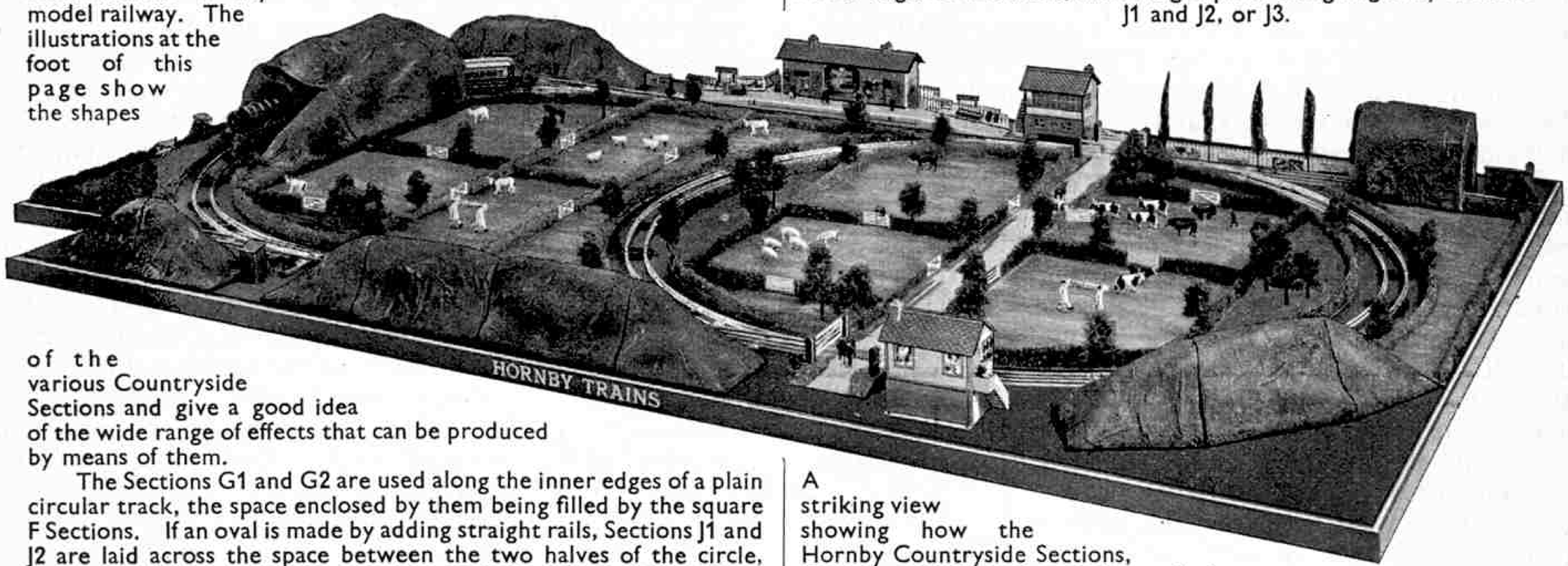
The new Hornby Countryside Sections provide model railway owners for the first time with scenery in a ready-made form that is suitable for any kind of 2 ft. radius layout. Splendid scenic effects may be obtained by arranging the Countryside Sections round a layout, and inserting here and there the Hornby miniature animals—cows, sheep, horses and pigs—Modelled Miniatures No. 2. The realistic effects produced in this manner add enormously to the attractiveness of any model railway. The illustrations at the foot of this page show the shapes of the various Countryside Sections and give a good idea of the wide range of effects that can be produced by means of them.

The Sections G1 and G2 are used along the inner edges of a plain circular track, the space enclosed by them being filled by the square F Sections. If an oval is made by adding straight rails, Sections J1 and J2 are laid across the space between the two halves of the circle, their number corresponding to the number of rails added.

The No. 1 Level Crossing necessitates the use of road Section H, the breadth of which is equal to the length of the Crossing. Similarly a half-rail requires the narrow field Section J3. Section H fits under the sloping approach of the Crossing, and a packing piece R is used on the opposite side to preserve the level.

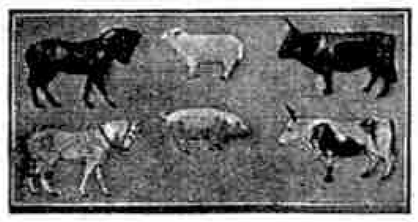
Triangular Sections K1 and K2 fit between the arms of the Right-Angle Crossing, so that "figure eight" layouts can be easily made up.

Curved Sections L1 and L2, and M1 and M2, are available for the outer edges of the track, the straight parts being edged by Sections J1 and J2, or J3.



A striking view showing how the Hornby Countryside Sections, Cuttings, and Tunnels may be applied to a layout is given in the above illustration.

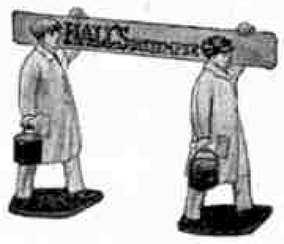
Ask your dealer to show you the new Hornby Countryside Sections



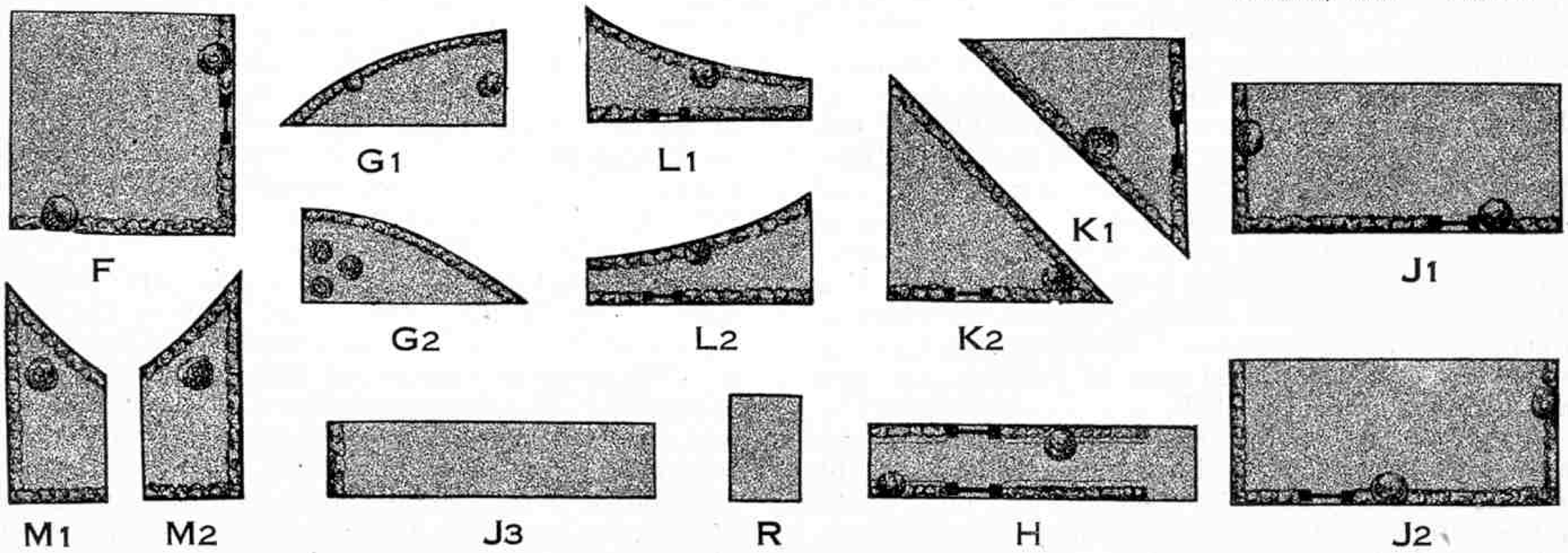
MODELLED MINIATURES No. 2
FARMYARD ANIMALS
Comprises six animals—Sheep, Pig, two Cows, and two Horses.
Price per set 1/6

PRICE LIST OF COUNTRYSIDE SECTIONS

Fields F	Box of four	10/–
Fields G1 and G2 ...	Box of eight (four G1 and four G2) ...	11/–
Roads H and Supports R	Box of two H with two R Supports ...	5/6
Fields J1 and J2	Box of four (two J1 and two J2) ...	11/–
Fields J3	Box of two	2/–
Fields K1 and K2 ...	Box of four (two K1 and two K2) ...	8/–
Fields L1 and L2 ...	Box of four (two L1 and two L2) ...	7/–
Fields M1 and M2 ...	Box of four (two M1 and two M2) ...	5/–



MODELLED MINIATURES
No. 13
HALL'S DISTEMPER ADVERTISEMENT
This miniature of a well-known lineside advertisement is intended to be placed in the fields adjoining the railway track. **Price 9d.**



MECCANO LIMITED — OLD SWAN — LIVERPOOL

Suggested Hornby Train Improvements

SNOW PLOUGHS

During the winter months the Hornby Snow Plough is a very appropriate vehicle to be seen in service on a miniature layout. It is of the rotary type, which consists of a special vehicle carrying at the front a large scoop, in which is housed a fan or propeller with numerous blades set at an angle. This fan is rotated at high speed as the plough moves along, and so cuts its way through snowdrifts, flinging the excavated snow clear of the track through a chute in the top of the scoop or casing. The Hornby vehicle is of sturdy construction and runs on four specially heavy spoked wheels. On the leading axle is a small pulley connected with a corresponding pulley on the fan shaft by means of a spring belt, so that the fan revolves as the Plough is pushed along. It makes a very interesting sight as it is propelled in this manner at the head of a passenger or freight train; or if a heavy drift is supposed to be obstructing the line, as the leading unit of a special snow-clearing train.

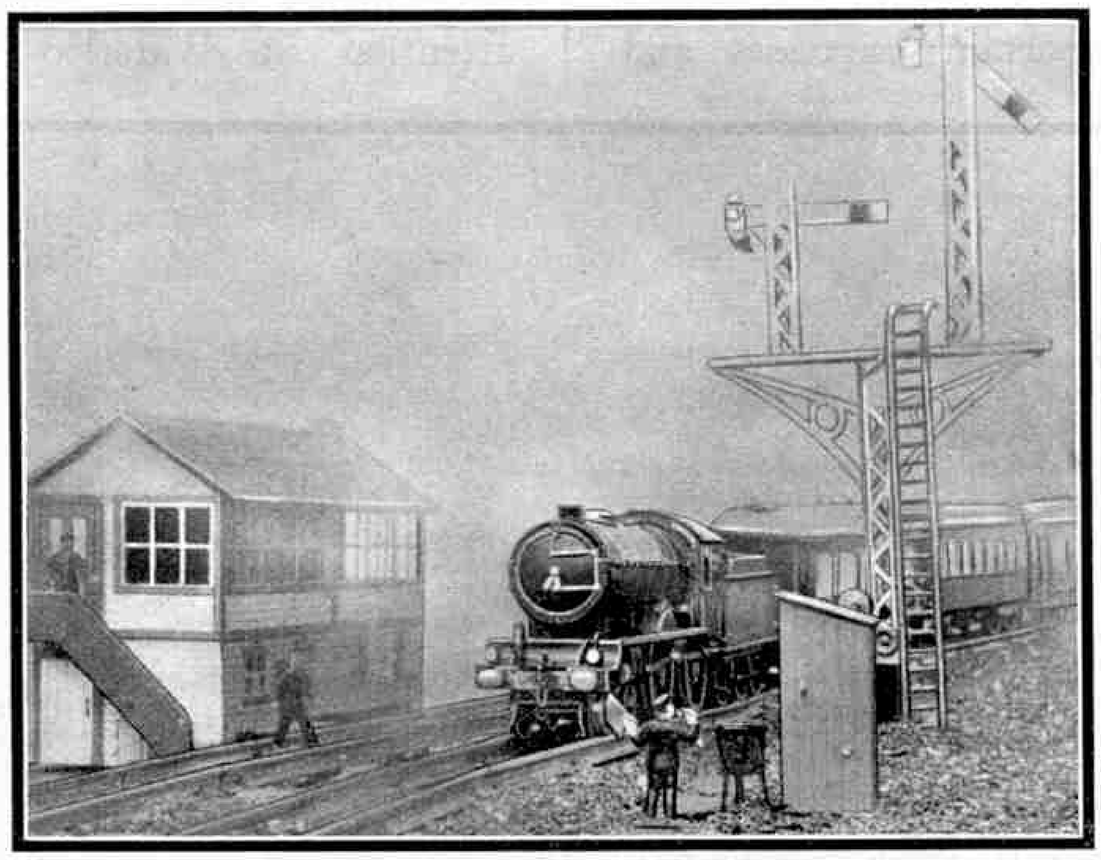
Some readers may care to test the actual capacity of the Plough. A suitable material will be found in the cork chippings that are used for packing purposes, and they may be had from most greengrocers. These should be distributed along a length of track and different depths of "drift" matched against the Plough. The bottom edge of the scoop is normally some distance from rail level, to allow for such items as the ramp of the Brake and Reverse Rail. This edge will have to be bent downward slightly, so that it barely clears the rails, otherwise the Plough is likely to be derailed by the obstructing "drifts." When the Plough is propelled by a locomotive it is quite exciting to watch it deal with the "snow," the track being cleared in a realistic manner. The lubrication of the various parts should be attended to, as the free working of the Plough mechanism is essential. A little oil behind the fan itself and behind the brass collar within the casing, in addition to the fan shaft bearing inside the body of the vehicle, will make the operation of the Plough quite smooth.

THE HORNBY COMBINED RAIL GAUGE, SCREWDRIVER AND SPANNER

Tools of many kinds are necessary in the maintenance of machinery, the usual oil can and spanner being supplemented by numerous special-purpose types developed for the peculiar needs of particular machines. To our readers the kits of tools supplied with motor cars are probably the most familiar examples of this kind of equipment. As might be expected, numerous special gadgets are in use in connection with the maintenance of locomotives.

The handy Meccano Spanner has probably been used by every Hornby Railway owner at one time or another in attending to the servicing of Hornby Locomotives. Recent developments have led up to the production of the combined Rail Gauge, Screwdriver and Spanner that is packed with the various Hornby locomotives where its use is appropriate, and is available separately at 3d. As will be realised from its name, it is distinctly a multi-purpose implement. It resembles an ordinary spanner, except that what would be the handle portion is specially shaped along one edge, the width across two projecting pieces of metal exactly corresponding to the width between Hornby rails, so that this portion forms a useful rail gauge. For testing any doubtful pieces of track, and for checking up the truth of the line generally, it is invaluable, for it instantly shows up any "tight" places that might cause derailments by "pinching" the flanges of the wheels. The centre of the gauge is specially recessed to permit of its use on electrical layouts, where the centre rail has to be allowed for.

The tail end of the tool is tapered like a screwdriver blade, and a small recess is provided in the centre of its tip. This screwdriver is intended for use with the circular nuts that secure the wheels of certain Hornby clockwork and electric locomotives to the axles, the wheel bosses having circular recesses to house the nuts. The nuts are slotted across to receive the screwdriver, but as the axle passes through and projects into the slots, the centre of the screwdriver blade is cut out to clear it. The screwdriver portion is set at a convenient angle to the rest of the tool to allow of its easy use.



A fog scene on a Hornby railway! The train is about to restart after a signal stop; the figure crossing the track represents the fireman returning from the cabin where he has been to announce the presence of his train, according to rule.

The other end is shaped like an ordinary Meccano Spanner and will be found useful when the coupling or connecting rods of a locomotive are removed, as it fits the hexagon nuts provided on the screwed type of pins. In removing the mechanism the Meccano-type nuts on the mechanism-holding bolts also may be dealt with. Thus for general use, and particularly for running repairs to Hornby locomotives, the Combined Rail Gauge, Screwdriver and Spanner should be included in the equipment of every Hornby Railway engineer.

LOADING GAUGES

The loading gauge is a familiar feature of every goods yard, large or small. Normally it consists of a timber post with a projecting cross-piece, and to some extent it resembles an old-time gallows! From the cross-piece is suspended the curved metal gauge bar that indicates the limits for loading when bulky consignments are being dealt with. On some gauges a small bell is mounted on the gauge bar, so that if the bar is struck by the load, an audible indication of the excessive dimensions of the latter is given. The structure is of course so placed that the gauge bar is suspended centrally over the track concerned. Sometimes, where several tracks are involved, a gantry type of structure is used to span them, with a corresponding number of suspended gauge bars. With characteristic individuality the G.W.R., in addition to the timber type of loading gauge, have some of metal construction, the post being formed of two rails together, set in a concrete bed, the cross-piece being tubular.

Two Loading Gauges are included in the Hornby system, the ordinary Hornby pattern, and the M Series Gauge of simplified construction. The former consists of a stout post capped by a finial as in signalling practice, and from this projects the cross-piece and its supporting beam. The curved gauge bar is suspended by two light chains, and at its extremities has two small hinged pieces of special shape. In actual practice such fittings are not made of metal like the gauge bar, but of some lighter material. The object is to avoid injury to an engineman who might have to lean well out of his cab during shunting operations, to catch the yardmen's signals, and who might possibly strike his head against the fittings.

The M Series Loading Gauge is of simpler construction, but is none the less effective for its purpose. The post and the cross-piece and its support are made in one piece, and are thus very strong. The top of the post is finished off to represent the small cap type of finial, while its foot is embedded in a neat cast metal base. Again the gauge bar and the pieces at its ends are made in one, this assembly being neatly secured to the cross-piece.

Both Gauges are painted white, and their finials and the lower parts of the posts are picked out so that they conform with the Signals of the Hornby Series in this respect. Either may be used effectively by the Goods Department of a Hornby railway, and in a yard one should be placed in a convenient position near the Goods Platform. In a big yard, with a number of Platform Cranes in use, several gauges may be necessary, but the operator's convenience in handling the locomotive or wagons may cause the elimination of one or other of them. Even if only a single siding is available for loading, a Gauge looks quite well, and its provision ensures that the equipment of the line is reasonably complete.

METROPOLITAN LOCOMOTIVES.—The inclusion of steam-outline locomotives in Metropolitan colours in the Hornby Series would certainly render our range of locomotives more complete. As you point out, Metropolitan locomotives are interesting in themselves, but it is doubtful whether there would be sufficient demand to justify any true-to-type models. For the majority of enthusiasts suitable examples of the standard Hornby locomotives finished in the style of the Metropolitan Railway would probably be satisfactory. We note your remark that additions in transfers alone would be necessary, for the present red colour used for L.M.S.R. passenger locomotives would do for Metropolitan stock equally well. *(Reply to I. Weaver, Leyton, E.10.)*

SEPARATE VACUUM BRAKE PIPES FOR HORNBY ROLLING STOCK.—Your suggestion is interesting, and the addition of suitable vacuum brake pipes would increase the realism—and also the price—of the various items of rolling stock in the Hornby Series. Possibly you are unaware that the plain pattern of vacuum brake pipe that is used on the tenders of our No. 2 Special Locomotives could be fitted fairly easily by enthusiasts to almost any item of rolling stock. These fittings may be obtained by ordering them specially at 2/3 a dozen, the postage on this quantity amounting to 3d. *(Reply to R. O. Bridges, Hutton, Essex.)*

EIGHT-WHEELED TENDERS.—We agree that additional realism would be obtained if our No. 3 "Flying Scotsman" and "Lord Nelson" Locomotives were provided with eight-wheeled tenders of the patterns used by those engines in actual practice. Such special vehicles would necessitate an increase in price as compared with the existing tenders, however, particularly if the L.N.E.R. example were adapted as a corridor tender and connected to the train by means of a standard Pullman gangway. We shall not lose sight of your idea, however, and as soon as further true-to-type introductions are to be made in the Hornby Series the claims of the tenders that you mention will no doubt be considered. *(Reply to F. Yates, Worcester.)*

L.—"SOUTHERN" HORNBY TRAINS

PREVIOUS articles that have appeared in the "*M.M.*," dealing with various train services and their reproduction, by means of suitable locomotives and rolling stock of the Hornby Series, have proved very popular with our readers. To show still further the possibilities in this direction, the Southern group is to receive consideration this month, and in particular the Western section. This has numerous interesting characteristics, and many important expresses and other trains are operated over it. The Western section of course refers to the lines forming the one-time London and South Western Railway, running from Waterloo to Salisbury, Exeter and Plymouth; at Worting Junction the Southampton, Bournemouth and Weymouth line diverges, and there is of course also the Portsmouth route.

The Brighton route has long had its "*Southern Belle*," while the "*Continental Express*," and more recently the "*Golden Arrow*," of the Dover line are also well known; and the running of these trains in miniature has previously been mentioned in these pages. Until grouping, however, the Western section could not boast any named trains, but modern railway publicity created the title "*Atlantic Coast Express*" for the principal mid-morning train to the West. Similarly the "*Bournemouth Limited*" of 1929 saw the restoration of the two-hour non-stop schedules that were a feature of pre-war timetables. More recently still the re-introduction, after many years, of Pullmans to the Bournemouth service produced the luxurious "*Bournemouth Belle.*"

A notable feature of the Western section is the extensive and up-to-date terminus at Waterloo, which has 21 platforms and covers an area of 24½ acres. We can hardly hope to have 21 platforms in miniature, but special attention should be given wherever possible to a more or less spacious terminus such as exists in real practice. A familiar feature is the overhead or "A" signal box, which is on the site of an older structure. The reproduction of such a feature will no doubt be of interest to miniature railway engineers. Even if it is not possible to arrange for the control of signals and points from above, a dummy cabin on these lines would be very effective.

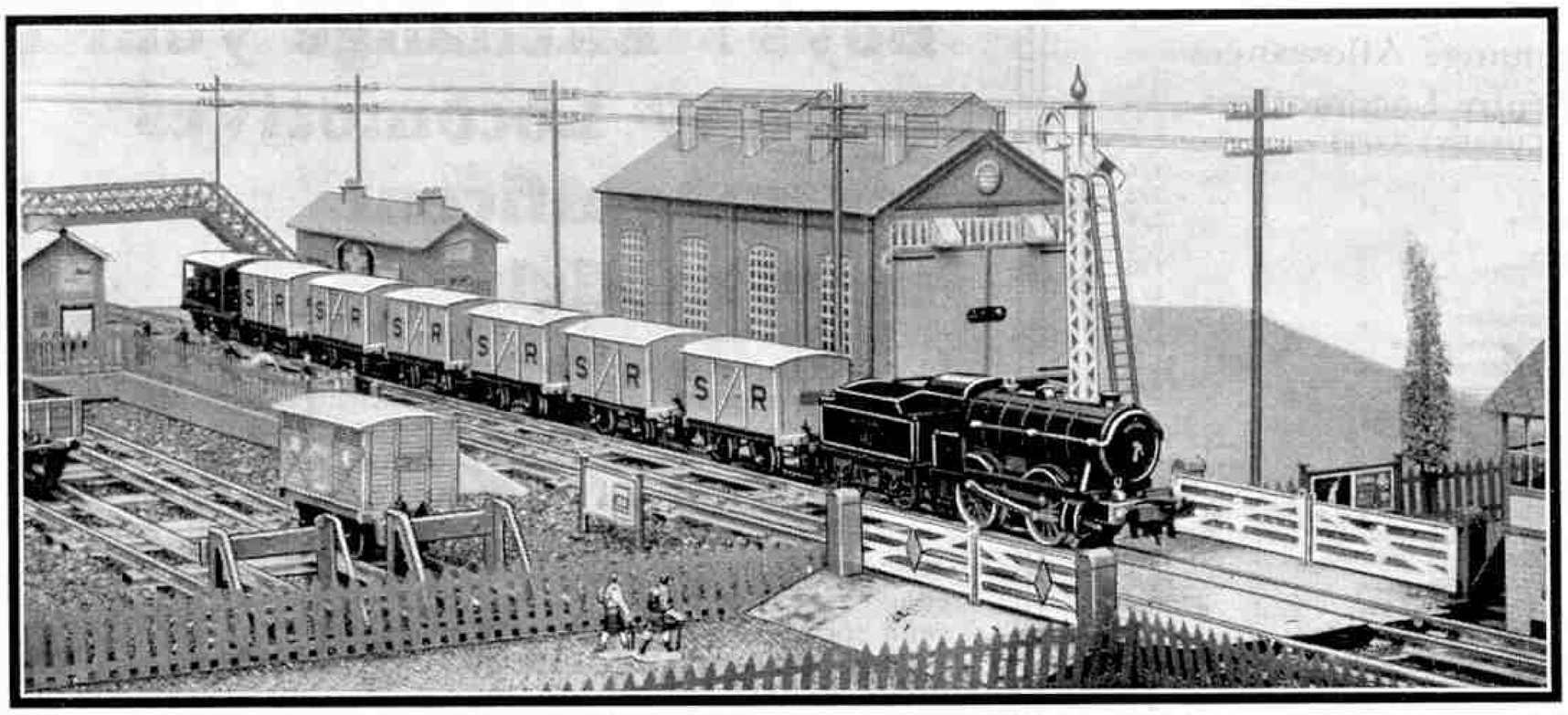
The fact that suburban traffic is electrically handled by multiple-unit trains may compel us to restrict our attention at Waterloo to long-distance "steam" traffic, but there is a fascinating feature in the amount of freight dealt with at Nine Elms Depot, which will naturally require provision for its handling in miniature. Again—still in the suburban area—lies Feltham Yard, the great concentration centre of the S.R., dealing with miscellaneous traffic to and from all quarters. This is not actually on the main line, but it is favourably situated on a loop line, and should certainly be included as far as is possible in miniature to enable the traffic working to be complete.

An S.R. Pullman Express hauled by a No. 2 Special Locomotive. Although an Eastern section engine it may be used on a miniature "Western section" layout, as locomotive exchanges are frequently made between different sections in actual practice.

If we assume that the Bournemouth main line is our prototype, in order to include the all-Pullman "*Bournemouth Belle*," once again we have a splendid opportunity for the employment of the Hornby No. 2 Special vehicles, complete with nameboards, displaying the proud title "*Bournemouth Belle.*" The locomotive used, if a Hornby No. 3E or No. 3C "Lord Nelson," may have the smoke deflectors reproduced in cardboard, as shown in one of the accompanying illustrations and as several times suggested in the "*M.M.*" A point of interest in connection with the Southern, to which we have drawn attention before, is the extensive use of head code discs. These indicate the routes taken by the various trains, for the Southern lines are very complex, even on individual sections. On the Western section fortunately the classification is fairly simple and the same photograph shows the code applying to trains for the Bournemouth line. If we were operating a miniature "*Atlantic Coast*

Express," the indication would consist of one disc below the chimney and one on the centre of the buffer beam.

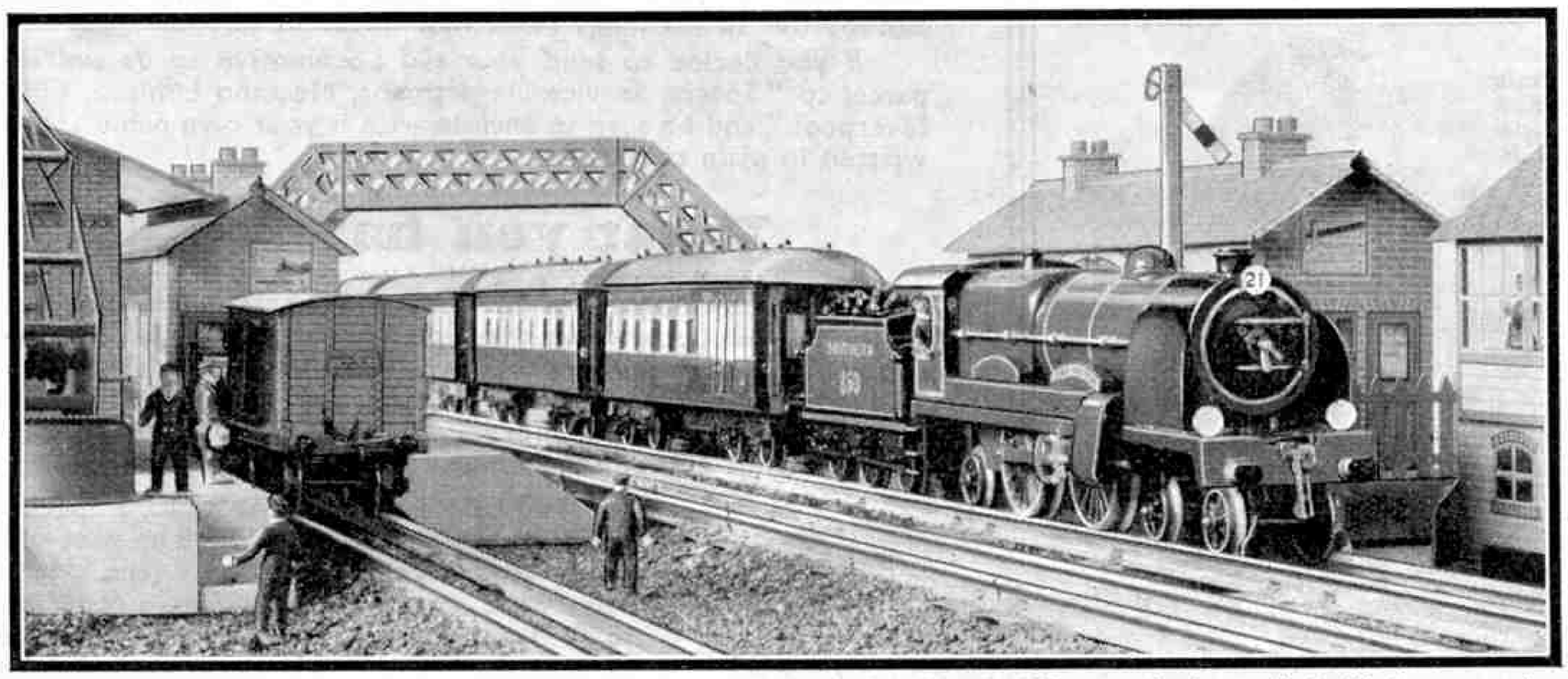
These discs may be made of circles of white card, rather less than $\frac{3}{8}''$ in diameter—11/32" to be exact—while a small strip of paper should be stuck on behind to form a loop. Another interesting feature, and certainly one that adds to the realistic effect of a Southern train when reproduced in miniature, is the fact that one or other of the discs displayed by Western section engines has a number on it. These numbers apply to the turns of duty undertaken by the locomotives at the various sheds, different numbers being carried on Sundays owing to the reduced number of turns to be worked. On weekdays the numbers allotted to Nine Elms—the principal depot in the London district—are 1 to 118, and on Sundays 1 to 43. The only other depot that need concern us at the moment is Bournemouth, where the corresponding numbers are 380 to 413 on weekdays and 109 to 114 on Sundays.



A train of Refrigerator Vans on a miniature Southern Railway. This reproduces very well the real "Southampton Meat Specials" that carry imported meat to London at express speeds.

The presence of the port of Southampton on the route to Bournemouth introduces further features of interest. A great deal of "Ocean Liner" traffic is dealt with there, and there are many other less known maritime activities. If possible suitable facilities should be provided in miniature, even if the docks and the shipping have to be represented on a scenic background owing to limitations of space. Where such features can be incorporated the various items of quayside equipment will of course be most effective. Pullman cars have now for some time been run on the boat trains, and the Hornby vehicles of this type will appear most important if duly labelled "*Ocean Liner Express.*" In actual practice the starting and terminal points, "*Waterloo*" and "*Southampton Docks,*" are also included, but it will probably be necessary in miniature to omit these. Again, any trains running in connection with special cruises will add to the amount of traffic to be dealt with, and the Southern steamer services to the Channel Islands and French ports must not be forgotten, for during the Bank Holiday week-end last August over 10,000 people were conveyed there from Southampton.

As regards goods and perishable traffic, there is a great deal of chilled meat imported at Southampton, and most of this is conveyed to London in S.R. refrigerator vans, or special containers. Several trains may be required according to circumstances, and they are run at express speed up to Nine Elms Depot, where motor vehicles take their loads on to Smithfield. One of our photographs shows such a train in miniature made up of Hornby S.R. Refrigerator Vans in their characteristic pinkish buff colour, and hauled by a No. 1 Special Locomotive. The Southern Railway, on account of its situation, has not a great deal of heavy goods and mineral traffic to be dealt with, so that we do not find any of the "goods and mineral" type of engine, though there are many useful mixed traffic locomotives. These are quite suitable for general and fast goods work, and the more important of them can of course be pressed into service on passenger trains when necessary.



A miniature all-Pullman train representing the "Bournemouth Belle." The Hornby 3C Locomotive is provided with dummy smoke deflectors and carries the correct head code of three discs, one of the latter displaying the number of the locomotive "turn" of duty involved, which is a characteristic feature of the practice of the Western section of the S.R.

For this reason a miniature Southern system should certainly include a Hornby No. 1 Special Tender Locomotive, which may represent the numerous 2–6–0 mixed traffic engines used on the S.R. The example shown in the photograph bears a Central section number "B 343," but as locomotives are frequently exchanged between the three sections, according to traffic demands, this is no great objection. In miniature, therefore, Eastern, Central and Western section engines may quite reasonably be used together on a layout representing perhaps one section only, as in the case we are considering. Another of our photographs shows a Hornby No. 2 Special Locomotive "Southern A 759" on Western section duties.

HORNBY TRAINS

Part Exchange Allowances for Hornby Locomotives

CURRENT TYPES	
M0 Locomotive	1/4
M1 /? Locomotive	2/3
M3 Tank Locomotive	3/9
No. 0 Locomotive	5/3
No. 1 Tank Locomotive	6/3
No. 1 Locomotive	6/3
No. 1 Special Locomotive	8/3
No. 1 Special Tank Locomotive	8/3
No. 2 Special Locomotive	11/3
No. 2 Special Tank Locomotive	11/3
No. 1 Electric Tank Locomotive, Permanent Magnet	12/6
No. 2 Electric Tank Locomotive	18/9
No. 3E Locomotive	18/9
No. 3E Riviera " Blue " Locomotive	18/9
No. 3C Locomotive	13/9
No. 3C Riviera " Blue " Locomotive	13/9
Metropolitan C Locomotive	11/3
Metropolitan L.V. Locomotive	20/-
OBSOLETE TYPES	
M2930 Locomotive	1/-
George V Locomotive (These models were identical)	3/3
No. 00 Locomotive (These models were identical)	3/3
M3 Locomotive	4/3
Zulu Locomotive	5/3
Zulu Tank Locomotive	6/3
No. 2 Locomotive	10/-
No. 2 Tank Locomotive	11/3
No. 1 Locomotive, fitted for Hornby Control	7/6
No. 1 Tank Locomotive, fitted for Hornby Control	7/6
No. 2 Locomotive, fitted for Hornby Control	11/3
No. 2 Tank Locomotive, fitted for Hornby Control	12/6
Metropolitan H.V. Locomotive	20/-

A keen Hornby Train enthusiast operating a Hornby No. 2 Special Locomotive, L.N.E.R. "Yorkshire."

Boys ! Exchange your old Hornby Locomotives for magnificent new models

Thousands of Hornby Train enthusiasts have already taken advantage of our wonderful Part Exchange offer and are now the proud owners of brand new Locomotives in place of their old ones. They realise that the Hornby Part Exchange Scheme represents the finest and most generous offer ever made to owners of Hornby Locomotives.

Perhaps you, too, have a Hornby Locomotive that you have been using for some years and would now like to exchange for one of the fine new models featured in the latest Hornby Catalogue. If you have you should carefully study the range shown in the catalogue, and select the up-to-date Hornby Locomotive you want. Then, carefully pack up your old Hornby Locomotive and post it to us, enclosing your order for the new one and the necessary remittance. You can easily ascertain how much to send by deducting the part exchange allowance indicated in the accompanying list from the price of the new Locomotive, and adding 1/- for postage on the new model you purchase.

If you prefer to do so, you can effect the exchange through your dealer, who will be pleased to give you all the information you require.

The allowance that will be made for your old Locomotive is shown in the list of Part Exchange allowances for Hornby Locomotives given on this page. Please note that the catalogue price of the new Hornby Locomotive you purchase *must not be less than double the Part Exchange allowance made for your old Locomotive.*

No matter what the age or condition of your old Locomotive, you can exchange it under our " Part Exchange " plan. It is important to note that we cannot accept more than one old Locomotive in exchange for a new Locomotive.

If you decide to send your old Locomotive to us address your parcel to " Special Service Department, Meccano Limited, Old Swan, Liverpool," and be sure to enclose with it your own name and address written in plain characters.

What you have to do

Here is an example of how the plan works. Assuming you have a No. 1 Tank Locomotive that you wish to exchange, you see from the list that its exchange value is 6/3. You then look at the Hornby Train catalogue and choose one of the new Locomotives, the cost of which is not less than 12/6 (or, in other words, not less than double the Part Exchange allowance we make for your No. 1 Tank Locomotive).

You decide, say, to have a No. 2 Special Tank, the price of which is 25/-. Pack up your old No. 1 Tank and deduct 6/3 from 25/- (the price of the new No. 2 Special Tank), enclose a remittance for 18/9 plus 1/- carriage on the new Locomotive—19/9 in all. Send the Locomotive and the remittance to Meccano Limited, Liverpool.

Alternatively, you can take your old No. 1 Tank Locomotive to your dealer with a remittance for 18/9, and he will give you the new No. 2 Special Tank Locomotive that you require.

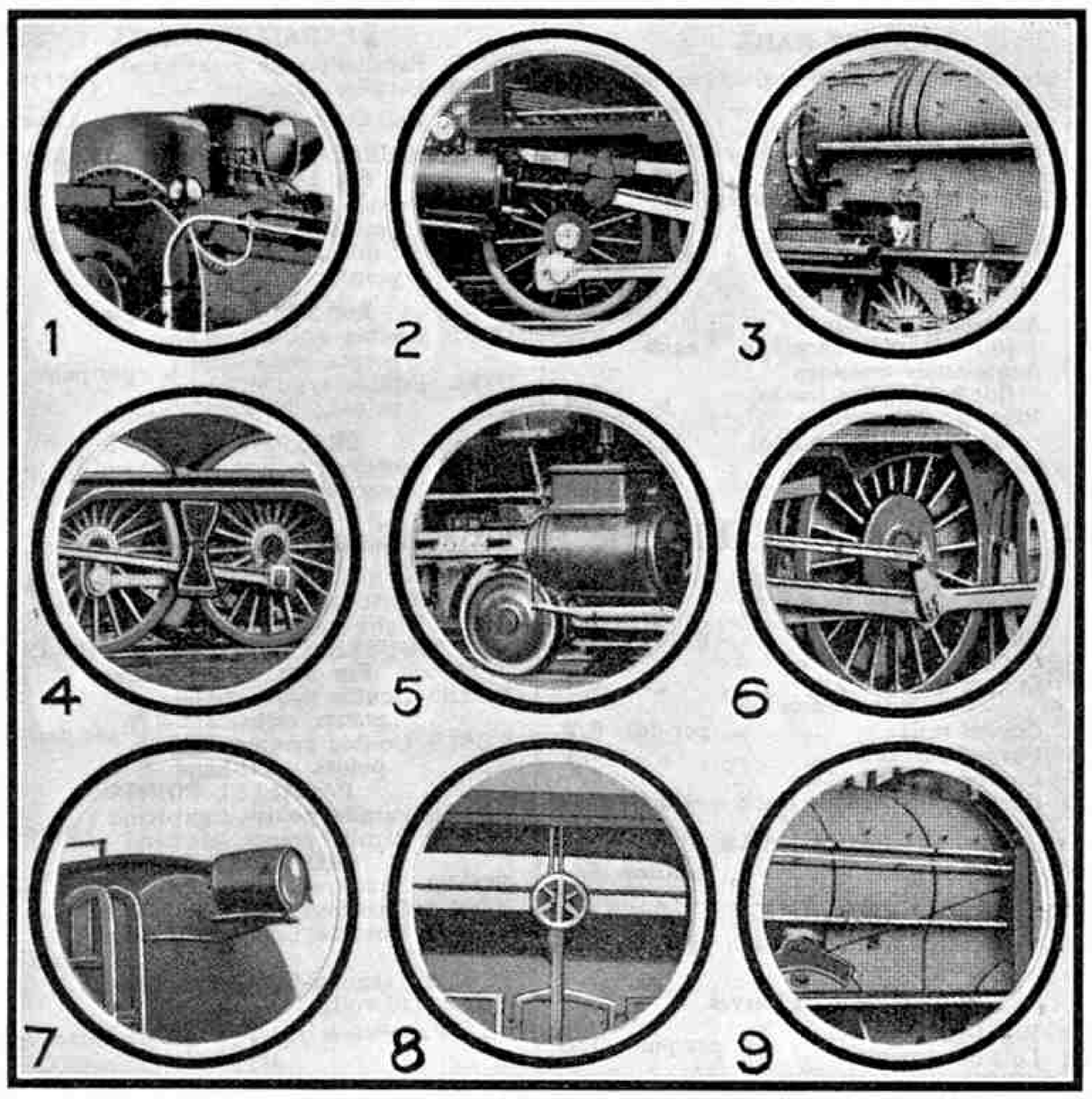
MECCANO LTD.
Special Service Dept., Old Swan
Liverpool

H.R.C. COMPETITION PAGE

Competitions appearing on this page are open only to members of the Hornby Railway Company. Envelopes containing entries should have the title of the competition clearly written in the top left-hand corner and should be addressed to the Hornby Railway Company, Binns Road, Old Swan, Liverpool. The name, address and membership number of each competitor should appear in clear writing on every sheet of paper used.

AN INTERESTING LOCOMOTIVE PROBLEM

The majority of locomotives, both in this country and overseas, possess some outstanding feature that makes them recognisable even at a casual glance. Some classes are practically identical in general design, but there is nearly always some point that distinguishes them. For instance, there is a remarkable likeness between the superheated "Precursors" and the "George the Fifths" of the L.M.S.R., but there is one feature that places them apart, and that is the wheel splashers. The "George the Fifth" class have a straight-topped splasher over the leading driving wheels extending to the cab, whereas the superheated "Precursors" have a simple semi-circular splasher. Again, the older G.W.R. 4-6-0s of the two-cylinder "Saint" or "Court" classes and the four-cylinder "Star" class are generally similar, yet the position and shape of their outside cylinders varies. When viewed from the front the box-like casing that houses the inside piston valves, projecting below the smoke-box, makes the four-cylinder engines instantly discernible from the two-cylinder ones. From the front end, too, the outside steam pipes of the L.N.E.R. "Shires" with poppet valves enable them to be picked out from the ordinary piston valve engines.



It is good fun and splendid practice to try to identify locomotives entirely by their special characteristics, and in this month's competition we provide H.R.C. members with an opportunity of doing this. We illustrate parts of nine locomotives, and in each case the portion shown gives a clue to the identity of the locomotive. Competitors are required to state the class of the locomotive, its wheel arrangement, and the owning railway company.

Hornby Train goods (or Meccano products if preferred) to the value of 21/-, 15/-, 10/6 and 5/- respectively will be awarded to the four competitors in each of the two sections, Home and Overseas, who submit the most nearly correct solutions in order of merit. In the case of a tie for any prize, consideration will be given to the neatness and general style of the entries.

Envelopes containing entries should be marked "*H.R.C. Locomotive Problem*" and posted to reach Meccano Ltd., Binns Road, Old Swan, Liverpool, not later than 28th February. The closing date for the Overseas section is 31st May.

It must be remembered that the omission of the H.R.C. number from any entry will cause it to be disqualified. This is an important condition to which members should pay special attention, as its neglect in the past has caused entries to be discarded that otherwise might have been successful. Members should ensure that their name and full address is clearly written on each sheet of paper submitted, as entries continue to be sent in not bearing any name and address.

Drawing Contest

Drawing contests with items of railway interest as their subjects always produce a good crop of entries, and therefore this month we announce another. In each of our previous contests of this nature it has been necessary to submit a drawing of a certain specified subject; this month, by way of variety, we allow competitors to choose their own subjects. In order to enter this contest, therefore, all that is necessary is to submit a drawing of any item of railway interest. This freedom from restrictions gives every H.R.C. member an opportunity of drawing his favourite subject or the one with which he happens to be most familiar.

To the senders of the four best entries received in each section, Home and Overseas, will be awarded prizes consisting of Hornby railway material, Meccano products, or drawing materials, to the value of 21/-, 15/-, 10/6 and 5/- respectively. In addition a number of consolation prizes will be awarded to entries that just fail to reach prize-winning standard.

A competitor may submit more than one drawing if he so desires, but no competitor will be awarded more than one prize. On the back of each drawing must be clearly written the sender's name and full address, and H.R.C. membership number. Unsuccessful entries will be returned if they are accompanied by a stamped addressed envelope of suitable size.

Envelopes containing entries must be marked "H.R.C. Drawing Contest," and posted to reach Headquarters at Meccano Limited, Binns Road, Old Swan, Liverpool, not later than 28th February. The closing date for the Overseas Section is 31st May.

Original drawings will have a better chance of success than those that are copied from illustrations that have appeared in the "*M.M.*" or elsewhere.

COMPETITION RESULTS

HOME

November "Hidden Stations Contest."—First: A. Bruce (3937), Cleadon, Nr. Sunderland. Second: D. H. Bayes (25638), Walthamstow, London, E.17. Third: J. F. Aylard (25864), Old Southgate, London, N.14. Fourth: R. C. Forrest (18603), Ilford, Essex.

November "Engine Shed Drawing Contest."—First: P. A. Vicary (25935), Cromer, Norfolk. Second: C. A. Brunt (10229), Leeds. Third: D. W. England (29151), Woodside, Aberdeen. Fourth: K. Costain (5108), Bolton, Lancs.

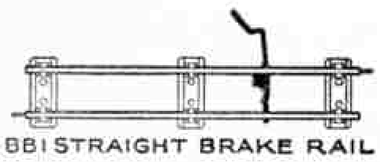
November "Accessory Voting Contest."—First: S. L. Dorman (1488), Sedbergh, Yorks. Second: G. W. R. Whitby (30872), New Southgate, London, N.11. Third: R. H. Mousley (3053), Luton, Beds. Fourth: V. Lemaistre (30067), Broughty Ferry, Angus, Scotland.

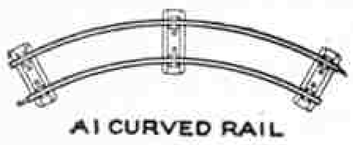
OVERSEAS

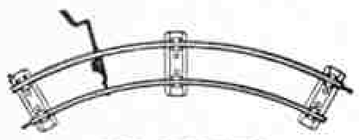
August "Mutilated Names Contest."—First: D. J. White (9333), Dunedin, New Zealand. Second: H. H. Matthews (24642), Parramatta, N.S.W., Australia. Third: S. Smith (30082), Dunedin, New Zealand. Fourth: C. McCrorie (21337), Dunedin, New Zealand. Consolation prizes: R. B. McMillan (9592), Melbourne, Australia; G. Hallack (17578), Capetown, S. Africa; H. C. Key (24764), Park Circus, Calcutta, India; J. G. Gnanadurai (1964), Trichinopoly, India; B. Chiles (9191), Port Elizabeth, S. Africa.

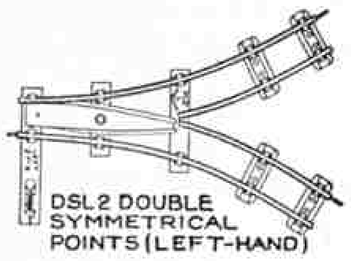
Hornby Rails, Points and Crossings

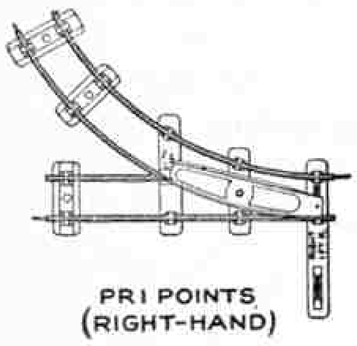
B1 STRAIGHT RAIL

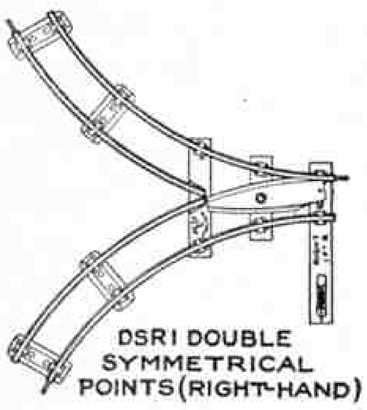

BB1 STRAIGHT BRAKE RAIL

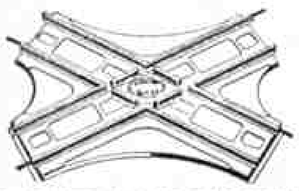

A1 CURVED RAIL


AB1 CURVED BRAKE RAIL


DSL2 DOUBLE SYMMETRICAL POINTS (LEFT-HAND)


PR1 POINTS (RIGHT-HAND)


DSR1 DOUBLE SYMMETRICAL POINTS (RIGHT-HAND)


CA2 ACUTE-ANGLE CROSSING

Rails for Clockwork and Steam Trains, Gauge 0, 1¼″

CURVED RAILS

9-in. Radius (for M0 Trains)

M9	Curved rails	... per doz.	3/-
MB9	Curved brake rails ...	... each	3½d.

1-ft. Radius

A1	Curved rails	... per doz.	4/6
A1½	Curved half rails ...	... "	3/6
A1¼	Curved quarter rails	... "	3/-
AB1	Curved brake rails ...	... each	6d.

2-ft. Radius

A2	Curved rails	... per doz.	4/6
A2½	Curved half rails ...	... "	3/6
A2¼	Curved quarter rails	... "	3/-
AB2	Curved brake rails ...	... each	6d.
DC2	Curved rails, double track ...	½ doz.	7/6

STRAIGHT RAILS

BM	Straight rails (for M0 Trains)	per doz.	2/9
B1	Straight rails	"	4/-
B½	Straight half rails	"	3/-
B¼	Straight quarter rails ...	"	2/6
BB1	Straight brake rails... ...	each	5d.
BBR1	Straight brake and reverse rails	"	1/6
DS1	Straight rails, double track	½ doz.	6/6

CROSSINGS

CA1	Acute-angle crossings (for 1-ft. radius tracks)	each	2/-
CA2	Acute-angle crossings (for 2-ft. radius tracks)	"	1/9
CR1	Right-angle crossings (for 1-ft. radius tracks)	"	2/-
CR2	Right-angle crossings (for 2-ft. radius tracks)	"	1/9

POINTS

9-in. Radius (for M0 Trains)

MR9	Right-hand points	per pair	3/-
ML9	Left-hand points		

For 1-ft. Radius Curves

PR1	Right-hand points	per pair	4/-
PL1	Left-hand points		

For 2-ft. Radius Curves

PR2	Right-hand points	per pair	4/-
PL2	Left-hand points		
PSR2	Points on solid base, right-hand	per pair	8/6
PSL2	Points on solid base, left-hand		

PARALLEL POINTS

PPR2	Parallel points, right-hand	per pair	5/-
PPL2	Parallel points, left-hand		
RCP	Rail Connecting Plates ...	½ doz.	2d.

DOUBLE SYMMETRICAL POINTS

For 1-ft. Radius Curves

DSR1	Double symmetrical points, right-hand	per pair	5/-
DSL1	Double symmetrical points, left-hand		

For 2-ft. Radius Curves

DSR2	Double symmetrical points, right-hand	per pair	5/-
DSL2	Double symmetrical points, left-hand		

CROSSOVER POINTS

COR2	Crossover points, right-hand	per pair	12/-
COL2	Crossover points, left-hand		

Rails for Electric Trains, Gauge 0, 1¼″

CURVED RAILS

1-ft. Radius

EA1	Curved rails ...	... per doz.	6/6
EA1½	Curved half rails ...	... "	4/6
EA1¼	Curved quarter rails	... "	4/-

2-ft. Radius

EA2	Curved rails ...	... per doz.	6/6
EA2½	Curved half rails ...	... "	4/6
EA2¼	Curved quarter rails	... "	4/-
EDC2	Curved rails, double track	½ doz.	9/-

STRAIGHT RAILS

EB1	Straight rails ...	... per doz.	6/-
EB½	Straight half rails ...	... "	4/6
EB¼	Straight quarter rails	... "	4/-
EDS	Straight rails, double track	½ doz.	8/6

POINTS

For 2-ft. Radius Curves

EPR2	Right-hand points	per pair	7/6
EPL2	Left-hand points		

CROSSINGS

ECA	Acute-angle crossings ...	each	4/-
ECR	Right-angle crossings ...	"	4/-

DOUBLE SYMMETRICAL POINTS

For 2-ft. Radius Curves

EDSR2	Double symmetrical points, right-hand	per pair	8/6
EDSL2	Double symmetrical points, left-hand		

PARALLEL POINTS

EPPR2	Parallel points, right-hand	per pair	8/6
EPPL2	Parallel points, left-hand		

CROSSOVER POINTS

ECOR2	Crossover points, right-hand	per pair	24/-
ECOL2	Crossover points, left-hand		
TCPL6	Terminal Connecting Plates (6-volt)	each	1/6
TCPL20	Terminal Connecting Plates (20-volt)	"	1/6

Electrical Points for 1-ft. radius curves are not supplied.

Centre Rails for Converting Ordinary Track to Electrical

CURVED CENTRE RAILS

1-ft. Radius

AC1	Curved centre rails ...	per doz.	1/-
AC1½	Curved centre half rails ...	"	9d.
AC1¼	Curved centre quarter rails	"	6d.

2-ft. Radius

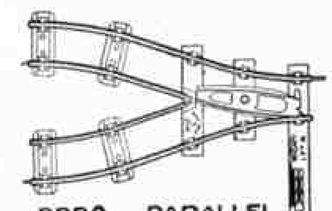
AC2	Curved centre rails ...	per doz.	1/-
AC2½	Curved centre half rails ...	"	9d.
AC2¼	Curved centre quarter rails	"	6d.

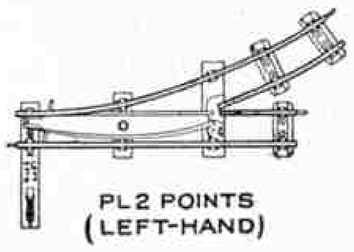
STRAIGHT CENTRE RAILS

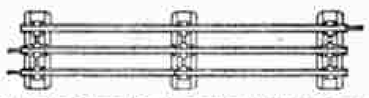
BC1	Straight centre rails ...	per doz.	1/-
BC½	Straight centre half rails ...	"	9d.
BC¼	Straight centre quarter rails	"	6d.

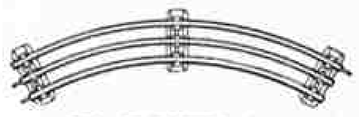
ICR	Insulators for insulating centre rails	per doz.	3d.
CCR	Clips for fixing centre rails	"	6d.

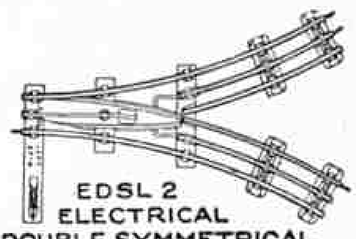
The realistic miniature railway layout shown below is only one of many that can be constructed with Hornby Rails, Points and Crossings. Many interesting illustrations and much useful information is given in a booklet entitled "How to plan your Hornby Railway." This booklet is obtainable from your dealer, price 3d., or from Meccano Ltd., Old Swan, Liverpool, price 4d. post free.

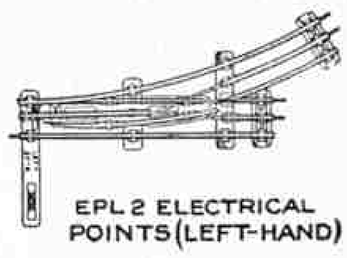

PPR2 PARALLEL POINTS (RIGHT-HAND)

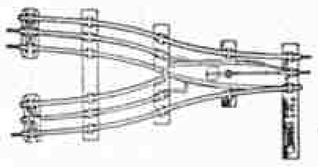

PL2 POINTS (LEFT-HAND)

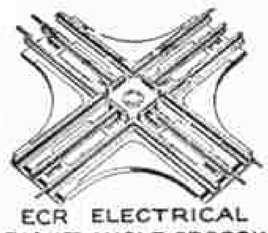

EB1 ELECTRICAL STRAIGHT RAIL

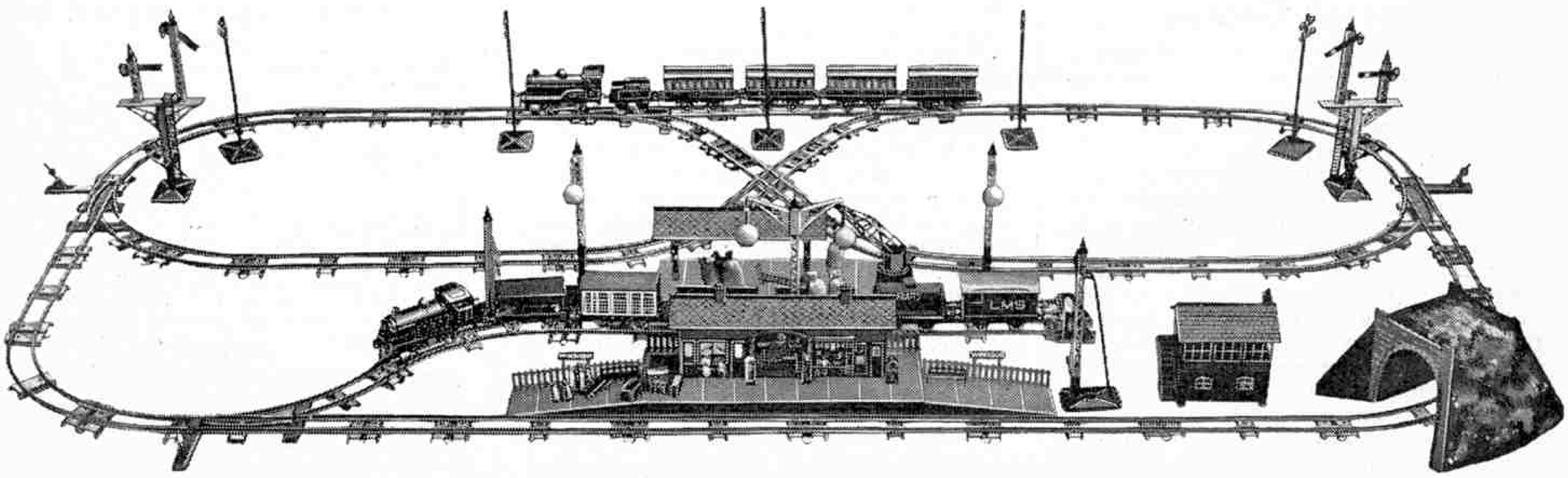

EA1 ELECTRICAL CURVED RAIL


EDSL2 ELECTRICAL DOUBLE SYMMETRICAL POINTS (LEFT-HAND)


EPL2 ELECTRICAL POINTS (LEFT-HAND)


EPPR2 ELECTRICAL PARALLEL POINTS (RIGHT-HAND)


ECR ELECTRICAL RIGHT-ANGLE CROSSING



Manufactured by MECCANO LIMITED - OLD SWAN - LIVERPOOL

The Hornby Railway System, 1920-1933

By "Tommy Dodd"

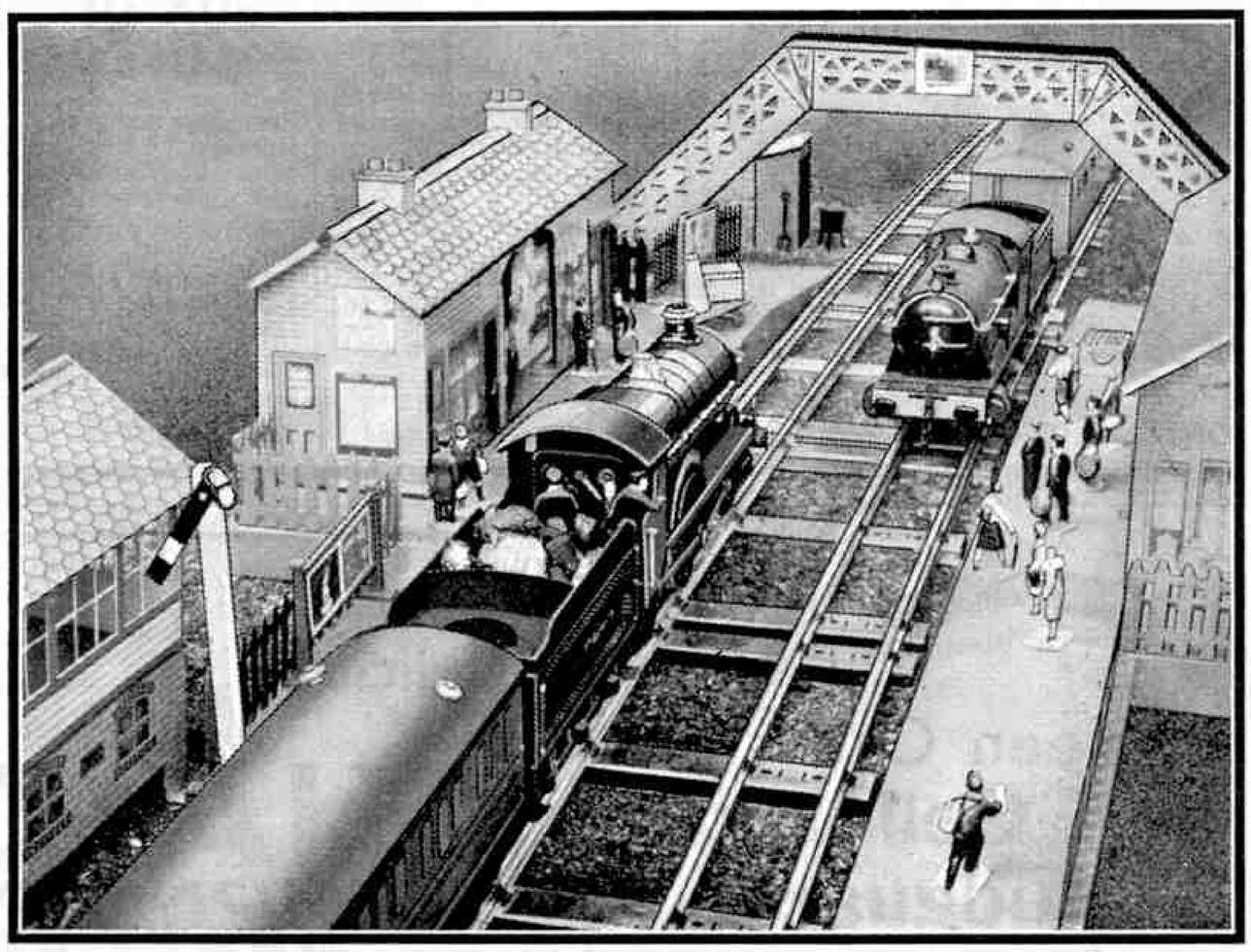
AFTER looking through the 1932-33 "*Hornby Book of Trains*," which describes and illustrates the most wonderful miniature railway system in the world, it occurred to me to turn up the earliest announcements of Hornby Trains, which appeared in 1920. At that time there was only one train set, consisting of an engine and tender and one wagon, with two straight rails and six curved rails of 1 ft. radius. The set was obtainable in the colours of five of the pre-group companies, the London and North Western, Midland, Great Northern, Caledonian, and London, Brighton and South Coast railways. There were no points or crossings, so all that could be done with this set was to run the train round and round the small oval track; and there were no signals, stations, or accessories of any kind. What an astounding contrast to the Hornby Railway System of to-day! For the benefit of new readers, and new members of the H.R.C., it will be useful to survey very briefly the main features of this system.

First of all comes the track. The standard radius of curves is 2 ft., and this has been decided upon as being the smallest on which all the items of the Hornby System can be run with complete success. It is realised, however, that some boys have not sufficient space at their disposal to use these curves, and for their benefit curves of 1 ft. radius are available. The extreme limit is reached in 9 in. radius curves for use with the smallest train sets in the Hornby Series. The possibilities of these small sets are necessarily limited, but points are available, and quite a practical system may be laid out on a very tiny floor space, or even on a good-sized table. For the 1 ft. and 2 ft. radius curves there is available a complete range of points. Right-angle and acute-angle crossings are made to suit systems of either radius, so that "figure eight" and other popular layouts may readily be formed. The difficulties formerly met with in making up double track main lines with inner and outer curves really parallel are overcome by the fine Hornby Double Track, with up and down lines, straight or curved, laid upon common sleepers.

Track for electric trains is not made in quite the same variety as that for clockwork trains, but there is sufficient material for the successful operation of the various electric locomotives of the Series in interesting and railway-like layouts. Means are provided also for the conversion of clockwork track to electric.

As regards the actual Train Sets, practically any type of train, passenger or goods, from the luxurious Pullman to the humble coal train, may be made up effectively with Hornby components, even including the electric-type trains of the London Metropolitan Railway. In addition, service vehicles, such as Snow Ploughs and Breakdown Cranes, are ready for emergency use.

All the clockwork locomotives are fitted with brake gear that can be operated from a cab lever or from a suitable brake rail, and all, excepting the MO, have reversing gear. This gear in the No. 1 Locomotives and upward, may be operated from the track, as well as from the cab lever. Express engines, such as the large No. 3s and the famous true-to-type No. 2 Special Locomotives and Tenders, are available for each railway group, while there are many general purpose engines, such as the No. 1 Special, No. 1 and No. O Locomotives. There are Tank Engines for a variety of work, from the large 4-4-2 No. 2 Special to the small but handy M3 Tank.



This interesting photograph gives some idea of the realistic possibilities of the Hornby Train System. The various accessories shown in addition to the trains themselves add considerably to the effect.

The range of electrically-driven models includes one specially interesting member—the No. 1 Electric Tank Locomotive. This has a permanent magnet motor, and can only be operated from an accumulator; but as reversal of current reverses this type of motor, complete control for speed and direction of travel is possible from a lineside switch. It is undoubtedly an ideal engine for shunting, particularly when it is remembered that all Hornby rolling stock now has automatic couplings that engage automatically on impact. A train of vehicles may thus be quickly assembled by a No. 1 Tank, without the out-of-scale human hand interfering at all.

This degree of realism is further enhanced if the Points and Signals are operated from a Lever Frame by means of the Hornby Control System. This system makes possible remote control from a Signal Cabin and thus allows the miniature railway owner to carry out the duties of a signalman as in actual practice.

Various Stations are available, and to some extent the constructional principle has been embodied in them, so that they may be extended by additional lengths of platform. A Goods Platform (*Continued on page 154*)

A Wonderful Display of Toys, Models, Games, etc., always on view.

GAMAGES

THE BOYS' OWN STORE

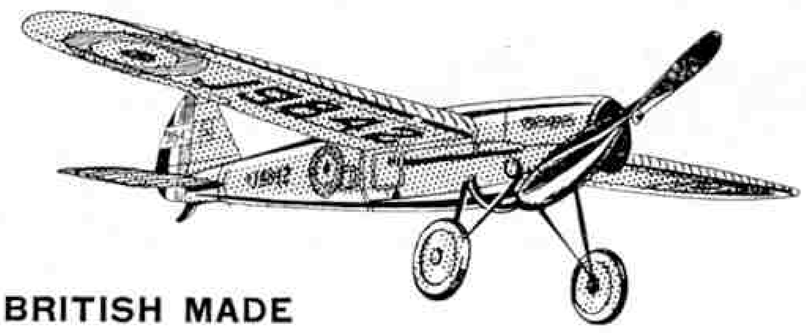
We stock all Hornby Train and Meccano Parts and give prompt delivery to all parts of Britain.

Good things for Conjuring, Experimenting, Flying, etc.

Inexpensive Chemical Cabinet

Here is the finest value you can obtain in good Chemical Cabinets. This new outfit contains sufficient chemicals and apparatus for dozens of instructive and interesting experiments. Price complete **5/-** Post 6d.

Note: Gamages have a magnificent selection of Chemical Cabinets at prices to suit all pockets.



BRITISH MADE

"FROG" MODEL AEROPLANE

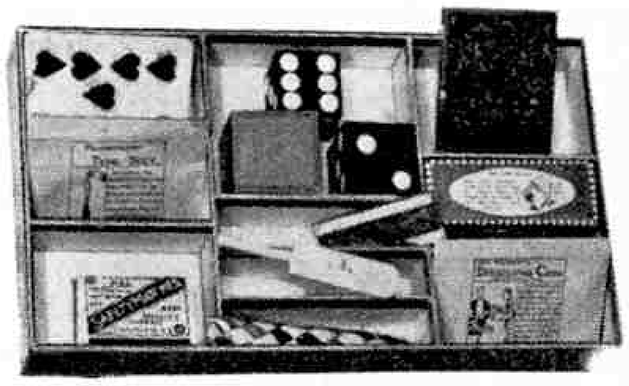
Exact to scale model of interceptor Fighting Mark IV. Will fly 300 ft. at height of 70 ft. Rises straight off the ground. A really fine job that will give endless fun. Price **10/6**

SAVAGE REPEATING PLAY RIFLE

A sturdily constructed model Repeating Rifle—fires fifteen fibre balls at one loading. Packed in attractive carton with special scoring target. Post free. **25/-** *Foreign*

Note: The target is fitted with a bell that rings every time the bull is hit. This rifle guarantees hours of fun.

BOXES OF CONJURING TRICKS



Another example of Gamages wonderful value. This box contains 10 entirely different tricks. To mystify your friends with conjuring tricks is great fun and a sure way to popularity. Price **2/6** Post 4d.

Larger Box 4/6. Post 6d.

GIANT BOX OF SOLDIERS

Specially made for Gamages. It contains 24 Infantry and 12 Cavalry. All made to scale. The finest value obtainable. Price per box. **4/6** Post 6d.

GAMAGES, HOLBORN, LONDON, E.C.1. *Telephone: HOLBORN 8484.* *Also at 107, Cheapside, E.C.2.*

Keen Cyclists prefer **Celluloid Mudguards**

They are much lighter than metal, and will not rust, chip or dent. The cleverly designed quick-release fittings are adjustable to suit all cycles. Ask for genuine **Bluemels** like the Clubmen use! Illustrated are "The Featherweight" pattern, **5/-** per pair, in black; **5/9** in white. White guards are now in demand, as they are more easily picked out by motorists' headlights at night.

★ A fine range of lightweight Inflators, Mudguards, Handles, Reflectors, Sports Shades, etc., are illustrated and described in our list A-211, post free.

Bluemel Bros. Ltd., Dept. 27, Wolston, nr. Coventry.

Delicious . . . . . hot or cold

KIA-ORA

LEMON ORANGE GRAPE FRUIT

Kia-Ora Squashes owe their fine flavour and health-giving qualities to the fresh fruit from which they are made . . . choice lemons, oranges and grape-fruit . . . picked at the moment of perfect tree ripeness and crushed there and then on the spot. . . . Sufficiently sweetened with cane sugar, and ready for use by adding five parts of water . . . hot or cold.

Prices: 2/- and 1/1d. per bottle

Sole Makers:

KIA-ORA LIMITED
Blackfriars, London, S.E.1

Competition Corner

AN ENGINEERING SHORT STORY

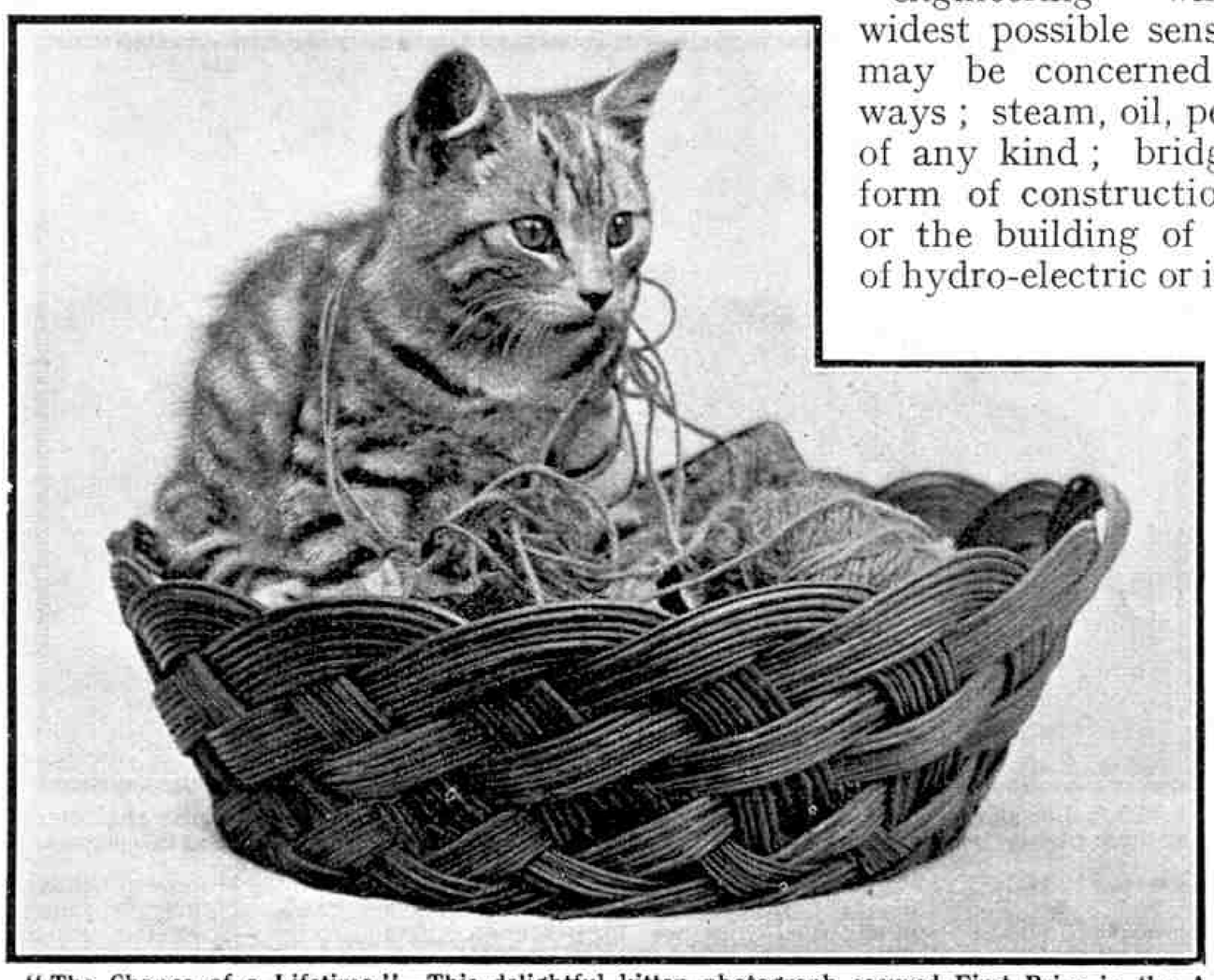
The "*M.M.*," the boys' magazine of engineering, differs from all other boys' papers in its almost entire exclusion of fiction. A few short stories of engineering interest have been published at various times, however, and have proved generally popular. Readers often ask why we do not publish more of such stories. The reason is simple—we cannot find enough really good ones!

Among the great army of "*M.M.*" readers there must be many who have the ability to write a good yarn, and this month we offer a set of prizes with the object of tempting such readers to make the effort. Prizes of Meccano goods to the value of £2/2/–, £1/1/–, 15/– and 10/6 respectively will be awarded in each of the two sections, Home and Overseas, for the four best "*Stories with an Engineering Interest.*" There will be also a number of consolation prizes for the next best entries.

Competitors are advised to make their stories from 1,000 to 1,500 words in length; but a story will not be disqualified for being longer than this, provided that it does not exceed 2,000 words. Each story must have its main interest centred round some phase or incident of engineering. For this purpose the word "engineering" will be considered in its widest possible sense. The scene of a story may be concerned with aeroplanes; railways; steam, oil, petrol or electric machinery of any kind; bridge-building, or any other form of constructional work; road-making, or the building of dams and other features of hydro-electric or irrigation schemes. Stories must be written on one side of the paper only, and on the back of each sheet used must be written clearly the competitor's name and address. Competitors may submit more than one story if they wish, but no competitor can win more than one prize.

The Editor reserves the right to publish in the "*M.M.*" any of the prizewinning entries.

Entries must be addressed "Engineering Story, Meccano Magazine, Binns Road, Old Swan, Liverpool." Home entries must reach this office not later than 28th February and Overseas entries not later than 31st May.



"The Chance of a Lifetime."—This delightful kitten photograph secured First Prize in the A Section of the September Photo Contest for W. M. Hunter, Lewisham, S.E.13.

February Drawing Contest

In the first of our recent "open" Drawing Contests one competitor created many chuckles in the judges' sanctum, and incidentally walked off with the first prize, for one of a splendid batch of humorous sketches. It occurs to us that other readers may have tried their hands at illustrating jokes, but have not submitted them in the belief that they might not be acceptable as competition subjects. In order to give encouragement to readers to experiment in this fascinating branch of drawing we offer prizes this month for the best illustrations of jokes.

The Contest will be divided into the usual two sections—Home and Overseas—in each of which prizes of Meccano products or drawing materials to the value of 21/– and 10/6 respectively will be awarded in class A for competitors of 16 and over, and in class B for those under 16.

Entries should be addressed "February Drawing Contest, Meccano Magazine, Binns Road, Old Swan, Liverpool." Closing date, 28th February. The Overseas closing date will be 31st May.

Ideas for New Contests

The competitions that have appeared month by month on this page have covered a wide range. Inevitably some have been more popular than others, but a very high average number of entries has been maintained year after year. This month we give readers an opportunity of putting forward suggestions for new competitions, or for interesting variations of those we have already announced. These suggestions may be for any type of contest, provided that it is not a purely Hornby Railway or Meccano contest.

The competition will be divided into two sections, Home and Overseas, and in each prizes of Meccano products to the value of 21/–, 15/–, 10/6 and 5/– respectively, will be awarded. In addition there will be a number of consolation prizes for the next best suggestions.

Entries should be addressed to "Competition Ideas, Meccano Magazine, Binns Road, Old Swan, Liverpool," and must reach this office not later than 28th February. Overseas entries must reach us not later than 31st May.

COMPETITION RESULTS

HOME

Advertisement Letter.—1. M. E. Taylor (Dulwich Common, S.E.21); 2. J. D. Figgins (Barry Island); 3. J. H. Marshall (North Shields); 4. K. E. Milburn (Chingford, E.4). Consolation Prizes: H. Cadman (Wolverhampton); S. H. Farr (Gravesend); J. Knowles (Leeds); A. Nicholl (Rochdale); B. de B. Nicol (Aberdeen); P. Starling (Norwich); R. D. Wilson (Belfast).

November Drawing Contest.—First Prizes: Section A, A. E. Lukey (Camden Town, N.W.1); Section B, G. Emerson (West Drayton). Second Prizes: Section A, R. B. Rolfe (Palgrave); Section B, K. Marshall (Weymouth). Consolation Prizes: L. Bond (Minehead); K. Costain (Bolton); J. M. Darlow (Bedford); J. Flude (Bradford); L. E. Hutchinson (Abergele); R. Milton (Camberley); P. Rochard (Kendal); L. J. Scott (West Malling); J. E. Skelton (Ashtead); C. Spencer (Warwash); B. Sturrock (Llansantffraid).

OVERSEAS

August Photo Contest.—First Prizes: Section A, A. A. Boult (Auckland, N.Z.); Section B, R. T. Robinson (Auckland, N.Z.); Second Prizes: Section A, H. N. Walter (Adelaide); Section B, M. Halliday (Sydney, N.S.W.). Consolation Prize: Mac L. Morgan (Cremona, N.S.W.).

August Crossword Puzzle.—1. R. T. J. Blick (Canterbury, N.Z.); 2. E. Harper (Cambridge, Cape Province); 3. R. Blair (Victoria); 4. H. Gudmanz (Elliot, S. Africa). Consolation Prizes: H. Wallace (Calgary, Alta.); L. Blair (Victoria); W. Richards (Victoria); W. S. Eagle (Bombay).

"The Merseyside Express"—(Cont. from p. 115)

catch a glimpse of Willesden locomotive depot alongside the embankment on which this line is carried. While passing through the station we are crossed by the L.M.S.R. Broad Street to Richmond electrified lines—once the old North London Railway—that are accommodated above in Willesden (high level). On our left are the Willesden carriage sheds, where numerous examples of L.M.S.R. coaching stock of all kinds are to be seen. We notice the line bearing away to the right that eventually forms the West London line after crossing the Grand Junction Canal and G.W.R. main line at Mitre Bridge, and joining up with a connection from that system at the strangely-named North Pole Junction. It is over that route that the "*Sunny South Express*" passes, being taken over by an S.R. locomotive at Willesden, corresponding arrangements applying on the return journey.

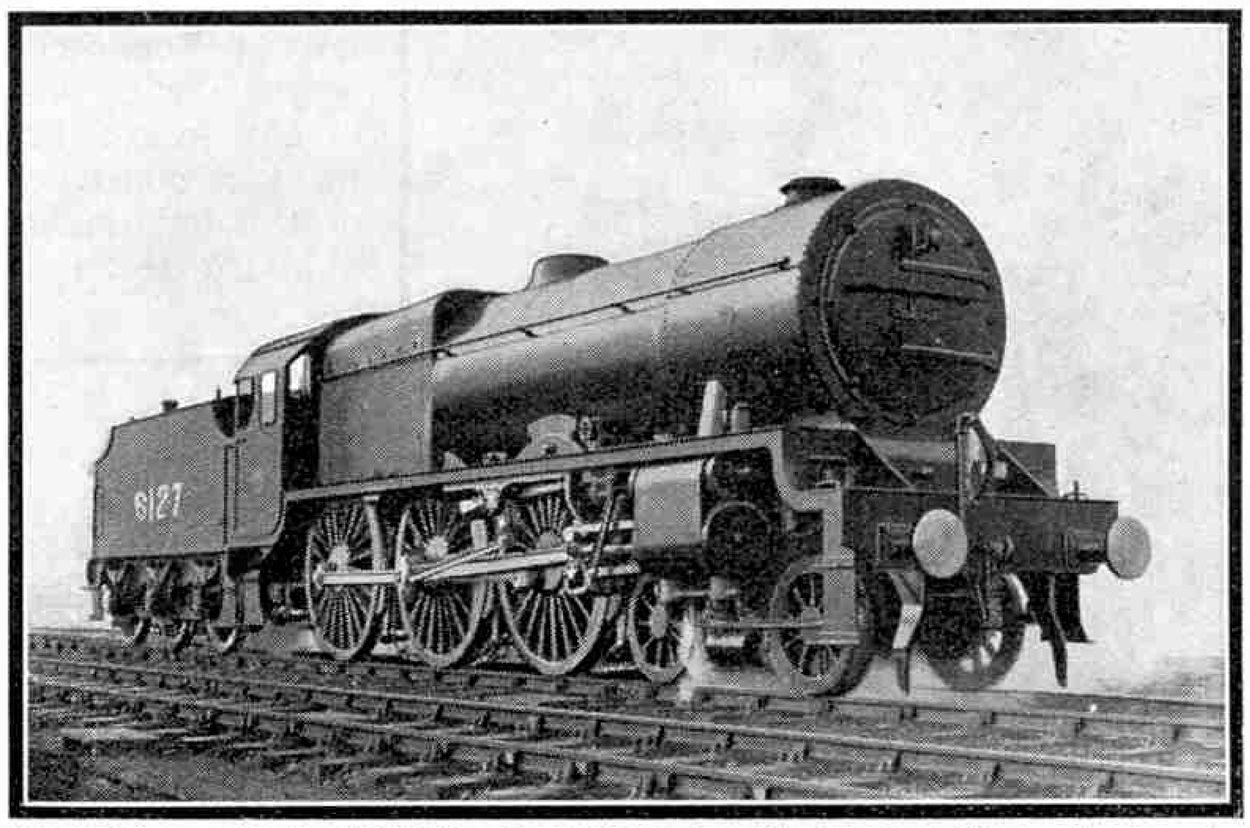
Soon the New Line joins us again, and at Queen's Park makes connection with the London Electric Railways. It is by means of this connection that the through trains from Watford previously mentioned pass on to the Underground system.

After passing through South Hampstead we quickly find ourselves in Primrose Hill Tunnel. It is interesting that many years ago, when a track known as the "Third Line" was in use from Bletchley to Camden for up goods trains, it was carried through this tunnel, and that at Watford also, by the method known as "gauntletting." By this arrangement, which is sometimes seen on tramways, one rail of the goods line was led inside the rails of the up main track and the other rail kept outside. Facing and trailing points were thus unnecessary, but the up lines through the tunnel could only be used by one train at once.

On emerging we come upon the "Camden Widening" that was in hand for so long, but was completed with the progress of the electric system into Euston. A remarkable array of tracks exists between the mouth of Primrose Hill Tunnel and Camden engine sheds, enabling the electric suburban trains and empty coach trains in both directions to work in and out of Euston without fouling other traffic. The electrified lines that commenced at Watford on our right passed under us to our left at Wembley, and now are found between the up and the down fast lines! There are of course numerous flying and burrowing connections in order to secure this result, and it is a pity that much of the remarkable trackwork at this spot is in tunnel.

Camden locomotive sheds will now engage our attention with the strings of engines of various types that are to be seen there—"Royal Scots," "Compounds" and other examples of the standard classes, together with numerous engines of Crewe design; "Claughtons," "Princes," "George the Fifths," and other classes, less important but at the same time useful. Easing gently down the gradient, for the approach to Euston is awkward and it is necessary to have the train well in hand, we run into the terminus on the arrival or left-hand side, the driver bringing the train to an almost imperceptible stop.

We have been brought up to the Metropolis in splendid style, and shall be prepared to maintain that this service, together with that in the down direction at 6.5 p.m., will be difficult to improve upon for comfort and convenience.



L.M.S.R. Locomotive No. 6127 "Novelty" of the "Royal Scot" class. The massive character of these engines is emphasised when they are seen from the ground, as is the case in this picture.

British Aircraft—(Continued from page 109)

roof are of celluloid. The side windows are made to slide for ventilation purposes. Behind the cabin is a large stowage space for luggage. The machine is provided with an undercarriage of the split type.

The Spartan "Cruiser" has a wing span of 54 ft., a length overall of 39 ft. 2 in. and an overall height of 10 ft. The tare weight of the machine, when fitted up for passenger use, is 3,400 lb., and the fully loaded weight 5,500 lb. It has a maximum speed of 135 m.p.h. and a cruising speed of 110 m.p.h., the initial rate of climb being 600 ft. per minute and the ceiling 15,000 ft. When fully loaded the aeroplane will maintain height at 3,000 ft. with any one of its three engines stopped.

The Vickers "Jockey" is a single-seater tractor landplane designed as a day fighter and chaser for the interception of enemy aircraft at high altitudes. For this duty special attention has been given to fighting view and manœuvrability, and the aeroplane is easy to handle. Tail trimming gear is provided to enable the aeroplane to fly horizontally at all speeds within flying range. The controls are light and every aerobatic manœuvre can be performed with ease, while the pilot has an excellent view forward and upward, an important feature for formation flying.

The fuselage is constructed entirely of metal, as also are the coverings of the planes. The tailplane, rudder, elevator and ailerons, however, are fabric covered. For shock-absorbing purposes Vickers Oleo-pneumatic units are incorporated in the legs of the undercarriage, and as a special non-freezing oil is used in these, no trouble should be experienced with them even when a temperature as low as 30°C. below zero is experienced.

The aeroplane is provided with two Vickers machine guns firing forward between the propeller blades. It is equipped with a Bristol "Jupiter VII.F" engine fitted with a Townend ring, and it has an overall length of 23 ft. and a span of 32 ft. 8 in. When empty it weighs 2,268 lb. and has an all-up service weight of 3,161 lb. At ground level it is capable of attaining a speed of 186 m.p.h., but the maximum speed is reached at an altitude of about 9,850 ft., when it can travel at 218 m.p.h. Above this height the speed falls off gradually, and at nearly 19,700 ft. the maximum speed is 207 m.p.h. The absolute ceiling is 31,500 ft. The machine possesses a phenomenal climb, and is capable of rising at a rate of 1,850 ft. per minute on taking off from an aerodrome; and it lands at a speed of 62 m.p.h. It is capable of flying at a cruising speed of 186 m.p.h. at an altitude of 8,000 ft. for a period of about 1.65 hours. These performance figures are for a machine provided with two Vickers machine guns, a double set of interrupter gear and 1,200 rounds of ammunition, in addition to an Irvin parachute, a Verey pistol and eight cartridges, oxygen breathing apparatus and electrical equipment for gun and cockpit heating.

The growing popularity of the low wing type of construction is partially due to its suitability for work where the highest possible speed is required together with "light" landing. These features are characteristic of the low wing monoplane, for the "roller" of air compressed below the wing when landing acts as a kind of cushion for the machine, and in comparison a high wing monoplane appears to "flop" on to the ground. A biplane combines many of the advantages of both types of monoplane, of course, but usually at the expense of loss of speed.

Kay Sports Company's December Competition

The following is the list of prize-winners in the Kay Sports Company's competition announced in the December "*M.M.*":—First Prizes: Ralph Nelson, 31, Hill Avenue, Victoria Park, Totterdown, Bristol; B. and D. Davenport, 35, Lansdowne Road, Erdington, Birmingham. Second Prizes: Derrick Holloway, "Wybourne," Slewins Lane, Squirrels Heath; Douglas Bishop, 6, Walcot Parade, Bath. Third Prizes: R. Honeybourne, 41, Bellevue Road, West Cross, Swansea; H. Kaye, 60, Beaconsfield Street, Princes Park, Liverpool.

A Stamp Album for Sixpence!

Continuing their policy of catering specially for the young stamp collector, Stanley Gibbons Ltd., have published a new album at the remarkably low price of sixpence. This album, which is known as the "Boy's Own," is a bright and attractive production containing 88 pages and with space for more than 2,500 stamps and is illustrated with clear reproductions of stamps that the young collector is most likely to come across.

Great Ports of the World—(Cont. from page 97)

dry docks, both of which are 750 ft. long, while their widths are 100 ft. and 110 ft. respectively. The Tilbury dry dock is so constructed that it can be rapidly extended to a total length of 1,000 ft. when necessary without interference with its use. The dock can be emptied of water in 2½ hours, the water passing out by way of discharge pipes 4 ft. 6 in. in diameter.

The Port of London Authority are responsible for maintaining adequate river channels for shipping, and the dredging service is one of the most important of their river services. When the Authority was formed in 1909 the ruling depth in the river channel from the estuary to Gravesend was 25 ft. at low water of ordinary spring tides, and this depth gradually decreased all the way up to the City. The largest vessel that had used the port up to that time drew 27 ft. of water, but there is now a good navigable channel 1,000 ft. wide, with a general depth of 30 ft. at mean low water of spring tides, from the Nore to the Cold Harbour Point, a distance of about 35 miles. From this point to the Royal Albert Dock, six miles, the channel is 27 ft. deep and 600 ft. wide; then for over four miles, as far as the entrance to the West India Dock, the depth is 20 ft. with a width of 600 ft. Above this point the channel continues sufficiently deep and wide to enable fairly large sea-going steamers to ascend to the Pool of London. Vessels that draw up to 37 ft. of water, the normal draught of the largest vessels in the world, now use the port. The task has involved the raising and removal of 47,000,000 tons of material at a cost of over £2,000,000. This service is only one of many, as the river duties of the Port of London Authority include all matters relating to navigation.

We are indebted to the courtesy of the Port of London Authority for much of the information contained in this article.

Tommy Dodd—(Cont. from p. 151)

enables freight traffic to be handled expeditiously, a crane being mounted on it; while separate Cranes, Loading Gauges and Lamp Standards are other features suitable for goods yards. For the use of the Locomotive Department other interesting accessories are the Turntables made in two sizes, the Water Tank and the Engine Sheds.

The stations and railway premises generally may be given a more lively appearance by the use of the various sets of miniature figures now available. The true-to-life aspect of the line may be improved also by the use of the miniature Posters, which may be stuck direct on to different buildings, or attached to Paled Fencing, over-bridges, etc., by means of the special Poster Boards. An effective display of these accessories may be made also on the Station Hoarding.

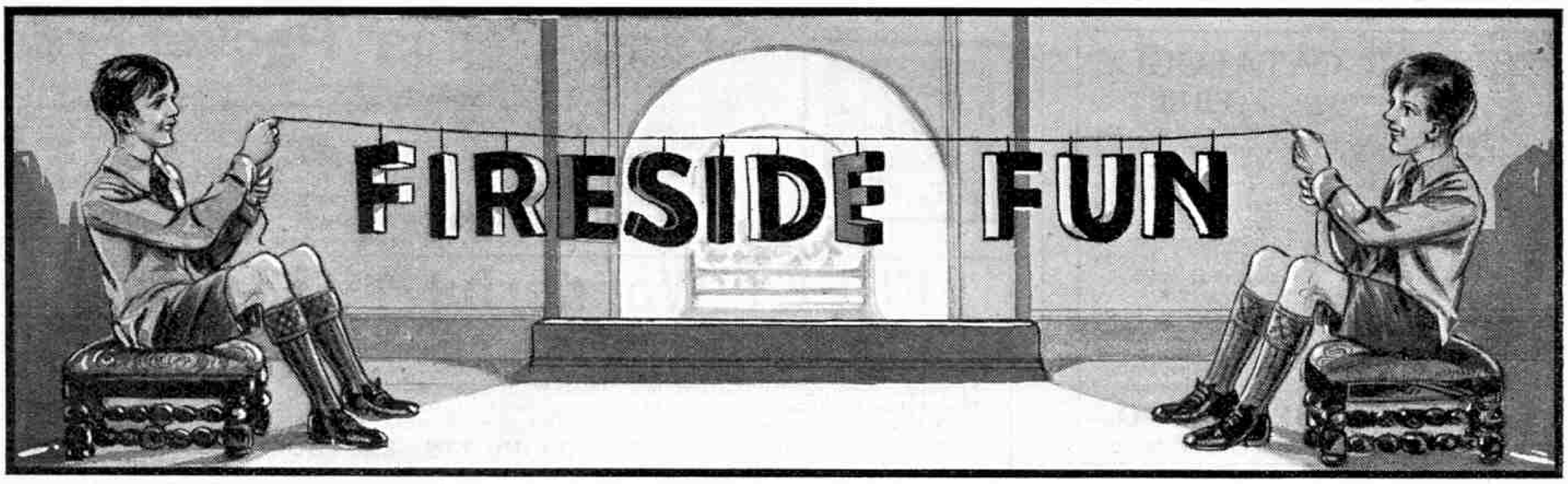
New fabric Tunnels and Cuttings that can be laid end to end to make up any length are available, and finally there are the splendid Countryside Sections that enable any 2 ft. radius layout to be placed in most realistic scenic surroundings.

How to Get More Fun—(Continued from page 141)

appear at the head of a miniature "drag" of Hornby Hopper Wagons, and with a caboose completing the tail of the train the whole arrangement would look most effective. It is interesting, incidentally, that such a train would be called a "black snake" by American trainmen.

In addition to the vehicles of English pattern already mentioned as being suitable for American-type layouts, the No. 2 Cattle Truck should not be forgotten. The operation of stock trains is a notable feature of American railroads in certain districts, and with the Miniature Animals now obtainable in the Hornby Series quite a realistic representation of a stock train can be made up. Again the Trolley Wagon is very suitable for any special loads such as transformers, big girders and other bulky items, and we may recall the enormous "Steel Specials" operated from Pittsburgh by the Baltimore and Ohio line to carry the products of the mills in almost all directions. The No. 2 Lumber Wagon is for carrying rough logs or poles, and the No. 2 Timber Wagon is specially adapted for the transport of sawn timber; and both may be employed for numerous other purposes in addition.

The great size and weight of American stock, particularly locomotives, make necessary a corresponding capacity on the part of the breakdown cranes that have to deal with them after any mishaps. The "wrecker," as it is called on American lines, is a massive affair, and is frequently capable of travelling under its own power. One of our illustrations shows a Hornby Breakdown Van and Crane, being made ready to proceed down the line as part of a "wreck" train. A Box Car is included in the train for the accommodation of some of the crew and the various tools, while a Caboose completes the make up in an appropriate manner.



STANDING THE TEST

Small Boy (to father): "The new telephone book came in this morning, Dad. It seems all right, as far as I can see."

Father: "All right? What do you mean?"

Small Boy: "Well, I've been unable to find any mistakes so far, and I've been trying out the numbers all morning."

* * * * *

"You say the officer arrested you while you were quietly minding your own business?"

"Yes, your honour. He caught me suddenly by the coat collar and threatened me with his baton unless I accompanied him to the station."

"You were quietly attending to your own business; making no noise or disturbance of any kind?"

"None whatever, sir."

"It seems very strange. What is your business?"

"I'm a burglar."

* * * *

Mother (hearing no sound downstairs and fearing her small son is up to mischief): "What are you doing down there, dear?"

Small voice from below: "Nothing, mother!"

Mother (not convinced): "Then stop it at once, you naughty child!"

* * * *

"What does it mean in this book by 'seasoned troops'?"

"Probably troops that had been mustered by the officers and peppered by the enemy."

* * * *

Food Crank: "Do you get any pains after sleeping on a heavy meal?"

Friend: "I always sleep on a bed."

* * * *

Neighbour: "Why do you use such a high cot for your baby?"

Proud Parent: "So that we can hear her when she falls out."

* * * *

Speed Hog: "I say, fellow, is there any speed limit here?"

Native: "Naw, you fellows can't get through here fast enough for us."

* * * *

"I saw the doctor you recommended to me."

"Did you tell him I sent you?"

"Yes, of course I did."

"What did he say?"

"He asked me to pay in advance."

* * * *

Recruiting Sergeant: "What's yer name and what branch of the Service d'ye want to be in?"

Perkins (who stammers): "Pup-p-p-p-pup-pup-"

Recruiting Sergeant (writing): "Cannot speak English and wants to join machine gun corps."

* * * * *

SIMILAR "FEET-URES"

The recruit was up before the O.C. on a charge of having sold his boots.

"Did you not know," said the officer, "that your wearing apparel is not your property? The boots you sold belonged to the King."

The recruit seemed interested. "I did not know he wore size tens, too," he remarked.

SOME BIRD

A little boy's essay on geese:

"A geese is a low heavy set boid which is mostly meet and feathers. His head sits on one side and he sets on the other. A geese can't sing much on account of dampness of the moisture. He ain't got no foot between his toes and he's got a baloon on his stomach to keep him from sinking. Some gooses when they gits big has curls on their tals and is called ganders. Ganders don't have to sit and hatch, but just loaf and eat, and go swimmin. If I was a goose, I'd rather be a gander."—"*New Zealand Railways Magazine.*"

* * * *

Artist: "Shall I paint you in a frock coat?"

Mr. Newrich: "Oh, don't make any fuss—just wear your overalls!"

* * * *

"Why are you wearing such a loud tie?"

"I got it as a present from my aunt, and she's stone deaf."

* * * *

HAD ENOUGH!

There had been a railway collision, and Jock, the Scotsman, had received slight injuries.

"Never mind, Jock," said his rescuer, consolingly, "you'll get damages for it."

"Damages!" roared the exasperated traveller, "ha'e I no' had enough, guid sakes. It's repairs I'm seeking noo."

* * * *

A man walking along the banks of a canal saw another struggling in the water. After helping him out he said:

"How did you come to fall in?"

"I didn't come to fall in," was the reply. "I came to fish."

* * * *

"What's the matter with you? Had an accident?"

"No, I bet Bill he couldn't carry me up a ladder on his back, and I won."

* * * *

Tommy's father had promised him a bicycle if he got at least 60 marks out of 100 in the exams.

The examinations came to an end, and one day Tommy arrived home with his rather unsuccessful school report. "Here it is, dad," he said.

Father scanned it, and Tommy watched his face anxiously.

At last his father laid the paper down.

"Well, my boy," he said, "what will you have, a couple of spokes or a brake block?"

* * * *

"Are the skins of cats any use, Brown?"

"Yes, sir."

"Well, what are they used for?"

"For keeping cats warm."

* * * *

Pupil (flattered): "You think I ought to insure my voice?"

Professor: "Yes, against third party risks."

* * * *

Old Lady (to bus conductor): "Do you stop at the Grand Hotel?"

Bus Conductor (tersely): "No, madam, not on the money I earn."

FIT FOR HEROES

Mike: "This is a great country, Pat."

Pat: "Why?"

Mike: "Sure, th' paper sez yez can buy a ten shilling postal order for three-halfpence."

* * * *

Little Boy (looking up from book): "Father, what part of the body is the fray?"

Father: "Fray? What do you mean?"

Little Boy: "Well it says in this book that 'the knight was wounded in the fray!'"

* * * *

"I hope we shall see a great deal of your friend when he comes to town. My daughter will be home by then. She is a wonderful pianist, you know."

"Don't worry, that won't stop my friend from coming. He is stone deaf!"

* * * *

As the long-winded lecturer paused and drank from a glass of water a voice called out in protest,

"It's all wrong," shouted the interrupter.

"What do you mean, sir?" demanded the chairman.

"I mean that a windmill should not go by water."

* * * *

A passenger on an American express train looking under his sleeping berth in the morning, found one black shoe and one brown shoe.

He called the negro attendant, who scratched his head.

"Well," he said, in perplexed tones, "Ef dat don't beat all! Dat's de second time dis mornin' dat mistake's happened."

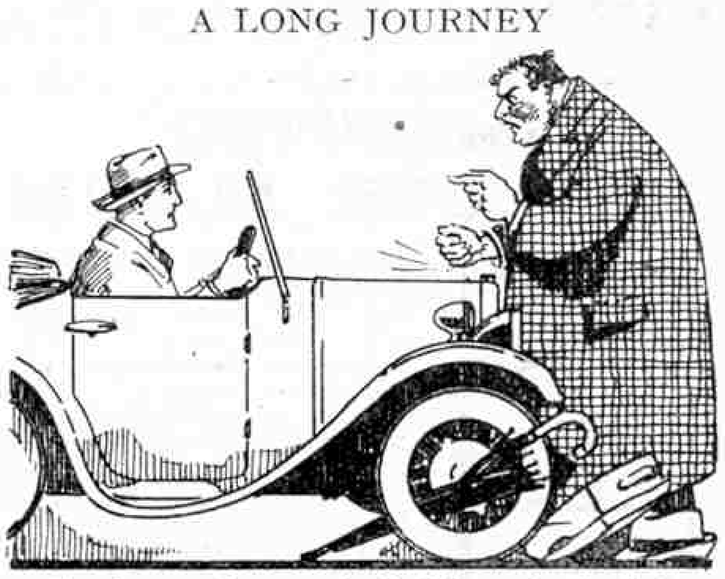
* * * *

A Japanese undergraduate had been requested to write an essay on the subject of "The Banana." After thinking the matter over for a short time he commenced as follows:—

"The banana are great remarkable fruit. He are constructed in the same architectural style as the honourable sausage. Difference being, skin of sausage are habitually consumed, while it are not adviceable to eat rapping of banana. Perhaps are also intrissting the following differences between the two objects: banana are held aloft while consuming; sausage usually left in reclining position. Banana are first green in culler, then gradually turn yellowish. Sausage start out with indeffinit culler (resemble terrier cotta) and retain same hue indeffinitely. Sausage depend for creation upon human being or stuffing machine, while banana are pristine product of honourable Mother Nature. Both article resemble the other in that neither have pit or colonel of any kind. In case of sausage both conclusions are attached to other sausages, honourable banana on opposite hand are joined on one end to stem; other termination are entirely loose, and finally banana are strictly members of Vagitable Kingdom, while affiliation of sausage is often undecided."

* * * *

A LONG JOURNEY



The fat gentleman who had been involved in an accident with a baby car thumped the bonnet angrily.

"Why didn't you go round me?" he shouted. "There was plenty of room."

"Well," said the driver, "I really didn't think I had enough petrol."

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The Voyages of Captain Cook

Trivial incidents have a far greater bearing on history than most of us would readily believe. An accusation of theft sent James Cook, a young draper's apprentice, to serve before the mast of an East Coast collier. He became the greatest of British navigators, made three great voyages of discovery in the Pacific Ocean, located more new coast line than any previous explorer, and annexed New Zealand and Australia for Britain. At the height of his career another trivial theft was the direct cause of his death.

The life story of Captain Cook, the hero of these exploits, was given in some detail in the "*M.M.*" for December, 1928, and it would be occupying space unnecessarily to go over that ground again. Certain incidents in his life have been commemorated on stamps, however, and the collector who regards his stamps as a pleasant method of learning history, might well build up the story of Cook's career around these stamps, five of which are illustrated on this page.

Cook's first great achievement was a highly accurate survey of the St. Lawrence River in the course of General Wolfe's assault of the Quebec citadel in 1759. A splendid view of the scene of this survey is given on the 12c. value of Canada's current issue. This is a view of the St. Lawrence from the Quebec Bridge, and shows in the background the Heights of Abraham, successfully stormed by Wolfe's troops.

Cook's work on the St. Lawrence led to his appointment to the marine surveyorship of Newfoundland, and subsequently to the command of a scientific expedition to Tahiti to observe a solar eclipse. This was his first great voyage in the Pacific and it was during this voyage that he explored the coast of New Zealand and annexed the country for Britain. Later in the same voyage he encountered the East coast of Australia and planted the British flag on that continent, then known as New Holland.

Cook's landing in New Zealand and the raising of the British flag are depicted on the 3d. and 6d. stamps of New Zealand's 1906 issue commemorating the Christchurch Exhibition. It is an interesting point, however, that the apparently friendly reception being accorded to Cook by the Maori chiefs shown in the stamp, does not coincide with the historical records of the incident. History tells that the Maoris were so suspicious and hostile that Cook was forced to go back aboard his ship and sail along the coast, followed by Maori war canoes.

Cook's success on this trip marked him out for other enterprises of the same nature. From that time onward he spent very few years at home, the greater part of his time being occupied in exploring the Pacific Ocean. It was in the course of the outward run of what has come to be known as his third voyage that the group of islands known as the Cook Islands was discovered, and the landing at Aitutaki, the principal island in the group, is shown on the ½d. value of Aitutaki's 1920 issue, which also includes a very fine portrait on the 1½d. stamp. Similar designs were adopted for the ½d. and 1d. values of the combined Cook Islands issue of last year.

It was during his third voyage that Cook met his death. His mission was to discover a North East passage from the Pacific to the Atlantic Oceans, and on the homeward run he decided to winter at Hawaii. In a scuffle following the theft of a ship's boat by natives, Cook was struck down and killed.

Equipping the Stamp Collector

Many thousands of boys take up stamp collecting for the first time during the early months of the year, possibly as the outcome of the receipt of a packet of stamps or an album as a Christmas present. Most of those boys have one object in view at the outset of their stamp collecting—the acquisition of as many stamps as possible! That is not real collecting, however. It is mere accumulation and brings no lasting pleasure. The boy who seeks real pleasure in stamp collecting must study his stamps and learn all that he can about them. There are at least six interesting features in every stamp. The stamp collecting pages of the "*M.M.*" are written specially to help young collectors, and month by month on this page we shall discuss some topic of general interest that will help our readers to obtain a fuller understanding of stamps and the infinite interest of the hobby.

We have often heard boys jeer when it has been suggested that the stamp collector needs a proper equipment no less than, say, the cricketer. The possession of an album, some stamp mounts and a few stamps are the only essentials for a commencement, of course; but just as the enthusiastic young cricketer quickly begins to feel that tree trunks as wickets are not quite in keeping with the best traditions of the great game, so the enthusiastic stamp collector will find himself handicapped by the lack of suitable equipment.

The minimum equipment is an album, a few stamps and a packet of stamp mounts, and since the album and stamps have been presented, we propose to assume at this stage that the album is just the right thing and the stamps all perfect specimens. There is quite a lot to be said concerning the type of album and the condition of stamps, but they are matters to be left for later discussion.

Stamp mounts are in a different category. Even if they have been thoughtfully included in the gift, the young collector would be well advised to look this gift horse in the mouth. The only satisfactory mounts are those that may be peeled cleanly away from the stamp or the album page if it should be necessary to make a change for any reason. Such mounts may be purchased at 8d. per 1,000, only a copper or two more than the cheap dangerous bits of gummed paper so often sold as stamp mounts.

Cheap mounts will not peel off cleanly; they either tear a piece off the album page or cannot be removed from the back of the stamp without risk of damage to the stamp itself. The lost value of one or two stamps ruined quickly offsets any "economy" effected by using cheap mounts. One word of warning must be given, however. In no circumstances should the removal of a mount from a stamp or album page be attempted while the gum is damp. If a change is to be made, the mount must be left to dry and it will peel away easily.

The collector who endeavours to go far with only the items we have indicated will find himself in difficulties very quickly. He will find the necessity for the guidance that only a good catalogue can afford in deciding the order of appearance of his stamps in the album or in identifying some of the more curious stamps.

With the acquisition of a catalogue the significance of perforation and watermarks will be revealed, and the collector will realise that these parts of a stamp's anatomy have an important bearing on its value. In other words he will find the interest of studying stamps, and will examine them rather more intently than hitherto. He will become, in fact, a stamp collector.

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The "1,000 Packet" contains 500 excellently assorted Stamps ; a **Complete Sheet of 100 Unused** (very useful for exchange purposes) ; a neat 12-page booklet for holding duplicates ; 25 British Colonials, usually sold at ½d. to 1d. each, including new and obsolete issues ; 375 Magic "Strip" Mounts, which mount stamps three times as quickly as the old-fashioned single ones, and my price list of stamp bargains. In addition, free sets will be sent to those who send names of stamp-collecting friends. *Ask for my famous Approvals.* "B.O.P." and "Captain" monthly parts cheap. Write for particulars.

H. C. WATKINS, "M" DEPT. GRANVILLE ROAD, BARNET.

Stamp Gossip

A Piccard Commemorative

An interesting addition to the aeronautical stamp group is the series issued by Belgium to commemorate the balloon ascents made by Professor Piccard of the Brussels University and his assistants.

These ascents were described fully in the October "*M.M.*", and it is unnecessary here to do more than record briefly the facts associated with the stamps for the benefit of those who desire to describe them in their albums.

The essential feature of the design is the balloon itself. The full capacity of the envelope is approximately 500,000 cubic feet, but in the stamp design the envelope is shown in its condition at the outset of ascents, barely 30 per cent. inflated. Low inflation is necessary to provide for the expansion of the gas in the envelope following the reduction in atmospheric pressure as the balloon rises. The aluminium sphere in which Professor Piccard made the ascents can be seen hanging below the envelope.

The dates displayed to the right of the balloon are those on which the ascents were made. The first was from Augsburg in Austria, and was made on 27th May, 1931. The balloon rose to a height of 51,458 ft. and later descended on a glacier in the Oetz Valley in the Tyrol. The second effort was from the Dubendorf Aerodrome, Zurich, on 18th August last, and on this occasion a height of 54,540 ft. was achieved, almost twice the height of Mount Everest, and more than two miles higher than the existing aeroplane altitude record.

Falkland Island Commemorative

A centenary commemorative issue will shortly be issued from the Falkland Isles, and supplies of the actual stamps have already been despatched to the Islands.

The issue will comprise a full range of 12 values with designs as follows:—½d., Romney Marsh Ram; 1d., Iceberg; 1½d., Whale Catcher; 2d., View of Port Louis; 3d., Map of the Islands; 4d., South Georgia; 6d., Whale; 1/–, Government House; 2/6, Battle Memorial; 5/–, King penguin; 10/–, Arms of the Colony; £1, King George V.

Belgium's Christmas Issue

Once again the funds raised by Belgium's annual Christmas Charity issue are to be devoted to the work of the Anti-Tuberculosis campaign. We are indebted to our publishers' agent in Belgium, Monsieur A. Fremineur, of Brussels, for an early set, a specimen stamp from which is reproduced here.

The design is common to the complete series of seven stamps, and shows a group of children turning to wave their farewell thanks to the great sanatorium at Waterloo, shown in the background.

The values in the series range from 10c. to 5 fr., each stamp bearing a premium for the charity.

A Meter Mail Catalogue

Those readers who read the stamp article in the April, 1931, "*M.M.*" dealing with the collection of meter mail impressions, and have since followed the rapid development in the use of the postal franking machine, will be interested to know that a catalogue of meter impressions is shortly to be published in Germany.

It is less than 10 years since the meter was introduced, first in New Zealand and shortly afterwards in Great Britain. Now its use is authorised in no less than sixty countries. It will be realised then that the preparation of a meter mail catalogue has involved an enormous amount of work and the compiler, Herr R. Glasewald, has been fortunate in securing the co-operation of leading collectors in England, Holland and Germany. The date of publication is not yet announced, but it is understood that the catalogue will contain more than 200 illustrations and will be priced at no more than 2/–.

Russia's Five-Year Plan

Most of our readers know that the first of the Russian Five-Year Plans for the re-habilitation of the country has recently concluded and the second campaign started.

The second Five-Year Plan even lays down a list of subjects for commemorative stamps to be issued in the years 1933 to 1937. Nine sets are projected for 1933, but the only one that is likely to be of interest to "*M.M.*" readers will be that celebrating the 350th anniversary of Russian printing. No specific details are available yet.

Stamp Voting Contest

The year 1932 was an interesting year for stamp collectors. Four new stamp-issuing states came into being and there were rather more than 1,700 new issues. The most interesting of those stamps have been illustrated month by month in the "*M.M.*," and on this page we reproduce a selection of 10 of them. Readers are invited to place these in their order of popularity among stamp collectors.

Each competitor is asked to write on a post card, *A*, the stamp he prefers most, and *B*, to forecast the order of popularity that will be indicated by the massed votes of all the competitors. It will be noted that the competitor is not required to place his own favourite stamp at the head of the list *B* unless he believes it will occupy this position in the massed voting; it should be listed in its probable position in the general estimation. In compiling the list the stamps should be referred to by numbers in the order of their appearance in the illustration, 1 to 2 reading from left to right in the top row, 3 to 5 in the second row, 6 to 8 in the third row, and 9 to 10 in the bottom row.

Prizes of stamps or stamp collecting material, to be chosen by the winners themselves from the catalogues of "*M.M.*" advertisers, to the value of 21/–, 15/–, 10/6 and 5/– respectively, will be awarded to the four entries most nearly forecasting the result of the voting.

Entries should be addressed to "Stamp Vote, Meccano Magazine, Binns Road, Old Swan, Liverpool," and should be sent to reach this office not later than 28th February. Similar prizes will be awarded among entries from Overseas readers. These must arrive not later than 31st May.

Intending competitors are reminded that they may not submit more than one entry, and care should be taken to see that their names and addresses are mentioned on the post card. Every month we have to reject many entries owing to the omission of these details.

Competition Result

Stamp Scenes — May Competition: S. T. Hopkinson, Birmingham (Menin Gate Memorial, Belgium 35c., 1929, Anti-tuberculosis issue); June, A. F. Brooks, Montreal (Quebec Citadel, Canada 12c., 1930); July, M. Jacobsen, Cape Town Groote Schuur, South Africa 3d., 1927); August, T. S. Smyth, Sydney (Sydney Harbour Bridge, Australia 1931 issue); September, R. W. Scanlon, London, W.12 (Statue of Richard I, Cyprus 18c., 1928 issue); October, J. Michel, Paris (Arc de Triomphe, France 2fr. 1931).

We thank Stanley Gibbons Ltd. for their courtesy in loaning the stamps from which the illustrations for our stamp pages have been made.

HORNBY SERIES

HORNBY ACCESSORIES

GAUGE 0

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.

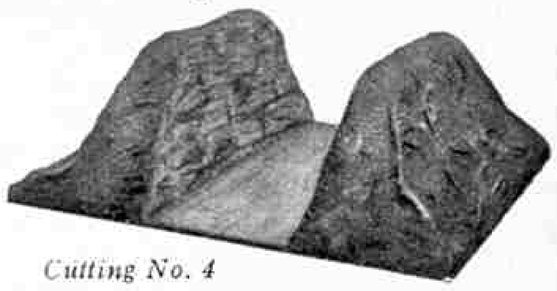
A selection of Hornby Accessories is illustrated below. Your dealer will be pleased to show you the full range.

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

TUNNEL No. 1 (Straight)
Length 7 11/16 in. Width 6¼ in. (as illustrated).
Price **2/-**

TUNNEL No. 2 (Straight)
Length 15⅝ in. Width 9½ in. Price **4/-**

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 **10/-**

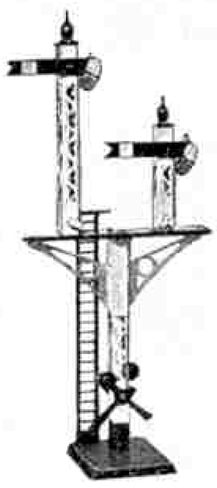


Cutting No. 4

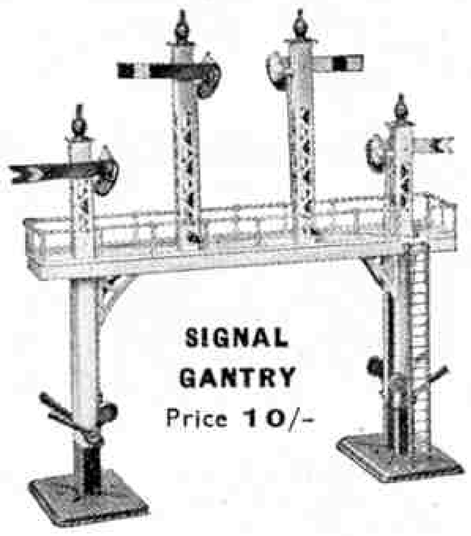
CUTTING No. 4 (STRAIGHT)
This is a double cutting, mounted on a base over which the railway track is laid.
Base measurement: Length 15⅝ in., width 15 in. Price **6/-**

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 14¾ in. Length of track 17¼ in. Price **7/6**

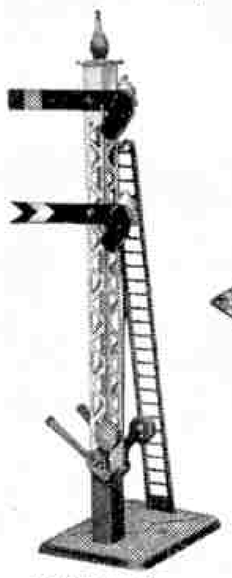
TUNNEL No. 6 (RIGHT-HAND, CURVED)
Similar to No. 5 Tunnel, but with track in the reverse position. For 2 ft. radius tracks only. Base measurement 15⅞ in. x 14¾ in. Length of track 17¼ in. Price **7/6**



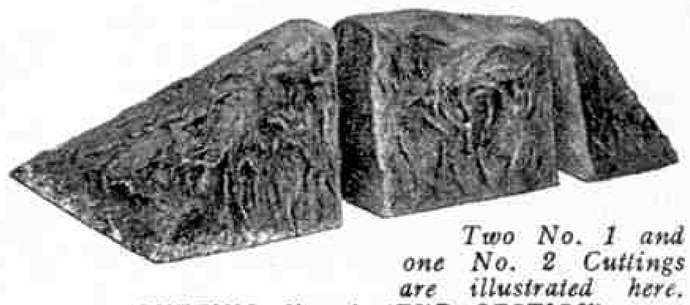
JUNCTION SIGNAL
"Home" or "Distant." Signal arms operated by levers at base. A very realistic model.
Price **6/-**



SIGNAL GANTRY
Price **10/-**



SIGNALS, DOUBLE ARM No. 2
Price **3/-**

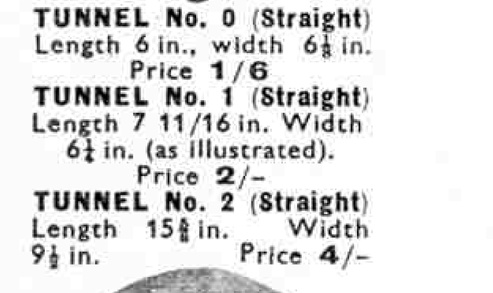


Two No. 1 and one No. 2 Cuttings are illustrated here.

CUTTING No. 1 (END SECTION)
(illustrated)
Base measurement: Length 7 11/16 in., width 6 in. Price, per pair **3/-**

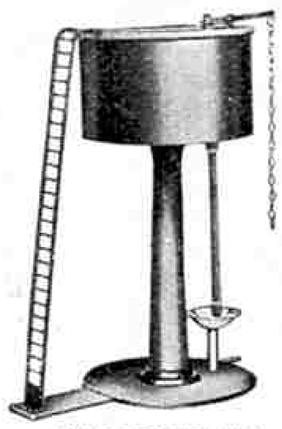
CUTTING No. 2 (CENTRE SECTION, STRAIGHT)
(illustrated)
The addition of these centre sections enables a Hornby Railway cutting to be extended to any length. They are intended to be used in conjunction with the End Sections (Cutting No. 1), between which they are fitted.
Base measurement: Length 10¼ in., width 6 in.
Price **2/-**

CUTTING No. 3 (CENTRE SECTION, CURVED)
This is used for curved tracks in the same manner as the straight centre section, described above, is used for straight tracks. It is suitable for both 1 ft. and 2 ft. radius tracks. Price **2/-**

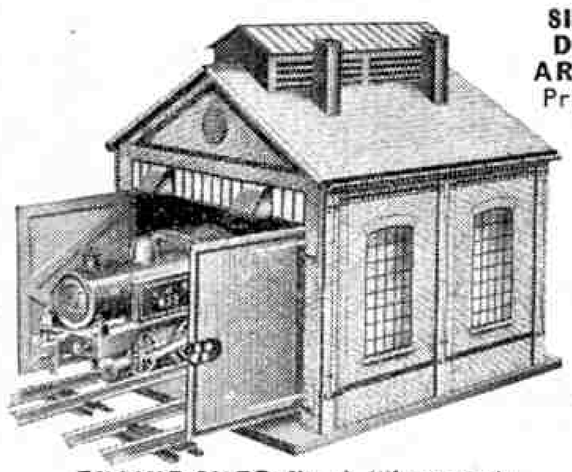


TUNNEL No. 3 (Curved)
Length 13 in. Price **4/6**

TUNNEL No. 4 (Curved)
(as illustrated)
Length 20 in. For 2 ft. radius tracks only. Price **5/6**

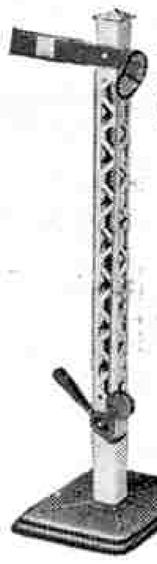


WATER TANK
Fitted with flexible tube and valve lever.
Price **8/6**

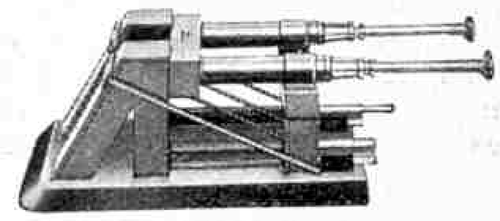


ENGINE SHED No. 1 (illustrated)
This Shed will accommodate Locomotives and Tenders of the M Series, and No. 1 Tank and No. 1 Special Tank Locomotives.
Price **15/-**

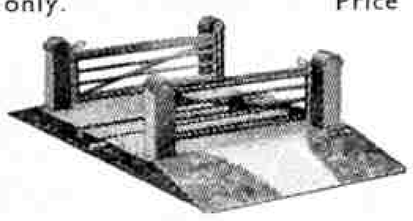
ENGINE SHED No. 2
This Shed will accommodate any Locomotive and Tender in the Hornby Series.
Price **22/6**



SIGNAL No. 1
Packed in pairs (one "Home," one "Distant").
Price, per pair **3/3**



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



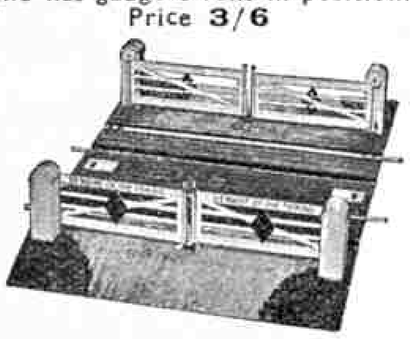
LEVEL CROSSING No. 1
Suitable for a single track only, and has gauge 0 rails in position.
Price **3/6**

STATION No. 1
Length 16¾ in., width 6 in., height 6 in. This Station is a well-made model, richly finished in bright colours. By placing several of these Stations at intervals along the track, and using the Railway Station No. 2 as the main terminus, a very realistic effect is given to a miniature railway layout. Price **6/-**

TURNTABLE No. 2
Price **4/6**

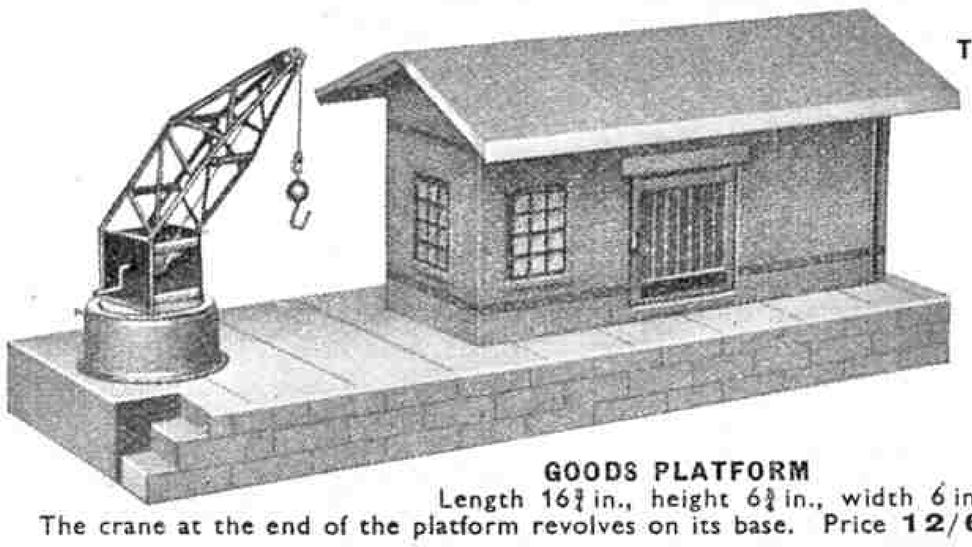
SIGNAL CABIN No. 1
Finished in colours. Price **2/9**

SIGNAL CABIN No. 2 (illustrated)
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. 2
Measures 13½ x 10¼ in., with two tracks of gauge 0 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**



GOODS PLATFORM
Length 16¾ in., height 6¾ in., width 6 in.
The crane at the end of the platform revolves on its base. Price **12/6**

No. 1 FOOTBRIDGE, WITHOUT SIGNALS
Price **4/-**

No. 1A FOOTBRIDGE, COMPLETE WITH SIGNALS Price **4/9**

No. 2 FOOTBRIDGE, COMPLETE WITH DETACHABLE SIGNALS
(as illustrated). Price **7/6**

Signals only (for Footbridge No. 2)
Price, per pair **3/9**

MECCANO LIMITED — OLD SWAN — LIVERPOOL

HORNBY SERIES

HORNBY ROLLING STOCK

GAUGE 0

Hornby Rolling Stock includes almost every type in use on the big railways, and a selection of the splendid range available is illustrated on this page. The various items are modelled on realistic lines, strongly built and beautifully enamelled.

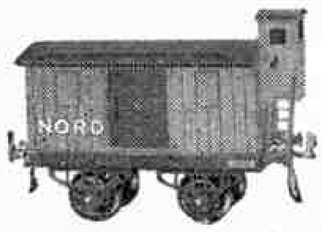
Ask your dealer to show you the full range of Hornby Rolling Stock.

OIL TANK WAGON "MOBILOIL"
Finished in battleship grey. Price **2/6**

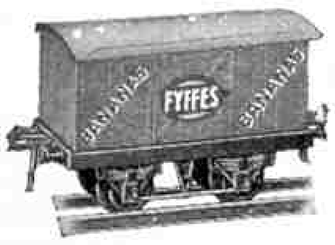
PETROL TANK WAGON "B.P."
Finished in yellow. Price **2/6**

PETROL TANK WAGON "SHELL"
Finished in red. Price **2/6**

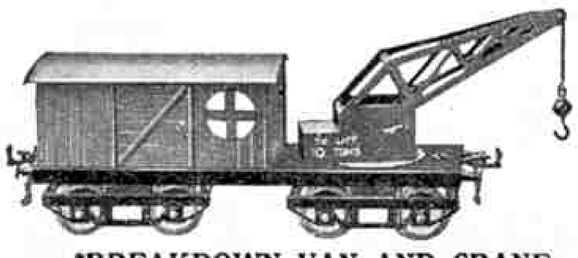
OIL TANK WAGON "CASTROL"
An attractive model. Enamelled green with lettering in red. Price **2/6**



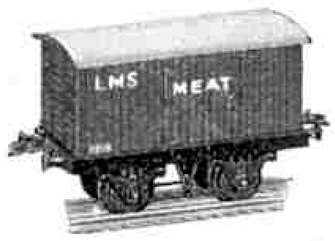
BRAKE VAN (French Type)
Lettered "Nord." Beautifully finished in colours. Opening doors. Price **4/-**



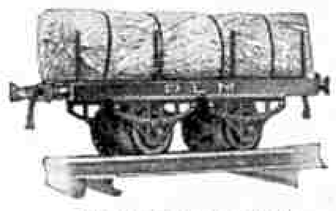
BANANA VAN
An attractive model, finished in yellow and green. Price **3/-**



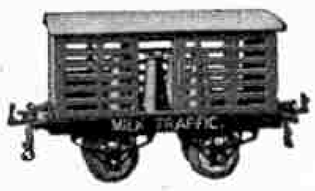
***BREAKDOWN VAN AND CRANE**
Beautifully coloured in brown and blue, with opening doors. Suitable for 2-ft. radius rails only. Price **6/3**



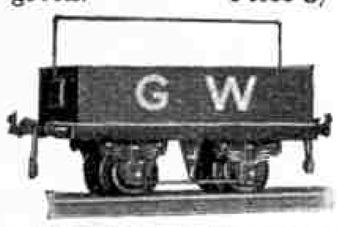
MEAT VAN
This is a very realistic model. Available lettered L.M.S. only. Price **2/6**



FIBRE WAGON
This is an interesting model of a type of wagon used in France and other European countries. Price **1/9**

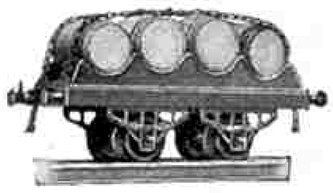


MILK TRAFFIC VAN No. 1
Fitted with sliding doors. Complete with milk cans. Price **3/-**



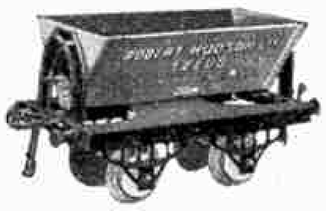
***OPEN WAGON "B"**
Similar to Hornby Wagon No.1, but fitted with centre tarpaulin supporting rail. Price **2/3**

MITROPA COACH No. 3
Lettered "Mitropa," with either "Speisewagen" or "Schlafwagen" in gold. Beautifully finished in red enamel with white roof. Price **15/6**

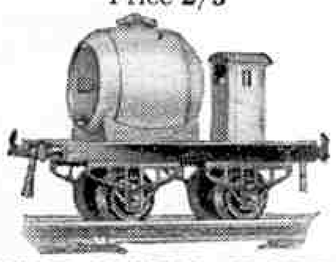


BARREL WAGON
This is another interesting model of a type of wagon used in France and other European countries. Price **2/9**

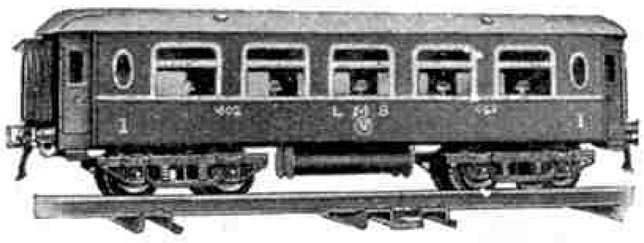
GAS CYLINDER WAGON
Finished in red, lettered gold. Price **2/6**



SIDE TIPPING WAGON
Excellent design and finish. Lettered "Robert Hudson Ltd." Price **2/6**



WINE WAGON, SINGLE BARREL
An interesting model of the single-barrel type of wine wagon used in France. Finished in red and green. Price **4/-**

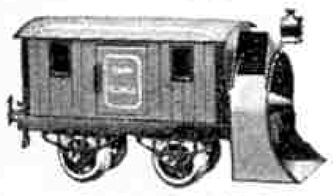


No. 2 SALOON COACH
Realistic in design and beautifully finished. Two types are available: L.M.S. (as illustrated) enamelled maroon, and L.N.E.R. enamelled brown. Suitable for 2-ft. radius rails only. Price **11/6**

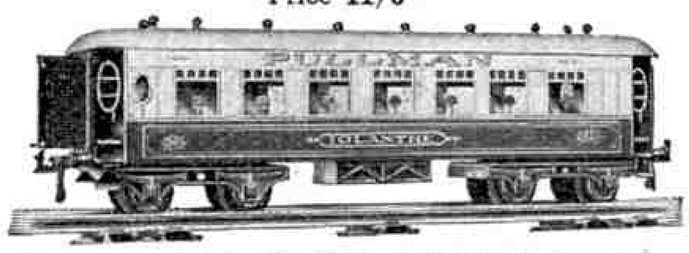
COVERED WAGON (French Type)
This wagon is fitted with frame and sheet. French type lettered "Nord." Price **3/-**

ROTARY TIPPING WAGON
Finished in blue and yellow. Price **3/-**

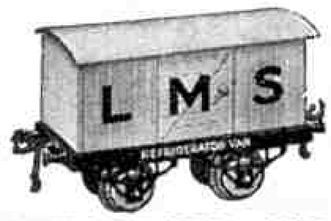
TIMBER WAGON No. 1
Beautifully enamelled in yellow and red. Price **1/9**



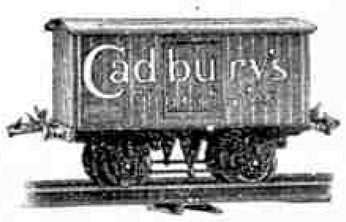
SNOW PLOUGH
With revolving plough driven from front axle. Price **5/6**



HORNBY No. 2 SPECIAL PULLMAN COACH
As supplied with No. 2 Special and No. 3 Pullman Train Sets. This splendid coach is perfect in detail and finish. Suitable for 2-ft. radius rails only. Price **15/-**

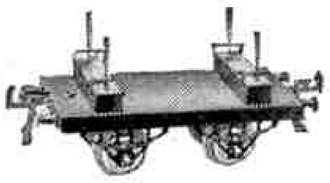


***REFRIGERATOR VAN**
Beautifully enamelled. Fitted with opening doors. Price **3/-**



CHOCOLATE VAN "CADBURY'S"
This new van is beautifully enamelled in blue with orange roof. Price **3/-**

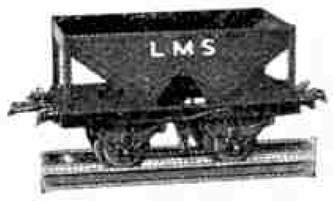
***GUNPOWDER VAN**
Finished in red. With opening doors. Price **3/-**



LUMBER WAGON No. 1
Fitted with bolsters and stanchions for log transport. Price **2/-**

TROLLEY WAGON
Finished in brown and blue. Suitable for 2-ft. radius rails only. Price **4/6**

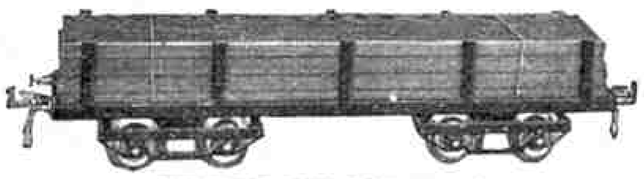
CRANE TRUCK
Finished in brown and blue. Price **3/6**



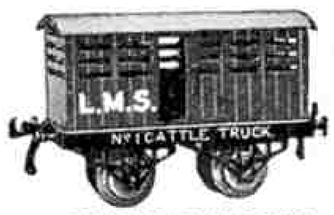
HOPPER WAGON
Mechanically unloaded. Finished in green. Price **3/6**

BITUMEN TANK WAGON "COLAS"
Finished in blue. Price **5/3**

MITROPA COACH No. 0
Finished in red with white roof. Lettered "Mitropa," with either "Speisewagen" or "Schlafwagen" in gold. Price **1/6**



TIMBER WAGON No. 2
Beautifully enamelled in green and red. Suitable for 2-ft. radius rails only. Price **3/6**



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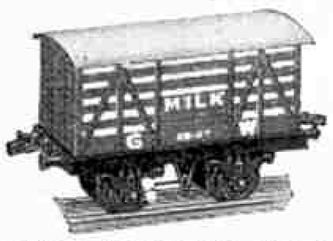

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This is similar to Hornby Wagon No. 1. It is fitted with embossed representation of coal. Price **2/3**

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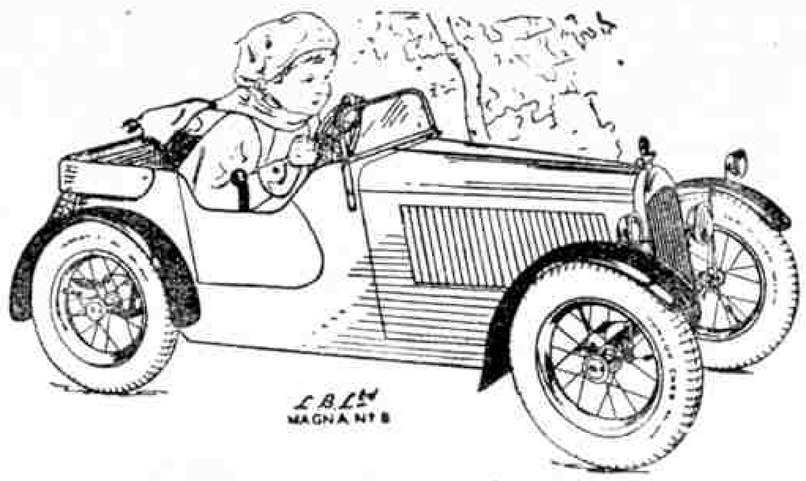

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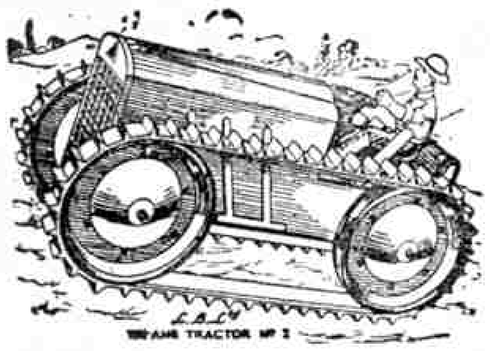
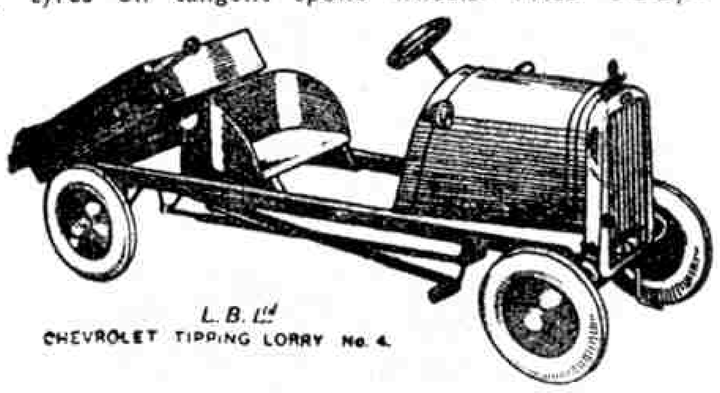
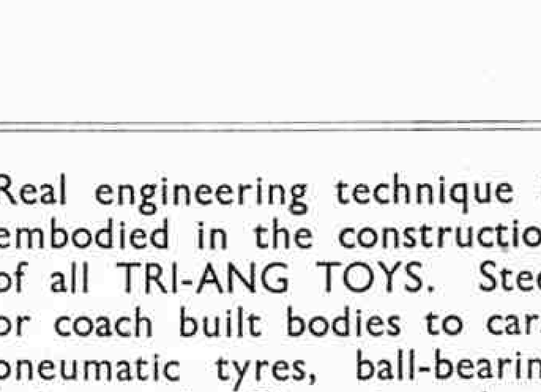


TRI-ANG TRACTOR No. 2. Steel construction, cellulose painted red. Reliable motor with control lever. Rubber bands on steel wheels. Length 8½". Price **3/11**



CHEVROLET TIP LORRY. Levers operate from driving seat to raise tipping truck and open tailboard. Double crank action drive. 9" balloon disc wheels with ⅝" rubber tyres and ball-bearing back axle. Price **28/6**



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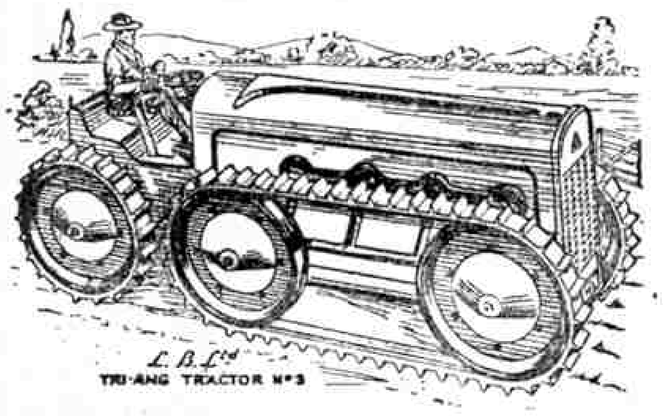

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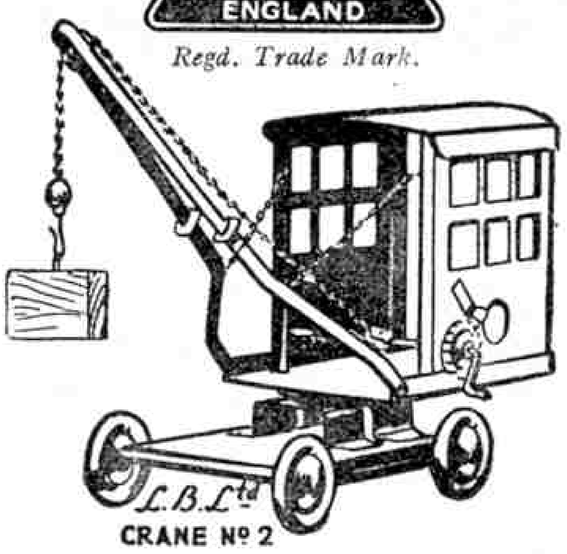
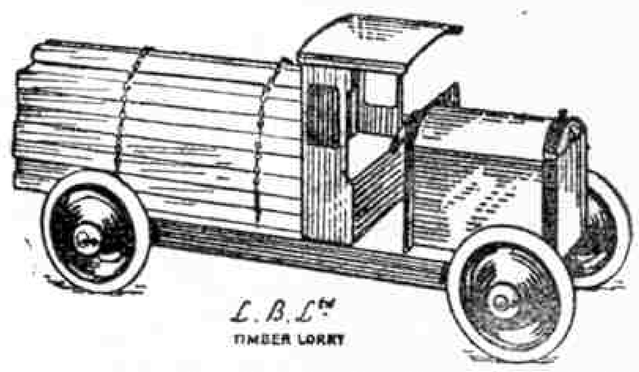
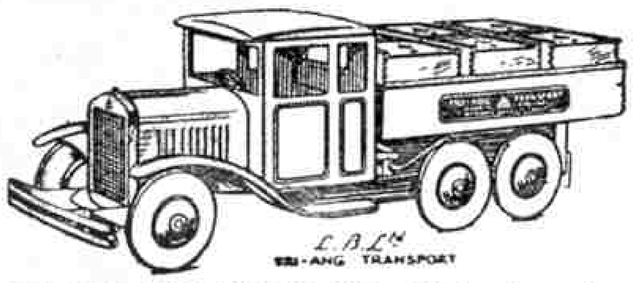


CRANE Nº 2

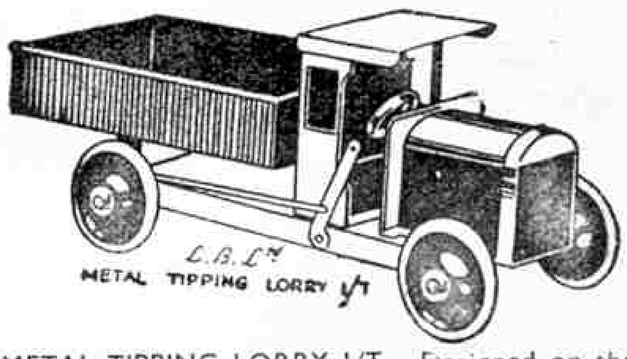
ALL STEEL CRANES. Stove enamelled red, with black undercarriage. Welded joints. Steel disc wheels with rubber tyres.



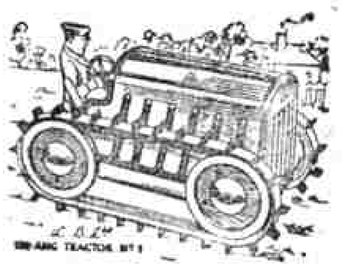
METAL TIMBER LORRY. Steel lorry loaded with planks fastened to chassis by chains. Steel disc wheels, rubber tyres.



TRI-ANG TRANSPORT SIX. Made throughout of steel. Six wheels with balloon rubber tyres. Driven by heavy flywheel geared to rear wheels. Motor type steering. Complete with six cases. Length 20". Price **10/6**



METAL TIPPING LORRY I/T. Designed on the same lines as the real thing. Body tipping is operated by lever from the driving cab. Steel disc wheels, rubber tyres. Length 17½".



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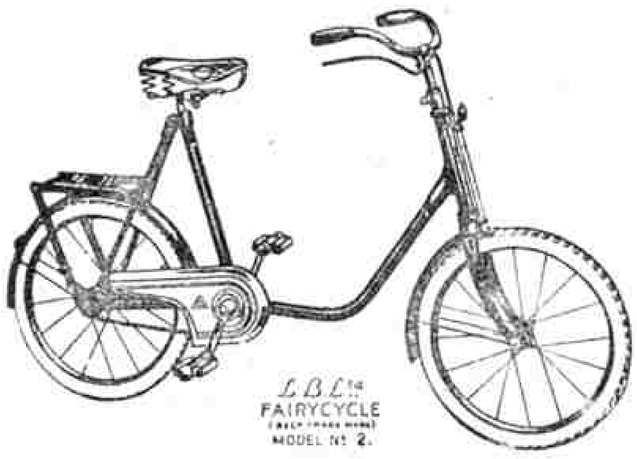

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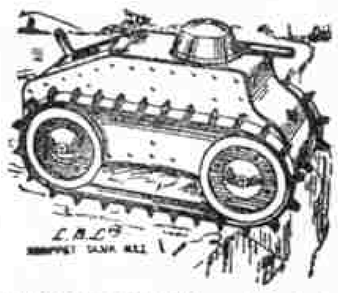

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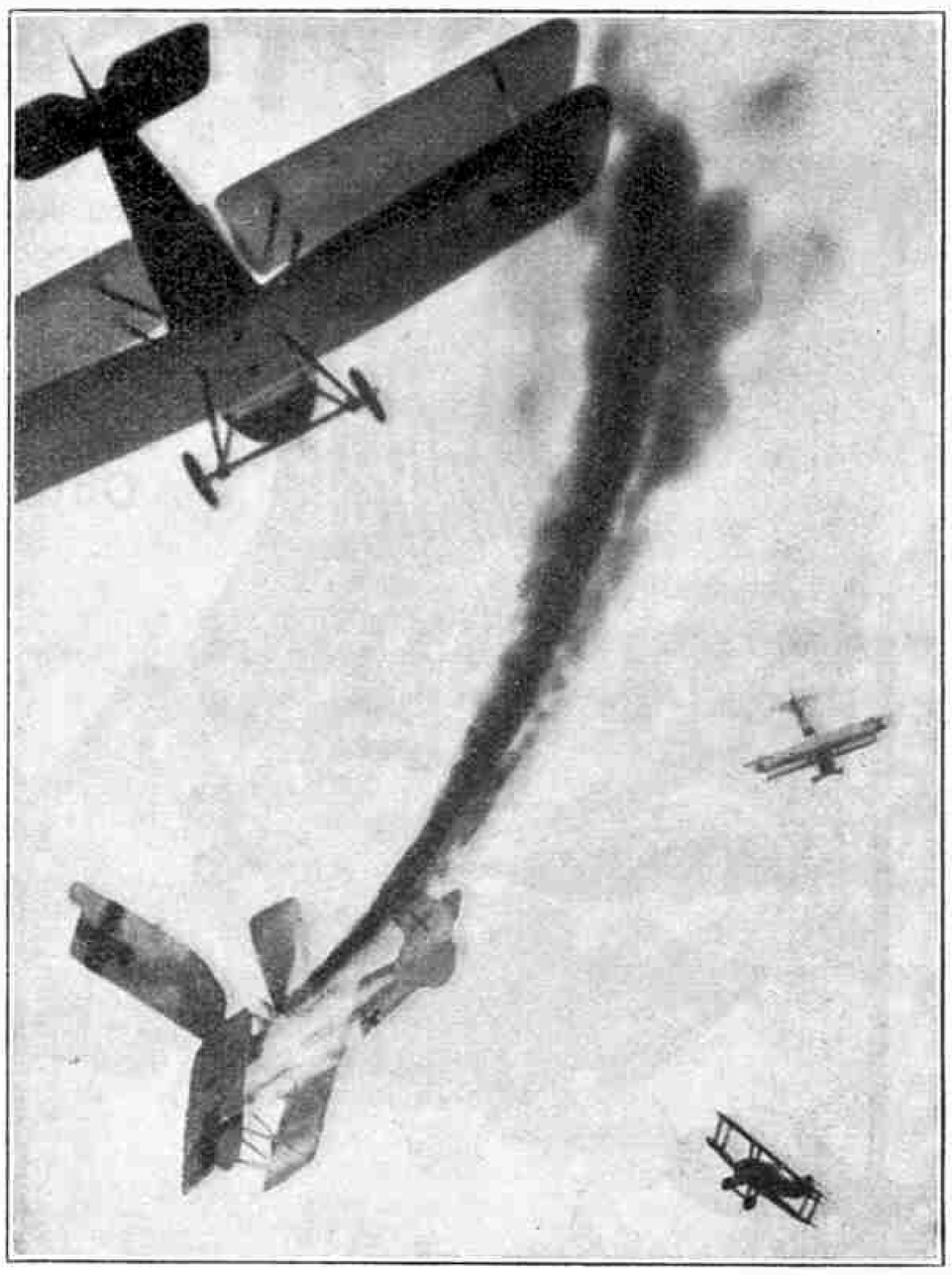

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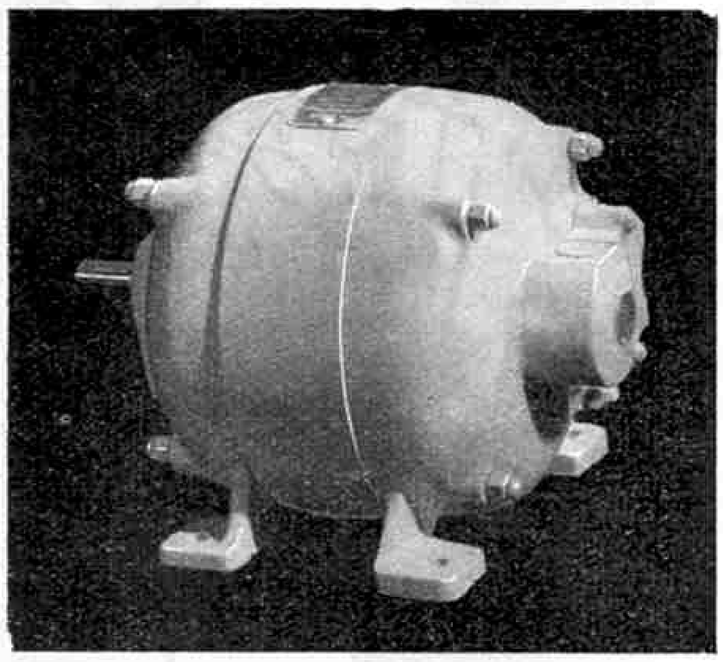

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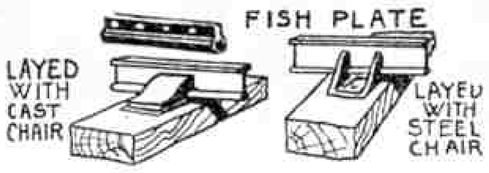

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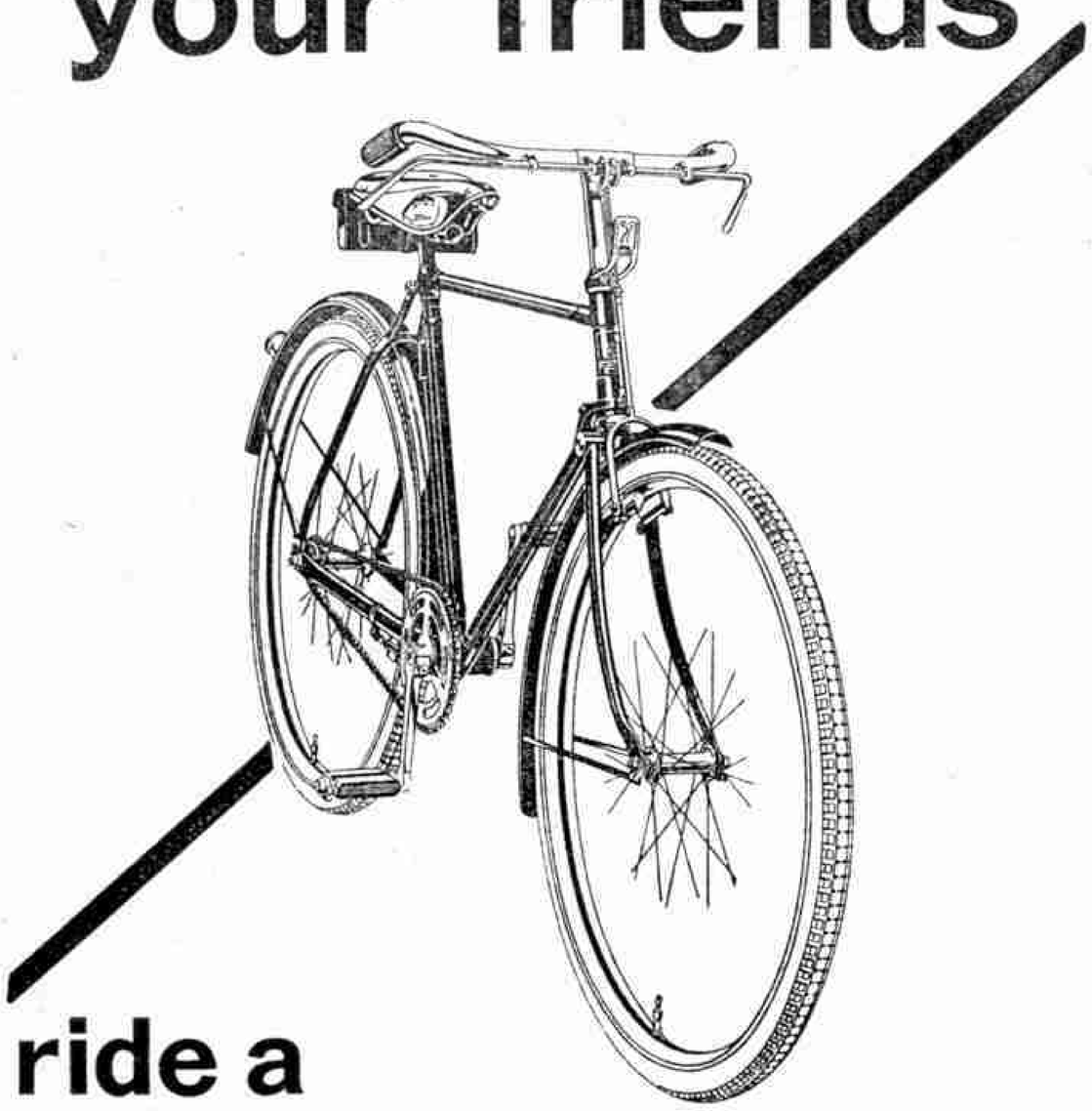

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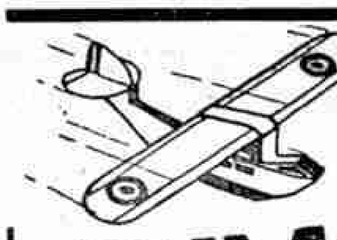

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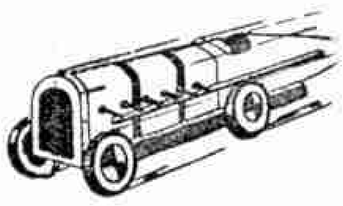

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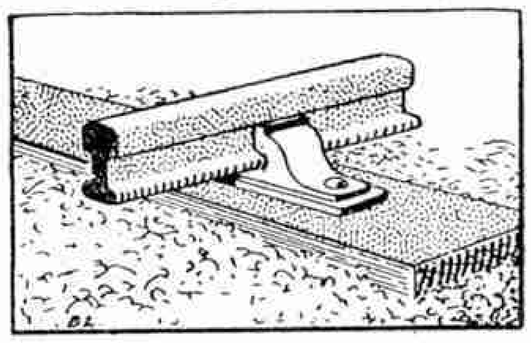

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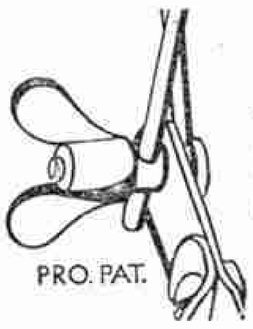

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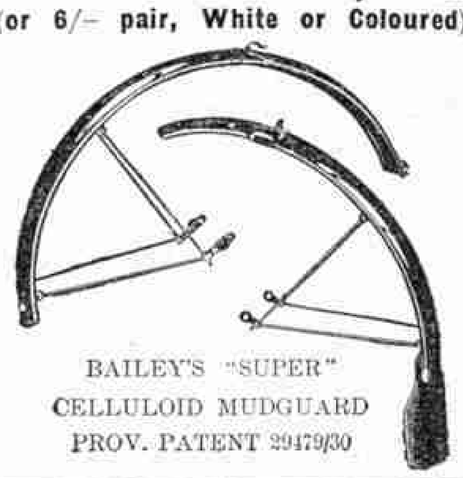

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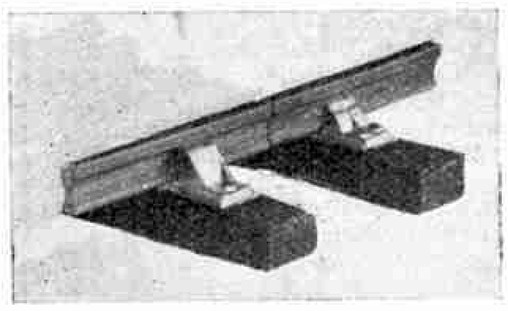

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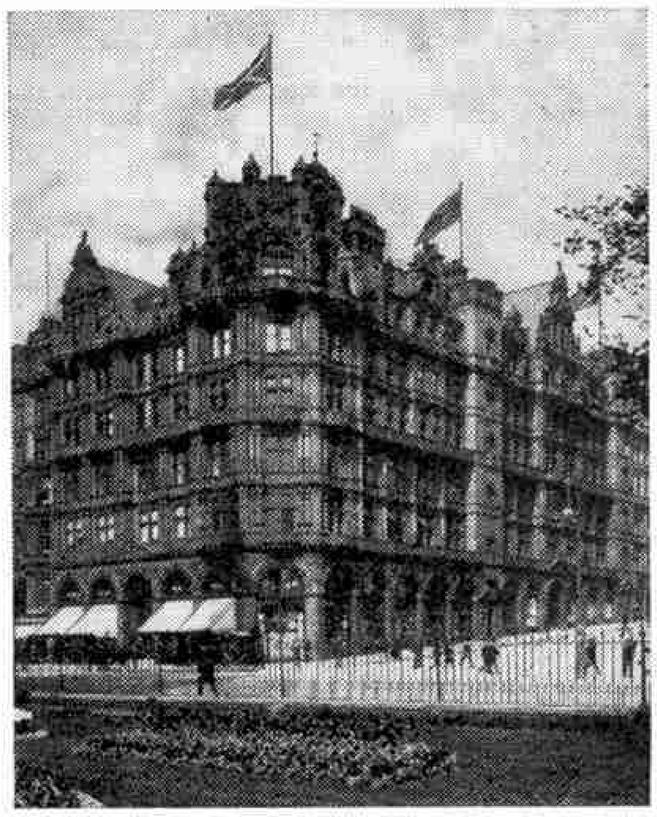

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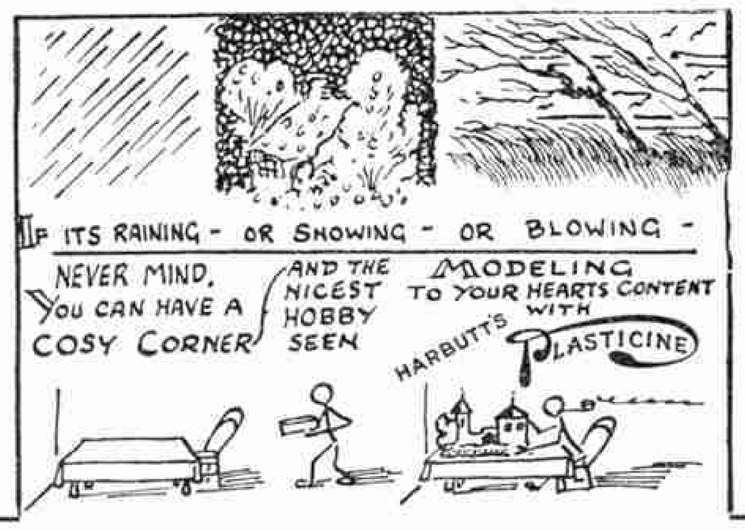

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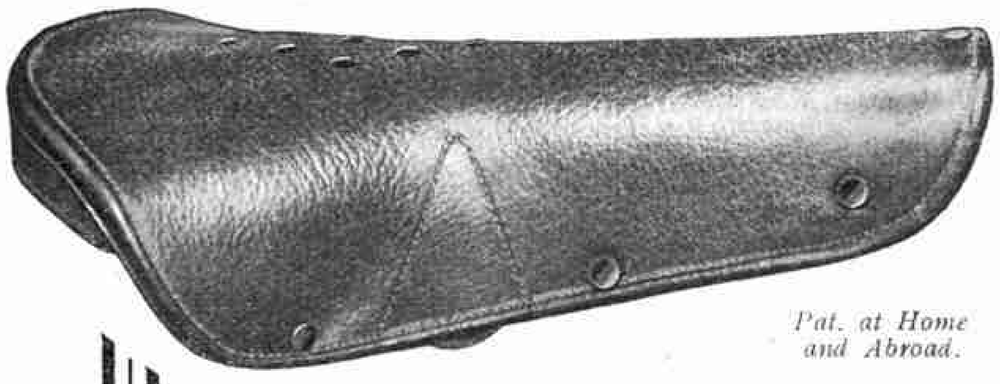

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This Month's Special Articles

	Page
Air News	110
British Aircraft Developments	108
Books to Read	120
Competition Page	153
Engineering News	98
Fireside Fun	155
From Our Readers	122
Great Ports of the World. II—London	95
Guild Pages	126–7
Hornby Railway Company Pages	137–151
Life Story of Meccano	124
London–Brighton Electric Expresses	112
Making of Iron and Steel	90
Model-Building Contests	131
Model-Building Contests Results	134
Motor Vehicles in Meccano	128
Our Busy Inventors	102
Priestman "Universal" Excavator	100
Railway News	116
"Single-Wheelers" in Retirement	118
Sounding the Sea by Echoes	104
Stamp Collecting	157
Stamp Gossip	159
Story of the Quebec Bridge	92
Suggestions Section	132
"The Merseyside Express"	114
With the Model-Builders	135
"What Shall I Be?"	106

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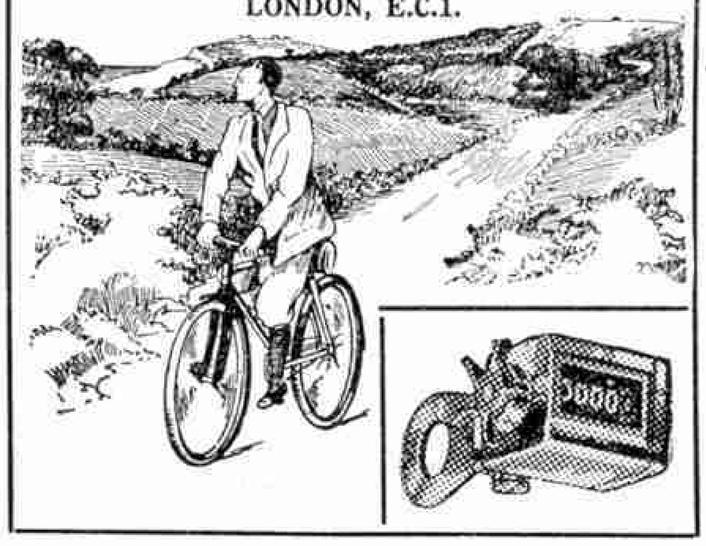

MECCANO MAGAZINE

Registered at G.P.O., London, for transmission by Canadian Magazine Post.

EDITORIAL AND ADVERTISING OFFICE:—
OLD SWAN, LIVERPOOL, 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.

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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.

The Making of Iron—(*Continued from page 91*)

process could be obtained.

In the Siemens furnace hot gas produced by burning coal with a limited supply of air is passed through a chamber of chequered brickwork called the regenerator chamber. This chamber is previously heated, and in passing through it the already hot gas is further increased in temperature. Air is passed through a similar chamber and raised to a very high temperature, and the hot air and the hot gas are brought together in the furnace and combustion takes place at once.

The gases resulting from this combustion are drawn out of the furnace at a very high temperature and passed through chambers exactly similar to those through which the air and gas passed previously. The combustion gases part with their heat to the brickwork and then, by means of valves, the whole process is reversed—the air and the unburned gas passing through the chambers heated by the gases produced by combustion, and the latter gases passing through the chambers that have become cooled by giving up their heat in the first place to the air and active gas. This reversal is continued at regular intervals, and results in a gradual increase in the furnace temperature up to the point required.

The molten steel is run into ingot moulds, and while these are being filled pieces of aluminium are thrown in to prevent the production of blow holes caused by gases dissolved in the metal separating out as the metal cools and solidifies. After about aalf an hour the moulds are removed and the ingots placed in gas-fired or coal-fired re-heating furnaces, which serve the same purpose as the coking pits used for ingots of Bessemer steel.

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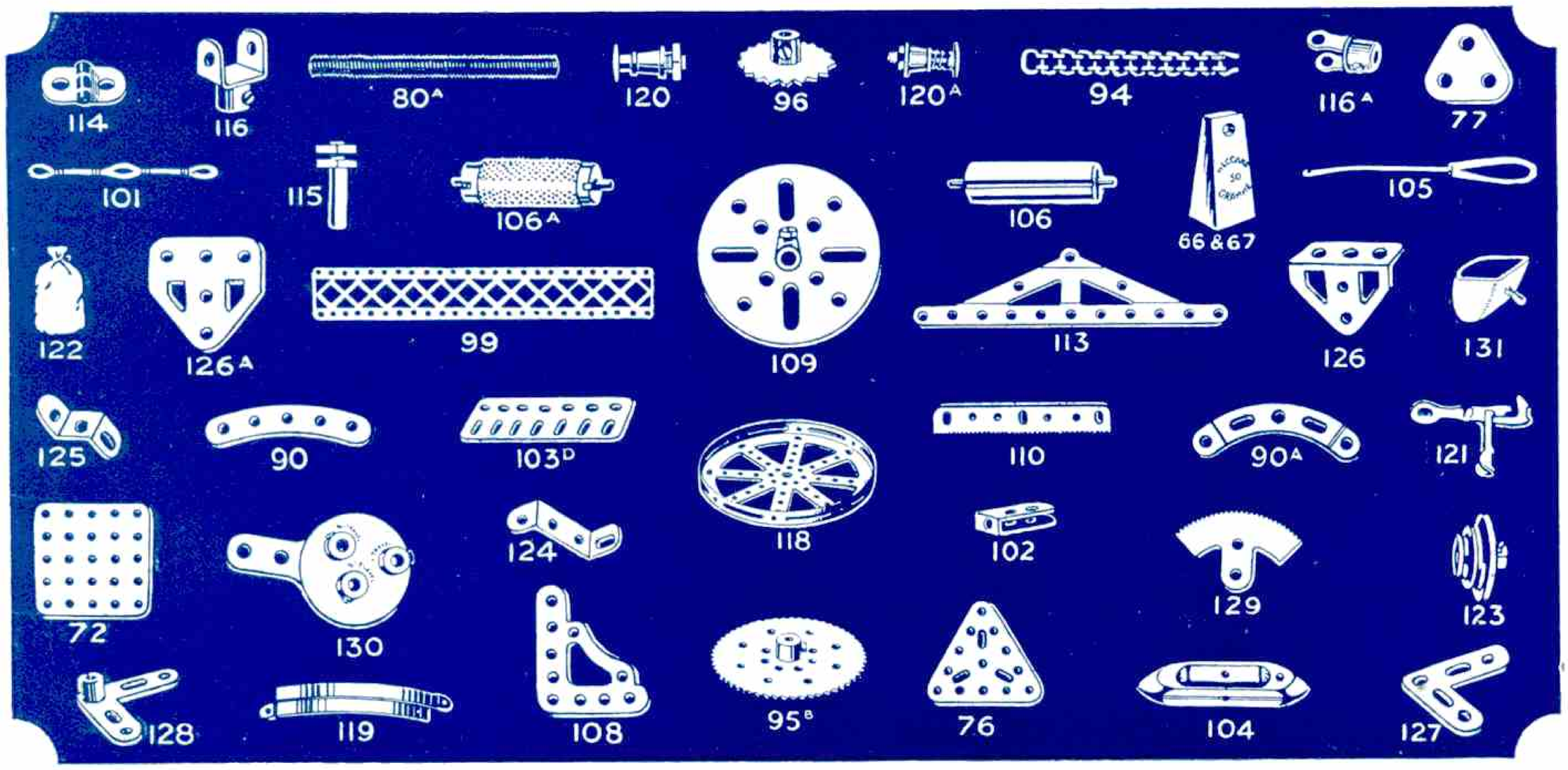
MECCANO
PARTS & ACCESSORIES



No.		s.	d.
66.	Weights, 50 grammes ... ... each	1	0
67.	" 25 " ... ... "	1	0
68.	Woodscrews, ½" ... ... doz.	0	3
69.	Set Screws ... ... "	0	3
69a.	Grub Screws, 5/32" ... ... "	0	4
69b.	" " 7/32" ... ... "	0	5
70.	Flat Plates, 5½" × 2½" ... ... each	0	4
72.	" " 2½" × 2½" ... ... "	0	2
73.	" " 3" × 1½" ... ... 2 for	0	3
76.	Triangular Plates, 2½" ... ... each	0	2
77.	" " 1" ... ... "	0	1
78.	Screwed Rods, 11½" ... ... "	0	6
79.	" " 8" ... ... "	0	5
79a.	" " 6" ... ... "	0	4
80.	" " 5" ... ... "	0	3
80a.	" " 3½" ... ... "	0	3
80b.	" " 4½" ... ... "	0	3
81.	" " 2" ... ... "	0	2
82.	" " 1" ... ... "	0	1
89.	5½" Curved Strips, 10" radius ... "	0	2
89a.	3" " " cranked, 1¾" radius, 4 to circle "	0	2
89b.	4" " " cranked, 4½" radius, 8 to circle "	0	2
90.	2½" " " 2⅜" radius ... "	0	1
90a.	2½" " " cranked, 1⅜" radius, 4 to circle "	0	1
94.	Sprocket Chain ... ... per 40" length	0	6
95.	Sprocket Wheels, 36 teeth, 2" diam. each	0	5
95a.	" " 28 " 1½" " "	0	4

No.		s.	d.
95b.	Sprocket Wheels, 56 teeth, 3" diam. each	0	6
96.	" " 18 " 1" " "	0	3
96a.	" " 14 " ¾" " "	0	3
97.	Braced Girders, 3½" long ... ... ½ doz.	0	9
97a.	" " 3" " ... ... "	0	8
98.	" " 2½" " ... ... "	0	8
99.	" " 12½" " ... ... "	2	6
99a.	" " 9½" " ... ... "	2	0
99b.	" " 7½" " ... ... "	2	0
100.	" " 5½" " ... ... "	1	0
100a.	" " 4½" " ... ... "	0	10
101.	Healds, for looms ... ... doz.	0	9
102.	Single Bent Strips ... ... each	0	1
103.	Flat Girders, 5½" long ... ... ½ doz.	0	10
103a.	" " 9½" " ... ... "	1	2
103b.	" " 12½" " ... ... "	1	3
103c.	" " 4½" " ... ... "	0	9
103d.	" " 3½" " ... ... "	0	7
103e.	" " 3" " ... ... "	0	6
103f.	" " 2½" " ... ... "	0	5
103g.	" " 2" " ... ... "	0	4
103h.	" " 1½" " ... ... "	0	4
103k.	" " 7½" " ... ... "	1	0
104.	Shuttles, for looms ... ... each	5	0
105.	Reed Hooks, for looms... ... ... "	0	4
106.	Wood Rollers ... ... "	1	6
106a.	Sand Rollers ... ... "	1	9
107.	Tables for Designing Machines ... "	1	6
108.	Architraves ... ... "	0	2
109.	Face Plates, 2½" diam. ... ... "	0	4

No.		s.	d.
110.	Rack Strips, 3½" ... ... each	0	2
110a.	" " 6½" ... ... "	0	3
111.	Bolts, ¾" ... ... 2 for	0	1
111a.	" ½" ... ... 3 for	0	1
111c.	" ⅜" ... ... doz.	0	3
113.	Girder Frames ... ... each	0	3
114.	Hinges ... ... per pair	0	4
115.	Threaded Pins ... ... each	0	2
116.	Fork Pieces, Large ... ... "	0	3
116a.	" " Small ... ... "	0	3
117.	Steel Balls, ⅜" diam. ... ... doz.	0	6
118.	Hub Discs, 5½" " ... ... each	1	3
119.	Channel Segments (8 to circle, 11½" diam.) ... ... "	0	4
120.	Buffers ... ... "	0	2
120a.	Spring Buffers ... ... per pair	0	8
120b.	Compression Springs ... ... each	0	1
121.	Train Couplings ... ... "	0	2
122.	Miniature Loaded Sacks ... ... "	0	2
123.	Cone Pulleys ... ... "	1	3
124.	Reversed Angle Brackets, 1" ... ½ doz.	0	4
125.	" " " ½" ... "	0	3
126.	Trunnions ... ... each	0	2
126a.	Flat Trunnions ... ... "	0	1
127.	Simple Bell Cranks ... ... "	0	1
128.	Boss Bell Cranks ... ... "	0	3
129.	Rack Segments, 3" diam. ... ... "	0	5
130.	Eccentrics, Triple Throw ... ... "	1	0
131.	Dredger Buckets ... ... ½ doz.	1	0

Details and prices of the complete range of Meccano Manuals may be obtained from any Meccano dealer.

The Meccano system is composed of some 250 real engineering parts, mostly made of steel or brass, each one of which has a definite mechanical purpose. These parts combine to form a complete miniature engineering system that enables practically any movement known in mechanics to be duplicated. A group of the parts from No. 66 to No. 131 is listed above.

New parts are always being invented in order to keep Meccano model-building in line with the most modern engineering requirements. The greatest care is taken in the designing of these parts to ensure that they function exactly as their counterparts in actual practice.

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MECCANO LTD. — Binns Road — Old Swan — LIVERPOOL

This model of a Biplane is built with Meccano Aeroplane Constructor Outfit No. 2.

MECCANO

AEROPLANE CONSTRUCTOR OUTFITS

Boys, the Meccano Aeroplane Constructor Outfits are fine! The parts contained in them are all interchangeable on the famous Meccano principle and they enable aeroplane construction to be carried out on sound engineering lines. The illustrated Manual included in each Outfit shows how to build wonderful models of Monoplanes, Biplanes, Seaplanes and giant amphibian machines; in fact, models of almost every type of aircraft can be made with these splendid Outfits. Your dealer will be pleased to show them to you.

Meccano Aeroplane Constructor Outfit No. 0 Price **5/-**

Meccano Aeroplane Constructor Outfit No. 1 Price **9/-**

Meccano Aeroplane Constructor Outfit No. 2 Price **16/6**

Meccano Aeroplane Constructor Outfit No. 2

AEROPLANE HANGAR
29" × 22" × 10½"

This splendid hangar, with its realistic double sliding doors, has been specially designed to house model aeroplanes. It will accommodate six machines built with the No. 0 Meccano Aeroplane Constructor Outfit, or two built with either No. 1 or No. 2 Outfits.
Price **25/-**

MOTOR CAR CONSTRUCTOR OUTFIT

This splendid Motor Car Outfit—one of the latest Meccano developments—enables models of sports and speed cars to be built, each strikingly realistic, a masterpiece of design and workmanship.

An extremely powerful clockwork motor is included which gives the models a run of 150 feet on one winding.

The Outfit is available in three different colours—Red, Blue and Green. Please specify the colour you require when ordering, or, better still, ask your dealer to show you a specimen of each Outfit.

Price **25/-**

Meccano Motor Car Constructor Outfit

MOTOR CAR GARAGE
14¼" × 9" × 7⅞"

This miniature garage provides splendid accommodation for a model motor car. It is strongly built, and its pebble-dash finish gives it an extremely attractive appearance.
Price **10/6**

This fine model of a sports car is made entirely of Meccano Motor Car Constructor Parts.

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