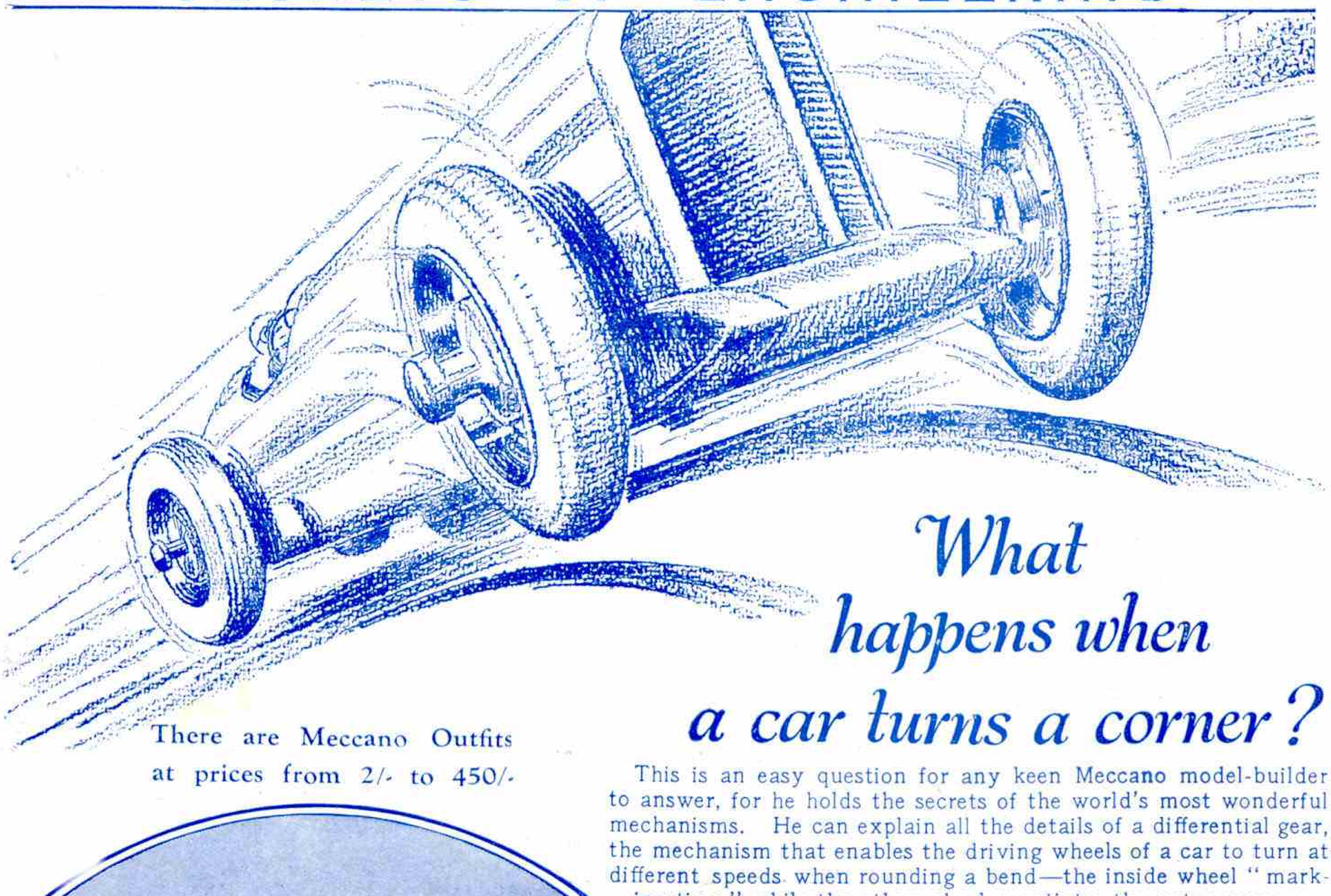
VOL. XVI. No. 4. APRIL 1931.

MECCANO MAGAZINE

QUARRYING A GIANT BLOCK OF GRANITE (see page 274)

6D.

SECRETS OF ENGINEERING



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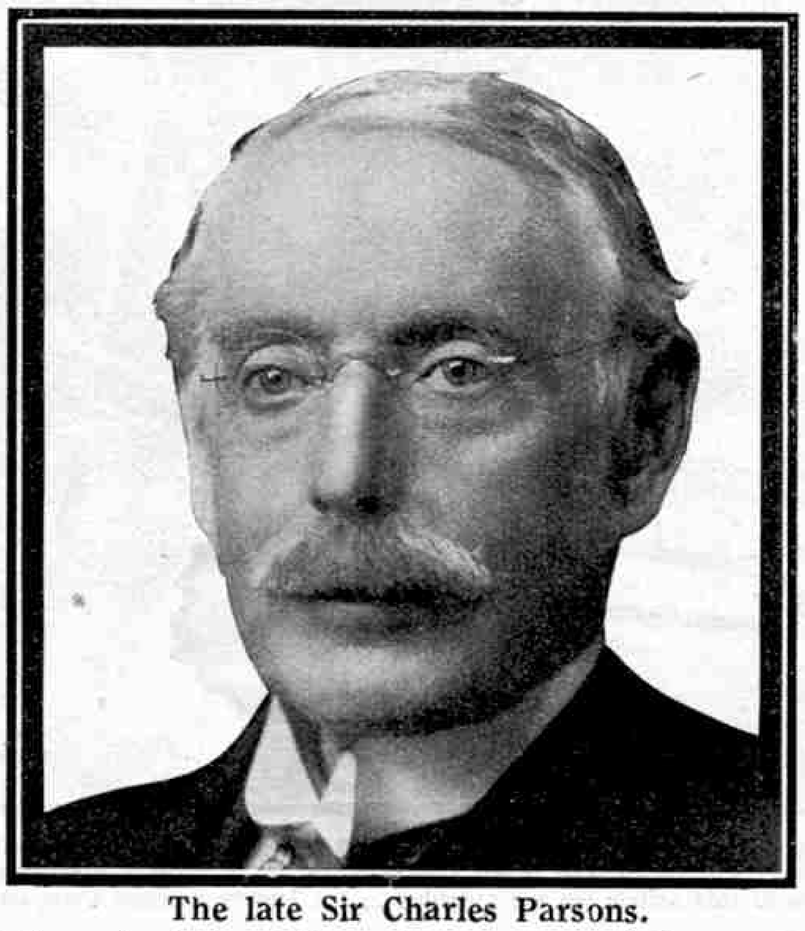
With the Editor

British Inventors and the Steam Engine

By the death of Sir Charles Parsons the world has lost one of the greatest pioneers in the history of steam engineering. In a later issue I hope to give an account of Sir Charles' wonderful career and achievements; for the present I wish to draw attention to a fact that is not sufficiently realised. This is that to British genius are due practically all the great inventions that have led up to the present marvellous development of steam power on land and on sea. It may fairly be said that the outstanding figures in the history of the steam engine are Thomas Savery, Thomas Newcomen, James Watt, Richard Trevithick and Charles Parsons.

Savery was the first to make use of steam on a practical scale, in the form of an engine for pumping water out of flooded mines and for raising water to supply houses and towns. This engine was terribly wasteful of fuel, and for mine purposes its use was limited by the steam pressure that the boiler could bear. It is an interesting fact that Savery is credited with the first use of the term "horse-power" as a measure of the power of an engine. Newcomen brought about many improvements in Savery's engine, and eliminated its worst faults. As compared with Savery's engine, Newcomen's possessed the great advantage that the pressure in the pump was not limited by the pressure of the steam; but as regards consumption of fuel it was little better than its predecessor. Newcomen's engine began to come into use for mine pumping about 1711, and it held its place for some three-quarters of a century.



The late Sir Charles Parsons.

In 1773 Watt was led to the serious study of the steam engine as the result of being called upon to repair a model of Newcomen's engine. The outcome was his discovery of the principle of the separate condenser, which made possible for the first time a really efficient and economical steam engine. Watt introduced further important improvements, and ultimately brought the low-pressure engine to an advanced state of perfection. The comprehensive nature of Watt's patents made matters difficult for other inventors. Trevithick solved the problem by abandoning the use of low-pressure steam and introducing a high-pressure non-condensing engine, which led the way to the development of the steam locomotive.

In 1884 Charles Parsons patented the first really practical steam turbine, and thereby set on foot a revolution in steam engine practice. The turbine has now completely displaced the piston engine for the production of electrical energy on a large scale at central stations, and for the driving of war vessels and the fastest type of passenger ships.

Can Earthquakes be Foretold?

The disastrous earthquake in New Zealand raises again the question of whether it will ever be possible for us to foretell the coming of such terrible visitations. Earthquakes are disturbances of the surface of the Earth, caused in all probability by fractures taking place in the depth of the Earth's crust. For this reason it appears extremely unlikely that we shall ever be able to predict them in the sense in which we can predict the tides of the ocean, or eclipses of the Sun and the Moon. Earthquakes appear to occur in cycles, but although some earthquakes of recent years, notably in Japan, have taken place at approximately the time they were due according to calculations, this method of foretelling them is far too vague and uncertain to be of practical value.

What is required is some means of giving warning of the immediate approach of an earthquake to the inhabitants of the area involved; and it has been suggested that this may possibly be done by the use of an instrument known as the tiltometer. Before an actual fracture occurs in any substance a certain amount of "give" takes place. This appears to be the case in regard to fractures of the Earth's crust, and on various occasions the tiltometer has registered slight tilts of the surface two or three days before earthquakes have occurred. It is true that the earthquakes in question have been of comparatively small importance, but the results encourage the hope that, if the instrument turns out to be a reliable guide, loss of life such as has taken place in New Zealand may possibly be avoided, or at any rate greatly reduced.

Britain's Largest Book

This month one of the world's largest books will be written. It will consist of about 30,000 volumes containing approximately 13,000,000 pages, and will weigh more than 120 tons! In spite of its gigantic size this book will be written in a single day, for it will consist of the actual census returns for 1931, and will be the joint production of the millions of householders in Great Britain.

The idea of taking a census is a very ancient one. It is believed that in China a survey of the people and their occupations was made nearly 5,000 years ago; and in the British Museum there are to be seen tablets of baked clay inscribed with figures relating to a census taken in Mesopotamia about 2400 B.C. The ancient Greeks and Romans also adopted the custom, which eventually spread throughout the western world.

In ancient times and in the Middle Ages the chief purpose of a census was to enable a ruler to take stock of the fighting men at his disposal, or to learn the actual wealth of his subjects, usually in order to tax them more thoroughly! To-day a census is intended to provide what we might call an instantaneous photograph of a whole nation, for comparison with similar pictures taken previously.

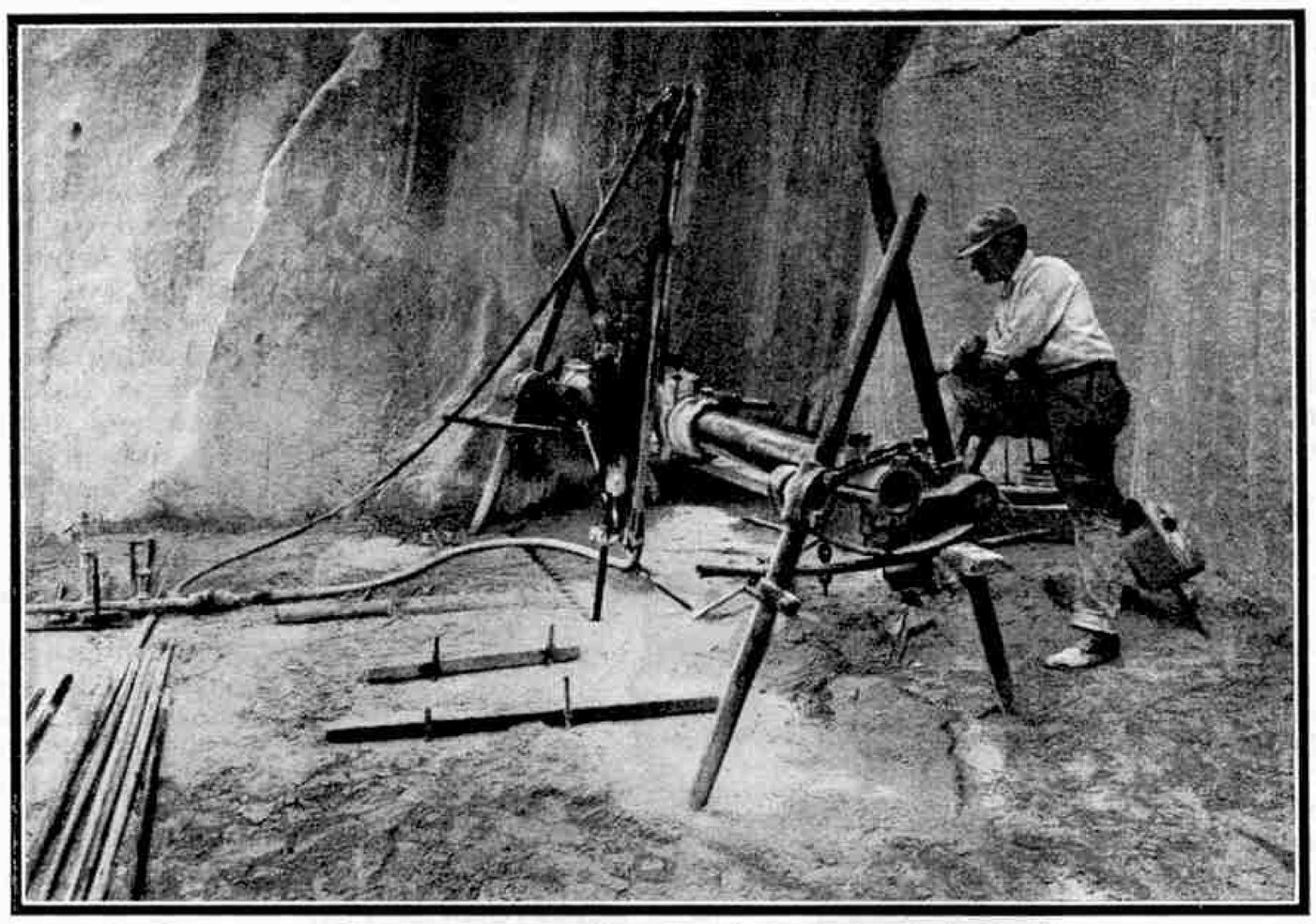
The first census that may be described as modern was carried out in Canada, where the inhabitants of the Province of Quebec, then under French rule, were numbered as early as 1665. In Europe the lead was given in 1675 by Sweden. Great Britain did not adopt the idea until the middle of the 18th century, and the proposal to hold a census met with considerable opposition. The fact that it was compulsory to answer the questions asked on the census form was regarded by many people as the final blow to English liberty; and fears were expressed that some great public misfortune or disastrous epidemic would be the result! All foolish ideas of this kind have now died away, and on the 26th of this month 13,000,000 authors will co-operate in writing what well may be called "The 1931 Book of the British People."

Quarrying by Compressed Air

Drills that Eat into the Hardest Rock

THE quarrying industry affords a striking example of the transformation that may be brought about by the use of compressed air as a source of power. The introduction of the air-driven rock drill has made it possible to break the hardest rock with ease, and at a speed that, in the days of the hand drill, would have been regarded as incredible. The use of compressed air in quarrying is not by any means confined to the operation of drills, however, but extends to a great variety of processes in the course of getting out and preparing the stone.

Some of the most interesting quarries from the point of view of mechanical operation are to be found in the United States. Our cover this month shows a scene in one of the J.K. Pirie Estate quarries at Barre, Vermont, U.S.A. This particular quarry has been operated for many years, and from it are obtained light, medium and dark granites of beautiful quality. This granite, and also most of the granite quarried in the Barre district, is extensively used for monumental purposes on account of the fineness of its grain and the evenness of its colouring. The pit shown is 175 ft. in depth. The stone is cut out mainly with Ingersoll-Rand air-operated rock drills, and the output averages about 90 car loads per month, each car load consisting of between 150 and 175 cu. ft. of block granite. The drills that are seen in the photograph are equipped with automatic feed, which makes it possible to do 20 per cent. more drilling per day than with drills not so equipped.



Channelling in a Barre granite quarry. The drill, operated by compressed air, is drilling a row of holes, the bridges between which will be broken down subsequently by a broach substituted for the drill steel. For the illustrations to this article we are indebted to the Ingersoll-Rand Company Ltd., London.

The Barre granite industry may be said to date from about the year 1780, when settlers in Vermont found that stone from the neighbouring hills made millstones of excellent quality. The millstone industry gradually established itself and flourished, and by degrees other uses of the hard stone suggested themselves. The field of use of the granite thus became extended, but progress on a large scale was impossible until the Central Vermont Railroad extended its line to Barre in 1875, and thus provided the quarries with an easier outlet for their product.

Even then there remained the problem of getting the granite blocks from the quarries on the hill behind the village down to the freight cars waiting below. Large blocks were brought down with great difficulty on wooden rollers. Sometimes the weight of the stone crushed the rollers into soft ground, where they stuck fast; and at other times the blocks had to be prevented from sliding too fast by the desperate efforts of teams of horses pulling in the opposite direction. This state of affairs lasted until 1889 when a railway line was built to the quarries. This line, which is now 30 miles in length and winds its way in and out of the various quarries, may be said to have solved the transport problem for the Barre quarries.

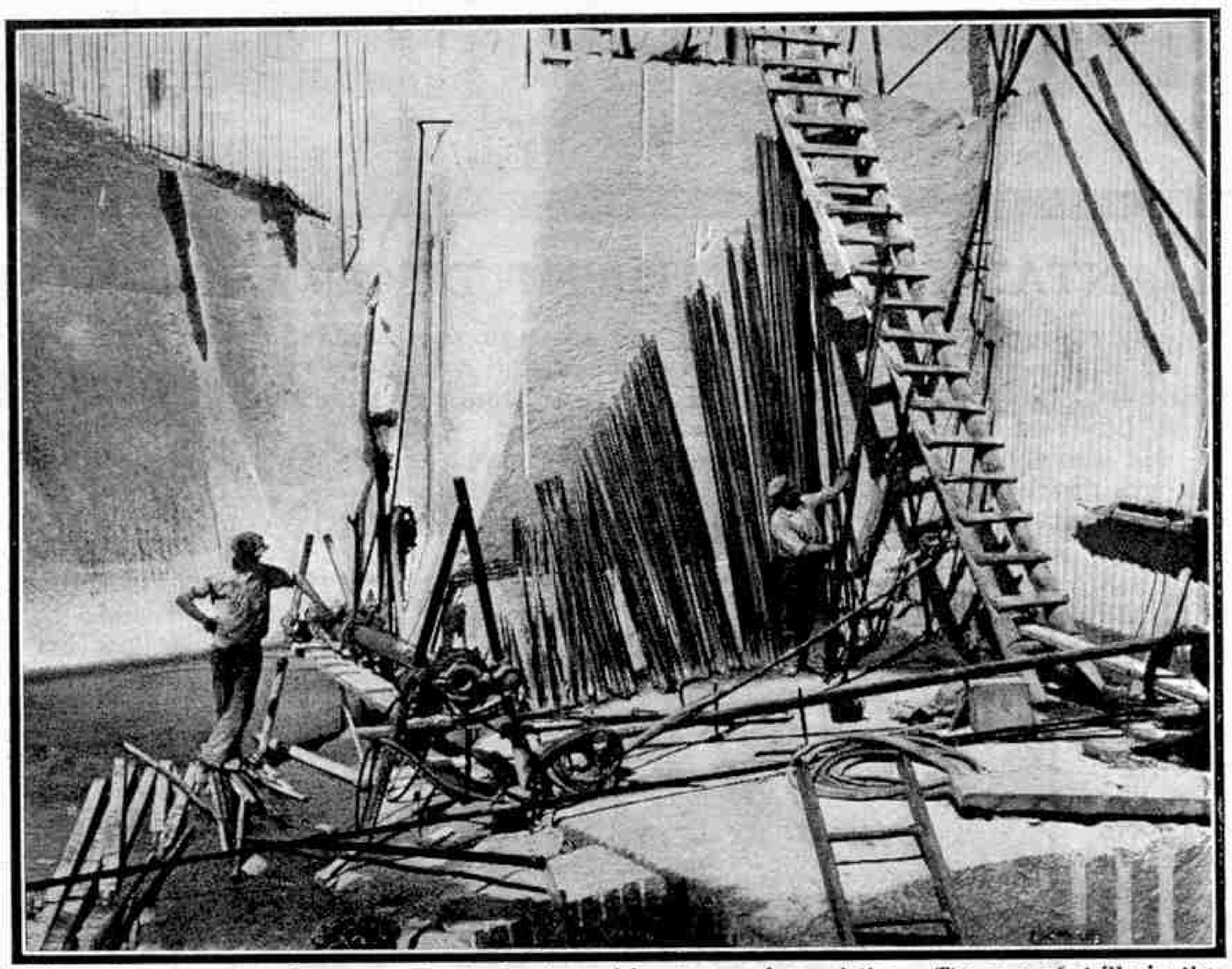
In the early days the granite was quarried by hand. One man held the drill, while another struck it a heavy blow with a sledge hammer. As may be imagined, this work was desperately hard, and it was considered a good performance for one day to make a drill hole 2 ft. in depth. A great step forward was made when steam-operated reciprocating piston drills were introduced. The manual labour was now very greatly reduced, and the daily amount of work was increased enormously. Steam as a source of power was unsatisfactory in many respects, however, and gradually it was superseded by compressed air.

Up to the close of the Great War, quarrying was done by means of air-operated reciprocating piston drills. With a drill of this type having a piston diameter of $3\frac{5}{8}$ in., it took three days to channel a cut 6 ft. in depth and 4 ft. in length. A great improvement was brought about in 1923 by the introduction of the Ingersoll-Rand "X-70" hammer drill, which became standard for all quarries in the Barre district. With this hammer drill a cut that had taken a reciprocating drill three days to make was finished in a single day, with the result that the output of the quarries was very largely increased. Since that time the Ingersoll-Rand Company have brought out still more powerful drills, together with special sharpeners for rapidly reconditioning the steels used by the drill.

For channelling, the drills are mounted on quarry bars $5\frac{1}{2}$ in. in diameter, and channels can be cut to a depth of 12 ft. The drill holes are spaced about $3\frac{1}{2}$ in. between centres, leaving thin bridges that are broken down

subsequently by a broach that is substituted for the drill steel. The drill steels, which are made of $1\frac{1}{4}$ in. hollow round steel and have four-point bits, are changed every 2 ft., because by that time the bits are dulled by the grinding action of the granite. No explosives are used in this work, the detaching of the granite masses being done entirely by means of the rock drill. The freed blocks are lifted from the pit by derrick cranes situated so that they can deposit the blocks on any part of the floor of the quarry. Some of these derricks have masts 110 ft. in height and booms 90 ft. in length, and are capable of lifting blocks weighing up to 60 tons.

On arrival at the cutting yard the blocks are often split into smaller blocks of definite dimensions. This is done by drilling lines of small holes and inserting plugs and wedges which, when hammered tight, split the stone along the required plane. Until recently the operator engaged in this work had to guide the drill with one hand and to rotate the bit with a wrench held in the other hand, in order to prevent the bit from becoming wedged in the rock and jamming. This fatiguing operation has been overcome by the introduction by the Ingersoll-Rand Company of plug-drill bits that rebound and turn themselves after each blow of the drill piston, thus preventing jamming.



Typical pit in Barre granite quarry, showing a channel in process of completion. The row of drills in the centre of the photograph gives an idea of the range of lengths required for drilling at different depths.

Some idea of the importance of the part played by compressed air in the Barre district may be obtained from the fact that a large quarry will produce from 350,000 to 400,000 cu. ft. of granite in a year, using for this work from 40 to 50 pneumatic drills and channelers. The air for this purpose is maintained in the service lines at a pressure of from 95 lb. to 100 lb. Compressed air is used to operate drill sharpeners and oil furnaces, and for a great variety of other purposes in the blacksmith shops. It is employed also to operate the sand blast by which the granite is carved and lettered in the cutting sheds.

Large quantities of granite of notable uniformity of texture and colour are obtained from the Mount Airy quarry of the North Carolina Granite Corporation. The granite at Mount Airy differs from that in many quarries in being a single homogeneous mass, without what are known as "sheeting planes." The nature of the rock is such that it can be split easily in any direction by a properly applied force, and this enables artificial sheeting planes to be produced. By a combination of explosives and compressed air, large sheets are loosened from the solid mass in a manner that somewhat resembles the peeling of an onion. The following description of the method employed, given by the North Carolina Granite Corporation, is quoted from "*The Compressed Air Magazine*," to which we are indebted for much of our information.

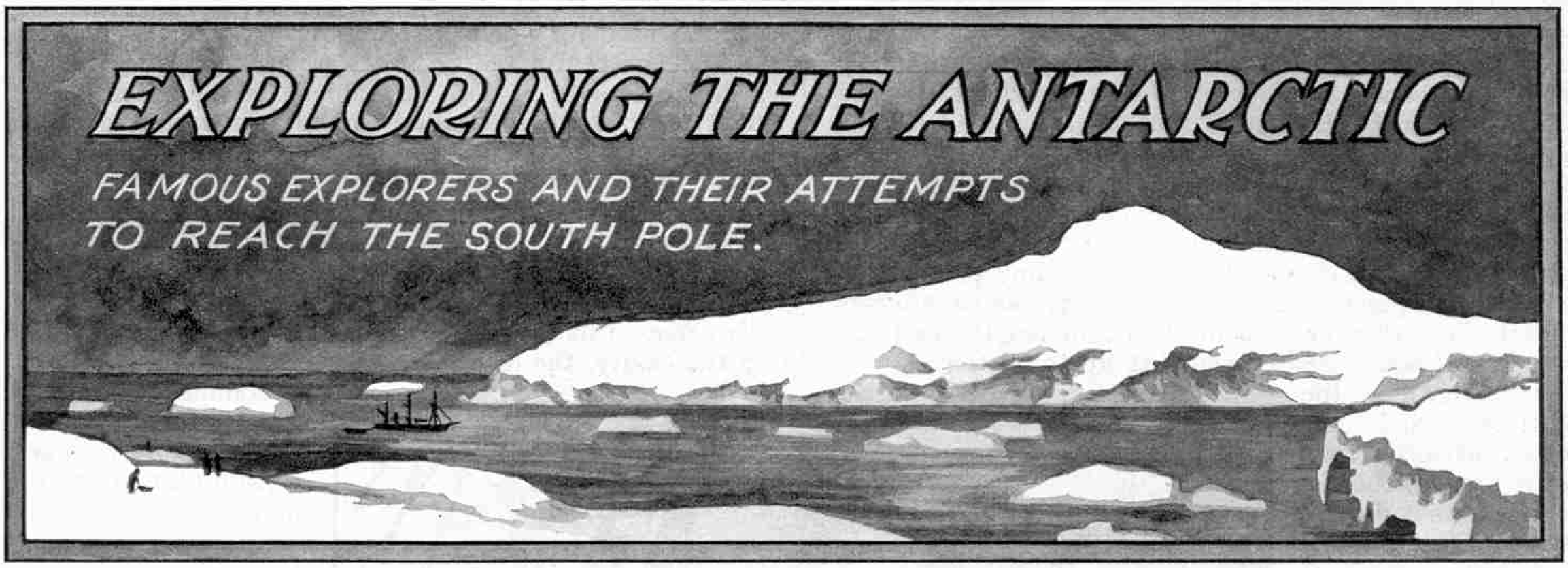
"In the centre of the sheet or area to be 'lifted,' a drill hole 3 in. or 4 in. in diameter is sunk from 5 ft. to 8 ft. in depth, depending on the greatest thickness of stone required, and the contour of the surface of the quarry at that particular point. The bottom of the hole is then enlarged into a pocket by exploding half a stick of dynamite. A small charge of powder, about a handful, is then exploded in the pocket, thus starting a horizontal crack or cleavage across its greater diameter. Charges of increasing size are next exploded in the cavity, the drill hole being plugged at each blast to confine the powder gases and thus to exert a more or less constant lateral force upon the stone.

"After the cleavage has extended to a radius of 75 ft. or 100 ft. in all directions from the lift hole, a pipe is inserted in the hole, tamped tight with clay, and then connected by means of a globe valve with the nearest service air line. Compressed air at 70 lb. to 80 lb. pressure is gradually admitted, and the cleavage extended until it comes out upon the sloping face of the quarry in a thin edge. A sheet of granite several acres in extent may be raised in this manner, affording an approximately level bed plane, to which the quarrymen can work, thus securing stone of any required thickness."

Air for operating rock drills and for use in the cutting sheds, etc., is supplied by two Ingersoll-Rand compressors, each having a piston displacement of 2,874 cu. ft. of free air per minute. In the course of the operations a large volume of scrap is inevitably produced. Some of this is worked up into curbing or paving blocks, and the remainder is run through a crushing plant with a daily capacity of 500 tons, and afterwards used for road building, concrete work and the ballasting of railways.

In this article we have referred only to the use of compressed air in granite quarrying, but this convenient power is used also in the quarrying of practically every kind of stone. A particularly interesting instance of its use is in the quarrying of rock asphalt in Texas. Here the asphalt contained in the rock complicates drilling operations seriously. It "gums" on the bit, and tends to plug the drill hole and to stall the drill rotation. These difficulties are overcome by means of a mounted drill of the wet type, specially designed to maintain a continuous flow of water to wash away the drill cuttings.

Compressed air is also used extensively in numerous limestone quarries in Indiana. The limestone is channelled, or cut away, in large blocks which are then split into smaller blocks by means of pneumatic drills and wedges.



II.—THE ANTARCTIC CONTINENT DISCOVERED AT LAST

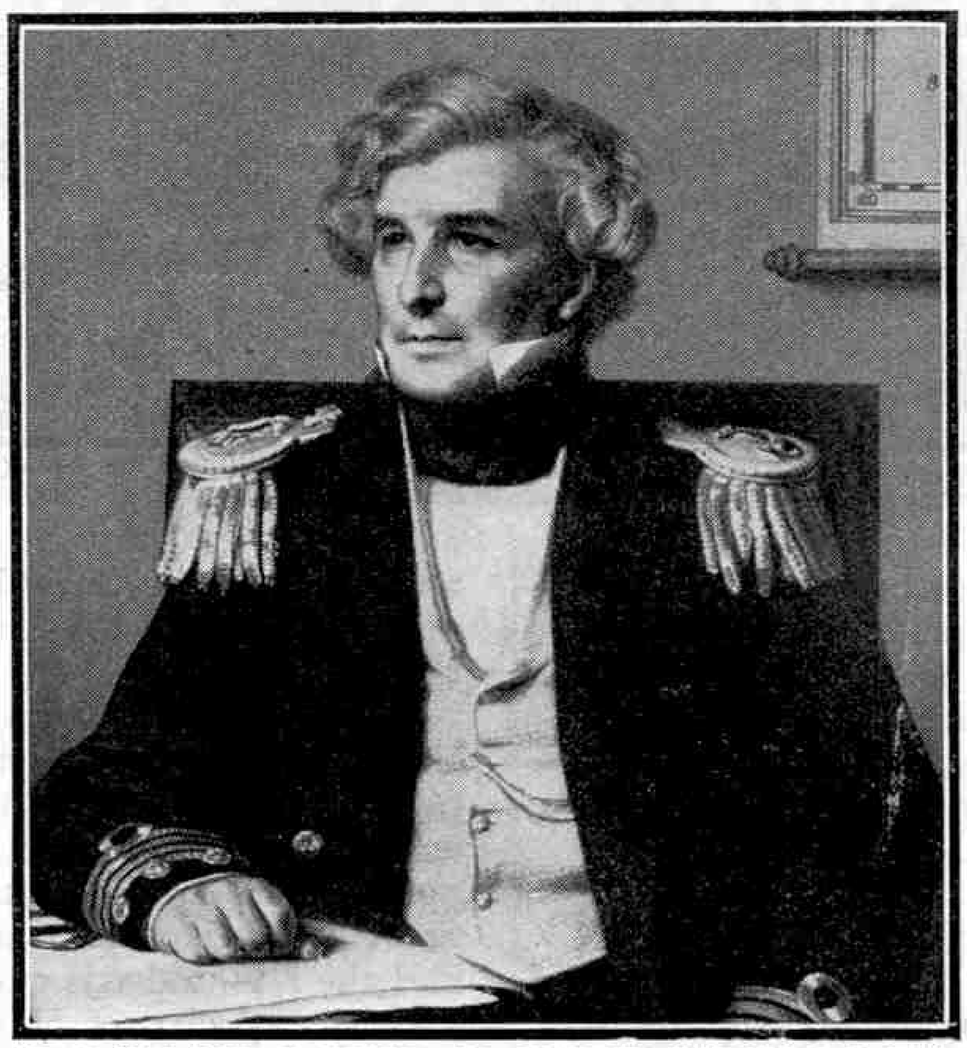
LAST month the story of the exploration of the Antarctic was brought down to the pioneer efforts of Captain Cook. The great British navigator made a complete circuit of the supposed Antarctic continent, and in this he created a Polar record by reaching a latitude of 70° 10′. He also showed that, if any land existed at all in the far south, it was restricted to a comparatively small area round the Pole and well within the Antarctic Circle.

It is interesting to recall that Captain Cook considered the risks run in the unknown icy seas of the Antarctic to be so great that nobody would ever venture further than he had done. His prediction that the surroundings of the South Pole would never be explored was soon proved to be mistaken, however, when less than 50 years later strenuous efforts to push southward were made by sealers and whalers. Their object was to find seas in which their prey abounded, and in 1823 a small expedition sent out by a whaling company created a Polar record that remained unbeaten for 18 years.

The leader of the expedition was James Weddell, who commanded the "*Jane*," a brig of 160 tons, and the "*Beaufoy*," a cutter of 65 tons. The vessels were provisioned for two years, and their crews numbered 22 and 13 respectively. The first discovery of interest was made early in 1823, when the two vessels reached the South Orkney Islands. The desolate appearance of this ice-bound, mountainous land greatly impressed Weddell, but in obedience to the instructions that had been given him he continued to push southward through seas that were thickly covered with pack ice. He was eager to make further discoveries, and offered a reward of £10 to the seaman who should first see new land. A keen watch was therefore kept by all on board, but there were many disappointments, for in the Antarctic, as in the similar regions in the far North, it is easy to mistake a bank of fog for distant mountains. Icebergs also deceived Weddell's men, for the fragments of rock and soil, brought from the southern Antarctic continent, that remained on them, often suggested the existence of solid land beneath the ice.

On one occasion the cry of "Land!" was very confidently raised, and a dark object was seen at a short distance from the vessel. Soundings were taken, but to the surprise of Weddell and his crew these showed the sea to be very deep. Eventually the mystery was solved, for on closer examination, the "land" was discovered to be nothing but the carcase of a whale!

Moving steadily southward, Weddell eventually reached the high latitude of 74° 15′ south, which was 214 miles nearer the Pole than had been attained by any previous explorer. The season was now growing late, and the nearest inhabited regions were 1,000 miles away. The return route necessarily passed through seas that daily became more thickly strewn with pack ice and with icebergs, and reluctantly Weddell decided that it was time to turn back. A gun was fired and the colours were hoisted, while the name of "King George the Fourth's Sea" was given to the desolate stretch of water over which the two vessels had sailed. This is now known to form an immense bay in the Antarctic continent, and to-day it is called Weddell Sea, in honour of its first explorer.


James Clark Ross, an explorer who was equally distinguished in Arctic and Antarctic expeditions.

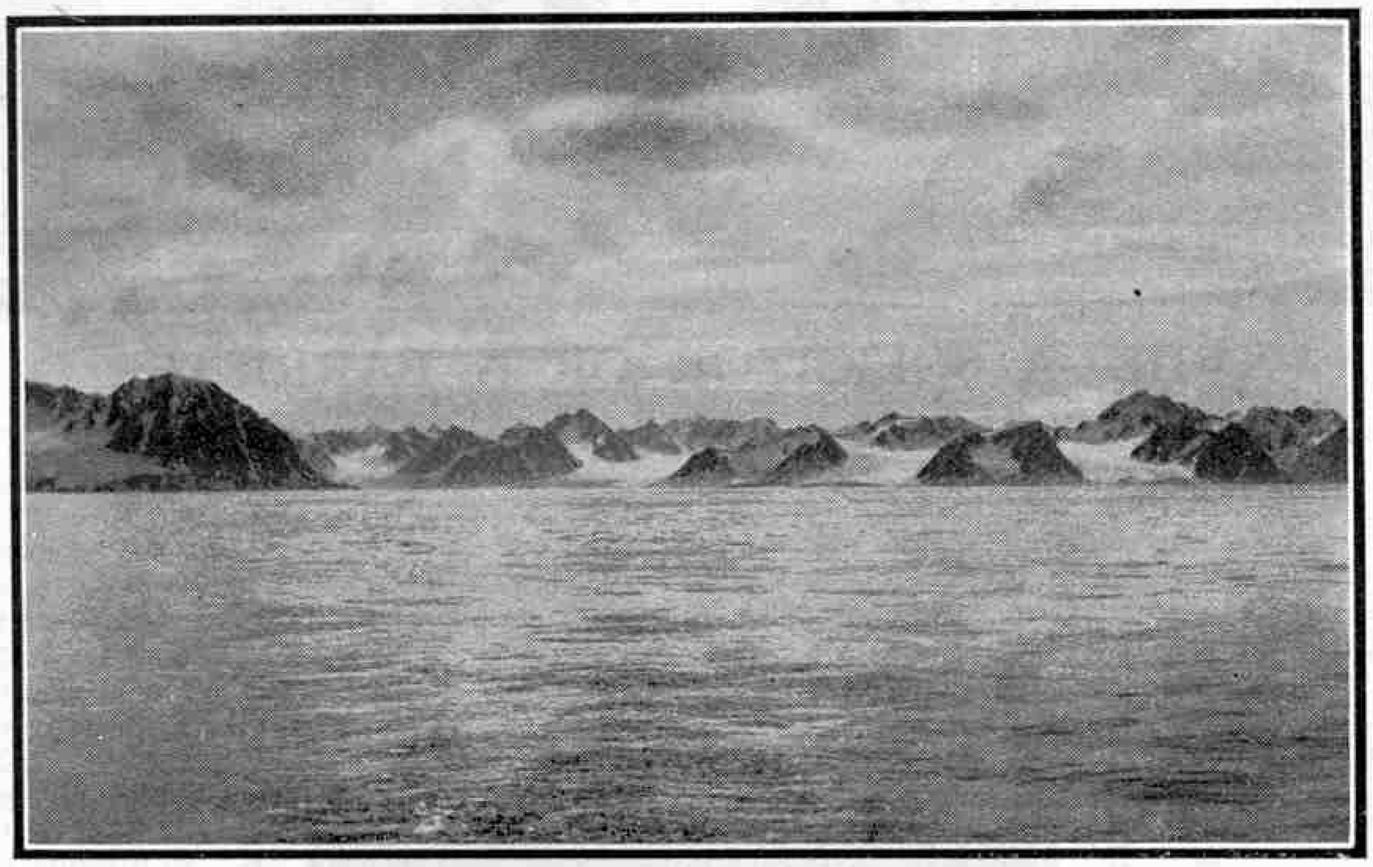
Since Weddell's return only four vessels have really endeavoured to follow his track. Of these the first two were prevented by the heavy pack from getting as far south as Weddell had done, and they returned without misadventure. In the third ship, Filchner, a German explorer, discovered new land far to the south, but his vessel was firmly gripped in the ice and slowly carried northward, to be set free 200 miles north of the point that Weddell reached. The fourth, Sir Ernest Shackleton's "*Endurance*," was completely overwhelmed and crushed by ice pressure. Possibly the season in which Weddell made his famous voyage was specially favourable, but there is no doubt that his success was due largely to his courage and determination, allied to mastery of the art of navigating Polar seas.

None of the expeditions immediately following that of Weddell penetrated so far south, and it was not until nearly the middle of last century that a new record was established. In 1840 a well-equipped British expedition, under the command of Captain James Clark Ross, sailed into the icy Antarctic waters south of Australia. Ross had already distinguished himself in three Arctic expeditions, becoming a member of the first when only 19 years of age. Later he took a prominent part in Parry's famous dash for the North Pole in 1827, and thus helped to create a Polar record of 82° 45′ N, that remained unsurpassed for nearly 50 years. Four years afterwards he discovered the position of the North Magnetic Pole while serving under his uncle, Sir John Ross.

The Antarctic expedition of 1840 sailed in two vessels, H.M.S. "*Erebus*" and H.M.S. "*Terror*." Ross himself was in the "*Erebus*," and the other vessel was under the immediate command of Captain Crozier, an explorer who later was second-in-command of the ill-fated Franklin expedition that disappeared among the islands in the Polar region north of Canada. One of the chief objects of the expedition was to make a record of magnetic observations in various parts of the Antarctic, and if possible to reach the South Magnetic Pole. After penetrating the Polar pack, therefore, Ross steered directly toward the Pole itself. On 11th January, 1841, a range of lofty mountains was seen at a distance of about 100 miles to the south, and very soon it was realised that new

land had been discovered. The mountains were from 7,000 ft. to 10,000 ft. in height and were covered with snow; while innumerable glaciers swept down their sides to end at the ice foot. This was the first unmistakable evidence of the existence of an extensive area of land in the Antarctic that had been discovered, and, as if to give complete assurance, rock could be seen protruding above the ice and snow in many places. Although magnificent in appearance, the new land was bleak and inhospitable, and its only inhabitants were penguins, skua gulls, and the seals that emerged from the sea to bask on its shores.

To his discovery Ross gave the name Queen Victoria Land. He reached it near a headland that is now called Cape Adare. There the coast turns southward, and naturally Ross sailed along it in the hope of approaching nearer to the Pole than Weddell had done. He was not disappointed, for on 23rd January, 1841, the vessels reached a latitude of 74° 20′ south, an occasion that was celebrated by general rejoicings.



A glacier-fringed coast line in polar regions.

The voyage was continued southward, and a few days later the striking discovery was made of a volcano, 12,000 ft. in height. Although it was completely smothered in snow and ice, it belched forth clouds of smoke, and its great crater glowed brightly at night. It was named Mt. Erebus, and the name of the second vessel of the expedition was given to an extinct volcano a few miles away. Ross thought that the two volcanoes were on the mainland that he had discovered, but it is now known that they are on an island. To this his own name has been given, and Ross Island has since become famous as the headquarters of the British expeditions led by Scott and Shackleton.

Ross could sail no farther south, and he now directed his course eastward. He then made a second discovery that was almost as striking as that of an active volcano only 700 miles from the South Pole. This was the Great Ice Barrier, a massive cliff of ice that in many places was several hundred feet in height. In great amazement, the explorers passed along these cliffs for a distance of 100 miles without finding any indication that they were nearing the end; and then the approach of winter compelled them to return northward.

Early in the following summer Ross set out to revisit the Barrier, this time approaching it east of his former position in the hope of discovering more new land. On the way southward the progress of the two vessels was greatly hindered by heavy pack, and while they were still struggling with it a tremendous gale sprang up. The sea was lashed by the wind into waves of terrific height, and the ships were in great danger of being smashed to pieces by the violence of the blows from the enormous blocks of ice flung at them by the angry waters. The rudder of the "*Erebus*" was rendered useless, and that of the "*Terror*" was completely destroyed. All night the vessels pitched and rolled and seemed to be at the mercy of the elements, but by what seemed a miracle they escaped serious injury. Before the necessary repairs could be effected, however, they drifted many miles northward, and lost so much valuable time that the thorough exploration planned by Ross became practically impossible.

The section of the Great Ice Barrier that Ross now visited was found to be more broken and indented than that further west. Hopes of finding new land were disappointed, although, as he sailed along the face of the Barrier, Ross noticed in the distance what appeared to be mountains covered with snow. His Arctic experience led him to take the precaution of marking this on the chart as simply "Appearance of Land."

Two summers in the Antarctic were not enough for Ross, and in the following season he again steered southward. He spent the winter at the Falkland Islands, to which he had sailed after his second exploration of the Ice Barrier, and in this third voyage he followed Weddell's track and endeavoured to improve upon his predecessor's record. He was unsuccessful, however, conditions in the Weddell Sea preventing him from reaching a higher latitude than 71° 30′ south, in spite of his resolute attempts to force his way through the barrier of ice that opposed his progress.

Ross finally sailed northward to the Cape of Good Hope, after spending three years in the most extensive and fruitful exploration of South Polar regions that up to that time had been attempted. He so greatly extended our knowledge of the Antarctic that there was a feeling that little more was to be discovered. Only the fringe of the Antarctic problem had been touched, however, although this was scarcely realised until more than 50 years later.

The first sign of a revival of interest in Antarctic exploration was the visit of the "*Belgica*," the first vessel to venture upon a stay in the Antarctic throughout the winter. Her commander was de Gerlache, a Belgian, and with him were scientists who were greatly interested in the many problems presented by the strange and unknown lands in the far south. One interesting member of the staff of this expedition was Roald Amundsen, then an unknown youth, who later became famous as the discoverer of the South Pole, and the hero of the flight of the "*Norge*" across the North Pole.

Emperor penguins, the most stately inhabitants of the Antarctic. They are nearly four feet in height and some of them weigh as much as 90 lb. Our photograph is reproduced by permission from "The South Polar Trail," by E. M. Joyce (Duckworth & Co.).

The "*Belgica*" was navigated into the ice-packed waters surrounding Graham Land, on the west of the Weddell Sea, and instead of retreating to warmer quarters when the short Antarctic summer ended, was allowed to be frozen in. Those on board settled down to a routine of scientific observations throughout the winter. In the summer various sledging parties left the ship, and these greatly extended our knowledge of the geography of the region.

Several expeditions to various parts of the Antarctic followed the return of de Gerlache. Of these one of the most interesting was that of Borchgrevink, who visited Victoria Land, and actually spent a winter in a hut that he built at Cape Adare. This was the first occasion on which human beings lived on the Antarctic continent itself throughout the dark, cold months. When summer came round once more Borchgrevink sailed south in the track of Ross, and achieved fame by landing on the Great Ice Barrier, a short march southward enabling him to exceed by a few miles the Polar record set up 58 years previously.

Borchgrevink found that the Great Ice Barrier had changed considerably, and in places its edge was 30 miles nearer the Pole than when Ross had visited it. Soundings showed that the sea was very deep immediately under (*Continued on page 337*

XVIII.—A SOLICITOR OR A BARRISTER

THE profession with which we are to deal this month is of very great importance, and may be said to have arisen with civilisation itself. In the earliest times disputes of a serious nature were almost always settled by fighting. This method had obvious drawbacks, and slowly the desire to avoid it arose, with the result of the gradual establishment of a code of rules that safeguarded the interests of all concerned. At first these rules would deal mainly with problems of ownership of goods, or of inheritance, and they would be developed on the basis of custom and commonsense.

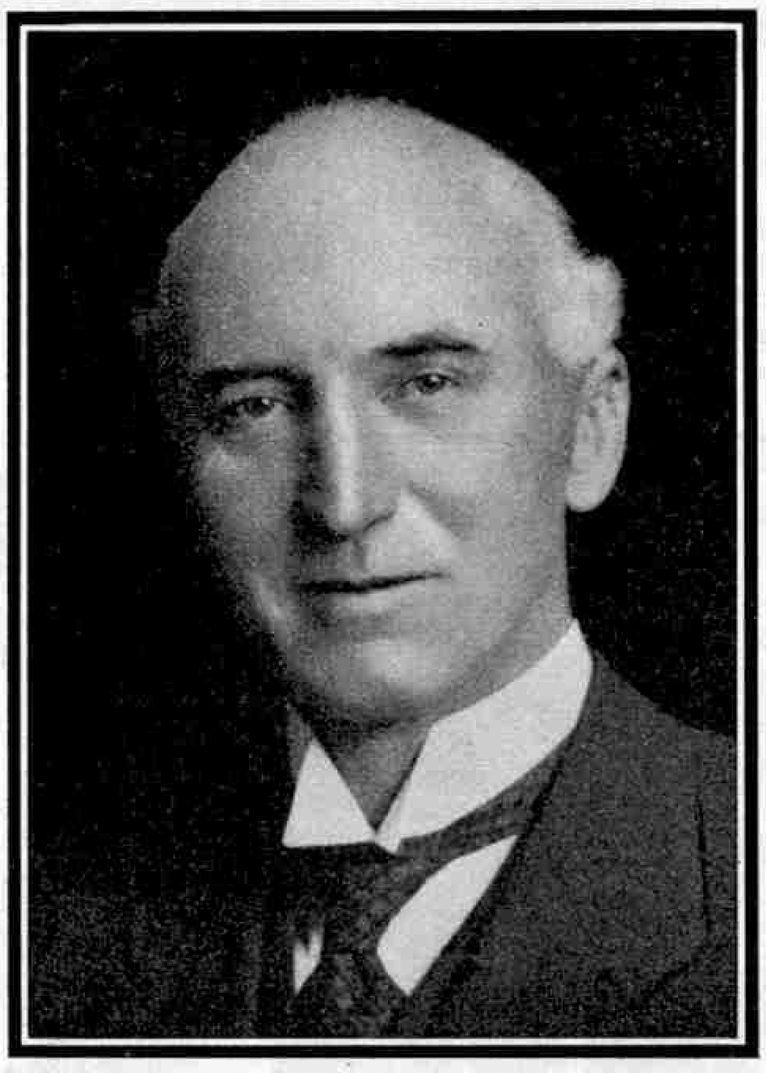
Simple as these early codes of rules or laws must have been, their interpretation would require a certain amount of judgment; and when disputes arose the oldest member of a tribe, or the one who had the reputation of being the wisest, would be called in to give an expert judgment. In this manner the legal profession may be said to have had its beginnings. The laws now in force in all civilised communities are the result of a long period of development, and naturally they are very complex.

Careers in Law may be divided into two branches, the members of which are known respectively as barristers and solicitors. The barrister gives specialised advice on legal points, and presents legal arguments in the Law Courts. He does not deal directly with clients, but his engagements are always made through a solicitor. The solicitor, on the other hand, comes into direct contact with the public. He gives general advice on matters of law, and carries out the preparation of legal documents. He also acts as intermediary between the public and barristers, approaching these consultants for opinions on difficult legal points, and "briefing" them, or engaging them to appear in the Law Courts on behalf of his clients.

The line of separation between the two branches of the profession is strictly determined, and in this country it is impossible for anyone to practice in both capacities, no matter what his qualifications may be. The only place where a solicitor may encroach to a certain extent on the work that is usually left to a barrister is in minor courts, such as Police Courts, where he may represent his clients in person.

The expense of becoming a barrister is much greater than that required for qualification as a solicitor. In addition, many years may elapse before a barrister's returns become really considerable. It is only natural that engagements to argue lawsuits should be given to men of known capabilities, and a young barrister cannot hope to make much progress until he has established a reputation and become known to solicitors. The work of a successful barrister is very arduous, for long and exhausting days in Court must often be followed by close study of briefs and legal authorities. The compensation is the high fees that a barrister can command when he becomes successful and therefore well-known.

A FAMOUS BARRISTER



The Right Honourable Sir John Simon, P.C., G.C.S.I., K.C.V.O., M.P., was called to the Bar at the Junior Temple in 1899. He rapidly achieved prominence in his profession and was appointed King's Counsel (K.C.) in 1908. In 1910 he became Solicitor-General. Three years later he was promoted to Attorney-General and given a seat in the Cabinet, and from 1915 to 1916 was Secretary of State for Home Affairs. He served in France as a Major in the R.F.C. during the last two years of the War.

Sir John Simon was knighted in 1910 and made a Privy Councillor in 1911. In 1927 he went to India as Chairman of the Royal Commission on Indian affairs, and presided at last year's official enquiry into the "R 101" disaster.

In order to become a solicitor it is necessary to take out articles with a member of the profession who is already established in practice. The term "take out articles" is the recognised phrase that describes what is really a form of apprenticeship, similar in character to that followed by entrants to the profession of accountancy. Most solicitors require a premium for their articled clerks, which varies considerably according to circumstances, and may be anything up to £500. A stamp duty of £80 also must be paid, and in addition it is necessary to provide the fees for the examinations that must be passed in order to qualify. A further expense that will have to be met is that of tuition at a Law school, where at least one year must be spent.

Before articles may be signed, evidence of a sound general education is required from candidates. This is best given by passing an approved preliminary examination, and therefore the Matriculation examination should be the aim of all those who wish to enter the profession. In certain instances the School Certificate may be accepted, provided that the subjects taken include Latin, English, and others that are regarded as specially desirable.

Articles are usually served for a period of five years, but those who have passed certain examinations, such as the Matriculation examination of London University, or that of the Northern Universities, may have this reduced to four years. Special privileges are given to University graduates, and to those who have served as ordinary solicitors' clerks for a period of at least ten years; the term of articled service required in these cases being only three years.

It is interesting to note that the Law Society recommend that a University degree should be taken before articles are entered into. The training necessary for a degree in Arts or Law is a valuable preliminary to professional work, but of course the adoption of this plan adds considerably to the cost of qualifying as a solicitor. Fortunately it is not absolutely essential, and may be omitted if financial considerations make it impracticable.

Apart from the preliminary examination or its equivalent, two examinations must be passed in order to qualify. The first of these is taken at the end of two or three years' service as an articled clerk, and the second or final examination after conclusion of the articles.

Although a young solicitor may enter upon practice on his own behalf immediately after qualifying, it is more usual to obtain employment as a professional clerk to one who is already in practice. This course is to be recommended, for a solicitor is called upon to deal with matters that demand not only an extensive acquaintance with legal, financial and commercial affairs, but also a knowledge of human nature. Unless a solicitor is content to confine his

attention to routine matters only, his success will depend largely on the soundness of his judgment; and he can best develop the ability to form sound conclusions, and to act upon them, by association with solicitors who are already well established. The salaries that may be earned by work of this character are quite good. In a firm of medium size a qualified man may earn from £200 to £500 a year, and in a busy office as much as from £600 to £800.

A qualified solicitor in the employ of another member of the profession will always be on the look-out for an opportunity of setting up in practice for himself. An alternative is to purchase a partnership. This usually requires a considerable outlay, but it has the advantage of leading almost immediately to an assured income. The returns from a partnership naturally vary considerably. In a small firm they may not exceed £500 a year, but a really capable man who becomes firmly established in a firm with a wide and varied practice may find an assured salary of anything up to £2,000. A solicitor who commands the confidence of a large number of valuable clients, whether he is in practice on his own behalf or in partnership, may make considerably more than this.

Many posts in the public services are usually filled by a solicitor, and indeed for many of them a qualified man is definitely required. For instance, a Town Clerk, or a Clerk to a County or Urban District Council, must possess legal qualifications, for he is in fact the solicitor of his employers. Occupants of positions of this kind have usually specialised in the kind of work they are called upon to do, and have acquired their training by serving articles under solicitors already holding such positions. The salaries to be obtained in these posts vary from £500 to £2,000 a year, or even more, according to the size of the Corporation and the measure of responsibility incurred. The staffs of these officials include qualified men, who in many instances are well paid; and such positions form stepping stones to promotion to the higher posts.

The entrance to the Royal Courts of Justice in the Strand. The Courts are reputed to have cost nearly £1,000,000 to construct.

There are also excellent prospects for solicitors in legal administration work, the more usual posts here being as County Court Registrars, Clerks to Assize, Clerks to Quarter Sessions and Petty Sessions, and Clerks in the Royal Courts of Justice. Solicitors securing posts as Clerks in the Royal Courts of Justice rank on equal terms with barristers. In addition there are many important Government positions, but these are greatly sought after, and can be obtained only by those who have wide experience.

Entry to the Bar, the second of the two branches into which the practice of the Law is divided, involves more arduous study and a longer and more costly preparation. In order to become a barrister it is necessary to seek admission to one of the four Inns of Court, the Inner Temple, the Middle Temple, Lincoln's Inn and Gray's Inn, all of which are of long standing. Their buildings have many historic associations, and interesting customs and traditions give to them an individual character.

Before admission to one of the Inns of Court may be obtained it is necessary to pass a qualifying examination, such as the Matriculation examination, or one of equal standing. No direct entrance examination is conducted by the Inns themselves, but details of the examinations that are accepted may be obtained from the Steward or Sub-Treasurer of any Inn, or from the Clerk to the Council of Legal Education, 15, Old Square, Lincoln's Inn, London, W.C.2.

As a rule candidates have no difficulty in satisfying the conditions laid down for admission to one of the Inns of Court, for the majority of them are University graduates. Competition at the Bar is very keen, and it may be said that only men with a very thorough and complete education can hope to make an outstanding success in this career. The usual plan followed by those who desire to become barristers is to secure a degree with honours at a University of high standing, before fulfilling the technical conditions required by the regulations and by the customs and traditions of the Inn to which they seek admission.

The admission fees to Lincoln's Inn, including lectures and stamp charges, are £58 14s. 3d.; at the Inner Temple and Gray's Inn they are practically the same, and those charged at the Middle Temple amount to £57 13s. 3d. In addition to the admission fees, certain deposits are called for, these being required to cover various duties and charges that become payable. The balance of these fees is usually returnable when qualification is secured, or on withdrawal.

Students of the Inns must "keep" at least twelve terms, covering a period of three years. Terms are kept by the old custom of dining in the Hall at least six times during each term; but members of recognised Universities in Great Britain and Ireland are granted the privilege of qualifying by eating only three dinners each term.

At the end of the three years' course candidates must pass a public examination in Law. The actual training necessary for this may be obtained at a University, but a student may read privately or may attend lectures on Law given under the auspices of the Council of Legal Education. A very high standard is demanded from candidates. They must possess knowledge of an all-round character, and specialisation in a division of the Law is usual. When a student has passed the examination, and has complied with the regulations, he is called to the Bar. The calling ceremony takes place at the Inn of which the candidate is a member, and is a recognition of his qualification to plead in British Courts of Law.

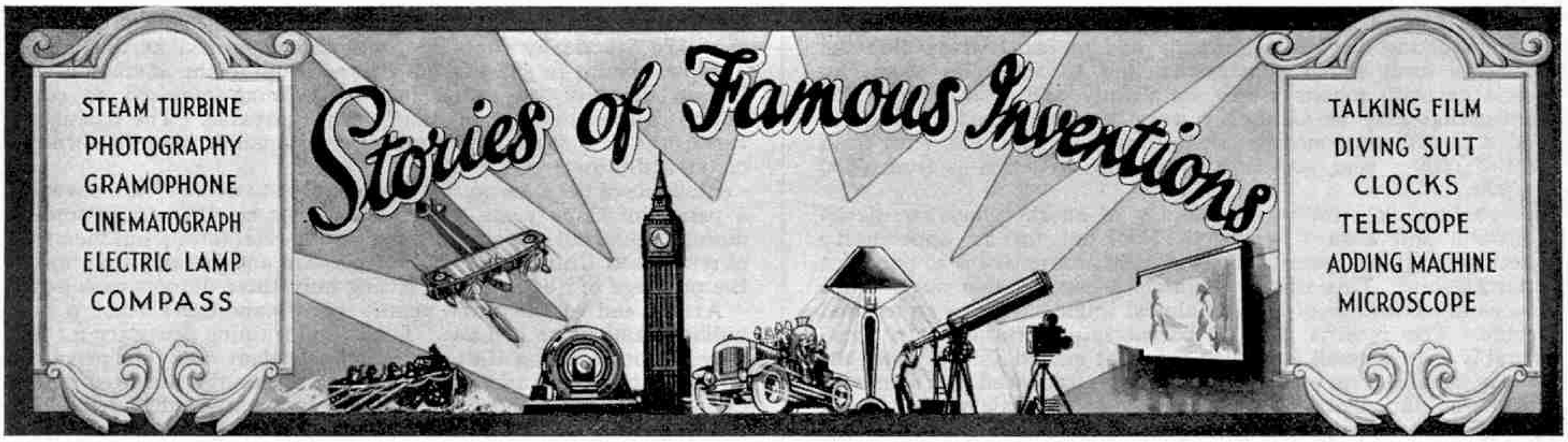
After he has been called to the Bar, it is the general custom for a man who can afford to do so to read in Chambers with a practising barrister for a period of at least one year, in order to gain experience of Court work. A fee of from 50 to 100 guineas is usually demanded for this privilege, but it is sometimes possible to obtain a grant towards this cost from one of the Inns of Court. An alternative to this method of obtaining experience is to share Chambers with a junior barrister. Young barristers who do this will at first find it necessary to work for their busier colleagues without payment, although after a period of this "devilling," as the practice is called, half fees may be given. It may also be possible to obtain Court work of lesser importance, but small financial returns are to be expected until a barrister has gained considerable experience of Court work and practice.

After spending a number of years at the Bar, a barrister may secure appointment as King's Counsel, and he is then entitled to make use of the letters "K.C." after his name. A "K.C." acquires certain privileges, but the distinction is mainly an honour that gives him a higher status in the profession.

A barrister who does not wish to practice in the Courts may secure an appointment in one of the Government Departments. The minor appointments of this nature that are available in this country are as Legal Assistants in the Land Registry Office, and professional clerks in the Royal Courts of Justice. Here salaries varying from £250 to £900 are obtained, while situations as Masters and Registrars in the Courts carry salaries of about £1,500 per year. Other situations in which the remuneration is more or less the same are those of Justices in County or Metropolitan Courts, Stipendiary Magistrates, Recorders and Coroners.

Other posts that barristers are qualified to fill include those of Lord High Chancellor, Attorney-General and Solicitor-General, the first of these being the highest legal appointment possible. The appointments are to-day political in character, and their holders are members of the Government, the first two usually being in the Cabinet itself.

His Majesty's Justices are recruited from the ranks of barristers in various Courts. Vacancies are filled by the appointment of men who have distinguished themselves in the practice of the appropriate branch of Law, and in doing so have gained wide experience of the kind of work they are called upon to do. In many cases acceptance involves a loss of income, for naturally the posts are offered to the most successful barristers; but the honour is regarded by the recipients as sufficient compensation.

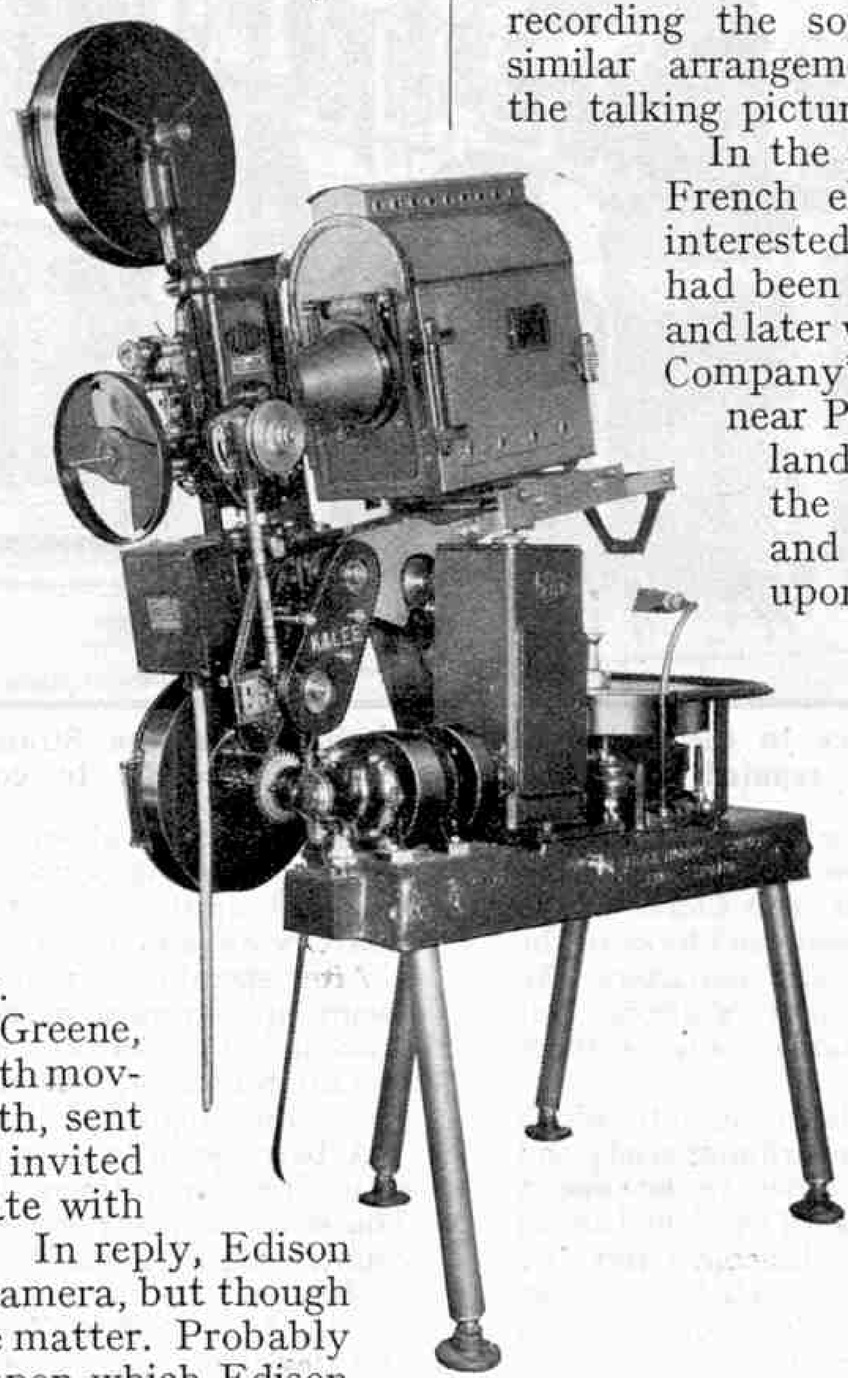


XXI.—TALKING PICTURES—(1)

TALKING pictures are regarded generally as a very recent invention, but in reality their history dates back almost half a century. The early attempts to produce talking pictures consisted of showing a silent moving picture accompanied by a phonograph or a gramophone record giving the sounds of the subject. As long ago as 1887 Edison produced a combined sound and moving picture record on this principle. He set a series of microscopic photographs, each depicting a successive movement, round a cylinder of the same size as the cylindrical records used on his phonograph. The picture record and a corresponding phonograph record were mounted side by side on a shaft and set in motion simultaneously. By using a microscope and a stethoscope at the same time, a person could both see and hear the "sound picture." Edison's apparatus was crude and imperfect, but it served to indicate that development of the talking pictures lay in achieving more perfect unity, or synchronisation as it is technically called, of sound and movement.

Two years later William Friese-Greene, whose pioneer work in connection with moving pictures we described last month, sent details of his camera to Edison and invited the American inventor to co-operate with him in producing talking pictures. In reply, Edison asked for working drawings of the camera, but though these were sent, nothing came of the matter. Probably the many subjects of experiment upon which Edison was engaged crowded out further consideration of the British invention. Other experimenters in this country, America, France, and Denmark, were attracted to the subject, and achieved varying degrees of success.

In November 1902 a French inventor, Léon Gaumont, claimed to have solved the problem of simultaneously recording and reproducing movement and sound, and he communicated the results of his labours to the French Photographic Society. He continued his experiments, and it was not until eight years later that he made public his invention. On 27th December 1910 he demonstrated the "chronophone," as he termed his apparatus, before the French Academy of Science. The chronophone included a talking machine using disc records and equipped with two horns for diffusing the sound throughout a theatre. The talking machine and the film camera were driven by two electric motors of equal power and having armatures designed to rotate at the same speed. Electrical connections between the two motors further ensured synchronisation in recording the sound and action of the subject. A similar arrangement was employed when projecting the talking picture.



Photos courtesy
[*British Thomson-Houston Co. Ltd.*

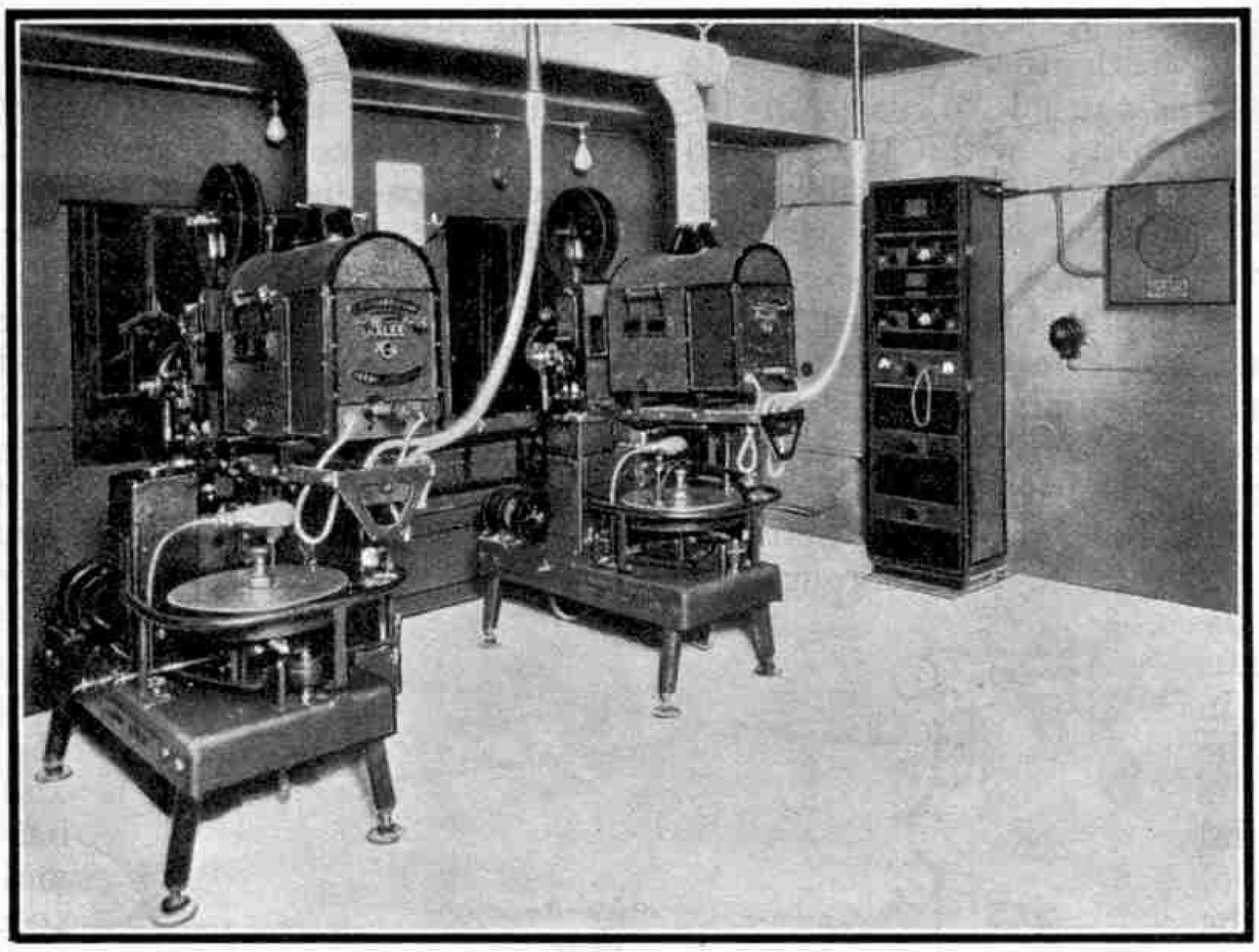
B.T.H. Projector. At the rear of the machine is the turntable that carries the sound disc record.

In the meantime Eugene Augustin Lauste, a French electrical engineer had become very interested in the subject. Early in his career he had been a member of Edison's technical staff, and later was in charge of the American Biograph Company's experimental motion picture plant near Paris. In 1907 Lauste patented in England "a device to record simultaneously the movements of persons and objects, and the sounds relating to them, optically upon the same photographic records, running side by side with, and at the same rate as, the image is received." It is claimed for Lauste that he was the first to photograph sound and motion upon the same film, and to reproduce the result. His invention was known as a "Photo-cinematophone," and several successful demonstrations were given with it in London. He did not succeed in establishing his apparatus commercially, but his patent forecast the important features of the talking picture industry of to-day.

The development of the successful talking film has been a process of gradual improvement. In theory, all that is necessary is a means of recording and reproducing sound and of making a moving picture, combined with a mechanism for maintaining correct speed relationship between the sound record and the film. In practice, however, the limitations in tone and volume of the ordinary mechanical gramophone have prevented the use of this method in its simple form, and commercial talking films have awaited the introduction of the modern electrical gramophone utilising valve amplifiers and loud speakers to obtain almost unlimited volume, together with better quality of reproduction.

A brief description of the general principle involved in the recording of sound will be helpful before we pass on to describe how talking films are recorded and produced.

Sound consists of waves of compression and rarefaction in the air, and when a sound wave is passing any point the air pressure at that point rises and falls about the normal value. If the pressure at every instant can be measured and the results plotted as a graph, a wavy line is obtained that is known as the "wave form" of the sound. In all practical methods of recording, the sound is made automatically to draw its own wave form, which may be in the form of the wavy groove in a gramophone record, or as a line of varying width or density on a photographic film. Other methods of recording are also possible, but in every case the record of the wave form, however it may be preserved, contains in its variations all the characteristics of the original sound. This sound may be reproduced at any time when the wave form is passed through suitable apparatus. The gramophone record is the best known illustration of this process, and the wave form of the sound may be seen by examining the grooves of a record with a strong magnifying glass.



Interior of theatre operating room, showing B.T.H. projectors, amplifier, and the loud speaker by means of which the operators check the sound reproduced by the loud speakers behind the screen.

The two main systems of producing talking films are, as just indicated, recording upon gramophone discs and recording upon photographic film. The latter method has two variations. In one case the sound waves recorded are of constant density and varying width, and in the other way they are of uniform width, but varying density. These two methods are referred to as the "variable width" and the "variable density" methods respectively.

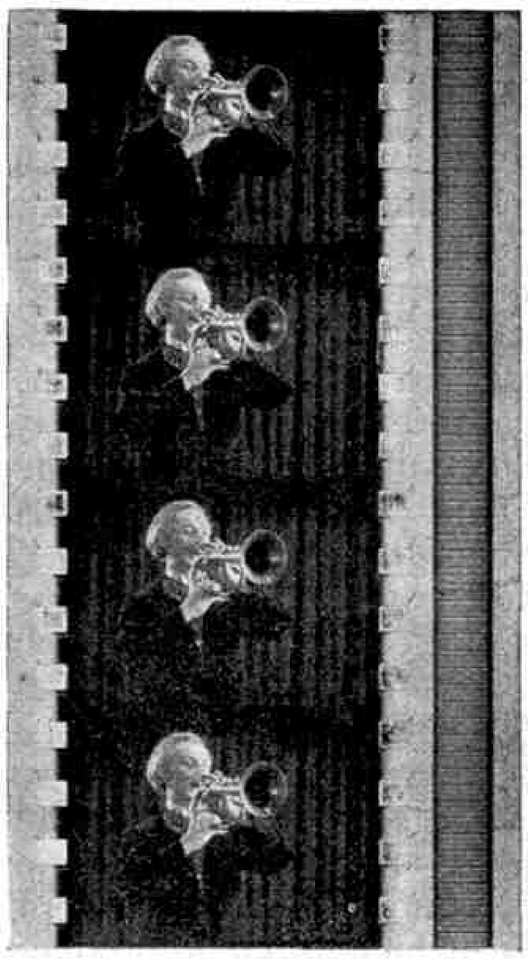
We will describe first recording by means of gramophone discs. When the original sound waves enter the microphone their energy is converted first into vibrations of the microphone diaphragm and then into minute but corresponding variations of an electric current. These variations are amplified by means of thermionic or wireless valves until they are powerful enough to actuate a cutting instrument that engraves the wave form of the sound on a rotating wax disc. The energy of the original sound probably changes several times from electric to magnetic energy and back again in the amplifier, and finally becomes mechanical energy in the cutter. The engraved wax disc is known as the "master record" and from it any number of ordinary records can be produced for use with the film.

Thus far the process is the same as that used in making an ordinary gramophone record. All that is needed to adapt it for talking films is that the recording disc should be driven synchronously with the film camera, so that events occurring a certain distance apart upon the film will have their corresponding sounds an equivalent distance apart upon the record; and great care is taken in a film studio to ensure that perfect synchronisation is achieved.

One of the most successful talking film reproducing systems is that introduced in 1919 by the British Thomson-Houston Company Ltd., to whom we are indebted for much of the technical information contained in this article. When the talking film is shown at a theatre, the gramophone records, in their correct order, are rotated upon a turntable adjacent to the projector, and a device known as a "pick-up" rests its needle within the record groove. This pick-up corresponds to the sound box of an ordinary mechanical gramophone, and its function is to translate the waves of the groove into corresponding variations of electric current, much as a microphone does with sound waves. The current is amplified to a suitable degree and is made to operate a number of loudspeakers, which then reproduce the original sound that entered the microphone. The sound-reproducing apparatus and the film projector are kept in time with each other, usually by some form of mechanical gearing between the turntable and the motor of the projector.

The only reason why this apparently simple and obvious process has not come into earlier use lies in the difficulty of ensuring that, at each of the numerous transformations of energy that the sound undergoes, no undue distortion is introduced. Both the wax master record and the final record may introduce distortion; and there is a similar chain of energy transformations in passing through the reproducing apparatus. On this account each of the numerous components involved in the chain has been the subject of long and laborious development work in order to obtain the best possible results, and it is only within the last few years that comparative success has been achieved. Similar remarks apply to the alternative methods of recording on and reproducing from film.

An elementary method of recording sound wave forms upon photographic film is to cause the waves to fall upon a diaphragm that in turn agitates a small mirror. A spot of light reflected from this mirror falls upon the travelling film, where it traces out a line corresponding to the movements of the microphone diaphragm. In practice, such a mechanical method would give poor reproduction, and actually an electrical method is used. This is illustrated diagrammatically in Fig. 2. The mirror is mounted on a coil of wire that is suspended between the poles of a magnet. The current from the microphone is amplified and passed through the coil, which is deflected to an angle that varies with the strength of the current. Such an arrangement is called an oscillograph and is very sensitive, the mirror oscillating rapidly in obedience to changes in the strength of the current. This method



Variable density sound record along the right side of film.

is known as "variable width" recording, from the fact that the light spot moves transversely across the film. It marks out a strip or "sound track" of varying width, that at any one point corresponds to the intensity of the sound at the moment it was made.

The difference between this and the "variable density" method is that in the latter case the light spot is given no lateral movement, and thus marks out a strip of constant width upon the film. It is caused to vary in intensity with the sound wave form, however, creating a series of light and dark areas along the length of the record. This variation is obtained by means of an instrument called a "light-valve," which is very similar in construction to an ordinary oscillograph, except that the usual mirror is replaced by a minute shutter attached to the moving conductor. The construction is such that the light on its way to the film has to pass through an aperture partly closed by this shutter, and is thus more or less diminished in intensity according to the position of the shutter as controlled by the sound current.

The process by which the original sounds are reproduced in the theatre is very interesting and is outlined in Fig. 1. A positive film is employed, this being a copy of the one obtained by developing the film taken by the means already described. On it the sound record is in the form of a series of minute dark lines to which no mechanical or electrical apparatus can respond. A narrow beam of light is passed through the film, the intensity of the light transmitted changing in accordance with the density changes on the record. To enable this to be radiated as sound, from the loud speakers, the variations of light intensity have to be transformed into corresponding variations of electric current, and this is accomplished by means of a "photo-electric" cell that is placed immediately behind the film and receives the transmitted light.

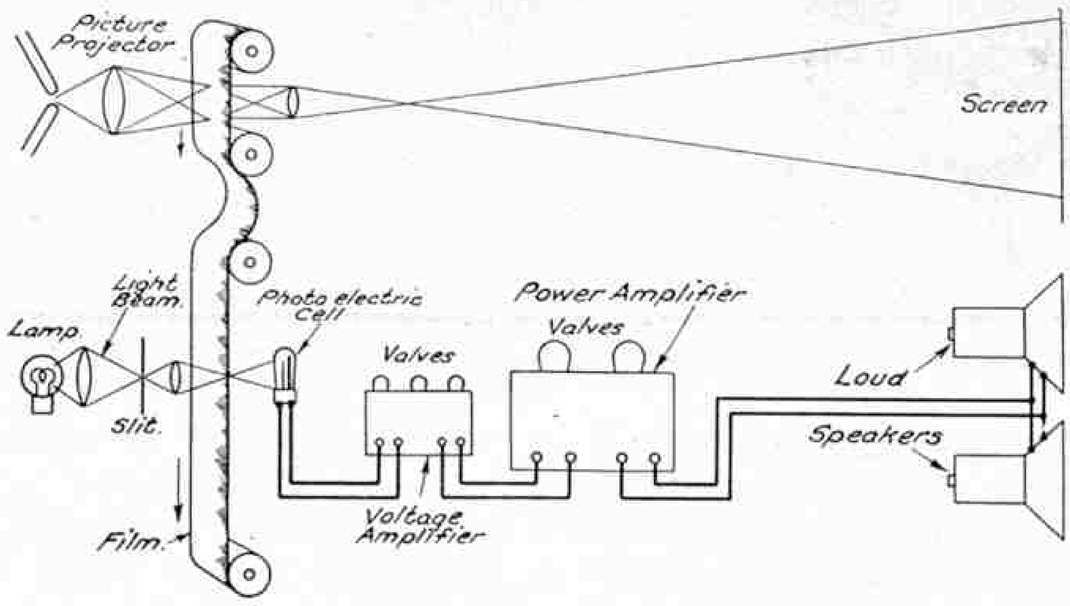


Fig. 1. Diagram outlining the method of sound reproduction from the film.

The photo-electric cell may be regarded as a microphone for light, for as a microphone translates sound into electrical impulses so the photo-electric cell translates fluctuations of light. The action of the cell is known as the "photo-electric effect." When certain metal surfaces are exposed to light they spontaneously emit electrons, which may be collected by any positively-charged conductor in the vicinity, thus forming an electric current. All metal surfaces have this power to a certain extent, but particularly the alkali metals sodium, potassium and caesium. A photo-electric cell, therefore, consists of a surface of one of these metals, together with a positively-charged collecting electrode, enclosed in an exhausted glass bulb. The vacuum is necessary to assist the transfer of the electrons. Even higher sensitivities can be obtained by introducing a very small pressure of some inert gas, usually argon, into the cell. The B.T.H. photo-electric cell has a surface consisting of a layer of caesium on silver oxide on silver-plated copper, in an atmosphere of argon.

Variable width sound record on the right of film.

The minute currents from the photo-electric cell are amplified and fed into loud speakers, which reproduce the original sound, the process being the same whether the sound track on the film is of the variable width or the variable density type.

The B.T.H. sound film projector shown in the accompanying illustration is designed for sound reproduction from either disc or film. The turntable to accommodate disc records is seen on the right of the apparatus, and is mounted on the same base plate as the projector and the driving motor. The speed of the motor is controlled by a centrifugal governor working in conjunction with a uniform direct current supply of 110 volts from a specially compounded generator. The motor drives the projector through a gear-box that reduces the motor speed from 1,800 to 800 r.p.m., which is the running speed of the drives for both the projector and the turntable gear-box. Oil chambers are provided in the gear-box so that the gears are always adequately lubricated, and a gauge is provided to ensure that the correct oil level is always maintained. The turntable drive is taken through a tubular rubber coupling to the turntable gear-box, which reduces the speed again to 33/1–3 r.p.m. by means of a worm reduction gear. The turntable itself is a heavy casting weighing about 76 lb., so that its own momentum helps considerably to keep the speed constant. The drive from the base to the lower film magazine is transmitted by smooth running chains.

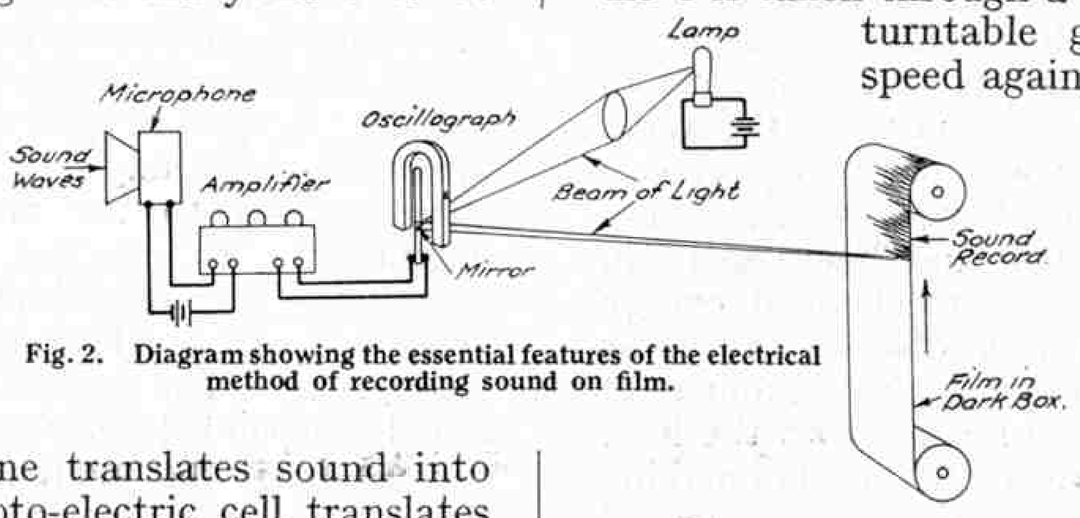


Fig. 2. Diagram showing the essential features of the electrical method of recording sound on film.

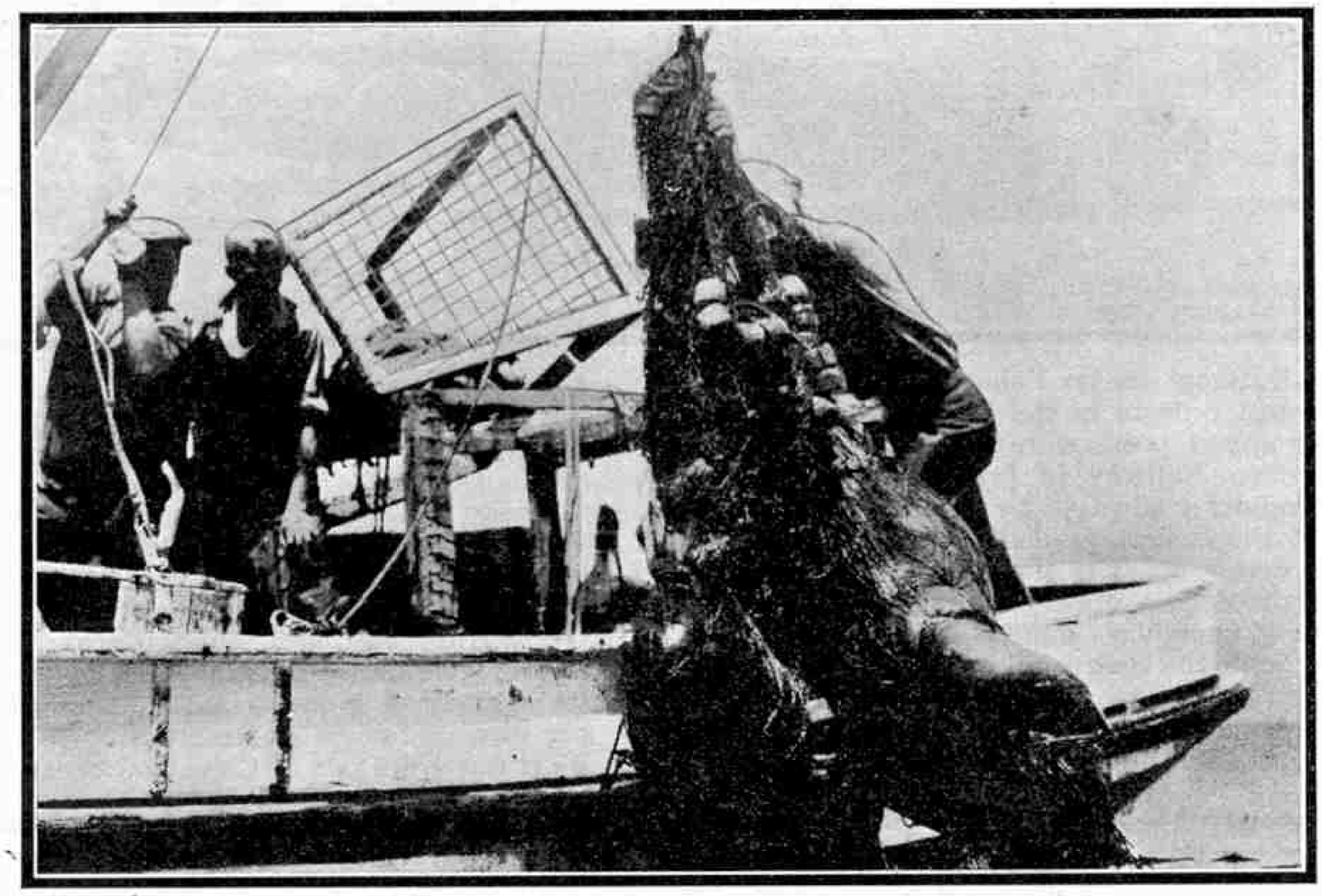
Beneath the top film magazine and in front of the projector head is a three-chamber casting called the "sound head." The first chamber holds on a turntable three exciter lamps, any one of which (Continued on page 348)

Thrills of Sea-Lion Catching

By H. J. Shepstone, F.R.G.S.

IT is not generally known that the sea-lions seen on the stage, and also in the leading zoological gardens of the world, come from a single source—the Coronado Islands, a tiny group of islets just off the coast of Lower California. The islands are in Mexican waters, and the animals are secured by two Italian fishermen, Steve Zolezzi and his son John, who hold a special permit from the Mexican Government. They are the only fishermen having this privilege, and the seal trade of the world may be said to be in their hands. In four years they have captured 600 of these strange creatures, often after very hard struggles.

When the men receive an order for seals they set out in their 33-ft. sloop-rigged boat for a narrow cave on one of the islands. This is a great rendezvous for seals, and from 200 to 300 congregate here at a time. Across the entrance to the cave a strong net is set, and when all is ready a couple of shots are fired into the cave. The noise frightens the seals and out they rush in a panic; the foremost ones dashing blindly into the net where they are caught and held by its meshes. In a few minutes six or eight of the creatures find themselves entangled in the net, and they at once begin to bark and snap viciously at the cords and at one another. The other seals quickly sense the danger and avoid the net either by diving to the bottom or by leaping over the cork tops. It is seldom that more than eight or nine seals are taken at one time, although as many as 300 may dash out from the cave.



Hauling in the net in which sea-lions of the Coronado Islands, off Lower California, are caught. The catch may weigh as much as 1½ tons!

The next step is to get the captured seals on board the boat. A single catch represents a weight of anything from 1,000 lb. to 1½ tons, and therefore heavy tackle is necessary to raise the net. Deprived of their liberty, the animals become extremely vicious and bark and snap at everything within reach of their sharp teeth, for which reason nets of exceptional strength have to be employed. In addition, the wooden gunwales and sides of the boat have had to be covered with copper sheeting to prevent them from being damaged by the seals. The necessity for this will be realised from the fact that the larger seals will tear chunks half-an-inch in thickness from the hard wood of which the boat keels are made! Once on board the animals are dumped into the hold, and when dock is reached they are driven into crates and landed in that manner.

The seals that the men endeavour particularly to secure are young males of from two to two-and-a-half years old. Such animals weigh somewhere about 250 lb., and they are the ones most in demand. No one will take cubs, or old seals, and therefore these are always given their liberty.

The larger seals possess remarkable strength. On one occasion the men had completed their catch and brought the seals below deck, among those captured being a bull weighing over 400 lb. Steve stood on the hatch while John went forward for an anchor and a length of heavy chain to weigh down the hatch during the trip home. Steve is not a small man, weighing some 14 stones in his rough sea clothes. His weight meant little to the angry bull below, however, for he reared himself against the hatch covering with such force that Steve flew off and over the side! Fortunately he had a rope in his hands at the time and he succeeded in holding on, otherwise he would have been thrown straight into the sea. As it was he dangled over the side until he recovered and hauled himself back on to the deck.

No one knows exactly what age the Californian sea-lion attains. Some are known to have weathered 40 winters, but in captivity few live longer than 12 years. Even their life habits remain a mystery to scientists, who still dispute whether the seals destroy large quantities of commercial fish, or consume fish in reasonable numbers and afterwards finish their meals on some other ocean food at present unknown.

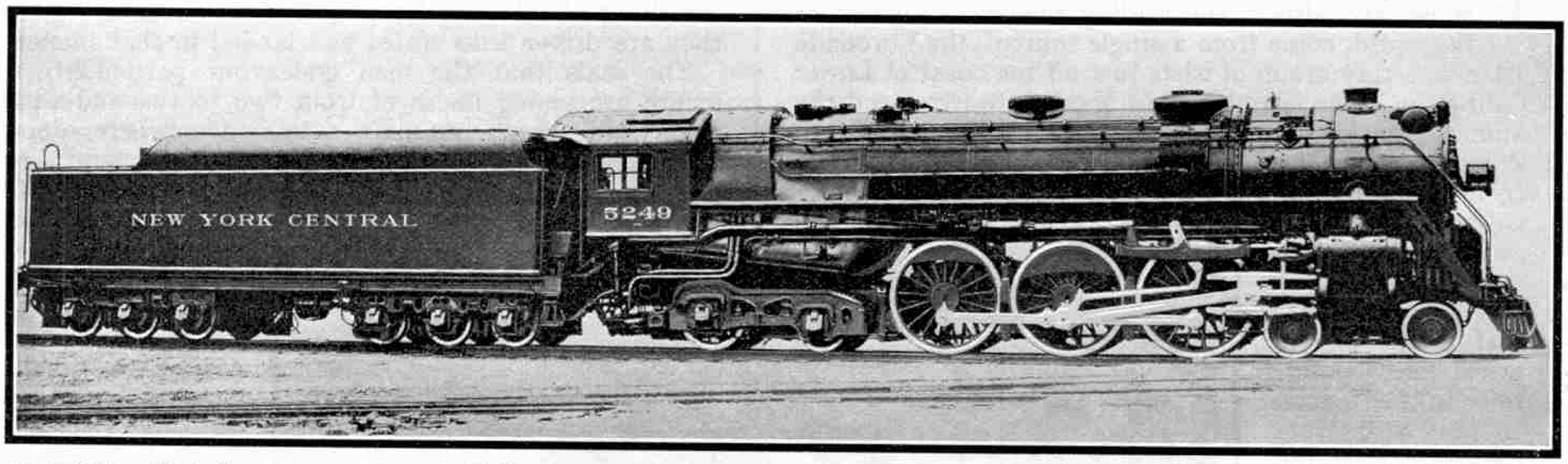
The sea-lion belongs to the family of eared seals, as distinct from the true seals, which have no external ears. It has a coat of close hair.

Seals in general are unusually intelligent animals. Considering their mode of life, one would not expect them to be easily tamed, but as a matter of fact they take to domestication more readily than almost any other animal. In captivity they display a most affectionate disposition, and with careful training their intelligence develops to a remarkable extent.

Locomotive Work on the New York Central

Notes on Some Interesting Footplate Trips

By David L. Smith

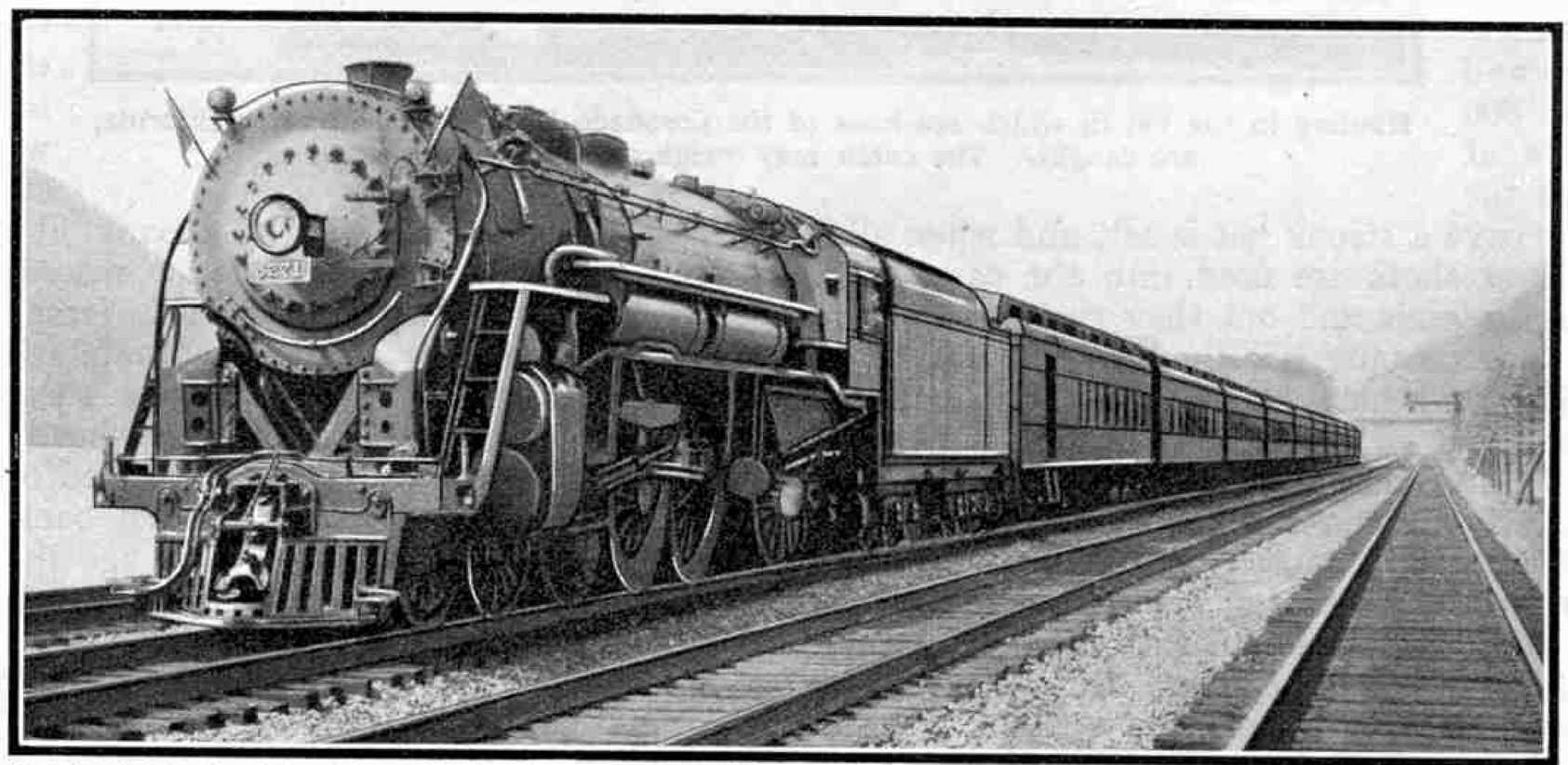


THE New York Central, except for its Pullman traffic, is not in any respect the largest railway in the United States, but it seems to me to occupy a position rather like that of our London and North Western Railway in pre-grouping days. I mean the position of "Premier Railway," by reason of its pioneer ancestors, its securing of the easiest graded route, its wonderful roadbed—not surpassed, in my opinion, by the finest we have in Britain—and its general air of long-established reliability. It is a strange railway, too; for it spends no money on ornamentation. Its stations, for instance, with the exception of the famous Grand Central Terminal of New York, and the beautiful structures in Buffalo and Cleveland, both recently opened, seem somewhat primitive to a British eye; but in the essentials of service—safety and comfort, punctuality and speed—no trouble or money has been spared, and a very high standard has been reached and is maintained.

Consider, for example, the main line from New York to Chicago, 960.6 miles, largely four-track, and automatically signalled throughout, except at the principal stations and junctions, where intervene interlocking plants superior in many respects to our British installations. When we remember that every main line engine is fitted with automatic train control; that the latest engines are fitted with speedometer and pilot valve, the former recording the speed, which by rule is limited to 70 m.p.h., and the latter indicating the proper cut-off at any given speed; and that all trains, passenger and freight, are braked throughout, we visualise a very high standard of safety, in some respects higher than that which prevails on our home railways.

The rolling stock of the New York Central is efficient and well maintained, but for some years, probably on account of the easy grading of the main line, there seemed to be a tendency toward only moderate dimensions in the locomotives. Even the splendid 4–6–4 "Hudson" type now evolved for the heaviest express work has a tractive effort (without booster) of only 42,300 lb., not much in excess of our Great Western "*King George V.*" By the courtesy of Mr. D. R. MacBain, General Manager, Cleveland, I was enabled to make a trip on the footplate of one of these locomotives from Cleveland to Toledo, and to see for myself locomotive work which, for expenditure of energy, leaves far behind anything that Europe can produce.

The train selected for my trip, No. 19, the "*Lake Shore Limited,*" is not so well known as the "*Twentieth Century,*" but is accounted by enginemen a much harder proposition to work owing to its big load and more numerous stops. On the morning I travelled by it our train out of Cleveland consisted of the club car, parlour car, two diners and twelve sleeping cars. The tare weight, as nearly as I could estimate, was 1,145 tons, or 1,175 tons with passengers and equipment—quite a useful load with which to tackle the five miles of 1 in 132 and three further miles of 1 in 330 that constituted the immediate start from Cleveland Union Depot, since replaced by a magnificent $88,000,000 structure that is 93 per cent. owned by the New York Central Lines. But neither "Hudson" No. 5247, nor her crew, Driver Charles F. Fahlbusch and Fireman Al. Cullenen, of Toledo, were at all upset by this prospect.



Our top illustration shows Locomotive No. 5249 of the "Hudson" type referred to in this article. The 4–6–4 wheel arrangement allows of a greater development of the boiler and firebox than is possible with locomotives of the "Pacific" type. The lower illustration on this page shows a "Hudson" east-bound on the main line on the east bank of the Hudson River. For these, and the other illustration to this article, we are indebted to the New York Central Lines.

I found the enginemen jointly engaged in the work of inspection and lubrication, while in the meantime the mechanical stoker, with alternate turns of its feed-screws, was depositing coal upon a beautifully even and comparatively thin fire. They gave me some very amazing information. They told me that No. 5247 had hooked on to their train at Harmon, New York, at 6.23 on the previous evening, and would not be detached until reaching Chicago at 3.45 p.m. (Central Time) that day—a run of 927.9 miles, extending over a period of 22 hours 22 minutes. During that time

she would be under the successive charge of seven different crews, none of whom had any proprietary interest in her ; and it says a great deal for these crews and the maintenance staff that an engine should be able, day in and day out, to perform satisfactorily such arduous work under such conditions. Driver Fahlbusch and Fireman Cullenen had taken charge at 105th Street Station, Cleveland, to which they had worked on No. 22 eastbound, leaving Toledo at 12.15 a.m.

Our departure time was 8.40 a.m., and 1½ minutes late the signal whistle in the driver's corner blew three times. The driver opened his regulator, the booster cut in, the fireman quickened his coal-feed and we were off. The start out of Cleveland, as I have said, is difficult, and the short level over the swing bridge does not allow of much speed being gathered. We had scarcely reached 20 on the speedometer before we were on to the grade. Out came the regulator to full open, the screw reverser remained at round 70 per cent., and there we went up. It was a fine morning, pleasantly cool ; and in the bright sunlight we must have made an inspiring picture as we blasted our way up the bank. Gradually the speed increased, and just as we topped the 1 in 132 and sighted West Park Station we had reached 28 m.p.h., no small achievement with a load of 1,175 tons. Our steam pressure remained throughout at 10 lb. below the red mark at 225, and the water level did not come below half-glass ; while the fireman, varying his feed, inspecting his fire, shifting his hopper doors on the tender, breaking lumps and pulling down coal, was sparing no effort to maintain these satisfactory conditions.

And now, with the gradient eased to 1 in 330, to be succeeded by a slight decline, the driver brought his reverser back to about 35 per cent. and, his hand upon the valve of the air-operated whistle, began to peal out the deep-toned blasts—two longs and two shorts—the level crossing signal, which no traveller by an American train can fail to notice. Speed mounted up and our recorder had touched 50 when a stony-hearted flagman brought us down peremptorily to 20 for relaying right through Berea Station. But no time was wasted in regrets ; with lengthened cut-off we roared down past Olmstead Falls and, with the grade still slightly favourable, reached 70 just before Shawville. Travelling on the big engine was remarkably steady, but the driver, with a fine regard for breakfasting passengers, braked us gently down to 65. So we ran until the towering bulk of Elyria coal dock loomed ahead, spanning the four tracks like a colliery screening plant ; and I was informed that we should call here to take on some 20 tons of coal.

With painful slowness we got our tender under the chutes, the canvas curtain was lowered behind the cab, and the dusty operation proceeded. Ashpan cleaning should have formed a feature of our stay here, but a slight mechanical defect prevented our opening the hopper doors and we had to proceed as we were. Our engine had stopped on the dead-centre and baulked at the first lift, so that altogether, in stopping at the coal dock, hauling the train a further mile to Elyria passenger station and making the stop there, we had consumed 10 min. 40 sec., and were now 7¾ min. late.

The start from Elyria is excellent, consisting of some two miles of level, followed by 11 miles downhill at 1 in 330, a fine galloping ground. No. 5247 was in a perverse mood at Elyria, however. The centrifugal pump, which forces the feed-water through the smoke-box heater, was giving trouble ; water level had fallen to quarter-glass, and pressure to 180 lb. The injector was therefore started in addition to the pump. It remained on for the rest of the journey, and by the time we had reached the foot of the bank conditions were normal again.

Once more we were unable to take full advantage of a favourable grade, for two miles short of Vermilion another permanent way check pulled us down from our 70 m.p.h. limit to somewhere round 40 and spoiled our average for the descent. Hard hammering on the slightly adverse length to Ceylon had raised us up to the 70 mark again when "track pans," or, as we call them, water troughs, loomed ahead at Huron and compelled another reduction to 50 in accordance with N.Y.C. practice. After this a quick finish over the level length to Sandusky brought us into that station in the very creditable time, all difficulties considered, of 37 min. 20 sec. for the 34.6 miles.

At Sandusky there commences a very picturesque piece of line. After skirting Lake Erie so closely that, looking from the south side of the footplate, it appears as if the engine were going to sea, the N.Y.C. cuts right across the extensive waters of Sandusky Bay by a causeway some two miles in length, intersected by a lifting bridge for the passage of shipping. A level run of some 5½ miles then brings us to Port-Clinton and the estuary of the Portage River. This the railway formerly negotiated by a curving causeway across its mouth, but a new station on a higher level has recently been constructed in Port-Clinton, and the railway has been carried straight across the waterway on a new causeway joining up with the old line on the west shore of the river. Speed limits are in force over this section of 45 m.p.h. at Bay Bridge drawbridge ; 15 m.p.h. through Port-Clinton new station, where the bank is not quite settled ; and 45 m.p.h. over the causeway, where track-laying is not yet complete.

A 45-sec. stop sufficed at Sandusky station. We got away only 3¾ min. late, and were accelerating finely when warning signals at Venice presaged our diversion to the slow road, relaying being in process on the fast track. On the slow road, therefore, we ran for two miles to Bay Bridge, where a severe slack was necessary to rejoin the now double track there. We soon made amends, however. Out across the causeway we thundered, waking all the echoes of Sandusky Bay and scattering the section gangs, all save one placid individual who lay with updrawn knees, his feet only eighteen inches from our destroying path !

Through Danbury and Gypsum we kept hard at it, and had reached 60 when we had to come down abruptly to dead slow for the negotiation of Port-Clinton station. After carrying out our orders in exemplary fashion, we then accelerated out across the gleaming white track of the new causeway, where the line winds about, sometimes on the location of the future fast track, sometimes on the slow. Our big steed was held in restraint until the old line, with its mile of idle box-cars stowed there waiting on the harvest, swung in to join us on the right, and we turned the corner for La Carne and Toledo. And then —— !

Out came the regulator, full open ; back came the cut-off to 65 per cent., and there it remained ! Up climbed the speedometer—50, 55, 60, 65, 70 ; up to the top mark it went and there it remained ! Sixty-five per cent., full regulator, and 70 miles an hour ! I looked to see if the water were in sight ; it remained steady at half-glass. I watched the steam gauge, it never fell below 215 lb. There we flared on across those level meadows. The gradient went faintly against us, but still that marvellous locomotive continued to whirl its 1,175-ton train along at her 70 m.p.h. limit. As a matter of fact the speedometer must have been registering slightly low, for our average for the 12 miles from Rocky Ridge to Millbury, covered in 10 min. 5 sec., was 71.4. And still that marvellous boiler continued to supply the terrific demand for steam without any sign of flagging or stress ; and our placid crew continued to drive her ahead, unmoved by what was apparently an everyday occurrence. Only once, at Millbury, when a motor car, trying to make a level-crossing ahead of us, skidded to within two yards of us in a cloud of dust, did Driver Fahlbusch's calm forsake him for a moment.

Whether this long cut-off was actually necessary for the maintenance of this speed on this journey (*Continued on page 348*)

Cleveland Union Terminal Station, Cleveland, Ohio, opened on 28th June, 1930. The New York Central Lines own 93 per cent. of this terminal, which cost 88,000,000 dollars.

Alarm Signals on Passenger Trains

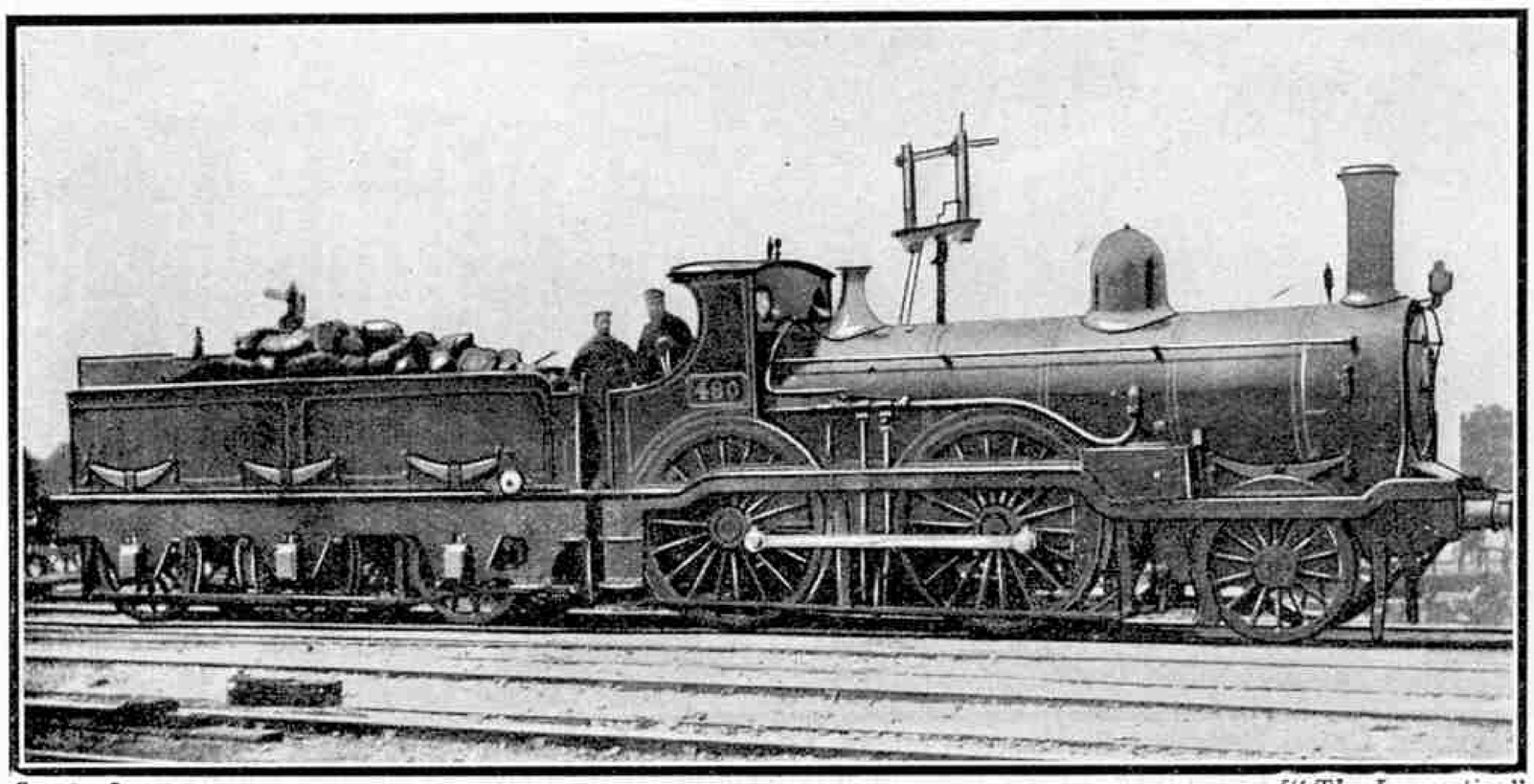
An Interesting Chapter of Railway History

By Capt. E. A. Humphery Fenn, F.R.G.S.

WHEN railways first came into existence they were looked upon almost entirely from the point of view of goods carrying. Until the Liverpool and Manchester Railway astonished its directors and everybody else by earning from passengers nearly double the revenue derived from the carriage of merchandise, practically no attention was given to the provision of comfortable vehicles for travellers. In the earliest trains passengers were carried to a large extent in open trucks little different from those used for goods, and a journey under such conditions must have been a thoroughly trying experience. If there was a good feature in such trains it lay in the fact that the driver and the guard had the majority of their passengers under direct observation, so that if anything went wrong they were immediately aware of it. There was therefore no necessity for any mechanical means of communication between the passengers and the officials in charge of the train. This state of affairs did not last long, however. Passengers put forward emphatic demands for comfort in travelling, or at least for less discomfort; and soon the open truck was abandoned entirely and the closed carriage took its place. With this change a new set of conditions arose. The driver and the guard could not see what was happening in the carriages, and no matter how serious an emergency might arise the passengers had no means of communicating with the officials and having the train stopped. As the number of trains and the length of non-stop journeys increased, the seriousness of this defect became increasingly evident; but in spite of repeated complaints little was done in the matter for some time. In 1864 public indignation was thoroughly aroused by the murder of a fellow-passenger by a foreigner in a carriage on the North London Railway, and the railway authorities began to tackle the problem in earnest. Two years later the efforts of the railways were still further speeded up by a letter sent by Queen Victoria to the various companies, asking that something should be done to make railway travelling safer by introducing means of communication between passengers, guard and driver. In 1868 the definite step was taken, in the Regulation of Railways Act, of making it compulsory for some method of communication between the passengers and the guard to be provided on all trains running more than 20 miles without a stop.

In the days of open carriages the guard was seated in an elevated position from which he could look over the whole length of the train and also could signal to the driver when necessary. In some cases the guard was provided with a seat at the rear of the tender as shown in the accompanying illustration. At this period, of course, travelling speeds were slow; one wonders what would happen to a guard seated above the tender of a modern express!

When the observation system had to be abandoned in favour of mechanical communication, all kinds of schemes were suggested for the purpose. One moderately successful plan was that of fixing a gong to the right-hand side of the tender of the locomotive and another gong in the guard's van. These gongs were connected up throughout the train by a cord running down the right-hand side of the carriages. Sometimes this connecting cord was coupled to the whistle on the engine instead of to a gong. In some cases the engine whistle could be operated by means of a lever placed beneath the seats of the carriages.

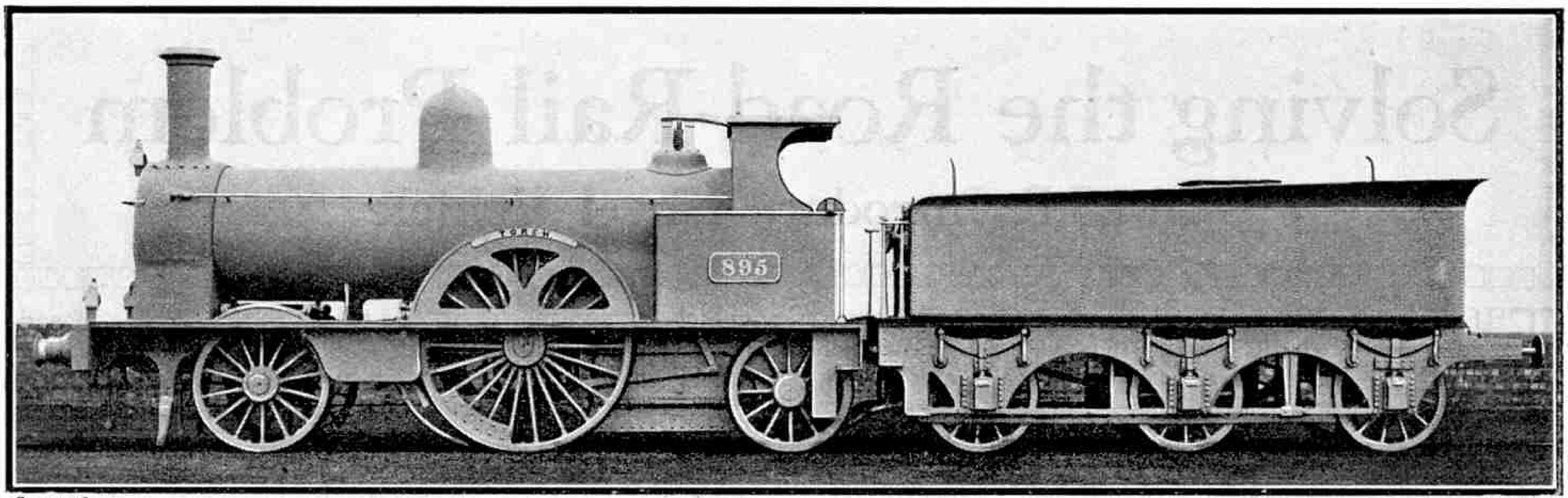


Courtesy] ["The Locomotive"

A G.W.R. standard gauge express locomotive built at Swindon in 1869, as reconstructed with cab, and showing the alarm gong fixed on the side of the tender.

In February 1865, on the same day that Lord Harris laid the foundation stone of the Battersea Railway Bridge, a number of railwaymen travelled in a special train from Waterloo to Wimbledon to test by practical experiment a train communication invention that was thought to be a vast improvement on any previous scheme. On each side of the partitions of each compartment was situated within easy reach a small circular box with a glass front. In order to attract the attention of the guard in an emergency the glass had to be broken. This breakage had the effect of setting free a spring that caused a small arm to move outward from the side of the window of the compartment in which assistance was required. At the same time an electric current was switched on and this caused a bell to ring in the guard's van. The attention of the guard was attracted by the ringing and by looking out of his window he was able to see instantly which compartment had signalled for his help.

The guard was in electrical communication with the

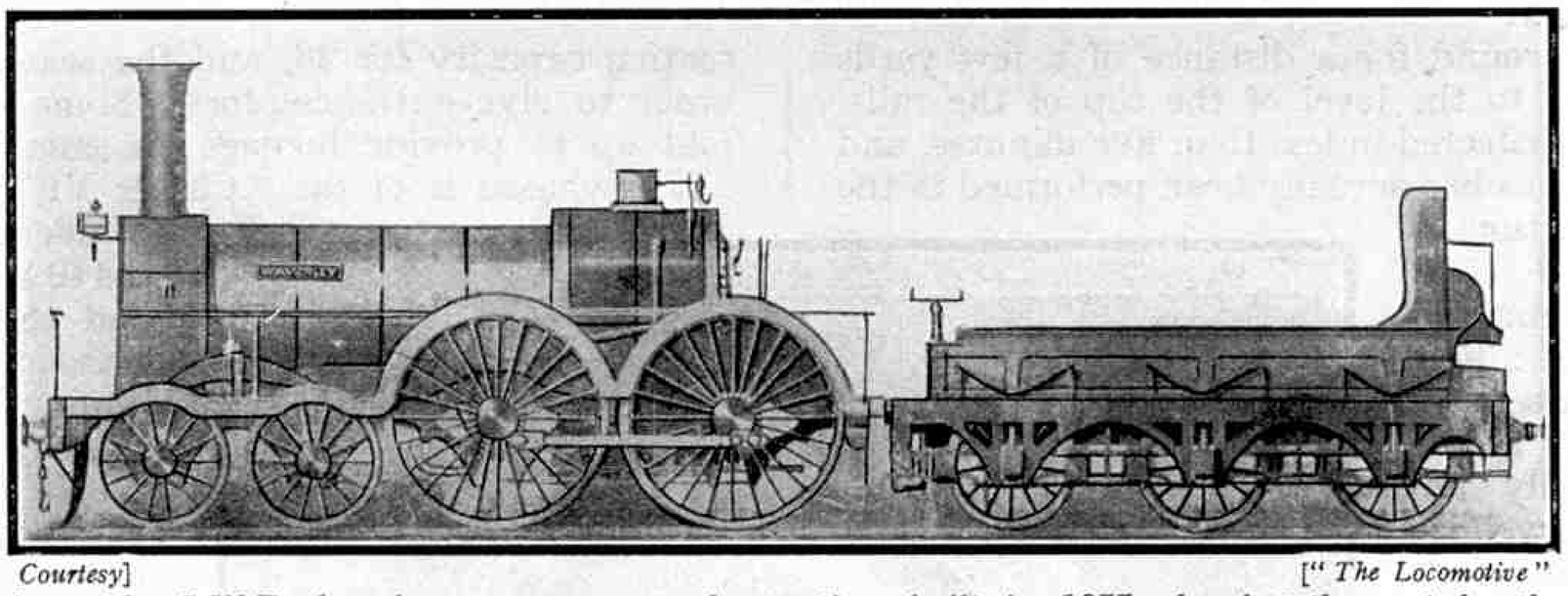


Courtesy] [L.M.S.

The rebuilt two-cylinder 2-2-2 express locomotive "*Torch*" of the L.N.W.R. "Bloomer" class, showing davits fitted to the tender to carry the cord connecting the coaches with the alarm whistle or gong.

driver by means of a system of signals. In the guard's van and on the engine there was a disc about the size of a large watch, on the top of which was a press button. When the button above either disc was touched with the finger it operated a needle on the disc at the other end of the train. One beat from the guard to the driver signified that a message was about to be sent; two beats meant "Go ahead, all right"; three beats, "Something wrong, be prepared"; four beats, "Pull up and stop at next station"; and six beats, "Danger, stop at once." There was in addition means of communication by which both guard and driver were informed of any mishap in any part of the train. If for instance the couplings broke, the bells at each end of the train would be set ringing and the attention of guard and driver attracted.

There were many objections to this apparatus. Passengers were exposed to the risk of having their hands cut in breaking the glass of the emergency apparatus, and as the bell in the guard's van continued to ring until the broken pane was replaced by a new one, no other summons for help could be made on the same journey, no matter how urgent might be the need for it. In addition the apparatus was easily put out of order, and its cost was about £4 per carriage.



Courtesy] ["The Locomotive"

An early G.W.R. broad-gauge passenger locomotive, built in 1855, showing the seat for the guard at the rear of the tender.

Another scheme that was experimented with was more amusing than practicable. It resembled in some respects a method of communication between counter assistants and the cashier that was at one time popular in large drapery establishments. The idea was for the passengers to send to the guard by means of air pressure, small wooden balls upon each of which was stamped the number of the compartment from which it was despatched. These little messengers were to be dropped into a horizontal tube running the whole length of the train, metal through the carriages but with rubber joints between them. The balls were to be propelled by means of bellows at work on the locomotive. On arrival at the guard's van each one was to open a valve, blow a whistle, and in fact do much more than a little wooden ball could reasonably be expected to accomplish!

A device that found a good deal of favour when it was brought forward had at least the merit of simplicity. It consisted of an ordinary bell, of a size sufficient to make enough noise to be heard along the train, placed upon the roof of each compartment and rung by a cord or chain that hung down into the interior.

All these and many other schemes were abandoned as the result of the introduction of the efficient system that is now in general use. This system has been developed as the result of the universal employment of the continuous automatic brake. All railway travellers are familiar with the short lengths of chain extending between the ends of tubes, high up but within convenient reach, at the sides of each compartment; and the accompanying notice: "To stop the train in case of emergency pull down the chain," followed by the ominous words: "Penalty for improper use, £5."

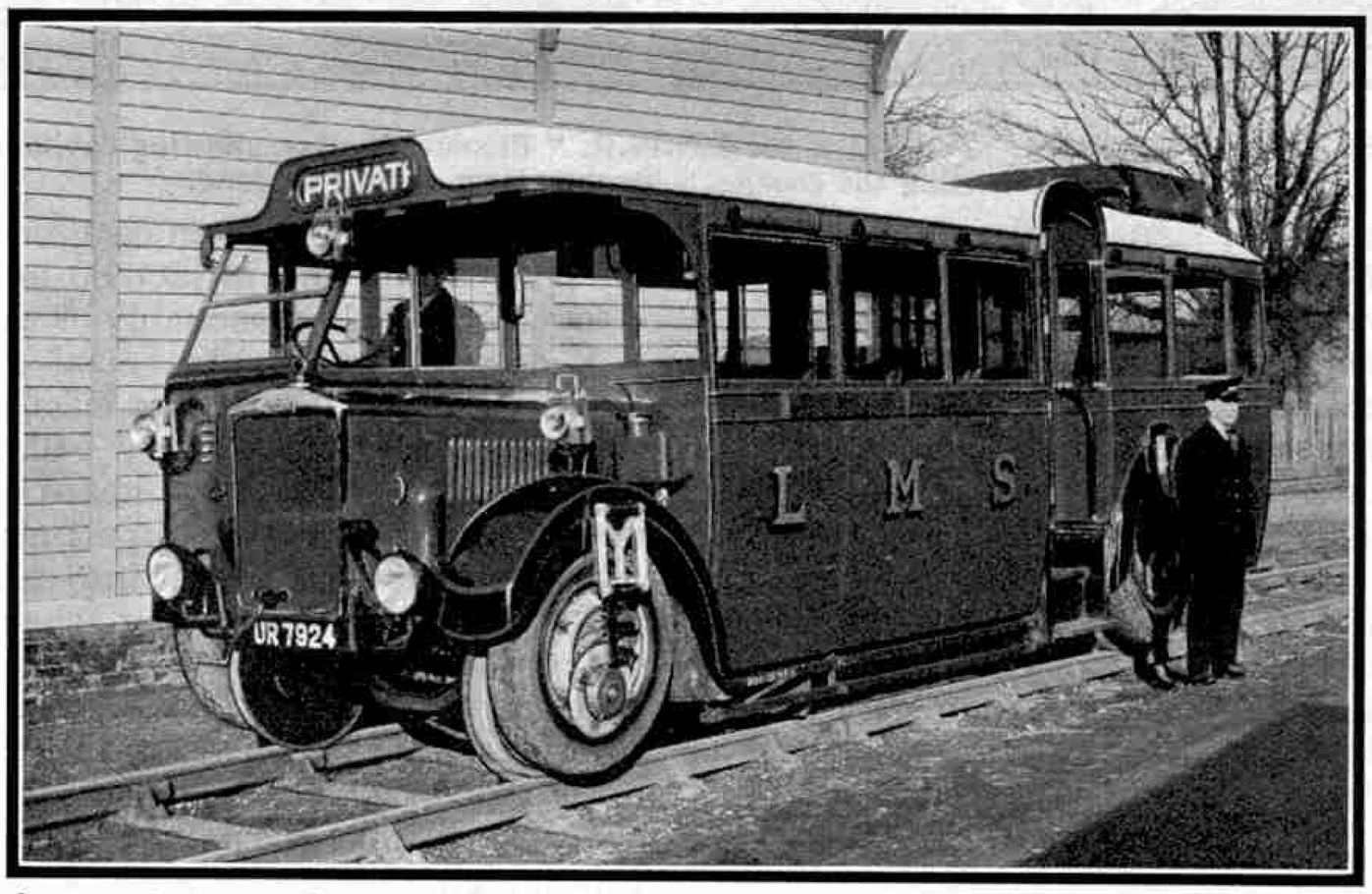
When this chain is pulled down it brings about a partial application of the automatic brake, which of course is continuous throughout the train. The braking effect thus produced is small, but it is quite sufficient to attract the attention of the driver and the guard and to cause them to look at their respective gauges. The indication on these gauges makes it clear that some passenger has pulled the emergency chain, and the driver brings his train to a stop as soon as possible. The guard's duty is to ascertain from which compartment the signal was given. The pulling of the chain causes small discs at the end of the coach concerned to be exhibited, and thus to catch the eye of the guard as he walks along the train. Having ascertained the coach, he then finds the compartment by looking for a slack emergency chain, for this chain, when once pulled, cannot be restored to its original position by any action on the part of the passengers.

Solving the Road-Rail Problem

L.M.S.R Introduce Novel Vehicle

THE London Midland and Scottish Railway have introduced an interesting new vehicle, known as the "Ro-Railer," from the fact that it can travel either on road or on rail. This is the first attempt to combine in one vehicle the great safety and cheap operating costs of rail haulage, together with the door-to-door transport of the road vehicle.

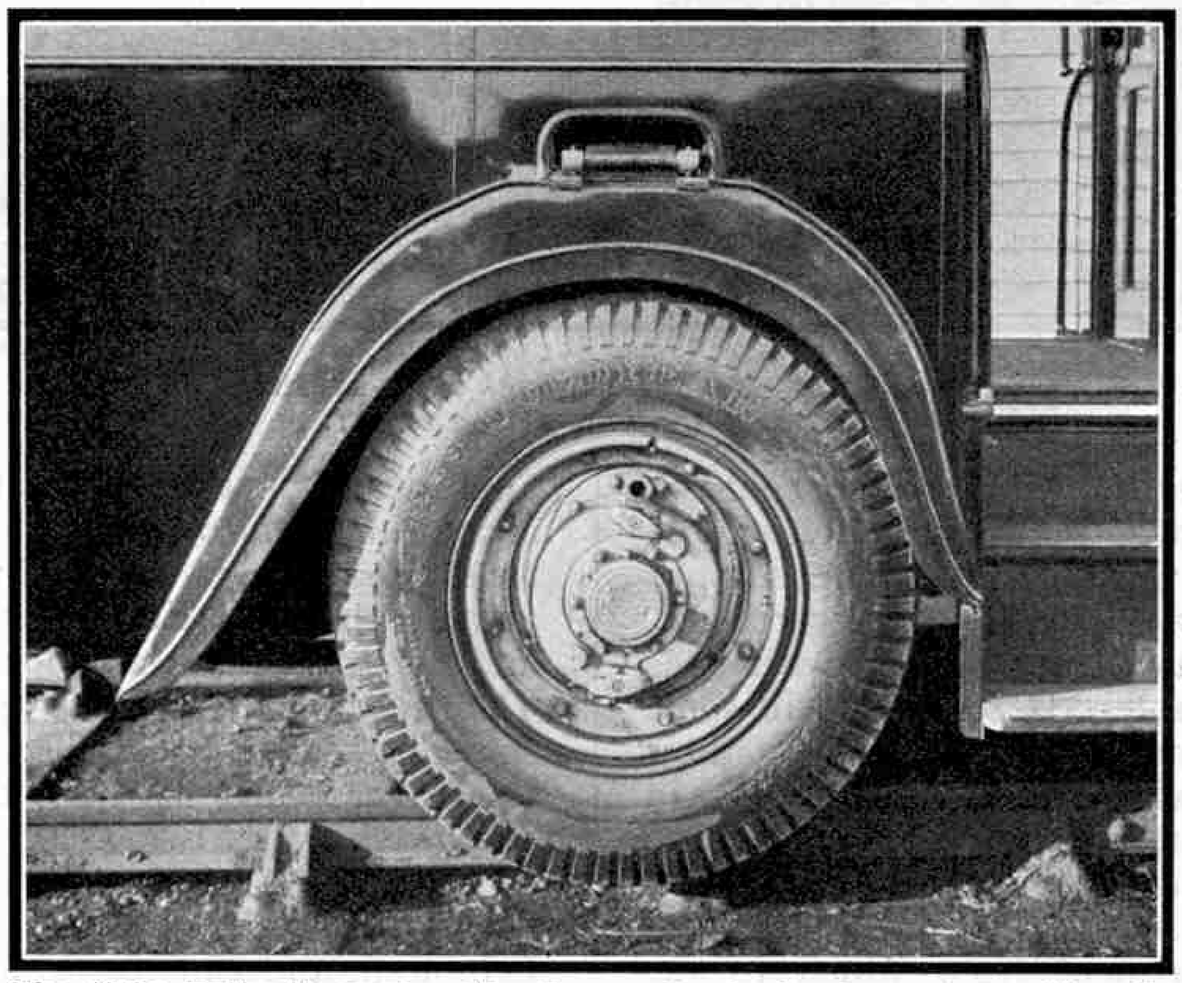
The vehicle may be changed at will from road to rail, or vice versa, at any place where a road or a yard adjoins the railway. No special equipment is required other than that incorporated in the design of the vehicle, except that at the point of exchange the ground for a distance of a few yards must be made up to the level of the top of the rails. The changeover is effected in less than five minutes, and under test conditions has actually been performed in the remarkably short time of 2½ minutes



A general view of the new "Ro-Railer" coach for travel either on road or rail. For our illustrations we are indebted to the courtesy of the L.M.S.R.

The first machine delivered to the L.M.S.R. is designed for passengers, but the system is applicable to practically any type of motor vehicle, either passenger or goods, and to tractors and truck trailers. The range in goods vehicles is from 30 cwt. up to 10 tons, while for passenger work small 20-seater omnibuses or high capacity double-decked, three-axled vehicles can be built.

The vehicle has been designed principally for use on branch lines generally, and in particular those branch lines where towns and villages lie at some distance from the railway. Passengers may be picked up and set down at any convenient point on the line, not necessarily at a station. There are also possibilities of utilising the vehicle for summer week-end traffic to the seaside. Road congestion, leading to both slow and dangerous travel, has already created a problem in this traffic, to which the "Ro-Railer" may provide a partial solution. Either the passenger or the goods vehicle may be attached to a goods or a passenger train, and detached and sent forward as an ordinary road vehicle as required.



The "Ro-Railer" coach with the road wheels shown in position for road use.

The "Ro-Railer" has been built by Karrier Motors Ltd., of Huddersfield, to the requirements of Mr. J. Shearman, L.M.S.R. Motor Engineer. On the road its appearance differs little from that of an ordinary road vehicle. It has seating capacity for 26, and the seats are staggered in order to give extra comfort. Some of the rear seats fold up to provide luggage accommodation.

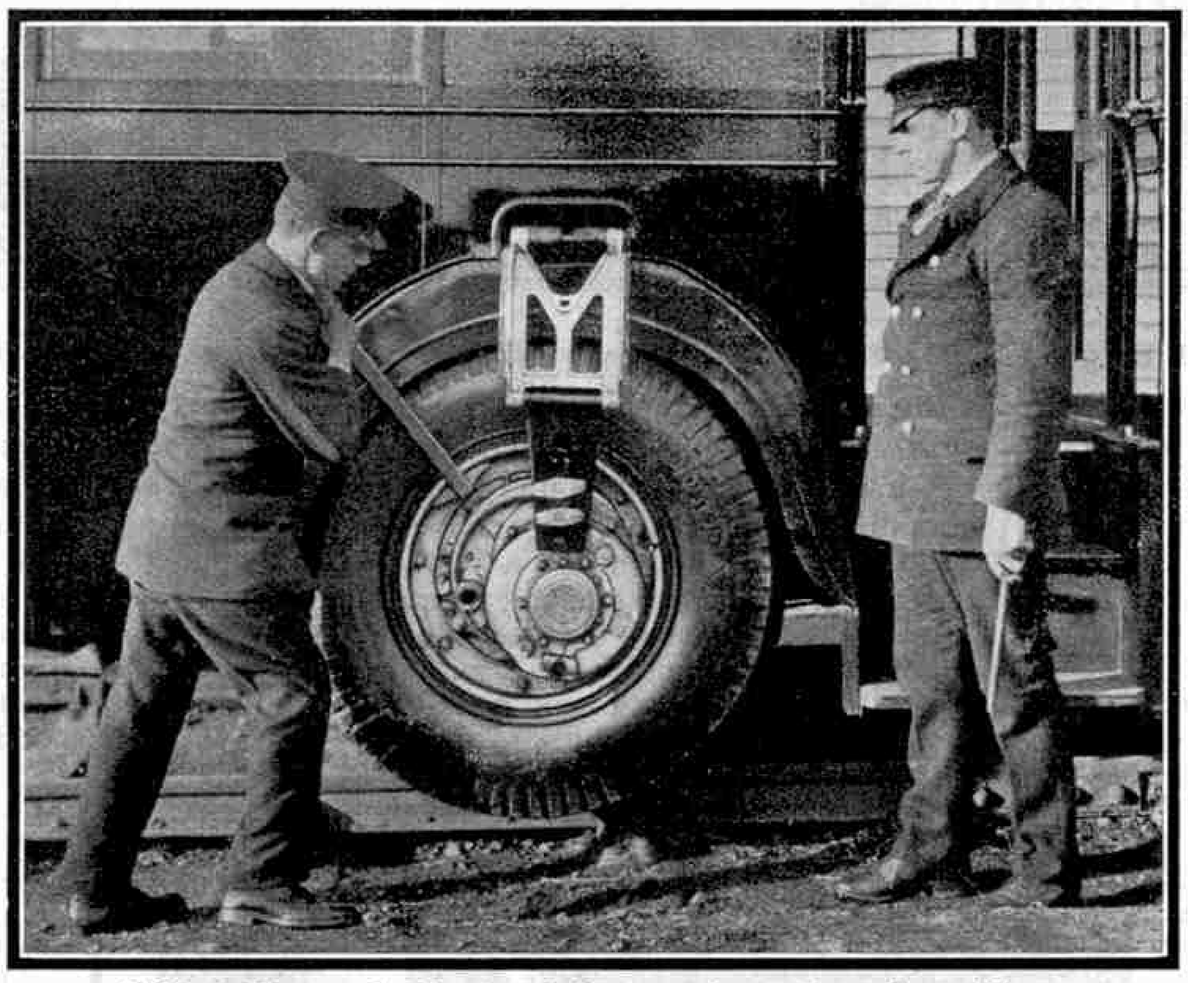
The chassis is of the "Chaser VI" type with a six-cylinder engine developing 65-110 h.p. For use on the road the gear ratios are of the usual type, but for running on rail a supplementary overspeed gear-box of suitable ratio has been provided, to reduce engine revolutions in relation to vehicle speed. This gear-box allows of a low engine speed with resulting fuel economy and reduction of wear and tear, and at the same time permits a high rail speed to be maintained. The tractive effort of the vehicle is sufficient to permit the towing of other vehicles when required. The varying requirements of road and rail running have necessitated the designing of special springs which make the vehicle very comfortable in all circumstances.

The body is divided into a front section accommodating

14 passengers; a rear smoking compartment accommodating 12 passengers; and a central vestibule, which provides entrance and exit on each side of the vehicle for either ground or platform levels. Large observation windows are fitted at the rear of the car.

Buffers and coupling gear have been arranged at both ends, and lamps are provided to enable the car to carry appropriate lights when it is being driven on rail in either direction. Sanding gear for use on the rail is also included.

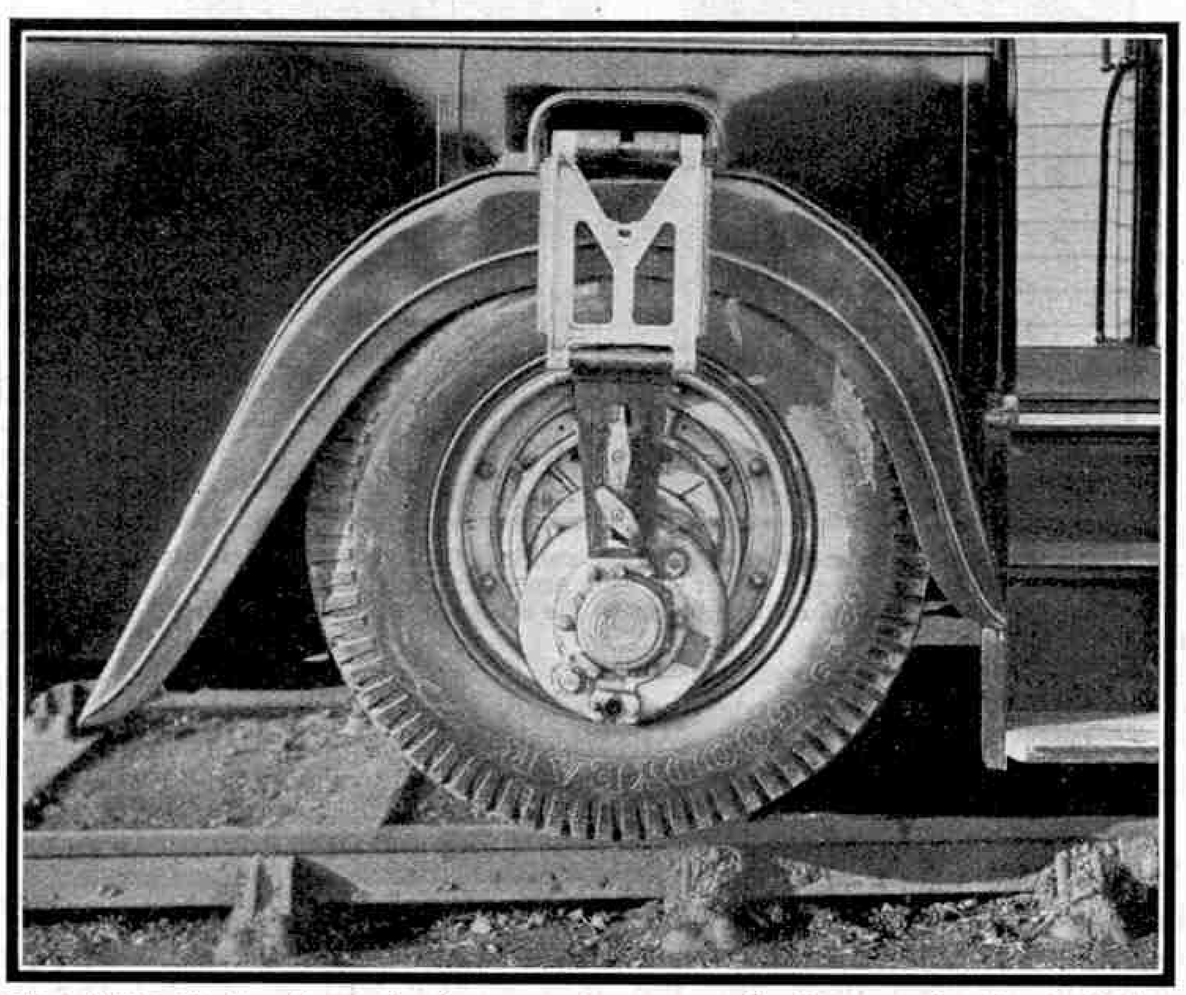
The low tractive effort necessary to propel the vehicle while it is on the rail appreciably lessens running costs as compared with a vehicle for road only, and there is a similar reduction in petrol consumption, maintenance and tyre costs. While on rail the car is capable of travelling safely at railway speeds. On short tests speeds of over 50 m.p.h. have been obtained, without the engine being extended to its full capacity. On rail the car will be protected by the same system that has made British railway travelling the safest in the world. This safety factor is given added importance by the continual increasing number of road accidents. More people are killed every day on the streets of London than are killed on British railways in a year.



Lifting the road wheels of the coach up to rail position.

Comfort and improved visibility as compared with the average type of branch line train, combined with the much greater safety of rail compared with road travel, should make a strong public appeal. Moreover the car when on the road is more comfortable than similar types of purely road vehicles. Journeys may be shortened, and the payment of heavy tolls for road bridges avoided by running the vehicle as an ordinary bus, and placing it on the rails at convenient points.

The advantages of low operating costs, safety and speed apply to the goods "Ro-Railer" as much as to the passenger vehicle. Traffic could be actually door-to-door without the necessity of transferring the load at any point during its journey.



The "Ro-Railer" ready for running on rail, the road wheels being lifted clear.

Inside the railway industry there is a possible use for the "Ro-Railer" in conveying men and materials to points where line construction or repairs are required. The vehicle could be taken by either road or rail to the most convenient point for unloading, and be moved immediately from the running lines, thus avoiding any interference with traffic.

Flanged rail wheels are fitted to the vehicle's axles, and on the outside of these are placed pneumatic tyred road wheels mounted on eccentrics fitted to an extension of the axles through the rail wheels. When the vehicle is on the road the road wheels are locked concentrically to the rail wheels, which are of smaller diameter, and thus clear of the road.

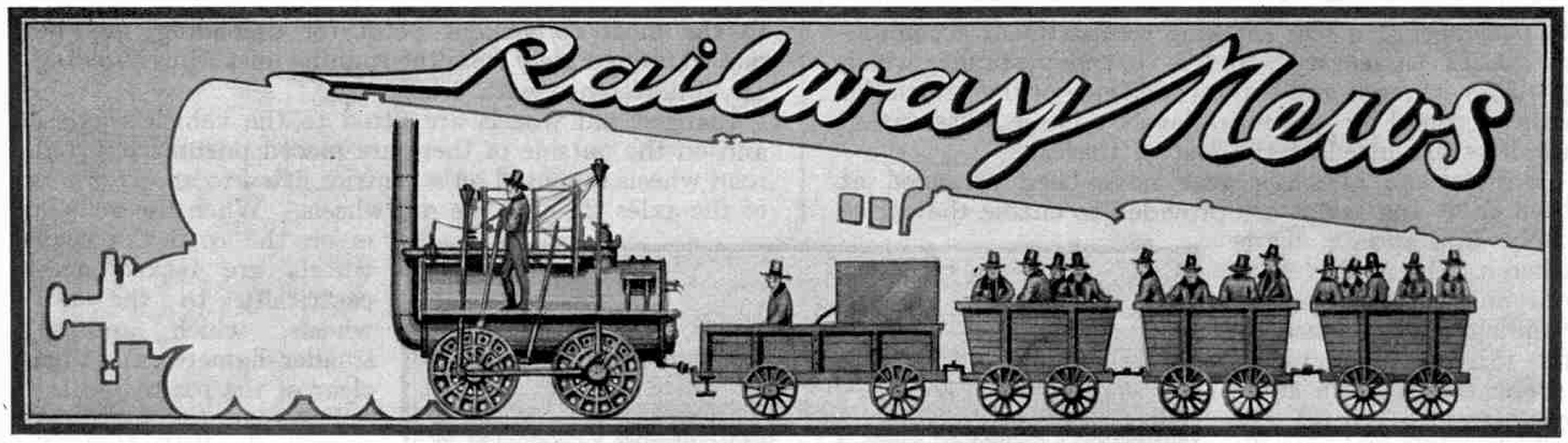
For road to rail transference the "Ro-Railer" is driven on to the rails at any point where the road has been made up level with the rail tops. Then, with the rail wheels directly over the rails, it is driven forward a few yards. When the point is reached at which the made-up road is tapered off, the rail wheels gradually come in contact with the rails, and take the weight of the vehicle off the road wheels. The road wheels are then raised above rail level by the driver giving them a half turn and locking them to the chassis frame by a pin. The road wheels do not revolve when the vehicle is running on rail.

For returning to road running the operations just described take place in the reverse order.

Adequate braking for both road and rail operation is secured by brake drums of the ordinary type, located on the rear axle and attached to the driving hub. It is claimed that the vehicle can be pulled up without difficulty in a very short distance, without any tendency to locking of the wheels, even when travelling at 40 or 50 m.p.h.

In order to eliminate as far as possible noise produced by vibration of the flanged wheels, Lang laminated wood wheels have been adapted. Wheels of this type possess a combination of resilience and great strength. They are shielded by steel side plates from heat from the brake drums, and this heat is further dissipated by thick steel circumference bands fitted to the drums. The tyres of the rail wheels are detachable and renewable.

The system of springing is interesting, for it has been designed specially to provide a satisfactory compromise between the requirements of road and rail running.



New Locomotives on the L.N.E.R.

Further engines of the three-cylinder 4–6–0 "Sandringham" class have been built at the works at Darlington. They are:—No. 2822, "*Alnwick Castle*" and No. 2823, "*Lambton Castle.*" Several engines of this class are located at Cambridge and sometimes work trains from there to King's Cross.

Doncaster works have turned out some more of the three-cylinder 2–6–2 tank engines of the new "V" class. Two of the latest, Nos. 2905-6, have been sent to Edinburgh (St. Margaret's). Some of the 0–6–2 tank engines, which these new engines have replaced, have been sent to the southern area.

G.W.R. Locomotive News

Following on the announcement in last month's "*M.M.*" that one of the two-cylinder 4–6–0 express engines was to be fitted with poppet valves and gear, it can now be added that the engine chosen for this interesting experiment is No. 2935, "*Caynham Court.*" This engine is at present at Swindon and the alterations necessary for the fitting of valves of the Lentz type are being made.

A number of engines of the "King," "Castle," and "Star" classes are passing through the shops at Swindon in preparation for the traffic of the coming summer. These engines, together with others of the "Saint" class, are having their spring gear altered, the equalising beams being removed and each spring fixed independently, as it has been found that the engines which have already been so treated run more smoothly.

Additional 0–6–0 tank engines have been received from outside firms, including Nos. 6746-9 from The Yorkshire Engine Co.; Nos. 7754, 7758-61, and 7763 from The North British Engine Co.; Nos. 7788-99 from Sir. W. G. Armstrong Whitworth & Co.; and Nos. 8725-8 from W. G. Bagnall Ltd.

Success of S.R. Electrification Scheme

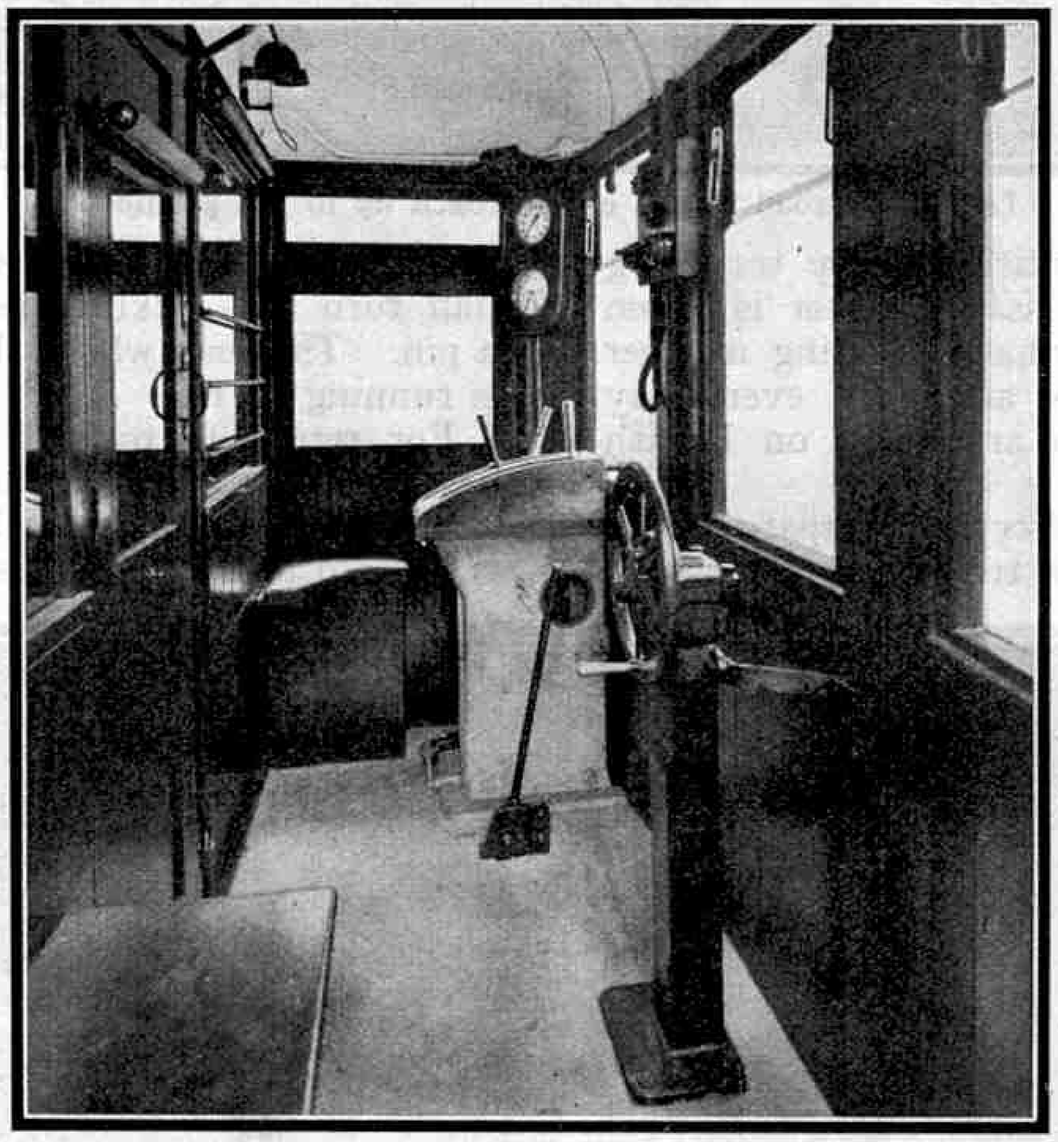
The bold, progressive policy that has been adopted by the Southern Railway in the electrification of its London suburban services has already justified itself by the remarkable results it has produced. During 1930, the number of passengers carried in the electrified areas showed an increase of 12,592,000 as compared with the previous year, with an increase in receipts of £192,000. This is distinctly satisfactory in view of the acute competition of road services.

Underground Railway Developments

In addition to building the new extensions to the Piccadilly Tube, which are now well in hand, the Underground Railways of London are busy with many developments that will greatly improve the services. All the principal stations in central London are to be reconstructed, escalators being installed in place of lifts. A new station is to be built. This will be known as "Green Park" and will supersede the present Down Street and Dover Street stations.

The sixty-two new cars which were ordered some months ago for the L.M.S.R. and Bakerloo joint services between Elephant and Castle and Watford Stations are now being delivered and placed in traffic.

Six new experimental cars, each of which embodies some distinctive features, have been built and put into service with a view to deciding which type will provide the best pattern for the 300 new cars which will shortly be required for the new extensions. These extensions have also necessitated the enlargement of the power station at Lots Road and the provision of new and very large car sheds. In the near future the Underground Railways will have 2,400 cars running.



In the driving compartment of a steam rail coach. The controls are simple and easy to manage, and the driver is well protected from the weather. Our photograph is published by courtesy of the Sentinel Waggon Works Ltd.

Train Speeds on the G.W.R.

To-day there are 40 expresses booked to run on the G.W.R. over distances ranging from 53 miles to 173¾ miles, and totalling in the aggregate 4,063 miles, at "start to stop" speeds of 55 m.p.h. to 66.2 m.p.h. They include "*The Cheltenham Flyer,*" which covers the 77¼ miles from Swindon to Paddington in 70 minutes, at an average speed of 66.2 m.p.h., and is believed to be the fastest train of its kind in the world; and the "*Cornish Riviera Express*" and the "*Torbay Limited,*" which between Paddington and Exeter, a distance of 173¾ miles, average 59.6 m.p.h.

Four daily runs also are made between Paddington and Bristol in 120 minutes, representing an average speed of 58.8 m.p.h. for the 117½ miles. Other notable runs are made between Paddington and Leamington, a distance of 87¼ miles. Five trains daily make this journey in 90 minutes, their average speed being 58.2 m.p.h.

New Station for Cardiff

Cardiff General Station and the adjacent Riverside Station are to be completely rebuilt by the Great Western Railway Company at a total cost of £820,000. As a result the two stations will virtually become one although the Riverside station will still retain its present name. The first stage of the work of rebuilding has commenced and it is anticipated will be completed early in 1934. The new scheme provides for additional, longer and wider platforms, increased running lines through the station, the provision of refreshment and waiting rooms on the principal platforms, convenient ample accommodation for stabling coaches and locomotives, and is designed to give greater convenience to the travelling public.

The Cardiff scheme is one of 38 big development schemes now being undertaken by the G.W.R. and totalling £8,500,000.

Season Tickets for Dogs

Arrangements have lately been made for the issue of season tickets for dogs accompanied by passengers. It is now possible for a passenger to obtain a season ticket for a dog for a period of not less than one month, at a substantial reduction on the ordinary charges. This facility will doubtless be appreciated by those who desire, for any reason, to take their canine friends with them when travelling by rail.

New Marshalling Yard at Acton

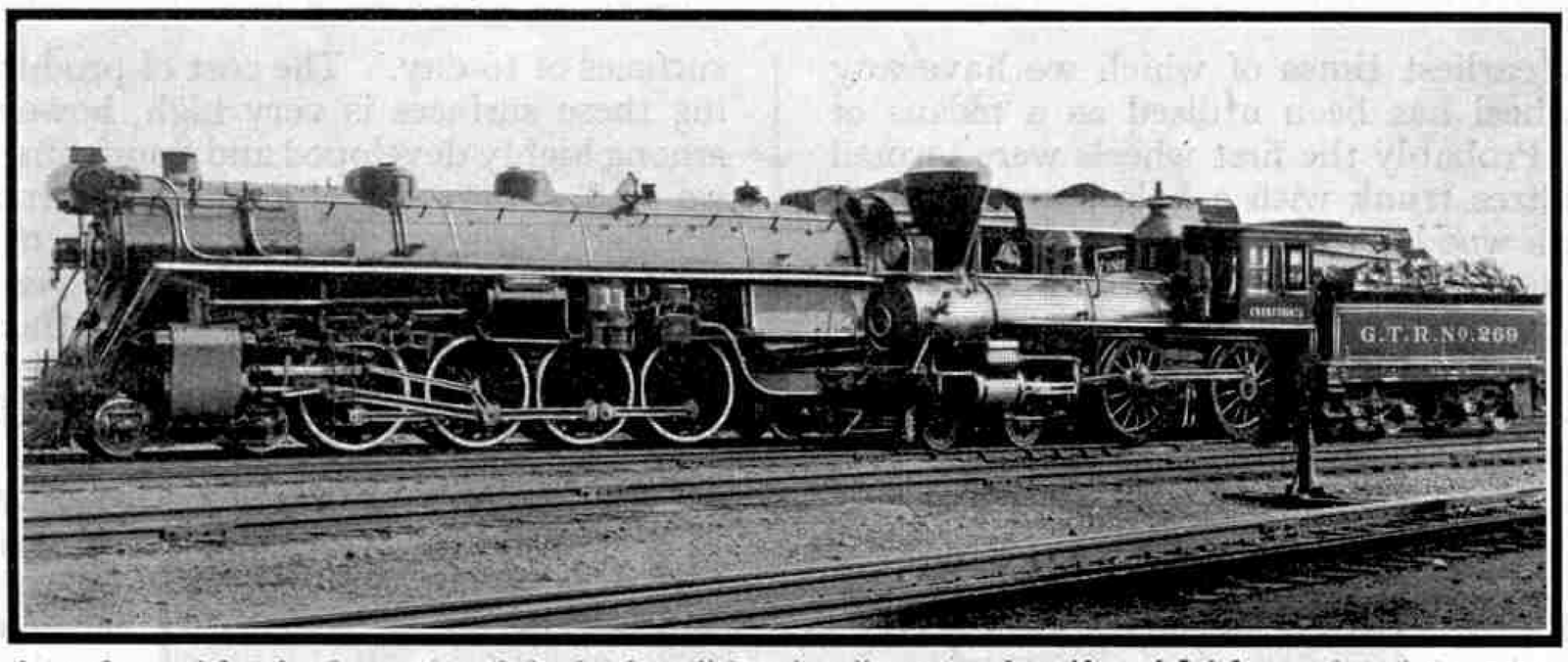
By the middle of next year, when the full scheme of improvements has been carried out, Acton will possess one of the largest marshalling yards in the Great Western Railway system.

Acton is the "key" or concentration point for the millions of tons of freight traffic passing annually to and from the G.W.R. system and the big London docks, Poplar, Smithfield and other markets, and the L.M.S.R. and L.N.E.R. areas. Freight traffic, and especially urgent shipping and market traffic, passing through the yard has increased considerably in recent years. In 1925 the total number of trains arriving was 21,489, and the number of wagons 596,191. The corresponding figures for 1928 were 22,341 and 640,807. Contributory factors to this increase in traffic are the steady growth of London itself and the big developments at the London ports.

To meet this growing demand the scheme provides for a new and enlarged marshalling yard, containing 28 miles of sidings, on the north side of the main G.W.R. London-Reading line, and capable of accommodating 2,481 wagons, as compared with 743 at present. The yard will be divided into two distinct sections for marshalling the "up" and the "down" traffic respectively. The present small coal yard on the south side of the line at Action station will be closed, and the whole of the local goods and coal traffic concentrated in the new yard. Provision is made also for the construction of a new "down" goods line between Acton and Ealing which will enable goods trains to leave the yard and proceed as far as Ealing before coming on to the main G.W.R. line.

It is anticipated that the new yard will cost approximately £100,000. In the course of the work there will be used 59,200 tons of ballast, 59,200 sleepers, and 3,950 tons of steel rails. The excavation work will involve the removal of 290,000 cu. yds. of earth. Part of this has already been removed and used to form the site of the new goods station at Brentford Town.

An important feature of the new yard, which will operate throughout the 24 hours, will be the provision of flood lighting by thirty 500 watt floodlight projectors that will turn night into day and greatly facilitate the working of the yard. The yard will be equipped in such a manner that the handling of freight traffic on the G.W.R. will be greatly speeded up.



An early wood burning locomotive of the 4-4-0 or "American" pattern alongside a 4-8-4 locomotive of the C.N.R. "Confederation" type. Our photograph illustrates the growth of Canadian locomotives during the last 60 years.

The Procession to the Scrap Heap

On all the railways large numbers of the older types of engines are steadily being consigned to the scrap-heap and as a result some of the classes that have been famous in their time are already extinct or soon will be so.

Only seven of the splendid "Gladstones," the 0–4–2 express engines of the old L.B. & S.C.R., are now left in service and they must soon share the fate of their fellows. Happily, "*Gladstone*" itself is safely housed for the present in the Railway Museum at York.

The once numerous class of 2–4–0 "Jumbos," of the former L.N.W.R., has now but few survivors. It is greatly to be desired that one of these wonderful little engines shall be preserved. For this purpose no better representative of the class could be found than the engine "*Hardwicke*," which covered itself with glory by making the record run in the Railway Race of 1895.

The P.L.M. No. 241-A-45 4-8-2 at Marseilles Rapide leaving Laroche. An engine of this type hauls the Blue train. For our photograph we are indebted to our reader, W. H. C. Kelland.

One very notable L.N.W.R. class—the "D.X" 0–6–0 goods—is now no more. The first engine of this class was built in 1858 and others were added until—including 86 for the L. & Y.R.—no less than 943 had been built. The earlier engines of the class bore names as well as numbers. They were very useful engines and were by no means confined to goods traffic. For many years they took a large part in the passenger services and many of the excursion trains of the L.N.W.R. were worked by them, even after the introduction of larger engines.

Self-Trimming Coal Bunker on L.M.S.R.

Three of the new 4–6–0 express locomotives of the "Royal Scot" class—Nos. 6164, 6165 and 6166—are now stationed at Longsight Shed, Manchester, and are working on the chief expresses between Manchester (London Road) and Euston, including "*The Mancunian*" and "*The Lancastrian*." "Claughton" engine No. 5902, "*Sir Frank Ree*," which was recently rebuilt with three cylinders, has also been stationed at Longsight and has undergone special tests.

Ten of the new standard 0–8–0 freight engines have been completed at Crewe and are numbered 9600-9. These are designated for work on the L. & Y. section, but they are first temporarily stationed at the Crewe South shed to be worked gradually into condition.

Derby Works continue to turn out passenger tank engines of the 2–6–2 type. Those fitted with condensing apparatus for use on the Metropolitan lines, to which reference was made in last month's "*M.M.*," are numbered from 15520 upwards.

One of the "Beyer-Garratt" locomotives, No. 4986, has been equipped with a new patent self-trimming coal bunker. The bunker is cylindrical in shape and is fitted with doors that are closed tightly after it has been filled with coal. It is somewhat inclined and can be slowly rotated in order to move the coal foward to the shovel plate from which the fireman can readily transfer it to the fire-box. In addition to saving the labour of trimming, several other advantages are claimed for this novel bunker.

Engine No. 5638, "*Charles James Lever*," of the "Prince of Wales" class, has been adapted to the Midland loading gauge.

Among the engines recently scrapped was one of the well-known 4–4–2 outside-cylinder tank engines of the old London, Tilbury and Southend Railway. It bore the L.M.S.R. number 2085 and had been in service more than 50 years. It was one of the first of a class of tank locomotives that attracted much notice when they were built, for they were of large size for that date. They were perhaps the first step toward the modern express tank locomotive.

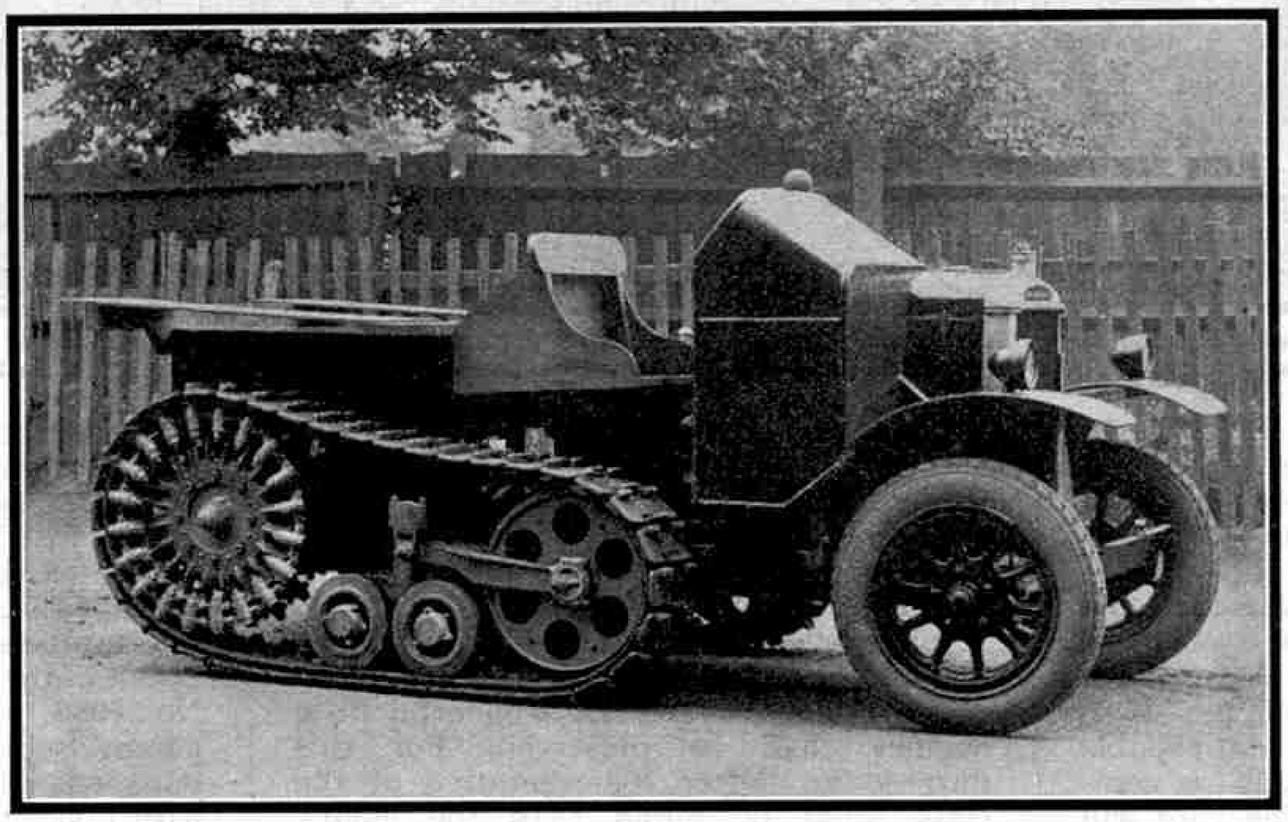
New Type of Ticket for the L.M.S.

A contract for the supply of 200,000,000 tickets a year has been placed by the L.M.S.R. with Insets Ltd. These tickets are of a patented British design, and carry small insets displaying advertisements of British goods. The tickets are of the same dimensions and weight as L.M.S. standard tickets.

The Future of Roadless Traction

Endless Track to Replace Wheels

FROM the very earliest times of which we have any record the wheel has been utilised as a means of movement. Probably the first wheels were formed out of sections of tree trunk with a hole bored through the centre to take a wooden axle. In some parts of Asia such wheels have remained in use up to the present day. In many of the remoter parts of China, India and Burma wooden axles are the only ones employed, and they seem to operate fairly satisfactorily. In many cases the wheel, although still merely a section of the trunk of a tree, is roughly fitted with an iron or steel band to act as a tyre. For scores of centuries such wheels operating over surfaces not prepared in any way to resist the loads imposed upon them, were the only known means of transport on land, if we except the still earlier methods of transport by the pack animal and the human carrier.



A Morris "Roadless" tractor. There is no metallic contact between the plates forming the endless tracks, the joints consisting of blocks of rubber. Our illustrations are reproduced by courtesy of Roadless Traction Limited.

Perhaps the most serious limitation to the use of wheels over the surface of the earth is due to the fact that in order to support the load the wheel must sink into the ground, thus producing the familiar effect of rutting and destruction of the surface. What is not so generally recognised, however, is the enormously increased effort required to move a wheel which, on account of the weight imposed is sunk into the ground. Because the ground surface may be generally level it is not realised by a casual observer that the wheel, on account of its sinkage, is being called upon to climb uphill all the time; the steepness of the gradient depending upon the depth of sinkage and the size of the wheel. The rolling resistance of wheels decreases as their diameter increases, but the practical limit of diameter of wheels appears to be somewhere about eight feet.

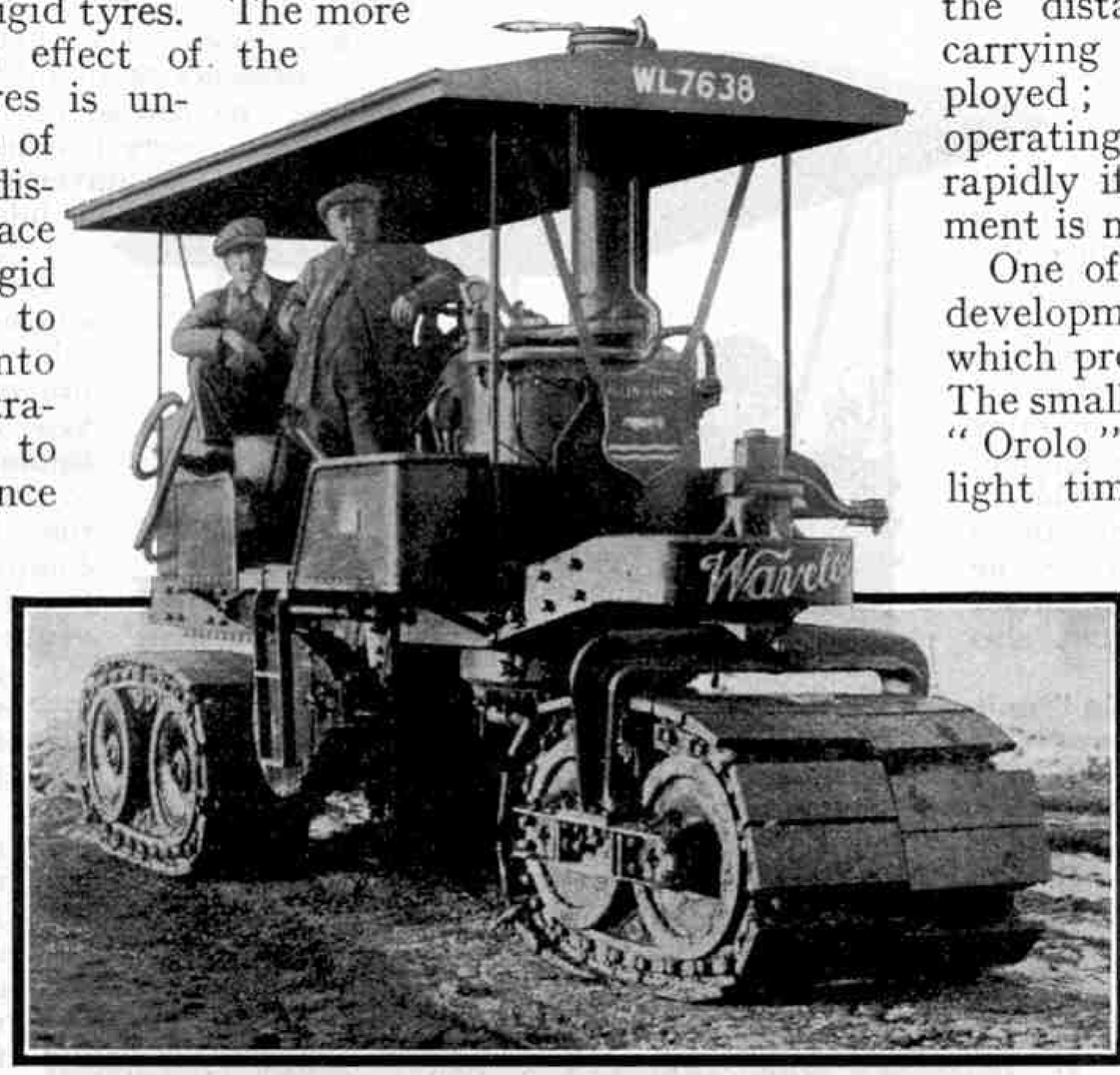
Barrow fitted with "Roadless" track unit in place of wheel.

The most obvious method of lessening the difficulties arising from sinkage is to provide a hard surface for the wheels to run over, and efforts in this direction have resulted in the development of the hard and durable road surfaces of to-day. The cost of producing and maintaining these surfaces is very high, however, and it is only among highly developed and flourishing communities that we find a network of roads sufficiently good to make wheeled transport efficient. Early efforts to cut down road-making costs and at the same time provide a better surface for wheels, resulted in the construction of the "tramways," from which have developed the railways of to-day. Railways are in many respects the most economical means of land transport, provided that sufficient traffic is available to keep them fully employed. Where the traffic is not sufficient, however, the great cost of building a railway is out of proportion to the benefits resulting from it. For this reason there must always be large tracts of country in various parts of the world in which railways can never be employed with anything approaching success.

The early rails were made of wrought iron, and their short life and the heavy cost of renewing them, provided a serious economic problem. One result of consideration of this problem was that the idea arose of building machines that would be capable of economising rails by lifting them up behind and laying them down again in front, while continuing to roll over them. Clearly this could be done only by cutting up the rails into short lengths and jointing them, and in this manner there came into being the idea of what we now term endless track, or what are frequently called "caterpillar" vehicles. At first it was believed that there would be little difficulty in designing vehicles of this type that would provide a full solution of the problem, but for a long time the various vehicles constructed proved very inefficient in operation owing to a variety of reasons. More recently considerable progress has been made, however, and most of the outstanding difficulties have been overcome as the result of persistent research.

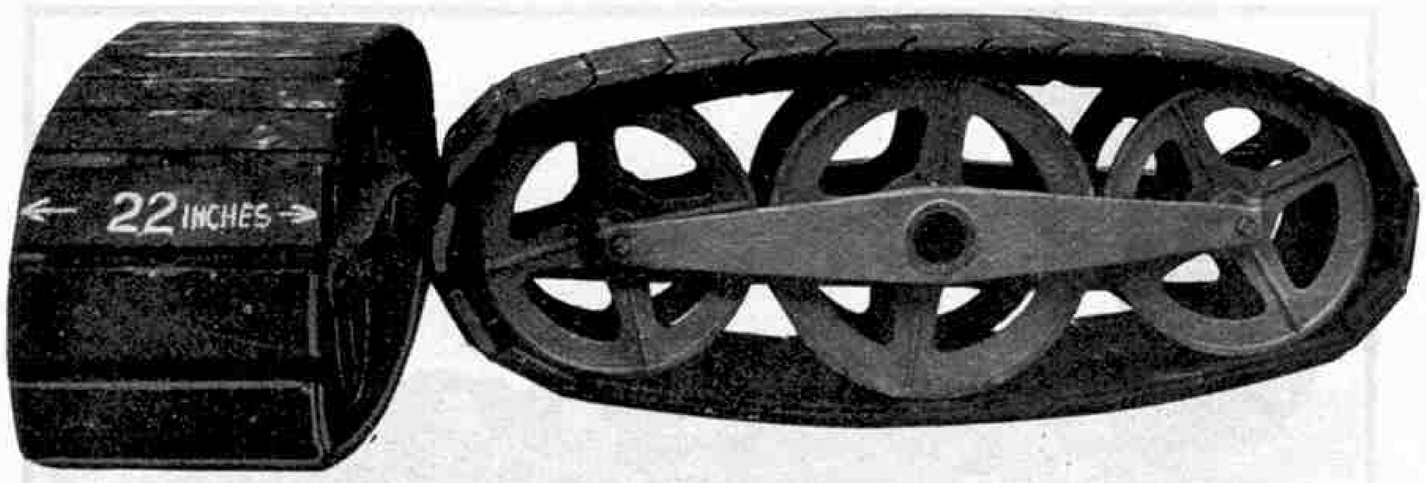
Before dealing with endless track vehicles in detail

reference must be made to one very important factor in the transport world of to-day, and that is, the fitting of wheels with tyres of a resilient nature. Such tyres have been beneficial to wheels in two ways. The less important of these is that they make movement over a rough surface possible at higher speeds than are attainable with wheels fitted with rigid tyres. The more important and far-reaching effect of the introduction of resilient tyres is undoubtedly that by deflection of the tyre itself the load is distributed over a greater surface than is possible with a rigid tyre. The effect of this is to reduce the tendency to sink into the surface that is being traversed, and consequently to reduce also the rolling resistance or effort required to move the vehicle. From this it follows also that wheels resiliently tyred are less destructive to the surfaces that they pass over.



"Waveless" roller fitted with girder track, which consolidates the surface without producing "waves."

The abundance of good roads in this country and the many excellent transport organisations that exist are apt to make us lose sight of the necessity for roadless traction. In many parts of the world, however, there are large areas where good roads are few and far between, while at the same time the development of the region depends upon adequate transport. In Africa, for instance, in places like the Gold Coast and Uganda, small portions of the Cape Province and Natal, there has been considerable development in so-called road building over appreciable areas, but these roads are not roads as we know them in England. They are in the main practically without foundations, are provided with very light metalling to form the surface, and are only preserved from destruction by severe restrictions on the type and weight of vehicles that are allowed to operate over them, by the type of tyres with which those vehicles are fitted, and by the fact that the volume of traffic is very small. In such regions there still exists a roadless transport problem.



"Orolo" track units as supplied for the moving of lifeboats over soft surfaces.

There can be no doubt that the prosperity of any community depends upon the cost of transport—the cheaper the transport the greater the prosperity. Cheap transport involves the carrying of large loads at one time. For instance, ocean liners carrying from 10,000 tons to 50,000 tons at a time operate with profit at a cost for transport of from 1/20 to 1/30 of a penny per ton-mile; whereas a human porter in tropical Africa carrying 60 lb. upon his head involves a cost per ton-mile of anything between eighteenpence and five shillings. These instances are, of course, extremes, but in between them the same law holds good substantially for every type and size of transport vehicle. The railway goods train carrying at one time, say, 500 tons, will transport goods at twopence per ton-mile; the cost per ton-mile of a light lorry with a capacity of half-a-ton will be from one to two shillings.

Two other points have to be borne in mind. The first is that the greater the load carried at one time the longer the distance for which the vehicle carrying it can be economically employed; and the second is that the operating costs of any vehicle increase rapidly if full and continuous employment is not found for it.

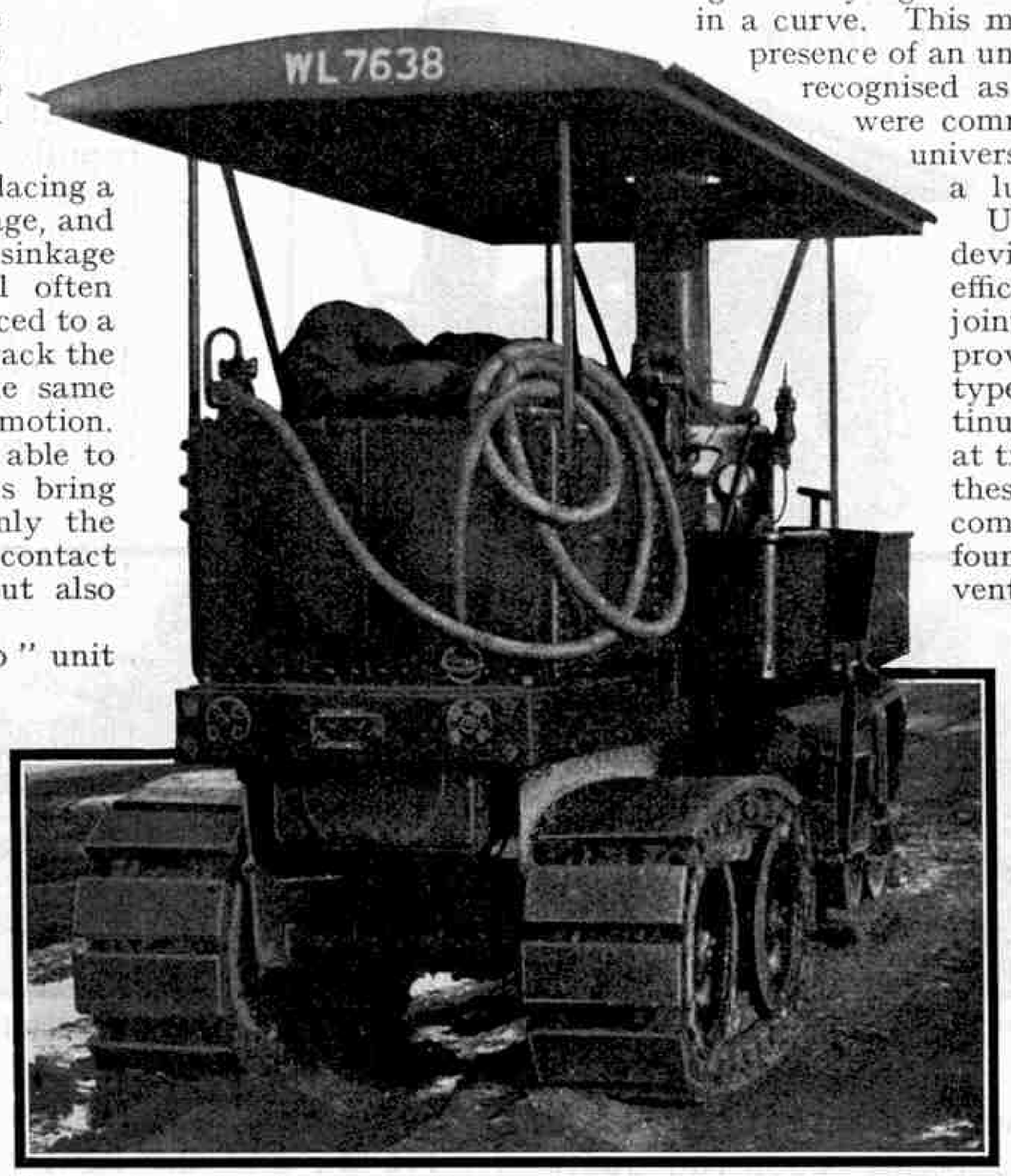
One of the most interesting roadless developments is the "Orolo" system, which provides for vehicles of all types. The smallest size of track built up on the "Orolo" plan is used for barrows, light timber and pipe carriers, small trucks, etc. Each unit consists of a length of pressed steel track, two pressed steel rollers and spindles, and a small bogie. The weight is carried by the bogie, which is pivoted by its fixed axle to the barrow or truck. The roller spindles are bolted into the ends of the bogie and carry the rollers, which have lubricating holes for the bearings, covered by a spring oiler ring. These holes are the only lubrication points. The bogie, spindles and rollers weigh only 14½ lb., and the lightness and strength of the unit is, in part, due to the absence of castings.

The track itself is 4 in. in width and weighs 11½ lb. It is built up of special steel pressings or "shoes" of simple and effective design. Each shoe is connected to its neighbour by two hollow rivets that are fixed firmly in one shoe, while at the same time being able to turn freely in the hole in the next shoe. At each end of the shoe and on each side are "noses" that come into contact with abutments pressed out from each side of the shoe, so that when the track is connected up these noses and abutments do not allow the track to lie flat, but bear against each other and hold it in a large curve. Also by interlocking they take all stresses due to vertical load off the rivets or hinge pins, which serve merely to keep the shoes in their proper relative positions. The wheel is 1 ft. 3 in. in diameter and the track has an effective diameter of about 10 ft. This curve, together with the bogie action of the rollers and in conjunction with the width of the track, enables the unit to be moved over uneven and soft ground with little more effort than is required over hard, smooth ground.

It might be thought that if a wheel 10 ft. in diameter, 4 in. in width and weighing only 11½ lb. could be built, it would be as effective as the "Orolo" unit. This would not be the case, however, for the endless track would still have two important advantages over the wheel.

In the first place the "Orolo" unit imposes on the ground only about half the pressure per square inch of a wheel of equivalent diameter and width when either the wheel or the unit are being moved. A wheel when standing still on soft ground makes contact with the ground for the full length of the portion of it that is sunk below the ground level. When the wheel is moved it leaves behind it a rut, and contact ceases over the rearward half of what is the area of ground contact when the wheel is at rest. As a result the pressure per square inch on the forward ground is doubled, and as the wheel begins to move on a soft surface it sinks farther into the ground to enable the necessary area to be obtained to support the load. This fact can be clearly demonstrated by placing a wheel on soft ground, noting the sinkage, and then moving the wheel forward. The sinkage will immediately increase, and will often continue to do so until the wheel is forced to a standstill. In the case of caterpillar track the contact area with the ground is the same whether the wheel is at rest or in motion. This is the case because the track is able to pivot about its centre axle and thus bring into bearing on the ground not only the forward half of the area that is in contact when the track is standing still, but also the rearward half.

The second reason why the "Orolo" unit is superior to a wheel of equivalent diameter and width for negotiating uneven surfaces is that when an obstacle is encountered that necessitates the raising of the wheel and its load, the total weight immediately has to be lifted by forward effort applied to it. In the case of track unit the initial lifting effort that has to be applied is only that required to overcome half the weight of the unit and load, because only half the weight is carried by the forward roller of the unit. Although the same effort is necessary to lift either the wheel or the unit with its load over a given size of obstacle, this effort is applied more gradually in the case of the track unit, and a "gearing down" effect is obtained. A simple demonstration of this gearing down can be provided by running a laden wheelbarrow against an obstacle such as a curb, and comparing the effort required to overcome the obstacle with that required to wheel the same load over it if a short length of plank is employed. This plank laid against the curb serves to gear down the effort required to surmount the obstacle in exactly the same manner as does the track of the "Orolo" unit.



Rear view of "Waveless" roller, at work on the fore-shore at Morecambe.

The objection that the track is harder to push than a wheel is true only when a comparison is made on hard, smooth ground, and then only to a very small extent. As soon as a comparison is made on a hard but rather bumpy road the advantage is all with the "Orolo" unit. The wheeling of an ordinary barrow over this kind of ground involves frequent jolts and sudden resistances, while a barrow equipped with the track unit glides smoothly and easily over the rough, uneven surface with the least effort on the part of the wheeler.

It is claimed for the "Orolo" track that roadless trains of 100 tons could be profitably operated. Such a train could be used to great advantage for transporting heavy loads over earth road surfaces, unmade roads, and virgin country, to act as a feeder for arterial railways and waterways, and to fill the gaps that exist in the transport systems of agricultural countries. The ideal composition of the train is probably that of a tractor hauling four trailers each of 25 tons capacity. In order to obtain the necessary adhesion to ensure a draw-bar pull capable of dealing with a net load behind the tractor of 100 tons, the tractor itself would have to weigh close upon 25 tons. No part of the equipment would put a greater pressure upon the ground when fully loaded than 12 lb. per sq. in. The tractor would be equipped with a Diesel type engine of 300 h.p. to 400 h.p., weighing possibly as much as seven tons, and of sufficient strength to give a draw-bar pull in low gear of 43,000 lb.

The conventional type of tractor is equipped with an endless track consisting of plates coupled together by pins, steering being accomplished by slewing the machine round bodily, the endless track itself being laterally rigid and incapable of steering by laying itself in a curve. This method of steering, together with the presence of an unlubricated unprotected pin joint, was recognised as unsound practice, and experiments were commenced with a view to producing a universal joint, laterally flexible track, with a lubricated and protected pin joint.

Ultimately a track of this type was devised and resulted in greater steering efficiency, while the lubrication of the pin joint gave high speed and greatly improved performance. Machines of this type are capable of being worked continuously at 15 to 20 miles per hour, and at times they attain speeds far exceeding these figures. In spite of their superiority compared with their predecessors, it was found impossible to devise means of preventing mud, dust, and grit from working into the joint, and further experiments were carried out with a view to devising a track joint in which the pin could be eliminated.

At an early stage it was recognised that rubber was an ideal material with which to make a joint. After several months of patient experiment a rubber joint was constructed that gave satisfactory results, and after long and continuous test in the workshops the rubber comprising the joint showed no signs of deterioration. A complete track was then made, and was fitted to an Army machine lent to the track inventor for the purpose by the British War Department. The single track on this machine, after having done over 3,000 miles of running, in the course of which two pin jointed tracks were worn out on the other side of it, is still in good workable condition. As a result of these excellent results the British War Department ordered a complete machine to be equipped with rubber-jointed track, and in the course of carrying out this contract opportunity was taken to introduce various detail improvements into the original design.

As this type of track now exists there is no metallic contact between the plates which form it, these being entirely separated from one another by blocks of rubber in compression. Lateral flexibility of the track to effect steerage has been preserved and is provided for by the rubber. The weight of the machine is also supported through rubber tyred rollers on to plates forming a rolling path, insulated from the ground by the blocks of rubber, which also take the drive transmitted to the track.

Man standing on "Orolo" links unconnected by pins, showing how these bear no stress from vertical loads.

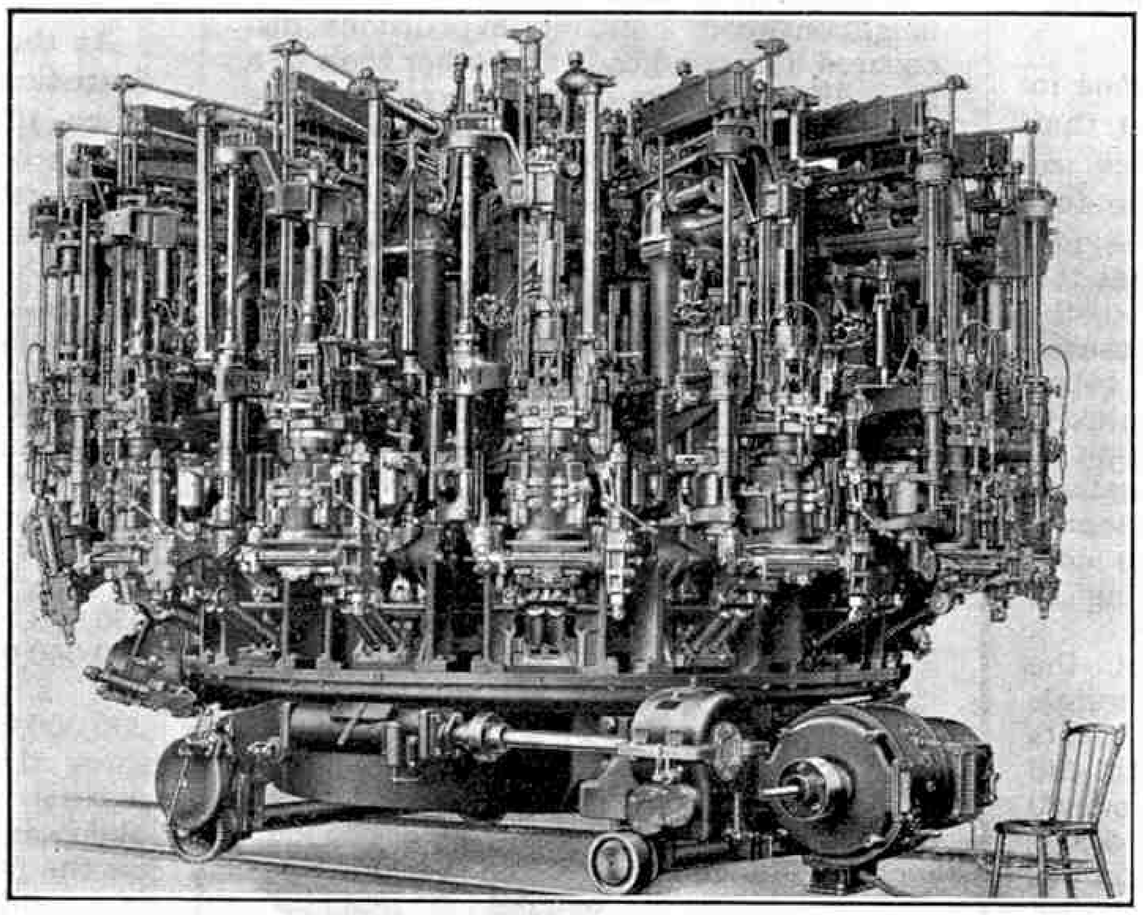
The first roadless model selected for this track weighed about three tons, and the efficiency was so high that one man could readily move it on level ground. The machine in question is intended for the transportation of field artillery, and with a load equivalent to the 18-pounder equipment behind it the machine has now been on test for a distance of over 3,500 miles without any appreciable wear or deterioration in any way of any part of the track mechanism. This machine clearly has great possibilities.

The ultimate life of the rubber joint has not yet been determined, but it is already known to be far greater than that of any pin joint; and even if it should prove to be shorter than is anticipated it can be completely renewed quickly and cheaply and with unskilled labour. The elastic drive, the absence of *Continued on page 348*)

One Million Bottles per Week!

A Wonderful Glass-Blowing Machine

BOTTLES, or narrow-mouthed vessels for holding and carrying water, must have been a necessity from the earliest times, and it is not surprising that there exist authentic records of bottles dating back many thousands of years. The bottles that have been found depicted on ancient Egyptian monuments were probably made from the skins of animals, generally goats; and the historian Herodotus relates that the Egyptians used to sew up the skin of the animal and make one of the legs serve as the bottle neck. The Bible contains many references to the skin bottles of the ancient Hebrews, and similar vessels were used by the Greeks and the Romans. The Hebrews used also earthenware bottles, and the Egyptians superseded their skin vessels by bottles made not only of earthenware, but also of porcelain, alabaster, stone, gold, silver, bronze and glass. Glass bottles were made also by the Phœnicians and the Romans. During the Middle Ages the art of making glass bottles was almost entirely concentrated in Venice, but gradually knowledge of the craft spread to other countries.

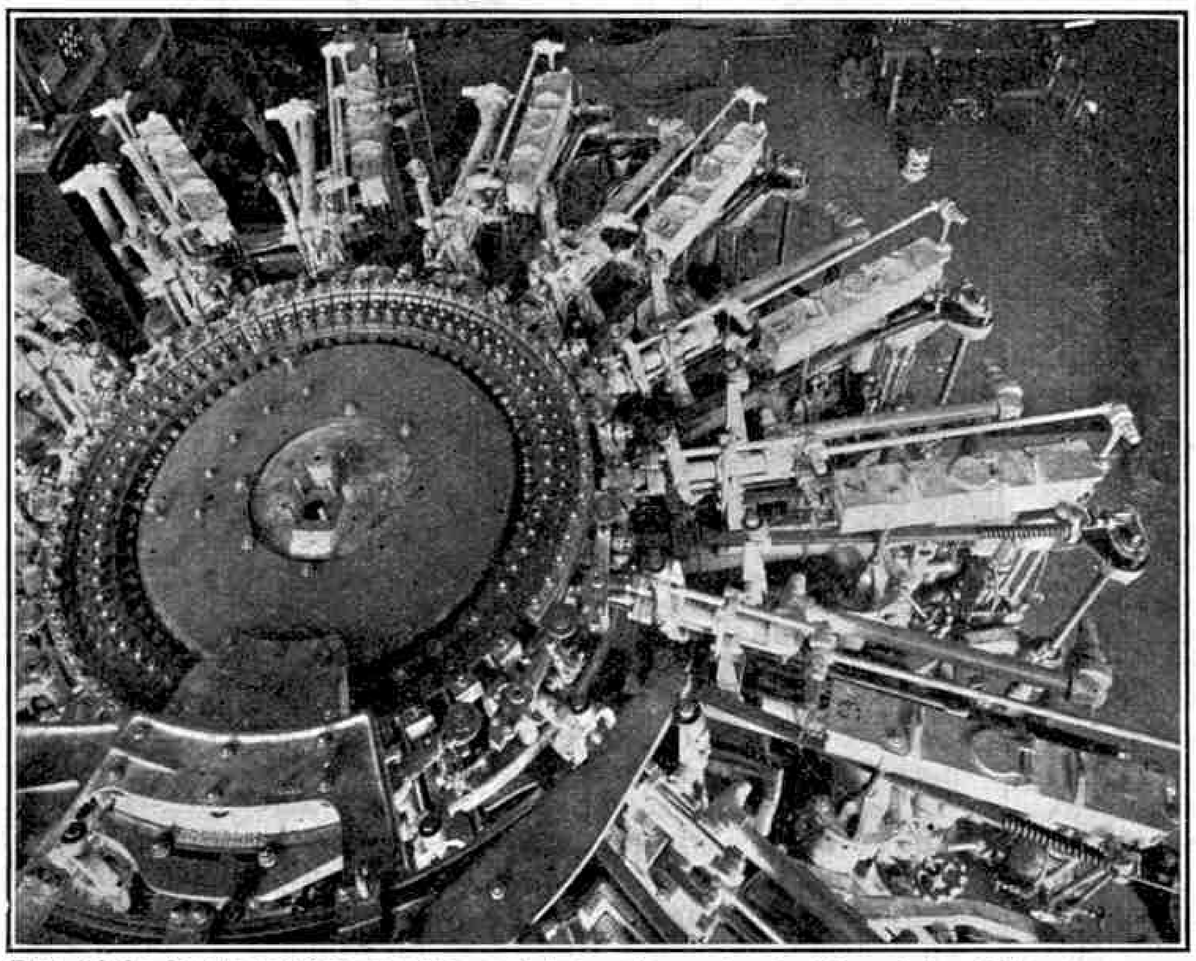


Fifteen-arm glass-bottle-making machine. Its size may be judged by comparison with the chair on the right. (See below).

Bottle-making by hand is perhaps the simplest branch of glass-working. The operator places one end of his blowpipe into a tank of molten glass and gathers up a "blob" of the liquid, which he then partially inflates by blowing. The partly-formed bottle that results is then dropped into a mould of brass or iron, and blowing is continued until the glass fills the mould and in this manner assumes the desired shape. The neck is moulded in a furnace, and the completed bottle is then tempered in an annealing tunnel. The moulds are maintained at a red heat while they are in use.

It is only comparatively recently that mechanical methods of making glass bottles have been introduced, but the success of these methods has been so great that now only a very small percentage of bottles are made by hand. Many ingenious machines have been devised for bottle-making, and the accompanying illustration shows one of the latest types.

In appearance, and also in principle of operation, this huge machine bears some resemblance to the massive rotary machines that are used to blow electric lamp bulbs. It consists essentially of 15 self-contained units that rotate slowly round a central column at varying speeds up to six revolutions per minute. Each complete revolution of the machine produces 15 bottles when single moulds are used, so that when working at the maximum speed it has an output of 90 bottles per minute. When dual or triple moulds are employed, or smaller bottles are being produced, the output is greatly increased. For instance, the machine is capable of making 120 pint bottles per minute, which is equal to a weekly production of over one million bottles. The moulds need not necessarily be all of the same type, and as many as 10 different types of bottles, ranging in height from 2½ in. up to 16 in., with a maximum diameter of 6 in., can be produced simultaneously by the machine.

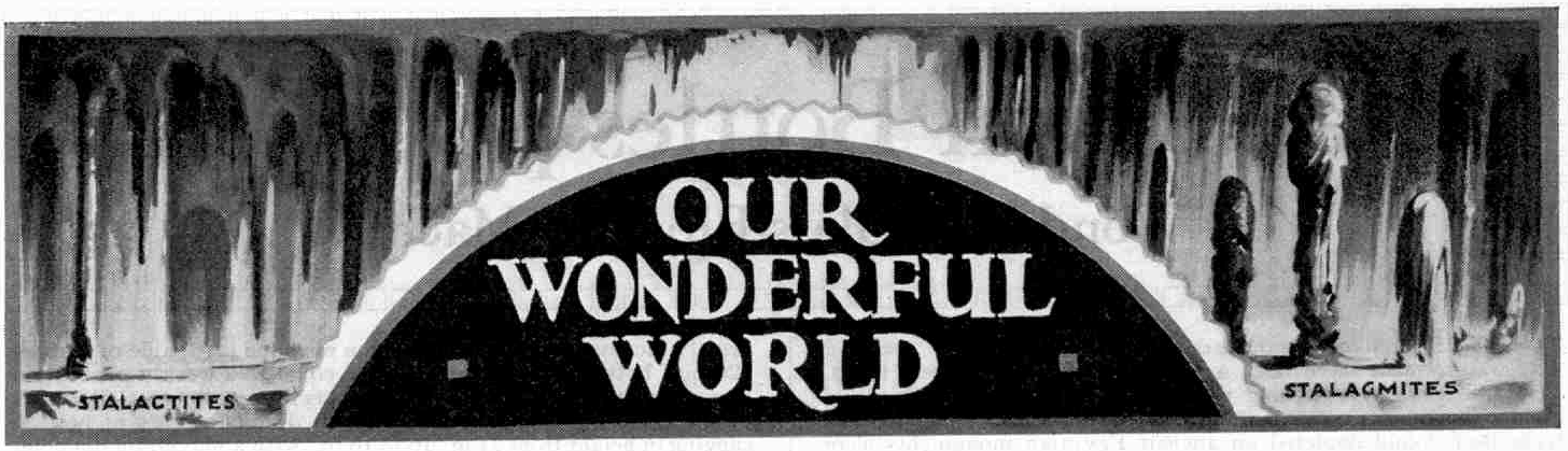


Part of the bottle-making machine seen from above, showing the circle of blowing cams. (Both these illustrations are reproduced from "The Book of Remarkable Machinery," by permission of G. G. Harrap Ltd., the publishers).

The chief parts of each unit are the blowing head, which is pivoted on to the split or two-part ring mould that shapes the neck of the bottle; and the two-part blank mould in which the "blob" of liquid glass is partially inflated. The blowing head dips into a revolving pot containing molten glass and immerses the bottom of the blank mould. A sufficient quantity of the liquid is then sucked up by vacuum into the mould. While these operations are taking place a plunger descends into the neck mould, leaving only a narrow space between the plunger and the inner surface of the mould. Some of the molten glass is drawn up into this aperture and, cooling rapidly, forms the mouth and neck of the bottle. The blowing head now rises, withdrawing the blank mould from the pot of liquid; and a mechanically-operated knife cuts off any glass that may be trailing out of the hole in the base of the mould.

An admission of compressed air inflates the soft glass until it fills the blank mould, the two halves of which then come apart, leaving a crudely-formed bottle, or "blank" as it is called, held by the neck mould. By this time the unit has moved to a position that enables another pair of moulds to rise up and close round the blank. More compressed air is forced through the mouth of the blank until this is blown out sufficiently to press tightly against the inner surface of the new mould. In this manner the bottle is correctly shaped. The mould then moves away, and the bottle is released and ejected from the machine. The whole process is completed in about 10 seconds, and it takes place at each unit in turn, with the result that a continuous stream of bottles is poured out.

The machine is too complicated to describe in detail, but it may be mentioned that the blowing cams are in small segments. There are 64 of these segments, and each in turn consists of 10 tiers. The lever governing the blowing valve on any of the units can be located readily by hand without stopping the machine, and there are provided 10 different blowing stations for 10 different sizes of bottles. The blowing cams also can be adjusted by hand while the machine is running.



Remarkable Effects of Minute Quantities of Chemicals

The presence of one part of chlorine in 2,000,000 parts of the cooling water that circulates in the condenser tubes of turbines is sufficient to prevent the formation of organic growths. This not only reduces the number of times that the tubes must be cleaned out—a costly and troublesome process—but also ensures efficiency in working, for clean tubes conduct the heat away more quickly. In one power station where chlorine is used for this purpose, 72,000,000 gallons of cooling water are used daily, and records show that its use has reduced the coal consumption so greatly that a saving of nearly £2,000 per annum is made.

Another interesting example of the effect of minute quantities of chemicals was shown during a series of experiments on the growth of tomato plants with and without small traces of boron, the chemical element that occurs in borax and boracic acid. Plants fed with a solution of chemicals not containing boron failed completely, while others grew rapidly when watered with a similar solution that contained one part of boron in 2,000,000 parts of water. In order to give an idea of the small amount of boron in this mixture it may be compared with pea soup of which 132 gallons have been flavoured with one pea! Perhaps the most remarkable thing discovered during these experiments was that the use of stronger solutions does not bring about better growth as might be expected, but actually kills the plants. Fortunately there is no need for the tomato grower to worry about the best proportion to use, for there is sufficient boron in the soil and in tap water to supply the needs of his plants.

Where did the Eskimos Come From?

One of the outstanding problems of the Arctic is the origin of the Eskimos. It is difficult to imagine why any race should deliberately choose to live in a region that is extremely inhospitable, for although it is alleged that the Eskimos are thoroughly at home in the far north and would not survive life in warmer regions, it must not be forgotten that they live a very precarious existence. The finding of sufficient meat and fish to keep himself and his family in existence is practically a whole-time occupation for the native of the Arctic regions, and in the past entire colonies have disappeared owing to lack of food.

There is some ground for believing that the Eskimos of Greenland found their way to that country from Alaska, and an expedition is at present engaged in exploring prehistoric sites around the Bering Sea in an endeavour to prove that the Eskimos originated in an ancient civilisation in that neighbourhood. Earlier expeditions discovered harpoon heads and other tools of a type different from those at present in use among Eskimos, and the contents of the "kitchen-middens," or piles of ancient refuse, are to be further probed in the hope that they will yield tools and weapons that will assist in the reconstruction of the life of the Eskimo thousands of years ago.

The "kitchen-middens" of prehistoric times are very useful to those who try to learn something of the manner in which the early people lived. In those days there were no sanitary inspectors and rubbish was simply flung aside, to accumulate in enormous heaps in the neighbourhood of settlements that endured for a considerable time. In warmer climates these heaps became covered over with earth and a great part of their contents has rotted; but their excavation has yielded many important finds. Turning over the kitchen-middens of the far north should be even more interesting, for their contents have practically been preserved in cold storage for hundreds of years.

Courtesy] [*S. A. Railways Magazine*

The lighthouse at Port Shepstone, on the south coast of Natal, South Africa. This is fitted with a 27,000 c.p. light and every ten seconds shows a white flash that is visible from a distance of 15 miles. The lighthouse is also equipped as a signal station.

The World's Population

At the Hague there is an International Statistical Institute that regularly undertakes the enormous task of making a census of the Earth's population. It is of course not possible to do this with the same accuracy as in the case of a census of highly civilised countries such as Great Britain, but the figures obtained are sufficiently reliable to enable those engaged in the count to announce that the total now exceeds 2,000,000,000.

The increase in world population during the past three years has beeen about 100,000,000. As would be expected, the most populous of the five continents is Asia, where the inhabitants number 950,000,000. Europe comes next with 550,000,000 people, followed by North and South America with a total of 230,000,000. The comparatively poor show the two Americas make in comparison with Europe, which has only one-twentieth of their area, is explained by the fact that only in the United States is a really dense population to be found.

The total of 2,000,000,000 is made up of the above figures, 150,000,000 in Africa, 7,000,000 in Australia, and the inhabitants of island regions not included in the figures already given.

The Lost Scent of the Musk

Twenty years ago the musk plant was a household favourite, and also was grown extensively in hothouses, its chief attraction being its remarkable scent. To-day it is practically impossible to find a musk plant that has any scent at all, and the disappearance of the odour is an interesting scientific mystery.

The loss of the scent of the musk plant appears to be world-wide, for to-day specimens grown in British Columbia, the original home of the plant, also possess no odour. Efforts are being made to discover the reason for the disappearance of the scent, but these are hampered by the fact that it is not known from which part of the plant the odour came. Practically the only guide is that the roughest plants had the strongest smell, and therefore the substance responsible for the odour may have been situated in the hairs that cover the leaves.

The disappearance of the smell of the musk is not due to the same cause as the loss of scent in many old-fashioned flowers. Plant breeders have cultivated roses, wallflowers, mignonette, carnations, and other plants for the size and colour of their blooms, and in bringing new forms into existence have failed to retain the characteristic odours. No such efforts have been made to improve the musk plant, however, so this explanation fails. At present it is impossible to give any reason for the curious change that has taken place.

An Untravelled Desert of 400,000 Square Miles

One of the few regions that remain to be investigated by explorers is the great southern desert of Arabia, known to the Arabs as the "Empty Quarter." This is as large as France and Spain combined, and it has never been traversed by a white man. Among the people who live near the edge of the desert, stories are current of strange tribes that inhabit its interior; and it has been suggested that in it may be found precious minerals, ruins of ancient cities, and even large supplies of water. The dangers of crossing it have deterred travellers, however, and practically nothing was known of it until the early months of 1930, when the riddle was partly solved by an English explorer, Mr. B. Thomas. He travelled for 35 days over its southern section, and proved that this portion of the desert was nothing but an enormous expanse of billowing sand.

During this remarkable journey, travelling in the loose sand proved so difficult that even the camels were unable to make progress, and this compelled Mr. Thomas to keep to the southern edge of the desert, where he secured valuable information regarding the local tribes. Finally he made a two days' journey into the interior, and there collected geological specimens, and birds, insects and snakes. The experience of the conditions prevailing in this enormous waste gained during this expedition probably will be put to good use in organising a further expedition to make a more extended survey.

A Mountain Higher than Everest?

There seems to be a possibility that Mt. Everest may lose its reputation of being the highest mountain in the world. About seven years ago General Pereira, the British explorer, made the difficult and dangerous overland journey from Pekin to Tibet. His travels took him near a range of enormous mountains that he thought to be at least 28,000 ft. in height, and he suggested that one of the higher peaks of this range might actually overtop Mt. Everest.

These mountains form the Amnyi Machen Range, and interest in them has been revived recently by the visit to the same region of Dr. Rock, an American explorer. He found that the country in which the range is situated is full of deep valleys and inaccessible heights. It is very thinly inhabited, and it contains wild animals in great variety. Through its gorges run the upper waters of the Yellow River, and the scenery is everywhere wild and magnificent, the most striking feature being the towering mountain summits themselves, which are worshipped by the few natives of the region.

Dr. Rock unfortunately had no theodolite with him, and therefore was unable to make accurate measurements of the height of the range. He estimated it at about 28,000 ft. however, and this leaves open the possibility that the greatest peak of all may be slightly higher than Mt. Everest.

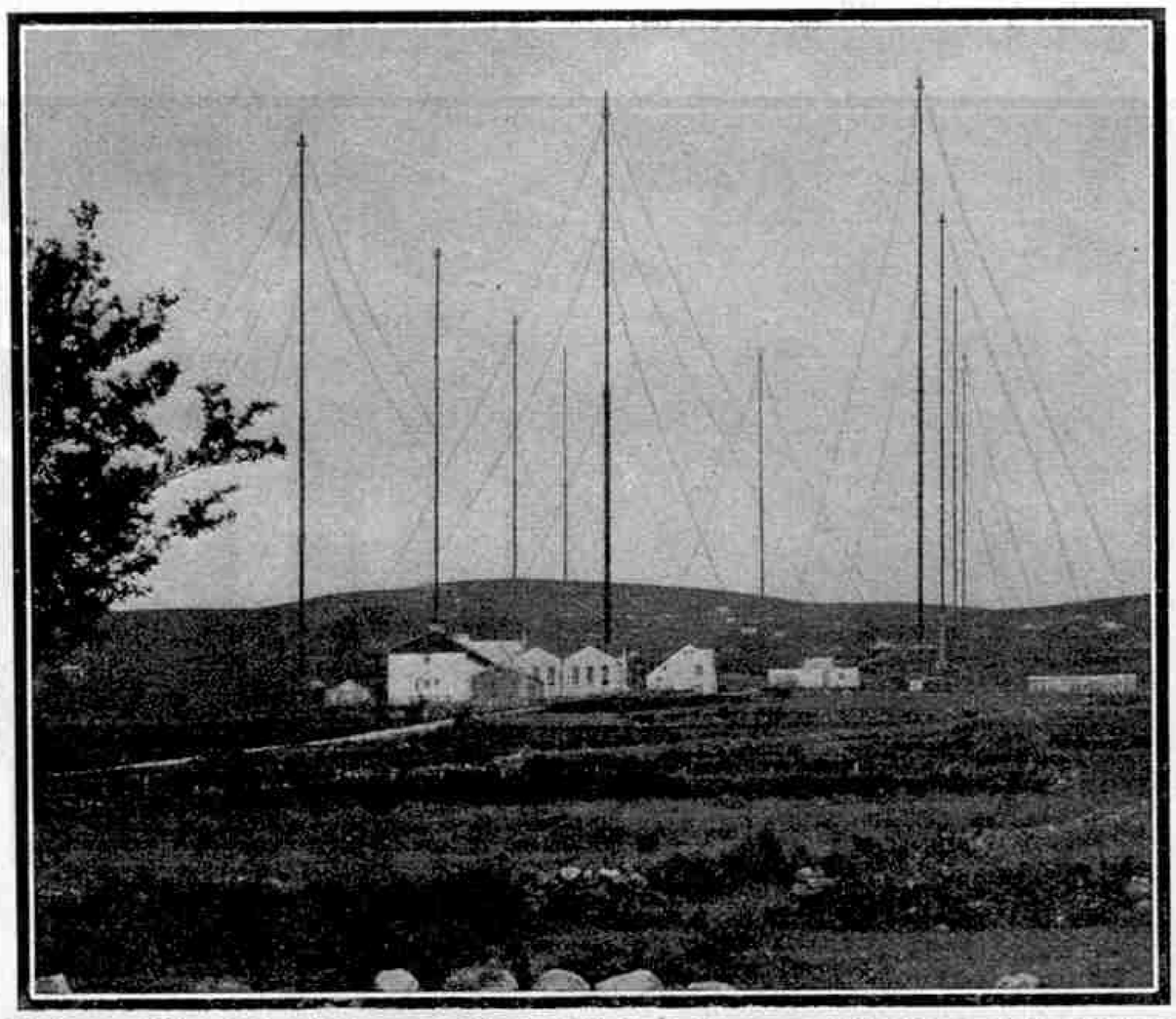
Fighting the Malaria Mosquito

An interesting scheme for banishing malaria completely has been proposed by a Russian doctor named Krysto. The plan depends on the apparent inability of the malaria mosquito to transmit the disease so long as it feeds on alfalfa and other leguminous plants, such as clover and beans. Many examples of the beneficial effect of these plants have been collected. For instance, in certain islands off the north coast of Holland malaria suddenly disappeared about 20 years ago, and it was discovered that at practically the same time wild leguminous plants were accidentally introduced. Another case was noticed by Sir William Wilcox, the famous engineer who has carried out remarkable irrigation schemes in Egypt. Sir William pointed out that cultivated districts in which clovers and similar plants are largely grown appear to be immune from malaria, while the disease devastates the population in countries such as Palestine and Greece, where these plants are not cultivated.

Apparently some constituent of the juice of alfalfa, clover and similar plants neutralises the noxiousness of the mosquito, and thus may be said to disinfect the insect. Dr. Krysto's plan therefore is to enlarge the area planted with such crops, and particularly to ensure that leguminous plants shall be grown largely in countries now ravaged by malaria.

It is also suggested that mosquitos responsible for transmitting malaria fever should be exterminated by natural means. Species of mosquito are known that do not sting human beings. In Brittany one of these has been discovered that crowds out the breed responsible for malaria; and in experiments on a small scale it has been found that the liberation of the Breton mosquito in malaria-infested districts has ended in the banishment of the disease.

Dr. Krysto suggests that a thorough trial of these two means of preventing the spread of malaria should be made on the island of Cuba, where the new mosquito to be introduced could be acclimatised more readily than in most countries subject to malaria.



The transmitting station of Marconi's Wireless Telegraph Company at Cenfdu, near Caernarvon. This high-powered station was built to send trans-Atlantic messages direct from Great Britain to New York, instead of via Glace Bay, Newfoundland, the original station in America.

Musical Thunder

The engineers of the General Electric Company, New York, recently began experiments to find means of increasing the power of the short-wave broadcast station at Schenectady. Little difficulty was experienced in designing suitable plant for handling powers up to 15 k.w., but attempts to increase this to 35 k.w. led to the production of vivid electric discharges from the aerial. These appeared only when the engineers attempted to broadcast.

The discharge commenced in the form of an arc about three or four feet from the aerial, and shot into the air to a height of four feet. It was interesting to find that the arc followed the music broadcast, alternately collapsing and being rebuilt in accordance with the modulation imposed on the carrier wave. The action also set up air wave vibrations that may be regarded as artificial thunder, but as the discharge was continuous, a musical sound was produced instead of the usual crack and roll. When heard from a distance of 300 ft. or 400 ft. this musical thunder resembled the output of a giant loud speaker. The arc moved upward toward the end of the aerial, and finally the intense heat cracked the insulators and melted the copper wire.

While the production of this musical thunder was of the greatest interest, it was very undesirable, for it prevented efficient transmission on high power. The trouble was overcome eventually by using an aerial of large diameter, at each end of which was fitted a large plate, in order to prevent the formation of an arc.

Crab's Long Journey

At the present moment the record for a long-distance journey by a crab appears to be held by one that started from a point on the east coast of Scotland between Arbroath and Montrose, and arrived at the finishing point near Banff four years and one month later. The distance covered in that time was approximately 100 miles, and thus the average speed during this record journey was about one mile a fortnight. Although the course was under water, and the crab was not seen at any intermediate point, there was no doubt of its identity, for it was carefully marked before being placed in the water at the starting point in order that it should be immediately recognised in the event of its re-capture.

Bees Travel 300,000 Miles

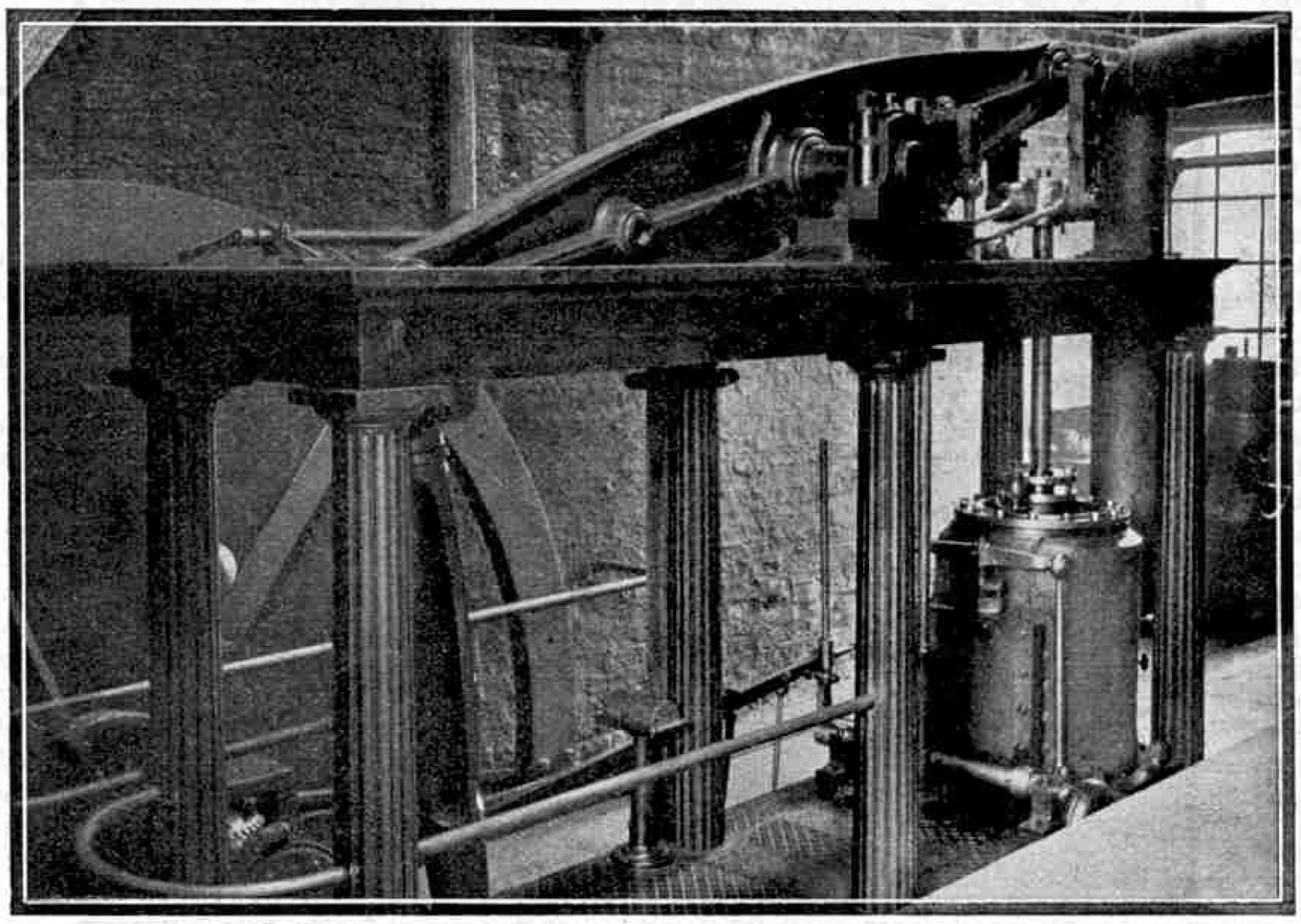
In certain experiments with bees conducted by the United States Department of Agriculture in Wyoming, the hives containing the insects under test were at a distance of eight miles from the nearest crop of alfalfa, the only source of honey available in the district. The bees made the long return trip daily, however, and it was calculated that in order to collect one pound of honey they covered a total distance of about 300,000 miles. It is believed that the necessity for travelling even greater distances would not put an end to the activities of the insects.

A Veteran Steam Engine

Eighty Years of Service Without a Breakdown

ONE of the most interesting relics of early stationary steam engines is to be seen at the Birkenhead Dock Yard. This is a beam engine that was installed by Messrs. George Forrester and Co., Vauxhall Foundry, Liverpool, somewhere about the year 1850, and it has been in constant use since that date for the purpose of driving lathes, saws, and other machinery in the workshops at the Dock Yard. This veteran is a single-cylinder beam engine of the non-condensing type, the bore of the cylinder being 18 in. and the stroke 3 ft. The maximum speed is 60 revolutions per minute, controlled by a simple conical pendulum governor as shown in the accompanying photograph.

A notable feature about this engine is the pressure at which it works. Originally the steam pressure was 40 lb. per sq. in., but in 1916 it was decided to replace the original boiler by one generating steam at a pressure of 65 lb. per sq. in., for use in operating steam hammers. Before this was done the engine was carefully examined, and calculations showed that it was capable of working under the higher pressure. The remarkable result is that, after nearly 80 years of service, without a single known breakdown, the engine is now working at a pressure more than 60 per cent. in excess of that for which it was originally designed!



A beam engine that has been continuously at work at the Birkenhead Dock Yard since 1850 without a single known breakdown.

The flywheel, which is of the built-up type, 14 ft. in diameter, is of cast-iron, in eight sections bolted to eight arms. These are bolted to the boss, which is secured to the crankshaft by four keys. The crankshaft and the flywheel have not been removed since the engine was installed. It is calculated that the engine is now capable of developing 120 h.p., although in all probability it was designed to develop only about 75 h.p. This is a notable increase in efficiency.

The few examples of early beam engines that are still in existence are of outstanding interest as examples of a type of steam engine that has almost disappeared. These engines take us back to the time of Thomas Newcomen, whose work paved the way for that of James Watt. Newcomen's engine, invented in 1705, was designed specially for pumping water out of the Cornish tin mines, work in which was seriously hampered by flooding. It was not really a true steam engine because the downward stroke of the piston—which was the working stroke resulting in the lifting of the pump rod—was effected by atmospheric pressure. The beam was a necessary feature in this engine. The use of water-packing for the piston required that the piston should move down in the working stroke, and a beam was needed to allow a counterpoise to pull the piston up and operate the plunger of the pump.

Watt produced an engine that operated solely by steam pressure, and his improvements made the beam no longer necessary. In spite of this he retained the beam type generally, and for many years it remained a favourite with the builders of large engines. The majority of the engines of this period were designed for pumping purposes, and the beam was a very suitable driver for pump-rods and valve-rods. Another point of importance was that engine-building methods in those days were somewhat crude, and the beam engine was easier to construct successfully than a direct-acting engine, in which the crankpin of the revolving shaft is connected directly with the piston-rod by means of a connecting-rod.

Mention of engine-building in those early days calls to mind the struggle of James Brindley with an engine he devised with the object of improving upon the Newcomen engine, especially in regard to fuel economy. Brindley made his cylinders of wood instead of iron, and used wood for the chains that worked at the end of the beam. He had to abandon his wooden cylinders, but as an alternative he surrounded the iron cylinders with a wooden case, with wood ashes as packing.

The quaint entries in Brindley's notebook, almost illegible and spelled in the weirdest manner, show that this engine gave him a great deal of trouble. It took him a year to construct his "engon," and when finished it seems to have proved very obstinate. Repeatedly Brindley reports "Bad louk (luck)." Then matters seem to have improved a little, for we find "Midlin' louk" for some days. Eventually the engine worked for a period of seven days, and Brindley was so excited that he wrote "Driv-a-Heyd (Drive-ahead)." The subsequent career of that ill-behaved "engon" is shrouded in mystery.

Vacuum Tubes that Control Electrical Energy

EVER since electricity, like a colossal work-horse that had been grazing idly for millions of years, allowed masterful men to slip a bridle over its head, the human race has progressed steadily towards greater comfort and greater leisure. The new "Thyratron" vacuum tube, a recent production of the research laboratory of the General Electric Company, Inc., suggests this tendency more definitely than ever. It is already accepting new tasks as a means of controlling electrical energy with an effectiveness not previously possible, and it has been tried experimentally in the important field of electrical transmission with great success.

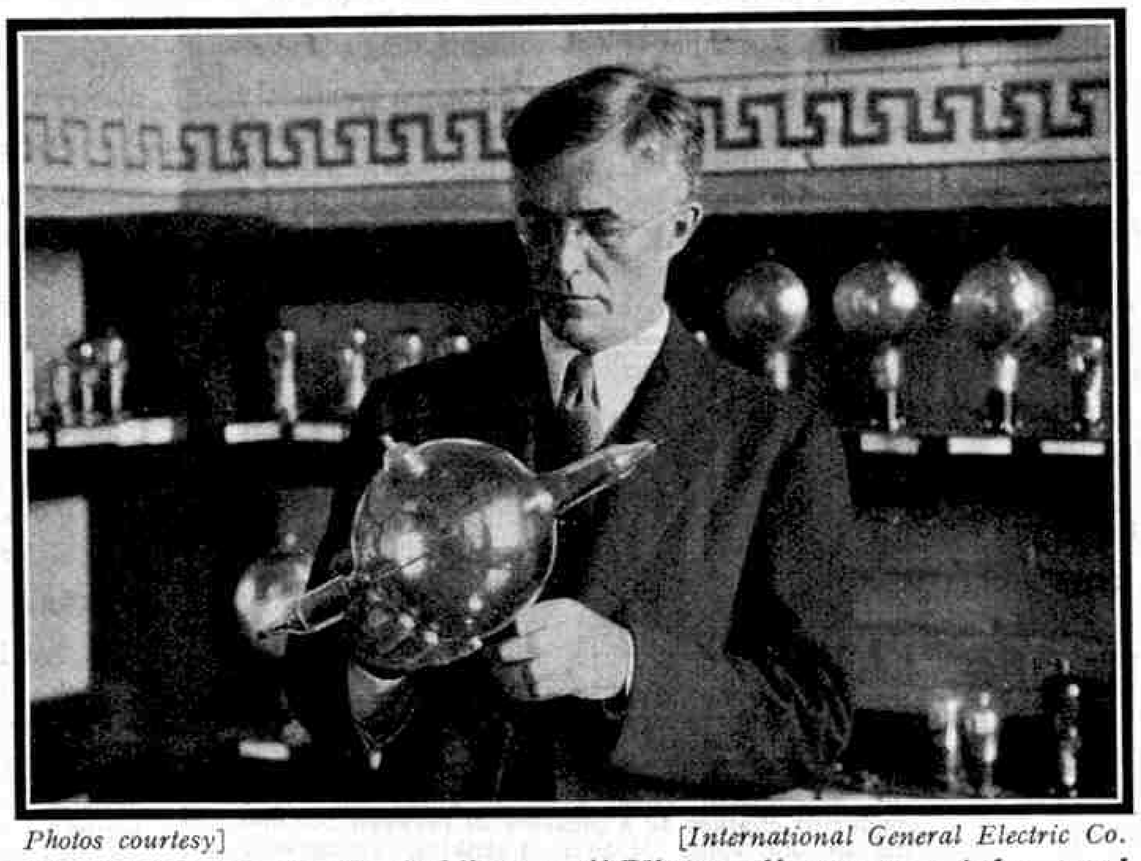
The "Thyratron" tube emphasises the fact that the now familiar vacuum tube devices form a numerous tribe of master workmen. They make the electrons do what man wants them to do. In their role of electrical valves they carry out orders with the utmost fidelity by controlling billions of these tiny workers, allowing electric current to pass or else preventing its passage.

Valves of 100-kilowatt power for radio-broadcasting. These are the largest members of the "tron" family of vacuum tubes.

The ancestry of all these vacuum tube devices goes straight back to the incandescent electric lamp. Edison introduced the second element, the plate, into his lamp, which already had its Edison filament. Fleming first used this combination as a radio detector, disclosing its valve effect, a fundamental characteristic common to the whole series. De Forest added the third element, the grid, and bestowed the name "Audion" on the more useful tube that sprang from his work. This took place round about the year 1912. The "trons," vacuum tubes distinctive for their high voltage and, as a rule, large amounts of energy controlled, had not yet been introduced.

About this period, however, Dr. Irving Langmuir, in the General Electric Research Laboratory, the birthplace of the "trons," entered upon a series of discoveries that raised the vacuum tube to a place of the utmost importance in radio, and disclosed for it a future of still wider opportunities in power-control applications. Langmuir's first vacuum tube, a direct descendant of the discoveries of Edison, Fleming and De Forest, but displaying a degree of vacuum and operating at a maximum voltage unknown in earlier tubes, was named the "Kenotron." The name is of Greek derivation. The suffix "tron" signifies an object that is used as an instrument or tool, and "Kenotron," freely translated, means "an instrument that consists of an enclosed space having nothing in it." The "Kenotron" made radio-broadcasting possible; an efficient detector and oscillator had now become available.

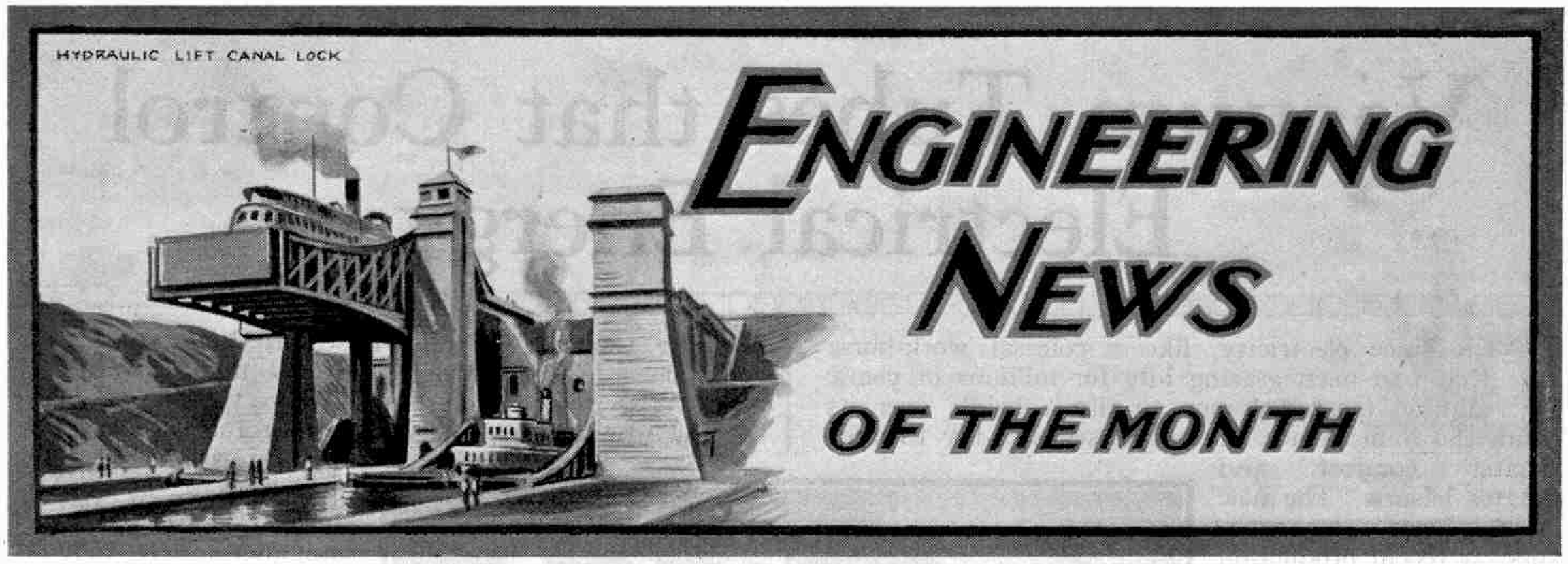
During the next 10 years the "trons" were increased by a number of new arrivals. First to appear was a tube that proved itself effective as an amplifier and therefore was named the "Pliotron," indicating "an instrument for obtaining more." In succession appeared the "Dynatron," "an instrument that generates power"; the "Magnetron," "an instrument operated by a magnetic field"; and the "Phanotron," "an instrument with a visible glow." Now comes the "Thyratron," its name being derived from a Greek word meaning a "door" or a "gateway." "Thyratron" thus means "an instrument that can be opened like a door."



Photos courtesy] [*International General Electric Co.*

Dr. Irving Langmuir holding a "Pliotron" vacuum tube used in 1914 for radio-telephone experiments.

The "tron" series of vacuum tubes developed in power from microamperes to milliamperes, and from milliamperes to amperes. To-day they are handling successfully thousands of amperes of electric current, and their future appears unlimited.



Great Japanese Railway Tunnel

Work on the Tanna Tunnel, which cuts through Mt. Higane in Japan, is expected to be completed shortly. This tunnel is being constructed by the Japanese Government Railways and is claimed to be the biggest engineering work ever attempted by them. When completed, it will save a detour of about seven miles. The slight saving in distance does not at first glance appear to justify the great cost of the tunnel, but the detour on the present track has to be made over tortuous lines. In addition, the railway climbs to a height of 1,200 ft. above sea level, while the height of the one to be constructed when the tunnel is finished will nowhere exceed 300 ft. Thus the saving in time and engine power will be considerable.

When the great earthquake disasters occurred at the end of last year it was thought that the tunnel had been destroyed, but a tour of inspection has shown that the damage was only of a superficial nature. In spite of this engineers have expressed doubts of the wisdom of constructing long tunnels in regions liable to volcanic action and earthquake tremors.

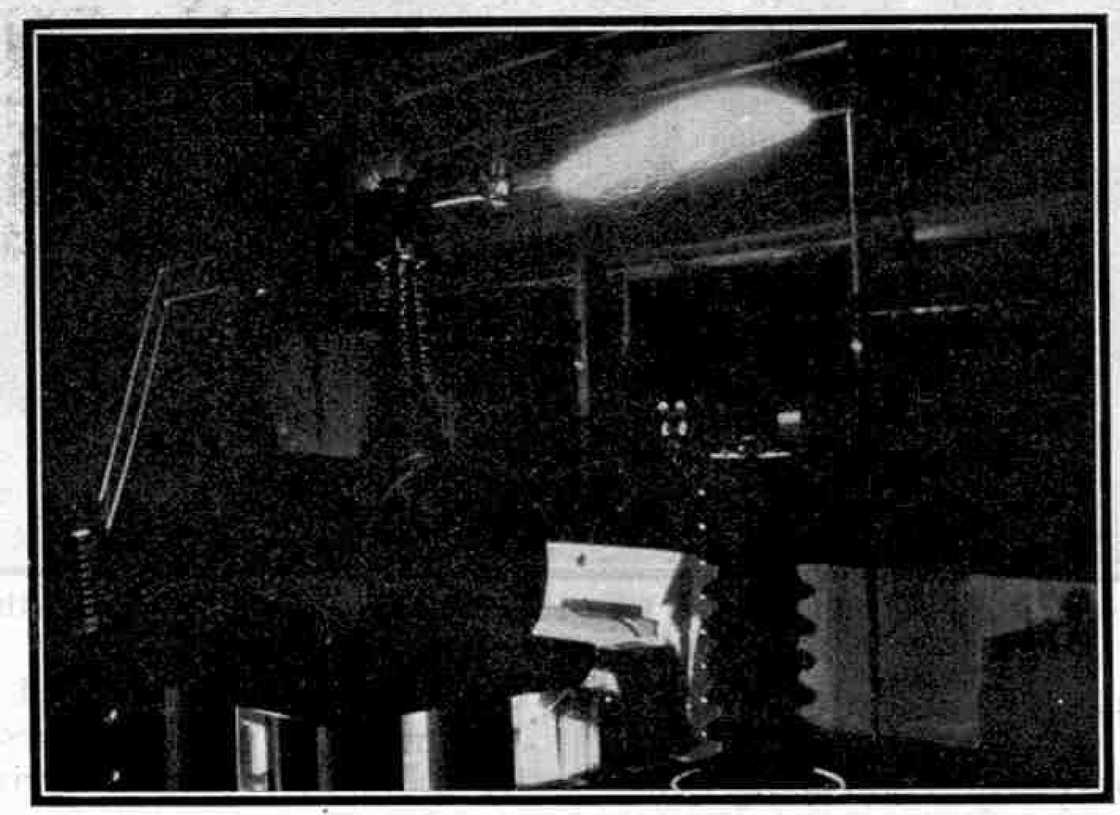
The construction of the tunnel appears to have had a very peculiar effect on the water in the surrounding strata, for the inhabitants of the neighbourhood claim that since work was begun, the wells on which they depend have begun to dry up. This is very serious, for it is impossible to irrigate the mountainous country, and a commission of experts has been appointed to examine the situation very thoroughly.

Diesel-engined Omnibus Trial in Sheffield

Trials of road vehicles driven by heavy oil engines continue to be made, and interesting results are reported from an experiment made in Sheffield. There an omnibus fitted with a Diesel engine was secured at the beginning of 1930. This has given satisfactory service and the Corporation has now introduced a second vehicle of similar design. Orders for further omnibuses of this type probably will be placed, for it is stated that a saving of £300 per year per omnibus is effected by using omnibuses fitted with heavy oil engines instead of those of the ordinary petrol type.

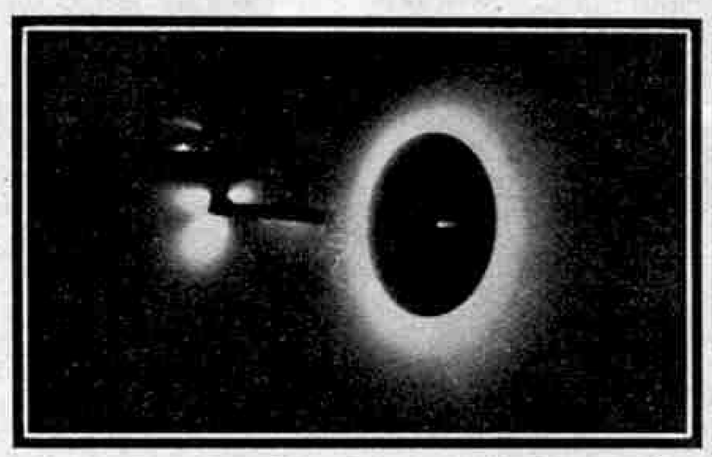
Stabilisers for Italian Liner

Three gyroscopic stabilisers are to be built in the hull of a new 45,000-ton liner, the *"Conte di Savoia,"* that is under construction at Trieste. They are expected to enable the boat to maintain a perfectly even keel, even when sailing in very rough weather. They will be of huge dimensions, the gyroscopic wheel of each being expected to measure about 30 ft. in diameter and to weigh about 100 tons. Gyroscopic compasses are already in use at sea, and gyroscopic stabilisers have been installed in a number of vessels. A 10,000-ton American steamship, the *"Henderson,"* was fitted with a gyroscopic wheel that was 30 tons in weight.



Courtesy] [*Ferranti Ltd.*

Artificial lightning ! A pressure of a million volts was employed to produce this awe-inspiring arc, 9 ft. 6 in. in length, at the Hollinwood Works of Ferranti Limited, during a demonstration of high-voltage testing equipment.



The magnificent violet glow produced around a conductor charged to a pressure of between 300,000 and 400,000 volts. It bears a striking resemblance to the corona seen during a total eclipse of the Sun.

Collier with Grab Cranes

The *"Caldare,"* a twin-screw collier recently built by an Aberdeen firm of shipbuilders, has been specially equipped with two grab cranes for use when calling at ports that have no coal discharging plant. Each crane is capable of lifting 3 tons of coal, and has a maximum radius of action of 38 ft. 6 in., and a minimum radius of 12 ft. Together they are capable of dealing with 60 tons of coal per hour and each crane is arranged to serve one of the two coal holds. The grabs hoist at a speed of 200 ft. per minute, and derrick at 100 ft. per minute, while the rate of slewing is $1\frac{3}{4}$ to 2 revolutions per minute against a maximum angle of careen of $6\frac{1}{2}$ degrees. The crane jibs are lowered and supported on gantries when the vessel is at sea.

The *"Caldare"* has a length between perpendiculars of 165 ft., her moulded breadth and depth being 36 ft. 6 in. and 13 ft. 3 in. respectively. The vessel will carry a total of 500 tons of coal on a 10 ft. 6 in. draught. She is fitted with twin-screw, triple-expansion engines of normal type, and these give her a designed sea speed of $10\frac{1}{2}$ knots.

Grain Elevators for Hull Docks

Two large portable bucket elevators for grain discharging purposes have recently been constructed for service at Hull. Each elevator is capable of dealing with 100 tons of grain per hour. An interesting feature is that they are provided with telescopic legs in order to make them capable of dealing with ships of any size. Both elevators are fitted with the necessary conveyors to carry away the grain after it has been lifted by the grabs.

New Thames Bridge at Richmond

A bridge is to be constructed across the River Thames at Richmond. It will be of ferro-concrete, and will have three spans in addition to two arches on land. Each of the land arches will be 56 ft. in length. The main span will have a length of 103 ft. 4 ins., while that of each of the side spans is to be 98 ft. 4 in. Thus the total length of the bridge will be 412 ft. The structure will have a width between parapets of 70 ft. It will carry the Chertsey arterial road, and is expected to cost £191,200.

Important African Bridge Opened

A new bridge over the Nile has been opened at Jinja, Uganda. This is within sight of the Ripon Falls, the outlet of the Victoria Nyanza that is regarded as the source of the great river. The bridge carries a road and a single railway track, and has been constructed in order that the Kenya and Uganda Railway may be extended to Kampala, the commercial capital of the Uganda Protectorate.

The bridge is of the three span type. Each of the approach spans is 100 ft. in length, while the actual river span, which is of the spandrel braced arch type, is 260 ft. 2 in. in length. The road carried by the bridge is 20 ft. in width between curbs, and two footways are also provided. The roadway is situated below the railway track, and special care has been taken to place both well above flood level. The roadway itself is 35 ft. above this level, and the railway track is about 69 ft. above the highest level to which the Nile has been known to rise.

The bridge cost £80,000 to construct. It will prove of great value in developing the Uganda Protectorate, for the new railway extension passes through country that produces sugar, coffee, rubber, timber and the raw material for the manufacture of alcohol. It is interesting to note that the bridge is the only one crossing the Nile between its source and Kosti, a point that is about 1,300 miles downstream.

Longest British Motor Coach Run

A daily limousine service, that is said to be the longest in operation in this country, has been inaugurated between Glasgow and Southampton. The coach travels via Edinburgh, Newcastle and London.

A suggestion has been made that an hourly motor coach service between Glasgow and London should be instituted. If the proposal is carried out, travellers will be able to choose whether they will go by way of Newcastle and the Great North Road, or by the English Lake District.

Motor Boat's 27½ Days' Non-Stop Journey

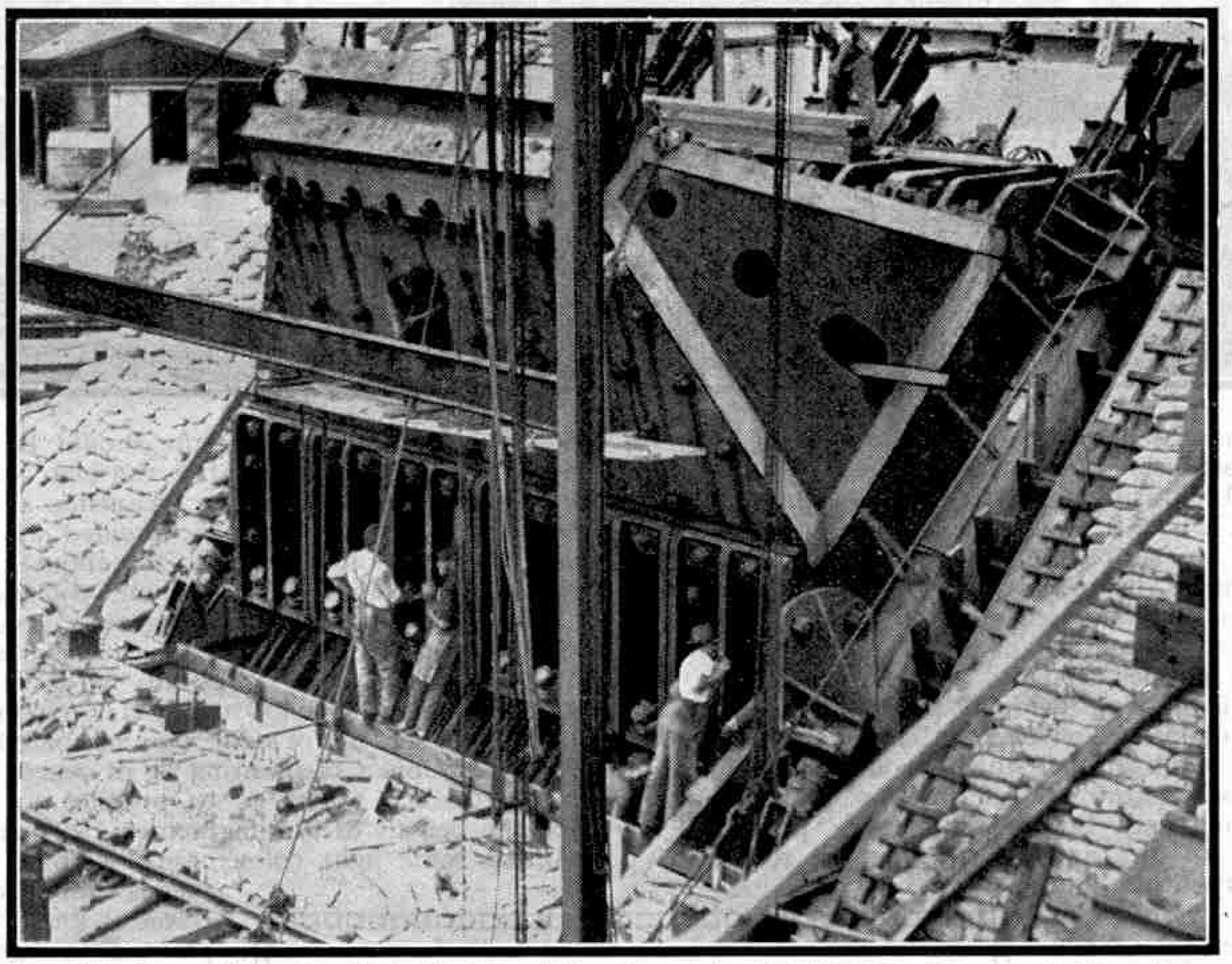
An interesting outboard motor boat record has been set up in Florida where two motor boat racers drove a small vessel round a lake for a period of 662 hours, or nearly 27½ days, non-stop. It is interesting to note that this time exceeds by 15 hours the aeroplane endurance record set up by Dale Jackson and Forest O'Brine!

It is said that into the 27½ days, the wear and tear of ten normal years' work was crowded, and the trial will give interesting information that will help to increase the average life of the outboard motor boat engines of the future. It is now to be followed by a series of similar runs that are to be undertaken in different parts of America.

Twin-engined Motor Coach

A motor coach that is fitted with two engines has been produced in Minneapolis, U.S.A. The two engines in this novel vehicle drive the front and rear pairs of wheels respectively, and it is said that their use in this manner reduces the effect of engine vibration. The engines are of the 6-cylinder Waukesha type and each develops 78 h.p. at 2,200 r.p.m. They are situated beneath two seats in the centre of the coach and access to them is gained either by lifting up the backs of the seats, or through a removable panel at the side of the coach.

An interesting feature of the coach is the cooling system. The radiators are situated at the front and are placed side by side. Separate cooling fans are fitted and these are driven by a motor that is set in operation automatically when the temperature of one of the engines becomes too great.



One of the four main bearings that take the weight of the great arch of the Sydney Harbour Bridge. There are two at each end of the Bridge and each has to withstand a thrust of 20,000 tons.

New Electric Tugs for Panama Canal

Two Diesel-electric tug boats, the "*U.S. Chagres*" and the "*U.S. Trinidad*," have been completed for service in the Panama Canal, where they will be the first of this type to be employed.

The tugs are the largest and most powerful Diesel-electric tugs in the world. The "*Trinidad*" is to operate at the Pacific end of the Canal, where it will be used for towing large vessels into and out of the entrance. The "*Chagres*" will be employed in dredging operations in various parts of the Canal.

Each of the vessels has an overall length of 150 ft. and is engined by two six-cylinder Diesel engines developing 480 h.p. The engines are connected directly to 330 kw. main generators and direct-connected auxiliary generators of 50 kw. The propulsion motor is of the single-armature, shunt-wound type and develops 750 h.p. at 150 r.p.m. It is governed on the variable-voltage method and its speed and direction of motion is controlled from the pilot house.

Interesting Canadian Tunnels

Two traffic tunnels are to be constructed below the Lachine Canal in the city of Montreal. They are for vehicular and pedestrian traffic, and are expected to assist greatly in the solution of Montreal's traffic problem. The cost of the tunnels is estimated at £230,000, and it is expected that work on the first of the two will be commenced shortly.

There is the possibility that another tunnel beneath the St. Clair River also will be constructed. This would connect Sarnia, Ontario, with Port Huron, Michigan, and thus would greatly improve traffic facilities between important districts in Canada and the United States. A definite decision with regard to the actual construction of the tunnel has not yet been arrived at, but a Bill seeking authority for the carrying out of the project is to be submitted to the Canadian Parliament during the coming session. The estimated cost of the proposed tunnel is £400,000.

"Baby" Car Speed Record of 103 m.p.h.

On 7th February, two days after setting up the world's land speed record of 246 m.p.h., Sir Malcolm Campbell made an attempt on the world's record for "baby" cars. In a "Baby" Austin he attained a speed of 81.09 m.p.h., which fell short of the existing record by 6 m.p.h. He was more successful in a later attempt, however, achieving a speed of 94.06 m.p.h.

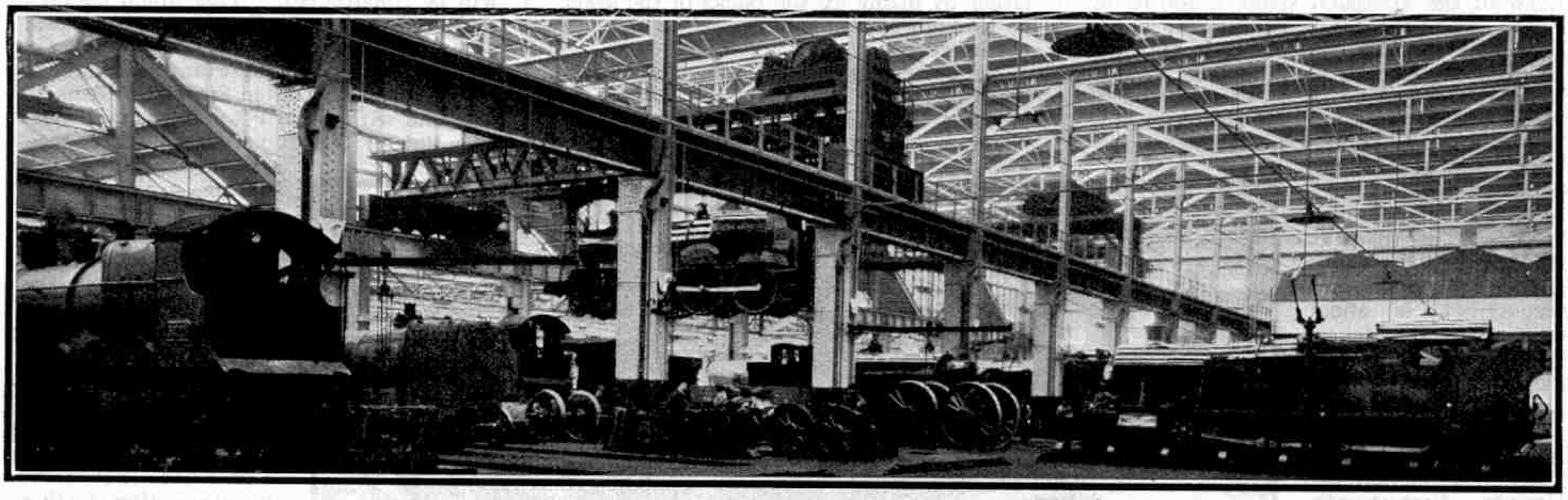
The record was not allowed to stand long, for on the Montlhery track, Paris, a few days later, Mr. G. E. T. Eyston attained a speed of 96.07 m.p.h. over five kilometres and 96.97 over ten kilometres. These records were set up in a "Baby" Austin, but three days afterwards the same driver attained the wonderful speed of 103.13 m.p.h. over a course five kilometres in length, and 102.43 m.p.h. over one of ten kilometres, in an M. G. Midget. Mr. Eyston is thus the first man in the world to exceed a speed of 100 m.p.h. in a "baby" car.

Electric Cars to Travel at 100 m.p.h.

A short time ago the electric car system between Cincinnati and Toledo, in the United States, suffered a great deal from competition by motor buses. In order to meet this competition the owners of the line ordered a number of new high speed cars to be constructed. The new cars are unlike previous ones that have been built for travelling at high speed, for they are not very large or very heavy, the weight of each one being only 24 tons, although it has seats for 40 people. During trials conducted on the cars, a speed of 90 m.p.h. was attained and thus they are able to complete the 225 miles between Cincinnati and Toledo in much less time than that occupied by the competing buses.

How a Locomotive is Painted

From First Coat to Finished Lining



The photograph above shows a portion of the huge erecting shop at the famous Swindon Works of the Great Western Railway. Several locomotives are seen in various stages of construction and reconstruction, most of them almost ready to make their appearance on the line. These Works, originally planned mainly by Brunel, came into general operation on 1st January, 1843, and now occupy an area of about 310 acres.

WHEN a locomotive has been completed in the erecting shop its appearance is still very unfinished, because it has not received any final painting. Before it proceeds to the paint shop it has to go on a trial trip. Nowadays the preliminary trial is not likely to reveal any serious defects, but it is a necessary part of the life of the engine. For the present we will assume that our engine has passed its trial successfully. It now returns to the sheds to receive its numerous coats of paint and the finishing necessary before it goes out into active service.

While the locomotive is passing through the final stages in the erecting shop a coat of lead-coloured paint is given to it to protect the metal from oxidisation, which would make the subsequent painting unsatisfactory. It is in this grey livery that the engine runs its trial trip. Before this first or "priming" coat of paint is applied, all dirt and grease must be removed from the metal with turpentine and sand paper, otherwise the paint would not adhere properly. When the locomotive comes back to the paint shop from its trial trip, the priming coat is scraped in places, with the object of ascertaining whether it adheres firmly. If it does, it is left on; if not, this indicates that the metal surface was not sufficiently clean, and therefore all the priming must come off.

First of all the whole surface is covered with a stopping consisting of white lead and ochre mixed with gold size; and well worked into the surface. After being allowed to harden it is rubbed down with flat pieces of pumice stone and "worked" with water until a perfectly smooth surface is obtained, with all the small hollows filled up. After this the first coat of lead colour is applied, and when this is dry the first coat of the final colour is put on. The lettering, figures, lines and stripes are added after the final coat has been applied, "transfers" being used for this purpose. An elaborate system of "lining out" the locomotive adds seriously to the cost of painting, but it greatly improves the appearance of the finished job.

When all is dry a first coat of varnish is applied. This, after drying, is rubbed down with powdered pumice stone applied on a horse-hair pad, thus producing a smooth surface to which a second and possibly a third coat is applied. For varnishing a copal varnish is used, which sets hard and lasts well. Only the very best material is employed, because the changes in temperature, the exposure to all sorts of weather, and the arduous conditions of service, form a very severe test of the work.

If the engine is urgently required for work on the main line, the time it spends in the paint shop will be cut down to the absolute minimum, usually by speeding up to the utmost the period of drying of the various coats of paints and varnish. If possible, however, the engine should be allowed to stand for a week in the paint shop after the last coat of varnish is applied, the shop being kept in the meantime at a uniform temperature. Dirt in paint shops is also avoided as far as possible. If the painting or varnishing work is scamped, or the subsequent paint cleaning is badly done, the engine soon loses its smart appearance.

The engine smoke-box becomes a good deal hotter than any of the other paint surfaces, so that one of the specially-prepared "smoke-box blacks" is usually adopted for it. Such parts as the brake gear, springs, and under portions of the tender, which are more or less out of sight, may be coated with the same material. The main object of painting is, of course, to resist corrosion, and the secondary object is to produce an attractive appearance. For the benefit of the enginemen the inside of the cab is usually painted some light colour, such as buff, although this is by no means universal. The inside of the frames and the motion are also painted a light shade, usually red or buff, so that when a driver is going round the lubricating points with an oil lamp at night, he has a better chance to see whether everything is all right or not.

The painting of the engine wheels after the engine is assembled is an awkward job, as owing to the splashers covering a large part of the driving wheels the engine has to be moved along to enable all parts to be reached. In some shops, therefore, it is the practice to paint and line the wheels before they are put under the engine.

The cost of painting a locomotive, particularly other than black, is a considerable item. Mr. Webb, one of the most outstanding locomotive engineers this country has produced, was once asked why he painted the London and North Western engines black; and is credited with the reply that he would paint them with gold leaf when the shareholders' dividend warranted it!

In pre-war days the appearance of locomotives generally was much smarter than is the case to-day. Each railway had its own particular colour scheme, and in the majority of cases the engines, both goods and passenger, were attractively lined out. Owing to the urgent need for economy since the War there has been considerable modification in the finish given to locomotives. A great saving has been effected by the use of plain black for goods locomotives, and many passenger locomotives are similarly finished on the L.M.S.R. and the L.N.E.R. systems, only the more important passenger locomotives being painted in colours. Green is still used for goods engines on the G.W.R., but these and the less important passenger classes of this group are not lined as are the principal express engines. One cannot help regretting this change, especially when one recalls such splendid liveries as the famous blue of the Caledonian, and the dark green of the Great Central.

BRAINS AND BRAVERY

BOYS WHO RANK WITH MEN

IN presence of mind and courage the boys of to-day are in no way behind those of former generations. They are just as prepared to take great risks when necessary to save others from danger, or even death, and from time to time we may read stirring stories of brave deeds showing that when called upon to do so, they face risks of all kinds with as little regard as ever for the consequences to themselves of their gallant actions.

A remarkable instance of true bravery exhibited by Robert Yen, a boy 13 years of age, occurred early in the morning of 2nd September, when a fire broke out in a house in Liverpool.

The alarm was given at 2.30 a.m. by "Spot," a dog belonging to Robert. Most of those living in the house made their way out in safety, but the boy's thoughts turned immediately to his sister and two brothers, who were sleeping in a room at the top of the building. The dog also seemed to remember them and dashed upstairs, Robert following in a heroic attempt to penetrate through the smoke and flames. He was unable to force his way through directly and eventually climbed out of the window of one room in the hope of being able to reach that in which the children were sleeping. In this he was unsuccessful, but his failure was not due to any want of resolution on his part. The boy could have saved his own life by leaving the building immediately the alarm was given, and in his brave effort to rescue the three younger children he was so seriously burned that he died next day in hospital.

John Murray, a nine-year old Liverpool Wolf Cub, who was awarded a gilt medal by Lord Baden-Powell, the Chief Scout, for a very brave deed.

A story of a different kind comes from East Africa. In February of last year a Hall Line steamer, the "*City of Worcester*," was lying in the harbour at Mombasa. One evening G. F. Reeves, a young apprentice, stood on deck watching several officers who were bathing in the river. Suddenly he noted that the Fourth Engineer appeared to be in difficulties. The Chief and Third Engineers went to the assistance of their comrade without hesitation, but his violent struggles prevented them from achieving their purpose, and in the end they too found themselves in danger and were compelled to abandon their efforts.

Immediately he realised that the two senior officers were unable to rescue the Fourth Engineer, young Reeves boldly dived into the water and swam toward the unlucky bather. By great efforts he managed to evade the clutch of the drowning man, but found it necessary to quieten him with a blow. Then he turned his attention to making for safety. At first he tried to swim to shore, but the strength of the tide prevented this. Eventually he saw a small boat anchored lower down the river and with his helpless burden made his way towards it. He succeeded in reaching it and later had the satisfaction of seeing the Fourth Engineer recover when artificial respiration was applied. Reeves was rewarded with a testimonial from the Royal Humane Society, his action having been officially reported by Capt. J. E. Roberts, the Commander of the "*City of Worcester*," who was a witness of his brave deed.

A Modest Hero

Gallant rescues from drowning are performed in home waters as well as abroad, and a test of courage and presence of mind may come when it is least expected. The test came to Leslie Smith, of Rock Ferry, a boy of 12 years of age, in August last while he was playing on the shore of the Mersey. He had been watching the movements of a small boy who was paddling in the water. Suddenly there was a lot of splashing and the small boy disappeared. Instantly Leslie ran down to the water. Realising the seriousness of the position, he plunged in without removing any of his clothes, and brought the child out to safety. Even then his task was unfinished. The boy he had rescued was unconscious, but with characteristic thoroughness Leslie revived him by applying artificial respiration.

By this time quite a crowd had assembled, of course, and Leslie took advantage of the first chance he had to slip quietly away and go home. But it was impossible to keep the knowledge of his action quiet. It so happened that rescuer and rescued attend the same school—the Rock Ferry Council School—and the sequel to his action was the presentation to the former of the Bronze Medal and Certificate of the Liverpool Shipwreck and Humane Society by the Mayor of Birkenhead. The occasion was celebrated by granting the school a half-holiday, and as a result, Leslie became an even greater hero in the eyes of his school friends!

The reward of courage and presence of mind. Leslie Smith, Rock Ferry, receiving a Bronze Medal and Certificate for gallantly rescuing and reviving a younger schoolfellow, also included in the photograph, who had fallen in the Mersey.

A Resourceful Meccano Boy

A younger boy than Leslie Smith distinguished himself by a similar feat while at camp at Irby, Cheshire. This was John Murray, a Liverpool Wolf Club only nine years of age. John heard cries of distress from one of his companions and on rushing out to investigate discovered that a boy visitor to the camp had got into difficulties in a pond. Without hesitating a moment the little fellow went into the water and pulled the victim of the accident out of danger.

In this case bravery appears to be hereditary, for John's father, who is also his Cubmaster, won the D.C.M. for conspicuous gallantry during the Great War. But it is remarkable to find so much resolution and presence of mind in a boy only nine years of age, and the Chief Scout, Lord Baden-Powell, rightly awarded John a gilt medal, a rare distinction that is only given for really outstanding deeds of bravery.

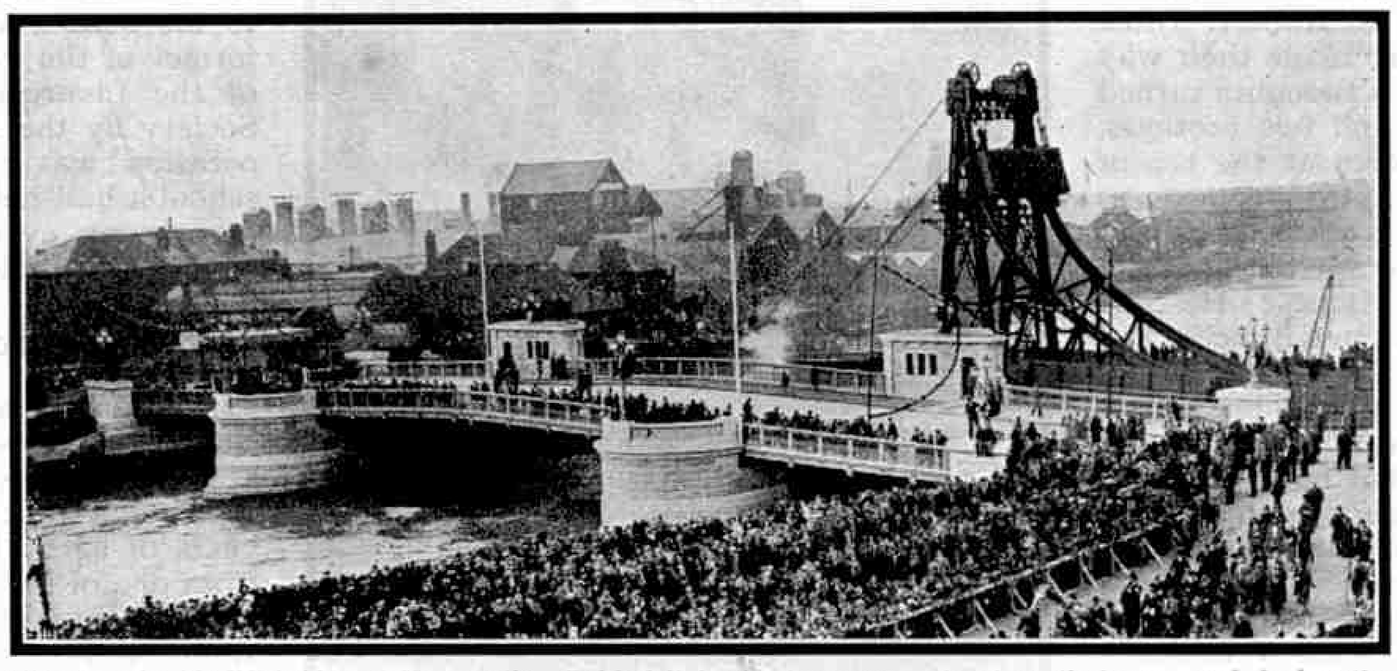
It is not only in deeds of active daring that modern boys show their mettle. An excellent example of quite another kind of courage comes from Grahamstown, South Africa, a town in which is the home of Edgar Bayes, a Meccano boy aged 9½ years. One night he was suddenly attacked with severe spasms of croup. The only way in which he could get relief was by inhaling steam charged with an aromatic vapour, but unfortunately the spout of the kettle in which this was produced was far too short. While his parents were frantically searching for some means of prolonging it, Edgar sat up in bed and pointed to his Meccano Outfit. He was unable to speak, but even the intensely painful choking sensation that croup brings with it did not prevent him from indicating by signs that he wanted two No. 7a Angle Girders. Rapidly he tied these together with string and wrapped paper round them in order to form a long tube for attachment to the spout of the kettle. The device was perfectly successful and Edgar owed the relief and comfort that he obtained throughout the night to the inventive ability that he showed under very unfavourable circumstances. When the doctor arrived next morning he spoke very highly of the ingenuity of the victim of the attack, and expressed the opinion that his prompt action in the sudden emergency had averted complications that might have become very serious.

FROM OUR READERS

Contributions not exceeding 500 words are invited, with or without photographs or sketches for use as illustrations, and payment will be made for all articles published. The Editor takes no responsibility for the accuracy of statements contained in such articles, nor for the opinions of contributors.

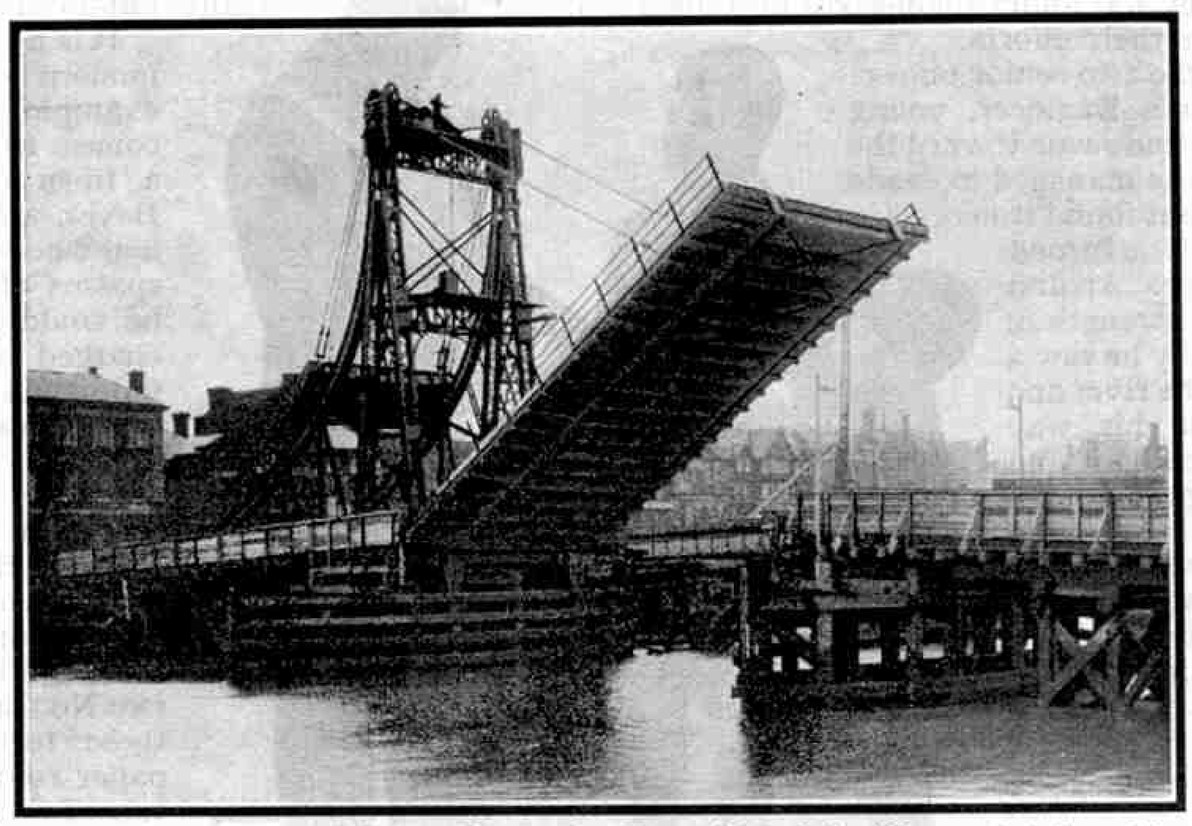
Interesting Bridges at Great Yarmouth

The New Haven Bridge over the River Yare at Great Yarmouth was opened last October by the Prince of Wales. The bridge is of the double leaf lifting type. It is 230 ft. in length and is wide enough to accommodate four lines of traffic in addition to pathways for foot passengers on each side. The opening leaves are of the rolling Scherzer type, and when fully opened a clear waterway 90 ft. in width is left between the piers. The leaves are operated by electrical machinery. Each weighs about 300 tons and the addition of the ballast acting as a counterweight brings the moving weight to more than 500 tons. Automatic motor control switch gear is installed and the navigation span may be fully opened in the remarkably short space of 50 seconds.



The new double lift bridge at Yarmouth. Behind it is the temporary structure that was used during the construction of the new bridge.

While the New Haven Bridge was being constructed, use was made of a temporary structure built alongside. This was of a very interesting character. It was of the balanced drawbridge type and was erected on timber-pile piers. As the accompanying photographs show, a steel tower was erected on one side of the river. This was 74 ft. in height, and from it the one lift span, 72 ft. in length, was raised and lowered by means of electrical machinery.



Opening the temporary bridge at Yarmouth. The weight of the lift span is balanced by that of the bogie descending the curved rails.

To watch the bridge being opened for river traffic was very interesting indeed. The counterweight was a bogie truck containing 80 tons of ballast. This was connected with the lift span by means of steel ropes passing over large pulleys at the top of the tower, and as the roadway was raised the truck ran down a curved track on the opposite side of the tower. An interesting feature of the bridge was that the curvature of the track was so arranged that the strains upon the ropes remained constant during lifting operations. C. WILSON (Great Yarmouth).

Extracting Sugar from Beet

During a recent visit to the Beet Sugar Factory at Cupar, Fifeshire, I had the opportunity of tracing the production of sugar from the entry of the beet into the factory to the removal into storage of the crystallised sugar produced. As they arrive from the farms the roots are dumped into storage vats, from which a stream of warm water washes them into the factory. There they are lifted into a trough by means of a revolving wheel provided with pockets and, after being washed and passed over a picking table, are carried by an elevator to the top of the building. They are then automatically weighed and cut into thin slices.

It is at the next stage in the process that the sugar is extracted. The slices of beet pass into a machine called a diffuser. This is a huge pipe tilted slightly upward, through which revolving blades force the slices through successive copper screens until they reach the top. A stream of warm water meets them as they are rasped in this manner and this dissolves out the sugar. During its passage through the diffuser, the beet is finally reduced to a pulp that is sold as a cattle food.

The solution that flows from the bottom of the diffuser is carried to settling tanks in which it is treated with lime and carbon dioxide in order to remove impurities, it is then filtered and bleached by means of sulphur dioxide before being evaporated in vacuum pans until ready for crystallisation. All traces of molasses and moisture are removed from the sugar that separates out by whirling it round in a drum that rotates at a speed of 1,500 r.p.m. I was interested to note that nothing was touched by hand during the extraction of the sugar.

J. L. STURROCK (Newport, Fifeshire).

The Ruins of Ctesiphon

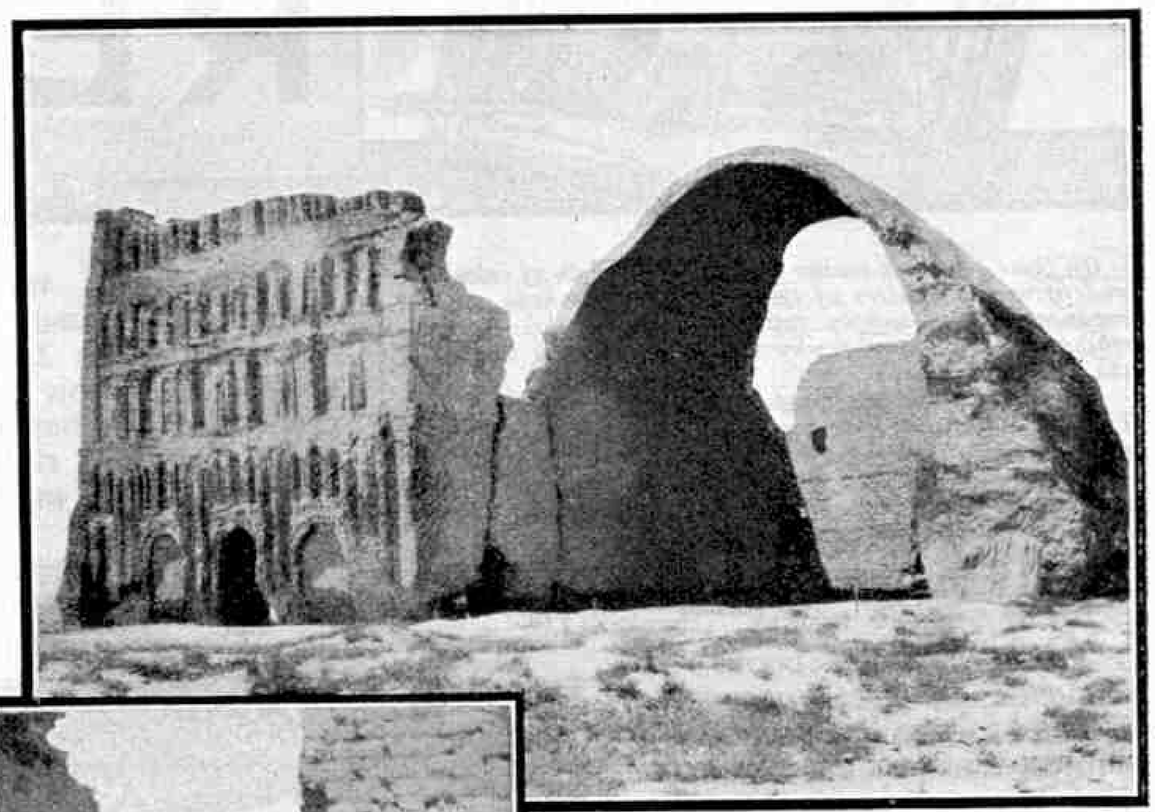
When I was stationed in Mesopotamia, I travelled to Baghdad by water. While proceeding up the Tigris toward the city, I was surprised to see on the left bank a large dark mass. As the boat came nearer I saw that this was an enormous arch attached to the ruins of a gigantic wall. I was informed that this was the arch of Ctesiphon, the sole remains of a great city that was the capital of the Parthian Empire in the early centuries of the Christian era. The arch is the dominating feature for miles around, for it towers high above the surrounding date groves and the desert.

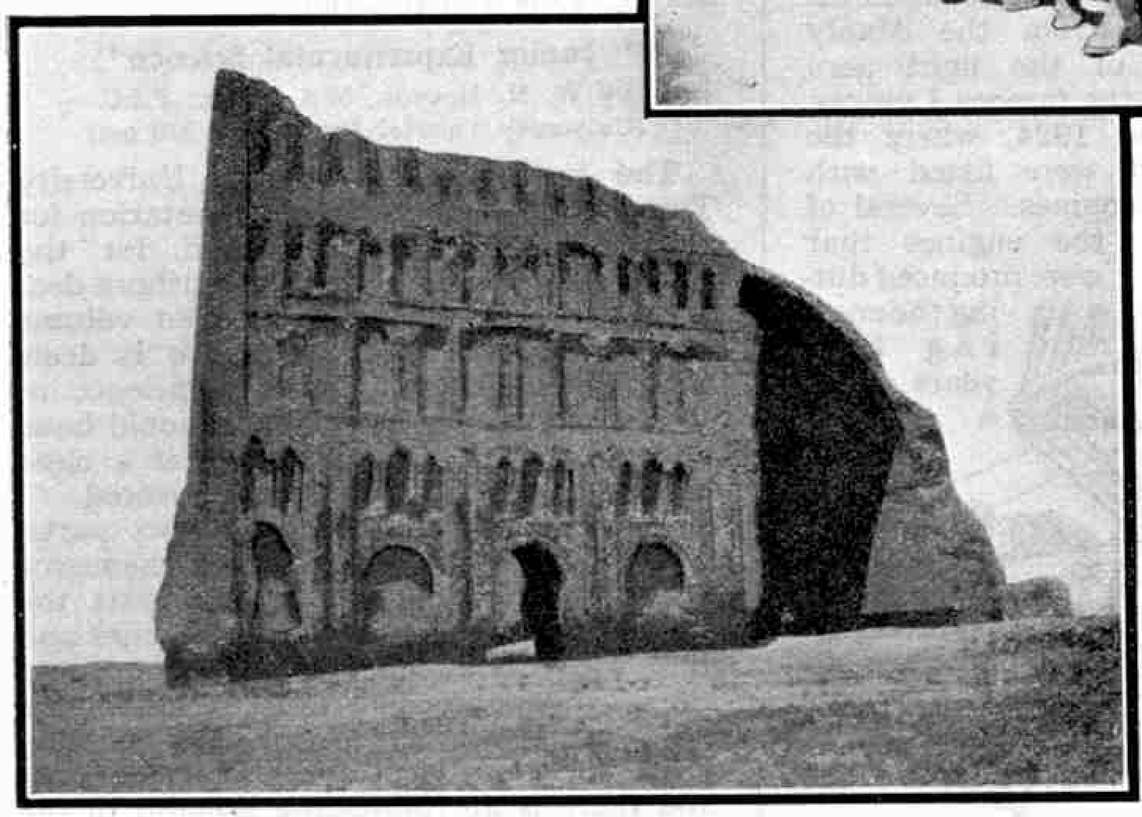
When I reached Baghdad I took the first opportunity of visiting the Arch. The 16 miles of desert that separate it from the city were covered in a car in just under two hours, and after the journey in the hot sun over the seemingly endless sand dunes its shade was very welcome.

On close examination my feeling of surprise at the extent of the arch was increased. Although it is 85 ft. in height and has a span of 72 ft., there is no supporting pillar, and it seems remarkable that both arch and wall have stood for so many centuries. Once they were in the centre of a crowded metropolis, for they formed part of the royal palace. The other buildings of the city collapsed long ago into heaps of sun-dried bricks, and to-day there are no other buildings of any kind for miles around. The district is practically deserted and when I visited it the arch was the home of a flock of noisy blue jays and of numerous scorpions that hid in the cracks.

The great palace of Ctesiphon was 450 ft. in length, 180 ft. in breadth, and rose to a height of 150 ft. In front it was adorned by a portico of 12 great marble pillars. The arch formed the roof of the central hall, and was decorated with golden stars arranged to represent the signs of the zodiac. The building was probably erected by slave labour, exactly as the Pyramids of Egypt were. The work was well done, for storms and floods have left the arch unmoved, and it was not disturbed by the concussion due to the artillery fire of the battle of Ctesiphon waged around it in 1915.

D. B. WEIR (Dysart).





The upper and lower photographs are views of the Arch of Ctesiphon taken by our reader, D. B. Weir, Dysart, who is the middle figure of the three seen in the central photograph.

A Visit to an Observatory

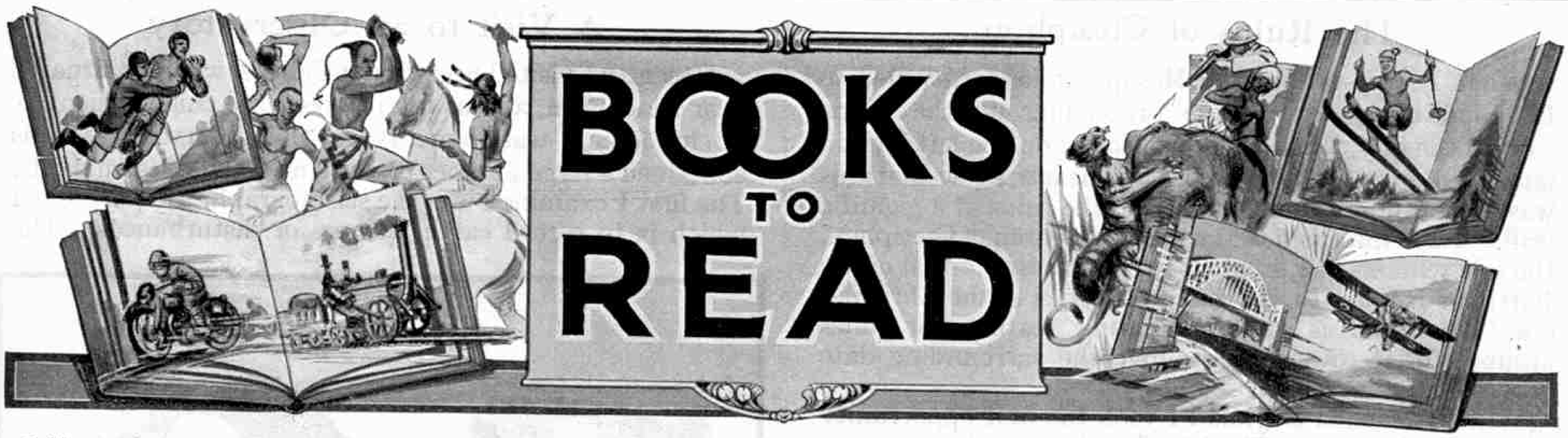
Recently I visited Stonyhurst College, which is situated near Blackburn, and as my interests are chiefly scientific in character, I was shown round the Observatory. This contained a large number of very interesting instruments. The first I examined was the seismograph, the purpose of which is to record earth tremors or disturbances. The delicately balanced bar of this instrument vibrates when very slight earth movements take place, and I was told it is sufficiently sensitive to record the entry of a visitor into the room in which it is installed.

The magnetic instruments next attracted my attention. These record changes in the direction and strength of the earth's magnetic field. The one that records variations in the direction of the magnetic meridian consists primarily of a bar magnet suspended by a silk thread. The magnet carries a mirror, from which a beam of light is reflected on to a moving strip of sensitised paper. Examination of the track marked on the paper by the spot of light reveals changes in the position taken up by the magnet.

The strength of the earth's magnetic field is measured and recorded by similar means. The magnet in the instrument used for this purpose is suspended by means of a silver wire and points approximately magnetic east and west, however. It is maintained in this position by twisting the wire. Variations in strength of the magnetic force due to the earth's field cause the magnet to change position slightly and the deviations are automatically recorded on sensitised paper.

Other instruments that attracted my attention included the wind recorder and a wireless set that is extremely selective and is used for receiving time signals and weather reports. The final event of my visit was the inspection of the 15 in. telescope of the observatory. I was greatly disappointed to find that no stars were visible because of clouds, but derived some consolation from admiring the remarkable ease with which the great telescope could be manipulated.

E. CRAVEN (Burnley).



On these pages we review books that are both of interest and of use to readers of the "M.M." We have made arrangements to supply copies of any of these books where readers find difficulty in obtaining them through the usual channels.

Orders should be addressed to the Book Dept., Meccano Limited, Old Swan, Liverpool, and 1/- should be added to the published price of the book to cover the cost of postage. The balance remaining will be refunded when the book is sent, as postages on different books vary according to the weight and destination.

"The Atlantic"

By Stanley Rogers. (Harrap. 7/6)

That Mr. Rogers' books have achieved so great a success is due to the interest of his subject-matter and the charm and accuracy of his drawings. In this volume he deals with the Atlantic, known to sailors as the Western Ocean—the stage on which many of the most important events in history have been played.

We read of the Vikings in their dragon-stemmed, red-sailed *snekkas*; the historic caravels of Columbus; puffs of smoke from the guns of the "*Golden Hinde*"; the scurvy-stricken ships of Magellan, Frobisher, Cartier, Hudson, and Raleigh; the swarthy rovers of the Main; the fat treasure-galleons rolling home to Spain; the brave little "*Mayflower*"; the privateersmen; the fighting sloops of 1812; the swift clippers bowling along under a cloud of white canvas; and, lastly, the huge shapes of modern liners silhouetted against the sky.

Mr. Rogers does not offer this book as a history of the Atlantic, but merely as a work of entertainment and interest. Amongst other subjects for the chapters are Freak Crossings; Lonely Isles; Atlantic Sea-Rovers; Atlantic Battles; The Sailing Packets; The Steam Ferry; Lost Ships; and Atlantic Mutinies.

A book to be read and treasured by all who love the sea.

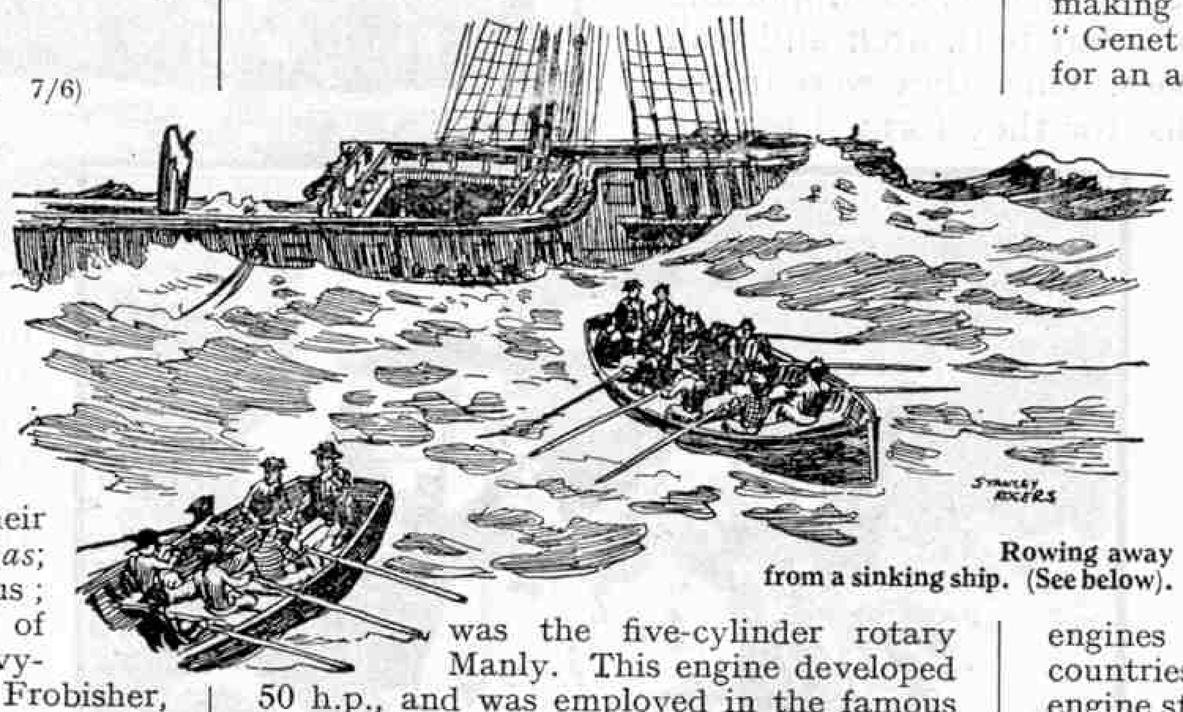
"Light Aero Engines"

By C. F. Caunter
(Sir Isaac Pitman & Sons Ltd. 12/6 net)

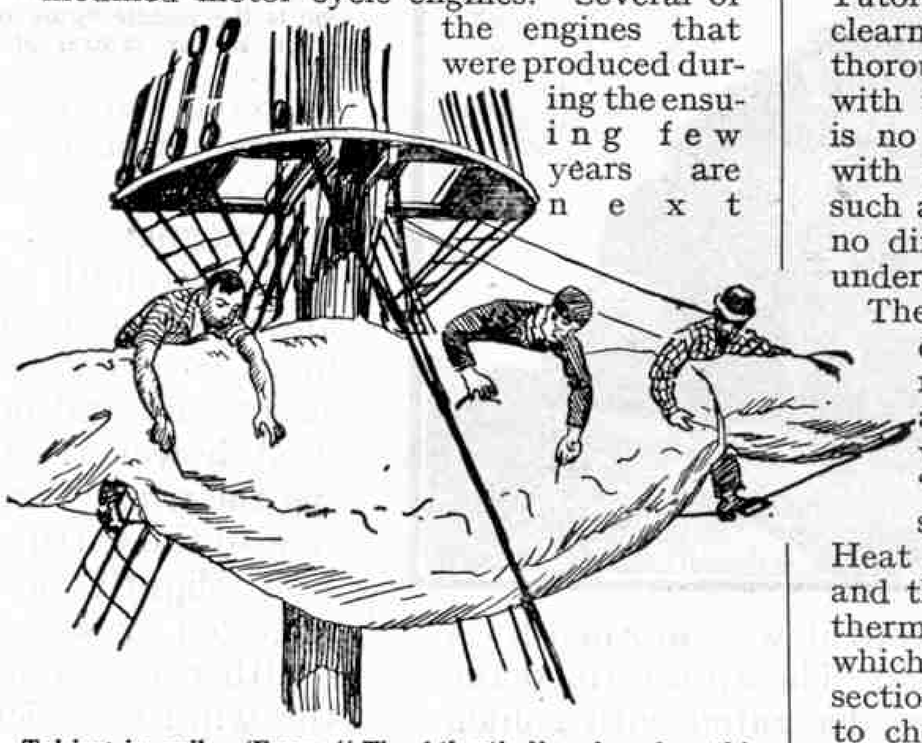
During recent years many books have been written on aeroplanes and aero engines, but Mr. C. F. Caunter's "*Light Aero Engines*" is the first to be devoted solely to aero engines designed specially for service in light aircraft. The author has had extensive experience of flying and of aircraft, and is the designer of the "Caunter" two-stroke aero engine, a description of which was published in the "*M.M.*" for December 1930.

The book begins with a brief review of the engines used in the pioneer flights of famous aviators. Many of these engines cannot really be termed "aero" engines, however, as they were for the most part merely adaptations of engines already in use. Some of the engines that were specially designed for work in aircraft also cannot be termed "light," for in spite of their low output they were very crude and cumbersome.

Mr. Caunter states that the original ancestor of the modern light aero engine was the five-cylinder rotary Manly. This engine developed 50 h.p., and was employed in the famous Langley "*Aerodrome*." It is interesting to note that Langley's supporters claim that it was in the "*Aerodrome*" that the first flight in a heavier-than-air machine was made. From the Manly engine the progress of the light aero engine is traced up to the famous Lympne meetings of 1923 and 1924, where the machines taking part were fitted with modified motor cycle engines. Several of the engines that were produced during the ensuing few years are next mentioned, among them being the Blackburn "Thrush," the Renault, Clerget, and Anzani. There is also a brief mention of the "Cirrus" Mark I, which has been described as "the engine that made the light aeroplane possible."



Rowing away from a sinking ship. (See below).



Taking in sail. (From "The Atlantic" reviewed on this page).

The five main classes into which light aero engines may be further divided are enumerated, and examples are given of engines falling into these classes. Reference is made also to a number of famous flights that have been carried out in light aeroplanes. A particularly interesting fact is that a few years ago the author assisted in making calculations for the equipping of a "Genet"-engined Westland "Widgeon" for an attempt on the duration record. It was then found that the estimated endurance of this machine fitted with the 80 h.p. de Havilland engine, was practically the same as that being secured by machines such as the Ryan, Fokker, and the Hawker "Horsley," which were specially designed as long-distance record breakers.

The construction and design of the various specialised components that are used in the manufacture of aero engines are dealt with, and brief specifications are given of many light aero engines made by manufacturers in all countries. Other matters dealt with include engine starters, the ignition systems of aero engines, carburetters, lubrication, and general methods of overhaul and maintenance. The book is well illustrated by photographs and diagrams.

"Junior Experimental Science"

By W. M. Hooton, M.A., M.Sc., F.I.C.
(University Tutorial Press Ltd. 3/6 net)

The books issued by the University Tutorial Press have a high reputation for clearness of explanation, and for the thoroughness with which the authors deal with their subjects. The present volume is no exception to the rule, for it deals with the elementary facts of science in such a manner that beginners should have no difficulty in obtaining from it a clear understanding of the ground covered.

The book is divided into two parts, dealing with physics and chemistry respectively. In the first part the author deals with measurements and with the elements of mechanics, and "*M.M.*" readers will no doubt be specially interested in this section. Heat and its effects are also dealt with, and there is an interesting account of the thermometer, and of the various means by which heat is transferred. The second section of the book is a useful introduction to chemistry. Simple preliminary operations are interestingly described, and from the results obtained is developed a good general outline of chemical principles.

The book is thoroughly practical throughout. It contains full instructions for carrying out a large number of experiments, and many helpful diagrams of the apparatus necessary for this purpose are also included.

"The Glory of Britain"

By DAVID MASTERS. (The Bodley Head. 8/6)

Too many people at home and abroad have come to regard this country as an object of pity, if not of contempt, and it is refreshing to find another point of view, as we do in this book.

The author has endeavoured to show how much the peoples of the earth owe to Britain, for the marvellous inventions that make life easier, the striking medical discoveries, and the ideas that have helped to sweep away slavery and tyranny and intolerance. He tells how Britain has saved the world from vassalage not once but several times; how she has produced a literature unmatched by any other nation; how she has tried to teach the world to govern, to "play the game," and to give justice to the underdog. Here are stories of the pioneers who opened the doors of the unknown world to modern civilization, of the scientists who discovered new wonders, of the miracle of the British Empire. It is a book for all who love Britain and her Empire—an attempt to capture and imprison a little of the Glory of Britain between two covers.

Our readers will peruse these pages with a glow of pride, and not a few may realize for the first time that the major part of the structure of modern civilization is the creation of British brains and hands.

"Marine Aircraft"

By CAPTAIN P. H. SUMNER
(Crosby Lockwood & Son. 16/- net)

This is a book that will appeal to the older Meccano boy who is a keen student of aviation. It should be of particular value to any boy who intends to take up aeronautical engineering as a career, and to the apprentice, whether with the Royal Air Force or with a civilian firm. Although the book is necessarily rather technical in parts, the majority of it will be readily understood by those who have read the articles on aviation that appear each month in the "*M.M.*"

The book deals with aircraft of the boat seaplane type, and the first section is devoted to a survey of flying boats of all nationalities. British machines naturally are given first place. The growth of the flying boat in this country is traced from the "*Revaud*," produced in 1909 by Saunders of Cowes, now the well-known firm of Saunders-Roe, manufacturers of the Saro "Cutty Sark," "Windhover" and "Cloud," to the very latest types, of which the Blackburn "Iris III" and "Nile," and the Supermarine "Flying Yacht," are examples. The next machines dealt with are those of Germany, and much interesting information concerning the many types of flying boats that have been designed and constructed in that country are given. French, Italian and American machines are then described. The leading particulars of most of the flying boats mentioned are given, together with a photograph; and this makes possible interesting comparisons between different types.

In the second chapter the forces acting upon marine aircraft are examined, and the stability of modern machines when in the air, and their controls and power units, are discussed. One of the most interesting parts of this chapter describes the balancing system fitted on the Dornier "Do.X." On this machine the great size of the controlling surfaces would prevent their easy operation direct from the pilots' seats, and they are therefore fitted with separate small surfaces that assist the movement of the main control surfaces. The Flettner servo controls employed in the British Short "Singapore" and "Calcutta" flying boats are also briefly described.

This chapter finishes with a review of the three methods now in general use of launching aircraft from ships. The compressed air system and the Kiwull "watersail" were illustrated and described in the "*M.M.*" for March 1930. It is of interest to learn that the compressed air system is not now considered to be so effective as that in which the aircraft is shot into the air by means of a charge of gunpowder.

The author of "The Glory of Britain" (reviewed on this page) about to have his helmet fitted before diving to the bottom of Scapa Flow to examine one of the sunken German battleships.

Other chapters deal with such problems as displacement, buoyancy and stability; and the book closes with chapters on materials and methods of construction, wood and duralumin structural members being dealt with separately.

An exceedingly useful appendix contains, among other things, the equivalent French, German, Italian and Spanish terms for a number of technical words connected with aviation. This is a very valuable feature, for most of these words are not to be found in standard dictionaries. The value of the book for reference purposes is reduced by a somewhat extraordinary index, in which the various entries are not arranged in alphabetical order.

"Easy Lessons in Television"

By R. W. HUTCHINSON
(University Tutorial Press Ltd. 3/6)

Interest in television is growing rapidly. It is beginning to be realised that there is nothing about the subject that is mysterious or difficult to understand, provided that a little effort is made to grasp the underlying electrical principles. This little book has been specially written to make the subject clear to beginners.

The earlier chapters contain what the author calls a "few necessary ideas" about electricity and light. Then follow descriptions of the actual apparatus used in television, and of the operation of condensers, inductance coils, valves, photo-electric cells and neon lamps. The remaining sections of the book show how the apparatus is used in building up television transmitters and receivers, and they are full of information on how to secure the best results from wireless receivers used for television, and from television sets themselves.

The book is simply but interestingly written. Meccano boys who already have some knowledge of electricity and wireless will find it easy to understand, and after reading it will be in a position to profit from more advanced books on television. It is attractively illustrated, and a noteworthy feature is the large number of diagrams, which help greatly in making the experiments clear.

"The Secret Valley"

By NICHOLAS SIZE
(Published by Warne. 2/6)

This little book is a convincing narrative of romantic events that prove the mettle of the men who inhabited the fells and valleys of one of the most delightful districts in England. When we visit Lakeland how few of us realise that the sturdy inhabitants who lived in this district centuries ago, fought so desperately for their freedom that the land in which they lived could not be recorded in the Domesday Book!

In the years that followed the Norman Conquest, Lakeland was the haven of hundreds of thousands of miserable refugees who fled from the savage Norman devastation of Yorkshire and Lancashire. For almost a century these refugees maintained a guerilla warfare, wiping out one Norman army after another, until the mysterious mountains of Cumberland were regarded with horror by the Normans. The repeated successes of the Lakeland heroes were not chronicled by the Norman monks, for they were regarded as the acts of wicked rebels against the Norman king and therefore not to be recorded.

One of the reasons of the long immunity of the men of Lakeland was a secret valley near Buttermere, which was adopted as his main centre (about 1070) by Boethar, the Younger. The access to this valley was difficult for it was surrounded by high mountains, the passes of which were particularly dangerous; the only safe and easy access to it was by means of boats on Crummock Water. Although this sanctuary was hidden from sight, its central position made it near to every part of Lakeland. Food for the thousands that it accommodated could come in from any side, and although the Normans might cut off some of the sources of supply, others remained available. Actually the Normans could do little, for supplies mostly came by paths that were death traps to a hostile army.

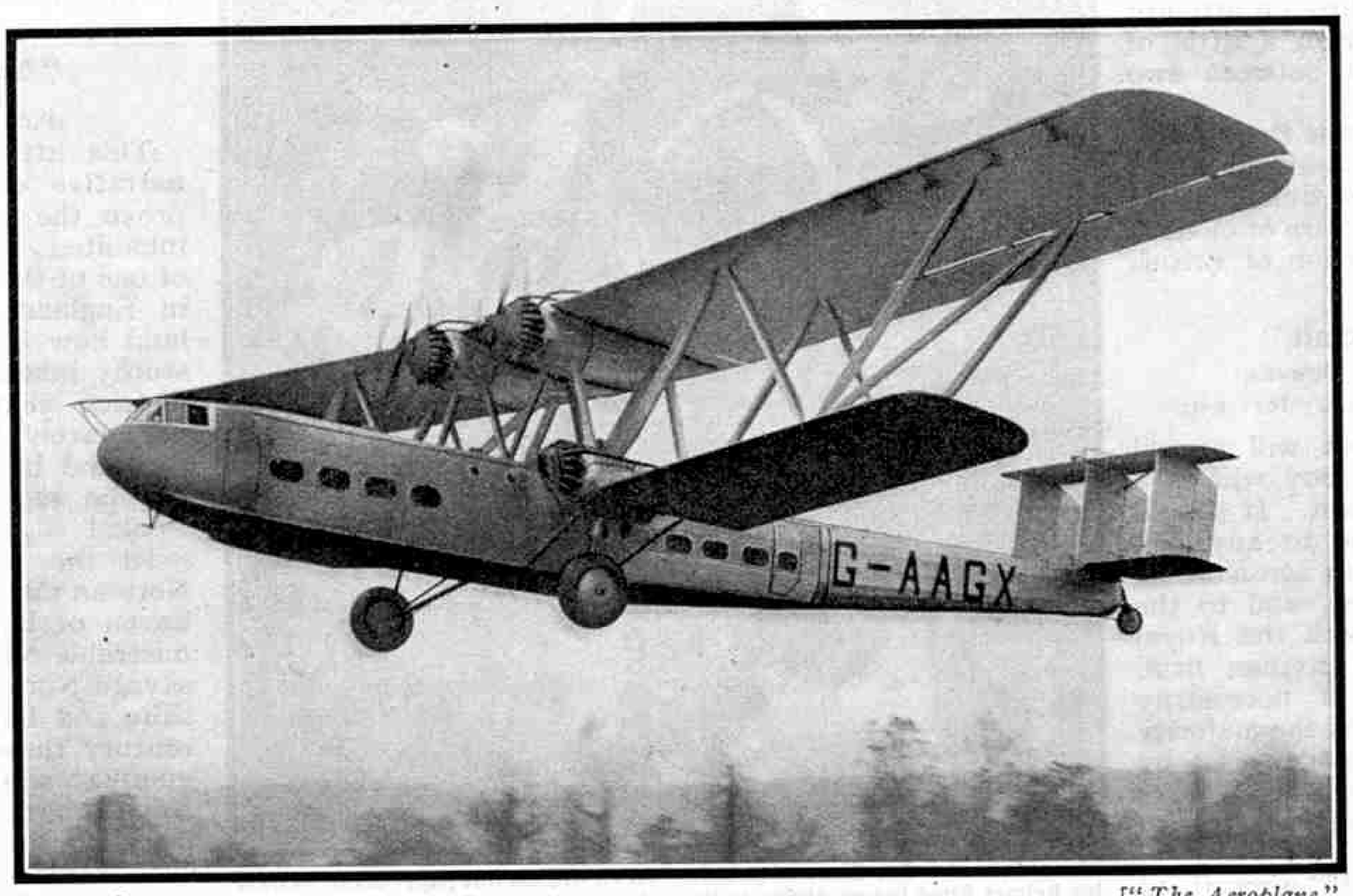
How well the Secret Valley served the refugees during the years that followed, and how the Norman hosts were trapped and slaughtered, must be read by all lovers of Lakeland, to whom we sincerely commend this book.

Largest British Air Liner

New Handley Page Aeroplane to Carry 40 Passengers

IT is now seven years since Imperial Airways was formed by the union of four firms that were operating air services between this country and various places abroad. The airways then in existence were steadily developed, until in 1929 it became possible to travel as far afield as India. The India Air Mail route then established is now very popular, the great gain in time and convenience that follows from its use proving a great attraction. Originally Karachi was its Indian terminus, but it is now possible to reach Delhi by air, and it is probable that before long the service will be extended to Calcutta and possibly also to Rangoon.

Another great air route has just been opened up by Imperial Airways Ltd. This is the line from London to Cape Town. Traffic on the section between Cairo and Mwanza, in Tanganyika Territory, commenced on the 5th of last month, and it is expected that the new airway will be extended to the southern limits of Africa in May or June of this year. Naturally this extension, together with the increase in air traffic generally, has made larger and more powerful aeroplanes necessary, and machines to carry 40 passengers in comfort and luxury are now being added to the company's splendid fleet.



Courtesy] ["The Aeroplane"

A view of the "Hannibal" in flight. As the pilot is high up in the nose of the machine, it was at first found necessary to rig a strut in front, as shown, in order to enable him to sight it against the horizon.

The new aeroplanes are being produced by Handley Page Ltd., and are made in two types, known respectively as the H.P. 42E and H.P. 42W. These are identical in external appearance, but their internal arrangements differ in order to make each suitable for the route on which it is to be employed.

The H.P. 42E is intended for use on the sections of the Indian air mail route east of Cairo. Machines of this type will operate across the Arabian desert to Baghdad, and also between that city and Karachi. For this reason they are known as the Eastern type, and the "E" in their official designation is thus an indication of their purpose. As the name H.P. 42W implies, the second machine is designed for use on the western section of this air route, which also forms the northern section of the recently-opened air line to Mwanza. Aeroplanes of this type will therefore be employed in carrying mail and passengers from Croydon to Salonika, or to some other selected Mediterranean port, in readiness for the journey in a flying boat across the Mediterranean Sea.

The latest Handley Page machine is the largest air liner ever produced in this country. The Western type has slightly greater accommodation than that intended for use in the East, for it is capable of carrying 40 passengers in addition to two pilots. The seating capacity of the Eastern type has been slightly reduced in order to enable a greater weight of mail to be carried.

The first machine of the new type has been called "*Hannibal.*" As our photographs of this aeroplane show, it may easily be distinguished from other aircraft by its unusual design. A particulary noteworthy characteristic is the great distance to which the nose of the machine appears to project beyond the leading edge of the lower plane. This distance is almost one-third of the length of the fuselage. An additional feature is that the aeroplane is fitted with four engines. Two of these are on the lower plane and two on the upper. The lower engines are further apart than those above them, and the distribution of the power units gives a characteristic appearance to the front view of the machine.

The fuselage of the "*Hannibal*" is 86 ft. 5 in. in length and is built in two parts. One of these includes the forward and central sections, and is constructed of duralumin. The tail portion, which is covered with fabric, is attached to the front section by means of four pins. The rear part of the fuselage consists of a four-sided tubular structure with tie rod bracings, and its sides are slightly faired in order to form continuous curved surfaces with those of the forward sections.

The planes are of unequal span and area. They are constructed in accordance with the standard Handley Page method, the spars being made of corrugated duralumin and the ribs of duralumin tube. The upper plane is fitted with automatic slots. It is interesting to note that all bracing wires have been eliminated. Their place has been taken by the patented rigid strut

The " Hanniba " on the ground. It will be seen from this photograph that steps will not be required to enter the machine.

bracing that is now a feature of the military aircraft manufactured by Handley Page Ltd. This is an important innovation, for machines so fitted combine the structural advantages of a biplane with the greater simplicity of maintenance that the absence of rigging gives to a cantilever monoplane.

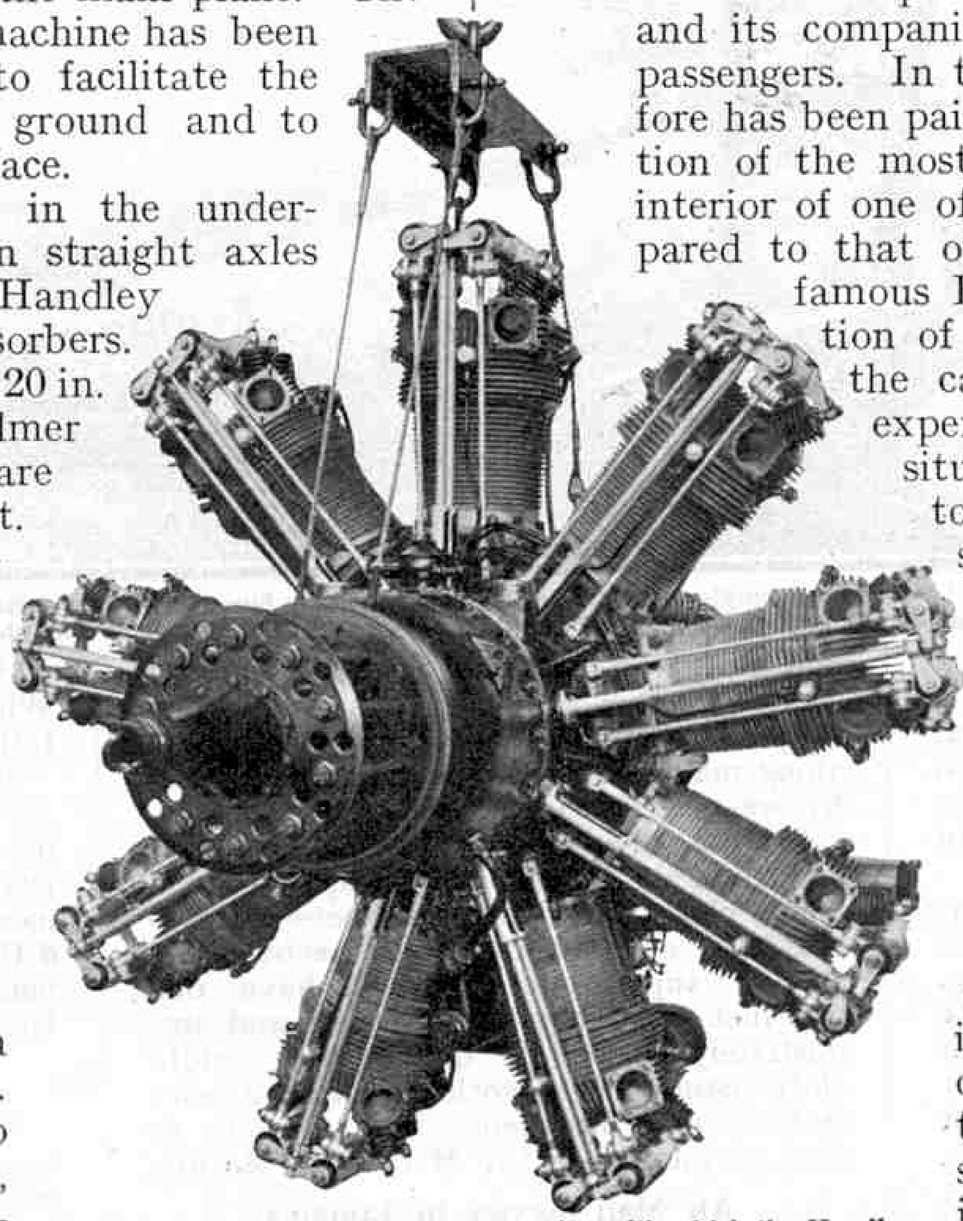
The tail unit of the " *Hannibal* " is of the biplane type, and in design is similar to the main plane. The customary skid at the tail of the machine has been replaced by a wheel in order to facilitate the handling of the machine on the ground and to reduce wear on the aerodrome surface.

Dunlop wheels are employed in the undercarriage. These are mounted on straight axles and sprung by the standard Handley Page oleo-pneumatic shock absorbers. The wheels are fitted with 60 in. × 20 in. tyres, and are provided with Palmer internal expanding brakes that are operated from the pilots' cockpit. An interesting feature is that the brakes are applied on both wheels when the operating lever is pulled back while in a central position, but if the lever is moved to one side the corresponding wheel only is braked.

A striking feature of the new liner is the position of the pilots' cockpit. This is in the nose of the machine, and is much farther in advance of the main planes than in any other modern aeroplane. It is completely covered. Two pilots are carried and, of course, dual control apparatus is provided.

The section of the fuselage immediately behind the pilots' cockpit is the wireless room, and aft of this is the forward saloon, in which seats are arranged four abreast, two on each side of the central gangway. In the centre of the machine there is a luggage compartment and a buffet. Behind this section is the smoking saloon, entrance into which may be gained by means of two doors. One of these communicates with the front saloon and the second is at the rear, where it gives access from outside. It is interesting to note that the " *Hannibal* " has been so constructed that when it is at rest passengers may step into it from the aerodrome without the aid of a ladder. Our photographs plainly show the low position of the fuselage that makes this possible.

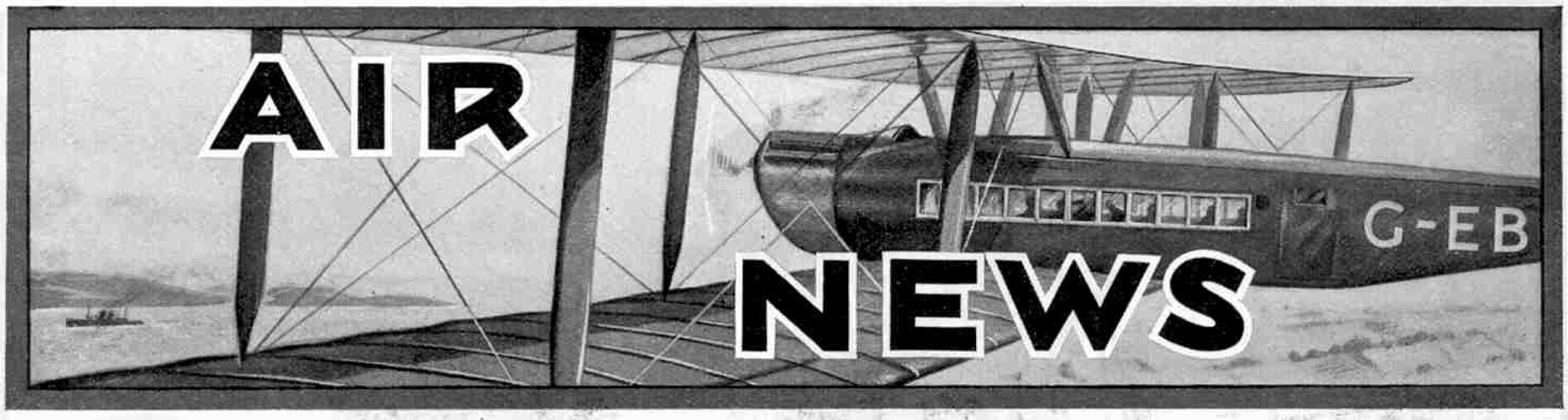
One of the two primary objects of the " *Hannibal* " and its companion machines is the transport of passengers. In their design close attention therefore has been paid to the provision of accommodation of the most comfortable character, and the interior of one of the new machines may be compared to that of a Pullman car on one of the famous British express trains. The position of the fuselage is itself evidence of the care and thought that has been expended in this direction, for this is situated below the planes in order to reduce the disturbance to passengers caused by the noise of the engines. Placing the cabin in this position also provides passengers with an uninterrupted view downward and outward, and alleviates the tendency to air-sickness of those who have not become accustomed to travelling by air.



The Bristo " Jupiter " XI F type engine with which the Handley Page 42W is equipped. For this photograph we are indebted to the Bristol Aeroplane Co. Ltd.

Another device that helps to reduce the noise in the saloons is the provision of a rigid metal cover. This eliminates noise due to the flapping of fabric. The space between the cover and the interior decorations also is padded with sound insulating material and the floor is covered with carpet. Finally the luggage compartment is placed directly below the propellers, a position in which it forms an efficient sound-damping bulkhead.

The saloons are normally warmed by hot air drawn from an engine exhaust muff, and in order to prevent the entrance of oily vapours with it, the air supply is taken from a point at the leading edge (*Continued on page 337*)



New Short Four-Engined Flying Boat

A new type of flying boat has been produced by Short Bros. (Rochester & Bedford) Ltd. for service on the Mediterranean section of the air routes of Imperial Airways. The machine is similar in construction to the Short "Calcutta," but it is fitted with four engines instead of three. It is also considerably larger, the lower wing of the new flying boat having approximately the same span as the upper wing of the "Calcutta."

The machine has accommodation for 16 passengers and their luggage in addition to a crew of three. The mail compartment is immediately in front of the passengers' cabin and holds 3,500 lbs. of mail. Up-to-date wireless equipment is fitted and the wireless operator is also expected to carry out the duties of navigating. The pilot and pilot-mechanic completing the crew of the flying boat are accommodated in a roomy cockpit that is fitted with dual controls.

An interesting feature of the new boat is that up to a little above the water line the hull is planked with stainless steel. This metal has not previously been used on such a large scale. The initial cost involved is large, but it is expected that the life of the hull will be considerably increased.

The length overall of the new flying boat is 78 ft., while the spans of the upper and lower wings are 113 ft. and 92 ft. 6 in. respectively. The tare weight of the machine is 17,900 lb. and the gross weight is 30,310 lb.

The maximum speed of the flying boat at 5,000 ft. is 132 m.p.h., while the cruising speed is about 100 m.p.h. The landing speed is 60 m.p.h. and the initial rate of climb 760 ft. per minute. At 5,000 ft. the rate of climb is 800 feet per minute, and the time required to climb to 10,000 ft. is 14 minutes. The flying boat has been designed to operate at a service ceiling of 19,000 ft., and to take off with full load in a calm sea in 18 seconds. Its endurance when fitted with standard petrol tanks is 5 hours, but this can be increased to enable it to undertake a flight of 8 hours, during which 800 miles could be covered.

Imperial Airways Distinguishing Badges

Pilots employed by Imperial Airways are in future to be distinguished by badges analogous to those of the Mercantile Marine. Those in command of air-liners will therefore wear two half-inch gold bands on the sleeves of their blue uniforms, while their second officers will wear single half-inch gold sleeve-bands.

After they have flown for five years in charge of Imperial Airways craft, pilots will be entitled to wear an eight-pointed gold star just above their sleeve-bands, and those who have risen in the Company's service till they are at the head of a group of pilots flying in any of the divisions along main routes, are to be distinguished by wearing three gold sleeve-bands.

Station superintendents of the first-class are to be distinguished by a quarter-inch white cloth sleeve band in between two half-inch gold bands, while second-class station superintendents will have one half-inch gold band sewn over and immediately below a quarter-inch white cloth band. The work of these airway station superintendents is analogous to that of pursers in the Mercantile Marine.

Air Mail Service to Jamaica

It is now possible for correspondence for Jamaica to be carried by air over a portion of the journey. Letters marked for transmission by air are sent from London to New York in the usual manner, and at New York they are transferred to an aeroplane that carries them to Kingston, Jamaica, by way of Miami. Letters sent by air reach their destination in from 11 to 12 days, while the time taken for ordinary mail varies from 12 to 17 days.

A side view of the Bristol "Bulldog" single-seater fighter machine, showing how the wireless aerial may be carried. We are indebted to the Bristol Aeroplane Co. Ltd. for permission to reproduce this photograph.

World's Duration Record Attempts

Two French airmen, MM. Bossoutrot and Rossi, a short time ago made two unsuccessful attempts on the world's duration record for flights in which refuelling is not permitted. On the first of these attempts the airmen actually remained in the air for 67 hours 53 minutes, 40 minutes longer than the existing world's record, but as this was not exceeded by the 60 minutes necessary in order to comply with the regulations, the flight did not officially constitute a new record.

The second attempt also was unsuccessful and on this occasion the flight only lasted for 27 hours on account of bad weather that was experienced.

The record was attempted in the Blériot 110. This is a high wing monoplane, equipped with a 600 h.p. Hispano-Suiza engine, and was specially constructed to the order of the French Air Ministry for use in making attempts on records. It has a span of 86 ft. 11 in., is 47 ft. 9 in. in length, and 16 ft. in height. When empty it weighs 9,900 lb. and when fully loaded 16,060 lb.

It is interesting to note that the French Air Ministry has ordered two other machines for record breaking purposes. They are a Bernard type 80 middle wing cantilever monoplane and a Dewoitine D.33 "Trait-d'Union" low wing monoplane. These machines also are equipped with 600 h.p. Hispano-Suiza engines.

New Air Services for Australia

A weekly air line service between Brisbane and St. George has now been inaugurated in Australia. The distance between these two places is about 300 miles, and on the inaugural flight was covered in two hours forty minutes. By other methods of transport the journey normally occupies twenty-seven hours. The service is operated by a metal Junkers machine.

It is possible that another Australian air service will be put into operation in a short time. The suggested service is to be in New South Wales, from Charleville and Narromine to Sydney, a distance of about 700 miles

The "*Southern Cross*"

The photograph reproduced on this page shows Air Commodore Kingsford Smith standing in front of his famous aeroplane, the "*Southern Cross*," the machine in which he has flown round the world. The "*Southern Cross*" has had a very interesting history. It was built from the remains of two Fokker machines that were employed by Sir George Wilkins during his Arctic expedition in 1925. These were damaged so badly that the wings of one of them were fitted to the fuselage of the other in order to form a single aeroplane. This was secured by Kingsford Smith in 1927 and equipped with three 225 h.p. Wright "Whirlwind" J.5 engines.

The first great flight to the credit of the "*Southern Cross*" commenced on 31st May, 1928, when Kingsford Smith and two companions left San Francisco for Sydney. The flight was made in three stages, and the total distance of 9,263 miles was covered in 83 hours 35 min. The longest section of this wonderful journey by air across the Pacific Ocean was made between Hawaii and the Fiji Islands, a distance of 3,144 miles.

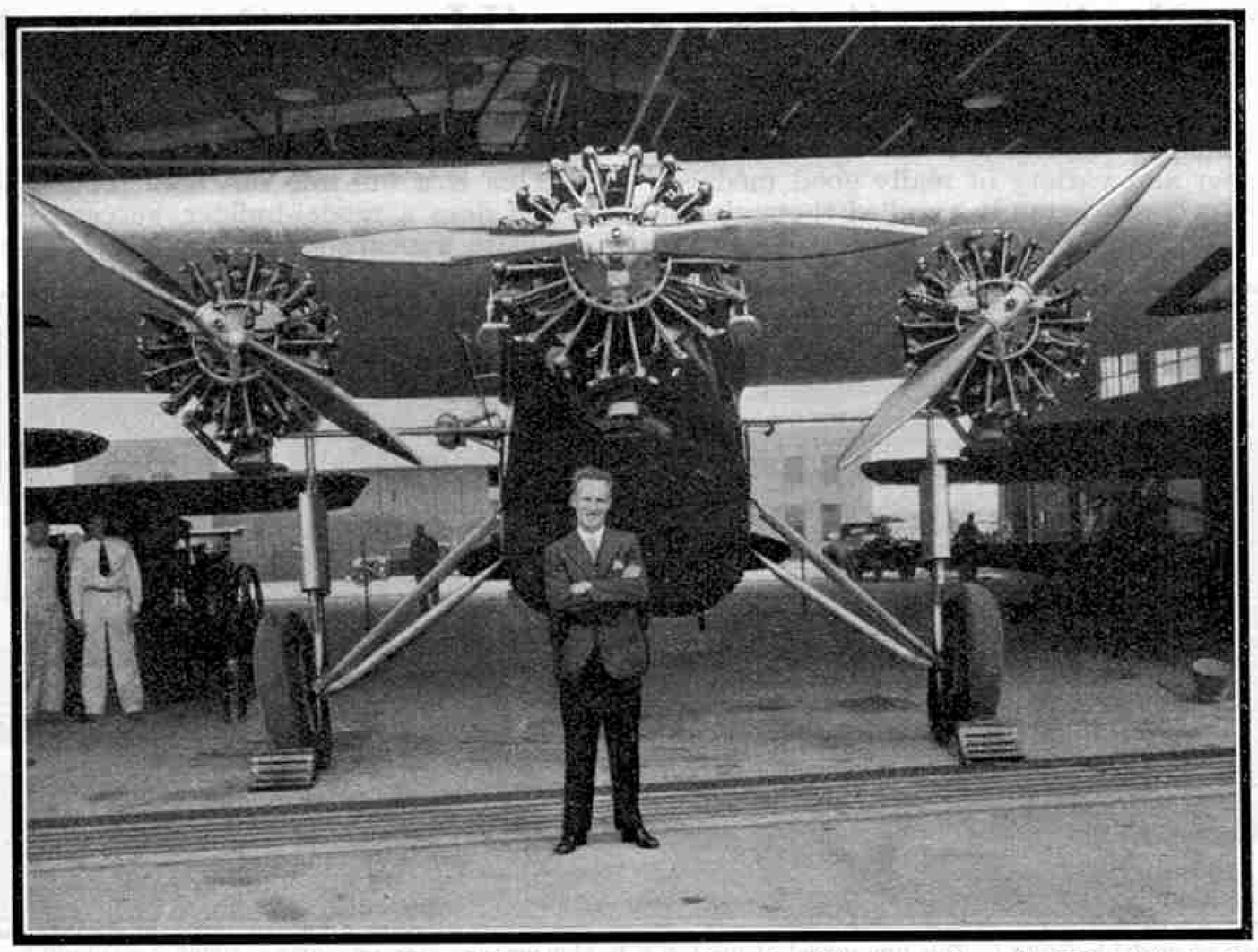
This achievement was followed by non-stop flights from Melbourne to Perth and from Perth to Sydney, the distances covered in these being 2,000 and 2,500 miles respectively, and a successful effort to fly from Australia to New Zealand and back. The "*Southern Cross*" was the first aeroplane to cross the Tasman Sea. On the outward journey the distance of 1,425 miles was covered in 14 hours, but the return flight occupied 22 hours.

The next achievement of the "*Southern Cross*" and its now famous pilot was to fly from Australia to England in the record time of 13 days, 23 hours, and in June, 1930, the machine was successfully piloted from Portmarnock, near Dublin, across the Atlantic Ocean to Harbour Grace, Newfoundland. From there Kingsford Smith flew to New York and eventually reached San Francisco, the starting point of his flight across the Pacific in 1928.

In recognition of his great feat Kingsford Smith was promoted to Wing Commander in the Royal Australian Air Force. He immediately proceeded to break yet another record, for in an Avro "Avian" that he named the "*Southern Cross Junior*" he flew from England to Australia in the astonishingly short time of 10½ days, thus reducing the record time of 15½ days taken by Lieutenant Hinkler two years earlier. Promotion to the rank of Air Commodore followed, and now the famous pilot has become interested in the establishment of air lines in Australia.

* * * *

Squadron-Leader A. H. Orlebar, A.F.C., has been appointed to take administrative charge of the British team for the Schneider Trophy Contest, but he will not act as pilot of one of the machines in the actual contest.



Wing Commander Kingsford Smith and his famous monoplane, the "Southern Cross." This photograph was taken at Croydon Aerodrome at the conclusion of the aviator's flight from Australia to England.

African Light Aeroplane Flight

During an excellent flight round Africa, made a short time ago by three Italian airmen, a distance of 17,150 miles was covered in 35 flying days. The flight was made in three Fiat A.S.2 high-wing monoplanes fitted with 90 h.p. Fiat A.50 engines.

The flight commenced at Rome, and outward to Cape Town was made by way of Tripoli, Cairo, Luxor, Khartoum, Nairobi, Bulawayo and Pretoria. The return journey was made via Luderitz Bay, Loanda, Libreville, Lagos, Dakar, Villa Cisneros, Casablanca, Tunis and Naples to Rome.

On one occasion a landing had to be made on swampy ground, and one of the machines was slightly damaged. This was the only time throughout the flight that any trouble was experienced.

Signor Francis Lombardi, one of the pilots taking part in the flight, has carried out several excellent flights in the Fiat light aeroplane during recent years, the most notable ones being from Rome to Mogdishu in Italian Somaliland, and from Vercelli in Italy, to Tokio.

THIS MONTH'S AIR STORY

Pilot (to passenger, after very daring nose-dive): "I'll bet 50 per cent. of the people down there thought we were going to crash!"

Passenger: "50 per cent. of the people up here did, too!"

Seaplane Altitude Record

A new altitude record for light aeroplanes has been set up by M. Vercruyse, who attained a height of 13,120 ft. in a Mauboussin light monoplane equipped with a British A.B.C. "Scorpion" engine developing 40 h.p. It is interesting to note that this machine is the seaplane version of the aeroplane in which M. Fauvel set up four world's records in the class for single-seater aeroplanes under 440 lb. in weight. These were for duration, height and distance covered.

New Range of Bristol Engines

A new range of engines has been produced by the Bristol Aircraft Company. It is known as the Bristol "Mercury" series, and the engines are of the 9-cylinder radial air-cooled type. The new engines are intended for service in aircraft specially designed to carry them. They have been subjected to numerous flight tests in various types of machines, and have successfully completed the Air Ministry's 100-hour type test.

An important feature of the new series is that the engines in it are constructed on the unit system, the many components of several types being interchangeable. Gas and inertia starting gear are fitted to them in addition to engine-driven petrol pump units with built-in relief valves, automatic ignition control to the magnetos and automatic boost control. Subsidiary drives are provided for the oil centrifuger, the electrical generator unit and other equipment.

The most powerful of the engines are the Bristol "Mercury" VIIa and VIIb types. These have a normal engine speed of 2,000 r.p.m. and at sea level develop 560 b.h.p. with engine running normally. At 4,000 ft., at which altitude they have been designed to function most economically, they develop 555 b.h.p. while the maximum output at that height is 570 b.h.p. Their fuel consumption is 41 gallons per hour, while they weigh 995 lb.

Autogiros for Fire Fighting

The Chief Fire Warden of the State of New Jersey has been interested in demonstrations of the use of the Autogiro for aerial fire fighting purposes, and if further tests to be carried out with the machine are completed to his satisfaction, it is probable that a fleet of these machines will be ordered for work in this connection.

The Naval Authorities of the United States consider that the Autogiro should be of great value for work in co-operation with sea-going ships not fitted with the necessary launching and landing apparatus to enable aeroplanes of the ordinary type to operate from them. They have therefore purchased an American-built Cierva Autogiro machine, equipped with a 300 h.p. Wright "Whirlwind" engine, for experimental purpose, and this will be subjected to a series of exhaustive trials and tests.

Experiments with Autogiros also are being carried out in this country, and the de Havilland Company have started work on an "Autogiro Puss Moth." Short Bros. Ltd., are also at work on an experimental Autogiro flying boat as a result of information gained from experience with an Autogiro seaplane last year. Two seaplanes of this type have been purchased by the French Government for service with the French Navy.

Results of Meccano Model-Building Contests

By Frank Hornby

"Christmas" Contest (Home Sections)

ON looking through the entries in the Home Sections of the "Christmas" Model-building Contest, I was greatly impressed with the number and variety of really good models submitted. Home competitors have certainly excelled themselves this time!

The names of the prize-winners are as follows:—

Section A (for competitors over 14 years of age).

FIRST PRIZE, cheque for £3-3s.: R. S. Miller, Newark, Notts. SECOND PRIZE, cheque for £2-2s.: Eric Whalley, Blackburn. THIRD PRIZE, cheque for £1-1s.: J. H. Wilkins, Clapham Common, S.W.11.

SIX PRIZES of Meccano goods, value 10/6: L. F. Atkinson, Addiscombe, Croydon; R. Byers, Worsbro' Dale, near Barnsley; E. Hemery, Cirencester; J. F. Huson, Upper Norwood, London, S.E.19; L. A. Mathews, Portarlington, I.F.S.; J. P. Smith, King's Lynn.

SIX PRIZES of Meccano goods, value 5/-: D. A. Bassil, Kingston; G. Hollis, Normanton; G. Leach, Heeley, Sheffield; A. C. Rose, Birmingham; R. C. Read, Southsea; J. K. Wheatley, Claygate, Surrey.

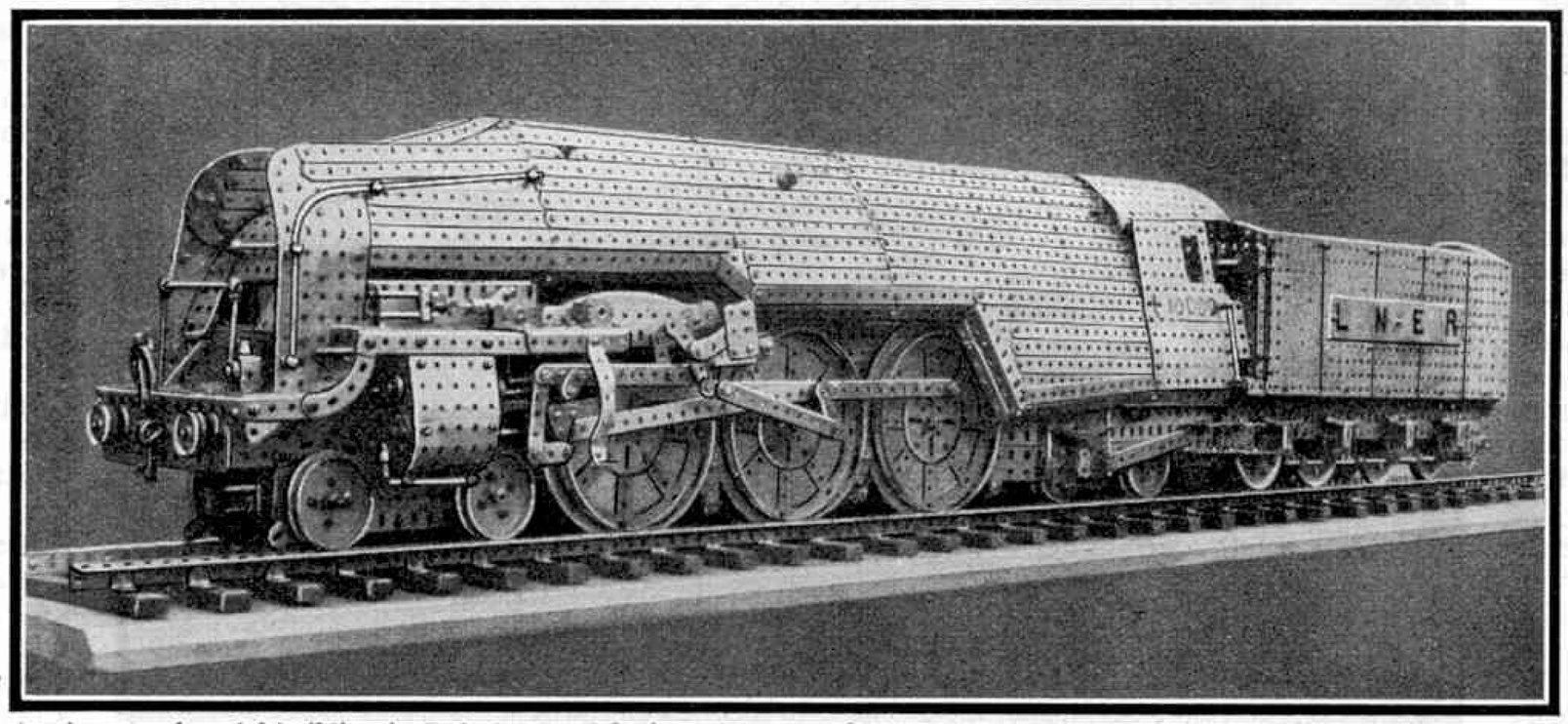
TWELVE PRIZES of an Engineer's Pocket Book: E. Brammer, Armley, Leeds; M. R. B. Blackmore, Wellington, Somerset; M. Edmondson, Waltham; E. Evans, Swinton, Manchester; A. Farr, Raveningham, Norfolk; R. Haylett, Loughton, Essex; R. C. Jensen, Grimsby; W. Lee, London, S.W.11; E. E. Reed, Gourock, Renfrews.; F. West, London, E.11; E. Whatley, New Moston, Manchester; J. A. Willman, Dumfries.

Section B (for competitors under 14 years of age).

FIRST PRIZE, Meccano goods, value £2-2s.: W. G. Tinney, Bishop's Stortford, Herts. SECOND PRIZE, Meccano goods, value £1-1s.: A. M. Campbell, Exmouth. THIRD PRIZE, Meccano goods, value 10/6: D. Eldridge, Stowmarket, Suffolk.

SIX PRIZES of Meccano goods, value 5/-: F. W. Hole, Taunton; K. Harrison, Twickenham; A. LeClaire, Worksop; G. Mitsotakis, Kingston Hill; F. Munro, Sheffield; P. Robson, Cardiff.

TWELVE PRIZES of a copy of "*Famous Trains*" by C. J. Allen: J. Bowers, Hill Top, Wilmslow; L. Harrison, London, N.W.1; J. Stuart Harris, Highams Park, London, E.4; A. Kirk, Leslie, Fife; T. Linacre, Edge Hill, Liverpool; R. Lamming, Edgware; S. May, London, E.2; Norman Parker, Birmingham; B. W. Sloane, S. Croydon; L. Stear, Bristol; G. Robert Woollett, Yalding, near Maidstone; P. M. Worfolk, Caterham Valley, Surrey.

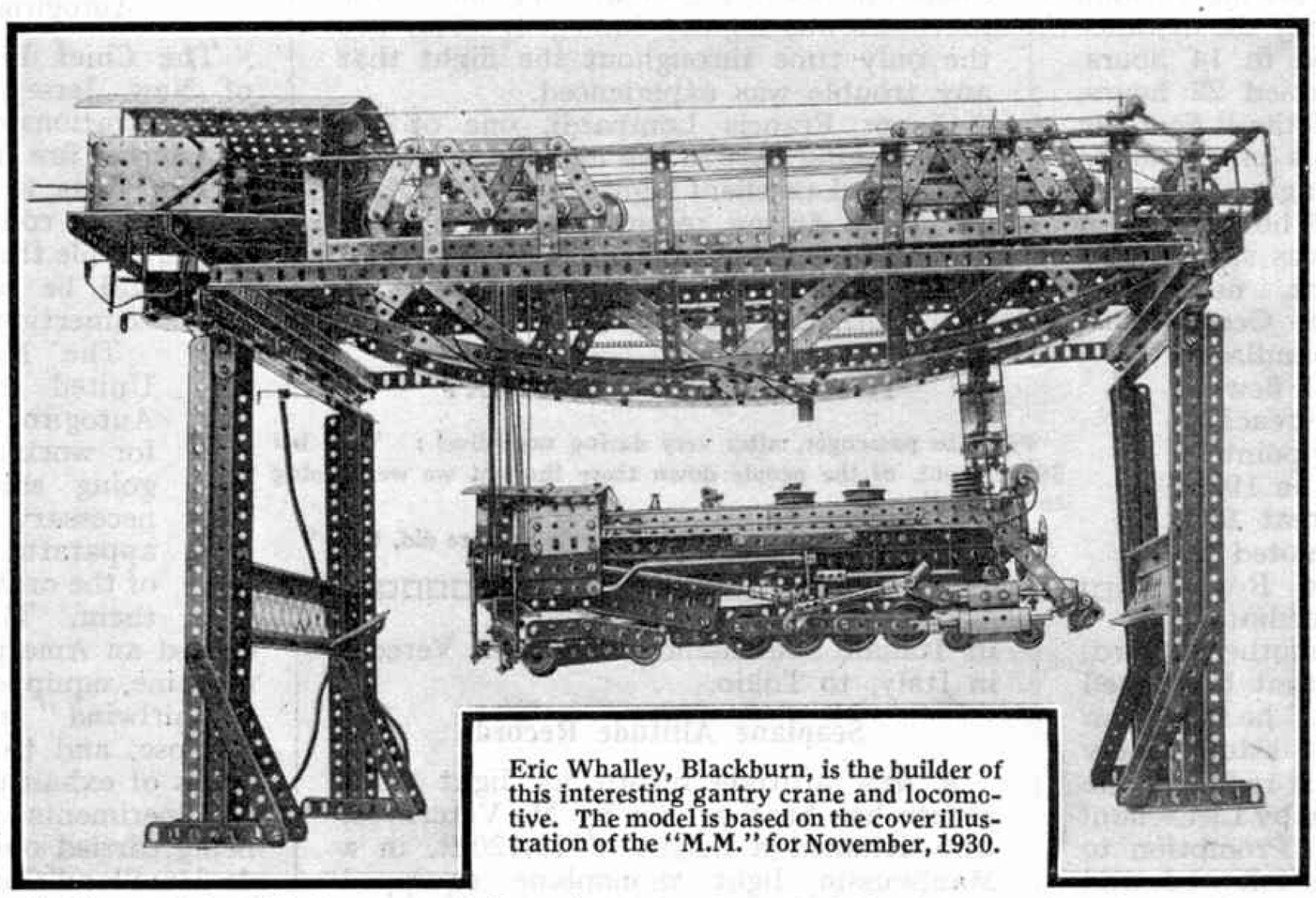


A triumph of model-building! This fine model of the L.N.E.R. high pressure locomotive "No. 10000" was built by Mr. R. S. Miller, Newark. It realises to a high degree the power, grace and dignity of the actual engine. Note particularly the valve gear and the fine modelling of the boiler casing.

In almost every Meccano Contest one or two models are submitted that are of such remarkable construction and design that they stand out boldly even among a host of well-built models. To explain my meaning I would refer readers to the accompanying illustration of the L.N.E.R. high-pressure locomotive "No. 10000," which won the largest prize for Mr. R. S. Miller, in the "Christmas" Contest.

This is a fine model, clean, bold and well proportioned. Not often does a model-builder succeed in securing such a solid and realistic appearance. Mr. Miller is an expert builder of model locomotives, and his skill in this field has brought him success in previous Meccano Contests, notably the Grand £100 Contest, organised in 1928. Those who are able to do so should turn to page 391 of the "*M.M.*" for May, 1929, where they will find illustrated a splendid model of the "*Flying Scotsman*," with which Mr. Miller won his prize in the £100 Contest.

Reverting to the model locomotive "No. 10000," I wish to mention particularly the neat manner in which the boiler, smoke-box and fire-box are constructed. The outer casings of these portions are composed of Strips secured to transverse stiffening ribs, which are shaped to follow the contour of the actual engine. Four cylinders and steam-chests are provided, the outside cylinders, which represent the low-pressure cylinders of the actual engine, being built up from Bush Wheels and Double Angle Strips. Piston valves are represented by 1" Pulleys. The high-pressure inside cylinders are similarly constructed, and are located above the front bogie axle where they are bolted to the frame.

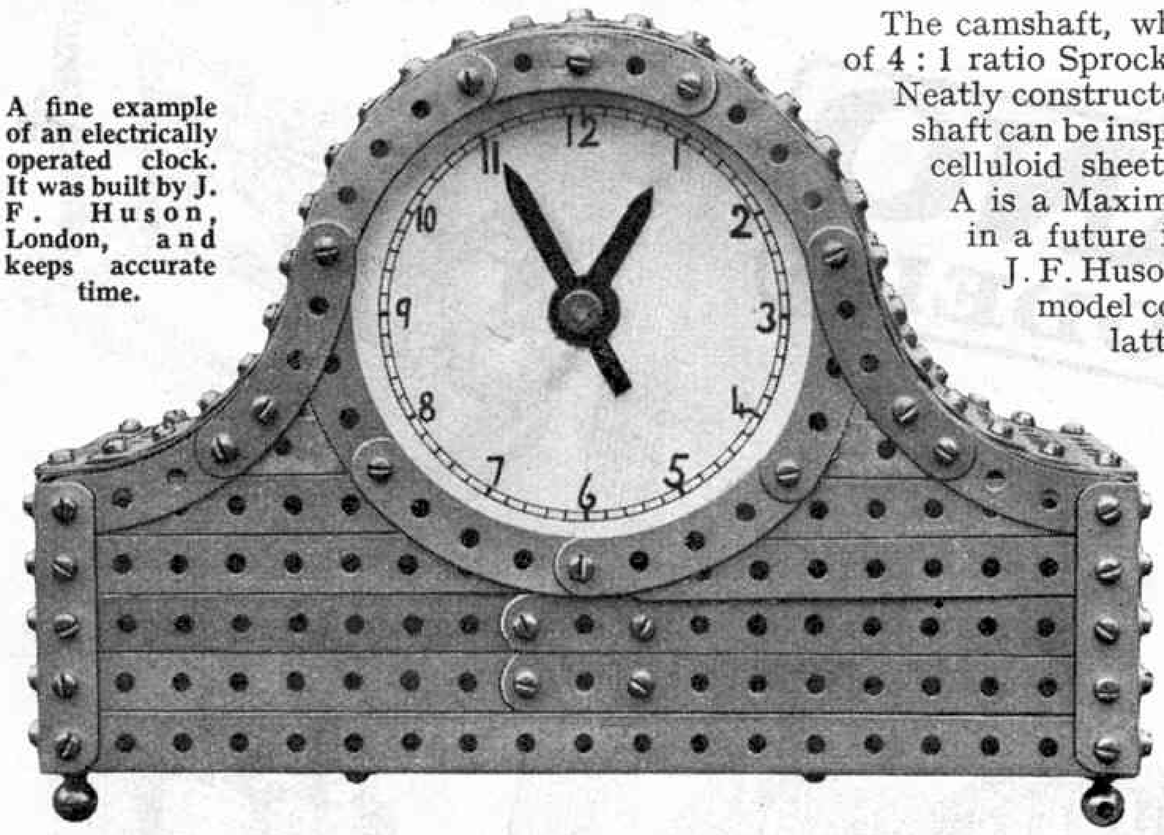


Eric Whalley, Blackburn, is the builder of this interesting gantry crane and locomotive. The model is based on the cover illustration of the "M.M." for November, 1930.

Gresley-Walschaerts valve gear is used for operating the valves on the four-cylinder compound principle, the inside cylinder valve spindles being operated through levers (Double Arm Cranks) connected by short links to the radius rods of the outside cylinders. Screw-operated brakes, worked from the cab, are fitted to the driving wheels; and handrails, lamps, brackets, "pop" valves, whistle, drawgear, footsteps and vacuum pipes are other items included in the fittings.

Some idea of the enormous amount of work and patience necessary to build the model may be gained from the fact that over 74 dozen nuts and bolts are used in its construction!

Although it is hard to find fault with the model, there are one or



A fine example of an electrically operated clock. It was built by J. F. Huson, London, and keeps accurate time.

two minor details that do not exactly follow the actual engine. For example, the balance weights on the main driving wheels are omitted, though this fact is not apparent at a first glance. The front handrail, after curving over the smoke-box, should resume a position parallel with the engine frame.

A photograph of the actual engine appears on page 102 of the February, 1930 "*M.M.*," and shows clearly that the boiler is "banded" in eight places. These bands are absent from the model and could have been represented quite easily by means of carefully bent Strips bolted round the boiler. The 3½″ Angle Girder that slopes down over the rear driving wheel, would be better reversed, so that its round holes appear on the outside instead of the elongated holes, thus preserving the "clean" edge of the boiler.

I was particularly glad to note among the entries in this Contest several models that have been copied from illustrations in recent issues of the "*M.M.*" One of these models won Second Prize for Eric Whalley. It is shown here, and it will be seen that he has produced with remarkable fidelity the fine gantry crane and C.N.R. Locomotive that formed the cover subject of the "*M.M.*" for November, 1930. The model was highly commended by C.N.R. officials to whom it was shown, and I think all readers will admit that Whalley has every right to be proud of his handiwork.

The large girder of the crane, from which the locomotive is suspended, is constructed from Angle Girders, Flat Girders and Flat Strips, as follows. First, two 24½″ Angle Girders are bolted side by side to two 12½″ Flat Girders. Then two 12½″ and one 3½″ Flat Girders are bolted together in one length, and the compound girder thus formed is bolted in turn, in the form of a bow, to each end of the 24½″ Angle Girders. This bow-piece is then strengthened by a number of 2½″ Flat Strips. Two of these built-up girders are placed side by side, 5½″ apart, and are connected at their ends by means of Angle Girders, Plates, and Strips.

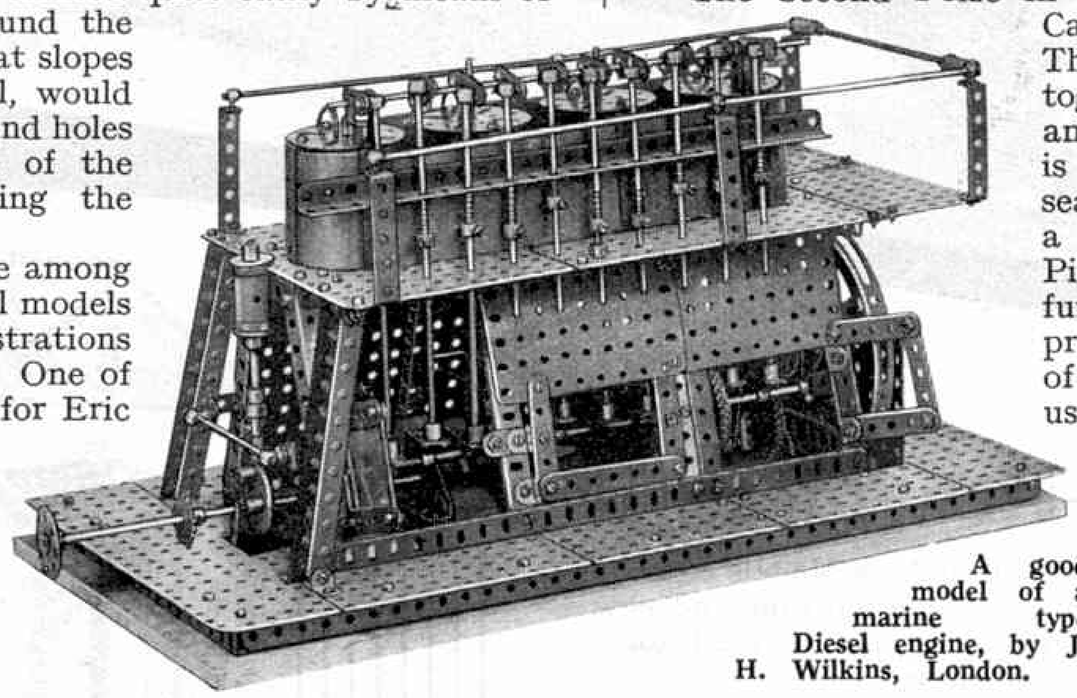
The crane is driven along the gantry by an Electric Motor and runs on six large Flanged Wheels.

At one end of the crane girder is situated the gear-box and winding apparatus, which controls all the mechanical movements of the model.

The model C.N.R. engine is of the 4–8–4 type. The boiler is made from three 5½″ × 3½″ Flat Plates, and a 5½″ Flat Girder bolted to an Angle Girder forms the running board. The chimney stack is built up from four 1″ loose Pulley Wheels bolted to the top of the smoke-box. The cylinders and valve-chests are constructed from Sleeve Pieces and Chimney Adaptors.

The model is driven by a 6-volt Electric Motor, the current being conveyed to the Motor by two wires insulated from each other and also from the model.

Another of the accompanying illustrations shows a realistic model of a four-cylinder marine Diesel engine, built by J. H. Wilkins, for whom it secured the Third Prize in Section A. A good feature of the model is the neat construction of the valve tappets, which are represented by Cranks, and operate 8″ Rods forming the "push-rods." Compression Springs return the valves to the closed position, the extent of their movement being adjustable.



A good model of a marine type Diesel engine, by J. H. Wilkins, London.

The camshaft, which operates the valves, is driven from the crankshaft by means of 4 : 1 ratio Sprocket gearing. Another item of interest is an imitation air compressor. Neatly constructed inspection windows are provided in the crankcase so that the camshaft can be inspected while in operation, the windows being enclosed with transparent celluloid sheet. One of the best of the smaller prize-winning models in Section A is a Maxim gun, submitted by J. P. Smith. As I hope to refer to this model in a future issue of the "*M.M.*," I do not intend to describe it here.

J. F. Huson sent in a good model of an electrically-controlled clock. The complete model consists of a "master" clock and a "slave" clock, and two views of the latter are shown herewith. Unfortunately, I am unable to illustrate the master clock, and since its working is rather complicated it is of little use trying to describe the mechanism. It must suffice to say that the master clock is fitted with a long pendulum, which, when set swinging, operates electrical contacts that permit an electric current to flow intermittently through the windings of electro magnets fitted in the slave clock. The electro magnets actuate a lever carrying a Pawl that engages the teeth of a Ratchet on the spindle of the main gear train of the clock. When the magnets are energised by an impulse from the master clock, the lever is pulled downward so that it rocks about its pivot. On the electro magnets becoming de-energised the lever returns, under its own weight, to its normal position, and in so doing the Pawl drives the Ratchet Wheel round one tooth, thus actuating the gear train of the clock.

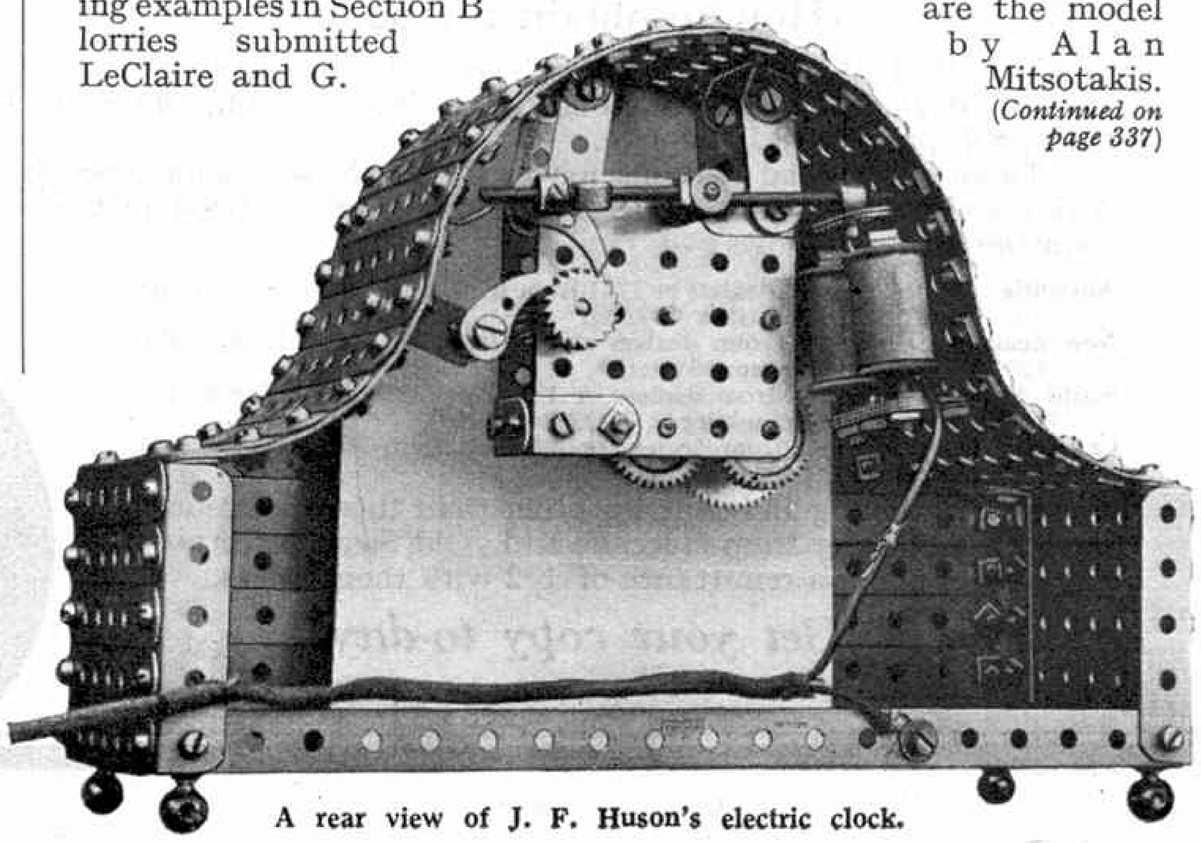
W. G. Tinney secured First Prize in Section B. His model represents a type of haulage tractor driven by an internal combustion engine, but in the model the latter is replaced by a Meccano Electric Motor, which is cleverly built into the model and supplies the drive to the rear road wheels. A two-speed gear-box provides ratios of 280 : 1 and 1,000 : 1 between the Motor armature and the rear axle, and in top gear the tractor can haul two boys of average weight. In bottom gear three boys can be hauled with ease.

The Second Prize in Section B was awarded to Angus M. Campbell, for his model of a minelayer. The hull of this interesting vessel is well put together with Strips and Angle Girders, and Flat Plates form the deck. The model is equipped with fore and aft guns and a searchlight, the last being represented by a Flanged Wheel fitted in a Small Fork Piece. Meccano Boilers are used for the funnels, and with the sides slightly compressed they are in keeping with the scale of the remainder of the model. A novel use is found for Meccano Sprocket Chain, which is utilised for the shrouds and ratlines. The bridge and deck-houses are neatly built up from Plates and Strips, but the deck-houses are rather too large in proportion to the rest of the model. A more satisfactory result would have been obtained if Flat Girders and Strips had been used.

Another interesting ship is the cargo steamer submitted by David Eldridge. The neatness of design and construction of this entry contributed largely to its success, but considering that most of the parts used are to be found in a No. 3 Meccano Outfit, the model is an excellent example of what can be done with a few parts, a little ingenuity, and perseverance.

Motor vehicles are always popular subjects with Meccano model-builders, but the "Christmas" Contest produced an unusually large number of entries of this nature. Outstanding examples in Section B are the model lorries submitted by Alan LeClaire and G. Mitsotakis.

(*Continued on page 337*)



A rear view of J. F. Huson's electric clock.

New Models—New Ideas

The 1931 edition of the Meccano Book of New Models consists of no less than 40 pages of new models, new mechanisms and new ideas, as compared with only 24 pages in all previous editions. Every Meccano boy should obtain a copy **now!**

The principal object of this book is to keep Meccano model-builders in touch with the latest improvements and developments connected with their hobby. The book contains illustrations and details of the best of the new models and new movements submitted in recent competitions, together with many others that have been designed by our own experts. The models shown in this book are of outstanding interest and variety. They range from simple models that can be built with small Outfits to elaborate types that will appeal to older boys.

How to obtain the book

The 1931 Book of New Models may be obtained from any Meccano dealer, price 9d., or direct from Meccano Ltd., Old Swan, Liverpool, price 10½d. post free.

There are special editions for Australia, New Zealand, South Africa and Canada and details of the prices of the book in these countries are as follows:—

Australia: Price 1/9 from dealers or 1/11 from E. G. Page & Co., 52, Clarence Street, Sydney. (P.O. Box 1832K).
New Zealand: Price 1/- from dealers or 1/2 from Models Ltd., P.O. Box 129, Auckland (Kingston Street).
South Africa: Price 1/- from dealers or 1/2 from Arthur E. Harris, 142, Market Street, Johannesburg. (P.O. Box 1199).
Canada: Price 25 cents from dealers or 30 cents from Meccano Ltd., 34, St. Patrick Street, Toronto.

Readers living in countries other than those mentioned above should order from Meccano Ltd., Old Swan, Liverpool, England, sending a remittance of 1/2 with their orders.

Get your copy to-day!

More Splendid Prizes for Model-Builders

No. 1 and No. 6 "Outfits" Contest

Cheques, Meccano Goods and Books for New Models

THIS month we announce the fourth of the 1931 series of "Outfit" Contests. In this Contest the Prizes listed in the centre of this page are offered for the "Best Models Made Entirely from Either a No. 1 or a No. 6 Outfit." Any type of model may be submitted in the Competition, provided that it is the competitor's own unaided work, both in design and construction. Model-builders who possess larger Outfits may of course compete, provided that in building their models they use only those parts contained in the No. 1 or the No. 6 Outfits respectively.

Entries will be divided into the following Sections. Section A, for models built entirely from the parts contained in No. 1 Outfits, by competitors living in the British Isles. Section B, for models built entirely from No. 6 Outfits, by competitors living in the British Isles. Section C, for models built from No. 1 Outfits, by competitors living overseas. Section D, for models built from No. 6 Outfits, by competitors living overseas. Each Section is open to readers of all ages.

Competitors may submit both a No. 1 Outfit model and a No. 6 Outfit model if they wish, but no competitor can win more than one prize in this contest.

Suitable prize-winning models will be illustrated in the "*M.M.*," and also will be included in new editions of the Meccano Manuals of Instruction.

The closing dates for this competition are as follows :—Home Sections, A and B, 30th May, 1931 ; Overseas Sections, C and D, 31st July, 1931. Entries received after these dates will be disqualified.

Full lists of the prize-winners will be published in the "*M.M.*" as soon as possible after the closing dates, and winning competitors will also be notified by letter immediately the judge's decisions are known.

The Prizes

The following Prizes will be awarded in each of the Sections B and D.

First Prize : Cheque for £3-3s.
Second Prize : Cheque for £2-2s.
Third Prize : Cheque for £1-1s.
Six Prizes of a Cheque for 10/6.
Six Prizes of Meccano goods, value 5/-.
Twelve Prizes of "Famous Trains" by C. J. Allen.

The following Prizes will be awarded in each of the Sections A and C.

First Prize : Meccano goods, value £2-2s.
Second Prize : Meccano goods, value £1-1s.
Third Prize : Meccano goods, value 10/6.
Six Prizes of No. 1a Accessory Outfits.
Six Prizes of Complete Bound Instruction Manuals.
Twelve Prizes of Meccano Engineer's Pocket Books.

Important Instructions

Readers should send in clear photographs or good drawings of their models, together with any explanations that may be necessary, although the latter should be made as brief as possible. Each entry must be accompanied by a complete list of the parts contained in the model. Actual models must not be sent. The competitor's name and address must appear on the back of each photograph or sheet of paper used, together with his age, and the name of the contest ("No. 1") or ("No. 6") "Outfit" Contest. Envelopes should be addressed to "Outfit Contest," Meccano Ltd., Old Swan, Liverpool.

A full list of the parts in the No. 6 Outfit will be found in the No. 4-7 Instructions Manual.

The parts contained in the No. 1 Outfit are :—4 of No. 1 ; 8 of No. 2 ; 1 of No. 3 ; 9 of No. 5 ; 5 of No. 10 ; 2 of No. 11 ; 8 of No. 12 ; 3 of No. 16 ; 2 of No. 17 ; 2 of No. 18a ; 1 of No. 19s ; 4 of No. 19b ; 4 of No. 22 ; 1 of No. 23 ; 1 of No. 24 ; 1 of No. 34 ; 8 of No. 35 ; 1 of No. 36 ; 36 of No. 37 ; 6 of No. 37a ; 8 of No. 38 ; 1 of No. 40 ; 1 of No. 44 ; 1 of No. 48 ; 6 of No. 48a ; 1 of No. 52 ; 2 of No. 54 ; 1 of No. 56a ; 1 of No. 57 ; 4 of No. 90a ; 2 of No. 100 ; 6 of No. 111c ; 2 of No. 125 ; 2 of No. 126 ; 2 of No. 126a.

Meccano "Bridge-Building" Contest

Bridges provide some of the most wonderful and beautiful examples of modern engineering construction, and at the same time they are particularly suitable for reproduction in Meccano, not only in their general plan, but also to a great extent in the details of their design. In order to draw attention to the possibilities of Meccano in this direction we announce this month a special "Bridge-building" Competition, in which splendid prizes are offered for good models.

Competitors may choose any type of bridge they like. They may reproduce as far as possible some particular bridge with which they are familiar, or they may create a design of their own. The range of choice is extremely wide, including cantilever, arch, suspension and girder bridges, in addition to the more complicated transporter, rolling, swing and lifting bridges. Meccano models of any type will be accepted.

Competitors must send in either photographs or drawings of their models, together with any explanatory notes that may be necessary. Actual models must not be sent. Any size of Outfit or number of parts may be used.

Entries will be divided into the following Sections. Section A, for Competitors living in the British Isles ; Section B, for competitors living outside the British Isles. Competitors' ages will be taken into consideration when judging the entries.

Prizes will be awarded for the best entries *from each Section* as follows :—First Prize, cheque for £3-3s. Second Prize, Meccano goods to value £2-2s. (to be chosen by the competitor). Third Prize, Meccano goods to value £1-1s. Ten Prizes, each consisting of Meccano goods to value 10/6. Ten Prizes, each consisting of a Complete Bound Instructions Manual, value 7/6. Ten Prizes, of "*Famous Trains*" by C. J. Allen.

Closing date for Section A, 30th May, 1931 ; Section B, 31st July, 1931.

Each competitor must write his age, name and address on the back of his entry. Envelopes should be addressed to "Bridge" Competition, Meccano Ltd., Old Swan, Liverpool.

Suggestions Section

Edited by "Spanner"

The ideas printed in the "Suggestions Section" should prove a real help to thousands of Meccano enthusiasts. Often we receive letters from readers who describe how they have solved some knotty problem or evolved an interesting model after studying some of the ideas that have appeared. We shall always be pleased to receive further contributions for the "Suggestions Section." Cash payments are made for all Suggestions published (excluding those mentioned in the "Miscellaneous" Suggestions column). Contributions should be accompanied by clear photographs or drawings and should be addressed to "Spanner," c/o The "Meccano Magazine."

(226)—Two New Types of Meccano Levers

(S. Heatherington, Bognor Regis, and F. Butement, London)

In its simplest form, a lever consists of a rod, one point of which is fixed, while pressure applied at some other point in it is balanced by a force operating at a third position. A wheelbarrow is an excellent example. In this the load in the barrow is lifted by means of forces applied at the handles. These are applied at points further away from the fulcrum, or fixed point, than the load, and the force necessary is therefore less than the weight lifted. A pair of nutcrackers forms an instance of a double lever of this kind, a comparatively small force applied at the ends of the levers breaking open the shell of a nut placed between them and nearer the hinge or fulcrum.

Practically every machine includes levers of some kind. Thus in a motor car levers are employed to apply the brakes. The models in Figures 226 and 226a show how they may be used for this purpose on model cars, and the levers shown may be used also for operating signals or points on a model railway. Both types of levers are fitted with locking devices by which they may be locked in any desired position. Particular attention should be paid to the latter point, as it is one of great importance to Meccano boys.

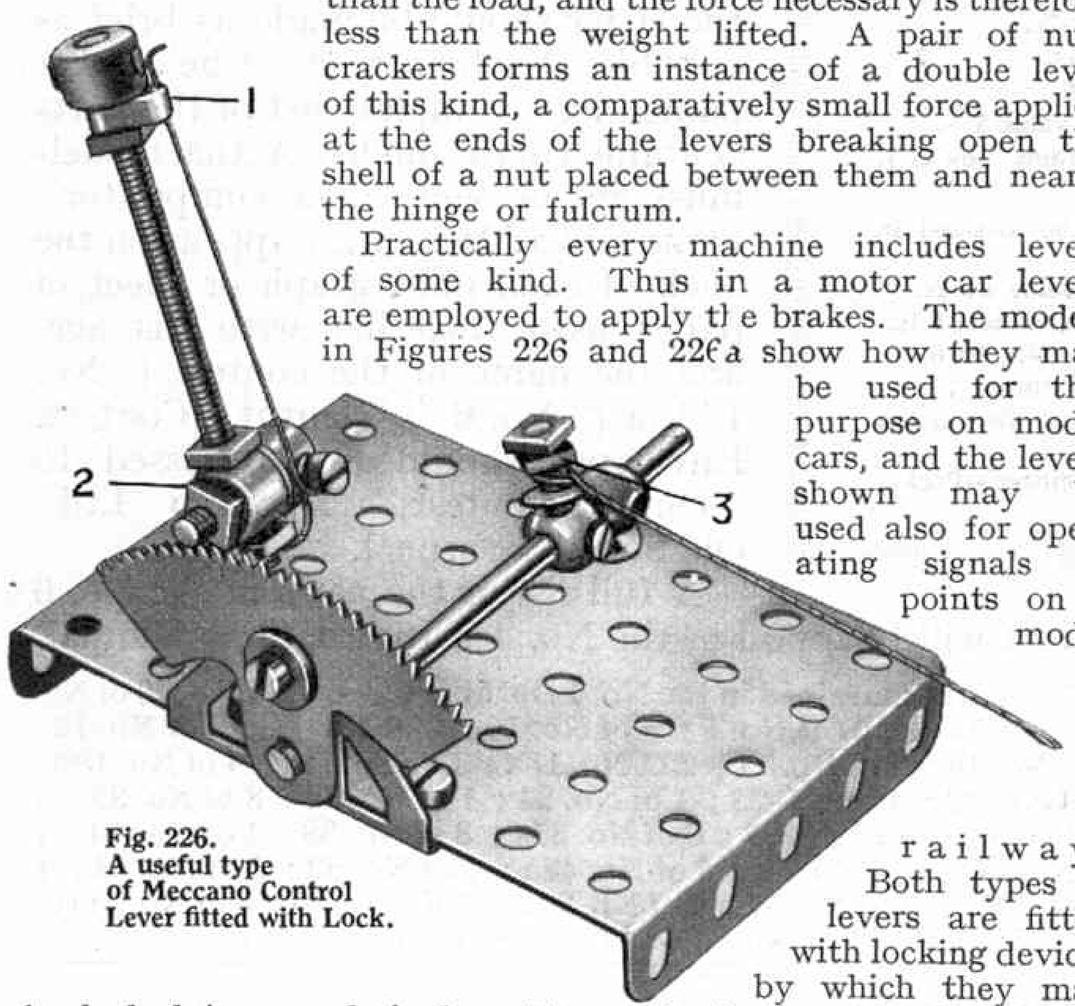


Fig. 226. A useful type of Meccano Control Lever fitted with Lock.

There are, of course, other examples of lever locks in Meccano; for instance, the gear change levers in the Meccano Breakdown Crane (Special Instruction Leaflet No. 30). The two 2½″ Strips comprising the levers are mounted pivotally in the lever frame. A round-headed Set-screw secured near the top of each lever, locates in the holes of a 2½″ small radius Curved Strip forming the top of the lever frame. The lever thus may be locked in three definite positions, so that the gears are always held in correct engagement.

Another method in which a lever may be restrained from free movement is as follows. The Rod on which the lever is secured, and which therefore forms the pivot, has mounted on it one or more Spring Clips. The arms of the Clips press against a ½″ × ½″ Angle Bracket fixed immovably to a fixed portion of the model, so that the Clip is restrained from rotation and the Rod is forced to turn in the Clip. Such a device does not, of course, provide positive locking of a lever, as in the previous example or in those illustrated; but it has the advantage of neatness and extreme simplicity. The two forms of levers with locking devices forming the subjects of the accompanying illustrations strike a distinctly original note, and will, we feel sure, prove interesting to a large number of our readers.

The lever depicted in Fig. 226 is the work of S. Heatherington and it consists of a 2″ and a 1″ Screwed Rod, screwed partly into the opposite tapped holes of a Collar. A second Collar on the lower end of the 1″ Screwed Rod, forms a means of attaching the lever to a transverse Rod carrying a Handrail Support 3. Both Collars are locked in position on their respective Rods by lock-nuts, care being taken to see that the ends of the Rods do not obstruct the bores of the Collars.

The shank of a Threaded Pin 2 is inserted in the bore of the Collar and a Collar is then secured to its end. A Set-screw, inserted in the tapped hole of the second Collar, has attached to it a short length of fairly stout gauge wire, a portion of which is passed through a guide 1 composed of a Dredger Bucket Clip, and bent over to form a convenient handle.

The squared portion of the Threaded Pin acts as a ratchet by engaging the teeth of the Rack Segment in the manner shown in the illustration. When it is desired to release the lever, the wire handle is pulled upward, an action that rotates the Threaded Pin and in so doing disengages the latter from the teeth of the Rack Segment. The Threaded Pin is retained in the normal position by a short length of Spring Cord attached to the fixed Collar and to the lever in a manner that may be seen from the illustration.

The second model, shown in Fig. 226a, is conceived on novel lines, for instead of Rack Segments being employed for a rack, two lengths of Sprocket Chain are used, one on each side of the lever. Each length of Sprocket Chain is carried on a pair of 2½″ small radius Curved Strips, and the Strips are attached by ¾″ Bolts to 1″ × 1″ Angle Brackets bolted to the base plate, the necessary spacing between each pair of Strips being supplied by Washers. In order to prevent the Sprocket Chain from slipping round the Curved Strips, it is clamped to the undersides of the Curved Strips by ½″ × ½″ Angle Brackets 2.

The lever is a 4½″ Strip to which a Flat Bracket is bolted. The Flat Bracket has attached pivotally to it an End Bearing, which carries in its boss a Centre Fork. Engagement or disengagement of the Centre Fork with the "rack" is effected by moving the wire 3 attached to a Set-screw in the tapped hole of the End Bearing. The lever is connected to the apparatus it is desired to work, by means of Loom Healds, one of which is attached to the brake lever by a bolt 1.

(227)—A Novel Scientific Model

An apparatus known as Boys' Rainbow Cup is very familiar in scientific circles, and many Meccano boys may wish to construct one in order to observe the beautiful effects produced by the device. As constructed by F. Brewin (Chesterfield), the apparatus is simplicity itself. It consists of a 1⅛″ Flanged Wheel that is mounted on a Rod capable of being rotated at a high speed by a hand wheel through suitable step-up gearing or by means of an Electric Motor. A soap film is stretched across the face of the "cup."

Centrifugal force causes the thickness of the soap film to vary with the speed of the cup, which gives rise to a number of concentric vari-coloured rings on the surface of the film. The positions and colours of the rings vary with the speed at which the Flanged Wheel is rotated.

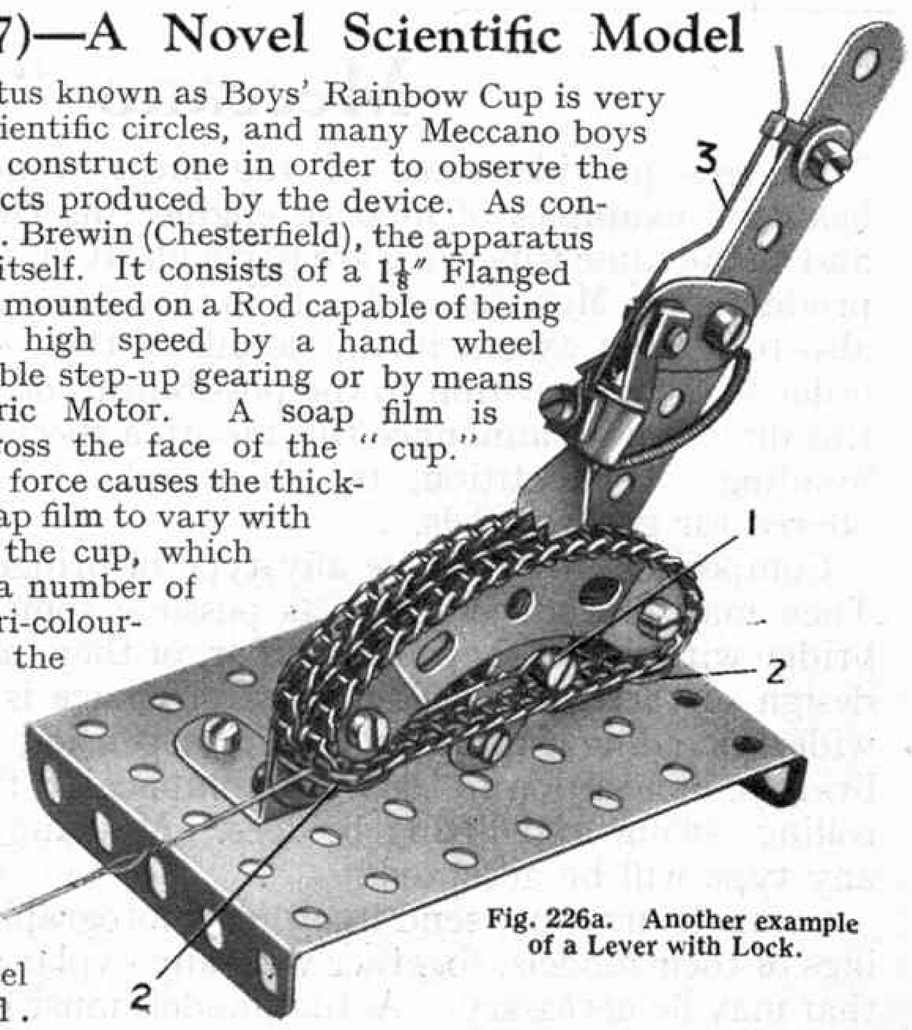


Fig. 226a. Another example of a Lever with Lock.

(228)—A New Crane Limit Switch

(R. Wertheim, London, N.W.6)

The device illustrated in Fig. 228 is intended for use in a Crane model to stop the Motor immediately the load touches the ground. This result is attained in the following manner. A 2″ Strip is pivoted at one end on a ⅜″ Bolt, which is lock-nutted to the jib member and is spaced from it by two Washers. The other end of the Strip carries a ½″ loose Pulley. The Pulley is mounted on a ⅜″ Bolt, which serves also to secure in place a ½″×½″ Angle Bracket 2. A ½″ Reversed Angle Bracket 1 is secured by means of an Insulated 6 B.A. Bolt to the jib, and a length of wire connects it to the accumulator, the other terminal of which is taken to the Motor. The remaining Motor terminal is "earthed" to the frame of the crane.

When the load is suspended on the crane hook the hoisting cord is taut, and the Angle Bracket and the Reversed Angle Bracket are held in intimate contact. As soon as the load touches the ground, however, the cord slackens, thus causing the switch to "open" and stop the Motor. When restarting the Motor, it is necessary to hold up the 2″ Strip until the hoisting cord becomes taut.

A better method is to connect a small push button switch between the Reversed Angle Bracket and the jib. By pressing the button an alternative path is provided for the current until the limit switch is making proper contact.

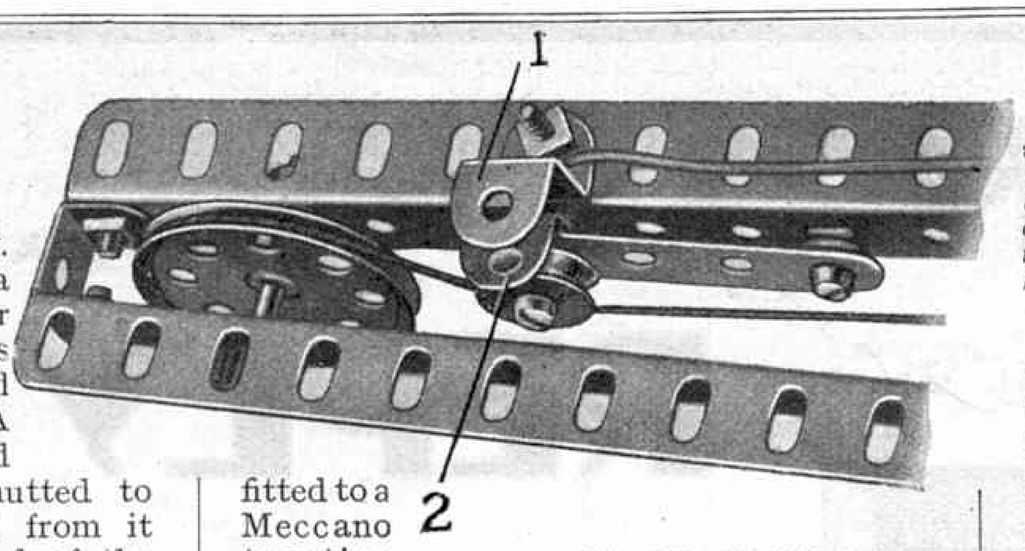


Fig. 228. Limit Switch.

(229)—Front Axle for Tractors

(L. Blithe, Winsford, Somerset)

As the front axles of heavy steam traction engines are invariably in one piece, and pivot about a central point, the stresses set up in the pivot pin when travelling over uneven ground are considerable. In order to obviate this undesirable factor, many vehicles of this type are fitted with front axles free to move vertically in every direction about the central point. An axle of this type fitted to a Meccano traction engine is undoubtedly a refinement that gives an added interest to the model, and such a device is shown in Fig. 229. The front axle itself is built up from two 3½″ Angle Girders bolted together to form a Channel Section, the Rods that carry the road wheels being journalled in Double Brackets. The central pivot is in two parts, a Handrail Support secured to the front axle, and a Socket Coupling, which is attached to the boss of a Double Arm Crank bolted to the underside of the boiler. The Handrail Support rests in the recess in the lower end of the Socket Coupling and is retained in place by two ½″×½″ Angle Brackets secured to the front axle, which engage with the groove in the body of the Socket Coupling when the axle is level. It will be found that this method allows the axle to move freely in every direction. Meccano model-builders will no doubt be able to find numerous applications for this principle.

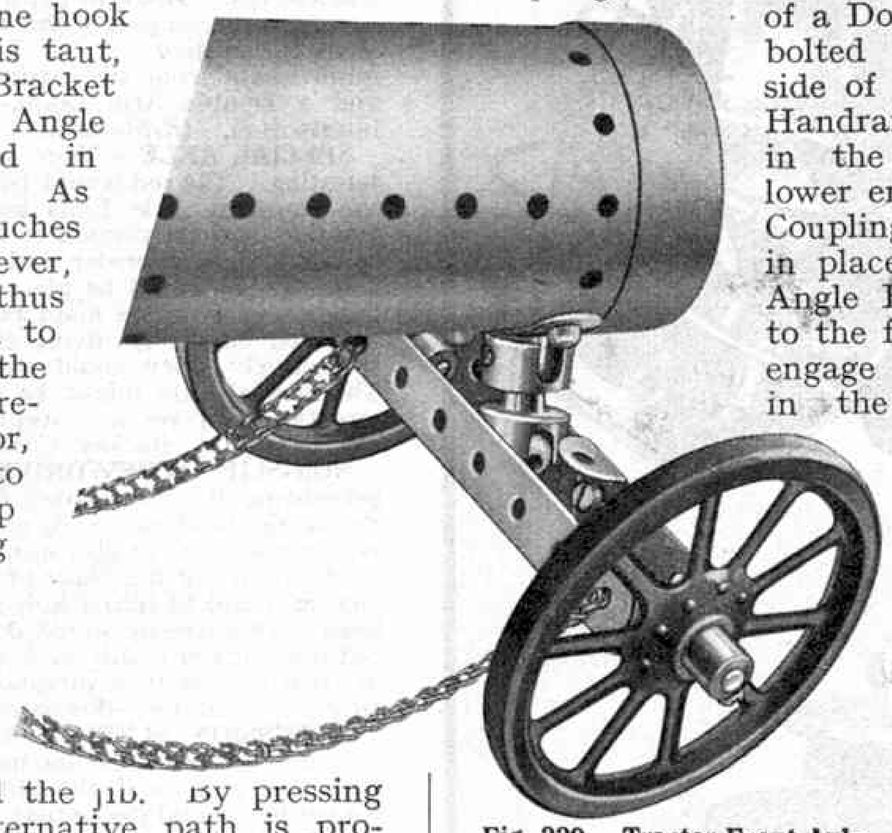


Fig. 229. Tractor Front Axle.

Fig. 230. An extremely neat model of a Screw Jack of the automobile pattern.

(230)—A Neat Screw Jack

(J. Shapley, Withycombe)

The extremely neat model illustrated in Fig. 230 is a typical example of a screw jack employed in connection with automobiles. The base of the Meccano model consists of a Flat Trunnion on which a Threaded Coupling is secured rigidly, with its tapped hole uppermost. A Crank Bent Strip is also secured to the Flat Trunnion, as indicated in the illustration, and this serves as a bearing for a short Rod carrying a Universal Coupling at one end and a ¾″ Contrate Wheel at the other. An Axle Rod is secured in the remaining portion of the Universal Coupling and its upper extremity is fitted with a handle for controlling the jack. The handle consists of a Collar having two Threaded Pins screwed into its tapped holes. The ¾″ Contrate Wheel meshes with a ½″ diam. Double-width Pinion which is secured on a 2″ length of Screwed Rod. The Screwed Rod works in the threaded bore of the Coupling and by rotating the Contrate, the jack is thus raised or lowered. The upper end of the Screwed Rod is supplied with an Eye Piece, which is free on the Rod and rests on two Nuts that are locked together on the Rod.

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.

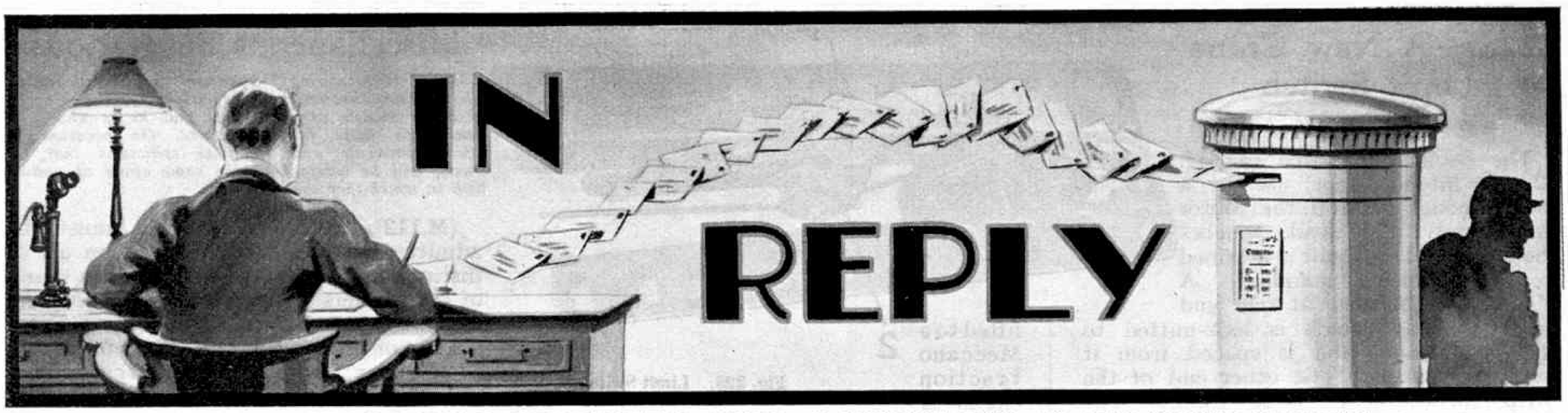
(M.112). Disc Wheels.—It must be admitted that disc wheels lend an air of distinction to a model car, so that many of our readers will welcome doubtless the idea of H. Jones (Newferry, Ches.). A circular disc of tin is cut out the diameter of a 3″ or 2″ Pulley, and a radial slot is cut in it in order that the disc may be given a conical or "dished" shape. In cutting out the tin disc three small lugs should be left on its periphery to form a means of attachment to the wheel. These lugs are bent over and pressed into the groove of the Pulley and the Tyre is then fitted into place.

(M.113). Automatic Lubricator.—An ingenious yet simple device for continuously supplying oil to a bearing is the suggestion of N. Hulbert (Trowbridge). It comprises a loop of absorbent material, which is placed on the shaft as near as possible to the bearing, and dips into an oil cup. The latter may conveniently consist of a Chimney Adaptor.

(M.114). The Magic Swingers.—This suggestion was sent in by W. West (Kettering, Northants.) and is based on a well-known scientific principle. Two pendulums are built up, each representing a small figure standing on the seat of a swing. Each pendulum must be exactly the same weight, and they are both hung, a short distance apart, on a tightly stretched string. When one pendulum is started the second one starts also, but with very small swings. These increase steadily, but at the expense of the swing of the first, which stops when the second has reached its maximum amplitude. The interchange of motion is continued for some time to a gradually diminishing extent, until all the energy has been dissipated in friction and both pendulums come to rest.

(M.115). Tractor Front Axle Suspension.—J. Clotworthy (Belfast) points out that a pivoted front axle for a traction engine may be constructed by attaching a Small Fork Piece to the boss of a Bush Wheel. This is done by passing set-screws through the holes in the ends of the arms of the Small Fork Piece and into the tapped holes of the boss, the Bush Wheel then being secured to the front axle so that its pivotal axis is at right angles to the axis of the front axle. The pin about which the axle turns is secured in the boss of the Small Fork Piece. The great disadvantage of the device is that it can only pivot freely in one direction—namely, when the model is travelling on a straight course—and when the axle is slewed round, a twisting stress is set up in the arms of the Small Fork Piece, which may easily wrench the part from its boss. A much better plan is to use a scheme similar to Suggestion No. 229.

(M.116). Automatic Slip-coach Mechanism.—An ingenious Meccano trip gear for uncoupling rolling stock automatically is sent in by H. A. Harding (Rugby). A trip lever consisting of two Couplings carrying a Flat Bracket at one end is pivoted on a Rod mounted on the buffer beam of the wagon, the slotted hole in the Bracket fitting over the coupling hook of the adjoining wagon, etc. A ramp consisting of a 2½″ Curved Strip is secured to the track so that on striking the ramp the lever is pushed up and the Flat Bracket disengaged from the coupling hook.



READERS' SUGGESTIONS FOR MECCANO IMPROVEMENTS

SPECIAL SLEEVE.—A tube or sleeve about 2″ long that would fit over the standard Meccano Axle Rods might perhaps be of use in certain mechanisms. Your suggested tube would have a perforated lug riveted to each end so that the sleeve might be joined to gear wheels, etc. This device would certainly enable two gears mounted on a common shaft to rotate at different speeds, and would be of use in clocks and similar mechanisms. We would point out to you, however, that the Meccano Socket Coupling is particularly suited for use in this type of construction, and is far more compact than your proposed sleeve. Illustrations of the use of the Socket Coupling are included in the "Standard Mechanism Manual." (*Reply to E. Hare, Vancouver, B.C.*).

MOTOR CYLINDER.—Small cylinders fitted with "fins" for use in building models of air-cooled petrol engines would form a novel addition to the system, as they would enable realistic aeroplane and motor cycle engines to be built. We shall consider this idea, but we would at the same time remind you that excellent "cylinders" can be devised from standard parts. In small models, for instance, Meccano Worms can be used to represent air-cooled cylinders, as the threads give an excellent suggestion of the cooling fins that are cast on the sides of an actual cylinder. In larger models, these cylinders can be built up by clamping a number of 1″ loose Pulleys together on a Rod. (*Reply to S. Weston, Cleethorpes*).

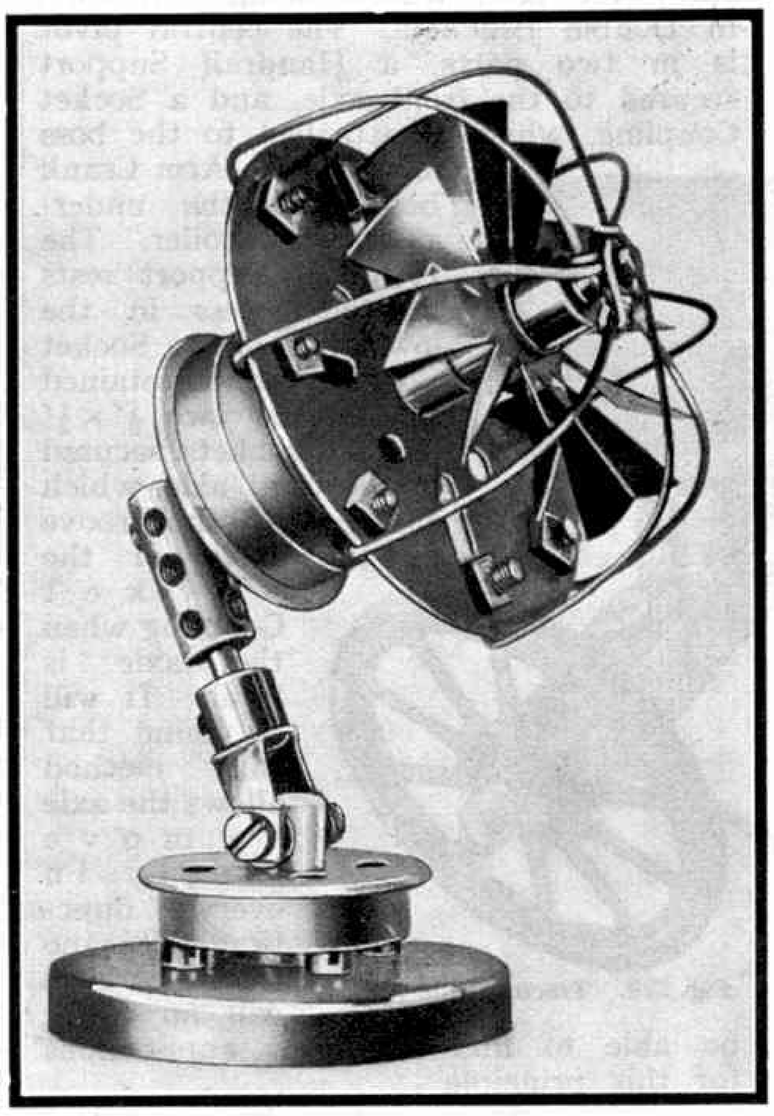
CRANE MAGNET.—A special circular electro-magnet for fitting to the hoist cord of a model crane, so that all kinds of steel parts could be lifted, would form an interesting addition. Magnets of this type are employed in engineering works where large quantities of small steel parts have to be handled, objects being attracted automatically to the magnet, and held in position while current is passed through its winding. A very satisfactory magnet can be constructed from standard Meccano parts. A Meccano Pole Piece (part No. 308) is used for the core of the magnet and a Meccano Bobbin (part No. 301), that has been filled full of No. 26 gauge wire, is pushed over the Pole Piece. The Bobbin and core are secured to the hoist cord of a model crane, and an accumulator is connected between the ends of the windings. The Pole Piece will then become a powerful electro-magnet capable of lifting Meccano Strips and other parts. (*Reply to P. Cardew, Nyon, Switzerland*).

MOTOR RADIATOR.—We have received your suggestions regarding the introduction of a special manufactured radiator to the Meccano system. This idea has, of course, been put forward on many previous occasions, but has been rejected as quite a realistic radiator can be built from standard parts. In spite of this, model-builders continue to clamour for the introduction of a special radiator (we receive dozens of suggestions for this part every month!) and we may accede to the demand and introduce a radiator for fitting to model cars. If we decide to do this, an announcement will be made in the "*M.M.*" (*Reply to G. H. Hampton, Prestbury, and R. Howe, Scarborough*).

SPLIT PINS.—Your idea regarding the use of split pins in the Meccano system is interesting. Split pins are used extensively in light engineering work to retain revolving or oscillating parts in position, and they are also utilised to lock stationary members in place. Such pins used in conjunction with "castellated" nuts are to be found frequently in aeroplane construction, where of course, the effects of continuous vibration have to be guarded against. We are afraid, however, that split pins could not be used with success in the Meccano system. The split pin method of anchorage is essentially for a "fixed" type of construction, and it would be necessary to perforate the Axle Rods, Screwed Rods, and Bolts in a large number of places if the scheme were to be at all adaptable. You will find it a much better plan to use Spring Clips or Collars for securing purposes. (*Reply to T. H. K. Hosie, Monkstown, Ireland*).

SMALL PLATE.—There are certainly possibilities in your idea for a 2″ diameter perforated disc. Several instances could no doubt be found where a 2″ disc without centre boss could be used. In most cases, however, we think you will find the Meccano 2″ diam. Pulley Wheel fulfils this function, but we are keeping your idea in mind. It would not be advisable to introduce a 1″ diam. disc, as the function of this part is already amply covered by existing parts (the 1″ loose Pulleys, Bush Wheels, etc.). (*Reply to P. Parish, Rugby*).

THREADED CRANK HANDLE.—It is doubtful whether any advantage would result if the axle portions of Meccano Crank Handles were threaded so as to resemble the Threaded Rods. This alteration would certainly enable the crank handle to be used in screw adjustment mechanisms, but its primary function would be affected. It is not good engineering practice to use Threaded Rods as axles with the plain type bearings, and the use of the Crank Handle in many of the simpler models would consequently be impaired. On the other hand, an adjusting handle may quite easily be attached to a length of Threaded Rod. A Bush Wheel fitted with a Threaded Pin forms an excellent handle. (*Reply to T. A. Bain, Elgin, Scotland*).



Our illustration shows the excellent model Electric Fan which secured a prize for H. Edwards, of Oundle, in a recent Model-building Competition.

TEN SHILLINGS FOR A BRIGHT IDEA! Many novel suggestions regarding Meccano parts are forwarded to us, and in order to provide additional interest we are offering a prize of 10/- for the most ingenious idea submitted each month. Each suggestion submitted should be written on a separate sheet, and the name and address of the sender should appear on each sheet used. Envelopes should be addressed to "Suggestions," Meccano Ltd., Binns Road, Old Swan, Liverpool.

The prize of 10/- for the month of February has been awarded to R. R. Pearce, Kingswood, Bristol, for his idea for a remote-controlled nut tightening device.

DOUBLE CONTRATE.—Very few uses could be found for a Contrate Wheel having teeth on both faces. The part might be used when it was required to employ a double right-angle drive, but instances of this kind would be very rare, and a simpler and more efficient system of drive transmission composed of standard Meccano Gears or Sprockets could nearly always be substituted. If you particularly require a double drive of this type you can employ two of the existing type Contrates mounted "boss to boss," or the Meccano Bevel Wheels can be utilised. (*Reply to S. H. Wood, Portsmouth*).

NEW SIZE BOILER.—A boiler unit having the same diameter as the present Boiler (part No. 160), but approximately 2½″ long, might be employed as the roller of a model road roller, but it would not be easy to find many other applications for the part. We are making a note of your idea for further reference, however. (*Reply to A. Shepherd, Bloemfontein, S. Africa*).

T-MEMBER.—Your idea for a T-shaped member fitted with centre boss is ingenious. The part could be used as a base for standards and supports of various kinds, and it might also be utilised in bracing large frameworks. There would not, however, be sufficient uses for a special part of this type, to justify our adding it to the system. A "T"-base can be constructed quite easily from two Strips placed at right angles and a Double Arm Crank secured at the point of intersection. (*Reply to H. Collen, Chadwell Heath*).

SPECIAL AXLE.—Your proposed axle rod is interesting. The rod would be of the same diameter as the standard Axle Rods for the major part of its length. A short portion of the Rod, however, would be reduced in diameter and over this section a thin metal sleeve would be placed so that it could rotate independently of the main axle. If Gear Wheels were mounted on the revolving sleeve and the main axle respectively, they could rotate at different speeds. The special axle might be of use in gear-box construction and we are keeping your idea in mind. (*Reply to J. A. Buchan, Consett*).

NON-SLIP SCREWDRIVER.—Your scheme for preventing the screwdriver from slipping out of the slot in the head in a bolt, etc., when being tightened, is ingenious. Your idea would be to form a projection in the centre of the blade of the driver, and this projection would fit into a hole in the centre of the bolt-head. This scheme would doubtless work quite well, but it would not be advisable to apply it to the Meccano Screwdrivers as their adaptability would be affected. (*Reply to C. Riders, Worcester*).

EXTENSION SLEEVE.—Your special drive extension unit for use in Meccano models of drilling machines, etc., has been well thought out. The unit would consist of a metal sleeve that would fit over a standard boss, and have two slots cut in it for the greater part of its length. One end of the sleeve would be secured rigidly to the rotating portion of the drill, etc. The drill shaft proper would be secured to a standard Collar provided with two bolts that would slide up and down in the slots in the sleeve. The drill shaft would consequently be capable of adjustment in a vertical direction while at the same time it would rotate as one unit with the main drive shaft. The idea is ingenious, but we would remind you that an identical mechanism can be reproduced from standard parts (see S.M. 270 on page 44 of the Standard Mechanisms Manual). Your suggested unit would, however, be slightly neater than the built-up Meccano mechanism, and it may be possible to consider its introduction on this account. (*Reply to J. R. Lockwood, Lincoln*).

RESISTANCE ELEMENT.—We were interested in your idea that small coils of resistance wire should be supplied for use in the construction of a resistance controller for the Meccano Electric Motors. Your idea would be to join a number of these coils in series, their ends being connected to insulated 6 B.A. Meccano Bolts. A rotating arm would pass over the heads of the bolts and it would thus be possible to include any number of the resistance coils in the Motor circuit, and the speed of the Motor could thus be controlled. This idea is ingenious, but we would point out to you that a resistance controller of this type has already been constructed and this is described in the Standard Mechanisms Manual (see S.M. 115, page 23). In this device, lengths of Spring Cord have been used for the resistance elements, and these function very satisfactorily. Your special resistance wire is consequently unnecessary. (*Reply to T. Swale, York*).

NEW MODEL-BUILDING TOOL.—A screwdriver fitted with a blade bent at right angles near the tip might be of some use as a turn-key for manipulating bolt and grub-screws in confined spaces. There are very few instances in general model-building however where this tool would be required, and we do not consider that it would form a practical addition. It is possible to use the existing type of Meccano Screwdriver as a "turn-key" if one side of the blade is filed down so that it will fit into the slot in the head of a bolt, etc. (*Reply to R. Dolicque, Paris, France*).

New Meccano Model

Electric Derrick Crane

IN modern engineering a great variety of types of cranes are employed. There are, for example, the huge block-setting cranes used in harbour construction; railway breakdown cranes for handling derailed or damaged locomotives; hammerhead and hydraulic cranes for dockside operations; gantry cranes for engineering shops; and many other special types too numerous to mention. Perhaps the best known type however, is the derrick, and it is a Scotch-type derrick crane that forms the subject of the new Meccano model described this month.

The Meccano model is built to a scale of ¾″ to 1 ft., the jib measuring 6 ft. in length. The arrangement of the mechanism in the model closely resembles that adopted in the prototype, and the three movements of hoisting, luffing and slewing are controlled from a gear-box of simple design. The model is capable of level luffing, and a safety interlocking device controls the pawl and ratchet gear on the luffing barrel. The motive power is supplied by a 6-volt Motor, the speed of which may be adjusted by means of a resistance controller, built-up from standard Meccano parts and inserted in one of the battery leads to the Motor.

The construction of the Meccano model should be commenced by building the jib. By a careful study of the general view (Fig. 1) the main details of this portion of the model should be fairly clear. Each of the main longitudinal members of the jib consists of three 24½″ Angle Girders, bolted together and overlapped two holes. The top and bottom members of the centre portion are joined together by 2½″ Strips, while each end section of the jib tapers down towards its extremity. The complete sides are connected together by 2½″ Strips at points one third from either end, the bottom end tapering down to a 7½″ Flat Girder while the top is bridged by a 1½″ Strip.

As will be seen from the illustration, the jib is very adequately braced by Strips on all four sides. The length and bracing of these Strips is the same throughout the centre section of the jib, each one consisting of two 2½″ Strips overlapped one hole.

The jib head pulley, over which runs the hoisting rope, is a 1½″ Pulley mounted on a short Rod that is journalled in the side members of the jib and to the ends of which Cranks are secured. To each of the Cranks two 12½″ Strips are bolted face to face, and to the ends of these Strips are secured a further pair of 12½″ Strips. The ends of the latter are fitted with Cranks, which serve to hold a 1½″ Rod that carries a 1″ loose Pulley forming one of the luffing purchases, and also a 1½″ Strip.

Each of the horizontal members or "sleepers" 2 consists of an 18½″ and 12½″ Angle Girder overlapped three holes, to the flanges of which are secured one 9½″ and two 12½″ Girders, giving the member a "channel" section.

The front ends of the sleepers are attached to a 5½″×2½″ Flanged Plate 1 in such a manner that they are at right angles to each other. The geared portion of a Meccano Ball Bearing (part No. 168) forms one part of the slewing race, and it is secured by bolts to the top flanges of the sleepers 2, additional support being afforded by means of 1″ Screwed Rods, which pass through the Plate and race, and are secured in place by nuts. A Bush Wheel bolted to the upper side of the race carries a 2″ Rod that forms the central pivot about which the model slews.

The rear ends of the sleepers are mounted on 5½″×2½″ Flanged Plates, to which they are attached by means of 5½″ Angle Girders. The Flanged Plates are spaced apart by the member 4, which consists of four 12½″ Angle Girders.

Each of the rear tie members 5 is 42 inches in length and is composed of six 12½″ and two 9½″ Angle Girders. The upper extremities of both members are fitted with 3″ Strips that project three holes beyond the ends of the Girders and the ends of these Strips are bent downward slightly. The end holes will eventually be passed over a 1½″ Rod mounted on the top of the mast 6.

The Vertical Mast and Gear-Box

Each side of the vertical mast 6 is composed of two 18½″ and two 12½″ Angle Girders with their flanges bolted to the edges of 12½″, 9½″, and 7½″ Flat Girders to form a channel-section girder of great strength. The top ends are bridged by means of two 1½″ Angle Girders, and a third 1½″ Angle Girder is bolted across the rear face of the mast in the second hole from the top. This latter Girder, together with the one above it, will form a bearing for the pin that serves as a means of pivotally attaching the tie

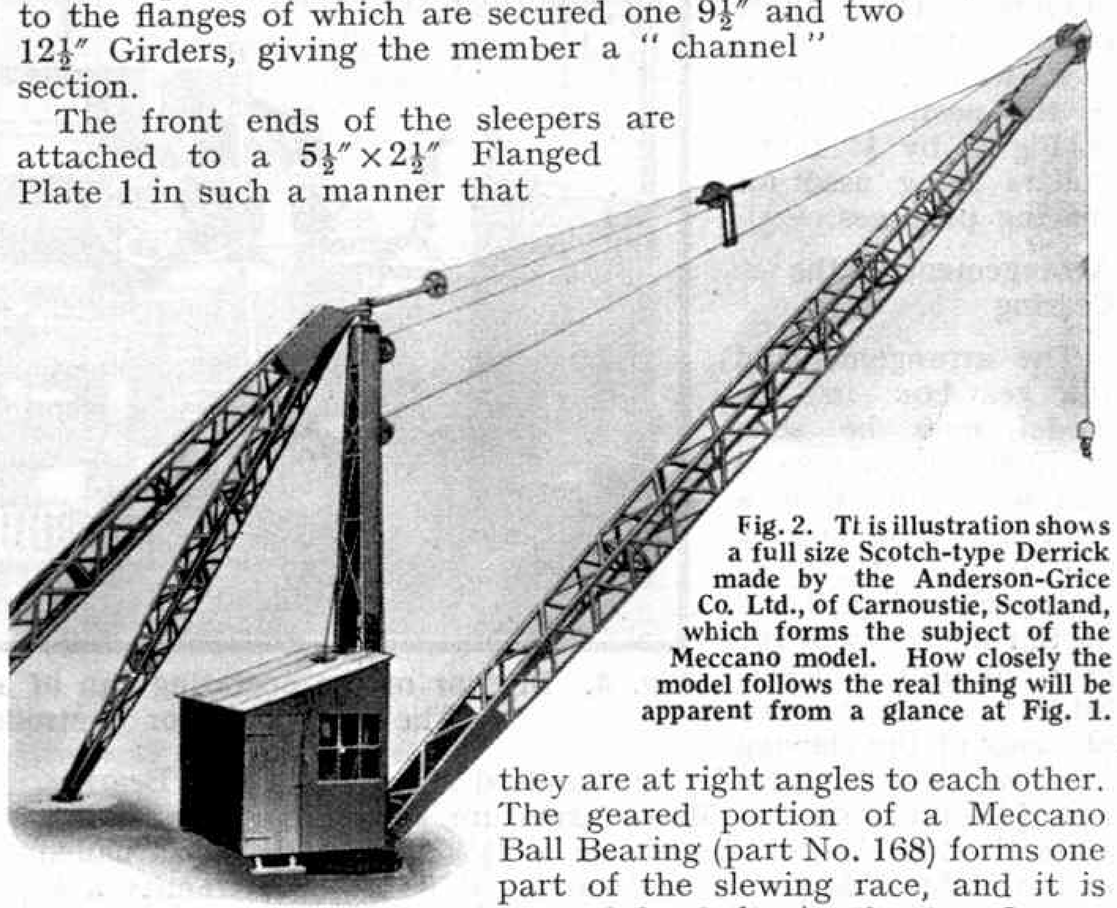


Fig. 2. This illustration shows a full size Scotch-type Derrick made by the Anderson-Grice Co. Ltd., of Carnoustie, Scotland, which forms the subject of the Meccano model. How closely the model follows the real thing will be apparent from a glance at Fig. 1.

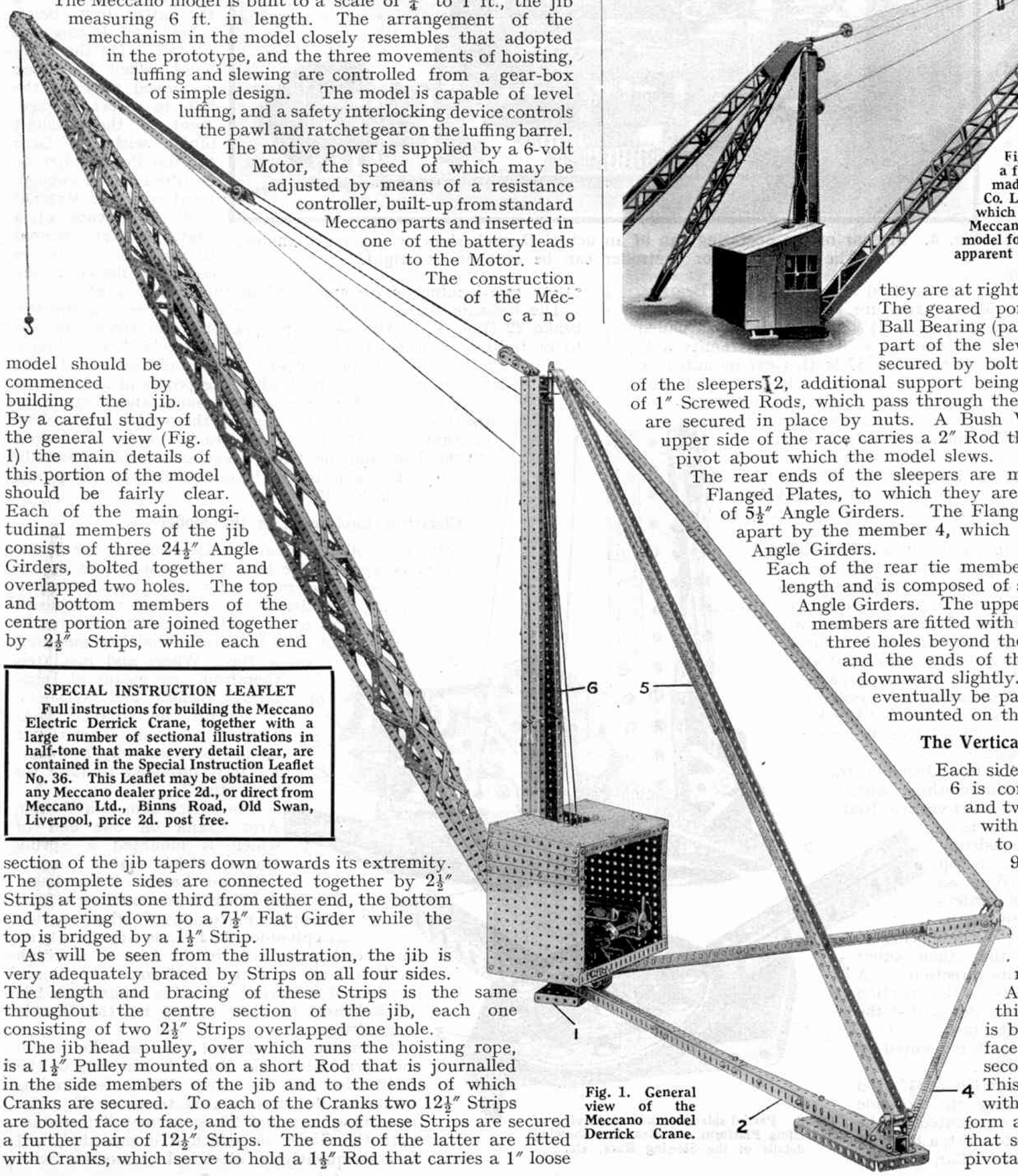


Fig. 1. General view of the Meccano model Derrick Crane.

SPECIAL INSTRUCTION LEAFLET

Full instructions for building the Meccano Electric Derrick Crane, together with a large number of sectional illustrations in half-tone that make every detail clear, are contained in the Special Instruction Leaflet No. 36. This Leaflet may be obtained from any Meccano dealer price 2d., or direct from Meccano Ltd., Binns Road, Old Swan, Liverpool, price 2d. post free.

members to the mast head.

The front of the mast, the lower portion of which may be seen in Fig. 3, is braced by 5½″ Strips. This view shows also how the mast is secured to the platform or swivelling base on which is built the gear-box. The foot of the mast is actually attached to a 9½″ Angle Girder 7 that forms the front edge of the platform, the floor of which consists of three 5½″ × 3½″ Flat Plates. Trunnions are bolted to the foot of the mast to accommodate the jib pivot pin. The gear-box sides are 4½″ × 2½″ Flat Plates, and they are attached both to the mast and to 5½″ Angle Girders that are bolted to the base, while to the underside of the latter is mounted the upper portion of the slewing race, which is secured in the position shown in Fig. 3 by ½″ Bolts, Collars being used for spacing purposes.

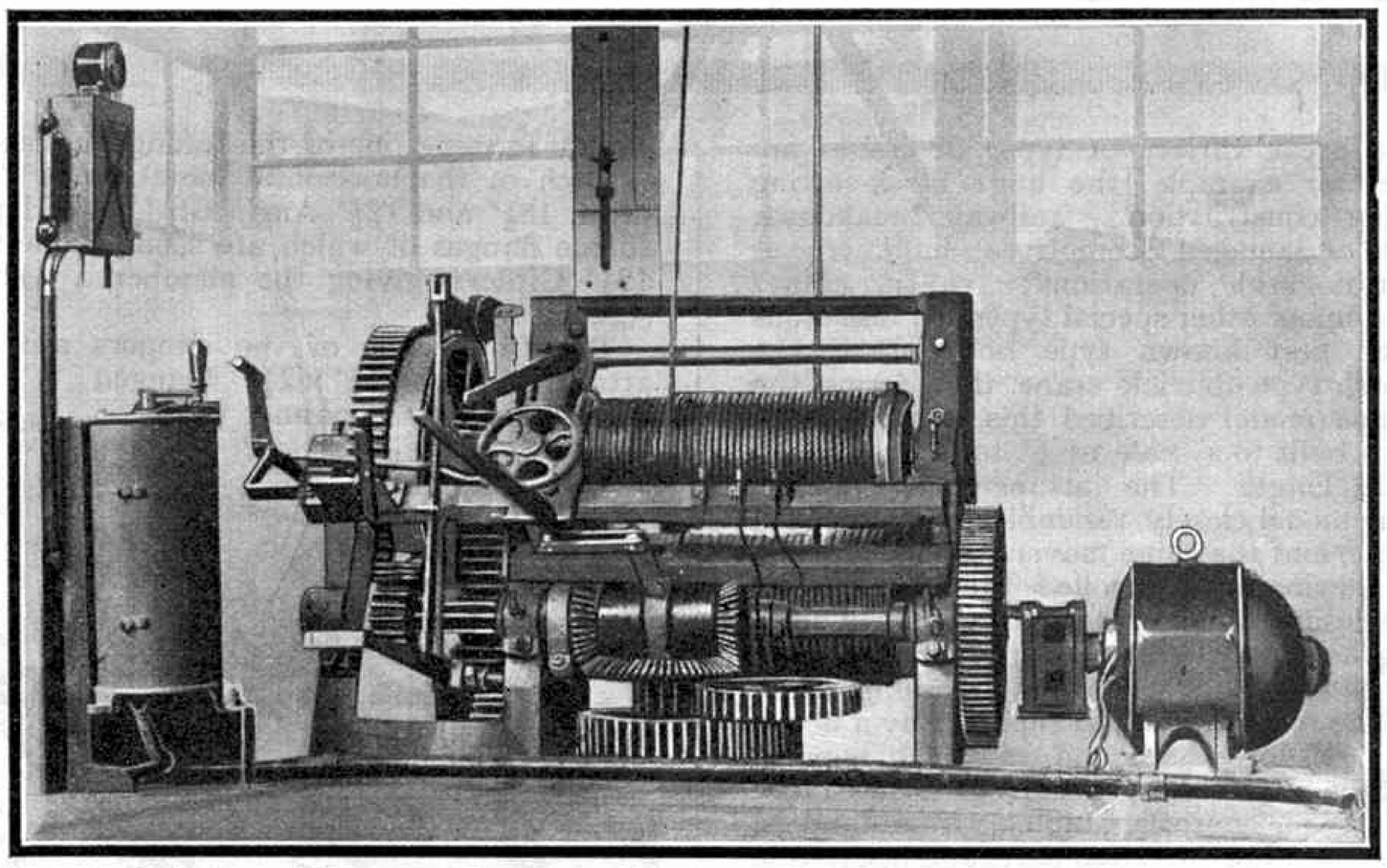


Fig. 4. Interior of the operating cab of an actual Derrick showing gears and motor. The electric motor controller can be seen on the right.

Arrangement of the Gearing

The arrangement of the gear-box in the model may be seen fairly clearly in Figs. 3 and 6. Fig. 6 is a semi-plan view showing the 6-volt Motor in place, while Fig. 3 is a partial side view of the gear-box unit, which is lifted to show the two portions of the slewing race, which is composed of a standard Meccano 4″ Ball Bearing.

A ¾″ Pinion on the Motor armature spindle engages with a 50-teeth Gear Wheel secured on a 2½″ Rod which is journalled in the Motor side plates, and carries at its other extremity a ½″ Pinion. The latter is in mesh with a 57-teeth Gear mounted on a Rod vertically above the first. On the same Rod is a ½″ Pinion engaging with a 57-teeth Gear on a 3″ Rod that is journalled in the gear-box side plates. This Rod has, on the end seen in Fig. 3, a ¾″ Pinion in constant mesh with a 50-teeth Gear 9, that is secured on what may be termed the mainshaft of the gear-box.

A ¾″ Pinion 10 (Fig. 6) on the mainshaft may be engaged with either the Gear 12 on the hoisting barrel or with the Gear 13 on the slewing shaft, by sliding the mainshaft in its bearings. The sliding movement is effected by means of the lever 11, which is attached pivotally to a 2½″ Angle Girder that is bolted to the vertical girders 6 and carries a ⅜″ Bolt, the shank of which locates between two Collars that are secured on the mainshaft a short distance apart. The lever works in a quadrant composed of two 2½″ Strips that are spaced apart by Washers and secured by ½″ Bolts a short distance below a transverse 2½″ × ½″ Double Angle Strip. The latter is seen clearly in the illustration.

The slewing shaft has, in addition to the Gear Wheel 13, a Worm meshing with a Pinion 14 mounted on a short vertical Rod. The latter is journalled in a reinforced bearing, consisting of three 1½″ Strips laid on top of each other and bolted across two parallel Z-section girders 21; each of these girders is composed of two 2½″ Angle Girders secured together so that their other flanges point in opposite directions. A Bush Wheel is also bolted to that portion of the Plate below the bearing so that the Rod passes through its boss. A ¾″ Sprocket Wheel 19 (Fig. 3) is secured on the lower end of the Rod.

The luffing winch barrel is a 3½″ Rod that is journalled freely in the side plates and on which are mounted, in the order named, from left to right, a Ratchet Wheel, one Washer, a Collar, the 50-teeth Gear 15, a Coupling, a Collar, three Washers and a ½″ fast Pulley.

A Pawl 18 engages with the teeth of the Ratchet Wheel and so prevents the unwinding of the luffing barrel. The Pawl pivots on a ¾″ Bolt that is secured to a Corner Bracket, bolted to the end of the gear-box plate.

The luffing barrel is driven from the hoisting barrel through the medium of a sliding layshaft 16, which is operated by the lever 17. The latter is attached pivotally to a 1″ × ½″ Angle Bracket on the left-hand gear-box side-plate, and is connected to the Rod that it actuates, in a similar manner to the lever 11. In its neutral position, that is when the layshaft Pinion is out of engagement with the Gear 12, the lever is over the top of the Pawl 18, thus preventing the latter from being raised and letting the jib fall. On the other hand, when the lever is moved over to the left to effect engagement of the layshaft pinion with the Gear 12, the Pawl is free to be lifted out of engagement with the Ratchet teeth by means of a Flat Bracket secured to its boss. This, of course, is similar to the safety interlocking device employed in the actual crane.

The hoisting barrel is fitted with an effective semi-automatic brake 22 (Fig. 3). Although this type of brake allows the load to be hoisted perfectly freely, the load cannot be lowered until the end of the brake lever is raised. It should be noted that these results can only be attained when the points of attachment of the brake cord are on opposite sides, and at different distances, from the fulcrum of the brake lever. The fulcrum is a 1″ × 1″ Angle Bracket which is bolted to the floor, and the brake lever is attached pivotally to the Bracket by a lock-nutted bolt (Standard Mechanism No. 263).

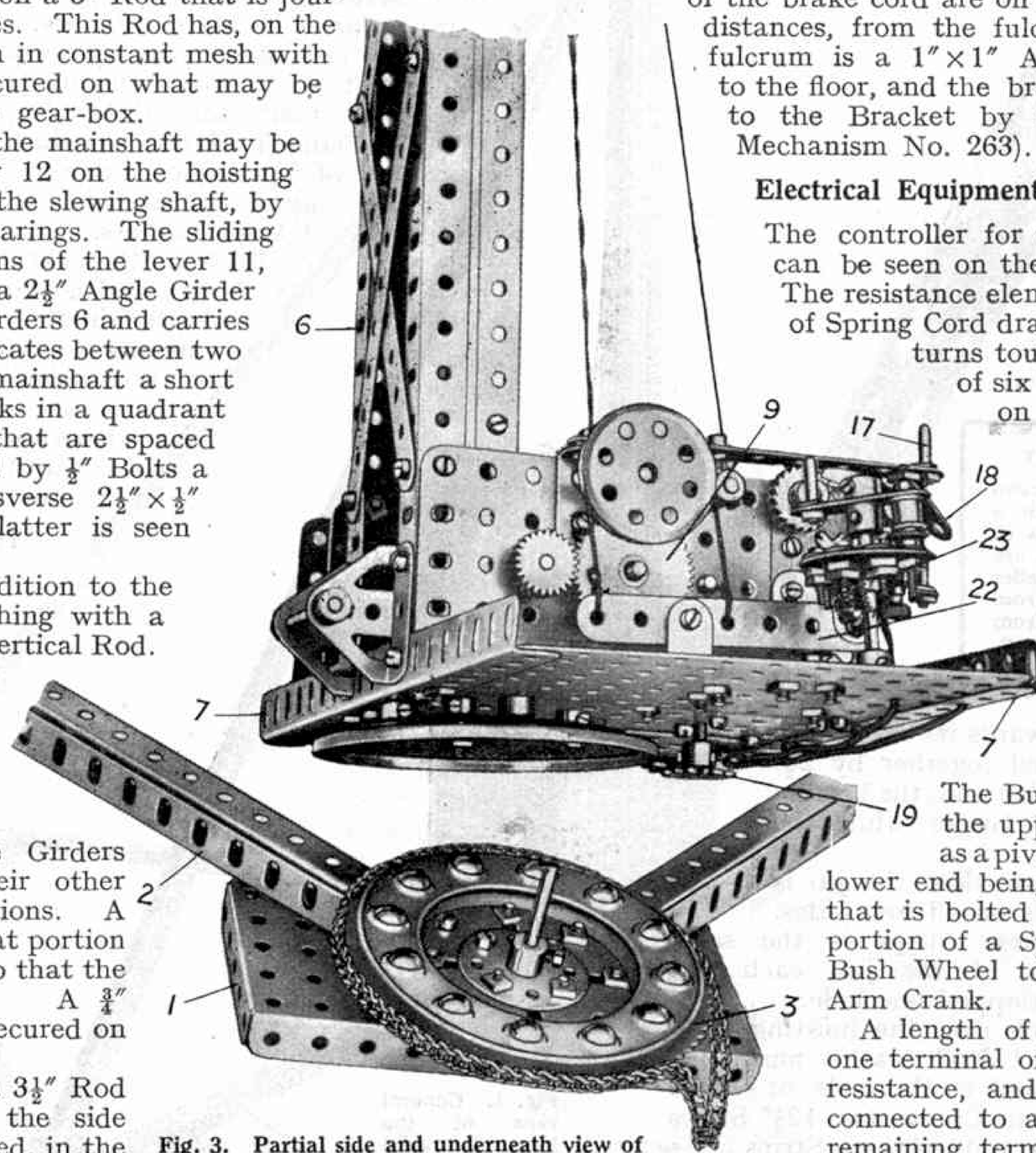


Fig. 3. Partial side and underneath view of Swivelling Platform and Gear-Box showing details of the Slewing Race, etc.

Electrical Equipment of the Model

The controller for varying the speed of the Motor can be seen on the left of the gear-box in Fig. 6. The resistance element is formed by a short length of Spring Cord drawn out so that no two adjacent turns touch, and attached to the shanks of six 6 B.A. Bolts that are mounted on a Bush Wheel and insulated therefrom by means of Insulating Bushes and Washers. A seventh insulated 6 B.A. Bolt is provided. This is not connected in any way, however, for it is intended to form an "off stud."

The switch arm is a Double Arm Crank on one end of which is mounted a Spring Buffer, which makes contact with the heads of the bolts. The Bush Wheel is mounted on a Rod, the upper extremity of which serves as a pivot for the Double Arm Crank, its lower end being held in the boss of a Crank that is bolted to the platform. The sleeve portion of a Spring Buffer is secured to the Bush Wheel to form a stop for the Double Arm Crank.

A length of insulated wire is taken from one terminal of the Motor to one end of the resistance, and the other Motor terminal is connected to an insulated terminal 20. The remaining terminal 20 is in metallic contact with the Girder on which it is mounted, and is consequently in electrical connection with

the switch arm of the controller. Hence it only remains to connect the Accumulator or Transformer to the Terminals 20 by suitable lengths of flex or insulated wire. The driver's cabin is illustrated upside down in Fig. 5. It will be seen that its construction is simple and no Meccano boy should find difficulty in building this portion of the model.

Final Erection of the Model

When the various units of the model have been completed, it only remains to fit them together in their respective positions — a simple task, as will be seen.

The first step is to secure the cabin (Fig. 5) to the swivelling base, and then to place this portion of the model over the central pivot (see Fig. 3), care being taken to see that the Ball Casing (part No. 168c) is included in the assembly.

The tie members 5 may now be put in place, their bottom ends being attached by 2″ Rods to the rear anchorages (the Corner Brackets on the members 2) and their top ends meeting on a common pin that is journalled in the 1½″ Angle Girders at the mast head. A length of Sprocket Chain is passed round the geared periphery of the lower portion of the slewing race 3, and round the ¾″ Sprocket Wheel 19 (Fig. 3). The model should now be secured by ordinary wood screws to a suitable base, and the attachment of the jib to the model proceeded with. This is accomplished by passing a Rod completely through the Trunnions that are secured to the foot of the mast and through the end holes of the jib-foot. If the model is secured to a portable baseboard, it may be found necessary to add ballast at the rear, to prevent it from overbalancing when heavy loads are lifted.

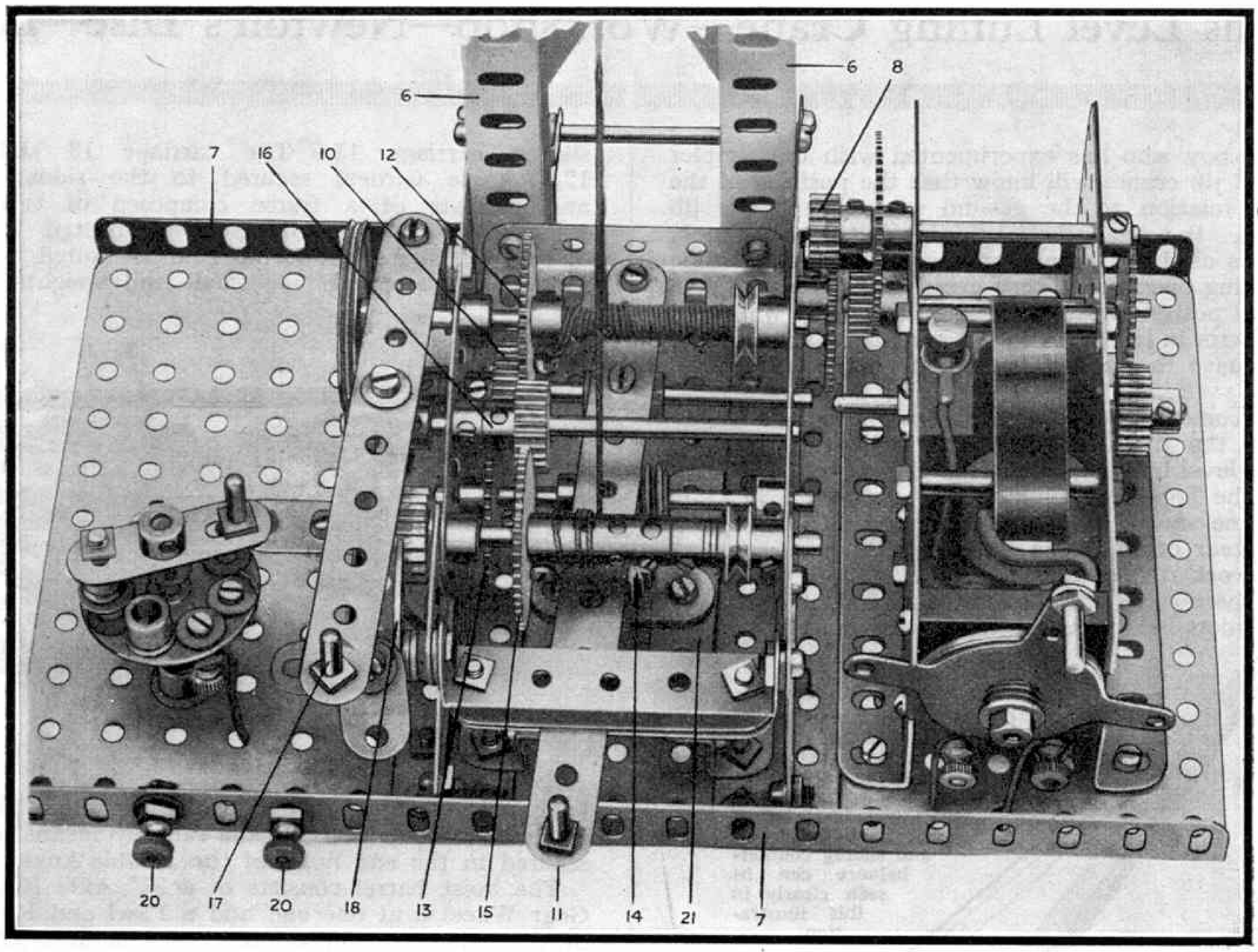


Fig. 6. Partial plan view of Gear-Box showing layout of Gears, Electric Motor, Controller, etc.

The standing end of the luffing cord is tied to the 1½″ Strip that is mounted by the side of the purchase pulley on the jib. The cord is then led over the pulley at the mast head and back round the pulley on the jib, from where it is passed over a 1½″ guide pulley that is mounted on a short Rod journalled freely in the sides of the mast, and finally secured to the luffing barrel.

The hoisting cord is attached to its barrel and led over a guide pulley on the mast to the 1½″ jib head pulley and then down to the hook. Matters must be so arranged that as the hoisting cord is wound on to the hoisting barrel, the luffing cord is simultaneously paid out, or vice versa.

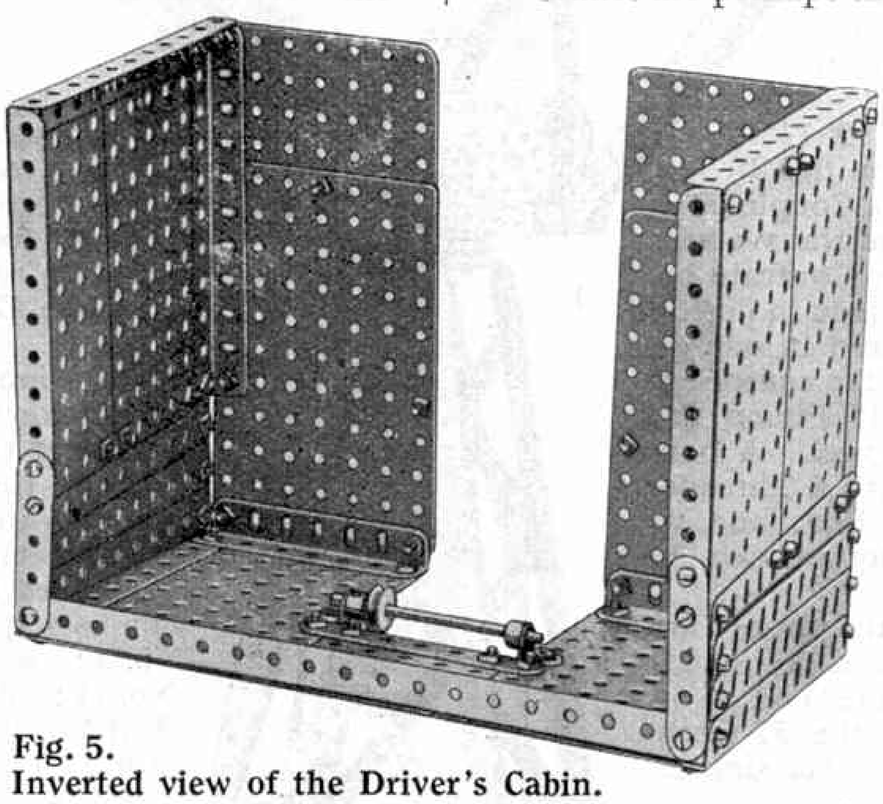


Fig. 5. Inverted view of the Driver's Cabin.

Owing to the fact that the luffing barrel is of a larger diameter than the hoisting barrel, and to the effect of the luffing purchase system, the load maintains a practically constant height when the jib is luffed in or out. With a non-compensated crane the load moves a considerable distance vertically, and thus power has to be developed by the motor to overcome the effect of the load as well as that of the jib. In addition, the crane driver often has difficulty in judging the exact position of the load after he has altered the angle of the jib—a matter of extreme importance in many instances.

In order to build the Meccano Scotch type Derrick Crane, the following parts will be required :— 8 of No. 1 ; 5 of No. 2 ; 3 of No. 2a ; 20 of No. 3 ; 14 of No. 4 ; 110 of No. 5 ; 5 of No. 6 ; 11 of No. 6a ; 12 of No. 7 ; 6 of No. 7a ; 26 of No. 8 ; 9 of No. 8a ; 12 of No. 9 ; 2 of No. 9b ; 5 of No. 9d ; 3 of No. 9f ; 1 of No. 10 ; 2 of No. 11 ; 3 of No. 12 ; 1 of No. 12a ; 1 of No. 12b ; 4 of No. 16 ; 3 of No. 16a ; 5 of No. 16b ; 7 of No. 17 ; 1 of No. 18a ; 1 of No. 18b ; 4 of No. 21 ; 2 of No. 22 ; 1 of No. 23 ; 2 of No. 23a ; 3 of No. 24 ; 4 of No. 25 ; 3 of No. 26 ; 5 of No. 27 ; 2 of No. 27a ; 1 of No. 32 ; 320 of No. 37 ; 14 of No. 37a ; 48 of No. 38 ; 4 of No. 40 ; 1 of No. 48a ; 3 of No. 52 ; 8 of No. 52a ; 2 of No. 53a ; 1 of No. 57b ; 3″ of No. 58 ; 37 of No. 59 ; 5 of No. 62 ; 1 of No. 62b ; 1 of No. 63 ; 5 of No. 70 ; 1 of No. 72 ; 3 of No. 82 ; 14″ of No. 94 ; 1 of No. 96a ; 6 of No. 103 ; 2 of No. 103a ; 2 of No. 103b ; 2 of No. 103d ; 2 of No. 103k ; 1 of No. 111 ; 6 of No. 111a ; 4 of No. 115 ; 3 of No. 120a ; 2 of No. 126 ; 8 of No. 133 ; 1 of No. 147 ; 1 of No. 148 ; 1 of No. 168 ; 8 of No. 302 ; 8 of No. 303 ; 9 of No. 304 ; 15 of No. 305 ; 3 of No. 306 ; 1 Electric Motor.

The Advantages of Crane Models

Cranes are perhaps the most popular models among the majority of Meccano boys, and it is not difficult to account for their popularity, for every one is gripped by the fascination of handling a model that may be put through such interesting operations as a properly constructed crane.

The prototype of the Meccano model must be a very familiar sight to most of our readers, as its splendid outline may often be observed placed on the top of some building under construction. The appearance of the original has been well brought out in the model, as a glance at the general view and that of the prototype will show, and the weight-lifting capabilities of the Meccano derrick compare favourably with those of the actual crane, for it will lift 15 lb. with the utmost ease.

An interesting refinement that may easily be added to the crane is a "jib radius indicator." The load capacity of a crane varies according to the particular angle of the jib. A luffing crane is designed to lift a certain load at a certain position of the jib, and it is essential that these figures are maintained. To minimise the possibility of an error being made in practice, a radius indicator is fitted to the majority of luffing cranes. A glance at this indicator tells the operator the position of the jib and the maximum load that he can safely handle without increasing the angle. The construction of the Meccano jib radius indicator is fully described under detail No. 282 in the Standard Mechanisms Manual.

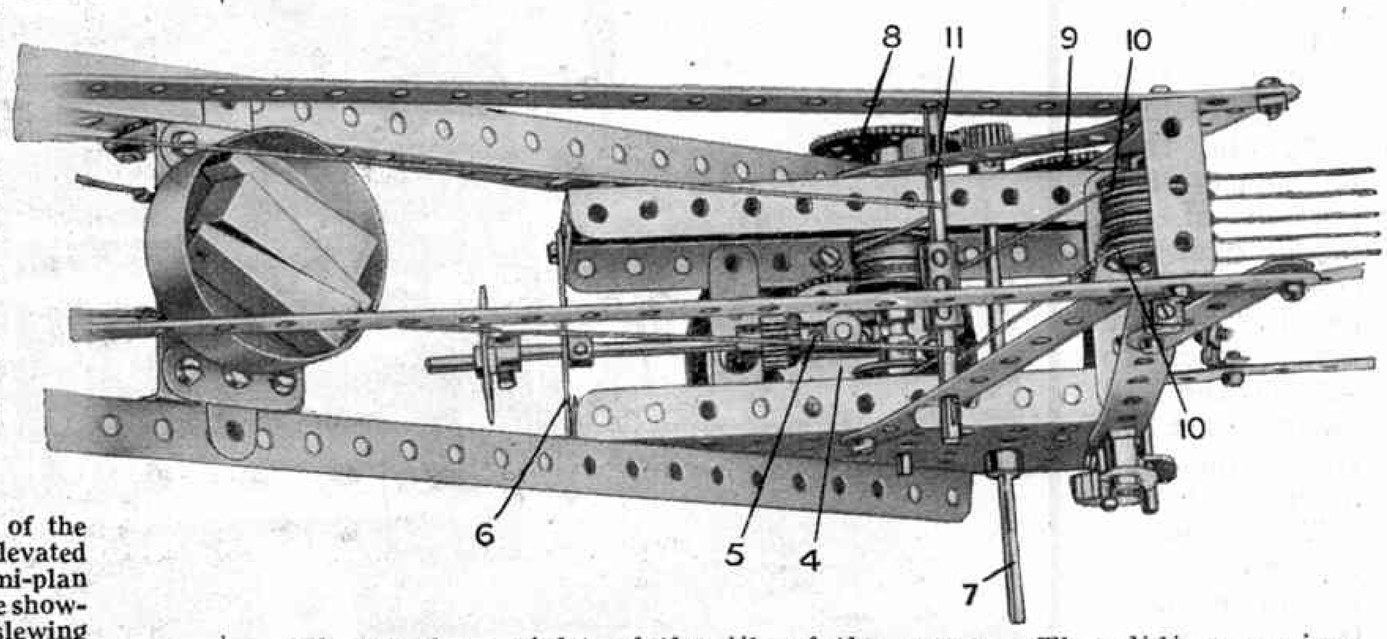
New Meccano Models

Toplis Level Luffing Crane—Workshop—Newton's Disc—Lathe

EVERY Meccano boy who has experimented with the simpler types of model jib cranes will know that the position of the load hook in relation to the ground varies when the jib of the crane is luffed. In actual practice this is a distinct drawback, and when a crane is used in confined spaces, such as in dockside loading and unloading operations, very great care is necessary in gauging the vertical position that the load will take up when the jib is luffed. An error in judgment in this respect may easily result in damage to the load or to surrounding objects.

In order to overcome this difficulty, several special methods of luffing the jib have been invented, and these are known as level luffing gears. One of the best known of these is the Toplis level luffing gear, and the model elevated crane shown in Fig. 1 incorporates a reproduction of a gear of this type.

The base framework of the model can be seen in Fig. 2, and it will be noticed that this is composed of four 12½″ Angle Girders held apart at their lower ends by 5½″ Strips and at the top by 3½″ Strips. Cross bracing of Strips of various lengths completes this portion of the model.



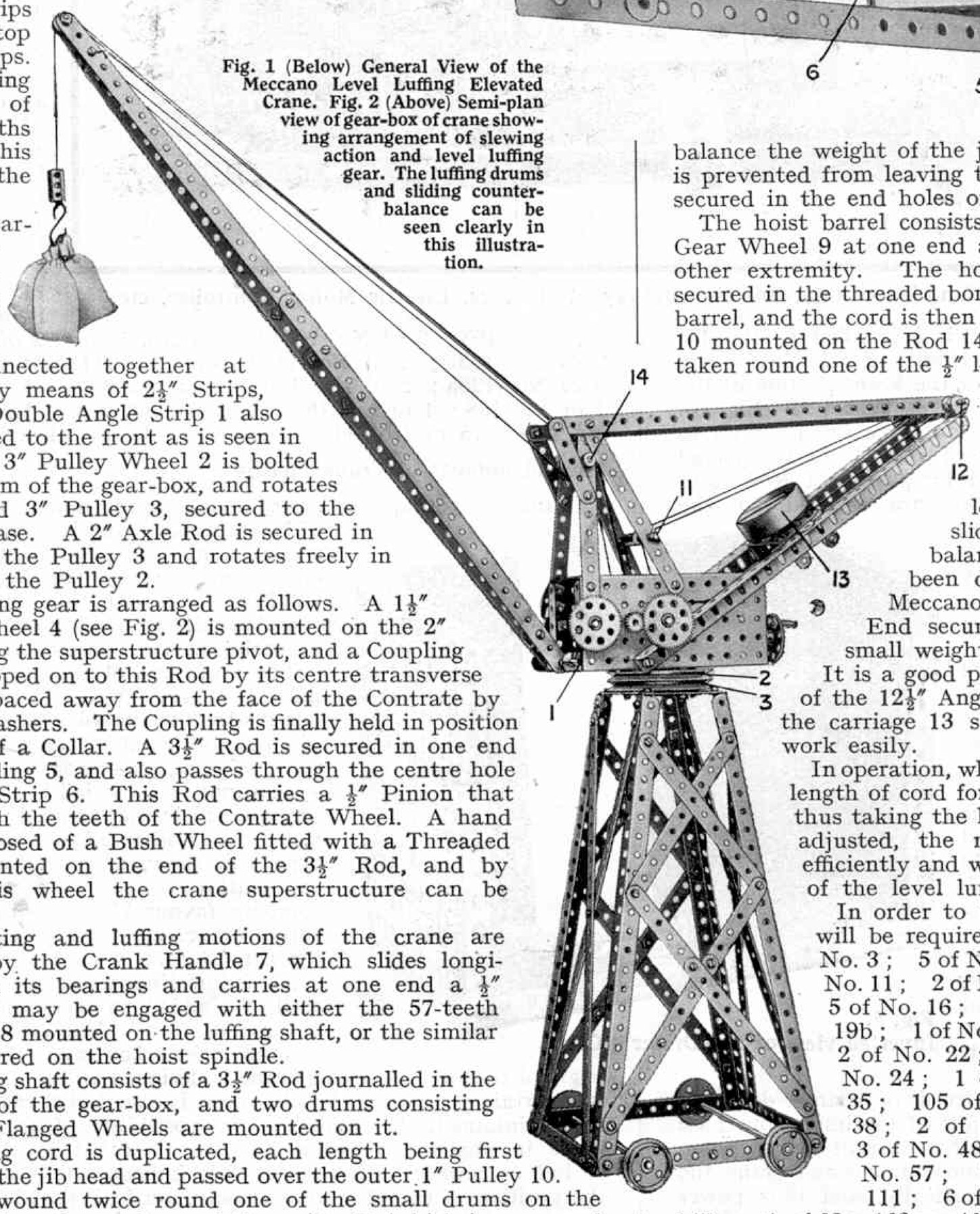


Fig. 1 (Below) General View of the Meccano Level Luffing Elevated Crane. Fig. 2 (Above) Semi-plan view of gear-box of crane showing arrangement of slewing action and level luffing gear. The luffing drums and sliding counterbalance can be seen clearly in this illustration.

The gear-box of the crane consists of two 5½″ × 2½″ Flanged Plates connected together at each end by means of 2½″ Strips, a 2½″ × ½″ Double Angle Strip 1 also being secured to the front as is seen in Fig. 1. A 3″ Pulley Wheel 2 is bolted to the bottom of the gear-box, and rotates on a second 3″ Pulley 3, secured to the travelling base. A 2″ Axle Rod is secured in the boss of the Pulley 3 and rotates freely in the boss of the Pulley 2.

The slewing gear is arranged as follows. A 1½″ Contrate Wheel 4 (see Fig. 2) is mounted on the 2″ Axle forming the superstructure pivot, and a Coupling 5 is also slipped on to this Rod by its centre transverse bore, and spaced away from the face of the Contrate by means of Washers. The Coupling is finally held in position by means of a Collar. A 3½″ Rod is secured in one end of the Coupling 5, and also passes through the centre hole in the 2½″ Strip 6. This Rod carries a ½″ Pinion that engages with the teeth of the Contrate Wheel. A hand wheel composed of a Bush Wheel fitted with a Threaded Pin is mounted on the end of the 3½″ Rod, and by rotating this wheel the crane superstructure can be slewed.

The hoisting and luffing motions of the crane are controlled by the Crank Handle 7, which slides longitudinally in its bearings and carries at one end a ½″ Pinion that may be engaged with either the 57-teeth Gear Wheel 8 mounted on the luffing shaft, or the similar Gear 9 secured on the hoist spindle.

The luffing shaft consists of a 3½″ Rod journalled in the side plates of the gear-box, and two drums consisting of four ¾″ Flanged Wheels are mounted on it.

The luffing cord is duplicated, each length being first attached to the jib head and passed over the outer 1″ Pulley 10. It is then wound twice round one of the small drums on the luffing barrel, and passed round the guide 11 (which is composed of two 1½″ Rods connected together by a Coupling), over the 4½″ Axle Rod 12 (see Fig. 1) and finally secured to the sliding carriage 13. The carriage 13 slides between the 12½″ Angle Girders secured to the sides of the gear-box, and consists of a frame composed of two 2½″ × 1″ Double Angle Strips and a 3½″ Strip connected together by means of two 1½″ Strips. A Boiler End is bolted to this frame and serves as a receptacle for small lead weights that are used to balance the weight of the jib of the crane. The sliding carriage is prevented from leaving the rails by means of bolts, which are secured in the end holes of the Double Angle Strips.

The hoist barrel consists of a 3½″ Axle Rod, and carries the Gear Wheel 9 at one end and a Pawl and Ratchet brake at its other extremity. The hoist cord is first attached to a Bolt secured in the threaded bore of a Collar mounted on the hoisting barrel, and the cord is then passed round one of the centre Pulleys 10 mounted on the Rod 14 (see Fig. 1). From here the cord is taken round one of the ½″ loose Pulleys at the jib head, and back again round the remaining 1″ Pulley 10, finally being passed over the second ½″ Pulley at the jib head and down to the load hook.

In order to obtain the correct level luffing action, the weight of the sliding carriage should exactly counterbalance the weight of the jib. This has been done in the model by placing three Meccano 50-gramme lead weights in the Boiler End secured to the sliding carriage, but any small weights may be employed.

It is a good plan to apply a little oil to the flanges of the 12½″ Angle Girders forming the rails on which the carriage 13 slides, in order that the latter may work easily.

In operation, when a load is put on the hook the double length of cord forming the hoist line tends to contract, thus taking the load off the luffing cords. If carefully adjusted, the model will be found to work very efficiently and will provide an excellent demonstration of the level luffing principle.

In order to build the crane the following parts will be required :—10 of No. 1 ; 20 of No. 2 ; 5 of No. 3 ; 5 of No. 5 ; 2 of No. 6a ; 6 of No. 8 ; 1 of No. 11 ; 2 of No. 12 ; 2 of No. 14 ; 1 of No. 15a ; 5 of No. 16 ; 2 of No. 17 ; 2 of No. 18a ; 2 of No. 19b ; 1 of No. 19s ; 4 of No. 20 ; 4 of No. 20b ; 2 of No. 22 ; 2 of No. 22a ; 2 of No. 23 ; 2 of No. 24 ; 1 of No. 26 ; 2 of No. 27a ; 9 of No. 35 ; 105 of No. 37 ; 8 of No. 37a ; 24 of No. 38 ; 2 of No. 40 ; 2 of No. 46 ; 2 of No. 48 ; 3 of No. 48a ; 1 of No. 48b ; 2 of No. 52 ; 1 of No. 57 ; 7 of No. 59 ; 3 of No. 63 ; 1 of No. 111 ; 6 of No. 111c ; 1 of No. 115 ; 1 of No. 147b ; 1 of No. 162a. All the parts required in the construction of the model Level Luffing Crane will be found in a standard Meccano No. 4 Outfit.

Steam-operated Workshop

The model steam-driven workshop shown in Fig. 3 forms an interesting example of the manner in which a number of small models may be driven from a single power unit, by grouping them around a common shafting standard and coupling them to it by suitable pulley and cord transmission.

Each shafting standard consists of two 12½″ Angle Girders held apart at the base by a 5½″ Strip and at the top by a 1½″ Strip. The Girders are braced by 5½″ and 2½″ Strips. Each standard is secured to the wooden baseboard by means of Angle Brackets, and woodscrews, and a pair of 12½″ Strips and a 12½″ Braced Girder are secured between them as shown to ensure rigidity. The main shaft consists of an 11½″ Axle Rod, which carries a 3″ and a 1″ Pulley and two ¾″ Flanged Wheels butted together to form a belt pulley.

The vertical standard of the drilling machine is composed of three 5½″ Strips, which are secured to a 3″ Pulley Wheel that forms the base of the model, by means of Angle Brackets. Flat Trunnions and 2½″ Strips are bolted to the sides of the vertical standard. The lower pair of 2½″ Strips provide bearings for a 1½″ Axle Rod that carries two 1″ fast Pulleys. The upper pair of Strips carry a 1½″ Axle Rod on which is mounted two 1″ loose Pulleys held in place by means of Spring Clips. A 3½″ Axle Rod, journalled in 1″ × 1″ Angle Brackets, represents the drill spindle. A 1″ Fast Pulley is secured to the top of this Rod, and a ½″ loose Pulley is held in place near the lower end by a Spring Clip. The drill table consists of a Bush Wheel mounted on a 2″ Axle Rod that is secured in the boss of the 3″ Pulley forming the base of the drill.

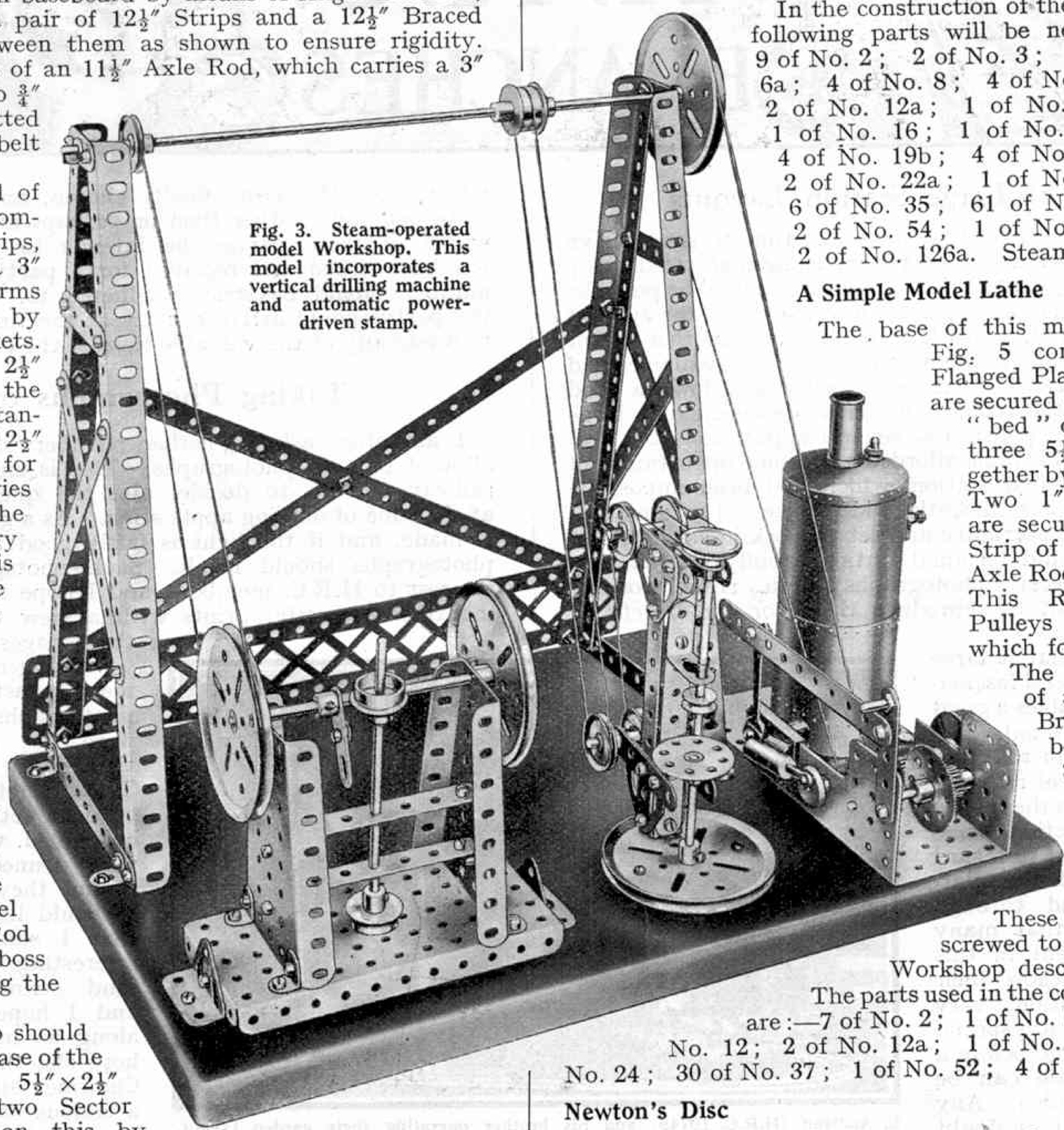


Fig. 3. Steam-operated model Workshop. This model incorporates a vertical drilling machine and automatic power-driven stamp.

The automatic stamp should next be built up. The base of the stamp consists of a 5½″ × 2½″ Flanged Plate, and two Sector Plates are mounted on this by means of Angle Brackets. Two 3½″ Strips are secured between the Sector Plates in the positions shown by means of Angle Brackets and a 4½″ Axle Rod is journalled in the top holes of the Sector Plates. This Rod carries two 3″ Pulley Wheels and a Crank (Part No. 62) having a bolt secured in the round hole in its web.

A 4½″ Rod is placed in the centre holes of the 3½″ Strips, and two ¾″ Flanged Wheels are secured on it. The upper ¾″ Flanged Wheel is adjusted so that when the driving shaft is rotated, the bolt secured to the Crank catches the edge of the Flanged Wheel, and draws it upward. As the rotation of the driving spindle continues, the Crank moves clear of the Flanged Wheel and the Rod falls on to the Flanged Plate.

The shafting standard is coupled to the Engine by an endless length of cord passed round the 3″ Pulley secured on the 11½″ Axle Rod and also round a 1″ fast Pulley mounted on the secondary shaft of the Steam Engine.

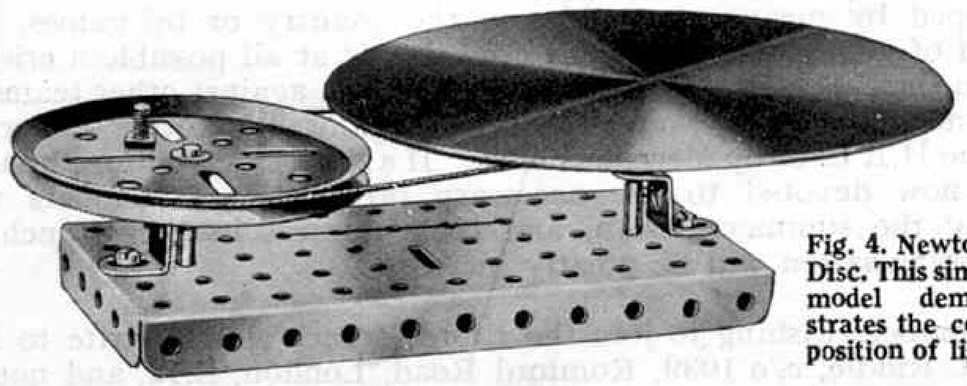


Fig. 4. Newton's Disc. This simple model demonstrates the composition of light.

An endless length of cord connects the lower 1″ fast Pulley of the vertical drilling machine with the belt pulley composed of two ¾″ Flanged Wheels, that is mounted on the 11½″ Axle of the shafting standard. From the lower 1″ fast Pulley on the drill, the drive is taken to the fast Pulley secured to the top of the drill spindle by means of a length of cord passed over the 1″ guide pulleys. The drill spindle consequently rotates at the same speed as the axle of the shafting standard. The automatic stamp is run at one-third the speed of the main shafting, the drive being taken through an endless length of cord passed over a 1″ Pulley on the shafting and round the 3″ Pulley on the stamp.

In the construction of the model workshop, the following parts will be needed:—2 of No. 1; 9 of No. 2; 2 of No. 3; 6 of No. 5; 2 of No. 6a; 4 of No. 8; 4 of No. 11; 12 of No. 12; 2 of No. 12a; 1 of No. 13; 2 of No. 15a; 1 of No. 16; 1 of No. 17; 2 of No. 18a; 4 of No. 19b; 4 of No. 20b; 5 of No. 22; 2 of No. 22a; 1 of No. 23; 1 of No. 24; 6 of No. 35; 61 of No. 37; 1 of No. 52; 2 of No. 54; 1 of No. 62; 2 of No. 126; 2 of No. 126a. Steam Engine.

A Simple Model Lathe

The base of this model Lathe shown in Fig. 5 consists of a 5½″ × 2½″ Flanged Plate and four 5½″ Strips are secured to this as shown. The "bed" of the lathe consists of three 5½″ Strips secured together by four Double Brackets. Two 1″ × 1″ Angle Brackets are secured to the upper 5½″ Strip of the "bed," and a 3½″ Axle Rod is journalled in them. This Rod carries two 1″ Pulleys and a Bush Wheel which forms the "face-plate." The "tool rest" consists of a ½″ Reversed Angle Bracket bolted to the bed and having a 1½″ Strip secured to it. It will be seen that Angle Brackets are bolted to the Flanged Plate forming the base of the lathe. These enable the model to be screwed to the base-board of the Workshop described previously.

The parts used in the construction of the lathe are:—7 of No. 2; 1 of No. 6a; 4 of No. 11; 6 of No. 12; 2 of No. 12a; 1 of No. 16; 2 of No. 22; 1 of No. 24; 30 of No. 37; 1 of No. 52; 4 of No. 90; 1 of No. 125.

Newton's Disc

The final example to be described this month is the Newton's Disc, shown in Fig. 4. This simple little model provides an interesting demonstration of the composition of light, which, as most Meccano boys will know, is made up of seven distinct colours.

Two ½″ Reversed Angle Brackets are secured to the base of the model, which consists of a 5½″ × 2½″ Flanged Plate, and these Brackets provide journals for two 1½″ Axle Rods. A 3″ Pulley Wheel is secured on the end of one of these Axles and held in place by means of a 1″ fast Pulley. The second Axle carries a Bush Wheel and a 1″ fast Pulley, and a disc of white card is glued to the Bush Wheel. The card should be divided into seven equal sectors, and painted in colours in the following order:—violet, indigo, blue, green, yellow, orange, red. The parts required for the model are:— 2 of No. 17; 1 of No. 19b; 2 of No. 22; 1 of No. 24; 2 of No. 37; 1 of No. 37a; 1 of No. 52; 1 of No. 111c; 2 of No. 125.

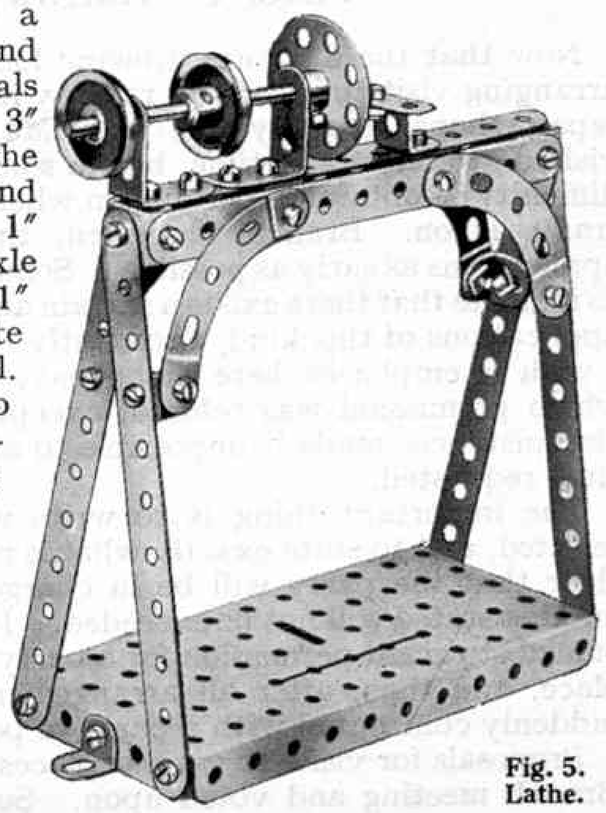
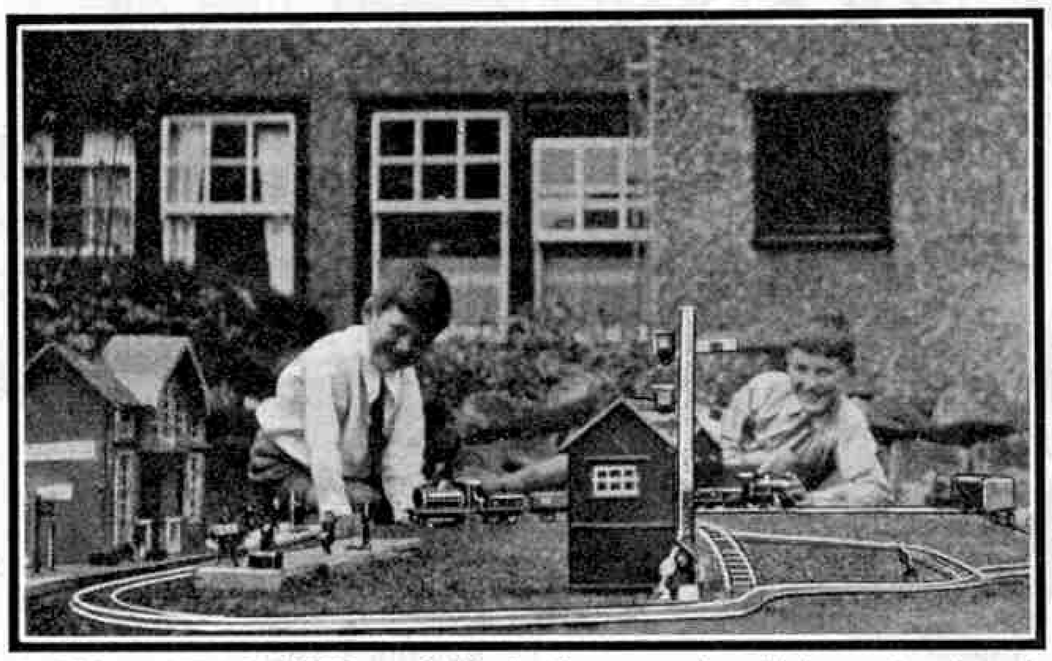


Fig. 5. Lathe.

Fascination of Large Station Layouts

News from all the Branches that have had time to settle down to work indicates that strenuous efforts are being made to develop interesting layouts, and to make them as big and varied as possible. The nature of a Branch layout depends, of course, upon the amount of track, engines and rolling stock at hand; but another factor of considerable importance is the amount of space available, and also its shape. One Branch, that had already laid down a good length of track round the room, came into possession of a large table, rather deficient in polish and general appearance, but still quite firm and level. This table afforded a welcome opportunity of developing a large terminal station, which had been impossible previously for lack of a sufficiently wide space. The members promptly seized their opportunity and set to work in earnest, and they have now a splendid terminal station rapidly approaching completion. I hope to receive photographs and descriptions of this station before long, and to reproduce them for the benefit of other Branches.

There is no doubt that a large station layout has a special fascination of its own, for it enables a great variety of train movements and marshalling operations of all kinds to be carried out on real railway-like lines. This month, in the "How to Get More Fun" section, some practical hints are given in regard to the arrangement of the platforms of terminal and through stations, and I hope that many Branches will experiment in this direction and let me know their results. Branch conditions vary greatly, and often there are special difficulties to be overcome before a satisfactory main station can be planned and laid down. Any Branch that finds itself in doubt as to the best means of utilising its available resources should write to H.R.C. Headquarters for advice, stating all particulars as fully as possible.



C. Addison (H.R.C. 10749) and his brother operating their garden layout. Traffic is handled by two Hornby No. 1 Locomotives, and good use is made of accessories, such as miniature luggage and platform machines.

Visits of Railway Interest

Now that the days are growing longer, the time is at hand for arranging visits to places of railway interest, such as engine sheds, repair shops, goods yards, etc. Many of these places may be visited at almost any time, but in some cases there is a little more difficulty in obtaining permission when the full rush of the summer traffic is on. Branch Chairmen, therefore, should make their applications as early as possible. Some of my correspondence seems to indicate that there exists a certain amount of hesitation in making applications of this kind, apparently for fear of receiving a refusal. I wish to emphasise here that I have never yet heard of a case in which permission was refused, except where special and unusual circumstances made it impossible to allow a visit at the particular time requested.

The important thing is to write well in advance of the day selected, and to state exactly what is required. It should be made clear that the party will be in charge of an adult, and that the number stated will not be exceeded. It is very annoying to railway officials to grant permission for a party of, say, 12, to visit a certain place, and then, after all arrangements have been made, to be suddenly confronted with a party of perhaps 20.

Proposals for visits to various places should be put forward at a Branch meeting and voted upon. Suitable dates should then be selected for the visits finally chosen, and each member should state definitely, either then or perhaps at the following meeting, which of these parties he intends to join. After permission has been asked and received for a party of a certain size, the number should be strictly adhered to. Another point is that the party should arrive exactly at the time appointed, so as not to waste any of the valuable time of the officials.

Taking Photographs on Visits

I am often asked whether members of a visiting party are allowed to take photographs. This is entirely a matter for the railway officials to decide, and the question should be asked at the time of making application. As a general rule no objection is made, and if the light is fairly good an instructive series of photographs should result. Such photographs are of general interest to H.R.C. members, and I hope that Branches will send me their successful prints with a view to their publication in these pages

Writing of photographs reminds me that last year many interesting photographs taken by Branches were not sent to me because they were considered unsuitable. These photographs were of the outdoor activities of the Branches concerned, with no particular railway connection; and for this reason they were not submitted. I should like it to be understood that I shall be glad to receive interesting photographs of any kind connected with Branches, and I hope secretaries will send along as many as they can. I hope also that this year all Branch Chairmen and secretaries will make a serious effort to secure a really good photograph of their members, and send this to me for addition to the series of Branch groups I have already published. In addition, I should like to publish portraits of the Chairmen and secretaries themselves, and look forward to receiving from many of them good portraits that are suitable for reproduction on these pages.

Attention also should now be given to the programme for the summer months, preparations for which can scarcely be made too early. Although light evenings and sunny half-days tend to distract members' attention, it is not necessary to abandon track meetings altogether, and at times these may be held in a garden, where splendid opportunities of real fun often present themselves. An excellent plan is to organise a cycling section, for then the delights of a cycle run may be combined with visits to places of railway interest.

Outdoor work should be planned so as to include as much variety as can be arranged. The lighter side of Branch life should be developed by means of rambles in the country or by games, the chief of which undoubtedly is cricket. If at all possible a cricket team should be formed, and matches played against other teams in the neighbourhood, preferably those organised by other Branches of the H.R.C. or by Meccano clubs. If a little care and forethought are now devoted to the necessary preparations, members will enjoy the summer session, and their interest in the Branch as an organisation will be greatly increased.

* * * * * *

Members wishing to join the Ilford Branch should write to Mr. R. S. Riddle, c/o 1039, Romford Road, London, E.12, and not to 5, Northbrook Road, Ilford, as stated in the March "*M.M.*"

Branch Notes

SIDMOUTH SENIOR.—The first meeting of the Branch was devoted to the appointing of officials, the fixing of subscriptions, and arrangements for supplying material for Branch operations. At the next meeting a large track with numerous sidings was laid, and instructions in the art of making up and running trains, and shunting them efficiently, were given by an official of the Sidmouth Railway staff. Secretary: Miss Edith Spencer, c/o Messrs. Gliddon & Son, Church Street, Sidmouth.

THE "BELFORT" (CATFORD).—Interesting visits have been paid to *New Cross Gate (S.R.) Sheds*; the *G.W.R. Signalling School, Royal Oak*; and the *South Metropolitan Gas Co.* An extensive programme has been drawn up, which includes visits of railway interest, track nights, debates, lectures, games evenings and rambles. There is still room for two or three more members, and any boy wishing to join should get in touch with the Secretary as soon as possible. Secretary: J. H. Forth, 31, Ardoch Road, Catford, London, S.E.6.

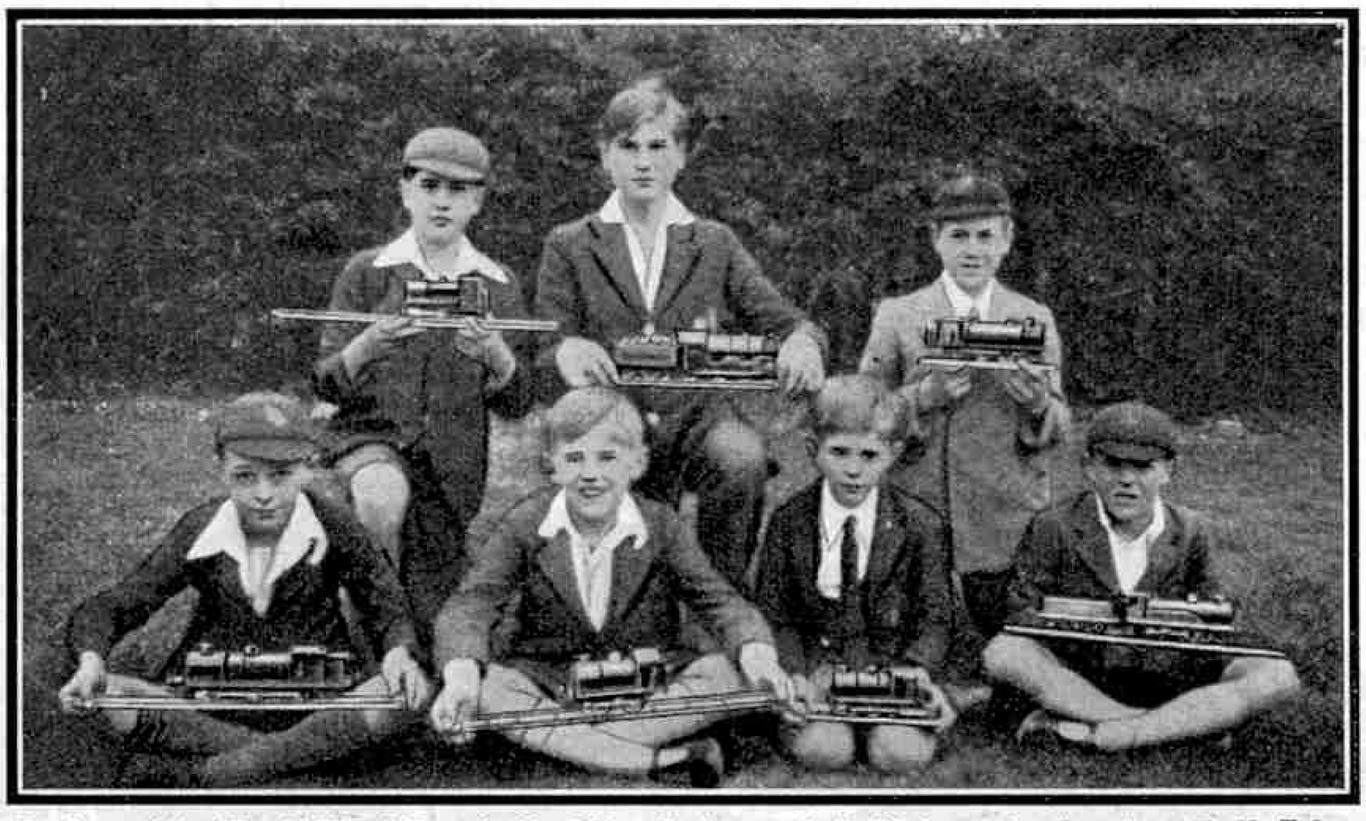
KING'S HEATH.—Visits have been paid to *New Street Station (L.M.S.)* in and out of which several of the new 2-6-2T engines have been seen working. Several visits have been paid to Solihull, where the G.W.R. main line is being widened. The cycling section has been re-formed and some interesting trips are being planned. Secretary: K. Icke, 65, Livingstone Road, King's Heath, Birmingham.

DALKEY.—The Branch layout has been laid permanently and a timetable drawn up. The Hornby Control system has been installed and a Branch library has been started. Gas is now laid in the club room and this greatly facilitates operations. Members are at present very busy in installing a complete signalling system. Secretary: J. W. L. Martin, Villaggio, Dalkey, Co. Dublin.

SPRINGBOIG (GLASGOW).—All the Branch locomotives have been carefully timed over the layout in order that a revised timetable may be drawn up. Signals constructed from Meccano parts have been introduced and are working efficiently. An instructive visit was paid to a model railway display in Glasgow. Secretary: David Ross, 86, Hermiston Road, Springboig, Glasgow.

LENTON SANDS.—Membership of the Branch has recently increased rapidly and another and larger club room has become necessary. The removal to new quarters was rapidly effected, the property of the Branch being installed within 24 hours of the room being offered to the Branch. A special committee of six members is meeting on Saturday afternoons to lay the stations and track of the permanent layout. A record number of 144 copies of the "*Lenton Sands Magazine*" were sold during the month. Sections for special purposes are now being formed. These are given the use of Branch room on nights mutually arranged. Secretary: F. W. Byron, 125, Harrington Drive, Lenton Sands, Nottingham.

"ROBERT HILL" (KIDDERMINSTER).—This Branch has been divided into Junior and Senior Sections. At the first meeting the juniors operated the track and the seniors spent the evening preparing a timetable and planning a new track. At the second meeting the President presented the Certificate of Incorporation to the Chairman, and expressed his delight in the progress that had already been made. A demonstration of complicated timetable working was given by the Senior members, which so fired the enthusiasm of the juniors that they have determined to learn as much as possible of this fascinating subject so that they can obtain full advantage from the layout. Some interesting engine tests were made over a set length of track, each competing engine hauling the same load. The winner was a 4-4-4, and its owner was loudly cheered. A Branch magazine is being started, and a Photographic Section is being discussed. A talk is to be given by a fireman on "*A G.W.R. Goods Train*," also one on "*Favourite Stations and Why*" by one of the members. Secretary: Wilfred Barker, 44, Clarence Street, Kidderminster.



Members of the Harold Wood Branch, No. 109. Chairman, G. B. Underwood, Secretary, E. N. Tyler. This Branch possesses a ballasted track to which embankments, fencing and home-made scenery give a realistic appearance. Operations on it are controlled by colour light signals.

CHINGFORD.—A magazine has been produced, entitled "*Full Speed Ahead*," which includes a number of extremely interesting articles. Amongst these are "*Recent Railway Developments*"; "*The Wuppertal Overhead Electric Railway (Germany)*"; "*The Future of English Railways*"; "*Railway Operation*"; "*Permanent Way*"; "*Tractive Effort*." It has been decided by vote that track meetings are the most popular, and consequently meetings are devoted almost entirely to track operating. Members are becoming very efficient in operating the most intricate of layouts. Express and suburban services are regularly included in the operations carried out on the Branch layouts. Secretary: D. G. Tucker, 31, Frederica Road, Chingford, London, E.4.

SAINT NICHOLAS (BIRMINGHAM).—A very interesting visit was paid to Snow Hill Station (G.W.R.) where the members were allowed to inspect locomotive No. 6019 "*King Henry V*." The Branch track is being laid down permanently, and operations are carried out on the partially completed track. It is hoped to pay visits to New Street (L.M.S.R.) and also the L.M.S.R. Signal Box if this can be arranged. Secretary: John E. Wilson, 23, Meadow Hill Road, King's Norton, Birmingham.

Further Branches in Course of Formation

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

BIRMINGHAM—S. S. Ward, 5, Franklin Road, Bournville, Birmingham.

BOURNEMOUTH—R. R. Common, Swiss Cottage, 13, Uplands Road, Bournemouth.

BRISTOL—A. S. Lomax, 58, Downs Park East, Westbury Park, Bristol.

CROSSGATES—P. Breckin, 22, Marshall Terrace, Crossgates.

GLASGOW, W.2—Iain Simpson, 28, Polwarth Gardens, Glasgow, W.2.

HILLINGDON—B. Kidd, "Stockham," Harlington Road, Hillingdon, Essex.

HIPPERHOLME—Sam Hoyle, "The Hollies," Hollybank, Hipperholme, Nr. Halifax.

HULL—J. Sanderson, 7, Lizzies Grove, Liverpool Street, Hessle Road, Hull.

NEILSTON—W. Harrison, 18, Millview Terrace, Neilston, Renfrewshire.

ROTHESAY—A. Fraser, "Lilyoak House," Ballochgoy, Rothesay.

SEVENOAKS—F. G. Finn, "Springfield," St. James Road, Sevenoaks.

SHEFFORD—P. J. Ransby, Campton Villa, Ampthill Road, Shefford, Beds.

SOUTHPORT—G. R. Bartram, "Milestones," Blundell Drive, Birkdale, Southport.

STALYBRIDGE—Mr. G. H. Snow, The Lodge, Stamford Lodge, Stamford Road, Stalybridge.

STIRCHLEY—A. S. F. Rippon, 83, Lyndworth Road, Stirchley, Birmingham.

SUTTON COLDFIELD—Ivor D. Fairfax, 90, Hollyfield Road, Sutton Coldfield.

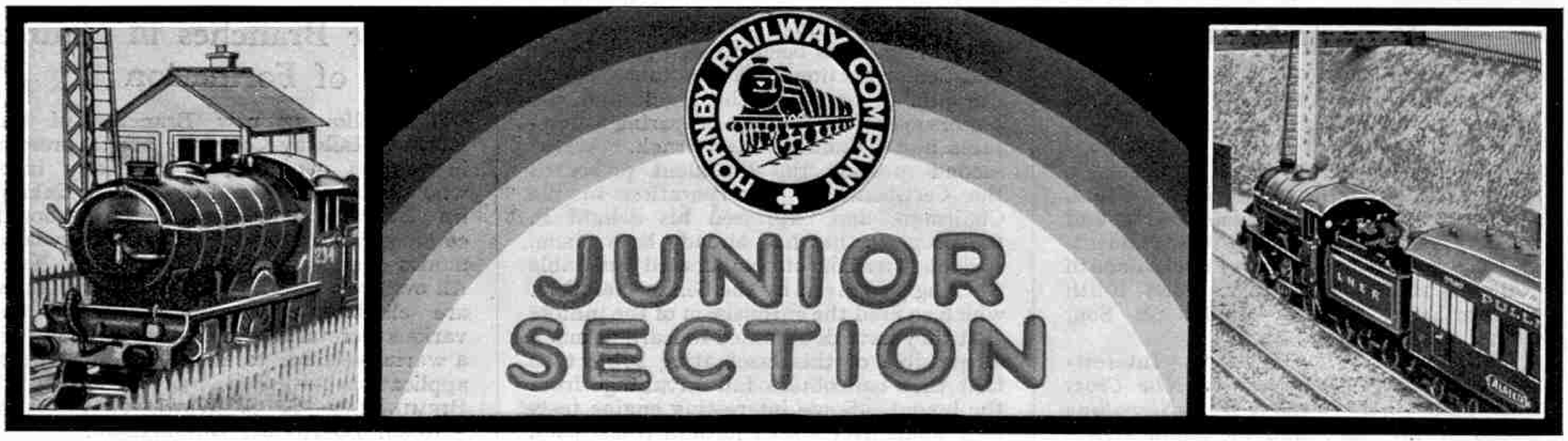
SUTTON-IN-ASHFIELD—E. W. Brown, 3, Beecrofts Row, Devonshire Square, Sutton-in-Ashfield.

WATFORD—Francis Canvin, 40, Bedford Street, Watford.

WILMSLOW—G. R. Holt, "Rough Lea," Hill Top, Wilmslow, Cheshire.

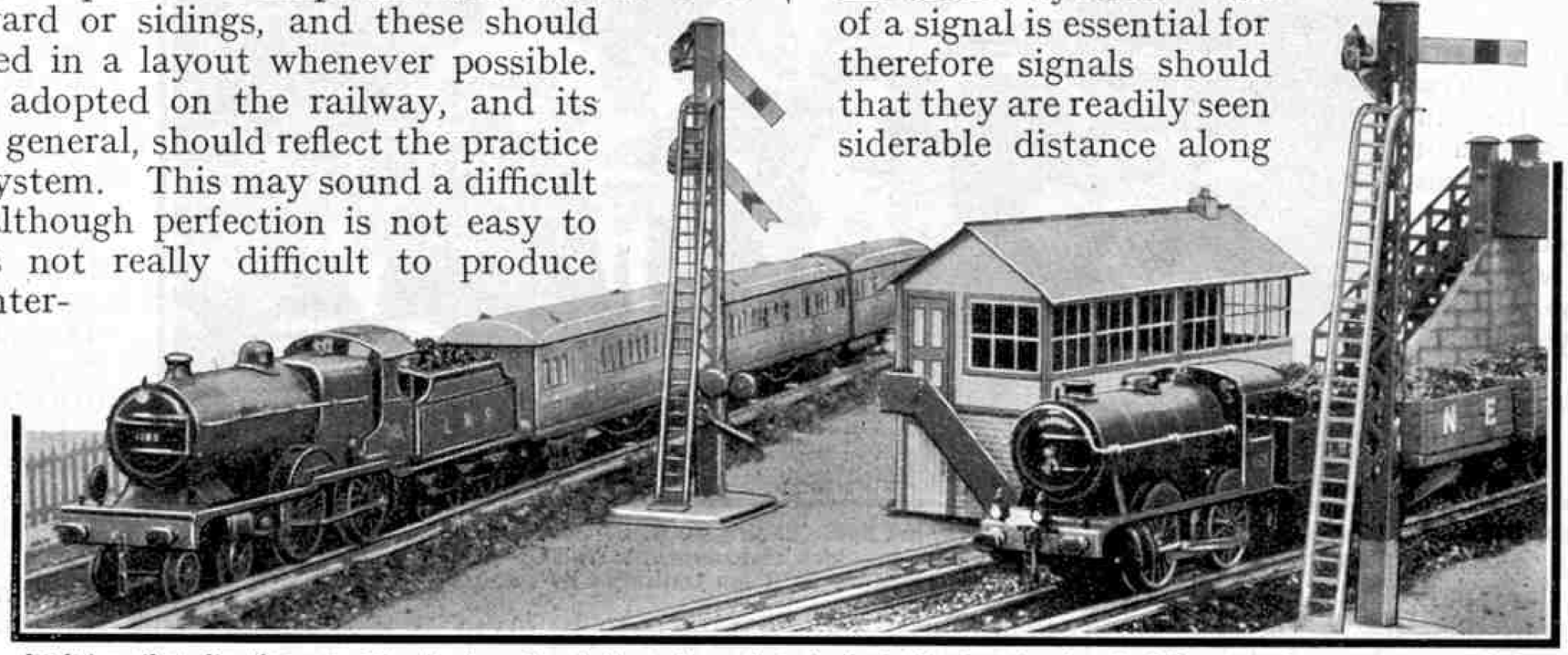
Further H.R.C. Incorporated Branches

159. SIDMOUTH SENIOR—Miss E. Spencer, c/o F. M. Gliddon & Son, Church Street, Sidmouth.
160. "FELTONFLEET" (COBHAM)—D. G. Sillars, "Feltonfleet," Cobham, Surrey.
161. ALL SAINTS BOYS' CLUB (STONEYCROFT)—Mr. Harry Farnham, 10, Aylesford Road, Old Swan, Liverpool.
162. "HILL TOP" (WILMSLOW)—J. Manby, "The Croft," Hill Top, Wilmslow, Cheshire.
163. OLTON (Birmingham)—J. T. Austin, "Stoneleigh," Kineton Road, Olton, Birmingham.



XXVIII.—AIDS TO REALISM ON SIMPLE LAYOUTS

THE success of a miniature railway system, as judged by interested onlookers, lies in its faithfulness or otherwise to actual railway practice. Not only must the trains run smoothly over well-laid tracks, but also they must commence and terminate their journeys in the proper manner at a station. In the case of goods trains the usual point of despatch and arrival is a marshalling yard or sidings, and these should be incorporated in a layout whenever possible. The methods adopted on the railway, and its appearance in general, should reflect the practice of a full-size system. This may sound a difficult matter, but although perfection is not easy to achieve, it is not really difficult to produce thoroughly interesting results. As in so many other matters, it is the little things that count, and so often make all the difference between success and failure.



An interesting situation on a Hornby layout. A through goods train is detained at the signal while a stopping passenger train has the right of way over the points. Both engines carry the appropriate headlamps as mentioned in this article.

Let us take first the question of stations. We frequently find that a miniature railway system includes a station, but that no particular advantage is taken of it. A station must be used in the correct manner or its effect will be lost to a very large extent. The trains should be made to stop there, either by use of the brake rail, or else by means of the method, frequently described in these pages, of giving the clockwork mechanism of the engine a sufficient number of turns of the key to bring it to rest with its train at the platform. This plan is obviously far better than that of starting a train anywhere on the line and merely letting it run until it stops, leaving the station entirely neglected, so that there is scarcely any reason for its existence. A feature that immediately increases the interest of a station is the provision of a siding near by, where goods wagons may be loaded or unloaded, or stored when not running in trains. A goods train may, of course, commence and end its journey at such a siding.

The question of signals and signal-cabins is very important, and care should be taken to see that these accessories are placed in suitable positions. A good situation for a signal cabin is at the end of the station platform, so that the signalman is provided with a good view of all that is going on in the station and the yard. Other cabins should be placed by any junction that occurs along the line, or near any point where the main line diverges into two separate roads of practically equal importance.

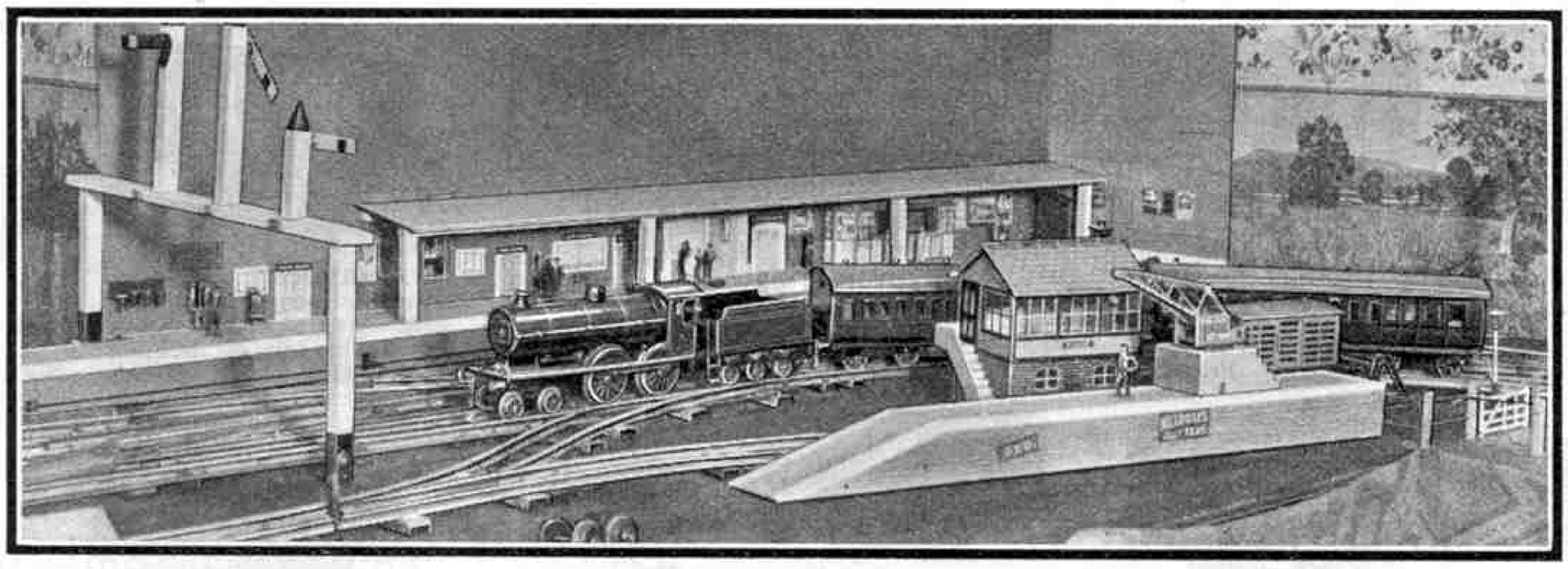
Signals are often the cause of trouble to younger enthusiasts, and a knowledge of the elementary principles of signalling is of great value in laying out a miniature system. An early sight of a signal is essential for a driver, and therefore signals should be placed so that they are readily seen from a considerable distance along the line. They are usually situated on the left-hand side of the line to which they apply, but there are exceptions to this. Where a better view of the signal is obtained by having it on the right-hand side, as would be the case in passing through a cutting on a left-hand curve, then the post is placed on the right. Stations should be protected by the necessary signals. The starting signals, the purpose of which is indicated by their name, should be placed at the end of the platform, or as near to it as circumstances permit. These signals should be included wherever possible, as their omission spoils to a large extent the realistic effect.

A subject that is not directly connected with signals on miniature railways, but may well be considered with them, is the correct use of locomotive headlamps when these are detachable. As most "*M.M.*" readers know, different positions of these lamps indicate different classes of train, for the guidance of signalmen and staff generally. Particulars of the standard head code and the various indications appeared in the "*M.M.*" for February 1930. Those who possess locomotives fitted with detachable lamps should make full use of them, for they will find that the interest of the railway from the onlooker's point of view is thus greatly increased.

Gradient posts are often placed at the side of the line without due thought being given to their purpose. If a viaduct is included, it suggests that the line either drops to the level of the viaduct, or climbs up from low-lying country. Where the Hornby Viaduct is used, the line is lower than the viaduct, and has to climb to cross it.

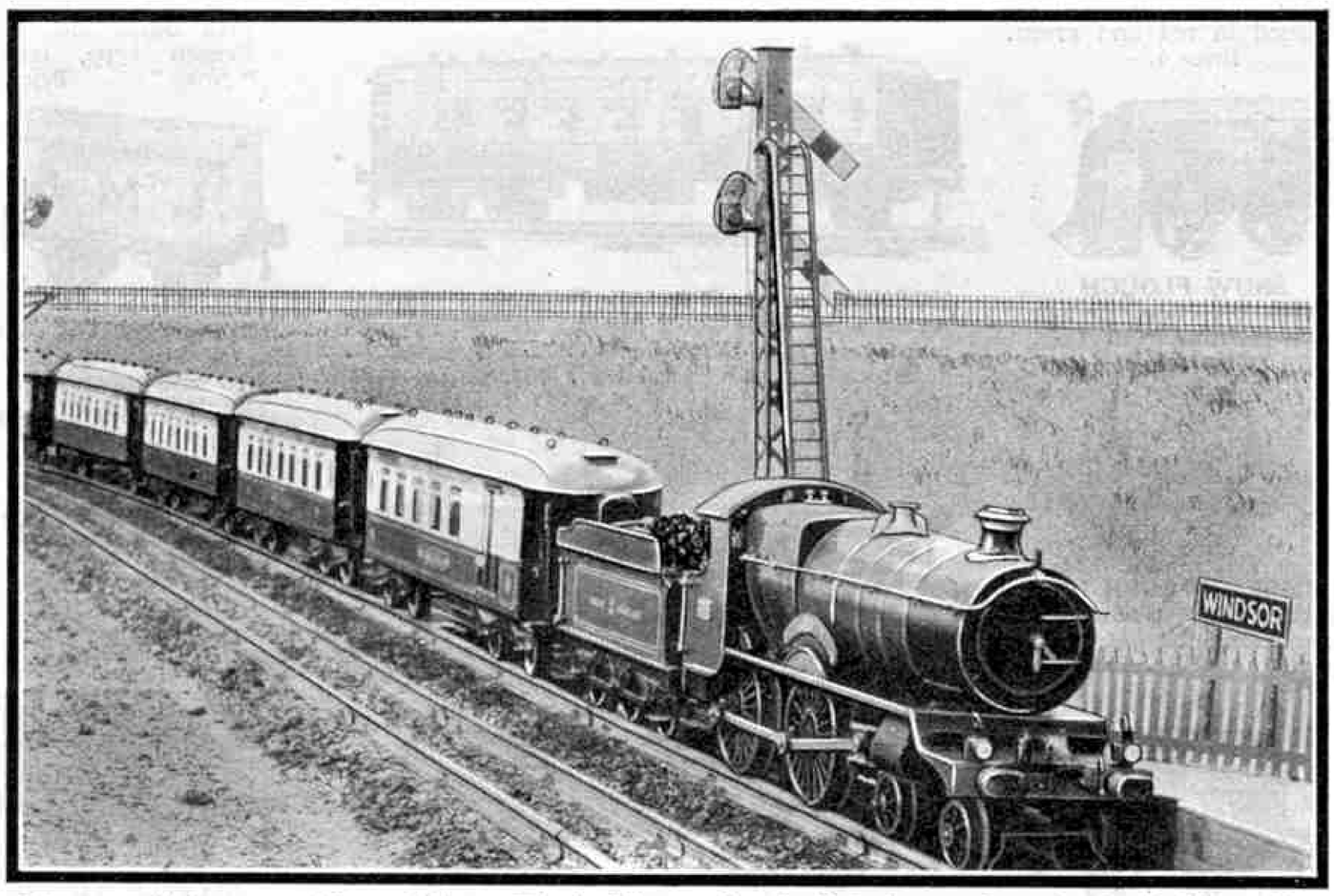
Gradient posts, therefore, should be placed on each side to show that the line rises. If a tunnel is used on the layout a gradient post should be placed at a reasonably long distance away from its mouth, to indicate that the ground falls to allow the line to pass through without unnecessary excavation. On the further side of the tunnel another post should be placed to show that the line rises again. Similarly, such signs as "Caution" and "Shut Off Steam" should be placed in appropriate positions.

A point that often strikes those who see a miniature railway for the first time is the bareness of the interior of the locomotive tenders. Any one who has seen a big express engine backing on to its train before commencing a long journey cannot have failed to notice the huge pile of coal in the tender, as much as six or seven tons often being heaped up there. The well-known L.N.E.R. corridor tenders carry nine tons of coal, for these tenders run behind the engines that travel the 400-mile non-stop run of the "*Flying Scotsman.*" The tenders of miniature locomotives therefore should be provided with fuel, and the effect of this addition is surprising, as those who try it for the first time will agree.



A realistic station on the layout of our reader Mr. J. Grime of Belfast. It is fully equipped with accessories, and the yard includes a loading platform and crane for goods traffic.

The method adopted will vary slightly for different tenders, but the basis of the scheme is as follows. A cardboard framework should be made up to fit accurately into the coal space, with its top a little below the edge of the tender sides. This framework should be painted black. When the paint is dry, thin glue should be spread over its upper surface, and on to this small pieces of coal—broken to about the size of dried peas and washed to remove as much dirt as possible—should be pressed, and the whole allowed to set. This coal will appear flat, and not as seen in actual tenders; so that further pieces should be glued on top of it until a realistic-looking pile is obtained. When all is set hard, any dust should be blown off, and the built-up coal heap is then ready for the tender. Coal made up in this manner cannot spill in the event of a derailment, and it may be removed without difficulty when it becomes necessary to do so.



An express train approaching a station. The double arm signal with both semaphores in the "off" position shows that the next home signal will give a clear indication also. The coal in the tender gives a very realistic appearance to the locomotive.

A similar plan may be followed for wagons, for these should not be run empty. Goods trains are run for a purpose, and this should be shown by the freight carried in the miniature wagons. Another point in connection with goods trains is the necessity of providing a goods brake van in the rear. On real railways no goods train is allowed to run without one, for with loose chain couplings and no continuous brakes a long train may easily get out of hand on a steep gradient, unless a brake van is provided to steady the train and assist the engine in controlling its running.

A criticism often made in regard to clockwork locomotives is that there is so much winding-up. This operation is of course necessary, but it is possible to carry it out in a far less noticeable manner than is usually done, especially by beginners. Only too frequently is the engine lifted off the track—leaving the unfortunate train looking as though it had been beheaded—and then held upside down in one hand, while the key is manipulated with the other. The effect is most un-railwaylike, and such a performance is quite unnecessary. If the locomotive is steadied by grasping the frame with one hand, while the key is turned with the other, it will remain in its place on the track and be wound up quite as easily and quickly as by the unrealistic method of lifting it. The advantage of holding the locomotive by the frame is that the bright finish of the boiler and upper works is not in danger of being spoiled by finger marks, as these parts are not handled in any way. Where a model railwayman takes particular pride in the appearance of his locomotives it is not a bad plan to wear an old soft glove on the left hand, as the engine is usually steadied by this hand when being wound up.

Another necessary operation, that of coupling up, is capable of being carried out in a more railwaylike manner than is often the case. The use of the Hornby Shunter's Pole enables this to be done more easily and quickly than where out of scale human fingers attempt to grasp minute links and persuade them over coupling hooks in the limited space between two vehicles.

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.

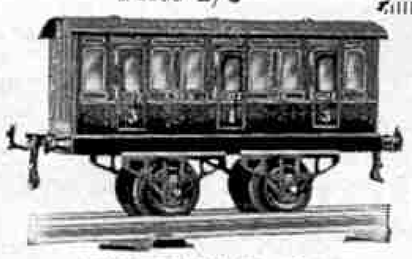
PETROL TANK WAGON "PRATTS"
Beautifully finished. Price **2/6**

PETROL TANK WAGON "B.P."
Finished in yellow. Price **2/6**

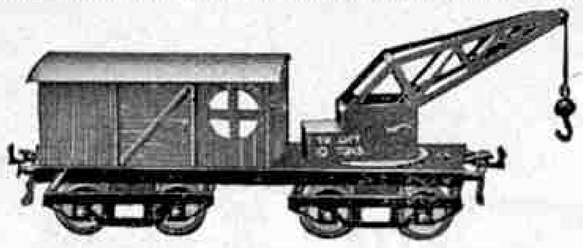
PETROL TANK WAGON "SHELL"
Finished in red. Price **2/6**

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/-**



***HORNBY No. 1 PASSENGER COACH**
Realistic in design and fitted each side with opening doors. Price **2/6**

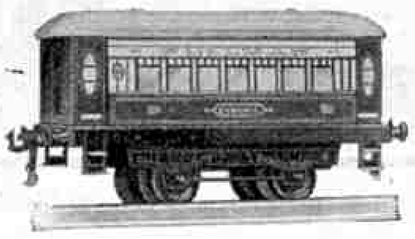


***BREAKDOWN VAN AND CRANE**
Beautifully coloured in brown and blue, with opening doors. Suitable for 2-ft. radius rails only. Price **6/3**

GUARD'S VAN
Realistic design, fitted each side with opening doors. Obtainable in L.N.E.R., L.M.S., G.W. or S.R. colours. Price **3/-**

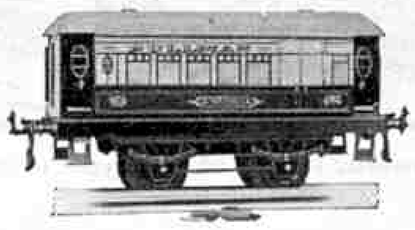
WAGON (French Type)
Lettered "Nord." Highly finished in colours. Price **3/3**

MILK TRAFFIC VAN
Fitted with sliding doors. Complete with milk cans. Price **3/6**

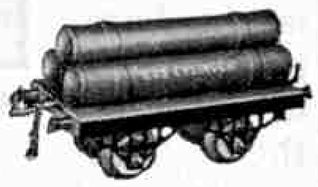


No. 1 PULLMAN COACH
Realistic design. Beautiful finish. Price **3/6**

RIVIERA "BLUE" TRAIN COACH
"Dining" or "Sleeping."
This is a beautiful model, substantially built and well finished. Suitable for 2-ft. radius rails only. Price **14/-**

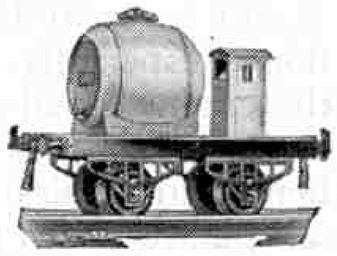


No. 1 PULLMAN COACH COMPOSITE
A well designed model. Richly finished. Price **4/-**

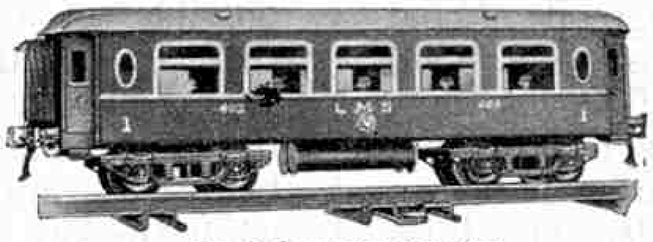


GAS CYLINDER WAGON
Finished in red, lettered gold. Price **2/6**

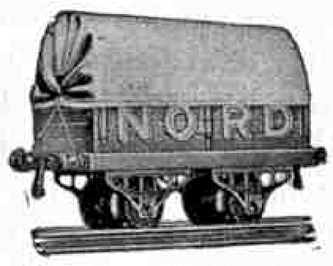
SIDE TIPPING WAGON
Excellent design and finish. Lettered "Robert Hudson Ltd." Price **2/6**



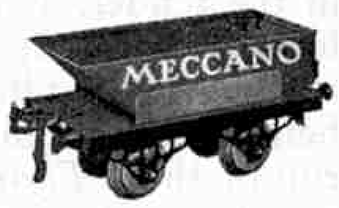
WINE WAGON, SINGLE BARREL
An interesting model of the single-barrel type of wine wagon used in France. Finished in red and green. Price **4/-**



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**

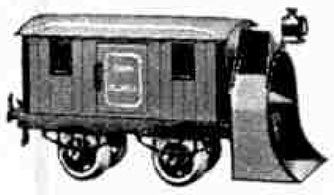


COVERED WAGON (French Type)
This wagon is fitted with frame and sheet. French type, lettered "Nord." Price **3/-**

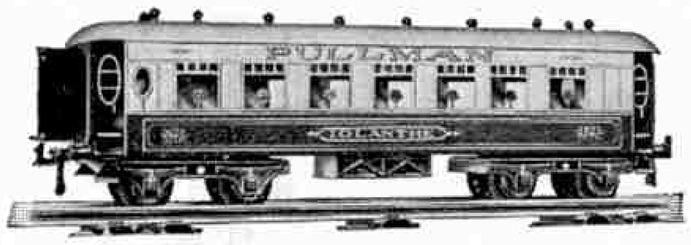


ROTARY TIPPING WAGON
Finished in orange. Price **3/-**

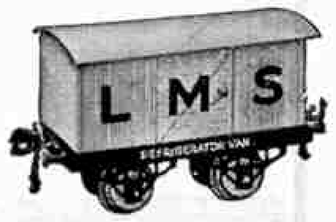
TIMBER WAGON No. 1
Beautifully enamelled in green and red. Price **1/9**



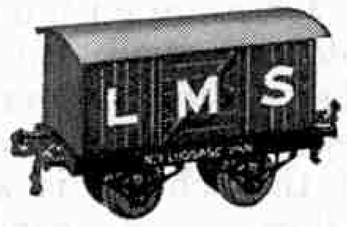
SNOW PLOUGH
With revolving plough driven from front axle. Price **5/6**



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/-**

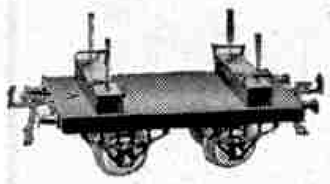


***REFRIGERATOR VAN**
Beautifully enamelled. Fitted with opening doors. Price **3/9**



***LUGGAGE VAN No. 1**
With opening doors. Price **3/6**

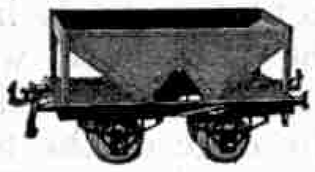
***GUNPOWDER VAN**
Finished in red. With opening doors. Price **3/6**



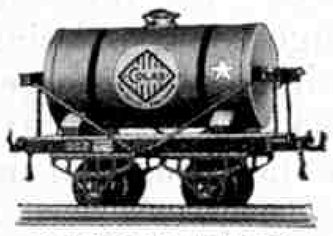
LUMBER WAGON No. 1
Fitted with bolsters and stanchions for log transport. Price **2/-**

TROLLEY WAGON
Finished in brown and blue. Suitable for 2-ft. radius rails only. Price **4/6**

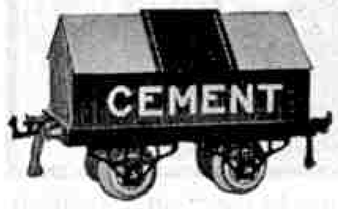
CRANE TRUCK
Finished in brown and blue. Price **3/6**



***HOPPER WAGON**
Mechanically unloaded. Finished in green. Price **3/6**

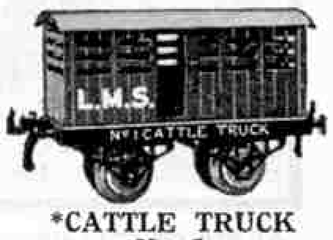


BITUMEN TANK WAGON "COLAS"
Finished in blue. Price **5/3**



CEMENT WAGON
Finished in red. Price **3/-**

TIMBER WAGON No. 2
Beautifully enamelled in green and red. Suitable for 2-ft. radius rails only. Price **3/6**

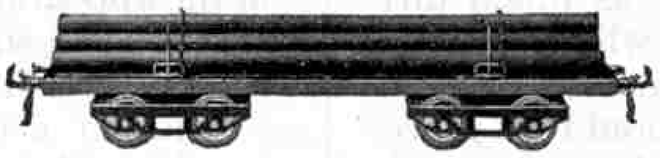


***CATTLE TRUCK No. 1**
Fitted with sliding doors. Very realistic design. Price **3/3**

MILK TANK WAGON "UNITED DAIRIES"
A very realistic model, finished in blue and white. Price **6/-**

JACOB'S BISCUIT VAN
Finished in crimson lake. With opening doors. Price **3/6**

CARR'S BISCUIT VAN
Finished in blue. With opening doors. Price **3/6**



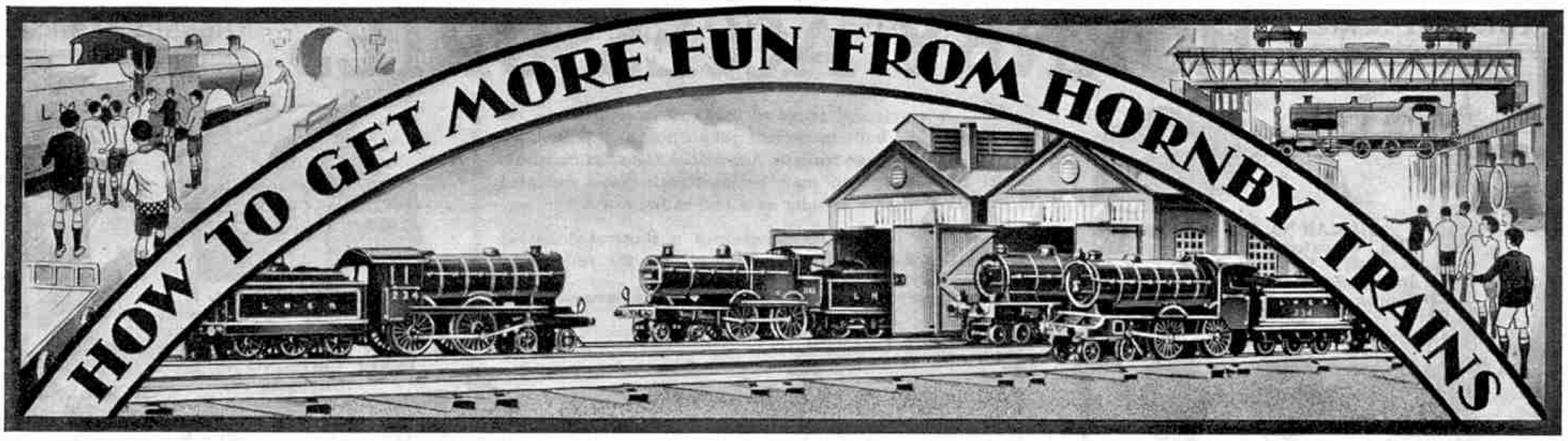
LUMBER WAGON No. 2
Fitted with bolsters and stanchions for log transport. Suitable for 2-ft. radius rails only. Price **4/-**

**In L.M.S., L.N.E.R., G.W., or S.R. lettering.*

CRAWFORD'S BISCUIT VAN
Finished in red. Opening doors. Price **3/6**

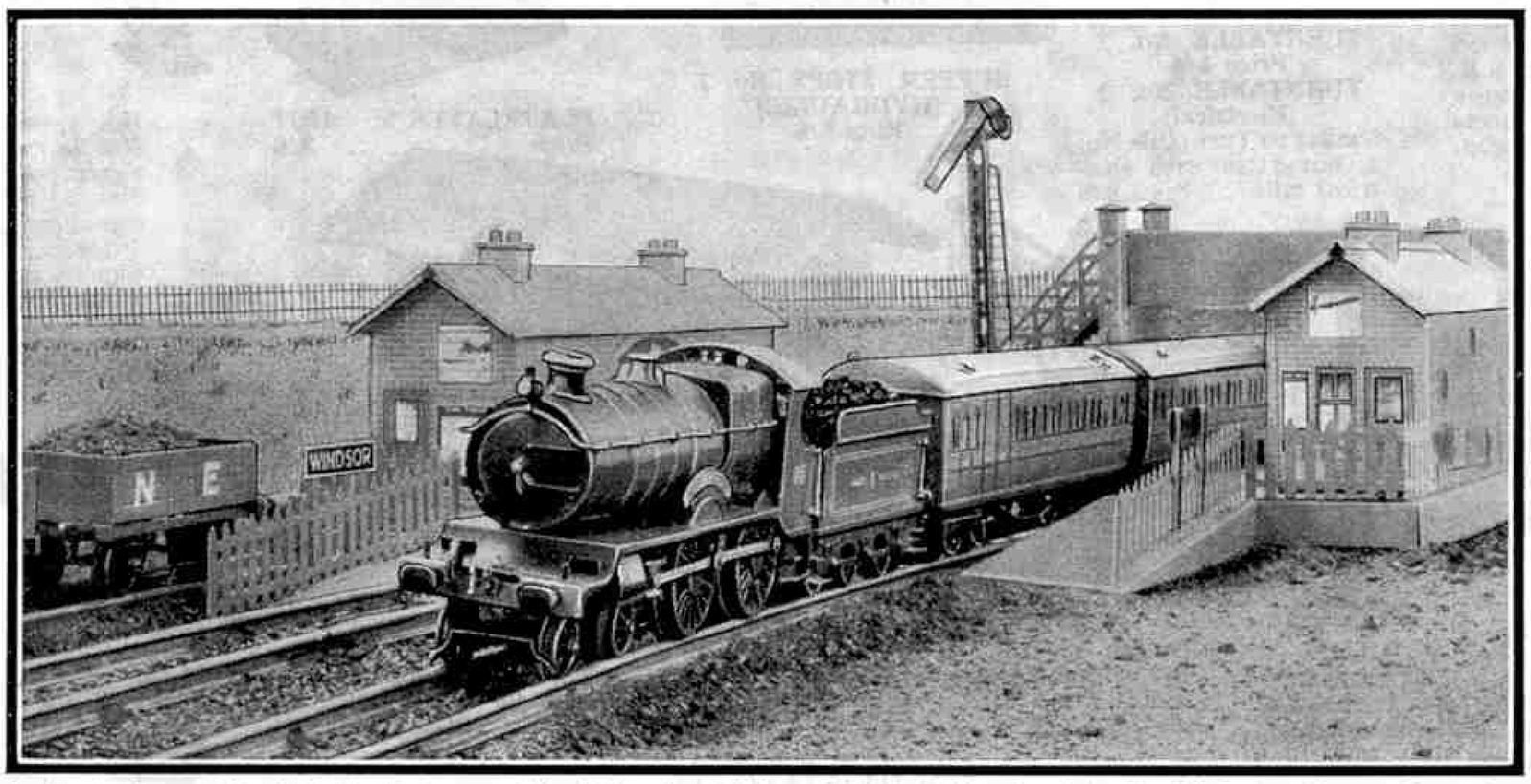
SECCOTINE VAN
Beautifully finished in blue. With opening doors. Price **3/6**

Manufactured by MECCANO LIMITED, BINNS ROAD, OLD SWAN, LIVERPOOL



XXX.—STATION PLATFORMS ON HORNBY RAILWAYS

MINIATURE railways vary enormously in the amount of importance played by stations. We know of one such railway that might almost be described as consisting entirely of one terminal station! In this case the railway began in the normal manner with a small terminal station and one or two country stations or halts. Then the railway owner began to add to his terminal station, and by degrees it increased in interest to such an extent that he became completely absorbed in it. The railway proper is now only an excuse for the existence of the station, and its proud owner obtains the keenest enjoyment from operating trains into and out of his station, which is elaborately signalled, and provided with ample siding accommodation, turntable and engine shed. At the other extreme we know of many interesting railways in which the stations are regarded merely as convenient stopping places, and are not developed in any way.



A stopping passenger train leaving a wayside station hauled by a G.W.R. "County of Bedford" locomotive. Connection between the two platforms is afforded by the use of the footbridge that appears in the background.

It is probable that many readers have not given sufficient thought to the question of stations. There is no doubt that a well-planned terminal or through station, even though it may not be large, adds greatly to the interest of a layout, and in this article we propose to give some hints in regard to the placing and formation of the platforms of such a station.

A main station may have only two main platforms for up and down traffic respectively, these being of sufficient length to accommodate two or three trains at the same time. This arrangement is fairly common, and it is to be seen in stations in many towns on British railways. One advantage of constructing a station on this principle is that there is no necessity for a roof of large span, such as is required to cover a series of platforms placed side by side. Very long platforms of this nature, however, will probably not suit the average Hornby layout, owing to the amount of space that is required to accommodate them, and the number of points that are necessary for their working.

At the same time the platforms in a model station must be of sufficient length to accommodate comfortably the trains that are likely to be run into them, so that there is no need for a train to have to pull up twice in order to bring the rear coaches into a position for passengers to alight. Naturally the amount of rolling stock that a railway possesses will have some bearing on the question, but it should always be borne in mind that the rolling stock is certain to be added to from time to time. For this reason the platforms should be constructed of ample length, or should be planned in such a manner that they may be added to without difficulty as required.

It is not necessary for all the platforms in a main station to be of equal length. It is customary for important expresses to be accommodated as far as possible in the longest platforms, which usually have roads laid on them in order to allow motor vehicles of all kinds to meet the trains. The smaller platforms are reserved as far as possible for the shorter and lighter local trains.

If the model railway owner aims at producing an elaborate terminal station, he will be well advised to follow the general design with which we are all so familiar. This consists essentially of a circulating area with booking office and station buildings all under cover at the rear of the station, and with the platforms connected to it more or less at right angles. Platforms of this nature for a model station may be formed by use of the lengths of Passenger Platform included in the Hornby Series. These sections are held securely together by means of an ingenious locking device. The circulating area may consist of the No. 2 Railway Station, which is fitted with locking devices on the platform face also, so that lengths of Passenger Platform may be

HORNBY SERIES

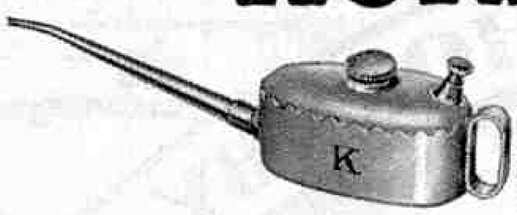
HORNBY ACCESSORIES

HORNBY SERIES

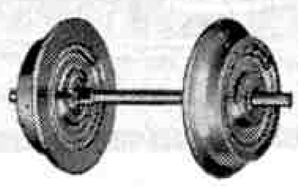
There is a splendid range of Railway Accessories in the Hornby Series, built in perfect proportion and beautifully finished. With these realistic Accessories the most elaborate model railway system may be constructed and operated in exactly the same manner as a real railway.

A selection of Hornby Accessories is illustrated below. Your dealer will be pleased to show you the full range.

DOUBLE ARM SIGNALS No. 1
Price 4/3 per pair.
DOUBLE ARM SIGNAL No. 2
(As illustrated).
Price 3/- each.

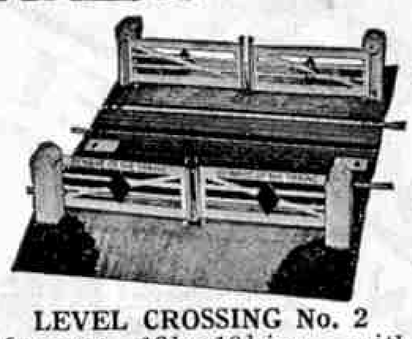


OIL CAN No. 2 ("K" Type)
This miniature Oil Can operates perfectly. The oil is ejected drop by drop by depressing the valve. Polished Copper. Price 3/6

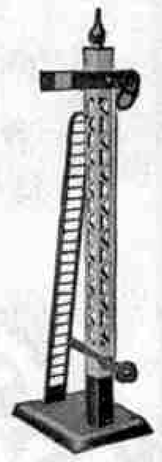


MANSELL WHEELS
These solid die-cast wheels are correctly designed and may be fitted to Hornby Wagons, Vans, Coaches, etc. Price, per pair, 4d.

M STATION SET, 7 pieces
Price complete 3/6
The components of the M Station Set may be purchased separately as follows:—M Wayside Station. Price, each, 1/-
M Signal Box ... Price, each, 6d. M Signals ... Price, each, 4d.
M Station ... Price, each, 1/3 M Telegraph Poles. Price, each 4d.

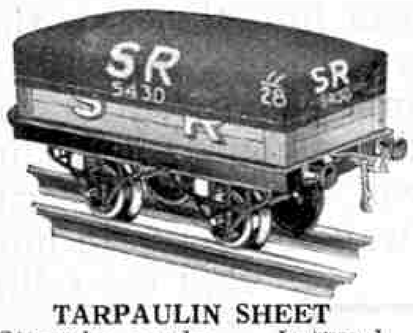


LEVEL CROSSING No. 2
Measures 13½ × 10½ ins., with two tracks of gauge 0 rails in position .... Price 5/6
LEVEL CROSSING No. 2 (Electrical)
Similar to Level Crossing No. 2, but fitted with two electrical tracks ... ... Price 8/-

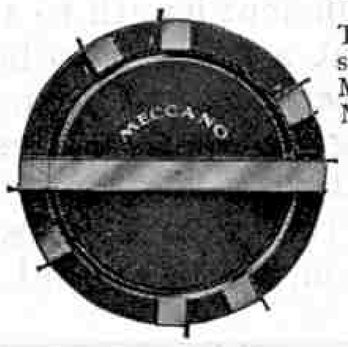


SIGNAL No. 2
Price 2/6 each. "Home" or "Distant."

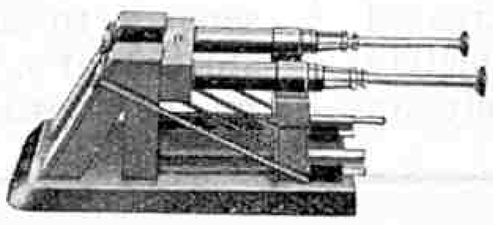
TUNNEL
Realistic and finished in colours ... Price 7/6



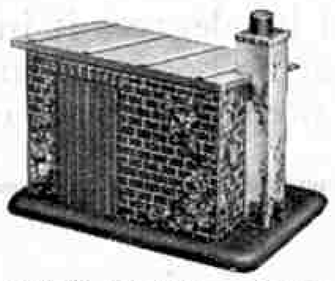
TARPAULIN SHEET
Strongly made. Lettered L.M.S., G.W., N.E. or S.R. The above illustration shows one of the Tarpaulin Sheets fitted to a Hornby Wagon. Price 3d.



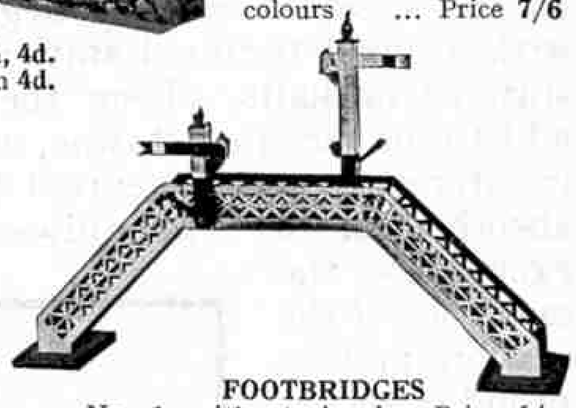
TURNTABLE No. 2
Price 4/6
TURNTABLE No. 2 (Electrical)
Similar to Turntable No. 2, but fitted with electrical rails ... Price 8/6



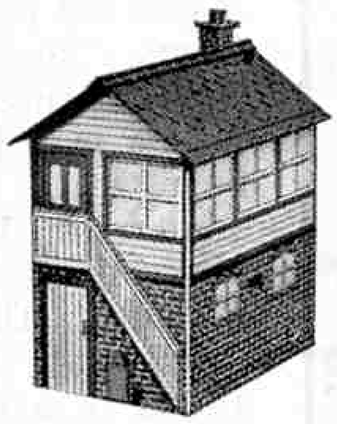
BUFFER STOPS No. 2 (HYDRAULIC)
Price 5/6



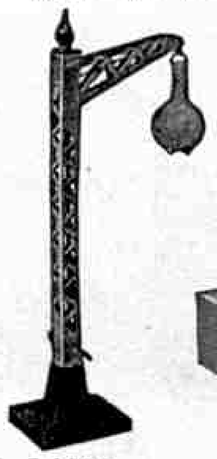
PLATELAYER'S HUT
Price ... 2/6



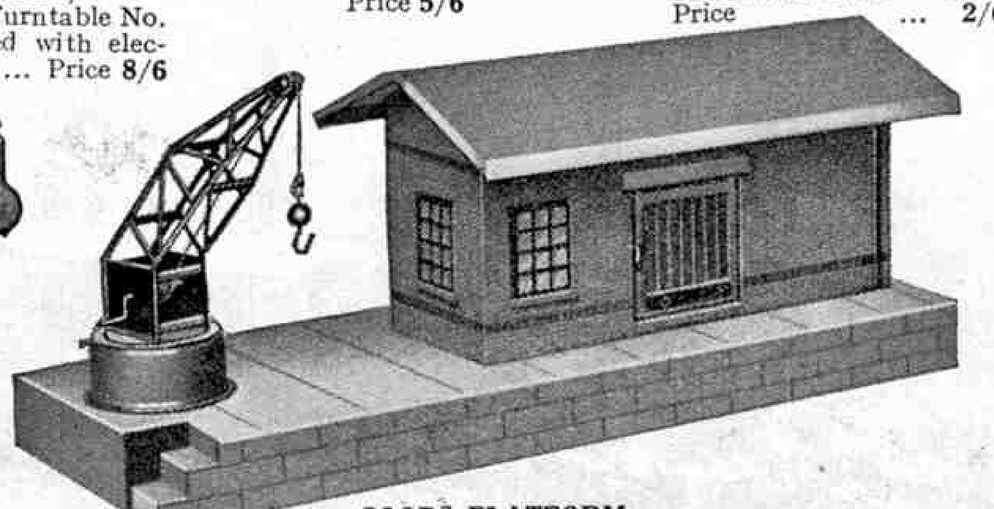
FOOTBRIDGES
No. 1, without signals. Price 4/-
No. 1a, with detachable tin-printed signal posts and arms ... Price 4/9
No. 2, with detachable enamelled signal posts and arms (as illustrated). Price 7/6
Signals only, for No. 2 footbridge. Price ... ... per pair 3/9



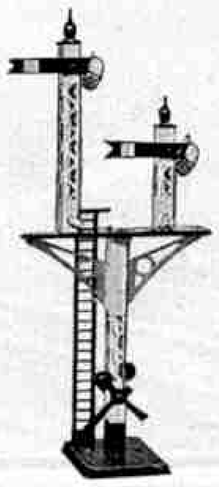
SIGNAL CABIN No. 1
Dimensions: Height 6 ins. Width 4½ ins. Length 6 ins. Finished in colours ... Price 2/9



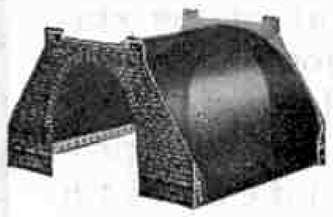
LAMP STANDARD No. 1 (SINGLE)
An electric flash-lamp bulb may be fitted into the globe. Price 3/6



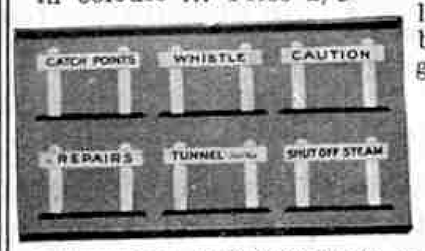
GOODS PLATFORM
Length 16¾ ins. Height 6¾ ins. Width 6 ins. The crane at the end of the platform revolves on its base. It is enamelled in colours and is fitted with a crank and ratchet mechanism for controlling the load ... ... Price 12/6



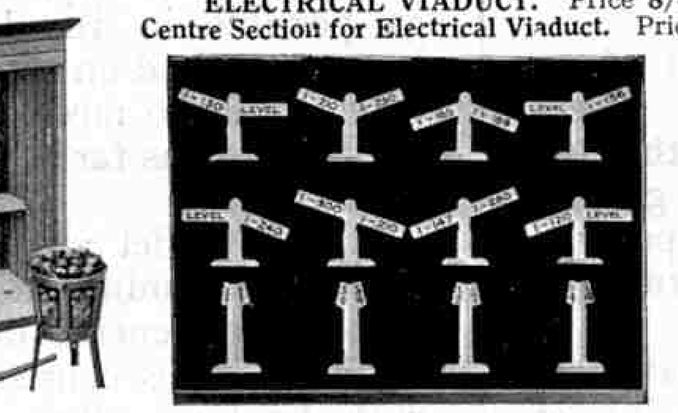
JUNCTION SIGNAL
"Home" or "Distant." Signal arms operated by levers at base. Very realistic model, standing 14 ins. in height. Price 6/-



TUNNEL ENDS
These Tunnel Ends add realism to Tunnels made of cardboard, or other suitable material. They may be fitted into position quite easily. Price, per pair, 2/9



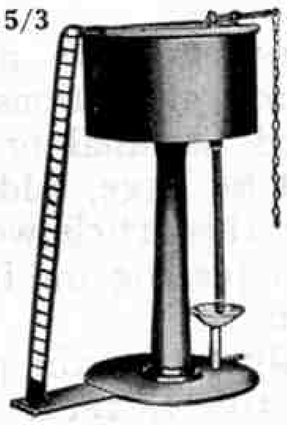
RAILWAY ACCESSORIES No. 8
Notice Boards.
Price, per set, 2/3



VIADUCT. Price 7/-. Centre Section only. Price 4/9
ELECTRICAL VIADUCT. Price 8/-
Centre Section for Electrical Viaduct. Price 5/3

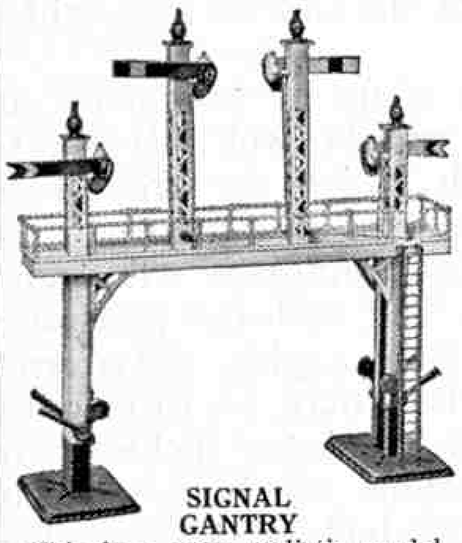
RAILWAY ACCESSORIES No. 7
Watchman's Hut, Brazier, Shovel and Poker ... Price 1/6

RAILWAY ACCESSORIES No. 5
Gradient Posts and Mile Posts. Price 2/-



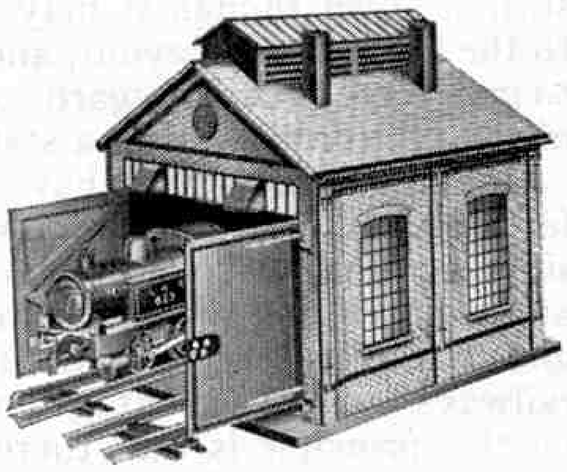
WATER TANK
Brightly coloured. Fitted with flexible tube and valve lever. Price 8/6

RAILWAY ACCESSORIES No. 9
Station Name Boards.
Price, per set, 2/6



SIGNAL GANTRY
This is a very realistic model, the signal arms of which are operated by levers at the base of the standards. Attractively finished in colours. Price 10/-

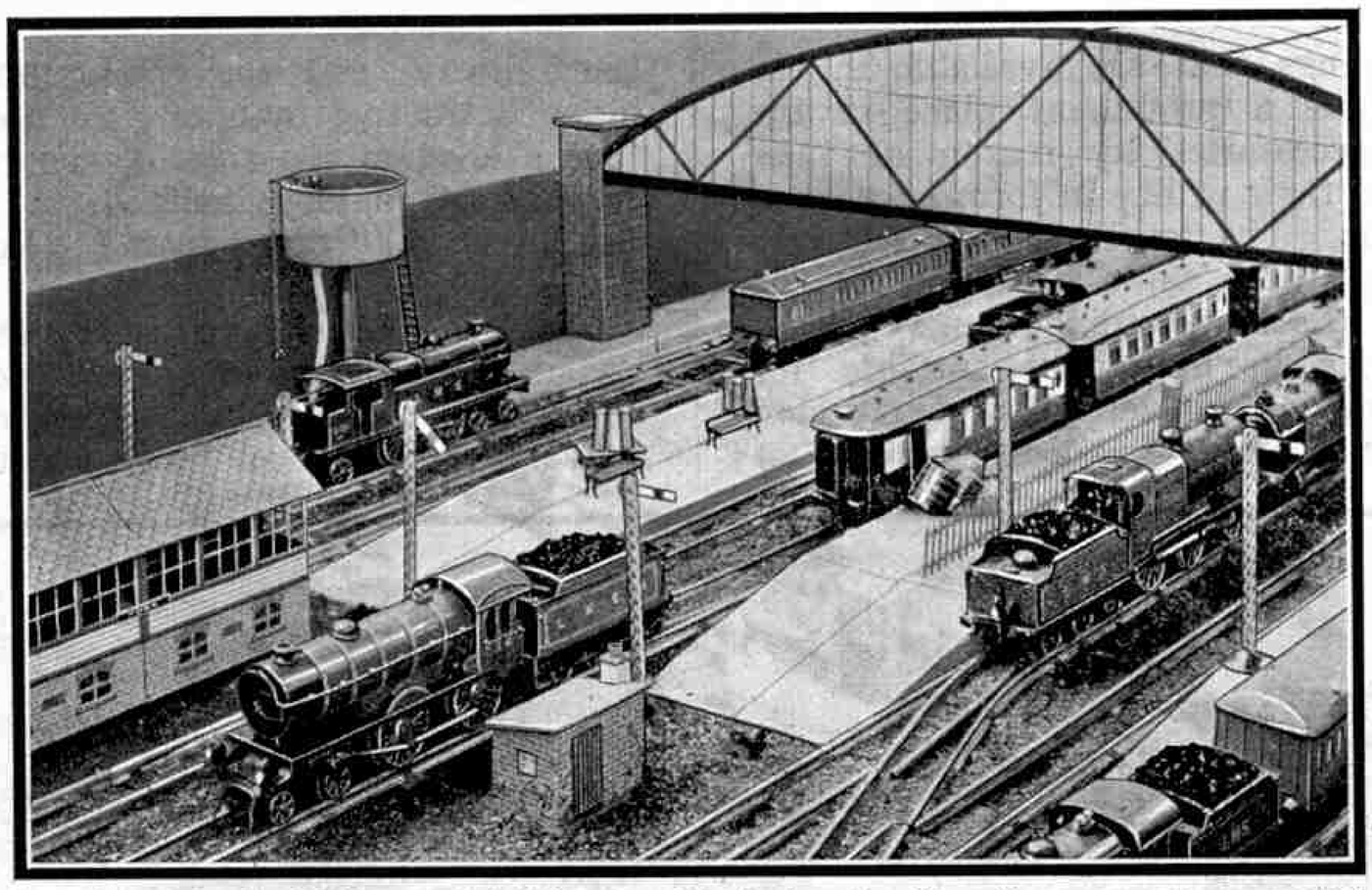
RAILWAY STATION No. 2. Excellent model, beautifully designed and finished. Constructed in three sections, which are detachable. Dimensions: Length 2 ft. 9 ins., breadth 6 ins., height 7 ins. ... ... Price 12/6



ENGINE SHED No. 1
This Shed is beautifully finished in realistic colours. It will accommodate Locomotives and Tenders of the M series, and Locomotives of No. 0 and No. 1 types ... ... Price 15/-

connected to it at right angles. These platforms may then be made up to whatever length is required.

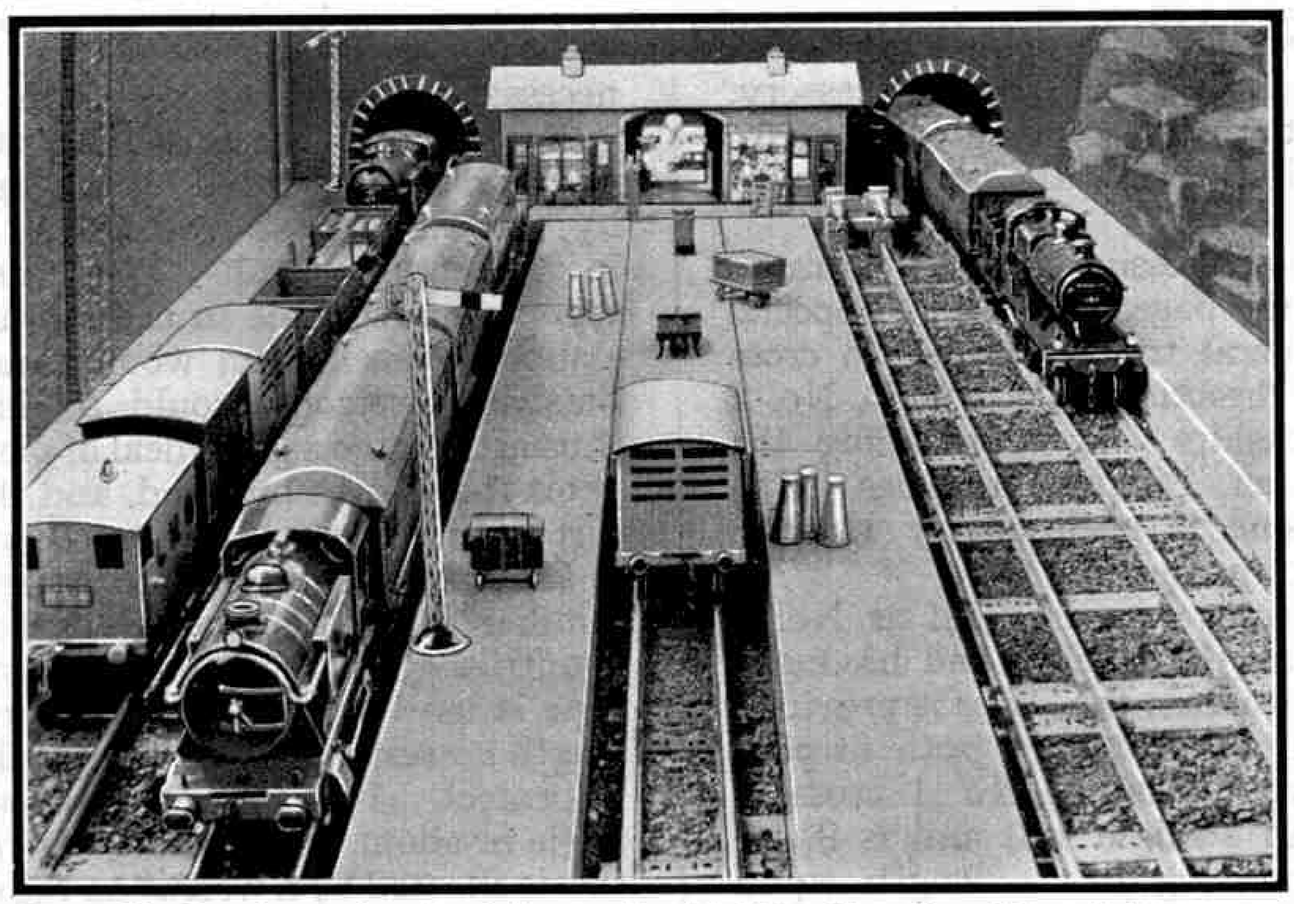
A terminal station built up in this manner has a most realistic and attractive appearance, and with a little trouble it may be made to represent fairly well any terminal station with which the model railway owner is familiar. The various features of such a station are well illustrated in the lower photograph that appears on this page, which shows a combined terminal and passenger station situated between a retaining wall and a rock cutting.



A good example of a jointly operated station on a Hornby layout. The railway companies represented are the L.N.E.R. and the L.M.S.R. and locomotives and rolling stock of each are therefore seen in this picture.

There is no reason why this plan should not be followed for an exclusively terminal station, crossovers being provided between the pairs of tracks on either side for greater convenience in releasing engines that have run up to the buffer stops. The platforms should be numbered, and every attempt made to reproduce the main details of an average real station. If it is desired to roof over the station, a suitable framework is easily built up with Meccano.

In some cases a through station is preferred to a terminal one, and in this case the arrangement requires some modification. A good scheme is to place a No. 2 Hornby Railway Station on the extreme left or right to represent platform No. 1, and the main circulating area of the station with the booking office and station buildings. The length of the platform may be increased by the addition of sections of Hornby Passenger Platform as previously described, but this is a point for the owner himself to decide, having regard to his own particular circumstances. A simple wayside station incorporating these features is shown in one of the accompanying illustrations.



The combined terminus and passing station mentioned in this article. Up and down trains are seen passing through, while a suburban train is ready to start from one of the terminal platforms. A short bay is let into the main platform to facilitate the handling of milk and similar traffic.

Where several roads pass through the station, the intermediate platforms probably will be of the island platform type. Hornby Island Platforms may be utilised, and extended as before with standard platform lengths. When these are placed in position, a train may come to rest at either side of them as may be required. Connection between the main circulating area and these platforms may be made by means of footbridges, as shown in the illustration of the country station just referred to. These footbridges, of course, may be placed either on the platform or at its ends, to suit the owner. This type of station allows trains to draw up alongside a platform, and either to terminate their journey or to continue on their way.

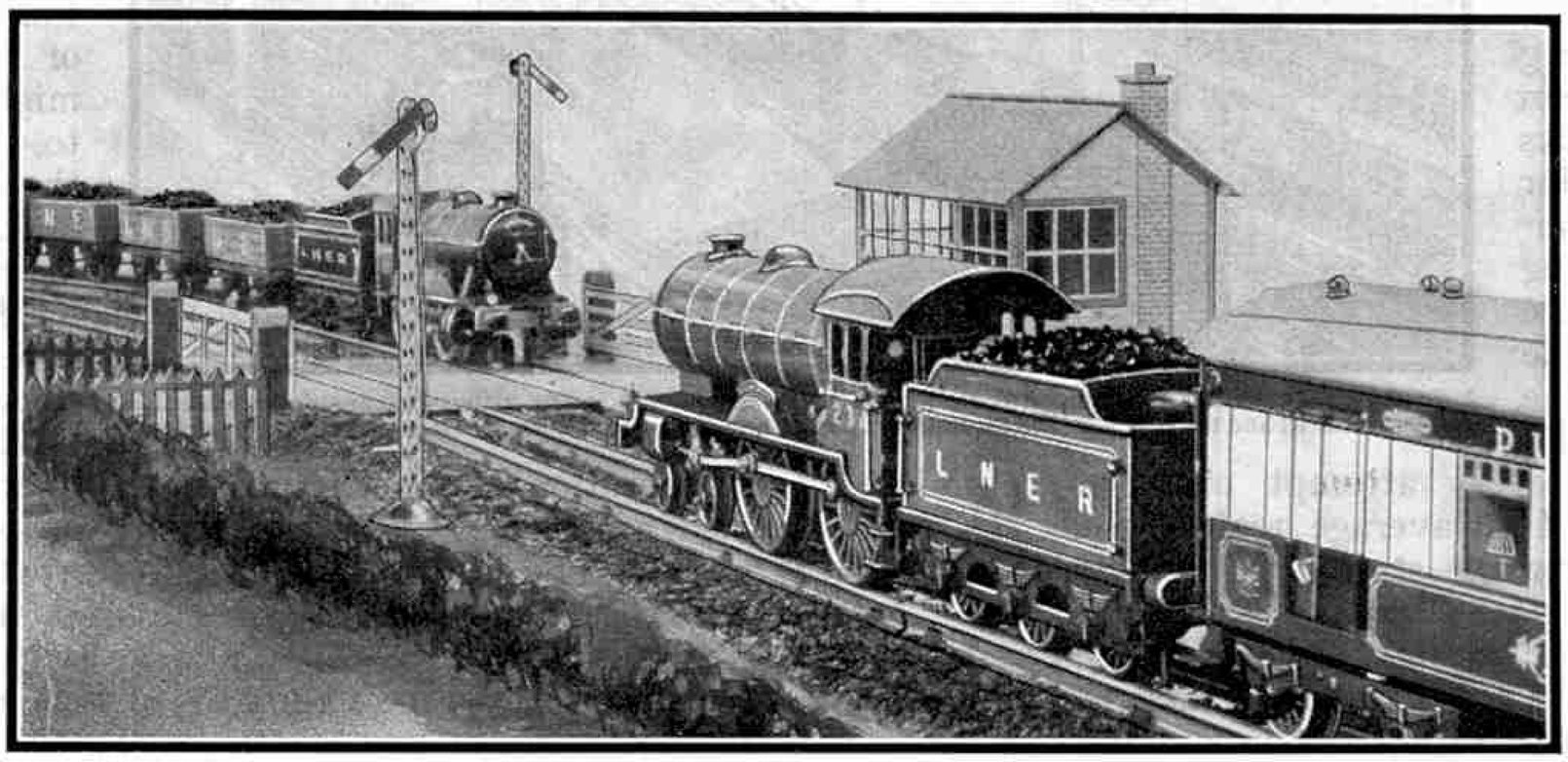
If there are two main entrances to an elaborate station, such as that representing York in the accompanying photograph, this will allow of two railways using the station on a joint system. A station arranged in this manner would be very interesting. For instance, some of the platforms might be devoted to, say, trains of the L.M.S.R. part of the system, and others reserved for those of the L.N.E.R. Schemes of working of this kind are actually in operation at many jointly owned stations. There is a vast amount of entertainment to be obtained by the working of a large model terminus to which two or three H.R.C. members contribute material and rolling stock.

An important feature of most large stations is the bays that are let in at the ends of some of the platforms. These are sometimes very short, and used only for loading theatrical traffic, motor cars and other items, where loading is carried out over the ends of the buffer stops. Very often, however, the bays are long enough to accommodate a branch line train. They serve the very useful purpose of keeping the main platform lines clear for important traffic. They may be used with advantage in a Hornby Station, where space permits, and there is no doubt that they give a good deal of extra realism. Branch line trains starting from these bays may connect with the main line services, and through traffic in milk and parcels may be dealt with in the manner shown in the photograph of the station situated in the cutting on this page. For such a purpose the main platform must be fairly wide; in fact a width of not less than three Hornby passenger platforms is required. Ample room is then afforded for the bay line and the platforms that enclose it.

Level Crossings in the Hornby Series

By "Tommy Dodd"

THE two level crossings that are available in the Hornby Series take a prominent place in the large range of accessories by reason of their realistic appearance and their utility in forming part of a model railway layout. The level crossing serves a dual purpose, in being at the same time part of the rails and also part of the surrounding scenery; and therefore such crossings are specially suitable for permanent or semi-permanent model railways in which scenery plays a definite part. The crossings can, of course, be used effectively on railways where the lines have to be put down and taken up again each time they are used; but they certainly show to the best advantage when they can be placed in a suitable setting on a more or less permanent line. A level crossing situated on such a line does not finish abruptly as a mere accessory, but it leads on to roads that may be surrounded by fields, and in this manner offers wide scope to the model railway owner for scenic effects.



A level crossing on a Hornby railway closed for road traffic, while two trains are seen approaching. The crossing is duly protected by home signals for each direction, and a signal cabin is appropriately situated near by.

The use of the No. 2 Level Crossing is well illustrated in the photograph on this page. A No. 1 Special Locomotive hauling a mineral train is about to cross the road, and in the other direction an L.N.E.R. No. 2 Special Locomotive "Yorkshire" is approaching the crossing hauling a train of Pullman coaches. The road leading to the crossing is enclosed by Hornby Paled Fencing in a realistic manner.

The Hornby Level Crossings are classified as No. 1 and No. 2, the former being the smaller and having a single track and two gates, whereas the latter is provided with double track and four gates. They both fit conveniently into Hornby layouts, as the No. 1 crossing is equal in length to a half straight rail and is 9½ in. wide; while the larger crossing has a length equal to a full straight rail and is 13½ in. in width. The white painted gates of each are appropriately decorated with red diamonds, and can be securely locked in either of the two positions by lifting pins that fit into small sockets.

To conform with the standard Hornby rails the crossings have turned-up edges, which enable them to be secured to the adjacent rails by means of the rail connecting plates. The bases of the level crossings are finished to represent a section of a road passing over the railway, and the colour printing is carried out in an attractive manner. In order to raise the road to the level of the tops of the rails, each side of the crossing is slightly inclined, so that miniature carts and lorries may easily cross the lines when the roadway is clear.

The No. 2 Level Crossing is now available for electric layouts, provided with two conductor rails. This addition to the Hornby System has been made for the convenience of model railway enthusiasts who operate electric layouts, and who wish to incorporate a level crossing for the sake of its picturesque effect. A Hornby electric locomotive would not "coast" over such a long gap as would be left if there were no conductor rail over the crossing, so that the inclusion of such rails is necessary to prevent the train stopping abruptly.

Most of the gates on important level crossings are mechanically operated by the signalman in a cabin near by, as would be the case in such a situation as that shown in our photograph. This mechanical operation is scarcely practicable in the Hornby System, for such an elaborate mechanism would mean that the price of the finished accessory would be high. In any case, enthusiasts derive a great deal of pleasure from operating the gates themselves by hand, and this is a task particularly suitable for the younger members of the operating staff.

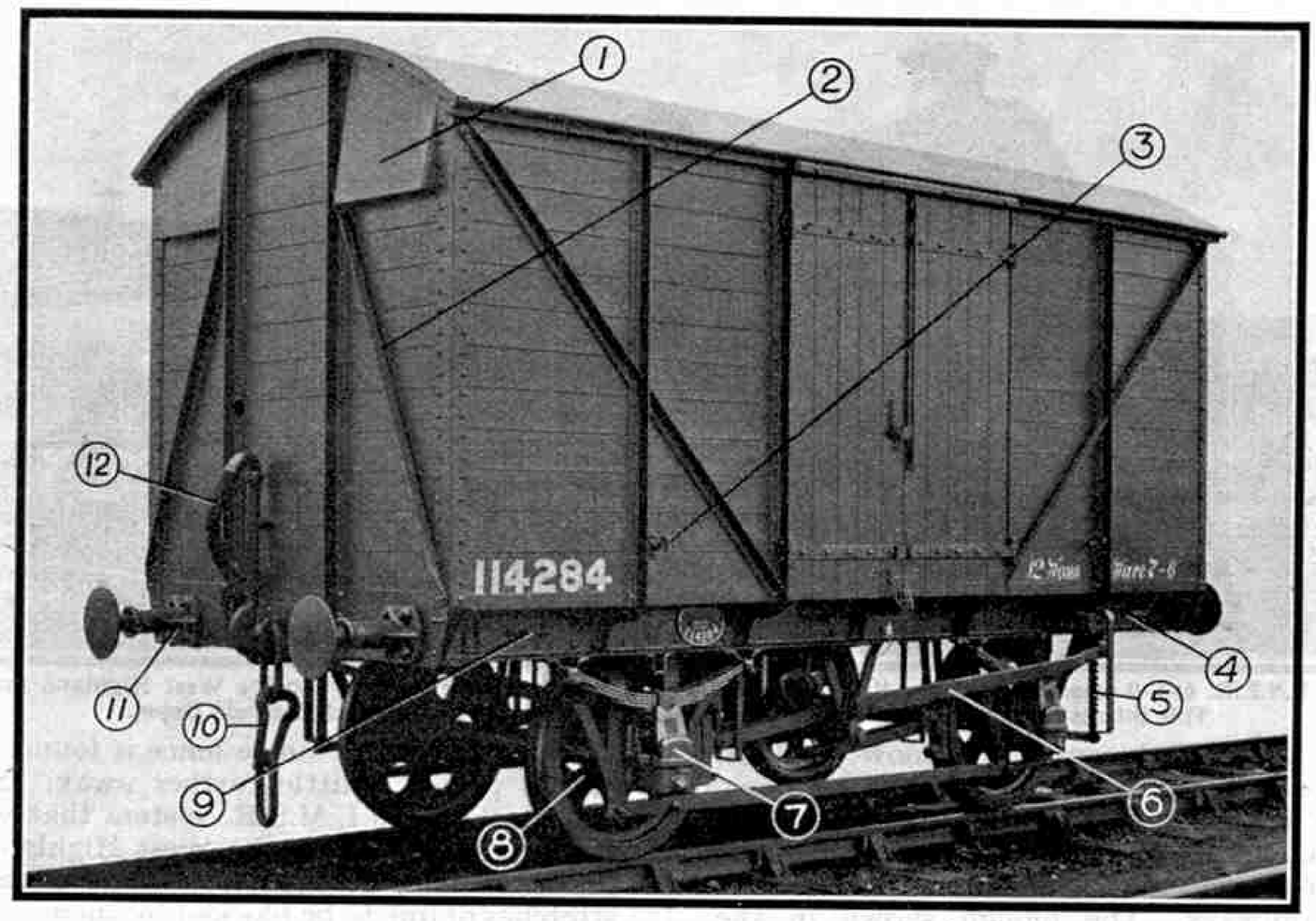
The pattern of level crossing with gates that is so familiar to us in England is not commonly used in other countries. On the Continent and in America the pole type is used, which consists merely of a round pole, its length corresponding to the width of the road that it has to protect. It has an upward swinging movement to an angle of about 60 to 70 degrees from the horizontal, and this is effected by a weight on the end of the pole at a little distance from the pivot. A red lamp is usually placed midway along the pole in a similar fashion to the lamps that are sometimes fixed on top of the gates of the ordinary crossings in this country. With the pole type of crossing the railway track is always clear, whether the pole is against road traffic or not. The advantages to be gained by this type are simplicity of operation and easy maintenance, as there is practically nothing to get out of order. The Great Western Railway are at present experimenting with this type of gate on one of their crossings.

H.R.C. COMPETITION PAGE

"Rolling Stock Contest No. 1"

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.

THE majority of H.R.C. members are able to tell at a glance the class of a locomotive and the railway to which it belongs. More than this, they can name correctly most of its component parts, and describe the purpose that each one serves. We wonder how many readers could do the same with a simple goods wagon! By comparison with a locomotive a goods wagon appears a dull, lifeless thing; yet it plays an essential part in the daily work of the railway. When we come to consider a wagon carefully we find that it has a special interest of its own, quite different from that of the locomotive, but nevertheless real and distinct.



In order to induce H.R.C. members to turn their attention for a little while to the humble wagon, we have devised a special contest. The accompanying photograph shows a typical British covered wagon, from which all lettering has been removed. Competitors are required to name the railway company to which the wagon belongs; to state the purposes for which such a wagon is usually employed; and to name each of the parts indicated by a number, and describe briefly the function of each part.

To the senders of the four best entries received Hornby Train goods (or Meccano products if preferred) to the value of 21/–, 15/–, 10/6 and 5/– respectively will be awarded. In the event of a tie neatness of presentation will be one of the deciding factors. A number of "*Famous Trains*" books by Cecil J. Allen will be awarded as consolation prizes to those boys whose entries show painstaking efforts. The contest will be divided into two sections—Home and Overseas.

Entries should be placed in an envelope clearly marked H.R.C. "*Rolling Stock Contest No. 1*" and posted so as to reach Headquarters at Meccano Ltd., Binns Road, Old Swan, Liverpool, on or before 30th April. The closing date for the Overseas Section is the 31st July. Every entry must bear the competitor's membership number, omission of which will result in immediate disqualification.

A Station Layout Contest

The planning of layouts is one of the most interesting phases of miniature railway work, and it is certainly one of the most important. In the majority of cases the difficulties experienced by enthusiasts are chiefly caused through the space available being limited, so that to secure as far as possible the desired results the economical use of track is necessary.

With this in mind we have decided to hold a Station Layout Contest. Competitors are required to draw up a plan for a station on a Hornby Railway. It may be either a terminus of a branch line, or a wayside passing station, as desired. There should be accommodation to enable goods traffic to be dealt with; provision for a locomotive to run round its train if necessary; and an engine shed and carriage siding easy of access from the main line. The space available is 6 ft. in length, and 3 ft. in width.

To the senders of the four best entries received Hornby Railway material (or Meccano products if preferred) to the value of 15/–, 10/6, 5/– and 2/6 will be awarded respectively. In addition to these copies of "*Famous Trains*" by Cecil J. Allen will be given as consolation prizes.

Envelopes containing entries should be clearly marked H.R.C. "*Station Layout Contest*" and posted so as to reach Headquarters at Meccano Ltd., Binns Road, Old Swan, Liverpool, on or before 30th April. The closing date for the Overseas Section is 31st July.

Competition Results

HOME

February "Word-finding" Contest.—1. K. H. Murphy (8905), Bray, Ireland; 2, R. Barbary (5580), Mevagissey, Cornwall; 3, C. E. Wrayford (6039), Moretonhampstead; 4, H. C. Newton (17066), Pontefract. Consolation Prizes: H. J. Bradbury (20347), Stafford; G. A. Cheetham (7370), Chesterfield; R. Lumley (20253), Plymouth; E. Matthews (3123), Leamington Spa; R. W. E. Shergold (21565), Salisbury; A. F. Milburn (16322), Chingford, London, E.4; H. C. Mason (2876), Ashby-de-la-Zouche; B. Thomas (19283), New Tredegar; J. D. Hamilton (12206), Cheltenham Spa; J. Morcom (13573), Par, Cornwall; A. J. Davidson (6201), Peebles; B. Rankin (3361), Swinton, Nr. Manchester.

February "Railway Drawing" Contest.—1, D. M. Walbourn (2896), Loughborough; 2, C. A. Brunt (10229), Leeds; 3, B. H. Bray (8259), Walton-on-Thames; 4, L. Martin (6922), Leicester. Consolation Prizes: R. A. S. Musker (13162), Hightown, Nr. Liverpool; D. J. W. Brough (8246), Cheam, Surrey; E. A. Smith (18407), Moreton; G. C. Dover (14699), Beaconsfield; J. E. Jones (2480), Portland; V. C. Kaile (17559), Mayford; W. D. Scott (7978), Blackheath, London, S.E.; A. S. Lucking (3556), Witham; J. F. Gardner (14761), Slough; R. Smith (14750), Ossett, Yorks.; R. Rodway (11677), Buckhurst Hill, Essex; L. T. Levitt (7965), Sketty, Swansea.

OVERSEAS

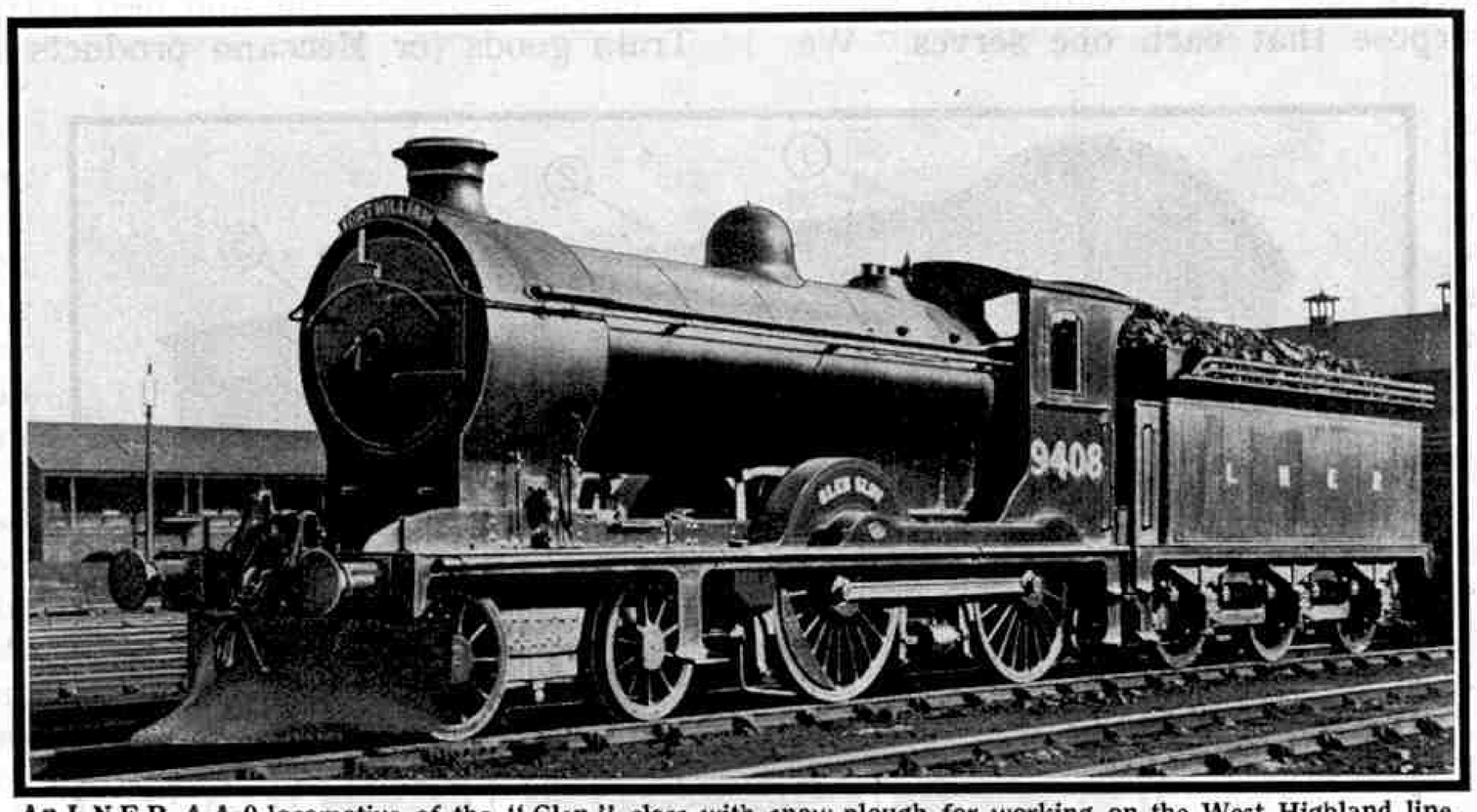
November "Hidden Expresses" Contest.—1, D. J. White (9333), Dunedin, N.Z.; 2, F. Lawson (1575), Grand Canary; 3, R. B. McMillan (9592), Melbourne, Australia; 4, W. Butler (17411), Cape Town, S.A. Consolation Prizes: M. R. Ince (11327), Mt. Eden, Auckland, N.Z.; Jan Hers (8270), Potchefstroom, S.A.; W. Fagg (8557), Milton, Otago, N.Z.; F. E. Mills (9375), Nilgiri Hills, S. India; C. Dover (7893), Benares, W.P., India; F. W. Whyte (17289), Ipswich, Queensland, Australia; B. Chiles (9191), Port Elizabeth, S.A.; F. D. Aria (12362), Bombay, India; M. L. Morgan, Cremorne, N.S.W.

November "Railway Drawing" Contest.—1, C. Carrel, Hawera, Taranaki, N.Z.; 2, D. Menzies (9399), New Plymouth, N.Z.; 3, A. Johnstone (16298), N.S.W.

How Railways Fight the Snow

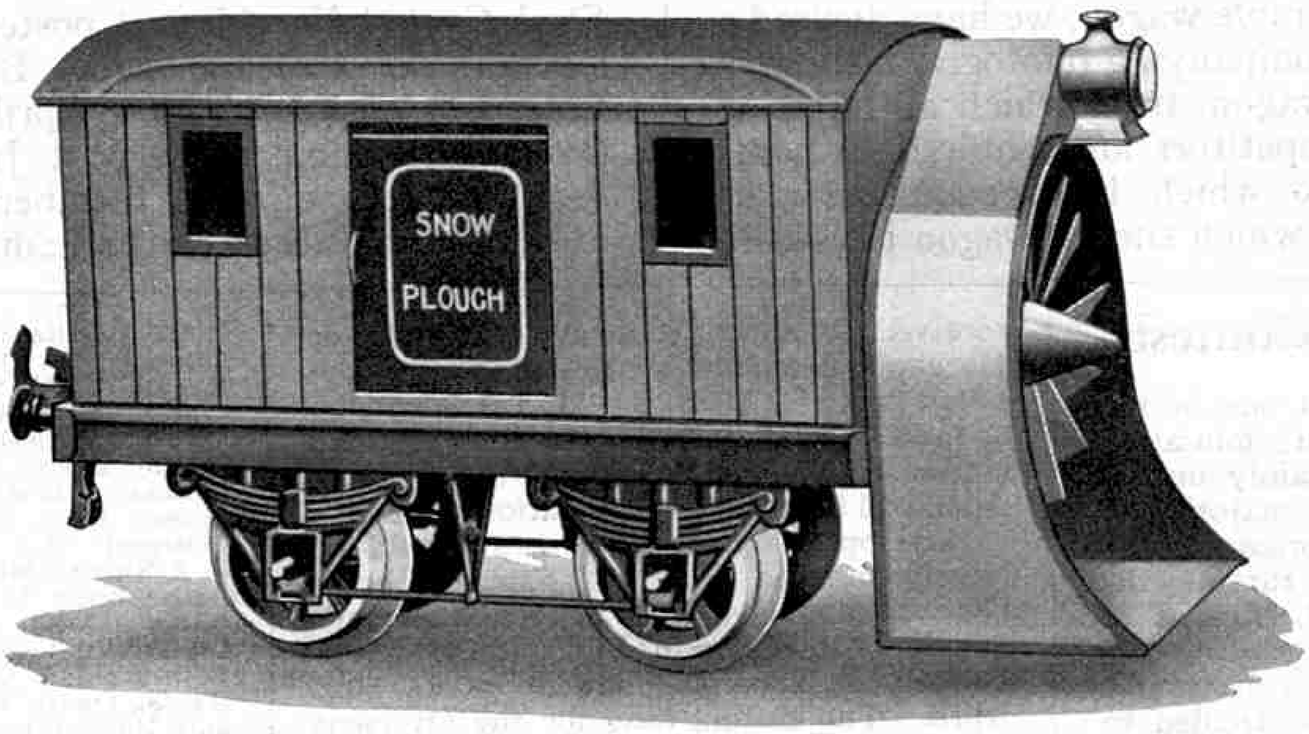
The Various Kinds of Snow-Plough

THAT ever-popular subject of conversation—the weather—has a great effect upon the working of railways. Heavy rains, high winds and fog can cause a great deal of dislocation to traffic, and while the first two can do much damage, the third causes considerable delay. Snow is perhaps the most formidable element that the railways have to contend with, however, and is the most costly. It can completely block a railway line and prevent any service being maintained at all for the time being. During recent winters we have had several instances of how the railways are upset by falls of snow. Many readers may remember how the main line of the Southern Railway between Basingstoke and Salisbury was snowed up in December 1927, and how main line trains had to be diverted to other routes. A simple fall of snow is bad enough in its effects, but trouble starts in earnest when the wind rises after a fall and causes the snow to drift.



An L.N.E.R. 4-4-0 locomotive of the "Glen" class with snow-plough for working on the West Highland line. This interesting photograph was taken by Mr. J. M. Craig of Glasgow, at Eastfield Depot.

In districts where the line is likely to become blocked by snow, arrangements have to be made to keep it clear, particularly where drifts may be expected. In order to remove snow from the track snow-ploughs are used, and there are two types of these in use on British railways. The plough shown in the lower photograph is a steel structure that resembles in shape the bow of an early ironclad. This is fixed to the buffer beam of the locomotive, and as the engine moves forward the snow is thrown to the left and right of the track. The plough has to be very strong, for snow is heavy and is difficult to move, particularly if frozen. Each locomotive may be provided with one of these small ploughs, for they are readily attached as soon as snow threatens, and they are quite satisfactory for clearing light falls.



The Snow-Plough of the Hornby Series. This is an effective representation of the Rotary type of plough described in this article. The fan revolves in a realistic manner as the plough is pushed along.

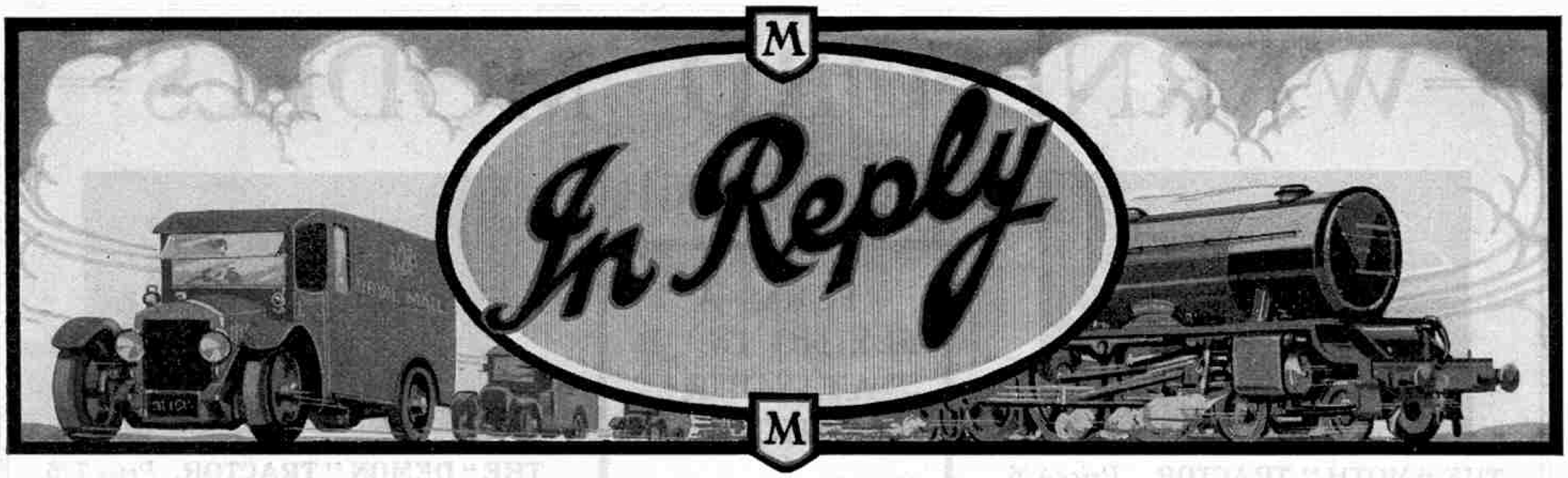
For dealing with heavier falls a more massive type of plough is brought into use. This resembles the smaller pattern in general design, but is made to extend the full width of the loading gauge, and to about as high as the top of the boiler of the engine. It is attached to the front of a locomotive, which, with others coupled to it, drives it over the sections of the line when blocks are likely to occur. Sometimes these ploughs are independent vehicles running on six wheels with accommodation at the rear for the snow-clearing gang, and they are pushed forward by two or more locomotives. They are naturally constructed in a very solid manner and are usually built of steel. If of wood, the nose of the plough is armoured with steel plates weighing perhaps as much as 26 tons. The wheels are almost entirely closed-in, and the vehicle presents a very formidable appearance. A small steel brush clears the path for the wheels, while the main body of the snow is dealt with by the plough itself.

Where the snow has drifted and accumulated to such a depth as to block the line, desperate measures are necessary. The drifts are charged by the plough, which thus gradually batters its way through the obstruction. Occasionally the plough and the locomotives propelling it become embedded in the snow, and it is necessary for the snow clearing gang to dig them out.

Where exposed cuttings are so situated that they are likely to be blocked in the event of a driving snow storm, they are protected by snow fences. These are of timber and slope towards the track. They are situated at some distance from the line, so that they trap the driving snow and prevent it from encroaching on the railway. Where a single fence is found to be insufficient, a second one is placed a little further away. Such fences are found on that part of the L.M.S.R. system that was formerly the Highland Railway, and also on the West Highland section of the L.N.E.R., for these two, by reason of their situation, are the most likely stretches of line to be blocked by snow. It is on the West Highland section that the locomotive shown in the lower illustration works, and this line is unique in possessing the only "snow shed" in the British Isles, though this is actually a rock cutting covered over with corrugated iron. Snow sheds are common enough abroad, and are erected over the line where this runs along the foot of a mountain range, in regions in which trouble is likely to be experienced through snow slides. If one of these occurs the snow passes over the sloping roof of the snow shed, and the railway track is thus kept clear instead of being buried.

The British types of snow-plough are not powerful enough to deal with the heavy falls and drifts of snow that are met with in mountainous districts abroad; and thus the well-known rotary type of plough is employed. This consists of a large propeller or fan, and is covered in, except at the front, with a hood or casing. The propeller is revolved at high speed, and the snow, being unable to pass backward, is whirled round and ejected through an opening at one side of the hood, and thrown clear of the track.

An excellent representation of a rotary snow-plough is included in the Hornby Series. This is a four-wheeled vehicle of attractive appearance, and at the leading end the rotary fan and its casing are fitted. As this vehicle is pushed along at the head of the train, the fan revolves.



Suggested Hornby Train Improvements

FIREHOSE BOXES.—These would look very effective if placed in the vicinity of stations, locomotive sheds and carriage sidings, as in actual practice. We will therefore keep your suggestion in mind when we are again making additions to our accessories. (*Reply to R. Pickering, Durham*).

L.N.E.R. (G.E. SECTION) 2-4-2 TANKS.—This wheel arrangement is now obsolete for new construction, no locomotives of this type having been built in this country for some time. The 0-6-2 and 2-6-2 types are in favour at present, so that we doubt if a 2-4-2 locomotive would prove popular. The duties on which these tank engines are employed may be realistically carried out on a Hornby Railway by the No. 1 Special Locomotives, and with these engines any unsteadiness due to two pony trucks is obviated. (*Reply to G. J. Smale, Palmers Green*).

EIGHT-WHEELED PETROL WAGON.—A vehicle of this description would no doubt look very effective on a model railway. The type is not yet in general use in this country, and therefore we cannot consider its introduction at present. (*Reply to R. Moir, Leeds*).

SMALLER BOGIE WHEELS FOR L.M.S. COMPOUND LOCOMOTIVES.—These would not be likely to increase the smooth-running qualities of the locomotives, and a bogie of the pattern you suggest would detract greatly from the realistic and true-to-type appearance. The bogie of the Hornby engine is centrally sprung and is pivoted on a pin as in real practice. (*Reply to G. R. Webb, Leatherhead*).

CLOCKWORK MECHANISMS IN BRAKE VANS.—We doubt if there would be a great demand for a brake van thus fitted, owing to the high cost of such an accessory. In cases where a Hornby locomotive is overloaded, the owner usually prefers to provide a pilot to assist it. (*Reply to S. Evans, Carshalton*).

IMPROVED HORNBY STATION.—We agree with what you say about having the central opening in the Hornby station building pierced, so as to provide an actual way through. The suggestion will be considered when our stations are next revised. (*Reply to S. J. Stevens, Mitcham*).

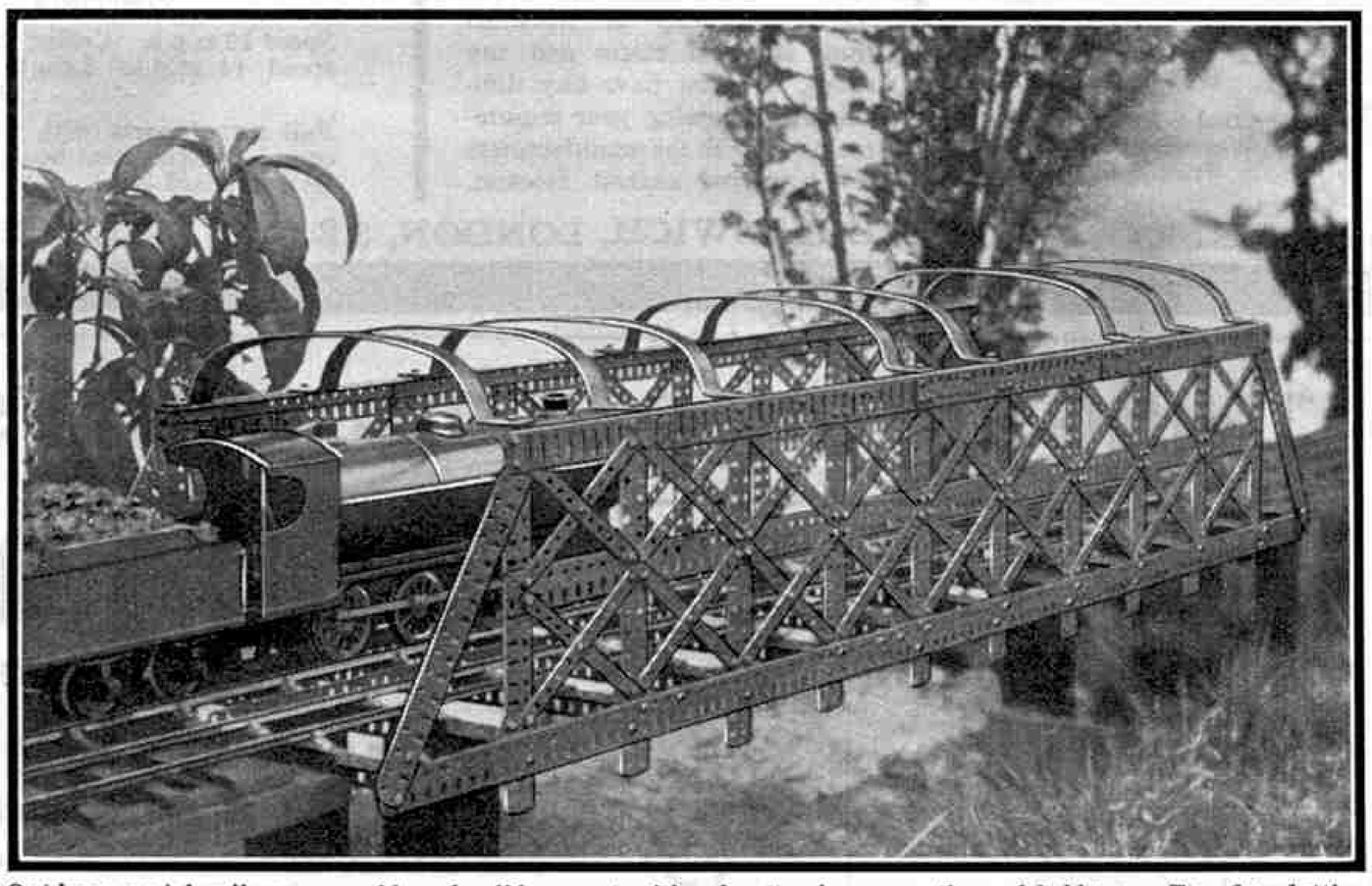
OUTSIDE STEAM PIPES ON "SHIRE" LOCOMOTIVES.—Your suggestion that we should fit outside steam pipes on our "Shire" locomotives is interesting, but only the "Shire" locomotives that are fitted with patent valve motion have outside steam pipes. As the "*Yorkshire*" has ordinary piston valves and no outside steam pipes, we cannot fit them on the Hornby model at present, as it would not be correct to do so. (*Reply to L. R. Taylor, Dunston-on-Tyne*).

NO. 1 SPECIAL TANK GOODS SET.—There is already available in the Series a No. 2 Special Tank Goods Set. If you wish to form a train composed of the rolling stock you mention, you can easily obtain the items separately, and make up as many varieties as you may desire. (*Reply to P. Jackson, Heaton*).

DOUBLE TRACK TUNNEL MOUTHS.—It is possible that we shall introduce double track tunnel mouths. For the time being, however, we suggest that you separate the up and down tracks on your layout at the point where the tunnel is required, and conduct each line through a single bore, as in the case with Woodhead Tunnel, near which you live. (*Reply to E. Wicker, Dunford Bridge*).

SMOKE TROUGHS ON OVERBRIDGES AND SIGNAL GANTRIES.—The provision of these fittings would be attractive, but we do not think their introduction would be justified. (*Reply to B. Maguire, Carnforth*).

MINIATURE ROAD VANS.—The provision of miniature road vans and lorries, lettered to represent the various railway groups, would certainly enable a goods yard to be made more realistic. As there are large numbers of model road vehicles, both motor driven and horse-drawn, to be obtained, could you not adapt one of these in a suitable manner? (*Reply to W. Blake, Darlington*).



Outdoor model railways provide splendid opportunities for the incorporation of bridges. The fine lattice girder structure here shown is on the layout of Mr. G. H. Hemm, A.R.I.B.A., of Liverpool, to whom we are indebted for the photograph. Meccano Parts are used, and the general effect is very realistic.

BOGIE PASSENGER BRAKE VAN.—We were interested in your proposal for the introduction of a Brake Van carried on two four-wheeled bogies, suitable for use with the Hornby Pullman Coaches. It is doubtful whether there would be sufficient demand for such a vehicle, however, as owing to the limitations of space, miniature trains are invariably short, and this generous provision of luggage accommodation would be out of proportion to the rest of the train. We suggest, therefore, that you use the composite Pullman Coaches already available, placing one of these at each end of the train, if the conditions on your railway make this necessary. (*Reply to S. N. Renishaw, Cardiff*).

NO. 2 SPECIAL TANK PASSENGER SET.—It is quite a simple matter to build up a set of this description by purchasing the component parts separately. By obtaining the various items as required, considerable choice in the matter of coaches is possible, for both types of Pullman Coach, the No. 2 Saloons, and the Metropolitan Coaches would be quite suitable for use behind a large 4-4-2 tank. In addition, for suburban services only, the No. 1 Coaches would be appropriate. (*Reply to G. Godfrey, Sunderland*).

IMPROVED METHOD OF SECURING PULLMAN CORRIDOR CONNECTIONS.—We were interested to note that you had found it an improvement to cut a horizontal slot near the bottom on each side of the vestibule opening, so as to allow the corridor connections to be more easily slipped into place. This will be borne in mind when revisions next occur. (*Reply to J. Slater, Belfast*).

"M" SERIES WATER TOWER.—This would prove a very interesting addition to the "M" Series, and as such towers are a very common feature on our railways we think they would prove popular. We will therefore give your suggestion full consideration. (*Reply to M. Grace, Wellingborough*).

FOREIGN TRAIN SETS.—Your suggestion that we should introduce foreign train sets is interesting, but you are evidently unaware that there is already available in the Hornby Series the "Riviera Blue" Train Set. The locomotive included in this is a very realistic model of those employed on the Nord system in France. (*Reply to H. O. Huntington-Whiteley, Rottingdean*).

LONGER G.W.R. GOODS BRAKE VANS.—We do not think that these would traverse 1 ft. radius rails satisfactorily, and therefore their popularity would be limited. The G.W.R. Goods Brake Van is characterised by its great length, but this is rather a disadvantage in miniature practice. (*Reply to R. Bakewell, Oxford, and others*).

SPECIAL TYPE OF SIGNAL BOX.—Special signal boxes in which an accumulator could be fitted would certainly be interesting. They would keep the accumulator out of view, and would allow it to be placed in a very convenient position near the railway, without spoiling the scenic effects in any way. At the same time we think that accessories of this nature are best made at home to suit individual requirements. (*Reply to H. Tholander, Hull*).

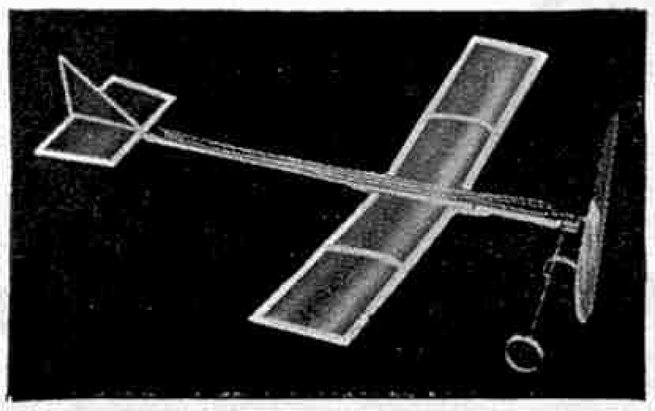
SIX-WHEELED BOGIES ON HORNBY TROLLEY WAGON.—We doubt if these would prove satisfactory in traversing curves of 2 ft. radius. The proportions of the vehicle would be spoiled by the increased length of the bogies, and the price would be higher. This would probably render the change unpopular with Hornby Train enthusiasts, so that we are unable to give further attention to your suggestion. (*Reply to G. Harris, Wakefield*).

4-6-2 TANK LOCOMOTIVE.—Your suggestion for a locomotive of this type is interesting, and as you point out, there is a certain similarity between the 4-6-2 tank locomotives on the Brighton section of the Southern Railway and those of the Caledonian section of the L.M.S.R. Both these locomotives would make very good subjects for a model, but as neither class ranks among the standard locomotives of the groups concerned, we fear that they would not be sufficiently popular to warrant their introduction. (*Reply to T. Payne, Edinburgh*).

NO. 1 SPECIAL GOODS LOCOMOTIVE PAINTED IN NORD COLOURS.—Such a locomotive would look effective if used in conjunction with the French type rolling stock already available in the Hornby Series. We will therefore give your suggestion careful consideration. (*Reply to R. Harris, Newhaven*).

WATER COLUMN FOR USE ON STATION PLATFORM.—We agree that these columns are extensively used, particularly on those railways that do not employ water troughs, and where it is necessary to take water at intermediate stations. The provision of this accessory at the end of a Hornby platform would add interest to the line, and we shall therefore consider the suggestion. There are several patterns of these columns in use, the most attractive for reproduction in miniature probably being that with the swinging arm which is pivoted on the column itself. (*Reply to R. Maxwell, Southsea*).

WARNEFORD MODELS



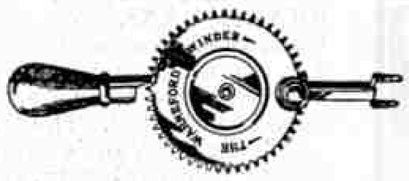
THE "MOTH" TRACTOR. *Price* **4/6**

Length 19 in., span 18½ in., fitted patent double-bearing and shock-proof chassis, 8 in. hand-carved and balanced propeller, covered red proofed silk. A splendid flyer, and beautifully finished, this model at the price is undoubtedly the finest value ever offered. (Patent No. 296946).

THE "SWIFT" TRACTOR. *Price* **10/6**

Length 30 in., span 26½ in., fitted 11 in. hand-carved and balanced propeller. Patent double bearing and shock-proof chassis. Covered yellow proofed silk with identification discs. A long and very steady flight is obtainable with this model, and though of large dimensions is very easy to handle. (Patent No. 296946).

USE "RUBERLUE" (Doubles the Flight) 6d. TUBE



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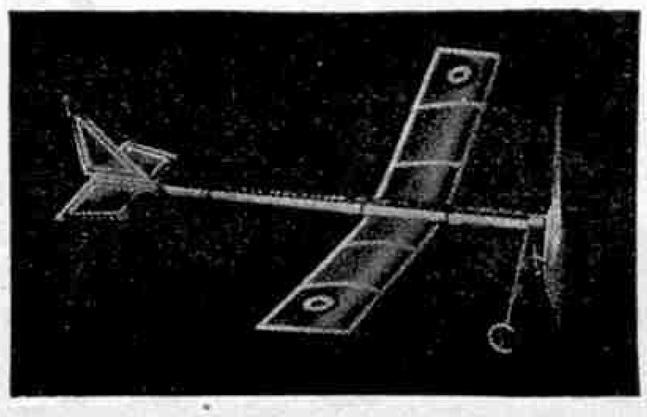

THE "DEMON" TRACTOR. *Price* **7/6**

Length 25½ in., span 23 in. Fitted 10 in. hand-carved and balanced propeller, patent double-bearing and shock-proof chassis, covered yellow proofed silk with identification discs. Weight and wind resistance are reduced to a minimum in this model, giving the utmost duration of flight. (Patent No. 296946).

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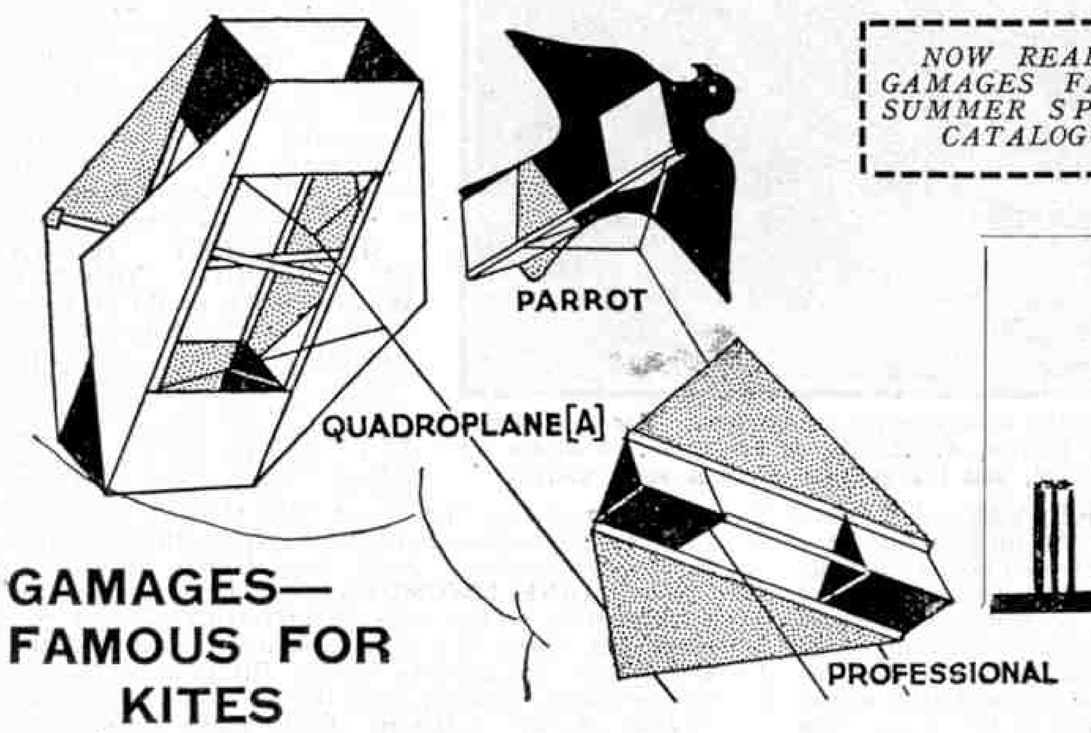

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Results of Model Contests—

(*Continued from page 313*)

Of these the model submitted by Mitsotakis is probably the more realistic, as the appearance of LeClaire's model is somewhat marred by the use of 3″ Pulley Wheels and Dunlop Tyres for the roadwheels. The 2″ diam. Pulleys would be far more suitable in this case. The internal details of both models are well thought out, and it is apparent that a good deal of time has been spent on their construction.

Another model I must mention is a racing car submitted by Philip Robson. The model is typical of a modern high-powered car, and Robson has succeeded in reproducing Ackermann steering gear, foot and hand brakes, and the usual internal features found on speed cars. Although I do not advocate the use of non-Meccano parts in the construction of Meccano models—competition models in particular—I think that the disc wheels used by Robson considerably improve his model. These are made by fitting discs of zinc to Meccano 3″ Pulleys, miniature Dunlop Tyres completing the effect.

Models of Britain's giant airships, R.100 and R.101, have frequently appeared in model-building contests, and although tragedy befell the latter airship, it is still a popular subject for model-builders. J. W. Hole carried off one of the awards in Section B with a model of R.101 at her mooring mast. The model closely resembles the actual airship, but a certain amount of "scrappiness" is present. This is rather unfortunate, as otherwise the appearance of the model is good. The mooring mast is constructed from Angle Girders interlaced with Strips, and a lift cage passes up and down inside the tower.

but as I always carry one in my tool-bag I don't mind if it rains tin-tacks. In fact I think it's great fun mending punctures with a "Chemico" Long-shape Repair Outfit, which only costs 6d. and lasts a season.

FILL IN THE COUPON BELOW.

To the County Chemical Co. Ltd., "Chemico" Works, Bradford Street, Birmingham.
Please send me a copy of the 1931 "Chemico" Catalogue.

Name .....

Address .....

.....

Exploring the Antarctic—

(*Continued from page 277*)

the face of the cliffs, and thus Borchgrevink confirmed Ross's opinion that there, at least, the Barrier is afloat, although farther south it probably rests on land. To these explorers in fact, it appeared to be nothing more or less than a stupendous glacier, fed by enormous ice streams from mountains nearer the Pole. It is undoubtedly the chief source of the enormous icebergs that are encountered in great numbers in the seas of the Antarctic region south of New Zealand that is sometimes called the Ross Quadrant in memory of its first explorer. These differ remarkably from the bergs to be found in Arctic regions, for they are far greater and are flat topped. They are so large that it is quite easy to mistake a typical Antarctic berg for an island, for several have been encountered that are from 15 to 20 miles in length. This may account for one of the mysteries of Antarctic exploration—that is the discovery by one explorer of islands of which his successors have found no trace. As already noted, it is quite easy to mistake even clouds for the appearance of land, and in dull foggy weather an iceberg will resemble solid ground even more than will a cloud, especially if the ice is dark in colour or if it still carries fragments of rock or earth.

When passing through Antarctic seas covered with ice, openings or "lanes" in the pack are usually selected by a man stationed in the crow's nest. Navigation in these circumstances calls for skill and experience.

The next great event in the history of Antarctic exploration was a memorable one. This was the despatch of a British expedition under the command of Captain Robert Falcon Scott, whose name is imperishably connected with discoveries in the section of the Antarctic continent that lies south of Australia and New Zealand. Scott's expedition was the first of a thrilling series of attempts to reach the South Pole and to explore the Antarctic continent, and next month we shall tell the story of the first of his wonderful marches southward over the Great Ice Barrier.

Famous Aeroplanes—(*Continued from page 309*)

of the upper plane. Before reaching the saloon it passes through a regulator in which cold air may be added in order to attain any desired temperature. The control for this is placed in the corridor between the saloon and the buffet.

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

The upper plane of each type of machine has a span of 130 ft. and a chord of 15 ft. 6 in., while the span of the lower plane is 94 ft. and it has a chord of 11 ft. 6 in. The overall length is 86 ft. 6 in., while the height with tail down is 25 ft. The wheel track is 28 ft. 2 in. The Eastern type machine makes use of four Bristol "Jupiter" XF MB type engines, each of which develops 555 h.p., while the Western type uses Bristol "Jupiters" of the XI F type. In both types of machine the petrol tanks fitted will carry sufficient fuel to give the machine a range of 500 miles. With normal tankage, however, the range is only 300 miles.

The H.P. 42E has a paying load of 6,301 lb., while the all up weight is 27,244 lb. The estimated maximum speed at sea level is 119.5 m.p.h., the cruising speed is 105 m.p.h., and the stalling speed 50 m.p.h. At sea level the rate of climb is 828 ft. per minute. The landing run is 225 yds., while the take-off requires 527 yds.

The Western type of machine has a paying load of 8,160 lb. and a gross weight of 28,500 lb. Its maximum speed at 1,000 ft. is 115.5 m.p.h., while its cruising and landing speeds are 95 and 50 m.p.h. respectively. The rate of climb at 1,000 ft. is 600 ft. per minute, while the service ceiling is 11,350 ft. The landing and take off runs are 220 yds. and 513 yds. respectively. At sea level this machine also has a rate of climb of 828ft. per minute.

With the Secretary

How New Clubs May Be Formed

While following the progress of a new club in one of our overseas Dominions I was very greatly pleased and interested to note how an old and well-established organisation in the same city continuously gave valuable help. No doubt the example of the older club itself impelled the organisers of the new one to take the necessary steps. The officials and members of the first of these were not content with setting the example, however, but also assisted in the actual work of formation. They freely gave their friends the benefit of their experience, and on one occasion a number of them made a journey of eight miles in order to be present at a special meeting of the new club. There they inspected the club room, in which an excellent array of models was displayed, and their Leader spoke on the aims and objects of the Meccano Guild. His address was of very great value, for he illustrated from the history of his own organisation the difficulties Meccano clubs may experience, and offered interesting suggestions for overcoming them.

With the aid of the encouragement thus given the new club was successfully launched and is now strong in members and enthusiasm. Perhaps the most promising feature is the great friendship that has sprung up between the members of the two clubs, and there is no doubt that the rivalry between them will be greatly to the benefit of both organisations.

The officials of many existing clubs probably could give useful assistance in forming new ones among Meccano boys who live within reach of their own district, but are a little too far away to attend meetings regularly. I hope that no reasonable prospect of extending the influence of the Meccano Guild in this manner will be overlooked, for the establishment of several clubs near each other tends to induce a spirit of rivalry that leads to expansion and progress.

Meccano Club Leaders
No. 50. Mr. R. H. Wright

Mr. R. H. Wright has been Leader of the Upwey and Broadwey Meccano Club since affiliation was secured in April 1927. Model-building is the chief feature of the programme, and Railway Nights also figure prominently in a varied syllabus. During the summer sessions a very successful Cycling Section is organised.

Making Club Life Happier

Experience has shown that the most successful Meccano Clubs are those in which the greatest efforts are made toward maintaining a cheerful spirit among members. An attractive programme, including regular Social Evenings and Games Nights, is a great help in establishing happy relations between members, and the introduction of competitions where possible is a great stimulus to their enthusiasm. But perhaps the most effective aid is a quiet but intense interest on the part of those responsible for the running of the club in the welfare of each individual member. This is perhaps best shown in quiet talks, undertaken in an apparently casual manner during an interval or while watching the progress of a game, in which the Leader makes enquiries regarding progress at school or work, or gives encouragement to the schemes or ambitions that occupy the mind of the member to whom he is speaking.

It is equally important to ensure that no member is left outside any activities of the club, whether these are normal or extraordinary. This applies particularly to those who attend meetings irregularly or for some reason do not appear to join whole-heartedly in the affairs of the club. The fact that a member has joined is in itself sufficient proof of his genuine interest in the Meccano hobby, and of his desire to share in the delights of membership of a Meccano club. Every effort therefore should be made to see that he gets opportunities of realising his expectations.

Visiting Committees

Members who are absent owing to illness or any other cause also should receive special attention, and the plan adopted in many clubs of organising a visiting committee may be recommended. If a member is ill, then a visit from a friend who can give him the latest news of the club will help to cheer him up. If absence is due to heavy work or similar causes, a member may be temporarily lost, but he will retain his interest in the club if his companions in their turn show some interest in his welfare.

If such methods are adopted and put into operation tactfully, interest in club affairs is retained over a long period. Members become very keen, and most of them develop into earnest recruiting agents, bringing their friends to the meetings and thus increasing the membership, and generally adding to the resources of their club. A sufficient membership of eager and satisfied Meccano boys is a necessary foundation for every organisation, and the problem of arranging a suitable programme is much simplified when all are keen to make the best of their opportunities.

* * * *

An Exhibition of models constructed by members of the Wimbledon M.C. will be held on the 25th of this month in the Girl Guides Hut, Compton Road, Wimbledon, S.W.19. The Exhibition will be opened at 2.30 p.m. and will close at 7 p.m. An admission fee of 6d. will be charged and Meccano boys of the neighbourhood and all others interested in model-building are cordially invited to attend.

Proposed Clubs

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

BEXLEY—N. H. Antenbring, "Hethersett," Salisbury Road, Bexley, Kent.
GRAND CANARY—Mr. F. Lawson, Apartado 192, Las Palmas.
IRELAND—B. Kiernan, 2, Steampacket Quay, Drogheda, Co. Louth.
QUARRY BANK—E. Hanke, 15a, Merry Hill, Quarry Bank, Staffs.
SOUTHAMPTON—B. G. Shearing, 1, Tennyson Road, Portswood Av.

CLUB NOTES

Ipswich M.C.—The club has now secured two new Leaders, Mr. Brewster and Mr. Crabbe having joined Mr. H. J. Wright. Mr. Crabbe is connected with the R.A.F. Experimental Station at Martlesham, and gave members a splendid talk on "*Aviation*." "*Why I Joined the Ipswich M.C.*" and "*My Suggestions for Better Meetings*" were subjects in an interesting essay competition for which small prizes were given. From these interesting information on member's wishes were obtained. Club roll: 14. *Secretary:* P. Samson, 81, Tuddenham Road, Ipswich.

Blyth Y.M.C.A. M.C.—Mr. H. Hall, Leader of the club, has been compelled to resign. He has been succeeded by Mr. F. Robson, and the club continues to make progress, the enthusiasm of members being shown by a 100 per cent. attendance at practically every meeting. A special feature is made of the construction of large club models. Club roll: 11. *Secretary:* B. Sinclair, 53, Windsor Avenue, Blyth, Northumberland.

Fulstow Junior M.C.—A special Meccano Outfit has been purchased and members may now borrow parts they require to complete their models. A Model Aeroplane Exhibition has been held, prizes of Meccano parts being awarded to the successful exhibitors. Building a model nearly five feet in length of the Sydney Harbour Bridge provided much enjoyment at one meeting, the model being an attractive replica to scale of the famous Australian structure. Games Nights and interesting Lantern Lectures completed a very fine programme. Club roll: 17. *Secretary:* L. W. Doe, The Stores, Fulstow, North Thoresby, S.O. Lincs.

Braintree County High School M.C.—Interesting Model-building Competitions have attracted splendid entries. In the first of these, members were required to build a model of the Bennie Railplane. The two prize-winners then made a combined model for exhibition on School Speech Day. Models of any type could be entered in the second contest, and a model of a Revolving Aeroplane attracted most attention. Other interesting items have been a Lantern Lecture on "*Beautiful Manxland*" and a talk on "*Swimming and Diving*." Club roll: 26. *Secretary:* P. Allen, St. Edmunds, Bocking, Braintree.

John O'Gaunt M.C.—The programme consists chiefly of Model-building Evenings and papers by members. Among the papers those on "*Miss Johnson's Flight to Australia*," "*G.W.R. Locomotives*" and "*The Internal Combustion Engine*" proved particularly attractive. Special nights are devoted to Games and Puzzles and also to operations on the club's Hornby Train Layout, for which many accessories have been constructed by members. On one evening a Cinematograph Projector was lent to the club and films were hired in order to give a good show. An admission fee of 3d. was charged and the proceeds amounted to 11/-. Club roll: 14. *Secretary:* J. B. Crosland, 4, Chester Place, Lancaster.

Weymouth Central School M.C.—Officials and members are keen on outdoor work and visits have been paid to Portland Waterworks, and to a Portland stone quarry, where a Circular Stone Saw attracted interested attention. Short Lectures by members have included Talks on "*Coal*," "*The Manufacture of Gramophone Records*" and "*Bridges*." At a Sale of Work various articles made by members of the club were readily disposed of, but members derived most satisfaction from the interest visitors took in the display of models made by themselves. These included a Pontoon Crane, a Bascule Bridge and other splendid working models. Club roll: 13. *Secretary:* S. Cann, 20, Southlands Road, Weymouth.

King's Lynn M.C.—Has been reorganised and a splendid series of meetings devoted to Debates, a Mock Trial, and Model-building Contests have been held. A Talk by Mr. I. J. Thatcher, Leader of the Club, on "*Memories of the War*," and Games Tournaments were included among other attractions. The festivities at Christmas time included a Dinner, at which a small present was made to the Leader in recognition of his splendid work on behalf of the club. Club roll: 22. *Secretary:* J. P. Smith, Carlton Lodge, The Chase, King's Lynn.

King's School (Peterborough) M.C.—A particularly interesting feature of the programme of this club was Engine Night, when various types of Steam Engines, and Clockwork and Electric Motors, suitable for driving Meccano models were examined. Other attractions have been a Meccanograph Evening, a Siege Engine Night, and a Simplicity Model-building Contest. A Debate has been held on the possibility of the displacement of land and sea transport by the employment of aircraft, and this gave rise to keen discussion. Club roll: 27. *Secretary:* M. H. Oliver, "Gildenburgh," Park Road, Peterborough.

Great Baddow M.C.—The club's Birthday Party was very successful. Mr. S. Beale, President of the Club, presided, supported by Dr. Spencer Phillips, Vice-President, and the former cut the Birthday Cake kindly presented by Mrs. Beale. A jolly evening was spent in Games and Competitions, in which visitors from the Chelmsford club joined. Club work continues to be of a very high standard and the junior members are making remarkable progress in Model-building. Club roll: 36. *Secretary:* D. K. French, Jeffrey's House, Great Baddow.

Solihull (Birmingham) M.C.—Meetings are held twice weekly, Model-building being the chief occupation. An interesting Lecture on "*Locomotives*" was given by Mr. N. R. Ayres, and this was illustrated by means of picture postcards. At one meeting an amusing sketch was given by two of the members. The Club Library continues to make good headway and a Hockey team has been formed. Club roll: 15. *Secretary:* B. T. Gray, Solihull School, Solihull.

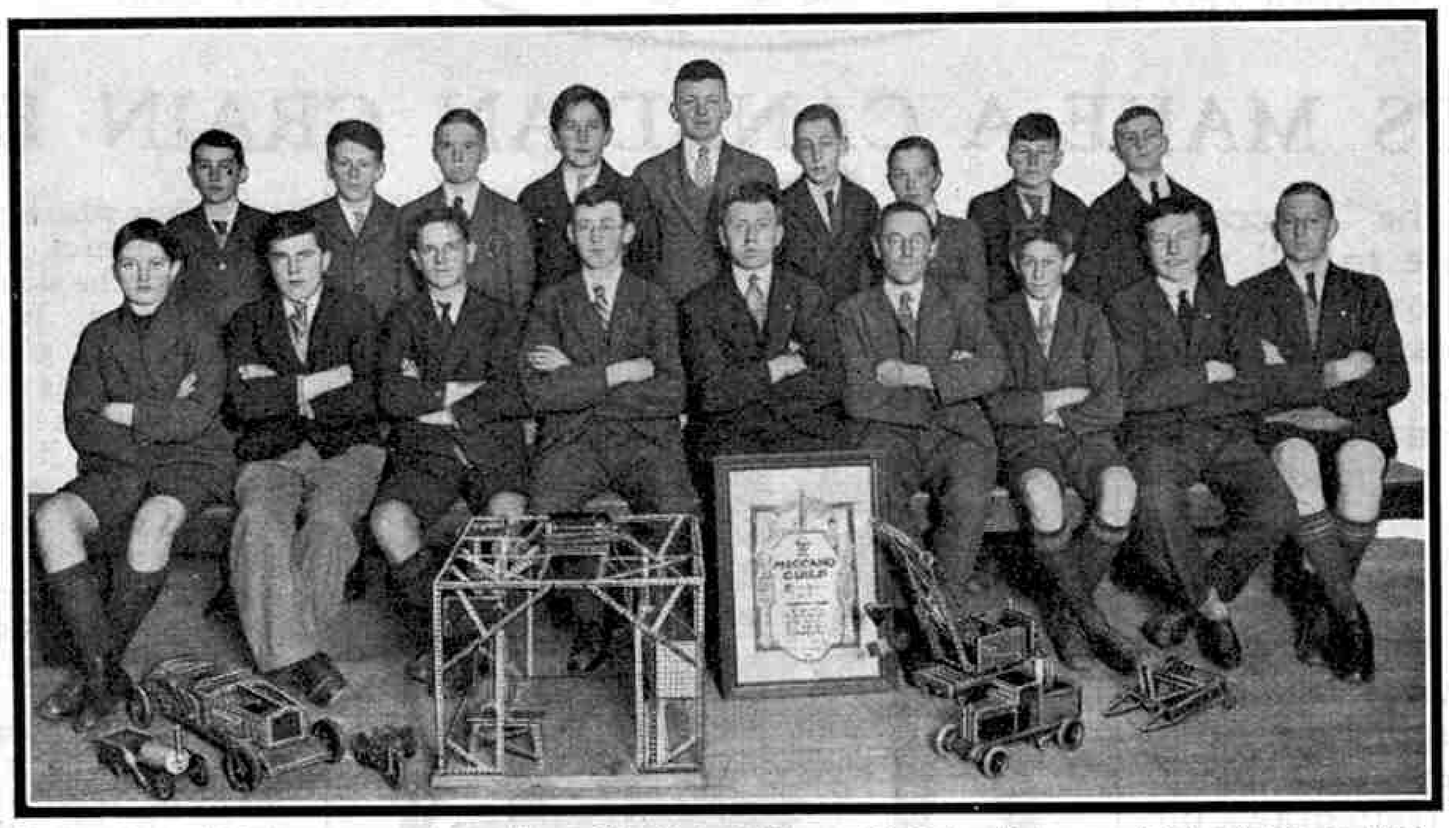
Kendal M.C.—A very successful Exhibition has been held, the models shown being greatly admired by a large number of visitors. Games Nights are frequently held, competitions being arranged in Table Tennis and similar recreations. Special sections are being formed in order to encourage the introduction of other hobbies. Club roll: 14. *Secretary:* A. Brown, 29, Crescent Green, Kendal.

Heywood Central School M.C.—Mr. G. N. Chaplin, Leader of the Club, lectured on "*The History of Games*," dealing with Football, Cricket, Lawn Tennis and Hockey. During the School Holidays, a party of members visited the Meccano factory in Liverpool, where they saw Meccano parts and Hornby Trains being made. Club roll: 50. *Secretary:* G. E. Strutt, 12, Regent Street, Heywood.

Portsmouth and Southsea M.C.—Interesting models were made by members for the club's Exhibition. These included a Weighing Machine reading up to 11 stone, Motor Chassis, Motor Cycle, Flashing Sign, and various models of Aircraft and Boats. Among the visitors were the Lord Mayor of Portsmouth, and the President of the Portsmouth Rotary Club. Several new members were enrolled during the Exhibition. Club roll: 19. *Secretary:* J. S. Kent, 57, Kirby Road, North End, Portsmouth.

AUSTRALIA

Melbourne M.C.—Meccano Model-building is pursued with great keenness, the usual procedure being to form groups, each under a "foreman," for the construction of various parts of a large model, the mechanism of which is planned and closely studied in advance. At one meeting a Lecture on "*Automatic Signals*" was given by Mr. Nicol, an honorary member of the club. At another Mr. Page, of E. G. Page & Co., the Australian agents of Meccano Limited, gave an interesting talk on "*The Story of Meccano and Meccano Clubs*." Several other visits have been made, and talks by members included one on "*The Brown Coal at Yallourn*" by G. Sexton. Club roll: 68. *Secretary:* F. G. Wallis, 2, Bellavista Road, Glen Iris, S.E.6.



Our photograph shows a group of members of the Hobart (Tasmania) M.C. which was affiliated in March, 1928. The President of the club is Professor W. H. Schneider, B.E., Dean of the Faculty of Engineering of the University of Tasmania, and the Leader is Mr. G. S. Green, who is seated in the centre of the group. The members are very keen and invariably show a splendid range of models at their Annual Exhibition and Fair.

SOUTH AFRICA

Turffontein Intermediate School M.C.—This club is now making excellent progress. Two sections—the "Springboks" and the "Duikers"—have been formed, and competition between them is very keen. An Exhibition of models was organised in connection with the School Concert, and a large number of parents and friends admired the display. Joint meetings have been held with the Malvern M.C. Visits were paid to the Fire Station, the "Castle" Brewery, and the "Sunday Times" Printing Works. Interesting talks have included a description by Mr. Lucas of "*A Tour of a Gold Mine*." Club roll: 39. *Secretary:* J. J. Pienaar, P.O. Box 1011, Johannesburg.

Clubs Not Yet Affiliated

Eston Scouts' M.C.—Members have worked well on the construction of the club's model railway track, and have built many Meccano models. Many additions have been made to the club's stock of Meccano parts and it is hoped to increase this steadily until it becomes a No. 7 Outfit. The most popular models are tractors and motor cars, as there is great scope in the large club room for demonstrating these. Club roll: 18. *Secretary:* E. Jones, 22, West Street, Eston, Yorks.

St. Peter's M.C.—Model-building Nights are held regularly and a splendid model station has been constructed. The members are very enthusiastic, and look forward to every meeting. Recently they gave considerable help in the Annual Church Bazaar, and raised quite a large sum of money. Club roll: 5. *Secretary:* S. Leach, 77, Union Street, Southwark, S.E.1.

Wembley M.C.—Meetings are devoted to Meccano Model-building and Hornby Train Nights. Models constructed at home by members are brought to the meetings for demonstration and criticism. Papers by the members on various engineering subjects are usually followed by short discussions. Club roll: 11. *Secretary:* Eric Curtis, 45, Monks Park, Wembley, Middlesex.

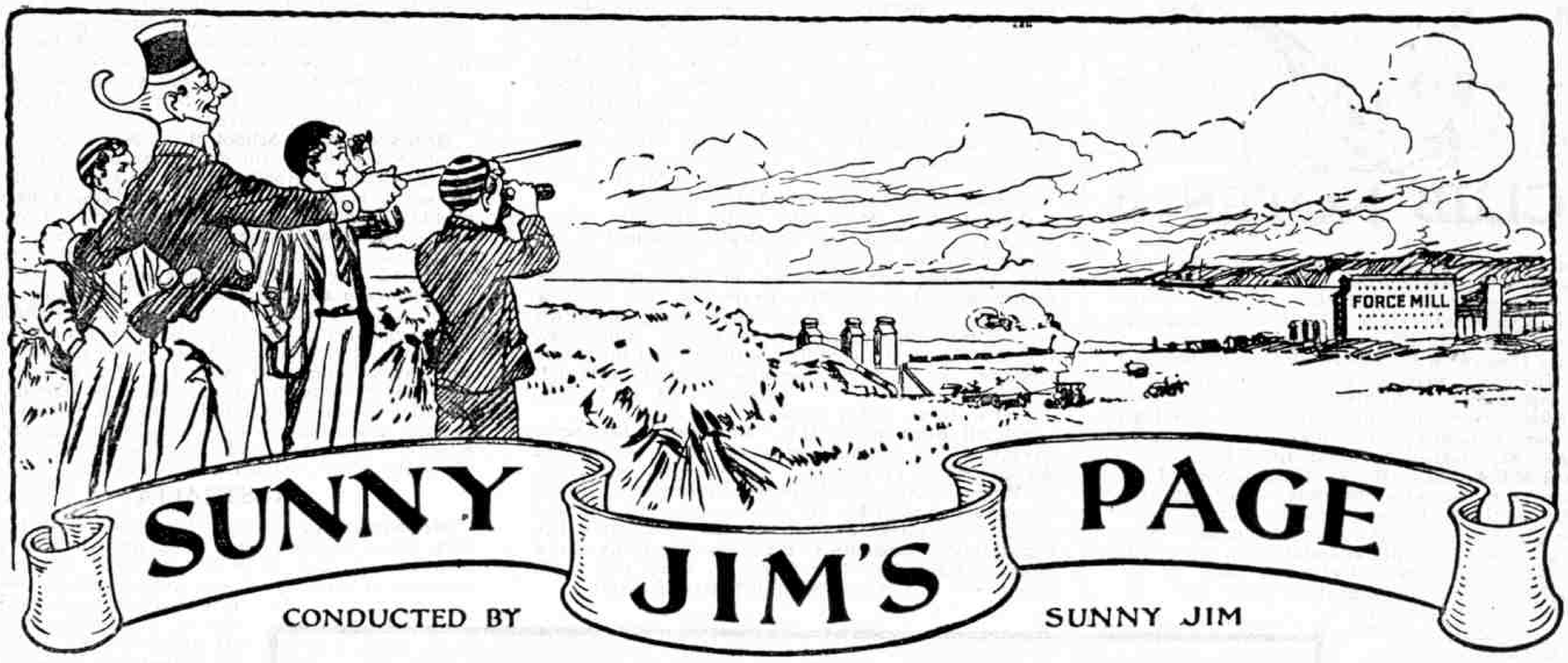
Ryde M.C.—Weekly meetings are held for Model-building, and a large Meccano Outfit has been loaned to the club by G. Sutton, the Sub-Leader. Papers are read by members, and prizes are presented by the Leader for the best of these. The club possesses a cinematograph projector, and splendid displays are given. Library books are circulated among members, and gramophone music frequently helps to provide entertainment at the end of the meetings. Club roll: 13. *Secretary:* H. Brickell, Brightside, St. John's Road, Ryde, Isle of Wight.

Bury Municipal M.C.—Model-building, Talks and Demonstrations of Mechanisms have formed the chief part of the programme. Mr. J. Aisbitt, Leader of the club, gave a particularly interesting demonstration of means of converting high voltage alternating current into direct current of low voltage. "*Rigidity in Models*" and "*Gear Boxes and Differential Gears*" were the subjects of other talks by the Leader, and mechanisms described have been incorporated in models. Club roll: 12. *Secretary:* R. K. Greenhalgh, 244, Ainsworth Road, Elton, Bury.

Chiswick Crusaders M.C.—Most recent meetings have been devoted to general Model-building. Members concentrated on this before the Exhibition, with the result that a splendid display was made. A Hornby Train Layout, on which a regular service was run, and a Gramophone were other attractions, and the evening concluded with a Lantern Lecture on "*The Story of London's Omnibuses*." Nearly £10 was realised. Club roll: 15. *Secretary:* H. P. Betlem, 139, Park Road, Chiswick, W.4.

Roe Green M.C.—Several Model-building Evenings have been devoted to the construction of Signals and other accessories for use on the Hornby Train Layout. A special night was devoted to the construction of scenery and railway material necessary for a large siding. Woodworking has been introduced; members are enthusiastic in regard to the new hobby, and many of them made neat models in wood for Christmas presents. Games Evenings are held regularly, and on one of these a member constructed an ingenious 9-hole midget Golf Course from Meccano parts. Club roll: 10. *Secretary:* P. J. Wallis, 345, Stag Lane, London, N.W.9.

Horsforth M.C.—An excellent display of models was made at the recent Exhibition and several new members were attracted by it. Profits amounted to 15/-. A fund has been organised in order to raise money for the purchase of a hut to be used as a club room. Short Lectures on Engineering subjects are given regularly by members, one on "*The Motor Car*" being particularly enjoyed. Special nights are set apart for members' hobbies other than Meccano. These are always well attended and usually conclude with Games. Club roll: 36. *Secretary:* H. Giles, 12, Kerry Street, Horsforth, Nr. Leeds.

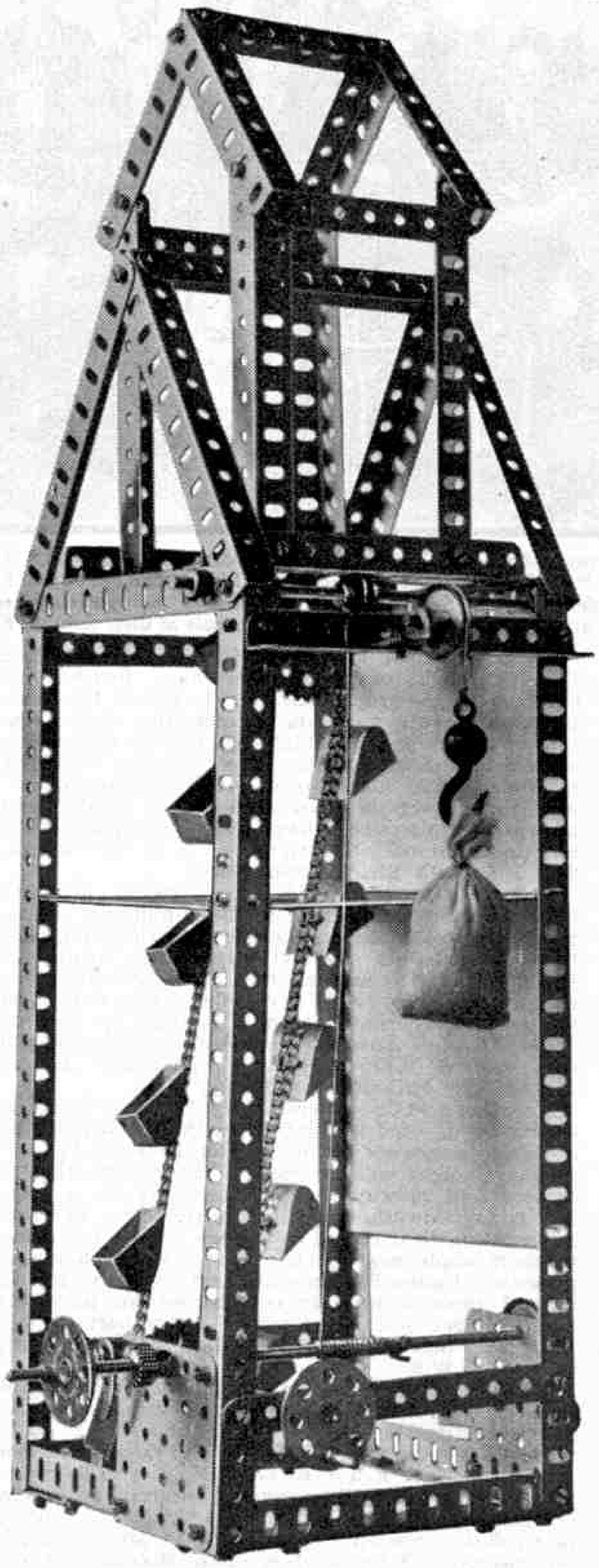


NOW LET'S MAKE A CANADIAN GRAIN ELEVATOR

In this number of the "Meccano Magazine" I propose to tell you how to make your own model of one of the grain elevators in which the wheat is stored before it is loaded on to the train which takes it to the mill to be made into "Force."

In a real grain elevator the wheat is carried to the top either by a corkscrew conveyor, or a small dredger-like appliance, until the whole of the elevator is full of wheat. When the train draws up alongside, the wheat is shot into the trucks, and, as each truck fills, the train moves along so that the succeeding truck is brought beneath the elevator pipe. Since it is impossible to fill a Meccano model with wheat in this way, we must modify the principle a little, but we can get a very fair representation of it as follows :—

Using the parts shown in the photograph build yourself a grain elevator.* It will be proportionate in size to an ordinary No. "O" gauge model railway. Of course if you have a model railway, or if you have a friend who has one, you will now be able to invent quite a realistic game which will bring into play your working model of the elevator. A little model horse wagon will add the final realistic touch. Loaded with loose wheat your wagon comes from the scene of the threshing into the elevator yard. It draws up at the base of the elevator and the wheat is transferred into the buckets of the conveyor. When the handle is turned away goes the wheat to the top of the elevator. As wagon after wagon comes in from the harvest field, each bringing its load of golden grain, ceaselessly the elevator buckets pile up the wheat ready for the arrival of the Canadian Pacific freight train.



Here is where your model railway will come in useful, for you can now run the train into the siding and stop it underneath the elevator. It is of course not possible to shoot the grain into the train in the actual way it is done in Canada, but you can get quite a good representation of this process if you load the grain into little sacks and lower it from the floor by means of the crane you will see in the picture. As one truck is loaded the train is moved forward to bring the next truck into position, and so on until the train is ready for departure to the "Force" Mill.

In real life when the wheat reaches the "Force" Mill it is carried through a series of very wonderful processes and eventually it becomes "Force"—the toasted, malted wheat flakes which are the favourite breakfast of most boys and girls. Firstly the golden grain is scientifically cleaned and steam cooked. Barley Malt is added to make it more easily digestible. Next each grain is carried between heavy rollers which flatten it out ready for toasting, the next process. Now the wheat grains have become the crisp golden flakes which we know as "Force." All the original goodness and nourishment in the wheat is retained in "Force" and as everybody knows, whole wheat is the finest of all cereals, "Force" is, therefore one of the finest foods.

Everybody who wishes to have a sturdy body and active brain should eat "Force" and milk regularly for breakfast every day. If you are not one of the lucky ones who already have "Force," tell Mother how good it is and ask to have it every day. If you would like to try "Force" first, send a postcard giving your name and address for a free sample to "Sunny Jim" (Dept. C.D.2) 197, Great Portland Street, London, W.1.

(This offer applies only in Gt. Britain and N. Ireland.)

*The Meccano parts used in making the model of a Canadian grain elevator illustrated on this page, were as follows :

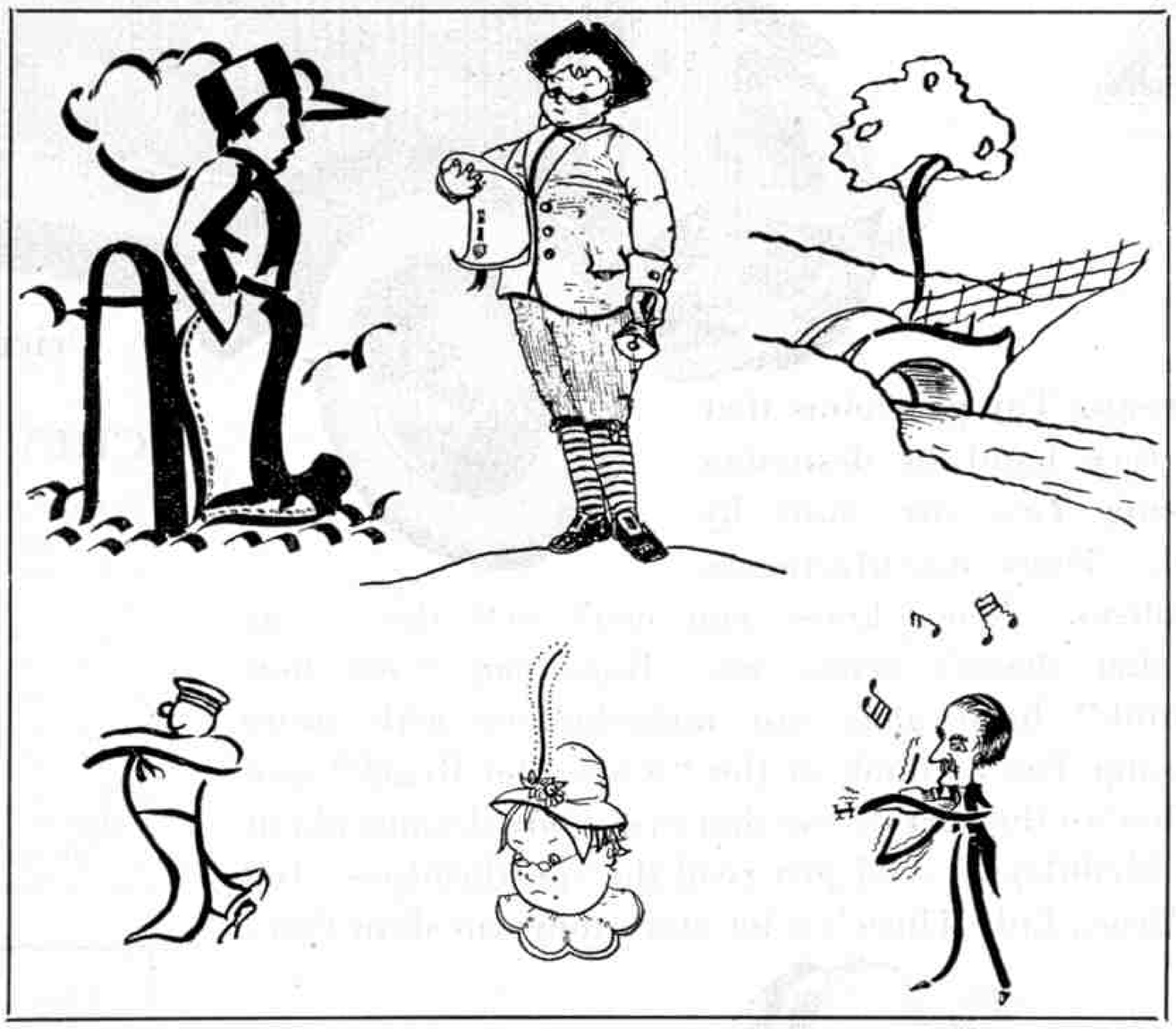
4 of No. 2	2 of No. 22	1 of No 94
5 ,, ,, 3	1 ,, ,, 23a	2 ,, ,, 95a
4 ,, ,, 8	2 ,, ,, 24	2 ,, ,, 115
18 ,, ,, 9	76 ,, ,, 37	1 ,, ,, 122
5 ,, ,, 9b	2 ,, ,, 38	12 ,, ,, 131
6 ,, ,, 12	1 ,, ,, 57b	4 ,, ,, 133
2 ,, ,, 12b	5 ,, ,, 59	1 ,, ,, 147
4 ,, ,, 14	2 ,, ,, 72	1 ,, ,, 148
1 ,, ,, 18a		

Competition Page

A MOTOR BOAT AT SPEED: DRAWING CONTEST

ONE of the outstanding events of the British sporting world this month, is Mr. Kaye Don's attempt on the world's motor boat speed record at present standing to the credit of the late Sir Henry Segrave. Mr. Don's craft is "*Miss England II*," in which Sir Henry lost his life after establishing his record. The vessel has been reconditioned and sent out to Buenos Aires, where a great motor boat regatta is to take place in connection with the British Empire Trade Exhibition that is now being held. The attempt on the speed record is the principal event of the regatta.

A really fast motor boat, all out, is one of the most thrilling aquatic sights and, in choosing "A Motor Boat at Speed" for the subject of a drawing contest this month, we believe it would be difficult to select a subject giving greater scope for the exercise of dramatic taste in artistic expression or for the play of a vivid imagination.



A selection of entries from the Third Sketchograms Competition. Reading from left to right, the artists' names are as follows :—Upper Row : Frank Gillson (Plaistow, E.13) ; Miss Beth Gow (Dumbarton) ; L. Holman (Camborne). Lower Row : S. Harry (Leeds) ; Miss Beth Gow (Dumbarton) ; R. Sewell (St. Ives).

For competition purposes the expression "Motor Boat" shall be held to apply to all forms of motor-propelled water craft, and readers are at liberty to take their ideas from pictures that have been published in newspapers or magazines, or to use their imaginations if they wish. Drawings may be in colour or black and white, and any competitor who prefers to paint rather than draw his entry, may do so.

In order to give our younger readers an opportunity to take part, there will be a special section of the competition for competitors under 16 years of age. This will be called Section B, and in Section A entries from readers aged 16 and over will be included. Prizes of Artists' materials, or Meccano or Hornby Train products (to be chosen by the winners) to the value of 21/- and 10/6 respectively, will be awarded to the best and second-best entries in each section. In addition there will be a number of consolation prizes.

Competitors may submit as many drawings as they wish, but the entrant's name, age and address must appear on each one. Entries must be addressed to "32nd Drawing Contest, Meccano Magazine, Binns Road, Old Swan, Liverpool," and must reach this office not later than 30th April; the closing date for competitors in other parts of the world than the British Isles will be 31st July. Entries that are to be returned must be accompanied by stamped addressed covers.

1931 Photo Contests

The increase in the popularity of our Photographic Competitions last year, following the removal of all restriction as to subjects, was so remarkable that we have decided to adopt the same conditions for the 1931 contests.

There will be separate competitions each month throughout the season, and the imposition of only two special requirements will enable every camera-owning reader to take part in one or another of the contests. The two requirements are, that the exposure must have been made by the entrant, and that each print submitted must bear a brief title explaining its subject. The photographs may be of any subject, and there will be no restrictions as to size of plate, film, paper or style of finish. Development and the printing may be carried out by a professional, but in a tie between a professionally-finished print and one prepared throughout by the competitor, preference naturally will be given to the latter.

Competitors may submit as many prints as they wish each month, but each must bear the entrant's name, age and address, in addition to the title. The entries will be divided into two sections, A for those from competitors aged 16 and over, B for those from competitors under 16, and prizes of Photographic Materials or Meccano products (to be chosen by the winners) to the value of 21/- and 10/6 respectively, will be awarded to the best and second-best entries in each section.

Entries for the April competitions must be addressed "April Photo Contest, Meccano Magazine, Binns Road, Old Swan, Liverpool," and must be sent to reach this office not later than 30th April. Overseas closing date, 31st July.

Entries can only be returned if a stamped addressed cover of sufficient size is sent with the entry for that purpose.

COMPETITION RESULTS

HOME

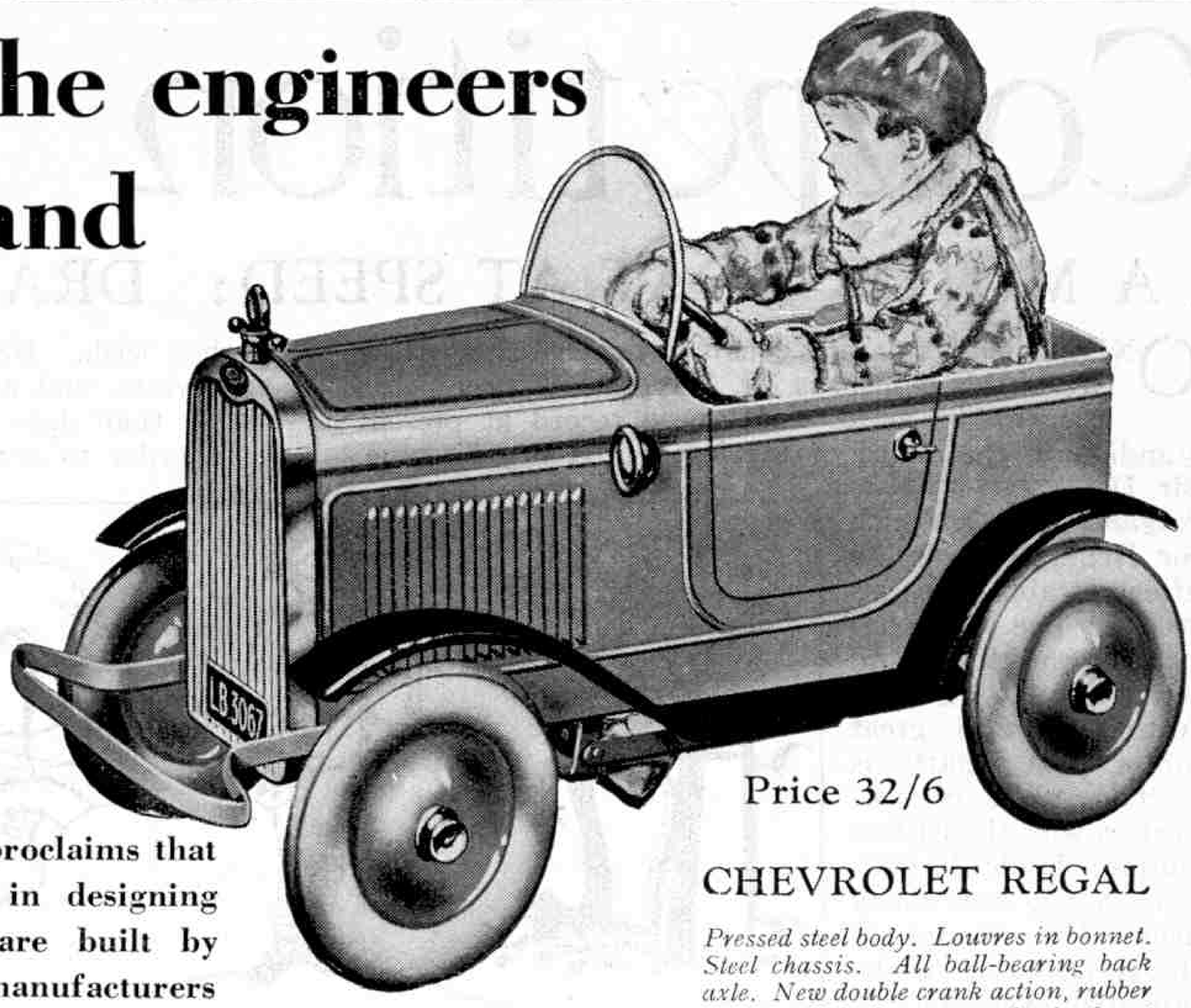
Cover Voting.—1. J. G. Wyllie (Jedburgh) ; 2. J. Bompas-Smith (West Didsbury) ; 3. W. S. Gauld (Golders Green) ; 4. H. Everitt (Norbury, S.W.16). Consolation Prizes : C. M. K. Dod (Liverpool) ; S. Douglas (Kilwinning) ; J. V. Goldsbrough (Hendon, N.W.4) ; E. Le Flufy (Blackrock) ; R. W. Newby (Bedford Park, W.4) ; A. E. Redburn (Bethnal Green, E.2) ; W. Robb (Belfast) ; E. Salmon (Retford) ; E. Simpson (Beckenham) ; K. G. Walford (Birmingham) ; A. J. Warren (Norwich) ; A. Weal (Southampton) ; C. Weatherbed (Sheffield).

New Year Resolutions.—1. J. G. Cherry (Eastbourne) ; 2. R. Carr (Coventry) ; 3. A. Armitage (Ossett) ; 4. R. J. Fullerton (Stanford-le-Hope). Consolation Prizes : C. R. Allen (Wellingborough) ; W. Harbord (Guildford) ; A. Horn (Muswell Hill, N.10) ; R. Lindsey (Harringay, N.4) ; C. J. Whillingham (Chester) ; A. Williams Yeovil).

OVERSEAS

31st Drawing Contest.—First Prizes : Section A : D. H. Adams (Sydney, Australia) ; Section B : Tony MacLachlan (Otago, New Zealand). Second Prizes : Section A : J. S. de'Conti Manduca (Sliema, Malta) ; Section B : J. D. Siddons (Alta, Canada). Consolation Prizes : J. Credie (Cape Town, S. Africa) ; C. W. Sharpe (Nelson, New Zealand).

Made by the engineers of Toyland



L. BROS. Ltd. LONDON BROS ENGLAND

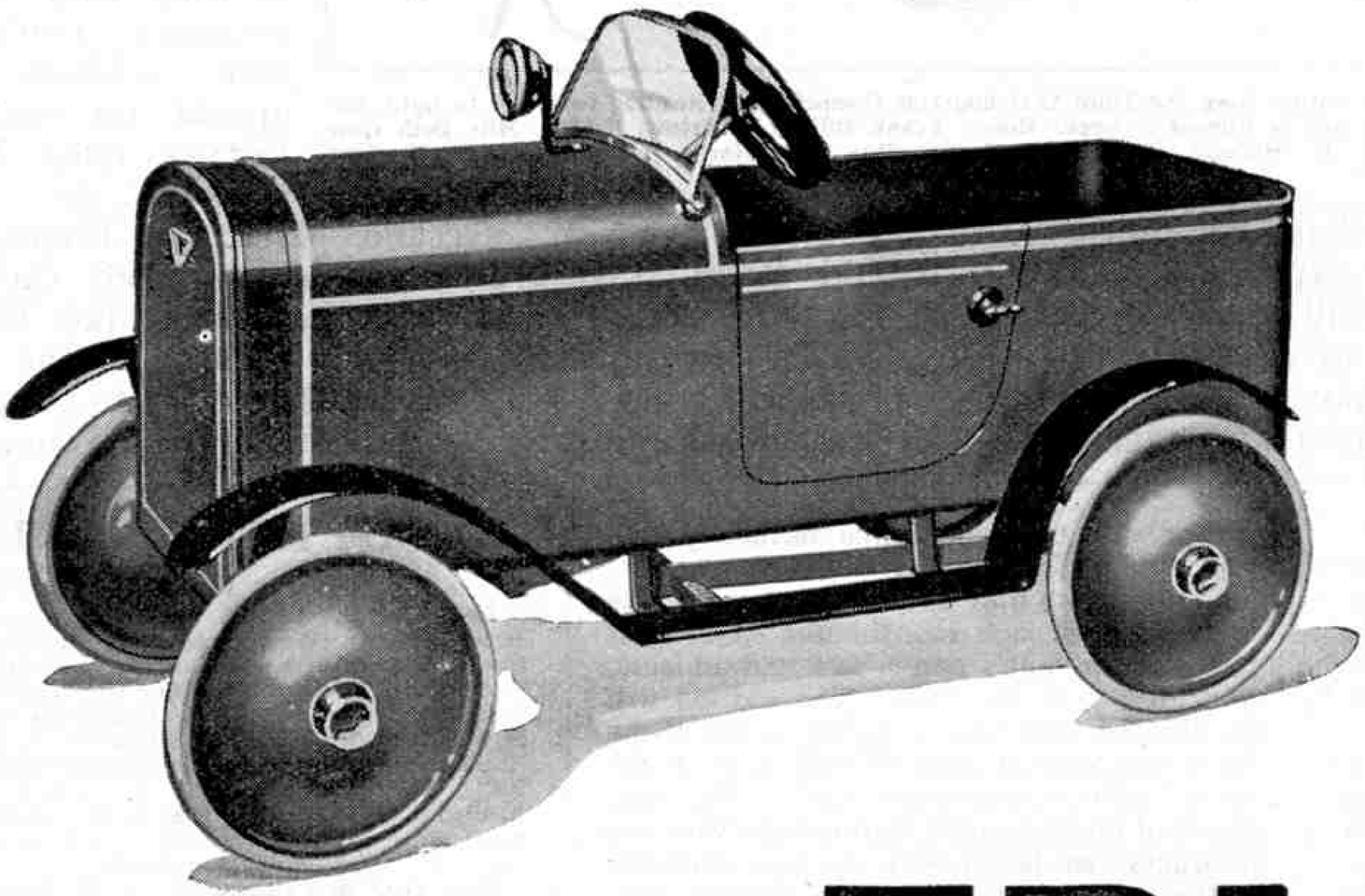
REGD. TRADE MARK

Price 32/6

Every detail of a Tri-ang Toy proclaims that engineering had a free hand in designing and making. Tri-ang Toys are built by Lines Bros. Limited. These manufacturers are strong for realism. They know you can't sell the young idea on anything that doesn't really go. Boys can "see how the wheels go round," little girls can make-believe with more belief, with any Tri-ang Toy ! Look at the "Chevrolet Regal" and "Rover Junior"—they're the sort of car that every boy dreams about the night before his birthday ! And just read the specifications. Get in touch with Lines Bros., Ltd. There's a lot more they can show you !

CHEVROLET REGAL

Pressed steel body. Louvres in bonnet. Steel chassis. All ball-bearing back axle. New double crank action, rubber pedals. Side door opens, back of seat upholstered. 9" steel disc balloon rubber tyred wheels. Instrument board has clock, speedometer, oil gauge, voltmeter, etc. Accessories—wind-screen, two lamps, bumper, petrol tin, oil can, etc. The Chevrolet badge on the bonnet has been approved by Messrs. General Motors. Azure blue finish, red trim.



ROVER JUNIOR

An all-steel model with opening side door, one-piece stove enamelled black mudguards, 8" steel disc wheels with ½" rubber tyres. Finished azure blue. Rubber pedals to double crank drive. New Rover badge on radiator. Wind-screen, one lamp. Extremely low in price.

Lines Bros. Limited make these all-metal toys — tip lorries, wagons, vans, break-down lorries, fire-engines, taxis, 'buses, planes, folding air-planes, dolls' prams, Fairycycles, Tri - ang cycles, scooters, pedal kars, locomotives, train sets, folding barrows, etc.

TRI-ANG

CARS & ALL-METAL TOYS

LINES BROS. LIMITED, MORDEN ROAD, MERTON, LONDON, S.W.19

TIME FOR REFLECTION

"How long is this case going to take?" the man in the dock asked his lawyer.

The man of the law smiled pleasantly.

"Well, it will take me about two days," he replied. "But I expect it will take you at least five years."

* * * *

Visitor (at quiet resort): "Whatever do you do when it rains?"

Bored Native: "Oh, we just let it!"

* * * *

Salesman: "I'm sorry, but I can't take this shilling; it's bad."

Shopper: "Impossible. It's a Queen Victoria shilling, and if it were bad, surely somebody would have found that out before now."

* * * *

The brothers had had a slight disagreement on some matter.

"If I were you," said one, as he turned to leave the room, "I should have more sense."

"Of course you would," returned the other quickly.

* * * *

"George and Mary were quarrelling over who should have the larger part of the cake," said Johnnie. "But I soon settled it."

"That's a good boy," said mother. "Whose part did you take?"

"I took both their parts."

* * * *

"Smith is very kind-hearted, particularly to animals."

"Really?"

"Yes! The other day he found that the cat often sleeps in the coal bin, so he ordered a ton of soft coal."

* * * *

The busy-body was being shown over an Indian reservation in Canada, and even the phlegmatic guide had begun to lose his patience at the seemingly endless stream of absurd questions.

"Oh, tell me," she cried, "who is that great silent Indian standing by himself over there?"

"Madam," answered the weary guide, "That is Sitting Bull. He is on his vacation."

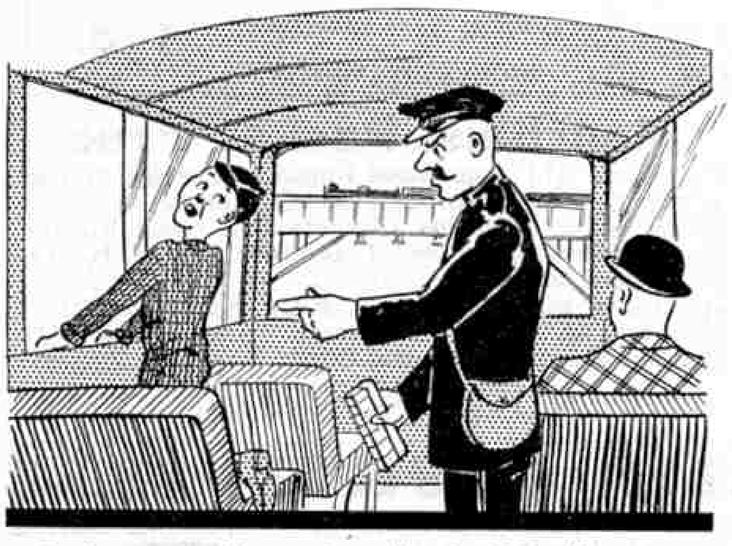
* * * *

"What are the constituents of quartz?"

"Pints."

* * * *

AT HIS OWN RISK



Conductor (to boy on top of bus): "Don't put your head out of the window, sonny."

Boy: "I can if I want to."

Conductor: "Of course you can, but if you break any of the iron structures on the bridge at the next corner you'll have to pay for the damage."

* * * *

"Wot yer lookin' upset abaht?"

"Work! Nuffink but work, work, work, mornin', noon and night."

"'Ard luck. 'Ow long yer been at it?"

"Start to-morrer."

THE ONLY WAY!

Policeman: "Hey, where are you going? Don't you know this is a one way street?"

Isaacs (in new car): "Vell, I'm goin' von vay, ain't I?"

* * * *

Insurance Examiner: "Were you ever in hospital?"

Applicant: "Yes, once."

Insurance Examiner: "Ah What for?"

Applicant: "To see my aunt."

* * * *

"You cannot get eggs without hens," said the speaker stressing the point.

"My dad can," piped a small voice from the rear.

"Please explain yourself, little boy," said the speaker irritably.

"He keeps ducks!"

* * * *

NOT SHIRKING HIS DUTIES

"Give me that tub of butter" said the farmer as he entered the village general store. "You can put that barrel of sugar with it, and get ready all the other stuff you have in the store. I'll call for it later."

"Gracious," said the woman behind the counter, "what do you want it all for?"

"I dunno," said the farmer. "But I'm the executor of your husband's will, and I've been told by the lawyer that I must carry out the provisions."

* * * *

"I hope you peeled that apple before eating it, as I told you, Jimmy?"

"Yes, father," replied Jimmy.

"What did you do with the peel then," demanded father, who was naturally of a suspicious nature.

"I ate it after I had finished the apple," replied Jimmy.

* * * *

"You were very restless in church to-day, dear," said mother. "You never see daddy behaving in that way. Why couldn't you be quiet, like him?"

"I'm sorry, mother," replied Dorothy, "but I wasn't a bit sleepy."

* * * *

Lady (interviewing maid): "And how long did you say you were at your last place?"

Maid: "My last? O-er-I didn't start at that one at all."

* * * *

The young dramatist stopped a friend who was leaving a theatre where his play was being produced.

"You're surely not going yet!" he said. "There are three more acts, you know."

"Yes," was the reply. "That's why I am going."

* * * *

"How far is it to the station?" demanded the traveller of a small boy.

"Well, sir," said the youngster. "It's about twenty minutes' walk if you run."

* * * *

New Maid: "Please, sir, a man's just stole' your car. I couldn't see what the man was like, but it will be all right, as I took the number of the car."

* * * *

"Waiter, it is half an hour since I ordered that turtle soup."

"Sorry, sir, but you know how slow turtles are."

* * * *

Irate Diner: "Waiter, look at the fly in my soup!"

Waiter (soothingly): "No, sir, that's not a fly. It's one of those new Vitamine Bees that we serve now with every order."

MUTUALLY DISTASTEFUL

Father (after reproving his son): "I don't like to shout at you, Jimmy."

Jimmy: "And I can't say that I like it very much, either, father."

* * * *

Vicar: "And what parable do you like best, my son?"

Boy: "The one about the multitude that loafs and fishes."

* * * *

John was struggling with his homework.

"Oh, dear," he sighed. "I can't find this Least Common Multiple."

"Is that thing still lost?" demanded Father, looking up from his paper. "They had me hunting for it for months on end when I was your age."

* * * *

The magistrate was stern. "Do you mean to tell the court that you refuse to take out another dog license?" he demanded.

"I do," replied the man in the dock.

"In spite of the fact that your old license expired four months ago."

"Yes, the dog expired at the same time!"

* * * *

A motor manufacturing firm staged an exhibition during which a car was put together in 12 minutes. This was widely advertised and the firm expected that the announcement would lead to considerable increase in sales. On the morning that advertisement appeared the works manager was rung up.

"Hello!" said a voice, "is that the Works Manager?"

"Yes," was the reply.

"Is it true that you put a car together in 12 minutes yesterday?"

"Yes," said the Works Manager.

"That must be the one I've got, then," replied the voice.

* * * *

A man who was very fond of animals had a short wait at a station and while walking up and down the platform was struck by the wretched appearance of a dog which was tied up to a post.

"That dog looks very miserable," he said to a porter. "Where is he going to?"

"That's the trouble," replied the porter. "I don't know, and you don't know, and the dog don't know. He's chewed up his label."

* * * *

A man who had been out of work for some time was applying for the position of assistant to a ship's cook.

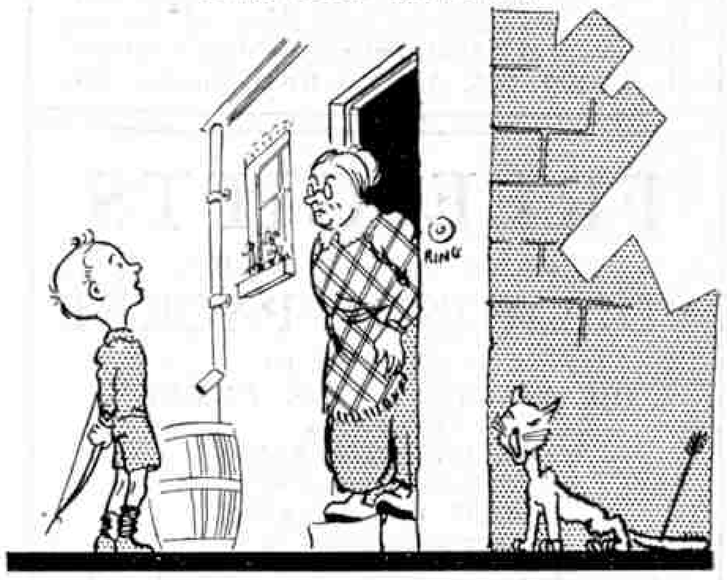
"Have you ever been on a ship before?" asked the cook when he had nearly finished cross-questioning the applicant.

"During the war I was a gunner in the Navy," was the reply.

"You'll do," said the cook, "start right away and shell those peas."

* * * *

THE CAT KNEW!



Boy (politely to old lady): "Please, ma'am, may I have my arrow? It dropped in your garden when I was playing with it."

Old Lady: "Certainly, sonny. Do you know where it is?"

Boy: "Y-Yes! I-I-I think it is sticking in your cat!"

* * * *

"I want a book to take home with me."

"Yes, sir, something light."

"It doesn't much matter, I have my car outside."

A Wonderful Stamp Album

The best album for a general stamp collection is the Gibbons "IDEAL," which has a space for every stamp and is fully illustrated.

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10	Norway	2d.	25	"	3d.
15	"	3d.	10	Greece	2d.
10	Denmark	2d.	15	"	3d.
15	"	3d.	10	Turkey	2d.
10	Sweden	2d.	15	"	3d.
15	"	3d.	10	Spain	2d.
5	Luxemburg	2d.	15	"	3d.
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10	"	4d.	10	Bavaria	2d.
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A NEW FIELD FOR STAMP COLLECTORS

ONE of the most interesting developments in philately in recent years has been the rapid extension in the use of postal franking machines, and if the present progress is maintained, there will soon be few commercial concerns remaining faithful to the use of adhesive stamps as a means of prepaying postage charges on ordinary correspondence.

The operation of a machine of this type is very simple. A cheque or cash to cover the value of the franks to be used is handed to the Post Office and the machine is set by a postal official to give the requisite value of impressions. It is then sealed, and the user can print franks of any value required until the amount prepaid is exhausted and the machine automatically locks itself. The value of each impression is registered on a totalisator device incorporated in the machine, and the balance remaining to be used is at all times clearly visible. This running record of the position facilitates the work of the cashier and also enables the user to note immediately when the prepaid amount is about to be exhausted.

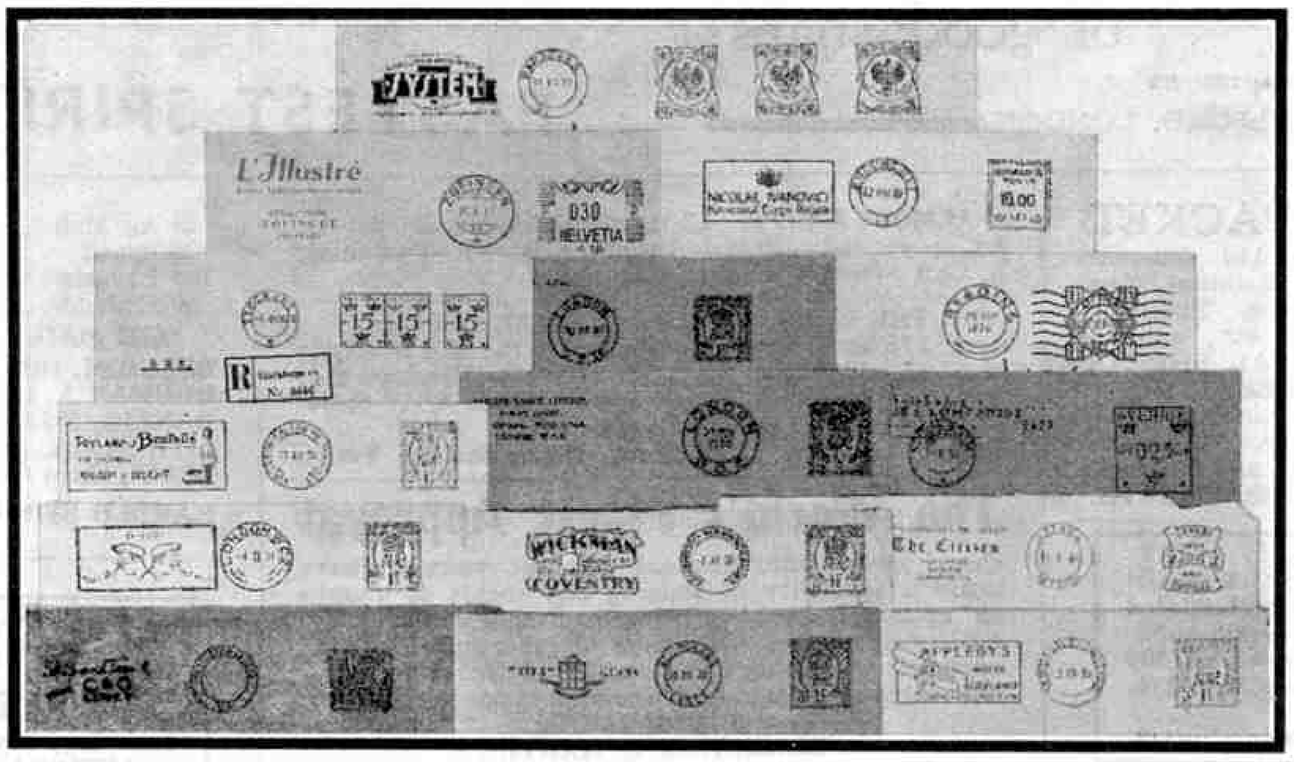
Standard machines may be supplied with dies for franking letters in three or five values. These range from ½d. to 1/–, those mostly used being ½d., 1d., 1½d., 2½d. and 6d. The inclusion of the 6d. value enables telegrams and parcels to be franked.

The types of machines chiefly used are four in number. One is the Neo-Post, a British machine that is exceptionally popular. The remaining machines are the Pitney-Bowes, an American product, and two manufactured by Universal Postal Frankers Ltd., one of which is called the "Midget."

No statistics are available to show the full extent of the use of these machines in Great Britain, but we are informed by Universal Postal Frankers Ltd. that out of 8½ million letters handled per week in the Inland section of the London General Post Office, covering the whole of the City of London's provincial mail, one million pieces, or approximately 12 per cent., are franked. The Postmaster-General of the United States reported that in the year ending 30th June, 1929, the total letter mail was 15,469,318,926 pieces, and of that number 1,449,614,141 pieces were metered mail, representing 9.4 per cent. of the total mail of the country. At that time there were 432 Post Offices in the United States from which franked mail was being despatched, and at the beginning of January last this number had increased to 563.

What will be the effect of the introduction of franking machines on the stamp collecting hobby? The more extensively they are used the fewer will be the number of adhesive stamps employed, but our hobby is not doomed to extinction in consequence. Although the machines may be set to impress any value, only the common values are sufficiently widely used to justify the expense of installing machines to eliminate the labour of sticking ordinary stamps in position. The stamps displaced will chiefly be those varieties that now are so common as to be valueless from a collecting point of view. Clearly that is not harmful, and, in fact, the extending use of the machines opens up a new and very wide field for stamp collectors. Every machine is licensed by the Post Office and given a distinctive number which, in effect, constitutes a private postmark. The collection of frank meter impressions, therefore, forms an interesting new branch of the hobby.

A glance at our illustration will make this clear. It includes several British marks and in a convenient position on each of the designs representing the stamps will be seen a letter and a number. This letter and number must be read in conjunction with the postmark of the town of origin. Thus, the "Vita Glass" envelope bears the identification *M1* and comes from St. Helens. The letter *M* signifies that the machine is a "Midget," made by the Universal Company, and the figure 1 shows that the machine is Midget No. 1 on the register kept by the St. Helens Head Post Office. The letters *N*, *PB* and *H* will also be observed, and these are used to denote the Neo-Post, Pitney-Bowes, and the second type of Universal machines, respectively.



An interesting group of covers that have been franked by means of the machines described in the article. We are indebted to the courtesy of Universal Postal Frankers Ltd., for several of the foreign covers.

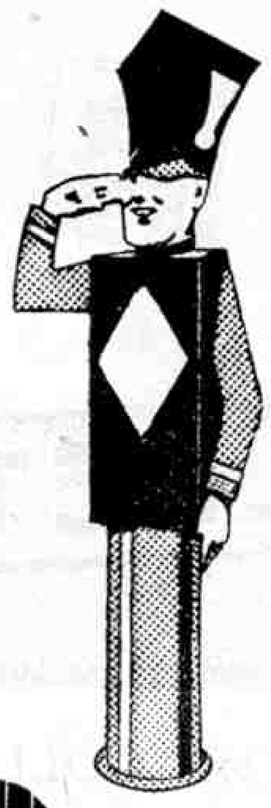
It will be seen that the British system of keeping registers at each post town involves the duplication of marks as used by firms in different parts of the country. Thus, for example, Messrs. Wickman, of Coventry, a specimen of whose cover appears in our illustration, use *N6*, which is the Liverpool mark of Meccano Limited. In foreign countries, as our illustration also shows, the practice differs. Usually one register is kept to cover the whole of the country, the individual number allotted to each machine appearing in the franking impression.

The formation of a collection containing one specimen of every different identity number would be a formidable task, but readers employed in large commercial houses should find no difficulty in compiling a representative selection of impressions, for the machines are in use in practically every part of the world. The Universal machines, for example, are licensed in Great Britain, the Irish Free State, Belgium, Peru, South Africa, Norway, Sweden, Canada, Brazil, India, Hungary, Switzerland, Uruguay, Straits Settlements, Siam, Poland, Kenya Colony, Italy, U.S.A., Argentine, Chile, Holland, Australia, Russia, and several other countries of which at the moment we have no record.

In addition to the stamping and postmarking devices, facilities are provided by the franking machines for the simultaneous impression of an advertising message, and the ease with which the advertisement plates can be exchanged—plates cost only 25/–, and can be taken out from or inserted in the machine in a few seconds—results in many firms changing their message frequently. Thus, to compile a complete collection of machine impressions, it would be necessary to include a specimen from each separate advertisement plate, and if foreign countries are to be included in the collection, the securing of a complete record (*Continued on page 347*)

Soon....

you will be putting away your Meccano for the Summer and getting your camera into action again



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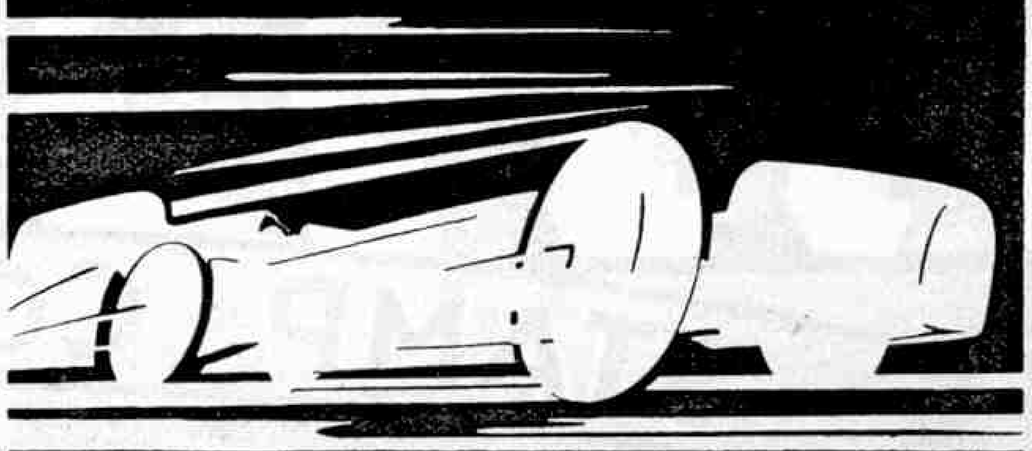

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ON **Pratts Ethyl Petrol**

SPECIAL FASTEST SPIRIT ON EARTH!

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GENUINE BARGAIN PACKET

No. 589. Post Free 3d. Contains 110 different Stamps, including Algeria, Poland, Estonia, New Caledonia, Siam, Jamaica, Southern Rhodesia, Indo China, Dutch Indies, Tasmania, etc., and all purchasers who ASK FOR APPROVAL SHEETS **RECEIVE 4 TRINIDAD FREE.**
New Approval Sheets ready. Grand variety. Good Discount. Write for a selection to-day. Duplicates exchanged. Exchange desired with all Colonies.
F. G. ROWE, 21, COMLEY ROAD, BOURNEMOUTH.

South West Africa (JUST ISSUED)

A new set of Stamps from this British Mandated Territory sent free of charge to bona-fide applicants for selections of duplicates on approval. 500 extra good Stamps (all different), post free, **1/6.**
HENRY TURNER,
110, Barnett Road, Preston, Brighton, Sussex.

DO YOU COLLECT Fine Used British Colonials? Then ask to see my collection of 600 different at ½d. each Stamp, the best value at the lowest cost. Sent on request. A good selection at 1d. each and upwards if desired. Foreign Stamps from ¼d. each Stamp.
BICKERS, Elveden, Lordswood Avenue, Southampton.

***9 Nyassa Triangles,** 1924, complete set ...	**7d.**
***14 Antioquia,** 1899, complete set (Cat. 2/11) ...	**6d.**
***1 Iceland,** 1930, 10 aur Triangular Air Mail ...	**3d.**
21 Belgium, 1923, large Parcel Post, to 5 fr. ...	**4d.**

*Unused. Postage 1½d. extra.
W. BENNETT, 53, Marlborough Road, London, E.8.

4 Abyssinia, 1930, Coronation	8d.
4 Bulgaria, Royal Wedding	1/-
6 Spain, Ibero-America (2 Air)	4d.
1 Papua, New Air Mail, 3 mint	4½d.

Post extra. New Delhi Pictorials free with selections.
J. R. MORRIS, 7, Audley Road, Folkestone, Kent.

ALMOST A GIFT. 12 British Colonials, 200 others, 8d. post free. Postal Orders only.—J. Dewhurst, 3, Cliff Street, Padiham, Lancs.

THE M.S.N. CIRCLE. SPECIAL OFFER.
Send 2/6 and request particulars of the M.S.N. Circle and you will receive the finest little lot of Stamps that you are ever likely to get; Worth over 5/-. Satisfaction Guaranteed.
George Lazenby, 16, Redburn Drive, Shipley, Yorks.

The World's Finest Approval

sheets are at your disposal. For 51 years we have made a speciality of sending out sheets of stamps on approval. Ask to see some and compare the quality and prices with those of other firms. To all applicants enclosing 6d. we will send two Provisional Nyassa Stamps cat. 4s. if the application is addressed to **Department 100,**
ERRINGTON & MARTIN,
South Hackney, London, E.9. Established 1880.

The New "TEN-SET" Packet

This splendid Packet (the first of a new series) will form a valuable addition to any collection. It contains Ten fine Sets of good Stamps only. **NO** common rubbish or damaged stamps here!
'Ten-Set' Packet A contains—8 **S. AFRICA,** ½d. to 1/-, 9 **ROUMANIA** Boy King, 4 **SPAIN** Catacombs, 6 **NYASSA** 1911, 6 **PERSIA** 1911, 6 **LUXEMBURG** 1921, 20 **LIECHTENSTEIN,** 7 **JAPAN** 1914, 10 **TRAVANCORE** Service, 4 **CHINA.** Ten Splendid Sets, 80 stamps in all, used and mint. Post Free for **1/9.**
G. HANSFORD, Barfield, Ryde, Isle of Wight.

25 Air Mail ...	7d.	50 Czecho-Slovakia	5d.
25 Brazil ...	6d.	100 ,,	1/5
100 Bavaria ...	1/3	100 Port. Colonials	1/8
50 Finland ...	8d.	25 Soviet Russia	8d.

AIR MAIL AIR MAIL AIR MAIL

BELGIUM, 1930 50c., 1.50, 2 Fr., mint	10d.
ROUMANIA, 1928 set with rare vertical wmk.	1/6
DANZIG, 1923 complete mint set of 12	7d.
LITHUANIA, 1921 comp. set of 7, cat. 2/9 ...	1/1
SPAIN, Goya Commem., 7 large pictorials ...	11d.

HAROLD STROUD, 57, New Bank Road, Blackburn.

COLLECTOR'S BARGAIN OFFER!

20 Mint British Colonials for 3/-!
Including **DOMINICA** (Cat. 2/- by S.G.), **ANTIGUA, BERMUDA, BARBADOS, etc.**
Approvals, **AIR MAILS** or **BR. COLONIALS.**
If Br. Col. desired, state Cat. up to, or over 2/6, Prices about ¼ Cat.
G. K. NICHOLSON, 46, Russell Street, Reading.

FREE Set of GRENADA or PALESTINE.

Fine **British Colonials and Foreign Approvals** sent on request and one of above **Free Sets** to all genuine applicants. My approvals contain **Kings' Heads** and fine modern pictorials. **Many hard to get at Bargain Prices.** Send to-day. Do not miss this opportunity to improve your collection.
C. H. SHAW,
95, Christchurch Avenue West, Kenton, Harrow.

"1,000 PACKET"

A WONDERFUL OFFER FOR 4½D.

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; 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.*

Postage 2½d. extra. Abroad 6d.ex.

H. C. WATKINS, "M" DEPT., GRANVILLE ROAD, BARNET

For further stamp advertisements, see page 348

Stamp Gossip

and Notes on New Issues

More Centennial Celebrations

Poland and Finland are the latest European States to commemorate with stamps the birth of the patriotic movement that secured ultimate freedom for their countries.

Poland has issued a set of four stamps to commemorate the centenary of the Revolution of November, 1830, and it is a worthy celebration, for the design, common to the four stamps, is easily the best that Poland has produced to date. It represents two Polish soldiers of the early 19th century, and the wing-like effect in the background, presumably, is intended to suggest the speedy spread of the Nationalist movement.

The Finnish commemorative strikes quite a different note, for there is nothing martial in the design, which celebrates the centenary of the foundation of the Finnish Literary Union.

There was no known important Finnish literature in 1809 when the country was ceded to Russia, and although 80 per cent. of the people spoke Finnish, there was a danger of the language being superseded by Swedish, the usual tongue of the educated, or Russian. The danger was averted by a band of writers and poets, headed by Elias Lonnsot, who pledged themselves to write no other language than Finnish, and thus commenced the long struggle for the freedom that came eventually in 1918.

There are two stamps in the series, 1 m. and 1½ m. A portrait of Lonnsot appears on the 1 m., as our illustration shows, and the seal of the Union, a star and a harp resting on a cloud bank, is used on the higher value.

* * * *

Recent weeks have been full of interest for collectors of British Colonial stamps. In addition to the new Canadian high value designs, the Indian New Delhi commemorative and the Newfoundland definitive air mail issues have actually appeared, and advance designs for the South-West Africa definitives have been made public. We hope to reproduce the Indian and Newfoundland stamps in our next issue.

New Air Mail Issues

The recently issued Czecho-Slovakian air stamps are a notable addition to the lists of air mail issues. There are eight values in the series, and, broadly speaking, there are four designs used in pairs for the 50h. and 1k., the 2k. and 3k., the 4k. and 5k. and the 10k. and 20k.

In the lowest values, a three-engined monoplane is shown flying over open country, and in the highest, the same machine is passing over the famous Hradschin. The design used for the 2k. and 3k. values is illustrated on this page, and for the 4k. and 5k. virtually the same design is used, differing only in that a front view of the biplane is shown and other landscapes are given.

The new Canadian air mail design also is available this month. It is not unlike the old 1928 design, but examination will show that the globe has been lifted to the centre of the stamp, and a figure of Mercury superimposed. This, with a background of clouds, comprises the central design, to the exclusion of the monoplane and angels surmounting a globe map of Canada, that were the central features of the old design. The ornamental corner scrolls that were a common feature of all 1928 Canadian stamps, have disappeared, and are replaced by simple maple leaf ornaments.

Canada's New Designs

The new Canadian pictorial designs are now coming into general use, and as a set they promise to equal in beauty the famous issues of 1928.

The most interesting of the new designs is the 20c. value, in which a harvesting scene in the prairies is shown. The old 20c. stamp showed a similar scene, and the outstanding feature of the new stamp, which is illustrated here, is the replacement of the horse-drawn reaping-machine shown in the old stamp, by a powerful caterpillar tractor-drawn reaping and binding machine.

The 12c. stamp shows a striking view of the old Citadel at Quebec, and the 50c. a view of the tiny church at Grand Pré, Nova Scotia, made famous by Longfellow in his poem "*Evangeline.*" The one dollar stamp gives a glimpse of Mount Edith Cavell in the Canadian Rockies.

Boosting Cotton

In the early part of the year, a Lancashire daily newspaper made a very determined effort to persuade the Government to issue a special stamp in connection with the exhibition of cotton goods held at the White City, London, in February, as a part of the annual British Industries Fair in London and Birmingham.

The effort was not completely successful, but, as most of our readers will know, it did result in the use of a special advertising slogan that appeared on all mail emanating from Lancashire during the Fair. It was worded "Visit Cotton Section, British Industries Fair," and doubtless played its part in the very successful outcome of the exhibition.

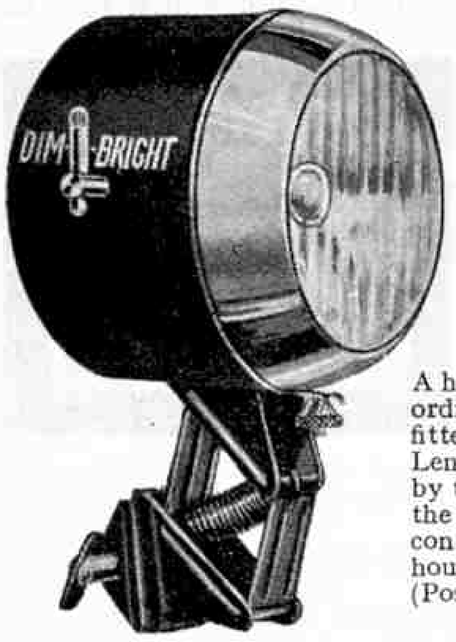
Stamp Collecting—(*Continued from page 345*)

of such plates involves a task before which the most stout-hearted of enthusiasts would quail. In the case of English business houses, their Advertising Departments would readily provide information as to the plates employed and the approximate dates upon which each came into use.

The collection of the advertising messages provided by the franking machines, is, of course, a simple extension of the collection of slogan postmarks, to which we have referred on several occasions in these pages, and is an interesting alternative to a full collection of meter impressions. Many of the messages are pictorial, and some are really humorous, the famous "Shell" two-headed device, shown in our illustration, being an interesting example.

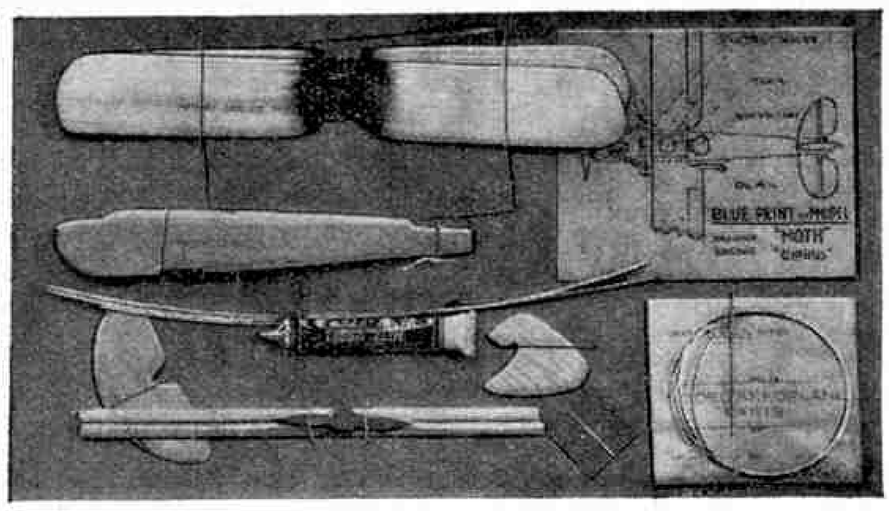
It will be seen quite clearly that, so far from constituting a threat to the stamp collecting hobby, the use of machine impressions for franking correspondence is merely its natural development in an age of machinery. The day is perhaps very near when every pillar box will be an automatic post office. The insertion of coins to prepay the postage will open a slot to admit the correspondence, which will be franked automatically as it drops into the box!

We thank Stanley Gibbons Ltd. for their courtesy in loaning the stamps from which the illustrations for our stamp pages have been made.



A NEW AND BETTER
ELECTRIC
CYCLE LAMP
"THE PIFCO"

A handsome Lamp, operated by two ordinary pocket lamp batteries, and fitted with special "Anti-Dazzle" Lens, and giving Bright or Dim Light by the movement of a switch. With the Dim Light this Lamp will burn continuously for over 20 hours. Black enamel finish. (Postage 6d.) Price 5/6



AEROPLANE BUILDER

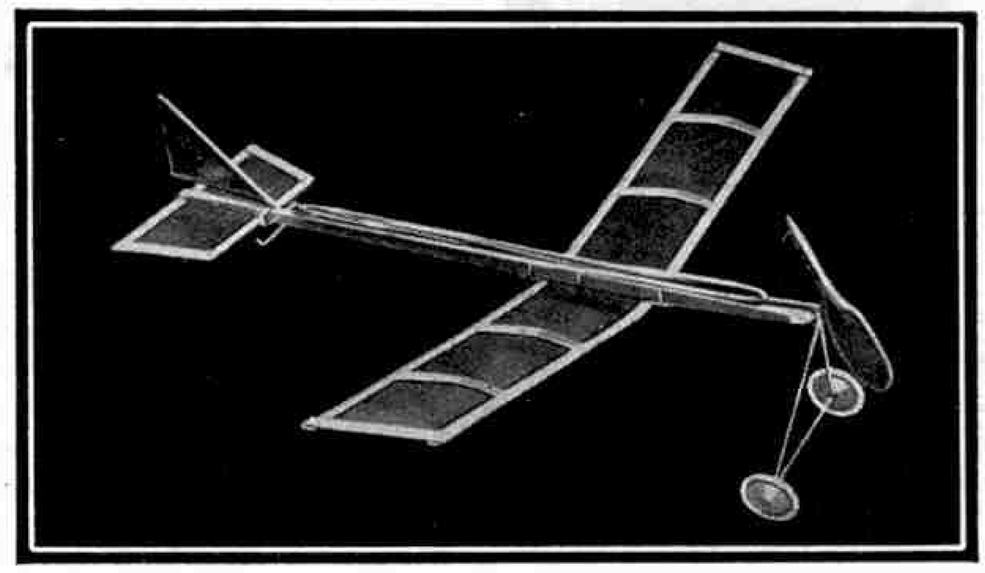
A complete set of parts in wood to build a Scale Model D.H. Moth Aeroplane (1/40th scale), complete with all necessary wire, pins, glue, sandpaper, etc., full directions and blue print. A fascinating and instructive hobby. (Postage 6d.) Price 4/9

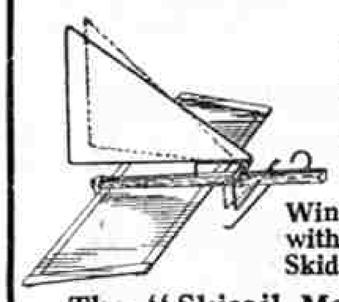
Hamleys
Estd 1760
HAMLEY · BROS · LTD.

Mail Order Department (M.):
200/202, REGENT STREET, LONDON, W.1.
And Branches: London and Croydon.

THE NEW "SKISAIL" TRACTOR
MODEL AEROPLANES

Constructed of highest quality materials. Perfect flight guaranteed.
Patent No. 23533. Patent No. 138210.





All models fitted with **Patent Adjustable Rudder** which controls flight of aeroplane in any direction, and **New Lightweight Shockproof Chassis.**

Wing Span of 18/6 Model 33 in. Fitted with Patent Safety Chassis with Landing Skids. Wing span of our 4/6 model 21 in.
No. 0 Price 18/6
" 1 " 14/6
" 2 " 10/6
" 3 " 8/6
" 4 " 6/6
" 5 " 4/6

The "Skisail Model de Luxe"
Wing Span 42 in. Price 27/6

The "Skisail" Monoplane Constructional Set 10/6
Postage 6d.

"SKISAIL" MONOPLANES are obtainable from the leading Stores, Toy and Sports Dealers, including Selfridges, Whiteleys and Gamages.

If unable to obtain from your local dealer send order direct to—
PATENT MODEL MANUFACTURERS,
159, Lymington Avenue, Wood Green, LONDON, N.22.
'Phone: TOTTENHAM 3278.

Locomotive Work on New York Central—

(*Continued from page 285*)

it is impossible for me to say, for the great weight of the train makes comparison with British standards very difficult. As an economic proposition it may be debateable, but as an exhibition of the boiler power of a great locomotive it was a simply wonderful performance.

And now, past Millbury, with the busy manufacturing area of Toledo closing in upon us, it was time to moderate our pace. The driver's estimate of 8 min. for the last 7.5 miles from Millbury proved to be somewhat optimistic. Actually, with two signal stops and the usual ultra-cautious passage of the swing bridge and the very sharply curved Toledo station, we took 12¼ min. over that final length; but we pulled up triumphantly, after all our hindrances, at 11 : 3 : 45, just 1¼ min. ahead of schedule time. On the platform stood Driver King and his fireman, and to them we resigned our mighty charge for the last stage of her journey to Chicago.

Consulting with Fireman Cullenen, I found that, by a rough estimate, we had burned some seven tons of coal for the run of 112.1 miles from Cleveland (105th Street) to Toledo. This figure of approximately 125 lb. per mile may appear enormous to British eyes, but once again we must recollect the weight of the train, and the fact that the engine hauling it is by no means immeasurably more powerful than British engines. Two of the older type Gresley "Pacifics" would have been required to handle a 1,175 ton load here, and, each burning 55 lb. of coal per mile, would have consumed much the same amount of fuel.

Famous Inventions—(*Continued from page 282*)

can be brought into position instantly. The second chamber contains the optical system within which is created the image of the slit. Part of the light from this optical system is diverted by means of a prism in order to enable the operator to judge whether the apparatus is in focus. The photo-electric cell is placed in the third chamber.

The amplifier included in the B.T.H. system is contained in a metal cabinet over 6 ft. in height, in which everything is in duplicate. There are two 20-watt amplifiers, for both film and disc. The set is designed for both amplifiers normally to be in use simultaneously, but a duplicate panel is used so that if one should break down the other can still carry on the show.

The talking film industry is still in its infancy, but it has already firmly established itself. The possibilities of utilising it for more serious purposes than entertainment have been recognised, and a wide field is opening up in connection with schools and universities.

The Model Railway Exhibition

The annual Model Railway Exhibition to be held by members of the Model Railway Club from 14th to 18th of this month, promises to be more interesting this year than ever before. The occasion marks the twenty-first anniversary of the club, and members are making a special effort to surpass all previous exhibitions in regard to the number and variety of models.

The exhibits include locomotives, coaches, wagons and signals in a variety of gauges. The locomotives in particular will be of outstanding interest, representing the latest in steam, electric and clockwork propulsion. This is an exhibition with a widespread appeal, and we strongly recommend all readers who are able to do so to pay it a visit. It is held at the Central Hall, Westminster, London, and details of opening hours and prices of admission will be found in the advertisement on page 359.

Roadless Traction—(*Continued from page 294*)

shock to the chassis, and the almost complete absence of noise at a speed of as high as 25 m.p.h. are three of the many desirable characteristics of this remarkable machine.

At first the impression gained ground that though rubber might be suitable for the joints of tracks employed on small, light machines, it would prove an unsuitable material for large and powerful machines with a considerable draw-bar pull. This is not the case, however, and a tractor has now been produced that weighs about 10 tons and has a draw-bar pull of not less than six tons. The design of the track fitted to the machine is such that the pressure per square inch on the rubber transmitted by the drive cannot exceed 200 lb. Bench tests and experiments have proved that a good quality of rubber will withstand, in the absence of skin friction, a pressure at this figure almost indefinitely.

Stamp Advertisements—(*Cont. from page 346*)

2/6 and 5/- K.G. Great Britain for 6d. post free to applicants for Selected British Colonial Stamps at ½d. each.—E. W. Small, 32, Downhills Park Rd., N.17.

FREE TO APPROVAL APPLICANTS. 50 Different Stamps.—Best Bros., 37, The Gardens, S.E.22.

AIR POST!!! 50 Mint, all different, 2/6. Post Free. —J. Anderson, 42, Baronscourt Terr., Edinburgh.

FREE. 100 superior stamps to approval applicants. —Gosling, 91, Foxhall Road, Ipswich.

GOOD STAMPS ON APPROVAL. 25% discount, post free.—Cox, 21, Paxton Road, Coventry.

100 DIFF. STAMPS FREE. Send for ½d. Approvals. —Cox, 3, Mornington Mansions, Westcliff, Essex.

£1 FOR 1/6. Our splendid offer still continues. See December "M.M."—EN*ZED Stamp Co.

2,000 UNSORTED MISSION STAMPS 1/6, sample 500 6d.—Cranwell, 11, Dawpool Road, London, N.W.2.

6 CAMELS, ZEBRAS FREE! for postage. Request Approvals.—Stuart, 183, Sherborne Road, Yeovil.

BOYS! Here Is A REAL

Super All-Steel Automatic Self-Inking

PRINTING MACHINE!

WILL PRINT ANYTHING FROM A

Chemist's Label to an Illustrated Magazine

BOYS! Here is something you've often wished for—a Real Printing Machine! Not a toy or a model but an Automatic Self-Inking All-Steel Adana Machine which uses real Printer's Metal Type and produces work just like that done by Professional Printers.

There's not a more exciting or interesting hobby than printing on my Wonderful Invention. You can print your own Noteheadings and Visiting Cards—Entertainment Programmes—Party Invitation Cards—School Magazines and a 101 other interesting things. It's so fascinating that you'll want to spend every spare moment at it!

The Marvellous "Adana" All-Steel Super 1930 Model Automatic Self-inking Printing Machine .... Specially designed for Commercial Use in All Large and Small Printing Establishments.

Price

45/-

Here are some of the things my Machine will Print

- School Magazines
- Fixture Cards
- Concert Programmes
- Dance Invitation Cards
- Noteheadings
- Visiting Cards
- Menus
- Tradesmans' Bills
- Club Notices
- Etc., Etc.

A GREAT OPPORTUNITY

NO BOY SHOULD POSSIBLY MISS!

No more "make-shift" rubber stamps or duplicators—here's the real thing and so low in price that you **MUST NOT** miss the chance of getting it!

Let me tell you all about my Wonderful Machine and what it will do. Send the coupon alongside TO-DAY and I will send you ABSOLUTELY FREE actual samples of work produced and explain how I will let you have it on Special Terms.

No boy should miss this Splendid Bargain. It is a Real Commercial Machine, for many men make Spare Time Money by printing on it for Local Tradesmen, etc. Find out all about it NOW. Send the Coupon alongside at once to

Mr. D. A. ADANA (Dept. M.C.9), 17, Church St., Twickenham, Middx.

COUPON

To Mr. D. A. Adana (Dept. M.C.9), 17, Church St., Twickenham, Middlesex.

Dear Sir.

Please send me at once and FREE, full details of your Wonderful 45/- Adana Printing Machine—together with full samples of ACTUAL Work produced.

Cut out this Coupon and Post at once with your full name and address attached.

The NEW *Patent* HOBBIES-BOWMAN AEROBOAT

from 12/6

Send P.C. for FREE Illustrated List

—containing full details of these new Aeroboats as well as our Clockwork boats and the wonderful Hobbies-Bowman Steam Launches which run up to two miles on a single filling!

Fastest Model Boats Afloat

Here's something you'll be proud to own—a patent racing launch that will win most races you care to put her in! The sleek, mahogany decked Aeroboat, master of speed and distance, driven by a powerful rubber-tension motor—Bowman's latest and greatest invention. This motor, fully charged in ten seconds by a simple keyless device, will drive the Aeroboat for 350 yards non-stop; or if you wish, can be tuned to hurl her across the water at a record-breaking speed. **In a recent test the Aeroboat II ran non-stop for over nine minutes.** *(A first-class clockwork boat, costing One Guinea, ran under test for only two minutes).*

Three Dashing Aeroboats!

Aeroboat No. I	Length 32″	Beam 3½″	15/–
„ „ II	„ 30″	„ 3″	12/6
Greyhound	„ 30″	„ 3″	6/6

All models fitted with control lever and special racing hull of light wood; all finished in three colours.

BOWMAN models

BOWMAN MODELS (DEPT. M.M.1), DEREHAM, NORFOLK.

From all Halfords and Hobbies branches and good shops everywhere.

The Herald of Summer!

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Published by the GT. WESTERN RAILWAY.

MORE THAN A GUIDE—A COMPLETE HOLIDAY SERVICE.

1,000 pages.

Over 8,000 Addresses of Hotels, Boarding Houses, etc., hundreds of Photographic Illustrations and descriptions of Britain's Best Holiday Resorts—dealing with

DEVON	**NORTH WALES**	**THAMES, SEVERN**
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DORSET	**ISLE OF MAN**	**Etc., etc.**

Letterpress by MAXWELL FRASER.

This Wonderful Sixpennyworth is obtainable at all G.W.R. Stations, Offices, and Bookstalls; leading Booksellers and Newsagents throughout the country; or by post from the Superintendent of the Line, G.W.R., Paddington Station, London, W.2 (no charge for postage).

THE ONLY HOLIDAY GUIDE YOU NEED.

Every Boy calls it the REALLY RECORD

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RALEIGH
THE ALL-STEEL BICYCLE

RECORD—in name, in reputation and in value! Built entirely of steel, and guaranteed for ever, it is just the ideal bicycle in every way. Exclusive, to the last detail—molybdenum-chrome steel tubing throughout; all stays of true circular section; drop-forged fork-ends with special Raleigh quick release; special Raleigh caliper brake, etc., etc.,—and like every Raleigh it is always

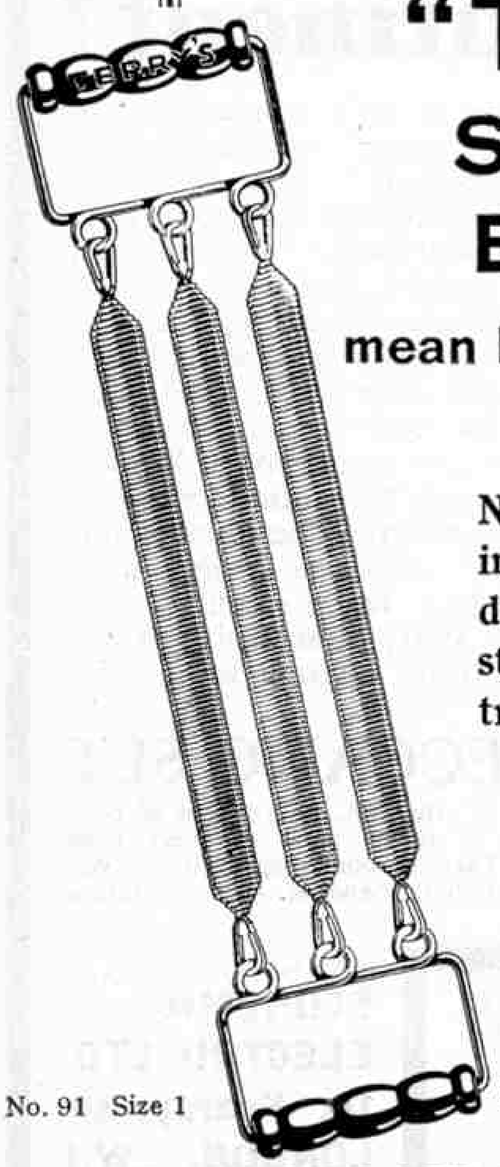
RIGID, RAPID AND RELIABLE

Other Models from £5-19-6
or by easy weekly or monthly payments
Fitted with Brooks Saddle. Sturmey-Archer 3-speed gear 20/- extra.

Send for "The Book of the Raleigh" free

THE RALEIGH CYCLE CO. LD., NOTTINGHAM

Here's Health!



No. 91 Size 1

"TERRY"
Steelstrand Expanders

mean health, and a perfect development.

No matter what sport you indulge in, 10 minutes a day on a "Terry" Steel-strand will keep you fit and trained to the minute.

Write now for new booklet "M" which tells of the full range and many other novel and useful specialities. It comes post free.

HERBERT TERRY & SONS LTD., Manufacturers, REDDITCH, Eng. Est. 1855.

DON BRADMAN

The Bat of the "Century"

BLADE. Specially selected English Close Bark Willow.

HANDLE. Best Sarawak Cane Treble Rubber Sprung. Fitted Rubber Grip.

As exclusively used by Don Bradman in making many World Records.

Prices :

11/6	size 4,	for Boys	approx.	4 ft. 3 in.	in height
12/6	,, 5,	,,	,,	4 ft. 6 in.	,,
13/6	,, 6,	,,	,,	4 ft. 9 in.	,,
18/6	,, Harrow, for Youths			approx. 5 ft. 3 in.	,,

Sent Carriage paid and money refunded within 7 days if not completely satisfied.

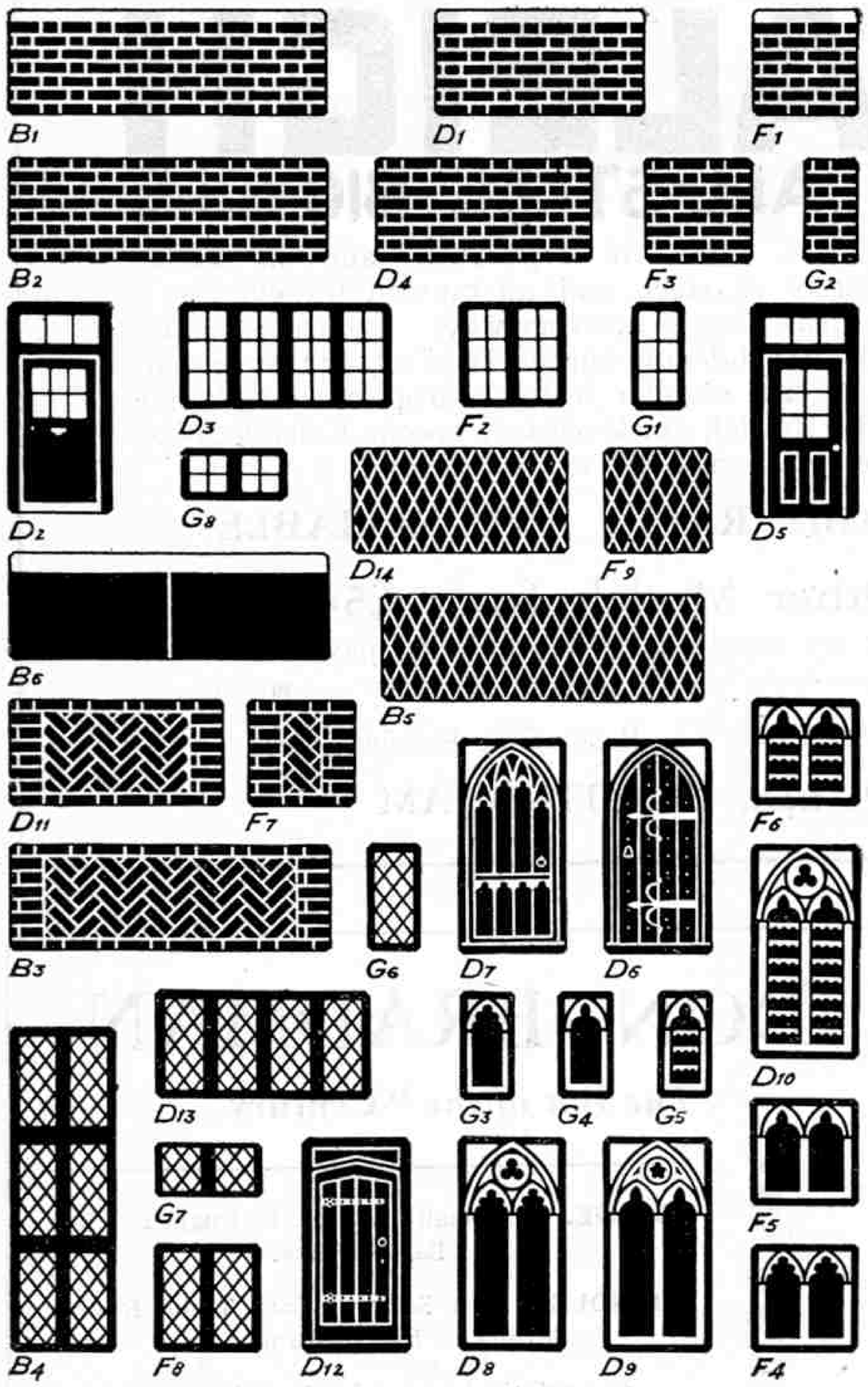
GREEN & WINTER,
Sports Specialists, ST. ALBANS, HERTS.

Made by the famous Firm, Wm. Sykes Ltd., Horbury, whose Bats have been used by so many Australian Test Teams.

EMBOSSED DESIGN BRICKS

FOR USE WITH

LOTT'S BRICKS



THE introduction of embossed design bricks to Lott's Bricks, adds very greatly to the realism and charm of the miniature buildings that can be made.

The designs shown on the top half of the diagram are for inclusion in all kinds of modern Houses and Railway Buildings. Those numbered B5, B6, D14, and F9, are for use in the construction of Railway Platforms.

The Herringbone bond base bricks and diamond paned windows on the bottom left side may be used for making very delightful old-fashioned Houses, Halls, etc.

The designs on the bottom right side help to make really perfect models of Churches and Chapels.

These bricks may be obtained loose through all Lott's Bricks dealers and are priced as follows :—

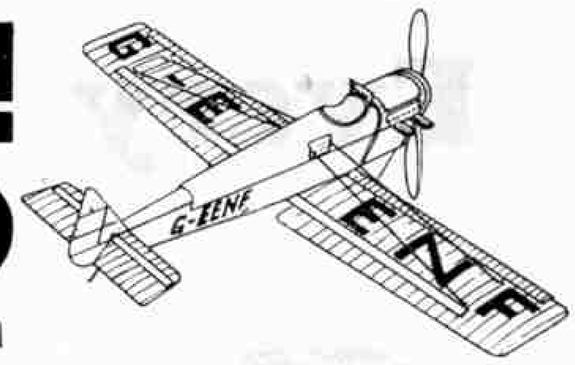
B's 2½d. each, D's 2d. each, F's 1½d. each, G's 1d. each.

All the embossed design bricks are appropriately coloured, and are suitable for use with either Lott's Bricks, Tudor Blocks, or Lodomo.

A Sheet illustrating the bricks in their colours will be sent free on receipt of a post-card.

LOTT'S BRICKS LTD., WATFORD, HERTS.

BOYS! BUILD THIS



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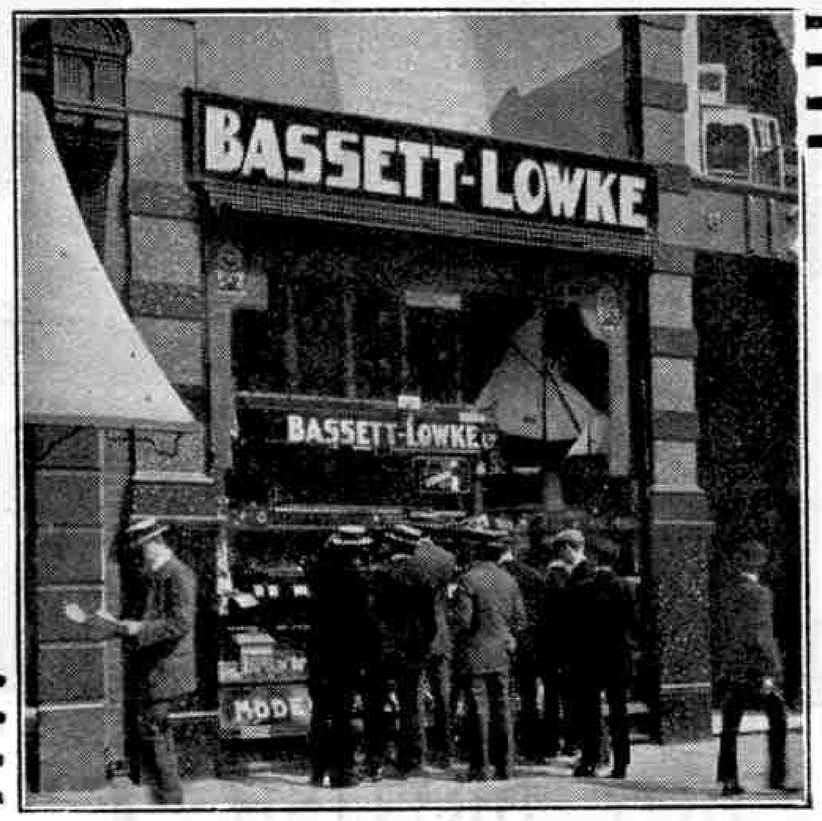

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The "GREYHOUND" Motor Boats are built for speed, streamlined and equipped with strong motors, both Clockwork and Electric. 2-blade brass propellers and brake control.

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GREYHOUND	No. 6	Length 12¼″	**...4/6**	each
	7	,, 16¼″	**7/6**	,,
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Superior finished, extra powerful Clockwork	V	Length 21″	**17/6**	,,
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GREYHOUND	No. 9	Length 21″	**17/6**	each
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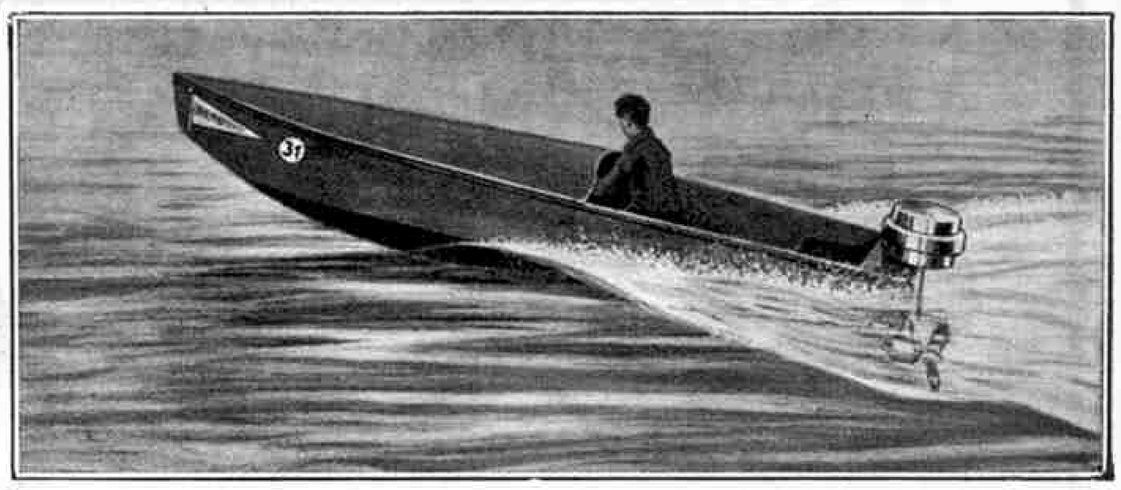
,, ,,	I	,, 25″	**35/–**	,,

No. I has 2-Speed Regulator worked by Two Batteries.



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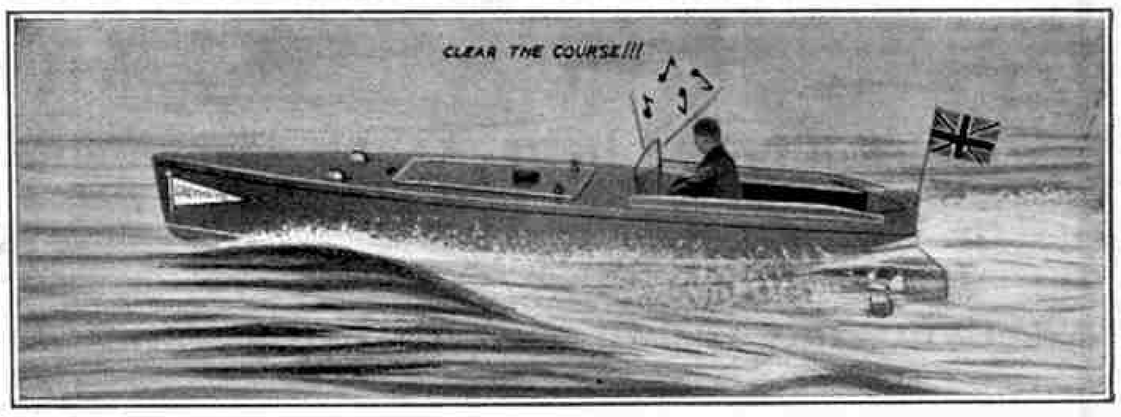

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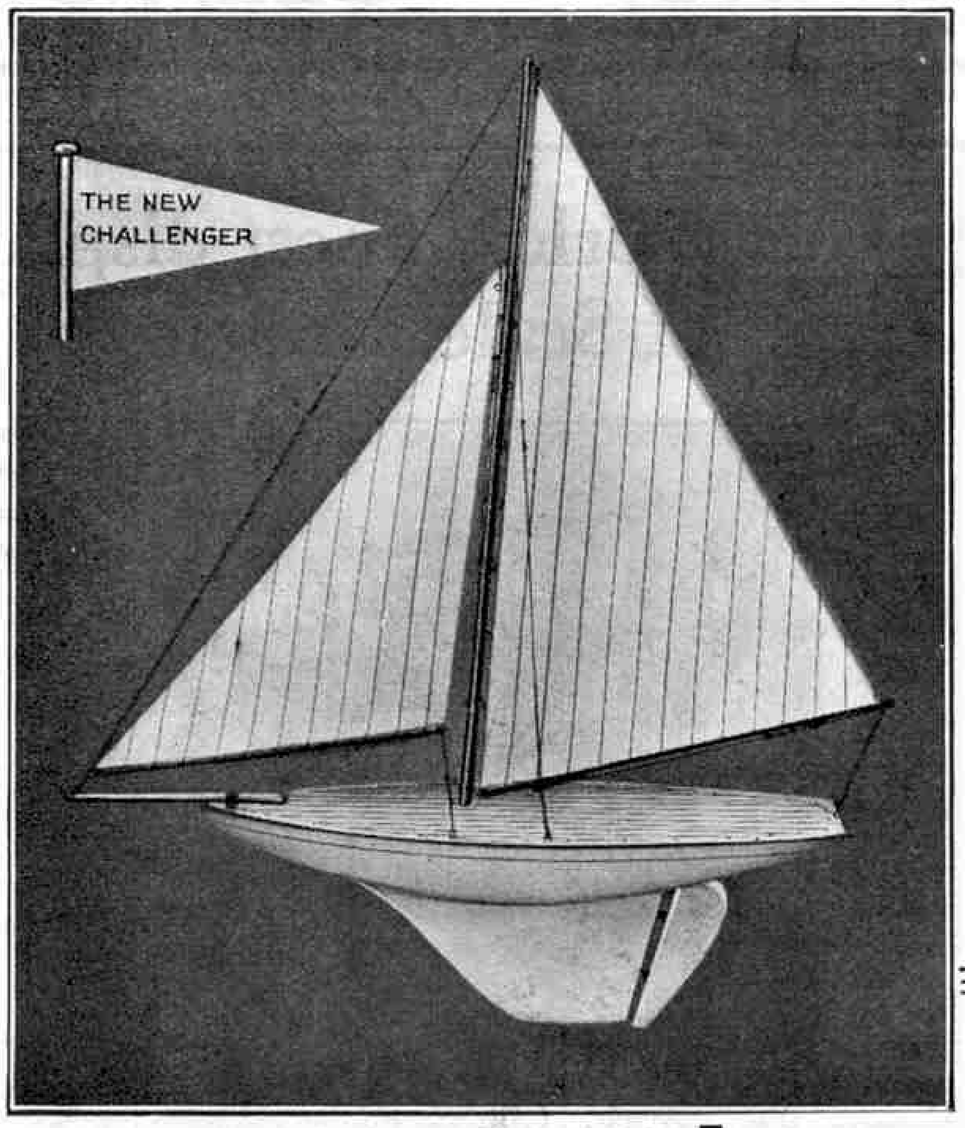

• The new 1931 "CHALLENGER" Yachts

White enamelled hull with blue line, balanced rudder, weighted Keel, the lead being inset into the wood Keel, which avoids the possibility of the heavy lead Keel becoming detached.

Varnished and lined decks, brass fittings. Sloop rig with Bermuda Lugsail and Staysail of best quality striped Sailcloth, Foresheet and Mainsheet running free on Deckhorses, which allow the Sails to adjust themselves, thus enabling the Yachts to tack automatically. Very simple to rig. The Mainmast has three supporting shrouds. Altogether, these Yachts have a most pleasing appearance and beautiful lines.

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14″	**7/6**	23″	**27/6**
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18″	**15/–**	30″	**45/–**
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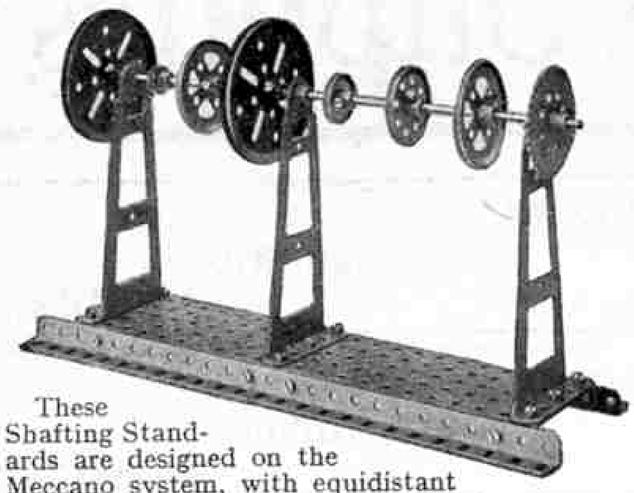

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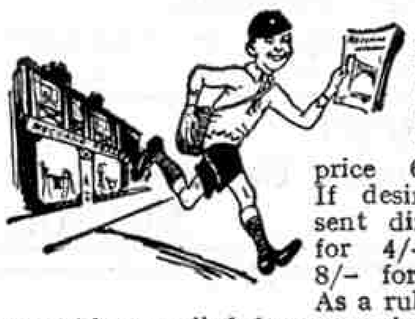

The "*M.M.*" may be ordered from all Meccano dealers, or from any newsagent or bookstall, price 6d. per copy. If desired it will be sent direct, post free, for 4/- for six, or 8/- for twelve issues. As a rule back numbers cannot be supplied, because only sufficient copies are printed to fill standing orders. To prevent disappointment, therefore, place a regular order with your dealer, newsagent, or the publishers—

"Meccano Magazine," Binns Road, Old Swan, Liverpool.

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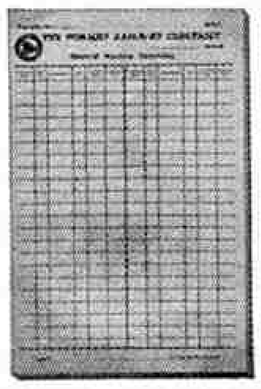

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Copies of back issues will be sent, post free, price 3d. for issues prior to 1925, 4d. for the issues of 1925 and 1926, with the exception of the December numbers. The December issues of 1925 and 1926, and all the issues of 1927, 1928, 1929 and 1930 are 8d. each.

Quotations for complete bound volumes may be obtained from the publishers—

"Meccano Magazine," Binns Road, Old Swan, Liverpool.

Local Model-Building Contest

Two local schoolmasters and a special representative from Meccano Ltd., were recently called upon to undertake the interesting duty of judging the entries in the annual Meccano model-building contest organised by the London Motor, Cycle and Sports Co., Staines. There was a larger number of entries than last year, and the quality of the models was excellent.

The awards were as follows:—First Prize, S. H. Fairhead (High Street, Colnbrook), for model Workshop. Second Prize, G. J. Wright (Poyle Farm, Colnbrook), model Motor Chassis. Third Prize, G. McKirdy (Laleham Road, Staines), model Windmill. Consolation Prizes were awarded to John Biggs, Dennis Strachan, Frank Hewlett, Peter Bainbridge, Leslie Reynolds and J. Capon.

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All the dealers whose advertisements appear on this and the opposite page carry full stocks of Meccano Outfits, Accessory Outfits, and Meccano parts, Hornby Trains and Hornby Train Accessories all the year round. The names are arranged in alphabetical order of town.

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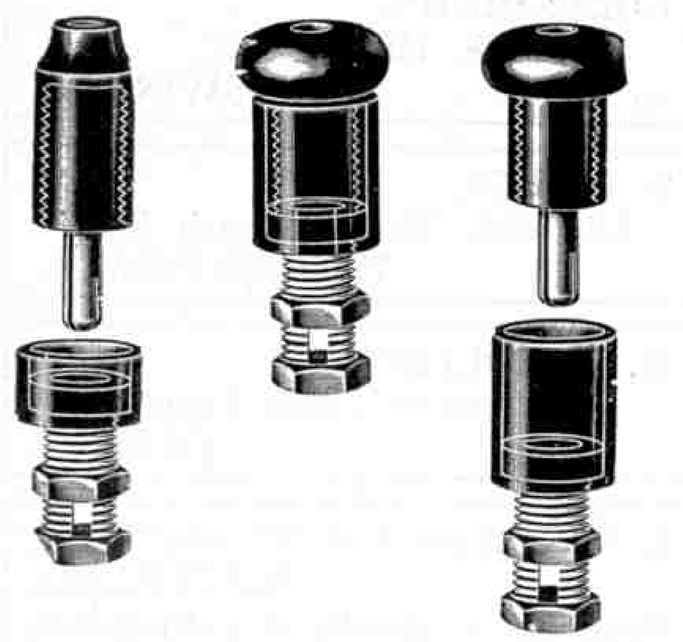

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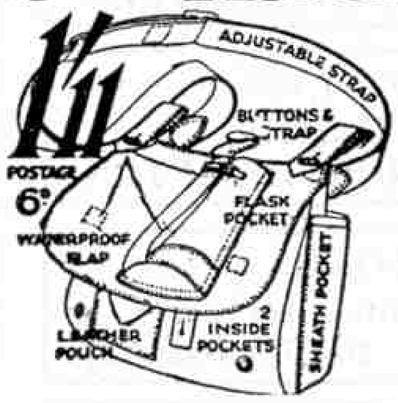

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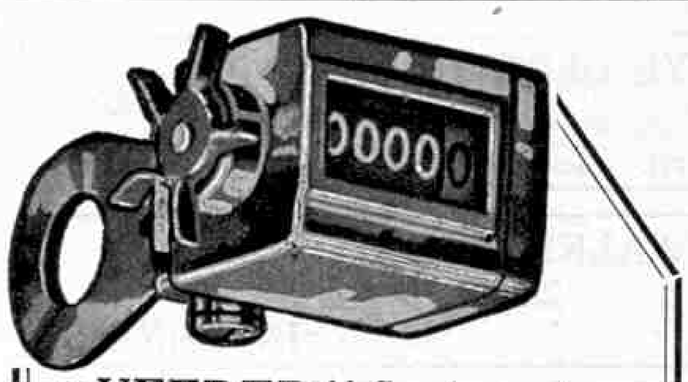

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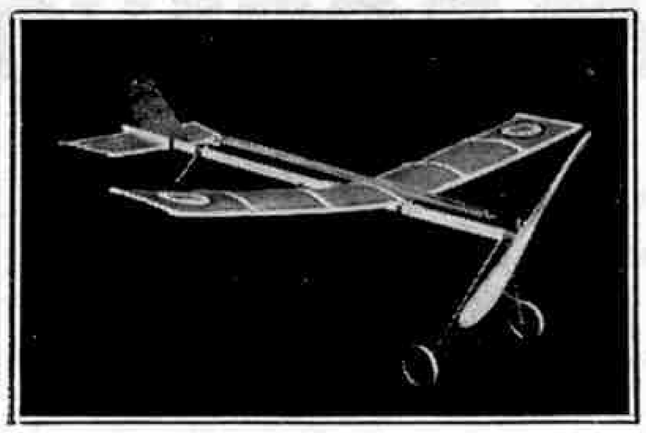

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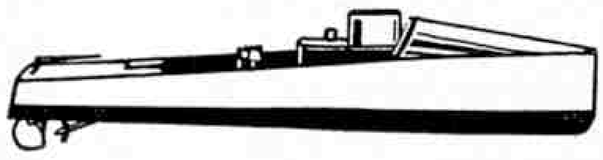

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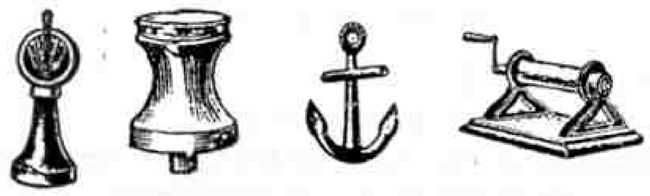

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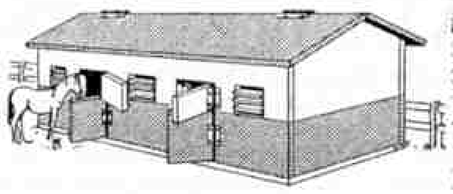

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This Month's Special Articles

	Page
Air News	310
Alarm Signals on Passenger Trains ...	286
Books to Read	306
Brains and Bravery	303
Competition Page	341
Engineering News	300
Exploring the Antarctic	276
Fireside Fun	343
From Our Readers	304
Guild Pages	338–9
Hornby Railway Company Pages ...	324–335
How a Locomotive is Painted	302
In Reply—Meccano Section	318
Locomotive Work on the New York Central	284
Largest British Air Liner	308
Meccano Electric Derrick Crane ...	319
Model-Building Contests	315
Model-Building Contests Results ...	312
New Meccano Models	322
Our Wonderful World	296
Quarrying by Compressed Air	274
Railway News	290
Roadless Traction of the Future ...	292
Solving the Road-Rail Problem ...	288
Stamp Collecting	345
Stamp Gossip	347
Story of Talking Pictures	280
Suggestions Section	316
Thrills of Sea Lion Catching	283
Vacuum Tubes that Control Electrical Energy	299
Veteran Steam Engine	298
" What Shall I Be ? "	278
Wonderful Glass-Blowing Machine ...	295

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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.

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Readers Overseas and in foreign countries may order the " *Meccano Magazine* " from regular Meccano dealers or direct from this office. The price and subscription rates are as above, except in the cases of Australia, where the price is 1/5 per copy (postage extra), and the subscription rates 9/6 for six months and 19/- for 12 months (post free) ; Canada, where the price is 15c. per copy, and the subscription rates 75c. for six months, and $1.50 for 12 months (post paid).

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Overseas readers are reminded that the prices shown throughout the "*M.M.*" are those relating to the home market. Current Overseas Price Lists of Meccano Products will be mailed free on request to any of the undermentioned agencies. Prices of other goods advertised may be obtained direct from the firms concerned.

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NEW ZEALAND : Models Ltd., Kingston & Federal Streets, Auckland.
SOUTH AFRICA : Mr. A. E. Harris (P.O. Box 1199), 142, Market Street, Johannesburg.
INDIA : Karachi : Bombay Sports Depot, Elphinstone Street, Bombay ; Bombay Sports Depot, Dhobi Talao. Calcutta : Bombay Sports Depot, 13/C, Old Court House Street.

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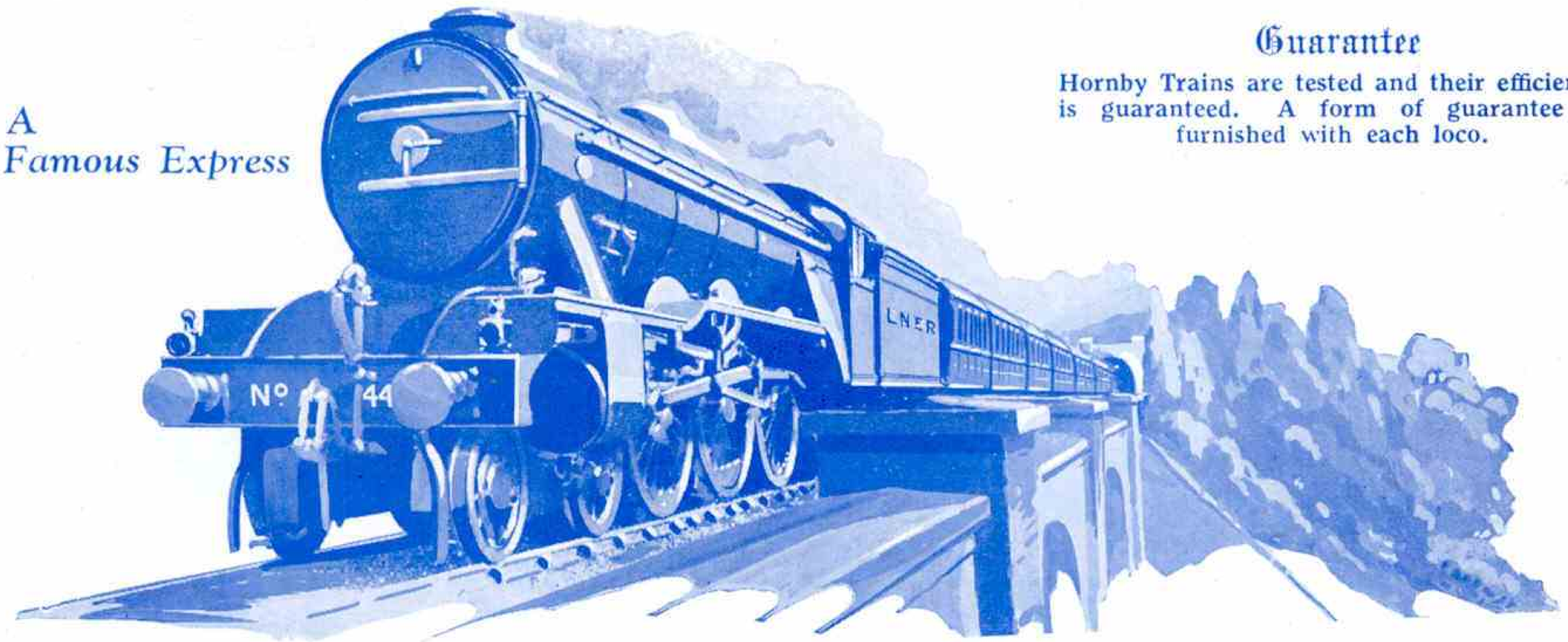

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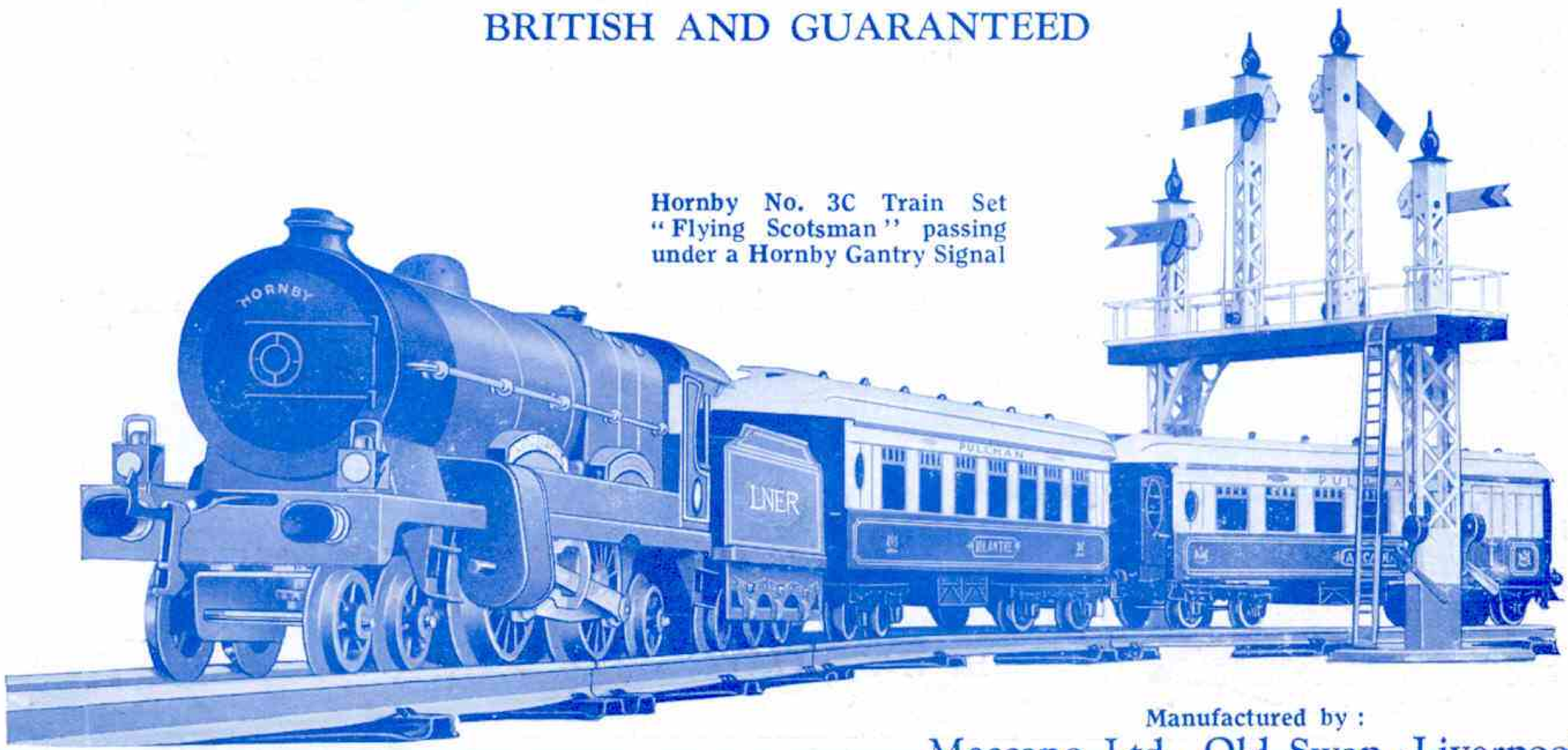
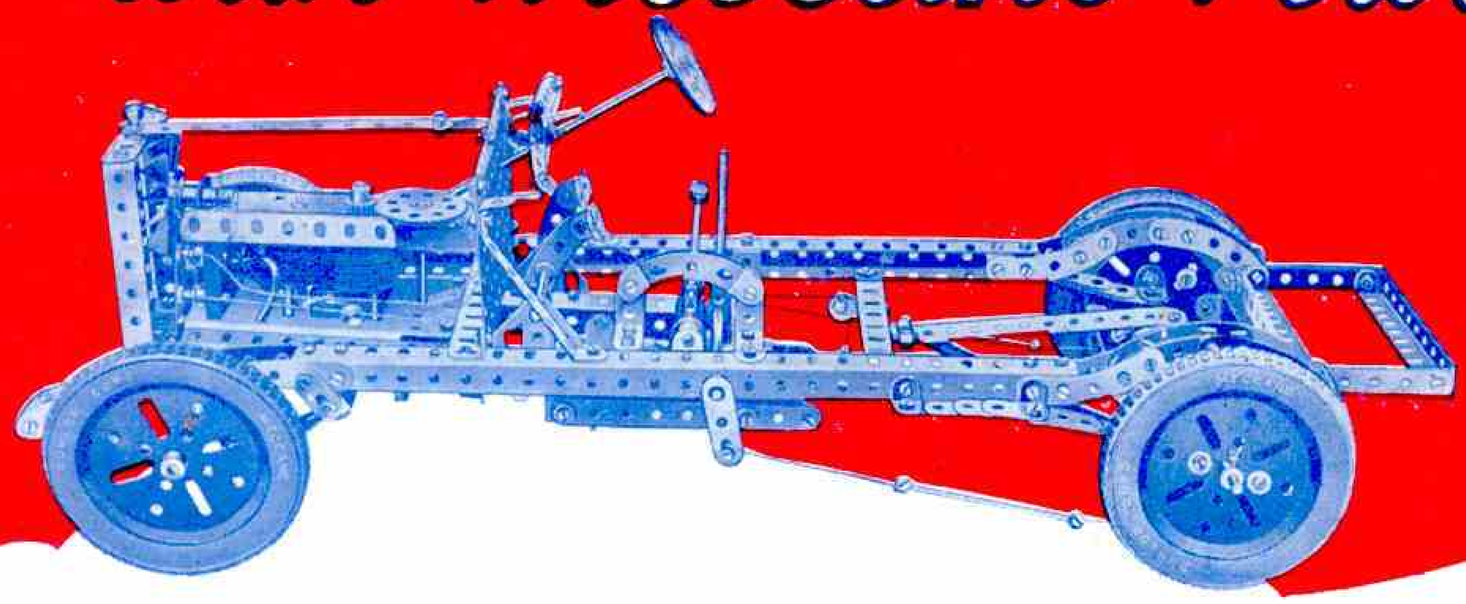
BRITISH AND GUARANTEED

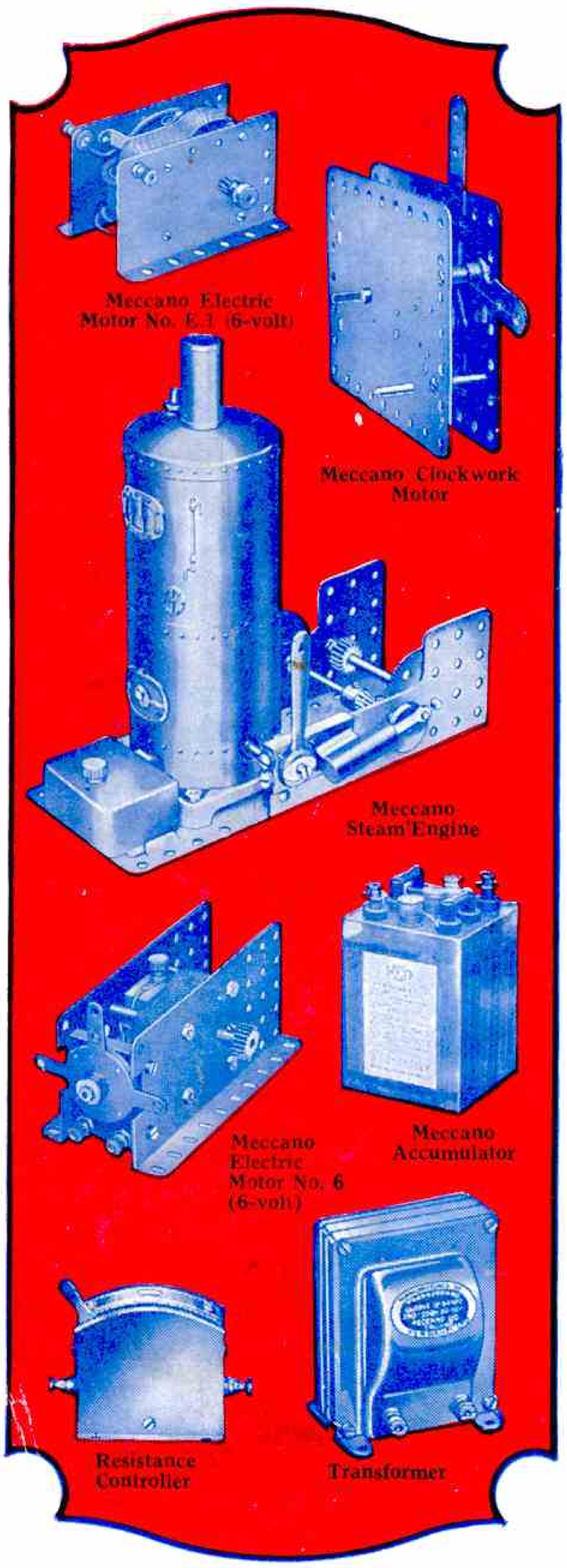
Hornby No. 3C Train Set "Flying Scotsman" passing under a Hornby Gantry Signal



Manufactured by:
Meccano Ltd., Old Swan, Liverpool

I run my models with Meccano Power





If you want to obtain the fullest possible enjoyment from the Meccano hobby you should operate your models with a Meccano Motor or Steam Engine. You push over the control lever of the motor or engine and immediately your Crane, Motor Car, Ship Coaler or Windmill commences to work in exactly the same manner as its "big brother" in real life. Could anything be more exciting?

The Meccano Motors and Steam Engine are strongly made and the utmost care is taken in their manufacture to ensure that they will give satisfaction. The side plates and bases are pierced with the standard Meccano equidistant holes, which enables a motor or engine to be built into any Meccano model in the exact position required.

Particulars and prices of the Steam Engine, Motors and Accessories are given below.

Meccano Clockwork Motor

This splendid Motor, which is specially designed for operating Meccano models, is a compact self-contained power unit.

An efficient governor controls the spring that is fitted on the motor and ensures a long steady run at each winding. Brake and reverse levers enable the motor to be stopped, started and reversed as required. Supplied complete with winding key and full instructions. Price **7/6**

Meccano Steam Engine

This is a particularly powerful steam unit designed for driving Meccano models. On actual test it has lifted over 56 lbs. A single cylinder of the oscillating type is employed, steam being admitted to it through a special reversing block. Operation of the reversing lever enables the crankshaft, which is fitted with a special compensating flywheel to run in either direction.

The spirit container for the lamp is placed well outside the boiler-casing, eliminating all risks of the spirit becoming heated. The boiler is fitted with an efficient spring safety valve of heavy gauge brass and there is no danger whatever of the boiler exploding. Price **25/-**

Meccano Electric Motor No. E.1 (6-volt)

This highly efficient Electric Motor (non-reversing) gives excellent service. A 6-volt Accumulator will operate it, but it may also be driven from the main (alternating current only) through the Transformer described in the next column Price **7/6**

Meccano Electric Motor No. 6 (6-volt)

This 6-volt Motor is specially designed to build into Meccano models. It may be run from a 6-volt accumulator or, by employing the Transformer described below, from the main. It is fitted with reversing motion and provided with stopping and starting controls. The gearing is interchangeable. Price **15/6**

IMPORTANT.—Meccano 6-volt Motors will not run satisfactorily from dry cells.

Accumulator (6-volt, 20-amps)

The Meccano Accumulator is of substantial construction and is specially recommended for running the Meccano 6-volt Electric Motors. Price **28/6**

Transformer

By means of this Transformer the Meccano 6-volt Electric Motors may be driven from the house supply (alternating current only). It is available for all standard supply voltages, from 100 to 250 inclusive, at all standard frequencies. The supply voltage and frequency must be specified when ordering. Complete with length of flex and adapter for connection to an ordinary lamp socket. Price **30/-**

Resistance Controller

By employing this variable resistance the speed of the Meccano 6-volt Electric Motors may be regulated as desired. The controller is connected in series with the motor and accumulator, or with the motor and transformer if a transformer is used as the source of power. It will not regulate the speed of a high-voltage motor connected to the main. Price **4/6**

MECCANO LTD.

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