VOL. XVIII. No. 3 MARCH 1933

MECCANO MAGAZINE

6D.

FORGING A STEEL INGOT WITH A 6,000-TON PRESS
(see page 174)

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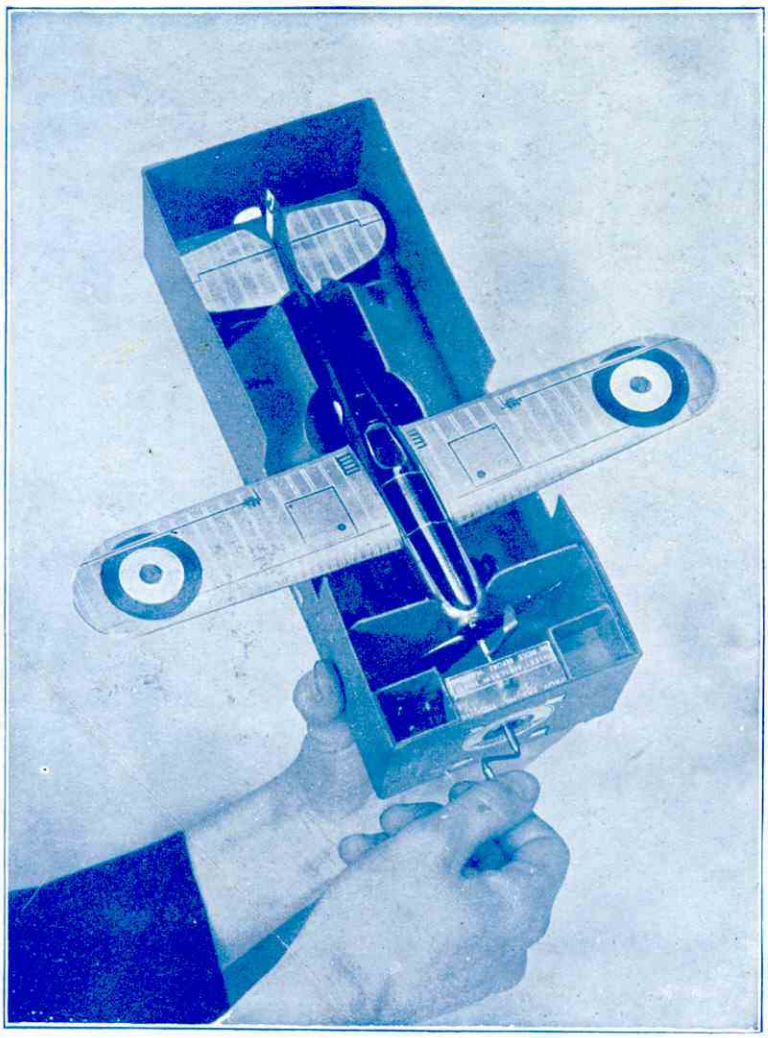

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MECCANO MAGAZINE

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With the Editor

Man and the Machine

The sudden appearance of the word "technocracy," meaning government of industry and production by engineers and scientists, has revived interest in the old problem of Man and the Machine. The present time has been variously described as the Age of Steel and the Age of Concrete, owing to the prominence of these materials in our daily life. It would be more accurate to speak of it as the Age of the Machine, however, for undoubtedly its most remarkable feature is the extent to which goods of all kinds that formerly were fashioned slowly and laboriously by craftsmen, are now produced by machinery at high speed and in immense quantities.

We are yet only at the beginning of the Age of Machines, and we must be prepared for the further development of existing machinery, and the introduction of the machine into phases of industry that it has not yet entered. Some people are alarmed by this prospect, for they are afraid that the increased use of machinery will bring about unemployment on an even larger scale than exists to-day. Similar fears occurred when Arkwright and other pioneers first introduced machinery into the textile industries. The workmen regarded themselves as being faced with the complete loss of employment, and tried to solve their problem by destroying all existing machines. Fear of the machine was the cause also of the serious disturbances, known as the Luddite Riots, of a little more than a century ago.

Machinery has undoubtedly displaced manual labour in certain directions, but in other directions it has opened up new spheres of work. The trouble now seems to be that machinery and scientific methods have been developed so rapidly during the past few years that the world has failed to accommodate itself to the change. This phase will pass, and the world will enter upon an era in which Man and the Machine will no longer be antagonistic. Rightly used, the world's machinery should enable us to produce our requirements with a smaller expenditure of time and energy, thus giving us leisure to make more of life than we can do at present.

A Gun Fired by the Sun

In these days of wireless time signals and electrically-controlled clocks we are apt to overlook the part played by the Sun in regard to time. The case was different in former days when sun-dials were in regular use, and the passage of time was marked in a more or less crude manner by hour-glasses, water clocks and other devices. An interesting relic of time-recording is the gun shown in the illustration on this page, which, until about 20 years ago, was actually fired daily at noon by the Sun's rays. This ancient weapon stands on the ramparts of the palace of the former kings of Portugal at Cintra, and exactly at noon each day the Sun's rays were focussed on the touch-hole by means of a lens in order to ignite the powder with which the gun was charged. As the position of the Sun at midday varies with the seasons, being considerably higher in summer than in winter, the lens is mounted on a quadrant that can be set at the required angle.

An old proverb says: "To see the world, and yet leave Cintra, is verily to go about blindfold." Whatever may be the town's other attractions, the possession of a gun that enables the Sun itself to announce the exact hour of noon to everybody within hearing is certainly something of which to be proud.

The firing of a shot has long been utilised as a means of indicating time. A notable example of a time gun is that at Morpeth Dock, Birkenhead. This is fired electrically, but the switch that completes the circuit is closed automatically at Bidston Observatory, 3½ miles away, where there is an astronomical clock that measures time with great precision. This gun is fired every day at one o'clock. Daylight saving arrangements do not affect it, for it continues to give the time signal at the same hour throughout the summer, although all the clocks and watches of Merseyside then protest that it is two o'clock!

The wireless time signals to which we have referred are known to all of us in the form of the familiar six "pips." These signals place every owner of a receiving set in direct communication with Greenwich Observatory, the centre of the time-keeping world.

A time gun at Cintra, Portugal, that until 20 years ago was fired daily at noon by the Sun.

The Trevithick Centenary

Next month occurs the centenary of the death of Richard Trevithick, the famous Cornish engineer who is now generally acknowledged to be the father of the steam locomotive. Stationary steam engines using low pressures had previously been developed by Newcomen, Watt and others, but Trevithick showed his genius first by boldly employing much higher pressures, and then by building a steam-propelled vehicle to run on the roads. His greatest claim to fame, however, rests on the construction of the first successful steam locomotive. This historic engine ran on the rails of a tramway at Pen-y-Darran in South Wales, and Trevithick followed his achievement by building in London a circular track on which he exhibited an engine with the challenging name of "*Catch-Me-Who-Can.*" The speed of this engine was about 12 m.p.h. A charge of a shilling was made for the privilege of seeing it run, and spectators who were not too timid were allowed to ride in an open carriage coupled to it.

The Trevithick centenary is being celebrated by the erection of memorials at the inventor's birthplace, and at Pen-y-Darran and near Euston Road, London, where his pioneer locomotives showed their powers. In addition, memorial services are to be held in Westminster Abbey and the Parish Church at Dartford, where Trevithick died in poverty after an eventful life. The full story of his remarkable career will be told next month.

The World's Greatest Meccano Model

French Expert's Astronomical Clock

MECCANO has been employed with outstanding success by scientists, inventors and engineers in the construction of complicated and delicate apparatus and mechanisms of all kinds; but the greatest triumph of this wonderful constructional toy is to be found in the marvellous astronomical clock constructed by M. Alexandre Rahm, a French Meccano enthusiast. From every point of view this must be regarded as the world's greatest Meccano model.

M. Rahm tells us that the idea of a Meccano astronomical clock came to him as a result of reading two articles that appeared in the French "*M.M.*" during 1924, one describing a new Meccano model clock, and the other giving details of that famous mechanical marvel, the clock at Strasbourg Cathedral. From that time onward he devoted all his leisure hours to the study of the problems involved, and the clock that is illustrated and described in this article is the result of years of research and experiment. M. Rahm's first schemes were on a comparatively modest scale, but as his plans proceeded he became more and more ambitious, and the clock in its present form embodies a number of remarkably brilliant solutions of the essential problems of a complete astronomical clock.

One of M. Rahm's first steps was to collect the necessary astronomical details, and in this task he received valuable information from the annual publication of the "*Bureau des Longitudes.*" He also derived considerable information from articles in this publication dealing with the Strasbourg Cathedral clock.

In the space at our disposal it is impossible to describe this wonderful Meccano clock in detail, but we hope to give some idea of the extraordinary variety of the indications that it gives and of how these are accomplished.

The clock frame stands 9 ft. high, and is 2 ft. wide, increasing to 2 ft. 6 in. at the base. It is in the form of an irregular octagon, six sides of which are 9½ in. long and the other sides 12½ in. The main framework that supports the mechanism, as well as the weight of the heavy motors, is composed principally of Angle Girders and Braced Girders bolted to the main outer members, providing the necessary strength and producing a solid and pleasing appearance. The whole of the mechanism is enclosed in a series of compartments extending from the top of the model to within 3 ft. 3 in. above the ground, representing in all a height of 5 ft. 11 in. for the mechanism alone.

The uppermost section of the framework contains the principal dial, on which the standard time is indicated on the Continental 24-hour plan. The hour hand, which makes one complete revolution of the dial in one day, is driven by a clockwork mechanism situated at the top of the model. This mechanism is divided into two distinct parts, the clock-driving portion proper and an automatic arrangement for winding up the weights. The latter movement is accomplished by means of two Meccano high-voltage electric motors, which operate automatically every 60 hours at 9½ hours and 21½ hours, that is, 9.30 a.m. and 9.30 p.m. Matters are arranged in such a manner that the clock escapement continues to operate while the rewinding is taking place.

The wonderful Meccano Astronomical Clock with its builder, M. Rahm.

The mechanism that drives the hands comprises two synchronised trains of gears operating the escapement wheel, which consists of a circular band of 40 Threaded Pins that serve as teeth. The pallet has 10 teeth, and is borne on a horizontal shaft carrying a claw operating the pendulum, which beats once every second. The pendulum bob consists of two Circular Plates bolted at their centres to a sliding Threaded Rod attached to the bottom of the pendulum. This pendulum is constructed from Angle Girders and Strips, and is made detachable by the addition of two hooks at its upper end. The bob can be raised or lowered by rotating the Threaded Rod on which it is mounted. The pendulum itself also may be lengthened if required, and in this manner a very accurate beat is obtained.

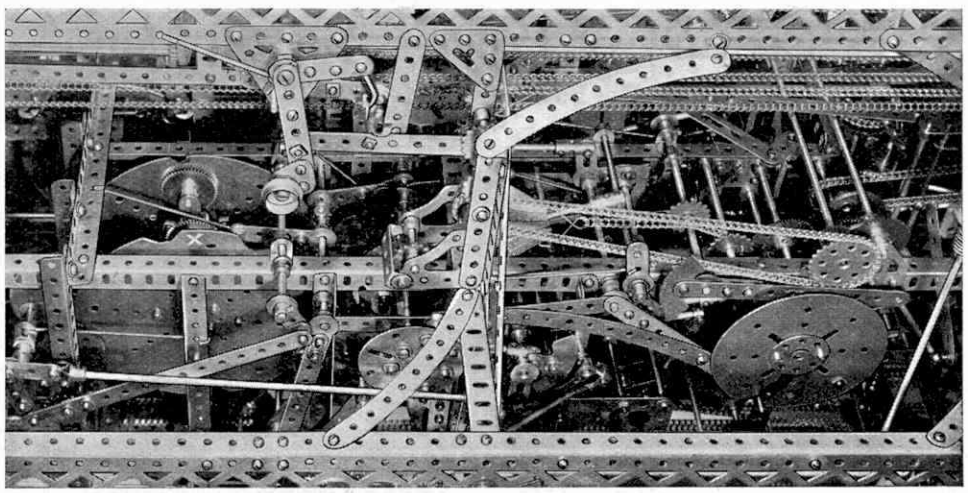
The necessary movements are transmitted by Rods to the minute hand and the second hand. The minute hand may be said to constitute the heart of the whole clock.

We come now to the perpetual calendar. This consists of a ring 20½ in. in diameter divided into 366 parts and operated by a cross mechanism that is thrown out of gear at midnight. A second ring, fitting inside the first, is graduated into weeks, and a third, inside the second, into months. These two rings, like the first, are operated at midnight. The application of the carefully-calculated gearing arrangements results in the outer ring rotating 1/366 every day, the second ring 1/52 every week, and the inner ring 1/12 every month. As all the years do not have 366 days, however, a special mechanism is provided to eliminate 29th February in three out of every four years. This mechanism consists of a cam fitted with a raised portion at three of its quarters, the fourth quarter being left regular. Thus, as this cam rotates once in four years, three days are jumped in that period, these days being timed to fall regularly on 29th February. Special arrangements are also made to deal with century years that are not Leap Years.

In the centre of the perpetual calendar is a card showing the Earth as viewed from the North Pole. This card turns in an anti-clockwise direction, and it indicates the time in all parts of the world. It is rotated by Sprocket Chain from the hour hand of the clock at the top of the model, and as it turns it operates two smaller reproductions of the Earth that give the world's time in minutes and seconds.

The sections of the clock so far described give all the necessary information as to the

world's time, and now we reach the most difficult and delicate movements of all, those that indicate ecclesiastical dates and astronomical movements. The mechanism for dealing with the ecclesiastical computations is extremely complicated. It is set in motion once every year at midnight on 31st December, and gives all the important ecclesiastical figures as well as the dates of the Julian and Gregorian Easters. The mechanism is actuated by two weights, which are rewound automatically during the year. When the winding mechanism is disengaged the weights are released, and the main wheel, governed by a flywheel turning at great speed, is rotated. When this main wheel has completed one turn, the mechanism stops until the following 31st December.



View of a section of the interior of the clock, giving some idea of the extraordinary complexity of the mechanism, and of the manner in which every inch of available space is utilised. On the left will be noticed a wheel marked with a cross. This wheel makes a complete turn once in 2,500 years !

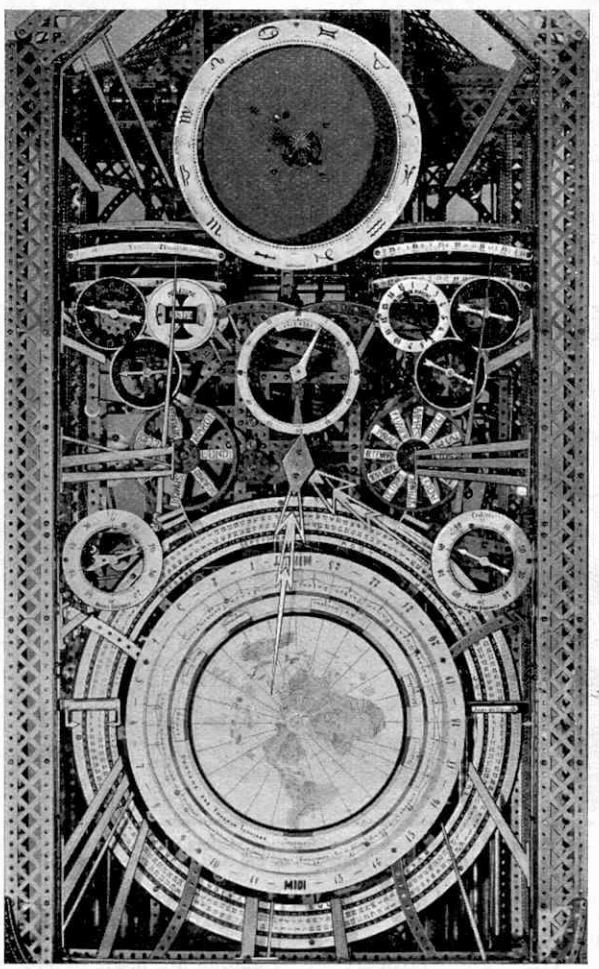
The main wheel sets in motion a number of secondary gear trains, which indicate on small dials the Roman Indiction, a period of 15 years introduced for fiscal purposes about A.D. 300; the Solar Cycle, a period of 28 years, after which the days of the week return to the same days of the month; the Golden Number, a number showing the position of any particular year in the Moon's cycle of 19 years, and called "Golden" because the calculations connected with the discovery of the cycle by Meton were printed in gold by the Athenians; the Dominical Letter, one of the first seven letters of the alphabet used to mark the Sundays of the year; the Year of the Christian Era; and the Epact, the excess of a solar year over a lunar year.

The date of the Gregorian Easter is indicated automatically by means of a snail wheel divided into 30 parts. It is made from a Circular Plate and is connected directly to the Epact hand. This snail wheel drives a hand indicating the date of Easter of the year to come. An exactly similar process is employed for determining the Julian Easter, the only difference being that the snail wheel is divided into 19 parts and connected with the Golden Number.

The astronomical indications afforded by the clock are specially interesting. These are concerned with the apparent movements of the Sun and the Moon around the Earth as effected by their principal irregularities, and the automatic prediction of eclipses. In order to obtain the extremely complicated movements involved it was necessary to work out an elaborate series of gear trains, and in this M. Rahm succeeded so well as to secure a maximum error of only one second per year. His six ratios gave him the Tropical Year, the interval between two returns of the Sun either to the tropic of Cancer or to the tropic of Capricorn; the Anomalistic Year, the interval between two successive occasions when the Earth is at its least distance from the Sun; the Synodic Month, the time required by the Moon to return to the same position in respect to the Sun; the Anomalistic Month, the interval between two successive occasions when the Moon is at its least distance from the Earth; and the period of Evection, an inequality in the motion of the Moon under the Sun's influence. Using these as a basis he obtained the true movements of the lunar and solar hands.

The movement of the Moon around the Earth is very complex, and the mechanism that reproduces this consists of a main gear train that makes one turn in one sidereal day. The sidereal day was obtained, starting from the mean day, by taking the tropical year as differential, and in this manner the error was reduced to less than one second in 2,000 years.

The lunar hand, which consists of a rod that carries a small sphere, partly black and partly silver, turns on its axis by means of a conical gear connected to the solar hand. In this manner the lunar hand makes one complete revolution in one synodic month.



The upper portion of the clock giving the following indications :—movements of the planets ; standard time ; ecclesiastical calculations ; time in all parts of the Earth ; day of the week ; the month ; the day of the month ; and the day of the year.

In order to reproduce eclipses it was necessary to give the lunar hand a to-and-fro motion depending on a curve cut in a circular plate, the ramps being specially calculated.

In the lower part of the clock at about 31½ in. from the ground is situated a celestial sphere 7½ in. in diameter, on which are painted the stars of the first, second, third, fourth and fifth magnitudes. They represent the daily movement of the stars and make one turn in one sidereal day. A mechanism with a reduction gear ratio of 1:9,450,000 reproduces the precession of the equinoxes of a period of about 26,000 years.

Above is situated the planetarium, reproducing the mean movements of the various planets. Above this planetarium is a lunar globe 2 in. in diameter, half silver and half black, that reproduces the phases of the Moon and makes one complete revolution in one synodic month.

The foregoing brief outline of the main features of this remarkable clock indicates some of the complex problems that had to be solved in its design and construction, and shows the remarkable manner in which the resources of the Meccano System proved capable of meeting all requirements. Never before have these resources been subjected to such an exacting test, and the result demonstrates the unlimited possibilities of Meccano in the hands of an expert model-builder.

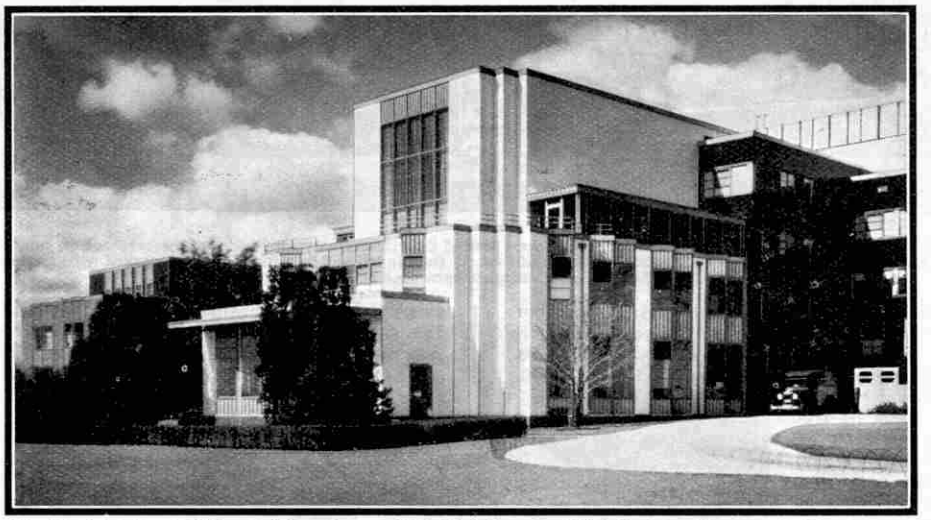
We feel sure that all readers will join us in congratulating M. Rahm on his success in building the world's greatest Meccano model.

Preparing the Chicago World's Fair

A "Century of Progress" Exhibition

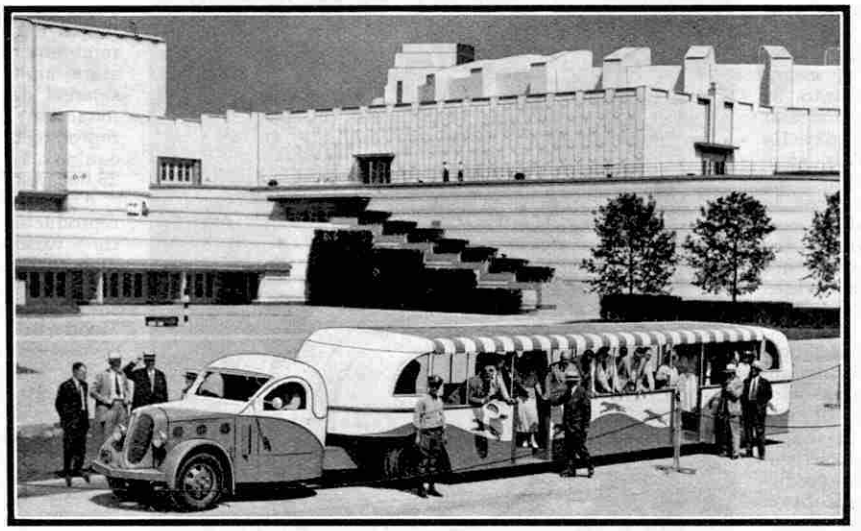
By Edward T. Myers

THE first Chicago World's Fair, held in 1893, was an immense success, and it left its stamp on the United States, especially the Middle West. Farmers who had never been to a great city before came to Chicago from the surrounding small towns and saw things that they had never dreamed existed. The eyes of the American people were opened to a new style of architecture. It was the beginning of a renaissance of classical architecture, much of which was borrowed from Europe. The theme of the second Chicago World's Fair, which will have for its name "*A Century of Progress*," will be the advancement of mankind in every direction during the past 100 years. This exhibition is to be opened on 1st June of this year, when light from the star "*Arcturus*" will be focussed by means of a telescope on a photo-electric cell, and will thus officially open the science exhibits. "*Arcturus*" is 40 light years distant, so that the impulses from it that will start the science exhibits this year left the star at the time of Chicago's first World's Fair in 1893 and have been travelling ever since!



The Administration Building at Chicago's second World's Fair, named "A Century of Progress." The structure is a striking example of the application of modern architectural principles. The illustrations to this article are reproduced by courtesy of "A Century of Progress," Division of Publications, Chicago.

The Fair covers a vast area, and when completed will resemble a miniature town. In addition to the many palatial buildings in which the exhibits will be housed, there will be extensive and beautifully laid-out grounds, and miles of highways and walks along which a fleet of 60 six-wheeled semi-trailer buses will convey visitors. These buses are of unique design and have been specially built for the Fair by the General Motors Truck Company. They are 45 ft. long and are fitted with two longitudinal seats arranged back to back, so that all the 90 passengers face outward and have an unobstructed view. The buses have a roof, but are otherwise open, curtains being provided for use in bad weather. The bodies of the vehicles are finished in an attractive colour scheme of blue and silver.

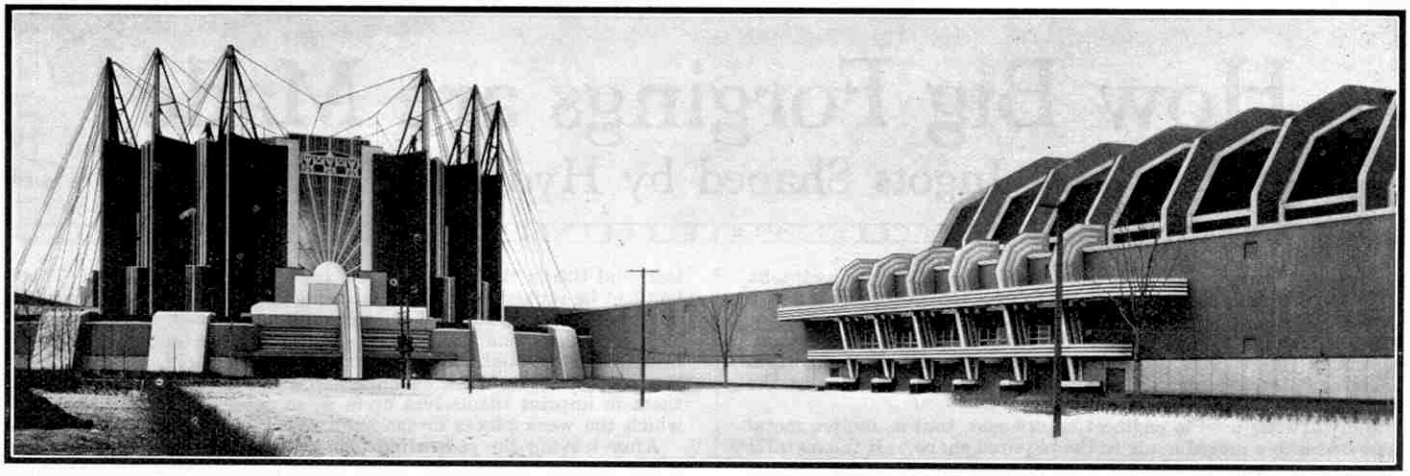


One of the 60 six-wheeled semi-trailer buses that will convey visitors about the Fair. The bus illustrated is standing in the courtyard of the Hall of Science.

The exhibition buildings total nearly 40, and prominent among them are the Administration Building, the Travel and Transport Building, the Hall of Science, the Electrical Group, consisting of Radio, Communications and Electrical buildings, the Home and Industrial Arts Building, and the Agricultural Building. A remarkable feature is that, with the exception of the Administration Building, all the main buildings are without windows. At first sight this seems strange, but a little consideration shows that it is not so. The buildings are intended solely to house exhibits, and for this purpose it is most convenient to have the walls uninterrupted by window space. Further, natural light varies from hour to hour, whereas artificial light of the required intensity can be maintained steadily as long as desired. The elimination of windows makes possible a large saving in woodwork and glass, as windows for temporary premises cost just as much as those for permanent structures. Another advantage of the windowless construction is that the solid exterior wall spaces can be "decorated" at night with constantly - changing combinations of coloured light projected on them from various points.

The visitor will find it difficult to believe that the substantial buildings and beautiful grounds are intended for only 150 days' service. The temporary nature of the Fair has been borne in mind by the builders, however, and everything possible is being done to eliminate waste of materials. The walls of the buildings are pre-fabricated in shops, cut into standard shapes and sizes, and shipped to the Fair ground, where they are either bolted together or held together with clips. This method of construction is rapid and cheap, and will greatly facilitate the work of dismantling the buildings when the Fair closes.

Many new materials are being used. For instance, the outside walls of the Administration Building are of asbestos cement board, the space between the outside walls and the inside walls of plaster boards being filled with an insulating material made of waste paper and emulsified asphalt. The insulation provided by these materials is estimated to be the equivalent of that of a 17 in. brick wall. The walls of the Travel and Transport Building are made of squares of sheet metal clipped or welded to a steel framework. The Electrical Group of Buildings utilise standard gypsum board for the walls, with a coating of metallic paint, which is being used also on the walls of many of the other

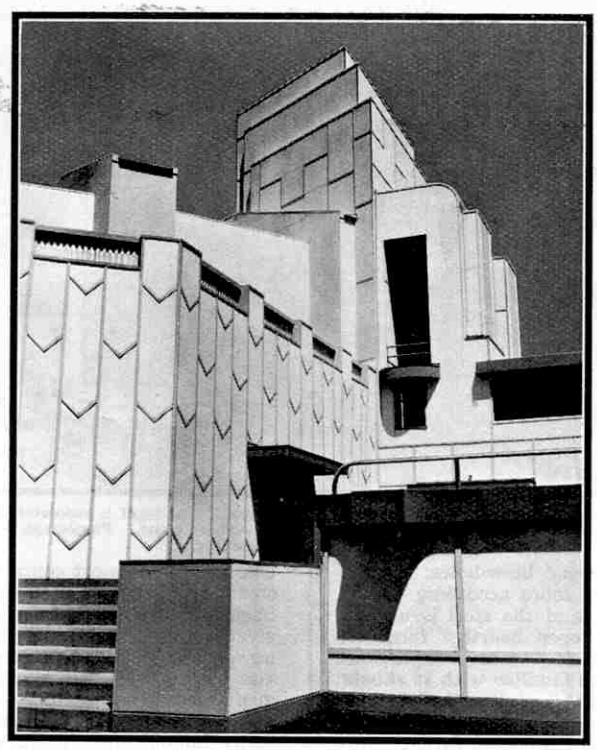


buildings. As the Fair will be held in the summer months no arrangements have been made to heat the buildings, with the exception of the Administration Building, which is used all the year round.

Some of the ideas employed in these buildings may turn out to be practicable for ordinary buildings also. A typical framework has been developed into a system of girders and columns extending across the width of the buildings at 20-ft. intervals, with steel joists extending lengthwise. Thus the frameworks are much like huge Meccano structures, capable of being taken down and built into something else. Open spaces between web members of the joists, and between floor decks and ceilings, are utilised as ducts of the exhaust ventilation system.

The first building to be completed was the Administration Building. This is in the shape of an " E," with its three wings facing a lagoon, and the closed side running parallel with Leif Eriksen drive, one of Chicago's most interesting water-front boulevards. The building is 350 ft. by 150 ft., of modernist design, and stands on sloping filled-in land. On the lagoon side the three wings are stepped down in terraces to the water's edge. A few years ago all this land was at the bottom of the lake, but with the constant use of dredges, this and much other water-front land has been reclaimed and added to Chicago. As a result many buildings now have a position a block away from the original shore line. Aluminium is used with great effect for ornamentation in the Administration Building, colour contrast being obtained by employing white for the central unit, and a midnight blue, so dark as to appear almost black and relieved by cobalt blue trimming, for each wing.

One of the most remarkable buildings is the Travel and Transport Building, the outstanding feature of which is a great dome constructed on unusual lines. Instead of being supported from below, the dome is suspended by cables attached to 12 huge steel towers arranged in a circle. These cables pass over pulleys at the top of the towers and are anchored in the ground. In summer, when the heat expands the towers, the dome will rise several inches, and will sink down again when the towers contract. This represents probably the first application to architecture of the principle of the suspension bridge. The absence of interior supports makes available the maximum amount of space for exhibition purposes, and beneath the dome the floor of the building has a clear diameter of 206 ft. The main building is 1,000 ft. long and two storeys in height, and will house exhibits by the leading railway companies, manufacturers of railway equipment, and others interested in promoting transport. In this building there is an escalator with a capacity of 8,000 persons per hour.



(Top) The Travel and Transport Building, showing the cable-suspended dome that encloses the largest known unobstructed area without supporting columns except around the periphery.
(Below) A near view of the Hall of Science that in common with most of the other main buildings intended solely to house exhibits is windowless and artificially lighted.

The Hall of Science probably will be the most interesting building of the Fair. It is 700 ft. long and 400 ft. wide, and is a two-storey structure with two wings pointing out towards the lake. At the north end of the Hall is a long ramp that leads up to the facade, round which tall pylons rise in a semi-circle. Within the " U " space, which is like a quadrangle with an open end towards the lagoon, is a rostrum from which speakers may address 80,000 people in the court. At the south-west corner is a tower 176 ft. high, equipped with a carillon that will record the time of day and also play a large variety of tunes on its tubular bells. At night the Hall of Science will look like a glass and metal building brilliantly illuminated. A particularly bright spot will be the tower, which will appear to sparkle with beautiful jewels in the form of electric projectors. This tower will be seen to very great distances as a blaze of light and colour.

The Electrical Group Buildings are on an island, known as Northerly Island, across the lagoon from the Hall of Science. The Radio Building is a rectangular structure 250 ft. by 100 ft., and the Communications Building is a square structure connecting the Radio Building to the Electrical Building, which is a three-quarter circular building surrounding the court and facing the lagoon and the mainland. On the same island are the Agricultural Building and the Federal and States Buildings, the two latter being erected side by side to symbolise the unity of the Federal and the States Governments. The Hall of States is a horse-shoe-shaped structure, and the Federal Building extends across the base of the shoe. The latter building is 620 ft. long and 300 ft. wide, with a rotunda 70 ft. in diameter and surmounted by a 75 ft. dome, round which are three tall towers representing the three branches of government, administrative, legislative and executive.

One of the most spectacular features of the Fair will be a cableway known as the " Sky Ride," that will carry visitors from the mainland to Northerly Island. It consists of two towers 600 ft. high and 2,000 ft. apart, connected at a height of 200 ft. by cables carrying cars that travel at immense speed. At the top of the towers are observation platforms, from which visitors will be able to see Chicago and the surrounding district for miles in all directions. High-speed elevators are provided to carry visitors aloft to the observation platforms and to the cars.

Another remarkable feature will be a replica of the famous Golden Pavilion that was built in 1767 at Jehol, the summer home of the Manchu emperors. The Pavilion is regarded as the finest existing example of Chinese Lama architecture. The replica will rise to a height of 60 ft.

(Continued on page 234)

How Big Forgings are Made

Red Hot Ingots Shaped by Hydraulic Presses

OUR cover illustration this month shows a 6,000-ton hydraulic press producing a big forging from a red hot ingot of steel. A " forging " may best be described as a piece of steel or iron shaped by the aid of heat. Actually the making of small objects in this way is properly known as " smithing," the term " forging " being reserved for large work, but in both cases the product is the same, that is, a forging.

Many articles used in engineering are cast, that is, molten metal is poured into a mould made to the required shape. If the metal is made to change its shape while it is red hot by pressing, hammering or rolling, it becomes much more suitable for engineering purposes, owing to the fact that the metal is thus made less brittle.

Rolling can only be used for such articles as railway rails, girders, or ship's plates, which are the same section or shape throughout their length. Other articles of more complicated form are shaped by forging. The smaller articles are produced by hammering with an ordinary blacksmith's hammer or with a steam hammer, but the heaviest forgings are always produced by hydraulic presses of great power, which squeeze the red hot metal so that it flows as if it were plastic like wax.

In this article we propose to deal only with the making of the largest forgings, such as high-pressure boiler drums, in the production of which a very interesting set of operations is involved.

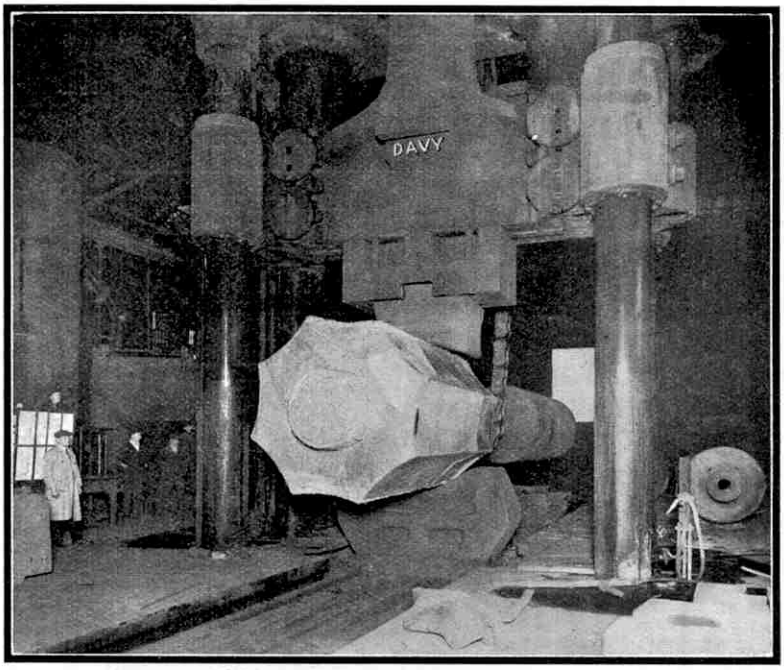
The preparation of the metal is, of course, a very important preliminary to the actual process of forging. The steel is first cast into huge blocks known as " ingots," the shape of these being specially designed to give material that is uniform in quality and free from cracks and blow-holes. Ingots weigh anything up to 175 tons or even more according to the purpose for which they are to be used, and the steel is usually produced in what are known as acid " open hearth " furnaces. This process has been described in the "*M.M.*" on several previous occasions, but those readers who are not familiar with it should refer to the article " *Forging Fifty-ton Crankshafts* " in the "*M.M.*" for May, 1929.

When the molten steel is ready it is run from the furnace into a large ladle, which is provided with a suitable outlet or stopper about 1" in diameter, at the bottom. When full, the ladle is conveyed by an overhead crane over the ingot moulds; the outlet or stopper is opened and the steel allowed to run into the moulds. When the metal has become solid the ingots are lifted out of the moulds and charged into re-heating furnaces.

The re-heating furnace consists of a large chamber, the interior of which is lined with firebrick, and which is heated by burning gas, coal or crude oil. The size of the chamber varies according to the size of work intended to be handled. The purpose of this furnace is to bring the ingot slowly and uniformly up to the temperature required for forging. In the course of making a complete forging several re-heatings may be necessary, in some cases as many as nine being required.

During the solidification of the ingot the more impure portions have a tendency to collect together or segregate, and by so doing they form weak spots in the ingot. Fortunately, however, the bulk of these impurities gather in that part of the ingot that sets last, and this in the case of a solid ingot, is the centre core. This fact can be proved in a very interesting way. If an ingot be made and then cut in two, and its cut surface polished, the steel will look just the same all through, but if a piece of photographic bromide paper, slightly moistened in sulphuric acid, be laid upon the polished surface, the chemical nature of the impurities enables them to imprint themselves upon it, so producing a picture from which the weak places in the ingot can be seen.

After leaving the re-heating furnace the ingot is ready for the actual forging operations, which consist of pressing the glowing metal into the shape required, by means of tremendously powerful presses. The presses are hydraulically operated and the largest of them are capable of exerting pressures up to 10,000 tons, stand over 40 feet high and weigh nearly 800 tons! The mechanism consists usually of two huge cylinders, about 40 inches in diameter, with a stroke of 10 ft. or even more. In these work rams, on the lower ends of which is fixed a mass of metal shaped like an inverted " T." The " T " piece takes the pressure of the rams on each end of its cross bar. A very powerful engine pumps water into the cylinders at a pressure of approximately 2½ to 3 tons to the square inch when the press is in action.



A 6,000-ton Davy Hydraulic Press forging a 95-ton ingot. The ingot is supported during the operation by a steel chain suspended from a powerful overhead crane. Photograph by courtesy of Davy Bros. Ltd., Sheffield.

The coming of the high-pressure steam turbine has created a big demand for immensely strong boilers capable of withstanding not only great steam pressures, but also of resisting the tremendous heat of the furnace. Modern practice therefore is to forge the steam drums from a single piece of material entirely without joins of any kind. One of the foremost concerns in the development of this type of steam drum is the English Steel Corporation Ltd., Vickers Works, Sheffield, to whom we are indebted for much of the information given in this article. This firm is equipped to produce drums upwards of 100 tons in weight, although the usual types for land and marine work are much smaller than these. Here it may be mentioned that the Italian liners " *Rex* " and " *Conti di Savoia* " and the Furness Withy liner " *Queen of Bermuda* " are among the many famous ships fitted with high-pressure boiler drums made by this firm by the solid forging process.

Solid forged drums of this type are used not only for steam boilers, but also as high-pressure vessels for various industrial purposes. For example, in the chemical industry they are used among other purposes as reaction chambers for the " cracking " of crude petroleum. This is a process in the extraction of motor spirit from crude oil, in which the yield of spirit from a given quantity of oil is greatly increased by the use of very high temperatures and pressures.

Some of these drums are 50 ft. in length and have a diameter of from 3 to 5 ft. while in other cases the vessels have comparatively short length and great diameter.

Various methods are adapted for closing the ends of the forged tubes. Some of them are closed by covers either bolted on to their ends or secured by a special type of joint, but for very high-pressure work and steam boiler drums, the ends are closed by " bottling," a forging process that will be dealt with later in this article.

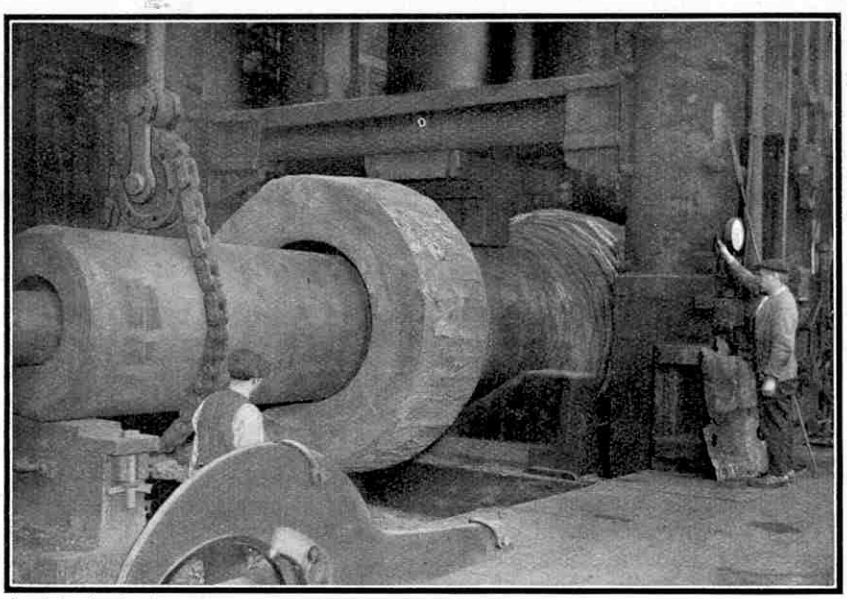
The making of a large drum of this kind provides an excellent

example of the work involved in producing big forgings generally, and therefore we are describing in detail the various processes and operations entailed in turning an ingot into a finished forged drum.

The metal usually employed in this class of work is high quality mild steel, and for exceptionally high pressures special grades of alloy steels are used.

Some of the ingots required in making these drums weigh as much as 175 tons. After casting, in the manner already described, the next process is to convert the ingot into a hollow billet ready for the forging press, which is done by removing the centre either by hot-punching or trepanning.

" Hot punching " is a kind of piercing process, in which a hole is made through the ingot without cooling it. First of all the surplus metal at each end of the ingot is cut off by means of a large cutter or knife, which is driven through the ingot by a hydraulic press. The remaining body of the ingot is next placed under a press, so that its axis is vertical, and a tubular punch is driven axially through it. By this means a central core is removed, which contains the less pure metal from the centre of the ingot, and a hollow billet is thus prepared from which the final forging can be made. When the hot punching process is used the completed forging is made from metal that has never been allowed to cool below a red heat after casting, until it is finally annealed as a finished forging. As the cooling of a 100-ton ingot may occupy a period of three or even four weeks, it will be realised that the hot punching process is of considerable value when a job is required urgently.



A tubular forging is produced by successive " heats " or forging operations, the middle of the tube usually being forged first, as shown in this illustration. Note the steel mandrel, which is being withdrawn after the middle portion has been formed. For the illustrations on this page we are indebted to the courtesy of the English Steel Corporation Ltd., Sheffield.

The trepanning method necessitates cooling the ingot, and is generally followed when time is not of great importance. Trepanning has the advantage, however, that when the surplus material has been cut from the ends of the cooled ingot, and the hole has been trepanned through it, a thorough examination of the end face and the bore can be carried out and drillings made at various places to test the homogeneity of the metal.

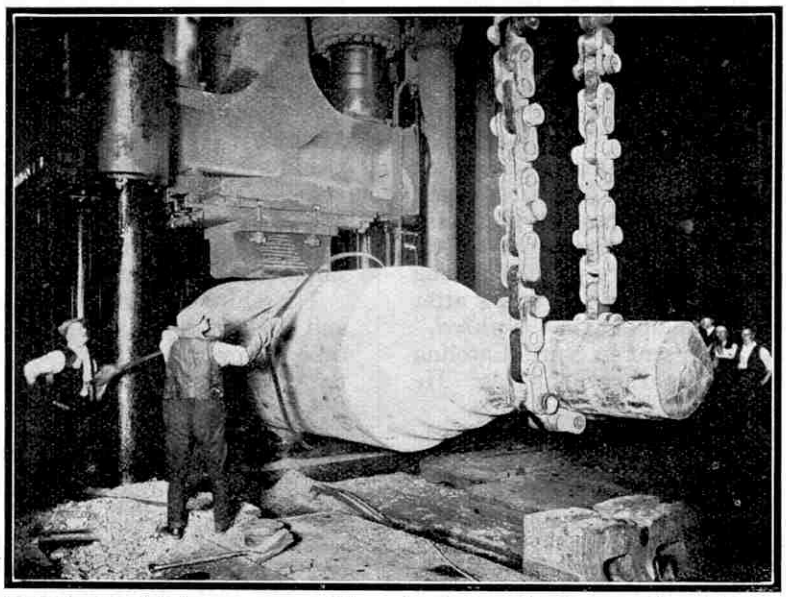
In the trepanning process the ingot is put into a powerful machine and the centre is removed by a revolving tubular tool. Before the billet goes to the forging press, however, a portion of the material from each end is removed, this in many cases being done before the central core is trepanned out. The billet is now ready to be forged into tubular form and leaves the trepanning machine to be charged into a re-heating furnace. Powerful cranes of anything up to 200 tons capacity are employed for handling the huge billets at this stage.

After re-heating the hole is enlarged. This is done by pressing the wall of the already hollow billet against a bar or mandrel that passes through the hole and is independently supported at each end. By this means the diameter of the existing hole is greatly increased.

Now comes the most important operation of all, that is, the forging of the billet into tubular shape. This is done by a succession of forging operations, between each of which the forging is re-heated. The middle of the tube is usually forged first.

After the middle of the tube is finished, one end of the billet is recharged into the heating furnace, and the other end, still in the rough state, is usually left outside the furnace. Careful control of the rate of heating is needed at every stage, and precautions are also taken to ensure that the work is uniformally heated throughout before further forging operations are proceeded with. Some of the largest drums require as many as eight or nine reheatings before they are completely forged. The smaller drums, however, require proportionally fewer forging operations, perhaps only two or three forging heats being necessary.

When the tube is completely forged it is taken from the forge to what is known as the heat treatment plant. The furnace used here is somewhat similar in type to the re-heating furnace, but the temperatures required are not so high. Into this chamber the forging is charged, brought up to a definite temperature throughout its mass, and then allowed to cool slowly and evenly so as to avoid any risk of internal rupture due to stresses set up by shrinkage in the cooling metal. The temperatures to which the steel is heated and the rates at which it is allowed to cool are fixed in accordance with the quality of the steel used and the tests which it will have to undergo. In order to obtain exactly uniform temperature throughout and to prevent any bending of the forging, arrangements are made whereby the forging is constantly rotated in the furnace during the annealing processes. Afterwards the outside of the forging is rough machined. If the ends are to be closed the drum now goes back to the re-heating furnaces and the ends are heated ready for the closure to be made. This is a very delicate operation, and special tools, much experience and manipulation, and good control of the forging processes are needed to form the ends to the correct shape and free from stresses. The process is carried out at the conclusion of the forging operation if one end only is closed, the machining of the interior being then performed through the large or open end. If the vessel is to be " bottled " at both ends the interior of the vessel is first machined and the exterior also is partly machined, and a predetermined excess of metal is left at the ends from which the bottle neck or closure can be produced.



Forging a rotor shaft for a super power station. The forging weighs 98 tons and is probably the largest rotor yet made in this country. The inverted " T " piece that takes the pressure of the hydraulic rams is clearly shown.

The method of closing adapted for large pressure vessels is known as " swaging." The end of the open-ended tube is placed between " swages " or curved tools under the hydraulic press. Slight pressure is applied and the tube is then rotated, the pressing action being repeated as rapidly as possible. In this way the diameter of the end of the tube is ultimately reduced to the dimensions required, whilst the wall is thickened and strengthened in the process.

V.—GEORGE ANSON

SOME of the admirals who are outstanding figures in British Naval history achieved fame by fighting victorious battles; others gained their reputation by the remarkable voyages they made. Prominent among the latter class is George Anson, one of the most famous admirals of the 18th century.

George Anson was born at Shugborough, near Colwich, on 23rd April, 1697. Nothing is recorded of his early boyhood or of how he came to choose a naval career. It is known, however, that he left home at the age of 14 to join the Navy, as he is entered in the books of the "*Ruby*" in January 1712 as a volunteer. After a short time in this ship he was transferred to the "*Monmouth.*" Promotion came to him rapidly, and four years after joining the Navy he was appointed Second Lieutenant of the frigate "*Hampshire.*" In 1717 he became Lieutenant of the "*Montagu,*" one of a squadron of ships commanded by Admiral Sir George Byng, that formed an expedition to Sicily. In June 1722 he was appointed to the command of the sloop "*Weazle,*" in which ship he was kept busy for many months in the North Sea capturing smugglers from Dutch ports.

Previous articles in the "*Lives of Famous British Admirals*" series have appeared as under:

Lord Howe.	July 1931.
Sir Francis Drake.	October 1932.
Sir John Hawkins.	December 1932.
Robert Blake.	January 1933.

In February of the next year Anson was promoted to be Captain of the line-of-battle ship "*Scarborough,*" and was sent to South Carolina to protect merchant ships against pirates. He remained there until 1730 and during his long stay he became very popular among the settlers, who named towns, districts and mines after him. In 1731 he was given command of the "*Squirrel,*" and shortly afterwards was again sent to South Carolina as the settlers feared attack by the Spaniards. He returned home in 1735.

More than three years elapsed before Anson was again ordered to sea. This time he was given command of the "*Centurion,*" a 60-gun ship of 1,005 tons. For a time he was engaged off the West African coast in protecting merchant ships and stations from attack by the French, and was then sent to the West Indies.

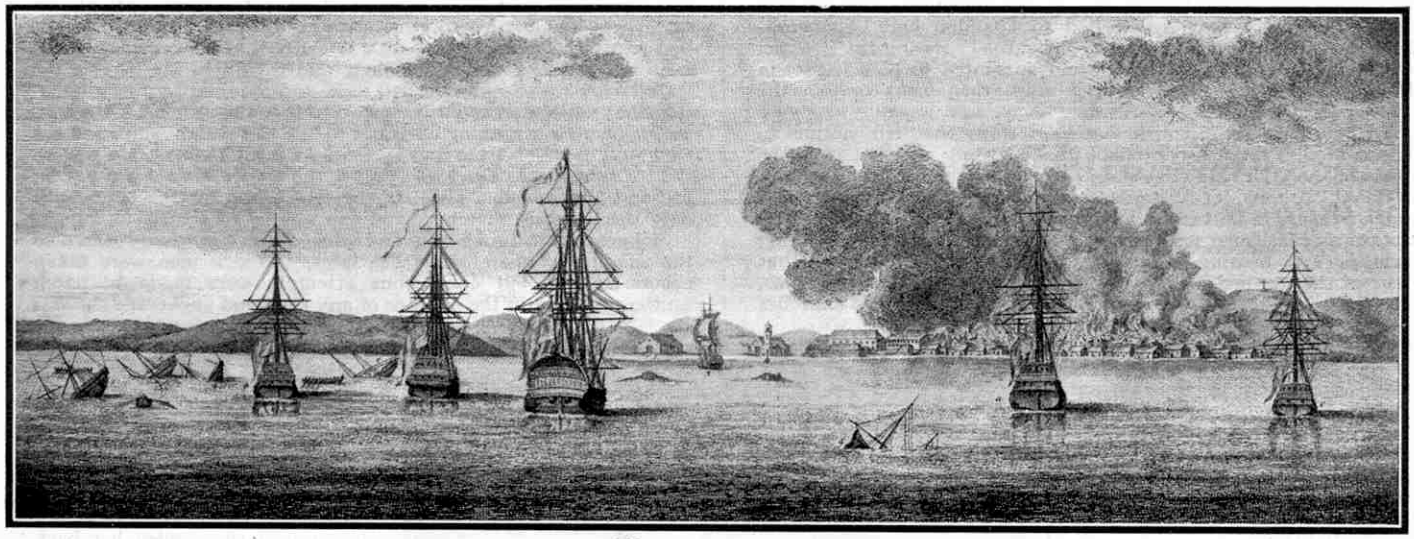
When war broke out with Spain in 1739, the Admiralty recognised, as Hawkins and Drake had done 140 years earlier, that nothing disturbed the Spaniards so much as attacks on their colonies. It was decided, therefore, to despatch a squadron to the Pacific for this purpose, and Anson was recalled from the West Indies to take command of it. He received his commission as Commander-in-Chief of the squadron on 10th January, 1740, and at once commenced preparations for an early departure. His ships consisted of the "*Centurion*" as flagship; two 50-gun ships, the "*Severn*" and the "*Gloucester*"; the "*Pearl*" of 40 guns; the "*Wager*" of 28 guns; the sloop "*Tryal*" of eight guns, and the "*Industry*" and the "*Anna,*" two supply ships of 400 and 200 tons respectively. Most of these vessels were more or less unseaworthy and their crews were not only too small, but consisted to a great extent of men who were physically unfit for such a voyage.

After many hindrances the ships sailed from Spithead on 10th August, 1740, and anchored at St. Helen's, Isle of Wight, to await a favourable wind. Bad weather delayed the squadron for 40 days, but on 18th September there began the voyage that was destined to last nearly four years and to take Anson round the world. The long delay in preparing the expedition had enabled news of it to reach Spain before Anson sailed, and a Spanish fleet was sent to intercept him off Cape Horn. Five weeks after leaving home he reached Madeira, where the Portuguese Governor told him that a Spanish fleet was cruising westward of the island. He sent a sloop to investigate, but she returned without sighting the Spaniards as they had sailed away to South America. Anson resumed his voyage on 3rd November heading for the Portuguese island of St. Catherine off Brazil. Shortly after leaving Madeira, the "*Industry,*" one of the supply ships, was unloaded and dismissed, and she sailed for Barbadoes to obtain a cargo for shipment to England.

The ships of Anson's squadron sailed with seamen and soldiers totalling 1,872 men, but sickness began to take heavy toll of them and during the second stage of the voyage scurvy broke out. At St. Catherine about 80 sick men were taken ashore from each ship and accommodated in tents while the ships' decks were scraped and the mens' quarters fumigated. By the time the squadron sailed on 18th January, 1741, 160 men had died and the sick list totalled 450.

Bad weather was now encountered, and during a thick fog the "*Pearl*" lost touch with the other ships and did not find them again until a month later. A few days before rejoining the squadron she came across the Spanish ships and was chased and almost captured. Anson was disturbed by this news of the nearness of the enemy, and would have hastened on his voyage if the "*Tryal*" had not been seriously damaged during a storm. As it was he had to endure a delay of eight days while the vessel was repaired at Port St. Julian.

When the squadron once more got under way it was favoured by fine weather until near Cape Horn, when high seas were encountered with fierce storms of snow and



sleet. Sails were torn to ribbons, and masts and rigging were repaired only to be damaged again almost immediately. The squadron was carried far eastward off its course and eventually became scattered. Only the "*Centurion*" succeeded in rounding the Horn. The "*Severn*" and "*Pearl*," both badly damaged, drifted far to the east and eventually made their way back to England; the "*Gloucester*," "*Tryal*" and "*Anna*" were lost sight of, and the "*Wager*" was wrecked off the Chilean coast.

The "*Centurion*" reached the island of Socoro in Patagonia early in May, 1741, and after waiting vainly for several days for the other ships she sailed on to the island of Juan Fernandez, the next pre-arranged meeting place. The mainland of Chile was sighted on 30th May, but owing to calms and adverse winds the ship did not reach the island until 10th June. Sickness among the seamen and soldiers continued and deaths occurred at the rate of five or six a day. Shortly after the ship had anchored in a bay of the island, the "*Tryal*" arrived with most of her crew on the sick list. All the fit men of the two ships were sent ashore to erect tents for the sick, and later 167 ailing men were conveyed to them. These men were in such a weak condition that 12 or 14 of them died either in the boats or very soon after they were carried ashore.

On 26th June, a ship carrying very little sail was seen far off for a short time, and re-appeared five days later. When she came nearer Anson recognised her as the "*Gloucester*," and he at once sent out to her a boat laden with fresh water and provisions. The ship had lost two-thirds of her crew and few of the survivors were fit for duty; and owing to adverse winds it was a month before she was able to anchor in the bay. During August, the "*Anna*" turned up and was gladly welcomed for she had on board provisions and other stores.

(Top) The burning of Paita, November 1741, by Anson and his men, to destroy merchandise that had to be left behind when they looted the town.

(Below) Portrait of Admiral Lord Anson. The illustrations on this page are from prints in the possession of T. H. Parker Ltd., 28, Berkeley Square, London, by whose courtesy we are enabled to reproduce them.

Unfortunately the stores were found to be badly affected by sea water, and the ship proved to be so unseaworthy that Anson transferred her crew to the "*Gloucester*" and she was broken up.

An unknown ship was sighted on the horizon on 8th September, and as she did not come near the island, it was feared that she was a Spanish ship and had discovered them. Anson decided to settle the matter and pursued her in the "*Centurion*," but lost trace of her during the night. He sailed on in the hope of finding her, and there was great excitement aboard the "*Centurion*" at daybreak of the fourth day of the search, when a ship was seen about four leagues distant. The "*Centurion*" crowded on all sail and gave chase, and was soon near enough for it to be seen that the ship was not the one first pursued. She was flying the Spanish flag, and was found to be the "*Nuestra Señora del Monte Carmelo*" (Our Lady of Mount Carmel), a merchant ship laden with a valuable cargo of sugar, cloth and several chests of plate. She was captured without a fight, and Anson learned from her crew that the Spanish squadron sent to intercept him had been scattered off Cape Horn by storms. The "*Centurion*" returned with her prize to the island.

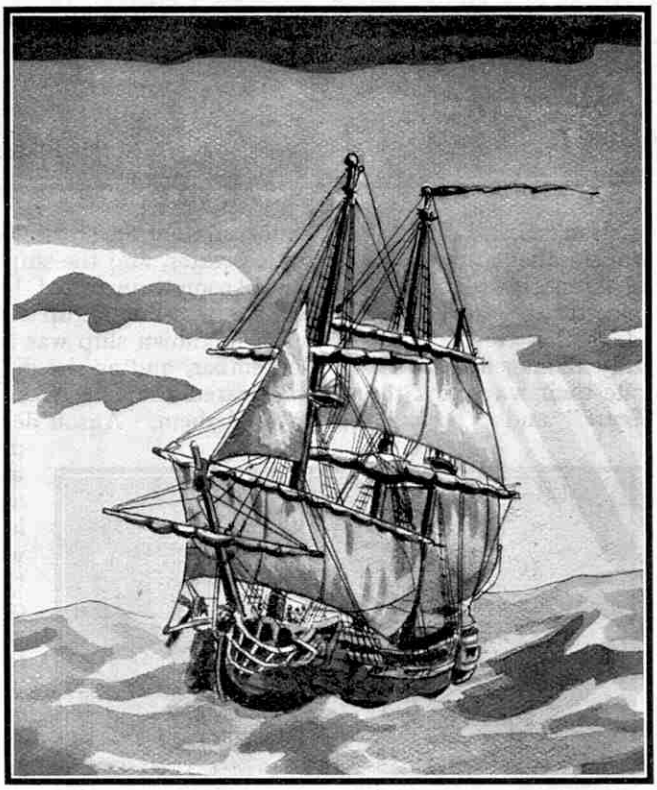
The "*Carmelo*" had been bound from Callao to Valparaiso, and Anson discovered from letters found on board her that other merchant ships had left Callao to make the same voyage. He therefore despatched the "*Tryal*" to cruise off Valparaiso and the "*Gloucester*" to cruise off Paita, instructing the latter not to venture close enough to the shore to be observed. The "*Centurion*," accompanied by her prize, left Juan Fernandez on 19th September, and four days later met the "*Tryal*," which had been fortunate enough to capture the "*Arranzazu*" of 600 tons, one of the largest merchant ships in those seas. The "*Tryal*"

was again in trouble, having sprung her mainmast, and she was leaking so badly that Anson had to abandon her. The crew, guns and stores were transferred to the "*Arranzazu*," which Anson re-named "*Tryal Prize*," and appointed to be a frigate in His Majesty's service. The three ships then went to join the "*Gloucester*."

To detail all the Spanish merchant ships that fell victims to Anson would make monotonous reading, but mention must be made of the "*Neustra Señora del Carmin*" (Our Lady of Carmin), of about 270 tons, for Anson learned from her crew that there was much treasure in Paita, and he therefore planned a night attack on the town. The men were rowed ashore in boats, and by yelling, shouting and beating drums they created such an uproar that most of the terrified inhabitants fled to the outskirts of the town. The few who remained were captured and locked in two churches isolated from the rest of the town. At dawn the ships anchored close to the shore, and the next three days were spent in transferring treasure to the ships. Anson set free the unfortunate inhabitants and also the prisoners taken in the various Spanish ships he had captured, and then fired the town to destroy merchandise that had to be left behind.

The ships sailed about midnight on 15th November, richer by at least £30,000 of treasure, and Anson ordered them to spread out so as to widen the search for the "*Gloucester*." When found she was accompanied by two captured ships, and the wealth of these added about another £19,000 to the booty.

The master of a Spanish merchant ship chased nearly to Paita by the "*Gloucester*" a few days before the raid had informed the Governor that the English were in the vicinity, and this alarming information had been passed on to the Viceroy at Lima, Peru. Anson thus had good reason to believe that his chances of picking up prizes in that part of the world were very small. He therefore resolved to steer for the Mexican Coast and there wait for a celebrated treasure ship from Manila that, according to all accounts, would reach the port of Acapulco about the middle of January.



The 60-gun ship "Centurion" in which Anson made his remarkable voyage round the world.

The various captured ships greatly hindered Anson's progress, and three of them were cleared of everything likely to be useful to the other ships and then destroyed. Alternate calms and storms caused further delays, and frequently carried his ships far off their course, so that he did not reach the vicinity of Acapulco until 26th January, 1742. He then ordered the ships to spread out at a distance of about 12 leagues from the coast, and at night sent a boat to see if the galleon had arrived before them. After a fruitless search for the port the boat returned five days later, and was sent out again the next night. This time it was more successful, and returned six days later with three negroes who had been captured one night while fishing. Anson learned from them that the galleon had arrived at the port on 9th January, had delivered her cargo, and was now taking in water and provisions preparatory to starting on her return voyage to Manila on 14th March.

On this trip the galleon would carry back the specie for which her cargo had been sold, and Anson decided to cruise off the Mexican coast until she came out. Preparations were made for the expected engagement, but although the ships cruised about until the end of the month there was no sign of the galleon, and Anson then decided to cross the Pacific and capture her as she neared Manila. Before making this voyage he further reduced his squadron, the two prize ships "*Carmelo*" and "*Carmin*" being cleared of all that was valuable and then destroyed. Anson had now only the "*Centurion*" and "*Gloucester*," and with these two ships he sailed, on 6th May, 1743, to Macao, a Portuguese settlement in the Canton River, China. At Macao he intended to refit his hard-worked vessels before proceeding to Manila to await the galleon.

The two ships were becalmed in the south Pacific for seven weeks. The "*Gloucester's*" mainmast was found to be defective and had to be partly cut away, and when the ships were at last under way she lost her foretopmast and foreyard during a spell of bad weather. She began to leak so badly that her crew could not keep the pumps going fast enough, and to add to the trouble the "*Centurion*" also sprang a bad leak, and required so much attention that not a man could be spared to help the stricken "*Gloucester*." There was nothing for it but to lose this gallant ship, and her crew and as much store and treasure as possible were removed to the "*Centurion*." On 15th August the "*Gloucester*" was set on fire and abandoned. Thus one by one Anson lost his ships until only the flagship remained, and she was in great need of repair.

Sickness again broke out, and when the "*Centurion*" came to the island of Tinian, six weeks later, 128 sick men were taken ashore. Crude but courageous attempts were made to patch up the ship, and in the absence of any sheltered anchorage she was moored by chains and ropes in the open bay. During a violent gale on the night of 22nd September she broke from her moorings, leaving Anson and 113 of his men stranded on the island, and five days passed before the men on board the ship managed to get her under control and secure the anchor. Exhausted but not discouraged they sailed her back to the island, and arrived on 11th October. Three days later she broke away again, this time with Anson and many of the experienced seamen on board, and was again brought back safely to the island. Water and supplies were taken on board, and the ship then resumed her voyage.

At Macao the "*Centurion*" was refitted from end to end, re-provisioned, and provided with an ample water supply. These matters took many months to carry out, and she did not leave the Canton River until 19th April, 1743. Anson knew that the Manila galleons always rounded Cape Espiritu Santo as they neared Manila, and that sentries on the headland signalled information to them as to whether the coast was clear or not. He therefore ordered the "*Centurion's*" topgallant sails to be taken down, and remained well out to sea. A sharp lookout was kept for the expected ship, but days and weeks passed without any sign of her. At dawn on 20th June, however, the lookout man sighted a sail, and as soon as the galleon was recognised preparations were made to attack her. The two ships came within firing range shortly after noon, the "*Centurion*" keeping leeward, as this position enabled her guns to be brought to bear upon the bow of the galleon, and made effective reply difficult. After a battle lasting nearly two hours the galleon hauled down her flag. She was a much larger ship than the "*Centurion*," and carried 36 guns and 150 men, and was found to be rich in treasure, having on board plate, silver and dollars to the value of £313,121 sterling.

Anson took the galleon back with him to the Canton River, where they arrived on 11th July, and remained until the monsoon was over. The galleon was sold to merchants at Macao on 15th December for 6,000 dollars, and on the same day the "*Centurion*," heavily laden with her booty, set sail for England. She arrived at Table Bay, Cape of Good Hope, on 11th March, 1744, and stayed there three weeks. On 19th April, St. Helena was sighted, and on 10th June an English ship was encountered from which Anson received his first news of the French war. The Lizard was sighted two days later, and after passing through dense fog in the Channel the "*Centurion*" arrived safely at Spithead on 15th June, 1744, after an absence of three years and nine months. Anson then found that during the fog they had passed safely through the midst of a French fleet cruising in the Channel.

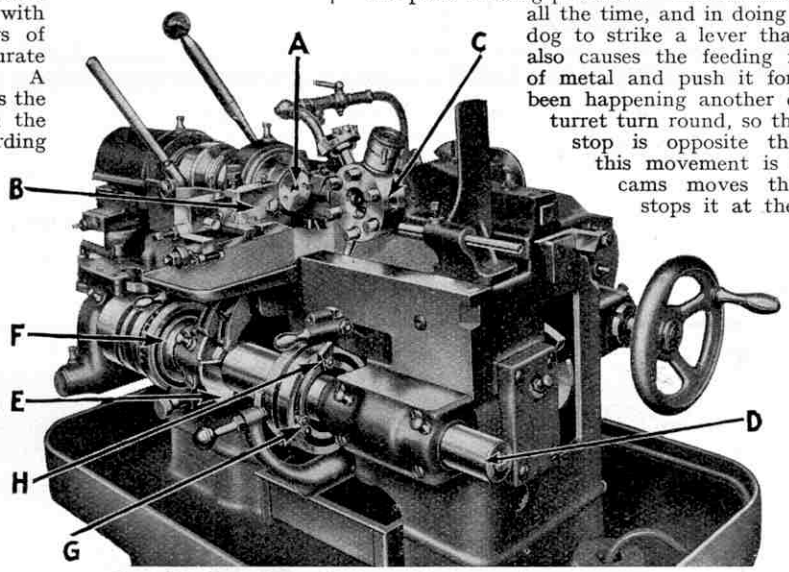
The re-appearance of the "*Centurion*" created a great sensation. The treasure was landed at Portsmouth and conveyed to London, where it was paraded through the city in 32 wagons, accompanied by the ship's company "with colours flying and bands playing." It included 18 chests of gold, 20 barrels of gold dust and 295 chests of silver, and was valued at £1,250,000

(*Continued on page 196*)

A High-Speed Production Machine

The B.S.A. Screw Automatic

MACHINERY of all kinds holds a great fascination for the Meccano enthusiast. At first the machines that attract the greatest attention are those in which brute force is directed to some definite end. For instance, no one can help admiring the ease with which a billet cropper bites its way through steel of 6 in. square section or larger. At a later stage interest shifts to machines of a more delicate nature—machines which, being fed with raw material, make vast numbers of intricately-shaped and perfectly accurate pieces without human assistance. A typical machine of this latter type is the B.S.A. Screw Automatic shown in the accompanying illustration. According to the size and shape of the piece required, and also the nature of the material used, it will turn out work at the rate of 1,200 pieces per hour. If absolutely every condition is against it, the output is slowed down to 40 pieces per hour; that is to say, provision is made for this slow rate, but a B.S.A. machine has never yet had to employ this feature.



The B.S.A. Screw Automatic, shown with its working parts uncovered.

Thousands of different articles that are in daily use are produced on these remarkable machines. As an example, the connector used to blow up a football bladder may be taken as typical. The evolution of this article is shown in the accompanying sketch. From the time one piece is started until it is finished, the machine has to make 15 movements that operate seven different tools; and all this happens in a fraction over six seconds, or at the rate of about 550 pieces per hour.

The B.S.A. Screw Automatic is shown in the illustration with its working parts uncovered. Part A is a special form of work holder known as a collet chuck, and behind that is another part called a feeding finger. At B is seen the front cross slide tool holder, immediately opposite to which is the rear cross slide tool holder. The remaining tools are carried in the tool turret C.

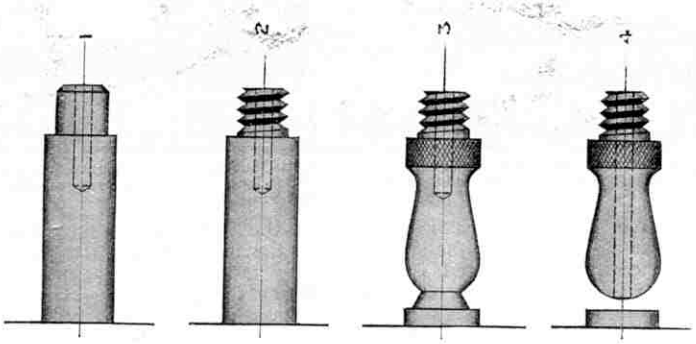
Now we come to the most important part of the machine, which might be likened to a sergeant, for it keeps all the moving parts in perfect step one with another. This is the front camshaft D. By a suitable arrangement of gears this is made to perform one complete revolution in the time taken to produce one piece. This time, which is fixed before work commences, is decided by a man who has had long experience in the cutting of metals on this particular type of machine. On the shaft are mounted cams, one of which is seen at E, and dog carriers. Two of the latter indicated are F and G, and on G may be seen one of the dogs H. It will be seen that cam E is of irregular shape; this is by design, and the design varies with each work-piece. This cam moves the tool turret forward at the correct fraction of a second, and stops it when the particular tool then in use has cut the metal to the correct length—correct length in this case being measured to within one-thousandth part of an inch. Another cam, also of irregular shape, similarly moves the front and rear tool slides.

It will be noticed that dog H can be secured by means of a nut and bolt in any position in the dog carrier. The man who designs the shape of the cams decides also where the dogs shall be fixed, and as there are several of these used in the various dog carriers, great care is necessary to obtain a correct setting in order to ensure that all movements start and stop at the correct moment.

Now let us follow the various motions that take place while one piece is being produced. The camshaft D is revolving slowly all the time, and in doing so it causes the correct dog to strike a lever that opens the collet and also causes the feeding finger to grip the bar of metal and push it forward. While this has been happening another dog has made the tool turret turn round, so that a tool called a stock stop is opposite the collet. As soon as this movement is completed, one of the cams moves the turret forward and stops it at the correct distance from the collet, so that the stock stop comes against the bar of metal when the exact length of the latter is sticking out from the collet. By this time the camshaft has turned round sufficiently to bring another dog into action which, by striking another lever, causes the feeding finger to relax its grip, but at the same time tightens the collet so that the bar is held securely in position.

As the camshaft continues to revolve, it revolves the turret to bring other tools into action or moves the cross slides for the same purpose, and the work-piece is completed in the stages shown in the accompanying sketch.

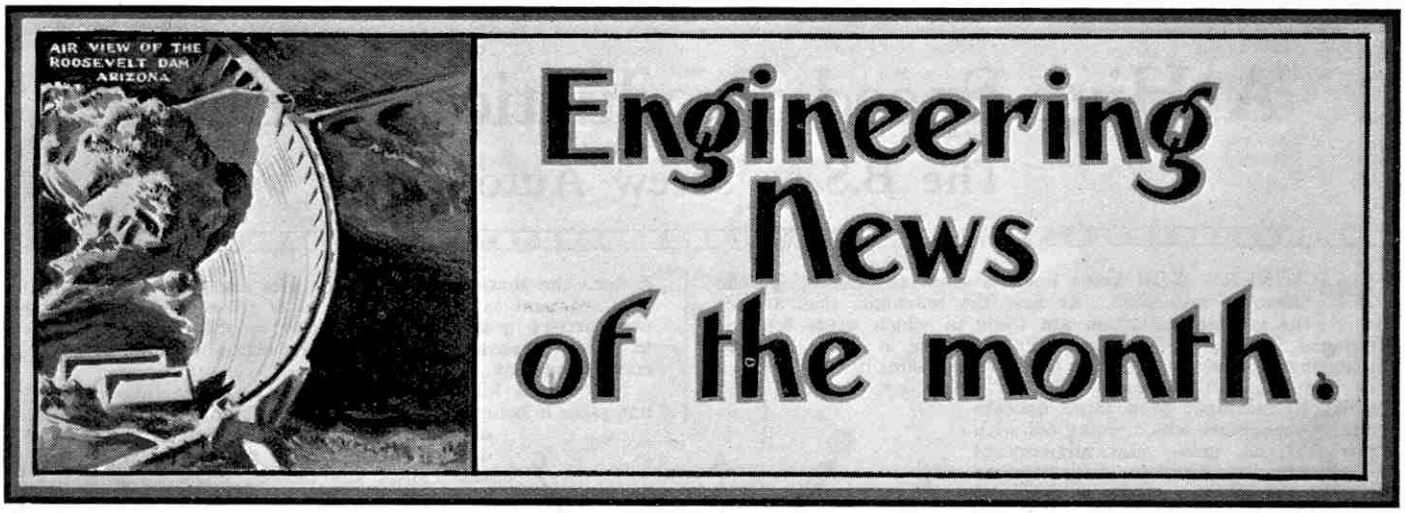
First of all a portion of metal is turned to the diameter of the screw thread, and at the same time the hole through the centre is partly drilled (1). The thread is then cut (2). This calls for a reduction in speed that is looked after by the camshaft, which also increases the speed as soon as the thread has been cut. After this a tool in the turret knurls, that is, cuts the diamond-shaped finger grip, while a tool in the rear slide forms the end that enters the football bladder (3). Next comes the completion of the drilling, and just before that is finished the front tool slide commences to part-off and finish the form (4).



Sketch showing the evolution of a connector used to blow up a football bladder.

The 15 distinct movements necessary to bring the tools into position, advance them into the work, and withdraw them, and to quicken or retard the speed, are all performed automatically by a suitable arrangement of cams and dogs. It will be realised that to enable these 15 movements to be made 550 times in an hour day after day, and week after week, calls for extremely accurate workmanship in making the machine.

The principal casting carries the work spindle, turret slide, and the tool and stock feeding cams. Immediately below and supporting this casting is a deep cast iron tray which contains the reservoir for the cutting oil. The whole is carried on substantial cast iron legs between which there is, suspended from the oil tray, the clutch case through which the automatic changes of spindle speed are effected.



New Motor Boat for River Severn

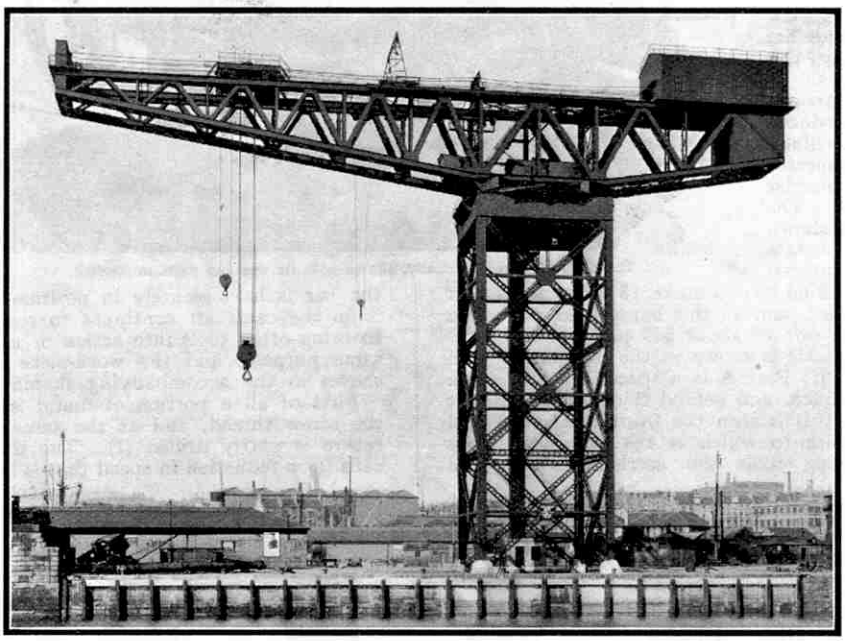
It is not generally realised that special types of vessels have been designed, as a result of years of experience, for use on the big commercial rivers of this country. An interesting vessel has recently been built for service on the River Severn, where it is necessary for a cargo boat to be sufficiently seaworthy to serve all the Bristol Channel ports, and at the same time to have a small enough draught to navigate the river as far as Stourport.

The new boat, which is named the "*Severn Trader*," is 89 ft. in length and has a beam on the deck of 19 ft. 10 in. It is equipped with a three-cylinder 120 h.p. engine, fitted right aft and controlled from the wheelhouse. The funnel, mast, wheelhouse and all the other superstructures may be lowered in order to enable the vessel to pass under low bridges; and to prevent any damage being done when travelling with an empty hold, special ballasting arrangements are provided so that the highest fixed point of the boat can always be brought to a maximum of 8 ft. 6 in. above the water line.

Normally the "*Severn Trader*" is worked by a crew of only three, and in order to ease their work there are a great many modern labour saving devices on board, including anchors of the self-stowing type that fit into recess anchor boxes in the bows. They are hoisted by means of a windlass driven by a horizontal Diesel engine. The designed deadweight capacity is 163 tons, but on the first journey of the type ship 170 tons were carried. The speed is eight knots.

Testing Chains with 750-Ton Pull

What is claimed to be the largest machine yet made for testing the chain cables that are used on ships has been constructed by W. & T. Avery Ltd., of Birmingham, for service in the approving station of Lloyds British Testing Co. Ltd. It has been built to exert a pull of up to 750 tons, and thus is capable of testing the largest chain cables yet made, for a stress of about 500 tons is considered sufficient for most of these. In addition to being extremely powerful the machine is very sensitive, and on one occasion when a pull of 200 tons was being exerted on a chain it was found that the addition of 8 oz. to the end of the weighing lever was registered on the indicator!



The 175-ton electrically-operated cantilever crane at Glasgow Harbour, for new vessels fitting out. The crane is 150 ft. high from quay level, and the cantilever is 253 ft. long. Photograph reproduced by courtesy of the Clyde Navigation Trust.

The principle on which the machine is constructed is common to most chain-testing machines. In the floor of the approving house is laid a cast iron trough 4 ft. 6 in. in width and 100 ft. in length—long enough to take a test piece of chain 15 fathoms or 90 ft. long. The chain is put in this trough and is secured at one end to a grip connected to the arm of a hydraulic cylinder that applies a tensile stress; the other end of the chain is held in a grip connected to a system of weighted levers attached to a measuring instrument. Special apparatus is included in the sides of the trough to accommodate bars that pull the chain under test and thus apply additional stresses. Although the machine is 178 ft. 6 in. in length, no part is 1-5000th of an inch out of line.

Coal Gas to Drive Motor Cars

The use of coal gas as a fuel for internal combustion engines is by no means a new idea. During the Great War, for instance, ordinary town's gas was used for some time for this purpose, motor vehicles obtaining their supplies from large "gas bags" on their roofs. Town's gas is now employed by a number of motor car constructors to "run in" their engines.

The greatest difficulty in using this fuel is the comparatively large receptacles required to store it. A gas bag suitable for use on a motor vehicle is capable of containing only sufficient gas to give a very small radius of operation; while the storage of the gas under high pressure has always necessitated the use of extremely heavy containers. Recently, however, a high-tensile steel alloy bottle has been produced that makes it possible for gas to be stored under high pressure and carried in a motor car without adding unduly to the deadweight of the vehicle.

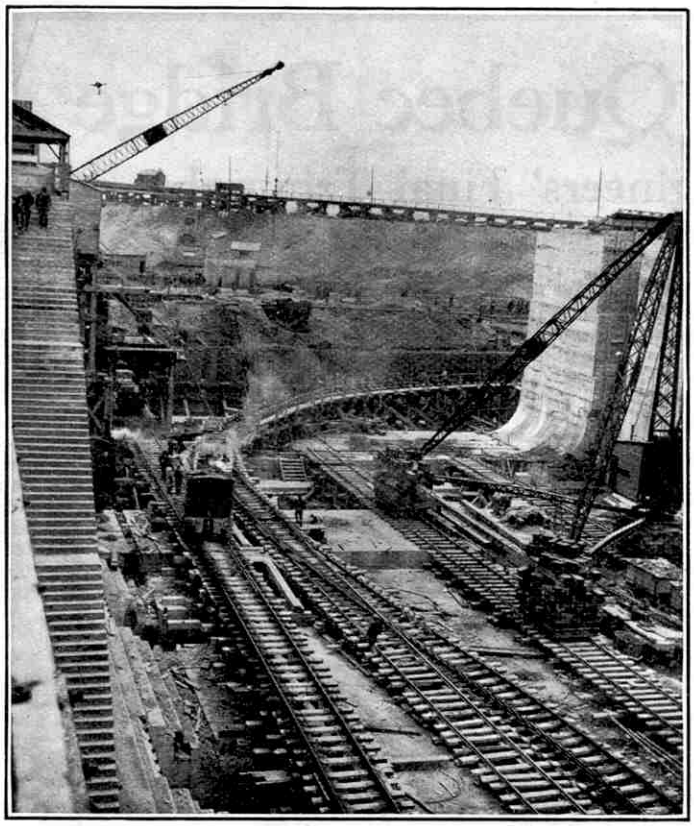
During experiments carried out by the Birmingham Corporation Gas Department, a 20 h.p. Austin van was fitted with five steel cylinders each 5 ft. 10 in. in length by 8 in. in diameter. These had a free gas capacity of 350 c. ft. at normal temperature and pressure, and were capable of withstanding internal pressures of 3,000 lb. per sq. in., which is approximately equal to 200 atmospheres. Each of the cylinders was 110 lb. in weight, and thus the total weight of the equipment in the vehicle amounted to $5\frac{3}{4}$ cwt., whereas a petrol tank and all its fittings would only have weighed about $1\frac{1}{2}$ cwt. Trial runs made by the van were very satisfactory, however, the gas consumption only being about 21 c. ft. per mile when carrying a load of 15 cwt. With the same load petrol consumption would have been one gallon for 12 miles, which means that 250 c. ft. of gas is about equal to one gallon of petrol. A compressor has now been built to compress gas to 5,000 lb. per sq. in.

Southampton Graving Dock

The photograph reproduced on this page shows work in progress on the new graving dock at Southampton that has previously been mentioned in these pages, and which when completed will be the largest in the world—1,200 ft. in length, 135 ft. in width at the entrance, and 59 ft. in height.

Readers may remember that this dock was undertaken primarily to house the new 75,000-ton Cunard liner, but it will be of sufficient dimensions to accommodate vessels up to 100,000 tons in displacement. It will contain 260,000 tons of water, which it will be possible to eject in four hours by means of four large centrifugal pumps. Work is now proceeding rapidly. The site of the dock has been enclosed by an embankment made of gravel dredged from the channel and supplemented with chalk, and it has been made watertight by driving along its centre line a continuous row of interlocking steel sheet pilings. Under this protection the top excavation has been carried out in the open by steam navvy and dragline excavators, which load the spoil into railway wagons to be hauled away and tipped at various places on the estate, the gravel thus recovered being conveyed to a special tip where it is stored for use in making concrete. The excavation for the lower part of the walls is carried out in timbered trenches, the concrete for the walls and floor of which is prepared at two central mixing stations situated at the north and south ends of the dock.

Underlying the site of the dock has been found a bed of sand containing artesian water at considerable pressure. This is covered by a bed of clay of varying thickness, but the pressure of water in the sand is so high that there is a possibility that the clay above it might be lifted while the excavation is in progress. Tube wells equipped with pumps working through filters have therefore been sunk to the sand bed, and the water is removed through these without disturbing the sand, thus greatly relieving the pressure on the deposit of clay.



Work in progress on the world's largest dock, which is mentioned on this page. For permission to reproduce this photograph we are indebted to the Southern Railway.

Emptying an Italian Lake

After preliminary work occupying some four years, the waters of Lake Arsa in Italy have now been drained away. The lake was a stretch of water about 2½ miles in length by 1¼ miles in width, situated in Eastern Istria near the coast about half way between Pola and Fiume. It was the centre of a large area of bog land, and was emptied in an attempt to reclaim this land. The plan followed consisted of driving a tunnel into the lake through which the waters could be drained to the Gulf of Quarnero. A tunnel about three miles in length had to be made, and it was necessary for this to be carried right through a mountain that stands between the site of the lake and the sea. The work was completed successfully, and it is estimated that about 3,000 acres of land have been made suitable for cultivation. The actual emptying of the lake was carried out very rapidly.

Vancouver Harbour Bridge To Be Rebuilt

Some two years ago the Second Narrows Bridge across Burrard Inlet, Vancouver, was badly damaged by a ship passing under, and has since been closed to traffic. The bridge formed an important artery connecting Vancouver proper with the North Shore municipalities, and it is therefore now to be repaired at a cost of about £258,000. It is expected that the bridge will be ready for traffic by next spring.

Important alterations are to be made to the bridge while the reconstruction work is being carried out, and it is thought that these will not only do much to eliminate the danger of accidents from ships, but will also facilitate navigation through the Second Narrows. The present bascule span, which is close to the south shore, will be replaced by a lifting span for its full width of 300 ft., so that the entire section will lift horizontally from towers at both ends. This section of the bridge is the one that was damaged in the shipping accident.

Three Elephants on a Glass Beam !

During an interesting test recently undertaken in order to determine the bending strength of armourplate glass, three elephants, together with three attendants, were lifted in a cage suspended from a piece of this glass 40 in. in length, 24 in. in width and 1 in. in thickness. This was used as a beam, and was lifted at the ends by a sling from a crane, the cage being suspended from the centre. Although the total weight of the cage and its contents was more than five tons, the load was raised without fracturing the glass. Glass of this nature has great possibilities in structural work.

A New Bridge Over The St. Lawrence

Work is shortly to commence on the construction of a new bridge over the River St. Lawrence at a point about six miles west from the centre of Montreal. The river here is about $\frac{5}{8}$th of a mile in width, but the bridge will be somewhat longer than this as it will extend from Ville la Salle, near Lachine, to the Indian reservation at Caughnavaga on the south bank of the river. The cost of the structure is estimated at about £639,000.

New American Liners

On page 13 of our issue for January last we gave brief details of four new liners constructed for the recently-instituted Panama mail service of the Grace Lines. The "*Santa Elena*," the last of these ships, has now been launched. With the exception of the interior furnishings, the vessel is similar in all respects to the previous vessels. All four are equipped with General Electric turbine gear propulsion apparatus, and are 508 ft. in length and 72 ft. in beam. They have a displacement of approximately 16,000 tons and they will be able to maintain a speed of 18 knots or more. The cargo capacity is large, and the most modern apparatus for handling cargos is provided. The "*Santa Rosa*," the first of the four to be completed, has satisfactorily made her maiden voyage.

Tank for Marine Research

A large new research tank has been built at the National Physical Laboratory, Teddington, Middlesex. It consists of a ferro-concrete water basin that is 680 ft. in overall length and 20 ft. in width at the water surface, except at one end where there is a small dock 3 ft. in width and 19 ft. in length. At the eastern end there is a depth of 9 ft. of water for 445 ft., while at the western end the water is 2 ft. in depth for about 180 ft., the transition between the two depths being accomplished in a distance of 36 ft. Lower levels of water can be provided by letting out water through a sluice valve.

The travelling carriage employed to tow models through the water is 10,000 lb. in weight. It is 24 ft. 5½ in. in overall length and has a wheelbase of 15 ft. 5½ in. Special brakes on the rails operate on the Westinghouse principle, and are arranged so that in the event of failure of the electric current they come into action automatically. Two 56 b.h.p. electric motors are employed to drive the carriage.

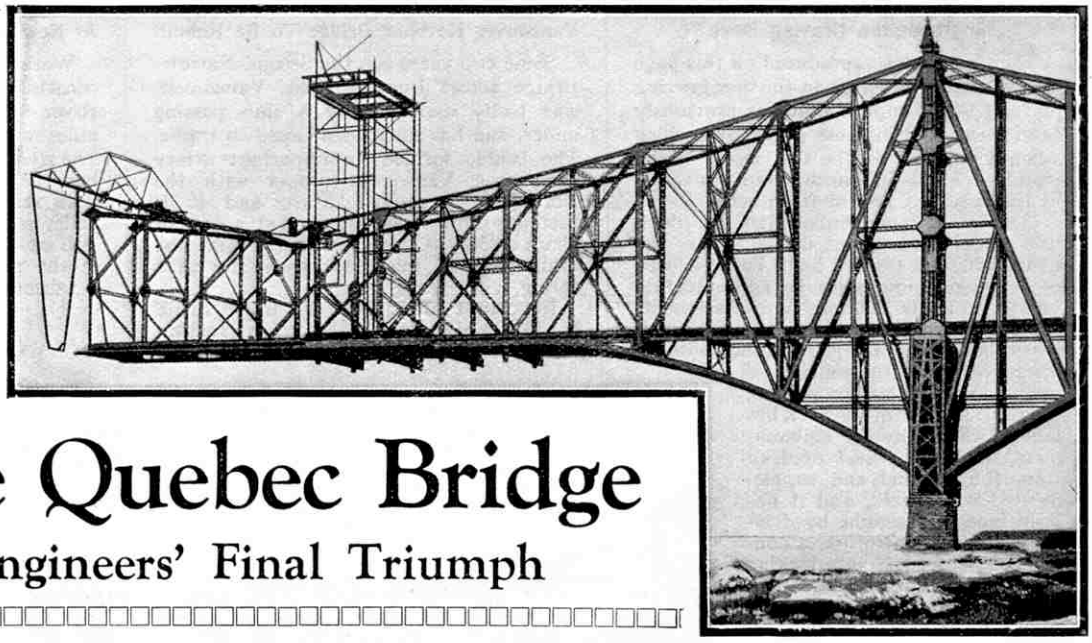
Mississippi Bridge 4¾ Miles Long

A decision has been made to construct a bridge over the Mississippi River at New Orleans at a cost of about £3,500,000. The bridge together with its approaches will be 4¾ miles in length, and it will carry two railway tracks and two highways, in addition to sidewalks for pedestrians. The roads will be 18 ft. in clear width and will be arranged on the one-way traffic system. The bridge will be provided with a main span of 790 ft. in length and 135 ft. above the river level in order to allow ocean-going ships to pass underneath.

FAMOUS BRIDGES

The Story of the Quebec Bridge

II.—Engineers' Final Triumph



LAST month we told how the first attempt to build a bridge across the St. Lawrence River at Quebec ended in disaster, and described the early stages of the construction of the great cantilever bridge that now spans the river at that point.

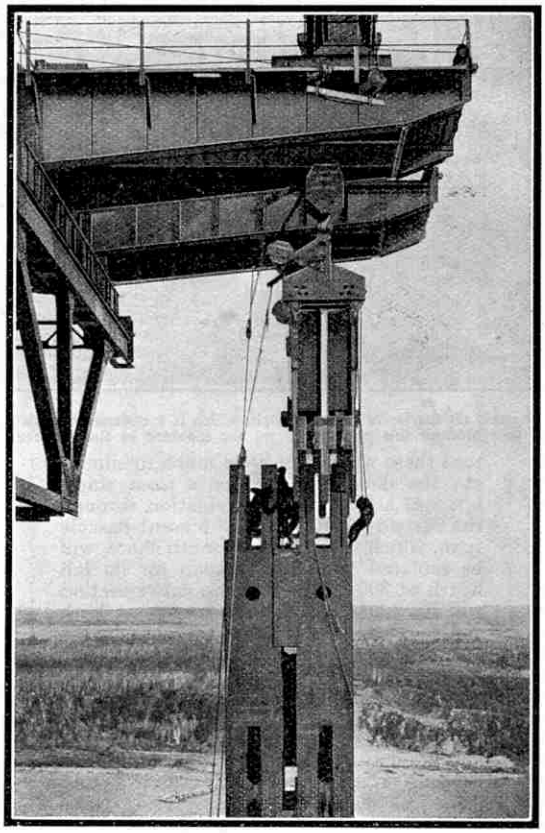
By the close of the 1913 season the approach arm of the north cantilever was completed, and when operations were resumed in the spring of 1914, work was immediately commenced on building up the K web bracing of the anchor arm and cantilever. Commencing at the shore extremity of the approach arm, the traveller gradually worked its way towards the cantilever pier, placing in position by means of the 90 ft. booms the necessary falsework, and during the return journey fitting the lower chords of the anchor arm. During the 29 weeks in 1914 in which work on the bridge was possible, 13,636 tons of steelwork were erected and secured in position, an average of 470 tons per week. With the exception of the last two K webs, the north anchor arm was completed. The early part of the 1915 season saw this work finished and the north cantilever span was then built up. When completed, the cantilever projected over the river for a distance of 580 ft. from its pier. At the south side of the river construction was not so far advanced, but by the close of the 1915 season the south anchor arm was completed.

Some idea of the remarkable progress made during that period may be obtained from the fact that 1,823 tons of steel were set in position on the south anchor arm in one week. The record for a single day's work was 670 tons.

Work was recommenced in the spring of 1916 and was carried on so rapidly that the south cantilever arm was completed by the beginning of September of the same year.

When the finishing touches were being put to the steelwork on the north portion of the bridge and the south cantilever span was being assembled the huge centre span for linking up the two cantilevers was also rapidly nearing completion. This was being built at Sillery Cove, about 3½ miles downstream from the site of the bridge. The Cove proved very favourable for carrying out this work, as it was protected by shallows and yet at high tide admitted sufficient water to float the pontoons upon which the span was eventually to be loaded. The lattice girder sides of the span were arch-shaped and were 110 ft. in height at the centre.

When word was received at Sillery Cove that the bridge cantilevers were ready to receive the central span, preparations were immediately made for transporting this to the bridge site. The span had been assembled upon the falsework at a height that allowed the pontoons to be floated beneath it, and 2½ hours before high tide on 11th September 1916, this was effected, six pontoons being safely manœuvred into place, three under each end of the span. Each pontoon was constructed of heavy steel framing and steel plate girder bulkheads, and was 165 ft. in length, 32 ft. in width and approximately 11½ ft. in depth.



The upper illustration shows the southern cantilever of the first Quebec Bridge, taken on the day before it collapsed. Below is seen a section of the large link being placed in position at the top of a main pier post in the second Quebec Bridge.

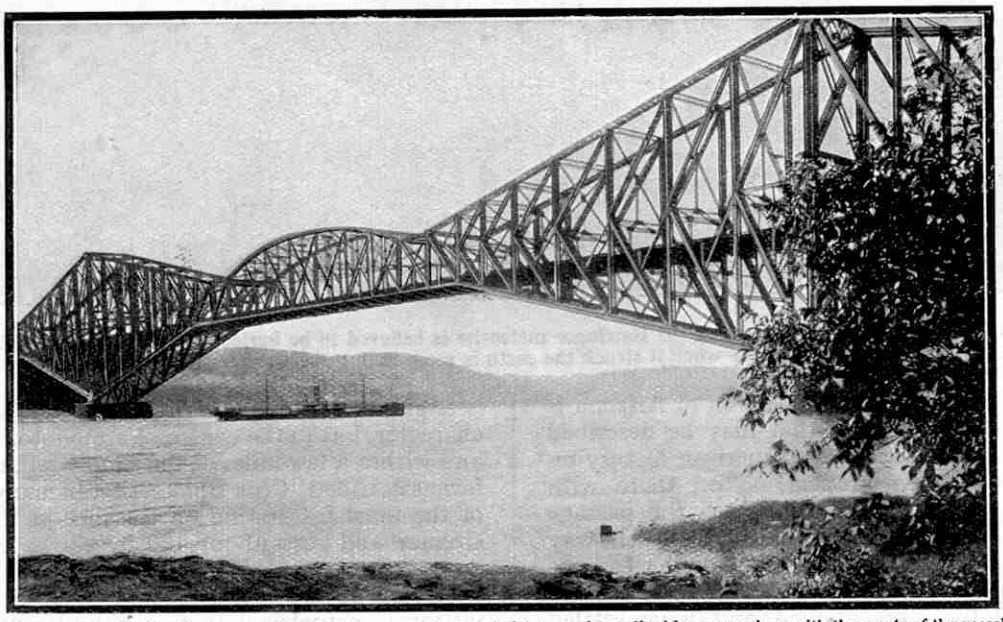
When the span had been made secure upon the pontoons the whole was floated out into the river and, responding to the tide, moved slowly upstream. Its rate of progress was suitably restrained by five tugs on the downstream side, four of 500 h.p. and one of 1,000 h.p. The 3½-mile voyage to the bridge site was accomplished without mishap and, after much skilful manœuvring, in which two reserve tugs that had accompanied the flotilla lent their aid, the span was brought to a standstill directly beneath the gap between the two cantilevers. The ends of the span were then secured by four 1¼ in. plough steel ropes, controlled by electric hoists on the bridge deck, to cantilever mooring frames, one of which was hinged from the end of each cantilever and hung vertically. Each mooring frame was capable of holding at its lower end a suspended load of 300,000 lb.

Two 30-ton girders, each fitted on the upper side with two shoes, were placed transversely under the ends of the suspension span, each shoe supporting a corner of the span. At the extremity of each cantilever arm an arrangement of rocker bearings supported a heavy transverse girder that served to equalise the load borne by each pair of hoisting chains. Hydraulic jacks were erected on this girder, while a second girder rested across the top of the jack plungers. These top girders, one to each cantilever, were known as lifting girders, and were all provided with holes large enough to admit easily the massive hoisting chains. The latter were of special design, and each consisted of four 28 ft. lengths of solid carbon steel, 28 in. in width and 1½ in. in thickness. Each length of chain had a series of 1 ft. diam. holes, 6 ft. apart,

for receiving movable pins of the same diameter, by means of which the lengths were linked up.

When the 30-ton transverse girders were safely placed under the floating span, eight hoisting chains were attached, one pair to each end of the two girders, the chains of each pair being 16 ft. apart. These chains extended up through the heavy cross girder—passing on the inner side of the jacks—to the lifting girder, to which they were secured by the insertion of a pin through convenient holes. When the span was safely held by the hoisting chains, the tugs cast off and moved away. The suspended span weighed about 5,100 tons, and the suspension and lifting gear roughly 440 tons, giving a total burden to be lifted of 5,540 tons.

All was now ready for the actual raising of the massive steel structure, and this task was commenced without delay. A power house on each bank of the river supplied compressed air to the hydraulic pumps situated two at the extremity of each cantilever. The pumps in turn actuated the jacks, each of which had a 22 in. diam. ram of 2 ft. stroke, and was capable of working at a pressure of 4,000 lb. per sq. in. As an emergency measure, four hand-operated 1ft. counter-weighted screw jacks were placed at each corner ready for immediate operation.



The completed Quebec Bridge seen from the shore. Its great height may be realised by comparison with the masts of the vessel passing beneath it.

Immense crowds of people gathered on the banks of the river to witness the hoisting into place of the great span, and a tense silence reigned when the signal was given for lifting operations to commence. As the pumps worked the jacks, the latter slowly raised the girders resting across the top of their plungers. When a lift of 2 ft. was safely accomplished, the pin holes next below those held in contact with the upraised top girder coincided with the pin holes of the lower girder, and 1 ft. diam. pins were now slipped through these latter holes and the coincident holes in the chains. The chains thus being safely locked in their elevated position, the original or top pins were withdrawn, and the jack rams—and in consequence also the lifting girder—were lowered to their original position, in preparation for the next lift. The cycle of operations was then repeated, each successful lift raising the great steel span a further 2 ft. above the river.

As the span was raised clear of the six pontoons, the latter, released of their load, were slowly carried away by the ebbing tide. Their departure from the immediate scene of operations provided a clear view of the span held in suspension by the chains and ropes, and the crowds of spectators cheered vociferously, while ships' sirens added their quota to the applause. When the span had been raised about 30 ft. operations were stopped while the workmen enjoyed a brief but well-earned rest.

After the resumption of operations one lift had been accomplished when the second disaster to the bridge occurred without the slightest warning. Suddenly, at the south end of the span, there was a loud report followed by the sound of ripping metal and, almost before anyone realised what had happened, the great span had partially twisted over and the south-west corner was in contact with the river. It was impossible that, with the tremendous strains now brought into effect, the span could remain in that position, and the sinking of the south-west corner was followed almost immediately by the breaking away of successive members of the girder bracing. The weight of the sagging mass of steel soon wrenched the whole span off its supporting transverse girders. With an appalling rumble and splash the structure lurched downward and completely disappeared into the river, bearing with it 90 men who had been engaged upon it in the hoisting operations. Of these men 81, including the chief engineer, were saved.

In face of this disaster it seemed as though the Quebec Bridge was ill-fated, but although the engineers were greatly dismayed by this fresh catastrophe they were not defeated. An official inquiry was speedily held. The hoisting equipment was closely scrutinised, but nothing wrong was discovered, and the experts finally concluded that the accident had been caused by the failure of the huge steel shoe upon which the span rested at the south end. At the same time no reason could be found for the failure. The cantilevers of the bridge were then subjected to prolonged tests to ascertain whether they had suffered by reason of the tremendous vibrations set up when the attached lifting gear had been so suddenly relieved of its load, and to the great relief of all concerned everything was found to be in order.

The bridge had to be built, and there was nothing for it but to construct another suspension span to replace the lost one. The falsework that had been erected at Sillery Cove for the assembling of the first span had afterwards been abandoned, and the task of restoring it to fitness prior to building a new span occupied many months. In the meantime the requisite material for the new span was ordered and obtained. The new central span was completed by August of the following year, and early on the morning of 17th September, 1917, pontoons and tugs conveyed it to the bridge site, where in due course it was safely attached to the mooring frames and hoisting gear.

A few minutes after 9 a.m. the signal to commence lifting the span was given, and once more pumps and jacks commenced their responsible task. Mindful of the catastrophe of the previous year, the engineers and workmen exercised the **utmost caution,** and no attempt was made to work to a speed schedule. Hoisting was carried out in easy stages, each of 15 min. duration. Twelve lifts, each raising the span a further 2 ft., were made on the first day; 22 lifts, equivalent to a rise of 44 ft., were accomplished during the following day, and 26 lifts on the third day, at the close of which the span was suspended within 30 ft. of its final resting place.

At the time that work ceased on the third day there was a rising wind and indications of a storm, and special precautions were taken to make the span secure. During the night the wind attained a force of 35 miles per hour, and it was an anxious body of engineers who inspected the span and hoisting gear on the following morning. Everything was found to be in order, and after assuring themselves that the lifting operations could be safely continued, in spite of the high wind still blowing, the engineers gave the signal for hoisting to be resumed. By 3.10 p.m. the hoisting of the span was completed and 50 minutes later the connecting pins had been driven and the span secured in place.

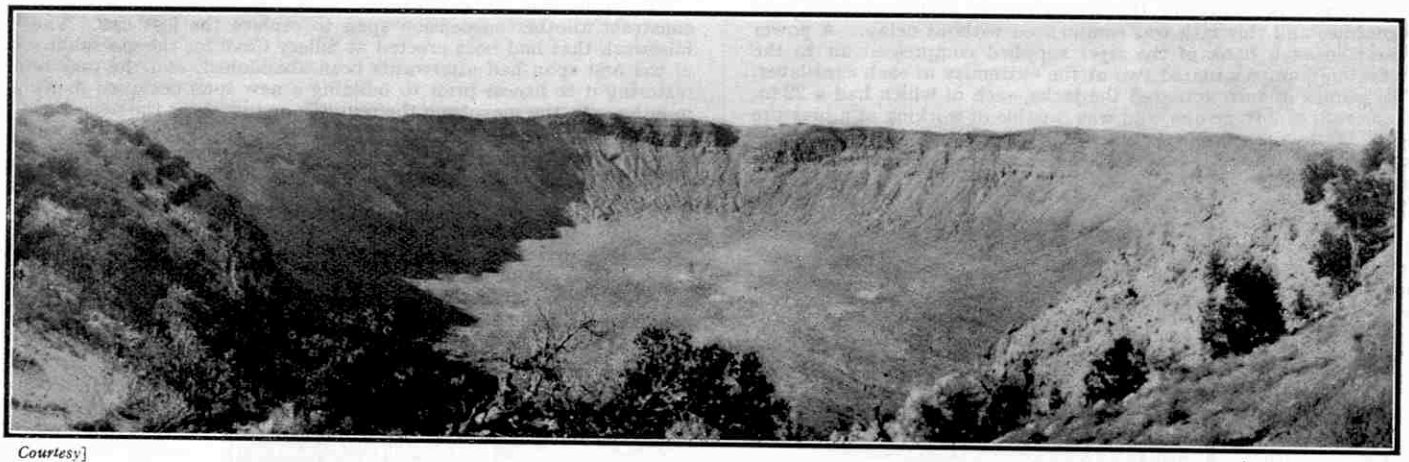
During the following three weeks the floor system of the central span was placed in position by travelling cranes and one of the two railway tracks was laid down and riveted. One month after the suspension span was raised into position the first train passed safely over, and on 3rd December, 1917, the structure was completed and opened for regular traffic. The concreting of the side walks for pedestrian traffic and the painting were completed later.

The building of the Quebec Bridge was a remarkable undertaking in many respects. It is probable that never before has an engineering structure on such a huge scale been carried to completion on the site originally assigned to it after two great disasters, in the first of which the crumpling girders dragged to their death 75 men.

To-day the Quebec Bridge carries the trans-continental line of the Canadian National Railways over the St. Lawrence River, reducing the distance between Halifax and Winnipeg by 200 miles, and stands as a monument to the ability, courage and tenacity of its engineers.

The Buried Comet of Meteor Crater

Search for Lost Meteorite Weighing Ten Million Tons

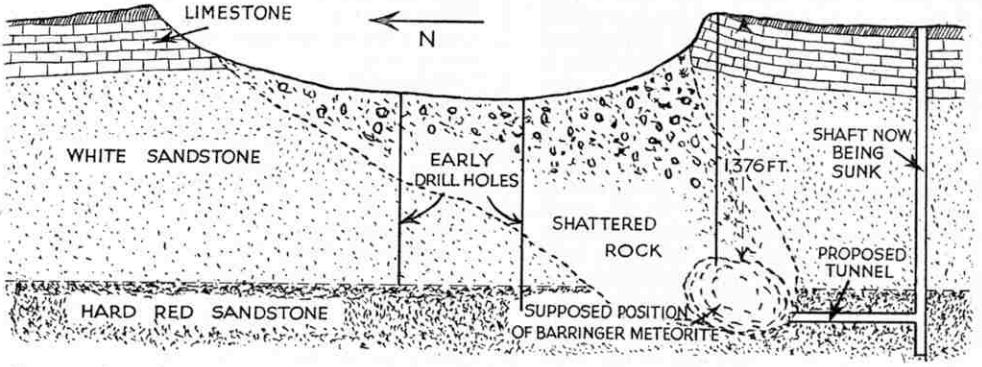


Courtesy] [Scientific American

The crater seen from its southern rim, under which the Barringer meteorite is believed to be buried. This probably weighs 10,000,000 tons and the depression that it made when it struck the earth is more than three-quarters of a mile in diameter.

TO the south-east of the Grand Canyon of Arizona is a huge stretch of country that may be described as a desert. It is famous in American history on account of the fierce warfare carried on there with Apaches and other Indians, who resented the passage along the Santa Fè Trail of the pioneers on their way to the riches of the Pacific Coast. To-day the Indians of Arizona, as well as those of all the western portion of the United States, are subdued and have settled down in peace under the white men who rule the country. The famous Trail has been abandoned in favour of the railroads that cross the state, and the large irrigation schemes that have been carried out ensure an ample supply of water throughout the year in places that formerly were arid and unproductive.

Although the building of huge dams and storage reservoirs has resulted in a great change in the character of certain portions of Arizona, an enormous area of the state remains in its natural condition. In many places the surface rock itself is exposed, and the wonderful colour of the red and purple sandstone thus revealed has earned for these tracts the alluring name of the Painted Desert. Where the rocks in these regions are covered with a layer of soil, this is so thin that very little vegetation flourishes, only sage-brush and stunted cedar trees finding support in it.

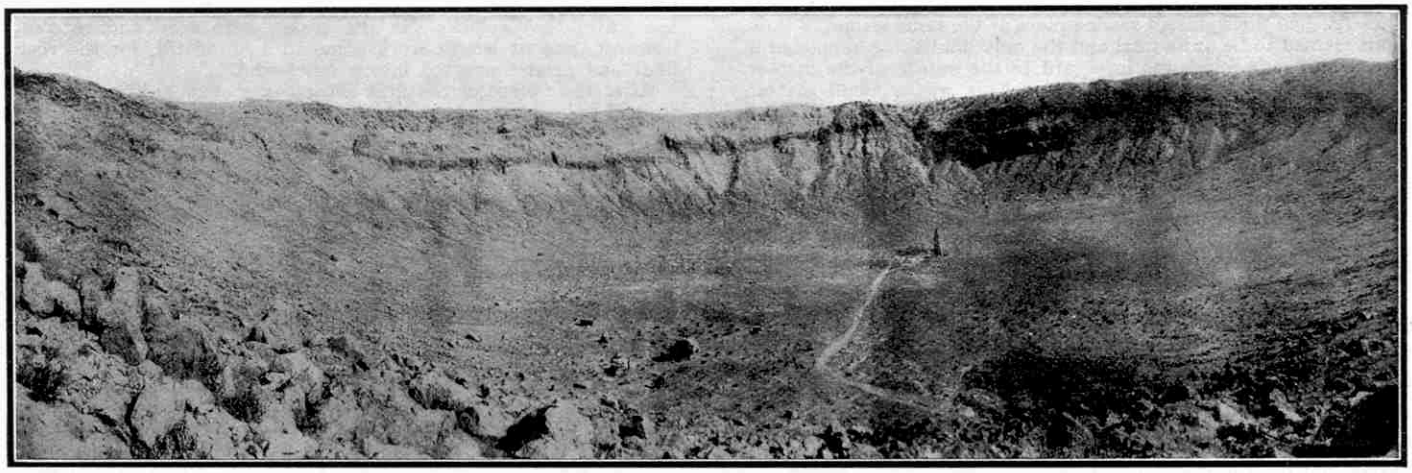


Cross section of Meteor Crater along a line running practically north and south. This shows the probable track of the meteorite and the positions of the holes drilled in successive efforts to reach it.

A great part of northern Arizona has a surface of this character, but in the centre of a monotonous rocky plain and within a few miles of the Trail itself, is a strange hill, formerly called "*Coon Butte*," that in many respects is one of the most interesting on the face of the earth. It is circular and rises about 130 ft. above the surrounding desert. On climbing its sides, composed of rock fragments overlying upturned limestone and sandstone strata, the visitor is astonished to find himself on the rim of an enormous depression. This is completely fenced off from the desert by a circular wall that he had previously mistaken for the sides of a flat topped elevation.

The floor of the depression is 440 ft. below that of the desert. It must have been at a greater depth than this when the great bowl was formed, for weathering of the rocks of the rim has converted the inner sides into steep slopes down which stones and debris have rolled. Borings have proved that in the central portion these have covered the original floor to a depth of about 800 ft. At one time there was a lake in the Butte, and at the bottom of this sediments 90 ft. in thickness were laid down. To-day the interior has the appearance of a huge stadium, or sports field, on which scores of football matches could be played at the same time. Its slopes could accommodate millions of spectators, for it is four-fifths of a mile in diameter.

Nothing exactly like this enormous hole has been found



The floor of Meteor Crater, on which is the derrick built when the first shaft was sunk in the mistaken belief that the meteorite had buried itself in the centre of the crater. Beyond the derrick and to its right is the elevated ridge under which this is now supposed to lie.

elsewhere on the surface of the earth, and the manner in which it was scooped out has been a subject for speculation for more than a generation. The few Indians yet remaining of the thousands that formerly roamed the plains have a tradition that it was made by one of their gods, who descended from the sky in clouds of fire in order to bury himself in that particular spot.

As a rule, legends of this character have very little weight, but, as we shall see, in this instance, it is more than probable that the tradition orally handed down bears some relation to the truth, and even may be a distorted report of the origin of Coon Butte.

When the strange hole was first seen by white men the outward form of it immediately suggested a volcanic origin. It was quite natural to assume that it had been made in this manner, for at one time districts about ten miles away had been the scene of volcanic action, and there are craters of many extinct volcanoes in the San Francisco mountains, 50 miles away. Unfortunately for this suggestion it is quite impossible to find in or near the crater itself any trace of lava or sulphur, the usual accompaniments of an eruption, or indeed of any rocks that have not been laid down in strata as sediments. Thus the existence of the crater cannot be accounted for on any theory of an outburst of lava or even on the supposition that there has been a vast steam explosion from below.

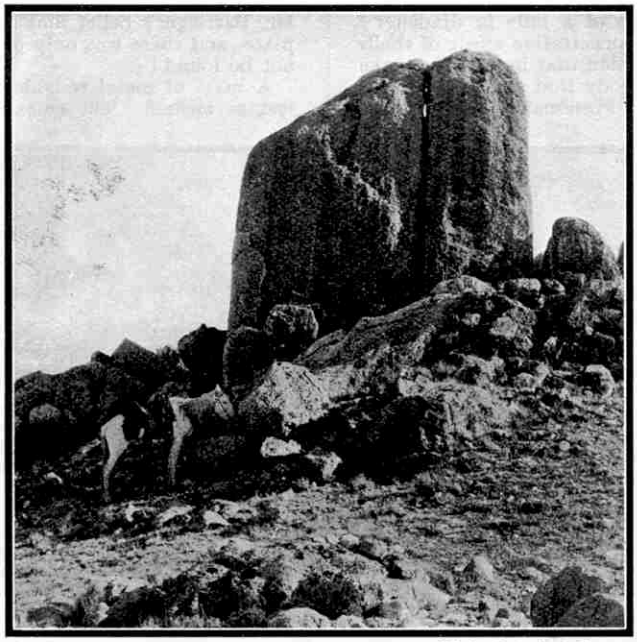


Photo [*U.S. Geological Survey*

A huge block of limestone ejected during the violent disturbance caused by the impact of the meteorite.

For years the manner in which Coon Butte was carved out continued to be a mystery. The solution of the problem was due to the painstaking work of Mr. Daniel Moreau Barringer, a geologist and mining engineer. His interest was aroused by news of the discovery near Coon Butte of small pieces of meteoric iron. It immediately flashed through his mind that in all probability the gigantic hole was the result of a terrific blow from above, and that this could only have been given by an enormous meteor.

After acquiring possession of the crater, Mr. Barringer decided to make a closer examination, a step to which he was impelled by a desire to solve the problem that had baffled scientists, and by the hope that he would find the real cause of the disturbance. The meteoric fragments found near Coon Butte were metallic, and it was almost certain that if the meteor really existed, it was a mass of nickel steel that probably was very valuable.

A camp was established on the rim of the enormous crater, and before many months had passed Mr. Barringer discovered sufficient evidence to prove that his idea was correct. The upper rock layers of the desert are horizontal, but inside the crater they had been broken up as if by a gigantic mass hurled at them with terrific force from outer space. The rock was shattered, fragments of it had been flung in all directions, and a layer or stratum of soft white sandstone had suffered so severely that much of it had been ground into a fine powder that could only be described as rock flour.

Countless thousands of fragments of the sandstone and limestone that here constituted the upper layers of the earth were found outside the crater by Mr. Barringer. Most of these are within a short distance of the rim and it was evident that they came from the interior of the bowl. Mixed intimately with them are pieces of meteoric iron. So numerous are these that more iron meteorites have been collected from the plains surrounding Coon Butte than from the whole of the rest of the earth's surface.

A very important discovery made by Mr. Barringer during his preliminary examination of the crater was that the fragments of rock and iron are so thoroughly mixed together that there is absolutely no doubt that

they reached their present resting place at the same second of time. This seemed to be quite final and the only doubt that remained in Mr. Barringer's mind was in regard to the nature of the meteor, which had collided with the earth. This was a small matter, however, for if the body that had crashed were not actually a single huge meteor, which from the evidence seemed most improbable, it must have been a swarm or cluster of meteorites that were more or less closely packed together.

The extent of the breakage and the size of the hole show that, whatever its form, it was no ordinary visitor from space that ended its fiery career on the plains of Northern Arizona, for no similar body has been known to penetrate more than 11 ft. into the ground. As many as 30,000,000 meteorites fall daily on the earth, but most of them are only tiny fragments, the survivals of fireworks in the sky, and they quickly become lost in the water or dust into which they fall.

The largest single meteorite yet seen was discovered in 1929 near Grootfontein, in South West Africa. It is 10 ft. square, 4 ft. in thickness, and weighs about 70 tons. When it struck the earth the impact must have been terrific—but the hole it made in the limestone upon which it fell is less than five feet in depth! What must have been the size of the meteor that made a hole a hundred times as deep and four-fifths of a mile in diameter?

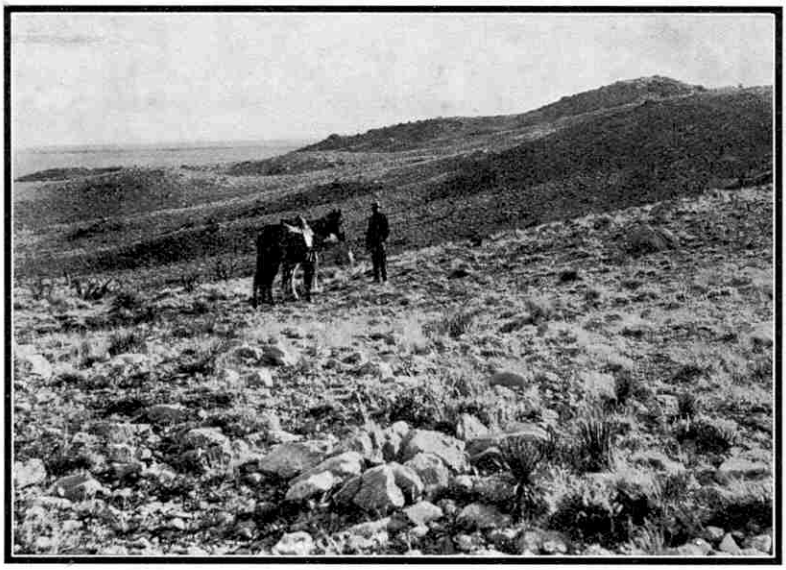
The experts who make trials of the penetrative effect of shells from big guns have come to the conclusion that in order to make a hole of the size of Coon Butte, the body that struck the earth must weigh about 10,000,000 tons. Presumably this remains buried somewhere underneath the Butte. For this reason the depression is now called "Meteor Crater," and in honour of its discoverer the gigantic missile, which can be nothing less than the head of a comet, has been named the "Barringer Meteorite."

The mass of nickel steel weighing millions of tons must be of great value, for besides its nickel content it probably contains an equal value per ton of the rare metals platinum and iridium. If the Barringer Meteorite resembles that found at Grootfontein it is ideal material from which to make armour plating, for the South African meteorite contains 6% of nickel, and is so tough that a visitor spent two hours and spoilt a dozen hacksaw blades in cutting off a piece as large as a matchbox.

After satisfying themselves that a meteor was responsible for the crater, Mr. Barringer and his friends set to work to dig their way down to the valuable mass of metal. How far it had buried itself was unknown, but it seemed unlikely that it had penetrated to a depth of more than 1,400 ft., for at that level is a bed of hard red sandstone of which no fragments appear to have been thrown out over the surface of the plain. Thus recovery of the valuable metal did not appear to be a very difficult task.

Plant was established in the centre of the crater and the work of sinking a vertical shaft was begun. Difficulties caused by the water that collected in the crater were soon encountered, however, and at length work came to a standstill, for the rock flour had been converted into a quicksand.

After the failure of the first effort the meteor hunters decided to drill holes at various points within the crater in order to find the position of their quarry and the best place in which to sink a shaft. Altogether 29 holes were drilled, with very interesting results. For a considerable depth the drills passed through broken fragments of rock mixed with pieces of meteoric iron. During their progress they brought up sandstone that practically had been fused into a glass, and similar rock that had been crushed into shaly layers by a pressure wave.

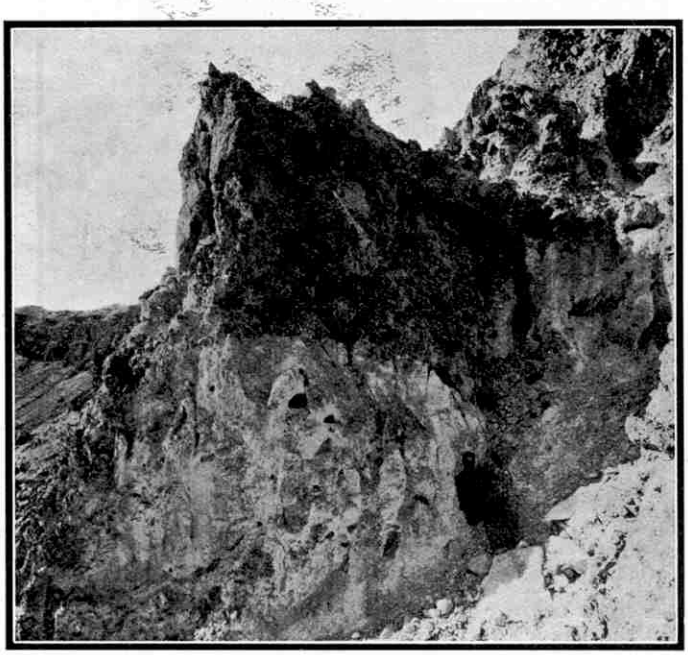


The outer slopes of the crater are covered with stones and boulders thrown out during the disturbance, and enormous numbers of meteoritic fragments have been discovered in the immediate neighbourhood.

The glassy sandstone is particularly interesting, for it proves that at one time the temperature at the place where it is found had been sufficiently high to melt the sandstone. Apparently this was moist when it was fused. The sudden rise in temperature turned the water into steam, and this formed in bubbles in the molten mass. The result is that the glassy sandstone has the appearance characteristic of pumice stone and actually floats on water as easily as a piece of cork!

These interesting discoveries were quite satisfactory up to a point. They confirmed Mr. Barringer's belief that a meteor had struck the earth at this place, and there was only one drawback—the meteor itself could not be found!

A mass of metal weighing millions of tons is not very easily lost or mislaid. The clues to its existence were very real and definite, and in spite of natural disappointment, Mr. Barringer remained convinced that somewhere within the bowels of the earth was concealed the formidable mass of nickel steel that he had hoped to find beneath the debris in the floor of the crater.



Photos] *[U.S. Geological Survey*

Shattered limestone on the inner rim of the crater.

The key to the mystery of the missing meteor was discovered accidentally a little later. Naturally Mr. Barringer had been interested in the manner in which the crater had been formed under the impact of the meteor, and in many instances he had succeeded in making similar holes by firing bullets into mud. One day he noticed that a hole made by a bullet travelling at high speed when striking the earth at an angle is practically as round as that made when one is fired vertically downward. This set up a new train of thought in his mind. In previous attempts to trace the course of the meteor it had been assumed from the shape of the hole that the white hot visitor had plunged vertically into the earth. It now occurred to Mr. Barringer that the lost mass of nickel steel probably had approached the surface at an angle. If this were the case it would be found, not under the centre of the crater, where they had been looking for it, but beneath the rim on the opposite side to that on which it has entered.

Immediately a new examination was made of the rim of the crater in order to find if the disposition of the rock layers was in

accordance with this new idea, and Mr. Barringer was delighted to find that this was the case. On the northern side the horizontal layers of limestone were only slightly disturbed, and few boulders had been scattered on the plain outside the rim, while on the east and west the rock had been tilted and shattered, and fragments hurled out in great profusion. On the southern side the amount of material thrown out was greater than anywhere else and a section of the rim had actually been lifted to a height that is nearly 100 feet above the position it originally occupied.

From this it appeared that the meteor had approached from the north. This immediately suggested that it had buried itself under the southern rim and that the strata above its final resting place had been heaved bodily upward when it had crashed into the rock beneath them.

A walk round the crater gave other proofs that the mystery of the lost meteor had been solved. On passing round the basin from its northern edge in a southerly direction, it was found that the rock layers became tilted, and as the explorers moved further away from their starting point the angle of tilt continuously increased. The climax was reached about two-thirds of the way round to the southern edge. There the strata were actually vertical. This was only to be expected. On first striking the earth the meteorite would merely graze the surface and the greatest disturbance would be caused at the place further south where it was completely enveloped in the earth.

Chiefly because of lack of funds it was impossible to take any steps to put the new idea to the test until 1920, when further subterranean explorations were commenced. A hole was drilled on the southern rim at a point nearly in the centre of the great ridge or arch that had been formed by the upheaval of the rock when the meteor had made room for itself beneath. This bore had reached a depth of 1,376 ft. when the drill became permanently stuck, and once more investigations temporarily came to an end.

Before this happened enough had been learned to show that the meteor probably had been found. From a depth of about 1,200 ft. the drill brought up broken and shattered sandstone mixed with fragments of meteoric iron. As the hole became deeper the proportion of the latter increased rapidly, and immediately before further drilling became impossible three-quarters of the material brought up was oxidised iron of meteoric origin. A small quantity of this could not possibly have penetrated the earth to a depth of nearly a quarter of a mile, and the iron can only have reached such a position as part of a mass of enormous size. Thus the abandoned drill is almost certainly in contact with the Barringer Meteorite itself.

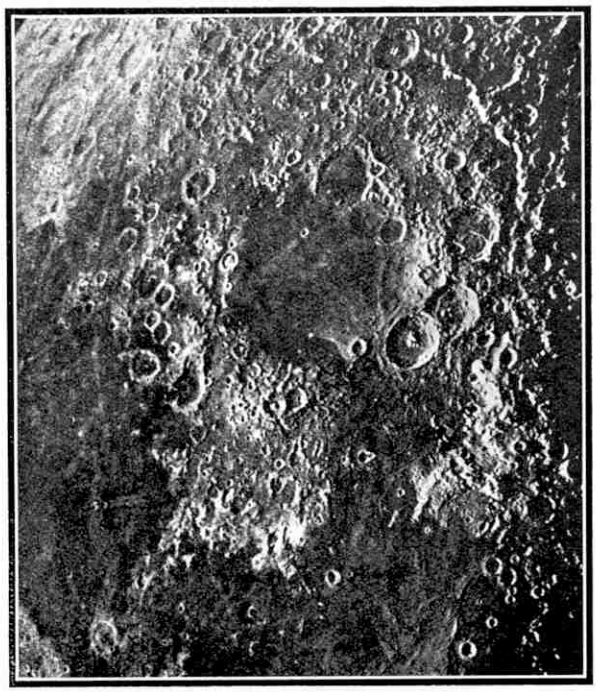
A new company is now attempting to reach the meteor by a different method. To sink a shaft at the point where Mr. Barringer made his last drill hole would be troublesome and costly, for it would have to be made in badly broken rock. For this reason it was decided to begin a little more than 1,000 ft. to the south of this point. The intention was to carry the shaft to the depth at which the meteor is supposed to lie, and from the bottom of the shaft to drive a tunnel northward to the mass of metal.

Work on the new scheme was commenced during 1928. Until the shaft reached a depth of about 650 ft. everything proceeded satisfactorily. Then an inrush of water and fine sand was encountered, with which the pumps were unable to deal. This was an unexpected difficulty. Northern Arizona is a desert and therefore the pumps installed were designed for removing a limited quantity of water. The explanation of the presence of a larger amount is that the crater has acted as a catchment area, and the water impounded over long periods of time has accumulated in the underlying rocks.

In the hope of preventing a further inrush of water into the shaft this is to be dealt with in a manner that previously has proved successful when boring through water-logged strata. From the bottom of the shaft holes will be driven downward at an angle into the surrounding rock and into them fluid concrete will be forced under high pressure. It is expected that this will spread through the rock and on setting will provide a barrier through which water cannot penetrate into the shaft workings.

Thus there now seems a reasonable prospect that after resting in the earth for centuries, the gigantic meteor again will see the light. Exactly how long it has lain beneath the southern rim of the basin is unknown. Meteor Crater is certainly more than 700 years old, for on its edge has been found a cedar tree with annual growth rings indicating that age. It is unlikely that it was made more than 5,000 years ago, or the broken fragments of limestone would have shown greater traces of chemical erosion. In all probability it is between one and two thousand years since the Barringer Meteorite flashed through the sky to bury itself to a depth of more than 1,000 ft., and to frighten by a celestial firework display the Indians whose descendants tell the story in their legends.

Fortunately such a startling event as the descent on the earth of a mass of metal weighing millions of tons is rare. The only occasion when anything of the kind is known definitely to have occurred was in 1908, when a swarm of enormous meteors fell upon the forest region in Northern Siberia. There an area several miles in diameter appears to have gone through a tremendous bombardment, millions of trees having been killed and enormous craters made in the earth. The effects of the disturbance were felt 400 miles away. Railwaymen at that distance heard a roaring sound and felt the air wave that spread out from the place where the meteor struck the earth.



A portion of the surface of the Moon. About 30,000 craters are visible on the face of our satellite that is presented to us, and it is believed that these were made in the same manner as Meteor Crater.

In all probability something of this kind happened in Arizona rather more than 1,000 years ago, practically the only difference being that in the case of Meteor Crater the falling body either was a single meteor or a very compact cluster, while a number of meteors more widely separated were responsible for the Siberian disturbance.

Possibly many craters similar to that explored by Mr. Barringer have been made on the face of the earth during the millions of years of its existence. But none of these is traceable to-day, for immediately after their formation rain, frost and wind have begun their erosive work and have effectually wiped out all traces of their existence. Similar craters have been well-known for many years, however, for the thousands of wide and shallow depressions on the surface of the Moon resemble Meteor Crater so closely that there seems to be little doubt that they were made in a similar manner. They have the same uplifted rim made higher by material ejected from the crater at the moment of the impact. Extending outward are radiant streaks that are similar in appearance to the spurts of "rock flour" seen at Meteor Crater. In many instances it appears that the greater part of this has been thrown in one direction, this clearly suggesting the line of approach of the body that caused the formation of the crater.

One curious feature of many of the craters to be seen on the Moon is the existence of a small central hill. This has been thought to be suggestive of volcanic action. It is scarcely likely that these are the summits of giant volcanoes of former ages, however, for on the Moon there is no water to form the steam that plays such a great part in eruptions on earth, and in every case the central hill appears far too small to have been the active cone within a volcanic crater.

Fortunately, a more reasonable explanation of their existence may be given. If the fall of a stone into a liquid is closely observed it is found that the first effect is to produce a slight depression that spreads out in ripple form over the surface. As the ripple moves outward the liquid in the centre of the disturbance surges upward to form a hill. This, of course, immediately collapses, but in the case of the impact of an enormous mass, such as a giant meteorite, on rock, the material struck would be pulverised to such a fine powder that immediately after the impact it would flow like liquid. Unlike this, however, it would retain its new shape more effectively, and the existence of these small central hills strongly suggests that the Moon's craters have been formed by the bombardment of the surface by meteorites. The craters on the Moon remain, while those on the earth have disappeared, simply because on our satellite there is no water and no atmosphere to wear them down to the level of the surrounding plain. *Continued on page 196*

XL.—AN ACTOR

ALTHOUGH the drama is one of the oldest of the arts, acting as it is known to-day is of comparatively recent origin.

In this country the stage first came into prominence in Shakespeare's time, and scenic arrangements were then very crude, changes often being notified merely by showing a card on which details of the scenes were given.

To-day there are many first-class dramatists and actors, and the standard of both plays and acting is as high as ever it has been in the history of the stage. Never before have there been so many competitive forms of amusement, however, and in consequence the number of theatres in the country tends to decrease. The cinema is, of course, the greatest competitor of the stage, for its range is much wider, and on the screen producers are able to send their characters all over the world without difficulty, which is mechanically impossible on the stage. On the other hand, the screen has opened up to a certain extent a new sphere to actors, particularly since the talking film has made a good voice and delivery necessary.

The competition of rival forms of amusement makes the stage probably the most precarious of the artistic professions. There are no organised methods of securing qualifications and appointments such as those that exist in medicine, accountancy, the law, and many other professions. In this respect conditions are much better on the Continent, for in both France and Germany a recognised training is practically essential, and the stage is looked on as a definite profession, which can hardly be said to be the case in England. It must be emphasized at the outset that the career of the actor is highly uncertain, and cannot be advised as a normal means of earning a living. If a boy has obviously outstanding ability the outlook is better, but in any case the profession should not be entered without long and careful consideration unless a boy has some private means that will tide him over bad times. This warning applies even more strongly to girls than to boys, as the opportunities are fewer on account of the much larger number of girl aspirants.

A would-be actor finds on finishing his training that there is no recognised method of obtaining an appointment. He has not had any experience, for he does not really "act" until he obtains his first part, and there is all the difference in the world between acting on an amateur or dramatic school stage and on the professional stage. All he can do to obtain work is to "worry" managers or theatrical agents, or to insert his "card" in one of the stage papers such as the "*Era*," or the "*Stage*," or on Thursdays in the "*Daily Telegraph*." Even if he is successful in securing an engagement his troubles are by no means over, for it is impossible to tell how long it will last. After rehearsing for many weeks, or even months, a play may only have a "run" for a few days; while if a young man joins a touring company he may find that the tour comes to an abrupt end after a fortnight. In such cases he has to start all over again in his weary search for employment.

Probably the greater part of an actor's time is spent in rehearsing, and it must be borne in mind that as a rule no wages are paid for rehearsals, except in the cases of actors who are to receive less than £10 per week during the actual run of the play for which they are preparing. In a year an actor may consider himself extremely fortunate if he is employed for 26 weeks, even when he is well known and in fairly good demand. Mr. William Armstrong, M.A., manager and producer of the Liverpool Repertory Theatre, to whom we are indebted for valuable assistance in the preparation of this article, confesses that before he took up his present position he considered himself lucky if his earnings in one year amounted to £250, although he was recognised to be a successful London actor.

Sir John Martin Harvey is one of the most prominent present-day actors. He intended to take up a career in naval architecture and received training for this profession, but his interest in the stage was so great that he eventually decided to become an actor. He was successful from the first, and rapidly established a great reputation, first as an actor and later as an actor manager. Sir John's most popular success was in "The Only Way," but he has achieved his greatest triumphs in Shakespearean plays. He was knighted in 1921.

In far too many cases people take up acting for the fun of the thing. Apart from the joy of acting, which every real actor experiences, there is little or no fun. The stage demands incessant work and even drudgery; hours of rehearsals in cold and draughty theatres; work in artificial light and no fresh air; and weeks and years of waiting for a chance that may never come. That is what the theatre demands from all who enter it, and in the end it gives most people in return a yearly income that would disgust the average business man.

There are, of course, brighter aspects. Actors will always be wanted, and there will always be big salaries paid to the fortunate few. The boy who has the love of acting in his blood will go on the stage, no matter what hardships he encounters, or how many people try to disillusion him, and it is for boys such as these that this article is intended.

If a boy wishes to become an actor there are certain qualifications that he must possess—great endurance, good looks, a good appearance and physique, and the ability to talk good English. He must also be capable of taking ups and downs, heartbreaks and rebuffs in a philosophical manner.

The best possible course that a would-be actor can adopt is to enter the Royal Academy of Dramatic Art in Gower Street, London, in order to undergo a thorough training in acting. If he is unable to adopt this course he should obtain admittance to one of the many smaller schools of dramatic art to be found in various parts of the country. The most famous of these probably is the school in connection with the "Old Vic," the famous repertory theatre in Waterloo Road, London, but there is a long waiting list here and it is very difficult to secure admission. Courses are arranged also by the Royal Academy of Music and the Royal College of Music.

Another method of taking up a stage career is to become a student with one of the repertory companies, but the number of openings of this kind is very limited. One great disadvantage of

this method is that most of the producers are extremely busy men and there is no recognised means of training for students following this course. Those who are keen and ambitious find such work valuable, however, on account of the great variety of experience they may gain, particularly if they are fortunate enough to be entrusted with small parts, and because of the contact with recognised masters of all branches of production and acting that is afforded them.

Still another plan is for a boy to take up some other career as a means of livelihood, and in his spare time to join a really good amateur theatrical society, if possible also attending classes in elocution at some school of dramatic art. If a boy becomes successful in this sphere he may decide to become a professional, and then his best plan is to "worry" producers and agents with a view to obtaining employment. Sometimes producers of theatrical companies can be induced to attend an amateur show in order to see a particular promising member, but cases such as these are extremely rare.

A class in Diction in progress at the Royal Academy of Dramatic Art. For permission to reproduce the photographs on this page we are indebted to Mr. Kenneth R. Barnes, Secretary to the Academy.

The courses provided by the various colleges of dramatic art differ in slight particulars, but are all very similar in general respects. The best of these is that organised by the Royal Academy of Dramatic Art. The Academy was founded in 1904 by the late Sir Herbert Beerbohm Tree, and is not conducted for profit. The objects of the Academy are to "advance the Art of the Drama by means of giving instruction in, and promoting the study, practice and knowledge of, dramatic literature and acting in all its branches; and to promote and supervise such instruction as might be thought most conducive to the cultivation of the Art of the Drama." The classes are conducted by professional actors and actresses, and a decided advantage of taking a course here is that very often dramatists and theatrical managers attend the plays given by the students. Once a year the students of the Academy give a public performance in a West End theatre, and in this way not only is valuable experience gained, but appointments also are sometimes secured.

Students of the Royal Academy of Dramatic Art rehearsing a play with a producer. The acting and producing of plays forms an important section of the syllabus of the Royal Academy.

All students wishing to obtain admission to the Academy are required to pass an entrance test, the fee for which is one guinea. The examination consists of the recitation of one of several passages chosen by the authorities, and of a second short recitation chosen by the candidate. The students of the Academy are classified into five divisions according to their progress. The ordinary course consists of from four to six terms, but students are promoted from one class, or division, to another, not merely according to the time they have been in the Academy, but also according to their progress. It is the object of the management to give students as far as possible the work that is most likely to develop their talent, and to encourage those who show sufficient talent and discourage those who do not. The inclusive tuition fees are 16 guineas per term, and therefore the total cost of a course should be a little more than £100, not including the cost of living. There is no hostel in connection with the Academy.

During the time that is spent at the Academy, tuition is given in a large number of subjects. These include voice production, speech, phonetics and the broadcasting of plays; acting and the rehearsal of plays under the direct control of the professors of Acting and Diction, and dancing, deportment and fencing. Some readers may be surprised to discover that lessons in fencing are given. This exercise is of great importance in deportment, and a knowledge of the art is also very useful when taking part in costume plays and may, in fact, make all the difference between receiving a part or continuing out of work. During the course lectures are given on English poetics, the history of the drama, the history of theatrical representation, and French dramatic literature. The B.B.C. have installed a complete broadcasting apparatus, and this enables practical training in the technique of speaking dramatic dialogue before the microphone to be gained by the senior students. The B.B.C. give prizes of £10 each year to the three students who are successful at special broadcasting tests.

A diploma in dramatic art is obtainable at the University of London, and the Senate of the University have recognised the Academy as a training centre for this diploma, the object of which is to testify that the holder has successfully undergone a course in training in dramatic art, with special reference to speech and movement, together with a literary and scientific study appropriate to such a training. The course of study for the diploma extends over at least two years and is open to students who are not less than 17 years of age.

There are various scholarships awarded in connection with the Academy. Among the most important of these are the two London County Council Scholarships, awarded every year, each tenable for two years during which time free training is provided. These scholarships are open only to London residents. No restrictions of this kind are connected with the six Leverhulme Scholarships awarded every year, which provide free training for two years, and a maintenance grant of £2-10s. per week during the actual weeks of training. Full particulars of these and other scholarships, and of the courses available at the Academy can be obtained on application to the principal, Royal Academy of Dramatic Art, 62, Gower Street, London, W.C.1.

A typical example of the courses organised by other colleges is that conducted by the Royal Academy of Music. This course is entitled "The Art of Speech" and is three years in duration. During the first year the principal subjects of study are voice production and speech, and stage movements, and the practical classes are supplemented by lectures dealing with various aspects of the voice and language, English literature and prosody and phonetics. During the second and third years the principal subject is the same as in the first year, but second-year students are given an opportunity to join either a dramatic class or a class in dramatic deportment. During this year there are lectures on the general history of drama and the stage, in addition to studies of famous dramatists of all ages.

Third year students are allowed to choose between attending fencing and dramatic deportment classes, as a second study. The lectures during this year deal, in the first term, with acoustics, reverberation, resonance, physiology

(Continued on page 196)

Old Man Gorilla

Thrills in a Central African Forest

By Commander Attilio Gatti

IT is the hushed hour before dawn. A huge, hairy creature, darker than the still lingering shadows, pushes aside the entanglement of lianas and other vines which he has arranged into a shelter the night before to protect his sleep and the sleep of his family. A monstrous head emerges. Two piercing eyes glitter in the half light as the creature rapidly scrutinises his surroundings. Silent in the silence, shadow in the shadows, he walks slowly down to the edge of a little forest pool and gazes up at the sky where the advance guards of the sun already have begun to sweep back the velvety black curtain of the African night.

He stands brooding, motionless. Then, just as the tip of the majestic golden ball appears above the distant horizon, the monster standing by the pool breaks forth in a cry of utter woe —a great cry of spine-chilling, almost human pain.

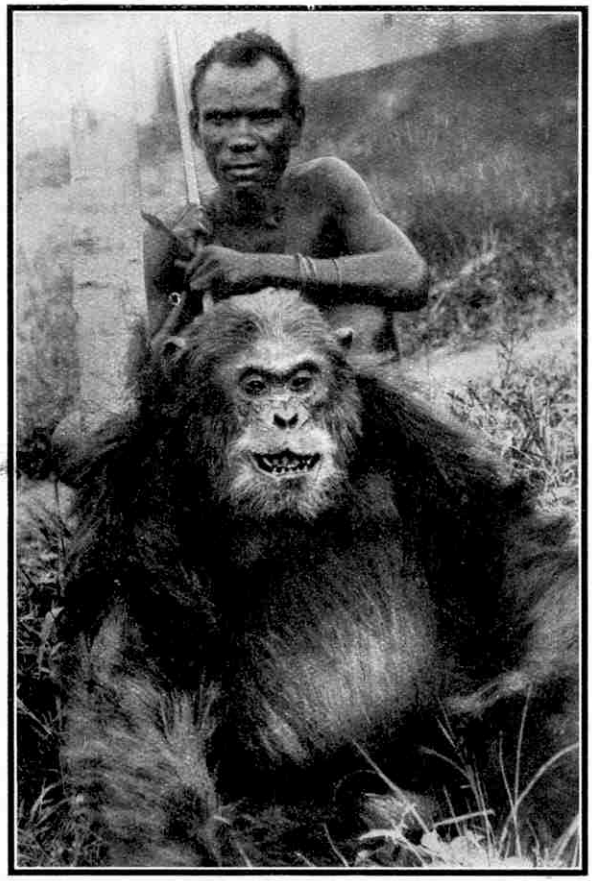
He is the most powerful male and the undisputed chief of the numerous gorilla families living in this corner of the forest. Old Man Gorilla at the height of his development and the fullest vigour of his strength—a formidable vision!

Standing alone in his domain, he beats his breast with his enormous man-like hand and once more lifts that cry of bewildered yearning—a primordial hymn to the African sun. And this he does each morning just at the moment when the sun returns to the world he knows.

The cry of the ape spreads in every direction under the thick green dome of the forest, which extends for hundreds of miles, threatening, mysterious and savagely primitive. It is an unknown world, this forest, which seems to have existed unchanged from the earliest prehistoric epochs. Through the dense vegetal entanglement oppressed by the wet, warm atmosphere of this cyclopic greenhouse, the cry echoes until it reaches a spot where the forest ends abruptly in a bare, undulated plain. Here in their poor huts some small, miserable human beings rouse from their sleep, listen with religious solemnity and whisper, "*Ngagi*"—"the one who ends the night."

The Mambuti Pygmies, who live on the fringe of the Tchibinda Forest, attribute the sunrise to the appeal of the gorilla. These diminutive creatures seem to be morally and physically kneaded together with the most contradictory qualities and faults. Their childish minds are filled with silly prejudices, ridiculous superstitions and deepest ignorance. But about the gorilla their knowledge is extraordinary, and even those stories which I was at first inclined to regard as wild tales were proved later by personal experience to be the truth. They know everything that is to be known about the life, habits and customs of *ngagi*. They keep track of the birth, sicknesses and history of almost every individual ape in their part of the forest, calling each one by an individual name and identifying every gorilla as easily and unfailingly as you or I would recognise a person with whom we are acquainted.

Small in stature and armed only with rudimentary spears, for immemorial ages until the arrival of the white people in this country, these Pygmies have been the most intrepid hunters of the largest African apes. But for no reason in the world would they dare to pass a night in the forest, or to build their huts within its boundaries. They live near the forest, they enter it in the day time, they love it and fear it, feeling, much more than thinking, that it is a great mother always ready generously to give them poles for their huts, wood for their fires, fibre for their scanty clothing, wild roots and fruit for their nourishment. But this mother must be approached cautiously with timorous respect, for at the smallest offence she will unchain on her miserable sons the most tremendous punishments. She can dispense terrific storms, the fury of *ngagi*, and hundreds of unknown misfortunes, this mother.



Gorilla killed by Commander Gatti for presentation to the Witwatersrand University.

During my last expedition in Africa I spent several months in the Tchibinda Forest studying the life of the gorilla. This mountainous jungle lies south-west of Lake Kivu, half a degree south of the Equator. It can be said to be literally in the heart of Africa, for it is situated half way between the Atlantic and the Indian Oceans on the west and east and between Capetown and Cairo. It is the centre of a country that has been occupied by whites only since the World War, and it is so vast and impenetrable that for the most part it is still unexplored.

Dead trees, lianas, branches and bushes are woven together, interpenetrating each other and forming one compact mass through which it seems impossible to force a passage. Under that thick green mantle everything disappears, hills and valleys, pools and streams; and all the known dangers and thousands of unknown ones seem to be waiting in ambush for you. Everything in Nature seems hostile and menacing within the forest. Thorny branches grasp your clothes and your skin as though consciously determined to stop your progress. Giant nettles of every variety stroke you with a treacherous caress as if to whisper to you to go no farther. Often it is necessary to proceed on all fours, hugging the ground in order to pass under entanglements of lianas too big or too thick to be cut. Sometimes you find yourself walking several feet above the ground on an insidious mattress of branches and moss into which, now and then, you sink knee-deep. Or you may disappear suddenly into an invisible hole like a trap.

No breeze can penetrate the thick vegetal curtain. The air is rarefied from the 6,000 feet of altitude, but at the same time the steaming breath of the jungle makes the atmosphere heavy and humid. This, together with the desperate effort demanded by every single step, cuts the breath, makes the heart pound and the ears roar.

For months, day after day, I had fought my way through the forest, accompanied by Kasciula, the Sultani of the Mambuti Pygmies, and a group of his wisest subjects. I trusted fully in Kasciula's sense of orientation and his hunting instinct, and every day they proved more and more infallible. I had all I could do to keep up with his small legs, so deceptively weak in appearance and so elastic and untiring in fact. Every day we followed from a distance the same herd of gorillas, trying to keep off the scent and not to reveal our presence in any way, so that we could peep through the curtain of the jungle and see how Old Man Gorilla comports himself when he thinks he is unobserved.

At sundown we returned to our camp on the edge of the forest. Every night I arrived at camp virtually broken, finished; face, arms and knees bleeding, often drenched to the bone from some sudden rainstorm. After a quick dinner I fell down in a heavy sleep. But in the morning, when the echo of the old gorilla's

call drifted out from the forest, I jumped up, keen to begin the new day's adventure.

Some hours later Kasciula, as certain as fate, would be sure to lead me to the shelter in which the gorilla family had passed the night. Normally the gorilla builds his shelter under a big tree. He clears away the underbrush from the ground and makes himself a comfortable mattress of leaves, branches and moss. Then he arranges the lianas that hang down from the tree into a sort of curtain all around his shelter, so that he will have a little privacy. Kasciula would examine the impress, still warm, left by the huge bodies, and tell me the name and disposition of each member of the family. Soon, however, the acrid odour left by the animals drove us out and at once we were on the trail, with a new thrill and a new and fascinating spectacle offered each day to my avid eyes.

The "N'tembo," the pygmy elephants of the forest.

Once it was a placid, patriarchal scene. In a small clearing the old gorilla sat on his haunches, leaning his back comfortably against a tree and taking a little nap. Head bowed on his huge chest, long, powerful arms relaxed, his enormous belly covering his short legs, he looked for all the world like some fat and gluttonous old man dozing in the midst of his family. Near by a half-grown male seemed to be doing his "daily dozen." He would climb swiftly up a liana, swing back and forth vigorously, slide down to the ground and then repeat the performance, all in a very serious and determined fashion. Two mature females were seated near each other, apparently exchanging the day's gossip. At least, although I was too far away to hear any sounds, I could see their monstrous mouths moving, while now and then one of them gestured in the air with her long arms. Another female was carefully selecting stalks of wild celery, peeling off the outer covering and eating the tender centre of the stalk. Near her was a youngster, perhaps a year old. He was jumping on her back, crawling under her belly, snatching from her hands her carefully peeled celery. At last the mother got fed up with his naughtiness and gave him such a smack that he tumbled over four or five times. I could hear him howl.

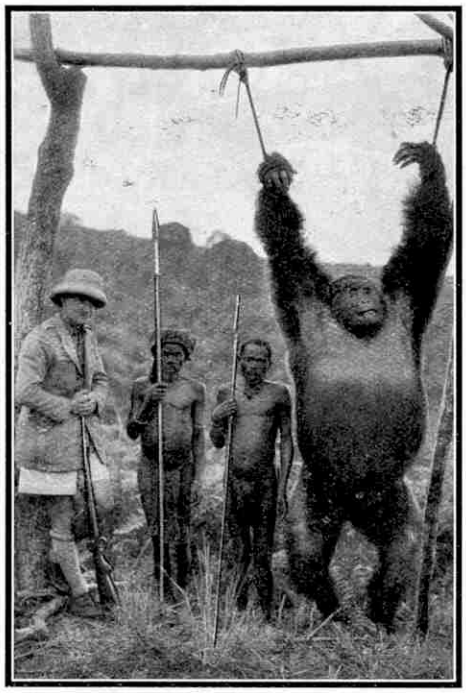
Another time we came upon the old gorilla standing on the top of a hill somewhat cleared of vegetation. He was making a strange sound. As he uttered his call he beat himself rapidly under the chin with his right hand so that his teeth clicked and a thin silvery trill resulted. It must have been some sort of a signal, for from every direction other gorillas silently approached until more than a score were gathered around him. We wanted to get a little closer to the scene and tried to advance with every possible caution against noise, but they must have sensed our presence, for they immediately disappeared, probably not liking to have their secret conference interrupted.

My most sensational encounter with *ngagi*, from my point of view, was my first one. I had been in the forest only a few days and was laboriously plodding through the undergrowth when, without warning from the Mambutis, I received the shock of my life, which brought me up short, nerves tensed, rifle ready, and all my strength concentrated in my eyes and ears. A few yards from me a superhuman howl had shattered the silence—a monstrous howl of fury such as I had never heard before and which I shall never forget. The howl was answered instantly by eight or ten others coming from different directions, and from a near enough distance to me to make it interesting, to say the least. Not a sound of another character, and not a movement of a leaf to indicate the position of the animals hidden in the thick green undergrowth. Complete silence followed, which seemed to me to last an eternity. Then a stick cracked very near, then others here and there, and the herd went away, creating in the passage of their heavy bodies through the leaves the illusion of a waterfall.

After that we were much more careful, trying to get as close as possible to the herd, but to avoid running into them by surprise. When he discovered our presence the chief of the herd always followed the same tactics. He would give a sort of grunt, always with exactly the same intonation, and as at an order the females and the young ones would quickly retreat, while the old man would stand rigidly, staring at us defiantly. This tableau would last a few seconds, then the patriarch would turn and walk slowly away, looking back over his shoulder at us several times before he disappeared.

One day during a short halt in the forest I was looking curiously at the bags of woven grass that the Pygmies wear tied bandolier fashion across their chests. These bags are their only pockets, and their precious safes in which they carry all their wealth. When I came to the bag of Katumbele, the Pygmy witch doctor who always accompanied us, I dumped out the usual mixture of boiled beans, fresh roots, pestilentially smelling pieces of dried meat, a roughly carved pipe, an empty sardine tin, bits of broken glass and other rubbish collected around our camp. Finally I discovered a number of small parcels carefully wrapped in fibre, which contained the assorted tools of the witch doctor's craft.

With exclamations of admiration, which made Katumbele proud and happy, I unwrapped nails and pieces of skin of leopards, elephant hair, herbs for magic concoctions, pieces of carved wood and so on. Then at the bottom of the bag I found a big surprise. I came upon a piece of skin about the size of my hand, covered with the thick hair that only the gorilla has. But instead of being black, the hair was red. Completely astonished, I asked Katumbele for some explanation; but I could not get a word out of him, nor from any of the other Pygmies. And so I began a campaign to win Katumbele's confidence. After several days, during which I had made him such extraordinary presents as a small bag of salt, a broken table knife and one of my old shirts, he told me secretly the history of that piece of red-haired skin.



Another gorilla shot by Commander Gatti, who is seen with two of his Nambuti Pygmy hunters. The enormous chest and arms of the gorilla are strikingly shown.

When his father was young and strong, and the biggest hunter of all the Pygmies, so Katumbele told me, he penetrated deep into the forest with some of his most intrepid companions. For days they walked towards the west, where never a white man has gone, and where not even the Pygmies have ventured before or since. One day they saw an amazing sight. A family of gorillas was feeding in a small thicket of young bamboos. They were immense creatures, much larger, stronger and more ferocious-looking than any the Pygmies had ever seen, but the astonishing thing was their hair. It was of a brilliant red colour.

The Pygmies decided to kill one of these gorillas, and each brought back a piece of the skin, the possession of which entitled him to become a witch doctor. When Katumbele's father died he bequeathed to his son the piece of skin, by virtue of which Katumbele also became a witch doctor.

My first thought was that the red gorilla must have been merely an abnormal individual, something like an albino. On the other hand, I had to admit that there was nothing impossible or unbelievable in the existence of a

(Continued on page 196)

African Air Mail News

The special chartering of aircraft for exploring and hunting is considerably on the increase in Africa, and many big game hunters now employ aeroplanes as a regular means of transport when they wish to carry out expeditions to places hundreds of miles away. Another development that the use of aircraft has rendered possible is the establishment of new camps for hunting and wild life study in parts served by air stations such as Juba and Kampala. Communication between these camps and the air stations could be maintained regularly by aeroplane.

Ground facilities play a vital part in the development of African aviation. Reports now indicate that new landing grounds are available for use between Salisbury and the Zambesi, and that working parties are busy on other ground and aerodrome improvements south of Bulawayo. This development work is being carried out under the Beit Trust scheme, by which £50,000 is being expended on improving air communication in Africa.

In Rhodesia the provision of new landing grounds will, it is hoped, enable a scheme to be adopted whereby mails will be delivered by air to townships and villages not served by railway. Light aeroplanes will fly to and from these places from the main routes.

Statistics now available show there has recently been an increase of more than 50 per cent. in traffic on the African air mail service. One of the important factors that has contributed to this growth is the regularity of the service, for on the northern section of the Cairo-Capetown route 99 per cent. of the flights were completed to schedule time, while in the south the figure was 100 per cent.

This photograph of the Imperial Airways air liner "Heracles" secured first prize in the "B" section of the September Photographic Contest, for W. R. Peacock, Cheltenham.

Flight Over The Himalayas

A remarkable flight over the Himalayas has been carried out by five Hawker "Hart" biplanes, fitted with Rolls-Royce "Kestrel 1B" engines, of No. 39 (Bomber) Squadron, R.A.F. The five machines flew from Rasalpur up the Indus Valley to Chilas and Gilgit, and from Gilgit they made two demonstration flights up the Hunza Valley. They followed the course of the Hunza River up to Mount Rakapushi, which is 25,550 ft. in height and only about 3,500 ft. lower than Everest.

This flight was made all the more remarkable by the fact that the machines used were standard service types employing unsupercharged engines of 480 h.p. and carrying full service load and a crew of two.

Italian Altitude Record

It is claimed that a new seaplane altitude record has been set up by Signor Furio Miclo, an Italian aviator. The flight was made in a Fiat A.S.1 monoplane on floats, equipped with a C.N.A. 140 h.p., C.7 radial engine, and an altitude of 7,362 metres, or about 24,150 ft., was reached. The aeroplane took off from the River Tiber at Rome at the start of the flight and alighted on it at the finish. The previous record was held by a German, Herr Wilhelm Zimmermann, who in June 1930 attained an altitude of 18,500 ft. in a Junkers seaplane fitted with an Armstrong Siddeley engine.

New Fokker Monoplanes

Two new types of commercial monoplanes are being constructed by the Fokker Company for K.L.M., the Dutch air line company. Both machines will be provided with retractable undercarriages. The first, known as the F.XX, will employ three Wright "Cyclone" engines, and will carry 16 passengers and a crew of four. It is being developed for the Amsterdam-London service, and its maximum speed is expected to be 186 m.p.h. and its cruising speed 155 m.p.h. It will be very similar in general appearance to the standard Fokker three-engined cabin type, but the retractable wheels are to be carried inside the engine nacelles when the machine is in the air. A retractable tail wheel is also provided.

The second new type is known as the F.XXXVI. This has four Wright "Cyclone" engines mounted in tandem in nacelles placed one on each side of the fuselage. The accommodation in this case also will be for 16 passengers, but the machine will be capable of carrying a load of 1,500 lb. of mail in addition. It is intended for the Amsterdam-Batavia Service of K.L.M., and it is estimated that the journey between these two places will be made in six days.

Service Record of The "Hannibal"

Since the Bristol-engined 42-seater Handley Page aircraft of the "Hannibal" type have been placed in service by Imperial Airways, it is estimated that nearly 50,000 passengers have been carried in the machines in perfect safety. During one week recently, of all passengers entering or leaving Croydon aerodrome, no less than 78 per cent. were carried in these machines.

640 H.P. Air-Cooled Engine

Another engine has been added to the range produced by Armstrong Siddeley Ltd. This is the "Tiger," of 640 h.p. which takes its place between the 535 h.p. "Jaguar Major" or "Panther" engine, and the 800 h.p. "Leopard." It has been designed for use in general purpose and torpedo-carrying aircraft, flying boats and civil aeroplanes, and in its design advantage has been taken of the wide experience gained with the "Jaguar Major." An interesting point about the engine is that both the valve rocker gear and the push rods are enclosed, thereby rendering the engine clean in service and neat in appearance. Another new feature is the fitting of a patented form of starting gear that enables the engine to be started by an electric starter or by "swinging the prop." The current for the starter can be provided by an ordinary radio 12-volt battery, or a service battery can be plugged into the circuit, the special advantages of the system being its light and compact design and low current consumption.

Other new features are the incorporation of the oil pumps within the front cover; the fitting of duplicate diaphragm petrol pumps, and the addition of cowls that direct the air round the backs of the cylinder barrels. The latter are of new design, the fins being shallower than usual and more closely spaced. The finning of the head has also received special attention, and every provision has been made to allow free passage between the valve chests.

The engine is of the 14-cylinder type, the cylinders having a bore of 5.5 in. and a stroke of 6 in., giving a swept volume of 1,996.4 c. in., or 32.7 litres. The compression ratio is 5.2 to 1, and the engine runs normally at 1,900 r.p.m. and has a maximum speed of 2,200 r.p.m. It is 50.8 in. in diameter and 64.11 in. in length, and when dry is 1,102 lb. in weight.

Flying Without Ailerons

A magnificent display of skill was given some time ago by Mr. E. C. Pellens, a pilot flying on the K.L.M. route to Batavia. Mr. Pellens had taken off from Bangkok, and after flying for about an hour was caught in a tornado that threw the machine into a left-hand spin and then over into a right-hand spin before the pilot was able to gain control. When he once again had control of the aeroplane, both the ailerons were torn off, but in spite of this, by using his two wing engines he continued the flight to Kohlak, where he made a gentle turn into the wind and landed safely. Mr. Pellens was flying a Fokker monoplane, fitted with three Bristol "Titan" engines. He is to be presented with a gold watch by the British Aviation Insurance Co Ltd., an award that is made every year to the pilot who achieves the most meritorious performance of this nature.

Flying Boat for Transatlantic Service

New York Pan-American Airways have published a specification for a big commercial flying boat intended for the operation of a transatlantic service. The flying boat will be of all-metal construction and will be a high-wing monoplane with four air-cooled radial engines.

A Fokker Super-Universal seaplane used for carrying mining supplies to outlying Canadian territory. Skis are fitted to the machines during winter so that they can alight on the frozen lakes. An article dealing with the work of Canadian Airways Ltd., to whom we are indebted for the photographs on this page, appears on page 194.

It will have accommodation for 50 passengers, a cruising speed of 125 m.p.h., and a range of 2,500 miles, plus a safety margin of 600 miles. Two well-known American firms, the Sikorsky Aviation Corporation and the Glenn L. Martin Company, have signified their willingness to prepare designs for such an aeroplane.

If the boats are constructed, Pan-American Airways state that they intend to inaugurate within two years a regular passenger, mail and freight service from America to Europe and the Orient. The service will at first be operated with six flying boats, and the route will normally be made by way of Bermuda and the Azores although during the summer months it is possible that a great circle route by way of Newfoundland and Ireland will be followed.

The first official mail arriving at Cameron Bay, Great Bear Lake, North West Territories, on 16th June, 1932. The machine that carried the mail, and which is shown in the illustration, is claimed by Canadian Airways, Ltd. to be the only aeroplane that has flown over the North Magnetic Pole.

Westland Aircraft for Everest Flight

On page 110 of our last month's issue we gave brief details of an expedition that is being organised to fly over Mount Everest to take photographs and films of the summit. A decision has now been made concerning the types of aircraft to be used on the expedition, and the choice has fallen on a Westland P.V.3 biplane and a Westland "Wallace," an improved version of the Westland "Wapiti."

The P.V.3 is a private venture machine, which means that it was constructed to a specification of the Air Ministry without any definite order having been placed. Actually the specification was dropped by the Air Ministry, and as a result the type was never put into production and only one machine was built. This aeroplane is similar in size and performance to the other machine, the Westland "Wallace," but it has single-bay folding wings. Both types have wide undercarriages of the split axle type in order to facilitate landings on uneven ground.

Slight modifications are being made to both aeroplanes. For instance, they are being equipped with Bristol "Pegasus S.3" supercharged engines, while all the military equipment has been removed, together with wheel-brakes and any other small items that would add to the weight. The necessity for reducing the weight to the last ounce arises from the fact that the machines must be able to reach a service ceiling of 34,000 ft. when carrying a heavy load of fuel and equipment. Approximately 90 gallons of fuel will be carried, together with a crew of two, full oxygen and heating equipment, an "Eagle" aerial camera, a cinematograph camera, and other special apparatus and equipment for the work over Everest. The observer's cockpit in each machine is being covered in, but sliding windows will be provided for work with the cinematograph cameras.

Record South African Parachute Jump

The South African parachute jump record has been broken by Mr. W. Kerr, a South African ground engineer who jumped from a height of 17,300 ft. at Durban. The jump was made from a "Puss Moth" without the assistance of oxygen, and with only one Irvin parachute. It was not made as a sensational stunt, but to demonstrate the safety of parachuting and to attract students to a school of parachuting that is shortly to be opened at Durban. Mr. Kerr took 20 min. to reach the ground and drifted 10 miles during the descent; and while travelling between 17,000 ft. and 8,000 ft. he suffered greatly from cold. This jump proves that it is practicable for a parachutist to get out of closed cabin machines similar to the "Puss Moth," for Mr. Kerr was able to leave the machine in five seconds.

Famous Air Line Companies

II.—Canadian Airways Limited

ONE of the most remarkable Canadian developments during recent years has been the rapidity with which air travel has been adopted by the people of the Dominion living in areas remote from railways. The nature of the country has had much to do with this. It would not be economically practicable to construct either roads or railways into many of the remoter areas of the country, and in such areas reliance on dog team and canoe has been general. The undeveloped parts of the Dominion are well adapted to air travel, however, for there are large numbers of lakes on which it is possible for aircraft to land during about ten months out of the year. In the summer season air routes in most cases can follow water routes, so that it is always possible for a forced landing to be made if necessary. As regards the remoter areas, air transport is actually cheaper than ground transport. The journey that formerly occupied several days can now be made in a few hours, and thus the costs incurred in preparing for a journey and throughout its duration are comparatively small.

(Above) The largest single-engined freight aeroplane in North America, on the Red River at Winnipeg. (Below) A flying boat used for exploration, photographed on Teigan Lake, Northern British Columbia. The illustrations to this article are published by courtesy of Canadian Airways Ltd. See also page 193.

In the opening up of these remote areas, and in the provision of transport services, a prominent part has been played by Canadian Airways Ltd., which is the largest company engaged in aerial transportation, exploration and survey in the Dominion of Canada. The company have divided their range of activities into three regional territories. The first of these is the country between Nova Scotia and Sault Ste. Marie, in which the service is known as the Eastern Lines. North Ontario, the Prairie Provinces and the central area, including the MacKenzie River to the Arctic Ocean, are covered by the Western Lines; and the Canadian Airways Pacific Lines operate in the territory from the Rockies to the Coast and from the United States border to the north of the Yukon.

It will be realised that the work of a company such as Canadian Airways Ltd. differs in many important respects from that of a company operating in Europe, such as Imperial Airways Ltd. Much of the Canadian company's work consists of exploration flights, aerial surveying, and what might almost be termed air-taxi work; and the operation of regular air lines is not such an important function as is the case with Imperial Airways. Many regular air mail services are carried out, however, but these are restricted to the Eastern and Western Divisions. In these Divisions air mail services are carried out from Montreal to Rimouski, from Moncton to Magdalen Islands, along the north shore of the St. Lawrence Gulf, and between Pembina and Winnipeg. There is also a night mail service from Toronto to Detroit, and this is linked by the United States Air Lines with the Western Lines of Canadian Airways at Pembina on the Manitoba–Dakota border. Daytime mail services in the Western Division are operated from Sioux Lookout to the Red Lake mining area, and from McMurray down the MacKenzie River to Aklavik, the most northerly point in the British Empire, situated 50 miles from the Arctic Ocean on the MacKenzie River delta. There is also another service from Peace River Crossing to Carcajou and Fort Vermilion.

On some of the mail services passengers are carried, and their numbers afford a striking illustration of the growth of this department of air transport. During 1931 Canadian Airways Ltd. carried 8,047 paying passengers; in 1926 the total number of passengers carried by all aircraft operating in Canada was only 6,436. An even better illustration of the development of air transport is provided by the miles flown. In 1926 all aircraft in Canada taken together flew a total of 393,103 miles; during 1931 the machines of Canadian Airways Ltd. alone covered 1,832,794 miles.

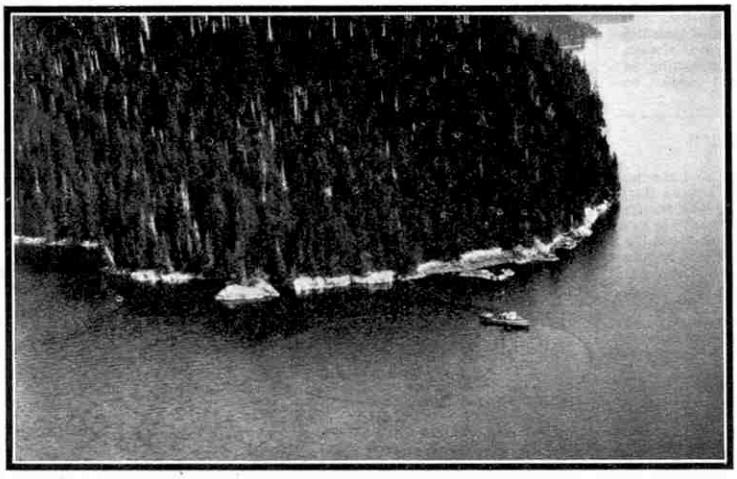
Much of the work carried out by Canadian Airways Ltd. consists of the transport of passengers and special loads to places not served by the regular air routes. For instance, some time ago two "Wasp"-engined Fairchild aeroplanes transported in six days 50,000 lb. of supplies from Senneterre to posts on Grand Lac, at distances varying from 48 to 60 miles. A very much longer period would have been required to carry such a large load by dog team. In British Columbia a Super Fokker, also with a "Wasp" engine, under the direction of the Pacific

Lines, carried 40,000 lb. of freight and 20 men from Burns Lake to McConnell Creek, a distance of 250 miles.

On another occasion five fully loaded aeroplanes left McMurray at the same time for Echo Bay, 800 miles away, completed the journey safely, and returned to McMurray. A week later the same five machines again flew with loads to Echo Bay and were back at McMurray within three days, having added by their two return trips a total of 16,000 miles to their flying records, the log of each machine being increased by 3,200 miles. Echo Bay, which is on Great Bear Lake, is the centre of an extensive mineral field, but was unknown to the general Canadian public until a year or so ago. This area could not have been opened up, nor interest in it fully aroused, if aircraft had not greatly reduced the time required for the journey from the "end of steel," as the railway terminus is called in Canada. By land transport the journey from the terminus to Echo Bay takes 30 days; by air it can be made in one day in summer and in one-and-a-half days during the winter months.

A typical mining party carried to their base of operations by a Canadian Airways machine. Until a few years ago these men would have travelled on foot and would have carried all their tools and stores by dog team, at great expense, both of time and money.

Many of the operations of Canadian Airways Limited are common to all the Divisions, but there are also operations peculiar to each Division, and determined largely by the geographical situation and topographical features of the area covered. The Pacific Lines, for instance, frequently carry out fishery patrols along the coast of British Columbia, the machines concerned being employed to watch for boats fishing in prohibited waters and to carry out certain other duties. In the Eastern Provinces there has been a steadily increasing use of aircraft for the carrying out of aerial photographic surveying in connection with the great industrial developments taking place in this region. The speed and accuracy of aerial surveying, especially in the preparation of primary reports of potential water power sites and irrigation schemes, make it of the greatest possible value to civil engineers. Another activity confined largely to the Eastern Lines is "timber cruising," which consists of the surveying and mapping out of various forest areas.



This photograph was taken by an aeroplane on fishery patrol. The ring in the water is the fishing net of the boat that was fishing for salmon in prohibited territory on the British Columbia Coast. The captain and crew of the vessel were arrested ten minutes after this photograph was taken, a message having been sent to a preventitive vessel by radio.

Before the coming of the aeroplane there were many occasions when demands for medical aid arose that were quite beyond the resources of the isolated trading posts. A bad accident is bad enough in any circumstances, but its seriousness is intensified enormously when it occurs in a place far remote from all expert medical assistance. Nowadays, when the necessity arises, aeroplanes are requisitioned to carry patients to the nearest hospital, and aerial transport has done much, not only to alleviate suffering, but to save lives. Never a month passes without a "mercy flight" being carried out. We may recall the case of a staff sergeant of the Royal Canadian Mounted Police who was shot while arresting a criminal near Arctic Red River, North-West Territories. The wounded sergeant was carried by aeroplane 100 miles to hospital, and was on the operating table within 90 minutes of starting on his journey. The doctors stated that the man could not possibly have lived for more than three hours without surgical treatment, so that air transport definitely saved his life. Another interesting example consisted of the transport of three invalids in one aeroplane to Edmonton. One of the men had been carried 1,280 miles, and another 980 miles.

The majority of the machines used by Canadian Airways Ltd. are cabin seaplanes carrying from four to six passengers. For a passenger service between Vancouver, Victoria, and Seattle, and also for the fisheries patrol on the Pacific Coast, Boeing flying boats are used. The combined fleets of the three Divisions include more than 50 machines, and the employees total more than 200. Adequate facilities for refuelling are a prime necessity when operations are conducted over such a vast range of territory. Advance petrol and oil caches have therefore been laid at strategic points throughout the whole of the North of Canada, and in many cases it is necessary for these to be replenished nine or even twelve months ahead of projected operations.

What Shall I Be?—(*Continued from page 189*)

and teaching, in the second term they are on various aspects of the producer's work and the main features of film acting and radio drama. In the final term of the course, lectures are provided on the characteristics of English verse. Each year during the course additional lectures are given on costume, scenic production and make-up and various other subjects, while informal rehearsals of lyrical and dramatic pieces studied through the term are held in the Academy's theatre.

It is impossible to give any details of the salaries paid to actors, as these range from a few pounds per week to practically pounds per second! Stage-struck youths may read of certain actors being paid several hundreds of pounds per week and they immediately multiply this by 52! It must be realised, however, that these salaries are paid probably for only three or four weeks in the year. The really fortunate actor is he who, at a reasonably good salary, can keep in work for at the very most 40 weeks out of the year; and these are the rare exceptions rather than the rule.

We cannot do better than end this article with a few words from Mr. William Armstrong, to whom we have already referred.

"If you feel within you an insatiable urge to act, and feel that if this is denied to you life will hold very little for you, then give your parents no rest until they pay for your training in voice and body. But if it is only a desire to show yourself in public and to receive the applause of kindly uncritical friends, you will be well advised to think of some other profession than the stage. When you have had your training, try and interview managers by hook or by crook, write letters, haunt theatres, grind axes and turn stones continuously. With sufficient perseverance you may arrive at last on the actor's side of the footlights, and the rest lies entirely with yourself and the all-important factor of luck. But never forget for a moment that you are embarking on an adventure that is an art, not a business; that the world of the stage is tragically overcrowded and that there are literally thousands of experienced actors unable to find regular work within its gates; and that the theatre can never be for one instant safe for its employees as the other professions can be. To quote the words of a dramatist and theatre manager of great reputation: "The art of the stage, like every other art, will always be bitterly unjust. Genius will keep slipping in, and an ignorant slip of a boy or girl will appear and, with the first line they speak, sweep you and all your 15 years of training and work into the background. This you must always be prepared for, and take with as little flinching as possible; but after all, you may be that genius, so go ahead and good luck to you!"

An early Meccano advertisement, a half-page in Messrs. Gamage's catalogue for Christmas, 1910. In their 1932 catalogue Messrs. Gamage allocated 10 pages to Meccano products, and even then it was impossible to list more than a selection!

Buried Comet—(*Continued from page 187*)

At first glance, Meteor Crater appears to have no central hill, for the floor of the basin is almost flat. But it is there, and borings made during the search for the lost meteor have disclosed its existence. It has become hidden by rock debris that has fallen from the rim, and by the mud and sand left behind when the lake that formerly existed within the crater disappeared.

Most of the craters on the Moon are, of course, enormously greater than that in Arizona. There are several reasons for this. The most obvious suggestion, of course, is that the meteors responsible for them were much larger than the one that fell in Arizona and in this connection it is interesting to find that, if it were as far away from us as the Moon, Meteor Crater would be visible with difficulty through a telescope 24 in. in diameter. To put the comparison in another way, on photographs of the Moon's surface taken with the aid of the 100 in. reflector at Mount Wilson—at present the world's largest telescope—the lunar crater "*Copernicus*," which is 55 miles across, has a diameter of ½ in. On a photograph of the Painted Desert taken under similar conditions, the Arizona crater would appear to have a diameter of only 1/145 in., and probably would scarcely show on the photograph!

Another reason for the great size of many of the lunar craters is that on the Moon there is no atmosphere to slow down approaching meteors by its resistance. The result is that these strike the surface of the Moon with enormously greater force than would be the case if they descended upon the earth. In addition, the pull of gravity at the Moon's surface is much less than on our own planet. A man who on earth could leap to a height of six feet would have no difficulty on the Moon in jumping over obstacles 45 ft. in height. This means that fragments thrown out from a crater on the Moon at the moment of its formation by impact would reach a much greater distance than under similar conditions on earth. It is therefore scarcely surprising to find that the radiant streaks that surround some of the larger craters on the Moon extend for many hundreds of miles.

It is now many years since the suggestion was first made that the craters on our satellite are enormous "shell holes" due to bombardments by meteorites encountered in the Moon's journey across space, and its only serious rival has been the idea that volcanic action was responsible for them. It seems strange that the investigation by Mr. Barringer of Meteor Crater should throw light on the manner in which craters a quarter of a million miles away were formed, but his work makes it probable that, like Meteor Crater, these were formed by impact from above and not by explosions from below.

Old Man Gorilla—(*Continued from page 191*)

hitherto unknown variety of gorilla living in that infinite forest that hides in its depths no one knows what mysteries. For instance, had there not been discovered in this same equatorial forest in recent years animals like the bongo and the okapi? Who would have believed, on the word of a native, in the existence of such a strange animal as the okapi, with the legs of a zebra, the body of an antelope, and a giraffe's neck and head?

Of course I was immediately seized with the mania to go in search of the elusive auburn ape, but Katumbele refused to guide me. And, a more serious obstacle, my old malaria was returning, leaving me too weak to withstand further hardships in the forest. I had to think, too, of my promise to bring back a specimen of gorilla to the Royal Museum of Florence.

Some days later, tired from the fever and the long march, I was about to turn back to camp, when Kasciula whispered to me "*Ico ngagi*," and pointed out a sort of tunnel climbing almost vertically up the thick vegetation. Crawling on all fours, I scrambled up as best I could until I reached a little plateau. While I was trying to disentangle myself from the vines and to free my rifle, three terrific howls greeted me, and three enormous gorillas rose from the high bushes about 30 ft. from me. They were enraged at my intrusion and advanced towards me, the big male in the lead, waving one huge fist in the air and beating his chest with the other, his eyes gleaming with fury and his mouth open in a terrible grimace that displayed his long yellowish teeth. I realised that one of us must go. I had just the time to take an aim at his heart and to fire. A louder howl, and he continued to advance towards me. A second shot, and he dropped—seven yards from where I stood.

But now the worst was just beginning. The two females had suddenly stopped, looking first at me and then at the male who lay motionless on the ground. Would they attack me? Like lightning there flashed through my mind the promise I had given the Belgian authorities when I had obtained the very difficult permit to kill one gorilla. For no reason could I kill a second one. During that second of thought I had been trying to reload my gun, but for the first time in my life it stuck.

Alone on that small plateau and oppressed by my promise, with a precipice at my back, a jammed rifle in my hand, and those two formidable females now beginning to advance on me, the situation altogether was not so comfortable. With a last desperate effort I succeeded in extracting the faulty shell and reloading my gun. The first female seemed to me at that moment to be near enough to touch me. I fired at her uplifted arm, then rapidly shot four or five times in the air. She stopped with a cry of rage and pain, hesitated a moment, then wheeled and ran away, followed by her companion.

Just at that moment as if by magic the Pygmies popped up all around me. Katumbele, overcome with joy, offered me his biggest gesture of admiration. "Bwana," he said, "as soon as you wish I will guide you where the red *ngagi* are."

But it was not to be. My fever became so bad that I was forced to leave the forest immediately. I was extremely lucky to reach the White Nile, where I could have doctors and nurses, when the severe attack came.

For permission to reprint this article we are indebted to the courtesy of the Editor of the "South African Railways and Harbours Magazine."

British Admirals—(*Continued from page 178*)

sterling. Anson was raised to the rank of Rear Admiral of the Blue, and less than a year later was promoted to be Rear Admiral of the White. In 1746 he became Vice Admiral of the Fleet.

When successes at sea encouraged France and Spain to prepare for a new descent on England, Anson decided that it was time he took command of the whole fleet. On 9th April, 1747, therefore, he hoisted his flag in the "*Prince George*," of 90 guns, and sailed from Plymouth with a powerful squadron that consisted of 12 line-of-battle ships and several smaller vessels. Off Cape Finisterre they intercepted a large fleet of merchant ships bound from France to the East and West Indies and escorted by six men-of-war, and they succeeded in capturing all the warships and four of the merchant ships. The news of this victory was received with joy in this country, and the Duke of Bedford wrote to Anson: "You will easily believe no one in this town did with greater joy receive the news of your great success than myself; and universally I may say it is, as I am just come home through illuminated streets and bonfires. The King told me this morning at his levée that I had given him the best breakfast he has had for a long time, and I think I never saw him more pleased in my life." As a reward for victory the King, George II, raised Anson to the peerage with the title of Lord Anson, Baron of Soberton.

In 1751 Anson was appointed First Lord of the Admiralty and he held this position almost continuously until his death. His last command at sea was in 1758, when for a time he commanded one of two squadrons engaged in harassing the French coast. His flagship on this occasion was the "*Royal George*" of 100 guns, which led a squadron consisting of 22 line-of-battle ships and nine frigates.

Anson was promoted in 1761 to Admiral and Commander-in-Chief of the Fleet. In February of the following year he accompanied Prince Charles of Mecklenburgh, brother of Queen Charlotte, to Portsmouth to show him the arsenal, and in waiting on him he caught a severe cold. The cold developed, and in conjunction with general ill-health brought about his death on 6th June, 1762. He was buried in the family vault at Colwich.

Junior Section—(*Continued from page 231*)

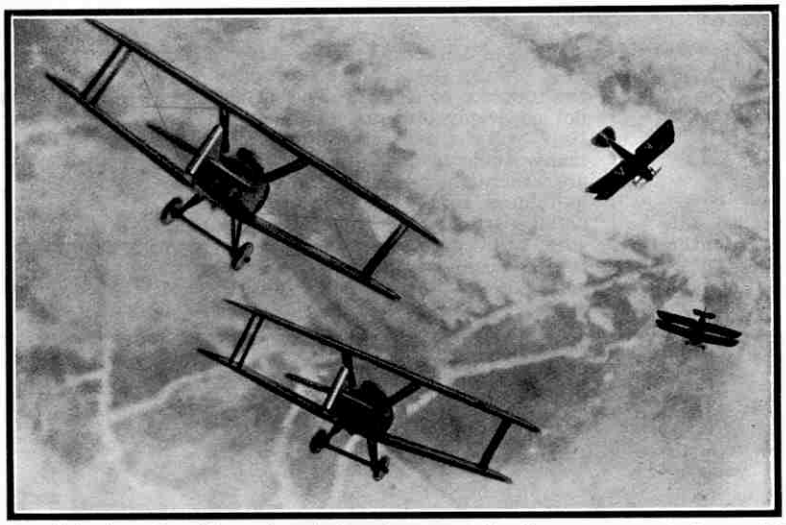
In addition to special traffic of this description numerous fast trains are run to convey miscellaneous freight. The well-known 3.40 p.m. express goods from King's Cross to Glasgow is a good example of one of these trains, and is well worthy of inclusion in the running programme of a Hornby layout. It makes six stops in its 436-mile run, the average speed throughout being 32.5 m.p.h. An assembly of Hornby wagons and vans, those of the No. 2 variety not being neglected, will enable a reasonable representation of the train to be made up; and an obvious choice in the matter of engine power is a Hornby No. 1 Special Tender Locomotive, which in several respects resembles the well-known "Moguls" of Class K3 that are employed on such duties in actual practice.

A good selection of locomotives is available in the Hornby Series, for many of the standard types suggest L.N.E.R. engines, apart from the famous true-to-type "*Yorkshire*" and the "*Flying Scotsman*," which are invariably found on most miniature L.N.E.R. systems. The outside steam-pipes, double-window cab, short chimney and the general contours of the No. 1 Special Locomotive and tender are features found in many L.N.E.R. designs. The Hornby No. O Locomotives are not unlike the Class J39 engines of actual practice, though the miniature design is shortened in proportion, on account of its running on four wheels instead of six. Again the No. 2 Special Tank may be used to represent any of the large-boilered tank engines in use on the L.N.E.R., and for lighter duties the other tank engines down to the M3 are all appropriate in L.N.E.R. colours.

Air Fight Photographs with Models

An Interesting Controversy

NOTHING in aeronautical circles has aroused so much discussion recently as the publication of the Cockburn-Lange collection of photographs of aerial fighting during the War. Mrs. Cockburn-Lange declares that the majority of the 57 pictures in the collection were taken by her late husband in fights in which he actually took part, or observed. The camera, we are told, was mounted on the side of the fuselage, and its shutter mechanism was coupled up with the trigger of the pilot's gun to secure the opening of the shutter at the instant of firing the first shot. Only one photograph per flight could be taken, as it was not possible to reload the camera during flight.



A realistic piece of model aeroplane photography, representing the commencement of an aerial battle. The machines in this picture are "Skybird" models superimposed upon an actual photograph of a portion of the War area.

Several of the photographs have been published in the "*Illustrated London News*" and the "*Sunday Pictorial*," and their appearance has created a storm of controversy. It is suggested by various expert critics that many of the pictures are not genuine War photographs, but were secured during the taking of some spectacular air film such as "*Hell's Angels*," or are downright fakes produced by the use of models. The interest that is being taken in the matter may be gauged from the space devoted to it in the aeronautical press. The "*Aeroplane*," for instance, in its issue for 21st December last devoted more than three full pages to a statement of the arguments for and against the pictures, and accompanied this statement by an "aerial fight" picture prepared by one of the paper's staff photographers from six separate negatives.

In their advertisement in the February "*M.M.*," A. J. Holladay & Co. Ltd., made use of a photograph of an aerial "dog fight" produced by "*Popular Flying*" with the firm's "Skybird" models. The photographs that appear on this page are also reproduced from "*Popular Flying*," by courtesy of the editor.

We do not propose here to express an opinion as to the genuineness or otherwise of the Cockburn-Lange photographs; our interest is confined to the results that can be obtained by photographing scale model aeroplanes of the "Skybird" type. As our illustrations show, most realistic scenes can be produced by the skilful use of these models. The easiest effect to obtain is that of aeroplanes seen against the sky. In this case the sky may be represented by a background of brown paper, crumpled slightly to suggest clouds. The various models are then secured with fine cotton so that they occupy the required positions, and are tilted at suitable angles.

As it is not desirable to have the paper background sharply focussed, the models should be suspended at least 12 in. in front of it. The camera should then be focussed on the machine that forms the central point of the picture. The other machines, which of course will not be in the same plane, will then be slightly out of focus, so that a natural effect is produced.

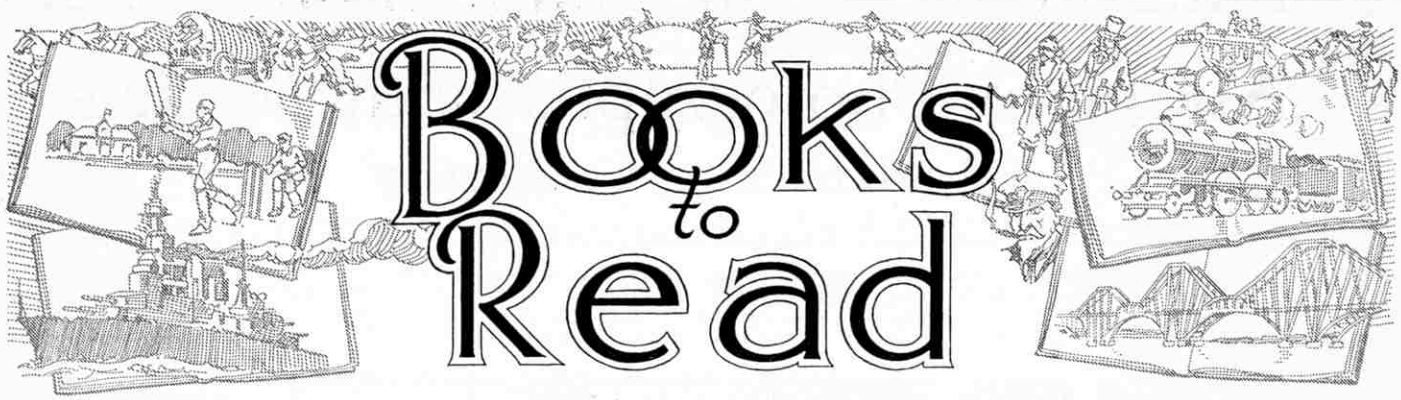
In most cases it is advisable that the focus on the principal machine should not be too sharp, as a slight softness in definition generally gives the most realistic result. Exposure will of course be governed by individual conditions, and it should be ascertained by means of an exposure meter or a "Wellcome" calculator.

Even more remarkable results may be obtained by superimposing photographs of models on a photograph of a suitable scene. In this case the models should be photographed against a perfectly plain background, and matters must be arranged so that the models will appear in correct scale when placed on the selected photograph. The photographs of the models are cut out, placed in suitable positions on the scenic photograph, and pasted down, and then the whole is re-photographed with not too sharp a focus. The photographs of both models and scenic background should be made on the same kind of paper and finished to the same tone, and it is a good plan to make the print of the models on thin paper, so that the cut-out edges will be less liable to show in the finished photograph.

A Sopwith "Camel" in a tight corner! The machines shown in this and the upper illustration are "Skybird" models, photographed by "Popular Flying," to whom we are indebted for permission to reproduce these pictures.

An example of superimposition is given in our upper illustration, which shows "the nucleus of a dog fight." A British aeroplane is engaging an enemy machine, and two Sopwith "Camels," out on patrol, are just arriving on the scene. "*Popular Flying*," commenting on this picture, says: "When this sort of thing happened it was usually only a matter of a few minutes before the air was full of whirling machines hurrying to the party." The machines in this picture are "Skybird" models superimposed on an air photograph of the lines of trenches taken in 1916, looking north-east towards Martinpuich, while a gas attack was in progress.

The lower illustration is in some respects even more effective. The uppermost machine, in particular, has a highly realistic appearance. It is just at the correct flying angle, and a slight unsharpness of focus subdues the detail and produces the effect of great speed. The pilot of the "Camel" is obviously trying to "get on the tail" of the lower German aeroplane, when he will rake its fuselage with his machine gun; but if he does not notice the other German who has just arrived on the scene, he is soon going to receive an unpleasant surprise!



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

"The Villages of England"

By A. K. WICKHAM. (Batsford. 12/6)

This addition to the "English Life" series of books will meet with an enthusiastic reception from all lovers of the countryside, to many of whom the variety and beauty of the English village is as yet largely unknown. The author divides the country into five main geological divisions, of which he explains the origin, and characteristics and influence on the formation of village types. Special mention is made of building materials and the methods by which they were handled, combined, and applied. We learn of the tinted plaster or sturdy brick of East Anglia: the flint and brick of Hampshire and Wiltshire; the grey limestone of the Cotswolds and Dorset, the picturesque half timber of the Welsh border, and the thatch and cob of Devon. Wherever it is of interest to do so, the village surroundings, and the chief features—such as the church, cottages, market hall, and almshouses, are discussed in an informative style.

A Staffordshire village. From "The Villages of England" reviewed on this page.

The variety of the beauty of our villages is phenomenal and does much to add to their charm—we find some villages grouped on a long curved street, others dotted about a wide expanse of green, or fronting a wide river or stretch of sea-shore. In the West country the villages cluster in wooded hollows, or wander along the course of a deep combe, but in the North the hamlets have no such shelter, for they are surrounded by the open fells or moorlands. All very delightful reading for these spring days, making one anxious to get "on the road" again to visit some of these picturesque villages of England.

No less than 32 counties are represented in the illustrations, which include over 100 beautiful photographic plates in half-tone, as well as numerous illustrations in the text.

"The Splendid Book of Achievements"

By G. GIBBARD JACKSON. (Sampson, Low. 2/6 net)

The achievements of which Mr. Jackson writes range from the work of the engineer in the construction of railways, canals, docks and harbours, to the story of the Post Office, the coining of money and the romance of rubber. The author does not go deeply into any of them, but the book will form a good introduction to many subjects in which modern boys are keenly interested. Unfortunately its usefulness is impaired by mistakes in detail, particularly in the portions dealing with railways and railway history. A typical instance occurs in the description of "Fowler's Ghost," the fireless locomotive used in the earliest days of the Metropolitan Railway. Steam is said to have been raised in this engine by placing white-hot firebricks around the boiler, although it is also stated that the boiler was given an outer jacket of asbestos in order to conserve the heat. The firebricks would have been of little use in the position ascribed to them, and actually the boiler surrounded the firebricks.

Another misleading chapter deals with the Welland Ship Canal. This describes the canal of 1887 as the "present canal" and explains briefly how it "will be" enlarged. The facts are that the 30-ft. canal was completed more than a year ago, and it was officially opened last autumn.

The book is illustrated by 16 photographs, which are not too well reproduced.

"The Adventure of the Faeroe Islands"

By M. HELEN GRAHAM. (A. H. Stockwell Ltd. 2/- net)

This is an account of the voyage of the author and her father from Bridgwater to the Faeroe Islands in a seven-ton cutter, 30 ft. long overall and 8 ft. 6 in. in beam. An Oxford undergraduate started the trip with them, but after the cutter had nearly "stood on her head" he asked to be put ashore at Fishguard! The voyage was comparatively uneventful, and father and daughter spent a happy time in exploring the Faeroes, of which an interesting description is given. This readable little book is illustrated by photographs and a sketch map.

"Games for Camp and Club Room"

By V. BARCLAY

(Brown, Son & Ferguson Ltd. 1/6 net)

In this volume Miss Barclay continues her valuable work of collecting material for the use of Cubs, Scouts and Guides. The book contains 60 outdoor and indoor games. These are meant to be recreations, but are so well chosen that they will not only be enjoyed, but also will help to develop keenness and to introduce variety into an important branch of Scout activities.

The first section deals with ball games, and a useful feature is the inclusion of a large proportion of interesting outdoor recreations for which no equipment is required. Great activity is required in playing many of the indoor games described in the next part of the book, and most of these are designed to encourage team work. Finally comes an attractive selection designed for camp fires.

"Three Arrows"

By E. RYERSON YOUNG

"Only A Tramp"

By GRACE STEBBING. (R.T.S. 2/- each net)

"*Three Arrows*," whose native name is At-toos Nish-to, is a young Buffalo Indian, and his exciting adventures on hunting and other expeditions form the theme of the book. There is a thrilling description of a conflict with a tribe of Blackfeet Indians.

"*Only A Tramp*" tells how a tramp, who feels that everything is against him, eventually makes good, through an interesting chain of circumstances.

"The Mystery of the New Girl"

By MARY LOUISE PARKER

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

Girls' school stories in which the characters really resemble live girls are not plentiful, and for that reason "*The Mystery of the New Girl*" is welcome. The new girl at Broadmead Hall is popular, but there is a mystery about her that worries some of her companions. The mystery is cleared up suddenly and unexpectedly after exciting happenings.

"The Seas"

By Russell and Yonge. (Fredk. Warne. 12/6)

Many books have been written about the natural history of the sea-shore, but the shore is only a narrow fringe of a vast world that lies beneath the surface of the water—a world entirely unknown to most people, yet of extraordinary interest. This book, one of the "Wayside and Woodland" Series, gives a very complete account of our knowledge of life in the sea. Swimming Animals, Drifting and Boring Life, Coral Reefs, the Sea Fisheries, and Products from the Sea, are but a few of the interesting chapter titles.

We learn that the sea is far richer in different forms of life than is the land or fresh water, and that there are many groups of animals that are exclusively marine. The average depth of the oceans is 12,000 ft., yet the deepest part of the North Sea is just under 2,000 ft. The greatest ocean depth yet reached is in the Pacific at 32,100 ft.—over 3,000 ft. deeper than the height of Mount Everest. In the Atlantic the lower limit of plant life is found at 650 ft., but sunlight penetrates beyond this, for a photographic plate exposed for 80 minutes at 3,280 ft. was found to be affected. At 5,578 ft. however, a plate was not affected even after 120 minutes exposure.

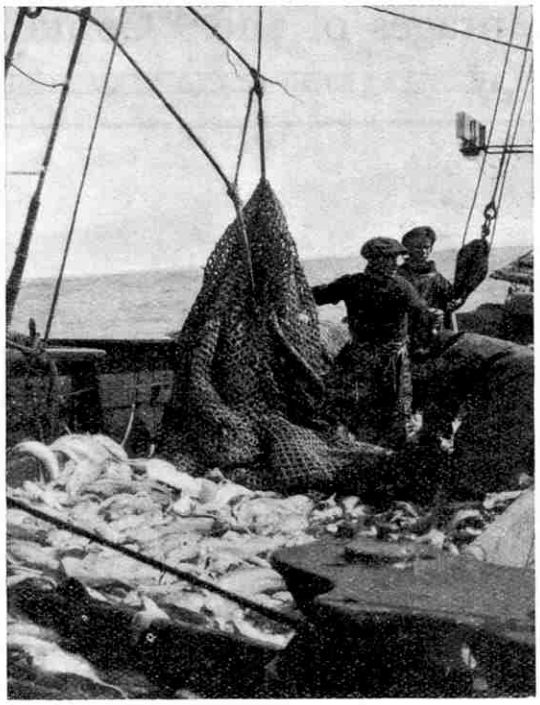
A most interesting subject is the migration of the common fresh water eel. "For years men in all countries of Europe have wondered how it is the eels in our streams thrive and multiply, and yet nobody has ever seen their eggs or their very tiny young." In 1922 a German student, Dr. J. Schmidt, cleared up the mystery, disclosing the amazing fact that when the eels in our rivers are fully grown they set off on one of the longest journeys undertaken by any fish. In the late summer and autumn they work their way down to the mouth of the rivers and swim out into the deep water of the Atlantic on their long journey. Their speed of travel has been partly determined from eels that have been captured and marked in the Baltic, and recaptured on their way to the North Sea. The interval showed that they had travelled about nine miles per day for three months. Even so they had completed only a very short distance of their total journey, their destination being the deep central part of the North Atlantic known as the Sargasso Sea, some three thousand miles away. The eels themselves have not been seen here, however, but there is irrefutable evidence that they must have been in those regions because it is only here that the baby eels are found. These baby eels, which are from a quarter of an inch to three inches in length, now start on their return journey, for which they require three years to reach European shores. The story of the location of their birthplace, and the tracing of their marvellous and in many respects unique life history deals with one of the triumphs of deep-sea study. It affords at the same time a splendid illustration of the interesting methods of this branch of science.

The book is lavishly illustrated with 384 illustrations, 167 of which are in full colour.

"Ciphergrams"

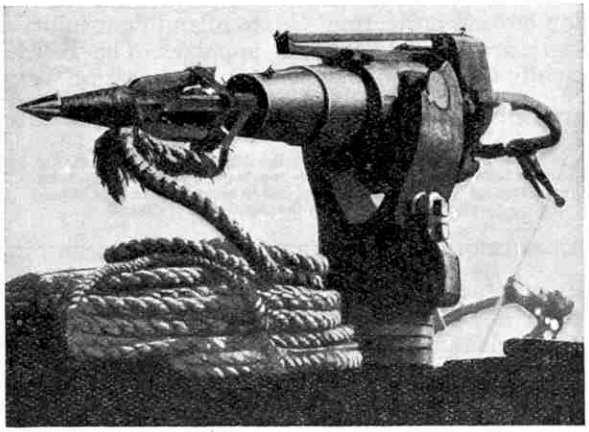
By H. O. Yardley (Hutchinson & Co. 2/6 net)

Secret messages in code and cipher have a fascination for everybody, and this is particularly the case when they are associated with dramatic spy episodes.



Landing the Catch. The fish have just dropped out of the "cod end." (See below.)

Major Yardley, the author of this volume, is recognised as one of the greatest living cipher experts. During the Great War he was responsible for deciphering messages ingeniously hidden in intricate codes by enemy agents, and he has now revealed some of the secrets of his work in an attractive form that enables everybody to become an amateur cryptographer.



A whale-harpoon and gun. From "The Seas" reviewed on this page.

Each chapter in the book describes one of a series of lessons given to a novice by a famous cipher expert. The problems are introduced by means of descriptions of unusual incidents in which spies and criminals are involved, and cross-ruled pages are included to enable the reader to solve the cipher under discussion before turning over the page in order to find the correct solution. During the 25th lesson the expert announces abruptly that he is called away for a month or more, but he kindly leaves behind him a series of 25 further problems on which his pupil—and of course, every reader of the book—may exercise his ingenuity during his master's absence!

Even those who do not wish to work out Major Yardley's problems for themselves will read his brief stories with interest, and will be fascinated by the solutions of the ciphers that form their central features. The majority of readers are sure to become deeply involved in detective efforts of their own, however, and will find a world of satisfaction in penetrating the secrets of the hidden messages.

"The Mechanism of the Car"

By A. W. Judge, A.R.C.S.
(Chapman & Hall Ltd. 4/- net)

This is the third of a series of Motor Manuals in which the construction and maintenance of motor cars of all types are explained. In the previous volumes of the series the author dealt with engines and carburetters, and now he turns his attention to the general mechanism of the car. The subject is a very wide one, for it includes the clutch, the gear-box and the back axle, in addition to steering systems, wheels and brakes.

The author has succeeded in packing into his book an astonishing amount of detail and valuable information on standard practices, and in addition has dealt thoroughly with recent developments, such as the fluid flywheel, the synchro-mesh and pre-selector types of gear-box, and various means of obtaining a satisfactory front wheel drive. The descriptions of these and other devices are practical in character, and explanations are given of the adjustments necessary to ensure smooth and efficient working. A special chapter is devoted to the important subject of lubrication, and a careful reading of this will help owner-drivers to keep their cars in good condition.

A particularly valuable feature of the book is the large number of illustrations. These include numerous sectional photographs that show the working of the parts illustrated, and there are also many instructive diagrams.

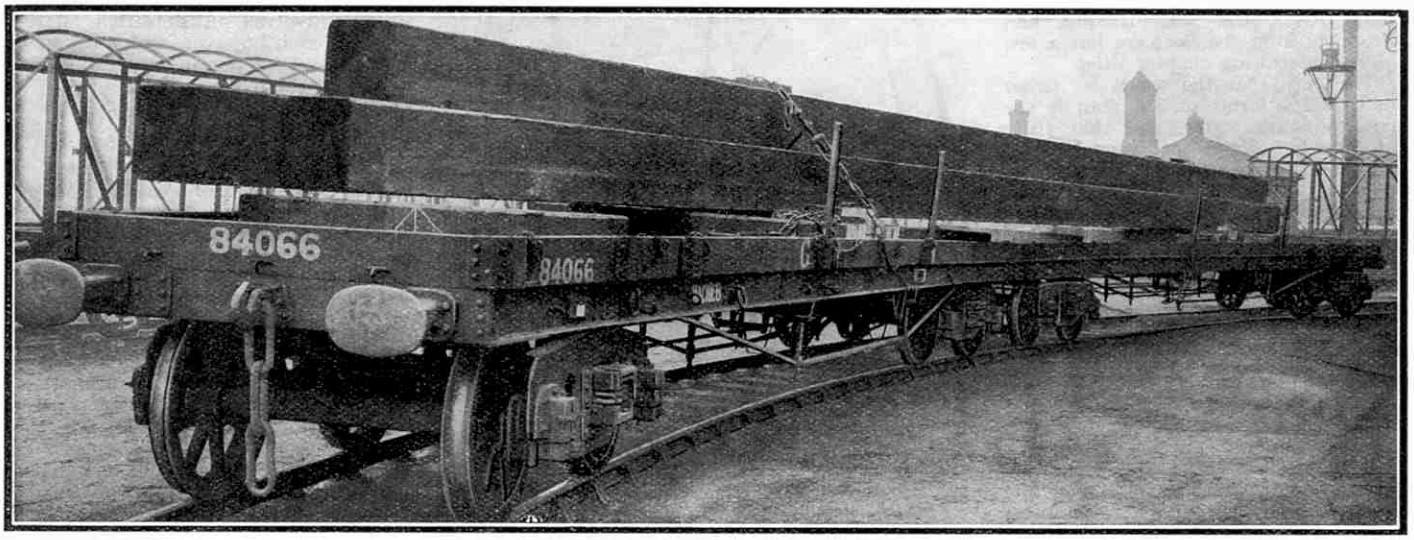
Interesting New Books

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

Touring the Ancient World with a Camera (The Studio Publications).
Told at the Explorers Club
by F. A. Blossom (Harraps, 10/6)
Heroes of Civilization
by Cottler and Jaffe (Harraps, 7/6)
The Magic Walking-Stick
by John Buchan (Hodder & Stoughton, 6/–)
Crusoes and Castaways
by Stanley Rogers (Harraps, 7/6)
The Unseen Foe
by John T. Huntley (A. H. Stockwell Ltd., 3/6)
The Nightingale
by Oliver G. Pike (Arrowsmith Ltd., 10/6)
A History of the Pirates
by Capt. Charles Johnson (Routledge, 12/6)
Flying Dutchman
by Anthony Fokker (Routledge, 6/–)
What Time Is It?
by M. Ilin (Routledge, 3/6)
The World We Live In
by Gertrude Hartman (Routledge, 10/6)
Black on White
by M. Ilin (Routledge, 3/6)
How Life Goes On
by A. G. White (C. A. Watts, 1/6)

Special Types of Goods Rolling Stock

Advantages of the "Container"



An awkward load on the G.W.R. Such long articles as the pine logs here shown loaded on two bogie bolster wagons must be secured with the utmost care, and in arranging the load allowance must be made for the negotiation of curves.

OF the one-and-a-half million wagons employed in the handling of British goods traffic, rather more than half are owned by the companies themselves. The remainder are privately owned and are engaged principally in the coal traffic.

The open wagon is by far the commonest type, and is used for many classes of "water proof" traffic, such as stone, coal and other minerals. When provided with a tarpaulin sheet the open wagon is available also for the carriage of goods that require nothing beyond protection from rain. Next in numerical strength are the ordinary closed wagons, which are used principally for the conveyance of lighter traffic. From these general wagons we pass on to special wagons provided for the conveyance of particular types of traffic. It would be hopeless to try to deal in detail here, with all the special forms of rolling stock, particularly those constructed for the carriage of heavy engineering products, which form a special and important class in themselves. We will therefore content ourselves with a reference to some of the more interesting types of vehicle.

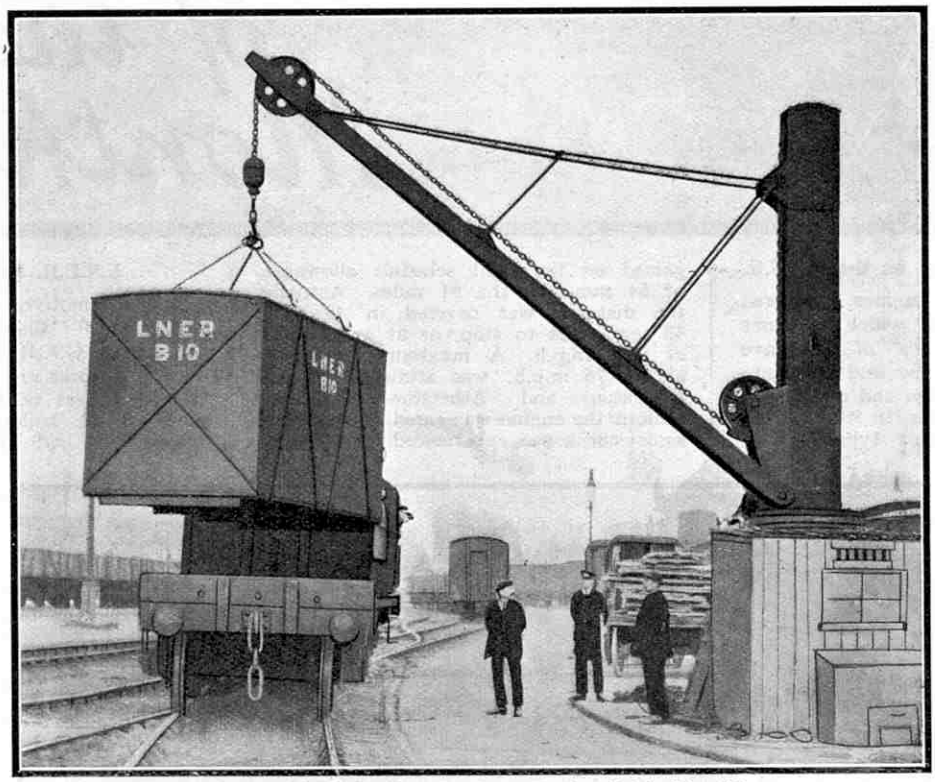
One of the features of British railways that strike foreign visitors is the small size of our goods stock. For instance, an ordinary 10-ton British open wagon will have a length of perhaps 18 ft.; whereas an American wagon slightly over 30 ft. in length will carry 50 tons. There are also much larger freight wagons in America, such as those used for coal traffic, which have a capacity of anything up to 100 tons. The smallness of our wagons is not due to the failure of our railway companies to appreciate the merits of the high-capacity wagon. For several years the Great Western Railway have endeavoured to induce South Wales coalowners to use 20-ton coal wagons. Offers of rebates on carriage charges and special tipping facilities at the docks have been made, and although progress towards general adoption has been slow, these G.W.R. wagons are now kept fully employed. Similarly the L.N.E.R. have encouraged the use of high-capacity coal wagons in the Durham and Northumberland coalfields.

Other important uses of high-capacity wagons in Great Britain are the conveyance of flour and bricks. Some time ago the G.W.R. put into service a number of 20-ton hopper wagons for carrying grain in bulk from Birkenhead to inland flour mills, and the innovation has proved very popular. The L.N.E.R. have provided 50-ton wagons for brick traffic between the Fletton brickfields and London.

The use of high-capacity stock secures considerable economy. For example, if 1,000 tons of coal are to be moved, a train of fifty 20-ton wagons weighing empty 450 tons, would be sufficient. The unloaded weight of a train of similar capacity made up of 12-ton wagons would be 630 tons. Further, the same trains in a siding would occupy 2,015 ft. with 12-ton wagons, but only 1,225 ft. with 20-ton wagons. Obviously considerably less space would be required for a coal siding in a large town if 20-ton wagons only were employed; and in large towns land is very valuable.

One of the most interesting features in goods traffic operation during recent years has been the widespread use of "containers." These are box-like structures of timber or pressed steel resembling the top of a covered wagon. They are fitted with ringbolts and may be slung completely away from the low-sided or flat wagon on which they are usually carried, and they may then be mounted on road lorries and carted to any required point. They are used for such articles as furniture, chinaware, etc., in addition to perishable goods. The great advantage of containers is that firms despatching large

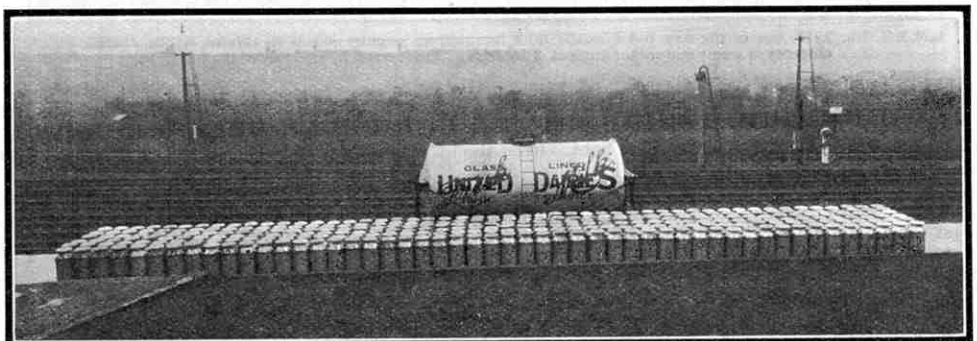
consignments of packed goods to local depots are able to do the packing in their own factories instead of this having to be done at goods sidings in the ordinary manner. On arrival at its destination station the container is lifted from its truck and carted to the consignee who does the unpacking himself instead of the goods being unpacked and reloaded at the arrival siding for conveyance to the final destination. The risk of damage in transit is greatly lessened by this avoidance of intermediate handling.



A loaded container being slung on to its truck as described in this article.

Reference must be made also to the 3,000-gallon milk tanks brought into service some time ago by the G.W.R. and L.M.S.R. for the conveyance of milk between the United Dairies' country depots at Wootton Bassett (G.W.R.) and Calveley (L.M.S.R.), and the firm's distributing depot at Willesden, in the north-western district of London.

Nearly 300 million gallons of milk are conveyed each year on British railways, and to handle this huge traffic by the old method, in churns, a train of milk trucks 2,500 miles in length would be required! If all this milk were conveyed in the new milk tanks, the train would be only 730 miles in length, equivalent to an economy of 70 per cent.! This economy is pictorially displayed by our illustration of a milk tank and the churns that would be necessary to convey an equal bulk of milk, and that will need handling themselves in addition.



An interesting comparison showing the economy in space afforded by the use of milk tank wagons. The vehicle illustrated will hold as much milk as the 300 ten-gallon churns in the foreground.

The tanks themselves are built of steel and the interior is lined throughout with glass enamel. Between the outer and inner casings there is a two-inch cork insulating lining to maintain the milk at a constant temperature during transit.

Insulated vans are provided also for meat and fish traffic, but the special wagons provided for this purpose do not rely solely upon the insulating material to prevent a rise in temperature, and an ice box is fitted in each wagon.

For banana traffic we pass to the other extreme. The huge quantities of this fruit imported into this country necessarily are picked "green."

Sudden changes of temperature are fatal to its condition, and for its journey from the port of arrival to its inland destination steam-heated vans are provided and maintained at a constant temperature. These wagons are in effect temporary ripening rooms. Other fruit and vegetables usually are conveyed in ventilated vans.

There are other types of special rolling stock that can be used for several kinds of traffic. For example, the Southern Railway have what is known as a "utility" van that is designed to carry traffic as dissimilar as theatrical scenery, motor cars and light guns. This van has folding doors at the sides and also hinged doors with bottom drop flaps at the ends, so that traffic may be loaded either from the sides or ends. Vans of this type can be distinguished by special markings, such as a broad white stripe that runs diagonally from top to bottom across the van's side. This facilitates the speedy identification of such vans as they stand in the goods yards.

The economic handling of empty wagons is one of a railway company's greatest problems. There is a serious non-productive expenditure involved in returning empty wagons from one depot to another, and in order to minimise the problem the "common-user" principle is employed. In this all company-owned wagons, unless marked to the contrary, can be used by any receiving station to forward traffic to any other station. Thus an L.N.E.R. truck may find its way to an L.M.S.R. depot, and be passed from there to an S.R. station and thence to a G.W.R. depot. In order to facilitate the repair of such wagons standard parts are used to a considerable extent in their construction.

"Stove-pipe" Chimneys on the L.M.S.R.

The new 0–4–4 tank engines, numbered 6400 and upwards, to which reference was made in last month's "*M.M.*," have been completed at Derby and sent into traffic. In general design and dimensions they are closely similar to the former Midland engines of that type, but in most of their details they follow modern L.M.S.R. practice. The most startling feature in the new engines is the chimney, which is of the tapered "stove-pipe" pattern! As the new 0–4–0 shunting tank engines, one of which is illustrated on this page, also have stove-pipe chimneys, it would seem that Mr. Stanier may be contemplating making the "stove-pipe" standard on the L.M.S.R.

From Crewe works two further 4–4–0 passenger engines of Class 2P have been turned out. They are numbered 699 and 700, and complete a series of 15 engines of the class. Additional standard 2–6–0 mixed-traffic locomotives also have been sent out and are numbered 13242 to 13244. These complete an order for 10 engines of this class.

A new batch of three cylinder 4–6–0 express locomotives of the "Baby Scot" type (Class 5X) is on order at Crewe. The 17 already in service are numbered as follows:—5902, 5936, 5942, 5949, 5958, 5959, 5966, 5971, 5974, 5982, 5983, 5985, 5987, 5992, 6005, 6010 and 6012. No. 5902 is named "*Sir Frank Ree.*"

These "Baby Scots" are doing extremely well in service and are great favourites with the enginemen. To their noteworthy runs already recorded in past issues of the "*M.M.*," another can now be added. On Saturday, 28th January, this year, engine No. 5966, in charge of Driver Benson, worked the 2.50 p.m. express from Euston to Manchester, the gross load behind the tender being 280 tons. A signal stop before Rugby occasioned the loss of several minutes but from Rugby to Stafford such brilliant running was accomplished that over 4 min. were gained on the tight schedule allowance of 54 min. for the 51 miles. Actually the distance was covered in 49 min. 43 sec., start to stop, or at an average of 61.5 m.p.h. A maximum speed of almost 75 m.p.h. was attained between Nuneaton and Atherstone. After Milford the engine was eased and a slight signal check was experienced approaching Stafford, causing a little delay.

L.M.S.R. No. 1540, one of the new 0-4-0 saddle tank locomotives recently placed in service. The "stove-pipe" chimney is a new feature for engines of this line. Photograph by courtesy of the L.M.S.R.

Recently a defective whistle that refused to be shut off caused the removal of a "Royal Scot" from the up "*Mancunian*" at Rugby. No. 5392, "*Penmaenmawr*," of the L.N.W.R. "George the Fifth" class, then took the train on to Euston, 82.5 miles in 84 minutes.

S.R. Locomotive News

As the electrification of the main line to Brighton has set free a number of the 4–6–0 "King Arthur" class engines for service elsewhere, it is not likely that any additional large passenger locomotives will be required by the Southern Railway for some time to come. Eastleigh works are continuing work on the order for 20 three-cylinder 4–4–0 express locomotives of the "School" class, however, and several have now been completed.

Ashford works are still engaged on a batch of 15 engines of the 2–6–0 "N" class. When these have been finished, 10 more 2–6–4 goods tank engines of the "W" class will be proceeded with.

L.N.E.R. Engines Rebuilt

Two locomotives, Nos. 8848 and 8890, of the 4–4–0 "Claud Hamilton" class of the former G.E.R. have been rebuilt at Stratford works and have received round-topped boilers of the "J39" class in place of the boilers with Belpaire fireboxes they had formerly.

Another of the 4–6–0 engines of the "B12" class, No. 8516, has been rebuilt with larger boiler. The splashers and running plate have also been altered to match those of the 8571 series, four of which have already been fitted with larger boilers.

The engine that was drawing the 10 a.m. express from Marylebone to Bradford when it came into collision with a goods train at Loughborough on Tuesday, 31st January, was No. 5423. It is of the 4–6–0 type, with 6 ft. 9 in. coupled wheels and two inside cylinders of 21½ in. diameter and 26 in. stroke. It was built for the former Great Central Railway at that Company's works at Gorton in 1912 and was the first of a series of six. The name "*Sir Sam Fay*" was given to it in honour of the general manager of the G.C.R. at that time.

New Electric Stock on the L.M.S.R.

Some new and improved coaches of the compartment type have been built by the L.M.S.R. for use on electric suburban services and a specimen coach was brought up to Euston for inspection recently. It has driver's and luggage compartments and eight for third-class passengers. As the new coach has a width of 9 ft. 3 in. there is comfortable seating for six passengers a side, the eight compartments thus providing 96 seats. The upholstery is both comfortable and artistic, a pleasing shade of blue being the predominant colour. The length of the coach is 57 ft. 1 in. and its weight 30 tons. The use of compartment stock will be noted. In the earlier days of electric traction, coaches with doors at the ends were employed.

G.W.R. to Build 121 New Locomotives

The batch of 10 new 2–6–2 tank engines, Nos. 6150-9, have been almost completed at Swindon, and work is well advanced on 10 further 0–4–2 tank engines of the "4800" class. A beginning has been made also with the building of 10 new 4–6–0 engines of the "Hall" class that will be numbered from 5921 to 5930. Another 10 "Halls" will be built later.

The new works programme that was authorised recently provides for the construction of 121 locomotives, but no express passenger engines are included among them. Only 10 tender engines are to be built and they are of the small 0–6–0 goods type. Of the various standard tank classes the following are to be built:—ten 2–6–2 engines for suburban passenger services; fifty 0–6–0 goods engines; thirty 0–4–2 engines for auto-train working; fifteen 0–4–2 engines for branch line working; and six 0–6–0 yard shunting engines.

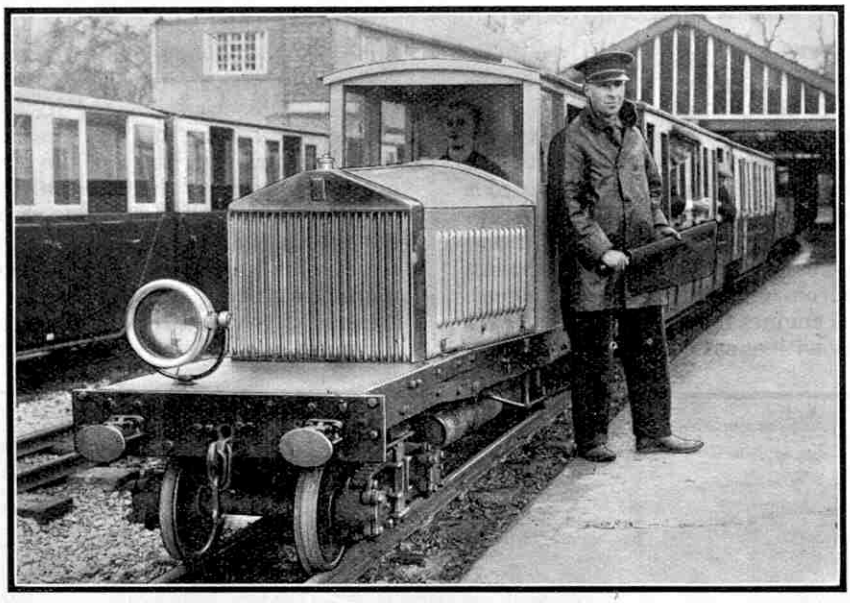
The Fastest Train on the S.R.

Since 1st January the 3 p.m. express from Waterloo to the West of England has been booked to run the 83.8 miles from Waterloo to Salisbury in 87 min. This is the fastest schedule ever operated between these points and demands an average speed of 57.8 m.p.h., thus making this the fastest train on the "Southern." The acceleration has been made in order to allow for the insertion of a stop at Templecombe, while still maintaining the former arrival time at Exeter.

Smart Running on the G.W.R.

A correspondent has kindly sent logs of two runs he made one day recently in travelling from London to Bristol and back. They record some exceptionally fine work on the part of the engines and their crews, since in spite of heavy delays the sharp overall timings were kept with over half a minute to spare in each case. On the down journey by the 11.15 a.m. ex Paddington, with engine No. 5010, "*Treago Castle*," and Driver King, the load at starting was 400 tons. As the weather was misty for the first 10 miles, cautious running was made and Southall was passed 2¼ min. late. The 35 miles from West Drayton to Cholsey were run off at an average of 69 m.p.h., however, and Didcot was passed 2 min. early. There coaches were slipped and the load reduced to 300 tons. At Wantage Road and at Challow long permanent way checks caused a loss of 5½ min. Smart running followed and a maximum of 84 m.p.h. was touched at Dauntsey. A slight check before Bathampton cost ½ min., and Bath was passed unusually slowly, the 106.9 miles from Paddington having taken 104 min. 15 sec. With a load reduced to 225 tons quick acceleration was made. After passing Keynsham, the engine was eased and the approach to Bristol was made with care. The overall time—inclusive of checks—for the 118.2 miles was 117 min. 20 sec. (40 sec. under schedule) or about 110½ min. net, an average of 64.18 m.p.h.

On the return journey on the 5.15 p.m. from Bristol, the load was 310 tons, drawn by engine No. 6000, "*King George V*," with Driver Hooper in charge. A long series of checks was experienced. At Stapleton Road and Filton Junction signals were on and thus in the opening stages five min. were lost. Later, at Wootton Bassett, adverse signals brought the train almost to a standstill and a further 3½ min. were lost. Swindon was passed at 50 m.p.h. and with the load reduced by one coach, speed rose to 80 m.p.h. beyond Uffington. At Wantage Road permanent way repairs demanded a long slack. Swift running ensued, but at Reading speed was reduced to 25 m.p.h. After that, with a load of only 240 tons, "*King George V*" went like the wind and 25 miles were covered at an average speed of 83 m.p.h. Another signal check at Westbourne Park caused a loss of a min. but Paddington was reached 50 sec. early, the 117.6 miles having been run off in 119 min. 10 sec., of which fully 15 min. had been lost through checks. The net time was not more than 104 min. To keep time and even arrive early with such exacting schedules and in spite of such tantalising delays called for truly magnificent work and both runs merit very high praise.



A 1914 Rolls-Royce chassis converted into a locomotive for service on the 15-in. gauge Romney, Hythe and Dymchurch Railway. During trials the remarkable speed of 56 m.p.h. was reached with a load of two coaches, each weighing four tons. For our photograph we are indebted to Rolls-Royce Ltd.

Disinfecting Plant for G.W.R. Coaches

The Great Western Railway Company have just brought into use at Swindon Works a new type of plant for purifying the inside and upholstery of its rolling stock.

The plant consists of a steel cylinder, 85 ft. 0 in. in length and 16 ft. 6 in. in diameter, in which is fitted a track upon which the vehicles to be treated are run, no dismantling being necessary. The cylinder is then sealed by an air-tight door swung into position, and the temperature in the cylinder is raised to 120°F. by passing steam through pipes that completely encircle the vehicle under treatment. At the same time air is withdrawn from the cylinder by a pump, until a vacuum reading of 28 in. of mercury is reached. The high temperature and vacuum are maintained for six hours, ensuring complete purification.

In cases where the vehicles have been exposed to infectious diseases, formalin is introduced into the cylinder during treatment. This comes from a small tank connected by a pipe to an evaporating chamber on the steam heating pipe line. In the tank the liquid becomes formaldehyde gas and this is drawn through perforated tubes into the cylinder, where it penetrates into every corner of the vehicle, thoroughly disinfecting everything, including such articles as cushions, bolsters and rugs.

A Brighton electric train near Clapham Junction. The new electric services on the London-Brighton line of the S.R. were described in last month's "M.M."

Faster Freight Trains on L.M.S.R.

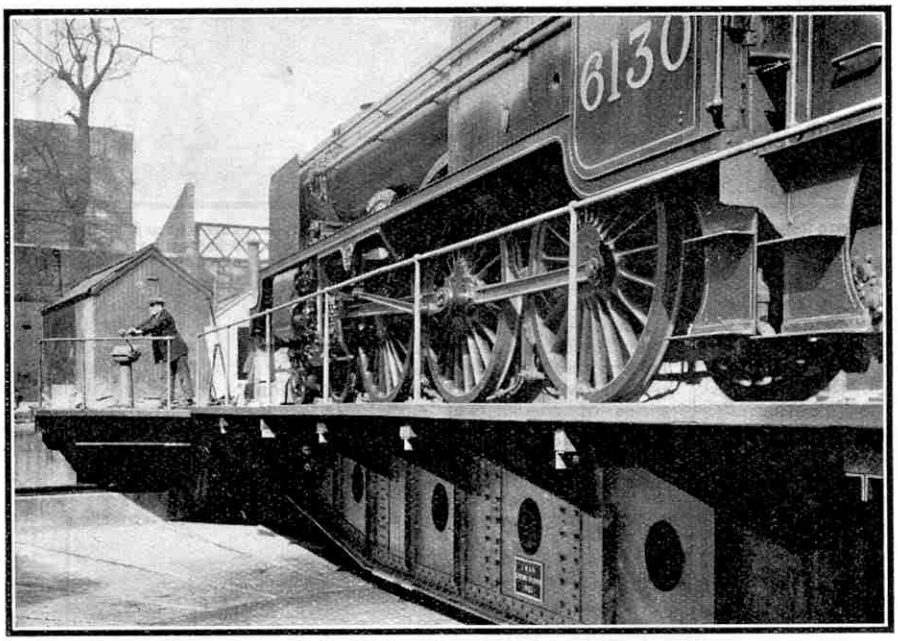
A report issued by the L.M.S.R. shows that during the past year 166 of the principal freight trains were accelerated by no fewer than 8,652 minutes per day. The intensive speed-up carried on during 1932 has been continued during the winter, with the result that since 12th September 60 important freight trains have been accelerated by nearly 2,000 minutes daily. The accelerations, varying in extent from 5 min. to 123 min. affect services throughout the country.

Among the trains that have been speeded-up is the 7.45 p.m. express freight from London (Camden) to Liverpool (Edge Hill). This train makes the journey of 191 miles without a stop, and holds the "Marathon" record for the longest non-stop journey of any British freight train.

How Locomotives are Turned

Giant Turntables and their Work

A TURNTABLE, as its name implies, is a revolving platform, and on a railway is the name given to the apparatus adapted to the turning of locomotives so that they may work chimney first when hauling trains. Tender locomotives are seldom used on trains with the tender leading, as this is inadvisable if a fairly high speed is required, apart from the discomfort occasioned to the crew. Turntables are therefore primarily intended for turning such engines, apart from their occasional use as traversers for transferring an engine from one line to another adjacent. It is not necessary for tank engines to be turned, as they are designed to run either way with equal facility, and the men have some protection from bad weather when the trains run in reverse; but it is the usual practice to turn tank engines that are being used for fairly long-distance local services at more or less high speeds. It is difficult for the enginemen to secure a good lookout over a large bunker full of coal, and management of the engine is inclined to be awkward when the controls are at the driver's back.



A striking view of a "Royal Scot" locomotive on the 70-ft. well-type turntable installed at Euston by the L.M.S.R., to whom we are indebted for this photograph. In spite of the size and weight of the locomotive, turning can be accomplished by one man in 1¼ minutes.

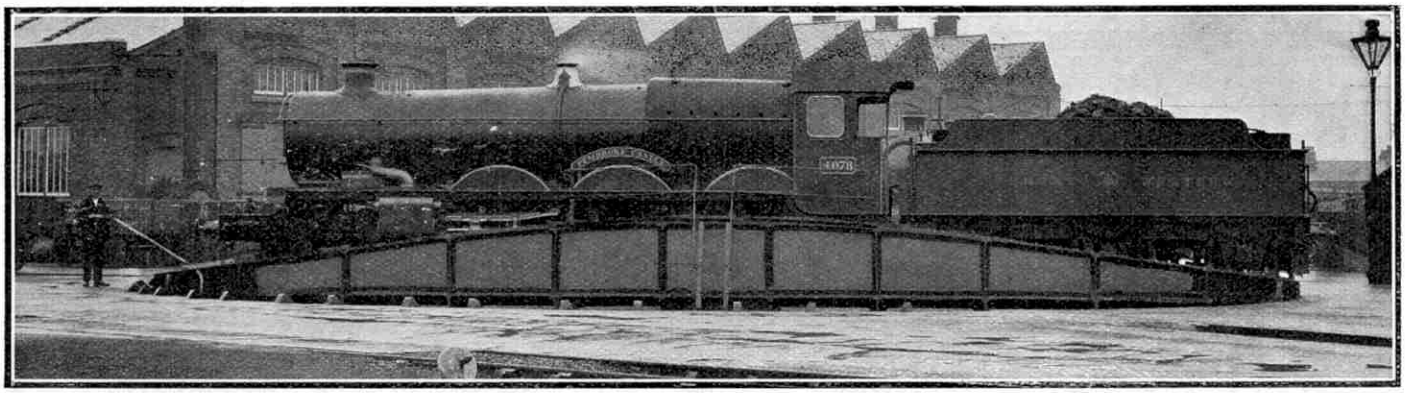
Turntables have been used since the earliest days of railways in this country. The transfer of through carriages at junctions was frequently accomplished in this manner, and also the shunting of vehicles at carriage depots and in stations. For many years the fact that carriage shunting on the L.N.W.R. was largely carried out by means of turntables had the effect of limiting to some 33 ft. the length of the coaches that could be run on that system.

In order to keep pace with the growth of locomotives, turntables have necessarily developed in size and capacity, although in many cases the engines have outstripped the turntables. A notable instance of this occurred on the Caledonian Railway when the pioneer McIntosh express 4–6–0s were introduced in 1903. These were Nos. 49, and 50, "*Sir James Thomson*," and for that date they were quite colossal engines with their enormous 5,000 gallon double-bogie tenders. They were in fact at the time the most powerful express engines in Great Britain. Their appearance was not due to any incapacity on the part of the 4–4–0s then in service, for these included the famous "Dunalastair" locomotives of the first three series; but train loads were ever on the increase.

Owing to the severity of the route between Carlisle and Glasgow, which involves the 10-mile climb to Beattock in the down direction and the exacting ascent to Craigenhill on the up journey, and also the fact that bad weather frequently prevails in the higher altitudes, Mr. McIntosh decided that, for all conditions of weather and load, the adhesion of six-coupled wheels and the steaming power of a large boiler were desirable. Hence the building of these monsters, as they certainly were in comparison with the average express engines at that period. A disadvantage owing to the lack of suitable turntables was the very inconvenient necessity of separating each engine from its tender each time it reached its journey's end, and no doubt those upon whom this extra work devolved did not consider these big engines any too favourably. The position was subsequently eased in 1906 by the installation of 72-ft. turntables at Perth, Aberdeen, Dundee and Carlisle.

Similarly when the Gresley "Pacifics" first came out in 1922 it was necessary for them to run light from King's Cross to Hornsey for turning, as there were no suitable facilities at the terminus. This light engine mileage was obviated about 1924 by the provision of a 70-ft. ball-bearing turntable with balancing rollers at the ends.

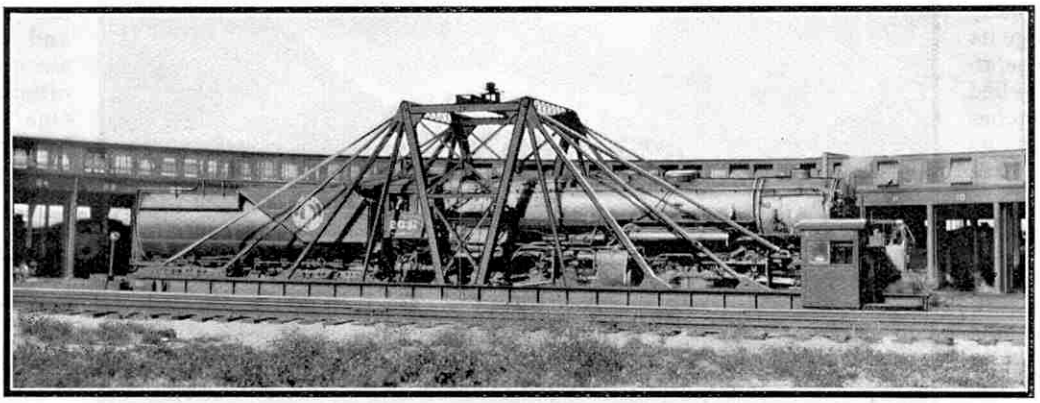
The kind of turntable most commonly used in this country is known as the well type which, as its name suggests, is situated inside a well or pit sunk in the ground. Substantial girders well braced together form the underframe of the table, and it is in order to secure sufficient depth for this to be of adequate strength that the pit is provided. Upon the underframe is fitted a wooden or metal platform for carrying the rails. In order to prevent accidents, such as might be caused to men falling from the table into the pit, iron railings are usually provided at the sides. The girders are pivoted in the centre of the well, and the wall of this is usually of brick, while the edge and ground level is often laid with wood for a width of about 3 ft. On this circular wooden path are fixed battens to provide a foothold for the men engaged in turning an engine, where the table is moved by pushing. For this purpose long iron



levers are fitted at both ends of the revolving platform. There are in addition levers operating locking devices to secure the turntable in a suitable position to lead to any of the roads radiating from it.

An interesting feature is sometimes to be seen when there are turntables in the vicinity of railway repair shops or stations. In such cases the revolving platform, instead of being only sufficiently wide to accommodate one track, is built so as to cover the whole of the pit opening, and this prevents the possibility of accidents caused by anyone falling into the pit.

Turntables nowadays are often fitted with an electric motor, and this naturally is a great help to the driver and fireman, as it relieves them of the effort required to move the table. An electric turntable is also much quicker in operation, and is therefore specially valuable when the time allowed for turning is short.



The photograph at the head of the page shows the G.W.R. pattern of balanced turntable that requires no pit and is thus exactly opposite in design to the well-type turntable. The engine shown on the table is "Pembroke Castle," a four-cylinder 4-6-0. The big engines of America require correspondingly large turntables. The lower photograph, showing a 2–8–8–2 simple-expansion "Mallet" locomotive being turned, was taken at Seattle by our reader, Mr. W. Hendry of Vancouver, B.C.

The diameter of a turntable is usually about 50 ft., and this will accommodate the majority of English engines of average size. Those installed recently are in the neighbourhood of 70 ft. in diameter, owing to the great length of engines of the latest designs. The smaller tables are quite common on lines where in pre-grouping days no very large engines were used. It is a fascinating sight to watch a long passenger locomotive being driven on to a turntable that will barely accommodate it, and readers no doubt will have watched this operation. The buffers and part of the frame of the engine may considerably overhang the well, but it is the length of wheelbase that counts, and possibly there will only be a few inches to spare at each end when the engine is finally placed. Such careful work as this requires a great deal of skill on the part of the enginemen in order to fit the locomotive accurately on the table.

The necessity for such fine balancing is done away with when turntables such as that installed at York Locomotive Depot are in use. This is of the Mundt type, so called because it was devised by Mr. Mundt of the Dutch State Railways. Comparatively shallow girders are used, so that the pit is not deep, and these are designed to give flexibility, placing 60 per cent. of the load on the centre pivot and the remainder on wheels carrying the ends of the table on a circular track in the pit. These wheels are slightly conical in profile, and the rail is machined to suit, so that there is maximum adhesion and avoidance of undue wear. The circular track has to be as even as possible in order to limit the effort required in turning.

No pit at all is necessary for the balanced turntable that is used a great deal by the Great Western Railway. These tables are usually built up of girders, and a pivot is situated in the centre of the floor. The ends of the table run on wheels, on a circular track as before, but this is laid at ground level, as the depth of the girder is above the turntable and not below as in the well type. These features are clearly shown in one of our illustrations, where "*Pembroke Castle*" is being turned on a typical G.W.R. turntable.

A notable engineering feat was recently achieved by the L.M.S.R. in connection with the installation at Euston of a new 70-ft. turntable. This replaced a smaller one that had become unsuitable for present-day use. The new turntable is capable of dealing with engines up to 160 tons weight, and by means of special equipment an engine of this weight can be turned by one man in $1\frac{3}{4}$ minutes! Owing to the confined space in which the turntable had to be installed, special arrangements had to be made for carrying out the work. One of the sidings had to be slewed to enable two 36-ton cranes to take up suitable positions for handling the table. Usually new turntables are delivered in sections at the site and subsequently assembled, a process occupying about three weeks; but on this occasion the table was built at Crewe Works and then forwarded by rail. On arrival it was placed on prepared foundations by means of the two cranes, and the work was accomplished without the slightest difficulty in about 80 minutes.

The size of locomotives abroad necessitates corresponding provision as regards turntables, and a view of an American installation appears on this page.

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

The "Inside Passage" to Alaska

After travelling northward to Alaska through what is known as the "Inside Passage," I came to the conclusion that this route is one of the most wonderful in the world. Its name is due to the fact that the splendid vessels in which the voyage is made pass between the mainland of Canada and Alaska and the many islands that fringe its shores. The vessel in which I travelled traversed stretches of calm water as narrow as the fjords of Norway, now heading directly for snow-capped island mountains reaching above the clouds, and then turning abruptly to right or left, when heavily-wooded rolling hills backed by rugged mountains became visible.

Juneau the capital of Alaska, with snow-capped Mt. Juneau rising to a height of 4,200 ft. behind the city. Photograph by J. Busey, Seldovia, Alaska.

Each of the places at which we called had some feature of special interest. For instance, at Ketchikan in South-east Alaska more salmon is packed than in any other place in the world. Further north is Juneau, the capital of Alaska, built on the slopes of Mt. Juneau, which rises to a height of 4,200 ft. As the accompanying photograph shows, some of the buildings are on the steep hillsides, and piles support others that are built on the edge of the sea itself.

The only real sea journey in the trip to Alaska by the "Inside Route" follows a call at Juneau, for there the liner turns into Icy Straits, remarkable for their gigantic glaciers, and then into the Gulf of Alaska. After a day and a half out of sight of land she approaches the harbour of Cordova, formerly known as the "Copper Gateway of Alaska." The electric lights, motor cars, picture houses and telephones give Cordova the familiar appearance of a modern city, in spite of its northerly situation.

At present Alaska is being developed as a mining country. Aeroplanes are largely employed for communication purposes, and it is remarkable to find that in many centres the natives are familiar with these, although they have never seen any other kind of machine.

One growing Alaskan industry is fox farming. Rearing white foxes for the sake of their fur is an uncertain business, for the animals are very nervous, and when they are alarmed, the females often kill their young. One fox farmer who lost three puppies out of a litter of four in this manner saved the fourth by persuading a cat to adopt it. Other farmers find it necessary always to wear the same clothes when they feed their animals in order to prevent them from becoming suspicious, and if a breeder begins to feed his charges with his hat off, he must continue to do so in all weathers! J. BUSEY (Seldovia, Alaska).

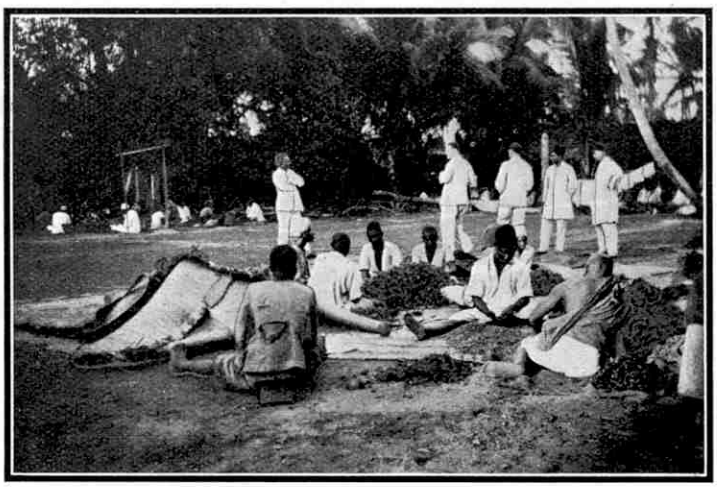
A Tasmanian Shot Tower

About seven miles from Hobart there is a tower, built of yellow stone, that was formerly used for making shot. It is 200 ft. in height, and about 12 ft. in diameter at the base. Entrance to it is gained through a storehouse, and inside is a spiral staircase, built of wood, that leads upward to a room and circular platform at the top of the tower. The owner of the tower himself acted as engineer, carpenter and foreman during its erection, and the first shot was made on 8th September, 1870. The records show that the tower once was very busy, but now it exists only as a landmark, and as shot towers are rare to-day, is a feature of interest to visitors, who ascend it at their own risk!

W. L. B. VERRALL (Hobart).

Clove-growing in Zanzibar

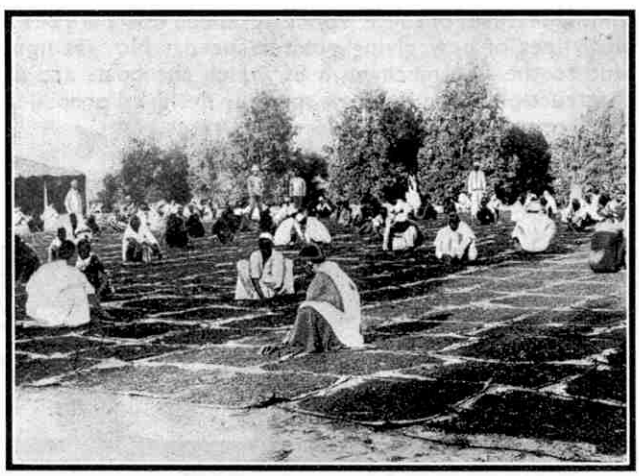
The production of cloves is the most important industry of Zanzibar, this and the neighbouring islands being responsible for about 80 per cent. of the world's supply of this spice. In the form in which it is familiar to most readers of the "*M.M.*," the clove is the dried unexpanded flower of a beautiful evergreen shrub that until about 150 years ago was grown only in the Moluccas or Spice Islands, where it was closely guarded by the Dutch. Then the French succeeded in carrying the plant to Mauritius, and it is said that it was taken from there to Zanzibar early last century by an exiled Arab who tried to regain the favour of the ruling Sultan by means of its introduction.



Natives separating cloves from stems on a plantation in Zanzibar.

Nature has given Zanzibar a soil and climate eminently suitable for clove-growing, and there are now about 3½ million trees in the island. Only once has disaster overtaken the plantations. This was in 1872, when a violent hurricane destroyed two-thirds of the trees. The island of emba fortunately escaped the storm, and enormous trees about 40 ft. in height and 75 years of age are to be seen there.

Clove seedlings are set out in rows in order to form a plantation. They do not commence bearing until they are six or seven years of age, and then they give increasing yields as they grow older, actually producing two crops a year. When the cloves mature, their fragrant red and green bunches present a beautiful sight against the background of green leaves. Picking then commences, native men and women working all day pulling off the cloves and separating them from the stems, stopping only occasionally for cups of stimulating Arab coffee. As sunset approaches their day's output is measured and paid for, and the cloves are then spread out on mats to dry, two days' exposure to the tropical sun being sufficient to prepare them for the market. The stems are not thrown away, for their value is about one-fifth of that of the buds.



Drying Zanzibar cloves in the Sun. The photographs on this page are by Mohamed H. S. Dewji, Zanzibar.

The crops vary according to the weather from about 3,000 tons to 18,000 tons, two-thirds of the quantity being produced on Pemba Island. The cloves are exported chiefly to the Dutch East Indies, India, the United States and European countries. In Europe and America they are mostly distilled in order to give oil of cloves, and in India they are employed as a spice. In the East Indies they are mixed with tobacco for smoking purposes.

MOHAMED H. S. DEWJI (Zanzibar).

Making Miners' Electric Lamps

Although a miner's electric lamp is simple in appearance, there are many intricate operations in its manufacture. The cylindrical case is pressed from sheet steel and the bottom, also a pressing, is electrically welded to the case by means of a spot welder. Minor components, such as nuts and bolts, are turned on high-speed lathes. The case contains a small accumulator and a lamp bulb and switch, and these were made in the works that I visited.

I found the construction of the lamp the most interesting part of the process. The bulbs are produced by heating short lengths of glass tubing and placing these in a mould to which compressed air is admitted in order to give them the required size and shape. Jagged ends are then cut off and the bulb is annealed, after which the glass tube that contains the filament leads is hermetically sealed in by means of a rotating machine capable of dealing with 50 or 60 bulbs at the same time.

The filament itself may have one of several shapes. It is often a spiral produced by winding the material round a piece of copper wire in an ingenious machine that handles it very delicately. The ends of the spiral are joined to the filament leads by welding them with the aid of very fine gas jets. The bulb is then sealed to its metal base by means of plaster of paris or a special compound.

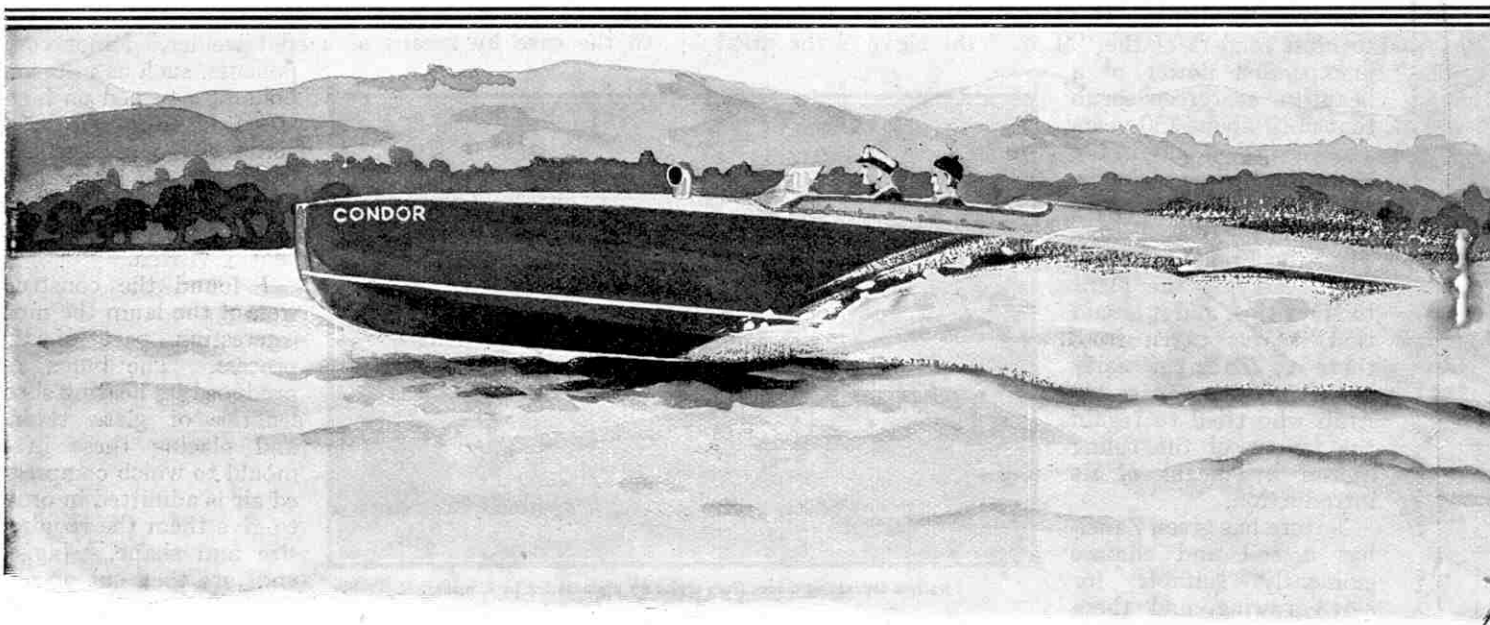
Finally the bulbs are completely evacuated or filled with the inert gas argon. The air is removed by a battery of pumps, and if argon is to be employed it is admitted to the empty bulb from a special storage cylinder, first passing through tubes containing chemicals that remove every trace of impurity.

Every bulb is carefully tested in order to make sure that the filament will stand up to the voltage applied to it, and the candle power is checked by means of a photometer in order to ensure that it will give ample light when in use. If the test proves it to be satisfactory it is ready for assembly in the lamps themselves.

The source of current is an accumulator. Increasing use is now being made of the alkaline cell, in which nickel and caustic soda are employed instead of the more familiar lead and sulphuric acid. This cell has the advantage of being much lighter and neater in construction than the ordinary accumulator, and in these respects is more suitable for inclusion in a portable lamp.

R. S. ATKINSON (Barnsley).

Boys! Now is the time to g



Nothing like the new 1933 Hornby Speed Boats has been known before in model speed boat construction. They are superb! Each model follows closely the design and general characteristics of the world's famous speed boats. All possible skill and ingenuity has been employed in the manufacture of these new speed boats.

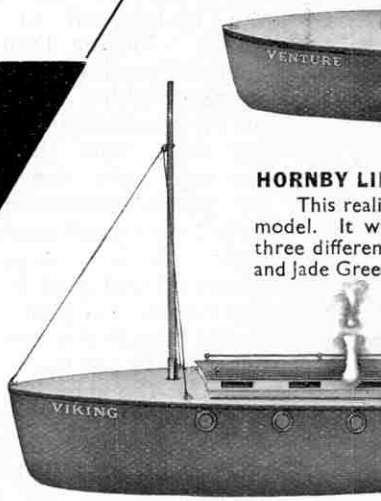
Boys who insist on speed and efficiency, plus power and sustained length of run, will choose a "Hornby." There are five splendid models, ranging in price from 5/– upwards, each attractively finished and available in three different colour combinations.

Perhaps the most outstanding features of these wonderful speed boats are the excellent streamlined hull and fine entry lines of bow giving greater speed. No less important is the amazing length of run due to the fine mechanism by which the boats are propelled, and the unique methods of construction of the hull. A specially designed propeller ensures that turn of speed so vital when competing in local speed boat races.

Ask your dealer to show you the 1933 Hornby Speed Boats.

The New Hornby Speed Boats will be ready early in March

HORNBY SPEED BOATS



HORNBY LI
This reali
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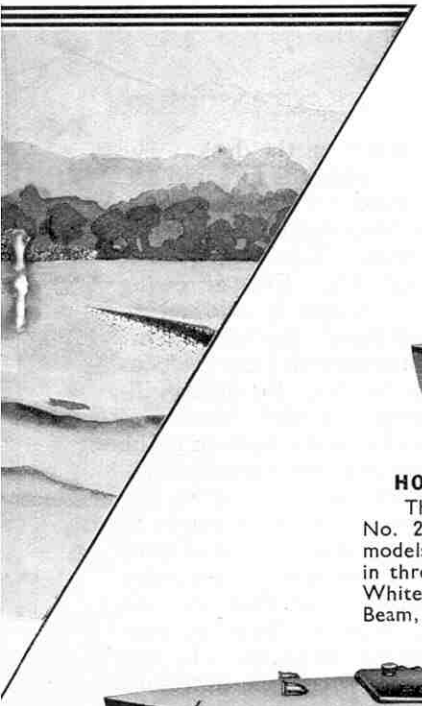
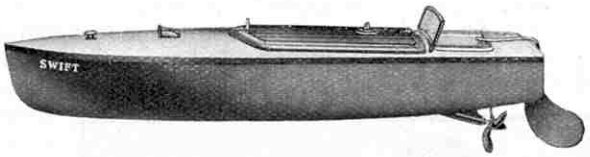
HORNBY CABIN CRUISER No. 5
The perfect design and handsome
Cruiser Speed Boat No. 5 makes it a
It will travel over 500 feet on one windi
colour combinations—Red and Crean
Green and Ivory. Dimensions : Leng

get a Hornby Speed Boat!



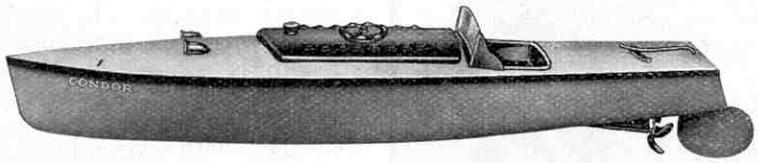
HORNBY SPEED BOAT No. 1. "MARTIN." PRICE 5/-

Hornby Speed Boat No. 1 is a very efficient model, measuring 8½ in. in length and 2⅜ in. in beam. It will travel over 160 feet on one winding. Finished in three different colour combinations—Red and Yellow, Blue and White, and Orange and Green.



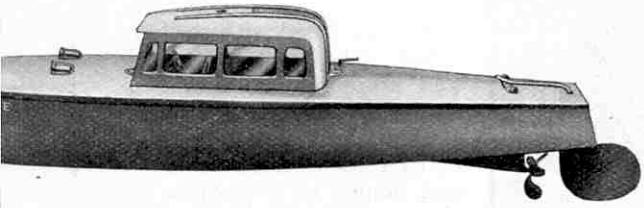
HORNBY SPEED BOAT No. 2. "SWIFT." PRICE 7/6

The exceptionally fine performance of Hornby Speed Boat No. 2 will make it one of the most popular of the Hornby models. It will travel over 300 feet on one winding. Finished in three different colour combinations—Red and Cream, Blue and White, and Yellow and White. Dimensions: Length, 12½ in. Beam, 3 in.



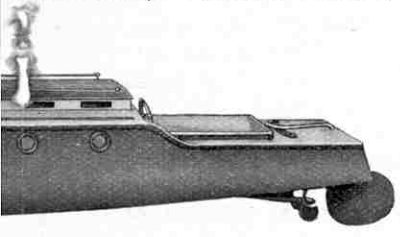
HORNBY SPEED BOAT No. 3. PRICE 12/6

Hornby Speed Boat No. 3 has already established itself as a great favourite. It will travel over 500 feet on one winding. Available with three different names and in three different colour combinations, as follows:—**"Condor"** (Red and Cream), **"Gannet"** (Blue and White), **"Curlew"** (Green and Ivory). Dimensions: Length, 16½ in. Beam, 3½ in.



Y LIMOUSINE BOAT No. 4. "VENTURE." PRICE 15/6

s realistic Hornby Limousine Speed Boat No. 4 is a magnificent It will travel over 500 feet on one winding. Finished in fferent colour combinations—Red and Cream, Blue and White, Green and Ivory. Dimensions: Length, 16½ in. Beam, 3½ in.



lo. 5. "VIKING" PRICE 16/6

dsome appearance of Hornby Cabin s it a model of outstanding merit. winding. Finished in three different Cream, Blue and White, and Jade Length, 16½ in. Beam, 3½ in.

This is an illustration of the Hornby Speed Boat Club Badge. Write for particulars and an entry form.

MECCANO LTD.
BINNS ROAD
LIVERPOOL, 13

The Hornby Speed Boats

A Fascinating Outdoor Hobby

DURING the summer months every active boy wants to be out in the open air as much as possible, and while he is out he wants to be doing something, not just loafing about. Games fill up part of the time, but there are always periods during which a boy wonders what to do with himself. There are various ways of filling up these periods, and one of the very best is to spend the time in model motor boating. This is a splendid hobby, and one within the reach of almost every boy. Once a boat has been obtained there is no further expense, and suitable sheets of water are to be found everywhere. The majority of the public parks in large towns and cities have a lake of some kind, and on most of these lakes model boating is permitted. As a rule park lakes are of a convenient size for the purpose. Too large an expanse of water is not desirable, as it is out of proportion to the size and capacity of the average small model boat, and a troublesome situation arises if for any reason the boat fails in " mid-ocean " ! The ideal lake is a shallow one, free from weed, and of such a size that boats can cross it comfortably with a little power in reserve.

A proud owner demonstrates to his chums the winding of the motor of his Hornby Limousine Speed Boat. The key passes through the roof of the cabin to the winding spindle inside.

For many years past Meccano and Hornby Trains have provided splendid winter hobbies for tens of thousands of boys all over the world, and it was in response to a widespread appeal for an interesting hobby to fill up the summer months that the first Hornby Speed Boat was introduced last year. The success of this boat was remarkable, and there was an immediate demand for other models. After long consideration and experiment four additional models were designed, and these are now available.

The original Speed Boat, now known as No. 3, is built entirely of metal, as are all the Hornby Boats. It is 18½ in. long, and its design is based on that of a popular and successful 45-ft. high-speed motor boat. It is very attractive in appearance, and when running in the water it reproduces to a remarkable degree the characteristic style of its prototype. The power is derived from a clockwork motor of exceptional strength carried in rigid bearers inside the midship section of the hull. This motor was specially designed to secure the greatest possible compactness, and it is made readily accessible by means of a large watertight hatch on the deck. The motor is screened by water-tight bulkheads fore and aft, and the propeller shaft is carried through the after compartment and into the midship section through a water-tight joint in the bulkhead. This arrangement makes the boat practically unsinkable. Even if, owing to neglect to secure the hatch, water is allowed to enter and flood the motor compartment, the fore and aft compartments have sufficient buoyancy to keep the boat afloat. This is an important feature, for many ill-designed model boats go straight to the bottom if the motor space becomes flooded.

Every model boat in the course of its career comes in for a certain amount of hard knocks, even if it is carefully handled ; and therefore the hull must be built of considerable strength. In the Hornby Boats the necessary strength is secured by the use of metal of the best quality and of adequate thickness, with every joint and seam carefully soldered. With reasonable care the boats will give many years of excellent service.

The appearance of the No. 3 Speed Boat is greatly improved by a cockpit placed aft of the motor compartment and fitted with a windscreen. The lever for starting and stopping the motor is situated in this cockpit, and the tiller arm is extended and carried forward so that its end comes to a position at the rear of the cockpit. The tiller moves over a rack fixed to the deck, and the position of the rudder is determined by the notch of the rack in which the tiller is placed.

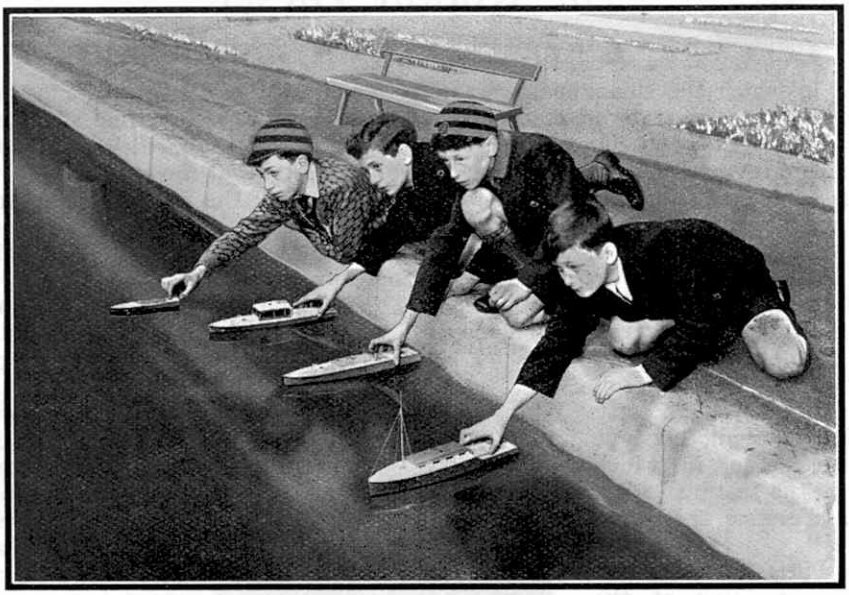
The boat is now available in three different colour schemes—blue hull with white deck, red hull with cream deck, and green hull with cream deck. For these colours special water-resisting enamel is used.

The performance of the No. 3 Speed Boat is even more remarkable than its appearance. On one winding it is capable of running continuously for a period of seven minutes, during which time it covers a distance of over 500 ft. in still water.

The four new Speed Boats that make their appearance this year consist of two smaller boats designed on the same general lines as the No. 3 Speed Boat, but differing in certain details ; and two boats of the same size as No. 3, one a Limousine Speed Boat and the other a Cabin Cruiser.

The two small boats, No. 1 and No. 2, are 8½ in. and 12½ in. in length respectively, and have a remarkable length of run for their size. On one winding No. 1 covers 170 ft. in 2 min. 50 sec.; No. 2 does 340 ft. in 4 min. 45 sec. These figures refer to still water. The boats are available in three different colour schemes—blue and white, red and cream, and yellow and white.

The Limousine Speed Boat No. 4 is more elaborate in construction than the No. 3, but its speed and length of run are similar. The design of the hull closely resembles that of the No. 3, and the propeller, rudder and motor are the same. The main difference is that the No. 4 carries a large limousine cabin, at the rear of which is fitted the starting and stopping lever. The cabin is provided with seats and steering wheel and celluloid windows at the front and the sides, and at the back it has an imitation sliding companion-way door. A hole is cut in the roof of the cabin for the insertion of the winding key. By undoing two screws, one forward and one aft, the entire cabin is made to lift off, so that the motor is made accessible. This attractive boat is supplied in blue and white, red and cream, and pale jade green and white.



Waiting for the drop of the flag! The start of a handicap short-distance race.

The Cabin Cruiser No. 5 is of entirely different design. It has a much higher freeboard than Nos. 3 and 4, and is provided with a well at the stern. The fore-deck, which occupies about two-thirds of the length of the boat, carries the cabin top, the roof of which is made to slide off towards the stern in order to give access to the motor compartment. A hole in the cabin roof is provided for the winding key to pass through. Handrails along the cabin top add greatly to the attractive appearance of the boat. Below the cabin on each side of the hull are four embossed scuttles enamelled to represent the familiar thick glass surrounded by a brass frame. Forward of the cabin is fitted a mast-step supporting a short mast held by three stays. These stays are attached at the upper end to a wire strap fitted near the top of the mast, and at the lower end they are taken to three separate deck hooks. The after end of the cabin is fitted with a dummy door leading into the well, a step being fitted as in actual practice. The well is 1 in. in depth, and a coaming is raised round its edge to prevent any small quantities of water that may lap over the cutaway portion of the hull from flowing into the well. On one side of the cabin door is fitted the starting and stopping lever, and on the other side is a neat and attractive dummy steering wheel. This boat is supplied in the same colourings as the Limousine Speed Boat No. 4, namely, blue and white, red and cream, and pale jade green and white.

An exciting finish! The result of this race was a tribute to the skill of the handicapper.

One of the many good features about model motor boating as a hobby is the absence of elaborate equipment. In addition to the boat itself, all that is really required is some means of dealing with the situation that arises when the boat stops either in the middle of a sheet of water, or at any rate too far from land to be reached by hand or with a walking stick. In some cases there is a boat on the lake that can carry out the necessary salvage work, but more often than not the motor boat owner is left to his own resources. A long pole, jointed if necessary, is useful for reaching the offending boat, but a much better method is to use a good length of strong cord with a lead sinker, weighing perhaps four ounces, tied at the end. This cord requires a little practice before it can be used with complete success. The object of course is to cast the sinker so that it falls just beyond the boat, which can then be hauled ashore without difficulty. Some boat owners take the sinker with a good length of cord in the hand and throw it as one would throw a cricket ball; others prefer to swing the sinker round rapidly in circles, releasing it when sufficient momentum has been obtained. If the swinging method is adopted it is very important to make sure that there are no onlookers within the range of the sinker, otherwise casualties are likely to occur!

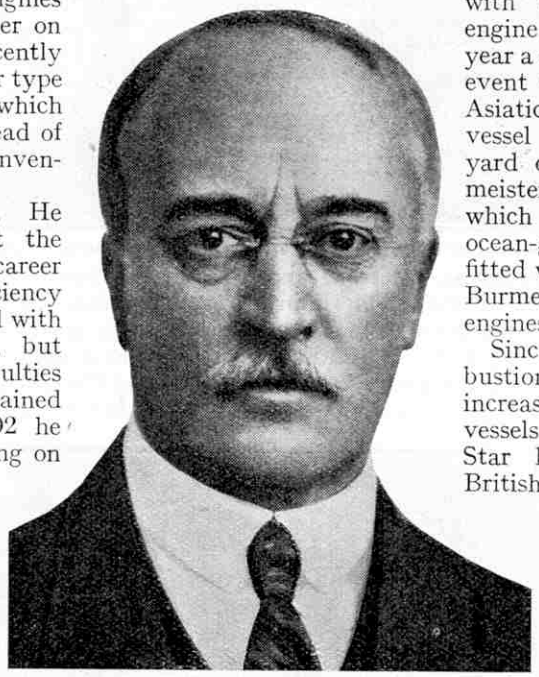
Splendid fun is to be had by merely cruising the boat up and down a lake, starting

(Continued on page 234)

The Pioneer of the Heavy Oil Engine

Dr. Rudolf Diesel

DURING the period in which the steam engine was slowly being brought to a state of efficiency, inventors never lost sight of the possibility of producing a self-contained or internal combustion engine. Early efforts to design an engine to develop power by the explosion of gunpowder inside a cylinder failed, but they paved the way for the utilisation of gases and inflammable liquids. In 1876 Dr. N. A. Otto produced the first really efficient gas engine, and eight years later Gottlieb Daimler brought out a practical petrol engine, from which have been developed the engines that to-day are providing motive power on land, on sea and in the air. More recently there has come into prominence another type of internal combustion engine, in which heavy oil is employed as the fuel instead of petrol. This is the Diesel engine, the invention of Dr. Rudolf Diesel.



Dr. Rudolf Diesel.

Diesel was born in Paris in 1858. He received his engineering training at the Munich Polytechnic, and early in his career he became impressed with the low efficiency of the steam engine. He experimented with an engine using coal dust as fuel, but abandoned this on account of difficulties arising from the ash and grit that remained as products of combustion. In 1892 he obtained a patent for an engine running on crude oil, and three years later he produced his first successful engine of this type. Improvements followed rapidly, in the course of which the original engine was modified greatly; and the Diesel engine of to-day is a highly efficient source of power for both land and marine purposes. Diesel did not live to see the great success of his engine. One night in 1913, while on a journey to England, he disappeared at sea, and the mystery of his death has never been solved.

The Diesel engine differs from other internal combustion engines in that the charge taken in during the suction stroke consists of pure air only, which is compressed to somewhere about 500 lb. per sq. in. The air is thus raised to a temperature sufficiently high to ignite the oil fuel. This fuel is sprayed into the cylinder at the end of the compression stroke by a blast of compressed air from a separate reservoir maintained at a pressure of from 100 lb. to 150 lb. per sq. in. in excess of the maximum pressure in the cylinder. It is important to notice that in the Diesel engine the fuel is not exploded as in the petrol engine, but is burned.

When the Diesel engine was introduced it was realised immediately that, if it could be adapted to ship propulsion, it would bring about a great saving in many directions as compared with the use of steam engines and coal-fired boilers. The number of men required for running the engines would be greatly reduced, as stokers and coal trimmers would not be required; and there would also be a large reduction in the amount of space required for carrying fuel. The early Diesel engines had certain defects that delayed their application to marine propulsion, but most of these have now been overcome, and to-day the marine Diesel engine is being installed in vessels of all types, and is so successful in its performance that it is a formidable competitor to the steam engine.

The first sea-going motor ship was the "*Vulcanus*," gross tonnage 1,180, built in Holland in 1910 and fitted with a Werkspoor four-cycle Diesel engine of 650 i.h.p. In the following year a much more important engineering event was the completion of the East Asiatic Company's 7,500-ton motor vessel "*Selandia*," at the Copenhagen yard of the well-known firm of Burmeister and Wain. The "*Selandia*," which may be regarded as the pioneer ocean-going motor cargo vessel, was fitted with two eight-cylinder four-cycle Burmeister and Wain marine Diesel engines, giving a total of 2,500 h.p.

Since then the use of internal combustion engines for ship propulsion has increased enormously. Among recent vessels may be mentioned the White Star liner "*Britannic*," the largest British motor vessel afloat, and the "*Reina del Pacifico*" of the Pacific Steam Navigation Company. The fastest motor vessel in the world is probably the Italian quadruple-screw ship "*Victoria*" of the Lloyd Triestino Line. The principal dimensions of this vessel are length on load water-line 533 ft.; breadth moulded 67 ft. 3 in.; draught 22 ft., and gross tonnage 13,400. She is propelled by four C.R.A. Sulzer single-acting two-stroke cycle Diesel engines, each developing 4,250 b.h.p. at 130 r.p.m. Her service speed is 20.5 knots, but on her trials she achieved 23.264 knots.

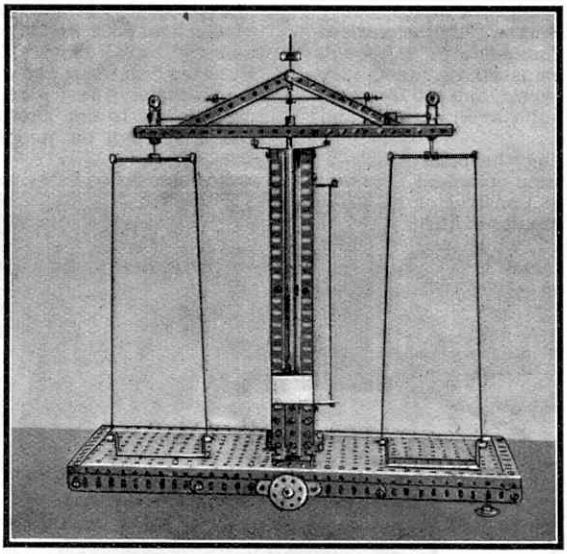
Diesel engines are used also on land for many purposes, including the generating of electricity and the driving of general factory machinery of various kinds, and for pumping. The Canadian National Railways have experimented successfully with a Diesel electric locomotive, the largest and most powerful of its kind in the world. It consists of two units weighing altogether a little over 290 tons when fully equipped, of which 214 tons are carried on the driving wheels. Each unit consists essentially of an oil engine generator set mounted on the locomotive frame; boiler equipment for steam heating of passenger coaches; four traction motors for propelling the locomotive; and air brake and other equipment. The engine is a Beardmore 12-cylinder oil engine with a nominal rating of 1,330 h.p. at 800 r.p.m.

Meccano Model-Building Contests

"March" Competition

It should be the aim of every Meccano boy to enter as many as possible of the special model-building competitions announced month by month in the "*M.M.*," for they afford the valuable opportunity of measuring his model-building ability with that of model-builders all over the world. The experience gained by working in competition with others will not only broaden the competitor's outlook, but will show him just how his work stands in relation with other experienced model-builders. In addition to this there is always the chance of winning a valuable prize.

In the present competition there are no restrictions as to the type of model that may be submitted, the only condition being that models must be built entirely from standard Meccano parts. When the subject for a model has been decided upon—and it should be remembered that the whole range of engineering and architectural subjects is open to competitors—it should be reproduced faithfully and neatly in Meccano, and then either a photograph or a good drawing obtained of the finished model. The competitor's age, name and full address should then be written clearly on the back of each photograph or drawing, and these should be sent, together with a brief written description of the model, to "March Model-building Contest," Meccano Ltd., Binns Road, Liverpool, 13.



This simple yet scientifically constructed model of a laboratory balance won a prize for S. F. Desai, Bombay, in a recent competition.

Competitors should try to be as original as possible in their choice of subjects for their models. Models that really work or that can be put to some practical use, always attract more favourable consideration from the judges than models that are not made to work. Any number of parts may be used in building models, but it should be borne in mind that good construction and straightforward design are of more importance than mere size.

For this Contest there are no entry forms to fill in and no fees to pay. In order to give each competitor an equal chance, entries will be divided into three different sections according to age :—Section A, for competitors living in the British Isles and over 14 years of age ; Section B, for competitors under 14 living in the British Isles ; Section C, for competitors of all ages living Overseas. The prizes to be awarded in each Section are as follows :—Sections A and C, First Prize, Cheque for £3-3s. ; Second Prize, Meccano or Hornby Train goods value £2-2s. ; Third Prize, goods value £1-1s.; Six Prizes of goods value 5/–. Section B, First Prize, Cheque for £2-2s. ; Second Prize, Meccano or Hornby goods value £1-1s. ; Third Prize, goods value 10/6 ; Six Prizes of goods value 5/–.

Entries for Sections A and B must be posted to reach Liverpool before 29th April, 1933. The closing date for Section C is 30th June, 1933.

Second Meccano X Series Building Contest

This is the second of the special competitions we are arranging for the benefit of owners of the new Meccano X Series Outfits. Only models built from parts contained in the No. 1 or No. 2 X Series Outfits may be submitted.

To enter the Contest it is only necessary to build a new model of any kind whatever, and then to send either a photograph or a drawing of the model to us. The model must be built by the competitor himself, but the drawings or photographs may be prepared by the competitor's parents or friends if necessary. *The actual model must not be sent.*

The Contest will be divided into three Sections—A, for competitors under 10 living in the British Isles ; B, for competitors over 10 living in the British Isles ; and C, for competitors of all ages living Overseas. Full details of the prizes in each Section are given in the panel on this page.

The Prizes will be awarded for those models that represent the most interesting and novel subjects, and are the most neatly and solidly constructed. Intending competitors will be well advised to refer to the articles that appeared in the December and January issues of the "*M.M.*," and on page 220 of this issue, which contain hints on building X models.

Competitors in Sections A and B must post their entries so as to reach this office not later than 29th April, 1933. The closing date for Section C is 30th June, 1933. Envelopes should be addressed " X Series Model-building Contest," Meccano Ltd., Binns Road, Liverpool, 13.

Prizes for Meccano X Series Contest

The prizes in Section A will be :—
First, Meccano or Hornby goods value £2-2s.
Second, Meccano or Hornby goods value £1-1s.
Third, Meccano or Hornby goods value 10/6.
Five Prizes of Meccano or Hornby goods value 5/–.
Five Prizes of " Famous Trains " by C. J. Allen.

In Sections B and C the prizes will be :—
First, Meccano or Hornby goods value £2-2s.
Second, Meccano or Hornby goods value £1-1s.
Third, Meccano or Hornby goods value 10/6.
Five Prizes of goods value 7/6.
Five Prizes of goods value 5/–.
Five Prizes of " Famous Trains " by C. J. Allen.
A number of Certificates of Merit also will be awarded in each Section.

Model-Building Contest Results

By Frank Hornby

"Aeroplane" Competition (Home and Overseas)

THIS Competition was arranged specially for owners of the Meccano Aeroplane Constructor Outfits, and as it is the first contest of this kind I have been looking forward with considerable interest to examining the entries, in order to see how adaptable the parts could be made in the hands of enthusiastic aeroplane builders. As I had expected, models of almost every type of aircraft were submitted, in building which the various parts have been used in scores of different combinations. Although the Aeroplane Constructor Outfits are comparatively new, they have penetrated already to all parts of the world, and the Overseas Section of this Contest contains models quite as interesting and well built as those in the Home Sections.

I take this opportunity of congratulating the prize-winners on their success in the first competition organised solely for models built from the Aeroplane Constructor Outfits. I strongly advise them to submit further models for the second Contest of this kind, which was announced in the February issue of the *"M.M."*

The principal prizewinners are as follows :—

Section A (Home competitors over 12 years of age).

FIRST PRIZE, Meccano goods value £3-3s. : Jack McIntyre, Edinburgh. SECOND PRIZE, goods value £2-2s. : W. R. Phillips, North Thoresby Lincs. THIRD PRIZE, goods value £1-1s. : T. H. Mullins, Plymouth.

SIX PRIZES of Meccano Aeroplane Constructor parts value 7/6 : H. Fowler, London, S.E.10 ; J. Bickford London, W.3 ; R. Simmins, Farnham, Surrey ; L. Stephenson, Bradford ; T. Rutter, Sunderland ; K. Jeavons, Birmingham.

SIX PRIZES of Meccano Aeroplane Constructor parts value 5/– : D. Bist, Thornton Heath, Surrey ; W. Deacon, Pentre, Rhondda ; R. Williams, London, N.10 ; E. Cooke-Yarborough, Doncaster ; W. Hulton, Bolton ; H. Deane, Dundrum, I.F.S.

Section B (Home competitors under 12 years of age).

FIRST PRIZE, Meccano or Aeroplane Constructor parts value £2-2s. ; R. Collins - Jones, Acocks Green, Birmingham. SECOND PRIZE, goods value £1-1s. : J. Keir, Edinburgh. THIRD PRIZE, goods value 10/6 : P. Bayly, Tavistock, Devon.

SIX PRIZES of Meccano Aeroplane Constructor parts value 5/– : R. Pack, Rushden, Northants. ; P. Wright, Doncaster ; R. Dipper, Farnham, Surrey ; J. Heath-Brown, Farnham ; J. Jenkinson, Rochdale ; N. Smith, Colchester.

SIX PRIZES of "*Famous Trains*" by C. J. Allen : G. Mirams, Moseley, Birmingham ; M. Allen, West Croydon ; G. Allen, West Croydon ; T. Rushen, London, N.W.10 ; C. Sutch, Gloucester ; L. Mills, Preston.

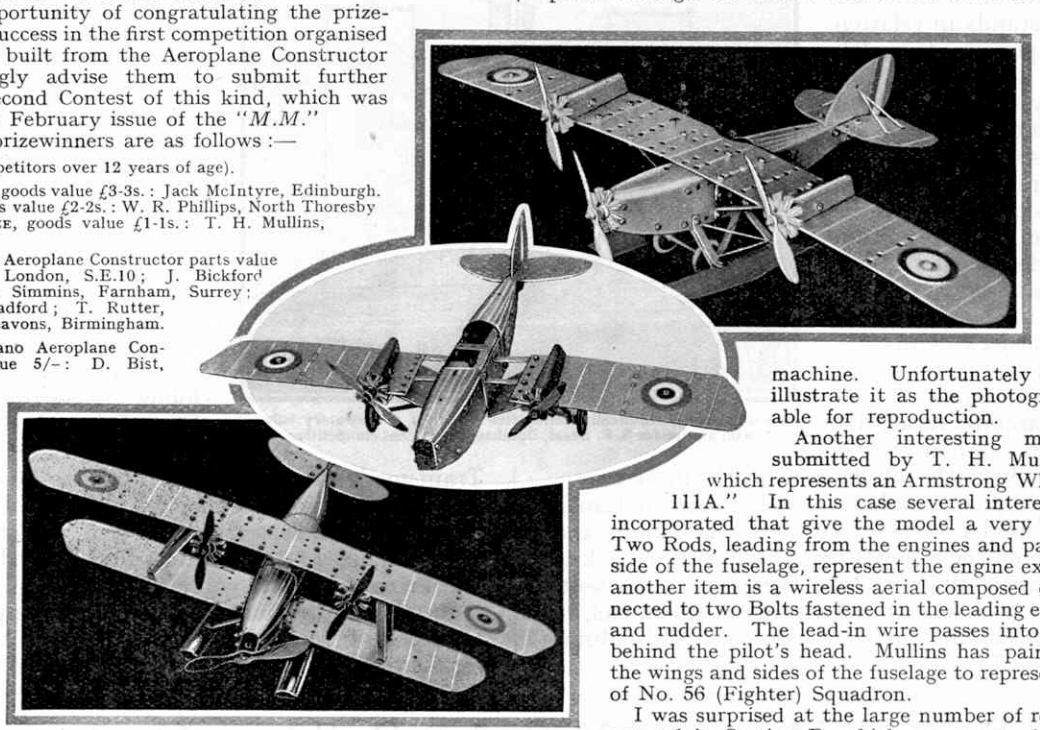
Section C (Overseas competitors of all ages).

FIRST PRIZE, Meccano or Aeroplane Constructor parts value £3-3s. : R. Paasch, Bergen, Norway. SECOND PRIZE, goods value £2.2s. : Camille Pareja, Brussels. THIRD PRIZE, goods value £1-1s. : G. H. Inwood, Christchurch, N.Z.

SIX PRIZES of Meccano Aeroplane Constructor parts value 7/6 : M.Camps, Barcelona; R. Rasmussen, Bergen, Norway ; M. Meredith, Montreux, Switzerland ; W. Kirby, Arcadia, S. Africa ; J. M. Appelby, Calcutta ; L. Morrison, Monte Video, S.A.

The construction of original and realistic model aeroplanes is by no means a simple task, for in addition to possessing a good knowledge of the uses of the various Aeroplane Constructor parts, the builder must also be acquainted with the special features of actual machines. Many competitors in this Contest have done really interesting work, and the wide range of types covered by the models submitted shows that the scope of the Aeroplane Constructor Outfits is almost unlimited.

The First Prize in Section A is a reproduction of an Autogiro. The tail unit is constructed from two Tail Planes (RH and LH) and two Fuselage Side Middle Sections, which represent the tail plane and elevator ; and the tail plane is connected with the fuselage by two Centre Section Straight Struts bolted to two Angle Brackets on each side of the fuselage. The blades are supported by two Struts, one of which is bolted to each side of the fuselage. To the top hole of each Strut is fixed an Angle Bracket through the horizontal hole of which an Axle Rod is passed and clamped in position by a Collar and a ½" Fast Pulley. The rotary blades are each made from two Fuselage Side Rear Sections (part No. P18) bolted to two Double Angle Strips (these parts are deleted from the latest Outfits) at right-angles to one another, and rotate on the Axle Rod, which passes through the middle hole of the two Double Angle Strips.



(Top) Model of the Short "Valetta" Seaplane by J. Jenkinson. (Centre) Two-Seater twin-engined "Monospar" machine by R. F. Collins-Jones, which won 1st Prize in Section B. (Bottom) A three-engined biplane seaplane by K. A. Jeavons.

W. R. Phillips made a fine attempt to copy the peculiar Sikorsky S.38 Amphibian machine. This craft was illustrated in the May 1932 issue of the *"M.M.,"* and the model very closely resembles the actual machine. Unfortunately I am unable to illustrate it as the photographs are unsuitable for reproduction.

Another interesting model was that submitted by T. H. Mullins, Plymouth, which represents an Armstrong Whitworth "Siskin 111A." In this case several interesting details are incorporated that give the model a very fine appearance. Two Rods, leading from the engines and passing down each side of the fuselage, represent the engine exhaust pipes, and another item is a wireless aerial composed of thin wire connected to two Bolts fastened in the leading edges of the wings and rudder. The lead-in wire passes into the rear fairing behind the pilot's head. Mullins has painted squares on the wings and sides of the fuselage to represent the markings of No. 56 (Fighter) Squadron.

I was surprised at the large number of really fine models entered in Section B, which was reserved for competitors under 12 years of age. The originality and general excellence of their work does them great credit, and I hope they will keep it up in future competitions. A typical example of the prize models in Section B is shown in the "Monospar" machine illustrated on this page. This fine machine takes its name from the spar formation of its wings, which is claimed to give a much lighter construction than more orthodox methods. The constructional details of the model are shown clearly in the illustration and do not require description.

H. Bayly, Tavistock, made an ingenious model of an Autogiro, but unfortunately he had bent some of the parts in order to secure effect, and consequently the model cannot be said to be an example of good construction. It should always be remembered that bent or otherwise mutilated parts seriously interfere with a model's chance of gaining an important prize.

It was also a model of an Autogiro that won the First Prize in the Overseas Section for E. R. Paasch. As the Autogiro differs so essentially from the ordinary aeroplane, this model is particularly interesting. The windmill blades are parts No. P18, mounted on a Rod journalled freely in the end holes of Wing Stay Struts bolted at their lower ends to the fuselage sides. At their inner ends the blades are maintained in position on the Rod by means of Collars. The axle of the air screw is connected to the axle of the landing wheels and rotates as the model is pushed along the ground.

The Second and Third Prize models in the Overseas Section are a three-engined seaplane and a flying boat respectively.

"Autumn" Model-Building Contest Results (Home Sections)

The "Autumn" Model-building Contest was announced in the October 1932 issue of the *"M.M.,"* and models of any kind whatever were eligible for entry. A selection of prize-winning models is shown on this page and the prize-winners in the Home Sections A and B are as follows :—

Section A (for competitors over 14 living in the British Isles).

FIRST PRIZE, Cheque for £3-3s. : H. M. Stewart, Surbiton, Surrey. SECOND PRIZE, Cheque for £2-2s. : B. L. Simpson, London, S.W.5. THIRD PRIZE Cheque for £1-1s. : L. Shepherd, Middlesbrough.

SIX PRIZES of Meccano or Aeroplane Constructor parts value 10/– : R. Farr, Costessey, Norwich ; R. Bellingham, Wolverhampton ; H. Ashley, Oldham ; L. Hollyoak, Coventry ; V. Kaile, Mayford ; E. Whalley, Blackburn.

SIX PRIZES of Meccano goods value 5/– : L. Knill, Leeds ; G. Sizer, Retford, Notts. ; B. Caley, Hull ; R. Lawford, Bexley Heath, Kent; F. Drane, Twickenham ; D. Medd. Aberdeen.

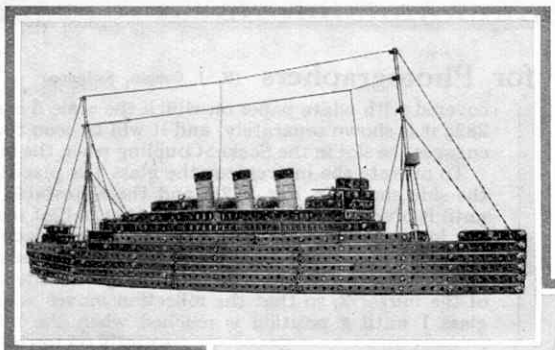
PRIZES OF *"Famous Trains"* by C. J. Allen : E. Hines, Addiscombe, Surrey; A. Hampson, Widnes; E. Leech, Ashton-under-Lyne ; D. Young, West Croydon, Surrey ; R. Morison, Cambridge ; A. Hope, Keswick ; W. Hicken, Mansfield, Notts. ; D. Holloway, Squirrels Heath, Essex ; J. Payne, Wellingborough ; A. Firman, London, W.5 ; P. Hilder, London, E.2 ; M. McDonald, Dublin.

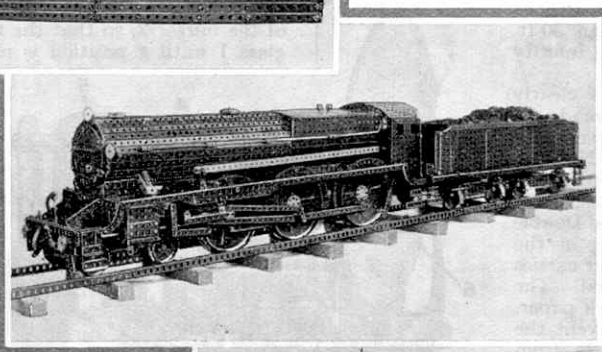
Section B (for competitors under 14 years of age).

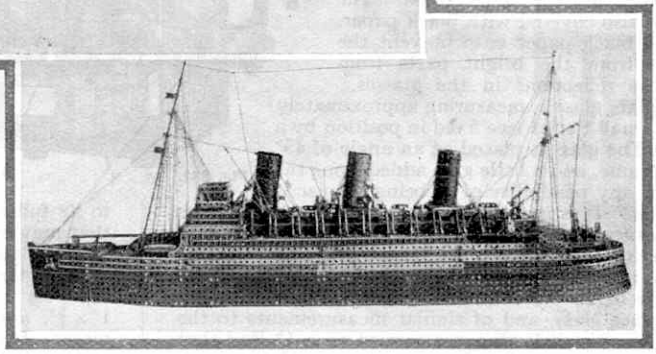
TWO FIRST PRIZES, Meccano or Aeroplane Constructor parts value £1-10s. : D. Carlisle, Manchester ; F. Bigg, Sevenoaks, Kent. Two SECOND PRIZES, goods value 15/– : S. Webb, Bloxwich, Staffs. ; R. Walford, Newton Abbot, Devon. Two THIRD PRIZES, goods value 7/6 : G. Mathieson, Angus, Scotland ; J. Rickett, Takeley, Essex.

SIX PRIZES of Meccano or Aeroplane parts value 5/– : J. Anscomb, Reigate ; G. Machen, London, N.W.2 ; C. Haw, Heworth, York ; R. Wilson, Warrington ; J. Twyman, Orpington, Kent ; I. Johnson, Southport.

PRIZES of Meccano Engineer's Pocket Books : E. Harris, Weston-super-Mare ; D. Mason, Gravesend ; A. Jepson, Manchester ; J. Pearce, London, N.7 ; R. Stephenson, Hull ; J. Booth, Kenton, Middx. ; F. Hutchinson, Nantwich ; G. Fudge, Bournemouth, ; M. Gray, Heworth, Yorks. ; S. Conibear, Ilfracombe ; C. Trimmer, Gillingham ; R. Hadley, Langley Green, Birmingham.







(Top) D. M. Carlisle won First Prize in Section B with this fine model liner. (Centre) First Prize in Section A was awarded for this model of a "Nelson" class locomotive of the Southern Railway, by H. M. Stewart. (Bottom) An ocean liner by B. L. Simpson.

H. Stewart, Surbiton, won First Prize in Section A with the model of a "Nelson" class locomotive of the Southern Railway shown here. It is 5 ft. long and is driven by a 6-volt Electric Motor, and as an example of locomotive building in Meccano it is a really beautiful piece of work. The constructional details are far too numerous to mention individually, but I would particularly advise readers to study the construction of the main frame, valve gear, and cab, from which they will find plenty of ideas for models of their own. The destination discs on the front of the locomotive consist of circular pieces of white card held in position by Bolts in the bosses of Eye Pieces, which slide on Angle Brackets that serve as supports. The steam pipes to the cylinders are realistically made from Sleeve Pieces held between Triangular Plates as shown, and the valve gear is controlled by a long lever represented by a compound Strip that communicates with the cab.

A peculiar feature of the "Nelson" class engines is that in order to keep the connecting rods of reasonable length the piston rods are extended beyond the normal and are joined to the connecting rods by means of guide blocks sliding in a separate guide bar frame. This feature is faithfully copied in Stewart's model, as also is the double bogie tender, which, although not unusual for British locomotives, is nevertheless a distinct feature of Southern Railway practice.

The winner of the Second Prize in Section A, B. L. Simpson, London, S.W.5, chose a famous liner as the subject for his model, which represents the *"Empress of Britain,"* the C.P.R. luxury liner. It is a really fine piece of work, as will be seen from the illustration. At first sight one is impressed with the great amount of detail work on the upper decks and in the stern, but a more leisurely inspection will reveal that the main feature of the model is its splendid proportions. The overall length of the ship is 4 ft. 5 in., its height being 1 ft. 9½ in., and its width 7 in. The three funnels (Boilers) are held secure by mooring wires, which are fastened to the funnels by means of Cord braced through holes near their tops. These cords are fastened securely by being braced to each other inside the funnels, and so hold the mooring ropes taut when they are drawn up. Life-boats are represented by 1½" Strips, suspended by Cord from 2½" Strips bolted to 2½" vertical Strips that in turn are fastened by Angle Brackets to the deck. The ventilators in front of the centre funnel are made with ¾" Flanged Wheels. Credit is due to Simpson for the good manner in which he has built the stern of the hull, for this is a task that might tax the ingenuity of the most experienced constructors. The hull as a whole is a fine copy of its prototype.

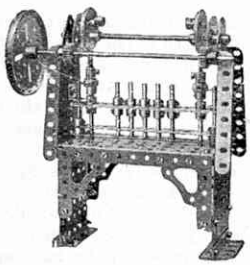
A three-funnelled passenger liner also formed the subject of the First Prize model in Section B. The construction is carried out with red and green parts and the colours have been so skilfully arranged as to give a very realistic appearance. This model, which is illustrated here, was built by D. M. Carlisle, and it is hard to say exactly what it is that produces the fine effect the model undoubtedly possesses. When compared with the ship built by B. L. Simpson, Carlisle's model appears to be lacking in detail, yet no one could say that it is not equally realistic. The bridge and boat deck in particular on Carlisle's model are well carried out, and another thing that assists greatly is the fact that the three funnels are correctly placed in relation to the bows and stern. When the funnels of a model ship are placed even the smallest amount out of position the whole appearance is spoiled. A careful examination of the illustration will show that the model is very simply constructed and does not require a large assortment of parts for its successful completion.

F. A. Bigg sent well-built models of an L.M.S.R. "Garratt" type locomotive fitted with a Beyer-Peacock patent revolving coal bunker, and a sturdily built air liner based on the "Golden Ray" machine, which is owned by the Air Union and used on the London-Paris service.

Electric trolley buses are now in use in many towns, and it is a model of this kind that won Third Prize in Section A. The chassis is fitted with all the usual mechanisms, and particular care has been taken to copy the exact axle suspension arrangements of the actual vehicle. Among the many details is a miniature driving mirror, which once formed part of a dentist's stock-in-trade, and a lamp fitted with blue glass, which indicates to on-coming traffic that the vehicle is a trolley bus and not a petrol-driven vehicle. Correctly assembled Ackermann type steering gear is used.

S. Webb, winner of one of the Second Prizes in Section B, submitted a model of an electric tramcar, an interesting feature of which is a workable life-guard at each end of the car. These are operated from the driver's cabin at either end by means of foot pedals. The trolley rod is pivoted in a spider from a Universal Coupling and this is mounted on a Bush Wheel that is free to revolve on a short vertical Rod secured in the roof of the tramcar. A Spring is attached to a Bolt in a hole in the Bush Wheel opposite to that in which the spider is mounted, and its other end is attached to the trolley rod, so providing the tension necessary for keeping the trolley in contact with the overhead conductor.

The other Second Prize model is a high-speed ship coaler, and the two Third Prize models are a crane, and a folding portable elevator of the kind used by farmers for stacking hay.



Suggestions Section

Edited by "Spanner"

(282)—A Useful Range Finder for Photographers (K. J. Coppin, Swindon)

Amateur photographers frequently find it difficult to estimate accurately the distances of objects from the camera, with the result that the focussing scale is incorrectly set, and the image appears blurred on the negative. Sometimes the distance can be measured before the photograph is taken, but this is a laborious operation, and not always possible. The model shown in Fig. 282 indicates the distance of any object between 3 ft. and 30 ft. by means of a sighting arrangement, so that the photographer can set his camera to the correct focus without difficulty. For objects farther away than 30 ft. the focussing scale is usually set at the infinity mark.

The two illustrations on this page show clearly how the casing for the range finder is made by bolting $1\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips between the ends of two $3'' \times 1\frac{1}{2}''$ Flat Plates (parts No. 73). The interior is lined with matt surfaced black paper, such as is used for wrapping photographic plates and printing papers. Two additional Double Angle Strips are fixed inside the casing in the positions indicated, and a $1\frac{1}{2}''$ Angle Girder carries two Hinges to which a Strip 3 is bolted. The insides of these are also covered with black paper. The purpose of the black paper is to prevent the reflection of light from the bright parts from interfering with the reflections in the glasses.

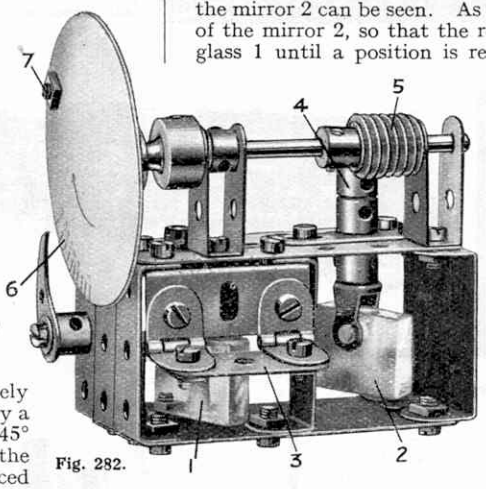


Fig. 282.

A piece of clear plate glass 1, measuring approximately $1'' \times \frac{3}{4}''$, is held in a small Fork Piece fixed in position by a $\frac{3}{4}''$ Bolt and nut. The glass is placed at an angle of 45° to the sides of the frame, and a little glue added along the lower edge prevents any possibility of its being misplaced once it is in position. It is important for the surface of the glass to be at right-angles to the top and bottom of the frame. Thinner glass may be substituted if plate glass is not available, but the latter gives better results owing to its freedom from distortion. Blue tinted glass is to be preferred if it can be obtained. The mirror 2, also of plate glass, and of similar measurements to the glass 1, is gripped in a small Fork Piece carried on a 1" Rod that passes through a Double Arm Crank and carries a $\frac{3}{4}''$ Pinion 4. The Crank is bolted to the top of the frame and the Fork Piece and Pinion are secured close to it to prevent up and down play. The Worm 5 is carried on a 3" Rod journalled in two Single Bent Strips, and engages the $\frac{3}{4}''$ Pinion. To enable the two to mesh, full use should be made of the play allowed by the bolts holding the Single Bent Strips in position. The purpose of employing a $\frac{3}{4}''$ instead of a $\frac{1}{2}''$ Pinion is to avoid any play between the teeth of the Worm, as this would cause inaccuracies.

The dial is detachable and consists of a Face Plate covered with white paper on which the scale 6 is marked. In Fig. 282a it is shown separately, and it will be seen that the set screw 9 engages the slot in the Socket Coupling when the latter is in position.

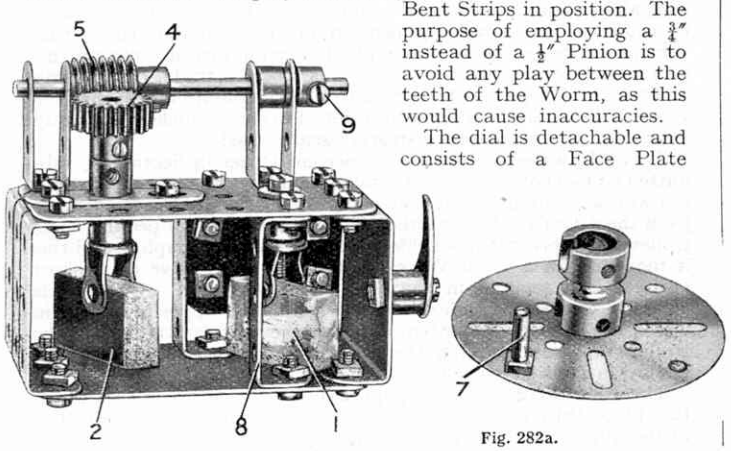


Fig. 282a.

To operate the instrument the glass 1 is placed to the eye, from the side shown in Fig. 282a, and the adjustable flap 3 is lowered until it obscures the vision in the upper half of the glass, but leaves the lower half clear. This dark background converts the upper part of the glass into a mirror, on which the image reflected from the mirror 2 can be seen. As the Worm 5 rotates it alters the angle of the mirror 2, so that the reflection moves across the top of the glass 1 until a position is reached when the reflected image fits exactly on top of the object viewed direct. This position should be obtained before calibrating the scale, and the grub screw in the Worm slackened off. The dial is then turned until the Threaded Pin 7 is in approximately the position shown in Fig 282 before the grub screw is re-tightened. The Pin forms a stop, and before taking a reading the dial should be turned anti-clockwise until the Pin checks further movement. The dial is then rotated in a clockwise direction until the two " pictures " seen in the glass 1 fit together, and the reading of the scale 6 is taken by means of the pointer, consisting of a Pawl. The object of turning the dial anti-clockwise to its full extent before taking a reading is to allow for any play that may exist in the Rods or gearing.

The plate glass and mirror referred to above can be obtained from a glazier, and it is advisable to have them cut to size. The cheapest method is to have two pieces of mirror cut measuring $1'' \times \frac{3}{4}''$, and afterwards to remove the silver backing from one piece. This can be done by rubbing with a soft rag soaked in methylated spirits, and removing the last traces of silvering with an india rubber.

It is a good plan to mark the scale with distances corresponding to those on the focussing scale of the camera. An article should be placed at a measured distance from the range finder—say 3 ft.—and the dial turned until it is correctly sighted. The scale is then marked appropriately opposite the Pawl. The same procedure should be carried out until the scale bears the full range of distances.

(283)—A Simplified Automatic Traffic Control Signal (C. Owen, Beeston, Notts.)

We have already dealt in these pages with a mechanically operated traffic control signal, but our contributor's traffic signal employs a much simpler method of operation. His switch gear should work well, and since it requires fewer parts to build will be of interest to many readers.

A Bush Wheel is provided with eight studs consisting of 6BA Bolts that are insulated from the Wheel. Two directly opposed studs are connected together, and a lead from these goes to the amber light of the traffic signal. The remaining studs are now in two sets of three, and one set is connected to the green light and the other set to the red light.

The collector brush consists of a Spring Buffer the head of which presses on the contact studs. The Buffer is mounted on a revolving Bush Wheel and slowly passes from one stud to another, causing each of the three lamps in the signal to light up in turn.

(284)—Variable Speed Gear (R. Fordham, Crewe)

A wide range of speed variations can be obtained with the device illustrated in Fig. 284. The drive is taken up by the 2½" Gear Wheel 1 carried on a 2" Rod, journals for which are formed by a Double Bent Strip and a Double Arm Crank. A 4" Circular Plate is bolted to a Bush Wheel on the end of the Rod, and drives two 1½" Pulleys fitted with Dunlop Tyres 4 and 5. The Pulleys are held in Socket Couplings, the inner ends of which carry 1" Bevel Wheels. A "spider" 3 taken from a Swivel Bearing or Universal Coupling is fixed on the 8" Rod 2 and carries two Pivot Bolts, on each of which a 1" Bevel is free to turn. The Pivot Bolts are locked in place by nuts and each Bevel is spaced from the nut by two Washers. Collars retain the Socket Coupling units in position, but should allow a little play between the Bevel Wheels to ensure free movement.

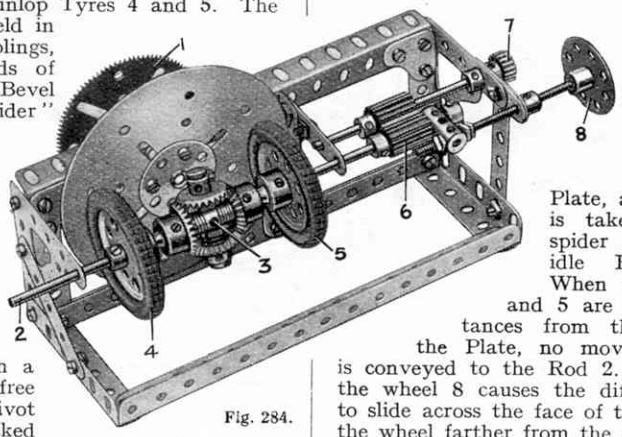


Fig. 284.

The Rod 2 is slidable, its movement being controlled by the Bush Wheel 8 on the end of a 3½" Screwed Rod. This is passed through the boss of a fixed Threaded Crank and carries a Coupling that is held in position by lock-nuts on each side. The Coupling is also passed over the end of the Rod 2 and is held between the ½" diam., ¾" face Pinion 6 and a Collar. The Pinion 6 engages a similar Pinion on a 3½" Rod, on the end of which is the Pinion 7 supplying the final drive.

The mechanism operates on the same principle as the differential gear fitted to the rear axle of a motor car. In this case the method of drive is reversed, however, and instead of the drive being applied to the bevels, the two "road" wheels are caused to rotate by the 4" Circular Plate, and the drive is taken from the spider carrying the idle Bevel Gears. When the wheels 4 and 5 are at equal distances from the centre of the Plate, no movement at all is conveyed to the Rod 2. Rotation of the wheel 8 causes the differential unit to slide across the face of the Plate, and the wheel farther from the centre rotates faster than the other. The differential makes up for the difference in speed, and causes the Rod 2 to rotate. When the wheel 4 is at the extreme left of the driving plate the maximum speed is attained by the driven shaft, and as the wheels slide over to the right the shaft 2 slows down and stops entirely when the central position is reached by the differential unit. As it continues to slide to the right the shaft 2 slowly rotates again, but this time in the reverse direction, and the maximum speed is attained when the Wheel 5 is at the extreme right of the Plate.

(285)—Puzzle (J. Nayler, London, S.E.6)

There is a certain satisfaction gained by solving an intricate puzzle, and as a rule the more difficult the puzzle the greater is the determination to solve it. The puzzle shown in Fig. 285 is to separate the two 3" Strips without cutting the Cord.

The Strips are held together in the following manner. A short length of Cord is doubled and the loop so formed is passed through the third hole of a 3" Strip. Another loop is formed from one of the lengths of cord and passed through the next hole of the Strip. The two single cords are brought round and passed through the two loops, and through the end hole of the second Strip, as is shown in the illustration. They are then threaded in and out of alternate holes, to be passed through the final hole and separated. The two ends are tied together to form the loop A enclosing the double Cord. To arrange the Cord the reader should carry out the operations stage by stage while reading the above, and careful scrutiny of Fig. 285 will make matters quite clear.

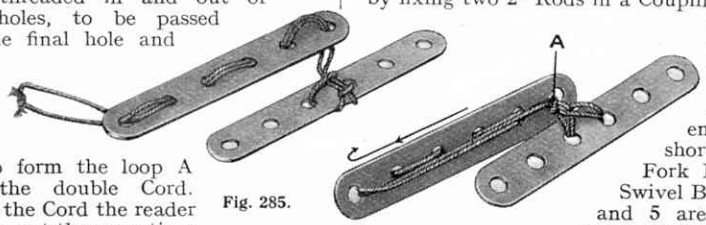


Fig. 285.

To separate the Strips the loop A should be moved in the direction of the arrow until it is in the centre of the Strip. The other Strip can then be passed through the loop, thus enabling the Cord to be unthreaded.

(286)—Reverse Drive

(J. West, Sydney, Australia)

This is an ingenious device for driving two shafts, arranged co-axially, so that they revolve in opposite directions. Fig. 286 shows the mechanism, and it will be noted that gears are not utilised for obtaining the necessary result. The Rod 1 is driven by means of a 57-teeth Gear and carries a Collar and also a Coupling mounted on the end by its centre transverse hole. The driven Rod 2 is provided with a Coupling similarly mounted, and both Rods are journalled in Trunnions spaced from the base plate by two Washers on each fixing bolt. Two further Trunnions provide bearings for the transverse Rod 3 formed by fixing two 2" Rods in a Coupling which carries in its centre a 1½" Rod. At each end of this short Rod the Fork Pieces of Swivel Bearings 4 and 5 are free to slide, and the "spiders" of each part are pivotally attached to the Couplings on driving and driven shafts by means of ¾" Bolts. The final drive is taken from the ½" Pinion on the Rod 2. All moving parts should work freely, and the device will give a silent drive with very little vibration when properly adjusted and oiled.

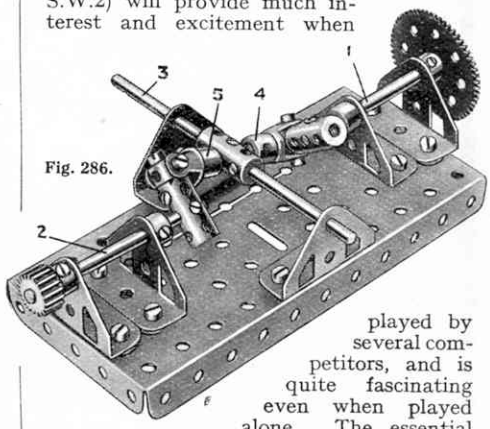


Fig. 286.

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.157.) Internally Toothed Gear.—The necessity sometimes arises for a small internally toothed gear, and as such a part is not yet included in the Meccano range a substitute has to be devised. K. Robertson (Bath), uses a 1½" Bevel Gear for this purpose, and places a ½" Pinion so that it meshes with the inner edges of the Bevel teeth. The Rod carrying the Pinion is not spaced a standard distance from the shaft of the Bevel, and suitable journals can be arranged by utilising the elongated holes of Double Arm Cranks and Flat Brackets. This gearing no doubt works quite well, but on account of the positions of the two Rods is not likely to be of great utility.

(M.158.) Compact Pawl and Ratchet Gear.—Where space is at a premium the neat pawl suggested by R. York (Sheffield) will be found very useful. It consists of a "spider" from a Swivel Bearing and a ½" bolt. The spider is pivoted to the model, in the next hole to the Ratchet Wheel, by means of a bolt inserted in one of the tapped holes and locked by a nut. A ½" bolt is screwed through the transverse tapped holes, and its protruding shank engages the teeth of the Ratchet. A length of Spring Cord can be used for holding the built-up pawl in place, and the end should be looped and inserted under the head of the ½" bolt.

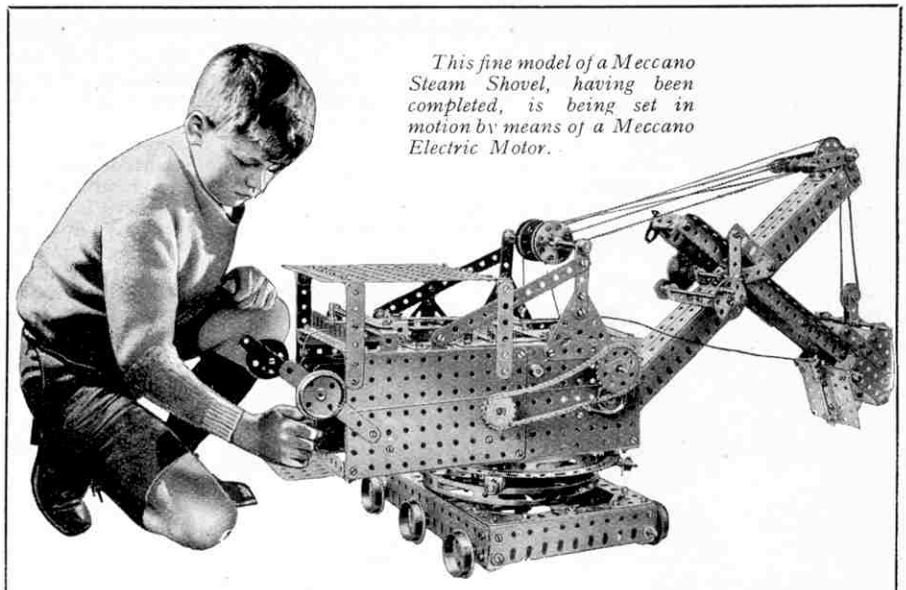
(M.159.) A Fascinating Game.—The game suggested by J. Blanks (London, S.W.2) will provide much interest and excitement when played by several competitors, and is quite fascinating even when played alone. The essential part of the game consists of two parallel cords tied at each end to Strips pivoted at their centres. A suitable frame is built up to carry the pivots for the Strips, one Strip being securely held on a vertical Rod by means of a Double Arm Crank. The Rod is geared by a Contrate and Pinion to a handwheel, so that by operating this the two parallel cords move in opposite directions.

A short Rod is placed on the cords, which should slope slightly downward away from the handwheel. The game is to manipulate the handwheel so that the Rod keeps on a straight course. If it gets on the slant it will roll off the cords. It follows that the shorter the Rod is the more difficult it will be to control it, and if several identical devices are arranged side by side, races may be organised. If this is done it is important to see that the angle of inclination of the cords is the same in each case.

Use a Meccano Power Unit

Building a Meccano model is the greatest fun in the world. Excitement increases steadily as the model grows, part by part, under your hands. Finally there comes the greatest thrill of all. You connect your completed Crane, Motor Chassis or Traction Engine to a Meccano Motor or Steam Engine, and see it work in exactly the same manner as its prototype in real life!

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. Particulars and prices are given below.



This fine model of a Meccano Steam Shovel, having been completed, is being set in motion by means of a Meccano Electric Motor.

DETAILS OF MECCANO POWER UNITS

MECCANO ELECTRIC MOTOR No. E1 (6 volt)
This is a highly efficient electric motor (non-reversing) that will give excellent service. A 6-volt Accumulator will operate it, but it may also be driven from the mains (alternating current only) through the 6-volt transformer described in the next column. Price **9/-**

MECCANO ELECTRIC MOTOR No. E6
This excellent reversing motor may be run from a 6-volt accumulator or, by employing the transformer described in the next column, from the mains (alternating current only). Price **15/6**
IMPORTANT—Meccano 6-volt Motors will not run satisfactorily from dry cells.

RESISTANCE CONTROLLER
By employing this variable resistance the speed of the Meccano 6-volt Electric Motors may be regulated as desired. Price **3/9**

MECCANO X SERIES CLOCKWORK MOTOR
(Non-Reversing)
A fine motor specially designed to drive with ease any of the X Series Models. It is non-reversing. Price **2/6**

MECCANO CLOCKWORK MOTOR No. 1
(Non-Reversing)
A long-running and highly efficient clockwork motor (non-reversing), fitted with brake lever. Price **5/-**

MECCANO CLOCKWORK MOTOR No. 1A
(Reversing)
This motor is similar in power and length of run to the No. 1 Motor, but is fitted with reversing motion. It has start, stop and reverse levers. Price **7/6**

MECCANO CLOCKWORK MOTOR No. 2
(Reversing)
This strongly-built reversing clockwork motor is a compact self-contained power unit. An efficient governor controls the powerful spring that is fitted on the motor, and ensures a long steady run at each winding. Price **10/-**

MECCANO STEAM ENGINE
On actual test this powerful steam unit has lifted over 56 lbs. The spirit container for the lamp is placed well outside the boiler-casing, eliminating all risk of the spirit becoming heated. Price **25/-**

MECCANO ELECTRIC MOTOR No. E20a
(20 volt)
A specially fine motor, having greater power than the 6-volt motors, and capable of running for long periods without excessive heating. It is non-reversing. Price **16/6**

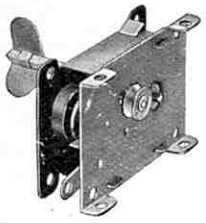
MECCANO ELECTRIC MOTOR No. E20b
(20 volts)
This is similar in power and efficiency to the E20A Motor, but is fitted with reversing motion and start and stop controls. Price **18/6**

6-VOLT TRANSFORMERS
These Transformers are specially designed for running the Meccano No. E1 or E6 Electric Motors and Hornby 6-volt Electric Trains. No. T6 is available for all standard supply voltages, from 100 to 250 inclusive, at frequencies of 50 cycles and upwards. Price **22/6**
No. T6a is also available for all standard supply voltages from 100 to 250 inclusive, at all standard frequencies. If required No. T6a can be wound for frequencies lower than 50 cycles. Price **30/-**

TRANSFORMER No. T20
(Output 20 V.A.)
This splendidly-designed transformer is intended for running the Meccano 20-volt Electric Motors and Hornby 20-volt Electric Locomotives. It has a five-stud speed regulator, and is available for all standard alternating current supply mains from 100 to 250 volts, 50-60 cycles. The supply voltage should be stated when ordering. Price **21/-**

TRANSFORMER No. T20a
(Output 35 V.A.)
This Transformer is similar in general design to the T20, but is provided with three pairs of plug sockets. The circuit provided by the first pair has a five-stud speed regulator incorporated. The second pair provide a steady output of 17 volts for lighting lamps. The third pair of sockets give the full output of the Transformer. Price **26/6**

ACCUMULATORS
The 6-volt 20-amp. Accumulator is specially suitable for running Meccano 6-volt Motors and Hornby 6-volt Electric Trains. Price **28/6**
The 2-volt 20-amp. Meccano Accumulator is supplied for converting 4-volt Accumulators to 6 volt. Price **10/6**

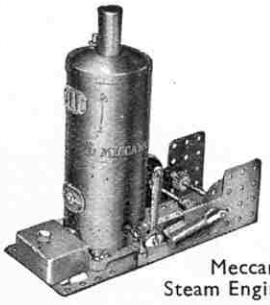


Meccano X Series Clockwork Motor

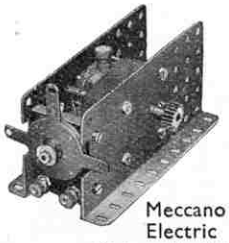
Meccano Clockwork Motor No. 1

Meccano Electric Motor No. E1

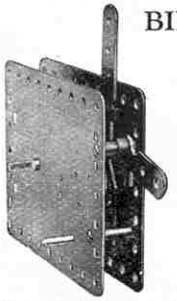
MECCANO LTD. BINNS ROAD, LIVERPOOL, 13



Meccano Steam Engine

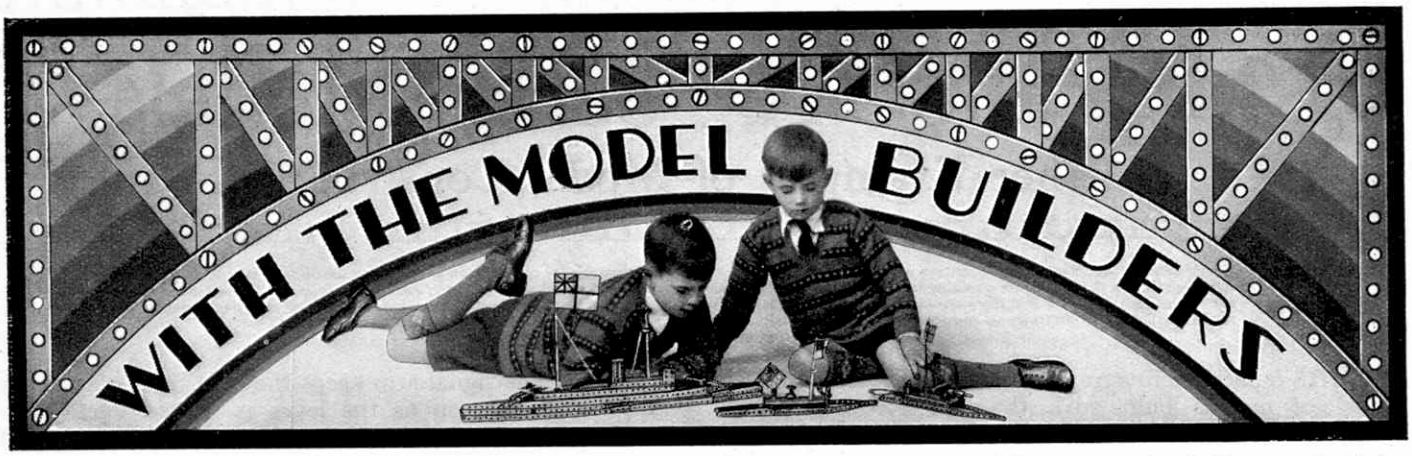


Meccano Electric Motor No. E6



Meccano Clockwork Motor No. 2

Meccano Transformer No. T20



WORKING MODEL SHIPS

Model ship-building in Meccano is very fascinating, and considerable ingenuity and constructional skill may be used in building the hull and the various deck fittings of different types of vessels. Many model-builders have been deterred from attempting this type of constructional work owing to the fact that they found it impossible to fit any mechanical movements to the models. They therefore have confined their efforts to the building of motor cars, cranes, tractors and similar models in which the application of motor power is relatively simple. It is true that Meccano ships cannot be made to operate in the same manner as actual vessels, but there are various ways of "animating" them so as to produce a realistic display.

An interesting motion effect is incorporated in the model Bar Lightship illustrated on this page. This is a special demonstration model, and many readers will have seen it in operation in displays organised by Meccano dealers. When working, the Lightship dips and rises slowly, and at the same time rolls in a very realistic manner. The baseboard of the model is covered with green cloth, which is attached loosely to the sides of the hull. As the model rises and falls the green cloth is drawn up and down, and in this way a characteristic "wave" effect is obtained.

The motion is imparted to the model in the following manner. The bottom of the hull of the vessel is open, and this allows for the stand on which the ship pivots to be secured direct to the baseboard. The pivot is of the two-way gimbal type, and allows the hull of the vessel to oscillate from stem to stern, and also from side to side, thus giving a rolling action. The actual oscillating motion is imparted by means of a crank driven by an Electric Motor, the Motor with its accompanying gearing being mounted at the back of the model so that it is hidden from view.

In order to be realistic the motion of the ship must be very slow, and it is therefore necessary to make use of a double reduction drive between the armature shaft of the Motor and the shaft on which the actuating crank is mounted. A drive consisting of two sets of 57-teeth Gear Wheels and ½" Pinions is suitable, or Worm Gearing using the Meccano Worm and a 57-teeth Gear Wheel may be employed. A Meccano Crank is mounted on the final driving shaft of the gear-box and a Swivel Bearing is secured to the web of this Crank. A short Rod is mounted in the boss of the Swivel Bearing, and a second Swivel Bearing is secured to the free end of the Rod and attached to the side of the hull of the model. When the Motor is started, the Crank commences to rotate slowly and draws the short Rod up and down, the Swivel Bearings allowing for the sideways action of the hull.

The realism of the complete display is increased considerably by the addition of a mains-voltage lamp in the lamp turret, fitted with a "flasher." This device causes the lamp to be switched on and off alternately at short intervals, and thus follows the intermittent lighting effect actually used on a lightship.

Another interesting method of providing motion in a ship model is to arrange matters so that the propellers or paddles are driven. To do this it is necessary to mount the model on supports constructed from Rods and Bush Wheels; or girder supports may be used if the model is very large and heavy. A Meccano Electric Motor is secured in the hull of the model and coupled to the propeller shaft through a reduction gear-box. This gear-box is necessary as the propellers are required to rotate at a slow speed, whereas the Electric Motor armature rotates at several thousand revolutions per minute.

This system may be applied with good results to many types of model screw steamers, but the result is even more effective when a paddle steamer forms the subject of the constructional work. In a model paddle steamer the Electric Motor should be coupled to the paddle shaft through reduction gearing as in the case of models fitted with screw propellers, so that the paddles rotate at slow speed. The interest of the model is increased if the blades of the paddle wheels are made to "feather" as they rotate, and this action can be achieved quite easily by using an eccentric motion.

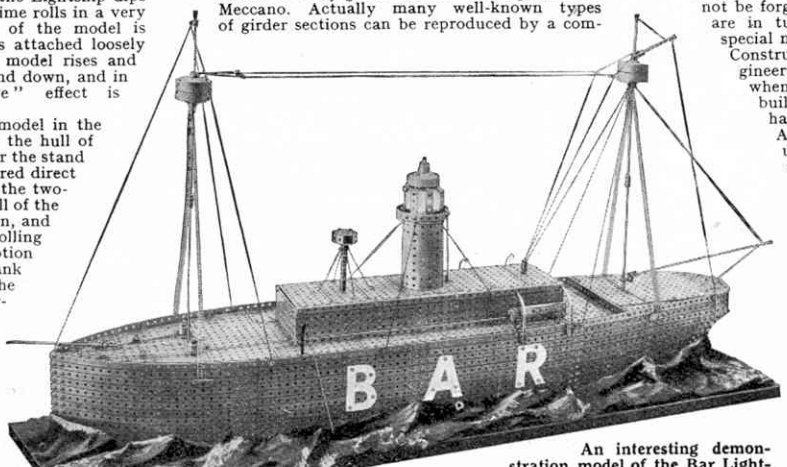
GIRDER CONSTRUCTION

All Meccano engineers know of the important part that girders play in engineering construction, and most model-builders are familiar with the use of the Meccano Angle Girders in the assembly of rigid frameworks.

Although the Angle or "L" Girder is the only standard section of girder included in the Meccano range—apart from the Braced and Flat Girders which are both of flat section—it should not be thought that this is the only girder section that is possible in Meccano. Actually many well-known types of girder sections can be reproduced by a combination of standard parts. The simplest variation from the "L" pattern girder is obtained by bolting two standard Angle Girders back to back, thus producing a "T" section girder. This girder possesses considerably greater strength than the simple "L" girder, and it may be used in any structure where heavy loads are involved. Another type of girder that requires the use of two Angle Girders is the "U" pattern. For this the girders are secured together round hole flange to slotted flange, so that a three-sided or "U" section is formed. For even greater strength the "U" type section may be duplicated, four Angle Girders being bolted together so as to form two "U" girders set back to back. The girder section produced by this form of construction resembles the letter "H."

One of the best known types of girder section is the "I" pattern. This type is used extensively in bridge and crane design, and is employed also in the steel frameworks of multi-storeyed buildings. The "I" girder may be reproduced in several ways in Meccano. The simplest method is to bolt four Angle Girders together in a similar manner to the "H" girder formation and arrange the completed member so that the flanges lie in a horizontal plane. An "I" girder having more scientific proportions may be reproduced by making use of a Flat Girder in addition to the four Angle Girders. In this form of construction two Angle Girders are bolted to each side of the Flat Girder, and the complete member is assembled in the model so that the Flat Girder lies in a vertical plane.

Numerous other types of girders may be built up in a similar manner, so that the Meccano engineer has a wide choice in the type of steel section that he uses in his models. Meccano Girders built up in this way have strengths in proportion to actual girder sections, and their stress-resisting qualities can be demonstrated in a spectacular manner by building a model bridge and loading it with heavy weights. Meccano Bridges constructed according to correct engineering practice with built-up girders are capable of supporting easily the weight of the builder, while in certain cases a load of several hundred pounds can be applied without any danger of breakage. Apart from their practical application in various models, Meccano built-up girder sections form interesting examples for experiment, and model-builders can obtain much interest and instruction from the assembly of the various types.



An interesting demonstration model of the Bar Lightship in Liverpool Bay. This model is fitted with an ingenious crank-actuated rocking motion.

AEROPLANE CONSTRUCTION

We have dealt from time to time with the use to which special Aeroplane Constructor parts can be applied in general Meccano model-building, but it should not be forgotten that the standard Meccano parts are in turn often of assistance in assembling special models with a No. 1 or No. 2 Aeroplane Constructor Outfit. Meccano aeroplane engineers will find that this applies particularly when unusual types of aircraft are to be built. For instance, many model-builders have wished to reproduce the famous Autogiro with their Sets, but have been unable to construct the rotor unit satisfactorily. By using Meccano Strips and other parts, however, a good effect can be obtained, and as the Aero parts are punched with standard size equidistant holes, no difficulty is experienced in fitting the Meccano parts in place. The framework supporting the rotor head of the Autogiro may be built up with the aid of Meccano Strips and Angle Brackets, while a Bush Wheel makes a very realistic representation of the rotor head. The rotor blades themselves may be formed either from Wing Stays (part No. P31) or Meccano Strips. In either case Hinges (part No. 114) may be used to hold the blades to the rotor head.

COIL WINDING. Your suggestion that a special coil winder should be introduced for winding solenoids and electro-magnets is interesting, but it is quite a simple matter to assemble an efficient coil winding lathe from standard Meccano parts. The lathe can be driven either by hand through step-up gearing or by means of an Electric or Clockwork Motor, the motor-driven instrument, of course, providing greater speed and efficiency. It may be designed as a simplified version of a metal-turning lathe, and the shaft to which the unwound bobbin is to be secured may be provided with a chuck and tail-stock which enables various types of bobbins to be fitted in place.

The best known type of Meccano Solenoid is that constructed from a Bobbin, part No. 301, wound to capacity with Meccano S.C.C. Copper Wire. The wire is wound on in layers, and in order to ensure that it is fed gradually from one side of the Bobbin to the other, a screw control hand feed can be used. This may consist of a ½" Pulley over which the wire passing to the Bobbin travels, the Pulley being attached to a Threaded Boss that travels on a Screwed Rod. The Screwed Rod may be rotated by hand through gearing, and on turning the Rod the guide Pulley is moved from side to side. This enables the wire to be fed on to the rotating Bobbin in even spiral layers.

An evenly wound Bobbin possesses considerable advantage over one that is filled with wire in a haphazard manner, for not only does the correct arrangement of the layers of wire add to the electrical efficiency of the solenoid, but it also enables a considerably larger quantity of wire to be wound on to the Bobbin. The coil winding lathe may also be used for winding large electro-magnets composed of Strips fitted with Coil Cheeks. (*Reply to J. R. Prout, Leicester.*)

Meccano "X" Series Models

Further Examples of Model Construction

The Meccano "X" Series Outfits contain an entirely new set of parts that make possible the construction of an almost unlimited range of models. Although the "X" parts are on a smaller scale than standard Meccano Parts, they embody the same system of equidistant holes, but the perforations are spaced only ½" apart and there are three rows to each Strip. This new system of parts simplifies model-building so that even our youngest readers will have no difficulty in constructing working models, which may be set in motion by an "X" Clockwork Motor. The "X" Series Parts can be used in conjunction with standard Meccano parts.

THIS month we illustrate the third group of examples of models built with the new Meccano "X" Series Outfits. Readers who have not yet become acquainted with the "X" Series parts will be able to understand the general principles of model-building with them from the new examples given below.

Glider

The simple glider shown in Fig. 1 is built by forming the fuselage from two 1¾" × ½" Double Angle Strips bolted together and extended by a pair of 4¼" Strips. The wings consist of four 2¾" Strips, and a short Strip represents the tail plane, with an Angle Bracket fixed in place to serve as a rudder.

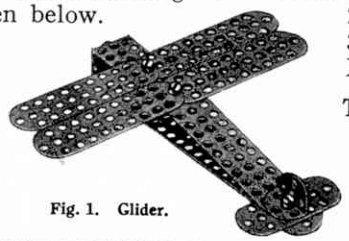


Fig. 1. Glider.

Parts required for Model Glider: 2 of No. X405; 4 of No. X407; 1 of No. X409; 1 of No. X421; 2 of No. X455; 5 of No. 37a; 5 of No. 37b.

Double Arm Signal

This model will be found useful by model railway enthusiasts. It is a type of signal used in cases where the arrangement of the track necessitates the placing of "distant" and "home" signals together. From these the engine driver is able to ascertain if the next "home" signal is at "line clear," and adjust his speed accordingly.

The signal post is attached to the base by a ¾" × ½" Double Angle Strip bolted to the larger Double Angle Strip forming the end of the base frame. Two pairs of 1¾" Strips carry a 2½" Screwed Rod on which the operating levers are pivoted. Each lever, consisting of a 2¾" Strip, is held in place by lock-nuts on each side. The nuts should be placed close against the sides of the Strips, but should not grip them firmly. A second Screwed Rod limits the movement of the levers, to the lower end of which cords are attached and tied to the signals.

The signal arms are pivoted on bolts fixed to the vertical post. They should be free to move up and down so that the weight of the signal arm keeps the cord tight, and drops the signal as soon as the lever is moved over. The cords are passed beneath a third 2½" Screwed Rod immediately behind the post.

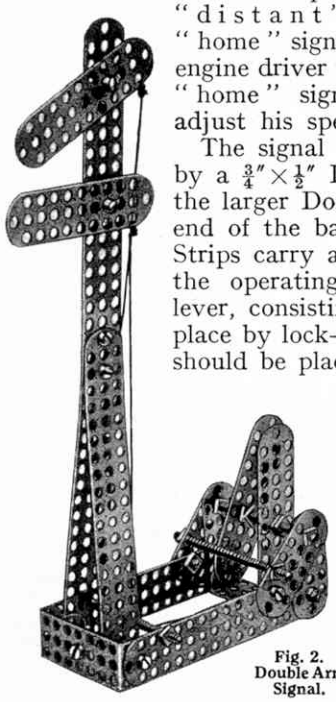


Fig. 2. Double Arm Signal.

Parts required for Double Arm Signal: 3 of No. X404; 2 of No. X405; 4 of No. X407; 4 of No. X409; 3 of No. X435; 2 of No. X455; 1 of No. X457; 33 of No. 37a; 13 of No. 37b. Cord.

Truck Propelled by Hand Lever

In Fig. 3 is shown a type of truck that is propelled by operating a hand lever to and fro. The steering is operated by a loop of cord. The frame is made by spacing two 5½" Strips apart at one end by a 1¾" × ½" Double Angle Strip. At the opposite end the two Strips each carry a 1¾" Strip fixed at right-angles, and an Angle Bracket. The Brackets are connected by a short Strip, and a seat is made from two 2¾" Strips. The front wheels are mounted on a Screwed Rod journalled in a 1¾" × ½" Double Angle Strip that is pivoted at its centre to the front of the frame. A length of Cord is tied at both ends to the pivoted Strip.

The rear wheels are arranged in the following manner. The left-hand wheel is fixed on a Screwed Rod passed through the vertical 1¾" Strip at the rear of the model, and retained in position by lock-nuts. The other wheel is held in a similar manner, but the Rod carries on the inside a ¾" × ½" Double Angle Strip. As can be seen in the illustration, this forms a crank that is connected to the lower end of the hand-lever by a 4¼" Strip.

Parts required for Hand Car: 3 of No. X404; 1 of No. X405; 4 of No. X407; 4 of No. X409; 4 of No. X421; 2 of No. X435; 2 of No. X438; 2 of No. X455; 1 of No. X457; 4 of No. X475; 36 of No. 37a; 15 of No. 37b. Cord.

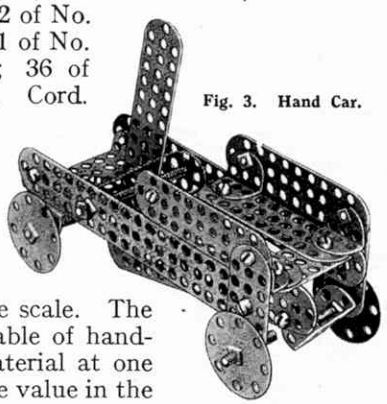


Fig. 3. Hand Car.

Mechanical Excavator

Excavators of the type reproduced in Fig. 4 are used extensively wherever digging operations are carried out on a large scale. The actual machines are capable of handling up to 16 tons of material at one scoop, and are of immense value in the

Meccano "X" Series Parts

Part No.	X404	Perforated Strips, 5½".
" "	X405	" " 4¼".
" "	X407	" " 2¾".
" "	X409	" " 1¾".
" "	X421	Angle Brackets.
" "	X435	Screwed Rods, 2½".
" "	X438	" 1".
" "	X455	Double Angle Strips, 1¾" × ½".
" "	X457	" " ¾" × ½".
" "	X475	Discs, 1½".
" "	X477	" ¾".
" "	X491	Combined Spanner and Screwdriver.
" "	37a	Nuts.
" "	37b	Bolts, 7/32".
" "	38	Washers.
" "	57c	Hooks (loaded).

Prices: No. XI Outfit, 1/3. No. X2 Outfit, 2/-. X Clockwork Motor, 2/6.

construction of canals, cuttings, etc.

The model can be built by combining the contents of four No. X2 Outfits. The travelling base and superstructure are shown separately in Fig. 5, which gives a good idea of the construction of the model. The base is made by forming angle girders from two pairs of 4½" Strips, and connecting them by 2¾" Strips. Each wheel is made up of three 1¼" Discs carried on a 1" Rod secured to the sides of the truck. The Discs are held on the Rods by means of lock-nuts.

The sides of the superstructure are made by extending 5¼" Strips with 2¾" Strips, and as will be seen from Fig. 5 these compound strips are connected by 2¾" Strips fitted at each end with Angle Brackets. To one of these short Strips a ¾"×½" Double Angle Strip is fixed, and the jib is secured to it. For the jib two pairs of 5¼" Strips are used and spaced apart at the upper end by a further Double Angle Strip. The jib is supported by two cords that are tied to the triangular frames, and the tops of the frames are connected by a 2½" Screwed Rod. Two 5¼" Strips are bolted at the base of the jib and their other ends are supported by 1¾" Strips secured vertically to a ¾"×½" Double Angle Strip bolted to the third 2¾" Strip from the rear of the model. Two 4¼" Strips are fitted to the upper edge of the 5¼" Strips, and a 2½" Screwed Rod is journalled between them, and carries a hand-wheel formed from a 1¼" Disc and a bolt. The Rod carries the cord that passes over a built-up pulley at the jib head and is tied to the digger bucket.

The bucket is made from 1¾" Strips bolted to 1¾"×½" Double Angle Strips. A ¾"×½" Double Angle Strip secures the bucket to the digger arm, consisting of 4¼" Strips and pivoted to the jib by bolts and lock-nuts. The bottom of the bucket is hinged by tying it with loops of cord, and a 2½" Screwed Rod slides in a Double Angle Strip. This Rod forms the bolt, and engages a 1¾" Strip at the front of the bucket to hold the bottom in position. A cord is attached to the bolt and this is pulled when it is required to discharge the contents of the bucket.

The superstructure pivots on a Double Angle Strip that can be seen in Fig. 5. The bolt in the centre hole of this Strip is passed through the centre of the travelling base and provided with lock-nuts.

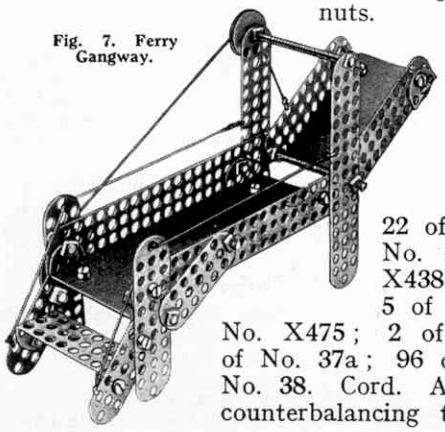
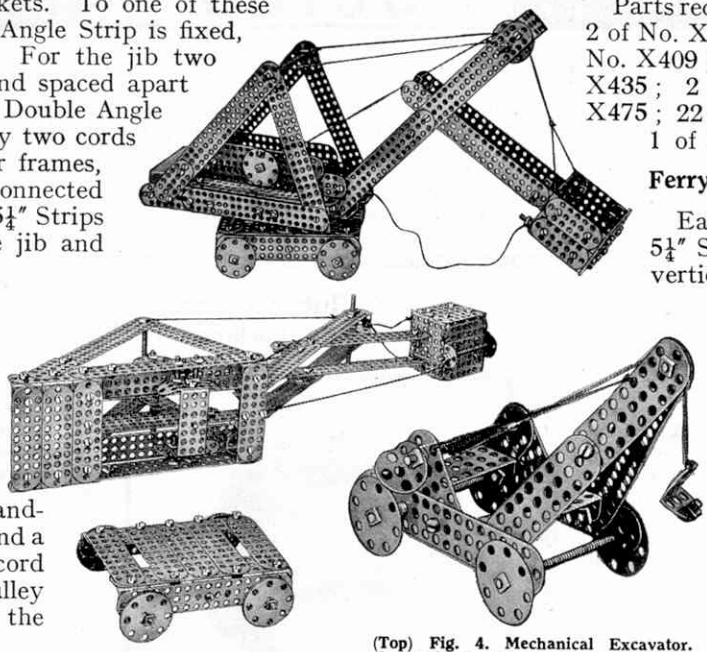


Fig. 7. Ferry Gangway.

Parts required for Mechanical Excavator: 16 of No. X404; 6 of No. X405; 11 of No. X407; 15 of No. X409; 22 of No. X421; 4 of No. X435; 8 of No. X438; 4 of No. X455; 5 of No. X457; 15 of No. X475; 2 of No. X477; 149 of No. 37a; 96 of No. 37b; 4 of No. 38. Cord. A small weight for counterbalancing the jib.



(Top) Fig. 4. Mechanical Excavator. (Left) Fig. 5. View of Excavator before final assembly. (Right) Fig. 6. Travelling Crane.

A Simple Type of Travelling Crane

To construct the miniature crane illustrated in Fig. 6, two 4¼" Strips are spaced apart by two 1¾"×½" Double Angle Strips. The jib is made of two pairs of 2¾" Strips, which are held together at the top by a bolt, but spaced by a Washer to allow the hoisting cord to pass between them. The winding shaft is journalled between 1¾" Strips at the rear of the crane, and an Angle Bracket forms a crank handle. Two short cords secured to the 1¾" Strips are also tied to the jib to support it. A hook is formed from an Angle Bracket and bolt, and the entire model travels on four wheels fixed to 2½" Screwed Rods.

Parts required for Travelling Crane: 2 of No. X405; 4 of No. X407; 4 of No. X409; 2 of No. X421; 3 of No. X435; 2 of No. X455; 4 of No. X475; 22 of No. 37a; 10 of No. 37b; 1 of No. 38. Cord.

Ferry Gangway

Each side is built up from a 5¼" Strip with a 4¼" Strip fixed vertically at one end and a 2¾" Strip at the other end. The two sides are held together by a Double Angle Strip and 2½" Screwed Rods. A step is formed from a Double Angle Strip bolted between two 1¾" Strips. Cardboard is bolted in position to form a platform. One of the 2½" Rods carries two 2¾" Strips that are free to pivot about the Rod, and the ends of the Strips are connected by a 1¾" Strip fixed by Angle Brackets. A piece of cardboard is bolted to these.

To operate the gangway a lever is fitted on the right-hand side, as can be seen in Fig. 7. This consists of a 2¾" Strip fitted with a bolt and carried on a 2½" Screwed Rod. The other end of the Rod carries a 1¼" Disc connected by cord to the hinged portion. The cord passes over a pulley consisting of two ¾" Discs placed on either side of a Washer, and held in position on the 2½" Rod by locknuts.

Parts required for Ferry Gangway: 2 of No. X404; 2 of No. X405; 4 of No. X407; 4 of No. X409; 4 of No. X421; 3 of No. X435; 2 of No. X455; 1 of No. X475; 2 of No. X477; 35 of No. 37a; 17 of No. 37b; 1 of No. 38. Cardboard.

Jumping Jack

For the arms 2¾" Strips are used and are pivoted on a bolt that is fixed by two nuts to the body, which is represented by a 4¼" Strip. The leg joints are pivoted in a similar manner. A head is made from a 1¼" Disc and a length of cord is attached to it, further cords being attached to the arms and legs.

Parts required for Jumping Jack: 1 of No. X405; 4 of No. X407; 3 of No. X409; 1 of No. X475; 1 of No. X477; 9 of No. 37a; 5 of No. 37b. Cord.

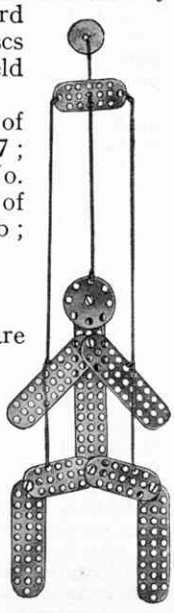


Fig. 8. Jumping Jack.

Looking Forward

In Great Britain the appearance of the March issue of the "*M.M.*" is the signal for the beginning of preparations for the outdoor programme, for if summer camps, games, rambles and cycle runs are to be successful, their details must be carefully thought out well in advance. In Australia, New Zealand, South Africa and other parts of the southern hemisphere also this time of the year brings with it a change in outlook, but of the opposite kind; for the summer programme is coming to an end, and the thoughts of officials and members are concentrated on club room work, in which model-building and indoor hobbies and recreations play the chief part.

Although clubs in various parts of the world thus appear to be proceeding along opposite lines, their members are animated by the same spirit of enthusiasm for the Guild and the determination to join whole-heartedly in combined efforts to obtain as much genuine fun as possible from their hobbies. Their differences in outlook are consequences of the world-wide distribution of Meccano Clubs, and it may be truly said that the Sun never sets on the Meccano Guild.

Exchanging Club Magazines

A gratifying sign of the keenness of Meccano enthusiasts is the number of excellent club magazines now being produced. These vary from small leaflets, of which copies are made by means of a jellygraph, to more ambitious efforts reproduced by typewriter and duplicator, or even printed. As their editors gain experience these magazines become larger and more attractive, and their value to the enterprising clubs producing them becomes greater, especially if members give full support by contributing interesting articles or notes, and by making the magazine known to their friends.

I should like to see a more general adoption of the plan, already followed by certain clubs, of exchanging copies of magazines, for this would not only help to broaden the outlook of members, but also would assist in circulating ideas that make for brighter and more attractive programmes. The inclusion of overseas clubs in exchanges of this kind would be a valuable means of bringing enthusiasts from distant countries into more intimate contact with each other. This has been realised by the editor of the "*Sydney Meccomag*," the official organ of the Sydney (Australia) M.C., and he wishes to arrange regular exchanges with editors of other club magazines. I shall be pleased to hear from those who wish to take advantage of this splendid opportunity of learning something of club life in the great Australian city, and I hope that they will write to me as soon as possible in order that I may be able to put them into direct communication with the editor of this interesting production. I should also be glad to help in arranging similar exchanges between clubs in Great Britain, and look forward to hearing from editors and club officials who desire to take part in a scheme of this kind.

Meccano Club Secretaries

No. 25. S. Cocking

S. Cocking is secretary of the Abington M.C., which owes its existence chiefly to his enterprise and enthusiasm. He has been well supported by the members and affiliation was secured in September last. The club is now firmly established and an appreciative account of its meetings, together with a photograph of members in the club room, recently appeared in the "Northampton and County Independent."

Meccano Games Nights

An excellent type of meeting that has been introduced by the Melbourne (Australia) M.C. takes the form of a Meccano Games Night, at which members take part in games played with Meccano models. The attractions arranged for a meeting of this kind include a Race Game, a Meccanograph, an Electric Game and other novelties that have been described in the "*M.M.*" itself, or in the well-known series of Super model leaflets. In addition, an interesting Electric Questioner has been built, on which the appearance of a light shows when illustrations of parts of the S.300 "Pacific" engine that hauls the "*Sydney Limited*," a famous Australian train, are correctly identified by those taking part.

On Games Night itself the club room is transformed into a Fair, and members thoroughly enjoy themselves among the many attractions provided. One of the most popular of the many sideshows is a Shooting Gallery, in which Collars are shot at the Electric Target described in the "*M.M.*" for February, 1928. The scoring of a bull's eye on this target is indicated by the lighting up of a flash-lamp bulb, and this model in itself would provide fun for many evenings when used in conjunction with one of the Meccano guns that have been described from time to time in the "*M.M.*" and in the Manuals.

There are many Meccano games suitable for events of this kind, and I shall be pleased to forward details of them to Leaders and secretaries who wish to follow the example of the Melbourne M.C. The range is large enough to enable an attractive programme to be arranged and to provide ample variety. I have no doubt that Meccano Games Nights will rapidly become favourites with members of clubs in which they are arranged, and I look forward to the introduction of new Meccano games devised by keen enthusiasts in order to increase the interest of these attractive additions to club programmes.

* * * *

Guild members and other readers living in the Harlesden district should keep in mind the forthcoming Exhibition of the Harlesden Wesleyan M.C. This will be held in the Lecture Hall, Tavistock Road, Harlesden, from 2.30 p.m. to 8.30 p.m. on 8th April, and the charge for admission will be 6d., children 3d.

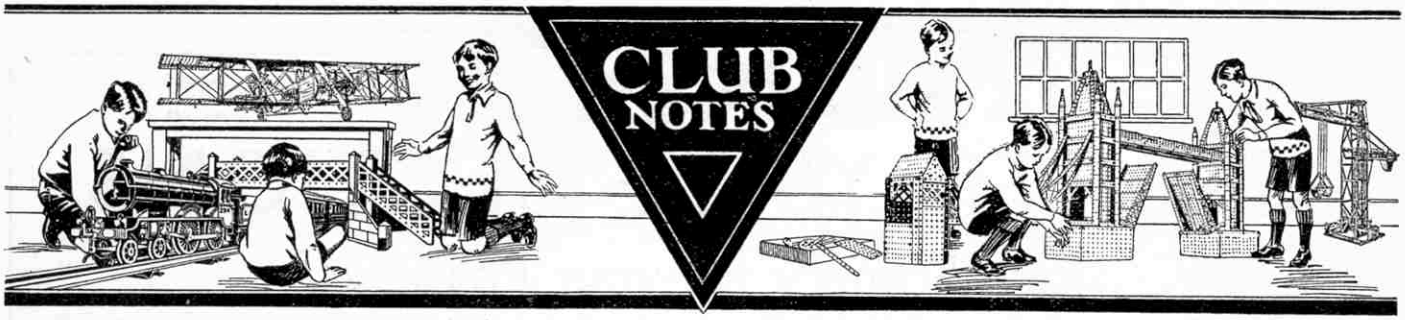
I wish to remind Australian readers of the Autumn Exhibition of the Sydney M.C. to be held at 23a, Barker Street, Lewisham, N.S.W., on 21st April. A cordial welcome and an interesting time is assured to visitors.

Proposed Clubs

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

ABERDEEN—Mr. D. Lamont, 4, Watson Street.

BIRMINGHAM—J. C. Button, 198, Harborne Road, Warley.



Gourock High School M.C.—The programme is devoted chiefly to contests of all kinds and short lectures given by members. In a Simplicity Model-building Contest the prize was awarded to a model of a Biplane built from 18 Meccano parts. A specially attractive meeting was devoted to an address on "*Geysers*" by Mr. A. Nisbet, Leader of the club, who visited Yellowstone Park last summer. Club roll: 9. *Secretary:* D. McLarty, 39, Cove Road, Gourock.

Greenford M.C.—Great enthusiasm prevails and members meet in the club room practically every night in the week. One evening is devoted to Games and another to short talks on various topics. Special interest is now being taken in Electricity and electrical experiments of all kinds are being carried out. The club room is being specially fitted to enable work of this kind to be pursued. Club roll: 17. *Secretary:* A. C. Cooper, 145, Costons Lane, Greenford.

Laindon (Essex) M.C.—Many excellent models were built for "Meccano Week," when the club room was open for inspection by parents and friends of members. The models were afterwards displayed in the window of a local Meccano dealer. This event was followed by displays of train working on the club's model railway, which was specially illuminated. Again a large number of visitors were present, including members of the Bell Hill and District M.C., and the interest aroused by the two events led to a welcome increase in membership. Club roll: 11. *Secretary:* A. Schofield, "Highfield," Inverness Road, Laindon, Essex.

Bridport Grammar School M.C.—The Chief Electrical Engineer of Bridport invited members to visit the Power Station, where they spent an enjoyable evening. A Lantern Lecture on "*North Germany*" has been given, and the library has been enlarged by a gift of books from a former member. Club roll: 33. *Secretary:* R. Hyde, 6, Melville Square, East Street, Bridport.

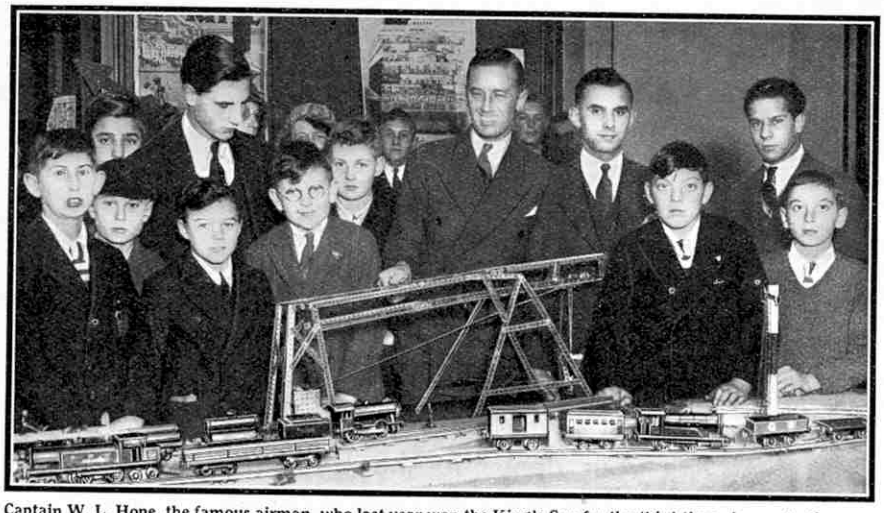
St. Saviour's (Raynes Park) M.C.—Special interest is shown in the construction of large club models of original design. Darts and Bagatelle have been added to the games available and these were greatly enjoyed at a recent Social, when the principal attraction was a Conjuring Entertainment. Croydon Aerodrome has been visited and there eight members were taken for flights. Club roll: 9. *Secretary:* R. Woollcott, 33, Crossway, Raynes Park, S.W.20.

St. Columbas (Sunderland) M.C.—Model-building on more extensive lines than in previous sessions is now being undertaken. Model-building Contests are held weekly, recent subjects in these including Dock Machinery, anything used in coal mining, and special forms of gearing, while in other contests members submitted models of their own choice. One result of the concentration on Model-building has been the rapid improvement in skill of younger members. Interest is maintained by including games of all kinds, a special book of amusements having been bought for this purpose, and by arranging Social Meetings as "Surprise Items." Club roll: 19. *Secretary:* D. Ferguson, 3, Edward Burdis Street, Southwick.

Wembley M.C.—A visit has been paid to the Science Museum at South Kensington and special meetings have been devoted to a Debate on the relative merits of Electricity, Steam and Gas, and to an exhibition of films. Model-building activities have proceeded satisfactorily, a specially interesting event being a Fire Evening, when members built model Fire Engines in competition with each other, speed in preparing to cope with an imaginary fire naturally being the chief requirement. A visit has been paid to the Old Oak Common Engine Sheds of the G.W.R., where members were allowed on the footplates of two locomotives, and a lecture on "*Electricity*" has been given by Mr. P. Marshall, Assistant Leader. Club roll: 27. *Secretary:* E. Burns, 31, Oakington Manor Drive, Wembley Hill, Middlesex.

Hele's School (Exeter) M.C.—Many splendid meetings have been held and one new member enjoyed his first attendance so much that he brought three recruits to the next meeting! Short Lectures have been given by members on "*Photography*," "*Aquaria*" and "*Is Mars Habitable?*" Special Hornby Train Nights have been arranged. At one of these the lights were turned out and night operations conducted. The session was brought to an end with a Party, members having made weekly contributions to a fund for the purchase of refreshments. Club roll: 14. *Secretary:* J. Drake, 12a, Gervase Avenue, Exeter.

Mary Swanwick School (Chesterfield) M.C.—This newly-formed club has made a splendid start. In addition to Model-building Evenings, Hornby Train Nights have been held at which Meccano Bridges and Cranes have been built for the club's layout. One of the cranes constructed was fitted with an electro-magnet. At each meeting points are awarded to the builders of the three best models and sessional prizes are given to those securing the largest totals. Club roll: 15. *Secretary:* F. W. Cooper, The Bull's Head Hotel, Old Whittington, Chesterfield.



Captain W. L. Hope, the famous airman, who last year won the King's Cup for the third time, demonstrating one of the working models shown at the recent Exhibition of the Wealdstone Methodist M.C. Captain Hope opened the Exhibition and promised flights as special prizes to the two members who gained the highest marks in the club's sessional Model-building Contest. Photograph by courtesy of the Editor, "Harrow Observer and Gazette."

Park Modern (Barking) M.C.—A splendid series of models was shown at the club's Exhibition, the First Prize being awarded to an ingenious "Penny in the Slot" machine for the sale of boxes of matches. More than 1,000 visitors were greatly interested in the display. A large party visited the Barking Power Station, where nearly four hours were spent in inspecting the extensive plant. A surprise attraction was the M.R.S. giant lorry recently described in the "*M.M.*" and a huge transformer brought to the station on it on the previous day. Club roll: 22. *Secretary:* F. Tingey, Hillcrest, 11, Shirley Gardens, New Barking.

Chertsey M.C.—Two interesting competitions were arranged for Surprise Evening. In one members drew subjects for Model-building from a hat, and a prize was awarded to the best model constructed in the time allowed; in the second entrants were asked to identify pieces of machinery or gearing from descriptions given. Special attention is devoted to junior members, to whom valuable hints on Model-building methods are given by officials and senior members. Once a month an evening is devoted to the construction of large models, members being grouped into sections for this purpose. Club roll: 15. *Secretary:* V. Brown, Arbon Grove Cottage, Lyne, Nr. Chertsey.

AUSTRALIA

Ravensthorpe M.C.—Great fun is being obtained on the Air Rifle Range, marks in sessional contests being awarded for successful shooting. Members also are busily preparing for a Concert at which two short plays are to be presented, and rambles are arranged regularly. Club roll: 14. *Secretary:* L. E. Daw, Carlyle Street, Ravensthorpe, Western Australia.

INDIA

Sind Madressah (Karachi) M.C.—Models built in the Competitions arranged at each meeting are judged by Mr. H. F. L. T. Harrison, President of the club, who suggests improvements. Recent subjects for these contests have included Locomotives, Aeroplanes, Cranes and Stone Sawing Machines. Interesting lectures on engineering subjects have been given by Mr. D. B. Thaker, and Mr. Thaker also gave a talk to the boys of the school on "*The Meccano Club and its Aims.*" Club roll: 15. *Secretary:* Akhtar Abbas, Faiz Hussainy Building, Kutchery Road, Karachi City.

NEW ZEALAND

Blenheim M.C.—The club room has been painted and given an attractive appearance by the use of Meccano streamers. Games and Meccano Nights have been held and interesting outings were arranged for the Christmas Holidays. In a Simplicity Contest remarkably ingenious models were exhibited. Club roll: 21. *Secretary:* K. J. Orams, Redwood Street, Blenheim.

Hawera M.C.—The Headmaster of the High School has kindly provided a room for club meetings, and the engineering workshop will be valuable to members. Contests in which speed and workmanship are the principal requirements are very popular with members, who enter keenly into any type of Model-building Competition. Talks have been given by Mr. A. H. Larkman, Leader of the club, on "*Inertia*," "*Capillarity*," and "*Elasticity*"; and members have contributed talks on "*Gas Engines*" and "*The New Tyne Bridge.*" A Cycle Run was combined with a visit to a local Power Station. Club roll: 12. *Secretary:* E. B. Cox, Tawhiti Road, Hawera.

Boys' Institute (Wellington) M.C.—An interesting lecture on "*Docks and Slips*" was given by Mr. Patterson. A series of travel talks by members has been arranged, journeys by rail in various parts of the world being described. Visits have been paid to the ferry steamers "*Matangi*" and "*Rangatira*"; the offices of the "*Evening Post*"; and the machine shop of the Wellington Harbour Board. The New Zealand Railway Workshops at Hutt Valley and a Meat Packing factory also have been inspected. Many excellent models were prepared for the Hobbies' Exhibition, senior members securing 1st and 2nd prizes with a Loom and Ship Coaler respectively. Club roll: 20. *Secretary:* E. H. Speers, 70, Cuba Street, Petone.

SOUTH AFRICA

Malvern M.C.—Rambles and picnics have been held during the summer months, and a specially interesting visit was paid to the Johannesburg Power Station. A special evening was devoted to papers by girl members, who contributed short accounts of "*Hero Worship*," "*What the Modern Girl Expects*" and other topics that aroused interested discussion. Members built many working models for display in shop windows during the Christmas season. These included the Big Wheel, Pithead Gear, Stamping Machine and various types of Cranes. Many competitions have been arranged, one in which entrants were required to inspect a badly constructed model and afterwards to write down the number of errors being particularly attractive. *Leader:* Mr. E. Sykes, P.O. Box 8, Cleveland, South Africa.

STRAITS SETTLEMENTS

Penang Free School M.C.—This newly-formed club is making excellent progress. A club room has been placed at the disposal of members by Mr. M. R. Holgate, Headmaster of the School and President of the club, and members are so keen that they hold meetings on Saturdays as well as on Tuesdays, the regularly appointed day. A visit has been paid to the Dry Docks at Prai. Club roll: 7. *Secretary:* Syed Ahmad Kabeer, 1c Lorong Salamat, Penang.

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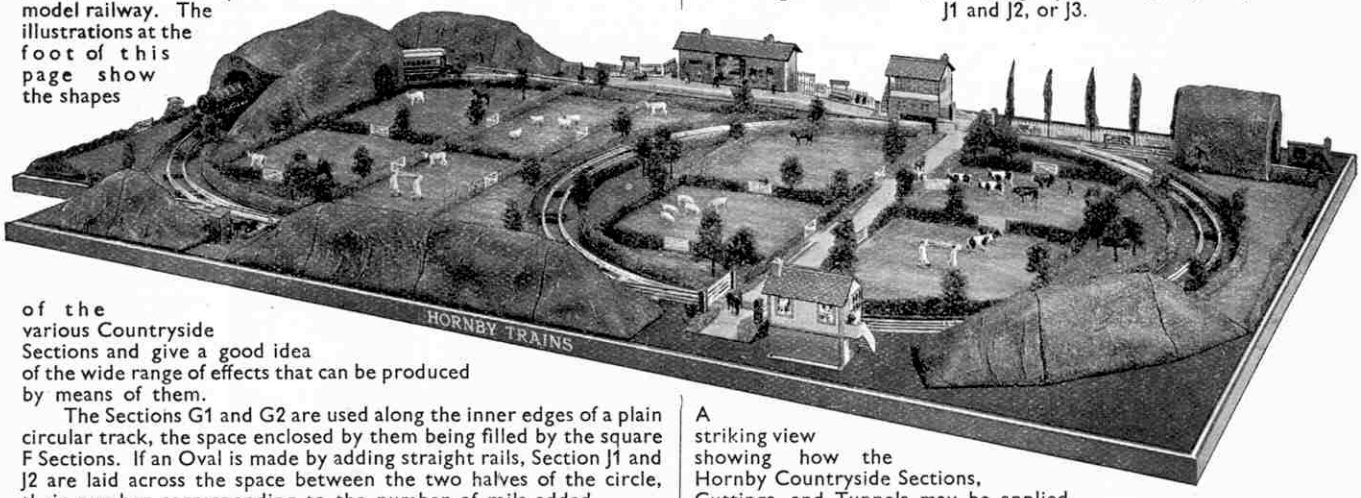
The Sections G1 and G2 are used along the inner edges of a plain circular track, the space enclosed by them being filled by the square F Sections. If an Oval is made by adding straight rails, Section J1 and J2 are laid across the space between the two halves of the circle, their number corresponding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

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

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

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



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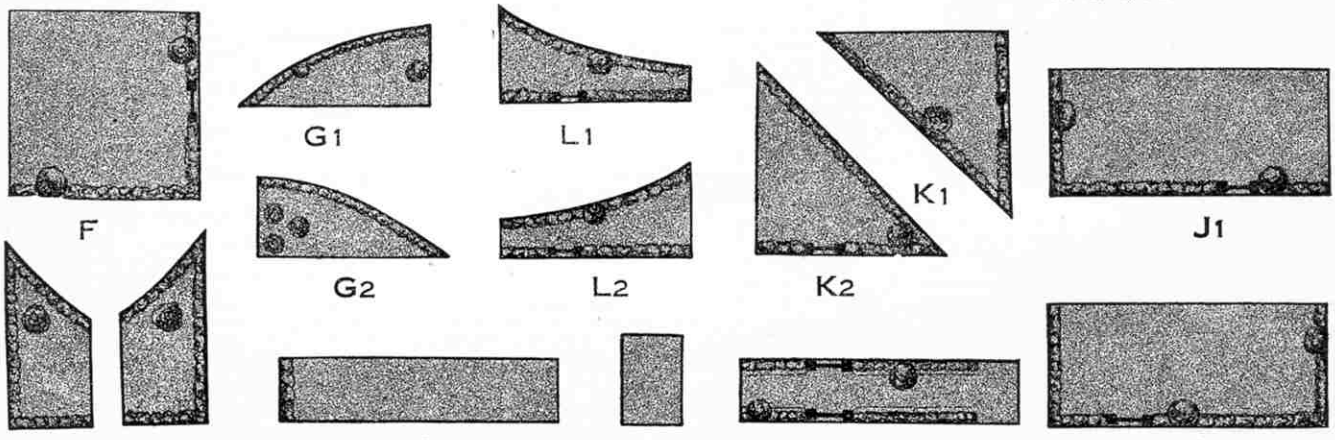
No. 13
HALL'S DISTEMPER ADVERTISEMENT
This miniature of a well-known lineside advertisement is intended to be placed in the fields adjoining the railway track. **Price 9d.**



MECCANO LIMITED - BINNS ROAD - LIVERPOOL, 13

Branch Notes

NOTTINGHAM HIGH SCHOOL.—The Branch Exhibition in December was an outstanding success. Many visitors were present and all were greatly interested in timetable working on a special track, the operations taking half an hour and being repeated several times during the display. An automatic electric track on which three locomotives ran was another attraction, and there was also a display of Meccano models, and a Scientific Exhibit kindly organised by the Science Masters of the school. A film, "*How a Car Engine Works,*" loaned by Shell Mex Ltd., was shown at regular intervals. A gramophone and amplifier provided music, and refreshments were supplied. Secretary: F. Nabarro, 4, Grosvenor Avenue, Mapperley Park, Nottingham.

ELMSIDE (EXETER).—Members are encouraged to make suggestions and these are dealt with at Directors' meetings. Regular visits have been made to Exeter Station, and at ordinary meetings new engines have been tested and trials made of working timetables. In one week a double record was created, for more new members joined than in any previous week, and traffic on the Branch track was extraordinarily heavy. On one evening so many trains were in operation that double line working in one direction became necessary. Secretary: Mr. J. Blaker, c/o 60, Elmside, Exeter.

KILMAURS.—Timetables worked out by members are given thorough trials on the Branch track under the supervision of the Superintendent. This plan gives members opportunities of introducing new ideas for making the best use of the numerous engines at the disposal of the Branch. Lectures on railway subjects are given regularly by Mr. J. L. Clarke, Chairman of the Branch. Secretary: J. L. Marshall, 52, Main Street, Kilmaurs, Kilmarnock.

1ST BOURNEMOUTH.—Track meetings are being held regularly, and a profitable visit has been paid to the S.R. Locomotive Works at Eastleigh. More members are urgently required and the secretary will be pleased to give details to applicants. Secretary: R. Common, 13, Uplands Road, Winton, Bournemouth.

HOLLANDERS (SPALDING).—Several experimental tracks have been tried by this newly-incorporated Branch, operations being conducted with the aid of a signalling buzzer. Locomotive tests have been carried out. A programme of Boxing, Wrestling, Singing and Games was held at Christmas to celebrate the completion of the Branch's first session. A Library is being formed. Secretary: C. L. Redshaw, Devon House, Pinchbeck Street, Spalding.

MAIDSTONE.—The Branch Exhibition was attended by nearly 800 visitors, who were greatly interested in the remarkably steady running of trains on the well-ballasted track. Other events have included a talk by Mr. S. B. Fletcher on his African experiences; and Lantern Lectures on "*Raw Materials,*" loaned by Dorman Long & Co. Ltd., and "*Touring Through Switzerland,*" loaned by the Southern Railway. A technical library is to be formed, and after a long discussion it has been decided to electrify the Branch layout. Secretary: W. Hills, "The Orchard," Lord Romneys Hill, Maidstone.

ST. SAVIOURS (RAYNES PARK).—Experimental tracks are laid out regularly in order to test members' ideas on operation, and to allow trials of coaches and coupling mechanisms suggested by them. Outstanding events have been a Social Evening that included a Conjuring Entertainment; and a visit to Croydon Aerodrome, where eight members were given flights in a "*Fox Moth.*" At Croydon members were greatly interested in the great beacon, and in the night landing lights, all of which were seen in use. Secretary: D. J. Fielden, 117, Bushey Road, Raynes Park, S.W.20.

A group of members of the Colwyn Bay Branch, No. 144. Mr. E. Jones, Chairman, is holding the certificate, and the secretary, R. E. Jones, is at the extreme left of the back row. The branch was incorporated in October, 1930. Track meetings of an attractive type have been held regularly and last year members visited the Meccano factory, Liverpool, to see Hornby Trains in the making.

AUSTRALIA

KEW.—Regular track meetings have been held. Members are very enthusiastic and are specially interested in scale speed trials. In one of these a Hornby "Flying Scotsman" attained the creditable scale speed of 148 m.p.h. Secretary: A. J. McCutcheon, 20, Studley Avenue, Kew, E.4, Victoria.

MELBOURNE.—Meetings are held on alternate Tuesdays in the Y.M.C.A. building. Recent events have included a Meccano Games Night and a visit to a Hobbies' Exhibition, in addition to ordinary track nights and a demonstration of the "block" system of working electric trains. Visitors' Night was very successful. One of the visitors was Mr. Neale, of "*The Age,*" who made appreciative references to the club in the next issue of the paper. A visit of absorbing interest was paid to Melbourne University, where the engineering and scientific laboratories were thoroughly explored. In a Voting Contest on items in the programme of the Branch, members expressed preference for illustrated descriptions of locomotives, using Meccano models as railway accessories on the Branch track, and goods train working. Secretary: L. Ison, 8, Hayes Street, Northcote, N.16, Victoria.

Branches in Course of Formation

The following new Branches of the Hornby Railway Company are now being formed, and 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:—

COSHAM—D. Squires, "Chislehurst," Highlands Road, Drayton.

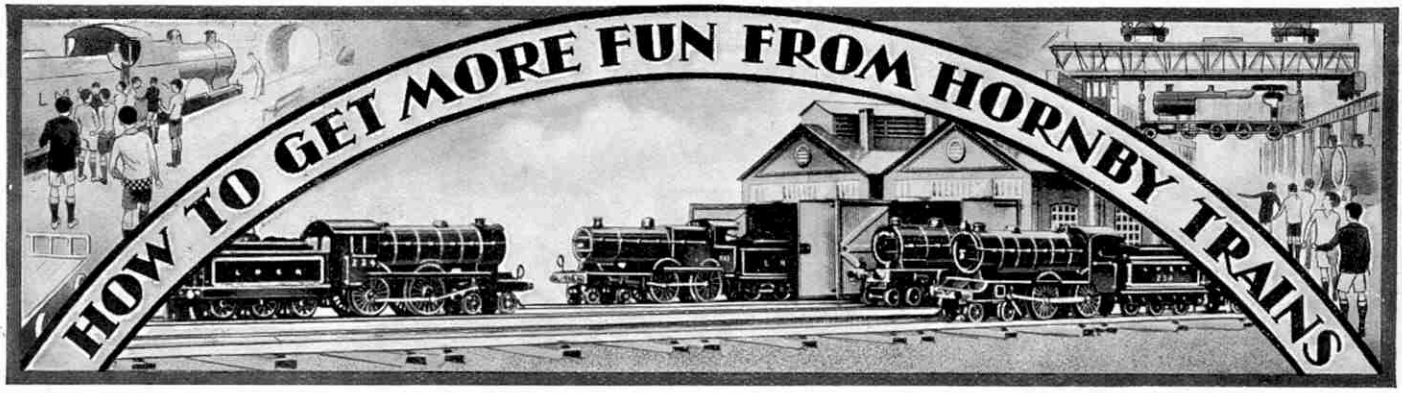
FILEY—G. Johnson, 2, Union Street.

HARLESDEN—E. Hamer, **6, Acton Lane, N.W.10.**

HARROW—A. Berryman, 41, Argyle Road, N. Harrow.

MERSTHAM—D. C. H. Stamford, Upalond, Shepherds Hill.

MOLLINGTON—C. J. C. Walker, 6, Overwood Avenue, Mollington, Nr. Chester.



LIII.—A USEFUL AND INTERESTING LAYOUT

MOST of our readers will agree that the development of a layout is a particularly interesting phase of miniature railway activities. Those who are now operating relatively complete layouts will recall how modestly the system started, probably with a simple circular or oval track. The next step was the addition of points to give alternative routes or sidings, and so on until successive developments have resulted in the present form of layout. In the earlier stages the geometrical type of rail formation is usually adhered to, and the possibilities of "figure 8" and similar schemes are fully tried. Then more railway-like arrangements demand attention, and even when the line has to be taken up each time after use the same plan is usually laid down again and again, especially where the formation adopted has been found to take the fullest advantage of available space, and to enable various characteristics of some actual section of line to be reproduced.

A Hornby suburban train waiting at a station. The M3 Tank Locomotive and the No. 1 Coaches make up a train particularly suitable for the type of services described in this article.

The layout shown in the accompanying diagram is interesting as being the plan adopted by an H.R.C. member, Eric Rayner of Heaton Mersey, after some correspondence with Headquarters. The scheme itself is simple, and a glance at the diagram shows that it is based on the familiar oval formation. Various modifications and additions are incorporated, however, with the result that some distinctly interesting train operations may be carried out. The diagram shows the arrangement of the main line only; the terminus and the principal goods yard are on a branch from the main oval, but their particular arrangement need not concern us here. Two tracks proceed from the terminus, forming up and down main lines. The up line throws off two curved branches that converge at the Double Symmetrical Points shown, and so form two sides of a triangle junction arrangement, the third side being the up main line itself.

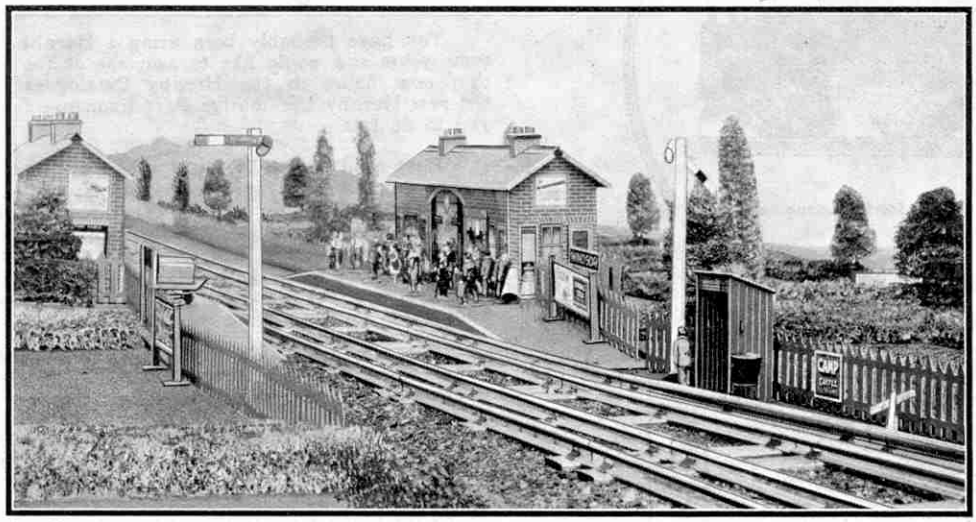
Left-hand Crossover Points form a connection between up and down tracks just before the Level Crossing is passed over, and both tracks, after a short straight run, curve round towards the station shown at the top of the diagram. The down line makes a somewhat wider sweep than the up, as the standard double track curves are not used, but the ordinary 2-ft. radius curved rails forming each quarter circle of the down line have a short length of straight in between them. After the station platforms are passed, the up and down tracks resolve themselves into a single line, and bear round towards the Double Symmetrical Points already mentioned. The curved sides of the triangle junction complete the connection with the terminal branch on the one hand and with the rest of the main oval on the other.

The complete formation makes up a layout with distinct possibilities. Let us follow the path of a down passenger train proceeding towards the main oval. It is running, of course, on the left-hand or lowest track in the diagram. Once clear of the neighbourhood of the terminus no points are met until the Crossover Points are passed. As these are left-hand or trailing points, they have no influence on the route taken by our train. If the points are set correctly and the way is clear over the Level Crossing, the train proceeds until the station is reached. It may run through if the way is clear, or it may have to wait if there is a train in the opposite direction due off the single line.

Assuming for the moment that a stop is made, then, after a suitable interval for the exchange of passengers and luggage, the train proceeds round the single line until the facing Double Symmetrical Points offer a choice of route. The left-hand track leads back to the starting point, and may be taken if a short-distance suburban train or rail motor service is being run. The alternative route to the right leads round to the up main line, where access to the down is possible by means of the Crossover Points. A train taking the latter route may thus make as many circuits as required, passing or stopping

at a station when necessary. Then when it is required to return to the terminus it does so easily and quickly by taking the left-hand route at the Double Symmetrical Points.

It may be, however, that a particular service is required to terminate at the passing station, and the return working of the stock in the proper manner is then necessary. This is easily provided for, although this part of the scheme did not appear in the original plan, but is included as a suggestion to add to the interest.



A typical passing station effectively situated. Special interest is given to the scene by the fact that no train is visible, but one is signalled and is evidently eagerly awaited by the figures on the platform.

The short spur extension of the up line beyond the Crossover Points at the station, terminated by Buffer Stops, will have been noticed. This can be made use of as a lie-by road for the engine that will work the train back to the terminus. This may be run there light at the commencement of the service, or where "turnover" working of locomotives is in force it will have proceeded there after the departure for the terminus of the train that it brought down. The down train arrives at the station, and after discharging its load is drawn forward until the last coach is clear of the Crossover Points. The locomotive is now uncoupled, and the second one waiting on the spur line runs forward into the station. When the points are set it reverses over the crossover and couples on to the train, and then draws it forward alongside the platform. After its departure the first engine may proceed to the spur line to await its next "turn," or if required elsewhere it may, as this is a miniature railway, take a short cut to the terminus via the triangular junction.

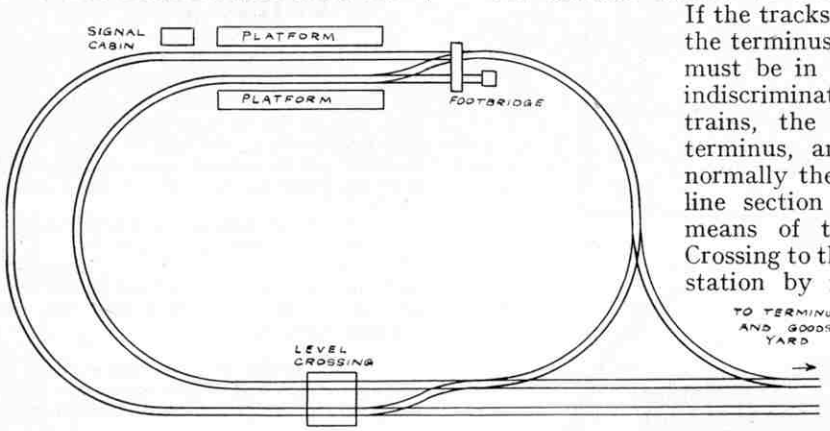


Diagram of the layout referred to in this article.

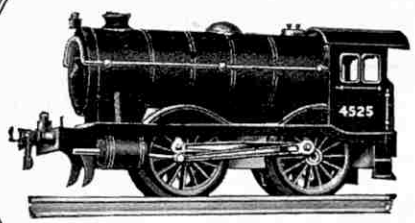
The course of the up train that we have just despatched is simple enough. It may make a number of circuits, stopping at the station if required, and perhaps having to wait now and again for its path over the single line section. Finally it runs into the terminus along the straight side of the triangle arrangement. On arrival there it may be shunted to the sidings if not required further.

It is possible, however, to have it ready for departure again with the same engine in a short space of time by running the engine round the train by means of a loop road. Such arrangements are not always possible in the restricted space common to miniature termini, and here again the triangular junction proves its usefulness. The complete train is backed out of the station and over the curved branch nearest to it. When the engine is clear of the Double Symmetrical Points, these are re-set for the other curved branch and the train is then run over this and over the Crossover Points on to the down main line. It can then be pushed back into the terminus, and is ready on the down line, with the engine at the head, for departure.

Where this is regularly carried out, quite an interesting service can be worked, and as the locomotives really work return trips from the passing station, up to the terminus and back, some provision might be made for their accommodation at the smaller station. The spur line could be extended round inside the main track and a No. 1 Engine Shed installed. This holds any of the smaller tank engines such as would be used for trains of the kind we have described, and two M3 or No. 1 Tanks or one of each kind might be stationed there.

Yet another scheme of working is easily possible. If the tracks in the neighbourhood of the terminus are used—as they often must be in miniature—more or less indiscriminately for up or down trains, the train might leave the terminus, and running on what is normally the up line, gain the single line section of the main track by means of the triangular junction. Crossing to the up track at the passing station by means of the Crossover Points, it may then take up a similar run to the train despatched to this station previously. On completing the required number of circuits its return to the starting point is an easy matter.

Interesting single-line working, too, may be carried out. A down train may leave the terminus and proceed normally to the passing station. Here it may wait until another train despatched from the terminus after it, and taking the triangular junction route, arrives in the opposite direction. Each train in turn may then make a number of circuits of the main track, while the other is detained by station duties. Then finally both may be despatched together, the first or down train taking the left-hand route at the Double Symmetrical Points and so reaching the terminus, while the other will run straight in a few seconds later, having traversed the main track and straight side of the triangular junction.



Hornby No. 1 Special Locomotive

BOYS! Here is a plan to secure a fine new Hornby Locomotive

You have probably been using a Hornby Locomotive for some years and would like to own one of the fine new models that now figure in the Hornby Catalogues. The object of the new Hornby Locomotive Part Exchange Scheme is to help you to do this.

First of all, carefully study the latest Hornby Train Catalogue, and select the new up-to-date Hornby Locomotive you want; then carefully pack up your old Hornby Locomotive and post it to us, enclosing your order for the new one and the necessary remittance. You can easily ascertain how much to send by deducting the part exchange allowance indicated in the accompanying list from the price of the new Locomotive, and adding 1/– for postage on the new model you purchase.

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

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

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

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

Part Exchange Allowances for Hornby Locomotives

CURRENT TYPES

MO Locomotive	1/4
M1/2 Locomotive	2/3
M3 Tank Locomotive	3/9
No. O Locomotive	5/3
No. 1 Tank Locomotive	6/3
No. 1 Locomotive	6/3
No. 1 Special Locomotive	8/3
No. 1 Special Tank Locomotive	8/3
No. 2 Special Locomotive	11/3
No. 2 Special Tank Locomotive	11/3
No. 1 Electric Tank Locomotive, Permanent Magnet	12/6
No. 2 Electric Tank Locomotive	18/9
No. 3E Locomotive	18/9
No. 3E Riviera "Blue" Locomotive	18/9
No. 3C Locomotive	13/9
No. 3C Riviera "Blue" Locomotive	13/9
Metropolitan C Locomotive	11/3
Metropolitan	20/–

OBSOLETE TYPES

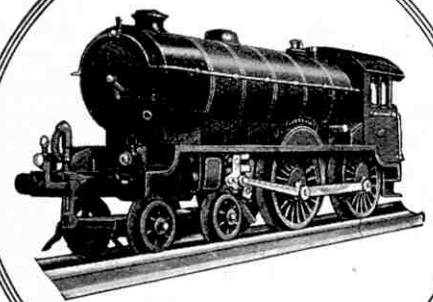
M2930 Locomotive	1/–
George V Locomotive (These models were identical)	3/3
No. OO Locomotive (These models were identical)	3/3
M3 Locomotive	4/3
Zulu Locomotive	5/3
Zulu Tank Locomotive	6/3
No. 2 Locomotive	10/–
No. 2 Tank Locomotive	11/3
No. 1 Locomotive, fitted for Hornby Control	7/6
No. 1 Tank Locomotive, fitted for Hornby Control	7/6
No. 2 Locomotive, fitted for Hornby Control	11/3
No. 2 Tank Locomotive, fitted for Hornby Control	12/6
Metropolitan	20/–

What you have to do

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

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

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



Hornby No. 2 Special Locomotive

HORNBY TRAINS

Manufactured by

MECCANO LTD., BINNS ROAD, LIVERPOOL, 13

Suggested Hornby Train Improvements

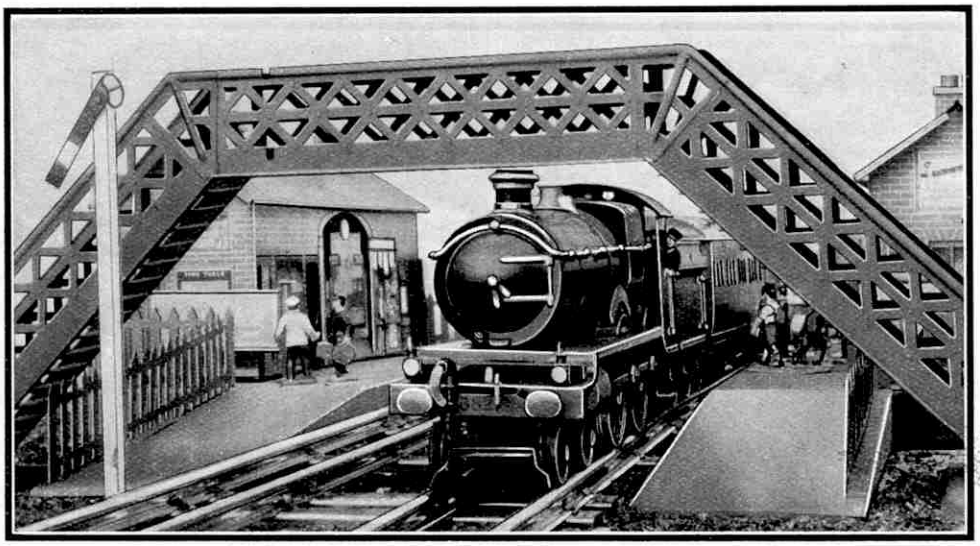
THE HORNBY GOODS PLATFORM

Of the various buildings and structures available in the Hornby Series for lineside use, the Goods Platform is particularly effective. It is an essential accessory on any miniature railway system where goods traffic receives special attention, but it should be provided for completeness of effect even where freight trains are run only occasionally. There are many smaller accessories that can be used in connection with it to stage realistic scenes that are such a delight to visitors inspecting the line. The luggage and milk cans of Sets Nos. 1 and 2 of Railway Accessories naturally suggest themselves, while various members of the railway staff of Modelled Miniatures Set No. 1 will add to the lifelike effect if they are disposed in natural attitudes, so that the bustle and apparent confusion common to goods premises may be reproduced.

The platform itself is 1 5/16" high, which brings the top to a convenient height when wagons are being dealt with. The length, 16¾", is such that three ordinary four-wheeled Hornby Wagons may be run alongside it, and the width of 6" allows plenty of space for handling the different consignments and, if the depot is placed at a transfer point, for storing and classifying loads according to their natures and destinations. The ends of the platform are not "ramped" as is the case with a passenger station, for, according to the particular situation, road vehicles may require to back up to the platform ends in addition to one or other of the sides. However, for easy access to the platform steps are formed at one end, and at the same end is mounted a light type of crane of the pattern familiar to most Hornby Railway enthusiasts. This can be revolved on its base by means of a crank handle and worm gear, while another crank handle with ratchet brake mechanism ensures effective control of the load when lifted. The hook and the usual ball weight complete the details, and the swivelling radius of the jib is such that loads may be dealt with from wagons on either side of the platform.

The shed building mounted on the platform i finished by the tinprinting process to represent brickwork, and the amount of detail shown makes the appearance very natural and realistic. A sliding door on each side is provided so that the warehouse portion is available for the actual storage of miniature merchandise if required, and for the handling of goods generally. The necessary office portion is indicated by the windows represented at one end, the goods agent thus having a view of all that is going on. The roof is of the sloped variety and is finished off with red ridge tiles, while the edges are turned down to imitate the usual fascia board and guttering. The roof, besides fulfilling its purpose on the building itself, is also made to form an awning over the platform at both sides of the shed. It is interesting that, as the shed building is situated at one end of the platform and the roof extends backward level with the platform end, two of these Goods Platforms may be placed together end to end with their bases and roofs abutting, so that they form a large depot. This arrangement is particularly suitable where the depot is of the "through" type, that is the lines do not terminate in buffer stops at either end, but are continuous so that the wagons may be received or despatched in either direction.

The Goods Platform is now available with electric lighting, a pair of twin plug fittings being provided to facilitate its connection to whatever power supply is used. If the yard also is provided with Electric Lamp Standards the effect will be very fine, and the night activities of important goods depots in actual practice may be faithfully reproduced. The station master of Modelled Miniatures Set No. 1 is a suitable figure to supervise operations generally, and the porters of the same set may be used with good effect as loaders. The engine driver may be employed as a crane man, and will complete the realism of the scene.



An interesting view of a passing station on a Hornby layout. The footbridge is used effectively at the near end of the platforms, and this arrangement is typical of many similar situations in actual practice.

MINIATURE TRAIN SET

An interesting addition made some time ago to the Hornby Series was Set No. 21 of Modelled Miniatures. This consists of a small train set made up of a tank locomotive and four goods vehicles of different types. The idea of its introduction was to provide the very junior Hornby Railway enthusiasts with a locomotive and train more suitable for management by them than the smallest existing trains running on rails and propelled by clockwork. Even a "push along" train has a tremendous fascination, and its activities are not limited by the extent of the system of rails. Unlike most train sets of small proportions, this Hornby Train is well designed and complete in detail, and the enamel finish is pleasing, the components of the set being die cast in hard metal.

First there is the Locomotive. This runs on six wheels, and in its general design is typical of the average tank locomotive built in actual practice for ordinary goods and shunting work. It has side tanks and looks very modern with the large boiler fitted. The smoke-box is of correct design and in the course of assembly the boiler is let into it so that the correct appearance of a raised smoke-box is the result. The construction is interesting in that the main frames, footplating and smoke-box form one complete unit, while the boiler, tanks, cab and bunker form another, the wheels of course being mounted in the main frames as in actual practice. The details are very complete, even to minute rivet heads on the smoke-box and main frames. Brake blocks and their hangers are represented also, and steps and guard irons add to the completeness of the underframe. The boiler has a squat dome and tiny safety valves of the Ross "pop" pattern, and even the boiler bands and handrails are not forgotten. The boiler, tanks, cab and bunker are painted a cheerful red, and the frames and smoke-box are picked out in a darker colour.

Each of the four wagons has a similar type of base or underframe; consisting practically of a flat truck mounted on four wheels. The Open Wagon is formed by the attachment of a miniature wagon body to this underframe. Typical features of up-to-date practice are incorporated in the details shown on this wagon body. The sides and ends are duly "planked" and the corners protected by raised corner plates complete with bolt heads. The side and end strapping—the latter of T-section—is also shown, and the hinge straps of the side doors; and even the pins and small chains for securing the latter may be seen. For detail within fine limits these wagons would be hard to beat.

The Crane Truck is simple, but none the less effective. The crane base, turntable and jib form a single casting secured to the standard underframe. The design on the whole follows that of the ordinary Gauge O Crane Truck of the Hornby Series. A miniature crank handle, hook and length of thread "cable" make it possible for the crane to work. The crane portion can be rotated on the base if required.

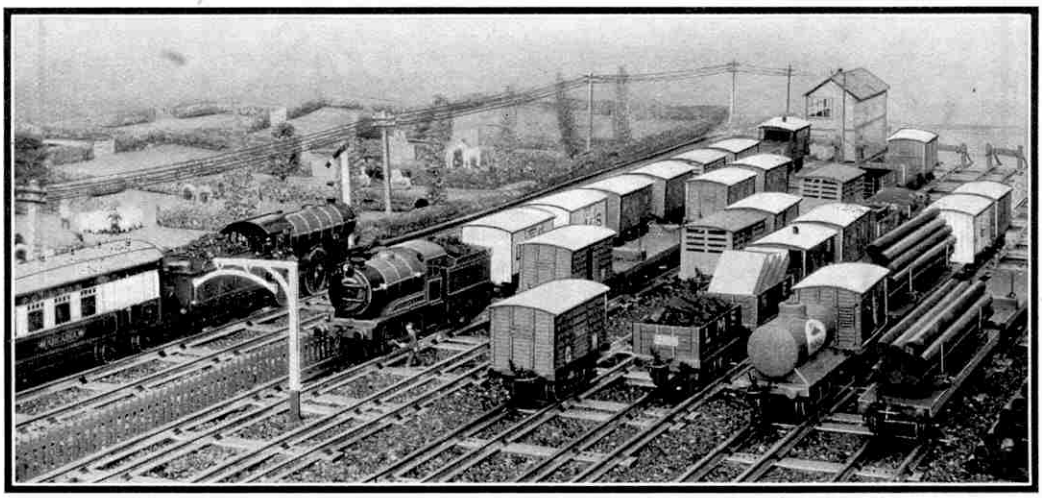
The "Shell" Petrol Wagon is a fine piece of work, the large capacity tank with its fittings forming a complete casting. The tank appears to rest on three supports, and raised straps secure it to the two outer ones. The special frames for retaining it in position lengthways are also provided, and the manhole and valve on the top of the tank and the raised rivets complete the details. The word "Shell" is in raised letters on the tank sides and shows up well.

The Lumber Wagon is made up of the standard underframe to which a pair of bolsters complete with stanchions have been added, so that it is of a simple nature. The load provided is a very realistic piece of modelling, however, and has the appearance of a length of tree trunk mounted on the bolsters. A representation of crossed chains securing it appears on the trunk. It is finished in a natural brown colour, while the red bolsters and stanchions of the wagon have a smart appearance.

Hook and loop couplings enable the complete train to be assembled, and as these are of strong wire let into the various bases during the process of casting they are not likely to come loose easily or break off, which is a common fault with miniature rolling stock of this kind. The engine has no coupling at the front end, but there is a small hole behind the buffer beam intended to take a string if necessary. This may be made use of when it is required to run the engine backward with its load. The hooks on the wagons will drop into the hole easily and the train thus may be worked in either direction.

LI.—MISCELLANEOUS L.N.E.R. FEATURES

READERS who favour the London and North Eastern Railway group will no doubt agree that, in view of the amount of territory covered by this system, its title is particularly modest. We should naturally expect its lines to reach Edinburgh and Aberdeen, and to serve practically the whole of the East Coast; but we find that it has also strong interests in the Midlands generally, and that its locomotives and stock may be seen even at Wrexham, Chester and Southport, as a result of the former G.C.R. activities in these districts. Again, the "Waverley" route brings it to Carlisle from Edinburgh, in addition to the old N.E.R. line from Newcastle; and it stretches across from Edinburgh to Glasgow and then penetrates to the West Highland districts of Fort William and Mallaig. It is thus a very extensive system, with a corresponding variety in its train services and in the features of operations and practices that are so interesting to those who desire to reproduce these things in miniature.



A view of part of a Hornby L.N.E.R. system. The marshalling yard in the foreground appears extremely busy while further realism is given to the scene by the passing Pullman Express and the Countryside Sections at the lineside.

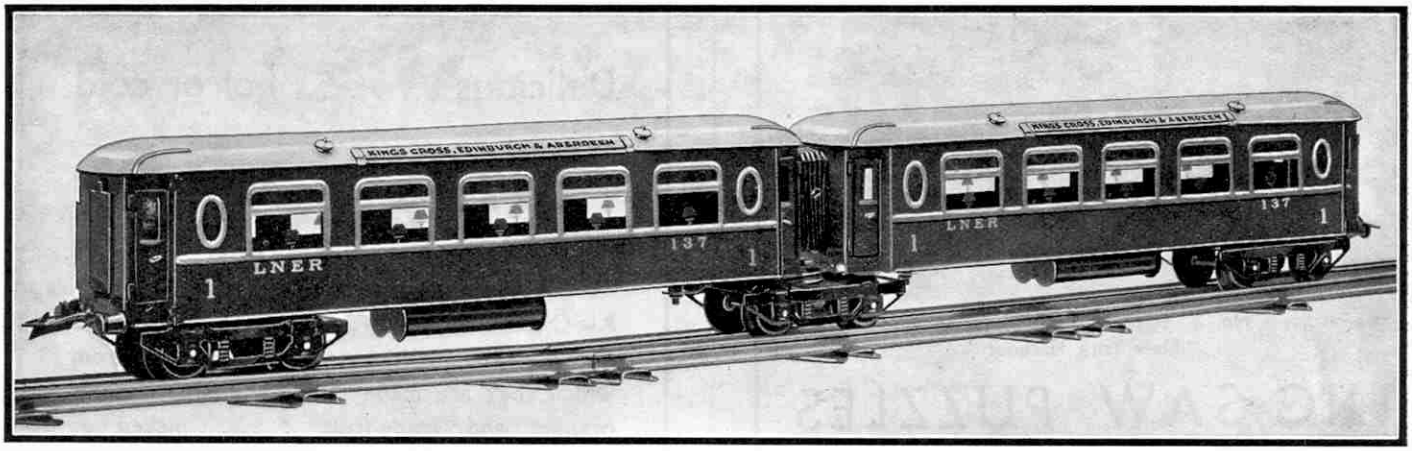
We have already mentioned from time to time different sections of the L.N.E.R., in addition to quoting items of interest common perhaps throughout the group. In October last year the G.E.R. section came in for its share of attention in the article entitled "*East Anglian Train Services*," and the N.B.R. lines were dealt with from various points of view in the articles dealing with Scottish practice in July of last year and January of this year.

The L.N.E.R. can claim to run what is probably the most famous train in the world, "*The Flying Scotsman*," and the miniature train and the locomotive of the same name are important members of the Hornby Series. For those who are keen on true-to-type details a very good representation of this train can be made up with useful No. 2 Saloon Coaches, duly provided with Train Name Boards bearing the famous title, and attached to the roofs by the special No. 2 Clips made for the purpose. The articulation of these vehicles is an interesting step and was described in the "*M.M.*" for last April, while kitchen compartments of dining car units may be distinguished by the familiar scheme of placing tracing paper between the celluloid "window" and the coach side. This gives quite good results.

Suitable composite coaches for the ends of the train will be found in the Metropolitan Coaches of this kind, which are finished in a similar manner to L.N.E.R. stock, with roofs of the same pattern as those of the No. 2 Saloons. These roofs have domed ends, a characteristic feature of many L.N.E.R. passenger vehicles; and they are suitable for the attachment of the No. 2 Clips for Train Name Boards. Additional luggage accommodation may be provided by attaching one or more of the No. 1 Guard's Vans, according to the requirements of traffic. The bogie No. 2 Luggage Van might be used if preferred, but the Guard's Van is finished in the passenger coach brown colour, and therefore matches the rest of the stock making up the train.

For representing the running of this express during the summer non-stop period, a continuous layout, electrically operated, is really essential; but except as an endurance test for the locomotive, such running has not much point in miniature. The ordinary winter schedule of the train with its various important stops and connections is therefore more interesting and more suitable for reproduction on a model L.N.E.R. system, particularly where clockwork is the motive power.

Again there are the various Pullman Trains, the "*Queen of Scots*" and the "*West Riding Pullman*," that

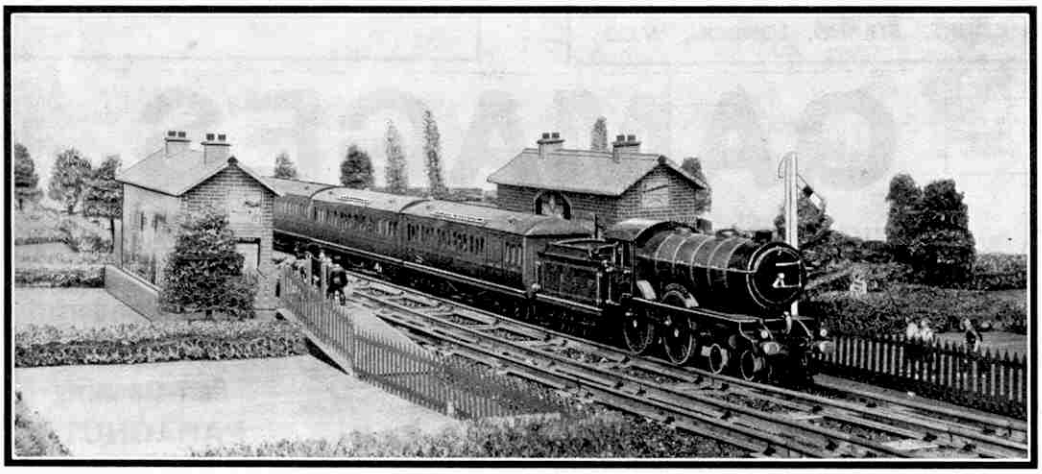


have gained such a splendid reputation for smart running and punctual working. Their luxurious character and fine appearance in the Pullman brown and cream colours, and with a smart light green L.N.E.R. engine at the head, makes them particularly attractive, and a Hornby express of No. 2 Special Pullmans headed by a "*Flying Scotsman*" or a "*Yorkshire*" is one of the finest miniature trains that it is possible to see. In view of the interest now taken in the illumination of accessories it may be well to mention that a scheme for providing electric light in the No. 2 Special Pullmans and similar coaches was described at length on the "In Reply" page of the "*M.M.*" for February last year.

Turning now to the G.C.R. section, a notable point is that its trains do not make remarkably long runs between stops, but their times are for the most part very tight, hard running being demanded of the engines in order to keep time over the awkward gradients. This sort of work is ideal for reproduction by means of clockwork engines, for these accelerate rapidly to a relatively high speed and make equally smart stops. As their loads are necessarily limited, the make-up of G.C.R. section expresses may be followed very closely for these are comparatively light. As regards locomotive stock, there is the fact that the standard group types of engines have not by any means ousted the "natives;" but for the hardest turns it will not be unreasonable in miniature to use a Hornby "*Yorkshire*," or if the name and number be neglected, a "*Flying Scotsman*" may be employed to represent more particularly the famous four-cylinder "*Lord Faringdon*" and similar engines.

A point of particular interest in connection with the G.C.R. section is its association with the Metropolitan Railway. This has been mentioned previously in articles dealing with that line, and interesting joint working may be practised in miniature as a result. For the sake of economy one set of Metropolitan Coaches might be made to serve for both systems. The famous "3.20 Down Manchester" and other notable trains take the Metropolitan route, as it shortens the journey slightly as compared with the G.W. and L.N.E.R. joint line via High Wycombe, though the latter route is more easily graded.

The L.N.E.R. serves wide industrial districts and therefore has greatly varied freight traffic. Practically any wagon in the Hornby Series may therefore appear on a miniature L.N.E.R. layout. The system is a notable coal carrier from the South Yorkshire and Nottingham coalfields to London. Bricks from the Fletton brickfields near Peterborough also swell the volume of traffic, so that plenty of open wagons should be provided by those whose interest is particularly centred on the G.N.R. section.



The upper photograph shows a pair of Hornby L.N.E.R. saloon coaches arranged as an articulated unit as described in the April 1932 "M.M." In the lower photograph an express train hauled by a Hornby "Yorkshire" locomotive is speeding through a country station situated among realistic surroundings.

Fish traffic plays a very important part in L.N.E.R. activities as will be remembered by those who read the article on Scottish Railway matters in the "*M.M.*" for January last. The herring fishing season occurs at different times along different parts of the coast. Starting in the spring on the West it provides traffic for the West Highland line. Subsequently Aberdeen and other Eastern Scottish fishing ports begin to be busy and in the autumn the East Anglian ports are at the height of their activity. Plenty of use therefore will be found for the Hornby Fish Vans that are such satisfactory reproductions of the actual vehicle. Numbers of these vans forming complete trains may be run or an odd van or two may be added to the make-up of passenger trains as required.

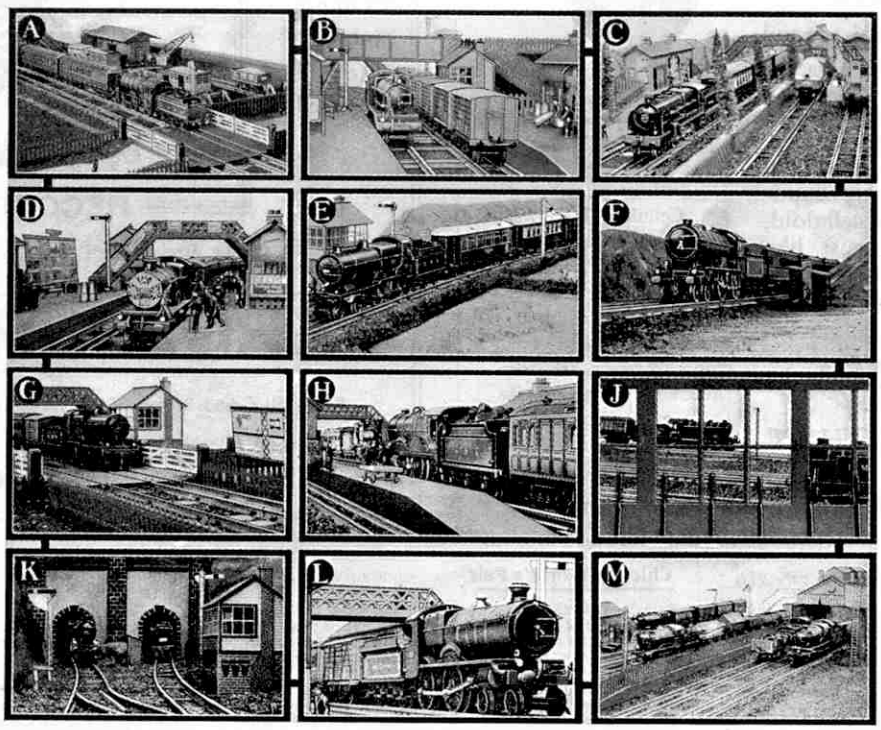
(*Continued on page 196*)

H.R.C. COMPETITION PAGE

Competitions appearing on this page are open only to members of the Hornby Railway Company. Envelopes containing entries should have the title of the competition clearly written in the top left-hand corner and should be addressed to the Hornby Railway Company, Binns Road, Liverpool, 13. The name, address and membership number of each competitor should appear in clear writing on every sheet of paper used.

MODEL RAILWAY PHOTOGRAPH VOTING CONTEST

During the past five years there have appeared in the H.R.C. pages of the "*M.M.*" large numbers of photographs illustrating various points of model railway practice and showing how the greatest possible interest and enjoyment can be obtained from a Hornby railway. These photographs have attracted widespread attention on account of their remarkable realism, not only in the actual railway arrangements depicted, but also in the various scenic effects that are obtained. The recent introduction of the Hornby Countryside Sections has greatly increased the possibilities in scenic realism, and consequently the photographs have reached a further stage of interest.



Our correspondence shows that these illustrations have been of the greatest value to model railway owners all over the world and have resulted in large numbers of model railways being entirely reconstructed on railway-like principles. The subjects dealt with in the photographs are very varied, and we should like to know which are the most popular. In order to ascertain this we reproduce this month twelve recent and typical examples of Hornby Railway photographs, and we invite readers to place these in order of merit according to their own personal views.

Competitors are required to do two things. First, they must decide upon the order in which they think the photographs should be placed, and make a list of the letters representing them accordingly. Second, they must state their reason for selecting the particular photograph that they have placed first in the list. There is no need for this to be stated at great length; all that is necessary is to make it quite clear why the photograph in question was chosen as being the most interesting of the series.

Prizes of Hornby Railway material (or Meccano products if preferred) to the value of 21/–, 15/–, 10/6 and 5/– respectively will be awarded to the four competitors in each section whose lists most accurately forecast the total vote of all the competitors. In the event of a tie for any of the prizes preference will be given to the neatest or most novel entry. In addition there will be a number of consolation prizes.

Envelopes containing entries must be clearly marked "*H.R.C. Photo Voting Contest*" in the top left-hand corner, and posted to reach Headquarters at Meccano Ltd., Binns Road, Liverpool, 13, on or before 31st March. The closing date for the Overseas Section is 31st May.

Breakdown Train Drawing Contest

At all important locomotive depots there is always in readiness a special train for use in case of a derailment or other mishap on the line. This train usually consists of engine and tender followed by the travelling crane, the match truck for supporting the crane jib, the chain van containing chains and wire ropes, the riding van in which the men travel, and the tool van containing the various appliances required. Breakdown trains were described and illustrated in the November 1931 "*M.M.*" and in the 1927–8 "*Hornby Book of Trains.*"

For our competition this month we ask Hornby Railway Company members to draw, and colour if they wish, a "*Railway Breakdown Train.*" The scene may be outside the engine shed or at the place of the accident.

To the senders of the four best entries received in each section—Home and Overseas—will be awarded Hornby Train goods or Meccano products to the value of 21/–, 15/–, 10/6 and 5/– respectively. In addition to these there will be a number of consolation prizes awarded to the competitors whose entries do not quite reach prizewinning standard but are deserving of some award.

Envelopes containing entries should be clearly marked "*H.R.C. Railway Breakdown Train Drawing Contest,*" and posted to reach Headquarters at Meccano Ltd., Binns Road, Liverpool, 13, on or before 31st March. The closing date for the Overseas Section is 31st May. The competitor's name, full address and H.R.C. membership number must be written on the back of his entry.

COMPETITION RESULTS

HOME

December "Christmas Puzzle Contest."—First: G. H. Wood (21541), Halifax. Second: D. A. Smith (7576), West Bromwich. Third: S. Howarth (21914), Delph, Nr. Oldham. Fourth: J. Bryce (9070), Paisley, Renfrewshire.

December "Futuristic Locomotive Drawing Contest."—First: T. R. Simm (18511), Charlton, London, S.E.7. Second: G. T. Porter (10259), New Barnet, Herts. Third: H. J. Murgatroyd (29846), Portsmouth. Fourth: R. A. Shone (26361), Ashton-in-Makerfield.

OVERSEAS

September "Jumbled Accessories Contest."—First: R. J. Ranikhetvala (30850), Bombay, India. Second: R. Robbins (29906), Victoria, B.C., Canada. Third: E. C. Heath (29104), W. Pennant Hills, N.S.W., Australia. Fourth: J. W. Boyes (9959), Wellington, New Zealand. Consolation Prizes: E. F. Penn (15668), Kogarah, N.S.W., Australia; C. H. Brown (21204), Victoria, Australia; R. Tennant (16549), Launceston, Tasmania; E. A. Gay (9963), Christchurch, New Zealand; J. W. W. Wilkinson (30834), Ontario, Canada; D. Unwin (23726), Johannesburg, South Africa; A. F. Inglis (7056), Johannesburg, South Africa; J. E. Brown (27407), Toronto, Canada; N. Finch (30544), Gawler South, Australia.

Hornby Speed Boats

—(*Continued from page 211*)

it from different points, and trying different settings of the rudder and noting the effect on the boat's performance of any breeze that may be blowing. It is particularly interesting to try to find the exact rudder position that will take the boat across the lake to some specified point. If there is a fair amount of breeze, and tiny wavelets are careering over the surface, it requires a considerable amount of experiment to make the boat reach its destination. Steering competitions are particularly good fun, and result in gaining much useful knowledge in regard to the special characteristics of one's boat.

Racing forms an interesting and exciting alternative to steering contests. The arrangement of the races will naturally depend on the conditions prevailing and on the boats available. Sometimes the boats taking part may be fairly equal in speed, but in other cases some system of handicapping must be resorted to in order to equalise matters and provide close finishes.

The Hornby Speed Boats need very little attention, but it is absolutely necessary that a new boat should be thoroughly oiled before it is sent off on its first run. Afterwards a small quantity of good oil should be applied occasionally. The Meccano Lubricating Oil is the best for the purpose, but if it is not available, sewing machine or typewriter oil is suitable. A small amount of graphite grease, which is supplied by Meccano Ltd. in tubes, should be brushed occasionally over the coils of the spring when this is unwound, in order to prevent rusting.

"Skybird" Competition Result

We are informed by A. J. Holladay & Co. Ltd. that the following competitors have been awarded "Efficiency" Cups for their entries to the "Skybird" Competition announced in our November, 1932, issue.

J. D. Breen (Cathcart, Glasgow); K. Brown (Newcastle); G. P. Barlass (St. Annes); P. J. Canavan (Gloucester); H. N. Deckman (Leigh-on-Sea); J. Ellis (Tunbridge Wells); R. H. Gehleken (Palmers Green); A. S. Hill (Baildon); J. B. Lacey (Englefield Green); I. C. Lucas (Hove); T. B. Moodie (Edinburgh); J. H. Markley (Tunbridge Wells); K. W. Osborne (Tilehurst); R. D. Osborne (Bedminster); K. Pearce (Cholsey); W. Puddick (Beckenham); J. Scrope (Hove); R. Salter (West Dulwich); R. C. Taylor (Weston-super-Mare); F. T. Wheeldon (Weston-super-Mare); D. Wallace (Southend-on-Sea).

At the time of going to press the final awards for the "All in" Junior and Senior Cups were not available. These awards are to be made by Sir Alan Cobham.

Chicago World's Fair

—(*Continued from page 173*)

from a 4-ft. stone pedestal, and will have a double-decked roof of copper shingles covered with a pure gold roof. On the outside of the Pavilion 28 wood columns in red lacquer 16 ft. high will support the lower deck, and 28 other columns 30 ft. high will form part of the wall. Inside twelve 37-ft. columns will support the gilded ceiling and upper deck, and elaborately carved grilles lacquered in red, blue, yellow and gold will enclose the glass window-panes.

Another replica of outstanding interest is that of Fort Dearborn, one of Chicago's most thrilling historical monuments. Near here a century ago stood the original Fort Dearborn, the brave inhabitants of which were massacred by Indians in 1812.

Mention must be made also of the General Motors Building, which will be approximately 420 ft. in length and depth, and shaped roughly like a huge butterfly with its head pointing to the East. The central unit will consist of a complete assembly plant, where visitors will be able to see motor cars assembled.

The Fair will be most impressive at night under the influence of floodlighting in every conceivable colour. Huge waterfalls of light will tumble down the walls of certain buildings, and on other buildings will be projected coloured patterns representing the reflection of the Sun on water. Even the sky will be made to lend itself to decoration, for the engineers have planned to create artificial clouds on which to project patterns. Masses of flowers will change colour, and geysers will spring up in the lagoons and be illuminated with light of every hue. Many objects will be treated with fluorescent materials that will be made to glow under the influence of invisible rays.

The Guildhall School of Music

Mr. A. Saxe Wyndham, Secretary of the Guildhall School of Music, London, has drawn our attention to the omission, in our article on "*Music as a Career*" that appeared in the issue of the "*M.M.*" for January last, of any reference to the diplomas granted by that school. These diplomas are recognised by the Royal Society of Teachers as being on a par with those of the Royal Academy of Music and the Royal College of Music, and the diplomas of the three institutions are the only ones recognised in this manner.

We take the opportunity of adding that the Guildhall School of Music also holds examinations for students who live in the provinces and are unable to take regular courses at the recognised schools of music in London. Subject to certain conditions those students may be accepted as candidates for the Licentiateship, a distinction that ranks with the Associateship granted to those who study at the Guildhall School of Music itself.

A New Cycle Horn

In these days of congested road traffic a really audible warning is essential to the safety of the cyclist. A new type of cycle horn with a clear, powerful note that can be heard easily above the noise of busy traffic has been introduced by Bluemel Brothers Ltd. It is called the No. 1 "Noweight," and is an attractive looking instrument. The body is moulded in polished celluloid, which has the advantage that it is extremely light and cannot rust, chip or dent like metal. A good quality rubber bulb is fitted, and a clip for standard ⅞ in. diameter handlebars. The price of the horn is 3/6. Bluemel Brothers Ltd., of Wolston, Nr. Coventry, will send an illustrated descriptive leaflet, free to any reader who applies mentioning the "*M.M.*"

For Staines Readers

Entries in the Annual Model-building Competition organised by the London Motor, Cycle and Sports Co. (H. W. Ginn), 106, High St., Staines, were exhibited on 2nd February and judged by Mr. W. J. Palmer and Mr. S. C. Shattock of the Kingston Road Boys' School. The prize-winners were as follows:

Section 1 (age 12-14): 1. P. Smith, Green Line Motor-coach Chassis; 2. G. Greenslade, "Q" Ship; 3. John Caton, Warehouse and Lift. Consolation prizes (given by the judges): M. V. Higgs, Tower Bridge; J. Rutherglen, Foden Steam Wagon. Section 2 (age 7–11): 1. J. Biddle, Windmill; 2. W. Lawrence, Breakdown Lorry; 3. B. Davies, Monoplane. Consolation prizes (given by the judges): W. Parfitt, Windmill; M. Pickering.

Warne's Jig-Saw Puzzles

There is something specially fascinating about jig-saw puzzles, for whenever the task of fitting one together is in hand, everyone is anxious to help! The well-known jig-saw puzzles issued by Frederick Warne & Co. Ltd., are made of wood of good quality, and the cuts are sufficiently irregular to make the puzzles a real problem. Our experience bears out the statement of the firm that their 150-piece puzzles take from 2½ to 3 hours to solve, while a 400-piece puzzle may defy the combined efforts of a whole family for hours! Readers will be specially interested in the railway series of puzzles, which depict famous locomotives of all the four British groups. An illustrated catalogue of these puzzles will be sent post free to any reader who writes, mentioning the "*M.M.*" to Frederick Warne & Co. Ltd., Chandos House, Bedford Court, Bedford Street, Strand, London, W.C.2.

HOT AND COLD

Impartial Spectator (discussing referee who has made several unpopular decisions): "I shall be mightily surprised if that referee doesn't get into hot water after the match."

Local Supporter: "Then you will be surprised. E's goin' in the 'orse trough."

* * * *

Father (sternly): "Worse and worse! Now you are last in the class instead of last but one."

Son (sadly): "But, dad, I can't help it if the bottom boy is ill."

* * * *

Wife: "I have bought a couple of tickets for a whist drive, dear. I thought you'd like a change."

Husband: "Yes, but neither of us can play whist."

Wife: "Never mind, dear, the drive will do us good."

* * * *

"Just what good have you done to humanity?" asked the judge before passing sentence on the pick-pocket.

"Well," replied the confirmed criminal. "I've kept three or four detectives in regular employment."

* * * *

Two shopkeepers were discussing business.

"Do you know," said Smith "I've a machine in my shop that would make me a millionaire if only I could keep it working all day."

"What sort of machine is that?" demanded the other.

"A cash register," replied Smith.

* * * *

"Can anyone tell me when Rome was built?"

"Yes, sir, at night."

"Who told you that?"

"You did. You've often said Rome wasn't built in a day."

* * * *

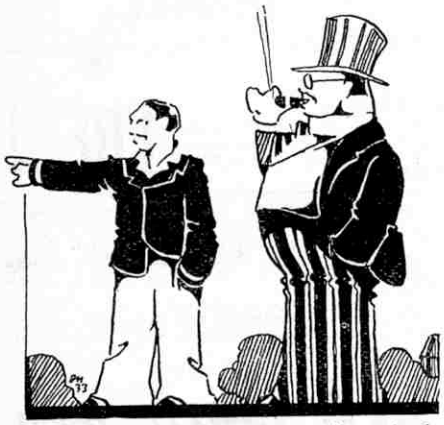
Shopkeeper: "Don't buy anything from the shop next door to-day."

Wife: "Why not, dear?"

"They've borrowed our scales."

* * * *

OH YEAH!



Johnny: "That's Jones minor; he took six wickets for three in the last match."

Hiram D. Gink (just over from U.S.A.): "Yeah! Waal, I guess I kent see the sense in playing a short-sighted guy like that."

* * *

"Nature," explained the lecturer, "always tries to make compensation. For instance, if a man loses an eye, the sight of the other becomes stronger; and if one goes deaf in one ear the hearing of the other becomes acute, and so on."

"Faith," said Pat to his neighbour, "an' I believe he's roight, for Oi've noticed that when a man has a leg shorter than the other the other is always longer."

* * * *

Mr. Needy: "What! Another bill? Just as we have decided to put something away for a rainy day."

Wife: "Well, that's all right. This is the account for my raincoat."

OUT OF ITS MISERY!

The prisoner had been arrested for shooting a saxophone player.

"I thought it was a cat, sir," he said to the magistrate.

"But you mustn't even shoot a cat," said the magistrate.

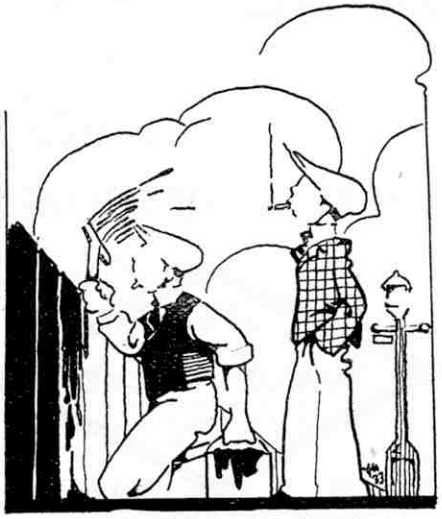
"I thought this one was very ill," pleaded the man.

* * * *

Little Girl (whose tooth has just dropped out): "Mummy, mummy, quick! I'm coming to pieces!"

* * * *

A (B)RUSH JOB



"Why are you painting the fence in such a hurry, Mr. Kelly?"

"I want to finish it before the paint runs out."

* * * *

The band in a little town had just finished a vigorous rendering of a selection. As they sat perspiring, the trombonist asked: "What's the next piece?"

"'The Last Rose of Summer,'" answered the leader.

"Wot!" ejaculated the trombonist. "That's wot I've just played."

* * * *

"My wife can hammer nails like lightning," said Mr. Green.

"That's a very remarkable accomplishment for a woman," remarked Mr. Brown.

"Not at all," added Mr. Green. "You know, lightning never strikes the same place twice."

* * * *

Lost Chinaman: "You tellee me where railway-station?"

Stranger: "What's the matter, John—lost?"

Chinaman: "No, me here—station lost!"

* * * *

"Do you like going to school, Jimmy?" asked his uncle.

"Oh, yes, uncle," was the reply. "I like going well enough, and I like coming back, too. What I hate is staying cooped up there between times."

* * * *

The football match was over and one of the policemen on duty in the ground observed a man clambering over the wall instead of going out with the crowd through the gate in the usual way.

"Hi, there!" he shouted. "Why can't you go out the same way as you came in?"

"That's what I am doing," replied the man, as he disappeared.

* * * *

"Forty at least," said the policeman as he stopped a car for speeding.

"Quite wrong, constable," said the young lady driver, very indignantly "I was twenty-two yesterday."

A BURNT OFFERING

The new maid was not at all sure of her duties, but she was anxious to learn.

"When I announce the evening meal, do I say 'Dinner is ready' or 'Dinner is served'?" she asked her mistress.

"If it is like yesterday's," was the reply, "just say 'Dinner is burned.'"

* * * *

When the plumbers had completed their job the business man and his wife watched them gathering up their tools in the dining room. Everything was collected and the apprentice even looked round the corners of the room to see if anything had been left. Finally the plumbing experts departed in triumph.

"You see, my dear," said the business man, "all those stories about absent-minded plumbers being unable to remember their tools are arrant nonsense."

An hour later he went into the bathroom to wash his hands, and fell over an eight-foot ladder the plumbers had left behind.

* * * *

Old Sea Dog! "Once when I was shipwrecked I lived for a week on a tin of salmon."

Bored Listener: "By jove! Not much room to move about, what!"

* * * *

"In time of trial what brings the greatest comfort?" shouted the preacher.

"An acquittal," answered a voice from the congregation.

* * * *

An employer was interviewing a prospective office boy.

"Did you do well at school?" he asked.

"Yes, sir," replied the boy, "I was the best boy in my class at thinking of excuses for not being able to answer the master's questions."

* * * *

Motorist (stopped at bridge by country boy): "What's the matter? Something wrong with the bridge?"

Boy: "No, but don't go over and shake it. Me brudder's got a nibble."

* * * *

Fortune Teller (reading hand): "I warn you that a dark man will cross your path."

Motorist: "Hadn't you better warn the dark man?"

* * * *

"Hi! What are you doing up in the apple tree?"

"There's a warning to keep off the grass, so I climbed up here."

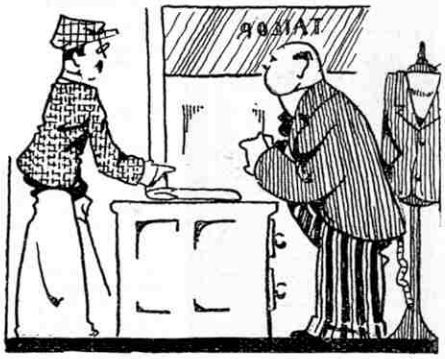
* * * *

"Come and look in this mirror, Jim, and you'll see a donkey."

"Really? And how did you discover that?"

* * * *

A FIVE YEAR PLAN!



"Is it true that my son has owed you for a suit for five years?"

"Yessir, have you come to pay the bill?"

"No, I would like a suit on the same terms."

* * * *

She: "Isn't that a sweet suite, sweet?"

He: "Yes, but it's precious dear, dear."

The Christmas Charity Issues

In our last issue we reproduced a specimen of Belgium's Christmas Charity stamp issue, and now the usual batch from the other Charity Stamp countries is available.

If only because it pays a tribute to a British-born organisation, we select the Dutch East Indies issue for first mention. The issue contained four stamps, 2c., 5c., 12½c. and 15c., sold at premiums ranging from 1c. to 5c. The funds raised from the premiums were devoted to the work of the Salvation Army, the only outside religious organisation permitted to work in the Colony. The Salvationist crest and motto (in Dutch) appear on each stamp. The designs generally deal with scenes of native industry, cloth weaving, embroidering and brass working.

Holland can always be relied upon to provide an interesting Christmas set for Child Welfare charities. This year the usual four stamps, 1½c.+1½c., 5c.+3c., 6c.+4c., and 12½c.+3½c., have designs embodying child portraits against backgrounds of flowers, each stamp symbolising one of the four seasons. The designs show gorse for Spring, cornflowers for Summer, sunflowers for Autumn, and the Christmas rose for Winter.

The Swiss *Pro Juventute* series strikes a new note by providing sporting designs on three of the four stamps. The flag game is shown on the 5c., putting the weight on the 10c., and wrestling, the favourite pastime of the Cantons, on the 20c. The 30c. stamp has a portrait design and thus follows recent practice. The portrait this year is of Eugen Huben, the eminent Swiss jurist who died in 1923.

The flag game is probably new to most of our readers; the nearest thing to it that we know in this country is the Army drum major's display of staff manipulation. The game is played with a large flag mounted on a short staff, and the player unfurls the flag and indulges in a series of dexterous movements that keep the flag swirling around his head and body. Occasionally the staff is thrown in the air and caught as it descends, all the movements being carried out to the accompaniment of music. The art of the game is the performance of amazingly intricate flourishes without allowing the flag to become entangled.

Year by year the Luxemburg " charities " have used a royal portrait for their design. The last member of the family was shown last year and for this season's inspiration resort has been had to mythology. The design chosen shows a picture of the fabled Contesse Ermesinde, daughter of a water sprite. The set contains five stamps ranging in value from 10c.+5c. to 1.75c.+1.50c., and is certain to be very popular.

Germany continues her " Nothilfe " series of views of historic castles with five beautifully engraved stamps ranging in value from 4Rpf.+2Rpf. to 40Rpf.+40Rpf. This year's castles are those at Marburg (40+40Rpf.), Nürnberg (12+3Rpf.), Lichtenstein (25+10Rpf.), Wartburg (4Rpf.+2Rpf.) and Stolzenfels (6+4Rpf.). The series will remain on sale until 30th June.

Not the least important of the season's issues was New Zealand's effort for the benefit of the funds of local Health Associations. The design shows Hygeia, the goddess of health, reclining on an altar. The stamp was sold at a premium of 1d., and the funds raised by the premium are to be devoted largely to health charities operating in the district of sale.

Equipping the Stamp Collector—(II)

In our last article we concluded by leaving the collector at the point where he had come to realise that the real enjoyment of stamp collecting lies in the study of stamps, and not in their acquisition alone. We mentioned that watermarks, perforations and other features of stamps play a great part in determining their value.

A slight error in the perforation of a stamp may add enormously to its value, as for example in the case of one of the first issues of King George V half-penny stamps. This series was perforated 15 × 14, and the catalogue value of a normal used stamp is 6d.; a small batch of this issue was perforated 14 all round, and specimens of this lot are priced in the catalogues at £20 each!

Perforations are measured according to the number of holes in a space of two centimetres. For example, the current stamps of Great Britain are perforated 15 × 14, that is to say, they are perforated along the tops and bottoms at the rate of 15 holes to two centimetres, and along the sides at 14. When the perforation of a stamp differs at the top from the sides, the top measurement is given first. When only one measurement is given, the perforation is the same all round the stamp.

At some later date we will discuss in detail perforations and other methods of separating stamps, but for the moment it is enough to emphasise that every collector must secure a perforation gauge to enable him to read the perforation of his stamps. The gauge consists of a series of rows of black dots representing spaces between perforation teeth. To measure its perforations, the stamp should be placed on the gauge and moved from one row of dots to another until the dots coincide with the spaces between the perforation teeth. The reading at the side of the row gives the required information.

Most boys know that watermarks in paper are to serve as a guard against forgery, and therefore we need not discuss them at length. Usually the watermark can be seen clearly if the stamp is held up to the light, but if it cannot be viewed thus it will usually show up when the stamp is placed face downward on a black polished surface. As a last resort a drop of benzine poured on the back of the stamp will cause the mark to show up and will not damage the stamp. Little black trays for use as *watermark detectors* can be purchased from any stamp dealer.

A magnifying glass is another valuable accessory. The presence or absence of a minute feature of a stamp—a slight break in some line of the design, for example—may have an important effect upon its value. Such points can rarely be studied with the naked eye, and the glass will be found invaluable.

Another helpful accessory is the colour guide. Slight differences in colour in printing have created rarities, and as few people are able to distinguish more than the primary shades, some reliable standard to help in identifying important shades will be found very useful indeed. Stanley Gibbons Ltd., publish such a chart at 2/6.

Finally, we urge every stamp collector to possess himself of a pair of tweezers for use when handling his stamps. This is almost the last piece of equipment that the young collector considers necessary, and yet, in our view, it ranks next to the stamp album itself. Stamps can so very easily be dirtied, and their value is so quickly depreciated by dirtiness that the use of tweezers is really of first importance as a guard against fingermarks that soon deprive a stamp of its " mint " condition.

THIS SPLENDID CASKET FREE to all STAMP COLLECTORS

BOYS! SEND FOR YOURS NOW!

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1	**China**, 1929. Large 15c. Air Mail pictorial	**3d.**
*1	**Iceland Triangular**, 1930. Air Mail ...	**3d.**
*16	**Armenia**, 1921. Large pictorials. Rare ...	**7d.**
5	**Liberia Triangular**, 1921. Snake type ...	**1/6**
5	**India**, 1931. New Delhi commemorative ...	**9d.**
*9	**Transvaal**, 1896. ½d. to 2/6 (Cat. 7/4) ...	**1/6**
4	**Belgian Congo**, 1920. Large Air Mail ...	**1/6**
*1	**Sudan**, 1932. 3 mils. Air. Monoplane pict.	**3d.**
1	**Latvia Triangular**, 1921. Air Mail. (Cat. 1/6)	**4d.**
*1	**Liberia Triangular**, 1919. 10c. (Cat. 1/6)	**3d.**
2	**Mexico**, 1929. Air Mails. Monoplane pictorials	**5d.**
2	**Syria**, 1931. Large Air Mail pictorials ...	**3d.**
3	**Latvia Triangular**, 1928. Rare Air Mails ...	**9d.**
*1	**Iceland**, 1928, 10 aur Air Mail. Monoplane type	**3d.**
25	**Holland ... 3d.** **100 British Colonials** ...	**9d.**
25	**Air Mails... 6d.** **500 Different Stamps** ...	**1/6**
200	**Hungary ... 1/7** **50 Russia** (Cat. 10/–)	**10d.**

* Unused. Postage 1½d. extra. All different.

W. BENNETT, 53, Marlborough Road, London, E.8.

WINDS ARE WILD

so are waves and woods. And so will you be, if, as a keen collector, you have missed seeing my four-a-penny selections.

L. D. MAYNARD,
78, RICHMOND ST., SOUTHEND-ON-SEA.

6D. THE "CENTURY" PACKET 6D.

Post. 1½d. **The Packet of the Century** Post. 1½d.

Contains **100 Different Stamps**, including 30 British Colonials, catalogued at over **13/–, astounding value** (no German). No two packets alike. **1,000 Mounts Free** to applicants for our **famous Approvals** from ½d. Write to-day, to-morrow never comes.

PUCKA STAMP CO., 27, NORMANDY AV., BARNET.

1000 DIFFERENT STAMPS 1000

ON APPROVAL

from which you may select any 100 for **3/–**. This selection is **not** made up of the thousand commonest stamps, but contains specimens priced by Stanley Gibbons up to 1/– each. For 3/– you have the opportunity of choosing 100 stamps of the catalogue value of 20/– or more.

H. HARDY,
39, Rosebery Gardens, Hornsey, London, N.8.

FOUND

THE BEST WINTER GIFT.

A magnificent **Pictorial Packet** which contains the beautiful **Sudan Air Mail** showing desert scene, camel and aeroplane. **Australia.** Latest Sydney Harbour Bridge Stamp (both stamps illustrated in last month's "M.M.") New **Gaboon** (river scene), **Andorra** (view of the Chapel of Meritxell), **Inini** (Carib Archer), etc., etc.

ALL FREE AND POST FREE

to applicants for my bargain approvals.

R. HEWSON, 36, Stert Street, Abingdon, Berks.

PAPUA (British New Guinea)

New set, issued 1933, of Stamps from this Oceanic Possession sent free of charge to bona-fide applicants for selections of duplicates on approval.

HENRY TURNER,
110, Barnett Road, Preston, Brighton, Sussex.

APPROVALS sent by Air Mail

for 6d. Excellent selection of the celebrated Richemont packets, sets and singles. Complete set Pro Juventute 1932, 1/3 mint, 9d. used. Mounted booklet 400 well assorted different Stamps, 3/–.

A. M. PHILLIPS,
Richemont, St. Légier sur Vevey, Switzerland.

THE "NEW ISSUE PACKET" FREE

This wonderful packet will be given **FREE** to all who apply for my famous Approval Sheets and enclose 1½d. postage. It contains **FINE PICTORIAL GABOON** (just issued) **NEW ISSUE ANDORRA**, a fine set of newly issued **CANADA**, including the **OTTAWA** Conference stamp, **U.S.A.** Bi-centenary of Washington, 1932; set of **UNION OF S. AFRICA**, pictorials, including re-issue of 2d., with war memorial added; new issue of **STRAITS** and **MALAY**, 5c. brown; a **FINE ICELAND** pictorial (see illustration); **RUANDA-URUNDI**, new pictorial; **TURKEY**, new head issue, etc. 50 Stamps in all. Have you had my 70-page illustrated booklet, price 1d.? Senders of stamp collectors' names receive an extra set free.

H. C. WATKINS, "M" DEPT., GRANVILLE ROAD, BARNET.

COLLECTORS

Fine selections of British Colonials and Foreign Stamps sent on approval to applicants. Please write and I will send you one. Prices are very reasonable, from ½d. each upwards, less 25% discount for perfect copies.

FREE: 100 Different Super Stamps to applicants.

ERIC J. WATTS,
48, London Road, Northampton.

New Guinea or Grenada

A **FREE** set of above sent to all asking for Approvals. Selections of superior class Stamps at moderate prices on approval, including **BRITISH COLONIALS** and Foreign. These approvals will appeal in particular to Collectors more advanced than beginners. **Send a Post Card To-day.**

C. H. SHAW (Dept. M),
95, Christchurch Avenue, Kenton, Harrow.

SPECIAL CLEARANCE SALE

A large accumulation of **Foreign and Colonial stamps** to be cleared at rock-bottom prices! Bumper Parcels at 1/–, 2/6 and 5/– each. Every parcel includes desirable stamps of high catalogue value. Hours of fun sorting. Complete satisfaction or money refunded.

W. A. JONES, 39, Neville Road, CROYDON.

WHOLE WORLD PACKET—FREE

Over **80 Different** including **Mint** Stamps from over **30 Countries** or **Colonies** and **all 5 Continents**—to all applicants for long list of other fine free bonus gifts of high value, including Brit. Cols., cat. over 10/– each, Nyassa, Bel. Congo., Siam, Turkey, Greece, etc., etc., requesting Approvals and enclosing postage.

D. B. SCOTTMAN,
22, WICKHAM ROAD, BECKENHAM, KENT.

Afghanistan Packet FREE

A fine packet of **all different Stamps**, containing a fine unused **Afghanistan**, new issue; **Abyssinia**, 1932, large pictorial, unused; **German**, 1931, unused; **Albania**, 1930, pictorial, unused; **Algeria**, high value; **Russian North West Army Stamp**; **Tunis**, high value; **Siam**, head; **Portugal**, 40c.; **Travancore**, etc. Free to all asking to see my famous Approval Sheets, and **enclosing 2d. for postage and packing** (abroad 3d.). Albums from 1/4 upwards.

S. HAMMOND, 2, CHESHAM FIELDS, BURY, LANCS.

"WORTH WHILE"

100 DIFFERENT BRITISH COLONIALS 1/- Post Free

including Gold Coast pictorials, ½d., 1d., 1½d., 2d.; N. Rhodesia, 1d., 2d.; Nigeria, ½d., 1d., 1½d., 2d., 3d.; Mauritius, 2, 4, 5c.; Iraq, ½, 1, 3 annas; N. Zealand, ½d., 1d., 1½d., 2d., 3d., 4d., 6d., 1/–. Newfoundland, Palestine, Jamaica, Fiji, Bahamas, etc., etc. Finest packet YOU have ever had. MONEY BACK if not satisfied. Ask for "Worth While" Approval Sheets.

JOS. H. GAZE, DIDSBURY, MANCHESTER.

THE AERO-SHIP PACKET FREE ! !

This huge parcel contains **505 Unsorted Foreign Stamps**, many scarce as imported from **Roumania** (Beautiful Monoplane), **Brazil** (Aeroplane), China (Sailing Junk), **Wallis and Futuna Is.** (Yacht), Denmark (Galleon), Greece (Steamer in Isthmus), Br. S. Africa (Mediæval Frigate), etc., a remarkable collection to sort over. Just send 2d. Postage and request our **Famous Extra-Large-Discount Approval Sheets** (Abroad 6d. P.O.).

LONGBOTTOM & EASTICK,
59, HOLDENHURST ROAD, BOURNEMOUTH.

ABOUT TURN!

In 1911 **certain** stamps of **Nicaragua were surcharged with new values on Reverse Side**, and actually used, **so to speak**, face-downwards! Send us **6d.** for one of these curious stamps.

For an **extra 1/9** we will send a genuine used copy of the **First Stamp ever issued** (British 1840 penny black), and for **another 5/–** a nice copy of the classic **Cape Triangular** (4d. blue). **Write for Free Lists.**

NORRIS & CO. (Dept. M), Norwood, London, S.E.19, Eng.

NO MYSTERY, BUT 15 BRILLIANT STAMPS OF SPARKLING INTEREST.

Old Abyssinia (King Solomon's Throne), Belgium (King in Trench Helmet), Chile (Columbus), Cuba (Gomez), Czechoslovakia (Bradschin at Prague), Greece (Theseus Temple), Hungary (Madonna and Child), Italy (Julius Cæsar), Japan (Mount Fujiama), Liberia (View), New S. Wales (Sydney view), Persia (Shah Sultan), Philippines (Baby King), Siam (King Vijiravudh), Ukraine (Schevtachenko). A truly magnificent lot from far-flung parts of the world. I do not say "ETC.," but tell you all 15 stamps. You know what you get before you write. FREE to genuine applicants for Approvals sending 2d. postage. (Abroad 4d.) without approvals. Price 1/–. **M. R. WILKINSON, 25, LAWSON ROAD, COLWYN BAY, WALES.** (Estd. 1889.)

KINGS HEADS, Colonial and Foreign **Duplicates** for disposal. One Farthing per stamp. Send **postcard** for trial.—Philatelist, 32, Josephine Avenue, Brixton, S.W.2

STAMP WALLET — FREE

Fitted with Perforation Gauge, etc., size 3¼" × 5½", and containing a fine Mint Central American Stamp, cat. 7/6, to **genuine approval applicants only**, enclosing 3d. for postage and packing.

ALIX HARLAND (Dept. A5), 4, Featherstone Buildings, High Holborn, London, W.C.1.

FREE! 10 DIFF. NEWFOUNDLAND

To all sending for **MY PRICE LIST OF SETS** and **PACKETS.** Enclose 1½d. Postage. **SEND 1/–** and receive Packet **500 GOOD STAMPS, FREE SET** as above and **RARE RHODESIA, Cat. 4/6. SCOUTS! ROUMANIA SCOUT STAMPS, MINT SET** of 4, **1/3**

(See illustration, Jan. No., Page 71.)

E. K. RUSSELL,
32, SOMERSET AVENUE, HOOK, SURREY.

For further Stamp Advertisements, see page 248

Stamp Gossip

and Notes on New Issues

The Good Companions

In our February issue we illustrated the Belgian Christmas Anti-tuberculosis fund stamps with a design showing the great sanatorium at Waterloo. Were it not that the two stamps followed one another so quickly as to rule out any possibility of plagiarism, one might accuse Belgium of having borrowed the idea; for only a few weeks previously Roumania had issued the 4+1 lei stamp illustrating a big Roumanian sanatorium.

This stamp was one of three issued to raise funds for invalided postal servants. The two other designs were:—6+1 lei, view of memorial to postal officials who fell in the War; 10+1 lei, the Carmen Sylva holiday home on the shore of the Black Sea.

An Aegean Commemoration

To celebrate the 20th anniversary of Italy's annexation of the Ægean Islands, a set of 10 commemorative stamps has been issued.

Only two designs are used. That on the low values, from 5c. to 30c., shows a group of islands with the Italian eagle flying overhead. The cross and crown of Savoy are superimposed on the design, with the Fascist motto "*Fert*," derived from the words "*Fortitudo Eius Rhodum Tenuit*."

The second design used on the 50c. to 25L. values shows a map of the Island of Rhodes and the cross of Savoy. The letters FERT quarter the cross. Both designs include the inscription Rodi, representing Rhodes, the principal island of the group, and the three dates 1912, 1922 and 1932.

A New British Colonial

One of the few remaining issues of British stamps overprinted for Colonial use has disappeared, following the issue of British Bechuanaland's permanent series.

The new series contains 12 stamps for general use, each using the design illustrated here, and three Postage Dues in the usual British numeral type. The design is engraved and recess printed, and shows a vignette portrait of H.M. The King, inset above a riverside scene.

We thank Stanley Gibbons Ltd. for their courtesy in loaning the stamps from which the illustrations for our stamp pages have been made.

Fascist Commemorative Issue

Italy has produced many interesting commemorative sets in recent years, but none of them equals the latest series, 20 stamps commemorating the 10th anniversary of the Fascist march on Rome that resulted in the setting up of the present Dictatorship.

We reproduce four of the stamps here, and it is sufficient to say that the same high standard of production and interest of design is maintained throughout. A particularly interesting feature is that each design symbolises some phrase taken from Signor Mussolini's speeches. The actual phrases are inscribed on the stamps.

There is not space to describe the series in detail, but brief particulars are as follows:—5c. (illustrated) typifying Agriculture by contrasting the old-time ox-drawn plough with the modern tractor implement. The inscription reads: "That Italy may have bread for all her sons"; 10c., Fascist Army; 15c., The Italian Forces; a soldier, a battle cruiser and a seaplane; 20c., Juvenile Branch Fascist Movement; 25c., The State, an allegory of united effort; 30c., Religion; 35c. (illustrated), The roads of Italy; the stamp shows a *miliarum aureum*, which in Roman times indicated the beginning of an Imperial highway; the inscription reads: "New roads for new legions"; 50c., Mussolini; 60c., Land Reclamation; 75c., Colonial Development; 1 Lire (illustrated) The Mercantile Marine; the design represents the two new Italian luxury ships, the "*Rex*" and the "*Conte di Savoia*," and in the background the tiny caravels in which Columbus sailed; the inscription reads "Our destiny has been and always will be on the sea"; Lire 1.25, The Italian Race Overseas; Lire 1.75, Sport; Lire 2.25, Child Welfare; Lire 2.75, Recreation; Lire 5.00, Archæology; Lire 1.25, Express, The Fascist Revolution; Lire 2.50, Express, The Driving Power of Fascism; 50c., Air, Eagle and Aeroplane; 75c., Air, A composite aerial panorama of famous Italian buildings, showing St. Peter's, Rome and St. Mark's, Venice: the inscription is "To fly is necessary."

Competition Results

November Stamp Contest.—1. K. E. Milburn (Chingford, E.4); 2. L. H. Goldsmith (Lowestoft); 3. B. J. E. Phelp (Hale End, E.4); 4. J. H. Smith (Cricklewood, N.W.2). Consolation Prize: J. B. Pinnock (Bedford).

U.S. Stamp Printings

In our September, 1932 Stamp Notes we referred to the huge task thrown upon the U.S. Postal Printing Department in the printing of new stamps to meet requirements arising from a change in postal rates. As a further illustration of the pressure imposed by the production of a new issue the following figures showing the actual printing quantities for the Washington Bicentennial stamps are illuminating. They are gleaned from the U.S. "*Weekly Philatelic Gossip*."

Values	Delivered to Post Office	Stock at Bureau on 1st October	Total
½c.	71,850,000	16,127,900	87,978,600
1c.	1,265,555,100	—	1,265,555,100
1½c.	247,337,700	57,589,100	304,926,800
2c.	4,222,198,300	9,600	4,222,207,900
3c.	428,926,900	22,334,000	451,260,900
4c.	125,215,600	25,991,200	151,206,800
5c.	122,893,400	47,685,500	170,578,900
6c.	94,469,400	17,270,000	111,739,400
7c.	57,783,500	25,473,900	83,257,400
8c.	84,126,500	12,379,600	96,506,100
9c.	53,537,400	22,171,800	75,709,200
10c.	129,501,300	17,714,700	147,216,000

As we mentioned in our last issue, certain of these stamps have already become "hard to find," a fact that seems incredible when it is seen that the smallest printing was 75 millions of the 9c.! The stamps have had a tremendous usage, however, and the four smallest printings ½d., 7c., 8c. and 9c., are well worth preserving. They have already advanced in price.

A Norwegian Commemorative

To celebrate the centenary of the birth of Björnstjerne Björnsen, Norway has issued a special set of four stamps, 10, 15, 20 and 30 ore values, each taking the design illustrated on this page. The design makes an interesting companion to those used for the Ibsen and Abel commemoratives of 1928 and 1929.

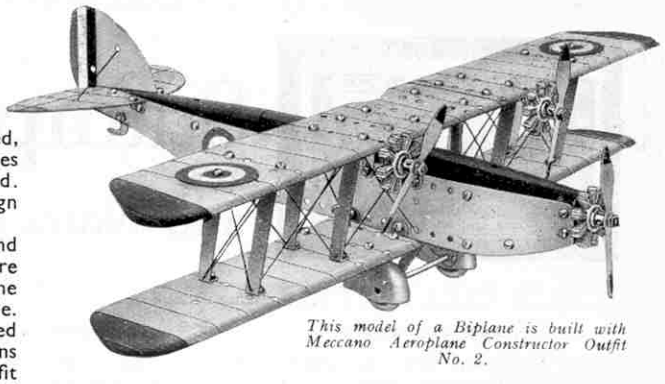
Björnsen was one of the greatest Norwegian men of letters and attained great fame both as novelist and playwright. He was born at Osterdalen in 1832, and from 1857-9 was director of the theatre at Bergen. In 1863, on his return from a long stay in Italy, the Norwegian Parliament granted him a pension in recognition of his literary merit. To be granted an official pension at the age of 31 is an experience that falls to the lot of few men.

AEROPLANE CONSTRUCTOR OUTFITS

Every boy should know how aeroplanes are designed and constructed, and should be able to recognise at a glance the different types of machines in order to understand the purposes for which they have been developed.

The new Meccano Aeroplane Constructor Outfits enable boys to design and build their own Aeroplanes quite easily.

The parts in these Outfits make possible aeroplane construction on sound engineering lines. They are all interchangeable on the famous Meccano principle. The beautifully illustrated Manual of Instructions included in each Outfit shows how to build wonderful models of high and low-wing Monoplanes, Biplanes, Seaplanes and giant amphibian machines. In fact, models of almost every type of aircraft can be made with these splendid Outfits. Ask your dealer to tell you more about them.



This model of a Biplane is built with Meccano Aeroplane Constructor Outfit No. 2.

PRICES OF MECCANO AEROPLANE CONSTRUCTOR OUTFITS

Meccano Aeroplane Constructor Outfit No. O	Price **5**/–
Meccano Aeroplane Constructor Outfit No. 1	Price **9**/–
Meccano Aeroplane Constructor Outfit No. 2	Price **16/6**

AERO CLOCKWORK MOTORS

AERO CLOCKWORK MOTOR No. 1
This long-running motor is specially designed to fit into the fuselage of models made with either No. 1 or No. 2 Outfits. It will rotate the propeller at high speed, thus greatly adding to the realism of the model. Price **2**/–

AERO CLOCKWORK MOTOR No. 2
This is a more powerful motor. In addition to rotating the propeller it also drives the landing wheels of models made with either No. 1 or No. 2 Outfits, making the machine taxi along the floor in a most realistic manner. An adjustable tail wheel is supplied with the motor. Price **4/6**

MECCANO

MOTOR CAR CONSTRUCTOR OUTFIT

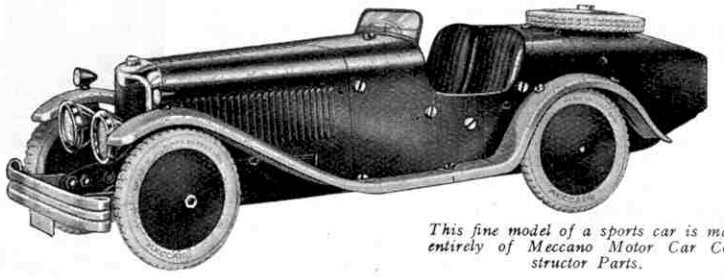
One of the most fascinating of all the Meccano Constructional Outfits is the Motor Car Constructor Outfit, which has already established itself as a firm favourite amongst boys, especially those who are keen on automobile engineering.

The parts contained in this splendid Motor Car Outfit are strongly made and beautifully finished. They enable models of sports and speed cars to be built, each strikingly realistic, a masterpiece of design and workmanship.

An extremely powerful Clockwork Motor is included that gives the models a run of 150 ft. on one winding.

The Outfit is available in different colour combinations, as indicated below, and the beautiful colouring of the parts is another feature that makes this one of the most attractive toys ever produced. Please specify the colour you require when ordering.

Price **25**/–.



This fine model of a sports car is made entirely of Meccano Motor Car Constructor Parts.

COLOUR COMBINATIONS

BODY : Choice of Red, Blue or Green.
MUDGUARDS : Cream.
RADIATOR FRAME : Chromium-plated.
BUMPER AND LAMPS : Chromium-plated.

SPECIAL FEATURES OF MECCANO MOTOR CAR CONSTRUCTOR MODELS

High Power Drive.
Ackermann Steering Gear.
Internal-expanding rear wheel brakes.
Solid die-cast wheels, fitted with rubber tyres.
Chromium-plated lamps, radiator frame and bumper.

MECCANO LIMITED — Binns Road — LIVERPOOL, 13

Competition Corner

HOW MANY MISTAKES CAN YOU FIND?

Some years ago we had a series of picture puzzles on this page. Readers were asked to spot the mistakes—both deliberate and unintentional—that our artist had made in pictures of everyday scenes. The puzzles were exceedingly popular, but our artist became badly disgruntled when, after discovering a host of unintentional errors, we published one of the pictures a second time and asked readers to discover what was right! It has taken quite a long time to persuade him to provide a further series, but at last we have been successful, and we believe that the new series will prove even more popular than the earlier one.

The first of the pictures is reproduced here. It shows an aerodrome complete with ground accommodation, but several deliberate mistakes have been introduced to test our readers' powers of observation. The number of deliberate mistakes is—but that's the point! Prizes of Meccano products to the value of 21/–, 15/–, 10/6 and 5/– are offered for the four most complete lists of genuine mistakes. In addition there will be a number of consolation prizes for the next-best entries.

It is important that the lists should be properly planned to avoid duplications, and competitors are recommended to work systematically across the picture, taking each feature in turn and exhausting its possibilities before passing on to another.

Lists must be written on one side of the paper only, and at the head of the first sheet there must appear the competitor's name and address, and the total number of mistakes found. Entries should be addressed to "Aerodrome Errors, Meccano Magazine, Binns Road, Liverpool, 13," and they must be sent to reach this office not later than 31st March.

A similar set of prizes will be reserved for entries from Overseas competitors—those residing outside the British Isles. Overseas closing date, 30th June.

In the event of a tie for any of the prizes preference will be given to the entry displaying the neatest or most novel presentation. For this purpose neat handwriting scores more marks than typewriting, of course.

March Drawing Contest

The recent "open" competitions for drawings of any subject proved so popular that we feel sure that another would be welcomed by our readers. Drawings submitted for this month's contest, therefore, may be of any subject that the competitor chooses. The expression "drawings," by the way, includes paintings.

Entries to this contest will be divided into *three* sections, A for competitors aged 16 and over; B for those aged 12 to 15; and C for those under 12. In recent months we have received an increasing number of entries from boys under 12, and the new section is added to this contest as an experiment to encourage the younger boys to further effort under conditions that give them a better chance of gaining a major prize. Obviously in the normal course a competitor aged 10 or 11 has little chance of success against one aged 14 or 15, despite the grant of an age allowance in the judging.

Competitors may submit as many drawings as they wish, but each drawing must be marked with the entrant's name, age and address. It is not sufficient merely to indicate the age group. The closing date for entries from home readers will be 31st March; for those outside the British Isles, 30th June. Entries should be addressed "March Drawing Contest, Meccano Magazine, Binns Road, Liverpool, 13."

COMPETITION RESULTS

HOME

Tree Figures Contest.—This contest undoubtedly proved a "teaser," and the huge number of entries was indeed a high tribute to our readers' patience and perseverance. As the Overseas section will have closed before these comments are published, the solution may be given now. The correct total is 2,679.

The prizewinners' names are as follows:—1. J. W. Trevethan (Bere Ferrers); 2. R. McKears (Derby); 3. M. L. David (Bedford); 4. H. M. Wilson (Lenzie); Special 4th. S. Bourne (Weybridge).

Feature Voting Contest.—1. J. M. Simmons (Cirencester); 2. K. E. Milburn (Chingford, E.4); 3. J. S. White (Hendon, N.W.9); 4. N. W. Preston (Manchester).

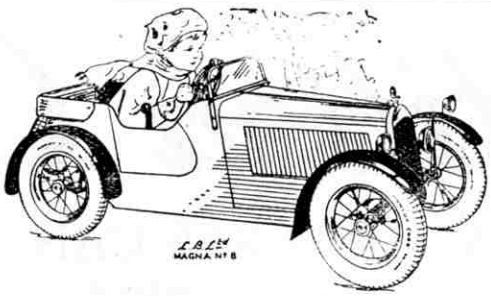
December Crossword.—1. R. Hims (Redditch); 2. R. Davenport (Birmingham); 3. R. Duckering (Sheffield); 4. Wm. F. Lane (Nottingham).

OVERSEAS

Adventure Voting.—1. F. Whyte (Ipswich, Queensland); 2. L. H. Orsmond (Transvaal); 3. M. Sanglas (Barcelona); 4. J. H. Credie (Capetown).

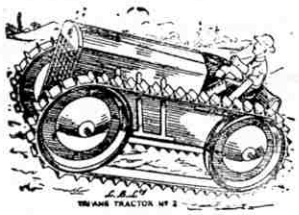
A fine range of toys to work with your models. Real precision jobs. British made. Tractors, Tanks and Motor Cars.

There are other models besides those shown here, including Magic Sports, Saloon and Racing Cars. Write for illustrated leaflet showing the wonderful lines we have.

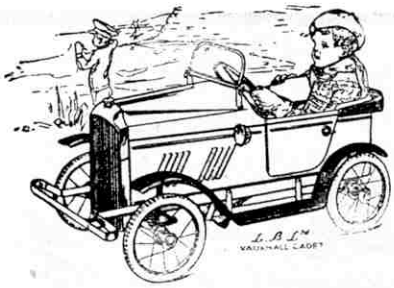


MAGNA No. 8. A reproduction of modern sporting cars. Wood body, model pressed radiator, Band brake, tubular front axle, ball-bearing back axle. 2½" balloon pneumatic tyres on tangent spoke wheels. Price **105/-**

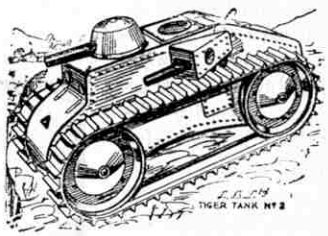
Real engineering technique is embodied in the construction of all TRI-ANG TOYS. Steel or coach built bodies to cars, pneumatic tyres, ball-bearing axles and Chromium-plated fittings. TRI-ANG clockwork toys are ideal to work with your models, they are the real thing in miniature and give endless satisfaction.



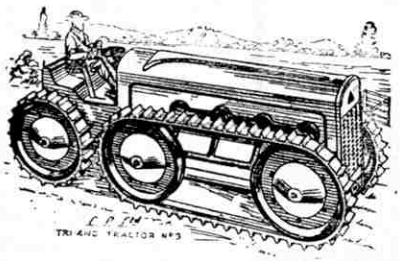
TRI-ANG TRACTOR No. 2. Steel construction, cellulose painted red. Reliable motor with control lever. Rubber bands on steel wheels. Length 8¼". Price **3/11**



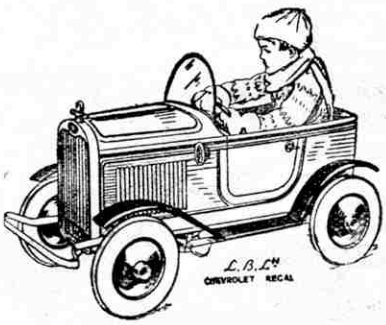
VAUXHALL CADET. A very realistic all steel car, with plated Vauxhall radiator. Adjustable windscreen, plated spring bumper. Upholstered back and dummy hood. For ages 2–4 years. Price **35/-**



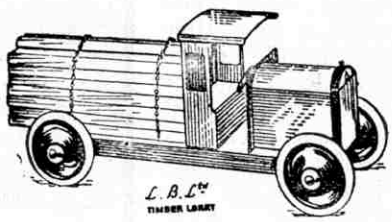
TIGER CLIMBING AND FIGHTING TANK No. 2. A powerful climber, made of steel, with wide rubber bands. Swivelling gun turret with firing device. Control lever and powerful motor. Length 10". Price **5/11**



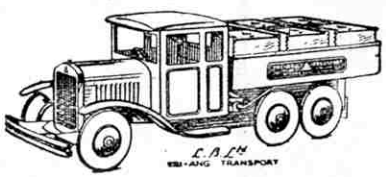
TRI-ANG TRACTOR No. 3. Super-powered six-wheeled model. Powerful motor with two control levers—start, stop and reverse. Rubber tyres and bands on steel wheels. Nickel-plated steel body. Length 12½". Price **10/6**



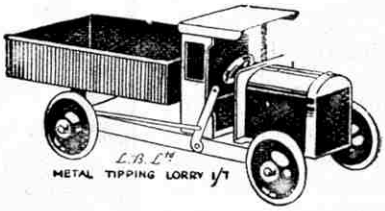
CHEVROLET REGAL. A smart pedal car with pressed steel body. Adjustable windscreen, spring bumper and correct radiator with badge. 9" balloon disc wheels with ⅝" rubber tyres. For ages 3–6 years. Price **29/6**



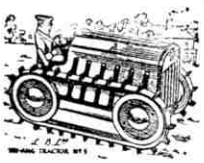
METAL TIMBER LORRY. Steel lorry loaded with planks fastened to chassis by chains. Steel disc wheels, rubber tyres.



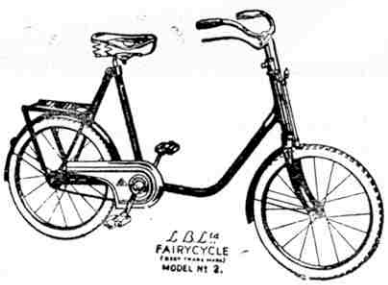
TRI-ANG TRANSPORT SIX. Made throughout of steel. Six wheels with balloon rubber tyres. Driven by heavy flywheel geared to rear wheels. Motor type steering. Complete with six cases. Length 20". Price **10/6**



METAL TIPPING LORRY I/T. Designed on the same lines as the real thing. Body tipping is operated by lever from the driving cab. Steel disc wheels, rubber tyres. Length 17½".



TRI-ANG TRACTOR No. 1 (NIPPY). Climbs obstacles in a marvellous way. Powerful clockwork motor geared to steel wheels. Thick rubber bands. Control lever. Length 5½". Price **1/-**



FAIRYCYCLE (Regd.) MODEL No. 2. Tubular frame. 14" wheels. 11/16th" white auto-tread tyres. Ball-bearing pedals and rim brake. Two-coil saddle and chain cover. Price **39/6**

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All the dealers whose advertisements appear on this page carry full stocks of Meccano Outfits, Accessory Outfits, and Meccano parts, Hornby Trains and Hornby Train Accessories all the year round. The names are arranged in alphabetical order of town.

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of

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will be ready shortly—from all Toy, Fancy and Art Stores.

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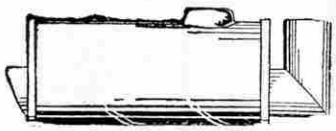
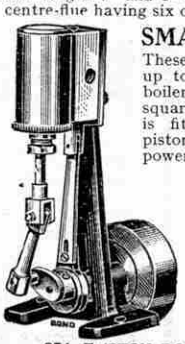
BOND'S

COPPER CENTREFLUE BOILERS



These Boilers are made of copper throughout and **Brazed** at all joints. Fitted with steam dome and safety valve bushing. Prices:
Boiler length 5½" and 2½" diam., fitted with 1½" centre-flue having four crosstubes. Postage 6d. **17/6**
Boiler length 7" and 3" diam., fitted with 1¾" centre-flue having six crosstubes. Postage 9d. **30/-**



SMALL BOAT ENGINES

These engines are suitable for boats up to 30" long and for use with boilers having a pressure of 25 lbs. square in. of steam. The engine is fitted with a double acting piston valve cylinder and is very powerful for its size. Price **7/6** *Postage 6d.*

Send for Bond's Illustrated Catalogue, 6d. post free, which contains everything wanted by the Model Maker.

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"COLLECT THE MILES"
THAT YOU MAY
"RECOLLECT WITH SMILES"

(Insist upon the genuine.) *Fit a* **Veeder**

Prices: Regular, all sizes, Standard Finish, 9/9; Black Bronze Finish, 10/3. Trip, Standard Finish, 24/-; Black Bronze Finish, 25/-.
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St. Andrew's House, Holborn Circus,
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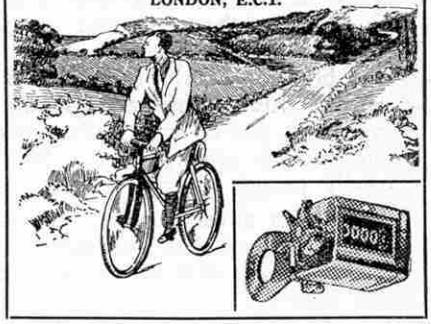

BIRDS' EGGS AND BUTTERFLIES! Send ½d. stamp for lists.—Forbes, Clutton, Chester.

ELECTRIC HOME CINEMAS, Standard Films, Cheap. Lists—"Pictures," 109, Kenlor, Tooting, London.

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Cowboys, Indians, Animals, Zulus, Model Farmyard Sets, Rodeo, etc. Our CASTING MOULDS make thousands from any scrap lead WITHOUT PREVIOUS EXPERIENCE. Send stamp to-day for NEW Illustrated Catalogue. **J. TOYMOULDS, 7, Jamacia Row, Birmingham.** *Mention "Meccano Magazine."*

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READERS' SALES

Bowman Loco and Tender, Model 234, £1.—R. Thomas, Lindens, Walton, Brecon, Wales.

Sale. "Meccano Magazines," January 1926–December 1930. Also 14 "Wireless Magazines." Highest offer.—J. Duckworth, 22, Ann Street, Kendal.

"M.M.'s," 1921–1926 inclusive, few older; 41 "Everyday Science," June 1920–Oct. 1923; "Railway Magazines," 20, good condition. Offers.—Bathe, 29, Tudor Road, Kingston Hill.

Sale. Lantern Slides and Model Railway. List.—Cooke, 90, Woodwarde Road, S.E.22.

Send 250 Stamps from yours and surrounding countries for 250 New Zealand and Australian.—D. G. Sherriff,72, Hazel Avenue, Corstorphine, Dunedin.

Wanted. "Magnets," under 1928; "Union Jacks," under 1930. Also "Sexton Blakes," under No. 216, and "Schoolboys' Own," under No. 110.—Wilmot, 11, Newbridge Hill, Bath.

Wanted. 1920 Hornby No. 1 Train Set or Parts.—J. L. Whitworth, Melville, Bramhall, Cheshire.

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Bargains. Just what you want. Including Bowman Stationary Engine, No. E.101. All in good condition. Stamp for list.—Henderson, Manor Road, Wantage.

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"M.M.'s," 1929–1932. Complete and 40 previous issues. Exchange for Birds' Egg Cabinet.—Wright, Highlands Road, Drayton, Portsmouth.

Sale. A Gauge 1 Engine, six Goods Wagons, three Carriages, 4 ft. Viaduct, and Rails. Good order. Price £2.—Hamilton, Fort Manse, Lisburn, Ireland.

Cash for four C.C.B. Red or Yellow "Break."—Tolkien, 20, Northmoor Road, Oxford.

Horizontal Steam Engine, Chemical Outfit, "M.M.'s," Model Yacht, Stamps. Write List—Fawcett, 5, Upper Calton Street, Keighley.

Sale. "Meccano Magazines," March 1925 to June 1930. Clean condition. Offers to Goddard Burrows, Lea Lodge, Gomshall, Nr. Guildford, Surrey.

Sale. "Meccano Magazines," December 1928–January 1933, complete. Excellent condition. Offers.—Peters, Meadowcroft, Yateley, Hants.

Two Clockwork Locos, 25 Rails, Trucks, Coaches, Bridge, Crane, 14/–, or separately. 35/– Cinematograph, 15/– Films, Boat—motor, what offers?—Nichols, 1, Winifred Road, Bedford.

Collection, over 2,400 Stamps in Looseleaf Album, catalogued over £25. £5 or nearest offer.—W. Corfield, Portland Place, Clifton, Bristol.

Sale. "M.M.'s," April 1924–Dec. 1932. Offers.—A. Higgs, Powys Avenue, Leicester.

Sale. Brand new Air Rifle. Cost 35/–. Accept 25/–. Apply—James, "Castle-Enigan," Ardaragh, Newry, Co. Down.

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Sale. "Meccano Magazines," "Modern Boys," 1929–1933. Stamp details.—Mills, 13, West Street, Dorchester, Dorset.

Sale. Silkworm Eggs, 1/– per 100.—Quarmby, 165, Melfort Road, Thornton Heath, Surrey.

"Mechanics Made Easy." Wanted. One of the first Meccano Outfits that were sold under the name of "Mechanics Made Easy." Also, any very early Meccano Parts, Manuals, literature, etc. Send full particulars and price asked to Box 301.

Books. "Victories of the Engineer," 4/–. "The Railways of Great Britain," 3/–. "All About Our Railways," 4/–. "Nelson's History of the War," 25 vols. 30/–. All post free.—Box No. 302.

For Sale. "M.M.'s," Hobbies, etc., all in perfect condition. Lists free.—R. S. Young, Ballymoney.

Bassett-Lowke Clockwork Royal Scot, Walker 0–6–0 Controlled Clockwork L.M.S. Coaches, and other Gauge O Goods as new, at half price.—Cosy Theatre, Rayleigh, Essex.

Sale. "Meccano Magazines," July 1926 to December 1927, March missing. Sell in three parts: July-December 1926, 9d.; January-June 1927, 1/3; July-December, 1/6. Hobbies, October 1930–September 1932. Sell in three-monthly parts at 1/– each. "Popular Wireless," March–August 1932. Offers?—Lennard, 234, Kew Road, Kew, Surrey.

"M.M.'s," Books, Stamps, Kodak Camera. Send stamp for particulars.—Allan, Grey End, Heyes Lane, Alderley Edge.

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MECCANO MAGAZINE

Registered at G.P.O., London, for transmission by Canadian Magazine Post.

EDITORIAL AND ADVERTISING OFFICE:—

LIVERPOOL, 13, ENGLAND.

Telegrams: "Meccano, Liverpool."

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To Contributors. The Editor will consider articles and photographs of general interest and payment will be made for those published. Whilst every care will be taken of articles, etc., submitted, the Editor cannot accept responsibility for any loss or damage. A stamped addressed envelope of the requisite size should be sent where the contribution is to be returned if unacceptable.

Readers' Sales and Wants. Private advertisements (i.e., not trade) are charged 1d. per word, minimum 1/–. Cash with order. Editorial and Advertising matters should not be dealt with on the same sheet of paper.

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Proofs of advertisements will be sent when possible for space bookings of not less than half-an-inch.

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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 1/2 per copy (postage extra), and the subscription rates 8/– for six months and 16/– 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).

The U.S.A. price is 15c. per copy, and the subscription rates $1 and $2 for 6 and 12 months respectively (post free).

Overseas readers are reminded that the prices shown throughout the "*M.M.*" are those relating to the United Kingdom and Northern Ireland. Current Overseas Price Lists of Meccano Products will be mailed free on request to any of the undermentioned agencies. Prices of other goods advertised may be obtained direct from the firms concerned.

CANADA: Meccano Ltd., 34, St. Patrick St., Toronto.

UNITED STATES: Meccano Co. of America Inc., New Haven, Conn. Meccano Co. of America Inc., 200, Fifth Av., New York.

AUSTRALIA: Messrs. E. G. Page & Co., 52, Clarence Street, Sydney, N.S.W.

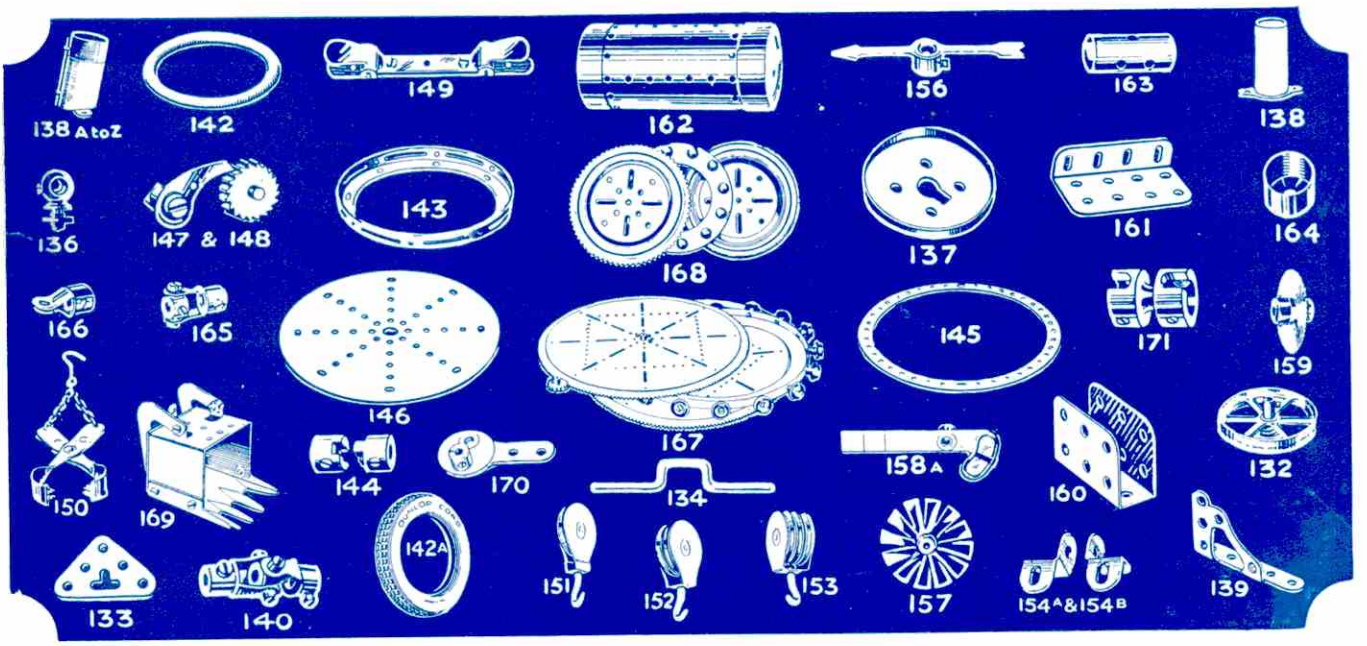
NEW ZEALAND: Models Ltd., P.O. Box 129, Paykel's Building, Anzac Avenue, Auckland.

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.

The Editor wishes to make known the fact that it is not necessary for any reader to pay more than the published price. Anyone who is being overcharged should lodge a complaint with the Meccano agent in his country or write direct to the Editor.

MECCANO
PARTS & ACCESSORIES



No.		s.	d.
132.	Flywheels, 2¾" diam. ... ... each	2	0
133.	Corner Brackets, 1½" ... ... "	0	1
133a.	" " 1" ... ... "	0	1
134.	Crank Shafts, 1" stroke ... ... "	0	2
135.	Theodolite Protractors ... ... "	0	3
136.	Handrail Supports ... ... "	0	3
136a.	" Couplings ... ... "	0	4
137.	Wheel Flanges ... ... "	0	3
138.	Ships' Funnels ... ... "	0	3
	Ships' Funnels, Raked		
138a.	Cunard S.S. Co. ... ... "	0	9
138b.	Isle of Man S.P. Co. ... ... "	0	9
138c.	T. & J. Harrison, Liverpool ... ... "	0	9
138d.	United States Lines ... ... "	0	9
138e.	P. & O. S.N. Co. Ltd. ... ... "	0	9
138f.	Alfred Holt & Co., Liverpool ... ... "	0	9
138g.	White Star Line ... ... "	0	9
138h.	Great Western Railway—Fishguard ... "	0	9
138i.	Holland America Line ... ... "	0	9
138j.	Ellerman Line ... ... "	0	9
138k.	Lamport and Holt Line ... ... "	0	9
138l.	Manchester Liners Ltd. ... ... "	0	9
138m.	L.N.E. Railway Co. ... ... "	0	9
138n.	Southern Railway, London Brighton & South Coast Section ... ... "	0	9
138o.	Aberdeen, Newcastle and Hull Steam Co. ... ... "	0	9
138p.	Nelson Line ... ... "	0	9
138q.	Clan Line ... ... "	0	9
138r.	Brussels S.S. Co. ... ... "	0	9
138s.	Union Castle Mail S.S. Co. Ltd. ... ... "	0	9
138t.	Canadian Pacific S.S. Co. ... ... "	0	9
138u.	Yeoward Line ... ... each	0	9
138v.	A. Coker & Co. Ltd. ... ... "	0	9
138w.	Moss Line ... ... "	0	9
138x.	Leyland Line ... ... "	0	9
138y.	Furness Line ... ... "	0	9
138z.	British and Irish S.P. Co. Ltd. ... ... "	0	9
139.	Flanged Brackets (right) ... ... "	0	2
139a.	" " (left) ... ... "	0	2
140.	Universal Couplings ... ... "	0	10
141.	Wire Line (for suspending clock weights) ... ... "	0	9
142.	Rubber Rings, 3" rim ... ... "	0	3
142a.	Dunlop Tyre to fit 2" diam. rim ... ... "	0	4½
142b.	" " " 3" " " ... ... "	0	6
142c.	" " " 1" " " ... ... "	0	3
142d.	" " " 1½" " " ... ... "	0	4
143.	Circular Girders, 5½" diam. ... ... "	1	0
144.	Dog Clutches ... ... "	0	6
145.	Circular Strips, 7½" diam. overall	0	9
146.	" Plates, 6" " ... ... "	1	0
146a.	" 4" " ... ... "	0	6
147.	Pawls, with pivot bolt and nuts ... ... "	0	3
147a.	Pawls ... ... "	0	2
147b.	Pivot Bolt with 2 nuts ... ... "	0	2
148.	Ratchet Wheels ... ... "	0	6
149.	Collecting Shoes for Electric Locos ... "	1	6
150.	Crane Grabs ... ... "	0	7
151.	Pulley Blocks, Single Sheave ... ... "	0	8
152.	" " Two " ... ... "	0	9
153.	" " Three " ... ... "	1	0
154a.	Corner Angle Brackets, ½", right hand ½ doz.	0	6
154b.	" " ½", left hand "	0	6
155.	Rubber Rings, ⅝" ... ... each	0	1
156.	Pointers, 2½" over all, with boss ... each	0	4
157.	Fans, 2" diam. ... ... "	0	4
158a.	Signal Arms, Home ... ... "	0	5
158b.	" " Distant ... ... "	0	5
159.	Circular Saws ... ... "	1	0
160.	Channel Bearings, 1½" × 1" × ½" ... "	0	2
161.	Girder Bracket, 2" × 1" × ½" ... ... 2 for	0	3
162.	Boiler, complete with ends ... ... each	1	0
162a.	Boiler ends ... ... "	0	3
162b.	Boiler without ends ... ... "	0	6
163.	Sleeve Pieces ... ... per pair	0	6
164.	Chimney Adaptors ... ... each	0	2
165.	Swivel Bearings ... ... "	0	6
166.	End " ... ... "	0	3
167.	Geared Roller Bearings ... ... "	20	0
167a.	Roller Races, geared, 192 teeth ... "	4	6
167b.	Ring Frames for Rollers ... ... "	3	0
167c.	Pinions for Roller Bearings, 16 teeth "	1	0
168.	Ball Bearings, 4" diam. ... ... "	3	0
168a.	Ball Races, flanged disc ... ... "	0	6
168b.	" " toothed " ... ... "	0	9
168c.	Ball Casings, complete with balls "	1	9
169.	Digger Buckets ... ... "	2	0
170.	Eccentrics, ½" throw ... ... "	0	9
171.	Socket Couplings ... ... "	0	9
172.	Pendulum Connections ... ... "	0	1
173.	Rail Adaptors ... ... per pair	0	6
174.	Grease Cups ... ... each	0	3
175.	Flexible Coupling Units ... ... "	0	6
176.	Anchoring Springs for Cords ... ... "	0	1
177.	Shafting Standards, Large ... ... "	1	0
178.	" " Small ... ... "	0	8
179.	Rod Sockets ... ... "	0	3

The Meccano system is composed of some 250 real engineering parts, mostly made of steel or brass, each one of which has a definite mechanical purpose. These parts combine to form a complete miniature engineering system that enables practically any movement known in mechanics to be duplicated. All the parts are interchangeable and each one may be used in hundreds of different models.

New parts are always being introduced in order to keep Meccano model-building in line with the most modern engineering requirements. The greatest care is taken in the designing of these parts to ensure that they function exactly as their counterparts in actual practice.

The above is the third and final group composed of parts 132 to 179 inclusive. The preceding groups appeared in the January and February 1933 issues of the "M.M."

A complete list of all the parts in the system may be obtained from any Meccano dealer on application.

MECCANO LTD. — Binns Road — LIVERPOOL, 13

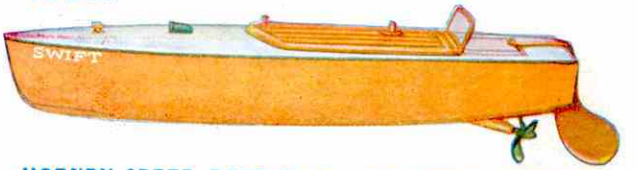
HORNBY SPEED BOATS

THE NEW 1933 RECORD-BREAKING MODELS

The 1933 Hornby Speed Boats (ready early in March) are the finest examples of miniature speed boat construction ever seen. Their remarkable performance, perfect design, and beautiful appearance definitely establish them as the leaders in their class.

HORNBY SPEED BOAT No. 1. "MARTIN." PRICE 5/-

The Hornby Speed Boat No. 1 is a very efficient model, measuring 8½ in. in length and 2⅜ in. in beam. It will travel over 160 feet on one winding. Finished in three different colour combinations—Red and Yellow, Blue and White, and Orange and Green.



HORNBY SPEED BOAT No. 2. "SWIFT." PRICE 7/6

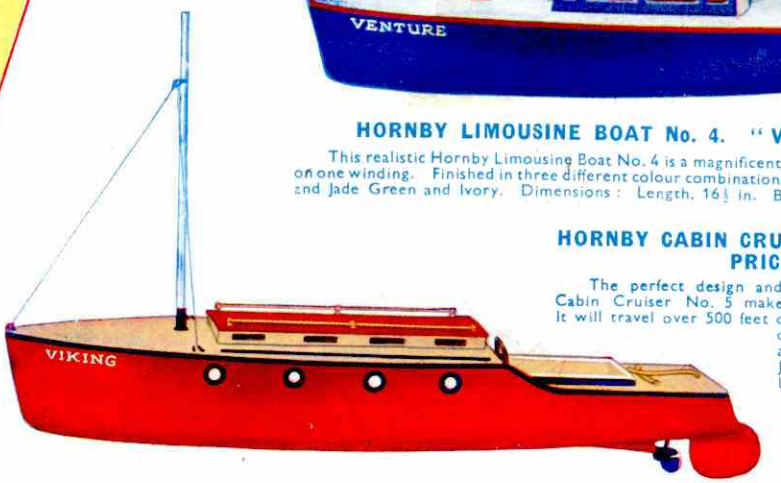
The exceptionally fine performance of Hornby Speed Boat No. 2 will make it one of the most popular of the Hornby models. It will travel over 300 feet on one winding. Finished in three different colour combinations—Red and Cream, Blue and White, and Yellow and White. Dimensions: Length, 12½ in. Beam, 3 in.

HORNBY SPEED BOAT No. 3. PRICE 12/6

Hornby Speed Boat No. 3, introduced in 1932, has already established itself as a great favourite. It will travel over 500 feet on one winding. Available with three different names and in three different colour combinations, as follows:—"Condor" (Red and Cream), "Gannet" (Blue and White), "Curlew" (Green and Ivory). Dimensions: Length, 16½ in. Beam, 3½ in.

HORNBY LIMOUSINE BOAT No. 4. "VENTURE." PRICE 15/6

This realistic Hornby Limousine Boat No. 4 is a magnificent model. It will travel over 500 feet on one winding. Finished in three different colour combinations—Red and Cream, Blue and White, and Jade Green and Ivory. Dimensions: Length, 16½ in. Beam, 3½ in.



HORNBY CABIN CRUISER No. 5. "VIKING." PRICE 16/6

The perfect design and handsome appearance of Hornby Cabin Cruiser No. 5 make it a model of outstanding merit. It will travel over 500 feet on one winding. Finished in three different colour combinations—Red and Cream, Blue and White, and Jade Green and Ivory. Dimensions: Length, 16½ in. Beam, 3½ in.

SPECIAL FEATURES OF THE HORNBY SPEED BOATS

- Each model fitted with powerful Clockwork Motor giving high speed and great length of run.
- Up-to-date fittings, including Windscreen, Brass Ventilators, Adjustable Rudder, etc.
- Scientifically-designed propellers.
- Beautiful finish.
- Perfect design.
- Unsinkable.

HORNBY SPEED BOAT CLUB

This is an illustration of the Hornby Speed Boat Club Badge. Write for particulars.

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