VOL. XVII. No. 7

JULY 1932

MECCANO MAGAZINE

ROAD THROUGH A GIANT TREE
(see page 490)

6D.

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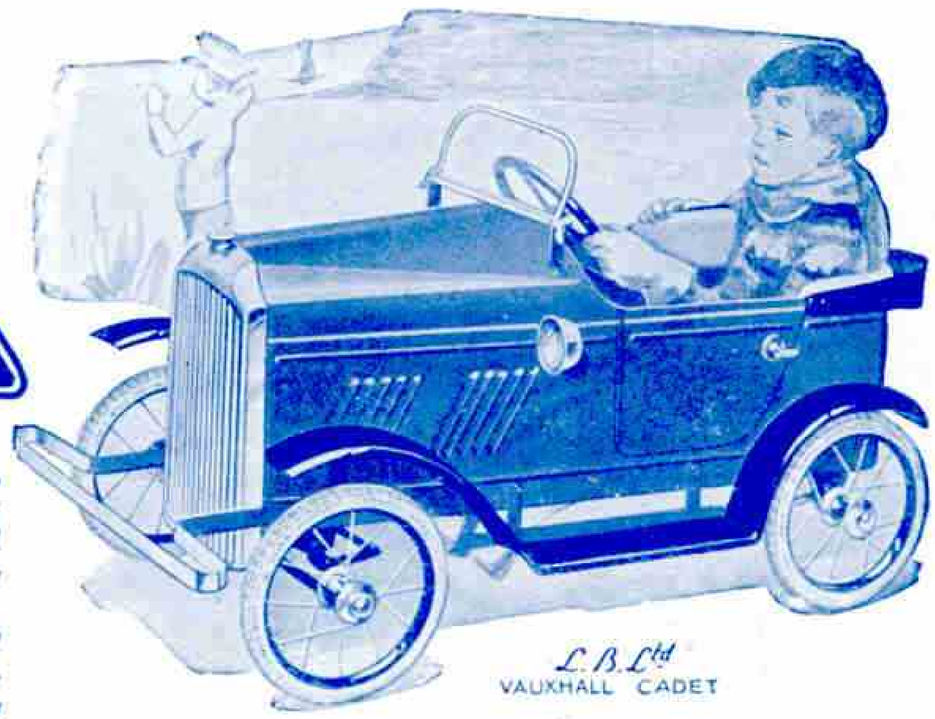

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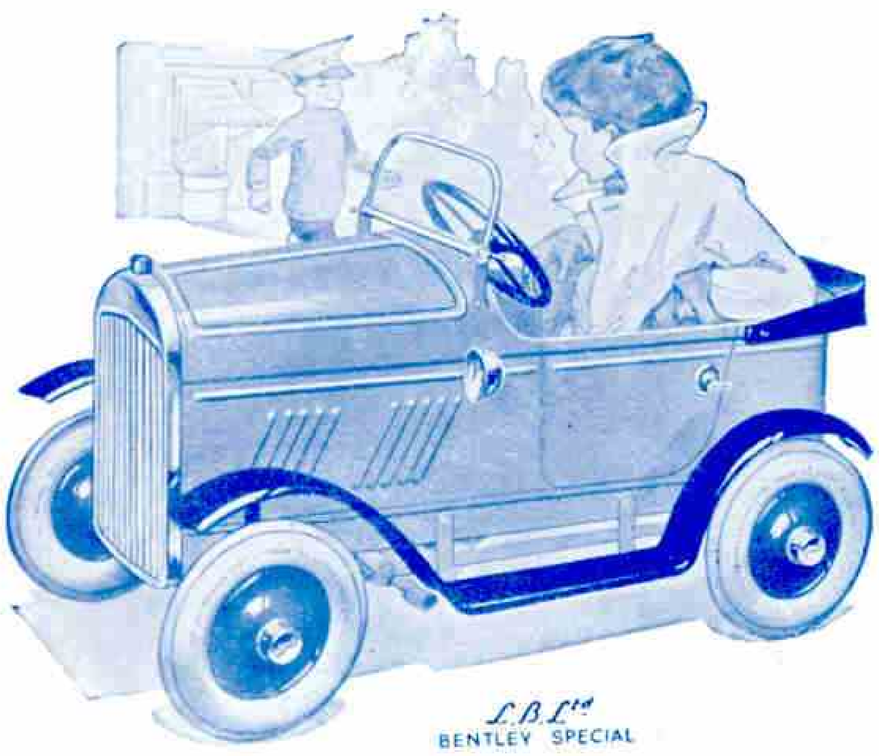

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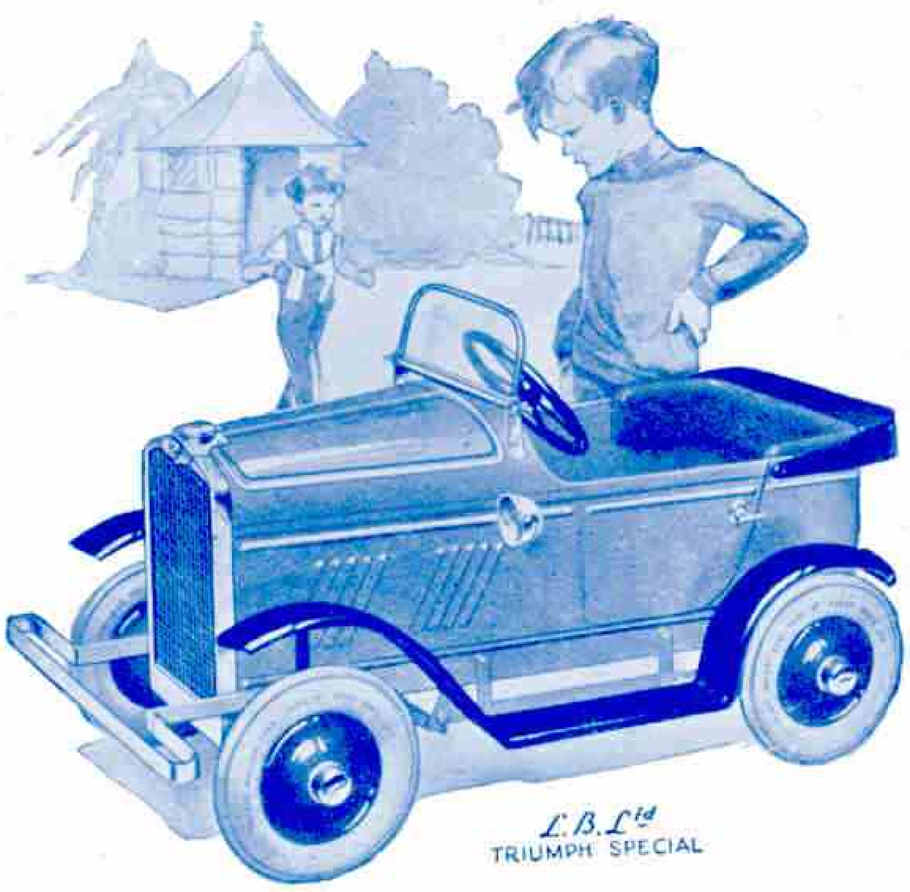

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With the Editor

Pioneers and Progress

Last month I pointed out the mistake of applying the policy of "Safety first" to the choice of a career, except where circumstances made this absolutely necessary. If this policy had been generally adopted throughout the ages the world would never have reached its present state of development. There would have been no pioneers, and therefore no progress. Almost every great advance that has been made in knowledge and in power owes its origin to some individual who took his courage in both hands and plunged into the unknown, confident of ultimate success and prepared to risk all to attain it. The early explorers—Columbus, Da Gama, the two Cabots, Magellan, and the rest—never allowed thoughts of personal safety, either first or last, to influence their plans. It is wonderful to think of Columbus in his tiny "*Santa Maria*" sailing on day after day across the "Green Sea of Darkness," as the Arabs called the Atlantic; and one can imagine his feelings when the branch of a tree bearing berries floated past, indicating that at last he was approaching land. No "Safety first" here!

Twenty-three years ago this month another pioneer made his mark on the world's history when Louis Blériot, the French airman, flew across the Channel. The distance was short, only 25 miles, but in the state of aviation existing at that time it was a great feat of courage and skill. Blériot set out from Calais, crossed the Channel at what was then regarded as the terrific speed of 45 m.p.h., and landed on the cliffs near Dover. It was the first sea crossing by air, and it led to a series of rapid developments that made possible the flying of the Atlantic ten years later by Sir John Alcock and Sir Whitten Brown, who safely negotiated the 1,890 miles between Newfoundland and Clifden in Ireland. Other flights across this ocean have been made since then, the latest being the solo flight of Miss Amelia Earhart in 13¼ hours; and probably the time is not far distant when such crossings will be regularly established, although a more northward air route may be adopted.

Louis Blériot, the French airman who made the first flight across the English Channel.

Another recent pioneer is the Belgian scientist Professor Piccard, who last year, in a specially designed balloon, penetrated into the atmosphere to a height of 10 miles—a mile higher than had ever been reached before. This was a feat that required extraordinarily careful planning and preparation and, at the last, courage of a high order. It is probable that this ascent will be followed by others, and in this manner we may hope to obtain information about the upper atmosphere that will be of great value to the meteorologist and the weather prophet.

A pioneer of a very different type was Captain Webb, the first to swim across the Channel. At the time he accomplished this feat, 1875, there existed none of our present knowledge of the details of tidal flow in the Channel, and the more efficient modern swimming strokes had not been developed. Webb simply entered the water at Dover and by sheer physical strength and dogged determination swam on and on until his feet touched the shores of France; and nobody succeeded in repeating the feat until 36 years later. Webb's great effort cannot be compared in importance with the Channel flight of Blériot, but I mention it as an example of the kind of pioneer effort that would never have been made if "Safety first" had been considered.

The International Model-Building Contest

The names of prize-winners in the recent International Model-building Contest were published last month, and on page 536 of the present issue appears the first of a series of articles describing and illustrating the most striking of the prize-winning models. The general standard of entries in this Contest was remarkably high, and the subjects chosen covered an astonishingly wide range. The Contest was truly international, models being entered from all parts of the world. Readers will be interested to know that the announcements sent to the successful competitors involved the use of twelve different languages! I was particularly gratified to find that Meccano boys living in isolated and lonely places in distant lands were well represented, and that their work reached a standard quite as high as that of the boys whose homes are in busy towns and cities.

A feature of the entries that quickly attracted my attention was the number of comparatively small models submitted. Whether this was to some extent the result of the series of "Simplicity" Contests that have been announced in the "*M.M.*" from time to time I do not know; but it is certainly true that these small models showed engineering ability of a very high standard, in that every part included was absolutely essential and was used to the best possible advantage. The ingenuity displayed in many of these small models resulted in several cases in their triumph over large and elaborate models containing a vast number of parts, but suffering from the defect that many of them either are entirely unnecessary or have been used in an unmechanical manner.

A Great Canadian Canal

The chain of Great Lakes in North America draining into the St. Lawrence forms one of the world's busiest waterways, and from time to time great engineering works have been carried out in order to improve the canals that have been dug to give easy communication along its whole length. The most recent of these works is the reconstruction of the Welland Ship Canal, through which Great Lake steamers pass across the Niagara Peninsula between Lakes Erie and Ontario. This canal is 25 miles in length and its gigantic locks give far higher lifts than any other similar structures in the world, three of them forming a continuous flight with a lift nearly equal to the height of the neighbouring Niagara Falls. The story of the reconstruction of this wonderful waterway will be told in early issues of the "*M.M.*"

The World's Most Wonderful Trees

I.—Californian and New Zealand Giants

THE oldest and largest living things in the world are to be found among trees, and the most remarkable of these undoubtedly are the giant sequoias of California. Some of these enormous trees are believed to be more than 3,000 years of age, and they are of almost unbelievable size. A small dance hall actually was built on the stump of one that was cut down in the days of the Gold Rush in the middle of last century, and a road has been driven through the lower part of one famous tree known as "*Wawona.*" This road is not a narrow pathway, but is large enough to accommodate ordinary road vehicles, and our cover illustration shows a motor coach passing through the strange tunnel.

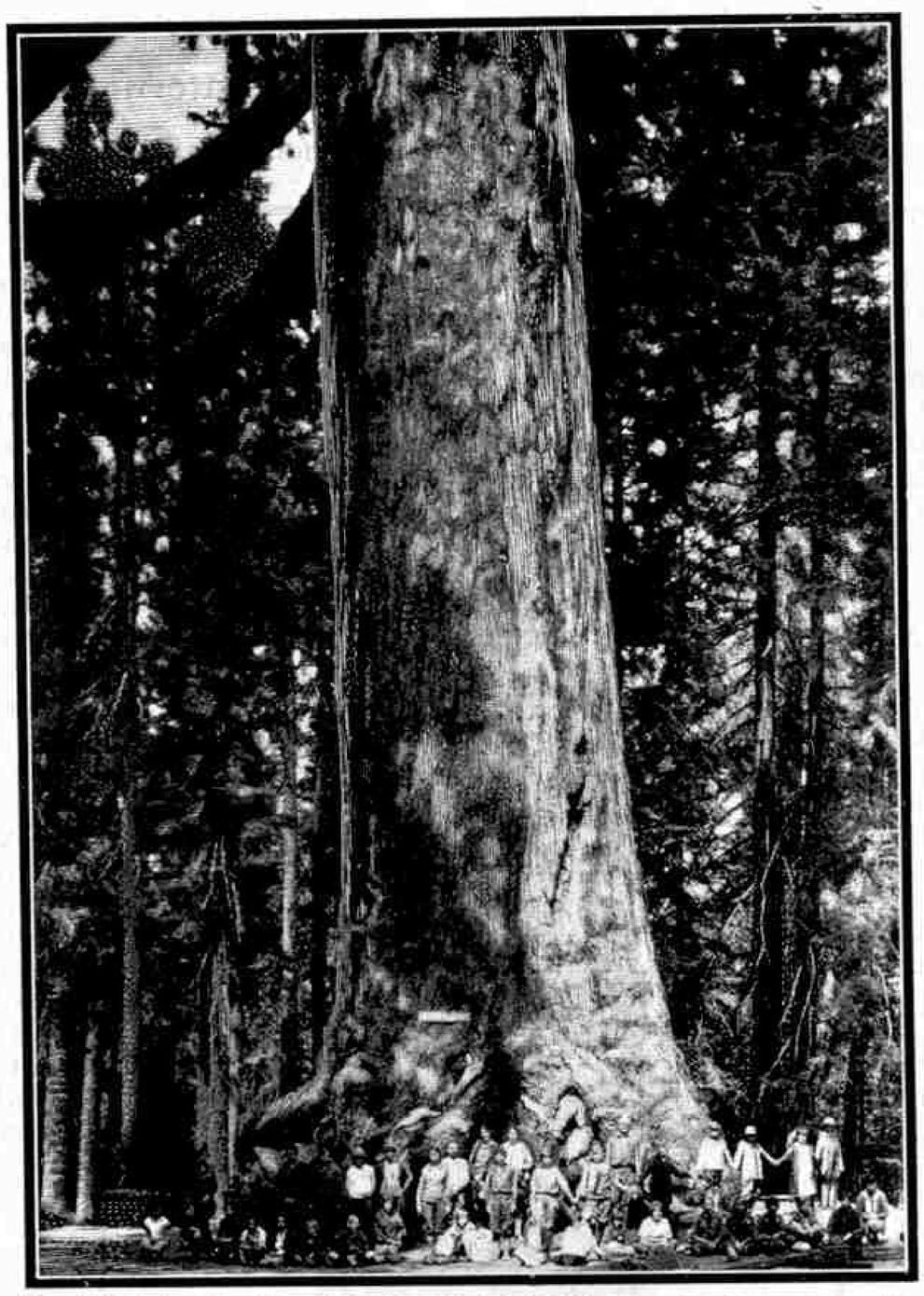
The sequoia is an evergreen conifer and appears to form a link between the firs and the cypresses. Only two species are known. One of these grows in the moist climate of the Pacific coast range, chiefly in California, although it is found as far north as Oregon. It is usually described by lumbermen as the redwood, from the colour of the timber obtained from it. It is remarkable for the straightness of its stem, which may rise to the great height of 340 ft., and the base may have a diameter of from 12 ft. to 15 ft. One peculiarity of the tree is that its lower trunk is bare of branches, and the boughs that spring outward from the upper section are short and irregular. The wood of this tree is useful, for it may be split evenly without difficulty and it takes a good polish, while it also is strong and durable.

The redwoods, enormous as they are, are dwarfed by the trees of the second species of sequoia, appropriately named *sequoia gigantea*, the giant sequoia. This tree grows in groves in the mountainous regions in the east of California, and is found at heights from 4,000 ft. to 5,000 ft. above sea level. The stems of the young trees in these groves shoot straight upward and in course of time may attain a height of 400 ft. or more, while at their bases many of them are more than 30 ft. in diameter, which gives them a girth of more than 100 ft.

The Californian sequoias are remnants of enormous forests that in past ages spread over North America. Formerly they grew also in Europe, and they have a long history, for they flourished in the genial climate of the Age of Reptiles, millions of years ago, when dinosaurs and other long extinct monsters roamed through enormous sequoia forests of which only fossil remains are now known. These fossils have been discovered in France and Great Britain, and even in Spitsbergen, Siberia and Greenland, where the climate now is Arctic. Magnificent fossilised sections of the trunks of sequoias from 6 ft. to 10 ft. in diameter have been discovered also in the Yellowstone National Park. It is curious to find that for many years sequoias were only known in fossil form, and it was not until the famous Californian groves were discovered that the existence of living trees of this species was revealed.

The giant sequoias cannot be described as beautiful, for they do not form symmetrical masses of branches and twigs covered with leaves, but consist of enormous columnar trunks, crowned at the top with scanty foliage carried on short rounded boughs. They grow very close together, however, and are impressive because of their immense size. The bark varies in thickness from 6 in. to 2 ft. and is of a rich red colour. It is heavily channelled, while the wood, which is darker in colour than that of the Coast redwoods, is not of very great value. The trees have attracted the attention of lumbermen, however, and many of the giants have been cut down, while forest fires have damaged others. To-day the most remarkable of them are protected, enormous groves having been included in reservations or parks. One of these reservations is known as the Sequoia National Park, while there are many famous sequioas in a second reservation, named after General Grant, and in the Yosemite National Park.

The first of the giant sequoias to become known were those growing in the Mammoth Grove at Calaveras. This grove contains more than 90 enormous trees and is said to have been discovered in 1852 by a hunter who was in pursuit of a bear. It must have been visited previously, however, for the date 1850 is carved on one of the trees. It was in this grove that a dance hall was built on the stump of a tree cut down in 1853, and many of the trees in it were given names that are recorded on marble slabs and are reminiscent of pioneer times. Other famous trees are to be found in the Mariposa Grove, now included in the Yosemite National Park. These include the "*Grizzly Giant,*" a tree illustrated on this page, 204 ft. in height and 29½ ft. in diameter, and the "*Faithful Couple,*" two gigantic sequoias of the same height that stand very close together, the branches at the tops of their enormous trunks interlacing with each other.



The "Grizzly Giant," a giant sequoia in the Mariposa Grove in Yosemite National Park, California. This wonderful tree is 204 ft. in height and, as our illustration shows, is of immense width.

The age of the sequoias is even more astonishing than their size. It is not a difficult matter to discover how many years they have been growing. If they have been cut down, all that is necessary is to make a careful count of the growth rings shown by their stumps, while the ages of living trees may be found by extracting radial cores with the aid of specially designed boring tools. Such holes are bored beyond the centres of the trees examined in order that the pieces cut out may give complete records of the ring systems. The trees are not harmed by this treatment if care is taken to fill up the cavities, and the holes are usually protected from damp and insects by pushing into them small branches from which the bark has been cut. The trees themselves take part in the healing process, for the crevices usually are quickly filled with sap or pitch.

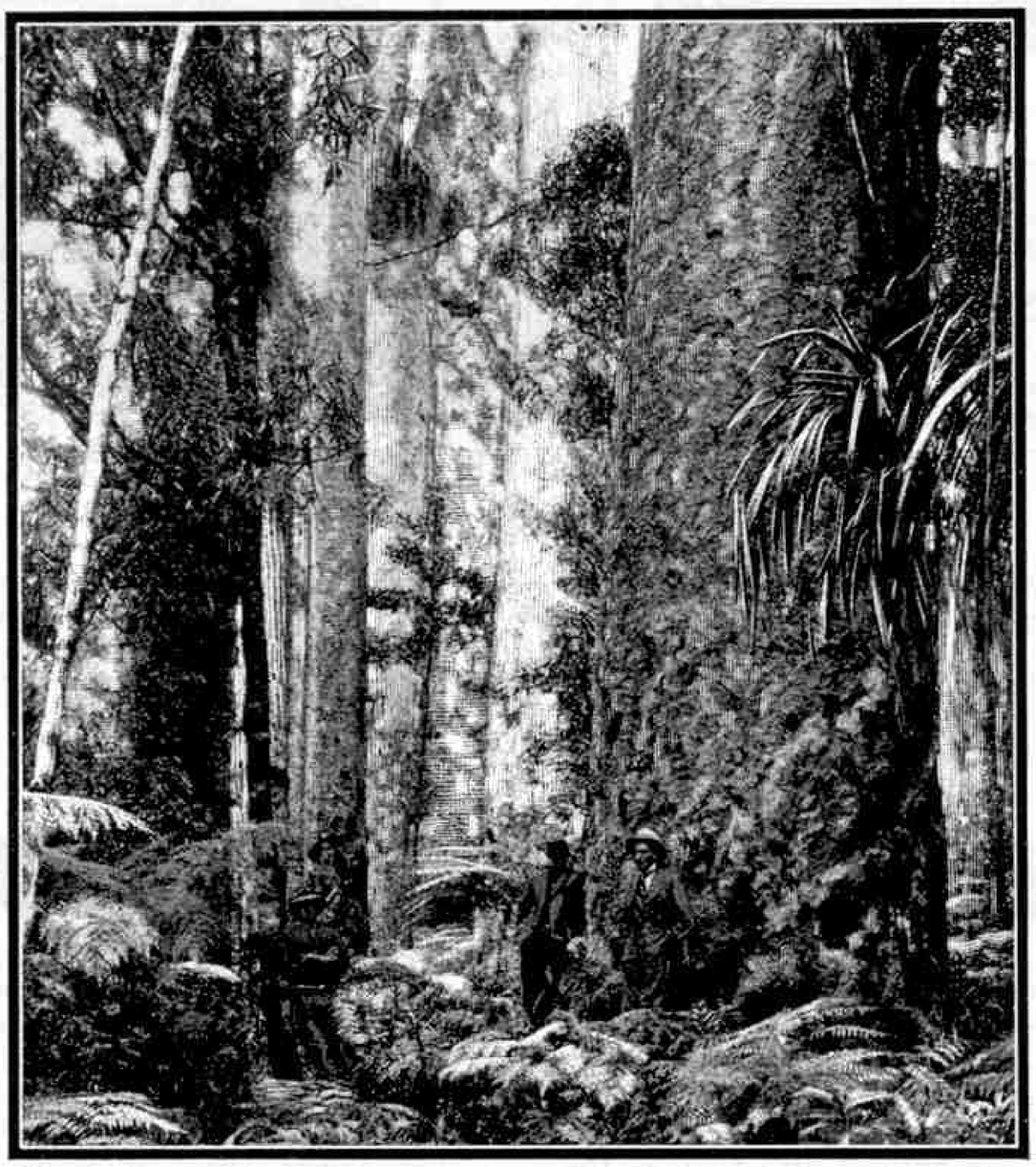
The rings form a surprisingly accurate guide to the growth of a tree, for each represents a year's growth. It is in the spring when the sap begins to flow upward from the roots to the branches, and then large white growth is made rapidly. As the season advances the supply of moisture diminishes, and the cells then formed are smaller, darker in colour and more closely packed. The tree rests in winter and the soft white wood of the following year is built up outside the dark autumn growth, forming a sharp contrast that enables the growth of one season to be distinguished from that of the next. In summers with a plentiful rainfall wide rings are formed, but narrower growths are produced in times of drought, or when low and unfavourable temperatures prevail. Thus the rings of a tree tell us something about the weather that prevailed during their growth, and in a future article we shall explain how this has enabled us to follow changes in the earth's climatic conditions for thousands of years past.

Ring counts of the giant sequoias have led to very remarkable results. The great tree in the Calaveras Grove on which a dance hall was built had about 1,200 to 1,400 rings, showing that it was a sapling between the fifth and seventh centuries of our era, when the Saxons were slowly conquering Britain. This and other enormous trees, varying in age from 1,500 years to 2,000 years, appear to have grown in districts in which there has been a plentiful supply of ground water, for their growth has been continuous and annual rings of fairly large circumference have been added. Other trees have grown in less favourable circumstances. They are found at higher levels, but not at the extreme upper limit of the sequoia groves, for there the winds are too strong to enable any but the strongest trees to survive for many centuries. These trees are not so enormous as those growing in moister soil lower down the slopes, but their age is stupendous and almost unbelievable. For instance, the Grant National Park contains many trees that are considerably more than 2,000 years of age. One famous giant, to which the name of "*General Grant*" has been given, appears to be about 2,500 years old, but the exact length of time during which it has been growing has not yet been settled. It is 35 ft. in diameter and is usually considered to be the largest tree in the world. Formerly a tree discovered in 1879, and named in honour of General Sherman, was believed to possess this distinction. This tree grows in the Sequoia National Park and is 280 ft. in height, its circumference at its base being 102.8 ft.

"*General Grant*" is not the oldest sequoia recorded, however, for three stumps are known that are the remains of trees that were more than 3,000 years of age when they were felled! One of these has a hole in the centre that probably once contained the growth of the first 80 years of the tree's existence. A second stump, in the Grant National Park locality, is more remarkable, for a ring that must have been formed in the year 1,305 B.C. has been traced in it. Even this ring was about an inch from the original centre of the stump, the missing rings probably accounting for a further six years. Thus the tree began its life about 1,311 B.C. and it attained the wonderful age of 3,200 years before it was cut down!

It is astonishing to reflect that this amazing tree began its life about 100 years after the Israelites left Egypt, and before the conquest of Palestine had been completed. It was a sapling when Great Britain was an unknown country, inhabited by men of the Stone Ages, and it was more than 300 years of age when iron first began to be used in this country. It was already a Methuselah, even among sequoias, when the New World was discovered and the first Spanish adventurers began to penetrate from Mexico into California. It is unfortunate that the venerable tree could not impress the lumbermen who cut it down with a knowledge of its age, and of its claim to be the oldest living thing in the world; and it is gratifying to know that the central part of the stump is now carefully preserved in one of the laboratories of the University of Arizona.

Although not so enormous as the sequoia of California, the giant kauri pine of New Zealand resembles it in being a noble tree of which only a few groves remain as representatives of great forests, and in being confined to one locality. At one time a great kauri forest covered practically the whole of the Auckland Peninsula in the North Island of New Zealand, and evidence of its extent may be seen in the logs and stumps that may yet be dug out of the ground there.

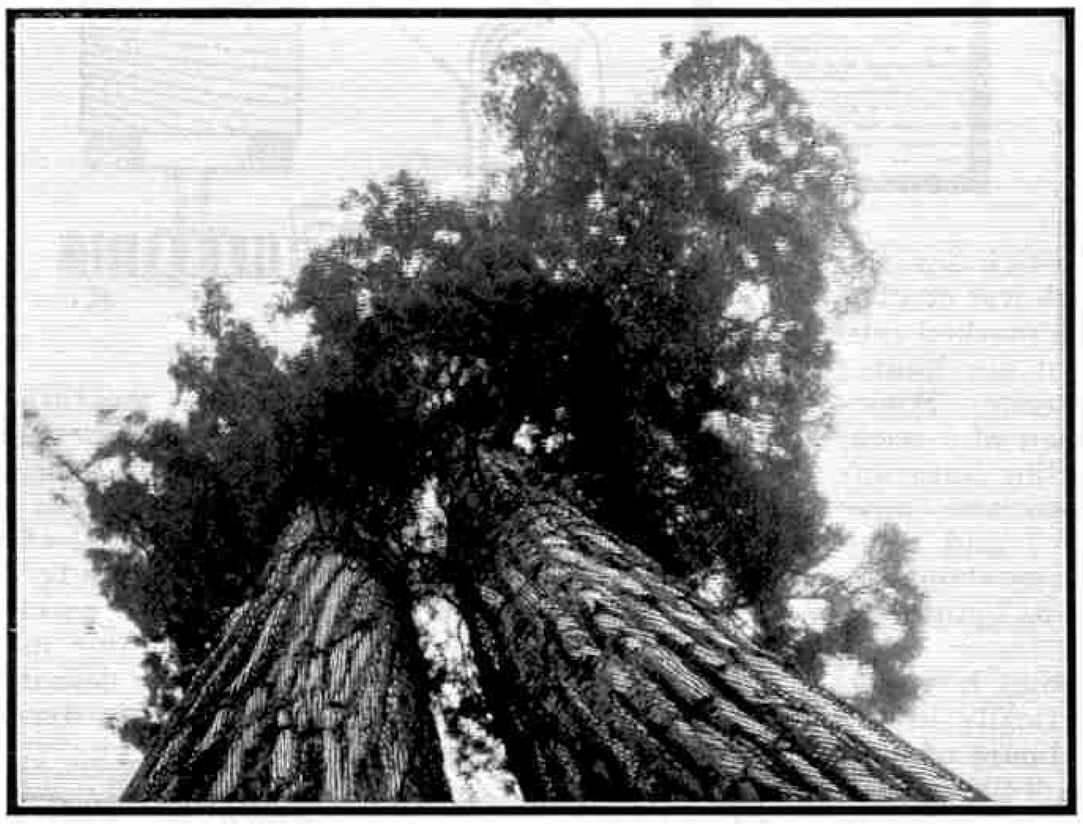


Gigantic kauri pines in Trounson Kauri Park, North Island, New Zealand. We are indebted to the New Zealand Government Publicity Department for this illustration and for interesting information about these remarkable trees.

The kauri pine attains a height of from 120 ft. to 180 ft. and is from 5 ft. to 12 ft. in diameter. The clean straight grain of its wood makes it useful for conversion into ship's masts and spars, and the wood has been largely used also in making deck boards, furniture and paving blocks. The inroads made on the kauri forests last century, when the value of the wood became known, has sadly depleted them.

The giant New Zealand pine is even more remarkable for the splendid resin known as kauri gum that it yields, and this has always been in great demand for use in the manufacture of certain varnishes and lacquers. The gum is so valuable that for many years hundreds of men were engaged in digging for it in the swampy ground in the Auckland Peninsula, where once the kauri pine flourished, for in a fossilised state the resin may be found in the ground wherever this tree has grown. Very large quantities of buried gum have been unearthed, and digging is still carried on to a certain extent, in spite of the slump in the market that has followed on the world wide depression in trade.

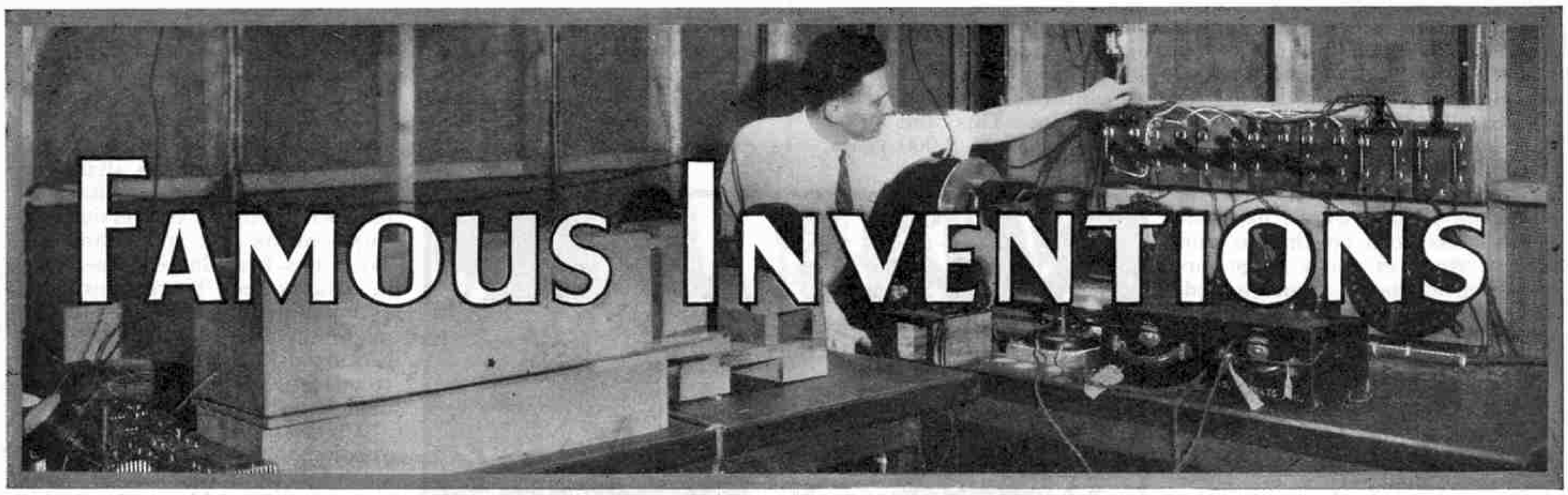
As in the case of the giant sequoia, the original forests of kauri pine have vanished. The trees may have been overthrown by heavy winds, destroyed by fire, or buried under ash and scoria thrown out in volcanic eruptions. The highly resinous nature of its wood makes the kauri pine very inflammable and fire is the most serious hazard to be faced in preserving it. Young trees are now springing up in many parts of the Auckland Peninsula, but the prevalence of fires started by gum diggers and others in efforts to clear rapidly growing scrub from the ground has the effect of making their chances of attaining maturity very slender.



Looking up at "The Faithful Couple," two giant sequoias growing side by side in the Yosemite National Park, California.

Fortunately the need for conserving the remaining growths of this splendid tree has become increasingly apparent, and to-day large areas have been set aside as permanent reserves, or national parks, in which this magnificent tree may still be seen in its natural surroundings. The most notable of these reserves is the Waipoua forest, situated near Hokianga Harbour in the far north of New Zealand. The splendid specimens of the kauri pine to be seen there include one enormous tree the trunk of which is 45 ft. in circumference and rises to a height of 100 ft. before throwing out a branch, forming a beautiful column containing sufficient timber for the building of several houses. Other trees in these forests are almost equally impressive, and it is an inspiring experience to stand in the centre of a great grove containing 30 or more huge columnar trunks overshadowed by their masses of olive-green foliage, through which stray patches of sunlight filter to light up the blue grey bark.

Trounson Kauri Park contains another fine stand of these great trees, the area in which they are growing having been presented to the Government and made into a permanent reserve. It is well that these two forests have been preserved, for the last commercial stands of kauri timber have been practically exhausted and very little kauri is being cut or milled at the present time.



XXXII.—EARLY TIME-MEASURING DEVICES

TIME is an illusion of our senses, but it is an illusion that we are obliged to take count of in our everyday life, and to try to measure it. The clocks and watches with which we are so familiar are the outcome of man's efforts to measure time accurately, and their invention is part of the wonderful story that lies behind the measuring of time throughout the ages.

Primitive man may have gained his first idea of time when he began to take notice of the changed positions of the Sun by day and the Moon by night. Gradually he evolved a method of measuring time approximately, and he divided it into "years" according to the apparent motion of the Sun among the stars; into "months" by the revolution of the Moon around the Earth; and into "days" by the alternate light and darkness caused by the rising and setting of the Sun. He noticed also that as the Sun moves through the sky the position of shadows caused by it continually change, and he divided the day, the period of daylight, into parts by placing stones or pieces of wood at different points in the path of a moving shadow. By this means he was able to measure the passage of time, principally with a view to obtaining a more accurate idea as to when to expect darkness to descend upon the land.

These simple methods of measuring time sufficed until about 4,000 years ago. The ancient Babylonians are believed to have been the first to advance time-measuring a stage further, by substituting a vertical stick for the stone placed on the ground. The stick was erected in the centre of a smooth flat surface marked into divisions that were the equivalent of our hours; and thus the sun-dial came into existence. Sometimes a stone column was used instead of a stick, and the flat surface bearing the dividing lines was correspondingly larger. Some historians have suggested that "Cleopatra's Needle" and other huge obelisks erected by the Egyptians about the 15th century B.C. may have served as giant sun-dials as well as memorials.

It is only at the North and South poles, however, that a shadow from a stick set vertically in the ground will indicate accurately the hours of daylight. In lower latitudes the position of the shadow of a stick placed in this way varies according to the season of the year owing to the Sun rising farther north until midsummer and from then more to the south until midwinter. It was a long time before this defect of the early sun-dial was discovered, and the ancient Greeks are credited with having introduced the first accurate sun-dial. In this device the stick or pointer was set parallel to the axis of the Earth and pointed to the North star, for the position of the shadow of a pointer inclined at this angle does not vary with the changing path of the Sun, and therefore the shadow accurately indicates the passing of the hours marked upon the "dial," as the Greeks named the flat surface bearing the dividing lines. The Greeks called the pointer of the sun-dial the "Gnomon," a word that means "one who knows." Examples of this improved type of sun-dial are still to be seen in old churches and gardens.

Other types of sun-dials were invented, and it is of interest to note that the earliest authentic reference to a sun-dial is thought to concern one of the less familiar types. This reference is found in the Bible, where in Isaiah, Chap. 38, v. 8, we read of the "sun-dial of Ahaz." It is worth while to recall briefly the circumstances of this reference. Hezekiah, King of Judah, was sick, and was feeling too pessimistic to believe Isaiah's prophecy that he would recover. The prophet then caused the shadow on the sun-dial of Ahaz to move back 10 degrees as a sign from heaven of the truth of his prophecy. Mr. H. C. Brearley, in his interesting book "*Time Telling Through the Ages*," states that this sun-dial was "probably a curved flight of steps rising like the side of a huge bowl at one end of the palace courtyard, with either a shadow cast by a pointer overhead or a beam of light admitted through an opening."

A primitive shadow clock from Egypt. The position of the shadow cast on the beam by the short crossbar varied as the Sun passed overhead during the day. This photograph and the one on the right of the opposite page are reproduced by courtesy of the Board of Education.

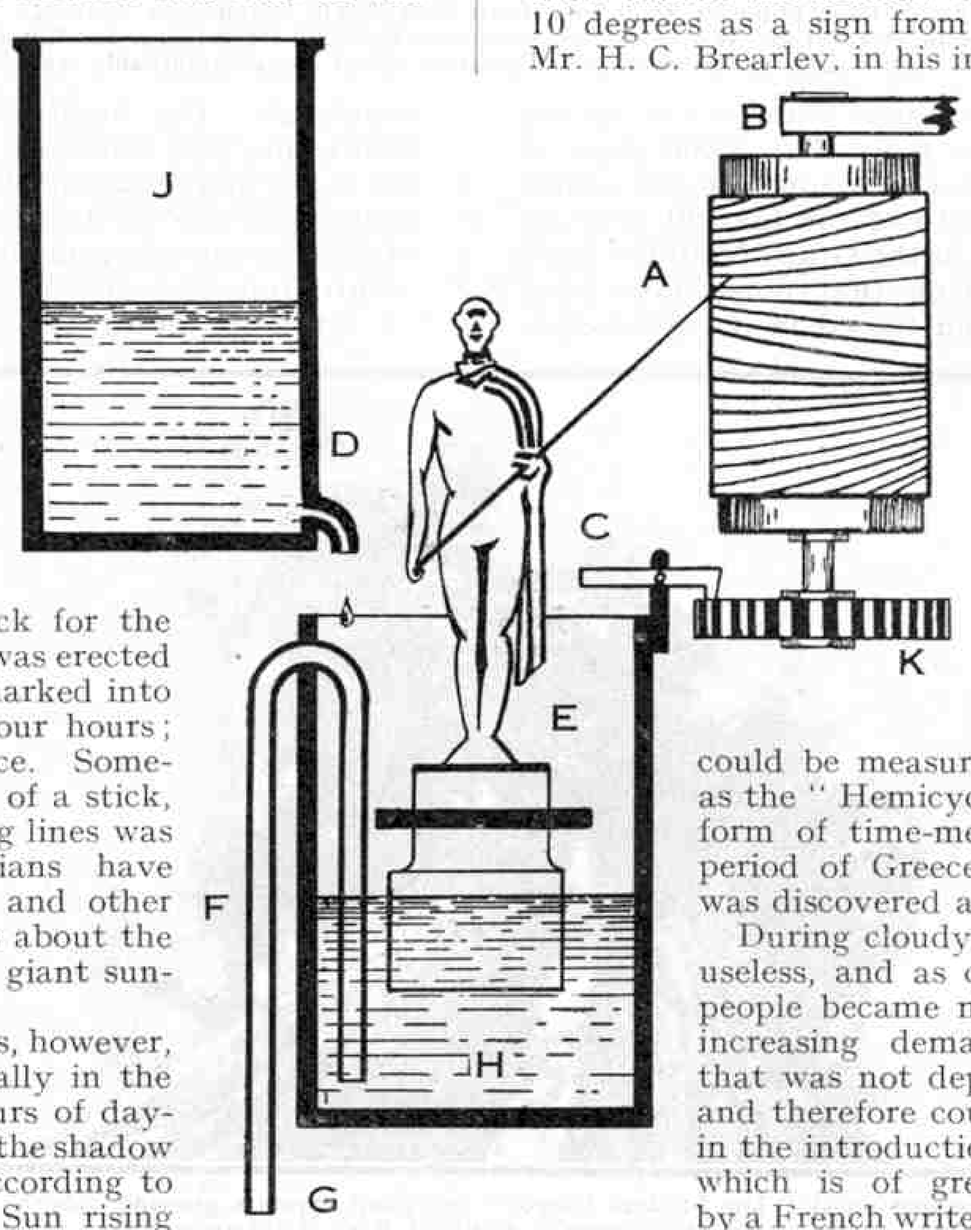


Diagram illustrating the working of a type of Water-Clock used in ancient Greece and Rome.

Another form of sun-dial was invented by Berosus, a Chaldean priest and historian who lived about 250 B.C. The dial of this device was shaped like a basin, and a shadow was cast into it by a small ball at the end of a pointer that projected horizontally over the dial. Lines similar to the lines of longitude on a map were drawn in this hollow dial, and as the shadow moved across these lines, the passage of time could be measured. This form of sun-dial was known as the "Hemicycle of Berosus," and was a very popular form of time-measuring instrument during the classic period of Greece and Rome. A sun-dial of this kind was discovered at Pompeii in 1762.

During cloudy weather and in the night sun-dials are useless, and as civilisation spread and the lives of the people became more ordered and regular there was an increasing demand for some time-measuring device that was not dependent on the appearance of the Sun, and therefore could be used at all times. This resulted in the introduction of the "Clepsydra" or Water-Clock, which is of great antiquity. Old documents found by a French writer give the origin of water-clocks as China, 2679 B.C. This statement lacks confirmation, but it is fairly certain that water-clocks were in use in that country in the 10th century B.C. The Egyptians also have been credited with this invention, and from old models discovered and from references in ancient documents we know that water-clocks were used by the Greeks and also by the Indian tribes of America. Julius Cæsar, when he invaded Britain in 55 B.C., found water-clocks in use among the natives, and with these clocks is said to have observed that the summer nights

in Britain were shorter than those in Italy.

In its original form the water-clock consisted of a vessel filled with water, which was allowed to escape slowly through a small hole; and by noting how far the level of the water had fallen the interval of time that had passed since the vessel was filled was determined. Water-clocks were subsequently improved, and in a later form the water dripped into a second vessel in which a wooden figure was placed. As the level of the water rose in this vessel, the wooden figure floated higher and higher, and the intervals of time were thus more easily noted. Soon afterwards hour symbols were painted on the inside of the second vessel, and a figure with an outstretched arm was used as a float. As the figure rose, the outstretched arm pointed to the hour on the inner side of the vessel, ultimately resulting in the hour-hand of our present-day clocks.

In ancient Egypt the hours were always equal, a summer day containing more hours than a winter one; but in ancient Greece and Rome the day was always divided into 12 hours irrespective of its length, so that the hours grew longer as the days lengthened and shrank as the days grew shorter again. The hour symbols painted on the Greek and Roman water-clocks therefore had to take into account this day-to-day alteration in the duration of the hours. The difficulty was overcome by incorporating in the water-clock a drum that completed one revolution a year, and on which a separate scale or division was provided for every day of the year. On the portion of the drum corresponding to the summer, for instance, each day hour would be equivalent to about 70 minutes, and each night hour to about 50 minutes. On the winter quarter of the drum these proportions would be reversed.

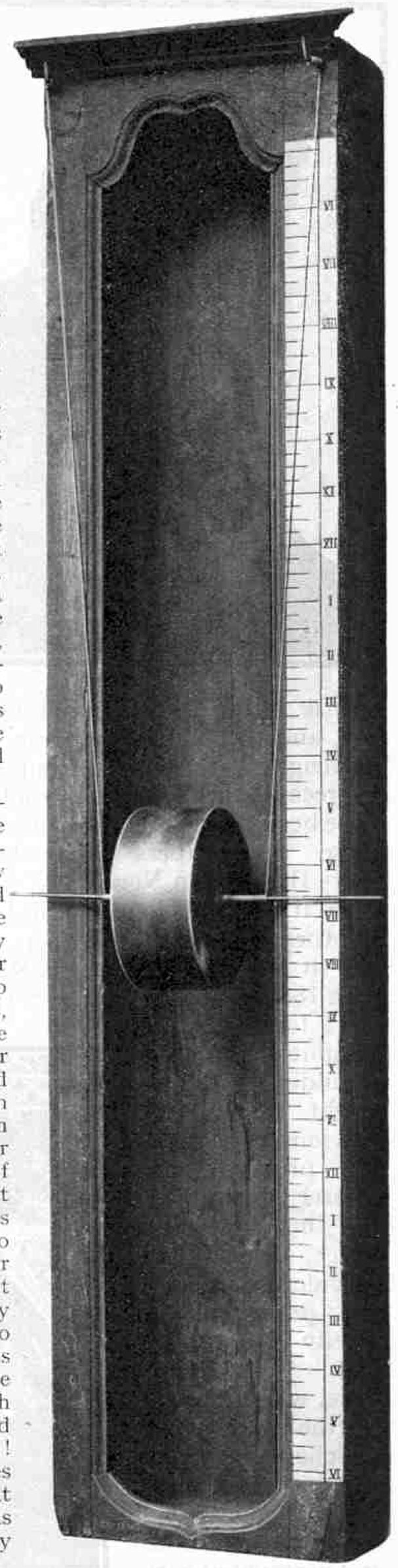
The accompanying diagram illustrates a water-clock of this type. The vessel J was filled with water that flowed through the outlet D into the lower vessel H, in which was a float E bearing a figure made of thin copper and equipped with a wand. As the quantity of water in the lower vessel increased, the float rose and the wand A moved upward over the grooves on the drum B. By the end of the day the figure had risen to the top and pushed forward one tooth the lever C, driving the cog wheel K, which contained 365 teeth. At the same time the syphon F quickly emptied the lower vessel of water, which passed out by the pipe G. This withdrawal of the water caused the figure to fall to the bottom of the vessel, where it was ready to rise and measure the time of another day. The only attention that the clock required was the daily renewal of the water supply in the upper vessel.

Candle with hour divisions marked down the side.

In another type of water-clock a dial similar to a clock face was placed over the vessel containing the water. On the water floated a piece of wood attached to which was a string running over a wheel connected to the hand on the dial. The water was allowed to drip from the vessel so that it took exactly a day to empty. As the floating wood sank lower and lower the string pulled the hand around the dial which had 24 figures. The device could only record the hours, however, because it had only one hand.

A considerable amount of skill was exercised in the construction of these water-clocks, as is evident from models to be seen in many of our museums. Some of these models are of very beautiful and clever craftsmanship, and not only tell the time but carry out interesting performances at each hour. A wonderful example of a water-clock was made in Gaza, about the sixth century A.D. In this clock there were 12 eagles made of bronze, each holding a crown. At each hour an allegorical figure representing the Sun gave a signal, and Hercules emerged from the interior of the clock and was crowned by one of the eagles, each of which represented one of his great deeds. Another curious water-clock, in brass, was that sent in the year 800 by the famous Persian caliph Harun-al-Raschid to the Emperor Charlemagne. The dial of this clock had 12 small doors, which opened at the hours that they represented and allowed little balls, the number of which equalled the particular hour, to fall out and strike the time upon a brass bell. Then 12 little knights mounted on horseback emerged one from each door and having paraded round the dial re-entered it, closing the doors after them as they marched back.

A type of water-clock that was introduced about the middle of the 17th century, and indicates hours of equal length, is shown in one of the illustrations on this page. This clock consists of a closed metal cylinder or drum suspended from a stand by two cords attached to a horizontal axle that projects from the flat ends of the drum. The drum contains a small quantity of water, and a number of partitions passing from its circumference tangentially to an imaginary circle of about one-third the diameter of the drum. When the drum is wound up, the cords are wrapped round and round the axle, and the water falls over the inner and open edges of the partitions into the lowest part of the drum. The weight of the drum then tends to make it descend, while the weight of the water in the bottom part opposes this motion which would, in the first place, involve raising this water to a higher level. Owing to the partitions being perforated, however, water can pass gradually from one chamber to another, and the drum descends slowly, the position of the axle indicating the time on a vertical scale.



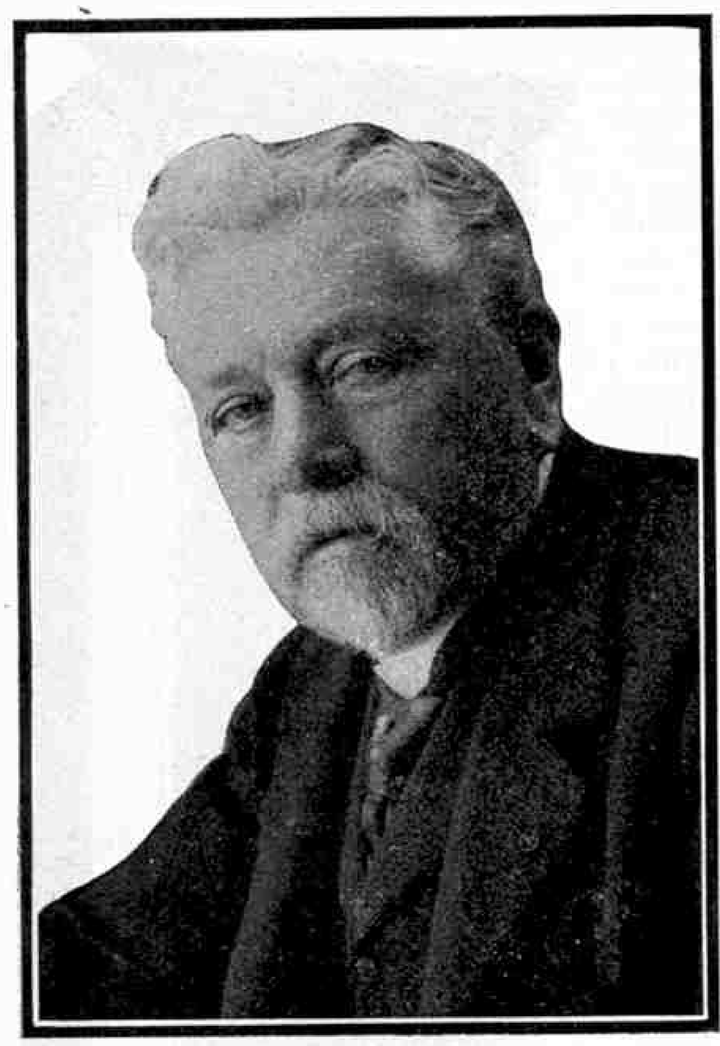
A 17th century Water-Clock.

About the year 330 A.D. sand-glasses were introduced. These were glass vessels shaped something like a figure 8, the narrow waist of which allowed the sand placed in the top half of the glass to run through grain by grain. It required an hour for the sand to pass from the top to the lower half of the glass, after which the glass had to be reversed, so that the next hour could be measured by the sand running back again. Although it was not difficult to ascertain roughly how much of the hour had gone by the quantity of sand that had fallen, the great disadvantage of sand-glasses was that people often forgot to turn them back after the hour was run, and so lost the correct time. Then again, unless they were continually attended to during the night, the time was lost and the hours could only be counted from the time at which the owner of the glass awakened and started off the sand-glass! Because of these disadvantages it is not surprising to learn that sand-glasses were not in use as regular timekeepers for very long.

Less responsible uses have served to keep sand-glasses in existence until the present time. Early in the 16th century they were introduced into churches to enable long-winded preachers to limit their sermons to one hour. Some preachers even used smaller sand-glasses in which the sand took only half-an-hour to pass to the lower portion of the glass. The use of sand-glasses for this purpose ceased about 1650. To-day they are used to measure the time required to boil an egg.

Another early method of measuring time was by burning long candles, made to burn for a certain number of hours and having divisions marked down their sides, each representing an hour. These candle clocks were in use at the time of Alfred the Great.

Sun-dials, water-clocks, sand-glasses and candles were useful for a time, but none of them solved the problem of accurately measuring time. This did not become an accomplished fact until the invention of the weight-driven wheel clock; and in the next article in this series we shall tell the story of this invention and of its development into the efficient clock of to-day.



Gustave Eiffel and His Great Tower

A Great Pioneer Engineering Work

FROM very early times structures of huge dimensions have exercised a great fascination over builders of all nations. The Colossus of Rhodes, a bronze statue 105 ft. in height, erected over 2,000 years ago, and the pyramids of Egypt, one of which is 484 ft. in height, are good examples of ancient structures. In recent times many structures of enormous height have been erected, notably in the United States. Among these "skyscrapers" may be mentioned the Empire State Building in New York, which reaches to a height of 1,250 ft., and is the highest structure in the world. Another notable skyscraper is the Chrysler Building, also in New York, which is 809 ft. in height.

In 1886 a French engineer, Gustave Eiffel, proposed to erect for the Paris Exhibition of 1889 a building of greater height than any previous structure. His proposal was severely criticised, and many prominent engineers ridiculed the idea and predicted the speedy collapse of such a structure. Eiffel was confident of the success of his scheme, however, and in spite of all opposition he commenced operations and persevered with his task. In two years his great Tower was completed in the Champ de Mars, where it stands to-day, one of the highest structures in the world.

A view through the arch beneath the first platform. The photograph gives a good idea of the great width of the tower at the base.

Alexandre Gustave Eiffel was born at Dijon on 15th December, 1832. From his early boyhood he was determined to become an engineer, and he was so successful at school in subjects connected with mathematical or engineering matters that he was placed as a student in the Paris School of Arts and Crafts. Here he qualified as an engineer, and while quite a young man was appointed to superintend the construction of an iron bridge over the River Garonne at Bordeaux. In 1868 he established his own engineering works, and from that time his name became closely associated with striking engineering achievements all over the world. Among these may be mentioned the famous Garabit Viaduct that crosses the Truyère at Cantal at a height of nearly 400 ft.; the great bridge over the River Douro at Oporto, and the movable dome of the observatory at Nice.

For many years Eiffel concentrated upon the study of the combined effects of iron columns and cross ties. After a good deal of experience in connection with metal bridges he undertook successfully the building of the framework of the huge Statue of Liberty in New York Harbour in 1884; five years later he became world famous as the designer and constructor of the Tower that bears his name.

In erecting this huge structure Eiffel's first task was to secure foundations capable of supporting the enormous weight of the tower, 6,500 tons. This was accomplished by building four trellis work piers, and work on the foundation of these was commenced early in 1887. The two piers farthest from the river Seine presented comparatively little difficulty, as a thick layer of gravel was found at a depth of 16½ ft., the ordinary water level of the river. The other two piers gave more trouble, however, as their foundation had to be taken down twice this depth in order to reach the gravel. The masonry foundations were laid on concrete, and the four uprights of each of the four pedestals were secured to the masonry by anchor bolts. In order to counteract any possible displacement of these bolts, a hydraulic press was inserted in each of the four feet of the structure.

The Tower itself was built of a series of main ribs braced together by elaborate trellis work. As far as possible the various parts of the structure were finished in the workshops and hoisted to their final positions by cranes, leaving only the junctions to be completed.

About 7,000 tons of ironwork and two-and-a-half million rivets were used in this work. When the Tower had reached a height of 720 ft. it was carefully tested for verticality and was found to be absolutely correct. The total cost of the Tower was £260,000, of which the State contributed £60,000. On completion of the great work Eiffel was made an officer of the famous Legion of Honour.

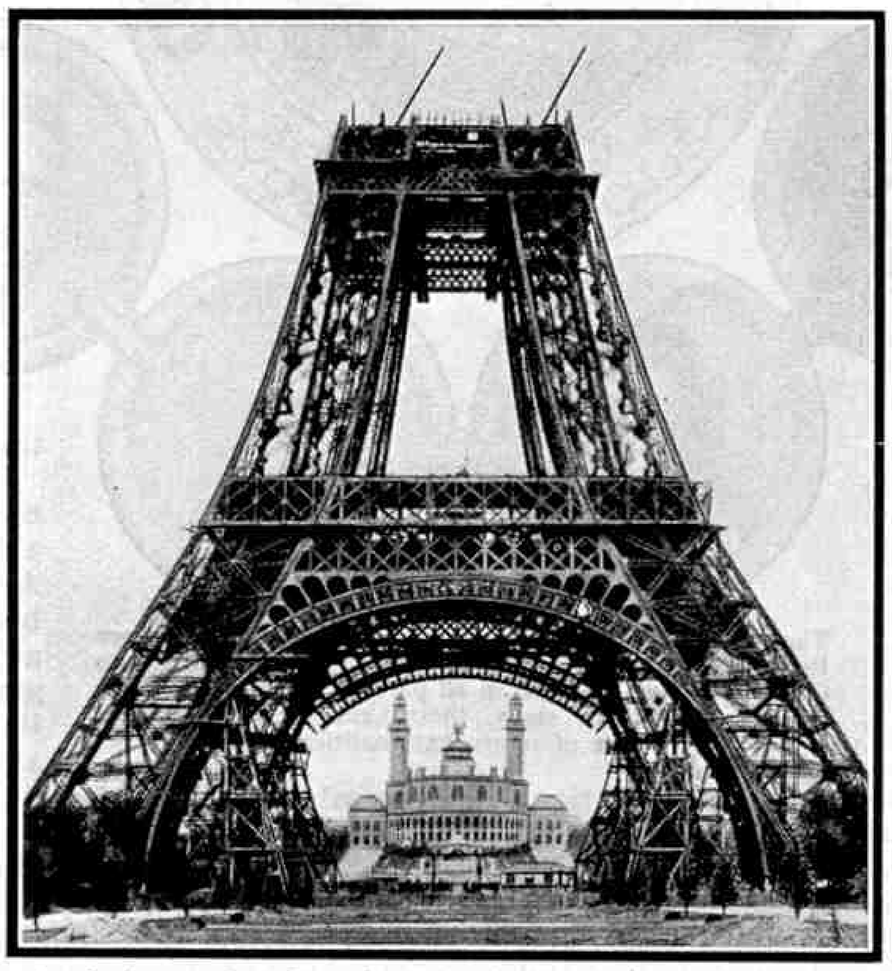
The total height of the Tower is 984 ft. from the ground, or 1,094 ft. above sea level. The first platform is 189 ft. up—only 27 ft. lower than the towers of the Cathedral of Notre Dame, Paris. The second platform is 380 ft. up and the actual tower that rises from this second platform is 526 ft. in height, finishing at the third platform at a height of 906 ft. The campanile and lantern above the third platform bring the structure to its full height of 984 ft.—more than twice the height of the dome of St. Paul's Cathedral. Blackpool Tower, which will be familiar to many thousands of *"M.M."* readers, appears gigantic when one is anywhere near it, and yet it is only 500 ft. in height, scarcely more than half the height of the Eiffel Tower!

An early stage in the erection of one of the massive piers.

The various platforms of the Eiffel Tower can be reached either by electric lifts or by a stairway. A lift is accommodated in each of the four main piers; two of them run to the first platform and the other two continue to the second. A further pair of lifts run between the second and third platforms, one lift operating over the first half of the distance, and the other over the second half. A spiral stairway that is not open to the public extends from the third platform to the top of the Tower.

The Tower has always been very popular with sightseers on account of the wonderful view of Paris and its surroundings that can be obtained from the upper gallery, and on a clear day it is possible to see for a distance of about 85 miles. During the Exhibition of 1889 tens of thousands of visitors took a trip to the top of the Tower to enjoy this view. On this occasion the Tower proved a great commercial success, but later it was found to be unprofitable, and eventually it was taken over by the municipal authorities of Paris, partly with the idea of using it as a scientific observatory. At various times spectacular feats have been staged from the Tower, and these have included climbing to the top by means of a rope and cycling from the highest platform to the ground.

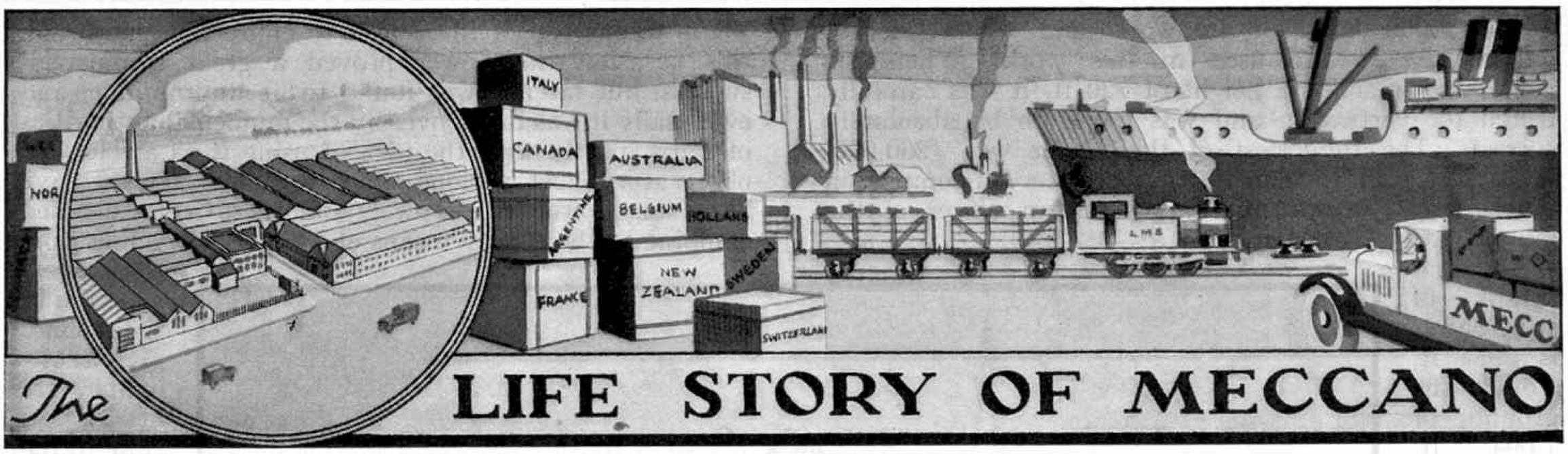
Searchlights are mounted close to the top of the Eiffel Tower, which during the War proved of the greatest value as an anti-aircraft observation post, enabling warnings to be sounded on the approach of Zeppelins and Gothas. Also it has for many years been one of the most powerful radio stations in the world. Many Meccano wireless amateurs are familiar with the well-known call sign of the Eiffel Tower, "FL." Speaking of the Eiffel Tower in this connection, the late General Ferrie, Inspector of the French Military Telegraphs, said that "FL." served so many important scientific and military purposes that if such a tower had not already existed it would have been necessary to build one.



A photograph taken in July 1888, when construction had progressed to the second platform.

Eiffel was always extremely proud of his achievement, and the success of his original plans must have been a source of great satisfaction to him. Until the time of his death, in December 1923, he maintained a flat on the third floor of the tower. There, 906 ft. above the ground, the great engineer would retire to his comfortable room to think in quietness of the past and plan out new schemes for the future. A memorial to Eiffel has been erected at the foot of the north pier of the tower and was unveiled on the 29th April, 1929. The memorial consists of a bust of him mounted on a huge granite pedestal.

Painting the Eiffel Tower to protect the ironwork is a very big task. The last painting was carried out in 1924 and 30 tons of paint were used, while the work occupied 100 men for a total period of 4,000 hours.



The LIFE STORY OF MECCANO

VII.—By Frank Hornby

WHEN a boy takes up a hobby, whatever it may be, he feels a desire to meet other boys who have interests similar to his own, and to compare notes and talk things over with them. This is particularly the case with Meccano. No Meccano boy is content to play a "lone hand" for long; he soon wants to meet other Meccano boys, to see their models and to show them his own, and to discuss plans and schemes for other and bigger models.

It is more than 20 years since Meccano began to take its place as the greatest of all hobbies, and even in those early days Meccano boys were forming themselves into little clubs and societies. Presently we at Meccano Headquarters began to receive letters asking us to set up some form of central organisation to which all the individual clubs and societies might look for guidance and that would weld them all into one great body. We realised that the desire for a central organisation was genuine and widespread and felt it our duty to do everything we could to satisfy this great demand.

It was in this manner that the Meccano Guild, the most remarkable brotherhood of boys in the world, came into being in 1919, and the announcement of its formation was received with the utmost enthusiasm throughout the great army of Meccano boys of all nations, and applications for membership began to pour in immediately in large numbers. To-day there is scarcely a civilised country in the world where members of the Guild cannot be found. More than 100,000 boys in every corner of the globe have undertaken to do their utmost to fulfil the chief aims of the Guild, and its constitution has caused it to be described as a "Junior League of Nations." With members of the Guild enthusiasm for their common hobby acts as a bond of union, and there is no doubt that the effect of the Guild on the actions of future generations will go far towards justifying this description.

We have been asked repeatedly why we chose the name "Guild" for the great Meccano organisation. The answer is that we wished our movement to be based upon the splendid ideals and traditions of the old Guilds—good fellowship and comradeship, and unselfish working for mutual benefit. The old Guilds are dead, but the spirit that animated them is as much alive to-day as ever, and we believe that that spirit animates the members of the Meccano Guild. So long as its members remain true to these ideals the Meccano Guild will live and prosper and become an ever-widening influence in the world of modern boyhood.

The three objects of the Guild, set forth in the form of application for membership, are as follows:—(1) To make every boy's life brighter and happier. (2) To foster clean mindedness, truthfulness, ambition and initiative in boys. (3) To encourage boys in the pursuit of their studies and hobbies, and especially in the development of their knowledge of mechanical and engineering principles.

In order to join the Meccano Guild it is necessary for the form of application to be filled up, signed and witnessed. This form is then sent to the Secretary with a remittance of 7d. (1/- Overseas) to pay for a badge. The applicant is then duly enrolled as a member of the Guild and his badge and membership certificate are sent to him. The neat little triangular badge—its three corners representing the three objects of the Guild—and the handsome certificate are always received with enthusiasm.

The Guild originated for the benefit of Meccano Clubs, and to-day there are more than 400 of these organisations. Their world-wide distribution is remarkable. Strong and flourishing clubs exist not only in Great Britain, but also in the great Dominions, such as Canada, Australia, and New Zealand; and the movement is particularly strong in the Union of South Africa. It is not confined to boys of British race living within the boundaries of the Empire, for in addition the youth of India and Singapore have been wholeheartedly welcomed into this world-wide brotherhood.

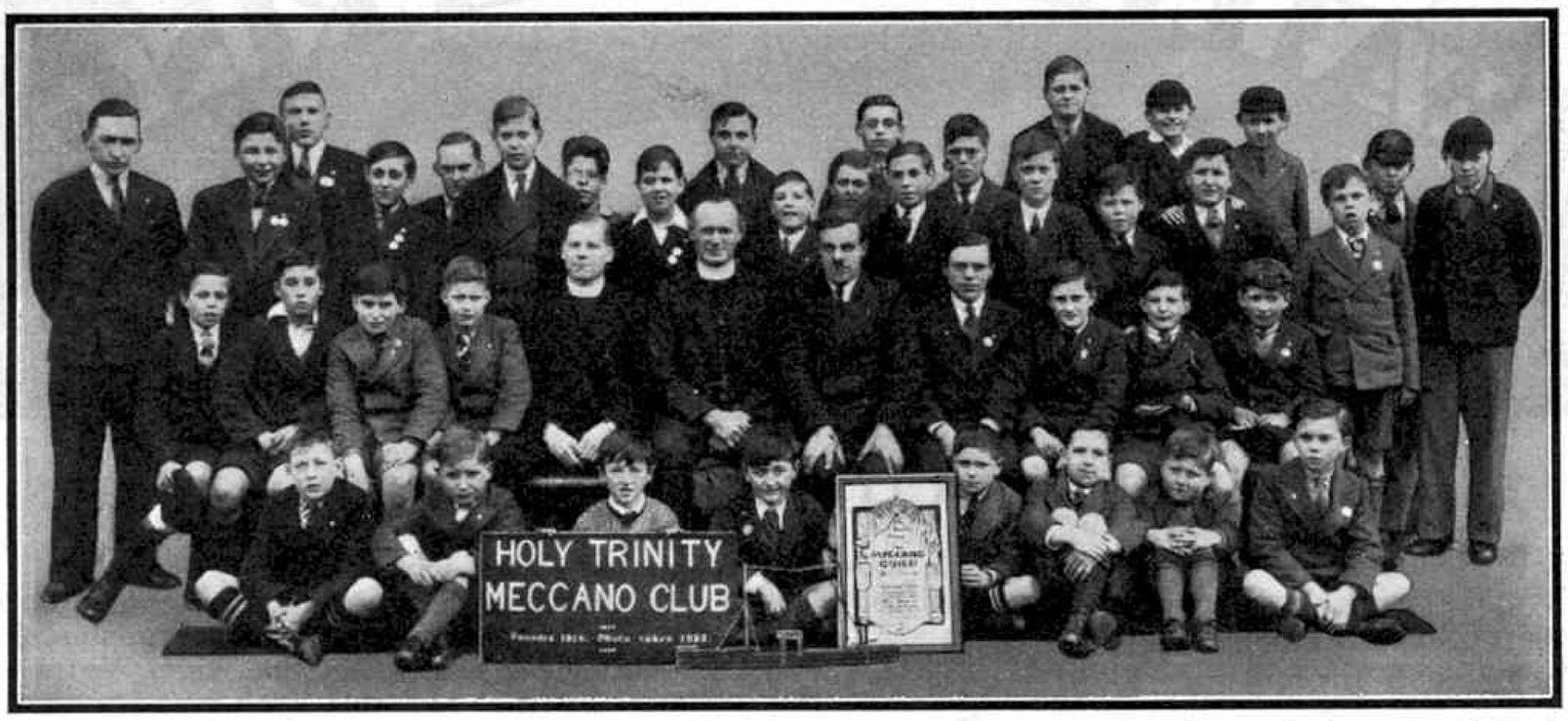
The Meccano Guild is the common bond that unites more than 100,000 members. More than 400 strong Meccano Clubs have been founded in all parts of the world, and as the above portraits show, their Leaders and members are of many nationalities.

The Meccano Guild has spread northward to Iceland, eastward to China and Japan, and westward to the Pacific Coast of America. It recognises no international boundaries, and the boys of other nations are as keen to unite in order to derive the greatest enjoyment from their hobby as are the boys of British nationality. Many affiliated clubs having large numbers of members exist in Egypt. In France and Belgium the Guild has been specially successful and in those countries a large number of clubs are firmly established. Italy, Holland, Switzerland and Spain all add support to the movement; and recently considerable progress has been made in Northern Europe, the Guild having obtained many recruits in Norway, Sweden and Denmark, where promising clubs also have been established.

Across the Atlantic Ocean, the youth of the two Americas have learned to appreciate the spirit that animates the Guild. In South America in particular great progress is being made, and it has become necessary to print all Guild literature in Spanish. How rapidly the Meccano Guild is gaining ground in South America is shown by the fact that a Spanish edition of the "*Meccano*

Magazine"—the official organ of the Meccano Guild—has been introduced and is proving remarkably successful.

The organisers of the Guild have not overlooked the "lone" members. In many cases these live far away from the headquarters of a Meccano Club and often at a great distance from any other Meccano boy. For these members a Guild Correspondence Club has been formed, and this places boys living in the remotest parts of the world in touch with others of similar interests. The Guild Correspondence Club has brought into being many thousands of friendships that have endured for years. In the majority of cases the correspondents have never met, and it is unlikely that they will ever do so; but in a considerable number of instances holiday visits have been paid by members to each other's homes, and personal and enduring friendships have sprung up.



A group of members of the Holy Trinity (Barnsbury) M.C. This London club has the honour of being the first to be affiliated with the Guild, and is one of the most progressive Meccano clubs in the world.

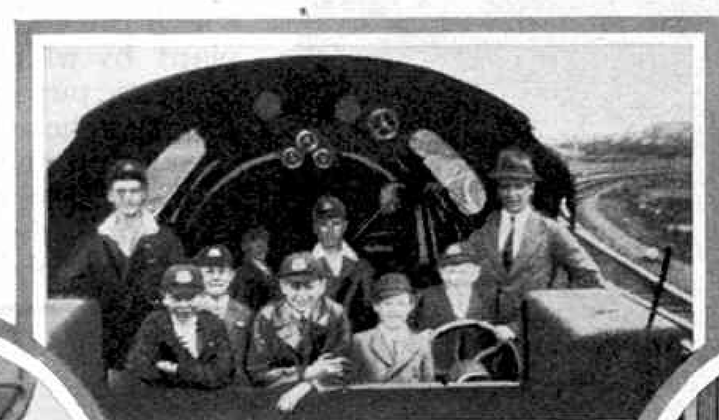
Many striking tributes have been paid by prominent people to the value of the Meccano Guild and clubs, and in this connection we are specially proud of the words of the Earl of Athlone, formerly Governor-General of South Africa. In opening an exhibition of models organised by the Association of the Peninsula Meccano Clubs at Capetown, the Earl of Athlone said;—

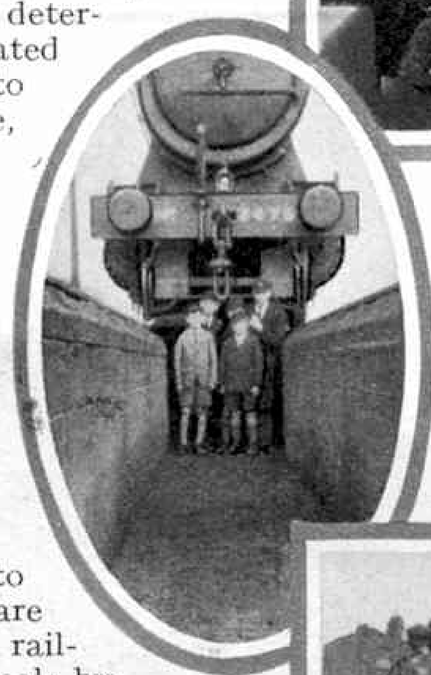
"We all want to acquire habits and qualities that will help ourselves and our fellow men—qualities such as perseverance, accuracy, conscientious method, interest and initiative. These are only some of the qualities that membership of this club helps to develop. Interest, I think, is one of the most important, for men and women who are consistently bored and without enthusiasms are not only a nuisance to themselves but to the world at large. No exhibitor who has shown himself capable of the painstaking work, intelligent curiosity, and determination to make good, indicated in the models, would be likely to fail in interest, or perseverance, or conscientious method in any walk of life."

Last month we described the origin and development of the Hornby Railway system. Soon after this system became thoroughly established there came about a repetition of what had occurred with Meccano. Hornby Railway owners were not satisfied to run their railways alone; they wished to meet other enthusiasts to compare notes and to carry out model railway operations on a bigger scale by combining their railway material. In this manner the demand arose for an organisation on similar lines to the Meccano Guild, but devoted primarily to Hornby railways. For some time we hesitated to inaugurate a second organisation of boys, but after a while we came to realise through correspondence that thousands of Hornby Railway owners were failing to secure the greatest possible fun and interest from their railways for lack of a little expert guidance. Ultimately we decided that something must be done, and in October, 1928, we were able to announce the formation of the Hornby Railway Company. Its immediate success was remarkable, and even with our experience of the rapid growth of the Meccano Guild, the rate of development of the new organisation has been a source of continual astonishment to us.

It was clear from the outset that miniature railway owners all over the world had been in need of the assistance that we were now able to give them. The announcement that membership of the Hornby Railway Company carried with it the right to obtain expert advice on all matters concerning model railways and their operation resulted in a flood of queries that still continues. The majority of these come from boys who are dissatisfied with their layouts, and who wish to extend and develop them on more railwaylike and realistic lines. All these queries are answered individually, and the various problems involved are dealt with as fully as possible. In many cases a diagram is specially prepared to show exactly how the layout is to be arranged. This is almost invariably done where station layouts are concerned, in order that there shall be no misunderstandings in regard to the details of sidings, etc.

The formation of local Branches of the Hornby Railway Company, each with its own adult Chairman, has brought entirely new possibilities into the world of model railway enthusiasts. At the meetings of these Branches, usually held once a week, miniature railway operations are carried out on a most elaborate scale, made possible by the combining of members' railway material. Very often the material available is sufficient to enable the arrangements of a local station or goods yard to be reproduced almost in full. The planning of such a layout is always a source of the keenest interest, and its operation, when completed, arouses even more enthusiasm.

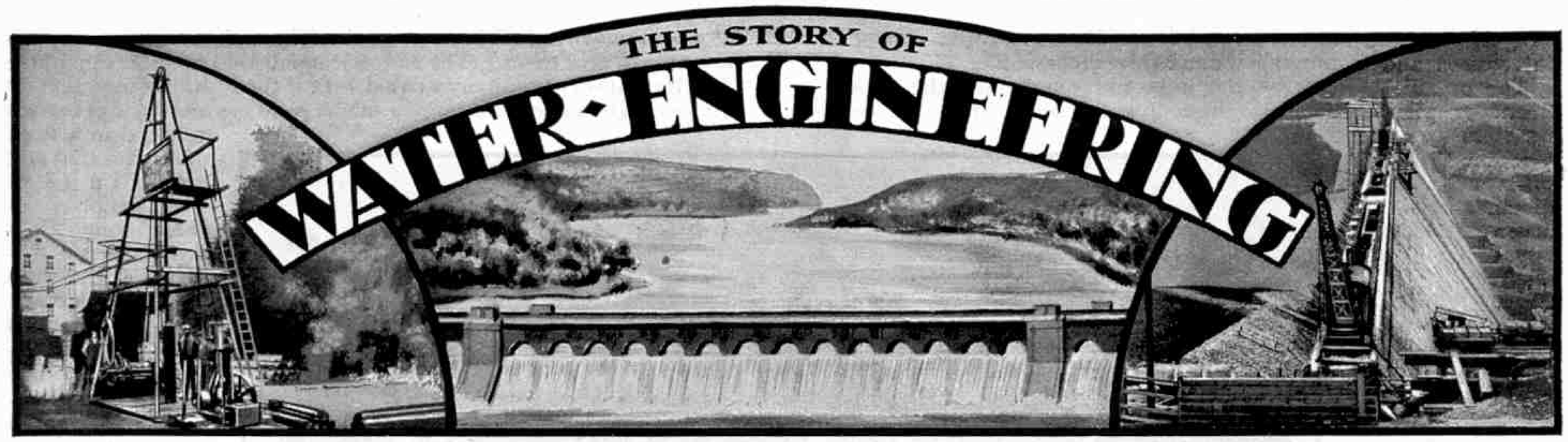




Members of local Branches of the Hornby Railway Company have splendid opportunities of visiting engine sheds, goods yards, stations and other places of railway interest. These photographs show happy groups of members inspecting locomotives.

Another interesting development that has been brought about through the inauguration of local Branches of the H.R.C. is that of systematic visits to places of railway interest. Previously it was difficult for a "lone" model railway enthusiast to obtain permission to visit such places as engine sheds, marshalling yards, etc., but membership of an H.R.C. Branch solves the problem immediately. From the inception of the Company, officials of all grades of the British railway groups have shown keen interest in the scheme, and have done their best to help it along. Local Branches now find no difficulty in obtaining permission to visit almost any places of railway interest under the guidance of their Chairman. Throughout the summer months we receive a succession of cheery letters from Branch secretaries describing visits that have been paid by the members, and the keen interest aroused as the result. In every case there are a few words of appreciation of the kindness and courtesy of the officials who supervised the visit.

The Hornby Railway Company has a Correspondence Club run on similar lines to that of the Guild, and it is an extremely popular feature. Membership of this club is open to any member of the Hornby Railway Company, whether he is a member of a local Branch or not. Through the medium of the Correspondence Club members may exchange railway news and thus learn about the many interesting things that are taking place on railways in far-off countries that it is unlikely they will ever visit. Another interesting feature made possible by the Club is the exchange of railway photographs either of miniature or real railways. It is impossible to over-estimate the value of being able to exchange such photographs with friends in different parts of the world.



III.—HOW MODERN CITIES OBTAIN THEIR SUPPLIES

IN the previous article in this series we described how the water supply of London has been developed since Roman times to meet the needs of the increasing population. The provision of the enormous water supply required daily by a large city is a very big undertaking, and this month we shall describe the extensive equipment of modern water works.

Towns obtain their water supply either from springs, artesian wells, convenient rivers or from distant lakes. The lakes may be natural basins that are tapped to yield the required water supply, or they may be artificial lakes, called reservoirs, created by damming up valleys. Either natural or artificial upland reservoirs generally become the only source from which a large inland town can obtain an ample supply of water for its population, although it may continue to use spring or well water to supplement this supply. Liverpool still draws a portion of its water supply from two deep wells near the city, and London also supplements its main supply with water drawn from various wells. This branch of water engineering is very interesting, and we shall deal with it in a later article.

The first city in Britain to seek a water supply from a distant upland source was Glasgow, which obtained an Act authorising the tapping of Loch Katrine to the amount of 50,000,000 gallons per day. The scheme involved the construction of a dam to raise the waters of the loch 4 ft. In 1855 Glasgow took over the water companies that were supplying water to the city and commenced work on the Loch Katrine scheme, which was completed by 1860 at a cost of £668,000, exclusive of the purchase of land. At that time the new water supply was ample, but the city grew so rapidly that 30 years later the consent of Parliament was sought and obtained to a scheme to raise the level of the loch a further 5 ft. Authority was also obtained to erect a dam to divert the waters of Loch Arklet from their outlet into Loch Lomond so that they would flow into Loch Katrine. This project was carried out, and made available in Loch Katrine another 60,000,000 gallons of water per day. The diversion of the waters of Loch Arklet was compensated for by bringing water from two other lochs.

The Straining Tower at Lake Vyrnwy, Montgomeryshire, the principal source of Liverpool's water supply. The water is drawn off at the tower, where it passes through large strainers before it is led away underground to Liverpool. This photograph and the upper one on the opposite page are reproduced by courtesy of Mr. J. R. Davidson, City Water Engineer, Liverpool.

In 1880 Liverpool obtained an Act authorising the construction of a large storage reservoir in Montgomeryshire by erecting a dam on the upper waters of the River Vyrnwy, a tributary of the River Severn; and this work was completed by 1892. In 1894 Manchester began to utilise the waters of Lake Thirlmere, in Cumberland, and 10 years later Birmingham obtained an increased water supply by damming two mountain valleys beyond the River Wye that were traversed by streams.

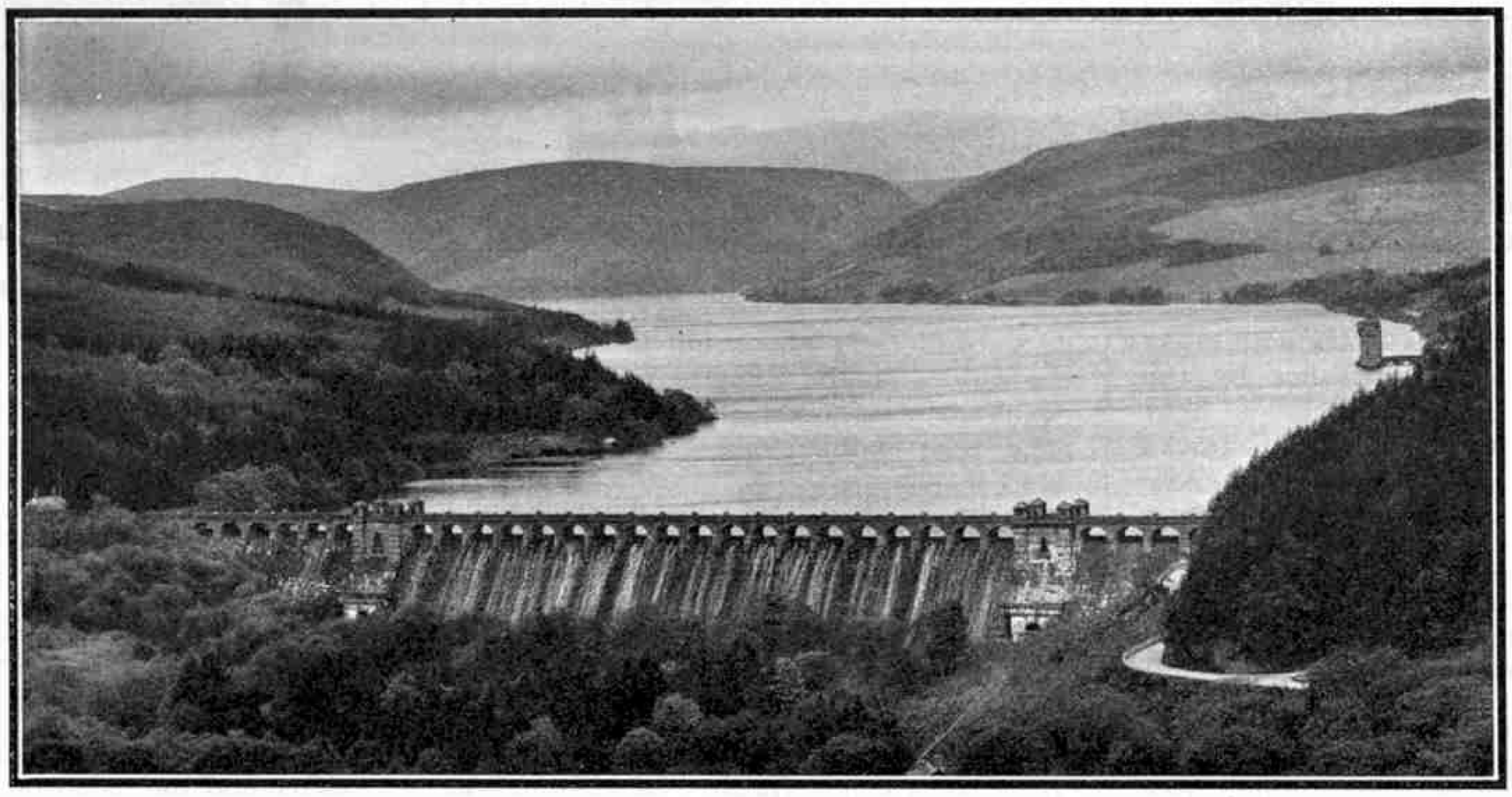
The land reserved as the source of a city's water supply is known as the "catchment" or drainage area, as the storage reservoir constructed within that area collects the waters of the streams flowing into the valley. A catchment area is always very extensive, and the one draining naturally into Lake Vyrnwy has an area of 18,262 acres. This has been increased by the construction of two tunnels that divert into the lake water from two tributary streams that originally joined the River Vyrnwy below the dam.

The main interesting features of a large waterworks are the huge dam that is necessary when the level of an existing lake is raised or an artificial lake is created; the long conduits by which the collected water is conveyed to the town; and the plant by which the water is purified and made suitable for domestic purposes. An immense amount of detailed preparation precedes the actual building of the dam of a reservoir, and the strength of the proposed structure is calculated carefully so that the dam will be capable of withstanding any anticipated pressure of the water. It is equally important that no water should percolate through the underlying strata, and therefore a deep trench is cut where the dam is to be built, and excavation is continued until a firm bottom is reached. The trench is then puddled with clay to make it watertight, and the building of the dam is carried out. The dam may be an earth embankment with a central core of puddled clay and an external facing of stone, or it may be built of great blocks of masonry thickly embedded in concrete and faced, above water level, with stone. Some earth dams in America are strengthened internally with timber and others with steel.

From time to time enormous quantities of surplus water descend the mountain streams to the storage reservoir, and if no means was provided for this water to pass away, the excessive pressure of the contents of the reservoir might prove too great for the dam. In many cases, therefore, a waste weir, or bye-wash, is constructed

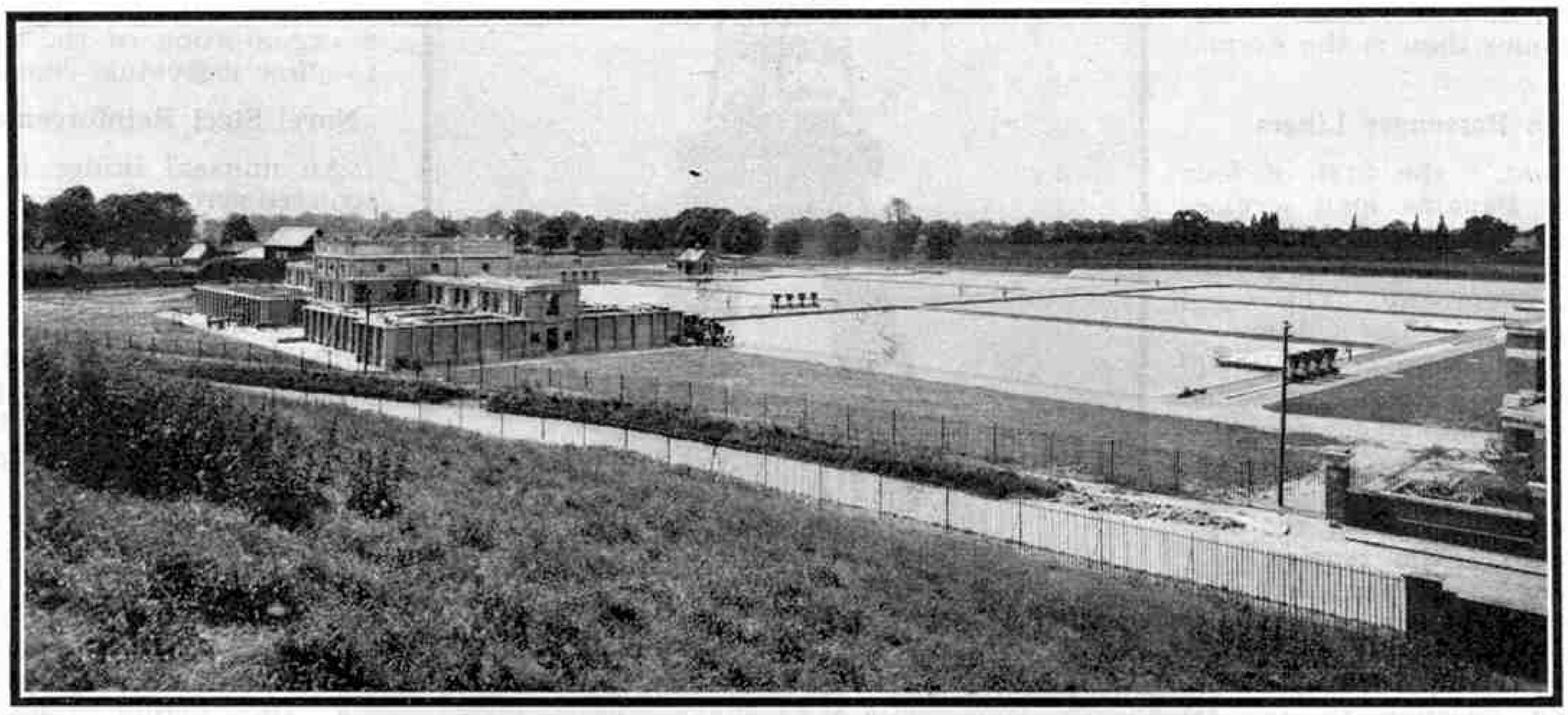
at the end of the dam and the surplus water passes freely over this, a series of steps breaking its force as it descends to the lower course of the stream. In the dam of Lake Vyrnwy the profile of the outer face was so designed as to form the overflow by means of which the surplus water passes into the old river course.

Fortunately failure of dams in this country is very rare, and the worst disaster of this kind that has ever occurred here was caused by a landslide partly wrecking a dam. The catastrophe took place about midnight on 11th March, 1864, at the Dale Dyke reservoir, about 6½ miles from Sheffield, and released about 3,000,000 tons of water toward the sleeping town lower down the valley. The mighty torrent rushed onward at the rate of 60 m.p.h., sweeping everything before it until it reached a wider part of the valley and spent itself. No less than 244 people were killed, and the disaster cost the unfortunate water company concerned the huge sum of £373,000 in compensation.



General view of Lake Vyrnwy. The lake is 4¾ miles long and has a total capacity of 13,125 million gallons. The masonry dam seen in the foreground has a maximum height of 144 ft.

The dam of Lake Vyrnwy already mentioned is a typical example of these great structures, and the accompanying illustration gives a good idea of its size. It is 1,172 ft. long, and 144 ft. high from the lowest part of the foundations to overflow level. It is 127 ft. thick at the base, and contains 260,000 cu. yd. of masonry; and a roadway 20 ft. wide is carried on arches above it. The dam is pierced by two culverts, one of which contains the valves and pipes by which the compensation water is regulated and discharged, and the other a draw-off pipe and valves used for discharging surplus flood water. This great structure cost £619,264 to build. The lake formed by the dam is 4¾ miles long and has a total capacity of 13,125 million gallons, its greatest depth being 84 ft.



The Primary and Secondary Filter Beds at the Walton Works of the Metropolitan Water Board, London, to whom we are indebted for this illustration.

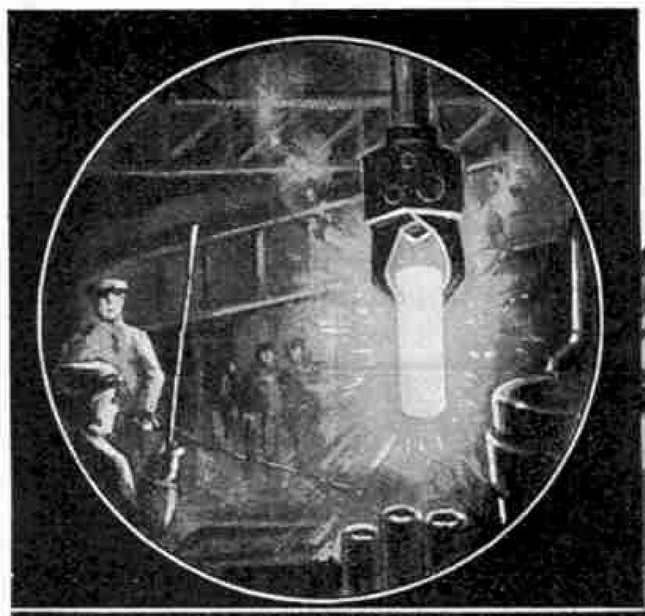
As compensation to the River Vyrnwy a constant quantity of water, at the rate of 10,000,000 gallons per day, is discharged immediately below the dam. An additional quantity of 40,000,000 gallons per day is also discharged on four successive days eight summer months in each year, making an average compensation of 13,500,000 gallons a day. A flood gauge having a length of weir of 80 ft. has been constructed on the river below the dam, and this gauge measures the entire yield of the Vyrnwy catchment area that is not taken by Liverpool, the depth of water passing being registered continually on an automatic recorder. Before the compensation water is discharged into the river it passes through a twin set of horizontal turbines coupled direct to dynamos generating direct current at 230 volts, which is used for lighting the hotel, church, vicarage, Corporation offices and cottages in the village, and also for power purposes in a saw-mill.

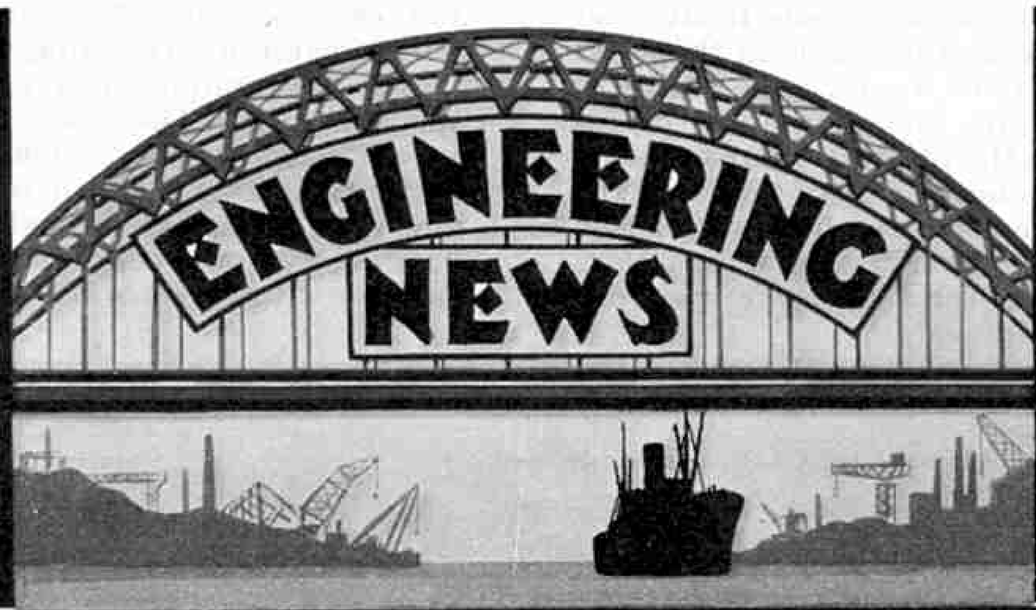
The water for the supply of Liverpool is drawn off from the lake at the Straining Tower, a photograph of which appears on the opposite page. The draw-off pipes in the basement of the tower are arranged in such a manner that they allow water to be taken from near the surface whatever the level of the lake may be, and the water is passed through three large cylindrical copper gauze strainers before it begins the long run to Liverpool. When necessary the strainers are lifted into the upper part of the building, where they are washed by means of jets of water revolving inside the cylinder. The whole of the machinery for lifting and lowering the strainers, and for manipulating the vertical tubes that regulate the level of the draw-off, is operated by hydraulic power.

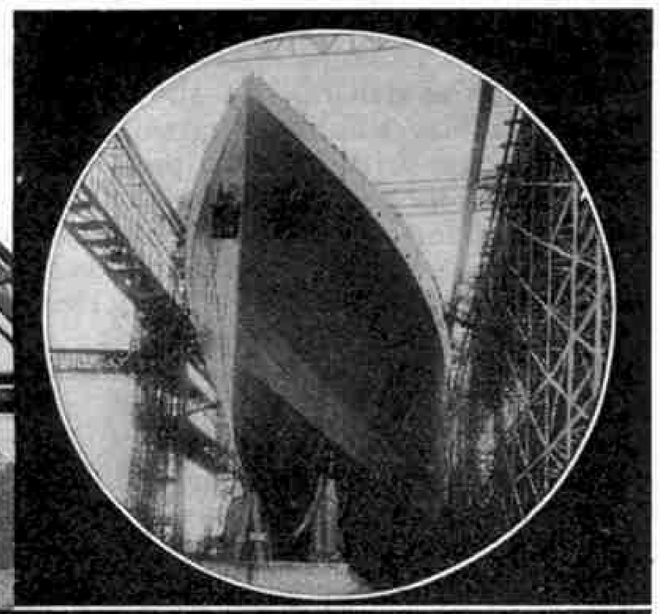
From the tower the water is fed along the bed of the lake in a concrete culvert to a shaft that contains the valves by means of which the draw-off for supply purposes is regulated. From this shaft the water flows through a 2½-mile tunnel driven through the mountain and emerging in the Hirnant Valley, where the water passes into cast iron pipes, 3 ft. 6 in. in diameter, that eventually lead it to Liverpool.

If a storage reservoir is not very high the water may pass from it to the distribution reservoir near the town by gravitation, but if it is at a great height the fall to the distant town is accomplished in stages, the end of each stage being marked by an intermediate reservoir, to take off some of the pressure on the pipes. At each of these intermediate reservoirs the water receives a fresh start and goes forward at a lower pressure. The water from Lake Vyrnwy begins its 68-mile journey to Liverpool from a height of 825 ft., and the conduits are divided into six stages by intermediate reservoirs situated at suitable points. The second stage carries the water as far as Oswestry, where it is filtered before continuing its journey to Liverpool.

Filtration is necessary not only to rid the water of impurities, but because unfiltered water may cause growths on the interior surfaces of the conduits, and these would seriously hinder and reduce the flow of the water. The filtration plant at Oswestry consists of 19 filter beds having a total filtering area of 73,568 sq. yd. The water passing through each filter is measured by a meter that records the rate of flow, and the average rate of flow of filtration in 1929 was 2.348 million gallons per acre a day. The most recent of these filter beds are each fitted with an automatic recorder that registers the loss of head of the water (*Continued on page 517*)







Light Tank with Four Creeper Tracks

Extensive experimental work with tanks is at present being carried out by the British Army authorities and a light tank fitted with four creeper tracks instead of the customary pair has now been produced. It is claimed that a tank of this type is as efficient for cross-country work as larger and heavier ones with only two tracks.

The experiments with four-track tanks were made because it has been found that small tanks fitted with only one pair of tracks subject their occupants to continual jolting. When surmounting obstacles, the nose of such a tank rises straight up into the air and crashes down again immediately the centre of gravity of the tank passes over the highest point of the obstacle. Steering also is difficult, as the machine can only be turned by skidding round. The four track type travels much more smoothly over rough ground and can be steered almost as easily as a motor car.

The new tank is sufficiently long to enable it to cross gaps that light tanks of earlier design could not have attempted. It is low in build, and is less easily distinguished by enemies than is the normal large tank.

New American Passenger Liners

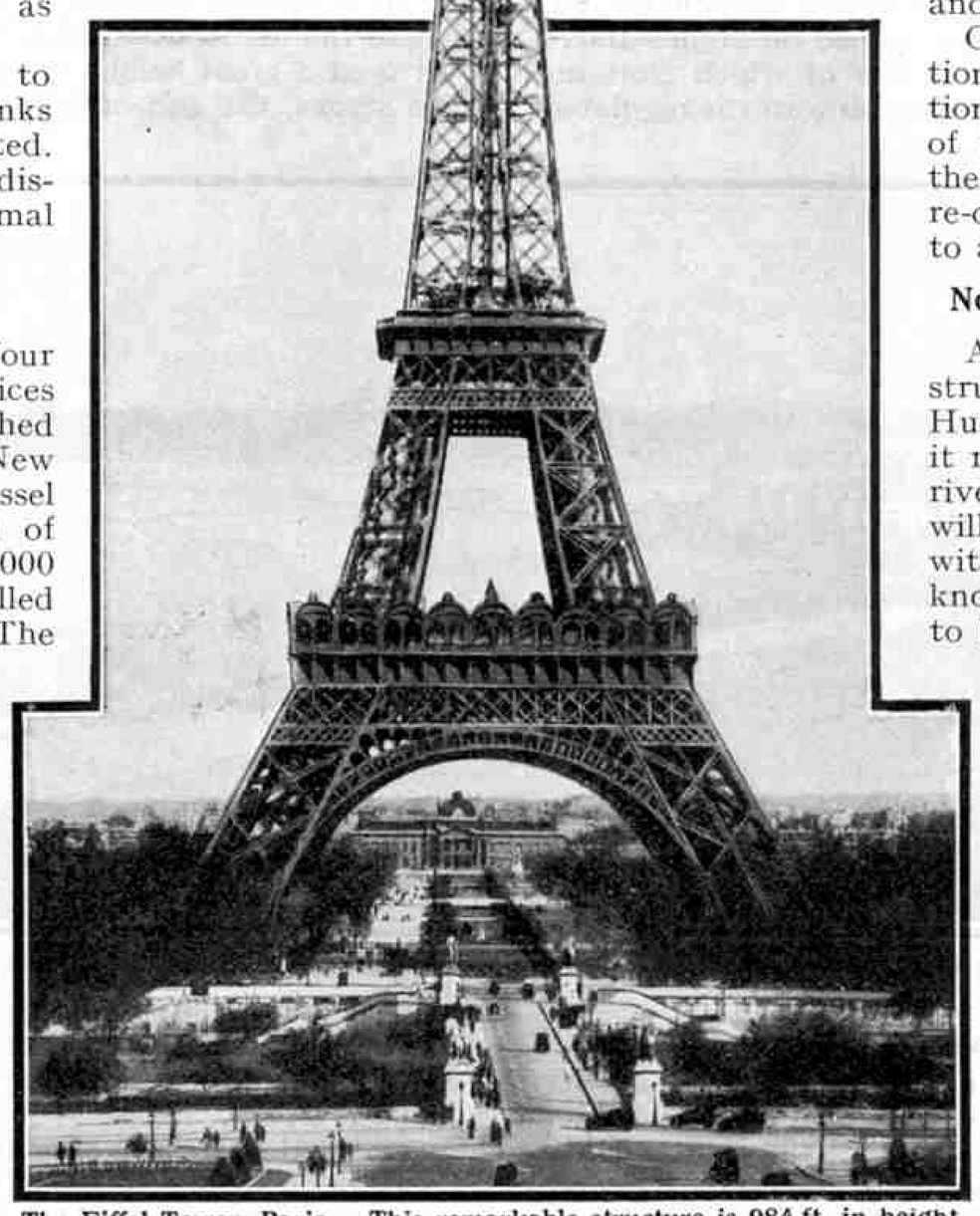
The "*Santa Rosa*," the first of four new ships for the Panama mail services of the American Grace Lines, was launched a short time ago from the yard of a New Jersey shipbuilding company. The vessel is 508 ft. in length and has a beam of 72 ft. Her displacement is about 16,000 tons, and the turbine engines installed give a speed of more than 18 knots. The cargo holds are large, and specially designed winches ensure rapid and easy handling of freight. As the vessel will operate in the tropics, ample refrigeration space has been provided for perishable cargo, and the public rooms are provided with large windows for natural ventilation and light in addition to an elaborate system of mechanical ventilation.

The four new vessels are to be similar in size and design, and they are being built to provide a rapid passenger, mail and freight service between New York and Los Angeles and San Francisco, via the Panama Canal. During their voyages between the Atlantic coast and the ports on the Pacific seaboard of the United States they will stop at Havana, Cartagena, Acapulco and other Central American ports, including those at the entrances to the Panama Canal.

Train Ferry Steamer for Chinese Service

A train ferry steamship is being built for service on the Yangtze River between Nanking and Pukow, China. The boat will be equipped with twin screws and will be 372 ft. in overall length, and 58½ ft. in overall width. She will be capable of carrying a dead weight load of 1,600 tons, and will have accommodation for three trains, each of seven wagons, on three tracks situated on the upper deck. Each track will be 300 ft. in length, and a special locomotive will be carried on the vessel in order to perform any shunting that may be necessary on board.

Train ferries are not uncommon in other parts of the world, well-known instances being those between Harwich and Zeebrugge, and the ferries by means of which communication is maintained between Copenhagen and the islands and mainland of Denmark.



The Eiffel Tower, Paris. This remarkable structure is 984 ft. in height. It is built of iron and is the highest all-metal structure in the world.

L.M.S.R. Steamers Reconditioned

The mail steamers "*Scotia*," "*Hibernia*" and "*Cambria*," which operate the L.M.S.R. service between Holyhead and Kingstown, have been reconditioned and greatly modernised. These vessels maintain a day and night service between Great Britain and Ireland and it is claimed that, with their speed of 25 knots, they regularly carry on the fastest channel crossing in the British Isles.

Extensive improvements have been made in connection with the general comfort of passengers, including the provision of hot and cold fresh water in all cabins, and the redecoration of the accommodation. More passengers may now be carried, each vessel being certified to carry 1,505, an increase of 91 on the previous number, and in each case the number of sleeping berths has been increased to 308, this total including 222 berths in the first class accommodation and 86 in the steerage.

Other important features of the alterations include the provision of an observation lounge on the boat deck, the fitting of plate glass windows to the sides of the vessel at the forward ends, and the re-organisation of the ventilation system to allow individual control by passengers.

Novel Steel Reinforcement for Concrete

An unusual bridge is now being constructed across the River Waag at Pistang, Hungary, for it is to be covered in order that it may be used as a promenade over the river. It will be 500 ft. in length and will be constructed of concrete beams with steel reinforcement of a new type known as "Isteg." Isteg steel also is to be used to reinforce the concrete piles on which the bridge will rest.

The new steel reinforcement is made by twisting two steel bars together, while they are in tension. When treated in this manner the steel is able to withstand increased stresses, and concrete beams in which it is employed may be smaller and lighter than when ordinary steel bars are used.

Isteg steel is rapidly becoming popular on the Continent and it is stated that in Austria it has been used as reinforcement for many large buildings recently erected, including one of 16 storeys built in Vienna.

Reinforced concrete is being increasingly used in the construction of roads, buildings and bridges, and in other engineering and structural work of importance. It has even been employed in shipbuilding, a yacht constructed of this material having recently been built in Sweden.

Long Intake Pipe in Lake Ontario

In connection with a scheme for increasing the water supply of Toronto, a large intake pipe is to be laid down on the bed of Lake Ontario with its mouth at a distance of nearly 1½ miles from the shore. The pipe will be 4,100 ft. in length, and it will be connected at one end to a tunnel that has been driven from a point in the east end of the city for a distance of 3,300 ft. under the lake. A large steel caisson will be sunk over the end of the tunnel in order to enable the connection to be made.

The intake pipe is to be laid down in 41 sections, each of which will be 100 ft. in length and will weigh 250 tons. Each section will consist of 10 cylinders of pressed steel covered with concrete to give an outside diameter of 10 ft. and an inside bore of 8 ft., and the inner surface of the pipe will be lined with a cement compound through which water cannot pass. The pipe will be laid in an open trench, dredged and levelled in the bed of the lake.

In preparation for the laying of the pipe a powerful derrick boat has been built by Canadian-Vickers Ltd., of Montreal. The vessel is known as the "*Foundation Scarboro,*" and its lifting capacity is greater than that of any similar vessel in Canadian waters, with the exception of the pontoon gate lifter built a little over a year ago to deal with the gates of the Welland Ship Canal.

The new derrick ship is 100 ft. in length and 42 ft. in width. It is electrically driven throughout, primary power being supplied by twin Atlas-Diesel engines of 200 h.p. each, connected directly with 220-volt direct current generators. The vessel is claimed to be capable of lifting more than 300 tons, being provided with twin sheer legs at the stern that will each take 150 tons lift.

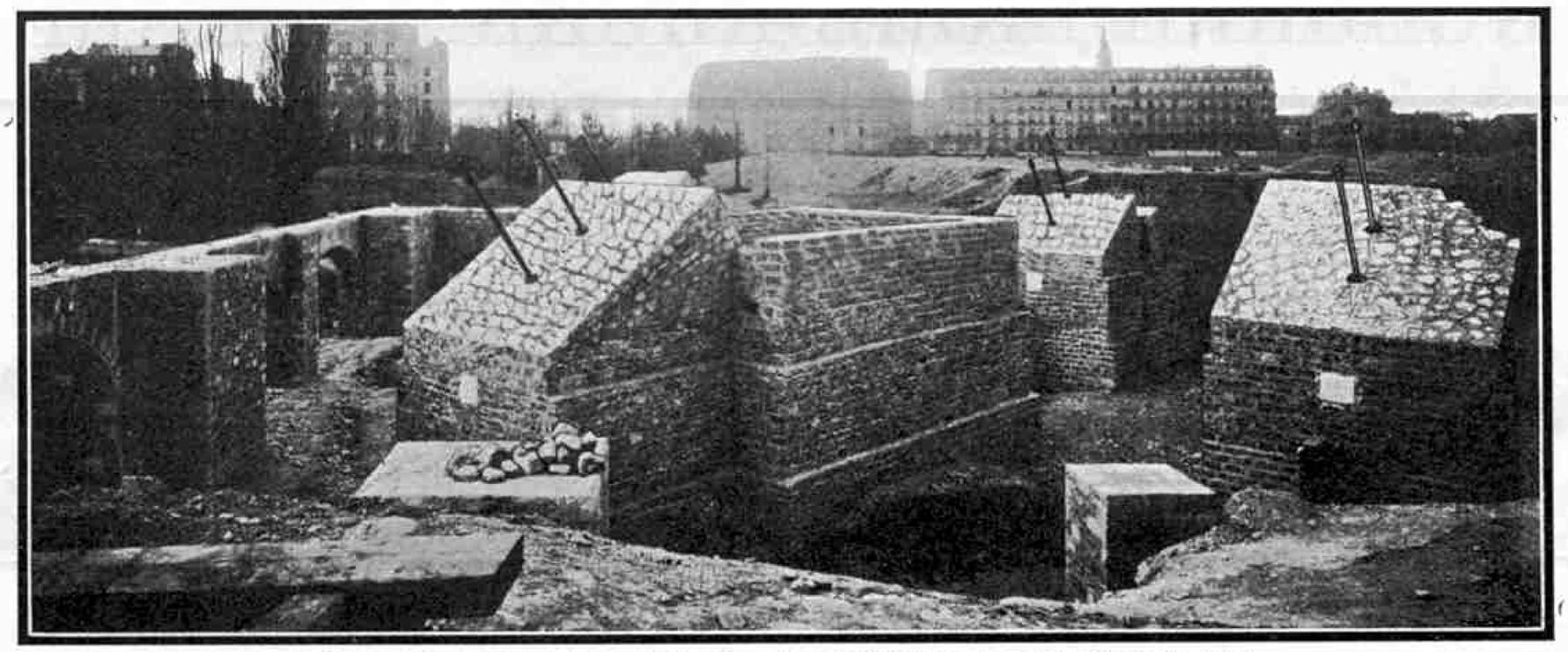
Birmingham Street Paved with Bricks

An interesting experiment is being made at Birmingham, where a street is being paved with bricks for a distance of about 150 yds. About 25,000 bricks are being used in the section and these are laid on edge in a bed of dry sand and cement on a reinforced concrete foundation, 10 in. in thickness. The bricks are placed as close together as possible and as the road in which they are laid carries a large amount of traffic, the test should be of particular value.

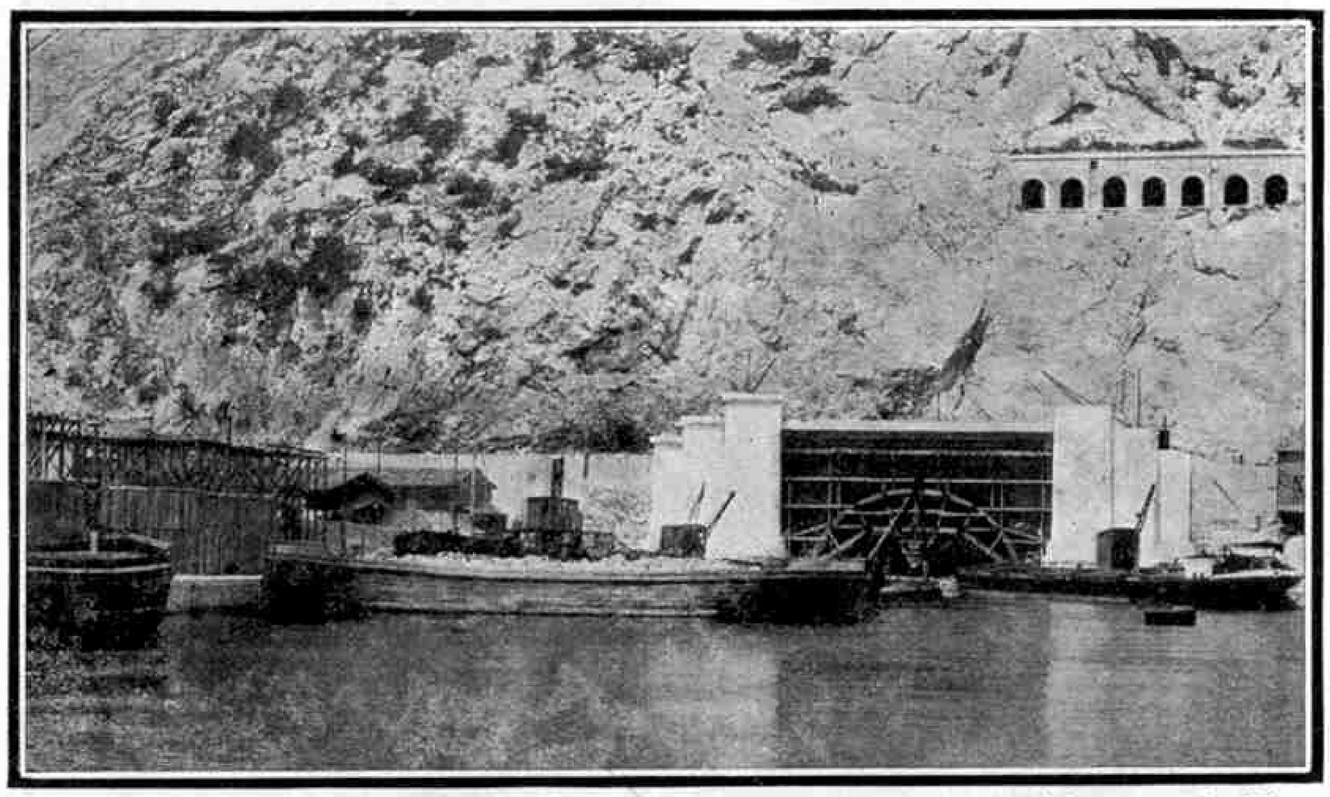
Great Pipe Line in Near East

A contract to the value of £500,000 has been awarded to a British firm for the supply of 60,000 tons of steel tubes for use in the construction of a pipe line to carry oil through Palestine to Haifa in Acre Bay. This forms part of a scheme for the construction of a long line from Kirkuk, in Iraq, to the Mediterranean coast, one branch passing through Palestine, and the other through Syria to end at Tripolis. The work is expected to be completed in 1935, and the total cost probably will be more than £10,000,000.

Contracts for more tubes are to be placed with various foreign firms, but a British company has secured the order for 63 steel buildings that will be used to house the engineers and labourers while the pipe is being laid. These will be erected before work on the line is begun.



The stone foundations of one of the piers of the Eiffel Tower in course of construction.



The entrance to the Rove Tunnel, which is 4½ miles in length and through which passes the Rhone Ship Canal. A view of the interior of the tunnel appeared on page 417 of last month's "M.M."

Electric Bicycle Introduced in Holland

An electrically propelled bicycle has been produced by a Dutch firm and tests carried out with it are said to have been so satisfactory that construction licenses have been granted to five Dutch firms. Current is supplied by an accumulator, and the machine is capable of a maximum speed of 13½ m.p.h. Unfortunately the accumulator has to be recharged after 50 miles have been covered, but improvements now being planned may increase the range.

Travelling Crane Wrecked by Explosives

An unusual method of dismantling an obsolete travelling crane was resorted to at the Sheffield works of Vickers-Armstrongs Ltd., a short time ago. The crane had been in service for 40 years and was capable of lifting loads up to 100 tons; and it weighed about 250 tons and was 85 ft. in height. The space available for wrecking operations was particularly small, and certain parts of the legs therefore were cut out and replaced by wood, and the timber was afterwards blown out by means of explosives. The crane crashed to the ground, every part falling within 18 in. of its calculated position.

A Salvage Enterprise in Table Bay

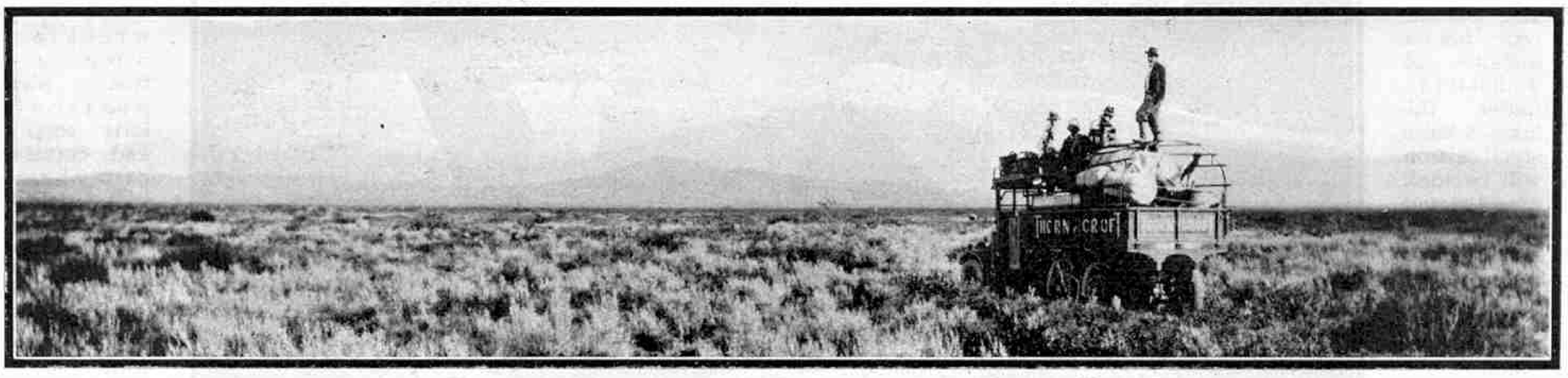
Wholesale salvage operations have been commenced on about 15 ships that are lying on the sea bed in Table Bay, Capetown. The whereabouts of the wrecks have been determined approximately and full details of the cargoes contained in their holds are now in the hands of the salvage company concerned.

The first wreck to be dealt with by the divers is that of a Norwegian sailing ship, the "*Ryvengen.*" This vessel contains nearly 1,500 tons of coal, and it is thought that it will be possible to bring most of this cargo to the surface. The "*Ryvengen*" is believed to be lying on the top of another wreck that is thought to contain a valuable cargo of copper, and when the coal has been removed the vessel also will be hauled away from its present position in order to give access to the one containing the metal.

Of the other wrecks, at least four have considerable quantities of Chinese porcelain on board, and another is loaded with copper. So far great difficulty has been experienced in working on the sunken vessels, for they are covered with immense quantities of seaweed through which it is almost impossible for a diver to force his way. The engineer in charge of operations therefore has invented a special scythe for the purpose of cutting the huge stalks. The divers also report having seen octopods while at work, and one of these measured 7 ft. across the tentacles. It is anticipated that the work will go forward steadily as soon as the marine growth has been cleared away.

Transport in Roadless Countries

II.—The Rigid Six-Wheeled Vehicle



THE development of motor transport to enable it to be carried on efficiently over stony and mountainous roads, and over desert and other roadless country, has been made possible through the invention of creeper track, as described last month, and by the introduction of the rigid-frame six-wheeled vehicle.

We mentioned last month that perhaps the most serious limitation to the use of wheels over the surface of the earth is due to the fact that, in order to support the load, the wheels must sink into the ground, an action that ruts and destroys the surface. The introduction of tyres of a resilient nature lessened this evil, for by deflection of the tyre itself the load is distributed over a greater area than is possible with a rigid tyre. The effect of this is to reduce the tendency to sink into the ground that is being traversed, and consequently to reduce also the rolling resistance or effort required to move the vehicle. From this it follows that wheels resiliently tyred are less destructive to the surface that they pass over, and make movement over rough country possible at higher speeds than are attainable with wheels fitted with rigid tyres.

In spite of this improvement the ordinary four-wheeled motor vehicle remained unsuitable for transport service under adverse conditions, and the rigid-frame six-wheeled motor vehicle has been developed to meet this need. This type of vehicle can travel as easily and rapidly over virgin ground as it can over good and bad roads. It possesses many advantages over the ordinary four-wheeled motor vehicle, the most important of which probably is that all the rear wheels take a share of both the drive and the load, whether the vehicle is travelling over the ordinary made highway or negotiating soft and uneven ground. As the load is carried on two rear axles instead of one, the weight on the ground, through each tyre, is reduced by half as compared with a single-axled vehicle; consequently the load-supporting capacity on soft ground is increased, thus reducing the possibility of wheel sinkage under these conditions.

The upper photograph shows a Thornycroft six-wheeled vehicle crossing roadless country covered with dense scrub, in the interior of Argentina. In the lower photograph a six-wheeler is seen ploughing its way over a deep muddy road in an Australian country district. The illustrations on this page are reproduced by courtesy of John I. Thornycroft & Co. Ltd.

Some remarkable transport feats over difficult and mountainous country have been accomplished by rigid-frame six-wheelers, and the suitability of these vehicles for such work has been abundantly proved. A Morris-Commercial six-wheeler was the first vehicle, so far as is known, to climb under its own power the famous Nan Kau Pass in Northern China. From the earliest times this pass has been the connecting link between China and Central Asia, either for trade or war, and it winds its way upward through old chains of fortifications that crown ridge after ridge up to the Great Wall of China. A more difficult and dangerous feat could hardly be undertaken, for the pass is narrow and is strewn with great boulders.

The Morris six-wheeler, carrying the owner, eight Britishers and two Chinese, and further burdened with sandbags to make the load over a ton, left Peking early one morning. After travelling over miles of rock-strewn road, an introduction to what was to come, the party reached the small town of Nan Kau at the foot of the pass. In an interesting account of the adventure, published in "*Motor Transport*," one of the party relates: "We stopped in Nan Kau to fill up with petrol and oil, and started the ten-mile climb with our objective the pass-head and the Great Wall. . . . The test of the pass lies in its surface, which is awful, for the rains have washed away the soil through the ages, leaving rounded boulders which stand up everywhere to a foot or more above what is left of the track, while these are reinforced by great stones which have rolled down from the hills above. For more than a mile the track led up the stream bed, and for miles it ascended in steps built at about every twelve feet and each one six to nine inches high. Frequently delays were caused by the strings of transport mules and other traffic which, for countless centuries, have used this famous pass.

"The Morris ran faultlessly, creeping steadily up, over or round the obstacles and rarely hindered by any. Twice only was it necessary to move a stone into the way of a wheel to provide a stepping stone by which to mount a boulder; otherwise the car asked for and received no help . . . our way wound up the magnificent valley, its hills crowned by successive chains of wall until we passed round a last shoulder, across a bare ledge of rock on which the car must have stood over at 20 degrees, and we were in front of the Great Wall, through which we passed a moment later . . ."

After pausing long enough to look over the car and verify that it was in perfect order the adventurers started on the return

journey, reaching Peking 2½ hours later.

A notable transport feat of a different character was the first crossing by motor vehicle of the Great Kalahari Desert in Bechuanaland, Africa, by the Imperial Government Expedition in 1928. This desert has been described as the worst in the African Continent, and is an immense waste of sand, more than half of which is covered with low bushes and with mimosa thorns that play havoc with motor tyres. There was a belief that water lay far below the parched surface of the desert, and many unsuccessful attempts had been made to discover it and to map out a route along which, by means of deep wells at intervals, water would be available for herds of cattle crossing the desert. The Imperial Expedition was another attempt to solve this problem and was planned to cross the desert from east to west, a route shunned by all other travellers on account of its lack of water.

The expedition, which was commanded by Captain Clifford, Imperial Secretary and British Agent in South Africa, was equipped with two Morris-Commercial six-wheelers, and started from Mahalapye, a station on the main line from Mafeking to Rhodesia. The two lorries, known as "*Old Bill*" and "*Twinkles IV*" respectively, had been specially prepared and they carried immense loads. Tanks were bolted to them and in these were carried 240 gallons of petrol, eight gallons of engine oil, three gallons of gear oil and 150 gallons of water. The camp outfit, guns, tools, six days' supply of food, and the necessary belongings of the 11 members of the party completed the burden. Practically all travelling was done during the cool hours, the expedition resting during the heat of the day. Creeper track, reserved for emergency purposes, was brought into use for the crossing of the desert. The track for each vehicle was laid out on the ground and the rear wheels were backed on to it, the track then being lifted up and securely fastened round the tyres.

A six-wheeler hauling timber from a forest in Sweden. Creeper track is attached to the wheels owing to the swampy nature of the ground.

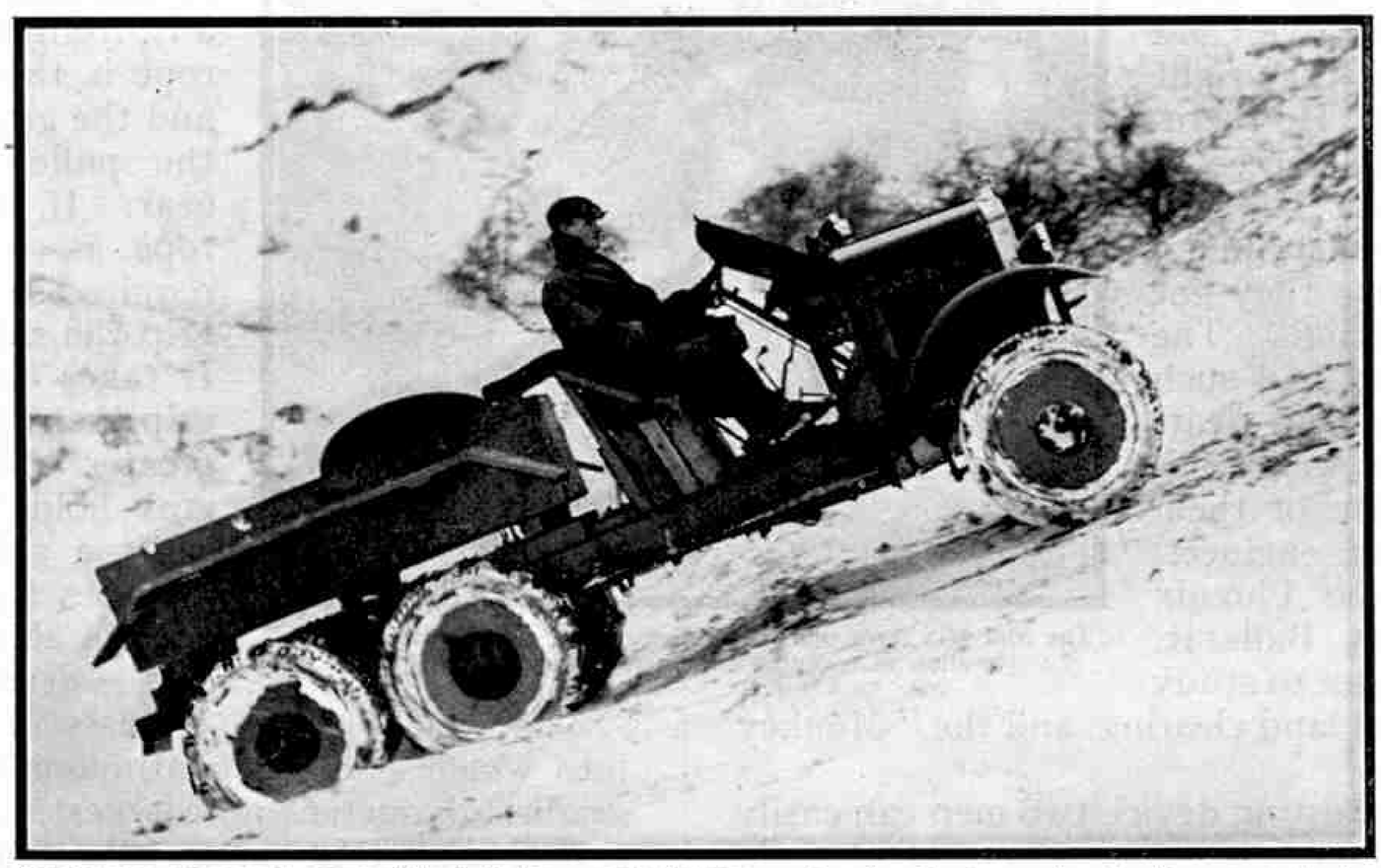
Mr. Hamilton Fyfe, in an interesting account of the journey, relates that when the expedition reached the desert and plunged into the thick, thorny bush, "their troubles began. Punctures were frequent. Many times one or other of the lorries had four tyres flat at the same time. The sand often became so loose that the vehicles almost sank into it. Now they would be slipping down very steep hillsides (with gradients like 1 in 3½ !) Now they had to toil painfully up long inclines. Scrub and sand reduced their speed sometimes to half-a-mile an hour. During the whole of one night they could not do better than two miles an hour. . . .

"Once the crew of '*Old Bill*' saw two lions and a lioness sitting within twenty yards of them, watching them go by. The party shot nothing except for food. All of them had strong views about that. Once wild dogs attacked them. Fierce eyes were seen in the circle of light made by the headlamps. A shot drove them off . . ." After traversing 300 miles of scrub and sand, the expedition came to grassy land which told of water beneath the surface, and eventually reached Ghanzi, on the western fringe of the desert. The journey across the desert took 12 days instead of six days as hoped, and if the vehicles had not been equipped with creeper track it might have taken 24 days, "or more probably" says Mr. Fyfe, "it would never have been finished at all." From Ghanzi the expedition continued through sandy and hilly country, negotiating gradients as severe as 1 in 5, and finally arrived at Victoria Falls, the end of their journey.

Rigid-frame six-wheeled motor vehicles are now regularly employed on transport service in South Africa, and an extensive fleet of Thornycroft vehicles of this class is used by the South African Railways for its road service through Swaziland.

A Thornycroft six-wheeler accomplished a remarkable run through the lumber and mining districts of Northern Ontario. The vehicle left Montreal in November with a full load, including the necessary supplies, and headed for the Government Forest Reserve country about 700 miles to the north-west. The whole country lay under snow, but the vehicle made quick progress over the first 420 miles before striking north through the forest country where roads gave way to trails. The next 90 miles were through deep snow along a narrow, hilly and often treacherous trail, and occupied 11 hours of hard going. Over 60 miles of this part of the run was through virgin country where the party saw neither log cabin nor any human being, the only sign of life being occasional bears. Further north the trail was buried beneath snowdrifts 5 ft. to 6 ft. in depth.

During the winter only dog teams and sleighs had previously been able to traverse the snowbound trails, but in spite of the fact that the temperature ranged from 20 to 30 degrees below zero the Thornycroft six-wheeler successfully ploughed its way. After traversing 260 miles of forest country the vehicle reached Timmins, an important gold mining area and lumber centre.



Climbing a steep snow-covered bank in Roumania by means of a six-wheeler equipped with creeper track. We are indebted to Morris Commercial Cars Limited for the illustrations on this page.

The return journey was accomplished without any delays other than those caused by snow-drifts that at times obscured the headlights, and Montreal was reached again after an absence of nearly three weeks. During the double journey the vehicle covered almost 2,000 miles, and no mechanical adjustments were necessary with the exception of changing one sparking plug.

An interesting cross-country journey was made by a Thornycroft six-wheeler employed by the Buenos Aires Western Railway in exploring and opening up new territory beyond Colonia Alvear, the company's western terminus. The country to the south and west of this station is little known and at present is inhabited mainly by squatters, who with their cattle are continually wandering from one district to another. The vehicle was equipped with low pressure balloon tyres for the journey. A start was made from Colonia in a south-westerly direction, and for the first 62 miles the vehicle followed a track that led through (*Continued on page 558*)

Pulling Up Trees by the Roots

Winch Enables Two Men to Exert 24-Ton Pull

IN the "*M.M.*" for January, 1931, we described a remarkable gear box that gives a ratio of nearly 2½ million to one—2,476,099 : 1 to be exact. In order to illustrate the possibilities of gearing we reproduced an imaginary illustration showing a Meccano Motor pulling up a tree by the roots. This is possible in theory, but not in practice, because with the gearing required to produce the necessary reduction the Motor probably would have to run continuously for several years in order to raise the tree by, say, one foot ! The accompanying illustrations show a practical method of pulling up trees by the roots by making use of tremendous leverage.

The appliance used, which is known as the " Monkey Winch," is a product of Trewhella Brothers Proprietary Ltd., of Birmingham, and its origin is interesting. About the middle of last century several brothers of the Trewhella family, who were yeoman farmers in Cornwall, emigrated to Australia to make their fortunes at the goldfields. Their best morning's work resulted in the production of gold worth £1,200. One of them eventually decided that gold mining was too speculative, and that agriculture was the right occupation for his sons. He therefore took up about 100 acres of primeval forest and set his lads to clear it. The job nearly killed them, but in due course they got the farm into production. The younger generation had had such a gruelling time in the land clearing, however, that they were completely " fed up." One of them decided to become an engineer, and was trained at the Phœnix Locomotive Works in Ballarat. Some years later he began to study seriously the problem of land clearing, and the " Monkey Winch " is the result.

The root of a large oak tree pulled out by a " Monkey Winch," to allow of widening a main road near Birmingham.

By means of this interesting device two men can easily uproot giant trees in a fraction of the time that it would take half-a-dozen men to carry out the task by ordinary methods. The leverage placed at their disposal actually enables the two men to exert a pull of 24 tons. In addition no picking or root cutting is necessary, for the tree, complete with all its roots, is extracted from the earth and pulled bodily over, leaving the soil ready for immediate cultivation. With the old axe method the work of cutting down a tree was not only much more arduous, but also the stump of the tree and the roots still remained in the ground, so that considerable further work was entailed in removing these before cultivation could be commenced.

One of the outstanding features of the " Monkey Winch " is its simplicity of operation. The device is attached by a wire rope to the tree to be felled, and anchored to another tree in a suitable position. Then the handle of the winch, which is a lever 5 ft. in length, is worked backward and forward, thereby rotating a drum, round which the pulling rope is wound. Such a tremendous strain is then placed on the rope that soon the tree is torn up by the roots and pulled clear. This enormous pull is obtained entirely by hand power.

The apparatus consists of a winch, together with a pulley block and wire ropes, a grab, and an 80-ft. length of wire pulling rope. The grab is a patented piece of mechanism that acts as a vice, and is used for the purpose of gripping the pulling rope at any distance along its length, so that the length of the rope may be adjusted easily to suit the varying distances between the anchor tree and the tree to be felled. One end of the pulling rope is attached to the tree to be felled at about 5 ft. from the ground. The pulling rope is then gripped in the grab, and the grab itself is hooked on to the pulley block of the winch gear. If, for instance, 50 ft. of rope is required to reach the required tree, the grab is set to grip the rope 50 ft. from one end. It takes only a second or two to grip the rope or release it, and the greater the pull the tighter the grab holds. The use of the grab saves a good deal of time, as it obviates the necessity of winding up the slack in the pulling rope on the drum of the machine.

The winch proper consists of a conical steel drum, into which is cut a continuous spiral groove from the smallest diameter to the largest. The drum is secured on a steel shaft that carries also a large ratchet wheel, and the whole is mounted in a very strong steel yoke. A pawl is suitably pivoted on the yoke to engage the teeth of the ratchet, and the yoke itself is mounted on two wheels, to enable the apparatus to be moved easily from tree to tree. Above the ratchet wheel is a special type of gear mechanism, the driving shaft of which is squared at the end to take the 5-ft. lever handle, by means of which the machine is operated. When the handle is working on this shaft the maximum power of the appliance is obtained. If desired, however, the

lever handle may be placed direct on to the shaft of the winding drum, the end of which also is squared; and when the lever is working here a quicker action is obtained, although the pulling power is less. In order to change the speed of working it is only necessary to remove the lever from one shaft and place it on the other.

When the tree is uprooted, or if for any other reason the mechanic wishes to ease off the strain on the machine, he simply presses a small lever fitted to the gear mechanism. Then, when the movement of the large lever is continued, the direction of rotation of the winding drum is reversed, and the load may be lowered off steadily and in perfect safety. As soon as the weight is off, the catches fly clear of the teeth, and the drum is free for the rope to be removed ready for a fresh pull. A light brake prevents the winding drum from spinning, which would be liable to cause the rope to become entangled.

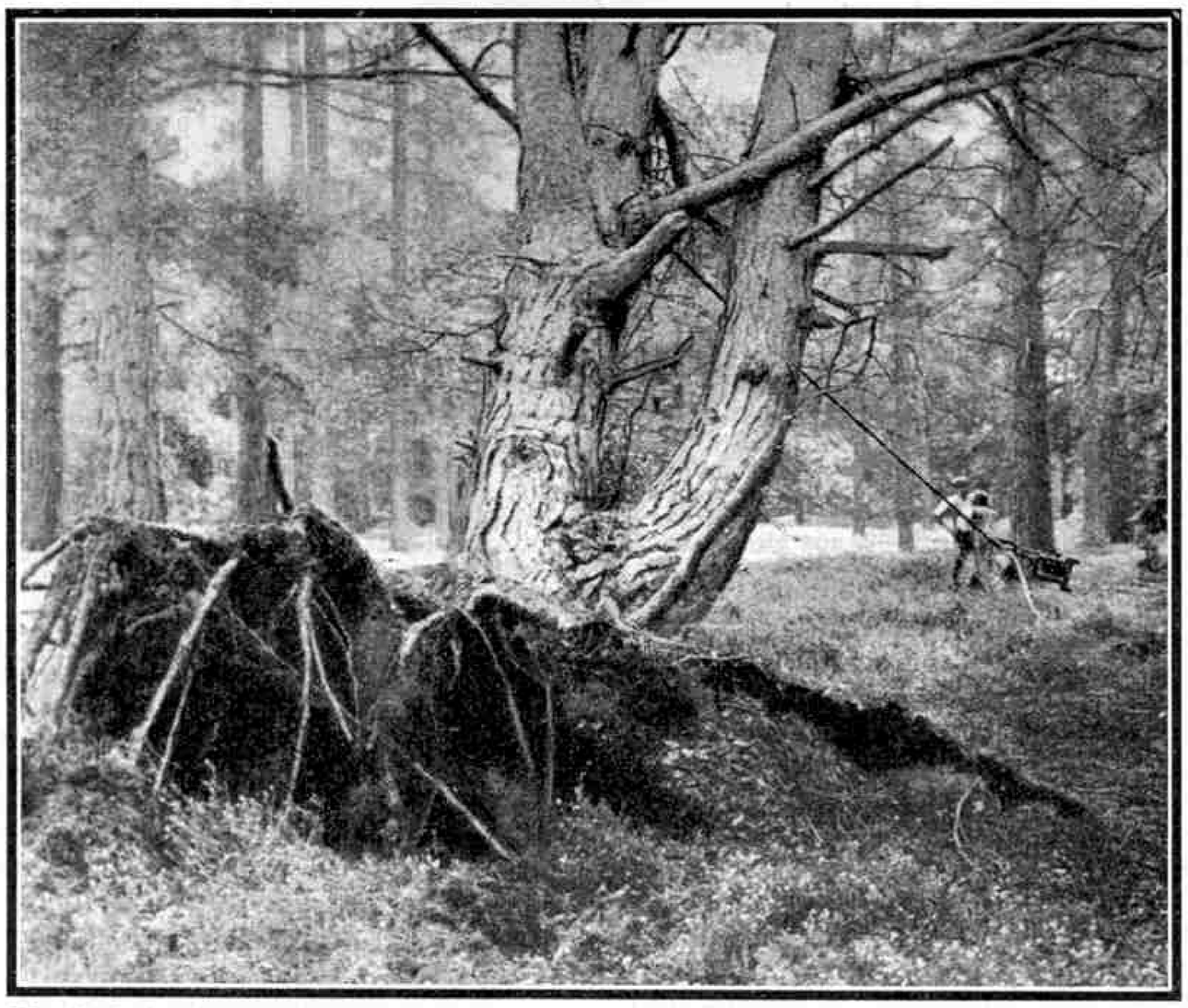
The "Monkey Winch" at work on the King's estates. This illustration shows clearly the general construction of the Winch, and how it is worked by the lever handle. The grab, by means of which the pulling rope is gripped, may be seen close to the pulley block.

The enormous power the "Monkey Winch" is capable of developing is due partly to the constantly increasing diameter of the winding drum, but mainly to the leverage given by the winch handle and the gear mechanism.

The pulling rope is not only extremely strong, but also light and flexible, so that it winds easily and snugly on the drum. It is made up of 114 separate wires of the highest grade Sheffield steel, each strand being carefully galvanised to protect the metal from rust. The ropes are fitted with special coupling hooks or eyelets, an interesting feature of which is that if a break should occur, the eyelets can be renewed in the field by the operator himself.

The working capacity of this device is remarkable. During the construction of the extension of the City and South London Railway from Clapham Common into Surrey, big trees were removed by it with amazing speed. An outstanding example was provided by a fine elm tree, 65 ft. in height. Two men working a "Monkey Winch," brought this giant to the ground in less than 10 minutes, with its roots intact. By the old methods it probably would have taken three men three days to remove the tree and its roots.

In addition to its value for removing trees, the winch is equally useful for uprooting the stumps of trees that have been felled near ground level with axes. For this work a "stumping trestle" is employed. A hold is secured on the stump by passing a special root rope under a few roots, and hooking both its ends to the main pulling rope. The trestle is placed a few feet away from the stump, and the pulling rope is passed upward from the stump over the top of the trestle, and then down to the winch. In this manner a lifting action is obtained, so that the great power of the winch is applied in just the right manner to lift out rapidly even the most obstinate stump.



The "Monkey Winch" at work. The machine is anchored to the tree in the distance and is pulling the tree in the foreground right out by the roots.

The usefulness of the "Monkey Winch" is not confined to clearing land. Its enormous power and its portability make it useful for all kinds of heavy pulling and lifting. It has been used successfully for hauling out "ditched" cars and lorries, pulling fallen timber out of rivers and lakes, erecting heavy roof girders, and overhead tanks, and for a variety of demolition work. For bridge building it will haul and support the heavy girders and other parts. The winch does not require to be loaded down, but can be anchored to a tree or hung from a beam, and will work in any position.

XXXIII.—A MEMBER OF THE ROYAL AIR FORCE

ALTHOUGH the Royal Air Force is the youngest of the three Services, it already possesses great traditions. It is military in character, of course, but the special nature of the duties carried out has given rise to considerable differences between its organisation and methods of administration and those of the Navy and Army. For instance, the proportion of officers to men is considerably higher than in the other Services, this being due to the fact that actual flying is chiefly carried out by men holding commissions. A reasonably high standard of education is demanded from the rank and file, most of whom enter on leaving school, and are trained as riggers, mechanics, electricians or wireless operators, before taking up regular duties as aircraftmen.

The special training required by officers and men of the Royal Air Force is given at Cranwell, Lincolnshire, and at Halton, in Buckinghamshire. The first of these establishments is devoted to the training of officers, while the second is the school of instruction for aircraft apprentices, the future aircraftmen of the Force.

The institution at Cranwell is the Royal Air Force College, which was established in 1920 with the object of preparing flight cadets for permanent commissioned service in the General Duties Branch of the R.A.F., and it is organised and conducted in a similar manner to the Army colleges at Sandhurst and Woolwich, and the Royal Naval College at Dartmouth. The training given at Cranwell normally extends over a period of two years, each year being divided into two terms. During the first year the flight cadets study English and scientific and geographical subjects in addition to the history of the R.A.F., the theory of flight and rigging, air pilotage map-reading, and Air Force law and administration. More time is allotted to training in professional matters during the second year, the aim being to give the cadet a thorough grounding in aeronautical and service subjects as a basis for further training and study after he has left the College and taken up his duties as a Commissioned Officer.

Training in flying is commenced on the arrival of the cadet at the college. Elementary training machines are generally employed during the first year, while in the second year tuition is given on aeroplanes that are representative of the main types in use in the Service.

Air Marshal Sir John F. A. Higgins, K.C.B., K.B.E., C.B., D.S.O., A.F.C., R.A.F., began his military career in 1895, when he entered the Royal Artillery. He served with distinction in the South African War from 1899 to 1902, and also in the Great War. He became a member of the Royal Air Force in its earliest days, and in 1924 was appointed Air Officer in command of the Forces in Iraq. He was specially interested in technical problems and in 1926 became Air Member for Supply and Research, in the Air Council, a position from which he retired in 1930.

Candidates for admission to the Royal Air Force College at Cranwell must be from 17½ to 19½ years of age, and also must be unmarried British subjects of pure European descent. Entrance is by open competition and application is made on a special form obtainable from the Secretary, Civil Service Commission. This, when duly completed, must be forwarded to the Secretary, Civil Service Commission, Burlington Gardens, London, W.1. The fee for the examination in London is £4; at any other centre the fee is £5 in addition to a local fee payable sometimes to college and school authorities. A candidate may undergo a preliminary medical examination by a Royal Air Force Medical Board not more than two years before he competes, on payment of a fee of £3 3s. 0d.

Candidates, except those nominated by the Headmaster of certain public schools, are required to produce school certificate A or B. Full information in regard to nominations from schools may be obtained from the Air Ministry, together with a list of institutions approved for the purpose. All candidates, whether nominated or not, compete for the vacancies offered.

A limited number of King's Cadets may be appointed by the Secretary of State for Air from candidates who are the sons of officers of the Royal Navy, Royal Marines, the British Army, the Royal Air Force, or the permanent fighting forces of India or of the overseas dominions or colonies, who have fallen in action, or have died of wounds received in action, or of disease contracted on service abroad and whose families are in reduced circumstances.

A limited number of Honorary King's Cadets may also be appointed from the sons of officers who die as the result of war service and whose families are not left in straightened circumstances, or from the sons of officers who have attained the substantive rank of squadron leader or above in the Royal Air Force, or relative rank in other services, and have performed long and distinguished service. No pecuniary advantage is attached to Honorary King's Cadetships.

A limited number of nominations to cadetships also are made by the Air Council from candidates belonging to families established and resident in the Dominions, Colonies and Protectorates. Candidates for these nominations are recommended by the Governors-General or Governors of Dominions and Colonies, and by the Secretary of State for the Colonies in the case of dependencies and protectorates; and application for details should be made to the overseas Governments concerned.

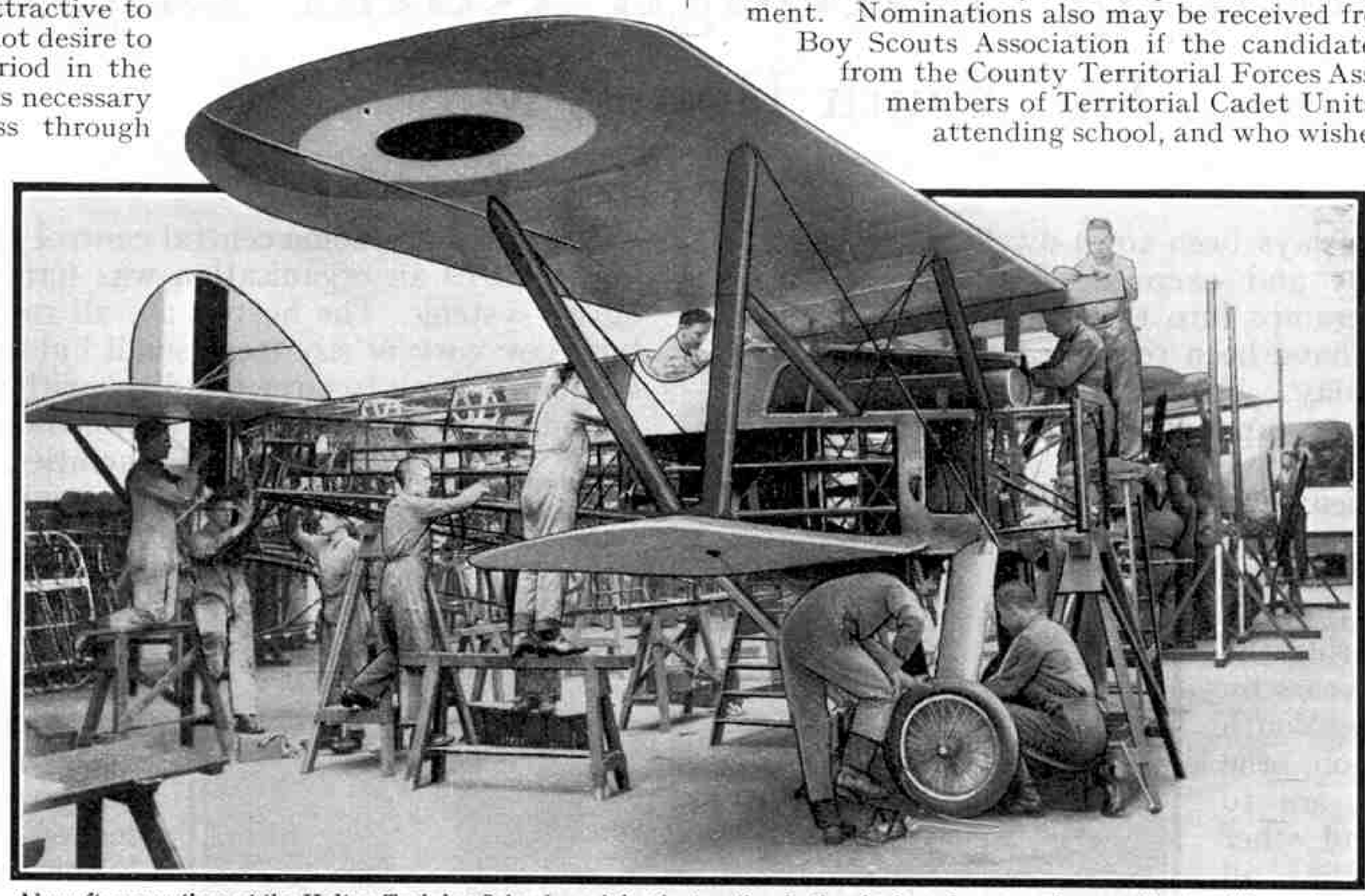
During their two years at Cranwell cadets are charged fees of £75 per annum, while further payments amounting to £100 are required to cover other costs. The total cost of the course therefore is £250, but during the whole of the time spent at the college cadets receive pay of 7/- per day, and this is sufficient to cover the usual expenses and to provide pocket money. A certain number of prize cadetships are awarded in order to enable boys of ability to enter the Air Force although their parents may be unable to meet the expenses of training. The awards are made to those who are highest in the entrance examination list, and the expenses of successful candidates are limited to about £40, which covers the cost of the two years' course. King's Cadets pay no fees, while reduced fees are payable by cadets who are the sons of officers and men who have seen a certain amount of service in the fighting forces.

On completing his training at Cranwell a cadet is granted a commission as Pilot Officer. Promotion to the rank of Flying Officer is obtained after 18 months' commissioned service, provided that a professional examination is passed; and further examinations must be negotiated in order to qualify for the ranks of Flight Lieutenant and Squadron Leader. Promotion to these and higher ranks is by selection, and of course each promotion brings with it higher pay.

Special regulations apply to those who have attended a university before taking up a career in the Air Force, for these candidates are above the normal age for training at Cranwell. Under the regulations, graduates between 20 and 25 years of age may be recommended by the authorities of the university they have attended. Approved candidates appear before a Selection Board, and those who are successful in securing entry to the Royal Air Force are given a course of training at a Flying Training School. On receiving commissions as Pilot Officers, men who have entered the Air Force in this manner may have their commissions ante-dated

by 12 months, or by 18 months if they hold a first or second class honours degree; and they thus start their careers on the same terms as officers who enter through Cranwell.

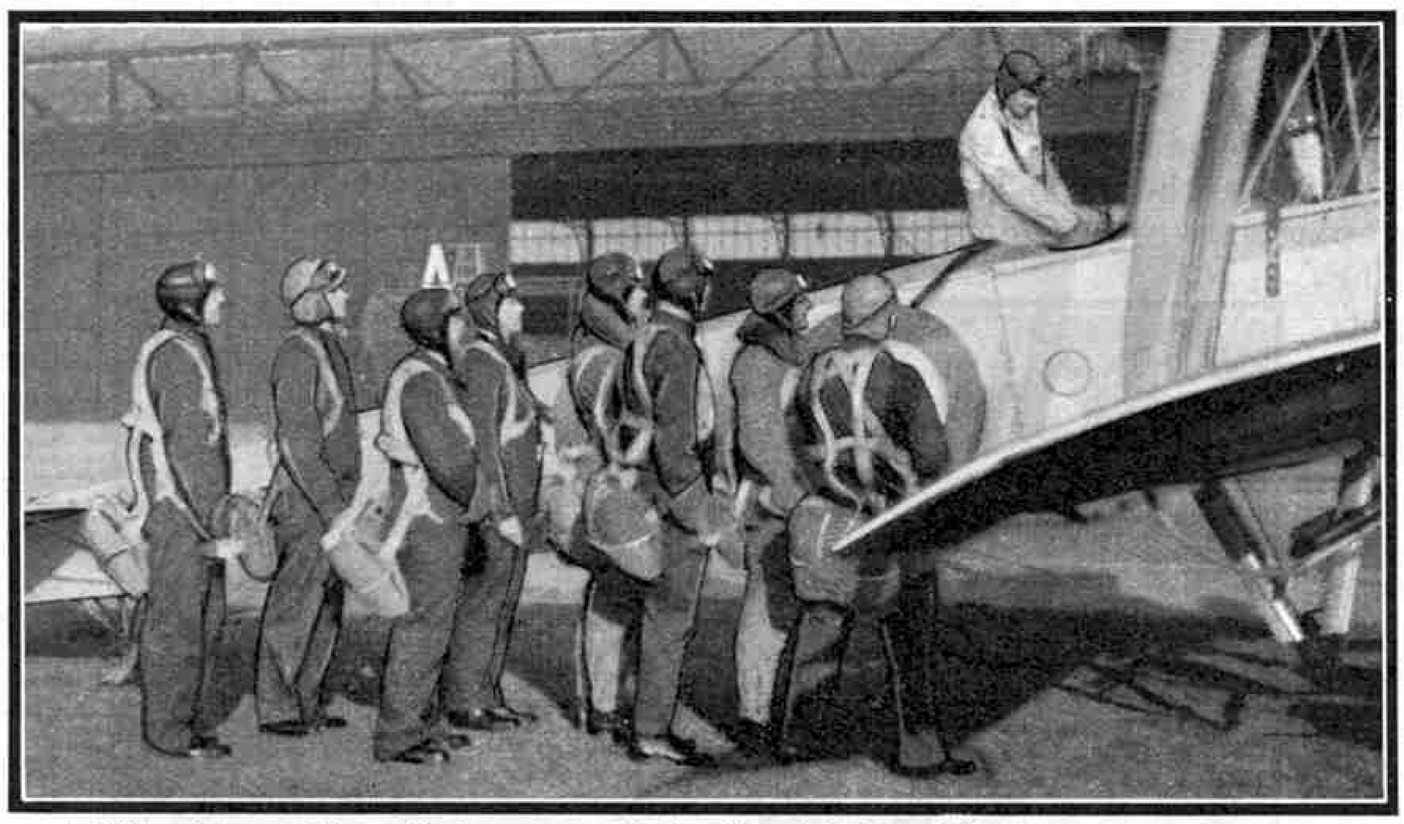
An interesting scheme introduced for the purpose of providing a sufficiently large reserve of air pilots may be attractive to many boys who do not desire to spend so long a period in the Royal Air Force as is necessary for those who pass through Cranwell. This is known as the Short Service Commission scheme. Entry into the R.A.F. in this manner is by selection and is open to candidates between 18 and 22 years of age. Application must be made on a special form, obtainable from the Secretary of the Air Ministry; and if a candidate's qualifications appear to be suitable he is asked to attend for interview and medical examination. Those who are accepted are employed for a period of six years on the active list, followed by four years in the reserve. They commence as Acting Pilot Officers on probation, and after a fortnight's preliminary training they are posted to one of the R.A.F. Flying Training Schools. The course of training normally covers a period of from eight to 12 months, and those who complete it satisfactorily are confirmed in their appointments, and attain the rank of Pilot Officer after completing 12 months' service.



Aircraft apprentices at the Halton Training School receiving instruction in the rigging of an aeroplane. The two illustrations on this page are Royal Air Force Official photographs: Crown Copyright Reserved.

A strictly limited number of permanent commissions are awarded every year to officers who hold Short Service Commissions, and in addition there are Medium Service appointments, the officers to whom these are awarded serving for five more years on the active list.

There are two other means of entry into the commissioned ranks of the R.A.F., but these are open only to those already serving in lower ranks, or to aircraft apprentices between 16 and 18 years of age who are being trained for such service. The aircraft apprentices who are highest in the examination that follows their training may be nominated as cadets and then undergo the customary training at Cranwell; but the number of such cadetships granted annually is very limited. Aircraftmen already serving may work their way up to commissioned rank, but very few qualify for promotion of this kind.



Flight cadets receiving preliminary ground instruction at the Royal Air Force College, Cranwell.

Boys who are attracted by the prospects of life in the Royal Air Force and are not in a position to take up cadetships should try to secure aircraft apprenticeships. Those who are successful receive three years' training in a skilled trade at the R.A.F. School of Technical Training, Halton, or at the Electrical and Wireless School at Cranwell. They are provided with a free outfit and are lodged and fed free of cost in addition to receiving pay. As previously mentioned, a limited number of cadetships at Cranwell are granted each year to outstanding apprentices. These boys pay no fee, and undergo the same course and have the same opportunities as Cadets entering through the normal channels.

There are four systems of entry as an aircraft apprentice, and in each case competitive examinations must be taken by the candidates, who must be from 15 to 17 years of age. What is known as a limited competition is open to boys nominated by local Education Authorities or by Advisory Committees for Juvenile Employment. Nominations also may be received from the Council of the Boy Scouts Association if the candidate is a Boy Scout, or from the County Territorial Forces Association in respect of members of Territorial Cadet Units. A boy who is still attending school, and who wishes to secure a nomination, should ask his headmaster to arrange this for him; while one who has left school may approach either his late headmaster or the local Employment Advisory Committee. The examination that follows is conducted by the Air Ministry at numerous centres twice yearly, in June and in November.

There is also an open competition held twice each year, usually about April and October, by the Civil Service Commissioners; and boys may enter for this, a fee of 5/– being required. Enquiries relating to the Open Competition should be addressed to the Civil Service Commission, Burlington Gardens, London, W.1.

The third means of entry is open only to candidates with special claims on account of their fathers' services with H.M. Forces. A limited number of such candidates may be granted permission by the Air Council to sit as "Service" candidates at the open competition conducted by the Civil Service Commissioners. They are selected from the sons of serving or ex-service personnel of or above the rank of Sergeant in the Army or Air Force, or Petty Officer in the Royal Navy. They are not called upon to compete with other candidates, but must reach the qualifying standard laid down by the Air Council. Special arrangements are made by the Air Ministry for "Service" candidates residing abroad to be examined locally.

Nominated candidates who have passed a first School Certificate examination with "credits" in mathematics and science, may be granted exemption from the educational entrance examination.

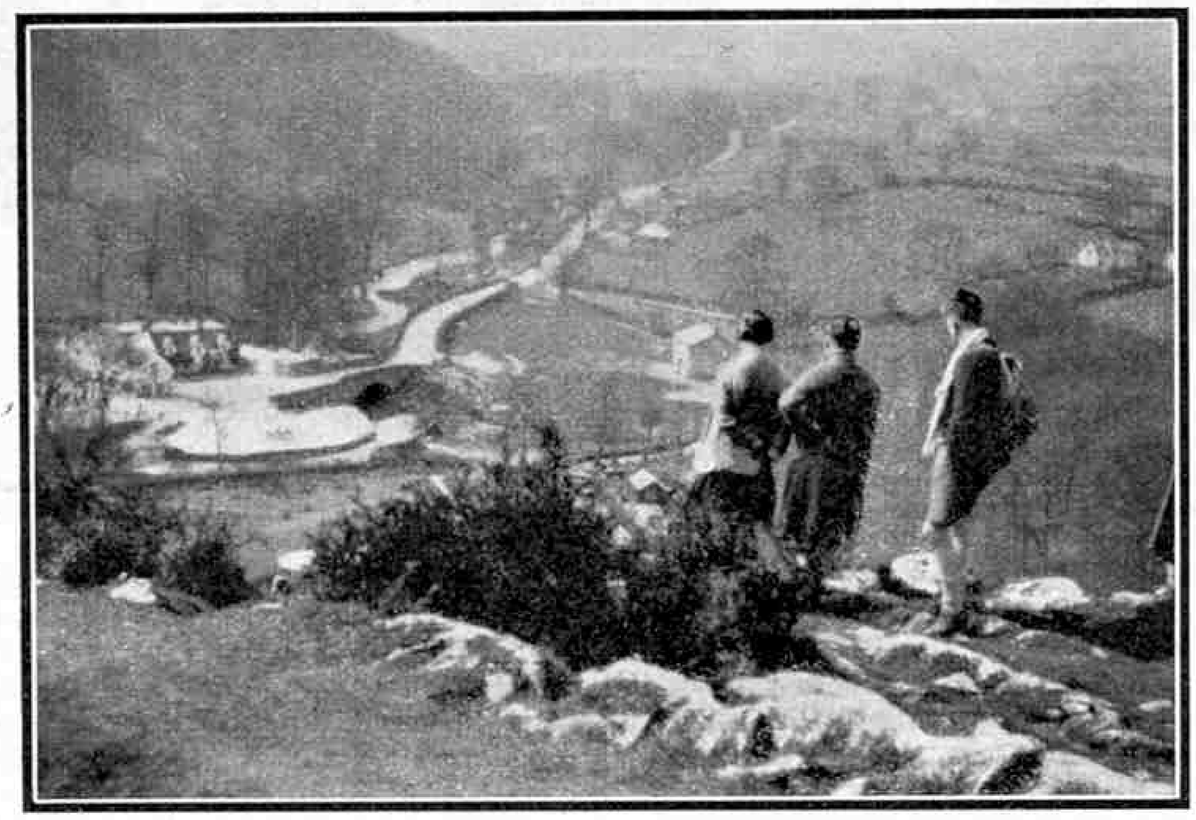
The examination that must be taken by those who wish to become aircraft apprentices consists of four papers, on mathematics, science, general knowledge and English composition respectively. Full details of the syllabus are given in a special publication, A.M. Pamphlet No. 15, obtainable from the Secretary, Air Ministry, Gwydyr House, Whitehall, London, S.W.1. The standard is well within the range of those who have received a good all-round education.

Candidates who are successful in the examination must satisfy the authorities of their physical fitness, and then they undergo training for three years, followed by 12 years' regular service in the Air Force after attaining the age of 18. Each boy is allocated to one of the trades in which there are vacancies. These include rigging, both in wood and in metal; fitting, particularly in connection with aero-engine work; and the electrical trades, including wireless operation. The rate of pay (Continued on page 517)

Rambling Through Rural England

The Youth Hostels Movement

THERE have always been town-dwelling enthusiasts for fresh air and exercise who have regularly made long tramps into the country, but in most cases their walks have been restricted to half a day or perhaps a whole day. Tramps extending over two or three days were comparatively rare until recently because of the difficulty of finding convenient and cheap lodgings for the night. A great change in this respect has been brought about during the last two or three years by the activities of the Youth Hostels Association, the objects of which are to provide hostels and other facilities for enabling all nature lovers to enjoy the beauty of rural England, preference being given to young people.



Ramblers stop to admire the view from the Loggerheads, N. Wales. The River Alyn and the road to Ruthin can be seen below.

The hostels movement originated in Germany. Some 25 years ago a schoolmaster named Richard Schirrmann, after spending most of his life in the country, was transferred to a school in an industrial town. This was a change greatly for the worse, but he made the best of things by taking long walks into the country whenever an opportunity arose. Eventually he decided to take some of his pupils with him so that they too could see for themselves and learn to appreciate the wonders of nature. During the holidays he took them on long excursions, and as many of them were too poor to pay for a night's lodging they slept in barns and other similar buildings. The disadvantages of this arrangement set Schirrmann considering whether it was possible to provide some kind of proper lodging for poor youths. In 1907 the idea occurred to him of "Jugendherbergen," or youth hostels, and as a commencement he converted an old building in Altena into the first hostel. This was a primitive sort of place, but it was the start of the hostel movement that has now spread through Europe.

A rest after lunch. On the extreme left is Mr. T. E. Fairclough, Hon. Sec. of the Merseyside Group, the first hostels group formed in the British Isles.

The hostel scheme quickly aroused public interest. Support for it was soon obtained, and more old buildings were bought and fitted up with sleeping accommodation. It soon became clear that these hostels could not flourish unless there was some central control for the movement, and in 1919 an organisation was formed to govern the entire system. The hostels are all run on similar lines, but they vary in size from small huts with very limited accommodation to large buildings with 600 beds or more. In addition to sleeping accommodation and washing facilities, a separate room is provided for meals and for use during the day. The "Herbergsvater," or father of the hostel, is in charge, and as a rule a "Herbergesmutter," or hostel mother, attends to the wayfarers generally and gives assistance when needed.

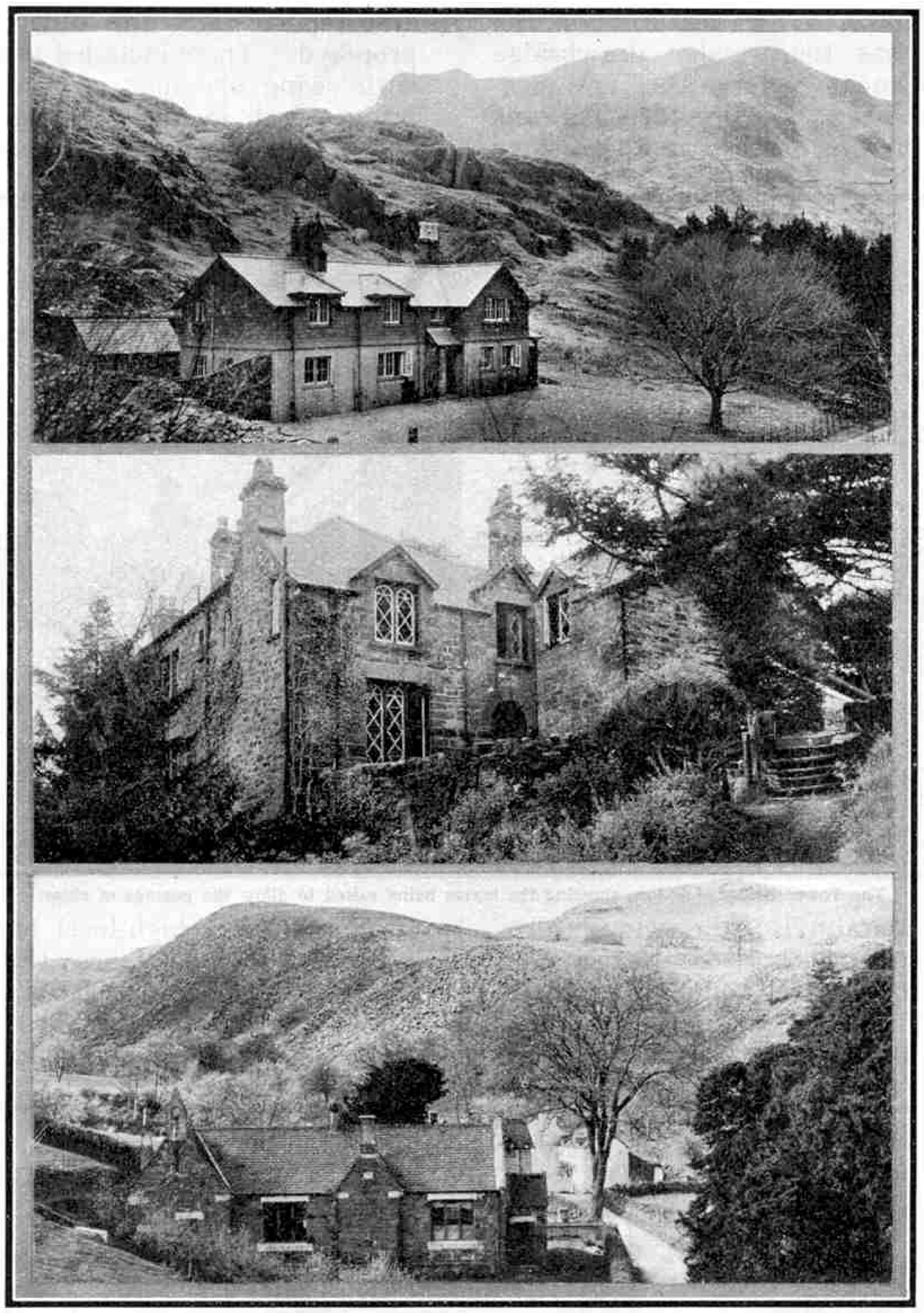
The war brought the hostel movement to a standstill for a time, but after the armistice it once more began to flourish, and since then it has extended on a remarkable scale throughout the whole of Germany. In that country there is now a chain of 2,300 hostels, where a light supper, bed and breakfast may be had for less than a shilling.

It was not long before the success of the movement in Germany attracted attention in other countries, and since 1929 hostels have opened in Great Britain, Austria, Switzerland, Holland, Denmark and France. The first British hostels to be opened were those organised by a Merseyside group as a result of a meeting convened by the Liverpool and District Ramblers Federation in December, 1929. Public support was invited, and plans were made for a chain of hostels in North Wales. One of the first to be opened was that at Maeshafn, and it was specially designed and built for the purpose; but many of the more recently opened hostels consist of converted farmhouses and country dwellings.

The Youth Hostels Association was formed in 1930, and there are already 18 Groups in operation, controlling 100 hostels. It is now possible for walkers to tour the most picturesque and interesting parts of the British Isles, staying each night at a hostel at a charge of one shilling per night. For this small sum a comfortable bunk bed with two or three blankets is provided. Cooking facilities also are provided,

some hostels using oil stoves and some Primus stoves, while others rely on coal fires. In one hostel at least gas meters are installed, and the visitor inserts a penny in the meter and obtains a supply of gas to cook food and boil water. In most cases meals can be obtained near by, and in the hostels in North Wales the wardens who look after the hostels all the time cook and supply hot suppers and breakfasts at a charge of one shilling or less, and will provide a packed lunch for sixpence.

Every variety of building has been pressed into service, and old mills, schools, castles, farm buildings, and even stables, are included in the hostels used by the association. As far as possible the hostels are arranged in lines or in chains, in order to make it possible for the walker or cyclist to see the very best of the country and thus obtain the greatest possible value from a holiday tour. One line runs from London down the Pilgrims Way to Winchester, and another from Stratford-on-Avon, Shakespeare's birthplace, across Gloucester and Somerset to North Devon, where there is another chain. From Birmingham a line goes towards North Wales, and the North Wales chain runs from Flintshire to the high mountains in Snowdonia. A chain in Derbyshire and a line from Manchester to Lakeland, with a chain round the Lakes, make possible wonderfully interesting journeys. From the North East the line follows the old North Wall. There is a hostels association in Scotland and one in Ireland, and one membership card is sufficient to take the visitor to any hostel.



Three typical Youth Hostels in the Merseyside Group, N. Wales. Top : Idwal Cottage, near Lake Ogwen in the Nant Ffrancon Pass with accommodation for forty-two. Centre : Gwydyr Ucha, an old 17th century house at Llanrwst accommodating eighty. Bottom : The old school house at Gyffylliog fitted out as a Hostel has beds for thirty-two.

Visitors to the hostels must have a cotton sleeping sack, and carry a knife, fork and spoon, and in some cases a mug and a plate in addition to their personal equipment.

The hostels are mostly about 15 miles apart and in some cases less, and a very pleasant holiday can be spent travelling between them. Although 15 miles may not seem very much for a day's walk, it is far too great a distance to be undertaken by anybody who is not in good walking form. A whole holiday may be spoiled as the result of over exertion on the first day. To avoid this a tramping holiday should be preceded by a regular series of walks, commencing with three or four miles and increasing this distance until 15 or even 20 miles can be covered in a day without undue fatigue.

The rambler should pay the most careful attention to his footwear. Nailed boots are invaluable for rough ground and mountain climbing, but for ordinary footpaths shoes are suitable and much lighter. The one thing that is really necessary in all footwear for tramping is a good thick sole. In buying boots or shoes for tramping purposes greater attention should be given to a perfect fit than is usually given to boots for town use. Boots that are right for the short distances one walks in the ordinary course of school or business may turn out to be a source of misery on a 20-mile walk. New footwear should be "broken in" by means of short walks before a long walk is undertaken, and should be softened by oiling with crude castor oil.

When very long walks are to be undertaken it is a good tip to rub over the inside of the socks with soap. At the end of the day's journey the feet should always be washed in cold water, as this hardens them; and in the evening slippers and a clean pair of socks will be found very restful. If the feet show signs of giving out during the walk, a rub with a towel will often freshen them; and a change of socks, if a clean pair is available, improves matters very considerably. Two or three spare pairs of socks weigh very little, and they make a tremendous difference to the comfort of a long tramp.

The handbook issued by the Youth Hostels Association gives full information as to the manner in which the hostels are operated and a description of the walks between them. This description is necessarily brief, however, and a good guide book to the district should be obtained in addition. The route to be followed should be read up in the guide book beforehand, as this will prevent the overlooking of interesting features along the way, and will save a great deal of time and trouble. If the walk is to be on an extensive scale a reliable map should be carried, the best being the one inch Ordnance map.

Readers who are interested in rambling may obtain full information in regard to the different groups of the hostel movement, and application forms for membership, by writing to the Secretary, Youth Hostels Association, 18, Bridge Road, Welwyn Garden City, Herts.

Modern Types of Opening Bridges

I.—The Tower Bridge, London

ONE of the most characteristic features of the mediæval fortress was the wooden drawbridge that crossed the moat before the entrance. Normally this bridge was down, and provided a means of communication between the fortress and the outer world. At night, however, or when there was danger of an enemy attack, the bridge was raised by means of chains, so that the moat then formed a strong line of defence. This type of bridge was the ancestor of the modern opening bridge, which has been developed with the object of providing a means of crossing a waterway without obstructing the passage of ships.

The Tower Bridge, London, showing the leaves being raised to allow the passage of ships.

Modern opening bridges may be divided into five main classes—the drawbridge or bascule, turning about a horizontal axis; the swing bridge, turning about a vertical axis, or a horizontal turntable; the rolling or draw-back bridge; the rolling lift bridge; and the vertical lift bridge. All these types are of considerable engineering interest, and we propose to deal with each one separately. This month we shall commence with the most famous example of the first, or drawbridge type—the Tower Bridge over the River Thames at London.

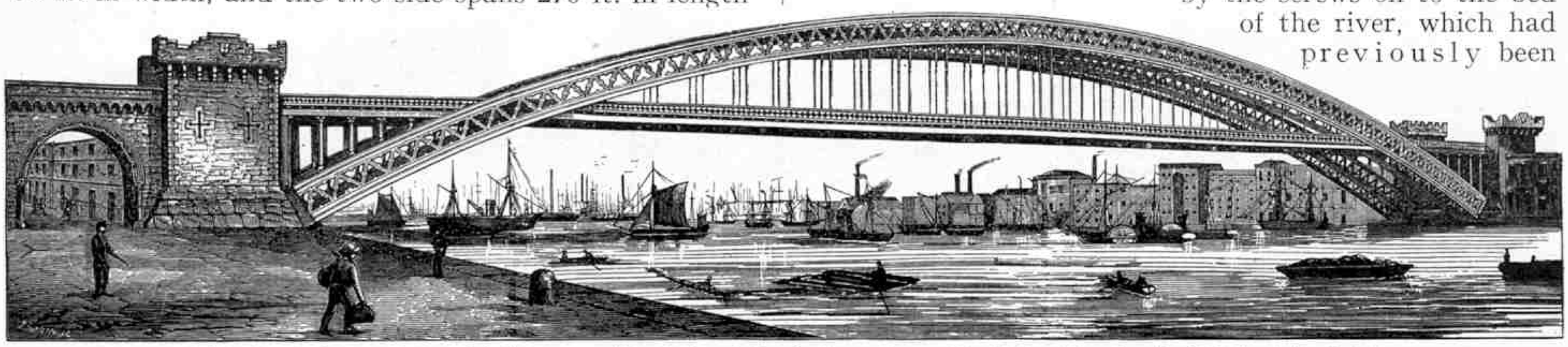
The Tower Bridge with leaves closed, for road traffic. Photograph by our reader S. Pargeter, London.

The building of the Tower Bridge came about as the result of a development of cross-Thames traffic that had far outstripped the capacity of the existing bridges. By the year 1870 the position had become serious, and between 1874 and 1885 some thirty petitions from various public bodies were brought before the authorities, urging either the widening of London Bridge or the construction of a new bridge, or both. A committee was appointed to consider the matter and report upon the different plans that had been proposed. These included schemes for low-level bridges with swing openings of various kinds, and high-level bridges with inclined approaches or with lifts at each end. There was also a proposal for a river railway line to be constructed at the bottom of the river and carrying above a staging and deck projecting beyond high-water level. Proposals for a subway and for large paddle-wheel ferry boats were also considered. None of these schemes was approved, and matters were thus no further advanced.

Schemes continued to be brought forward, prominent among which was one by Sir Joseph Bazalgette, the engineer of the Metropolitan Board of Works, for a high-level bridge. In 1878 Mr., afterwards Sir Horace Jones, the City architect, issued a report in which he declared a high-level bridge to be inadvisable, and put forward a proposal for a low-level bridge on the bascule principle. Nothing came of this proposal at the time, but it formed the basis of the design that was finally adopted in 1885. In that year an Act was passed empowering the Corporation of London to construct a bridge over the River Thames near the Tower of London, with the necessary approaches. Work was commenced in April 1886. Mr. Horace Jones was the architect, and Mr., afterwards Sir John Wolfe Barry, the engineer; while the builders were Sir William Arrol and Company and Sir John Jackson.

The Tower Bridge Act laid down that the bridge should have a central opening span with a clear width of 200 ft., and a height above highwater of 135 ft. when

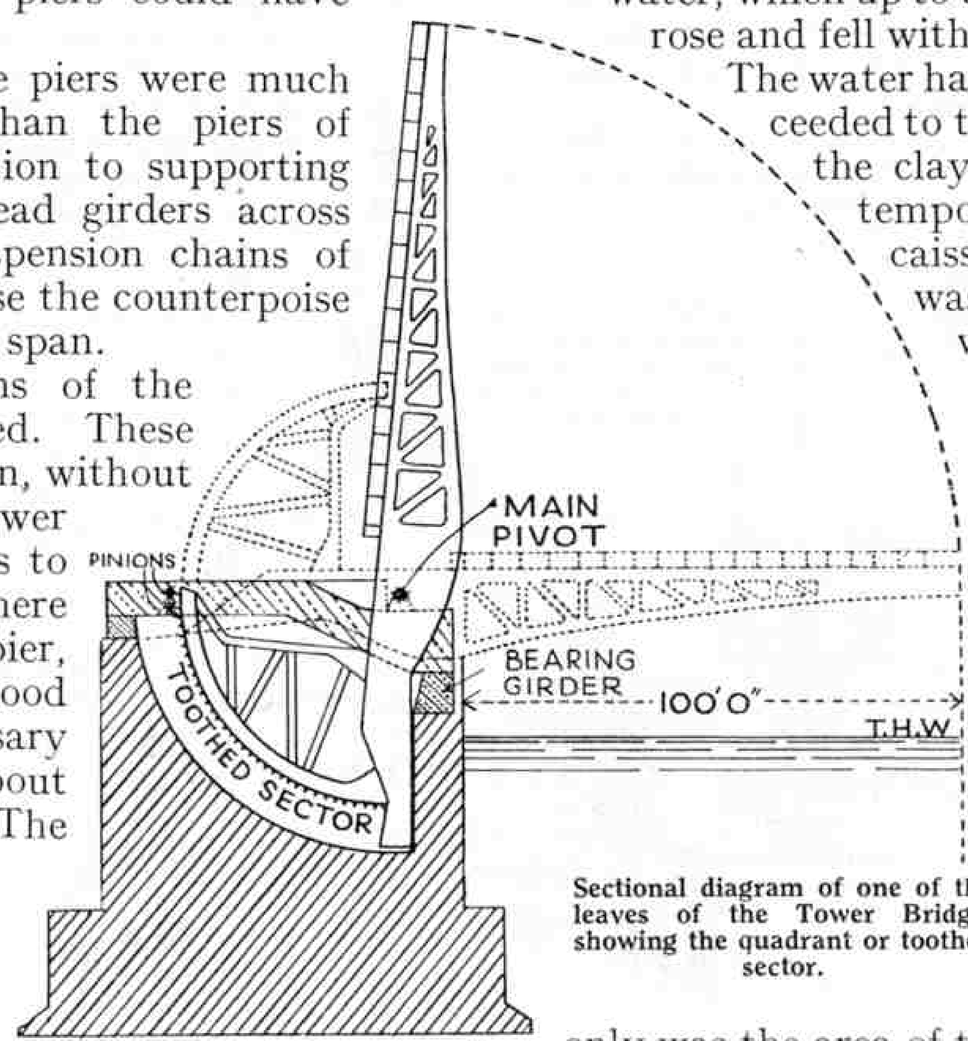
open for large vessels, and of 29 ft. when closed. The last two dimensions were actually exceeded, the open height being 5 ft. greater and the closed height 6 in. greater than was prescribed. The Act further stipulated that the piers were to be 185 ft. in length and 70 ft. in width, and the two side spans 270 ft. in length clear. There was also a clause rendering it compulsory to maintain at all times during the construction of the bridge a clear waterway 160 ft. in width. This stipulation made it impossible for the two piers to be built at the same time, because the staging necessary would have occupied far too much of the river space. The best that could be done was to adopt a system of small caissons around the circumference of the piers instead of one large caisson extending completely across a pier; thus making it possible, while one of the piers was being built, for work to proceed also at the shore side of the other pier. It is estimated that a saving of from 13 to 14 months might have been effected if operations on both piers could have proceeded simultaneously.



Sketch of a single span steel arch bridge proposed by Sir Joseph Bazalgette, engineer of the Metropolitan Board of Works, but rejected in favour of the opening type of bridge.

It should be noted that these piers were much more complicated structures than the piers of an ordinary bridge. In addition to supporting the towers carrying the overhead girders across the opening span, and the suspension chains of the fixed spans, they had to house the counterpoise and machinery of the opening span.

In preparing the foundations of the piers open caissons were employed. These were strong boxes of wrought iron, without either top or bottom, their lower edges being made so sharp so as to penetrate the ground easily. There were twelve caissons for each pier, and in order to secure a good foundation it was found necessary to sink them to a depth of about 21 ft. into the bed of the river. The lower portion of the caisson was known as the permanent caisson, and the upper portion, which was removable when the pier was completed, was called the temporary caisson. The object of this upper portion was simply to keep out water while the pier was being built. In an interesting account of the building of the bridge Sir John Wolfe Barry, the engineer, gives the following description of the sinking of the caissons.

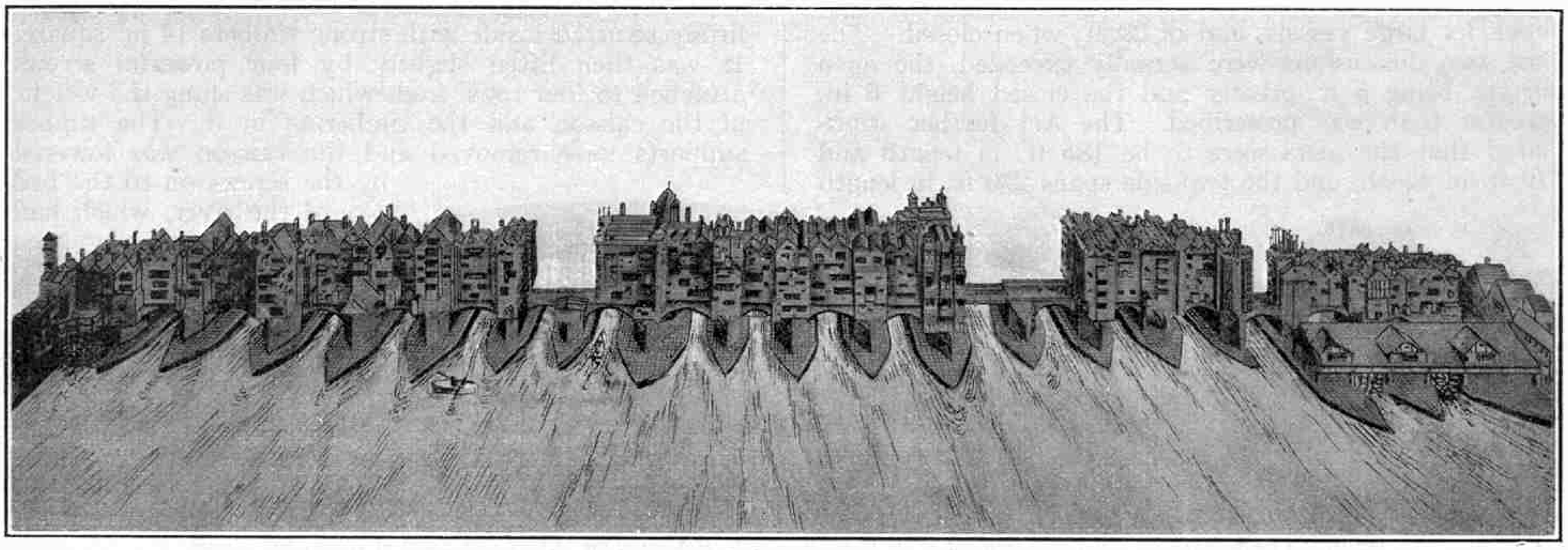


Sectional diagram of one of the leaves of the Tower Bridge, showing the quadrant or toothed sector.

"The temporary timber staging for the pier having been constructed with pile-work in the river, the next operation was to erect the permanent caisson upon the staging. The permanent caisson was 19 ft. in height, divided horizontally into two lengths. It was erected on timber supports, which were slightly above low-water mark, where it was riveted together and firmly strutted inside with strong timbers 14 in. square. It was then lifted slightly by four powerful screws attached to four rods, from which was slung the weight of the caisson and the timbering in it. The timber supports were removed and the caisson was lowered by the screws on to the bed of the river, which had previously been levelled by divers. After the permanent caisson reached the ground various lengths of temporary caisson were added to it, till the top of the temporary caisson came above the level of highwater. The junction between the permanent and the temporary caissons was made with indiarubber.

"Divers working inside the caisson excavated first the gravel and then the upper part of the clay forming the bed of the river, and as they dug away the soil, which was hauled up by a crane and taken away in barges, the caisson gradually sunk until at length its bottom edge penetrated some 5 ft. to 10 ft. into the solid London clay. London clay is a firm water-tight stratification, and when the above-mentioned depth was reached it was safe to pump out the water, which up to this time remained in the caisson, and rose and fell with the tide through sluices in the sides. The water having been pumped out, navvies proceeded to the bottom of the caisson and dug out the clay in the dry. Additional lengths of temporary caisson were added as the caisson sunk, so that at last each caisson was a box of iron 57 ft. in height, in which the preparation of the foundations could be commenced . . . . The caisson having been controlled from the first by the suspending rods and screws, its descent any further than was desired was easily arrested by the rods when the bottom of the caisson was 20 ft. below the bed of the river. The clay was then excavated 7 ft. deeper than the bottom of the caisson, and outwards beyond the cutting edge for a distance of 5 ft. on three of the four sides of the caisson. In this way not only was the area of the foundations of the pier enlarged, but as the sideways excavations adjoined similar excavations from the next caissons, the whole foundation was made continuous. The whole of the permanent caissons with the spaces between them were then completely filled with concrete, upon which the brickwork and masonry were commenced in the temporary caisson and carried up to 4 ft. above highwater."

The preparation of the foundations was a long and difficult task on account of the extent of the river traffic, which made it very difficult to berth the necessary working barges. The isolation of the piers themselves was an additional difficulty. The full extent of these



Old London Bridge, as Shakespeare saw it about the year 1600.

handicaps was under-estimated, and as a result this section of the work occupied much longer than had been expected. The abutments of the bridge were built by means of ordinary coffer-dams in the usual manner, and presented no particular difficulty.

We now come to the most interesting feature of the Tower Bridge, the opening span. This consists of two leaves, each turning on a horizontal steel pivot that rests on live rollers, and is 21 in. in diameter and 25 tons in weight. Each of the leaves is formed with four main longitudinal girders, 13 ft. 6 in. apart from centre to centre, and together providing for a clear width of bridge between the parapets of 50 ft. This width is sufficient to provide for a 32-ft. roadway and two footpaths, each 9 ft. in width. The spaces between the longitudinal girders are filled with cross girders and roadway plates, and on these are laid the wood pavement of the roadway and footpaths. Each of the moving girders is 162 ft. 3 in. in length and revolves on a main pivot set 12 ft. 9 in. back from the face of the pier. The distance from the centre of this pivot to the end of the girders at the centre of the span is 112 ft. 9 in., and to the end of the girders in the opposite direction 49 ft. 6 in.

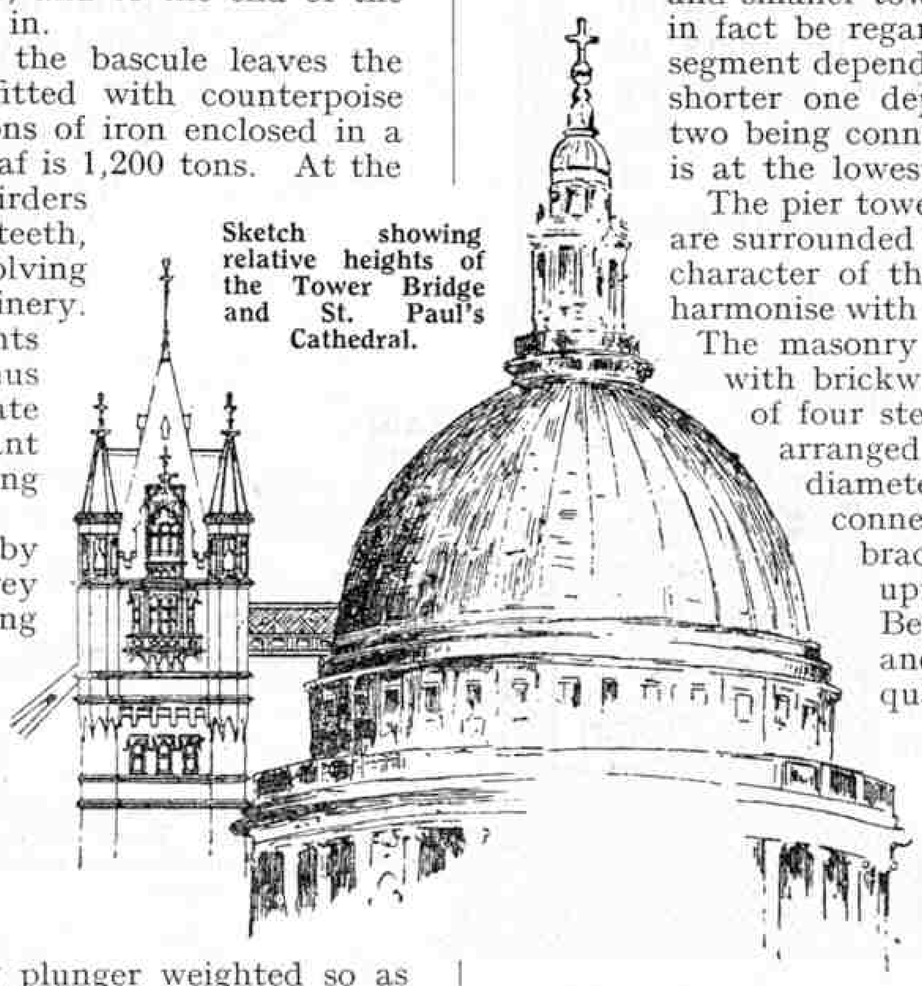
In order to preserve the balance of the bascule leaves the shorter or landward arm of each is fitted with counterpoise consisting of 290 tons of lead and 60 tons of iron enclosed in a ballast box. The total weight of each leaf is 1,200 tons. At the counterbalanced ends of the two outside girders of each leaf are quadrants carrying fixed teeth, which engage with similar teeth on revolving pinions actuated by hydraulic machinery. When the pinions are turned the quadrants revolve on their centres and each leaf is thus made to rise or fall. There are four separate pinions to each leaf—two to each quadrant—and each of the four is capable of operating and controlling the entire leaf.

The hydraulic power is generated by pumping engines situated on the Surrey side of the river, and capable of producing a water pressure of about 850 lb. per sq. in. The hydraulic machinery does not receive the high-pressure water direct from the pumps, but by way of accumulators. The object of the hydraulic accumulator is to accumulate or store up power and thus form a reservoir ensuring a plentiful and steady supply of energy. It consists essentially of a large cylinder in which fits a long plunger weighted so as to bring about the necessary pressure on every square inch of the area of the cylinder. The pumps are constantly at work pumping water at that pressure into the accumulator. The demand for hydraulic power is not continuous, but intermittent, and during each brief period of demand the accumulator is able to give out the power provided by the pumps at a greater rate than the pumps could do working alone. There are altogether six accumulators, two near the pumps and two on each pier.

The high-pressure water passes through pipes along the fixed span and up the tower on the south side, across the high-level footbridge and down the tower on the north side. After it has exerted its pressure at the hydraulic engines, which are situated beneath the footway on each pier, the water passes back again to the pumps where it is once more compressed. The hydraulic engines are duplicated on each pier to provide against the possibility of breakdown.

The operations of opening and shutting the bridge are safeguarded by every possible means. When the leaves are brought together, bolts fixed on one leaf are driven by hydraulic power into sockets on the other leaf. In the event of anything going wrong with the opening and closing mechanism there would be no danger of disaster, for the leaves would be brought gently to rest in either the vertical or the horizontal position. The machinery of the opening span is operated from cabins on the piers by means of a system of interlocking levers similar to those used in a railway signal cabin. It is impossible for an operator to withdraw the locking bolts and open the span until the bascules have been cleared of traffic and a chain has been fixed across the entrance to each pier.

The fixed portions of the bridge are the two 270-ft. shore spans and the central 230-ft. high-level span. The shore spans are suspension bridges, the chains—which are really riveted and braced girders—being carried on towers on each pier and smaller towers on the abutments. The chains may in fact be regarded as arched ribs, consisting of a long segment depending from the top of the pier tower and a shorter one depending from the abutment tower, the two being connected by a pin at their extremities, that is at the lowest point of the suspension curve.



Sketch showing relative heights of the Tower Bridge and St. Paul's Cathedral.

The pier towers are actually steel structures, and they are surrounded with masonry to retain the architectural character of the whole structure, which is designed to harmonise with the general style of the Tower of London. The masonry is granite and Portland stone, backed with brickwork. Each tower consists of a skeleton of four steel pillars built up of riveted plates, and arranged in the form of an octagon 5 ft. 6 in. in diameter and 120 ft. in height. The pillars are connected by horizontal girders and diagonal bracings, and they extend from wide bases upward to the chains that they support. Between the pillars are the public stairs and the passenger lifts, and spaces for the quadrants of the opening span when these are in the upward position. The abutment towers have similar but shorter pillars.

It was important that precautions should be taken to prevent any adhesion between the masonry and the steelwork of the towers. With this object the columns were covered with canvas as the masonry was built around them, and spaces were left in places where any subsequent compression of the steelwork would bring undue weight upon the adjacent stonework. The masonry covering forms an excellent protection against extremes of temperature. All parts of the metal to which access for painting purposes could not be obtained after the bridge was completed were coated thoroughly with Portland cement. Manholes were provided in the steel columns to make it possible to paint the interior whenever it became necessary.

The high-level footway bridges between the towers are cantilever structures, each with a suspended span. They are cantilevers for a distance of 55 ft. from each tower, and girders for the remainder of the distance of 120 ft. between the cantilever ends. The erection of these cantilevers attracted a great amount of attention on the part of the public, who watched their *(Continued on next page)*

Modern Bridges—(*Continued from previous page*)

gradual approach with the keenest interest.

The total length of the bridge, including both approaches, is half a mile; and the total height of the towers on the piers, measured from the level of the foundations, is 293 ft., or only 72 ft. less than the height of the top of the dome of St. Paul's Cathedral. In the construction of the bridge there were used about 235,000 cu. ft. of granite and other stone, 20,000 tons of cement, 70,000 cu. yd. of concrete, 31,000,000 bricks, and 14,000 tons of iron and steel. The steel used throughout the whole of the work was made by the Siemens-Martin process; and had a tensile strength of from 27 to 32 tons per sq. in. of sectional area, and an ultimate elongation of 20 per cent. in a length of 8 in. The steelwork was constructed in Glasgow and despatched by the steamers of the Clyde Shipping and Carron Companies. The vessels discharged their cargoes within half a mile of the bridge into the contractor's barges, and the material was then conveyed to either side of the river as required. The quantity sent forward was generally from 50 to 100 tons per week. As much as possible of the riveting was done before the steelwork was despatched to London, but for convenience of handling the weight of any one piece was limited to about five tons. From time to time material that was urgently required was sent by train. The erection of the bridge occupied eight years; and the total cost, including the approaches and the property that had to be purchased, was nearly £1,000,000.

We are indebted to Sir William Arrol & Co. Ltd., for much of the information contained in this article, and for the upper illustration on page 515 and the sketch on page 516.

Famous Aeroplanes—(*Continued from page 527*)

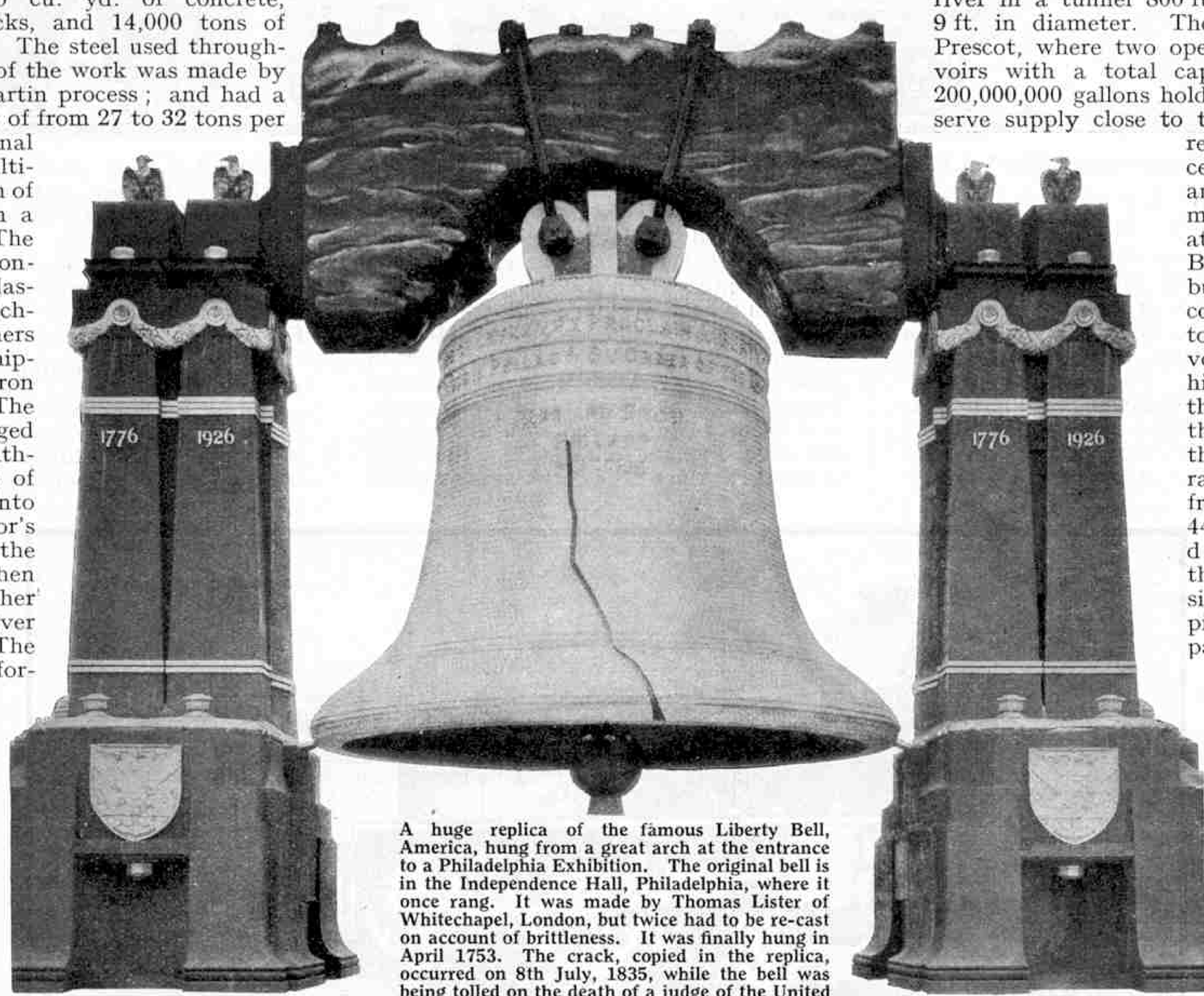
the engine unit is the same as that used on the "Puss Moth." The fuselage is, of course, of a new design. It is constructed wholly of wood and is provided with a covering of plywood. The undercarriage is of the divided type.

A D.H. "Gipsy 111" engine is employed on this machine, giving it a cruising speed of between 90 m.p.h. and 95 m.p.h. and a maximum speed in excess of 110 m.p.h. The normal range is 380 miles, which may be covered in four hours. The machine has a span of 30 ft. 10 in. and is 25 ft. 9 in. in overall length. Its empty weight is 1,050 lb. and when fully loaded it weighs 2,050 lb.

What Shall I Be ?—(*Continued from page 511*)

during the training period is 1/– per day for the first two years and 1/6 per day thereafter, until the apprentice has reached the age of 18 and has been posted to a unit on completion of his training. An examination must be passed on completing the course, and in conjunction with the report on the apprentice's work this settles his classification on promotion to leading aircraftman. Those who do not reach the necessary standard may be classified in an unskilled trade or discharged.

The commencing rate of pay for an aircraftman posted to a unit for duties varies from 3/3 to 5/6 per day (22/9 to 38/6 per week), according to the classification obtained in the passing-out examination. This is increased on promotion to corporal or sergeant, and also on securing a flying qualification. Opportunities are given to aircraft apprentices to volunteer for training as airmen pilots. About 80 volunteers from all trades are selected each year, but the final choice is not made until after a year's service. Those selected receive full training and on qualification are promoted to sergeant, but unless they are recommended for commissions they do not lose touch with their technical trade, to which they return later.



A huge replica of the famous Liberty Bell, America, hung from a great arch at the entrance to a Philadelphia Exhibition. The original bell is in the Independence Hall, Philadelphia, where it once rang. It was made by Thomas Lister of Whitechapel, London, but twice had to be re-cast on account of brittleness. It was finally hung in April 1753. The crack, copied in the replica, occurred on 8th July, 1835, while the bell was being tolled on the death of a judge of the United States Supreme Court.

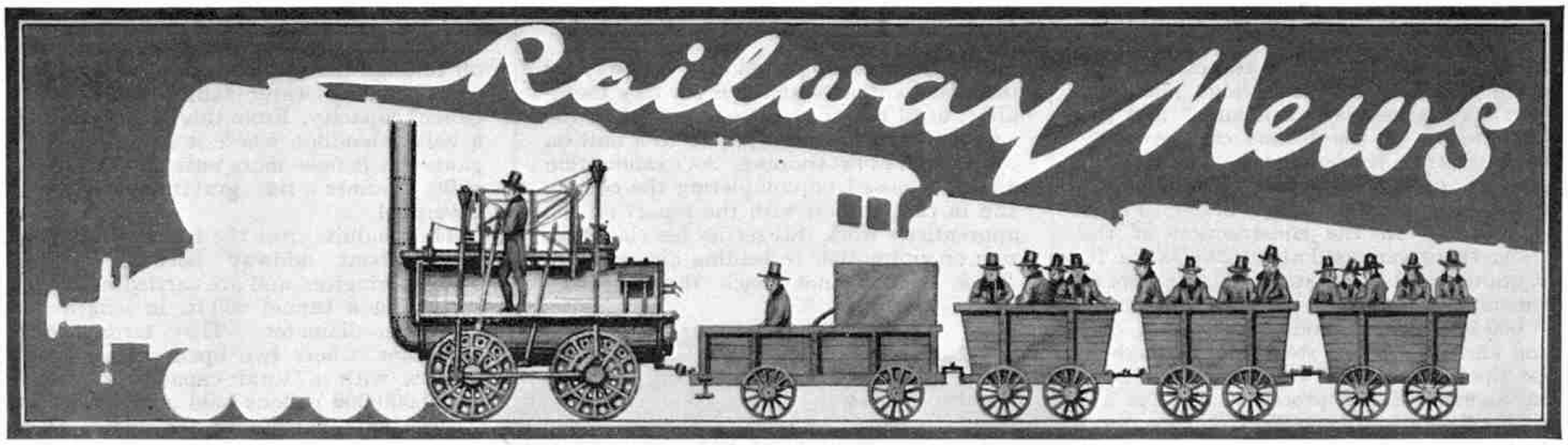
Water Engineering—(*Continued from page 503*)

in passing through the bed.

The water is passed upward through an inclined copper gauze screen of fine mesh, flows over a cast iron lip that extends the full length of the filter, and falls on to the bed, or "slow sand filter." This bed consists of a layer of sand 2 ft. 6 in. deep, beneath which is a layer of gravel 1 ft. deep laid over perforated tiles. The water sinks through the sand and gravel and is drained off through the tiles and collected in an uncovered clear water tank of 2¾ million gallons capacity. From this tank it passes to a valve chamber, where it is measured by gauges as it once more enters the conduits and resumes its gravitation toward Liverpool.

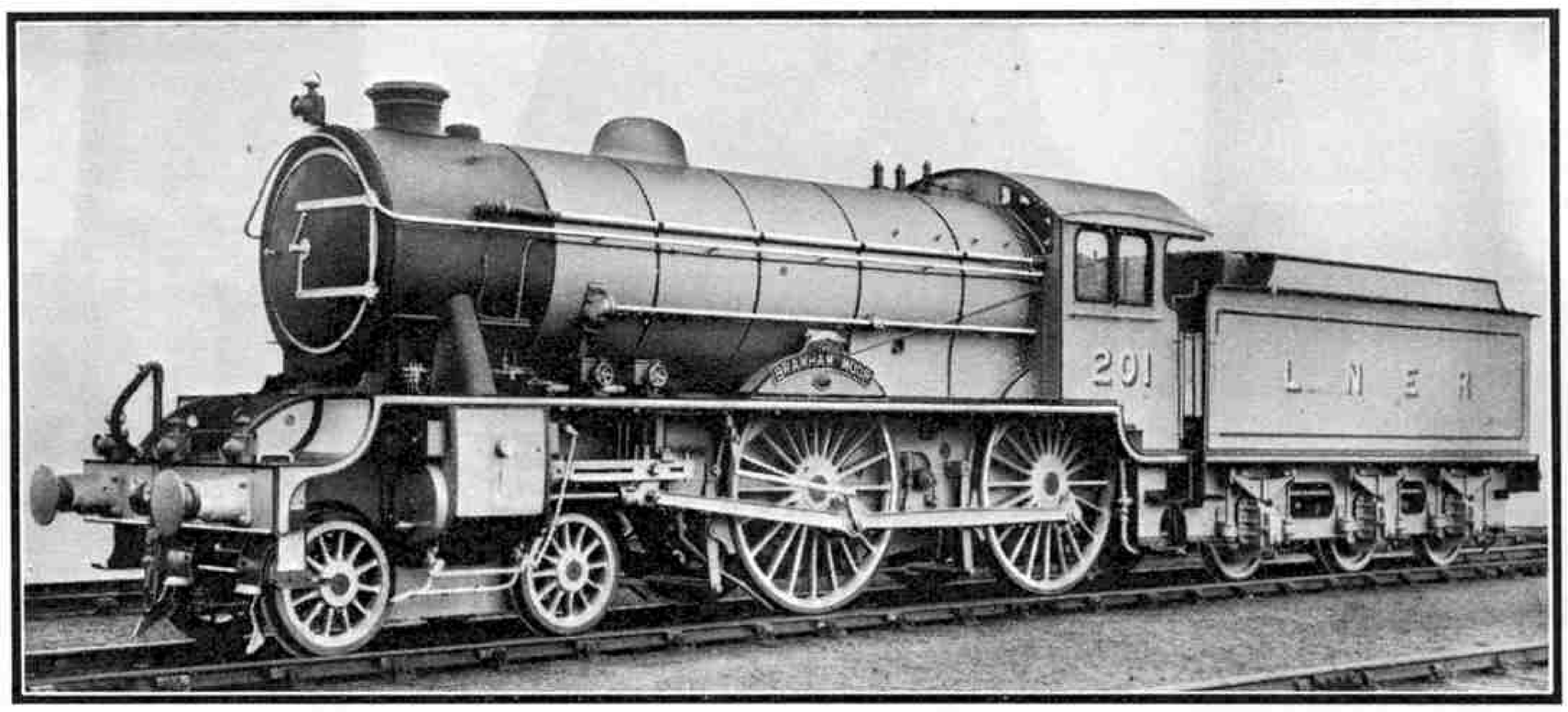
The conduits cross the River Mersey at a point about midway between Widnes and Warrington, and are carried under the river in a tunnel 800 ft. in length and 9 ft. in diameter. They terminate at Prescot, where two open storage reservoirs with a total capacity of about 200,000,000 gallons hold a few days' reserve supply close to the city. These reservoirs also receive water from another catchment area situated between Bolton and Blackburn. From Prescot the water is led to covered reservoirs located at high points within the city, reaching these reservoirs through pipes that range in diameter from 36 in. to 44 in. It is then distributed through an extensive system of pipelines to all parts of the city.

In contrast to Liverpool and other northern cities that obtain their water supply from lakes or reservoirs in hilly districts, London draws the bulk of its water from the rivers Thames and Lee, the water being pumped into storage reservoirs of which there are no less than 49. At the new Walton works of the Metropolitan Water Board, water is taken from the river by powerful pumps and passed through steel pipes of 54 in. diameter into two storage reservoirs that have a combined capacity of 1,198 million gallons. During the time the water is stored in these reservoirs it improves in quality, and when it is passed to the primary, or rapid, filter beds it is already less impure than when it left the river. These filters are mechanically worked and hold back the marine growths and coarser suspended matters contained in the water, which is then passed to the secondary or slow sand filters. There are six of these filters at the Walton works and filtration is effected in them at about three times the ordinary rate. The filtered water from each bed passes to a junction well where chlorine is added to complete the destruction of bacteria, and the water is then pumped to South London, 18 miles distant, through a 48 in. diameter cast iron main. In round figures about 27,000 million gallons of water are pumped yearly from the Thames at the Walton works. Of this huge quantity some 7,500 million gallons are filtered at this station and the remainder is filtered at other works of the Metropolitan Water Board



New "Hunts" Locomotives of the L.N.E.R.

As recorded in last month's "*M.M.*," a new series of three-cylinder 4–4–0 express locomotives is being turned out from the L.N.E.R. works at Darlington, and a photograph of the first of them—No. 201, "*The Bramham Moor*"—is reproduced on this page. Two further engines—No. 211, "*The York and Ainsty*," and No. 220, "*The Zetland*"—are now in service. All are being named after famous hunts in the territory served by the L.N.E.R. and the other engines as they are completed will receive the following numbers and names:— 232, "*The Badsworth*"; 235, "*The Bedale*"; 247, "*The Blankney*"; 255, "*The Braes of Derwent*"; 269, "*The Cleveland*"; 273, "*The Holderness*"; 282, "*The Hurworth*"; 283, "*The Middleton*"; 288, "*The Percy*"; 292, "*The Southwold*"; 297, "*The Cottesmore*"; 298, "*The Pytchley*."



L.N.E.R. No. 201, "The Bramham Moor," the first of the new 4-4-0 locomotives named after famous hunts. A description of these engines is given on this page, and for our photograph we are indebted to the courtesy of the L.N.E.R.

In addition, "Shire" locomotives No. 336, "*Buckinghamshire*" and No. 352, "*Leicestershire*," are to be renamed "*The Quorn*" and "*The Meynell*" respectively.

The new engines belong to Class D.49 and are practically identical with the engines of the "Shire" class. They have cylinders of 17 in. diameter and 26 in. stroke, and the coupled wheels are 6 ft. 8 in. in diameter. All engines in this new series will have Lentz rotary cam poppet valves.

L.M.S.R. Locomotive News

Crewe works have completed further 0–8–0 standard freight locomotives, and these are numbered 9659 to 9665.

The five 2–6–0 "Moguls" that have been equipped with Lentz rotary cam valve gear are Nos. 13118, 13122, 13124, 13125 and 13129.

The 2–8–0 locomotives of the Somerset and Dorset Joint Railway, which had been given the L.M.S.R. numbers 9670 to 9680, have again been renumbered and are now 13800 to 13810. This further renumbering has been done because the numbers 9670 to 9680 will be required shortly for some of the new standard 0–8–0 locomotives.

After being overhauled at Crewe, the reconstructed "Claughton," No. 5902, "*Sir Frank Ree*," was sent early in May to the Kentish Town (London) shed. Since then it has been working regularly on some of the fastest expresses on the Midland section. Its usual day's work has been to take the accelerated 9 a.m. Scottish express from St. Pancras to Nottingham and to return to London with the express due at St. Pancras at 3.56 p.m. In charge of another driver it has afterwards worked the 6.25 p.m. Manchester express as far as Derby, returning again with the milk train, due at St. Pancras at 2.35 a.m. Including light workings to and from the sheds, these double trips have totalled over 515 miles a day.

In working the 9 a.m. from London to Nottingham, No. 5902 has kept the exacting schedule with great ease, and on several occasions the distance of 123.5 miles has been covered in 126 min., or 3 min. under schedule time. An exceptionally smart run was made on Thursday, 26th May, when owing to an unusual delay, St. Pancras was left 3 min. late. Relaying on Sharnbrook bank required slow running for about a mile, yet Nottingham was reached one minute early. The other reconstructed "Claughton," No. 5971, was sent to Kentish Town at the end of May and several more now in course of reconstruction also will be stationed there as soon as they are ready for service.

The rebuilt Claughton, No. 5910, "*J. A. Bright*," has recently made several test runs on the expresses between Manchester and London. The dynamometer car which was first built for use on the Lancashire and Yorkshire Railway, was employed for the purposes of the tests. On Tuesday, 3rd May, No. 5910 worked the up "*Mancunian*" with a load of 400 tons behind the tender, and although stopped by signals at Crewe and severely checked later, arrived at Euston only one minute late.

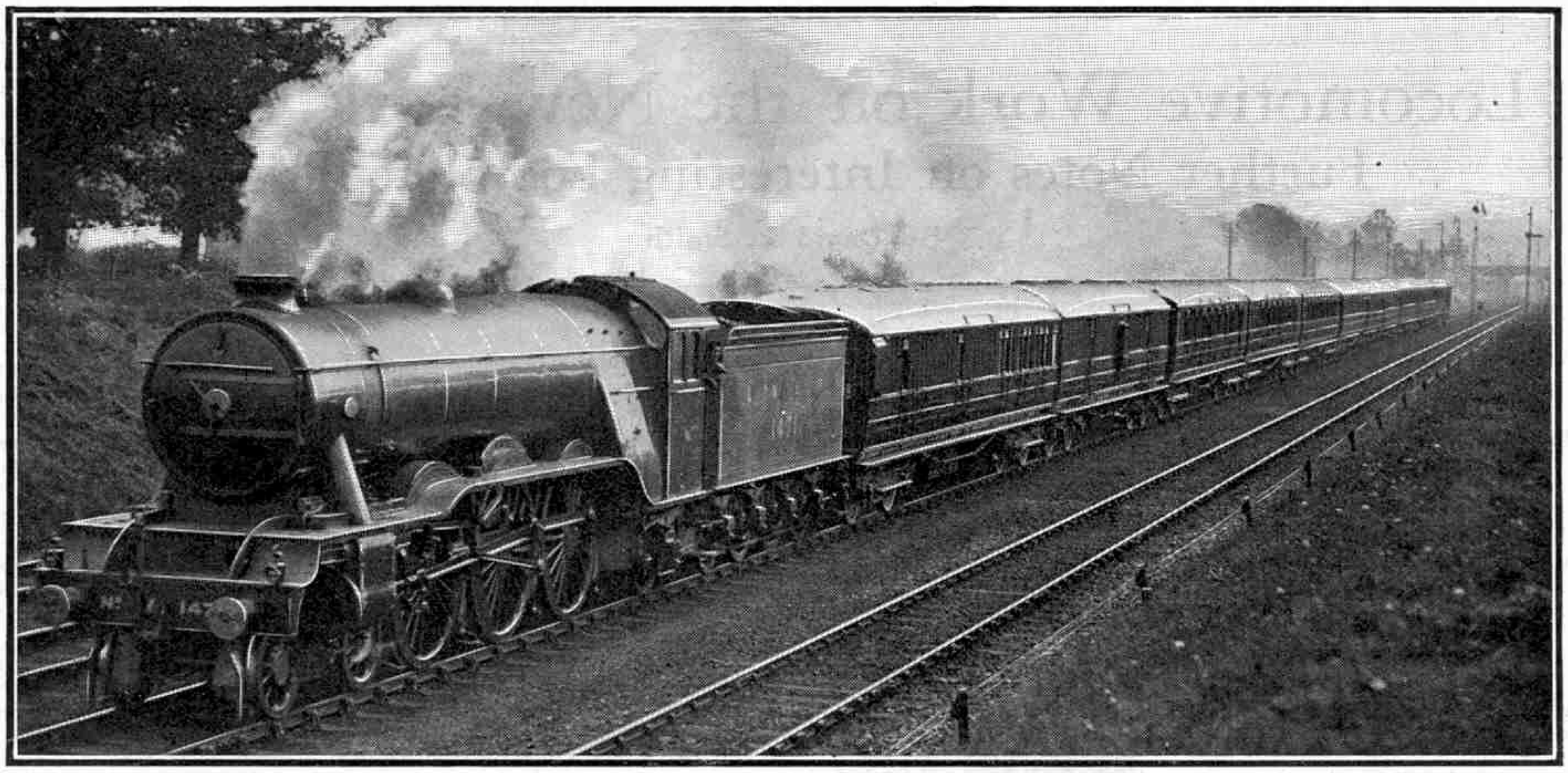
Engine Reconstruction on L.N.E.R.

During the last year or two, Mr. H. N. Gresley, chief mechanical engineer, has carried out several interesting reconstructions among the locomotives of the L.N.E.R. These have been duly described in the "*M.M.*" from time to time and this month another has to be recorded. In this latest case, one of the 0–8–4 tank engines of the "S.1" class, which was built by the former G.C.R. for hump shunting in the concentration yard at Wath, has been rebuilt and fitted with a reversible booster. The booster drives through gears on to the leading axle of the bogie. The trailing and leading wheels of the bogie also are coupled by means of side rods, with the result that the whole weight of the engine is made available for adhesion. The tractive power of the engine without the booster amounts to 34,523 lb. But with the booster, 12,373 lb. are added, making a total tractive effort of 46,896 lb.

The mechanism of the booster is very ingenious and provides for working either backwards or forwards. If the aid of the booster is not required, the engine can be worked without it.

The locomotive to which these alterations and additions have been made was formerly No. 1171 on the G.C.R., but now bears the L.N.E.R. number 6171. In the course of rebuilding, many changes in detail were made and the engine now has a chimney and dome of the standard L.N.E.R. patterns, together with pop safety valves and a new cab with two windows on each side.

Yet another interesting experiment in rebuilding is the fitting of engine No. 8579—a 4–6–0 of the G.E.R. type—with a new boiler similar to that carried by the "Sandringham" class.



Trial runs are often made with new rolling stock in order to ensure that everything is satisfactory before the vehicles are placed in service. The illustration at the head of this page shows a trial run of this kind, coaches intended for use on the L.N.E.R. East Coast services being hauled by "Sir Frederick Banbury," one of the two pioneer Gresley "Pacifics."

G.W.R. Build More "Castles" and "Halls"

The new 4–6–0 locomotives of the "Castle" class are now being turned out from Swindon at the rate of about two each week. Their numbers and names are as follows:—5013, "*Abergavenny Castle*"; 5014, "*Goodrich Castle*"; 5015, "*Kingswear Castle*"; 5016, "*Montgomery Castle*"; 5017, "*St. Donat's Castle*"; 5018, "*St. Mawes Castle*"; 5019, "*Treago Castle*"; 5020, "*Trematon Castle*"; 5021, "*Whittington Castle*"; 5022, "*Wigmore Castle.*" Several minor improvements have been introduced in these new engines and special attention has been given to the lubrication of the cylinders and axle-boxes.

The following numbers and names have been chosen for the 20 new engines of the "Hall" class which are on order at Swindon:—5921, "*Bingley Hall*"; 5922, "*Caxton Hall*"; 5923, "*Colston Hall*"; 5924, "*Dinton Hall*"; 5925, "*Eastcote Hall*"; 5926, "*Grotrian Hall*"; 5927, "*Guild Hall*"; 5928, "*Haddon Hall*"; 5929, "*Hanham Hall*"; 5930, "*Hannington Hall*"; 5931, "*Hatherley Hall*; 5932, "*Haydon Hall*"; 5933, "*Kingsway Hall*"; 5934, "*Kneller Hall*"; 5935, "*Norton Hall*"; 5936, "*Oakley Hall*"; 5937, "*Stanford Hall*"; 5938, "*Stanley Hall*"; 5939, "*Tangley Hall*"; 5940, "*Whitbourne Hall.*"

In recent months a large number of the engines that belonged previously to the small Welsh Railways have been scrapped at Swindon and engines of the standard G.W.R. 5600 and 6600 classes have been sent to fill their places. These are 0–6–2 tank engines.

Pneumatic-tyred Rail-Car on the S.R.

The rail-car with Micheline pneumatic rubber tyres, to which reference has been made in previous numbers of the "*M.M.*" has been undergoing further tests, this time on the Southern Railway where trial runs have been made between Ascot and Alton. The rail-car has also visited Waterloo Station where it was inspected by directors and officers of the S.R.

Making Railway History

It is evident that 1932 will be for ever memorable in railway history as a year when a definitely higher standard of express speed was adopted by the British railways. The notable accelerations which came into force at the beginning of May marked a very decided advance on previous timings, and with the introduction of the special summer services in the middle of July, more remarkably fast schedules will be put into operation. Further improvements are promised for October. It is clear that at last the value of speed is being realised by the railway authorities and that they are determined to give an effective answer to the challenge of the long-distance road motor services.

In addition, many new methods are being employed to attract excursionists to the railways. Special "mystery" expresses for hikers are being run and even "kiddies" have their own expresses, where they are specially catered for and entertainment is provided en route. More long-distance excursion trains at low fares are being put on this summer than have been run in any previous year.

"*Cheltenham Flyer's*" New Record

On Monday, 6th June, the G.W.R. "*Cheltenham Flyer,*" set up new records by covering the 77¼ miles between Swindon and Paddington in 56 min. 47 sec., the average speed being 81.6 m.p.h. The highest speed attained was 92 m.p.h. The engine was No. 5006, "*Tregenna Castle,*" and the train consisted of six coaches, weighing 186 tons. We hope to give further details of this run next month.

Fast Running on Birmingham Expresses

A correspondent has forwarded logs of two brisk runs in travelling to Birmingham and back by the L.M.S.R. route. On the down trip, the 4–4–0 compound locomotive No. 1108, with a load of 266 tons, passed Rugby in even time, the 82.6 miles having been covered in 82½ min., and that in spite of a permanent way repair slack soon after leaving Euston, which caused 10½ min. to be taken for the 5.4 miles to Willesden Junction. After Rugby, as time was well in hand, the engine was eased and nothing exceptional was accomplished, although the running was distinctly good.

On the return journey, made on the 8–40 a.m. express from Birmingham, an unrebuilt "Claughton"—No. 5963—was at the head of the train, the load being 390 tons tare, or, including passengers and luggage, well over 400 tons. Permanent way checks caused delay in the early stages and made the departure from Coventry almost 3 min. late. A colliery subsidence called for cautious running at Brandon but after that—save for the usual slack at Rugby—no further checks were experienced and some brilliant running was made. The 9.8 miles from Rugby to Blisworth were done in 8 min. 30 sec. From Blisworth to Bletchley an average of 73 m.p.h. was maintained, a maximum of 83 m.p.h. being touched at Castlethorpe. The 15 miles from Bletchley to Tring, mostly uphill, were covered in 13 min. 20 sec., the minimum on Tring bank being 57½ m.p.h. From Tring to Euston, 31.7 miles, occupied 28 min. 15 sec., giving an arrival no less than seven minutes early! The average speed from Rugby to Euston was approximately 67 m.p.h.

Progress at Whitemoor Marshalling Yard

In the construction of the new "down" marshalling yard on the L.N.E.R. at Whitemoor, the foundations for the Eddy Current Rail Brakes to be installed have been built, and it is expected that the yard will be in full operation in September.

Locomotive Work on the New York Central

Further Notes on Interesting Footplate Trips

By David L. Smith

IN the "*M.M.*" of April 1931, I described some fine locomotive work that I witnessed on the New York Central during a footplate trip on the "*Lake Shore Limited*" from Cleveland Old Station as far as Toledo. This train is not so well known as the "*Twentieth Century,*" but is accounted by enginemen a much harder proposition to work owing to its big load and more numerous stops. With a load of 1,175 tons, including passengers and equipment, the train arrived at Toledo 1¼ min. ahead of schedule time, in spite of various hindrances.

My return footplate trip from Toledo was made on Train 150, "*The Interstate Express,*" and was equally interesting. Our nine-coach train would scale, with passengers and luggage, some 595 tons; our engine, 4–6–2 No. 4893, had only 30,900 lb. of tractive effort, or slightly less than a Great Western "Castle," and quite comparable to a Gresley "Pacific" of the first (1922) batch. The schedule of this train is not very heroic, but under the guidance of Driver H. Cursner, Fireman T. Blanch, and Inspector H. Brown, our "Pacific" was urged to some capital work. The exit from Toledo was extremely slow, owing to tardy closing of the swing bridge. We were through Martin, 12.2 miles, in 19 min. 10 sec., however, and then covered the 15.8 miles thence to La Carne in the excellent time, load and engine considered, of 13½ min., an average of 70.2, the grade being only slightly favourable in places. Afterward a most exemplary passage of the Port-Clinton slows brought us into Sandusky 3¼ min. before our departure time, in spite of a 3¼ min. late start from Toledo.

The Central Terminal Station, Buffalo, N.Y., of the New York Central Lines, to whom we are indebted for the illustrations to this article. The tower is 271 ft. in height above track level, and when illuminated at night by floodlights is visible 15 miles away.

Sandusky provided an interesting example of American railway practice. Quite a commodious station is provided, to the north of the tracks, but there is not the faintest attempt at platforms. We arrived on the southernmost of the three tracks, and between us and the station a westbound freight of 100 cars went roaring through. Our crew merely remarked: "Gee! they've gotta full yard to-day!" The passengers waited at the station-house until the freight went past, then streamed across the tracks to our train! We left Sandusky on time and an easy subsequent schedule precluded any interesting work. Once again we took water at Huron troughs and coal at Elyria coal dock, and after an absolute crawl down the bank from Berea arrived in Cleveland 3 min. early.

This locomotive was hand-fired, there being two fireholes, a feature that in my opinion might be adopted with advantage on a Gresley "Pacific." The firedoors were pneumatically operated by a foot-trigger, as is customary in the States. During the early part of the run firing was brisk, but no more so than on a hard job in Britain; and steam was maintained without difficulty just under the 200-lb. mark. Cut-off, on the easier sections, was about 25 per cent., with partly-closed regulator.

In addition to these footplate trips I made several journeys as an ordinary passenger, and recorded some notable work. My first journey on the N.Y.C. was memorable in several ways. I was travelling east from Chicago on Train No. 4, "*The New York Limited.*" Our engine, 4–6–2 No. 3290, had the quite substantial load of eight cars, totalling approximately 500 tons full. With the usual crawl out through the yards, we took 14 min. for the first 6.7 miles to Englewood, but then proceeded to cover the next 78.8 miles to South Bend in 79 min. 35 sec., inclusive of a permanent way slack at Whiting, severe signalling checks at Otis, and a very long and severe slow through South Bend yards. There is quite a considerable length of upgrade on this section, from Indiana Harbor to beyond Otis. Severe slows, and two signal stops outside Elkhart, caused us to take 115 min. 50 sec. for the complete run, but even then we were 5 min. 10 sec. inside schedule.

We changed engine crews at Elkhart, but with a punctual start and an easy schedule ahead I rested from my labours; and beyond observing that we made a special stop at Kendallville, 41.6 miles out, I took no more times until, approaching Waterloo, I suddenly woke to the fact that the train was going pretty fast. And so I was able to record a series of very remarkable times.

I think I may fairly claim that they *are* remarkable times. To cover 32.3 miles from Waterloo to Stryker in 25 min. 40 sec. at an average speed of 75.5 m.p.h., is a rate of progression not usually associated with any railway outside our own Great Western; and this was not attained on any precipitous downgrade, there being nothing heavier than the ruling 1 in 330 in this section. The 81 m.p.h. from Bryan to Stryker must have been very steadily maintained, for I obtained no higher mile-post reading than 81.8 for a full mile east of Bryan. At this rate there was absolutely no noticeable oscillation in the train, which constitutes a fine tribute to the quality of the track and rolling stock of the N.Y.C.

We slacked for water troughs between Stryker and Archbold, but the good work was by no means over. In spite of the slack, and the fact that for the next 14½ miles the grades go against the engine, we covered the 60.3 miles from passing Waterloo to passing Swanton in 51 min. 40 sec., an average of just over 70 m.p.h.

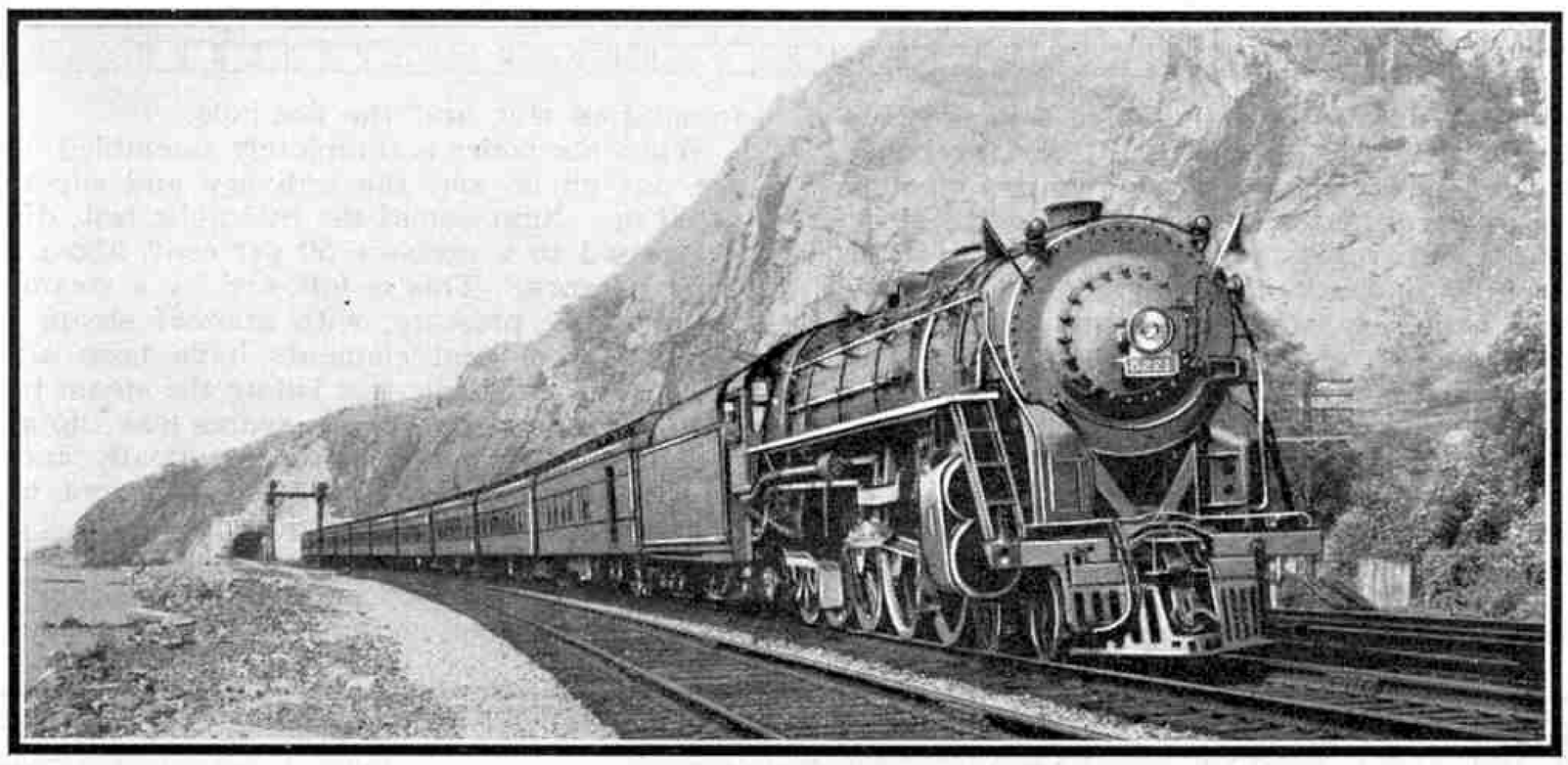
We had passed Swanton and were still going briskly when there came a sudden snatch at the brakes and we pulled up. A signal-check, I thought; but it was not. Two boys in a Ford coupé had tried to take a level-crossing in front of us—and had not succeeded. It was a tragic finish to our merry little sprint.

So we were late into Toledo, and there we suffered further delay. Our engine, No. 3290, had been slightly damaged by the collision and had to be taken off, and some time elapsed before another suitable engine could be procured. Eventually No. 4898, another 4–6–2, made its appearance, and we got away 44 min. late.

The load had now been increased to 560 tons, yet so well did we run that our 44 min. arrears leaving Toledo had been reduced to 27 min. late at Cleveland, in spite of the fact that we sat 6 min. outside the latter station awaiting the closing of the swing bridge. There were no spectacular speeds on this section, but the general running was of a high order. The ascent of the 11-mile bank of

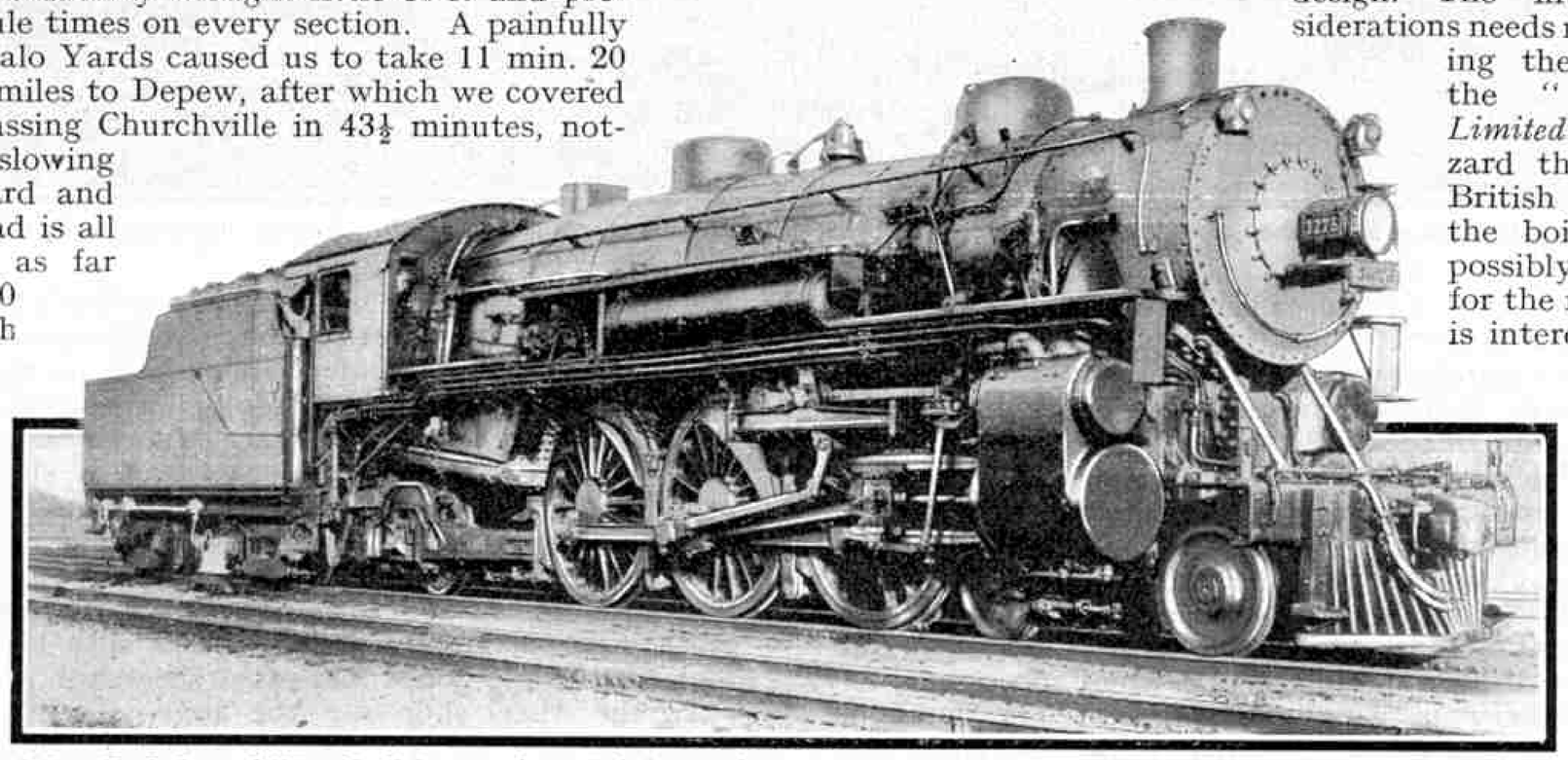
1 in 330 from Vermilion to east of Amherst was accomplished without the average speed falling below 60 m.p.h. The start from Toledo was again cautious, but Martin to La Carne, 15.8 miles, was run in 14 min. 10 sec. The 87 miles, Martin to Berea, including slows at Port-Clinton, Sandusky and Huron troughs, occupied only 85 min. 55 sec. It was a fine tribute to the power of a "Pacific" that an engine called upon at short notice to tackle a train of 560 tons should make such times as these.

I made a further trip over this section on Train 52, "*The Chicago-Buffalo Express.*" Our load of seven cars scaled only 435 tons full, and "Pacific" No. 4828 made some very smart running. Owing to swing bridge delay we were 7 min. late out of Toledo, but we buckled to our task with such energy that this had been recouped by Port-Clinton, our first stop! A fine start was made to Martin; we were doing 67 there, 68 at Rocky Ridge, and 69 at Oak Harbor. Martin to La Carne took 14½ min., and we finished our 34 miles Toledo to Port-Clinton, with the slow approach to the latter, in exactly 36 min., in place of 43 allowed by schedule. From there to Sandusky, 12.7 miles, only 15 min. is allowed, start to stop, and we exceeded this by 1¾ min. With overtime at stations we left Sandusky 3 min. late, but without any exciting running were easily on time into Elyria. A further stop was made at the coal dock, and Cleveland was reached without difficulty 5 min. early, in spite of the usual crawl down the bank from Berea.



The east-bound "Twentieth Century Limited," hauled by "Hudson" Locomotive No. 5271, passing through the Hudson Valley. The large boiler of this powerful engine is typical of American practice.

The last run dealt with is a typical example of the everyday work of a "Hudson." Train No. 56, "*The De Witt Clinton,*" was made up at Buffalo to the substantial figure of 12 cars and 805 tons all told; but our "Hudson," the number of which I was unable to ascertain, evidently thought little of it and proceeded to cut schedule times on every section. A painfully slow passage of Buffalo Yards caused us to take 11 min. 20 sec. for the first 6.9 miles to Depew, after which we covered the 44.1 miles to passing Churchville in 43½ minutes, notwithstanding severe slowing through Batavia yard and the fact that the road is all against the engine as far as Batavia. The 70 m.p.h. limit was much in evidence on this run, the brakes repeatedly being applied as this speed was reached. We were on historic ground here, for it was near Crittenden, just west of Corfu, that No. 999 is said to have reached her famous 112 m.p.h. We attained no such speed, but whirled our 805-ton train triumphantly into Rochester 7½ min. under schedule, after easy running over the last 15 miles from Churchville.



A New York Central "Pacific" Locomotive. It is interesting to compare this monster with the "Pacifics" of the L.N.E.R., the difference in the size of the boiler being particularly striking.

The remainder of this run is soon described. A long permanent way slack hampered our start from Rochester, but we were through Fairport, 9.8 miles, in 13½ min. Then came an "extra" in the shape of a 3-min. stop at a coal dock half-way to the next station of Walworth; but we got away splendidly, the 61.2 miles from passing Walworth to stopping in Syracuse being covered in 60 min. 40 sec. The whole 80.3 miles from Rochester to Syracuse, check and stop included, took only 88 min., as against 91 booked.

The start from Syracuse would send a British railway official into hysterics, for engine and twelve coaches leave the station and proceed placidly down the main street for about a mile, going at a speed of some 15 m.p.h., the bell ringing and nobody worrying! It should be stated, however, that a new line, eliminating level crossings, and a magnificent new station, are about to be constructed at a cost of $30,000,000.

This made a slow start, but for all that we covered the 52.8 miles Syracuse to Utica in 58½ min. as against 64 booked. The final stage of 77.7 miles from Utica to Schenectady, with load increased to 945 tons, took 81 min. 40 sec. We recouped a 4¼ min. late start from Utica, arrived in Schenectady 1 min. early, and so concluded satisfactorily my last trip on the New York Central.

It is, as I have said, difficult to present these runs so as to form an accurate comparison with locomotive work in Britain, and readers may be puzzled to observe locomotives, of tractive power very comparable to what we have here, doing work that would be beyond the capacity of our corresponding types. The explanation of this apparent paradox lies in the words "boiler power." Liberality of loading gauge has permitted the American engineer to place upon his engine chassis a boiler of vastly greater dimensions than we can ever hope to operate, and has thus provided his engines with a reserve of power that transforms their apparent dimensional capacity. A "Hudson" may not possess much more of a nominal tractive effort than a Great Western "King," but it would be impossible for the 2,514 sq. ft. of heating surface of a "King's" boiler to stand up to the demand for steam that the 6,435 sq. ft. of a "Hudson" supplies without difficulty.

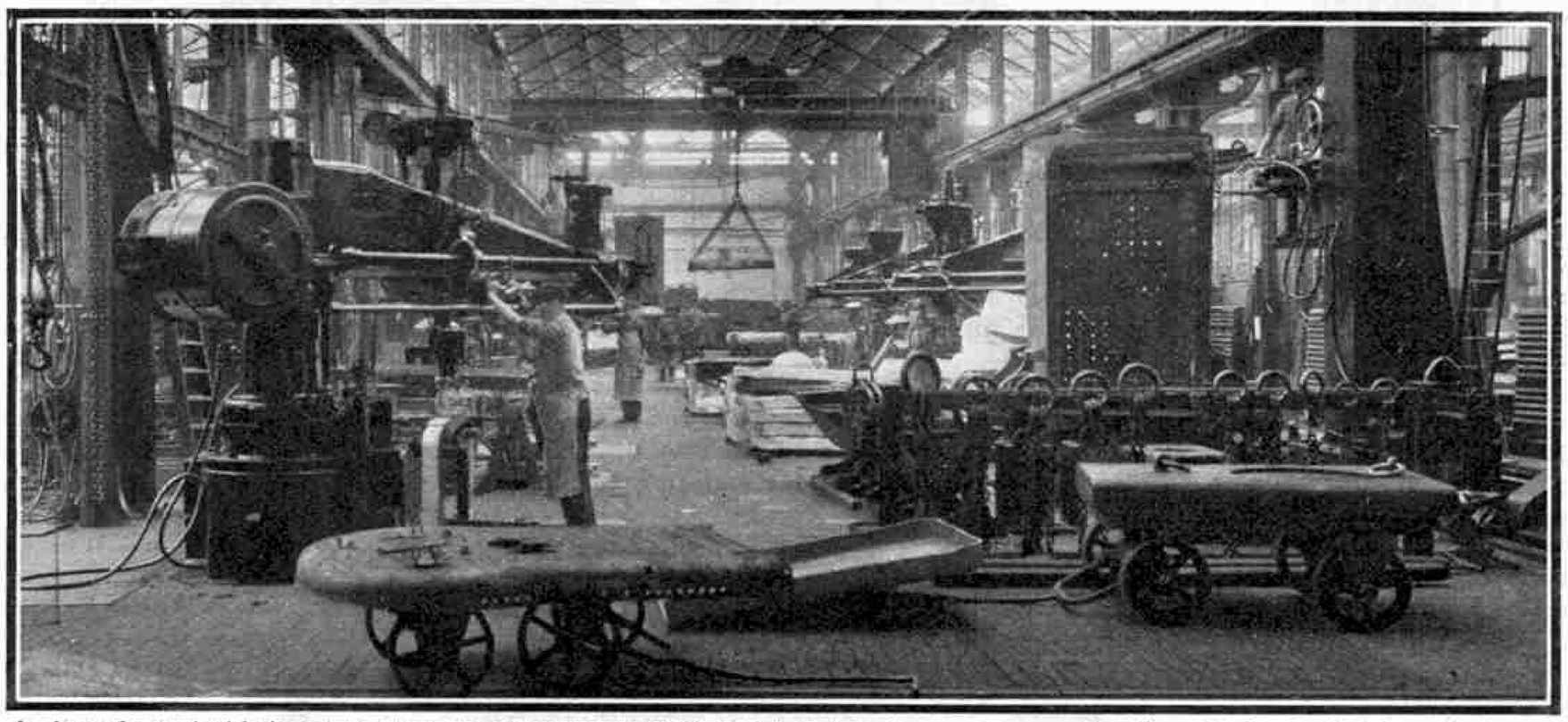
The provision of a reserve of power for bad weather, and for making up lost time, is the keynote of American locomotive design. The first of these considerations needs no explaining. Keeping the schedule time of the "*Twentieth Century Limited*" through a blizzard that would tie up a British railway needs all the boiler power one can possibly get. The provision for the recovery of lost time is interesting. Contrary to my previous belief, no bonus is paid to a New York Central driver for the recovery of time previously lost, for that is regarded as his duty, just as it is his duty to run to schedule on a train that starts punctually. If he does not make up time, he fails in his duty, and Headquarters has something to say. How different from our British methods, where the driver may make up time or not as he pleases! Nor is recovery due to speeding round curves and at junctions. On the contrary, time is made up by harder working of the engine on open pieces of road, and speed restrictions are much more rigidly observed than in Great Britain, whether the train is on time or not. Out of 20 long distance trains I saw, 19 arrived punctually or before time.

In conclusion I take this opportunity of expressing my thanks to Mr. D. R. MacBain, General Manager for the Section West of Buffalo, for his kindness in granting me permission to travel upon the footplate; and also my appreciation of the kindness and courtesy of all ranks of the New York Central Lines with whom I came in contact.

Boiler and Erecting Shops in a Locomotive Works

THE largest individual item in the make-up of a locomotive is the boiler, and in a visit to a locomotive works the boiler shop is easily distinguishable by the deafening noise it creates.

The boiler is built up of steel plates of acid open hearth steel, which are first passed through rollers to straighten them, after which one plate is carefully marked off to serve as a template for the others. Where necessary, the edges are planed and trimmed, and a certain amount of drilling is then done. The next process is to curve the plates to the required cylindrical form, which is done by passing them many times through sets of bending rollers. The three rings forming the boiler are then assembled vertically, the circumferential joints being covered by a joint ring, or belt, previously heated to a red heat before it is put on. The longitudinal seams are covered by butt strips. The plates are all "tacked" together by means of drift pins to keep them in position while the final riveting is done. Special multiple drilling machines are used to drill the large number of holes required, the usual size of rivet being $\frac{7}{8}$ in. Hydraulic riveters are much used for riveting up the boiler shell, after all the joints have been carefully cleaned with sal ammoniac. At one time all locomotives had boilers with a round topped fire-box, which were a little easier to construct than the more popular modern "Belpaire" type, in which the outer fire-box top is flat, so as to be parallel with the top of the inner fire-box.



A view of a typical boiler shop, showing a foundation ring being drilled by the machine on the left. A boiler backplate ready flanged is seen on the trolley in the immediate foreground.

Some boilers, notably those of the majority of modern Great Western locomotives, are made with the barrel conical in shape increasing in size backwards toward the fire-box. This gives greater steam space exactly where it is most required, and this, of course, is a valuable feature.

The fire-box outer casing or wrapper plate, also the throat and back plates, are more complicated, requiring flanging work done on them. The foundation ring, which unites the inner and outer fire-boxes, has to be drilled and machined where necessary, for which special machinery is usually employed. The wrapper plate is secured to the barrel temporarily while the back and throat plates are fitted, and then dismantled again while the fire-box end of the boiler is riveted up.

The inner fire-box is usually of copper and the necessary flanging is usually done by hand, whereas for the steel plates it is done in a hydraulic press. This method is also now employed for copper plates, the flanging being done cold. The G.W.R. boiler shop at Swindon was the first to carry out with success the cold flanging of plates by the hydraulic press. After the necessary drilling has been done, the foundation ring is attached to the inner fire-box, which is then placed inside the outer shell. After this the back plate is riveted in, then the tapping and screwing for the stays follows, the stays then being put in by hand from the outside. Every stay is carefully tested when in position. Special expansion stays are used for part of the fire-box roof. The ends of the copper stays are hammered over by pneumatic riveters, and an extra powerful machine is used for riveting the foundation ring and the fire-hole.

When the boiler is completely assembled, the various mountings are put on it, and the ordinary and superheater fire tubes are fitted in. Next comes the hydraulic test, during which the boiler is stressed to a pressure 50 per cent. above that at which it will have to work. This is followed by a steam test at 10 lb. above the working pressure, with another steam test after the superheater header and elements have been added. The object of having the hydraulic test before the steam test is that if anything gives way, or if any of the seams leak, no great damage is done. By reason of water being practically incompressible, it only escapes in small quantities, in the event of a mishap, and the pressure is immediately reduced.

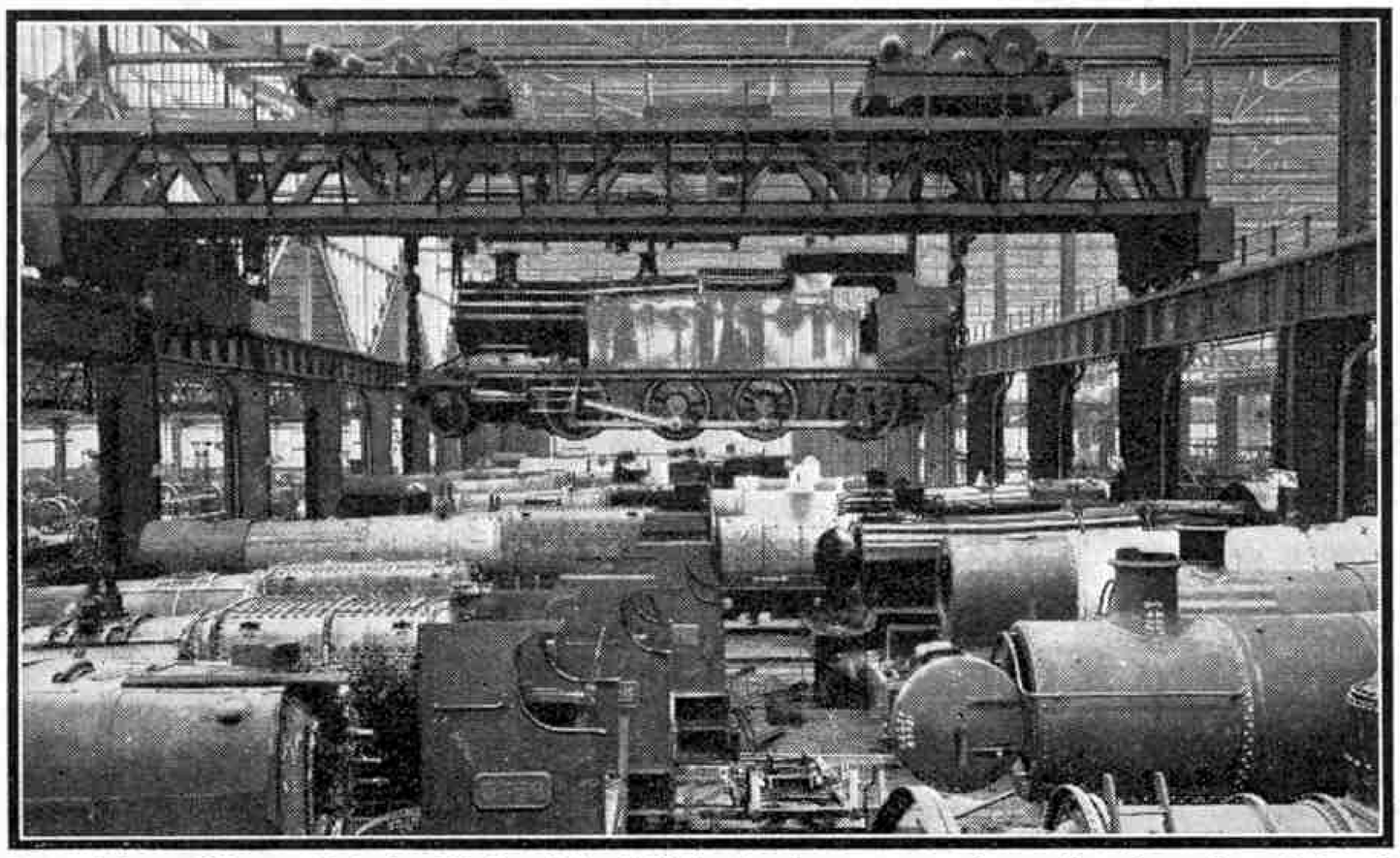
The smith's shop, in which we include the stamping shop and the coppersmith's shop, now claim our attention, and the stamping shop comes a good second to the boiler shop for noise. In it are produced by what is called "drop forging," a great variety of the small parts required on the locomotive and for which castings would not be good enough. The drop stamp is simply a large hammer, steam driven, the face of the hammer containing half the mould or die required to produce the forging. The other half of the die is in the anvil, so that a piece of metal placed under the hammer takes the shape of the two dies together. By this means sound forgings of clean outline are rapidly obtained, and therefore this method has made great progress within recent times. Under the larger hammers such articles as connecting rods and valve rods, are forged. In the smith's shop proper are many small hearths and a few steam hammers, by the aid of which a great variety of the smaller smithing jobs required on a locomotive are carried out.

In the copper and tinsmith's shops a great deal of interesting work goes on, largely in connection with the pipe details of the locomotive, but lamps and other sheet iron articles are also made.

In the wheel shop are the large wheel lathes of special construction into which a pair of wheels on their axle can be rolled for the tyres to be turned. In this shop the axles are hydraulically pressed into the bosses of the cast steel wheel centres, and the heated tyres are shrunk on to the previously turned rims. The balancing of the wheels of a locomotive, especially the driving wheels, is very important, as unbalanced wheels cause bad running and severe wear on the permanent way, so that all up to date wheel shops have a machine for testing the balance. In the earliest days of the locomotive little or no attempt was made at balancing, but later as they grew more powerful and the weight of the moving parts increased it became necessary to balance the revolving and reciprocating masses in order to counteract the disturbance caused by them to the movement of the engine. It was shown by D. K. Clark, who was responsible for much pioneer work in this direction, that balancing resulted in reduction of coal consumption, and a slight increase of speed. The principles he advocated have held good on the whole ever

since. With the object of improving the uneven motion common to engines of the day, Robert Stephenson together with William Howe, both of whom are associated with the well-known Stephenson's link motion, took out a patent in 1846 for a three-cylinder locomotive. The idea was that the third cylinder placed inside would counteract the alternate lifting of both sides of the engine, due to the impulses of the outside cylinders. In this they were successful, for Stephenson says " that the wriggling motion was overcome." Three and four-cylinder engines are, of course, common in modern practice, and these arrangements result in a well balanced engine. A good deal of the work of a wheel shop consists of the trueing-up of tyres that have become worn in service, and hence the liberal provision of wheel lathes.

All the work done in the shops so far described has been a necessary preliminary to the assembly or erection of the locomotive, a process we will now proceed to study in the erecting shop. To most visitors this will undoubtedly be the most interesting part of the works, because here they see all the five thousand or so parts of the engine put together to form the finished article.



Part of the well-known Swindon Works of the G.W.R. showing numerous locomotives in various stages of building and repair. Powerful overhead cranes are used for lifting the locomotives and a 2-8-0 Tank is shown hoisted up and being carried to another part of the shop.

First of all the frames of the locomotive, as received from the machine shop, are laid on trestles and the various centre lines marked out. They are then placed upright in forked supports and adjusted so as to be square with one another and truly vertical and level. The levelling is carefully done by straightedge and spirit level. The footplate brackets, cross stays, etc., are then riveted in after being bolted up temporarily. The bogie pivot casting and motion plate are fixed in at this stage. Then the cylinders are lowered into position, the weight being taken on jacks until the exact final settling is reached. The cylinders must be fixed with great accuracy, as on this depends the smooth working of the machine.

Once the cylinders are fixed the slide bars may be put in position and fixed. As there are top and bottom bars they have to be set truly parallel, and special gauges are made to ensure that this result is achieved. A " dummy " slide block is used to check the work and must be a free sliding fit between the bars. At this stage it is possible to check over the reciprocating parts of the engine and ensure that everything is true and fitted up as it is designed to be.

The erecting shop at Swindon, showing two 4-6-0's being repaired, while the frames of another engine are seen close by on the right of this picture.

The boiler, having been tested under steam, has been sent to the erecting shop, and can now be lowered on to the frames and secured. The boiler is possibly 5/16 in. longer when hot than it is when cold, and therefore allowance has to be made for this. The front end is fixed but the back end is carried on expansion brackets that rest on top of the frames. Having fixed on the boiler, the next step is to bolt the front tube-plate to the cylinder casting, at the same time attaching the expansion bracket guides to the frames at the fire-box end.

The material we see when we look at a locomotive boiler in a railway station is, of course, only the outer covering or cleading, of thin sheet metal, protected from the heat of the boiler by asbestos lagging, which also serves to retain the heat in the boiler. We have now reached the stage in the erection at which this lagging and cleading may be put on. On completion of this operation the smoke-box, cab, splashers, etc., are fitted.

While one gang is thus employed, another is fitting up the axle boxes in the horn guides. These are made by hand scraping to be a tight sliding fit in the guides, as they soon wear slack in service. After this the axle boxes are carefully fitted on to their respective journals.

Our locomotive has now decidedly taken shape, but it is still without wheels, a defect the erectors will now proceed to remedy. The engine is lifted up by an overhead crane, the wheels are rolled underneath on the track provided in the shop floor, and the axle boxes are guided into the horn blocks. Packings are put in until the springs are fitted.

The motion is now put in, and that highly specialised and skilled job known as valve setting is taken in hand. Upon its accuracy depends the general performance and economy of the locomotive, and it demands an intimate knowledge of the steam distribution of the valve gear. With this fixed, the springs can be put in and adjusted, followed by such details as brake gear, feed pipes, cylinder drain cocks and operating rods. The engine is then put on a siding, the boiler filled with water, and coupled to the tender, with its supply of coal and water. The erection of the tender has been proceeding simultaneously with that of the engine, the method followed being similar, except that the work is simpler, on account of the absence of moving parts.

The completed locomotive now goes to the weighing machine, which is so designed that each axle can be weighed separately. Any slight irregularities in the weights on the various wheels are smoothed out by adjustments to the springs. It is very important to ensure that each axle is carrying its correct proportion of the total weight. An engine of the type we have followed through the works would probably have on its driving axles the maximum load allowed by the permanent way engineer, and therefore it is very essential to make sure that this weight is not exceeded. Elaborate calculations have of course been made in the drawing office with this object in view, but many of the weights used in those calculations are only estimated, so there is room for small discrepancies. The adjustment possible by altering the springs is very slight.

The Swindon Works, where the locomotives and rolling stock of the Great Western Railway are built and maintained, are among the most extensive in the world, and occupy an area of 310 acres, of which 65 are roofed. The railway line through Swindon was opened on 16th December, 1840, and the erection of shops for the construction and repair of locomotives was commenced in 1841. Although the machinery was started in November of the following year, the shops were not put into general working until 1st January, 1843, Daniel Gooch being the first Locomotive Superintendent.

Air News of the Month

Trial of a Shock-proof Aeroplane

M. Albert Sauvant, a French designer, has for some time been experimenting with a special crash-proof aeroplane. The fuselage of the machine has an inner and an outer shell, separated by springs and shock insulating materials. In the event of a crash, the outer shell would be broken but the inner one would be unharmed, and the inventor claims that an aeroplane constructed in this manner may be dropped from almost any height without serious injury to its occupants.

M. Sauvant announced his intention of allowing a machine fitted with this type of fuselage to crash when a fairly high altitude had been attained, but the authorities stripped the machine of its wings and wheels in order to prevent him from making the attempt. The shell therefore was carried to some rocky cliffs in the neighbourhood and, with the inventor inside, thrown over the cliff by his friends. The fuselage dropped a distance of about 70 ft. and rolled down the rocky sides of the cliff for another 350 ft. The outer shell of the machine was completely smashed, but the inner shell was uninjured and the occupant unhurt except for a few bruises. It is stated that M. Sauvant is now anxious to test his apparatus in this country.

Ahrens Wind Indicator for Croydon

On page 637 of our issue for August, 1931, we published a description of the Ahrens indicator, in which a column of smoke is used to show pilots the direction of the wind. One of these indicators has been in service at the London Air Park, Hanworth, for some months, and the Air Ministry have now ordered two for use at Croydon Aerodrome and Cranwell.

London-Capetown Air Services

Passengers may now be carried from London right through to Capetown on the weekly African air mail service, instead of only as far as Nairobi as hitherto. The air fare from London to Capetown is £130, including the cost of meals and hotel accommodation en route, and the journey is accomplished in 11 days, or six days less than are required by surface transport.

Passengers travel by air from London to Paris, and proceed to Brindisi by night on a sleeping car train. The aerial journey is continued across the Mediterranean by flying boat to Alexandria, and after a short train journey to Cairo, the further distance of 5,500 miles to Capetown is covered in relays of flying boats and aeroplanes. Passengers spend each night at an hotel, or at one of the specially constructed Imperial Airways rest houses.

The air line between London and Capetown is 8,000 miles in length and is claimed to be the most perfectly equipped route of its kind in the world. It is provided with more than 50 main and subsidiary aerodromes, and there are 17 specially-equipped wireless stations.

* * * *

This summer a weekly air service is to be inaugurated between Halifax, Nova Scotia, and St. Johns, Newfoundland. Twin-engined seaplanes to seat 20 will be employed, and the journey will occupy five hours.

Assembling and testing airscrews at the United States Army Air Corps Technical School, Illinois. Metal airscrews must be very carefully balanced to operate satisfactorily. Official photograph, U.S. Army Air Corps.

Medical Examination During Flight

An aeroplane has been employed for a novel purpose in South Africa, where an engineer was tested by a doctor during a flight in order to ascertain if he was fit for work at high altitudes.

The subject of the test was a resident of Johannesburg who had been appointed to a responsible position at tin mines in Bolivia. These mines are situated at a height of 11,000 ft. above sea level and before the appointment could be confirmed, it was necessary to make certain that work at such a high altitude would not affect him. He was accordingly taken up with a doctor in a D.H. "Puss Moth" to an altitude of 16,000 ft. He was not seriously affected, and as he passed other tests carried out on the ground immediately after the flight, he qualified for a medical certificate stating that he was fit for work at the tin mines.

American Aircraft on European Air Lines

The first American aircraft to be used on a European air line are now in operation on the service between Zürich and Vienna of Swissair, an air line company with headquarters in Switzerland. The machines are two in number and are Lockheed "Orions," low wing cantilever monoplanes fitted with Wright "Cyclone" engines developing 575 h.p. They are fitted with retractable undercarriages, and possess accommodation for four passengers. A maximum speed of 227 m.p.h. when carrying a disposable load of 1,805 lb. is claimed for them, and the journey is completed at an average speed of 161 m.p.h., although a fairly lengthy stop is made at München. The machines formerly used on the service completed the journey at an average speed of only 88.2 m.p.h.

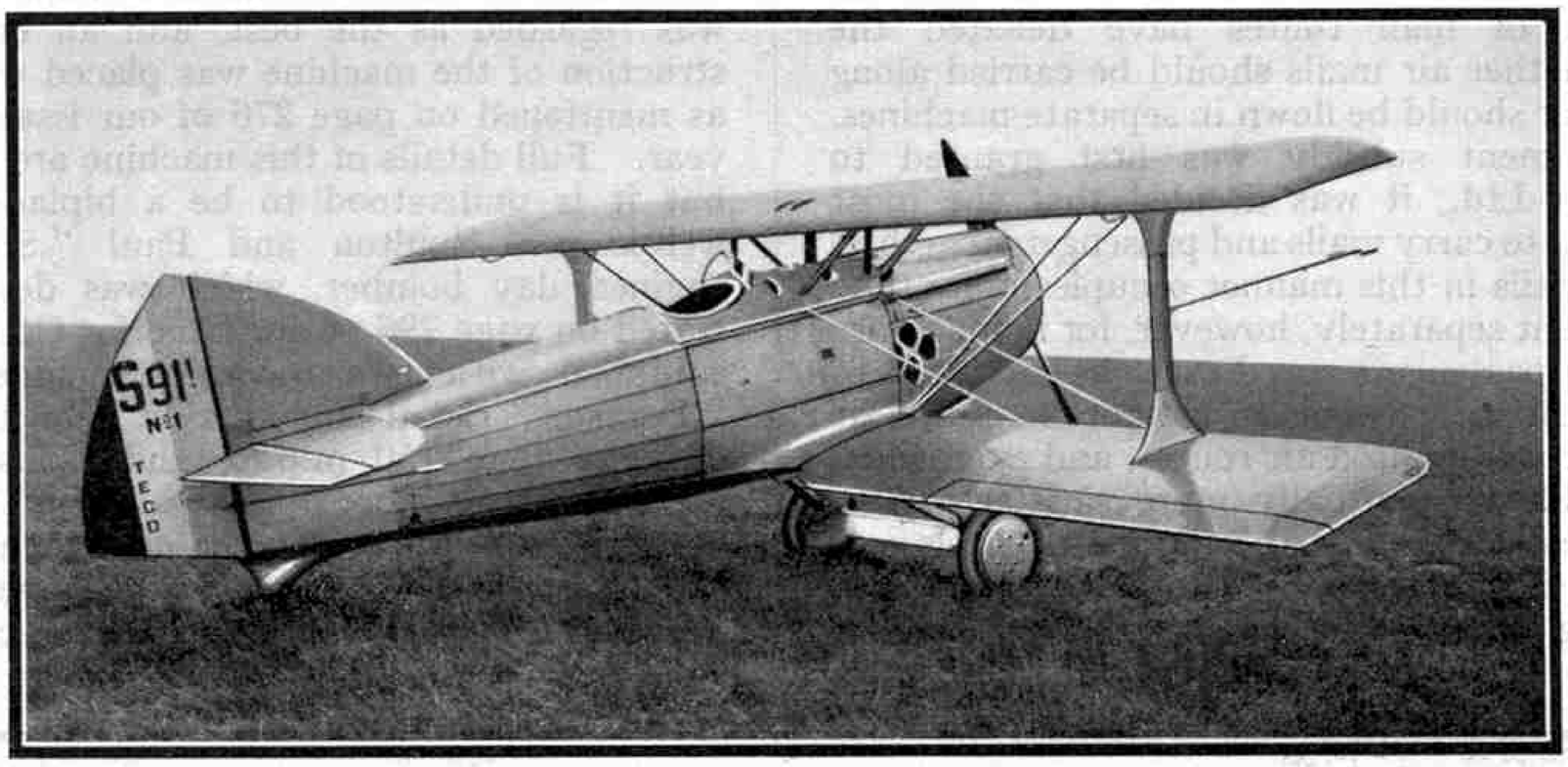
The "Spad" 91-C1 Single-Seater Fighter

During the War one of the most efficient aeroplanes produced for use by the Allies was the "Spad," this name being formed from the initials of the name, Société pour Aviation et ses Dérivés, of the company producing it. "Spad" machines were constructed under licence by many firms but the whole of the "Spad" interests were acquired some time ago by the well-known firm of Blériot Aéronautique.

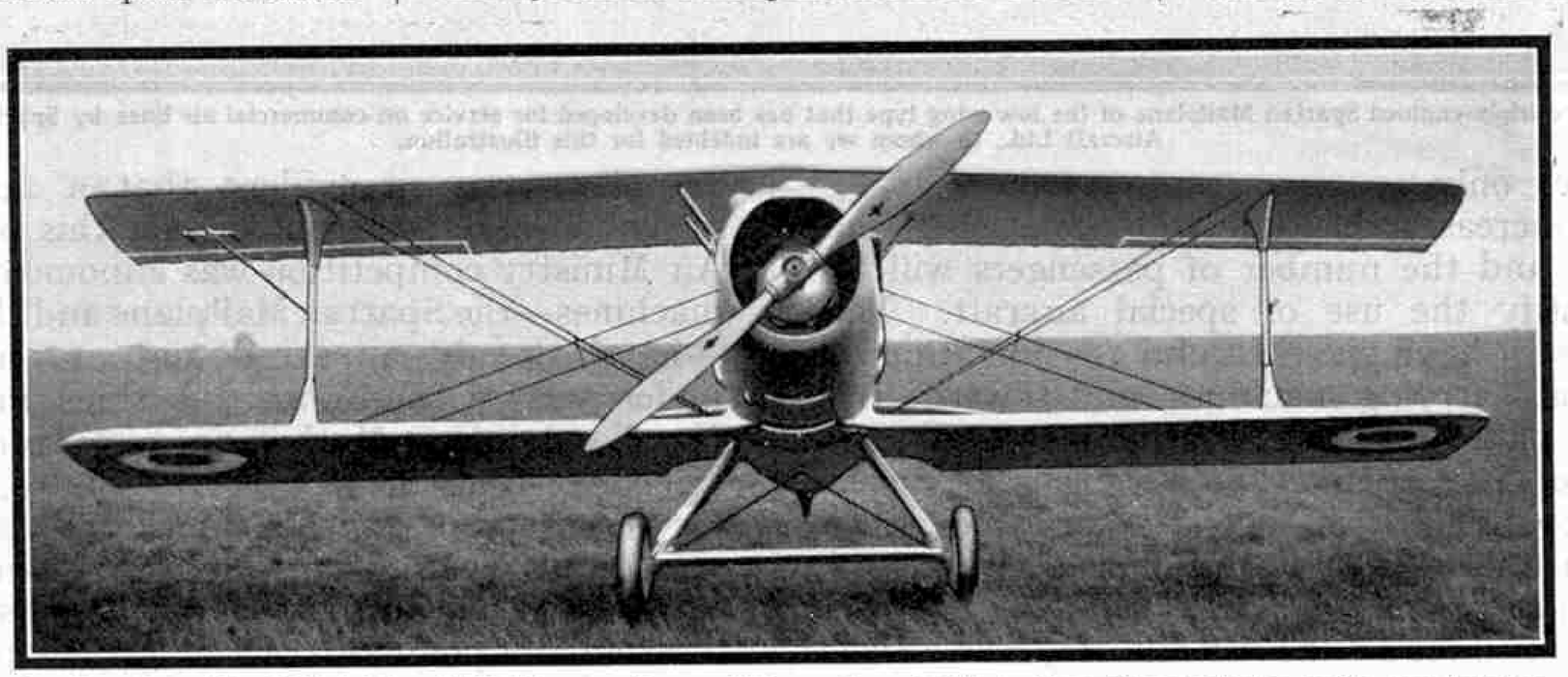
One of the latest machines produced by this firm is the "Spad" 91-C1 single-seater fighter, illustrated on this page. This is a biplane with wings of equal chord and span, the upper wing being provided with the noticeable sweep back that is characteristic of all "Spad" types. The fuselage of the machine is oval in section and is made in two parts. The front section, which ends immediately behind the cockpit, is built round duralumin formers and is covered with duralumin sheeting, while that in the rear consists of duralumin longerons braced by struts and is covered with fabric. The empennage, or tail unit, is of normal design, as also is the undercarriage, and the wheels are provided with an efficient internal springing arrangement.

A feature of the machine that gives it a somewhat unusual appearance is the position of the pitot tube, a small U-tube that forms part of the air speed indicator. The dial of the indicator is affected by the pressure of the air entering this tube, the pressure increasing with speed, and as our upper illustration shows, the tube is carried on a long rod projecting forward from one of the main struts.

The "Spad" 91-C1 is equipped with a Hispano-Suiza water-cooled engine developing 500 h.p. It is 28 ft. 5 in. in span and 21 ft. 4 in. in overall length, and when fully loaded for military service it has a total weight of 3,190 lb. It is capable of a speed of 168 m.p.h. at an altitude of 13,100 ft. and its ceiling is about 26,250 ft.



Three-quarter back view of the Blériot "Spad" 91-C1 single-seater fighter. For permission to reproduce both photographs on this page we are indebted to the courtesy of Blériot-Aéronautique.



Another view of the Blériot "Spad" fighting machine. This aeroplane is fitted with an Hispano-Suiza engine that develops 500 h.p. When fully loaded for military service it has a maximum speed of 168 m.p.h.

Record Solo Flight Across Atlantic

Miss Amelia Earhart, who was the first woman to cross the Atlantic in a heavier-than-air machine, left Harbour Grace, Newfoundland, in a Lockhead "Vega" on 20th May, in order to make a solo flight to Europe. She landed near Londonderry 13¼ hours later, this time being a record.

From Finland to Capetown by Air

Captain V. E. Bremer, a well-known Finnish airman, recently flew a Junkers "Junior" low wing monoplane, fitted with an 80 h.p. Armstrong Siddeley "Genet" engine, from Helsinki in Finland to Capetown. It is claimed that this machine is the lowest powered aeroplane to be flown from Europe to South Africa.

Captain Bremer was accompanied by a passenger from Helsinki to Naples, but the remainder of the journey was made solo, an additional petrol tank being installed in the rear cockpit in place of the passenger. The Mediterranean was crossed from Naples to Tunis non-stop and the flying time from Helsinki to Khartoum was only 72 hours. The 750-mile flight from Cairo to Wadi Halfa was made non-stop in seven hours.

Summer Services on European Airways

The summer services of all the European airways are now in operation and are so interconnected that there is regular daily communication by air between London and 130 cities and towns on the Continent. No fewer than 69 of these places, including some in countries as distant as Spain, Italy and Sweden, may be reached in less than 12 hours, and there are now very few districts in Europe that are more than two days journey from London by air.

The machines employed on the services are modern in type and in most cases well-equipped buffets are installed in order to enable travellers to have meals and refreshments while in the air.

The King's Cup Air Race

About 50 aeroplanes have been entered in the King's Cup air race of 1932, and a striking feature is that the ban on professional pilots, which caused so much discussion last year, has been lifted. Another alteration in the rules is that machines incapable of a speed of 110 m.p.h. may not be entered. Pilots taking part must have flown solo for at least 100 hours.

The Prince of Wales and Prince George are entering machines. The one selected by the Prince of Wales is a Comper "Swift," while Prince George's pilot will fly a "Puss Moth." Other interesting machines entered are the Spartan Mailplane and the Avro Mailplane, both of which are illustrated and described on pages 526 and 527 of this issue, while a Percival "Gull" and a Vickers "Viastra" 12-seater commercial monoplane also are included in the list.

This year the race will occupy two days and will be held on the 8th and 9th of this month. The starting and finishing points each day will be at Brooklands Aerodrome and the complete course will be more than 1,250 miles in length. On the first day the competitors will cover nearly 750 miles. They will fly from Brooklands to Lympne and Portsmouth, and then on to Bristol, which is to be a control. The next control will be at Leicester and will be reached by way of Castle Bromwich (Birmingham), Hooton Park and Woodford (Manchester), while there will be two turning points on the final stage, one at Ipswich and the other at Northampton.

On the second day the course will be confined to the South of England, and only the 50 machines giving the best handicap performances on the first day will be allowed to take part. An interesting feature of the second day of the race is that the aeroplanes are only to stop twice, on both occasions at Brooklands. They will make two circuits, one by way of Bristol and Northampton, and a second over Shoreham, Portsmouth and Bristol.

* * * *

Recently a Royal Dutch Air Line machine flew from London to Rotterdam in 75 minutes with the aid of a following wind. These places are 230 miles apart and thus the journey was made at an average speed of 184 m.p.h.

British Aircraft Developments

I.—Machines Designed to Carry Mails

FOR many years those who are concerned with the organisation of mail routes have debated the question whether air mails should be carried along with passengers, or should be flown in separate machines. When a Government subsidy was first granted to Imperial Airways Ltd., it was decided that the most economic plan was to carry mails and passengers together. The carriage of mails in this manner occupies more time than if they are sent separately, however, for in machines designed to carry passengers speed must be sacrificed to comfort. In addition, passengers cannot be flown at night except over well-lighted air routes, and even when these are available it is usually more satisfactory to arrange for passengers to pass the nights in hotels. A further handicap is that in bad weather the pilot of a machine carrying passengers may not feel justified in taking risks that he would readily accept if only mails were on board; and the speed of air mails is reduced when passengers are carried because the range of suitable machines is less than that of aeroplanes constructed for mail carrying purposes only.

The triple-engined Spartan Mailplane of the low wing type that has been developed for service on commercial air lines by Spartan Aircraft Ltd., to whom we are indebted for this illustration.

As air traffic increases the time will come when the volume of mails and the number of passengers will be sufficient to justify the use of special aircraft. The British Air Ministry have given careful consideration to the design of mail-carrying machines, and towards the end of 1931 they published a specification for a civil mail carrier. No aeroplanes of this type were then produced in this country, and British aircraft companies were invited to produce designs for a machine to correspond to the specification issued.

The machine called for by the Air Ministry was a two-seater all-metal landplane equipped with any British type of engine or engines. The specification required the machine to be capable of carrying at least 1,000 lb. of mails, and of cruising without refuelling at a minimum speed of 150 m.p.h. over a distance of at least 1,000 miles. An unusual feature for this country was that a self-starter was to be fitted in addition to approved hand starting gear, while provision was to be made for the necessary apparatus to drop and pick up mails during flight. It was also specified that the mailplane was to be provided with a tail wheel instead of the usual skid, and wheel-brakes capable of independent operation.

Of the designs submitted by various aircraft constructors, that of Boulton & Paul Ltd., of Norwich, was regarded as the best, and an order for the construction of the machine was placed with the company, as mentioned on page 276 of our issue for April of this year. Full details of this machine are not yet available, but it is understood to be a biplane, similar to the well-known Boulton and Paul "Sidestrand" twin-engined day bomber, which was described and illustrated on page 796 of our issue for October, 1931. It is equipped with two moderately supercharged Bristol "Pegasus" radial engines that give it a cruising speed of more than 150 m.p.h., and a maximum speed in level flight of about 200 m.p.h. The machine will fly easily with full load when one engine is out of action, and its range is stated to be well over the 1,000 miles demanded. When the machine is completed it will be put through a number of drastic tests on Empire air lines, and if these tests prove satisfactory the present air transport policy of the Air Ministry and of Imperial Airways may be greatly modified.

The need for a mail-carrying aeroplane was so evident that a number of British firms had designed machines for this purpose before the Air Ministry competition was announced. Two of these machines—the Spartan Mailplane and the Avro Mailplane—have already appeared and are now being tested under service conditions. A third machine is the de Havilland "Fox Moth," an aeroplane that is not designed solely for service on mail routes, but may be used for a variety of purposes, including passenger-carrying on "feeder" air lines, and private work for an owner who wishes to carry three or four passengers.

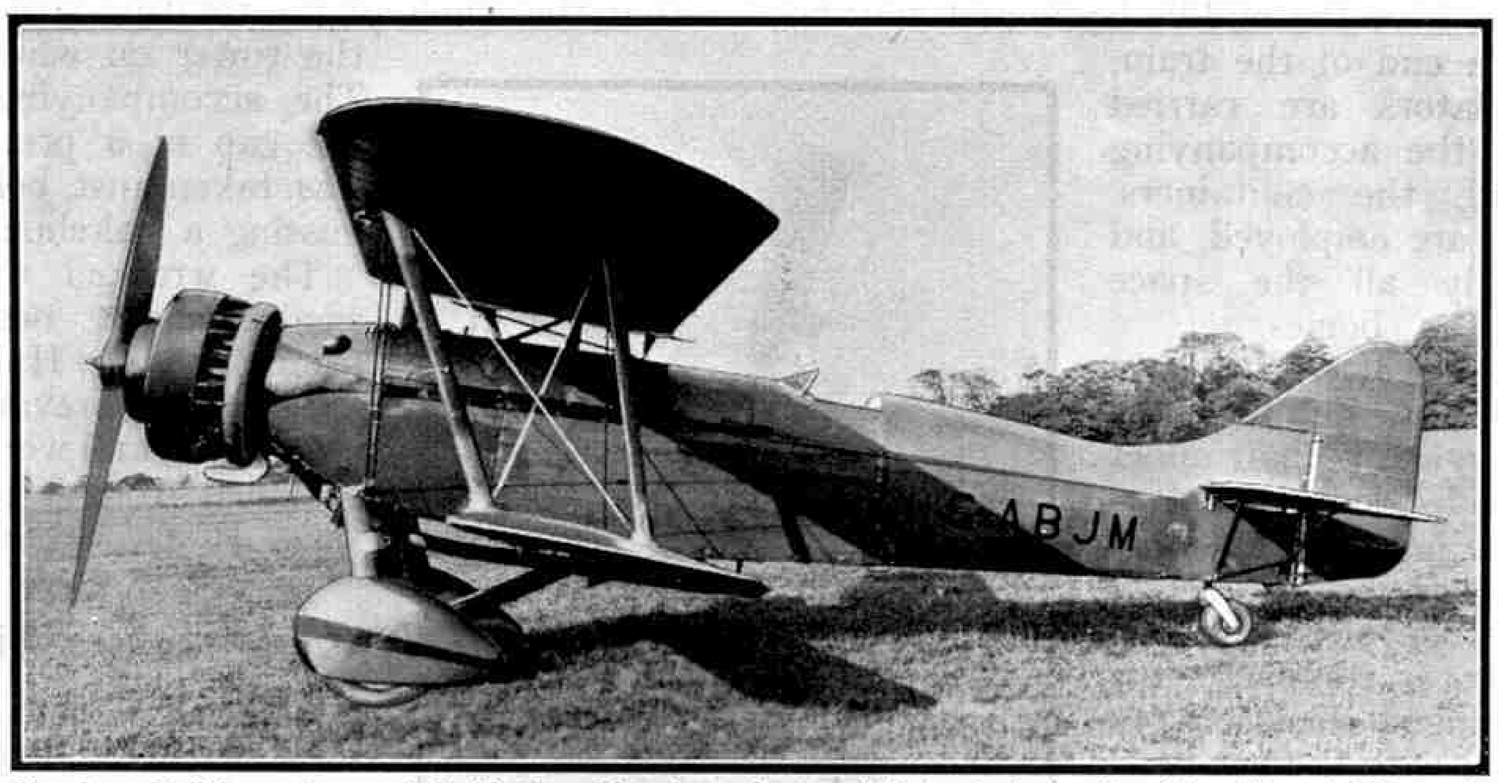
From the point of view of British practice, the most unusual of these three aeroplanes is the Spartan Mailplane. This machine is a three-engined all-metal low wing monoplane and is the only machine of this type that is constructed in this country. The engines employed are direct-drive air-cooled D.H. "Gipsy III's" developing between 110 h.p. and 120 h.p. The aeroplane has a span of 56 ft., and is 39.16 ft. in overall length and 9 ft. in height. It possesses a Certificate of Airworthiness for an all-up weight of 6,100 lb. and when carrying sufficient fuel to enable it to travel at cruising speed for six hours, or over a distance of about 650 miles, has accommodation for 1,175 lb. of mails. It is capable of travelling at cruising speed for about 10 hours,

and thus of covering more than 1,100 miles, when its load of mails is reduced to 530 lb.

At sea level the first machine of this type had a maximum speed of 133.5 m.p.h., and this was reduced to 127 m.p.h. at an altitude of 5,000 ft., and to 117.7 m.p.h. on climbing 4,000 ft. higher. The machine cruised at 112 m.p.h. and stalled at a speed of 60 m.p.h., the initial climb from sea level being at the rate of 550 ft. per minute. When fully loaded it was capable of taking off in 350 yd. provided there was no wind. The service and absolute ceilings were 10,000 ft. and 12,000 ft. respectively, and at cruising speed the petrol consumption was 16.5 gallons per hour, while oil was used at the rate of 0.28 gallons per hour.

The "Fox Moth," the latest addition to the de Havilland range of aircraft, is suitable for the transport of mails and general air line work. For permission to reproduce this photograph we are indebted to the de Havilland Aircraft Co. Ltd.

The Avro Mailplane, or Avro 627, also is of metal construction, but differs considerably from the machine just described, for it is a sesquiplane employing only one engine. It is a development of the Avro "Antelope," a two-seater high performance military biplane, and has been made a biplane in order to keep its overall dimensions as low as possible and also to facilitate the transport of spare wings over difficult country, when these are required to replace those damaged in a crash. Great attention has been paid to streamlining and an interesting method has been found to provide streamlined profiles for the ends of the struts. These are made by preparing a wooden mould of the correct shape and then dipping it repeatedly in aircraft dope until a cellulose skin of the required thickness is formed. This skin is then cut away from the mould and is ready to be placed at the end of the strut.



The Avro Mailplane, the speedy looking machine shown in our photograph, is capable of travelling at 170 m.p.h. and cruising at 147 m.p.h., and has been specially designed for the purpose of carrying mails. Our photograph is published by courtesy of A. V. Roe & Co. Ltd.

An unusual feature of the Avro Mailplane is that the tail skid is replaced by a tail wheel. All three wheels are provided with streamlined casings and the two in front are equipped with wheel brakes. The machine is completely equipped for night flying and is fitted with special retractable lights that may be employed when the machine is landing at night. The instrument board may be flood-lighted if required, while there is accommodation for wireless equipment. The maximum load of mails that may be carried is 870 lb.

The engine employed in the Avro 627 is the air-cooled geared Armstrong Siddeley "Panther IIa," which develops 525 h.p. at 2,000 r.p.m. The overall span of the aeroplane is only 36 ft., that of the lower wing being 32 ft., and the machine is 30 ft. 10 in. in length, and 10 ft. 6 in. in height. When empty the weight is 3,077 lb. and when fully loaded is 5,150 lb.

The machine is fast, having a maximum speed of 170 m.p.h., which can be maintained at all altitudes up to 3,000 ft. Even at a height of 5,000 ft. the speed is only 2 m.p.h. less, while at an altitude of 10,000 ft. this falls to 160 m.p.h. The landing speed is 66 m.p.h. and at a height of 3,000 ft. the cruising speed is 147 m.p.h. at three - quarter normal power. Sufficient petrol may be carried to enable the machine to remain in the air for 38 hours when travelling at this speed, during which time 560 miles may be covered, and by flying at a speed of 140 m.p.h. a distance of 600 miles may be covered. The initial rate of climb is 1,200 ft. per min. and the machine will reach an altitude of 1,000 ft. in 0.83 min. and of 15,000 ft. in 23 min. The service and absolute ceilings are 17,500 ft. and 19,000 ft. respectively.

As already pointed out, the D.H. "Fox Moth," the third machine dealt with in this article, may be used for other purposes than mail carrying. It differs in external appearance from other aircraft manufactured by the de Havilland Company in being provided with a comparatively large fuselage. The cabin or mail compartment of the machine is immediately aft of the engine and the pilot is carried in an open cockpit behind this. The aeroplane is particularly suitable for operation on routes where the volume of traffic is not sufficient to warrant the use of one of the larger special air mail machines.

An interesting feature of this type is its exceptionally low cost, its price being £995. It has been found possible to produce it at this price by making it almost completely of wood and incorporating standard parts that also may be used in constructing other machines in the de Havilland range. For instance, the wings are of the type employed on the "Tiger Moth," while the empennage is made up of standard "Puss Moth" and "Gipsy Moth" fittings and

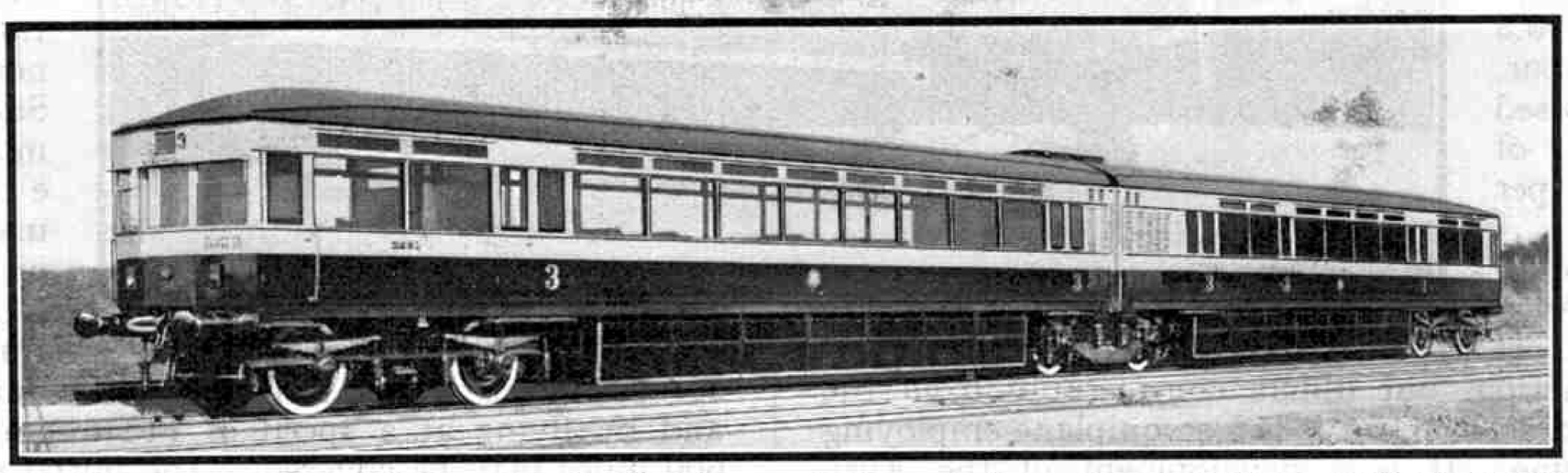
(Continued on page 517)

From Our Readers

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

An Interesting Irish Electric Train

Early last year the Great Southern Railways of Ireland began trials of the Drumm accumulator, for which the claim is made that it may be charged at a higher voltage and with a heavier current than accumulators of the ordinary type. The purpose of the Company is to produce, if possible, a passenger coach to be driven by motors supplied with current from this accumulator, for this would have many advantages over an ordinary electric train.



The Drumm battery train described by our reader, M. H. Duncan, Sandycove, in the accompanying article. For this photograph we are indebted to the courtesy of the Great Southern Railways of Ireland.

The trials are being carried out on the service between Dublin and Bray, and the train employed consists of two coaches, each 60 ft. in length, that are slung on three bogies. The motors drive the middle bogie and may be controlled from each end of the train, while the accumulators are carried under the coaches, the accompanying photograph showing the containers. Altogether 264 cells are employed, and these occupy nearly all the space available between the bogies.

Charging takes place after the train has run about 14 miles. For this purpose the train is brought to a halt under two bus bars suspended side by side a few inches above the level of the coach roof, the bars being placed parallel to the track. Two trolleys are swung upward from the motor compartments of the train until hinged shoes on top of them make contact with the bus bars. Current at 500 volts then passes through the batteries, which are ready for a further run of 15 miles after a charge occupying about 20 minutes. The charging current is taken from the mains, and is transformed into direct current at the station.

The train is fitted throughout with vacuum brakes operated by a small electric motor. It travels very rapidly between stations and is practically noiseless, in this respect being a great improvement on a steam train. At present it can only be used for suburban traffic, but for this purpose it is found to be very economical and convenient. M. H. Duncan (Sandycove, Co. Dublin).

A Tail-Winded Windmill

Recently I found three interesting photographs taken about 32 years ago, illustrating a rare kind of accident to a windmill built about 1860 by my great grandfather's firm, Upfield & Sons, Catsfield. It was a tower mill, having a rotating cap that carried the sails and also a fan tail, by means of which the cap was turned automatically to bring the sails into the wind. The cause of the accident was the jamming of the fan tail. The cap was unable to turn, and unfortunately the wind was directly behind the sails. A mill in this condition is said to be tail-winded, and in this instance the pressure of the wind was so great that the whole of the rotating structure was lifted from the tower on which it was supported. The accompanying photograph shows the cap in a precarious position, and was taken just before it fell, narrowly missing a bakehouse near the mill.

The cap of a tower windmill about to fall after being blown off its support. This photograph was forwarded by our contributor, H. G. Hobbs, Bexhill-on-Sea.

The wrecked windmill stood on a small hillock near the main road from Bexhill to Hailsham. It was in the path of the prevailing winds from the south-east, and wonderful views could be obtained from it on a clear day.

H. G. Hobbs (Bexhill-on-Sea).

Winchester's Historic Measures

Recently I spent a few days in the historic city of Winchester, and there I was greatly interested in the wonderful display of ancient weights and measures to be seen in the chamber above the West Gate. The oldest measure in the collection is the standard yard, an octagonal bronze bar marked on its ends with the letters E and H. It is believed that the rod was supplied to the city by Henry I, and that its length was adjusted in the reign of Edward I, and again in that of Henry VII, the sovereign's initials being marked on the end on each of these occasions. Other exhibits include two steel yards of the 13th century, and an interesting weight of 91 lb., a measure employed in the wool trade 600 years ago. E. Avey (Abinger Common).

A Buddhist Temple in Ceylon

When visiting a Buddhist temple at Colombo, I was asked to remove my shoes before entering, my guide explaining that "they liked it clean." I was then introduced to a small but very talkative boy, who explained the curiosities of the temple in good English.

The chief room in the temple is a large square chamber, in the centre of which stands a platform occupying about a quarter of the whole floor area. On three sides of this platform are enormous statues, tall enough to reach to the roof, representing prominent figures in the history and beliefs of Buddhism. They include statues, carved in wood, of disciples of Buddha, these being shown sitting cross-legged in prayer, while above them is a replica of the Bo-tree, under whose branches Gautama, or the Buddha, found peace of mind while meditating after his six years of penance. The fourth side of the platform is occupied by a large reclining figure about 15 ft. in length of the Buddha himself, who seems to be overlooking a row of horizontal memorial tablets on which flower petals were scattered.

Priests entering the Buddhist temple in Colombo visited by our reader, J. Reekie, Cockenzie.

A pictorial history of the life of Gautama covers the walls of the chamber, the paintings illustrating the miracles attending his childhood and the hardships he endured during his wanderings as a beggar. Another group shows stages in the life of man, beginning with his birth and finishing with the representation of a skeleton in a coffin—a gruesome if accurate conclusion! J. REEKIE (Cockenzie).

A Trip in a Schooner

While spending a holiday at a small seaside resort a few miles north of Dublin, I made friends with the skipper and crew of a small schooner, and to my delight was invited to sign on as an extra hand during the next trip to Glasgow. The vessel left port with the tide one morning about two o'clock, and by evening we were off Ailsa Craig, the gigantic rock 1,100 ft. in height at the entrance to the Firth of Clyde that is the home of countless seabirds.

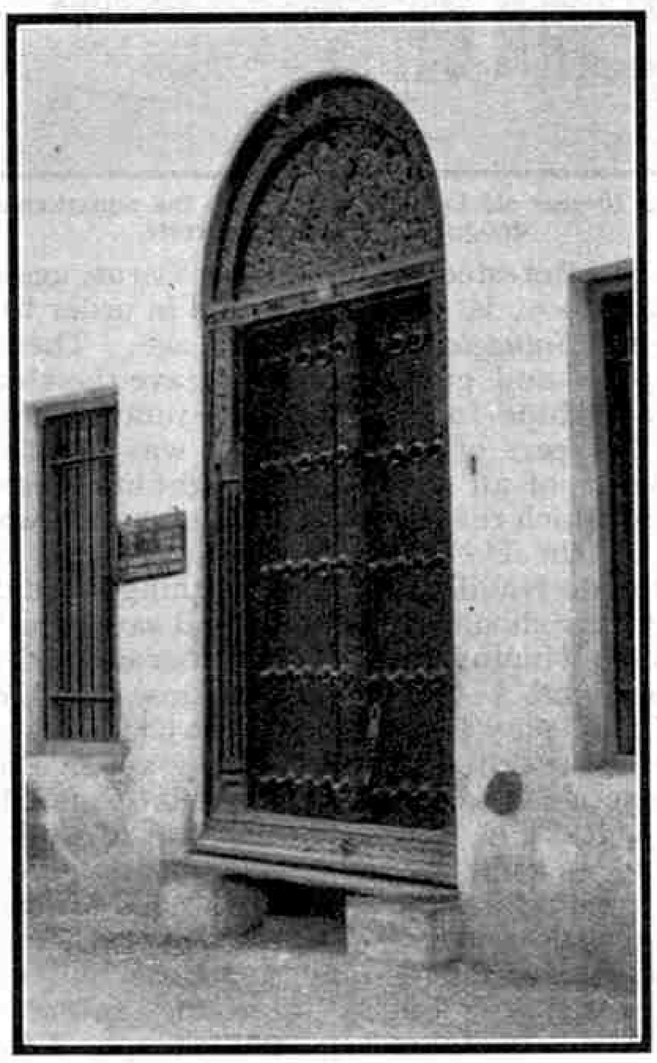
On reaching Greenock the pilot who was to take the vessel up the Clyde came aboard. Wind and tide were against us, and in spite of the efforts of our auxiliary engine, we began to drift astern, and it was necessary to drop anchor, the crews of passing steamers shouting humorous comments on our plight. We obtained a partial revenge next day, however, for in a half gale on the return voyage to Ireland we overtook a French vessel that had passed us in the Clyde, and at sunset she was lost to view astern. B. W. F. THOMPSON (Dublin).

A Visit to Zanzibar

One of the most interesting places I have seen is Zanzibar, the well-known island off the east coast of Africa. I visited it during a voyage from Beira to London, and on arrival in the harbour this was seen to contain many dhows, pretty craft with carved sterns and white sails.

On going ashore I visited the bazaar, a maze of narrow crooked roadways with high buildings on each side that give shelter from the tropical Sun. The only vehicles allowed there are bicycles, and instead of the traffic customary in large towns, native porters and heavily-laden pack donkeys pass leisurely through the streets, while fowls scratch in them and even tethered goats may be seen. Arabs in long flowing robes, Indians and Zanzibaris, dressed in long white garments, help to make the scene a truly Oriental one.

In the bazaar I noticed a sweet and rather sickly smell and found that this was due to copra, or the white fleshy part of the cocoa-nut. Large quantities of this are stored in many of the warehouses, from which it is exported to England and France in order to have oil extracted. Another smell that I always associate with Zanzibar is that of cloves, for the island is famous for its plantations, which supply the greater part of the world's requirements of this spice.



A carved Arab doorway in Zanzibar, from a photograph sent by our reader, R. Robertson, Enstone.

There are many splendid carved doorways in the bazaar, the doors themselves being studded with metal work. When I passed through, it was very hot and some of the shopkeepers seemed half asleep, while others were reading parchment books printed in Arabic lettering. Fascinating Eastern wares were on sale, these including Persian carpets, Indian silks and articles carved in cedarwood, ebony or ivory, these often being inlaid with silver and turquoise. Here and there were stores displaying American alarm clocks, sewing machines and cheap European goods, all of which looked very odd in such an eastern setting.

Many different kinds of grain were exhibited in certain shops, each variety being shown in a little brass bowl. There were also a number of sweatmeat sellers, but these were not busy, however, for it was Ramadan, the ninth month of the Mohammedan year, during which no Moslem may eat or drink between sunrise and sunset.

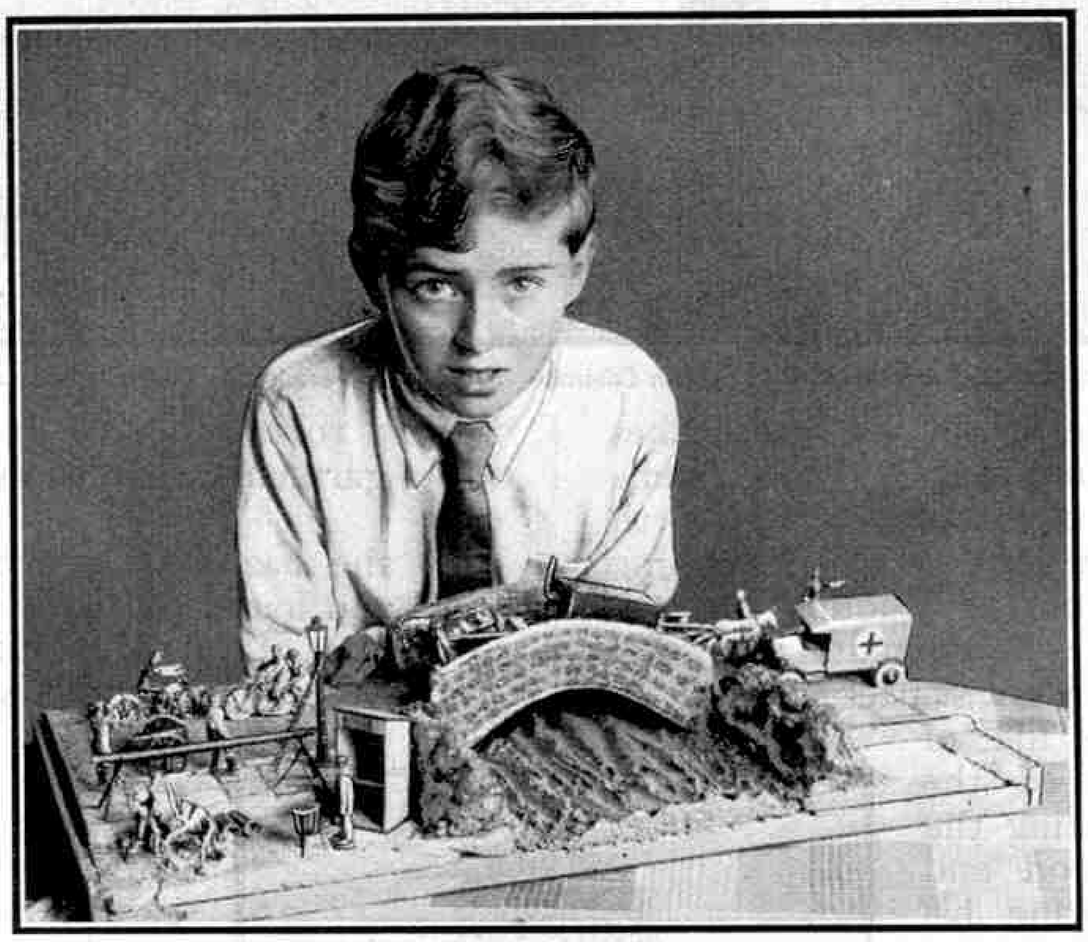
It was very hot and thirsty in the city, and I was glad to retreat to a hotel for tea. I sat on a shaded verandah, opening on to a central courtyard, and was interested to learn that most Arab houses are built in this fashion, the windows facing inwards. R. ROBERTSON (Enstone).

BRAINS AND BRAVERY

BOYS WHO RANK WITH MEN

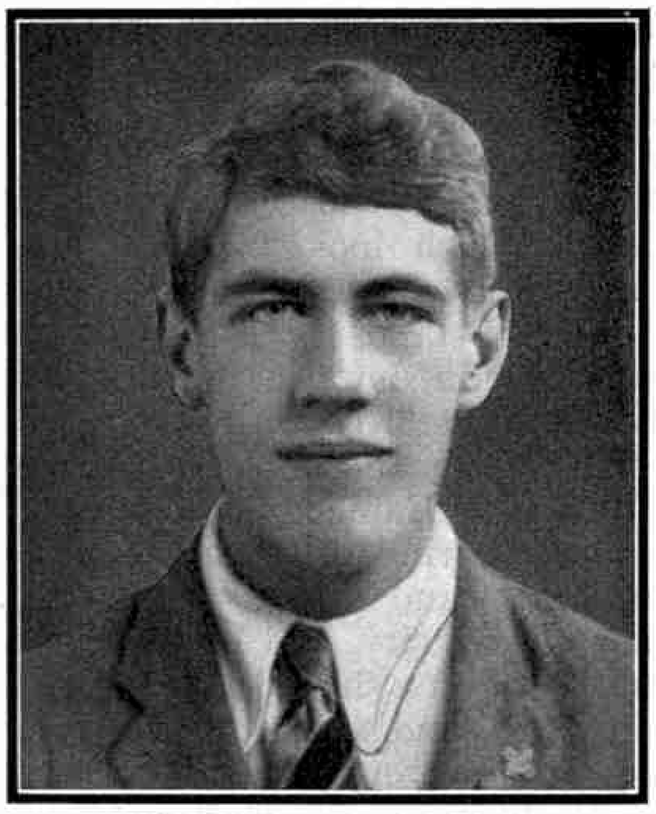
EDWARD WREATHAM of Holloway, London, appears to have been destined to give proof that the boys of to-day possess steady courage and presence of mind, for although he is only 14 years of age he has to his credit two attempts at rescue from drowning. Unfortunately the more recent of these efforts was unavailing, and Wreatham himself was in imminent danger of being drowned. The boy whose rescue he attempted on this second occasion was Frederick Paintin, who was seven years old and also lived in London. With a friend Paintin descended the Iron Gate Stairs leading down to the Thames near Tower Bridge, and fell into the water. Wreatham happened to be in the vicinity, and as soon as he heard of the accident he ran down the stairs and dived into the river, in spite of danger from the strong current then flowing. In the meantime Paintin had drifted towards the piles of a jetty. Wreatham swam after him, but the younger boy disappeared before he could be reached, and afterwards was only seen as he came to the surface for a moment near a ship. Wreatham managed to regain the shore, but only with great difficulty, and the fact that his prompt and gallant action was useless does not detract from its great merit.

Wreatham's previous rescue effort occurred at Leighton Buzzard, when he rescued a friend who had fallen into the canal. It is interesting to note that the boy's father, when a young man, jumped into a canal in Caledonian Road, London, to save a workmate who had fallen in.



Peter Johnson, a 10-year old London reader, with the remarkable model he has designed and built in concrete.

Turning now to achievements of a different kind, readers of the "*M.M.*" will be interested to learn that one of their number, an ardent Meccano boy, is now ranked as a playwright, for his short play entitled "*Smugglers*" was accepted by the British Broadcasting Company and given on the wireless on two occasions. His name is Edward Hope-Jones, and at the time when he wrote the play he was 15 years of age and at Eton. He was already known as the winner of an outstanding "*M.M.*" aeroplane contest held in 1926, in which readers of the Magazine were asked to suggest a name for the D.H.66, the new type of machine produced that year by the de Havilland Aeroplane Company. Hope-Jones suggested that this should be named "Hercules," and his proposal was adopted, winning for him a free flight.



Edward Hope-Jones, Eton College.

Hope-Jones' play is remarkable for the skill with which the action is adapted to broadcasting conditions, and an official of the B.B.C. said that the author showed remarkable knowledge of microphone technique, and avoided the mistakes usually made by beginners. No doubt many readers heard the play on one of the two occasions when it was presented, and will agree with this tribute to its author.

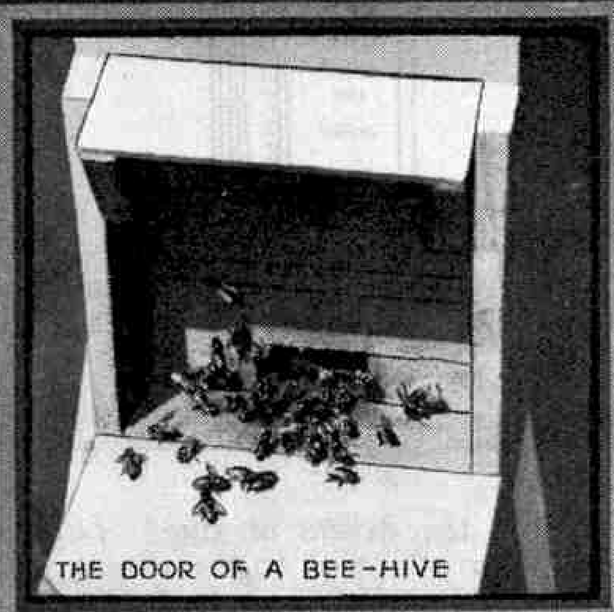
The plot of the drama is original and ingenious. Its sub-title is "*A Tale of Strong Tobacco,*" and it deals with the smuggling of tobacco into India. As might be expected in a play written by a Meccano boy, and particularly by one who is interested in aeroplanes, the smuggler travels from England to Karachi by air. He is followed to India in a second aeroplane by two young Englishmen who have learned his secret as the result of an accidental exchange of suitcases, and after exciting adventures he is trapped and arrested. The action begins in a train and continues in aeroplanes, while the gang is finally rounded up in a shed at Karachi Aerodrome connected by a secret passage with an hotel owned by the smuggler. The play was a great success, and at the request of the B.B.C. authorities the youthful author is now at work on a second.

Another Meccano boy who has shown that he possesses skill and ability beyond his years is Leslie Creasey of Simonstown, Capetown, S.A., secretary of the Simonstown Meccano and Wireless Club, of which his father, Mr. W. J. Creasey, is President. Leslie has shown such remarkable aptitude in drawing and painting that he has been appointed demonstrator in the Michaelis School of Art in the Capetown University. His career has been one of continued success. In one year he obtained his Diploma in Fine Art, won the Annual Painting prize of his School of Art, and in addition was awarded a special prize of £100 that is competed for annually. An outstanding feature of this last success was that for the first time the prize was not shared with any other student, as had always been the case in previous years.

A remarkable story of the fatal heroism of a very small boy comes from Liverpool. The boy was Peter Carus, aged eight, who plunged into the Leeds and Liverpool Canal in order to rescue his friend, Charles Arslenian, a boy of the same age. The two were seen struggling in the water by other boys who gave the alarm, and a ship's fireman who was passing immediately jumped into the water. He succeeded in grasping Arslenian as he was about to be carried by the current under the bridge, and brought him to the bank. Unfortunately Carus was not seen by the rescuer, and he appears to have sunk almost immediately. Arslenian did not recover consciousness for some time, and then almost the first thing he said was: "I came up again and heard Peter shout 'I will save you.'" These words are a magnificent testimony to the courage and determination of the boy whose gallant effort to save his friend ended in his own death.

The upper illustration on this page shows an example of skill and perseverance, for the model of the arched bridge crossing a narrow stream was designed and built in concrete by the subject of the photograph, Peter Johnson, London, who is only 10 years of age. The work is carried out in a most realistic manner, the water flowing under the bridge being particularly well represented in view of the comparatively unpromising nature of the material employed. A remarkable feature of the design is the excellent use made of the realistic modelled miniatures.

Edward Wreatham, Holloway, London.



The OUTDOOR WORLD

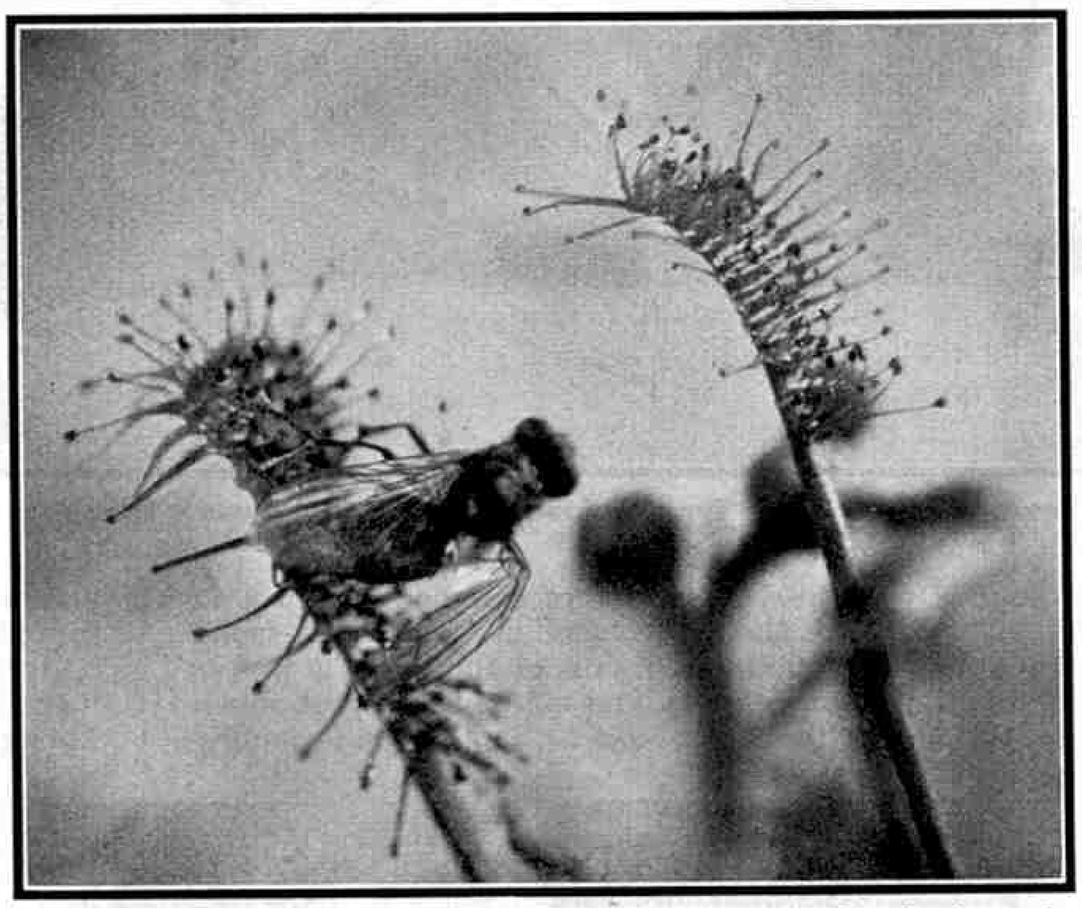
AND ITS HIDDEN BEAUTIES

PLANTS THAT FEED ON INSECTS

THE majority of plants follow the long-established custom of the respectable members of their world by drawing their nourishment from the soil. A few plants, however, are not content with this blameless but monotonous mode of life, and have embarked upon a more adventurous career. In short, they get their living either entirely or in part by setting traps to capture insects and other living things, and feeding upon their digested bodies.

One of the most remarkable of these carnivorous plants is the common sundew. This weird plant grows in swampy and marshy places, sometimes in quite large colonies, its clusters of red leaves making it conspicuous among the yellows and greens of the moss and marsh plants. These leaves quite overshadow the poor little white flowers that seem loath to open as though they were half ashamed of their existence.

From the upper surface of the leaves of the sundew project tiny filaments terminating in minute crimson knobs, which are actually glands. The shortest filaments are in the centre of the leaf, and the longest at the outer edge. Each gland secretes a drop of clear liquid, so that the whole plant glistens in the sun as if covered with dewdrops; and it is from this dewy appearance that the plant obtains its name. The liquid is extremely sticky and forms a death trap to any insect that is unfortunate enough to come in contact with it. The liquid holds its captives as firmly as a fly-paper holds flies, and the more they struggle the more hopelessly entangled they become. The number of insects the sundew captures during the days of midsummer is quite remarkable. There is no doubt that flies are attracted by the somewhat lurid red appearance of the leaves, and also by something peculiar in their odour. The great naturalist Darwin, who gave considerable attention to insectivorous plants wrote: "Whether insects alight on the leaves by mere chance, as a resting place, or are attracted by the odour of the secretion, I know not. I suspect from the numbers of insects caught by the English species of *Drosera* (sundew), and from what I have observed with some exotic species kept in my greenhouse, that the odour is attractive. In this latter case the leaves may be compared with a baited trap; in the former case, with a trap laid in a run frequented by game, but without any bait."



A leaf of a sundew plant holding a fly by means of its filaments. Shortly afterwards all the filaments will converge on the fly and cover it completely.

The sundew does not obtain nourishment from its captures by eating them as an animal eats its prey, but by absorbing the digestible portions of the creatures and rejecting the remainder. Immediately an insect is caught the filaments of the leaf begin to close in upon it with an action resembling the closing of the fingers towards the palm of the hand. The movement is slow but continuous, and in a period varying according to conditions from one to three hours the filaments are all converged upon it. Before long the captive is completely covered with the secretion from the glands, and there commences a process of digestion that occupies two or three days or perhaps longer. When the digestible parts of the insect have been dealt with, the filaments relax and return to their original position, and the undigested remains are soon blown away by the wind.

The most extraordinary part about the whole process is the manner in which an impulse is telegraphed from the filaments in contact with the captured insect to those all over the leaf, so that united action of the filaments commences immediately. The position of the insect on the leaf makes no difference, for in every case the filaments move towards the required point. If two insects should be captured on different parts of a leaf the filaments divide their forces, some moving towards one insect and some towards the other.

Another carnivorous plant is the bladderwort, a rootless plant that grows suspended in the water of pools and ditches in marshy districts. Some of the leaf divisions form bladders or pouches resembling to some extent miniature lobster pots. Each bladder has an aperture protected by bristles, and fitted with what may be described as a trap door. Tiny water creatures of various kinds find their way into the bladder, perhaps to take shelter, and are then hopelessly imprisoned, for the trap door makes it impossible for them to get out again.

Books to Read

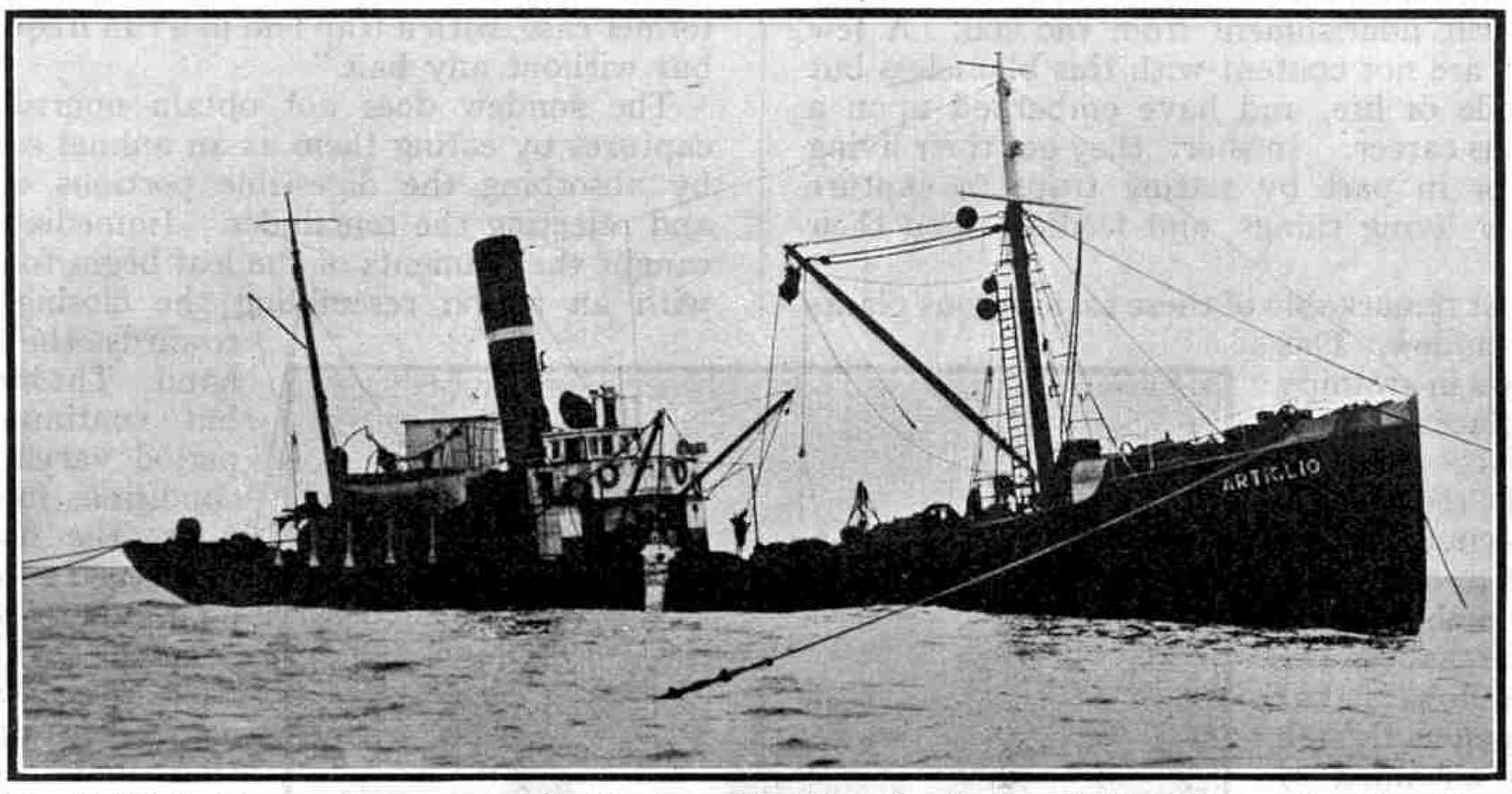
Here we review books of interest and of use to readers of the "M.M." We can supply copies of these books to readers who cannot obtain them through the usual channels. Order from Book Dept., Meccano Limited, Old Swan, Liverpool, adding 1/- for postage to the price. Postages on different books vary, but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

"Seventy Fathoms Deep"

By D. Scott. (Faber & Faber. 12/6)

Who of us has not been fascinated to listen to stories of those intrepid adventurers who go down into the sea? How we have been thrilled to learn of the mysterious sea-bed, of the corals, the sea-weeds, and the myriads of fishes that inhabit those dark green depths in almost every clime. But in these commercial days divers do not often descend for the mere pleasure of inspecting the submarine scenery. Before a diver goes down there must be some certainty that his venture will serve some utilitarian purpose—either the saving of human life, the recovery of treasure, or the locating of wrecks and other obstructions. It is with the practical side—the salving of sunken treasure—that this particular book is concerned. In twenty-three thrilling chapters we are told of the persistent attempts recently made by Italian divers, working from the salvage ship "*Artiglio*," to recover treasure in various forms from the two ships "*Elizabethville*" and "*Egypt*," sunk off the coast of Brittany.

The author, Mr. David Scott, is in a unique position in this matter for he was the only journalist to accompany the divers. He lived for weeks at a time in the "*Artiglio*" and was a witness of the thrilling operations carried on from that ship—thrilling because, by the aid of the latest invention in marine diving apparatus, it was possible for the divers to go down to depths that had never been reached before. This special equipment consisted of articulated steel diving shells, which are capable of withstanding high pressures and allow the diver to move the steel arms and legs by special flexible joints that work on ball bearings made waterproof by rings of thin rubber covering the small spaces between the working parts. The use of these steel shells enabled the divers to drop with ease to depths up to 400 ft., and to be shot up again without the physical discomforts that invariably are experienced by those who descend in ordinary rubber diving suits.



The "Artiglio" at her moorings over a wreck. The observation shell used by the divers is being slung over her side. (From "Seventy Fathoms Deep," reviewed on this page).

The Italian divers commenced work in 1928, the first object of their quest being £100,000 worth of uncut diamonds, as well as valuable ivory and mails, that went down on the "*Elizabethville*," a Belgian passenger steamer. Torpedoed by a German submarine in 1917 on her way home from the Congo, she lay in 240 ft. of water, and although the divers did many astonishing things they never found the diamonds.

In 1929 the divers of the "*Artiglio*" turned their attention to the wreck of the "*Egypt*," a P. and O. liner sunk off Ushant in 1922, and carrying over £1,000,000 of bullion. To find the wreck was like looking for the proverbial needle in a haystack, and after weeks of patient sweeping and diving the search was temporarily abandoned, whilst electrical detecting instruments were sent for as a last resource. In the following year the search was resumed and although several other wrecks were found, none turned out to be the treasure ship. At last, on a day in August, in an amazing manner and by pure chance, the prize that had eluded so many efforts gave herself up to the searchers. Blasting a way into the cabin, the divers found the Captain's safe, which was brought up by a special grab. To their disappointment, it contained only water-logged official papers, with signatures of Foreign Office dignitaries and marked "Secret."

A card from Britain's first official airpost, between London and Windsor in September, 1911, in celebration of the Coronation of King George V and Queen Mary. This illustration and that of Canada's first air stamp, shown on the next page, are reproduced from "Field's Air Mail Catalogue," reviewed on the next page.

As we read of these gallant and sustained efforts we come to know and to love those Genoese divers, who performed such remarkable feats of endurance. For them to have been cheated of the great prize—the contents of the bullion room—after so much work was hard enough, but for them to lose their lives as well was, indeed, a tragic climax to such heroic efforts. It comes as a shock to us to have to take leave of these fine fellows at the end of the book with the terrible tragedy that resulted in the total loss of the "*Artiglio*." One cannot but mourn the loss of brave men who pitted their wits against the relentless sea—only to be conquered when so near their goal.

We recommend the book to all our adventure-loving readers as one of the best we have read for some time. This story, so dramatically told, cannot fail to thrill everyone as an epic of modern adventure. We look forward to the time when other brave men succeed in making the sea give up its gold.

"Field's Air Mail Catalogue"

By D. Field. (10/6)

It has been one of the complaints of the keen aero-philatelist in the past that there has existed no reliable guide to assist him in the study of his hobby. An attempt to codify air mail activity has long been a necessity, but one had hardly hoped for so exhaustive a treatment as is given in the recently published Field's Air Mail Catalogue. All varieties of air mail stamps, official and unofficial, air mail covers, labels, special postmarks and pictorial cachets are listed, and priced where reliable data are available to make price-fixing practicable; and the quantities of covers carried on the important first flights are given in most cases. As an interesting example of detailed treatment, the case of Canada is worth citing. Canada's air mail history is comparatively recent, but the catalogue records details of over 150 different air mail flights and services, and provides a most interesting series of illustrations of the many special private labels and cachets employed.

Great Britain spreads itself over some eight pages. The 1903 balloon post, organised in connection with a fete held at Manchester in aid of the Royal National Lifeboat Institution, is the first item recorded, and it is interesting to learn that the special souvenir cards issued, showing a picture of a balloon over a rocky coast, are worth £20 to-day in flown condition. This is not Britain's greatest air mail rarity, however. This honour falls to a cover carried during the Coronation celebration flights between London and Windsor on 9th-15th September, 1911. Specially inscribed cards and envelopes were provided, and on one batch of these the wording "Hendon-Windsor" appeared in place of "London-Windsor." Mr. Field comments "We have seen but one example of this, which appears upon an envelope printed in brown." That single specimen is catalogued at £50.

It is possible that an even higher price would be commanded by another unique specimen if it were to come upon the market. This is the sole survivor of a packet of 14 letters carried by H.M. Airship R34 on the outward portion of its flight from Britain to the United States in July, 1919. The packet was dropped overboard from R34 as it passed over the village of Selmar in Nova Scotia but it fell clear of the village and lay undiscovered until 8th November, 1919. Only one surviving specimen is known, and it bears on its back the following inscription: "This letter was dropped by H.M. Airship R34 on 5th July, 1919, and picked up at Selmar, Hants. Co., Nova Scotia, by Milton Weldon, on November 8th, 1919. Forwarded to Halifax, Nova Scotia, by C. S. Waugh, Postmaster." The top of the front of the envelope is inscribed "Per H.M.A.S. R34."

One does not care to contemplate the enormous amount of painstaking research that has gone to the creation of Mr. Field's catalogue, for the air mails of all other countries are covered in a similarly exhaustive manner. It is worthy of a place in every stamp collector's library, and it will prove invaluable to the aero-philatelist.

Further details can be obtained from Mr. D. Field, 7, Vigo Street, London, W.1, by whom the catalogue is published, or from any stamp dealer or bookseller.

"The G.W.R. Engine Book"

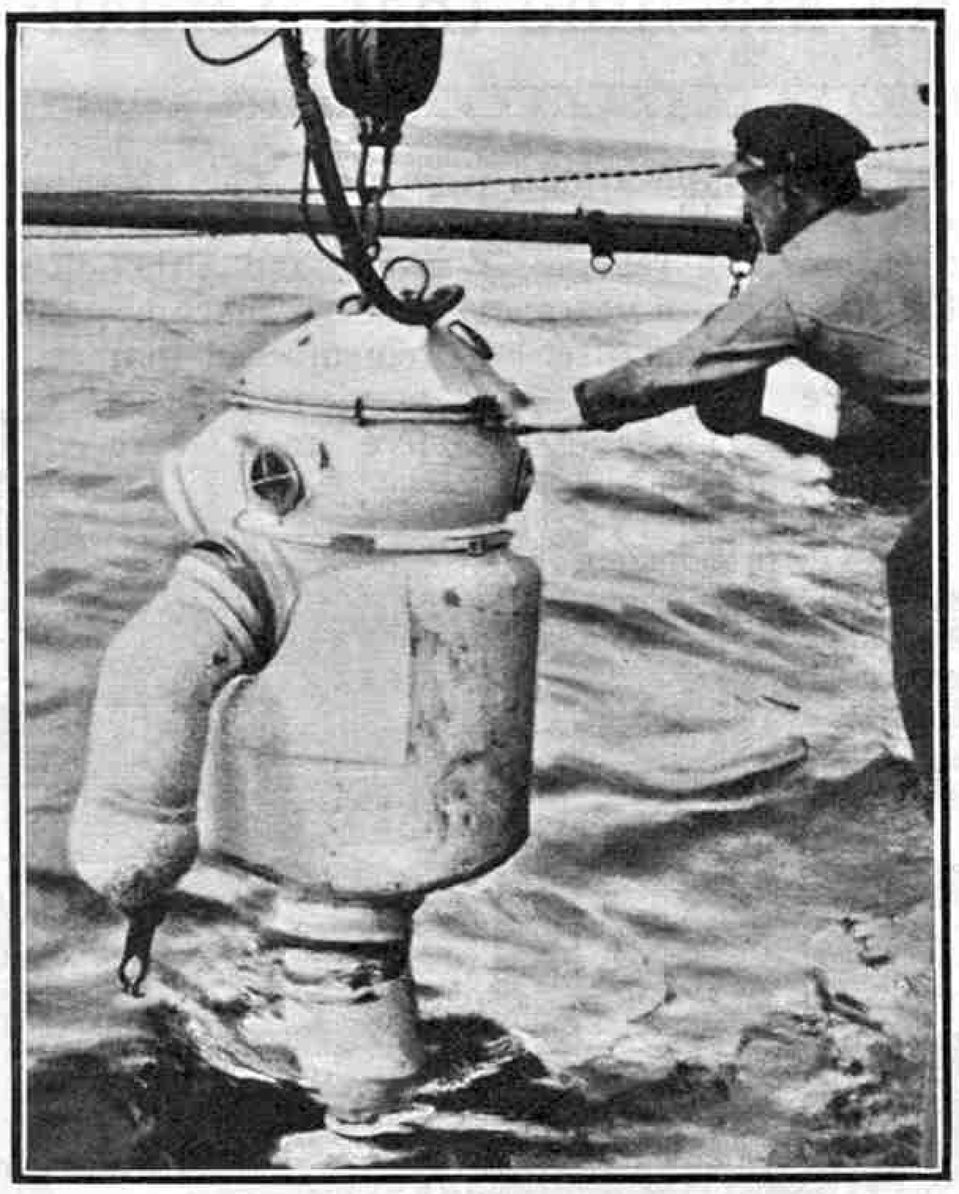
(Great Western Railway, Paddington. 1/- net)

In its general arrangement the latest issue of this well-known publication follows that which has proved so successful in its predecessors. The history of locomotive progress on the G.W.R. has been brought up to date, and a tabular statement showing the chief classes of engines built since 1895 has been included. The growth of Great Western locomotive power from the "*North Star*" of 1837 to the "Kings" of the present day is shown in a striking manner, both by photographs and by comparative tables of dimensions. Complete lists of the "Kings" and the numerous "Halls" will be welcomed by those requiring information about these engines, and particulars of the "2251" 0-6-0 class and the "5100" series of 2-6-2 tanks are given. Recent additions to the 2-8-0 tank locomotives, and the numerous "Pannier" tank locomotives of the "5700" and subsequent series, are also shown.

We note with regret that the 4-4-0 outside-framed type of locomotive with 6 ft. 8½ in. wheels is now obsolete on the G.W.R., the only survivor being the famous "*City of Truro*," which is now housed in the York Railway Museum. The "County" class, too, have been steadily reduced in number, and there are ominous gaps in the "Saint" series of two-cylinder 4-6-0s; which seem to indicate that these engines will be largely replaced in due course by the additional "Hall" and "Castle" locomotives to be built this year.

Train speeds, always a popular subject, have some space devoted to them, and a study of the table, which is headed of course by the Swindon to London sprint of the "*Cheltenham Flyer*," shows that the level of speed on the Great Western system is extremely high.

The book concludes with a brief history of the "*Cornish Riviera Express*." This represents the high-water mark of British train services, and its development during the past quarter-of-a-century has been paralleled by remarkable progress at Swindon Works in order to provide engines capable of dealing satisfactorily with it and other trains of a similar kind.



The diver being lowered into the water in the special steel shell. (From "Seventy Fathoms Deep," reviewed on the previous page).

"The Wireless Manual"

By Capt. Jack Frost

(Sir Isaac Pitman & Sons Ltd. 5/- net)

The present volume is the third edition of this publication, which first appeared two years ago, and was reviewed in the "*M.M.*" for April, 1930. It has now been entirely revised and brought up to date by Mr. H. V. Gibbons. The additional chapters deal with the gramophone pickup, an important branch of wireless that was in its infancy when the first edition of the book appeared and was then dealt with very briefly; radio gramophones, a comparatively recent development; and mains supply units, again a characteristic of modern practice. The section describing popular wireless sets has been completely rewritten and gives interesting descriptions of a large range of up-to-date receivers. In addition, the admirable explanations of the principles of wireless and the practical advice on buying sets and obtaining the best results from them given in the first edition have been extended where necessary, and an entirely new appendix gives the characteristics of practically every make of valve on the market, together with a list of the principal European broadcasting stations. The book is well illustrated and will be interesting to all practical wireless enthusiasts.

Canada's first air stamp used on correspondence carried by Royal Air Force machines between Toronto and Ottawa in August and September, 1918.

"The B.O.P. Cycling Handbook"

(The Boy's Own Paper Office. 1/- net)

The popularity of the bicycle has not been greatly affected by the coming of the motor car and of low-priced motor cycles, and indeed there now appear to be more machines than ever on the road. The present handbook has been written for boys, and particularly for those who are beginners. It gives a careful description of the construction of machines, and a special chapter is devoted to explaining how to make adjustments to a new machine in order to enable its rider to obtain a comfortable position and to acquire an easy style.

Other sections deal with the care of the bicycle generally, particular attention being given to the right use of oil, and to variable speed gears, tyres, brakes, lamps and other accessories. There is also much practical advice on other topics of interest and importance to all cyclists.

Another Splendid Working Model

A Printing Machine that Actually Prints!

AGES ago the Chinese learned the art of duplicating letters or designs by the use of carved blocks of wood smeared with ink and stamped in reverse on lengths of cloth or parchment. For hundreds of years this slow and laborious method was used, and even after the invention of iron type by a Chinese, Pe Ching, and the subsequent introduction of printing into Europe in the twelfth century, little or no alteration was forthcoming for nearly 200 years. About the year 1400, however, in the city of Mainz, Germany, Johann Gutenberg was born, and it is from him that the present-day idea of printing with type under pressure has grown. For over 20 years Gutenberg was engaged in secret research work, and during this period he perfected his new method of printing, which included the moulding and composition of type, the construction of a suitable printing press, and the making of a correct grade of paper. This method of printing was introduced into England by William Caxton about the year 1474, and for many years printing was carried out by it. It was not until 1802 that the first definite step towards modern printing was taken. In that year Frederick Koenig of Eisleben, Saxony, introduced a printing press with a movable printing carriage and automatic inking rollers.

As is usual with almost every invention, little notice was taken of this, and it was not until Koenig came to England that he began to reap the fruits of his labour. While in England he met a well-known printer, Thomas Bensley, with whom he formed a partnership and, after many years of experimenting, a printing machine was constructed that derived its motion from a steam engine. This machine was operated on what is known to-day as the platen principle, but while it was being constructed and sold commercially Koenig hit upon the idea of a rotary printing press, the principle of which has remained unchanged even in the latest presses of the newspaper world. This amazing machine, with the aid of two men, made it possible to take 800 printed impressions in an hour, and although as compared with the capacity of modern machines this figure appears small, it must be remembered that previous to this five men were required to take less than 100 impressions in the same time. To-day, with the latest all-electric rotary presses, it is possible to print more than 100,000 complete newspapers in one hour, all cut and folded ready for delivery.

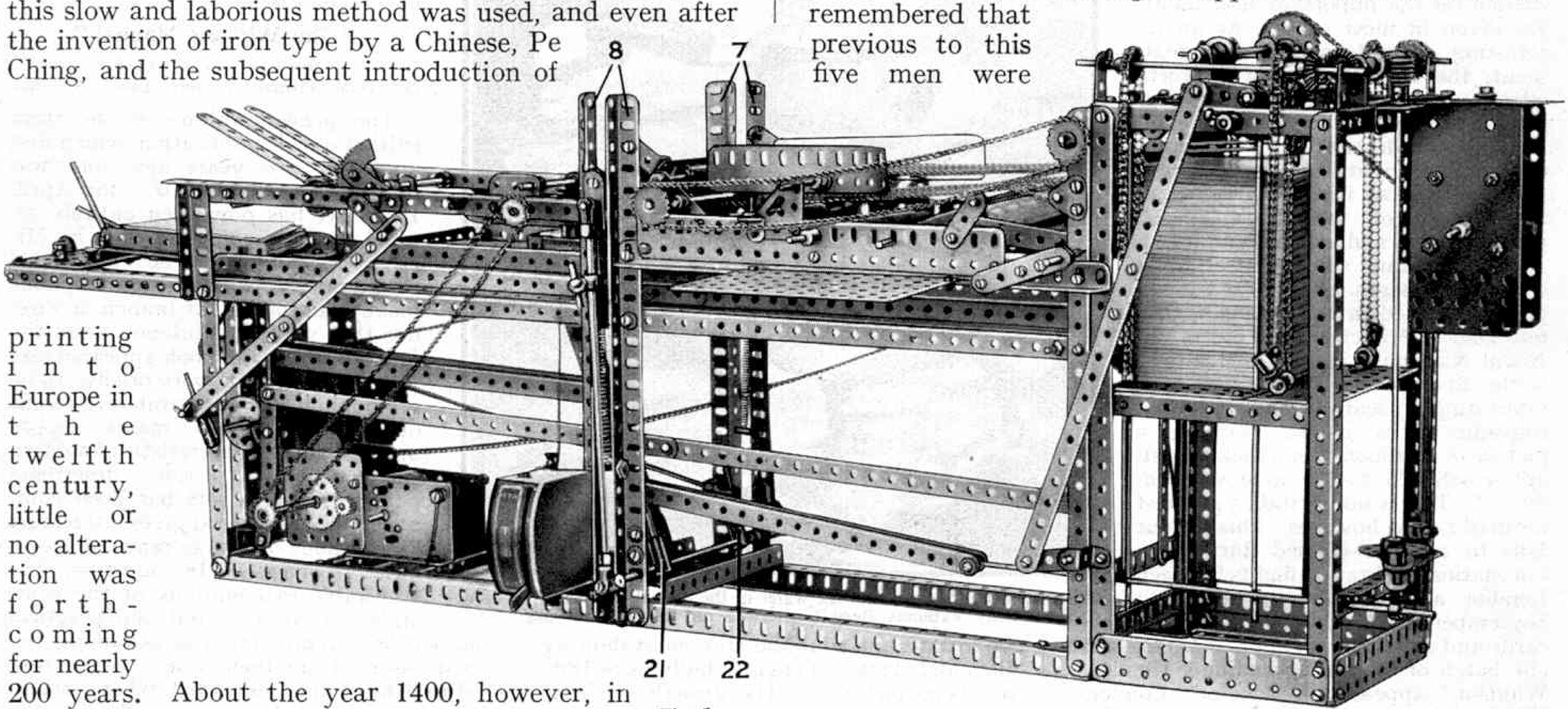


Fig. 1.
A Meccano Printing Machine that is capable of turning out 1,200 printed sheets per hour! It is entirely automatic, and after a pile of paper has been placed in the machine all that is necessary is to start the Electric Motors.

The Meccano model incorporates all the main movements found in a modern printing machine. The unprinted paper, when placed in the machine, is automatically delivered to the impression roller by means of a suction fan and endless belt. The sheet thus taken is then passed over the face of the type and receives the impression, after which a delivery arm deposits it, printed side upward, on to the delivery pile. During the short period when no paper is passing under the impression roller the type is automatically inked, the ink being taken from a duct at the rear of the machine and passed through spreading and tearing rollers prior to being smeared on the type. It is interesting to note that on test this machine printed 1,400 visiting cards in an hour.

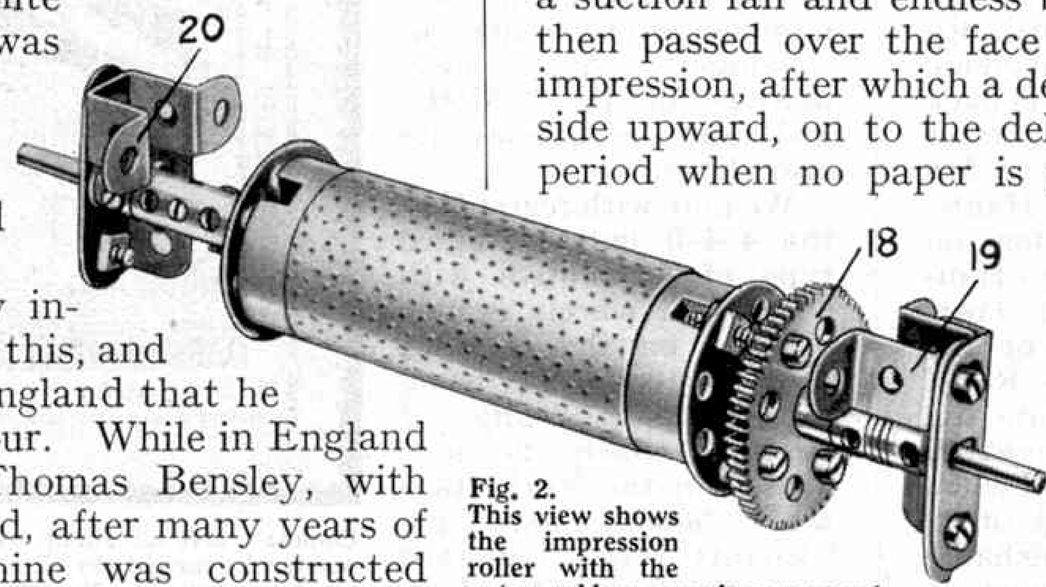


Fig. 2.
This view shows the impression roller with the outer rubber covering removed.

Building the Meccano Model!

The Framework. The base consists of two channel section 24½″ girders each of which is formed of two 24½″ Angle Girders (see Fig. 3). These are connected together

at each end by means of two $5\frac{1}{2}''$ Angle Girders 1 and 2, the required rigidity being gained by the use of four Corner Brackets. Four further $5\frac{1}{2}''$ Angle Girders 3 and 4 are now bolted across the base, in the positions shown in Fig. 3 and two $2\frac{1}{2}''$ Angle Girders are secured to the Girders 4.

Vertical members, consisting of two $7\frac{1}{2}''$ and two $12\frac{1}{2}''$ Angle Girders, are now secured to each of the four corners of the base, and to these are bolted the girders of the upper portion of the framework. Each of these latter girders is of reversed angle section and is built up from one $24\frac{1}{2}''$ Angle Girder 14, to one side of which is secured a $12\frac{1}{2}''$ and an $18\frac{1}{2}''$ Angle Girder. These two latter Girders are bolted in place so that their inner ends touch, and this weak point in the construction of the girder is strengthened by bolting a $7\frac{1}{2}''$ Angle Girder across the gap. It will now be noticed that a single girder protrudes beyond the built-up sections of the reversed angle girders, and the ends of these extensions carry an insulated switchboard, a $5\frac{1}{2}'' \times 3\frac{1}{2}''$ Flat Plate. A $5\frac{1}{2}''$ Angle Girder 5 is now fitted, and this supports two $7\frac{1}{2}''$ Angle Girders 6, the lower ends of which are bolted to the Girder 1.

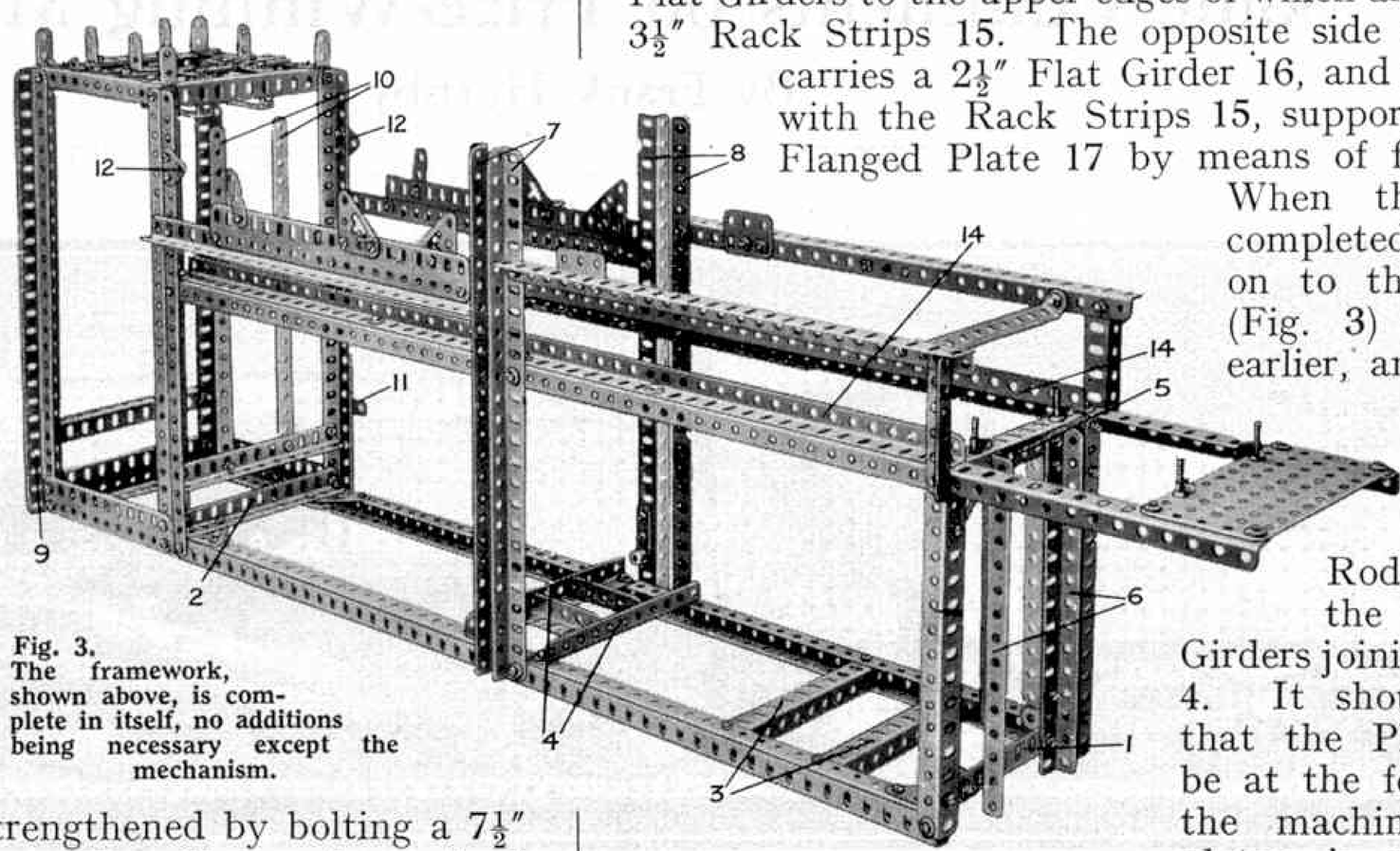


Fig. 3. The framework, shown above, is complete in itself, no additions being necessary except the mechanism.

The impression roller slides 7 and 8 are now secured in place, and these support four horizontal $12\frac{1}{2}''$ Angle Girders at their inner ends. The outer ends of the two right-hand girders are bolted to the top of 3″ Angle Girders, and the two left-hand girders are secured at their outer ends to the vertical Angle Girders forming the uprights at that end of the model. These last-mentioned horizontal $12\frac{1}{2}''$ Angle Girders carry $9\frac{1}{2}''$ Flat Girders to which are secured the Corner Brackets and $1\frac{1}{2}''$ Strips shown in the illustration.

The framework for the pile delivery may now be built, and this consists of a square skeleton frame $12\frac{1}{2}''$ high and $5\frac{1}{2}''$ square at its ends. One corner of the frame is fitted with an extra $12\frac{1}{2}''$ Angle Girder 9, and the lower portion of this section of the model is fitted with three $5\frac{1}{2}''$ Flat Girders for strengthening purposes. The top of the frame is fitted with a suction fan and a separating mechanism for the paper, and the construction of these movements will be described later.

The pile delivery may now be bolted to the main framework, after which two vertical $9\frac{1}{2}''$ Strips 10 are secured in place on their horizontal $5\frac{1}{2}''$ Angle Girder. A $\frac{1}{2}''$ Reversed Angle Bracket 11 is also fitted, together with two 1″ Triangular Plates 12.

The Platen and Impression Roller. Fig. 4 shows an underneath view of the platen or type bed, which consists of a rectangular framework filled in with four $4\frac{1}{2}'' \times 2\frac{1}{2}''$ Flat Plates. One end of the plate so formed is fitted with two $1'' \times \frac{1}{2}''$ Angle Brackets that carry a 1″ Rod on which is pivoted two $5\frac{1}{2}''$ Strips. The free ends of these Strips are secured by means of a $1\frac{1}{2}''$ Rod to a square section girder 13, constructed from two $7\frac{1}{2}''$ Angle Girders joined together by means of two $\frac{3}{4}''$ Bolts and fitted at their outer ends with Cranks.

The lower face of the platen is fitted on each side with a $9\frac{1}{2}''$ Angle Girder that slides on one of the Angle Girders 14. One side of the platen is fitted with two $9\frac{1}{2}''$ Flat Girders to the upper edges of which are bolted three $3\frac{1}{2}''$ Rack Strips 15. The opposite side of the platen carries a $2\frac{1}{2}''$ Flat Girder 16, and this, together with the Rack Strips 15, supports a $3\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate 17 by means of four $\frac{3}{4}''$ Bolts. When the platen is completed it is placed on to the Girders 14 (Fig. 3) as described earlier, and the end of the girder 13 is secured on a 3″ Rod mounted in the $2\frac{1}{2}''$ Angle Girders joining the Girders 4. It should be noted that the Plate 17 must be at the feeding end of the machine when the platen is moved to its fullest extent in that direction.

The impression roller shown in Fig. 2 is formed from a Sand Roller (part No. 106a) covered with a length of hard rubber tubing. This tubing is $3\frac{1}{2}''$ long, $1\frac{1}{4}''$ internal diameter, and $1\frac{1}{2}''$ external diameter, without the canvas covering, and is similar to that used on motor cars as a connection between the radiator and cylinders. It is particularly suitable for the Meccano model, as it is reasonably hard and durable and remains unaffected by printing ink. The Sand Roller is mounted on an 8″ Rod, in place of the somewhat shorter rod supplied, but it must be free to rotate on the Collars fitted at each end. One end of the Rod is now supplied with a Bush Wheel and two 57-teeth Gears 18, all of which are secured together by means of two short Bolts and two $\frac{3}{4}''$ Bolts, as shown in the illustration. The protruding ends of the $\frac{3}{4}''$ Bolts engage with the slots cut in the end of the Sand Roller, and in this way a rigid connection is made that prevents any slipping between the two parts while the machine is working under full pressure. The Grub Screws of the 57-teeth Gears 18 are taken out of their bosses and a Collar and three Washers are placed on the Rod, after which a slide is secured in place. This slide consists of a Double Arm Crank 19, to which are bolted a Double Bent Strip and a $1\frac{1}{2}''$ Angle Girder. Care must be taken to see that a space is left between the Double Bent Strip and the Angle Girder.

Fig. 4. This underneath view of the platen shows its construction and also the method of operation.

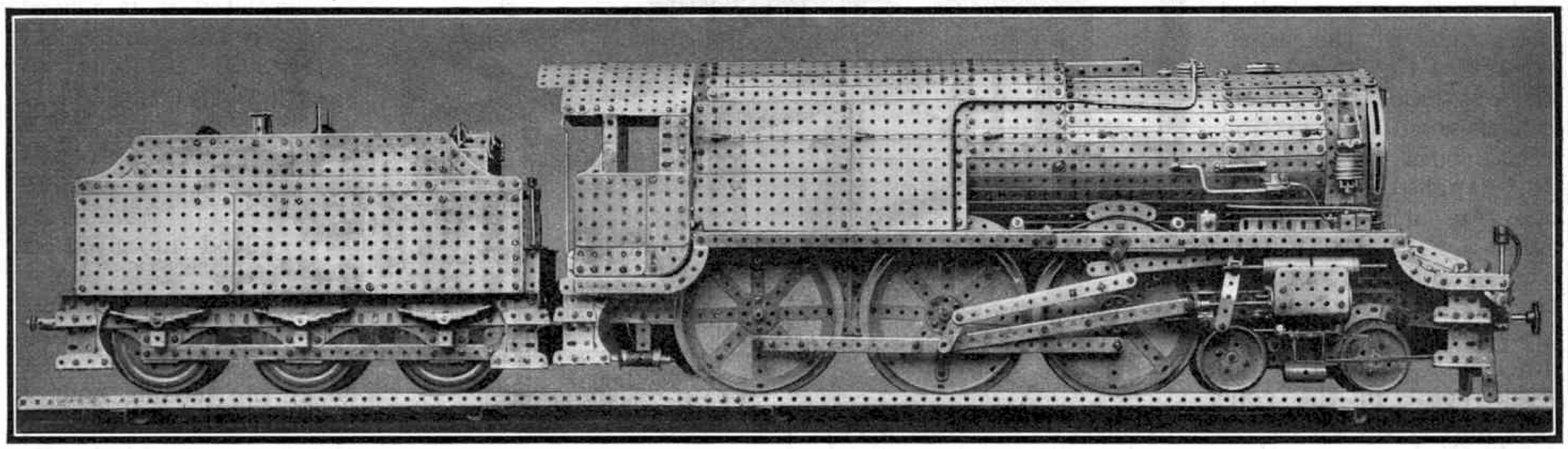
The opposite side of the Rod carries a loosely mounted Bush Wheel, and a fixed Coupling and slide 20, this last being constructed similarly to that on the opposite end of the Rod. It will now be seen that on turning

(Continued on page 558)

The International Model-Building Contest

Some Comments on Prize-Winning Models

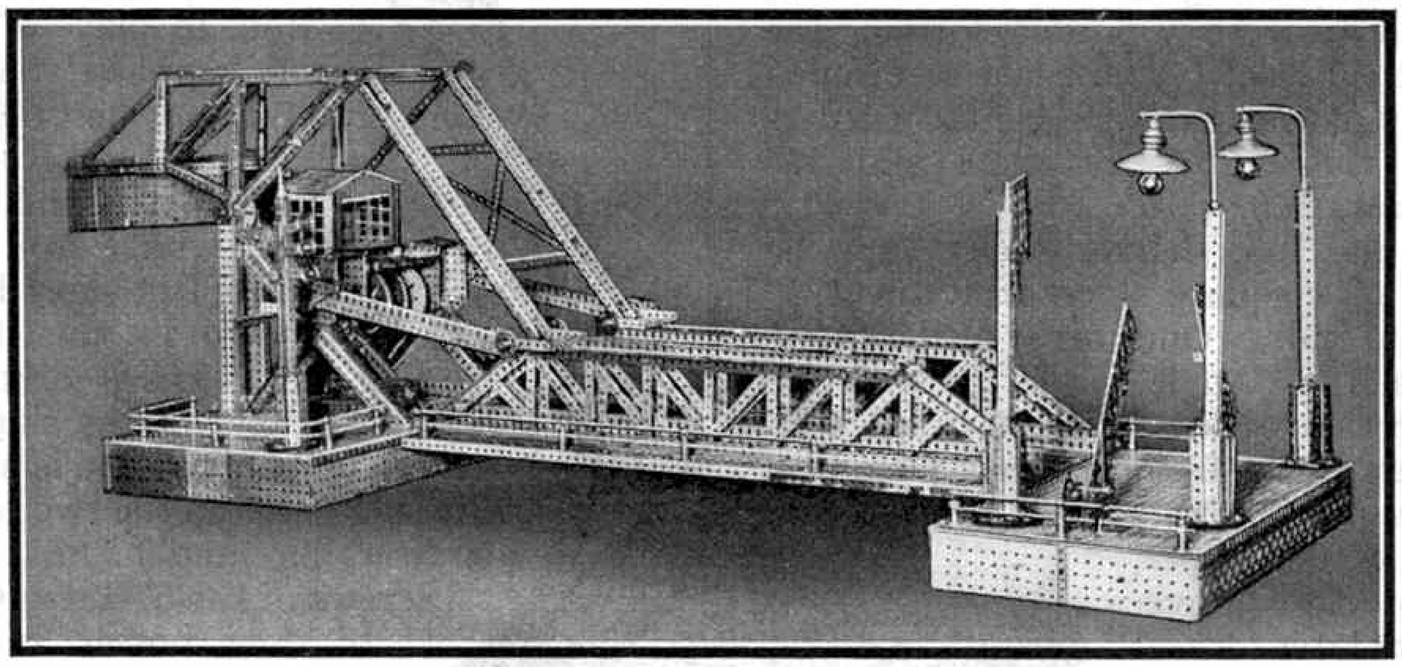
By Frank Hornby



IN last month's "*M.M.*" were published lists of the prize-winners in all sections of the International Model-Building Contest that has just closed. The lists occupied so much space that I found it impossible to make any comments on the prize-winning models. In this and subsequent articles, however, I propose to illustrate and describe as many of these as possible for the benefit of Meccano enthusiasts all over the world.

Before commencing this commentary I wish to take this opportunity of stating that I was intensely gratified by the number and quality of the entries to this great Contest. Looking back over previous International Contests, the first of which was held as far back as early 1923, I feel that there has been unmistakably a tremendous increase in the skill of Meccano model-builders. Year by year the standard has risen, and signs are not wanting that it will rise still further. This steady increase in skill of Meccano engineers—the real engineers of the future—is a source of great pride to me as the inventor of the Meccano System.

The models illustrated this month are taken at random from the various sections, and are intended to give some idea of the remarkable variety and originality of subject, and skill and neatness of construction, that characterise not only the prize-winning models, but large numbers of others that approach but do not quite reach this standard.



The bascule bridge shown here is a striking example of the general high quality of the models submitted in the £500 Model-building Contest. It was built by J. de Proft, Willebroeck, Belgium, and won a First Prize in Section A. The fine model of the L.M.S. "Fury" is by K. W. Cameron of Claughton, Cheshire, and is remarkable for its neat outline and wealth of external detail. This model also won a prize in Section A.

The bascule bridge illustrated here is a typical example of this fine construction and workmanship. This model carried off one of the First Prizes in Section A, and its builder, J. de Proft, of Willebroeck, Belgium, will be glad to know that the judges were most favourably impressed by the remarkable solidity and wealth of really worth-while detail that is to be found in the bridge and approaches. Nothing need be said regarding the constructional features of the model, for the illustration shows most of the details quite clearly.

In view of the articles that have appeared in the "*M.M.*" recently concerning the application of Meccano to architectural construction, it is interesting to find a reproduction of the beautiful Antwerp Cathedral among the principal prize-winners. The model, constructed by K. van Dommelen of Antwerp, won a Third Prize in Section A, in which it was the only representative of this type of work. Real ingenuity is shown in the construction of the clock in the spire. For this a Circular Girder is used the hour figures being represented by Flat Brackets bolted round its face. The fingers are short Rods held in the transverse bores of a Coupling. Curved Strips of various lengths are used in forming the arches of the windows and doorway, and the walls are built mainly from Angle Girders and Strips, the former making admirable buttresses.

From architecture we pass on to printing, and find a splendid model printing machine by W. Huszar of Bergen, which won a prize in Section B. The model reproduces many of the movements usually found in a machine of this type, and is operated by turning a handwheel, a Sprocket on the shaft of which is connected by Sprocket Chain with other Sprockets on the shafts of the feed rollers. Multiple-type inking rollers or distributors are represented by Rods covered with several turns of paper. An automatic device for feeding sheets into the press is an outstanding feature. It consists essentially of a vertical Threaded Rod at the feed-in end of the machine, on the lower end of which is a 57-teeth Gear Wheel engaging a Worm on a shaft driven by the handwheel. The Threaded Rod carries a Threaded Crank, to the arm of which a Flanged Plate is secured. This Plate forms the platform on which the paper sheets are placed. When the machine is set in motion the Threaded Rod is rotated, and the Crank, prevented from rotating with it, is caused to climb up the Rod, and so carries the platform with it. As one sheet is drawn off and passed into the press, the platform ascends a fraction of an inch and brings another sheet into position for the feed arm to take hold on it.

One of the most interesting events in the British railway world before the close of 1929 was the appearance of two powerful locomotives employing high-pressure steam. One of these was the L.N.E.R. "*No. 10000*" and the other the L.M.S.R. No. 6399, "*Fury*." Both these remarkable engines have been modelled in Meccano by boys, not only in this country but all over the world. Readers may remember the particularly fine models of the "*No. 10000*" by R. S. Millar of Newark, and R. O. Jukes of

Christchurch, N.Z., which were illustrated in the April and July, 1931, issues of the "*M.M.*"

Undoubtedly the finest model of the "*Fury*" that I have seen is that submitted by Keith W. Cameron, of Birkenhead, as his entry in the Competition. The great amount of patient work done on this model, and the careful planning and ingenuity in using Meccano parts to their best advantage, were rewarded with a big prize in Section A. Cameron describes his model as a "super-detail" model, and says he has endeavoured to include as far as possible all the external features of the actual locomotive. That he has succeeded in his object will be apparent from the accompanying illustration. Readers should compare the photograph shown here with the illustrations of the actual engine that appear on page 2 of the cover and on page 9 of the 1930-31 "*Hornby Book of Trains.*"

The model is built to a scale of 1 in. to 1 ft. and is 5¼ ft. in length. The construction throughout follows the unit constructive principle of actual locomotive practice. The boiler is worthy of note as this is undoubtedly the most difficult portion of the model to construct, and when the numbers of angles and curves are taken into consideration, the few parts that have been bent are permissible. Model-builders will find several well-planned uses for Meccano parts if a careful examination is made of this section of the model. The cut-away portion of the boiler behind the smoke-box contains a realistic reproduction of a feed pump that in actual practice feeds the high pressure steam drum from the low pressure boiler.

A good feature of the Contest is the cleverness shown by young competitors in Sections D and E in choosing original subjects for their models. As an example I may mention the model sent by Clifford Sharpe, of Ilford, who won one of the five First Prizes in Section D. Sharpe's model is a "New World" Gas Cooker, a type with which many of my readers will be familiar. This model will be illustrated in due course, and readers will then have an opportunity of seeing for themselves how a little ingenuity, combined with constructional skill, can make an interesting model of even the most commonplace subjects.

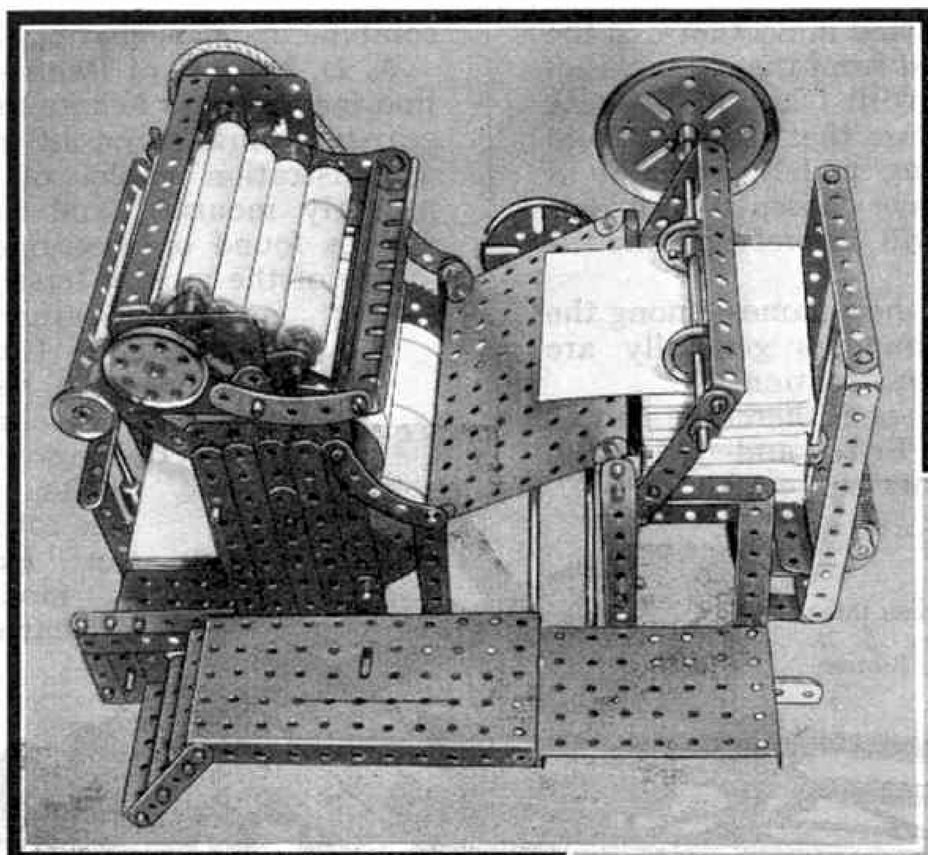
Section E produced a number of models which, considering the ages of the competitors, are very remarkable. Among the chief prize-winners in this Section is R. P. Plewman, of Pretoria. This competitor, who is only nine years old, constructed one of the well-known South African ox-wagons. A simple subject, readers may think, and so indeed it is; but, as I have so often pointed out in these pages, it is the simple subjects that frequently are the hardest to make into interesting models. The body of the wagon is built separately from the chassis. Five 5½″ × 2½″ Flanged Plates are bolted together to form the floor of the wagon, and a 5½″ Strip is secured by Angle Brackets down the centre to fill the gap between the two Plates placed lengthwise. The sides are formed by 12½″ Angle Girders secured by Flat Brackets, and the side rails are then completed by means of 12½″ Strips. The footrest in front is composed of two 3½″ Strips, one 1½″ Strip, and a 2½″ Triangular Plate. The arched framework for the hood is made up of three 3½″ Strips and two Curved Strips joined by five 5½″ Strips, and is then bolted to the sides of the body by Angle Brackets. A piece of linen is used for the hood.

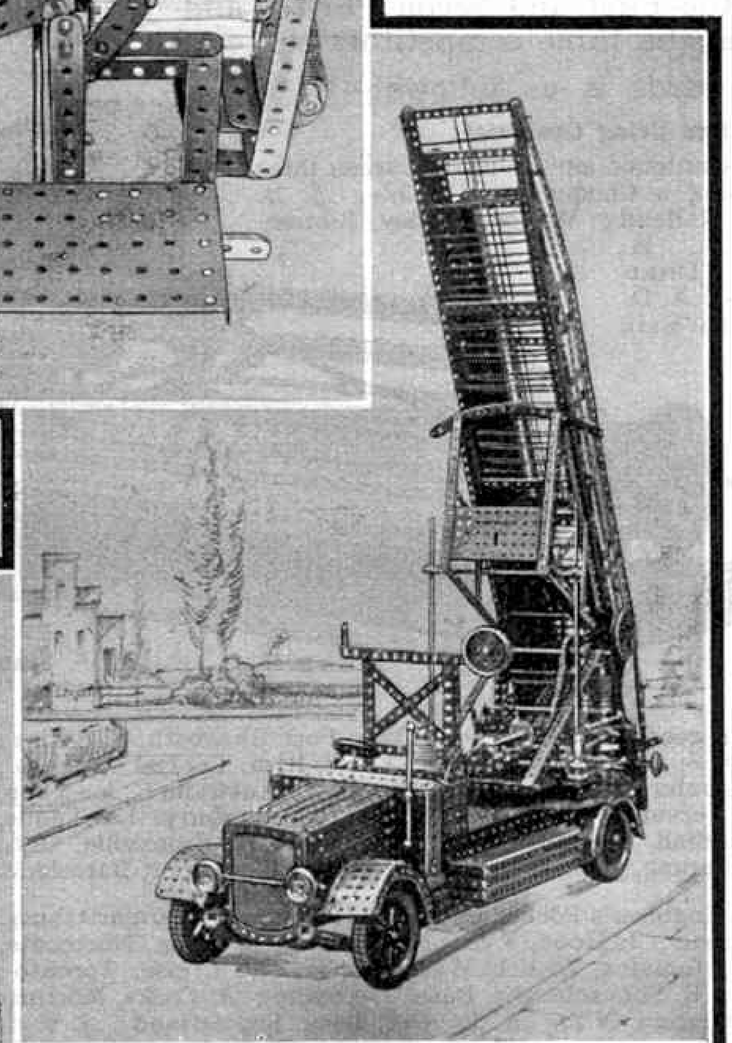
The front axle, a 6½″ Axle Rod, passes through a Double Angle Strip and is held in position by two Collars. The swivel for the wagon pole is composed of two Angle Brackets each fixed to a Curved Strip that in turn is fixed by Flat Brackets to the ends of the No. 48b Strip. The pole, consisting of four 7½″ Strips, is secured to the wagon by a 1½″ Axle Rod passed through the two Angle Brackets. The back axle (6½″ Axle Rod) is passed through two Trunnions joined together by two 5½″ Strips. Two Threaded Pins are fixed to the one Strip to fit into Reversed Angle Brackets in the body of the wagon. The front and back axles are now joined together by a 7½″ Strip.

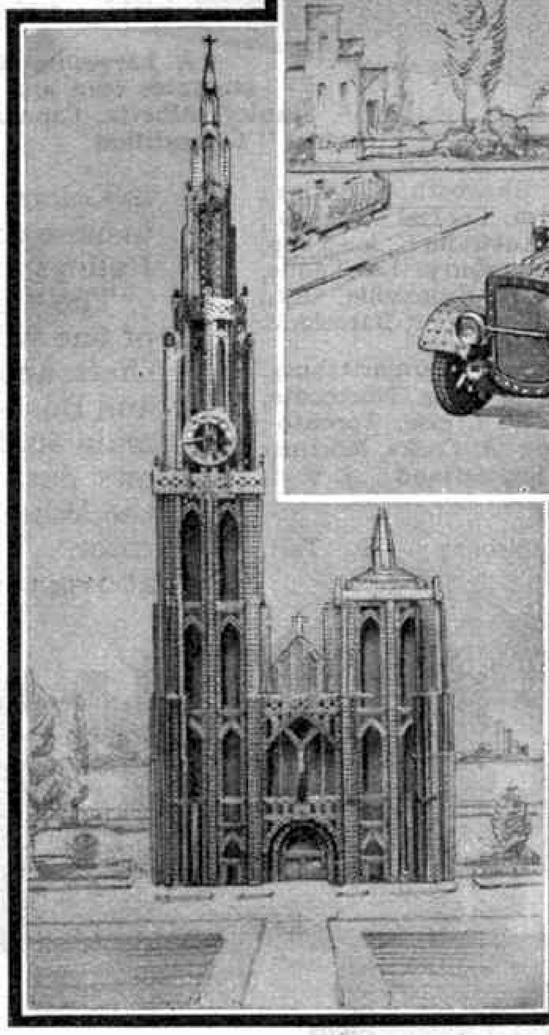
The brake beam consists of a 7½″ Strip. Near each end is fixed a Double Bracket, and a piece of cork is cut and fitted into each of these to form the brake blocks. Two further Double Brackets are fitted to the 7½″ Strip so as to fit round and be able to slip along two 2½″ Strips fixed to the Trunnions. An End Bearing is fixed to the centre hole of the 7½″ Strip and a 5″ Screwed Rod secured in it. The Screwed Rod carries a Threaded Crank, and by turning the Crank the brake blocks are either drawn against or released from the wheel rims.

An interesting model of quite different type is the fire engine and escape with which André Roberts won a prize in Section C. One of the notable features of this model is that the escape is extensible to a height of over 9 ft.! The motor chassis is 3 ft. 2 in. in length and 9½ in. in width. The ladder is mounted on a turntable and is therefore able to swivel in any direction to facilitate extension of the ladder and allow it to be used in awkward places. The base of the turntable consists of a 6″ Circular Plate resting on a roller ring composed of ½″ Loose Pulleys held on Bolts passed through Angle Brackets that in turn are bolted to a Circular Strip. The 6″ Circular Plate to which the base of the escape is attached is caused to swivel by the action of a ½″ Pinion fixed to the Plate, which engages a 2½″ Gear Wheel bolted to a lower 6″ Circular Plate. The ½″ Pinion is driven from the mechanism of the fire engine chassis.

The escape is in four slidable sections each of which is over 2 ft. in length, and the chassis has all the usual fittings, gearbox, clutch, differential, etc. The escape tapers from the foot to the upper end and the several stages slide neatly into each other, the flanges of the Angle Girders of one stage providing guides for the flanges of the Angle Girders forming the side members of the next stage.







Top: A printing press by W. Huszar, Bergen. Centre: Andre Robert's (Johannesburg) fire engine and escape. Bottom: A beautiful replica of Antwerp Cathedral by K. V. Dommelen, Antwerp.

Close observation of the illustration of the model will reveal a realistic alarm bell suspended near the driver's seat. This is composed of five 1″ Pulley Wheels, one Flanged Wheel and one Bevel Gear all held on a short Rod. The Flanged Wheel is placed on the Rod first, then the five Pulleys, and last of all the Bevel.

In commenting on the models this month I have not attempted to deal with them in any particular order. I have simply chosen one or two at random in order to give readers an idea of the fine general quality of the work done by the prize-winners.

I am taking this opportunity to remind model-builders that all the most interesting models in the International £500 Model-Building Contest are contained in the 1932 "*Book of Prize Models,*" that has just been published.

Details are given for constructing the models so that model-builders can reproduce these fine entries themselves. The numerous splendid models dealt with include cranes, famous British and foreign locomotives, a Meccano typewriter, ships, aeroplanes, excavators, and an intricate mechanical butter churn.

In addition to prize models from the £500 Contest the book contains many of the best entries in recent "*M.M.*" Competitions.

Model-builders should obtain copies of the 1932 "*Book of Prize Models*" without delay, for it will provide them with a host of new ideas!

Model-Building Contest Results

By Frank Hornby

"August" Competition: Section "C"

THE splendid quality of the models submitted in Section C of the "August" Competition may be judged from the examples of prize-winning entries shown here. I wish I had more space at my disposal this month, because I feel sure that readers would like to see illustrations of other prize-winning models, for many of them are very fine indeed. However, I have chosen two models of greatly different types that I think will interest all model-builders.

A feature of the Contest is the number of new names among the prize-winners, which shows that model-builders generally are improving in their style and methods of construction.

Three competitors tied for First Prize, and therefore it was decided to combine the First and Second Prizes and divide the total amount between the three competitors concerned.

The full list of awards is as follows:–

Section "C" (for competitors living Overseas).

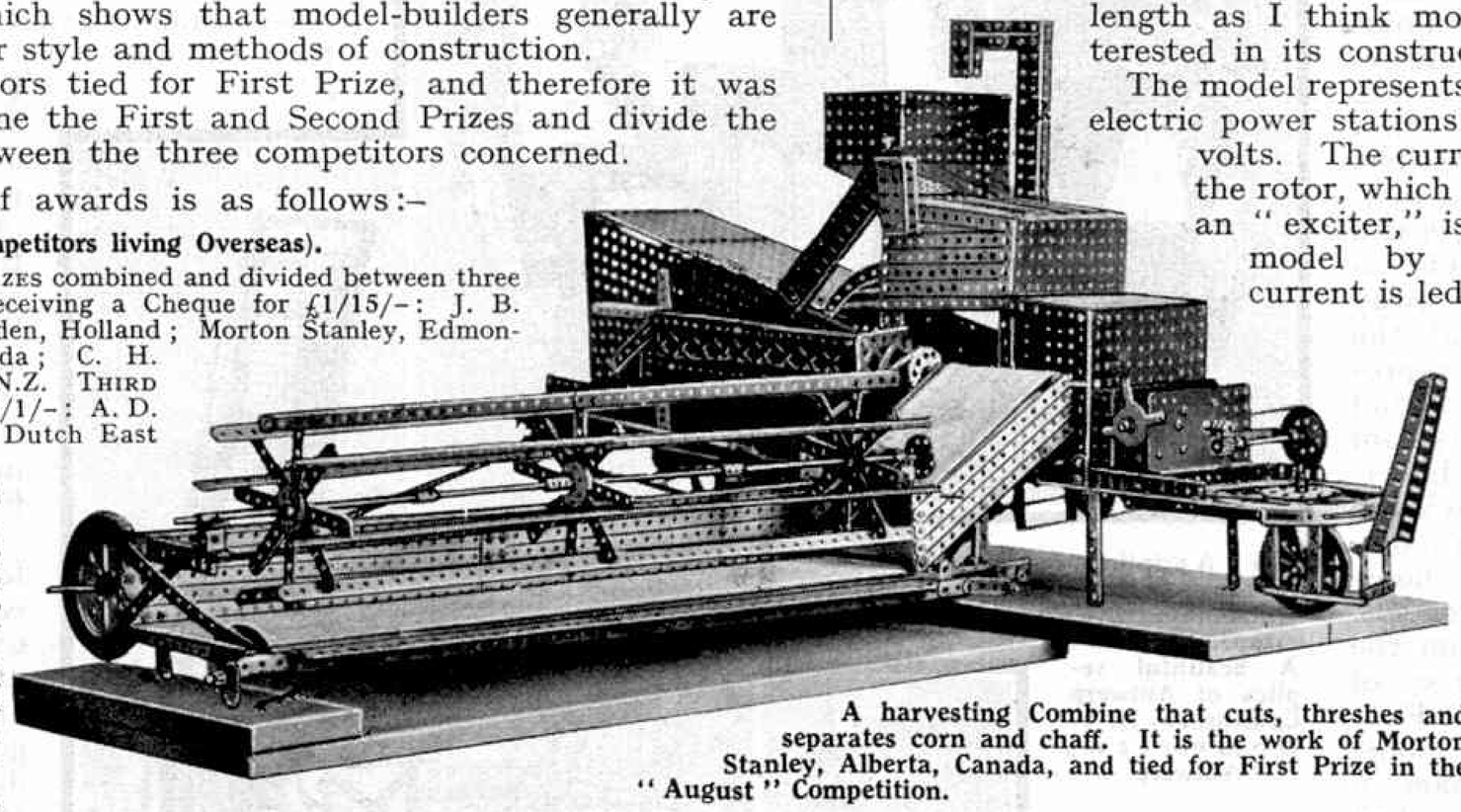
FIRST AND SECOND PRIZES combined and divided between three competitors, each receiving a Cheque for £1/15/-: J. B. Ringnalda, Leeuwarden, Holland; Morton Stanley, Edmonton, Alberta, Canada; C. H. Taylor, Ashburton, N.Z. THIRD PRIZE, Cheque for £1/1/-: A. D. Morrees, Bandoeng, Dutch East Indies.

SIX PRIZES of Real Leather Pocket Wallets: B. Warner, Transkei, S. Africa; A. Cramp, Sydney, N.S.W.; A. Reynolds, Fairfield, N.S.W.; E. Hughes, Gisborne, N.Z.; Juan A. Roca, Barcelona; Josè G. Perez, Madrid.

TWELVE PRIZES of Meccano or Hornby Train goods value 5/-: R. Dale, Port Elizabeth, S. Africa; E. v. Vreede, Kimberley, S. Africa; K. Ernest, Costa Rica, Central America; M. Rankin, Toorak, Australia; L. Sparrow, Leongatha, Australia; A. Rapp, Hobart, Tasmania; G. Vervalle, Courtrai, Belgium; F. Bunbury, La Tuque, Quebec, Canada; D. Threlfall, Vancouver, B.C.; G. Whalley, Brockville, Ont., Canada; J. Diephuis, Semarang, Java, Dutch East Indies; M. Sanglar, Barcelona.

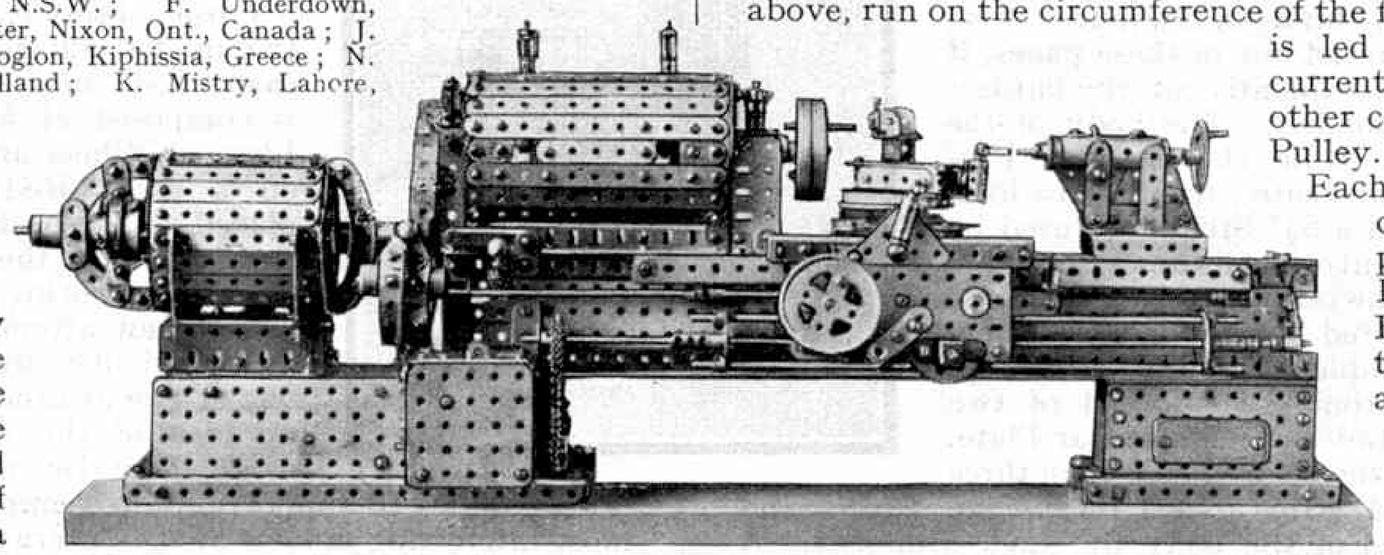
TWELVE PRIZES of Meccano Engineer's Pocket Books: J. Beyers, Pietermaritzburg, S. Africa; F. Brook, Durban; I. Hood, Ryde, N.S.W.; N. Brennan, Northcote, Australia; C. Pengelley, Jamaica, British West Indies; W. Cruise, Toronto; J. Hall, Vancouver, B.C.; E. Schneeberger, Basel, Germany; A. Cocks, Morrinsville, N.Z.; E. Allen, Tauranga, N.Z.; A. Beyeler, Bern, Switzerland; J. v. d. Deure, Bennekom, Holland.

TWELVE CERTIFICATES OF MERIT: E. Smith, Johannesburg; E. Tait, Durban; J. Fry, Sydney, N.S.W.; F. Underdown, North Sydney, N.S.W.; C. Carter, Nixon, Ont., Canada; J. Coryell, Toronto; M. Sonyondjoglon, Kiphissia, Greece; N. Rambonnet, Schoonhoven, Holland; K. Mistry, Lahore, India; J. Treasuriwalla, Bombay; G. Morgan, Wellington, N.Z.; J. Butchers, Wellington, N.Z.



A harvesting Combine that cuts, threshes and separates corn and chaff. It is the work of Morton Stanley, Alberta, Canada, and tied for First Prize in the "August" Competition.

Model-builders who are interested in machine tools will find much to admire in the work done by J. Ringnalda in his fine reproduction of a "Lodge & Shipley" Lathe. The slide rest is moved forward and backward by means of three Rods driven from a gear-box that is controlled by a handle. The slide can be coupled to the driving Rods by means of a second handle placed near the head of the machine. Above the longitudinal slide is a second transverse slide, and running in guides on this there is a third slide that works at right-angles to the second slide.



This is a particularly fine model of an automatic screw-cutting lathe. Special features include a compound slide rest, and variable feed to the lead screw, and tail-stock. It was built by J. Ringnalda, Leeuwarden, Holland.

C. H. Taylor's model is a New Zealand Locomotive. It was originally built for an Exhibition organised by the Ashburton Meccano Club, and was afterwards exhibited in a local Meccano dealer's window where it attracted considerable attention.

The third model that shared the principal prize is an agricultural combine machine that cuts, threshes and separates corn and chaff.

A. D. Morrees of Bandoeng, D.E.I., sent a model motor chassis that incorporates Ackermann steering gear, three-speed and reverse gear-box, clutch, and differential; and Juan Anglada Roca sent a demonstration model of an astronomical reflecting telescope, properly mounted and fitted with all the precise adjustment devices found on instruments of this kind.

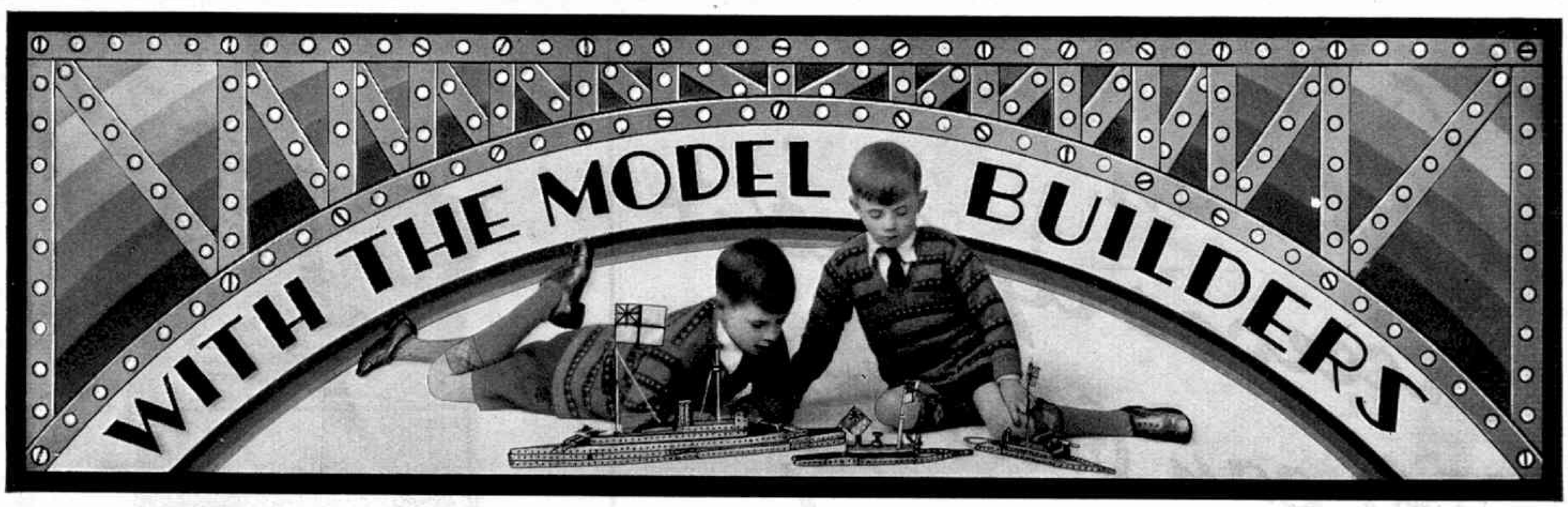
One of the most interesting models is an electric alternator by Brian Warner. I am describing this model at some length as I think most model-builders will be interested in its construction.

The model represents the type of alternator used in electric power stations for generating 3,000 or 4,000 volts. The current for energising the coils on the rotor, which in the prototype is supplied by an "exciter," is supplied in the case of the model by a small accumulator. The current is led from the accumulator to two Rods journalled in Swivel Bearings that are insulated from the base of the model by insulating Bushes and Washers. These two Rods represent the current brushes of the actual machine. To the upper ends of the Rods are attached small Fork Pieces, which hold ½" Loose Pulleys between their prongs by means of Pivot Bolts and Nuts. Short lengths of Spring Cord are attached to Collars journalled on the Rods, so as to keep the ½" Loose Pulleys in close contact with the "collecting rings." Thus, by means of the Pulleys, friction at the points of contact is reduced to a minimum.

The "collecting rings" are exactly similar, so that a description of one will be sufficient. A 2" Fast Pulley is secured to the main shaft, and by means of 6BA Bolts and Nuts and Insulating Washers and Bushes, a Wheel Flange is secured to the 2" Fast Pulley on the main shaft. Thus the Wheel Flange is completely insulated from any part of the model. A length of copper wire is connected to the Wheel Flange and is led to one end of the coils of wire on the rotor. The ½" Loose Pulleys on the end of the Rods, described above, run on the circumference of the flange, and thus the current is led to the rotor coils. The current returns by means of the other collecting ring and ½" Loose Pulley.

Each of the cores on the rotor consists of ten 2½" Strips, placed upon each other. Finally two 2½" × ½" Double Bent Strips are placed on the Strips, one on the top and one below, thus forming a laminated core. Eight of these cores are required, and they are clamped between the Flanges of Hub Discs. The lower end of the core is secured to a 1½" × ½" Double Bent Strip, and the bent ends of the latter are used to secure the core to the Hub Discs, and also to keep the Hub Discs the correct distance apart.

The cores of the stationary armature windings consist of 1½" Flat Girders to which are secured 1½" Girders, the whole forming a short "T" Girder. The exciter is represented by means of two Boiler Ends, bolted to the bearing of the main shaft. The bearing at this end consists of a Double Arm Crank. The rotor and armature coils consist of 300 and 400 turns of 28 S.W.G. wire respectively.



RATCHET GEARS

A simple but extremely useful mechanism in engineering is the Ratchet Gear. In Meccano, the standard method of representing this gear is by means of the Ratchet Wheel (part No. 148) and the Pawl (Part No. 147a). The Ratchet Wheel is mounted on the shaft that is to be controlled, and the Pawl is secured pivotally to the fixed portion of the model by means of a Pivot Bolt and two Locknuts. A short length of Spring Cord is secured to the perforations in the Pawl, and the other end of the Cord is anchored to the fixed portion of the model (the Spring Cord Anchoring Hook, part No. 58b may be used here). The Spring Cord serves to hold the teeth of the Pawl in contact with the teeth of the Ratchet Wheel, and prevents the shaft from rotating in one direction. This ratchet mechanism may be fitted to the hoist drums of cranes, winches, etc., where a "one-way" braking action is required. It may also be utilised in any model or mechanism where a "free-wheel" action is required (see S.M. 112, page 21 Standard Mechanisms Manual), and where a slow intermittent feed mechanism is to be employed. It is also possible to build up the equivalent of a ratchet gear from other standard parts, and several ingenious movements of this type have been produced.

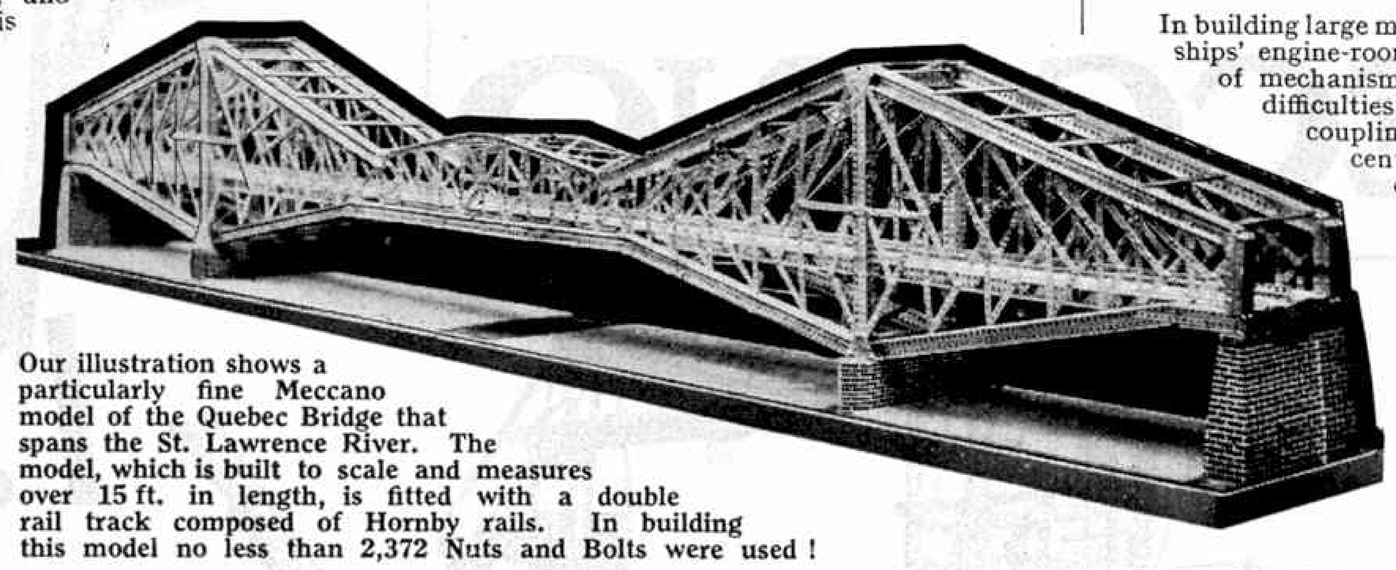
A novel free-wheel mechanism can be assembled from a 1½" Flanged Wheel, a Coupling, two Threaded Pins and two Collars. The Coupling is secured rigidly on a shaft and two Threaded Pins with their "flats" set at a slight angle are inserted in the transverse bores of the Coupling and held in place by means of Grub Screws. The Flanged Wheel is then placed loosely on the Rod and pushed over the Coupling complete with Threaded Pins. Two Collars are now placed in the spaces between the Threaded Pins and the flange of the Flanged Wheel, and this Wheel is connected to a suitable gear train by means of a Socket Coupling. When the Rod to which the Coupling is secured is rotated in a certain direction, the Collars jam between the "flats" of the Threaded Pins and the flange of the Flanged Wheel. A positive connection is thus formed, and the model or mechanism may be driven round. When the Rod carrying the Coupling is rotated in the opposite direction, however, the Collars ride idly and the Rod is free to rotate independently of the Flanged Wheel; a "free-wheel" action is thus provided. Readers who study motor cars will see that this device resembles to some extent the "sprags" that are fitted to some makes of cars to provide easy starting on hills.

An interesting form of ratchet feed mechanism that will be found useful in the construction of automatic oiling gears, etc., may be assembled from a Flywheel and a pair of Pawls composed of Curved Strips. These Pawls press against the rim of the Flywheel at opposite sides and an oscillating motion is imparted to them by means of an Eccentric. As the curved pawls rock backward and forward, they drive the Flywheel round slowly and the feed action is thus effected. This type of mechanism is only suitable for light drives, and if a considerable strain is imposed, slipping will result.

VERTICAL CONVEYORS

In certain types of Meccano models it is sometimes required to raise a number of Steel Balls, marbles, peas or other small articles to a height, and a chain hopper conveyor is generally employed for this purpose. A conveyor of this type may be constructed by fitting a number of Dredger Buckets to an endless length of Sprocket Chain that passes over Sprocket Wheels mounted in the framework of the model. A Clockwork or Electric Motor is coupled to one of the Sprockets so that the chain carrying the buckets may be driven round.

A vertical conveyor of a rather novel type was recently constructed for raising Meccano Steel Balls, but the conveyor could be used equally well for raising other small articles. The conveyor consists essentially of a vertical channel of square section composed of four Angle Girders. One side of an endless length of Sprocket Chain passes through the channel and the chain is led over the Sprocket Wheels at the top and bottom of the channel. Several Angle Brackets are now secured at regular intervals to the chain by means of Dredger Bucket Clips, each clip being pushed partly into the round hole of the lug of each Angle Bracket. One of the Sprocket Wheels is coupled to a Clockwork or Electric Motor so that the conveyor chain with Angle Brackets attached may be driven up the vertical channel. The Steel Balls are introduced through a trough at the bottom of the vertical channel and are carried up by the Angle Brackets. They are then discharged through a chute consisting of Angle Girders or Sleeve Pieces. The advantage of this type of conveyor is that there is no possibility of the Balls falling out during their passage to the top of the shaft, and therefore it will be found very useful in demonstration models where absolute reliability is essential. It is capable of delivering Steel Balls, marbles, etc., at the top of the chute with perfect regularity over long periods and without any signs of jamming or breakdown.



Our illustration shows a particularly fine Meccano model of the Quebec Bridge that spans the St. Lawrence River. The model, which is built to scale and measures over 15 ft. in length, is fitted with a double rail track composed of Hornby rails. In building this model no less than 2,372 Nuts and Bolts were used!

INDUCTION COILS

From time to time readers enquire regarding the use of the Coil Cheeks (Meccano Electrical Part No. 309) in the construction of electro-magnets, induction coils and electric "shocking" machines. A few notes on the subject will therefore be helpful.

The Coil Cheek is composed of a stout sheet of fibre and has an oblong slot cut in its centre. To build an induction or "shocking" coil, four 4½" Strips are taken, and a Coil Cheek is pushed on to each end of the Strips. A layer of brown paper or insulating tape is then bound round the Strips, and the primary winding wound on. The primary winding may be composed of 200 turns of Meccano 23 S.C.C. Wire. When this is completed, a layer of brown paper or insulating tape is placed over the winding and the secondary winding then commenced. The secondary may be composed of 1,500 turns of Meccano 26 S.C.C. Wire. The step-up ratio will then be 7.5 : 1, and if a 6-volt Accumulator is connected to the primary winding, a current of about 45 volts will be generated in the secondary. An "interrupter" must be fitted in the primary circuit, and this may be built up quite easily from an insulated Strip and a pair of Meccano Silver-tipped Contact Screws (part No. 307). The ends of the secondary of the coil are connected to a pair of metal handles or grips composed of Strips, and a very interesting and amusing piece of apparatus capable of providing considerable "excitement" will result! The Coil Cheeks may also be used in the construction of a massive electro-magnet, but in this case only one winding will be required, and the ends of the coil are joined to a suitable battery. A more compact magnet is the "horseshoe" pattern. This consists of two Pole Pieces fitted with Bobbins and yoked together by 1½" Strips.

NOVEL CHAIN DRIVE

In the majority of Meccano models the Meccano Sprocket Chain fulfils the function of a flexible driving chain very efficiently. In models where a very powerful drive is required the Sprocket Chain may be duplicated, or a form of chain drive may be built up from standard parts. One particularly interesting form of drive is constructed as follows. The links of the chain are composed of 1½" Strips pivoted to each other by means of Bolts and Locknuts. The wheels over which the chain passes are each composed of two Pulleys butted together and fitted with Dunlop Tyres. The chain passes round the grooves formed by the two Tyres, and the studs on the tyres provide a good grip for the chain. This type of gearing will be found very robust and reliable. It is particularly useful in Meccano models where smaller models and mechanisms have to be secured to the moving belts so that they may be carried round with it. It is quite a simple matter to substitute a length of Screwed Rod for one of the pivot bolts of the chain, and afterwards secure the model or mechanism to the Screwed Rod.

COUPLING MECHANISMS

In building large models of engine houses, workshops, ships' engine-rooms, etc., which consist of a group of mechanisms mounted close to each other, difficulties are sometimes experienced in coupling the various mechanisms to the central source of power. One way of overcoming this trouble is to employ the "unit" system of power distribution. In this system each mechanism has its own small power unit and this may be either the Meccano E1 Electric Motor or the No. 1 Clockwork Motor.

With a little ingenuity it is possible to link many of the subsidiary mechanisms to the main drive without the use of separate transmission belts, cords, etc. In a model marine engine, for instance, the condenser vacuum pump may be driven by a rocker arm attached pivotally to one of the crossheads, while the pressure and feed pumps may be coupled to one end of the crankshaft through Bevel Gearing.

An interesting (and at the same time amusing) application of this principle is contained in the Ancient Motor Car (see model No. 4.50, 00-4 Manual). The motive power in this case is a Clockwork Motor which is coupled to the rear road wheels through Contrate gearing. The motor shaft is also coupled to a secondary shaft carrying a crank and connecting strip, which in turn is joined to one end of the front axle. The steering wheel is also connected to the front axle through a crank and connecting rod. When the model is set in motion, the front wheels oscillate from side to side so that the car makes a number of remarkable turns. The driver is also secured to the steering wheel so that he performs a number of amusing antics as the model travels forward.

NEW WEB MEMBER.—A Strip fitted with a boss at each end would form a useful accessory in building up crank shafts and other mechanisms. The part could also be used as a trip lever and as a dual support for Axle Rods. Your idea possesses distinct possibilities and will receive careful consideration. *(Reply to I. R. Christy, Glasgow.)*

MODIFIED WINGS.—Your suggestion that the corners of the inner ends of the Meccano Aeroplane Wings should be rounded is interesting. This modification would enable the folding type of wing to be constructed, and would certainly add to the interest of the models. We have made a note of your suggestion and shall give it attention. *(Reply to L. Underwood, Towcester.)*

SPRING STRIP.—Perforated Strips prepared from tempered steel would be useful in the construction of laminated springs for model motor chassis. *(Reply to J. E. Smail, Edinburgh.)*

With an Accessory Outfit you can build bigger + better models!

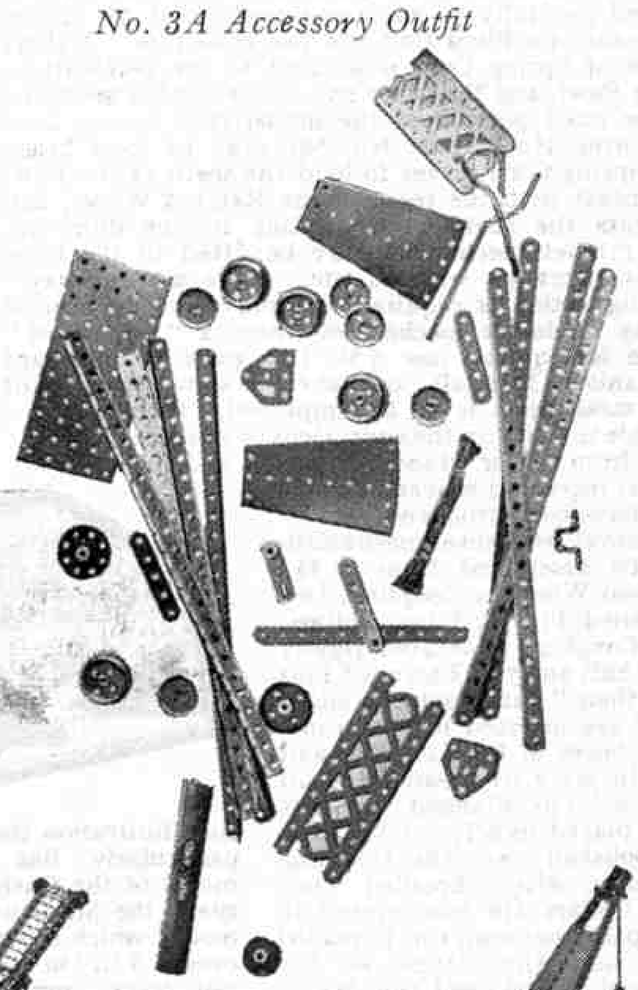
Meccano Accessory Outfits connect the main Outfits from No. 00 to No. 7. They may be well described as the stepping stones to bigger and better models. A No. 00 Outfit may be converted into a No. 0 by adding to it a No. 00a Accessory Outfit, and a No. 0a would then convert it into a No. 1. In this manner, a boy who commences with one of the small Outfits may build it up by degrees until he possesses all the parts contained in the largest Outfit.

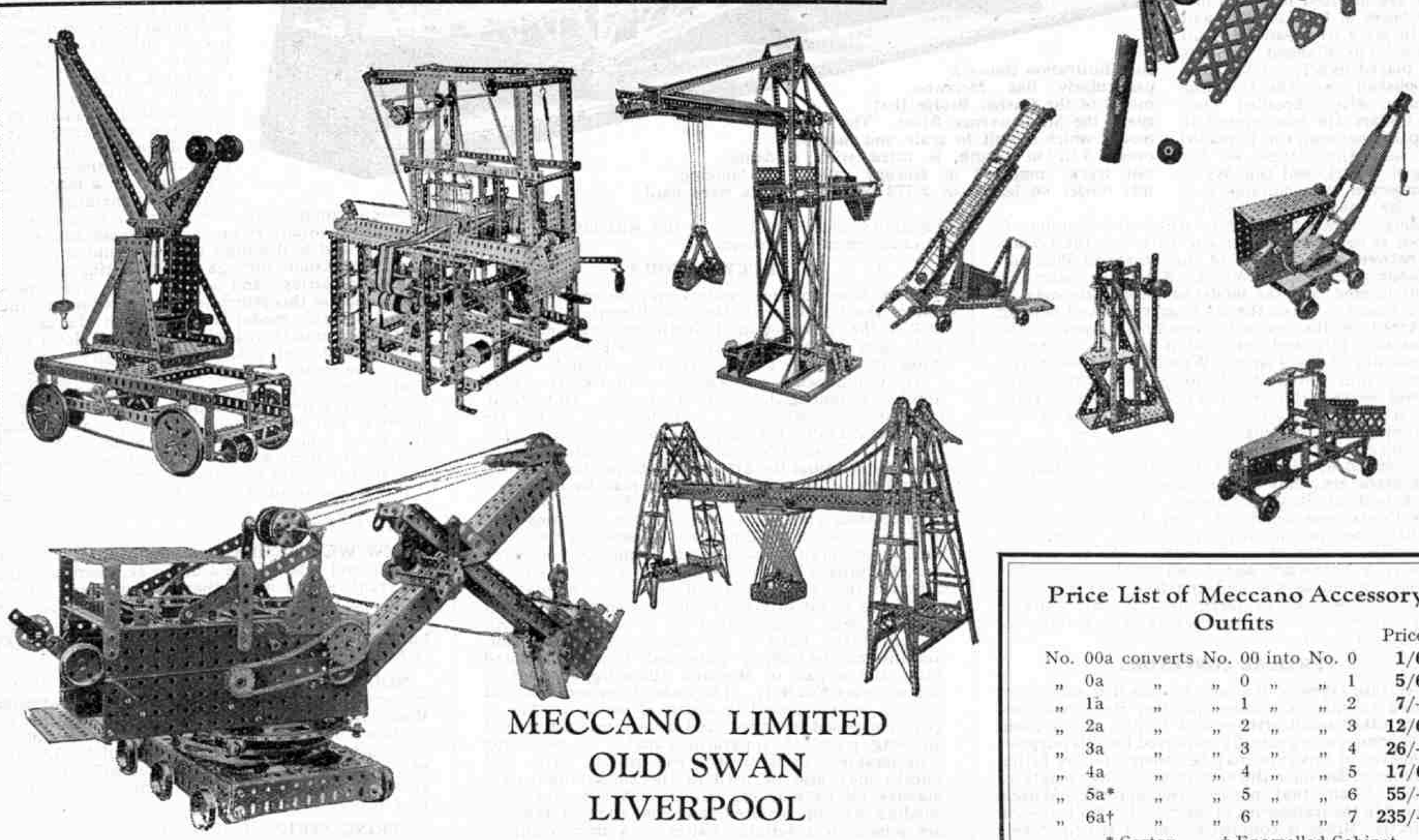
An Accessory Outfit No. 000a is not supplied, but details of the extra parts required to build all the models in the No. 00 Manual will be found in the Instruction Folder included in the No. 000 Outfit.

Your Meccano dealer carries stocks of all Meccano Accessory Outfits. He will be happy to give you any further information you may require.

MECCANO

No. 3A Accessory Outfit





MECCANO LIMITED
OLD SWAN
LIVERPOOL

Price List of Meccano Accessory Outfits

						Price
No.	00a	converts	No. 00	into	No. 0	**1/6**
„	0a	„	„ 0	„	„ 1	**5/6**
„	1a	„	„ 1	„	„ 2	**7/–**
„	2a	„	„ 2	„	„ 3	**12/6**
„	3a	„	„ 3	„	„ 4	**26/–**
„	4a	„	„ 4	„	„ 5	**17/6**
„	5a*	„	„ 5	„	„ 6	**55/–**
„	6a†	„	„ 6	„	„ 7	**235/–**

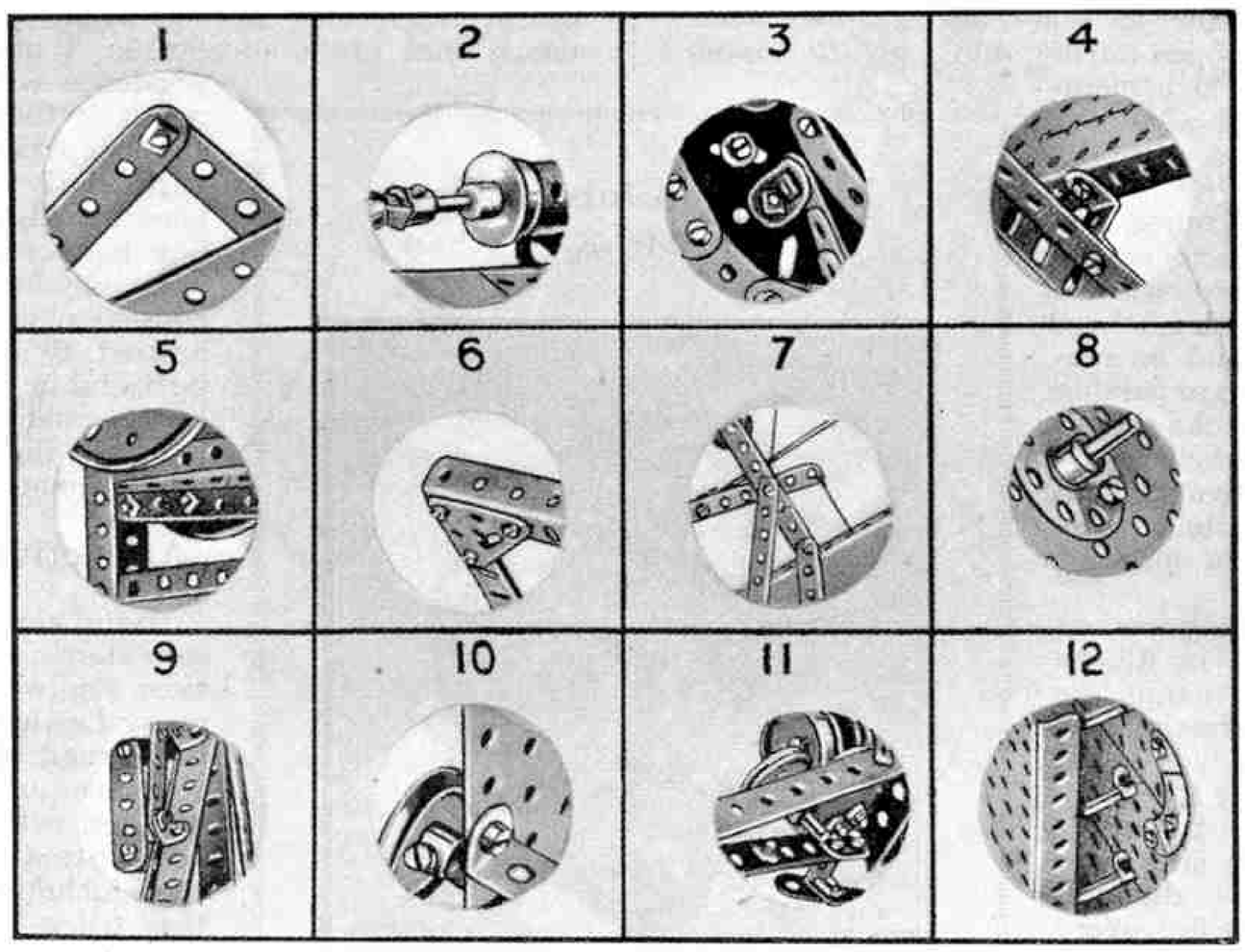
* Carton. † Enamelled Cabinet.

"Lynx-Eye" Competition

From Which Models Are These Fragments Taken?

AT this time of the year Meccano enthusiasts rightly spend as much time as possible out in the open air, and confine their model-building activities mainly to wet days. For this reason we announce this month a competition that can be dealt with just as easily out in the open air as indoors. This competition requires only copies of the current editions of the No. 00-4 and No. 5-7 Instruction Manuals, paper, a pencil, and a pair of sharp eyes!

The task before competitors is that of finding out from which models in the Meccano Manuals the twelve fragmentary pictures reproduced on this page have been taken.



At first this may appear a difficult task, but a careful and systematic inspection of the separate models will soon enable competitors to "spot" from where quite a number of the illustrations have been taken.

It is most important to observe closely the nature of the parts shown in each fragment, as these will afford valuable clues in discovering the models of which they form part. For example, if the picture contains a Coupling on an End Bearing, it is quite obvious that it can only have been taken from one of the larger models. On the other hand, if the only parts shown are Strips and Pulleys, competitors may reasonably expect to find that the fragment has been removed from one of the more simple models, and most probably will be found in the No. 00-4 Manual. It will thus be seen that the search is very considerably narrowed down.

One important point to remember is that the various fragments illustrated here are not necessarily printed in the same angular positions that they occupy in the Manuals. Some of them are shown here upsidedown and sideways when compared with the positions they occupy in the Manual illustrations.

The Contest will be divided into two Sections—A for readers living in the British Isles, and B for readers living Overseas.

In each Section a fine range of prizes will be awarded as follows:—First Prize, Meccano or Hornby Train goods value £2-2s. Second Prize, Meccano or Hornby Train goods value £1-1s. Third Prize, Meccano or Hornby Train goods value 10/6. Ten prizes of goods value 5/-. Ten prizes, each consisting of a copy of "*Famous Trains*" by Mr. C. J. Allen.

In the event of more than one competitor solving all of the 12 puzzles correctly the prizes will be awarded to the correct entries first examined.

Competitors should not be disheartened if they cannot identify every one of the 12 fragments. They may easily win one of the prizes although their entries are not absolutely complete, for if no competitor submits an all-correct entry the prizes will be awarded to the competitors whose entries contain the greatest number of correct solutions.

In preparing their lists competitors should write down carefully on a postcard, first the number of the picture, and then the Manual number of the model from which it is taken.

The postcard must also contain the competitor's name, age and full address, together with the letter A or B indicating the Section for which the entry is eligible.

Entries must be addressed July "Lynx-Eye" Contest, Meccano Ltd., Binns Road, Old Swan, Liverpool. The closing dates for the Competition are as follows. Section A, 31st August, 1932. Section B, 30th November, 1932.

Successful competitors will be notified by letter as soon as possible after the closing dates, and lists of prize-winners will be published later in the "*M.M.*"

Contests of this type that have been organised in the past have proved very successful and thousands of entries have been received. This seems to indicate that model-builders find the task of solving the puzzles a welcome change from actual constructional work. We strongly advise all readers who have not entered any of the previous competitions to start identifying the present set of pictures immediately. They will be astonished to find how fascinating a task it is!

Special "Bridge" Model-Building Contest

Model-builders should remember that the Special "Bridge" Competition is still open for entries. Full details of this Competition were published in connection with the article "Meccano Helps American Engineers" that appeared in the May issue of the "*M.M.*" Any kind of model bridge may be entered and a Cash Prize is offered for the best model received. The Contest closes for entries on 30th July, 1932.

Week-end Holidays Under Canvas

I am very glad to learn that during the present summer more clubs will spend a short time under canvas than in any previous year. The increased popularity of camping is very satisfactory, for there is no more pleasant way of spending a holiday.

It is not necessary to organise an elaborate camping week, or fortnight, in order to enjoy open-air life, and I greatly favour the semi-permanent camp to which members may go at the week-end or whenever they have a few days to spare. Cricket gear and other requirements for games should not be forgotten, of course, for space in which to carry on these activities usually is available; and as the weather may prove unfavourable, those in charge of such a camp should be prepared with plans for some means of passing the time spent under cover. If the shelter of a barn is available, handball, badminton or a similar game may be possible, and in any case simple competitions may be arranged, or indoor games may be played.

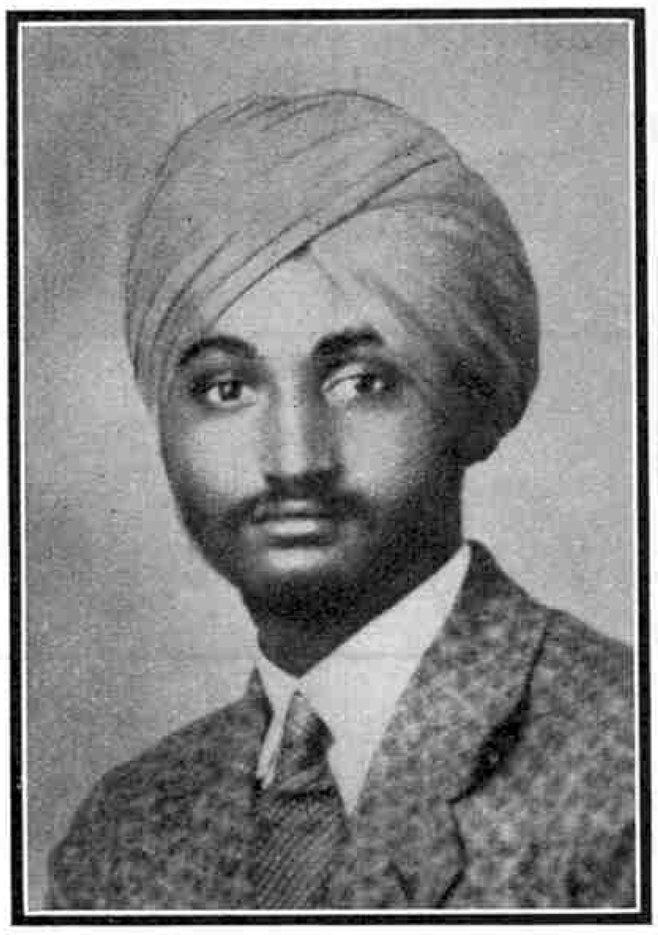
Given enthusiasm and friendliness on the part of those taking part in it, the requirements for a successful camp are very simple, and those interested will find helpful information and advice in the article "*Planning a Camping Holiday,*" that appeared on page 428 of last month's issue of the "*M.M.*" Suitable sites may be found within a reasonable distance of the headquarters of practically every club in the country. The best of these positions usually are situated well away from busy roads and crowded resorts, and therefore have the great advantage of being safe, a point of importance when the parents of members have to be approached for the necessary permission!

The Best Time for Making Plans

Although indoor activities usually are restricted in July, owing to the attraction of games and outdoor pursuits, the thoughts of keen club officials continually return to consideration of the club programme, for what I may call the resting season is the most suitable time to review the activities of the past, and to think out variations and additions that will make next winter's work even more attractive. The present month also gives opportunities for considering general policy. For instance, certain members of a particular club may find their greatest pleasure in exciting competitions, or in elaborate exhibitions, while others may prefer to work on quieter lines. In cases of this kind, Leaders should weigh up the position, and try to plan general proceedings on lines that will satisfy the majority of the members concerned. The actual details of the programme also call for consideration, and here again the Leader is largely guided by the wishes of members, as shown during last session, and he should try to organise as many meetings of a favourite type as possible. In doing so he should not overlook the necessity for providing sufficient variety, however, for if this precaution is neglected, the programme is apt to be monotonous.

Meccano Club Leaders

No. 59. Mr. R. S. Khati



Mr. R. S. Khati, Leader of the Ranjit (Lahore) M.C., an Indian club that was affiliated in October of last year. The members of the club are keen Meccano enthusiasts and follow a splendid programme of Model-building Competitions, Fretwork and Lectures, while a special feature is made of visits to places of interest.

Exchanging Ideas on Programmes

Leaders are in the best position to judge whether the various features of the programmes they arrange are popular with their members, and for this reason, I hope that when writing to me they will tell me how their members respond to different types of meetings, and also give me details of any novel arrangements that prove successful. I am already in constant correspondence with many Leaders who write regularly to discuss their programmes, and their experience is of the greatest value, particularly to clubs that have only been in existence a short time. I should like to receive more letters of this kind, however, for if this plan were followed consistently, these pages would become a kind of exchange for ideas likely to be useful in club work and every organisation would benefit, thus carrying into practice the true spirit of brotherhood that animates the Meccano Guild.

Attractive Exhibition Features

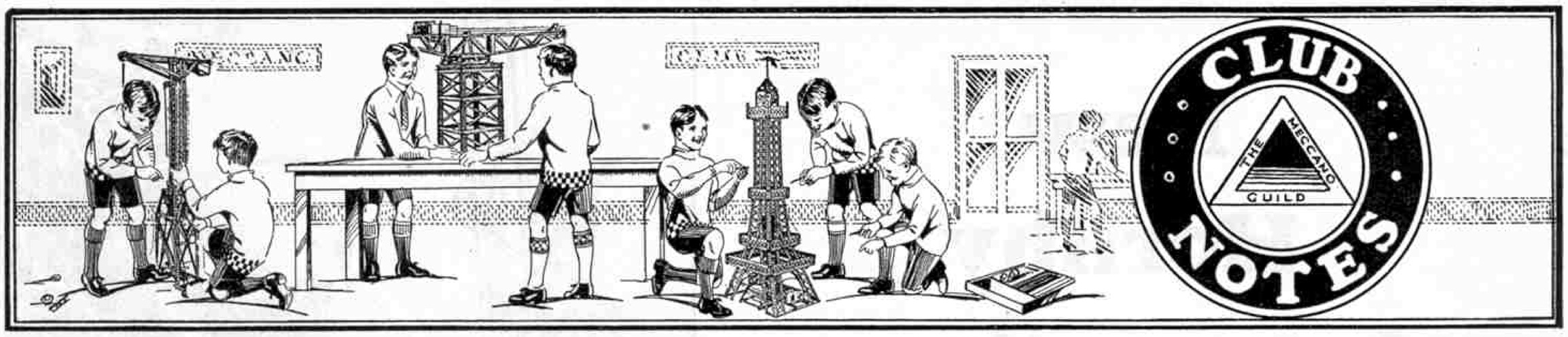
Useful hints on the provision of attractive side shows and other features at Exhibitions also would be greatly appreciated by many Leaders. From time to time I have made suggestions for this purpose in these columns, and most of these have been adopted with great success. Others have been introduced by experienced Leaders, these including a Mock Art Gallery, in which the titles of well-known pictures are humorously interpreted, and other side-shows of a similar type in addition to lantern shows and cinematograph entertainments.

Further ideas continue to occur to keen and energetic officials and an attraction that led to a great deal of fun at a recent Exhibition was a Telephone Exchange, from which visitors were supposed to be able on payment of a small charge to ring up a Meccano boy in practically any country in the world. It is scarcely necessary for me to point out that the Exchange had only one trunk line, in spite of the wonderful facilities that it offered; or to add that at the further end of the wire was a quick-witted member of the club, who made appropriate replies, often very humorous in character, to the queries that were addressed to him!

Proposed Clubs

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

BRISTOL—B. Greenhill, 55, Kellaway Avenue.
CHEAM—E. Fryer, The Mount, Burden Road, Cheam.
CLECKHEATON—R. A. Alderson, 5, Cliffe Lane, Cleckheaton.
FELPHAM—G. King, Bohemia, Blakes Road.
JERSEY—G. Bisson, "Hillary," Greve D'Azette, St. Clements.
LONDON—W. Milner, 75, Halidon Street, Hackney, E.9.
RUISLIP—R. Lawson, "Littledene," Eastcote Road.
SOUTH AFRICA—T. C. Brook, 21, Booth Junction, Natal.



Westbury M.C.—Mr. C. E. Badcock has been compelled to resign the position of Leader owing to pressure of work, and Mr. H. Taylor has kindly taken up the task. A full programme of Model-building, Competitions and Games has been followed, and a special event was made of the exhibition of a film kindly loaned by Ariel Works Ltd. A visit has been paid to the local Waterworks. Preparations for the Exhibition also have occupied members. Club roll: 40. *Secretary:* E. D. Moye, 24, Burnell Rise, Letchworth, Herts.

Anderson Baptist M.C.—The chief recent event was a talk by Mr. W. Harris, B.A., on "*The Ascent of Mount Everest,*" and the interest of members was shown by the large number of questions asked. A Debate was held on "*Whether Steam is Better than Electricity for Modern Travelling.*" The speeches were very thoughtful and reached a high standard, the supporters of steam winning by nine votes to seven. Club roll: 25. *Secretary:* R. E. Hoffler, 27, Pitcroft Avenue, Reading.

Kendal M.C.—The recent Exhibition was very successful. The excellent models on view included a Racing Seaplane, a Destroyer, an Overhead Crane, and a representation of the "*Rocket.*" The Hornby Train layout was a great attraction to visitors, who were greatly interested in the minor crashes that occurred, and appreciated the excitement that followed each accident! The Guild literature available aroused great interest among Meccano boys present and five new members were enrolled. Regular club work also has been successful, and one interesting evening was devoted to an account of "*My Visit to the Meccano Factory,*" contributed by one of the members. Games and competitions, particularly Air Gun Shooting, have been greatly enjoyed. Club roll: 20. *Secretary:* L. Haslam, c/o 34, Park Avenue, Kendal.

Whitgift School M.C.—Interesting visits have been paid to the printing works of the "*Evening News*" at Northcliffe House and to the H.M.V. Gramophone Factory at Hayes, where the actual making of records was watched with great interest. Other events have included a lantern lecture on "*London's Underground,*" and the annual Model-building Competition between the club and the Whitgift Middle School M.C. The model to be built this year was a suspension bridge, and the award of the judges was in favour of the Whitgift Middle School M.C. Mr. R. Gurner, M.C., M.A., Master of the school, has very kindly accepted the position of President. Club roll: 61. *Secretary:* J. D. Mellor, 71, Birdhurst Rise, S. Croydon.

Bagshot and Lightwater M.C.—Now that affiliation has been granted members are more enthusiastic than ever. The club's first birthday was celebrated by a Social, and other meetings have been devoted to games and competitions, Blindfold Model-building Contests being a great attraction. A useful Library has been formed. New members are required, and those wishing to join should write to the Leader or secretary. Club roll: 10. *Secretary:* E. Hart, 3, Providence Cottages, Guildford Road, Bagshot, Surrey.

New Bradwell M.C.—A party to celebrate the first year of the club's existence was a very enjoyable affair, members' parents and friends kindly providing refreshments. During the year membership has risen from six to 33. Model-building Evenings are alternated with Hornby Train operation, and interesting visits have been paid to works of various kinds. Club roll: 33. *Secretary:* R. Bellchambers, 29, King Edward Street, New Bradwell, Bletchley, Bucks.

Southampton M.C.—There was an attendance of 73 members at the first meeting. Groups were formed for Model-building and for Hornby Train operations. Those working on the club layout developed an excellent timetable, and sectional marks were awarded to the groups building the best bridges. The end of the meeting came too soon for most of those present. Recruiting is very satisfactory, and members are enthusiastic. Club roll: 136. *Secretary:* Mr. P. Atkinson, c/o Messrs. Plummer Roddis Ltd., Southampton.

Harlesden Wesleyan M.C.—The chief recent event was an open meeting when a lantern lecture on "*The Production of a Daily Newspaper*" was given by Mr. K. Seymour, the Rev. B. Harris, President of the club, taking the chair. A collection was taken on behalf of club funds. Handball is played on games evenings and rehearsals for the club's concert have been carried out. A special competition organised by Bowman Bros. Ltd., the local Meccano dealers, led to the construction of many excellent models. Club roll: 25. *Secretary:* L. V. Rallison, 6, Harley Villas, Harley Road, Harlesden, N.W.10.

Hele's School (Exeter) M.C.—Membership is steadily increasing, and an attractive programme of indoor meetings and outdoor pursuits, such as cricket and cycling, is being followed. A special event was a mock trial, and the defendants, accused of kidnapping, were severely dealt with after excellent speeches for the prosecution and the defence. Club roll: 13. *Secretary:* J. Drake, 12a, Gervase Avenue, Exeter.

A happy group of members of the St. Peter's (Wolverhampton) M.C. with their Leader, Rev. J. Du Boulay Lance. This club was affiliated in March, 1931, and has since followed an interesting and varied programme of Model-building, Lectures, Debates and Musical Evenings. Stamp Collecting is a favourite activity of members, and a Hornby Railway Section has been formed, while the club magazine, "Nuts and Bolts," is a successful and prominent feature of club work.

Macclesfield Central School M.C.—Has now secured affiliation, to the great pleasure of members. A model Fairground has been constructed, and a special Exhibition arranged to which all interested in model-building were invited. An interesting day was spent in Liverpool, where members visited a liner in the Docks in addition to inspecting the Meccano Factory. Club roll: 12. *Secretary:* V. G. Walmsley, "The Bungalow," Higher Lane, Kerridge, Nr. Macclesfield.

Great Baddow M.C.—A very successful concert, at which the programme was provided by senior and junior members, enabled the sum of £4/8/- to be raised. Dr. P. T. Spencer-Phillips, Vice-President, presided and prizes and medals won by members during the session were presented by Miss Patricia Spencer-Phillips. Mr. S. Beale, President of the club, was a welcome visitor, and he and Mrs. Beale have kindly asked members to spend a summer evening at Baddow House. Regular club work also has been carried on with great enthusiasm. Club roll: 36. *Secretary:* Miss D. French, Jeffrey's House, Chelmsford.

Holy Trinity (Barnsbury) M.C.—The Annual Exhibition was a great success. The models shown included a Breakdown Crane, Motor Chassis, Delivery Van and very effective Simplicity models, and all were original in design and well-constructed. The Hornby Railway in operation was so attractive that one visitor sketched the layout for use at his own club. Cinema and Lantern Shows, and a Mock Fine Art Gallery, greatly attracted visitors, many members of other London clubs being present. The proceeds amounted to nearly £9. Club roll: 39. *Secretary:* J. A. Hines, 331, Liverpool Road, Islington, N.1.

AUSTRALIA

Hobart M.C.—Model-building Contests have been varied by evenings for impromptu speeches, play reading, and interesting lectures given by interested friends of the club. A visit has been paid to the Fire Brigade Station, and a particularly interesting excursion was made to the summit of Mount Wellington, a mountain 4,166 ft. in height that was covered with snow. The nearest meeting to the date of the opening of the Sydney Harbour Bridge was a special "Bridge Night," members exhibiting models of every type of bridge in a special competition. At a social evening arranged for the purpose, an inscribed gold medal was presented to Mr. F. Downie in recognition of his services as founder of the club, and secretary for nearly four years. Mr. Downie also was made an honorary life member. Club roll: 15. *Secretary:* J. D. Hurburgh, 69, Cross Street, New Town, Hobart, Tasmania.

NORWAY

Sandefjord M.C.—Meetings are chiefly devoted to model-building, members being reluctant to leave when the allotted time ends. A display of models has been made on the premises of the local Meccano dealer, and a special meeting was devoted to a study of a Windmill with electric drive kindly loaned by Messrs. Ingwald Nielsen, Meccano Agents in Norway. Club roll: 8. *Secretary:* Torleif Jacobsen, Jernbanealleen 5 III, Sandefjord, Norway.

NEW ZEALAND

Blenheim M.C.—The chief recent event was a visit to the generating station of the Marlborough Electric Power Board. After inspecting the power house itself, members walked over the hills to the dam supplying the necessary water. A member who has left the district has kindly given a prize of Meccano parts to be competed for by members in Model-building and general club work. The award will be made to the member earning the most points in the session. Club roll: 18. *Secretary:* K. J. Orams, Redwood Street, Blenheim, New Zealand.

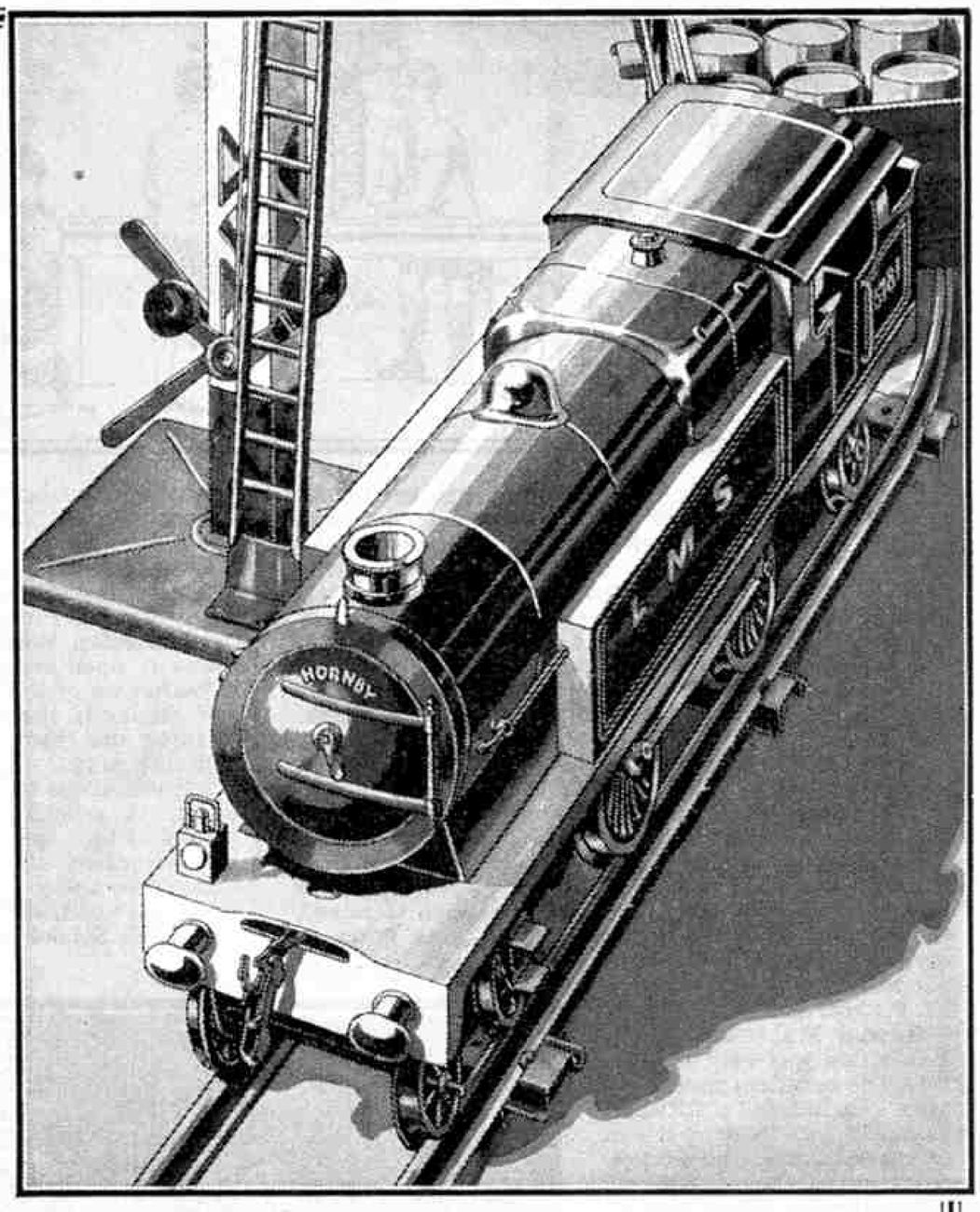
SOUTH AFRICA

Malvern Methodist M.C.—A varied programme of competitions and games has been followed. One interesting evening took the form of a "Find-it-out Night." In this members were asked to track down articles displayed in shop windows by means of clues handed to them in sealed envelopes, prizes being awarded to the first to reach the club-room with the complete list. The cricket team has had an enjoyable summer, and the Annual Sports Meeting, jointly held with other Meccano Clubs in Johannesburg, was the occasion of a very keen contest for the Harris Cup. Club roll: 44. *Secretary:* Mr. H. Farrow, P.O. Box 8, Cleveland, South Africa.

Turffontein M.C.—A new clubroom has been secured, and although it is smaller than the previous one it is quite satisfactory. There has been a slight decrease in membership but it is hoped that new members will soon be enrolled. At the Annual Sports the club retained the Cup presented by Mr. A. E. Harris, the agent of Meccano Limited in South Africa, for competition among the Johannesburg clubs. The prizes gained by members were presented at a Social held shortly afterwards by the club. Club roll: 21. *Secretary:* J. J. Pienaar, Box 1011, Johannesburg.

New Hornby Locomotives for old!

Wonderful offer to owners of Hornby Trains



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 Catalogue. The object of the Hornby Locomotive Part Exchange Scheme is to help you to do this.

The allowance that will be made for your old Locomotive is shown in the list of Part Exchange Values of Hornby Locomotives given on this page.

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

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 value of your No. 1 Tank Locomotive).

Say that you decide 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/– to cover postage and packing 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.

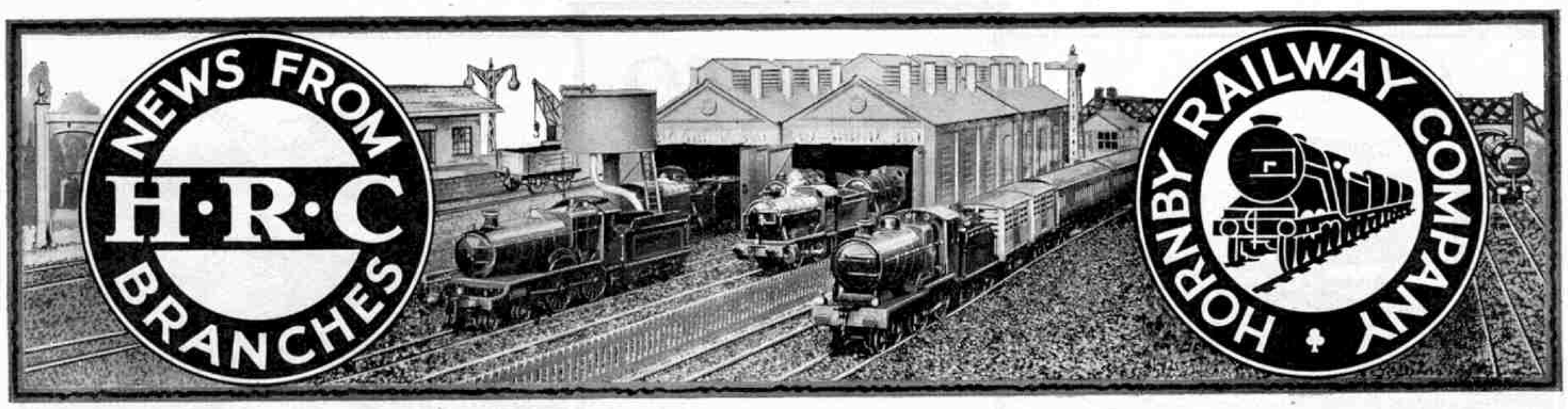
List of Part Exchange Values of Hornby Locomotives

CURRENT TYPES	
M0 Locomotive	1/4
M1/2 Locomotive No. 3031	2/3
M3 Tank Locomotive	3/9
No. 0 Locomotive	5/3
No. 1 Tank Locomotive	6/3
No. 1 Locomotive	6/3
No. 1 Special Locomotive	8/3
No. 1 Special Tank Locomotive	8/3
No. 2 Special Locomotive	11/3
No. 2 Special Tank Locomotive	11/3
No. 1 Electric Tank Locomotive, Permanent Magnet	12/6
No. 2 Electric Tank Locomotive	18/9
No. 3E Locomotive	18/9
No. 3E Riviera "Blue" Locomotive	18/9
No. 3C Locomotive	13/9
No. 3C Riviera "Blue" Locomotive	13/9
Metropolitan C Locomotive	11/3
OBSOLETE TYPES	
M2930 Locomotive	1/–
George V Locomotive / No. 00 Locomotive (These models were identical)	3/3
M3 Locomotive	4/3
Zulu Locomotive	5/3
Zulu Tank Locomotive	6/3
No. 2 Locomotive	10/–
No. 2 Tank Locomotive	11/3
No. 1 Locomotive, fitted for Hornby Control	7/6
No. 1 Tank Locomotive, fitted for Hornby Control	7/6
No. 2 Locomotive, fitted for Hornby Control	11/3
No. 2 Tank Locomotive, fitted for Hornby Control	12/6

HORNBY TRAINS

BRITISH AND GUARANTEED

MECCANO LTD. — SPECIAL SERVICE DEPT. — OLD SWAN — LIVERPOOL



Branch Notes

" Brooke House " (Streatham).—Constructional work is a feature of the Branch programme, and at the recent successful Exhibition, a number of locomotives and wagons built by members, or under construction, were attractive features of the display. Operations also were carried out on the large Branch track, goods and passenger trains being run at the same time on different sections of the layout. The greatest attraction of the display was a passenger-carrying railway. This ran on a track 120 ft. in length outside the hut that serves as a Branch room, and was very popular with visitors. Ordinary meetings also have been very successful. The track is continually being extended and operations on it become more interesting as it grows. Secretary: L. J. Ling, " Brooke House," Rotherhill Avenue, Streatham, S.W.16.

Tilehurst.—An extensive steel track, provided with chairs and sleepers of regulation pattern have now been laid down and successful track meetings are being held. Other activities have included a Cinematograph Display, Lantern Lectures and a visit to a model railway, owned by a local gentleman, that is remarkably complete and realistic. An interesting excursion was made to the M.G. Motor Works at Abingdon. A recruiting campaign is being carried on, and a hearty welcome will be given to all interested in model railways who wish to join the Branch. Secretary: C. W. Whiteley, Hilltop, Westwood Road, Tilehurst.

Teddington.—At early track meetings, layouts planned by various members were tried, but a permanent track has now been established in the club room, this being laid down on shelving fitted up by members themselves. Grit is employed as ballast and telegraph poles have been erected. The effect is very realistic and shunting and marshalling operations are carried out on it regularly. Meetings close with refreshments, these being kindly provided by the secretary, at whose house meetings are held. A special visit was paid to the exhibition of the Model Railway Club, and an interesting time recently was spent at the S.R. sidings at Feltham, where members enjoyed several footplate trips in addition to watching marshalling operations on the " hump." Secretary: Mrs. B. Armitage, 37, Cambridge Road, Teddington.

Olton (Birmingham).—Regular track meetings have been held, when interesting time-table operations have been carried out with both passenger and goods trains, hauled by a variety of locomotives. On one evening, one section carried out the usual track work, while other members made various alterations to the track, this work being done without interfering with the passage of trains, although temporary lines had to be laid down in certain places. This scheme was suggested by operations in progress on the G.W.R. track at Olton, and formed an attractive variation of the ordinary proceedings at track meetings. Secretary: J. T. Austin, " Stoneleigh," 58, Kineton Road, Olton, Birmingham.

Plumstead.—The Branch track has been dismantled and reconstructed on three levels in order to make it easy of access, and yet large enough to accommodate the rails and rolling stock available. Recent events also have included a visit to the Old Oak Common engine shed of the G.W.R., and two Concerts, one of which was in aid of the local church, the amount raised being £3/10/–. Members also won a prize of £5 in a competition held in a local picture house, and the amount was forwarded as a donation to the National Institute for the Blind. Membership has greatly increased and the club is now divided for track work into three sections. The S.R. Bricklayers' Arms goods station also has been visited. Secretary: E. R. Atwell, 11, Leghorn Road, Plumstead, S.E.18.

The cricket team of the Eaglehurst (Palmers Green) Branch, No. 166. Chairman, Mr. P. T. Garton; Secretary, Mr. H. Hossent. Our photograph was taken immediately after a match, when the members were wearing smiles of victory! Last year the team won 24 of the 29 matches played.

NEW ZEALAND

Minton.—Meetings have been chiefly devoted to time-table running on the Branch layout, and great care has been taken to tidy up after working, ballast being swept on to the track, the accessories carefully dusted and fresh water being placed in the lake. A ferry service on the lake has now been introduced. This is supervised by a junior member and is operated in connection with the train services. Members have the privilege of entering the Branch room at any time in order to run trains on the layout, or to carry out repairs. Secretary: J. R. Fisher, 107, Normans Road, Papanui, Christchurch.

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:—

Birstall—G. B. Gibson, 49, Front Street.

Bushey—N. T. Harvey, House G, Royal Masonic (Junior) School, London Road.

Dewsbury—L. Woodward, 23, Netherfield Road, Ravensthorpe.

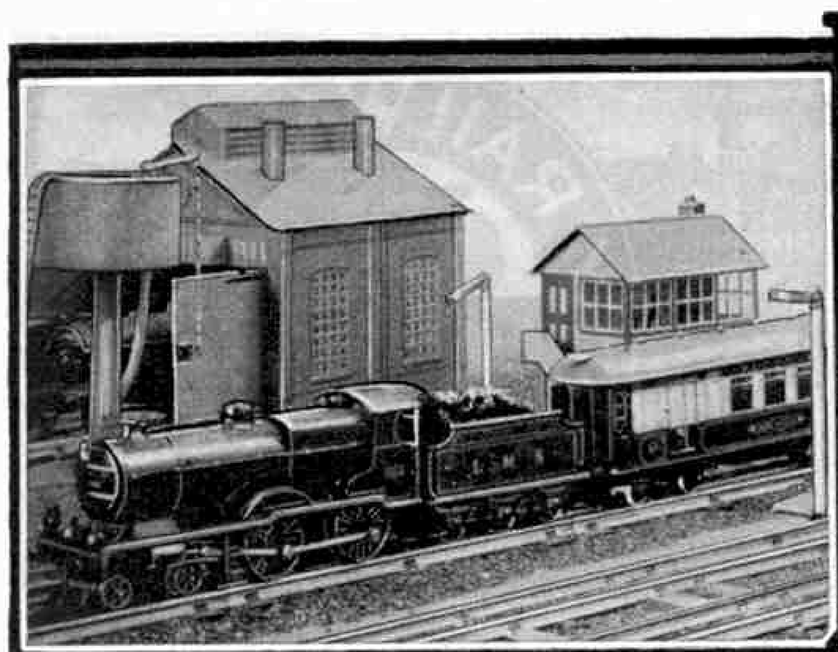
Lewes—P. G. Perry, The Coombe House, Malling Street, Lewes.

London—D. J. Fielden, 117, Bushey Road, Raynes Park, S.W.20.

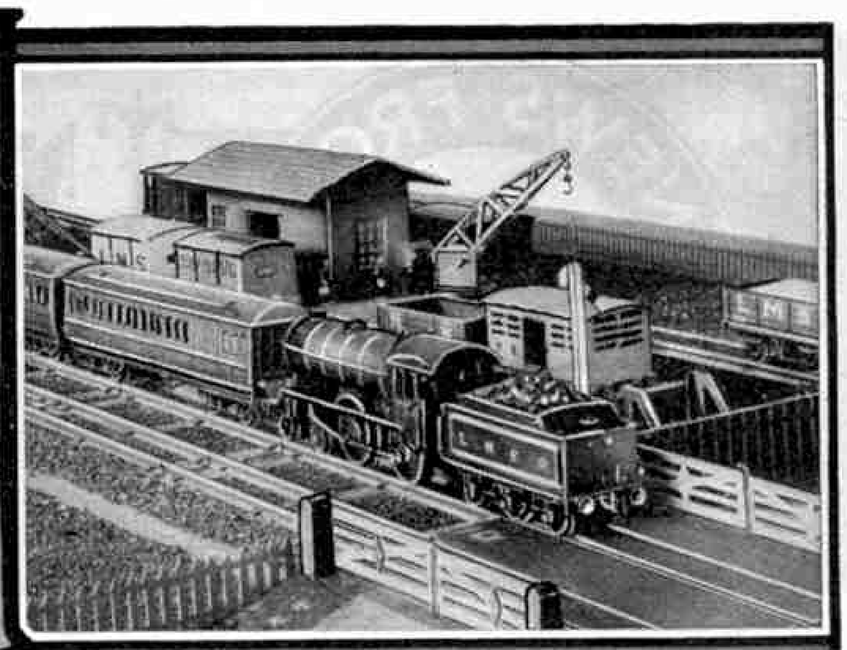
Northampton—A. F. Crick, Homegarth, Weston Way.

Branches Recently Incorporated

220. Dover—Mr. F. W. Prue, 136, Folkestone Road.
221. Heywood—Miss Vera W. Bennett, 7, Pym Street, Heywood.
222. Pannal Ash College—Peter D. Beckett, Pannal Ash College, Harrogate.
223. Teddington—Mrs. B. Armitage, 37, Cambridge Road, Teddington.
224. Melbourne (Australia)—L. Ison, 8, Hayes Street, Northcote, N. 16, Victoria.



HOW TO GET MORE FUN FROM HORNBY TRAINS

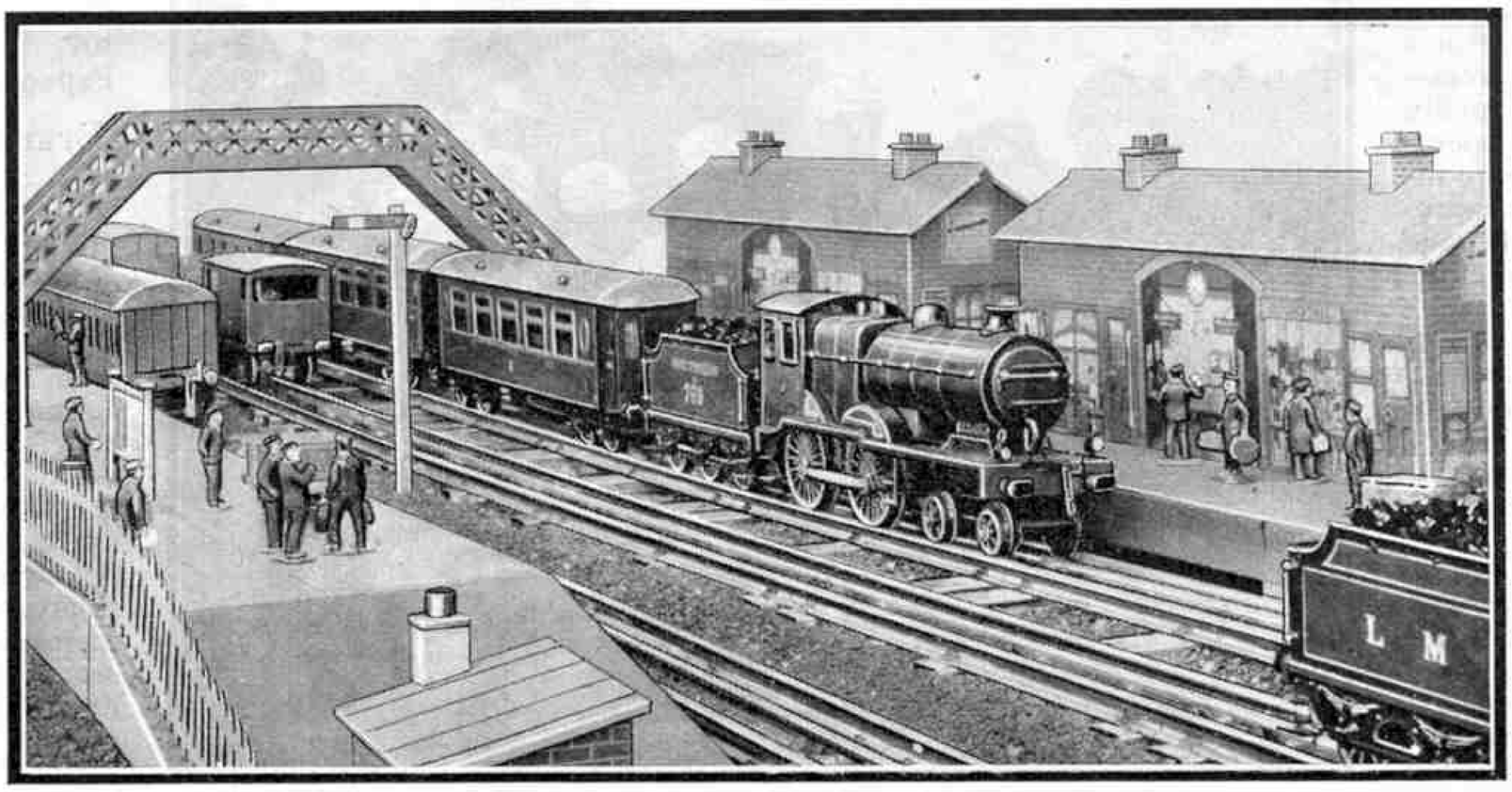


XLV.—AN INTERESTING LAYOUT FOR JOINT WORKING

THERE is a definite tendency nowadays among miniature railway owners to adopt certain sections of actual railway as the prototypes of model layouts. As a result the line is laid out as far as possible to reproduce the chief characteristics of the real railway and the trains operated in miniature represent the locomotives and stock working on the actual system. Several examples of such lines have been dealt with in the "*M.M.*" at different times, and have proved so popular that we think readers in general will be interested in the line we propose to deal with here, with a few hints as to how Hornby railway equipment may be used to represent different trains.

The line to which we refer is not the least interesting of the railways that run more or less on the outskirts of London, and act as connecting links between the different great trunk systems. It is generally referred to as the "West London Line." There are actually two systems, the West London Railway and the West London Extension Railway, and together they effect a connection between the L.M.S., Great Western and Southern railways. Engines and rolling stock of each of these groups are to be found on the West London Line, and Metropolitan type electric stock is also run on account of that company's joint interest with the G.W.R. in the "Hammersmith and City Line," which connects with the West London system at Uxbridge Road, and running powers are exercised over part of it.

Taking the West London Railway itself first, this commences at the quaintly-named North Pole Junction, where an L.M.S.R. line from Willesden Junction and a connection from the G.W.R. main line come together. The first station is St. Quintin Park and the next is Uxbridge Road. Some distance before the latter the Hammersmith and City Line referred to previously is passed under, and a connection from this slopes gradually down to join the West London near Uxbridge Road. The next station is Addison Road, a much more elaborate affair than the other two, which are simply of the two-road passing type. Proceeding, a connection is thrown off that passes to the District Railway and so reaches Earls Court. A little way beyond this connection the line becomes the West London Extension Railway, in which the S.R. have an interest in addition to the West London owners proper, the L.M.S.R. and G.W.R. Passing West Brompton and Fulham, the line crosses the Thames at Battersea, and by means of the different lines that diverge at the Latchmere Junctions connects up with all three sections of the S.R., Western, Central and Eastern.

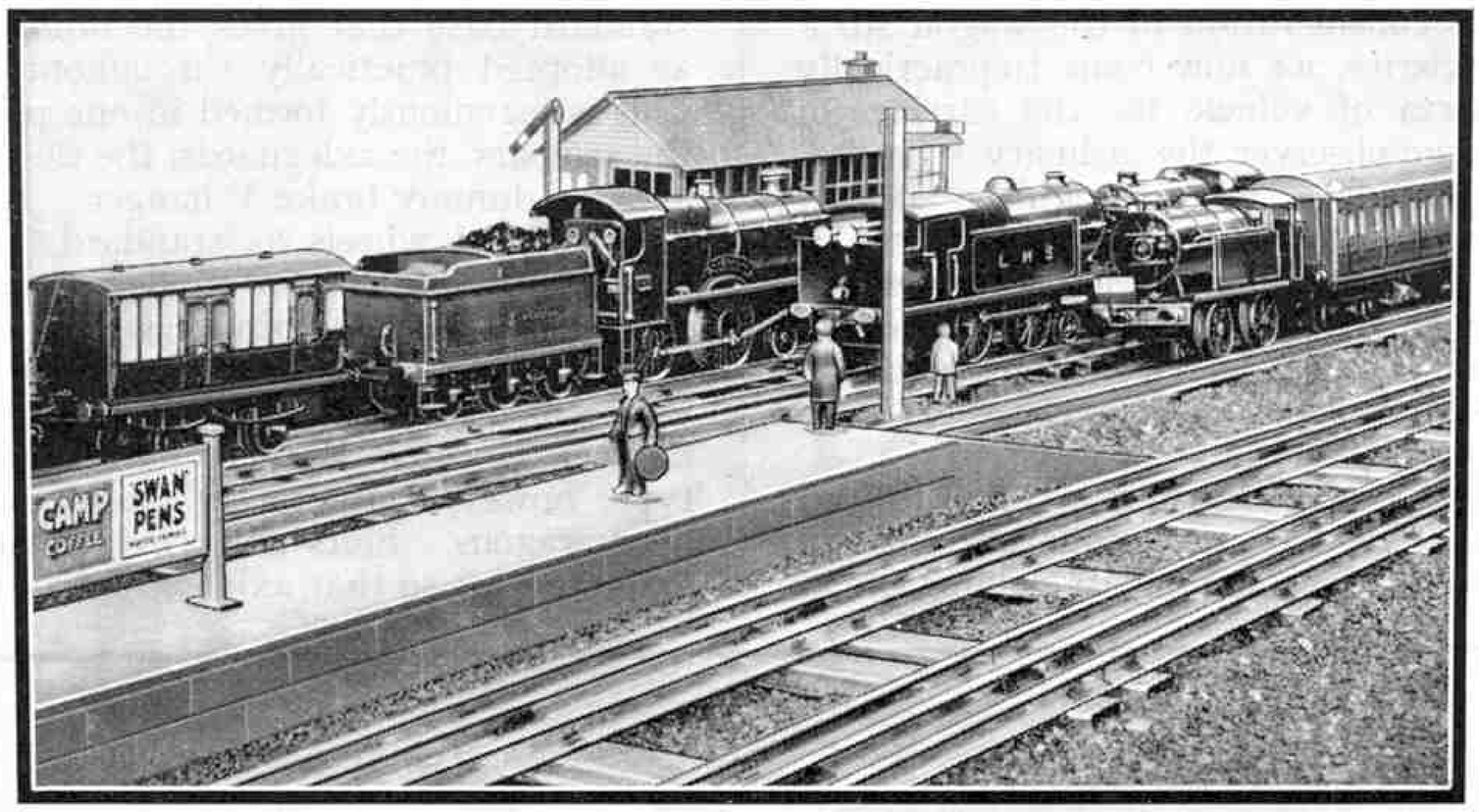


An interesting station on a Hornby layout representing Addison Road on the West London Railway. The train entering the station is composed of L.M.S.R. No. 2 Saloon Coaches hauled by an S.R. locomotive, thus reproducing the operation of "The Sunny South Express" in actual practice.

Model railway owners who favour the use of rolling stock of several groups on the same layout thus may obtain splendid opportunities by basing their systems on the West London Line. An interesting variety of engines and coaching stock of the joint companies are to be seen at one time or another, while goods wagons of all kinds are very common. The reproduction of this line, therefore, would be an interesting scheme for an H.R.C. Branch layout, or where several Hornby Railway owners combine their resources to form a large system. The accompanying photographs give a few suggestions, the situation depicted in each case representing part of a miniature "Addison Road."

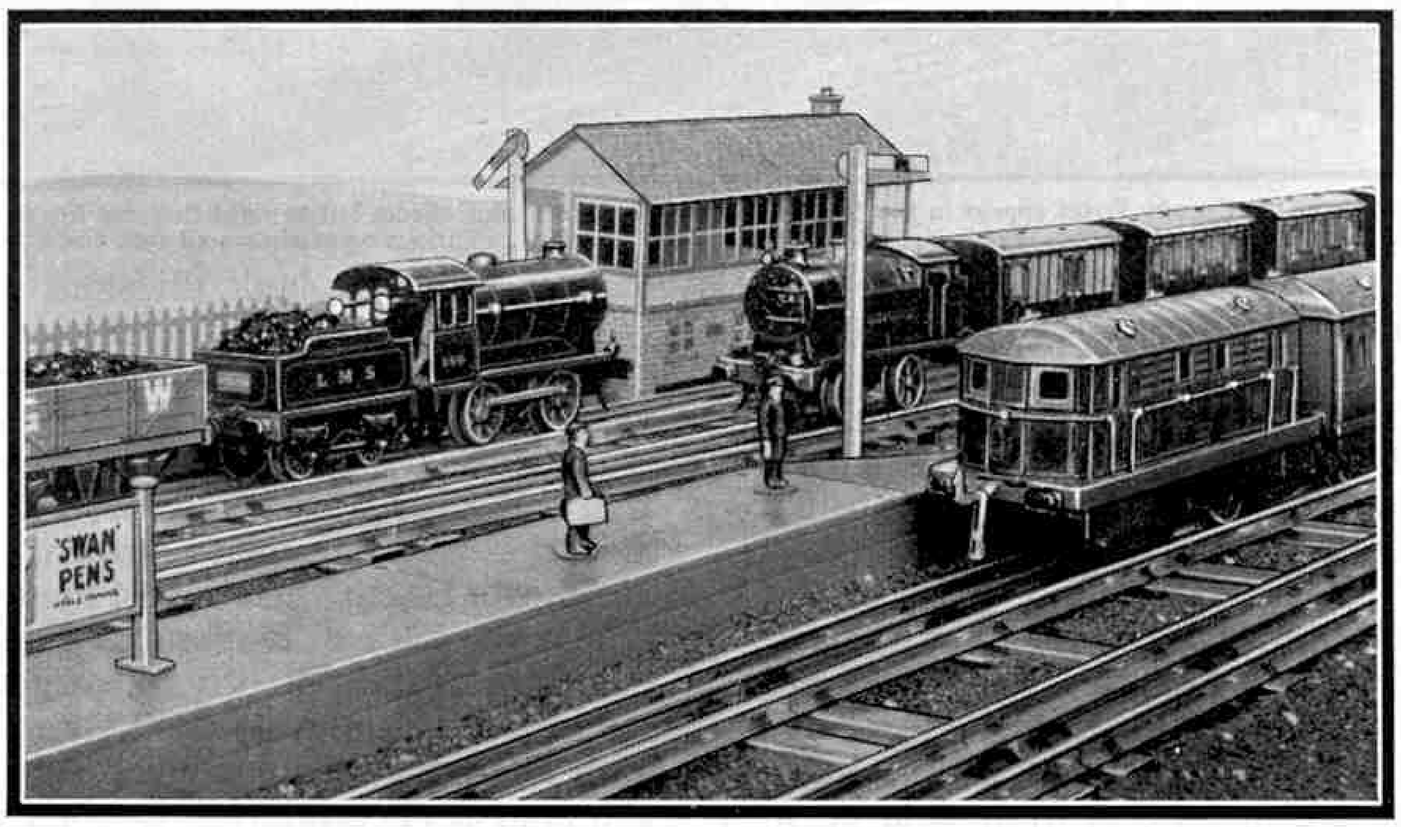
Of the numerous trains that traverse West London metals the famous "*Sunny South Express*" is probably the most important, and is certainly a good example of joint operation. The L.M.S.R. train from Liverpool, Manchester and Birmingham is handed over to an S.R. locomotive at Willesden Junction on the L.M.S.R. main line, and the train then proceeds over the West London

and West London Extension lines. The portion for Brighton and Eastbourne passes to the Central section of the S.R. One of our illustrations shows a miniature "*Sunny South Express*" composed of No. 2 Saloon Coaches in L.M.S.R. red livery, hauled by a Hornby No. 2 Special S.R. Locomotive painted the well-known green. Coaches for Margate and Ramsgate are also conveyed on the "*Sunny South*," and these follow the Brighton and Eastbourne vehicles from Willesden in charge of an Eastern section S.R. engine. For the return journey similar arrangements apply, but in the reverse order, the S.R. engines working the trains to Willesden and the L.M.S.R. taking charge from there. Although a tender engine is shown in the photograph referred to, a Hornby No. 2 Special, or the corresponding Electric Tank Locomotive, might be employed. Big tanks are commonly used on the S.R. for such work, and those of the same wheel arrangement as the Hornby example, 4-4-2, have made a special reputation on the Brighton train. These services are extremely popular, for many passengers take advantage of the convenience afforded by the through coaches, as the crossing of London from northern to southern termini, possibly with a good deal of luggage, is avoided. This useful train has developed from a through carriage between Liverpool and Eastbourne via Willesden Junction and Brighton that commenced running in July, 1904, exactly 28 years ago!



The possibilities of joint working are well shown in this illustration. A train of G.W.R. vehicles is leaving the station with a "County" locomotive, and a special hauled by an S.R. M3 Tank is running in, while two L.M.S.R. locomotives running light are held by the signal on the centre road.

What we may term the L.M.S.R. local services over the West London Railway are operated between Willesden Junction (High Level) and Earls Court by means of electric trains. The Metropolitan and G.W. joint trains are of course electric and use the same lines between Uxbridge Road and Addison Road, where they are accommodated in a bay platform. One of our illustrations shows a miniature Metropolitan train entering the bay hauled by one of the well-known Hornby Metropolitan Locomotives. This is not strictly accurate, as these trains actually are not hauled by separate locomotives, but are made up of motor and trailer cars. As the latter are not yet included in the Hornby Series, however, there is every justification for the employment of the Hornby Metropolitan Locomotive. This is available with either electric or clockwork mechanism, so that it is easily possible for the Metropolitan services over the West London Railway to be represented.



A Metropolitan train entering the bay platform at "Addison Road." Actually motor coach trains are used, and they are the joint property of the Great Western and Metropolitan railways, the latter company having no powers of its own over the West London Railway.

Many H.R.C. members make use of what may be described as "push power" for reproducing the motor coach and trailer type of electric train. This may not appeal to all, as there are definite limits to its possibilities; but it has many good points and is therefore worth consideration. Some time ago we published a description of a miniature railway operated on this principle by Mr. M. B. Flanders of Walthamstow. This followed the G.E. section of the L.N.E.R. as regards its general characteristics, but the various locomotives were operated not by their own tractive effort but by "push power," the operator thus as it were driving the engine. This method has several advantages. Trains may be accelerated gradually; may make reductions of speed round curves and over junctions, and be brought gradually to a stop at stations. Shunting, too, may be carried out at a realistic speed, and the differences in the speeds of the principal expresses, semi-fast, stopping and goods trains, may be observed. Signals may be sighted "on the run" and obeyed in the correct manner. Bridges and tunnels are not desirable on layouts to be operated in this manner.

Utilising this method for our Metropolitan motor coach and trailer train, we make it up of a Hornby Metropolitan Coach as the trailer, flanked by a corresponding Composite Coach at each end to represent the motor coaches, motive power being supplied by the operator's hand. The idea is particularly worth consideration for these trains, as they do not run a great distance on West London metals. If an actual sloping descent from the Hammersmith and City Line to Uxbridge Road is arranged for, the running of the trains downward may be

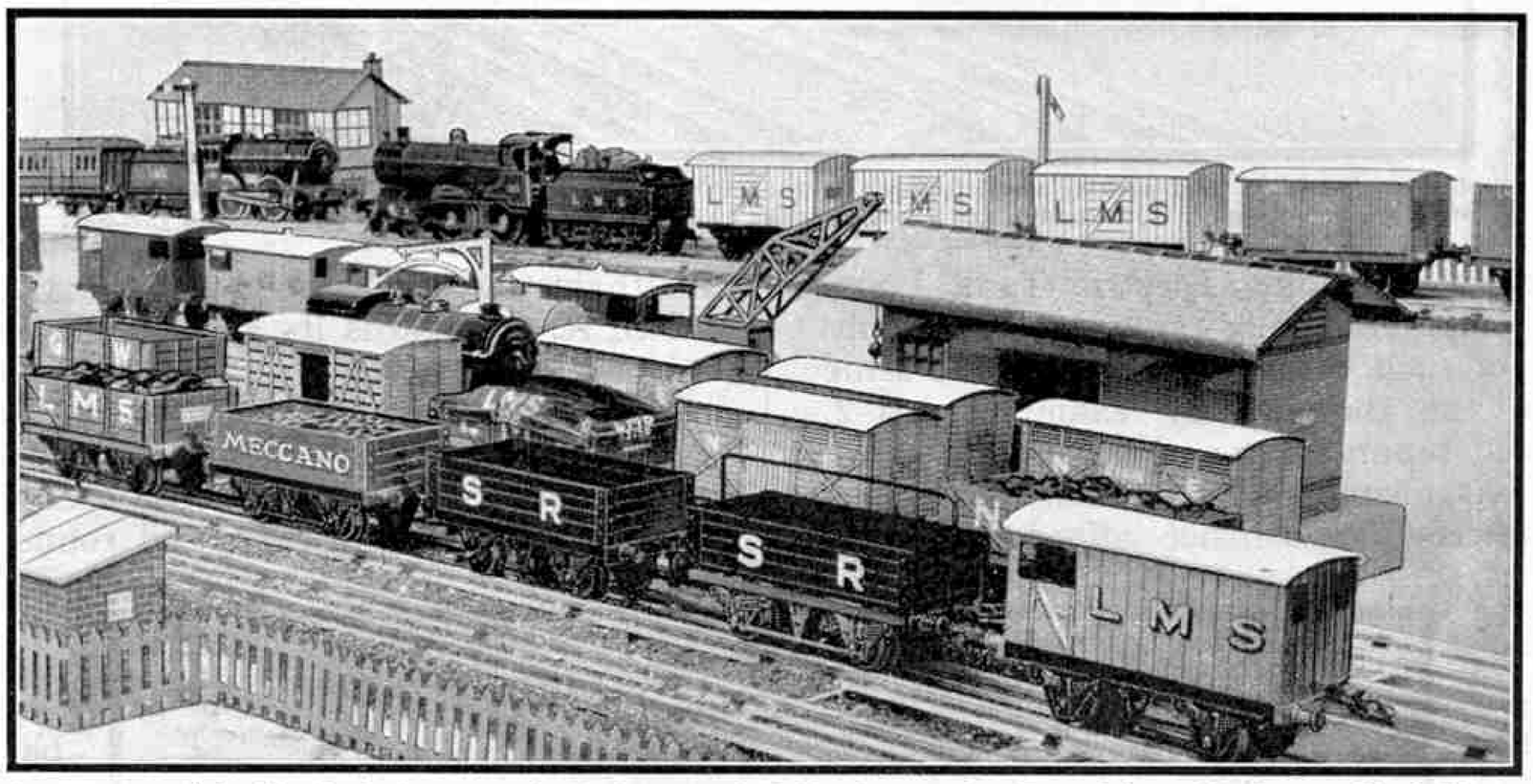
(*Continued on page 572*)

Open Wagons of the Hornby Series

By "Tommy Dodd"

CONTINUING our consideration of the wagon stock of the Hornby Series, we now come to practically the simplest form of vehicle for the carriage of freight. To the average observer the ordinary "truck," as it is generally termed, is a commonplace enough article on our railways, but to the enthusiast there is much of interest in the humble open wagon, into which category there fall such diverse types as the imposing 40-ton all-steel wagon carried on two bogies and the small four-wheeler with a capacity of perhaps six tons and with sides only two planks high.

The very commonness of the ordinary 10 or 12-ton wagon makes it essential that any miniature railway should possess several of these among its rolling stock. Each of the four groups is represented in the Hornby Series by appropriate open wagons and there are one or two special varieties that deserve more than passing mention. The first to be considered is the Hornby No. 1 Open Wagon, which represents the ordinary four-wheeler with a capacity for 8 or 10 tons that is used for the carriage of coal, minerals and a wide variety of general merchandise.



Open wagons of the Hornby Series appear in the foreground of this photograph. From left to right they are No. 0 Wagon L.M.S.R., "Meccano" Coal Wagon, Wagon No. 1 S.R., Open Wagon "B" S.R. Various types of covered vans also are shown.

In actual practice the underframe is built up in the usual manner of stout timbers forming the solebars, headstocks or buffer beams and transomes that stiffen up the construction, well braced and strengthened, and jointed by ironwork. Modern methods favour the employment of all-metal underframes and these are largely applied nowadays, though some companies have had them in use for a number of years. The bodywork is built up of sound planking, metal corner plates being fitted to protect the edges of the wagon, while door openings are strengthened by strapping that is also applied in various ways to the main portions of the sides. Formerly the ends were strengthened by stout battens with strapping bolted on to the buffer beams and extending to the top of the wagon ends. These are now largely superseded by angle irons of T section, which are extremely strong and less liable to damage than the corresponding timber parts. The top edges of the sides and ends are protected by metal strips with rounded top sides, and do much to prevent damage under the rough conditions of railway goods work.

The underframe of the Hornby Open Wagon is the now standard base that gives the buffer height of one inch as adopted practically throughout the Hornby range. This is ingeniously formed in one piece and incorporates the solebars, the axleguards, the tie-bar connecting them, and the dummy brake V hanger. It is mounted on four pressed steel wheels as standard, and thus reproduces the latest practice, for modern wagons are frequently fitted with this type of disc wheel. If they desire to do so, Hornby railway owners may fit the die-cast spoked wheels as used on the Special tenders; or if preferred the famous Hornby Mansell pattern wheels. The latter type, however, are rarely found in actual practice on open wagons. Slots are provided above and below the axle bearings so that axleboxes may be fitted if required, as suggested some time ago in these pages.

The bodywork is strongly built up, and it is in this particular portion that the differences between the various types available are found. The floor and buffer beams are in one piece, and mounted upon this are the sides and ends. The No. 1 Wagon has the plank divisions actually embossed as in the case of the No. 1 Van we considered recently; while the corner plates are properly raised and are provided with miniature bolt heads. The wagon is therefore of a realistic character and is finished by enamelling, the L.M.S.R., L.N.E.R., and G.W.R. examples being grey, and the S.R. chocolate brown.

An interesting variation of identical construction is the "Meccano" Coal Wagon. This is representative of the many thousands of private owners' wagons running on our railways and belonging to collieries, coal merchants and manufacturing concerns. This Coal Wagon is coloured a cheerful red, for private owners' wagons are found in practically all colours of the rainbow.

Open Wagon "B" as it is called is fitted with a movable bar to support a tarpaulin running the length of the wagon and pivoted to the ends.

The next vehicle to be considered is the No. 0 Wagon. This is generally similar to the No. 1 variety, but instead of being enamelled it is finished by the tinprinting process. The corner plates, too, are embossed, but the planking divisions, doors, hinges, strapping and end battens are printed on to the wagon bodies. As a result they look extremely effective, and are arranged to represent the rolling stock of the four groups.

H.R.C. COMPETITION PAGE

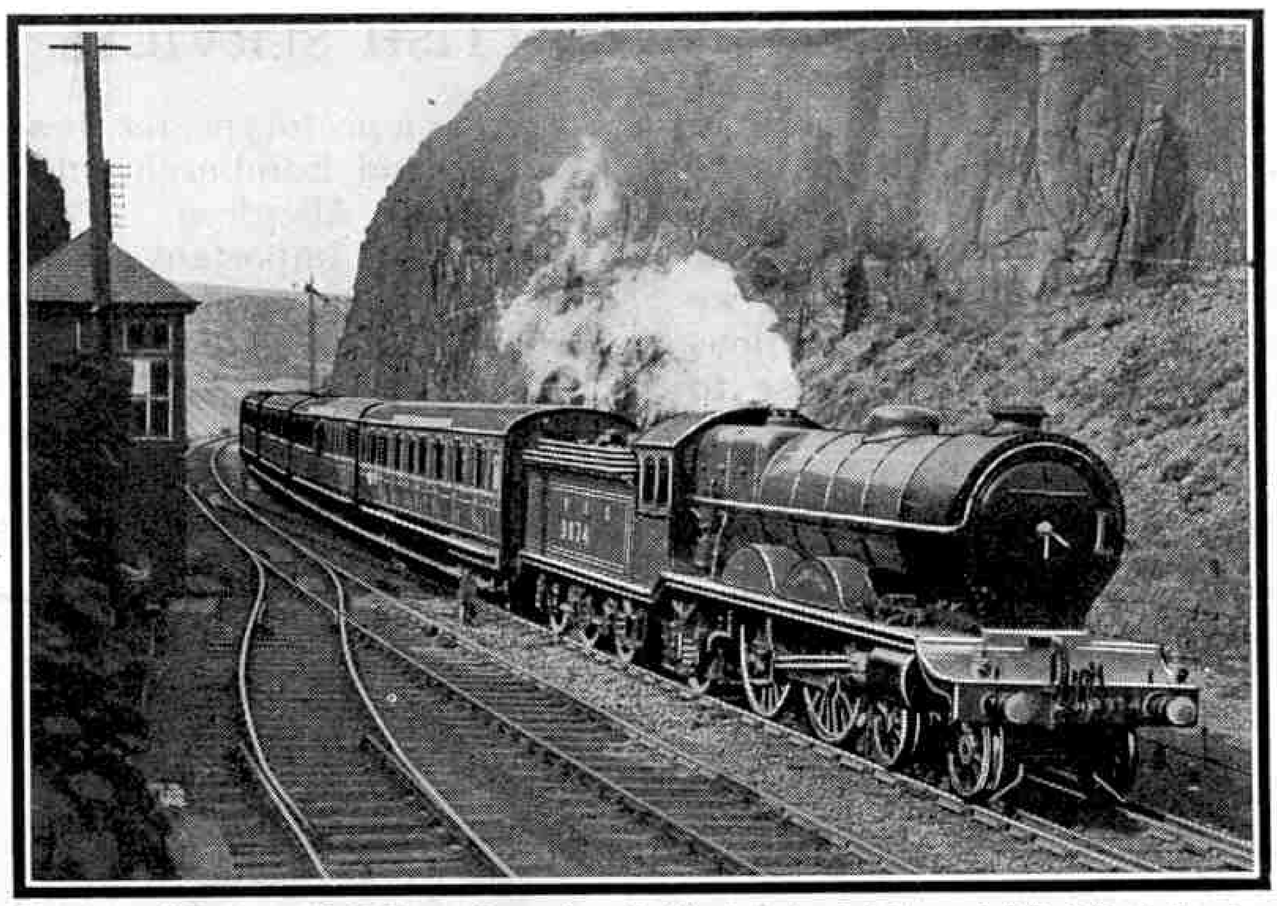
Competitions appearing on this page are open only to members of the Hornby Railway Company. Envelopes containing entries, should have the title of the competition clearly written in the top left-hand corner and should be addressed to the Hornby Railway Company, Binns Road, Old Swan, Liverpool. The name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

ANOTHER "IMPOSSIBLE TRAIN"

Previous "Impossible Train" Contests have proved remarkably popular, and in response to many requests we announce another one this month. As before, we give a description of the journey of this "impossible" train, and competitors are required to read through the story, pick out as many mistakes as they can find, and make a list of them. Here is the story:—

"On the stroke of 9.45 the '*Portsmouth Pullman*' draws out of Paddington. Near Southall we climb the familiar Beattock incline, and at Slough, where our speed is just under 70 miles an hour, we have to reverse as there is no direct line through the station. If we are running to time, we should stop at Reading, 46 miles out of Euston, in 50 minutes. Here we cross the Grand Junction canal by means of the Trowse Viaduct.

"A severe brake application heralds the approach to Doncaster, which is passed in 60 minutes from our starting point. Here comes an installation of track-troughs, where our locomotive takes a third long drink. Shortly after these follow dropping grades through the valley of the Chiltern Hills to Brewham. Once through Brewham we have a further high-speed stretch down to Castlecary, near Maidstone, 100 miles from Paddington. The grade here is mostly ascending at 1 in 120, and exceptionally high speeds are run to make up for time that is often lost before this point. Automatic colour-light signals are installed here and it is very fascinating to watch their arms operate on the "somersault" principle.



The down "Portsmouth Pullman" nearing Paddington, hauled by a 4-6-2 "Castle" class locomotive, No. 6100 "Clumber Castle."

"At Taunton a welcome division of the train ensures that the engine will not have an exceptionally difficult task in ascending to Whitehall. Once over Whitehall we have a downhill run of 12 miles to Exeter, which is passed in just over two hours from Liverpool, our average speed at this point having been no less than 49.7 m.p.h. Our journey finishes with a two miles rise at 1 in 42 from Hemerdon Box to the sea at Ais Gill; and on the stroke of 4.35 p.m. our 'Claughton' brings the *Pullman* to rest at North Road, Portsmouth."

* * *

We feel sure that readers will agree that here is a wonderful opportunity for finding mistakes. Each competitor should make a list of these on one side of paper in the order in which they occur, and when he thinks that every error has been accounted for, he should write his name, full address and membership number on the reverse side. Envelopes containing entries should be clearly marked "*H.R.C. Impossible Train Contest No. 3,*" and posted to reach Meccano Ltd., Binns Road, Old Swan, Liverpool, on or before 30th July.

Prizes consisting of Hornby Train goods (or Meccano products if preferred) to the value of 21/–, 15/–, 10/6 and 5/– respectively will be awarded to the senders of the four best entries. In addition a number of consolation prizes will be given.

Entries from Overseas readers should be posted to reach Headquarters not later than 31st October.

Summer Photo Contest

The majority of railway enthusiasts who possess cameras take every opportunity of photographing items of railway interest, but as a rule they do not deliberately set out to photograph a series of special features. In other words, snapshots are made of anything of railway interest that attracts attention, either because there is something unusual about it or merely because it makes a striking picture. The result is that H.R.C. members accumulate by the end of the summer a considerable number of railway photographs of a thoroughly miscellaneous character, with no special type of subject predominating.

For this reason we announce this month "*A Summer Railway Photo Contest,*" without restrictions of any kind as to subject or otherwise. This wide scope will enable any railway photograph to be entered with a chance of success, its prospects depending of course upon its interest from a railway point of view.

There will be four prizes consisting of Hornby Train material (or Meccano products if preferred) to the value of 21/–, 15/–, 10/6 and 5/– respectively awarded to the senders of the four best entries. In addition a number of consolation prizes will be given. Only H.R.C. members are permitted to compete. Every photograph submitted must bear the competitor's name, full address and membership number. Members may send as many prints as they wish, but they are only entitled to one of the prizes.

Envelopes containing entries must be clearly addressed to "*H.R.C. Summer Photo Contest No. 2,*" Meccano Ltd., Binns Road, Old Swan, Liverpool. The closing date is 30th July. The Overseas section closes on 31st October. Entries received after the published closing dates will not be entertained.

COMPETITION RESULTS

HOME

April "Popular Loco Contest."—First: G. L. Nash (19918), Eastbourne. Second: C. Marsh (26619), Didcot, Berks. Third: C. F. Davis (8575), Bedford. Fourth: J. P. Cunliffe (4534), Burton-on-Trent.

April "Layout Planning Contest."—First: C. E. Wrayford (6039), Moretonhampstead, Devon. Second: J. Cables (21250), London, S.E.13. Third: F. E. Saunders (7989), Folkestone. Fourth: K. L. Waite (27337), Waddington, Lincoln.

April "Cab Fittings Drawing Contest."—First: R. A. Shone (26361), Ashton-in-Makerfield, Lancs. Second: K. Costain (5108), Bolton, Lancs. Third: V. C. Kaile (17559), Mayford, Nr. Woking. Fourth: D. A. Newcombe (5903), Cheltenham Spa, Glos.

OVERSEAS

January "Route-Finding Contest."—First: D. J. White (9333), Dunedin, New Zealand. Second: G. C. Gera (29165), Sliema, Malta. Third: L. S. Osborne (24478), Victoria, Australia. Fourth: G. Hallack (17578), Capetown, S. Africa.

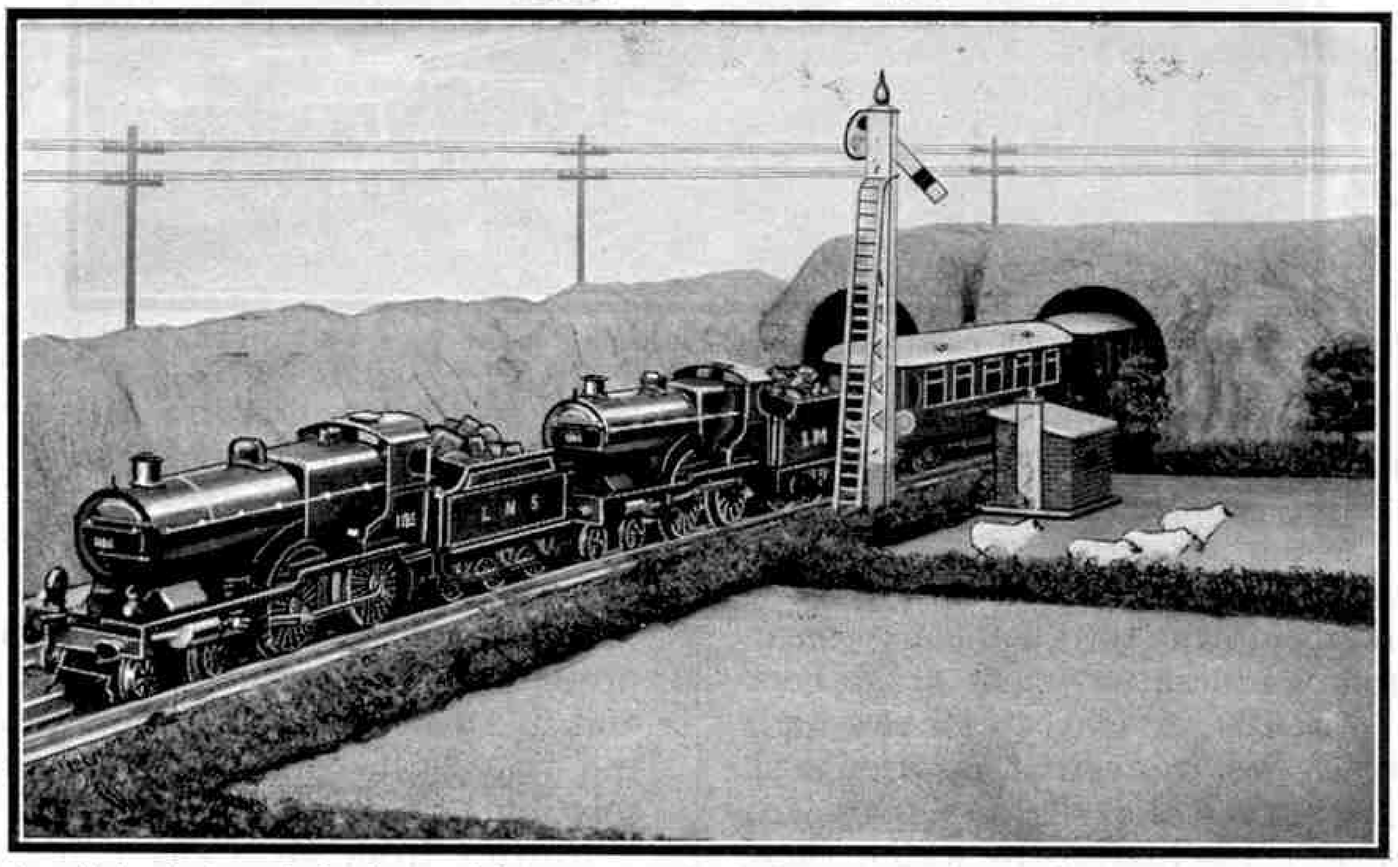
January "Snow Plough Drawing Contest."—First: S. D. Kurlawala, Tardeo, Bombay, India. Second: D. H. Adams (17401), Sydney, Australia. Third: J. E. Brown (27407), Toronto, Canada. Fourth: G. van Eeden, Lusaka, N, Rhodesia, S. Africa.

XLIII.—HINTS FOR SCOTTISH SERVICES

IN the various articles that we have published from time to time upon layouts and different methods of train formation and operation, reference has often been made to the individual practice of the four groups. In the case of the L.M.S.R. and L.N.E.R. we have usually limited our remarks to the English sections of their lines. This month, however, we propose to devote particular attention to Scottish features, as there are numerous points of interest that render them distinct from the characteristics obtaining in England. Also, as a number of our readers will probably be eagerly anticipating a holiday in the North when they read this, they will be keener still to observe such practices as those we are about to deal with.

We will consider first of all the question of motive power, for this to many boys is one of the most important features of the whole railway. In this respect Hornby Railway owners are particularly fortunate, for the largest express classes of the two groups concerned work to and from Glasgow and Edinburgh on the chief expresses such as "*The Royal Scot*" and the "*Flying Scotsman.*" The appropriate Hornby No. 3 Locomotive may therefore be used where available, and if the summer season non-stop running between King's Cross and Edinburgh is to be represented, the semi-circular nameboard on the smoke-box of the engine, as described in the May "*M.M.*," should not be forgotten. "Royal Scot" locomotives are in use on the Caledonian main line, occasionally working up as far as Perth, and there are also two of the latest batch allocated to the G. & S.W.R. section, so that those who favour this rather neglected line may run "*The Thames-Clyde Express*" as between Carlisle and St. Enoch in the appropriate manner. The corresponding Edinburgh train, or "*The Thames-Forth Express*" as it is known, may be hauled by a Hornby "Flying Scotsman" if the famous Waverley route is taken as a prototype, for these engines now work between Carlisle and Edinburgh, and in addition between Edinburgh and Aberdeen.

For less important duties in actual practice the Midland Compounds and the L.N.E.R. "Shires" are largely employed, so that their representations in the Hornby Series—the No. 2 Specials—may be given plenty of work to do. Some extremely hard work is demanded of these engines on occasions, and it is interesting that the Compounds are given much more difficult duties to perform without pilot assistance in Scotland than on their parent system. One particular turn involves running the 240½ miles from Aberdeen to Carlisle, so that in miniature endurance tests may quite conveniently be made on a train representing this particular service. For a clockwork engine, trains such as this are very suitable, as at each stop the engine may be rewound and the entire journey performed in a realistic manner.

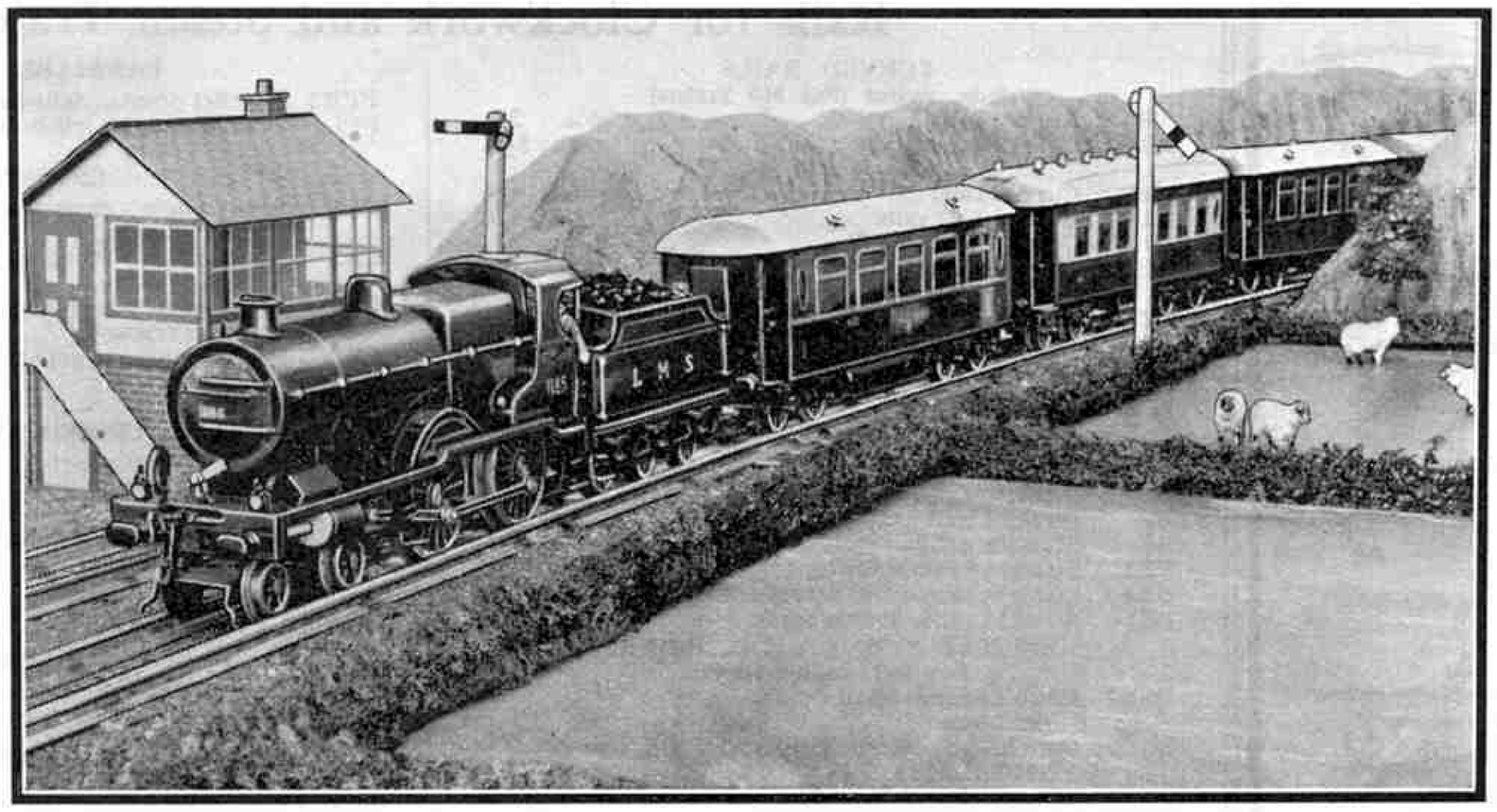


A realistic photograph showing a miniature express hauled by two Hornby L.M.S.R. "Compound" locomotives. Many of these engines are in use in Scotland, where they have some extremely difficult duties to perform both in load hauling and gradient climbing.

A notable route for the "Shire" locomotives is the Glasgow and Edinburgh line of the N.B. section. The extreme flatness of this is similar to the generally level formation of most miniature railways, and favours the haulage of heavy loads, which the engines tackle with success. Only at the Glasgow end is there any particular incline, but the steepness of this fully compensates for the level conditions elsewhere, as the incline is at 1 in 41. Banking engines are therefore in use to assist outgoing trains, so that on a miniature system laid out on these lines the use of assistant engines would be a novel and interesting feature. Formerly trains were assisted up the incline by endless rope haulage, a winding engine being situated at the summit. Although this arrangement has been out of use since 1908, any Hornby Railway owner in search of fresh schemes might experiment, using a stationary engine and winding drum made up from Meccano parts and driven by a Meccano Motor. The haulage up the slope

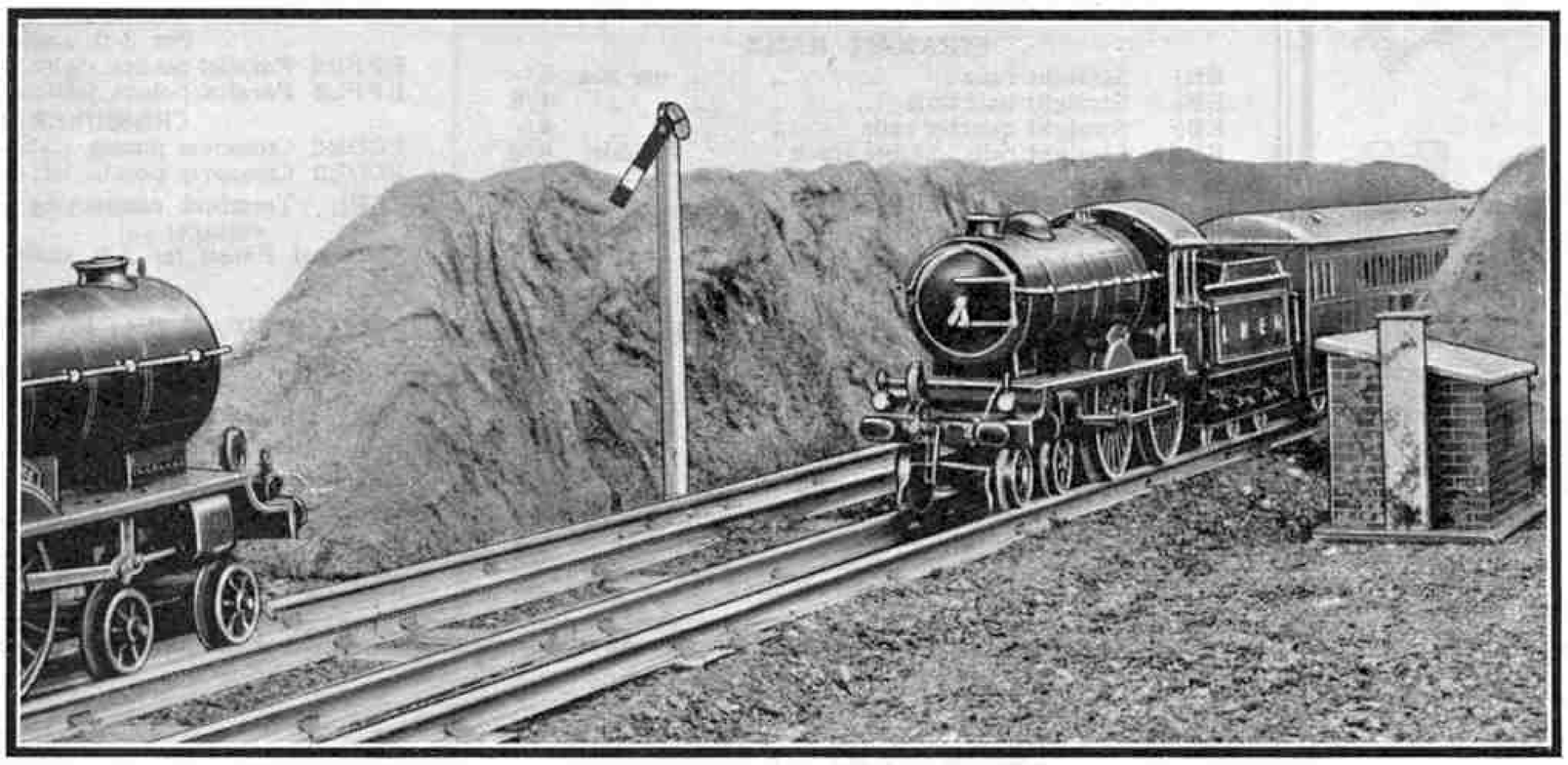
would probably not cause any great difficulty, but special arrangements for the safe passage of trains down the grade would probably be necessary.

"Shires" are also to be found on the N.B. routes to the North to Perth and Aberdeen, where they have some difficult territory to negotiate; and trains for both destinations cross the famous Forth Bridge. A Meccano model of this giant structure would add considerably to the interest and effect of a layout intended to represent the L.N.E.R. in Scotland or a portion of it. As regards goods traffic, practically all sections have a number of the standard locomotive designs working over them, so that the Hornby No. 1 Special, No. 1 and No. 0 Locomotives can be used with every justification. Tank engines of course should not be neglected, and the Ayr trains of the G.S.W. section and the Clyde Coast services on the Caledonian are largely in the hands of big tank locomotives, so that the Hornby No. 2 Special Tank may be found plenty of employment. Engines of this wheel formation are also used on the L.N.E.R. (N.B. section).



In this photograph there appears a Hornby L.M.S.R. locomotive displaying a miniature semaphore route indicator. The train shown represents the Glasgow and Ayr services upon which Pullman cars are run as in this picture.

In the question of coaching stock also Hornby Railway owners are in a favourable position. The famous "*Queen of Scots*" Pullman train is, as its name implies, made up exclusively of Pullman cars, so that a complete train of Hornby No. 2 Special Pullmans may be run to imitate it. Between Edinburgh and Glasgow "Shire" locomotives frequently haul it, so that the Hornby No. 2 Special L.N.E.R. is the obvious choice in miniature. For expresses made up of ordinary stock, Hornby No. 2 Saloon Coaches, some possibly articulated as recently suggested, should be used. Owing to the resemblance of the colour of Metropolitan Coaches to the varnished teak L.N.E.R. stock, the Hornby Metropolitan Coaches may well be employed for semi-fast and local services. Branch and suburban trains may be handled by M3 and No. 1 Tanks, with trains of No. 1 Coaches made up as required.



Two Hornby L.N.E.R. trains passing at speed. Both are hauled by "Shires," and that approaching is made up of Hornby Metropolitan Coaches, as suggested in this article.

Although the L.M.S.R. do not operate any all-Pullman trains as a regular feature—specials are made up thus on occasions—Pullman cars with restaurant facilities are run on a large number of trains, where their handsome umber and cream livery enables them to be picked out readily from the standard red L.M.S.R. coaches. The use of Hornby No. 2 Special Pullmans is therefore again correct, one of them perhaps being included in the make-up of a train otherwise composed of L.M.S.R. No. 2 Saloons. Standard centre-corridor stock is used on practically every part of the L.M.S.R. system, so that the corresponding Hornby Saloons should find a wide use on all the more important trains.

Two of the accompanying illustrations show Hornby L.M.S.R. trains, one double-headed by two Compounds and composed of Saloon Coaches, and the other representing a train on which a Pullman car is run, being in this case the second vehicle from the engine. These cars operate on the Caledonian section to and from Glasgow, Carlisle, Edinburgh, Aberdeen and Oban, and in connection with the latter service may be mentioned the handsome Pullman observation car "*Maid of Morven*." This has no actual counterpart in the Hornby Series, as it is too specialised a vehicle—the only one of its kind in Great Britain—but a Hornby No. 2 Special Pullman run at the end of a miniature train could fulfil the same duties quite well. Pullmans have also worked through from Glasgow to Aviemore on the Highland section since 1922, and they also operate on the Ayr route of the G.S.W. section.

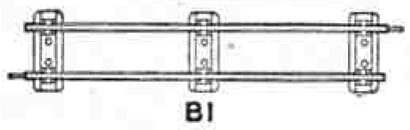
An interesting fitting in use on the C.R. and G.S.W.R. sections of the L.M.S.R. is the semaphore pattern route indicator carried on the locomotives. It was formerly used on the C.R. only, but

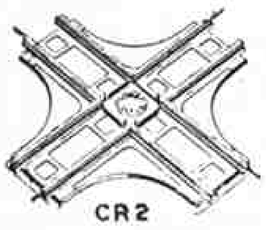
(*Continued on page 572*)

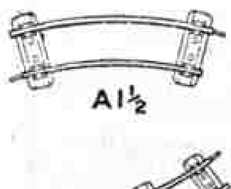
GAUGE O

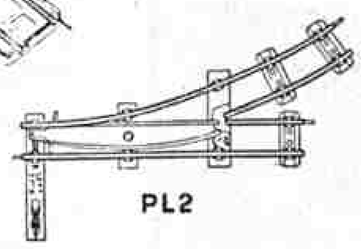
ALTERNATE PEGS

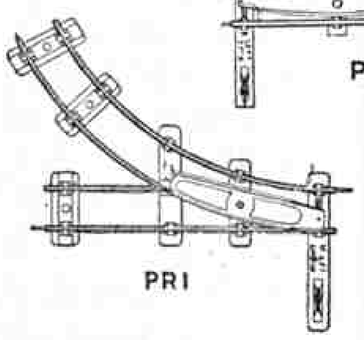
RAILS, POINTS & CROSSINGS

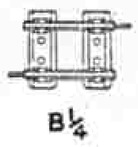


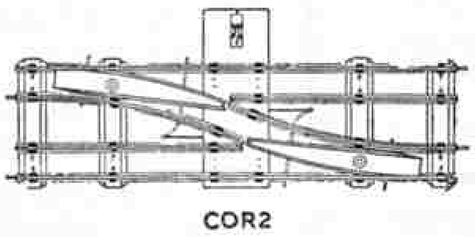


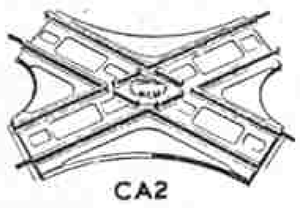


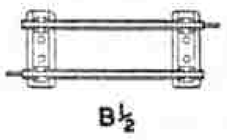


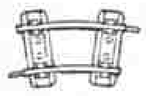


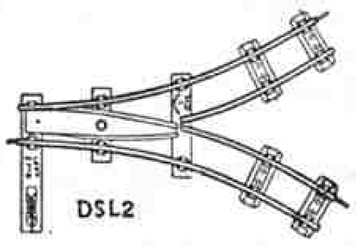


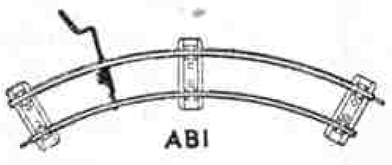


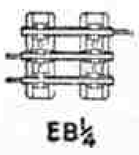


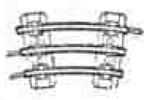


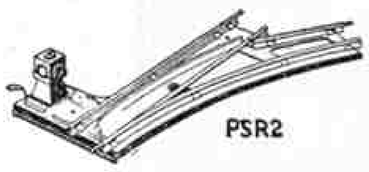


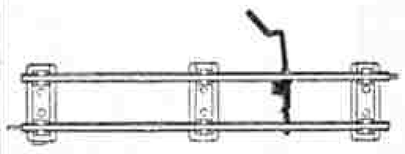


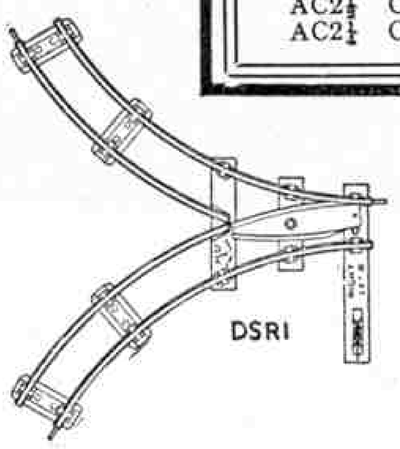


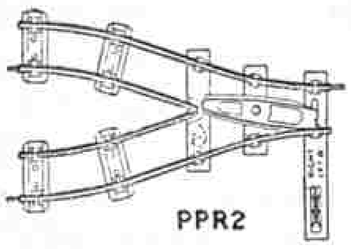


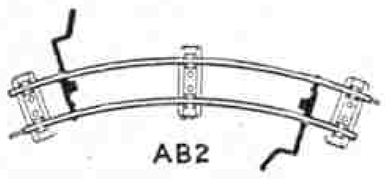


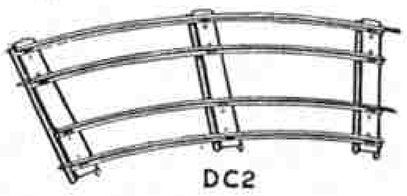


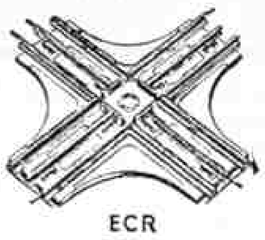


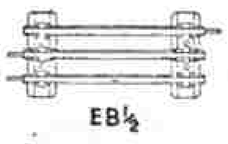


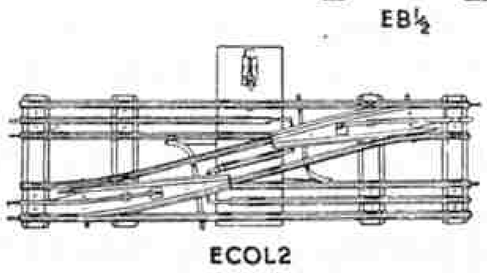


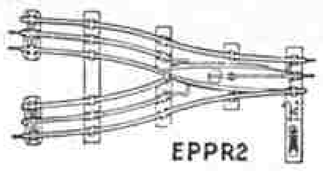


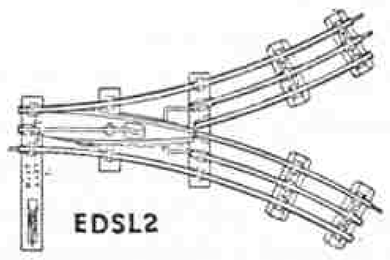


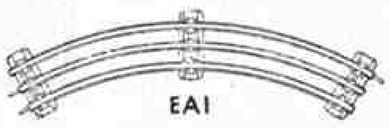


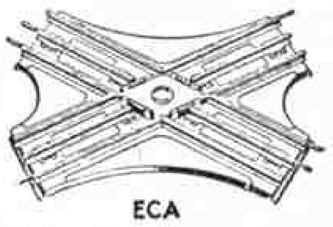


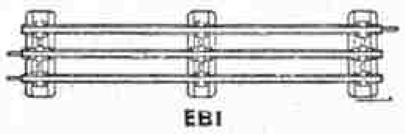












Hornby Rails, Points and Crossings are designed to meet the most exacting requirements of model railway enthusiasts. They make possible an almost endless number of realistic and railway-like layouts. Only the finest materials are used in their manufacture.

Rails for Clockwork and Steam Trains

CURVED RAILS

	9-in. radius (For M0 Trains)		
M9	Curved rails	doz.	3/-
MB9	Curved brake rails	each	3½d.
	1-ft. radius		
A1	Curved rails	per doz.	4/6
A1½	Curved half rails	"	3/6
A1¼	Curved quarter rails	"	3/-
AB1	Curved brake rails	each	6d.
	2-ft. radius		
A2	Curved rails	per doz.	4/6
A2½	Curved half rails	"	3/6
A2¼	Curved quarter rails	"	3/-
AB2	Curved brake rails	each	6d.
DC2	Curved rails, double track ...	½ doz.	7/6

STRAIGHT RAILS

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

DOUBLE SYMMETRICAL POINTS

	For 1-ft. radius curves		
DSR1	Double symmetrical points, right-hand	per pair	5/-
DSL1	Double symmetrical points, left-hand		
	For 2-ft. radius curves		
DSR2	Double symmetrical points, right-hand	per pair	5/-
DSL2	Double symmetrical points, left-hand		

PARALLEL POINTS

PPR2	Parallel points, right-hand... ...	per pair	5/-
PPL2	Parallel points, left-hand		

CROSSINGS

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

CROSSOVER POINTS

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

POINTS

	9-in. radius (For M0 Trains)		
MR9	Right-hand points	per pair	3/-
ML9	Left-hand points		
	1-ft. radius		
PR1	Right-hand points	per pair	4/-
PL1	Left-hand points		
	2-ft. radius		
PR2	Right-hand points	per pair	4/-
PL2	Left-hand points		
PSR2	Points on solid base, right-hand ...	per pair	8/6
PSL2	Points on solid base, left-hand ...		
RCP	Rail connecting plates	½ doz.	2d.

Rails for Electric Trains

CURVED RAILS

	1-ft. radius		
EA1	Curved rails	per doz.	6/6
EA1½	Curved half rails	"	4/6
EA1¼	Curved quarter rails	"	4/-
	2-ft. radius		
EA2	Curved rails	per doz.	6/6
EA2½	Curved half rails	"	4/6
EA2¼	Curved quarter rails	"	4/-
EDC2	Curved rails, double track ...	½ doz.	9/-

STRAIGHT RAILS

EB1	Straight rails	per doz.	6/-
EB½	Straight half rails	"	4/6
EB¼	Straight quarter rails	"	4/-
EDS1	Straight rails, double track ...	½ doz.	8/6

CROSSINGS

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

POINTS

	For 2-ft. radius curves		
EPR2	Right-hand points	per pair	7/6
EPL2	Left-hand points		

DOUBLE SYMMETRICAL POINTS

	For 2-ft. radius curves		
EDSR2	Double symmetrical points, right-hand ...	per pair	8/6
EDSL2	Double symmetrical points, left-hand		

PARALLEL POINTS

	For 2-ft. radius curves		
EPPR2	Parallel points, right-hand	per pair	8/6
EPPL2	Parallel points, left-hand		

CROSSOVER POINTS

ECOR2	Crossover points, right-hand	per pair	24/-
ECOL2	Crossover points, left-hand		
TCPL	Terminal connecting plates (low voltage)	each	1/6

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

Centre Rails for Converting Ordinary Track to Electrical

CURVED CENTRE RAILS

	1-ft. radius		
AC1	Curved centre rails	per doz.	1/-
AC1½	Curved centre half rails	"	9d.
AC1¼	Curved centre quarter rails ...	"	6d.
	2-ft. radius		
AC2	Curved centre rails	"	1/-
AC2½	Curved centre half rails	"	9d.
AC2¼	Curved centre quarter rails ...	"	6d.

STRAIGHT CENTRE RAILS

BC1	Straight centre rails	per doz.	1/-
BC½	Straight centre half rails	"	9d.
BC¼	Straight centre quarter rails ...	"	6d.
ICR	Insulators for insulating centre rails	"	3d.
CCR	Clips for fixing centre rails... ...	"	6d.

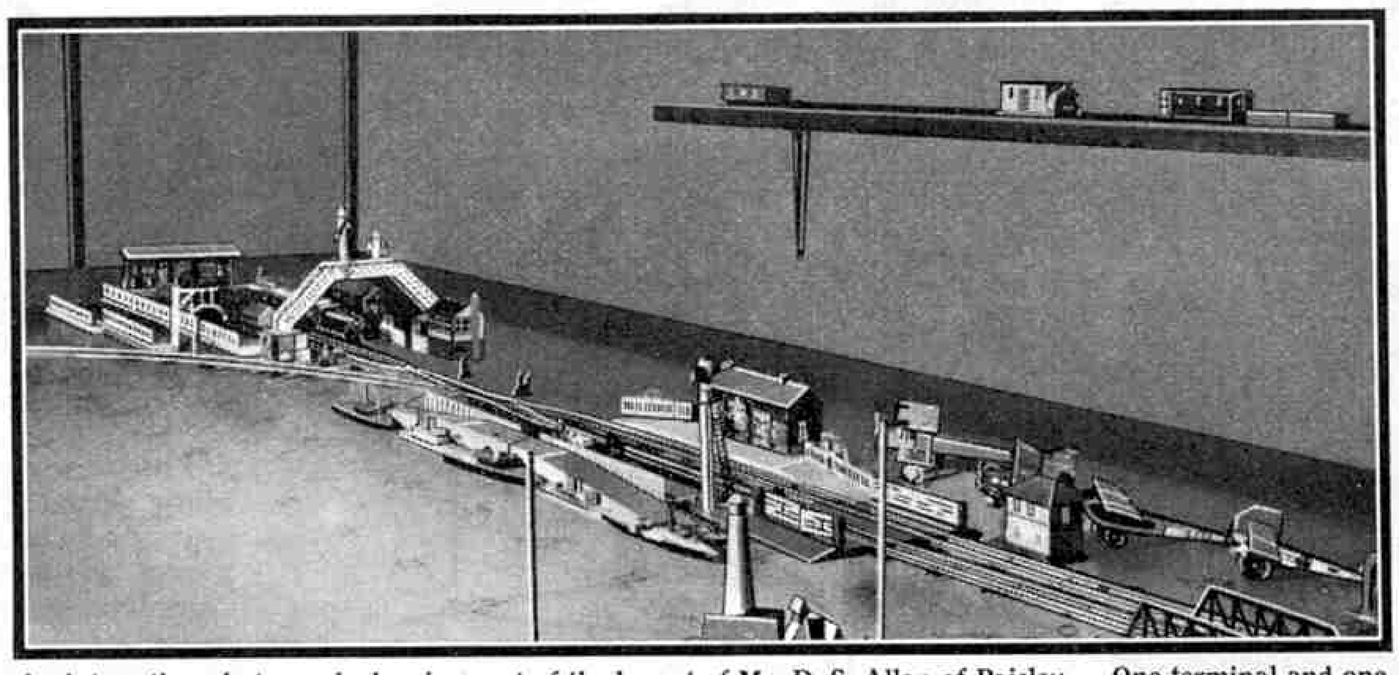
Manufactured by - - MECCANO LIMITED - - OLD SWAN - - LIVERPOOL

Suggested Hornby Train Improvements

VARIOUS USES OF THE PLATELAYER'S HUT

One of the most popular accessories for miniature railway systems is the Hornby Platelayer's Hut. Most readers will be familiar with its general features, for it has a most effective appearance. It imitates a brick-built hut with wooden roof, duly tarred and battened to withstand the ravages of the weather. An outside chimney stack is provided, surmounted by a short pot; and a final touch is the door, which is made to open, and closes automatically by a spring. These miniature huts look well wherever they are placed on the system—at the lineside, near a station or tunnel mouth, or grouped together in a goods or locomotive yard.

A prominent feature of any goods yard is the number of huts or offices belonging to the different coal merchants or colliery agents, who receive coal at the yard and distribute it by means of carts or lorries among the general public of the neighbourhood. A local goods yard may have two or three of these offices on the premises, while in a large yard, or one particularly reserved as a depot for coal supplies considerable numbers of these huts will be found. It has been suggested that the Hornby Series should incorporate a typical coal office, complete with board bearing the merchant's name. Here the main difficulty is to select a design that is suitable in every way for reproduction, and the choice of the name of the merchant or colliery is also a problem. Names familiar in one district are unknown in others, while fictitious names that are sometimes used on such accessories are never satisfactory.



An interesting photograph showing part of the layout of Mr. D. S. Allan of Paisley. One terminal and one passing station appear in the illustration, the latter having connecting steamer services on one side and an aerodrome on the other.

One solution of the problem is to use a Hornby Platelayer's Hut for a coal office. For this purpose it is quite suitable in design, and even the youngest Hornby Railway owners will find no difficulty in arranging the necessary nameboard. This may be made of a piece of thin card, 3½ in. long by ½ in. wide, marked out and arranged as desired, and fixed on the roof. The name of a local merchant or colliery company may then be written on with ink or paint, the style of lettering adopted being copied from the real thing as the result of observation in a neighbouring goods yard. Seccotine on the lower edge of the board will secure it to the top of the roof at the front, and to complete the necessary support separate triangular pieces of card may be attached behind as struts, the slope of the roof being allowed for in drawing these out, so that the board stands vertically. Alternatively these struts may be made in one piece with the board itself by marking them out at each end of the board and bending them round. To complete the hut the words "Coal Office" may appear on a small board over the door, and a miniature price list of the various brands of coal, from kitchen nuts to slack, may be Seccotined to the front wall for the inspection of prospective customers!

When placed in a goods yard the effect of the coal office so arranged will be very striking, especially if one or two miniature "coal stacks" stand near by. The method of constructing these has been described in the "*M.M.*" several times, but for the benefit of new readers a brief note will be of advantage. Some small pieces of coal are placed in a bowl and allowed to stand over-night in water. The water is then poured off, and the coal is spread out on a board or newspaper to dry. A cardboard box of suitable size is then taken and painted black. When the paint is dry, glue is applied to the outside surfaces, and pieces of the dried coal are set in this, so that they cover the sides and top of the stack, as it now becomes. It may be necessary to do the sides and the top separately in order to secure the best results. A neat stack thus formed is quite clean to handle, and yet has the advantage of being formed of real coal, which is far better in effect than the various imitations sometimes used. The top edges and corners of the stack should be smeared with white paint to imitate the whitewashed markings found on real stacks. These markings enable the dark mass of the stack to be picked out at night, thus avoiding the possibility of accidents, and also making any theft of coal immediately apparent. A fine busy air will be given to the goods yard on any layout by the appearance of a coal office and stacks made up as described. A line that makes a feature of its coal traffic may of course have a special yard for this purpose alone, and a number of offices will then be necessary to represent different coal concerns. Readers who put this scheme into practice will be very pleased with the results.

"DOUBLE-ENDER" TANK LOCOMOTIVES

Although the range of locomotives in the Hornby Series is now very extensive, we constantly receive suggestions for additional types and classes to be incorporated, or for modifications to be made to existing engines. There are obvious limits to the numbers of engines of different types that can be manufactured, and it is doubtful whether many of the alterations in design that are proposed from time to time would be generally popular. Fortunately it is often possible for model railway owners to carry out such alterations themselves.

Many readers have asked for the introduction of a 2–4–2 or 4–4–4 "double-ender" type of tank locomotive. This term is applied to engines with a symmetrical wheelbase, the driving wheels being more or less centrally disposed, and the leading and trailing ends supported on similar arrangements of carrying wheels. The original Hornby No. 2 Tank had the 4–4–4 wheel arrangement, but this has been replaced by the 4–4–2 Hornby No. 2 Special Tank, and there is in addition the Hornby No. 2 Electric Tank Locomotive for those whose layouts are operated by electricity. There are relatively few 4–4–4 tanks in use, and the 2–4–2 type is obsolete for new construction, although many of them are still in service, especially on the L.M.S.R. and L.N.E.R. The Hornby No. 2 Special Tank, or the corresponding Electric Locomotive, can be readily converted to a 2–4–2 if required. As thus rebuilt, G.W.R. examples would be relatively correct to type, for that company have several fairly large engines of this wheel arrangement. L.M.S.R. and L.N.E.R. enthusiasts will have to assume that their engines represent possible rebuilds with larger modern boilers of the Lancashire and Yorkshire section "Aspinall" 2–4–2s, or the G.C. section 2–4–2 tanks, as the case may be. Both these types are found with Belpaire fire-boxes and, as regards the general shapes of cab, tanks and bunker, are not unlike the Hornby Tank in question.

The conversion is carried out as follows. The bogie pin is unscrewed, and the bogie truck removed from the engine. The frame above the bogie wheels is taken off by prizing up the lugs that secure it to the main footplate. It is also necessary to remove the leading steps. A pony truck as fitted to the rear of the engine is now required to furnish the leading wheels of the 2–4–2, as the locomotive is now to be. If one from an old engine is not to hand, a new one may be obtained by ordering it specially, the cost of one pony truck being 11d., post free. It will be noticed that there is a projecting "nib" pressed out in the upper arm of the truck and this normally engages in a slotted guide in the cab floor. For our present purpose, however, this nib is removed by bending it alternately one way and then the other. Each side of the small slot now left in the long arm is carefully filed out about its centre just sufficiently to allow the shank of a Meccano Bolt to pass through, but without the Bolt being able to slide in the slot. A line is drawn across the arm of the truck 1/16 in. behind the end of the slot, and the centre of it is marked. If a metal saw is available the arm is now cut through across this line. Alternatively a cut with a file may be made, and the piece not required removed by alternate bending about the cut. From the centre point already marked, lines are drawn to each edge of the arm about ¼ in. away from the previous cut. The surplus metal is removed as before, and any roughness trimmed up with a file.

It will now be found that the shortened pony truck will fit in front of the clockwork mechanism or electric motor of the engine, the forward holding bolt acting as a pivot for the pony truck and passing through the hole that has been adapted for it. Careful adjustment by means of washers and locknuts will be required, so that the pony truck has sufficient up and down movement. A few tests should be made before finally tightening up the nuts, in order to ensure that all is correct. The fixing of the mechanism need not be interfered with, and the holding bolt is long enough to accommodate the pony truck and its locknuts with ease.

If the fitting has been carried out correctly the running of the engine will be quite satisfactory in either direction, the symmetrical disposition of the driving wheels being an advantage; and the smoke-box will overhang the leading wheels by just the right amount. An engine thus altered will be a novel addition to many lines, and if the owner tires of the scheme it can easily be restored to its former condition.

JUNCTION SIGNALS.—Your suggestion that a signal for use at junctions where the branch line is on the left should be introduced will receive careful attention. The present junction signal is quite correct for working right-hand branch lines. (*Reply to T. Tucker, Bristol.*)

WAGONS FITTED WITH BRAKES.—Your proposal that we should introduce brake-fitted wagons is interesting. It would be useful when a number of wagons are to be held on an incline and we shall consider the idea. (*Reply to J. A. Evans, Cardiff.*)

FOOTBOARDS ON GOODS BRAKE VANS.—An improvement in appearance would be effected by fitting footboards to Hornby Goods Brake Vans and other vehicles on which their use is appropriate. On revising our rolling stock careful consideration will be given to this point. (*Reply to L. Gates, Darlington.*)

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Please send me the complete constructional plans for the C C B AIR PARK. I enclose the top from a C C B packet.

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NATURAL FARMING

"You look very happy," said the walker.

"Yes," said the farmer, who was seated on a fence smoking his pipe. "I was just going to fell this tree when the lightning came and did it for me."

"That was fortunate, but what are you waiting for now?"

"An earthquake to dig up my potatoes."

* * * *

During his first tour of the office the new chief was stopped by an old clerk.

"Do you know, sir," he said, "I have been with the firm for forty years and during all that time have made only one mistake."

"I congratulate you," said the new chief. "But in future please be more careful."

* * * *

Bill: "What did you get that certificate for, Jimmy?"

Jimmy: "For politeness, you silly idiot!"

* * * *

"Now, Martha, I'd like you to polish the silver until I can see my face in it."

"I wouldn't, if I was you, mum."

* * * *

Customer: "You are very slow at figures, my lad."

Newsboy: "I'm out of practice, sir. Most of my customers say 'Keep the change.'"

* * * *

Judge: "You say this man robbed you. Can you distinguish any of your property among this heap?"

Witness: "Yes. That handkerchief is mine. I know it because there's an 'M' in the corner."

Judge: "But that's no proof. I myself have a handkerchief with 'M' in the corner."

Witness: "That's right, sir, I lost two."

* * * *

The little girl was very worried and she came downstairs with her dress unbuttoned in order to express her grievance.

"How can I button my dress when the button is at the back and I'm at the front?" she demanded tearfully.

* * * *

Stout Teacher: "Can any boy tell me what a canary can do and I can't?"

Small Boy: "Please, sir, have a bath in a saucer!"

* * * *

"Now, I'll give you a piece of my mind," said the cook wrathfully to the kitchen maid.

"Just a small helping, please," murmured the maid.

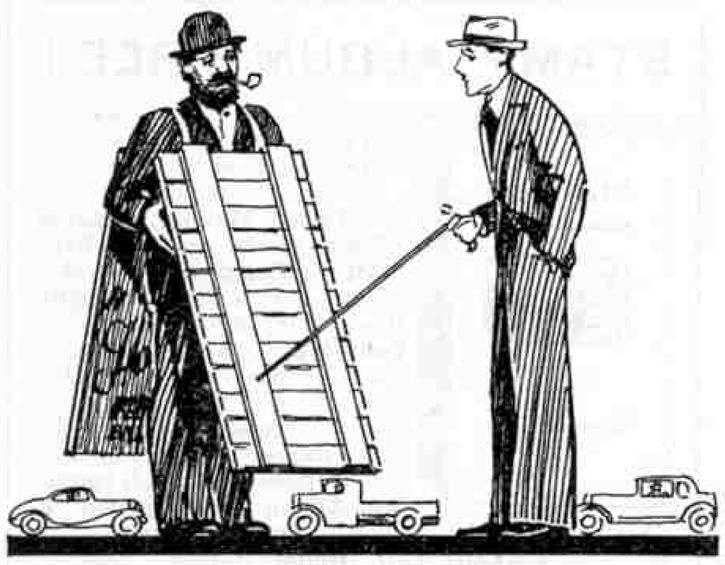
* * * *

Mr. Brown: "I was surprised to see your little boy driving your car."

Mr. Green: "Why shouldn't he? He isn't old enough to be trusted as a pedestrian."

* * * *

AN INTERVAL FOR REST



"Excuse me," said the well-meaning pedestrian, "Do you know that your advertisement boards are turned wrong side out?"

"Sure, I know it," was the reply. "Yer don't suppose I'm goin' to work in me lunch hour, do yer?"

* * * *

Customer: "What's this in my soup?"

Waiter: "Don't ask me, sir. I don't know one insect from another."

ESAU WOOD'S SAW

Esau Wood saw a saw saw wood as no other wood saw Wood saw would saw wood. Indeed, of all the wood saws Wood ever saw saw wood, Wood never saw a wood saw that would saw wood as the wood saw Wood saw saw wood would saw wood, and I never saw a wood saw that would saw as the wood saw Wood saw would saw, until I saw Esau Wood saw wood with the wood saw Wood saw saw wood.

* * * *

Wagg: "Did you have any luck when lion hunting in Africa?"

Bragg: "Rather! I didn't meet a single one."

* * * *

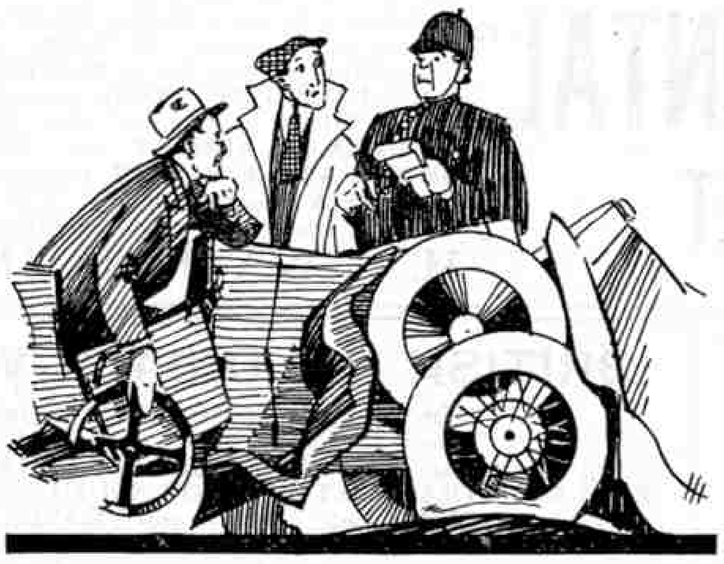
A man was crossing a street when a large dog knocked him down. He was getting up when he was knocked down again, this time by a "baby" car.

A policeman rushed to his assistance and asked if he was hurt.

"The dog didn't hurt me," replied the dazed pedestrian. "It was the tin can fastened to his tail that did the damage."

* * * *

PUTTING THINGS IN ORDER



Constable O'Grady hurried to the scene of the collision and produced his pocket book.

"Now then," he demanded of the drivers, "which of yez cars hit the other one first?"

* * * *

"Can you employ my son in your office?"

"What can he do?"

"Why ask? If he could do anything I should employ him in my own office."

* * * *

"Got a bit o' baccy to spare, Bill?"

"I thought you'd given up smoking?"

"I have, but I'm a-breakin' meself of it gradual. I don't smoke me own baccy any more."

* * * *

Sunday School Teacher: "And when it rained forty days and forty nights, what happened?"

Bright Boy: "The natives said it was very unusual."

* * * *

The policeman was taking the offender's name and address.

"Why do you always lick your pencil before you write down the particulars?" asked the culprit.

"To make the case look blacker," said the constable, frowning ominously.

* * * *

Father: "Now, Henry, hurry up and cut that wood. It's far easier to do a thing than to sit and think about it."

Jimmy: "Well, dad, you cut the wood and I'll do the hard work."

* * * *

"We don't print any such stuff as that," said the Editor, handing back the poem.

"You needn't be so haughty about it!" retorted the poet. "You're not the only one who won't print it!"

* * * *

Cinema Commissionaire: "I'm sorry, madam, but you can't take that cat into the pictures. You'll have to leave him with me."

Lady (indignantly): "I shouldn't dream of it. Pussy particularly wants to see 'Mickey Mouse.'"

A RECORD PERFORMANCE

The actor had just returned from a country tour.

"What sort of run did you have at Ditcham?" a friend asked.

"Oh! we were lucky there," said the actor, "we beat the audience over the parish boundary by half a minute."

* * * *

Head Clerk: "Don't ever dare call me big boy again! I've had quite enough of your film expressions."

Office Boy: "O.K., chief."

* * * *

The schoolboy was discussing his guardian with a friend.

"He may be very kind, but my requests for more cash are always ignored in his letters to me. What sort of kindness do you call that?" he asked bitterly.

"Unremitting kindness," was the reply.

* * * *

Old Gentleman: "I am surprised to see a boy like you throw that stone at a little bird. I could never do a thing like that."

Little Boy: "Oh, it's really quite easy."

* * * *

"Can you kindly spare a crust, mum?" said the tramp.

"But I gave you some cake last week," said the lady of the house, "and yet you call again."

"That's quite right, lady," replied the tramp. "Your cake didn't worry me; you see I used to be a sword swallower."

* * * *

"I don't like that fellow Brown."

"Why not?"

"He is the sort of man who pats you on the back to your face and smacks you in the eye behind your back."

* * * *

Actor: "Did you see how the audience cried when I acted in the death scene?"

Critic: "Yes; they knew you weren't really dead!"

* * * *

Artist: "A thousand wouldn't buy this picture!"

Candid friend: "Quite right, and I'm one of the thousand."

* * * *

The Small One: "Might I have this dance?"

The Tall One: "Yes, you mite."

* * * *

Farmer (to boy): "Hold my horse a while, my lad."

Boy: "Will it bite?"

Farmer: "No."

Boy: "Will it run away?"

Farmer: "No."

Boy: "Then what d' ye want me to hold it for?"

* * * *

UNRECOGNISED

Constable: "Have you seen a pedestrian pass this way recently?"

Farm Labourer: "No, sir, I've been workin' in this field more'n an hour, an' only one man has passed me, an' he wuz afoot."

* * * *

Owner of Village General Shop: "A pound of ochre? Do you mean red ochre for painting bricks?"

Small Boy: "No, it's tappy ochre fer mother to make puddin' with."

STAMP COLLECTING AS A CAREER

Have you ever thought of becoming a stamp dealer yourself? If so, then you **must** read the special article appearing in GIBBONS' STAMP MONTHLY for June in which Mr. Stanley Phillips, the well-known philatelist, discusses your chances and your prospects.
The Magazine also includes interesting articles on the new Garibaldi stamps of Italy, on Siam, Jamaica and Poland, etc., while a Supplement to Gibbons' Catalogue is given away FREE. This number (for June) will be sent you for **4d.** post free.

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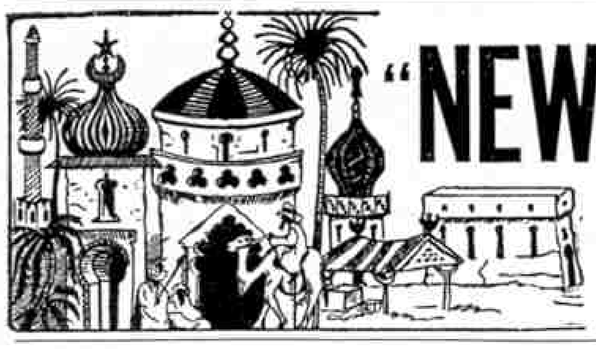

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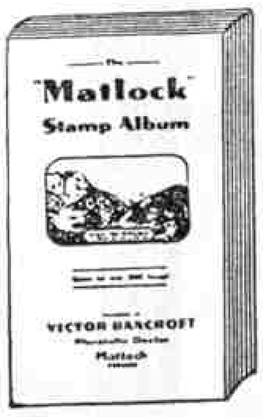

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Stamp Advertisements continued on page 558

Stamp Gossip

and Notes on New Issues

The Sydney Harbour Bridge Commemorative

Australia's philatelic celebration of the opening of the Sydney Harbour Bridge is a worthy mark of an important occasion. The production of the stamps is well up to the high standard that the Australian Government Printing Department has set for itself in recent years. The issue consists of three stamps only, 2d., 3d. and 5/- values, each bearing the design illustrated here, showing a splendid view of the bridge itself.

Readers of the "*M.M.*" are already familiar with the details of the bridge, for several special articles dealing with it have been published in the "*M.M.*" in recent years. For the benefit of those who wish to include brief details in their stamp albums, when "writing up," we list the main dimensions; Length of main arch span, 1,650 ft.; Total weight of steel in five northern and five southern approach spans and main span, 50,200 tons; width of bridge, 150 ft.; highest point of arch, 445 ft. above high water; clearance under bridge at high water, 172 ft.; traffic capacity, 160 trains and 6,000 road vehicles in both directions, and 40,000 foot passengers per hour.

We reproduce also the 1/- value of Australia's new general issue which is gradually superseding the existing King's Head design. Readers will recall that details of the designs of the new issues were given in our Stamp Gossip notes in November last.

* * *

Messrs. Whitfield King & Company announce that in future all references to Abyssinia in their lists and catalogues will be made under the name Ethiopia. Although the country has been commonly called Abyssinia for many years, its true name has been Ethiopia since the time of King Menelik; and from 1909, when Roman characters were first used in the country's stamp designs, the name "Ethiopie" has appeared.

In their "*Philatelic Bulletin*," in which this announcement appears, Messrs. Whitfield King further comment that the Ethiopian people resent the use of the word "Abyssinia" because of its derivation from the Arabic *Habesha*, meaning "mongrel."

We thank Stanley Gibbons Ltd. for their courtesy in loaning the stamps from which the illustrations for our stamp pages have been made.

Britain's Earliest Air Mail

It is a common belief that Britain's first air post was a balloon post operated in connection with a "Lifeboat" fete at Manchester in 1903. Mr. Oscar Mathias, of the Berlin Philatelic Society, writing in *Gibbons' Stamp Monthly*, states that this is an error. The first English air mail was a balloon post sent out by the British Admiralty in 1850 in an attempt to make contact with Sir John Franklin during his expedition in search of the North-West Passage from the Atlantic to the Pacific.

In 1845 Sir John Franklin set off on his great adventure, and when two years had passed without any news of the voyagers expeditions were sent out from Great Britain and the United States in an effort to locate them. Among the suggestions for communicating with Franklin was one from an Englishman, Shepherd by name, who conceived the idea of sending out balloons to carry news to the lost explorers. Shepherd sent a whole wagon load of balloons, and with them small slips of soft paper, light green in colour, five inches in length by two inches in depth, printed on a hand press on one side in black and on the reverse in red. On the front were the words "Despatched —— by a balloon from H.M.S. —— in Lat. —— N., Long. —— W., to Sir John Franklin." The reverse side bore the words "Provisions left at ——. Steering for ——. Intending to winter at ——, or in the vicinity."

In 1850 the most important relief expedition of the British Admiralty was sent out, consisting of eight boats under Captain Austin working from the Atlantic Ocean, and two boats under Captain McClure working from the West through the Behring Strait. When Captain Austin's squadron was icebound in Assistance Bay, messages for Sir John Franklin were sent out by Shepherd's balloons.

One of these balloon post messages has survived until the present day, and was shown at a meeting of the Berlin Philatelic Club in September, 1930.

A Southern Rhodesian Issue

Memories are awakened by Southern Rhodesia's introduction of the Victoria Falls as the subject of the stamp design to replace the existing 2d. and 3d. issues.

As our illustration shows, the design is almost identical with that of the British South Africa Company's 1905 issue.

Garibaldi Memorial Series

Italy has celebrated the Jubilee of Garibaldi, the great Italian champion of the oppressed, by a special postage stamp series, that was issued on 6th April.

The set consists of five air stamps and ten general issues, each bearing the dates 1882–1932 and depicting some incident in Garibaldi's life, as follows:—Air Mail series, 50c. and 1L., Garibaldi's house at Caprera; 80c., the Farmhouse in which Garibaldi's wife Anita died; 2L.+50c., Portrait of Anita Garibaldi; 5L.+1L., Portrait of Garibaldi; General issue, 10c., View of Caprera, where Garibaldi died; 20c. and 30c., Meeting of Garibaldi and Victor Emmanuel; 25c. and 50c., Garibaldi at the Battle of Catalafimi; 75c., Garibaldi carrying his dying wife when hunted by the Austrians; 1L. 25c., Garibaldi's tomb; 1L.75c.+25c., Rocks of Quarto, where Garibaldi's legionaries embarked for Sicily; 2L.25c.+50c., Garibaldi memorial; 5L.+1L., Portrait of Garibaldi.

Ireland's Eucharistic Congress Issue

The most interesting of the Irish Free State's commemoratives to date is the Dublin Eucharistic Congress issue illustrated here.

The design strikes an interesting note, for a Latin inscription appears on an Irish stamp for the first time. The general motif of the design is a chalice set upon the famous Cross of Cong, a magnificent 12th century ornament of silver and gold made specially for Turlough O'Connor, then King of Connaught. The cross, which is now included in the National Museum at Dublin, is 2½ ft. in height and magnificently covered with Celtic decoration.

It is another interesting fact that, although the Eucharistic Congress has been held regularly since 1881 in various parts of the world—Malta, Australia, England, Spain, Italy, Germany and Palestine, for example—and is usually attended by many hundreds of thousands of people, this is the first occasion that it has been commemorated philatelically. The issue comprises only two values, 2d. and 3d., the design being the same for both stamps.

The Irish Free State has in preparation a further commemorative set to celebrate the 1,500th anniversary of St. Patrick's arrival in Ireland.

Stamp Advertisements cont. from p. 556

100 DIFFERENT STAMPS FREE. Send for ½d. Approvals.—Cox, 21, Dennis Mansions, Westcliff.

Quality and Quantity. Marvellous value Approvals. Nothing over 1d.—H. Bulland, Wood House, New Barnet.

500 WORLD-WIDE STAMPS, 6d. 200 BRITISH COLONIALS, 9d.—Way, Wilmslow, Cheshire.

FREE ! 50 diff. Stamps or 15 Czecho-Slovakia. Request approvals.—J. Cowell, 59, Manor Rd., West Ham, E.25.

250 Brit. Cols. incl. Egypt 9d., or 300 Mixed, 5d. Postage 1½d.—J. A. Adams, 51, Bannfield Road, Harpenden, Herts.

6d. The Wonder Packet, 6d. Postage 1½d. **FREE ! ! !** Up to 20 good stamps (Cat. 2/6 to 6/- guaranteed). This packet contains 500 unsorted mission stamps in which many rare kinds have been found. Purchasers of above asking for approvals will receive this unique gift.—**G. L. Wright, 27, Normandy Ave., Barnet.**

THE FIRST STAMP EVER ISSUED
(Great Britain 1840 Penny Black), a genuine postally used copy for 1/9. You must have one of these. 2d. Blue companion stamp (cat. 20/-) for 5/-. CAPE triangular 5/-. LISTS FREE.
NORRIS & CO. (Dept. M), NORWOOD, LONDON, S.E.19

DOMINICA
A new set of handsome pictorial stamps from this British Colony, sent free of charge to bona-fide applicants for selections of duplicates on approval. 20 different Malta post free, 1/-.
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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.
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39, Rosebery Gardens, Hornsey, London, N.8.

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I am sending FREE 65 different stamps to all applicants who request books of British Colonials and Pictorials, from ½d. each, less 25% discount. This excellent packet includes obsolete Iraq, 3 Tigers of Malay, 2 Str. Sett., 3 Pictorials of South Africa, Old Gold Coast, and many other good stamps.
ERIC J. WATTS, 48, London Road, Northampton.

SARDINIA PACKET FREE
A fine packet of all different Stamps containing **Sardinia,** unused; **Brunei,** unused; **Jamaica, 1/-** and **2/-**; **Mesopotamia**; **Transvaal 1d.,** unused; **Paraguay,** 1931, 1c. and 2c., unused; **Set of 3 Prussian,** officials, unused; **Philippine Is.**; **Siam,** large head; **Travancore**; **Turkey**; **New South Wales,** etc., free to all asking to see my famous approval sheets and enclosing **2d. for postage** and packing (**Abroad 3d.**). Albums 1/4, 1/10, 3/-, 4/-, 6/-, 7/6, 10/- and upwards.
S. HAMMOND, 2, Chesham Fields, Bury, Lancs.

INININI. This French territory, formerly a part of French Guiana, has made a provisional issue of stamps by overprinting the stamps of French Guiana "TERRITOIRE DE L'ININI." We can supply a set of 5 different. Price 6d. Post Free.
ASK TO SEE OUR APPROVAL SHEETS.
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THAT YOU MAY
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(Insist upon the genuine.)
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Sole Importer: **F. E. DICKINSON,**
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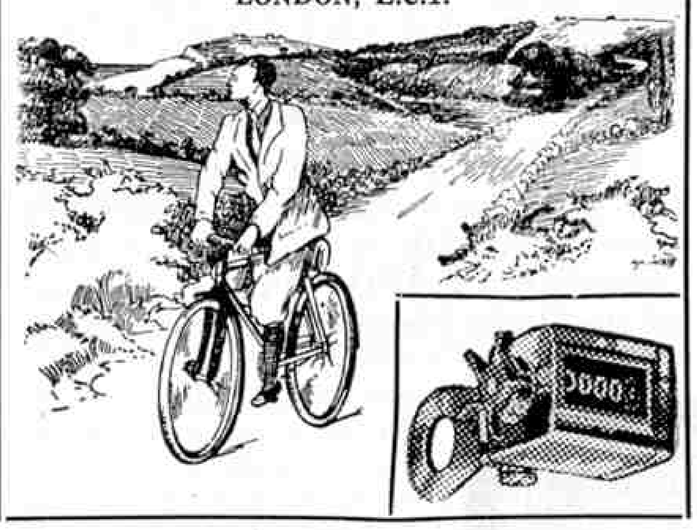

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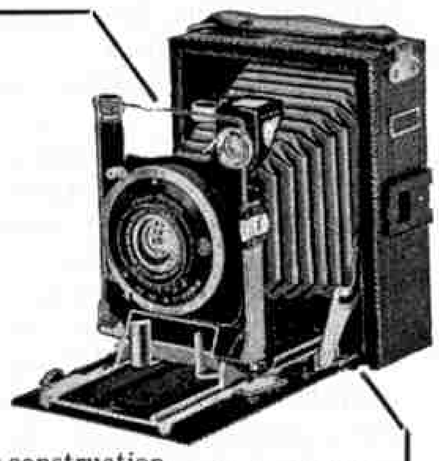
The 1932 Special Zodel de Luxe

Size 3½ × 2½, de luxe construction throughout. Full double extension, as rigid as a rock. Rising and cross front. **Fitted with our world-famous F/3.8 ZODELLAR,** 105-mm. focus. Latest pattern Compur shutter with delayed action. Direct-vision viewfinder. With 3 slides. A first-class camera throughout.
YOURS FOR 18/5 and 8 similar monthly payments.
CASH PRICE £7/17/6.
Roll Holder, **15/-**. F.P. Adapter, **8/6.**
Extra Slides, **3/-** each.
Send 2d. Stamp for Free Bargain List!
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Photography—(*Continued from next page*)

exposed to the light falling upon the subject to be photographed, and a note is made of the time taken by the paper to darken to the same shade as that of a sample tint alongside it. When this time has been found, the correct exposure is quickly calculated for the particular plate or film in use according to the instructions issued with the meter.

Exposure calculators differ from meters in that there is no actual measuring of the strength of the light. Simple tables are provided for each month of the year, the time of day, and the general weather conditions. One of the most reliable calculators of this type is that incorporated in the Photographic Handbook published by Messrs. Burroughs Wellcome & Co. This calculator is remarkably simple to use, and will save many times its cost in plates or films in the course of a season.

In using a calculator judgment is really only required in regard to the subject. This is made a perfectly simple matter with the Wellcome calculator, for the various types of subject are illustrated so clearly by a series of small photographs that it is almost impossible to go wrong.

Roadless Transport—(*Continued from page 507*)

a district of sand dunes covered with scrub, which had proved impassable to ordinary heavy motor vehicles. In spite of the difficult ground conditions and a 3-ton load, however, the six-wheeler crossed the soft sand without difficulty and maintained an average speed of 11 m.p.h. until the foothills of the Andes were reached. Here the sandy ground gives place to soil of a more clayey nature, with occasional patches of lava. During the rainy season this soil is readily carried away, and as a result the track in places is washed into ruts 2 ft. to 3 ft. deep. The six-wheeler therefore left the track and travelled across country, and arrived by a roundabout route at the one ranch in the district five days after leaving Colonia, having covered nearly 400 miles of difficult country.

The return was made by the direct route and the distance of 124 miles was covered in about 10 hours, whereas the native mule carts drawn by six mules take 10 days to accomplish this journey. The tour proved the value of six-wheeled vehicles in opening up new districts where there is at present no satisfactory means of transport and insufficient traffic to make the construction of good roads or branch lines profitable.

Working Model—(*Continued from page 535*)

the Gears 18 the impression roller is also rotated, but the slides 19 and 20 remain stationary. The roller is now placed in its position on the machine by passing the slides over the double Angle Girders 7 and 8 and lowering the entire roller until the Gear 18 engages with the teeth of the Rack Strips 15 (Fig. 3). In this way the movement of the roller is synchronised with the movement of the platen during printing operations.

The impression mechanism (Fig. 1) is operated in the following manner. Each end of the 8″ Rod carrying the impression roller is fitted with a Small Fork Piece that is prevented from slipping by means of a Collar secured on the Rod between its jaws. The Fork Piece carries a Vertical 8″ Rod, the lower end of which is fitted with a second Small Fork Piece carrying a Coupling. This Coupling is attached to one end of an 8″ Rod, journalled in the bosses of Cranks secured to the Girders 7 and 8; and this carries two further Couplings 21 and 22, the purpose of which will be described later. The necessary compression is given to the impression roller by means of two Springs, one of which is fitted to each 8″ side Rod by means of a Collar. This Collar is held in place on its Rod by a Handrail Support fitted with a 1″ Rod. The lower end of the Spring is connected to the frame by means of a ¾″ Bolt. By securing the Springs to their respective Rods as indicated it is possible to alter the amount of compression on the impression roller quickly and easily, and small file notches in the Rods will assist in retaining an even pressure on both sides of the roller. This, of course, is necessary, as different types of printing require different pressures.

An Efficient Pocket Microscope

We have received from Mr. H. A. Crowhurst, F.S.M.C., Victoria Road, Surbiton, a pocket microscope that is about the size of an ordinary fountain pen, and is provided with a clip to enable it to be carried in the pocket or in a holder. In spite of its small size the microscope is highly efficient, for it has a magnification of 25, and the simple but effective focussing device incorporated produces a perfect image.

The instrument will be particularly valuable to those who are interested in nature study. It is sufficiently powerful to show clearly the forms of the stamens, pistils, etc., of even tiny flowers, and the wonderful structure of the wings and other parts of insects. The microscope will be exceedingly useful also to readers who are interested in stamp collecting, where minute differences between apparently similar specimens are frequently encountered.

The instrument undoubtedly will prove a constant source of delight to any keen Meccano boy, and readers interested are referred to the advertisement on page 570.

SHUTTERS AND THE EXPOSURE PROBLEM

A refreshing drink outside a Zanzibar store.

PHOTOGRAPHIC exposures may be made by means of a cap fitting on the hood of the lens, and this method works quite well for fairly long exposures with a camera used on a stand. For use with a hand camera, however, some kind of mechanical shutter is essential. The simplest form of shutter works at one fixed speed and consists of a metal plate revolved on a pivot by a spring, and containing an aperture that passes in front of the lens, so making the exposure. Before and after the exposure the lens is covered by the metal plate. The speed of a shutter of this type may be anything up to 1/25 of a second. Sometimes an arrangement is fitted by means of which the aperture may be made to stop in front of the lens as long as required in order to give "time" exposures.

This type of shutter is not only comparatively slow in working, but it has also many other disadvantages; and it is replaced on good class cameras by a shutter having two metal or vulcanite plates that open and close to make the exposure. The speed of these shutters is controlled by a pneumatic valve operated by turning a dial. Most shutters of this type are marked with the letters "B," "T," and "I," which represent respectively "Bulb," "Time" and "Instantaneous." If the shutter is set for "Bulb," the small trigger operating the shutter is pressed down and the shutter remains open until the trigger is released. The term "Bulb" is derived from an earlier form of shutter that was operated by a ball and tube, such an exposure as we have just described being given by squeezing the ball and not releasing it until it was desired that the shutter should close.

A Zanzibar milk boy.

When the shutter is set at "T," it opens when the trigger is pressed. The trigger is then released, and the shutter remains open until a second pressure is made, when it instantly closes. "Instantaneous" exposures are made by one pressure of the trigger, and the varying speeds at which the shutter will work are usually indicated on a dial that is revolved to set the required speed.

The roller-blind shutter, which works on a similar principle to the familiar domestic spring blind, has an opening that makes the exposure by passing in front of the lens. The blind is wound by pulling a cord, and released by pressure on a small trigger. This form of shutter is excellent for stand camera work, but is not at all satisfactory for small hand cameras.

All the foregoing types of shutter are always fixed close to the lens. We now come to a shutter fitted at the back of the camera, so that it works immediately in front of the plate. This is the "focal plane" shutter, which is in many ways the most valuable and the most interesting of all shutters. In many respects the focal plane shutter is similar to the roller-blind type, and as in the case of the latter its blind has to be wound up and released. It has two outstanding advantages—an exceedingly high speed, and great light efficiency, that is to say it allows more light to reach the plate during a given exposure than almost any other type of shutter. A focal plane shutter is capable of giving exposures of one-thousandth of a second or even less, and for this reason it is used for the photography of rapidly-moving objects such as trains or motor cars, or for obtaining snapshots of cricket, football and other games.

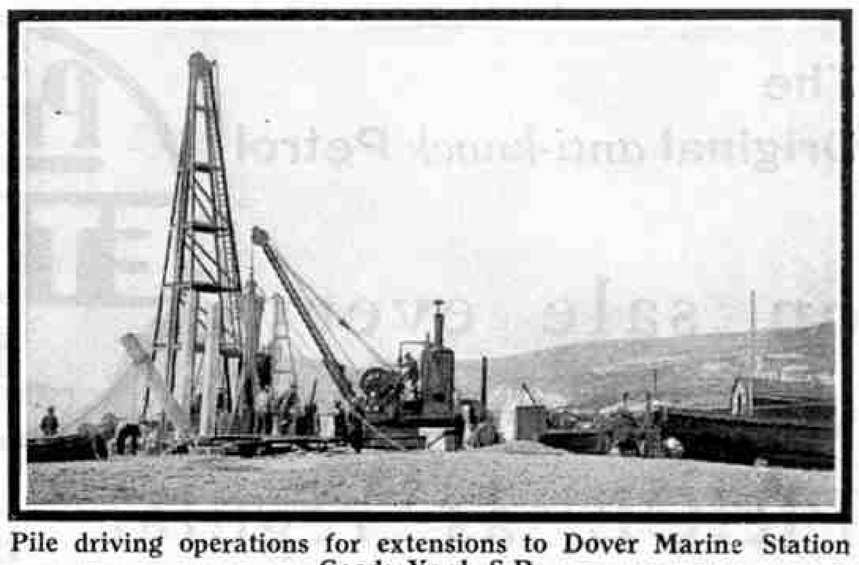
In taking a photograph the aim of every photographer is, or should be, to produce a "perfect negative," that is one that reproduces faithfully all the varying gradations of tone in the subject. Such a negative can only be obtained by allowing the light reflected from the subject to affect the sensitive emulsion on the plate or film for exactly the correct length of time. In other words, the plate or film must be given the correct exposure. At one time it was generally believed that, although correct exposure was highly desirable, yet if by any chance the exposure was wrong it could be compensated for in the subsequent process of development. This idea is now known to be erroneous. It is quite true that incorrect exposure may be remedied slightly during development, but the improvement thus effected is barely noticeable and is very difficult to obtain.

There are five factors governing exposure—the strength of the light; the aperture of the lens; the speed of the plate or film; the nature of the subject to be photographed, and the movement of the subject. The strength of the light depends mainly upon the height of the sun above the horizon and the clearness or otherwise of the atmosphere. For many years photographers used to guess the strength of the light, the success of such guesses of course depending largely on the length of the photographer's experience. In addition to the errors introduced by this guesswork there was also the difficulty that the speeds of the various plates used were not known with anything like accuracy.

To-day the exposure problem is rendered comparatively simple by means of exposure meters or exposure calculators. In order to estimate exposures accurately by either of these means it is obviously necessary that the speeds of the various brands of plates or films should be known, and therefore the makers of the best exposure meters and calculators issue lists of plates giving definite and accurate speed numbers, which are obtained by actual tests, without reference to the speed numbers given to the plates by their manufacturers.

An exposure meter consists essentially of some kind of a case containing a strip of sensitized paper that darkens when exposed to light in accordance with the photographic strength of that light. A tiny piece of this paper is

(Cont. on p. 558)



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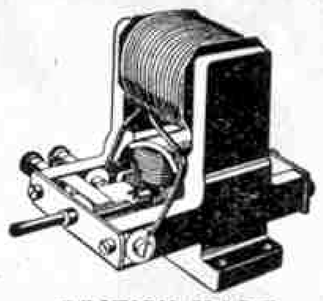

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A clever novelty that causes merriment whenever he starts his weird antics. First wind 'Bogey Bogey' up with the special key provided and the little black demon will begin the fun. Price only ... Post 3d. **1/3**

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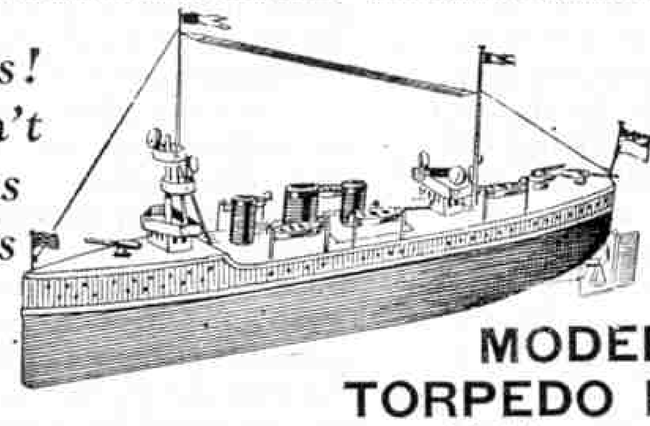
These models incorporate the very latest ideas in model aeroplane construction—silver fabric and the new automatic rudder. They give longer flight and are of improved appearance.

Model No. 2. (As illustrated). Length 19". Wing span 19". Silver Silk. Coloured Propeller. Distance 350 ft. Price **4/6**. Post 6d.

Model No. 0. Exclusive to Gamages. Length 15½". Wing 16". Silver Silk. Plain wood Propeller. Distance 250 feet. No illustration. Price **2/-** Post 4d.

Boys! Don't Miss This



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3 Fold Ring, Complete Net...**5/11**

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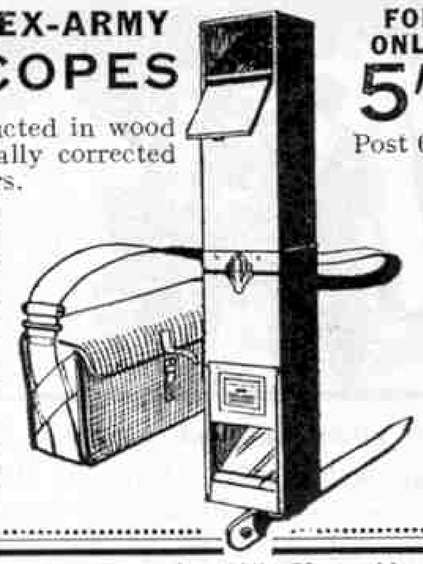

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Upon dismantling, the 2,450 parts of the Rolls-Royce Schneider Trophy engine with which Flt. Lieut. Stainforth set up the world's speed record of 407 m.p.h., "looked like those of an unused engine," states the "Daily Telegraph" Aviation Expert. The petrol used was **PRATTS ETHYL SPECIAL, Fastest Spirit on Earth.**

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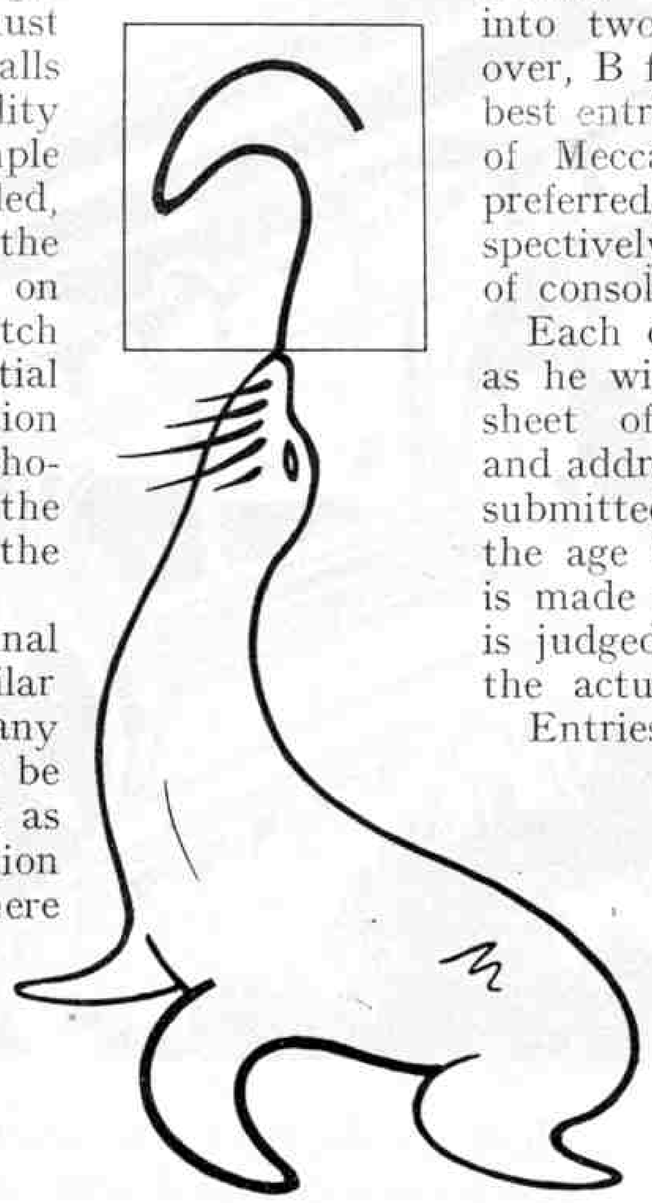
Competition Page

SKETCHOGRAMS

As the outcome of insistent requests from many readers, we re-introduce this month the Sketchogram contest that had so immediate a popularity when first produced in the *"M.M."* three years ago.

For the benefit of new readers we must explain that this form of drawing contest calls for no greater artistic skill than the ability to include a given line or lines in a simple sketch. The problem, if such it may be called, is to incorporate the "Sketchogram," the wriggly line shown in the box balanced on the sea lion's nose, in a simple original sketch in such a manner that it forms an essential part of the outline. To make this explanation perfectly clear, our artist has used the Sketchogram in drawing the sea lion. It forms the left front flipper, and the underside of the animal's body.



Readers are asked to submit original sketches in which the line is used in a similar way. It may appear in the sketch as many times as the competitor desires, and may be tilted to any angle or turned on its back as required. The drawing of the sea lion must not be copied, of course, but there are no other restrictions as to the subject or nature of the drawing.

Competitors who succeed in incorporating the "Sketchogram" more than once will be given credit for the effort, but it would be well to emphasise that a bold and simple drawing in which it appears but once and is immediately obvious, will stand a better chance of success than a complicated drawing in which it appears several times merely as a minor feature.

In order that our younger readers may have a fairer chance of success, the entries will be divided into two sections, A for readers aged 16 and over, B for those under 16. The first and second-best entries in each section will be awarded prizes of Meccano products (or Artists' Materials, if preferred) to the value of 21/- and 10/6 respectively. In addition there will be a number of consolation prizes.

Each competitor may submit as many entries as he wishes, but each must be upon a separate sheet of paper. The competitor's name, age and address must appear on the back of each entry submitted. It is not sufficient merely to indicate the age by the group letter A or B. Allowance is made for the competitor's age when his entry is judged and it is important, therefore, to give the actual age.

Entries must be addressed to "Sketchograms, Meccano Magazine, Old Swan, Liverpool," and must reach this office not later than 31st July.

A similar set of prizes will be awarded under exactly similar conditions for Overseas entries, which must reach us not later than 31st October.

Competitors who wish to have their entries returned after the close of the Contest must send a stamped addressed wrapper of suitable size with the entry. Prizewinning entries are retained by the Editor, and can be returned only in very special circumstances.

July Photo Contest

There is little that need be said by way of introduction to *"M.M."* photographic contests. There are two restrictions only—the exposure must have been made by the competitor, and each print must bear a title. Any subject is eligible; any make of camera, plate, film or paper may be employed, and competitors may submit as many prints as they wish, provided that each individual print bears the competitor's name, age and address on its back.

To give younger readers a fair opportunity of success, the entries will be divided into two sections, A for competitors aged 16 and over, and B for those under 16; and in each section prizes of Meccano products or Photographic Materials to the value of 21/- and 10/6 respectively will be awarded to the first and second entries in order of merit.

Entries sent this month must be addressed "July Photo Contest, Meccano Magazine, Binns Road, Old Swan, Liverpool," and must reach this office not later than 31st July. A duplicate set of prizes to the same value and in similar age groups will be awarded for Overseas competitors. Overseas closing date, 31st October.

MARCH CROSSWORD PUZZLE.—The Overseas section now having closed, we reproduce above the solution to the March Crossword Puzzle.

(*Continued from third Column*)

The awards in the Home Section of the Contest have been announced already, and it remains only to give the list of Overseas prizewinners, which is as follows:—1. A. C. F. Beck (Rotterdam); 2. G. Morrison (Johannesburg); 3. P. Vink (Capetown); 4. K. E. Thorpe (Capetown).

COMPETITION RESULTS

HOME

April Photo Contest.—First Prizes: Section A, A. B. Bishop (Bristol); Section B, D. Greensted (St. Ives). Second Prizes: Section A, W. M. Hunter (Lewisham, S.E.13); Section B, J. L. Rice (Northampton). Consolation Prizes: B. Adam (Holywell); J. P. Boileau (Tonbridge); F. H. Culverhouse (Sheffield); K. Exley (Bradford); V. Khambata (North Kensington, W.10); H. Marrack (Ashtead); E. H. Morris (Ashtead); W. Whitaker (Hornsea).

Hats Contest.—1. H. P. Dicken (Wrexham); 2. A. Little (Cleland); 3. H. Farrell (Dublin); 4. W. Taylor (Sutton); Consolation Prizes: D. R. Barrett (New Barnett); R. H. Eastop (London, N.1); P. Goulding (Wotton-u-Edge); P. J. Gwatkin (Worthing); N. Lunnon (Kingskerswell); R. Lynn (Wisbech); R. B. Montgomery (Chesham Bois); R. Morris Chatham).

OVERSEAS

Christmas Jokes.—1. J. Ross (Invercargill, N.Z.); 2. W. Green (Kaiapoi, N.Z.); 3. C. W. Dover (Benares, India); 4. J. Turner (Cambridge, S. Africa). Consolation Prize: J. Twohill (Auckland).

Cover Voting.—The popularity of this contest seems to grow each year, and once again we have to record an increased number of entries, both in the Home and the Overseas sections.

The results of the voting showed a striking similarity in taste between both groups of readers. In each section the November cover was an easy favourite, with the July cover second. The actual voting was as follows:—Home Section: November, July, March, September, May, August, October, February, December, June, April, January. Overseas Section: November, July, March, August, May, September, October, December, February, April, June, January.

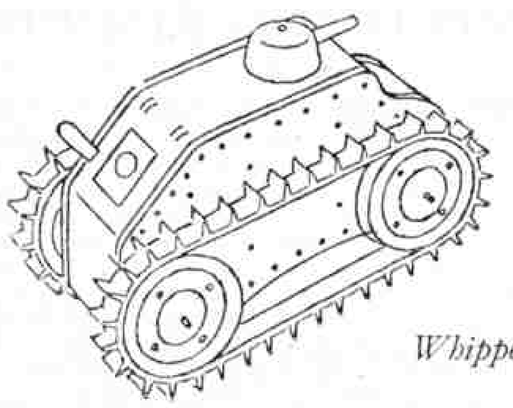
(*Continued at foot of preceding Column*)

Have you seen these new Tri-ang Toys?

Regd. Trade Mark

TRI-ANG
POWERFUL CLOCKWORK TOYS

Tractor No. 1	1/3
Tractor No. 2	4/11
Tractor No. 3 (6 wheels)	10/6
Whippet Tank	1/6
Tiger Tank	6/11
Magic Racing Car	12/6
Magic Sports Car	12/6
Magic Saloon Car	12/6

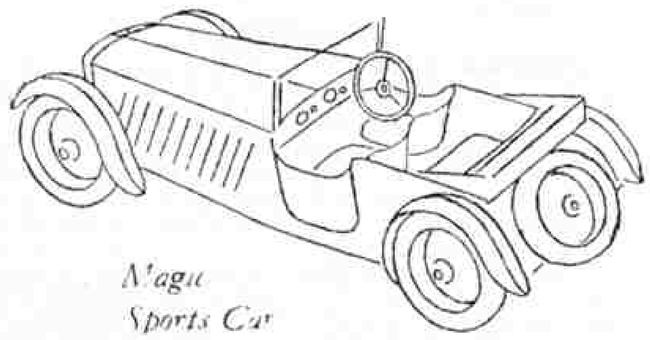


Whippet Tank

Here are the toys you want to work with your models. All real precision jobs fitted with super powerful clockwork motors.

A tractor to pull goods up steep gradients and over the roughest roads from your docks to your works. The new TRI-ANG tractor is made in three sizes, Nos. 1, 2, and 3 (No. 3 is a 6-wheeler with reversing gear, illustrated above). A tank to use with your soldiers. A model of the latest design of fighting tank, bristling with guns, climbing over the trenches, smashing the barricades. There are two models, the Whippet Tank and the Tiger Tank. You can see them in your local toyshop.

You should also remember the Magic Autos. A speedy, realistic sports car, a racing car and a saloon car, correct in detail and built to last. These three cars will be ready in August. What fun you could have with these toys! Ask for



Magic Sports Car

TRI-ANG TOYS

Regd. Trade Mark

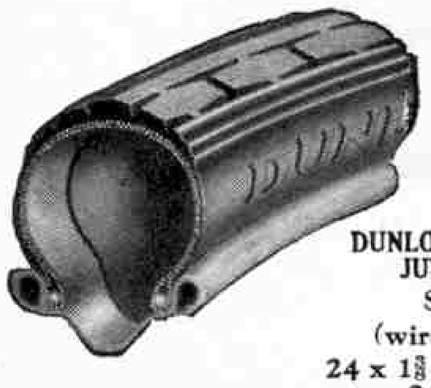
Regd Trade Mark

British made from the finest British materials

LINES BROTHERS LIMITED, MORDEN ROAD, LONDON, S.W.19

Ask Dad why he used to cycle on DUNLOP TYRES

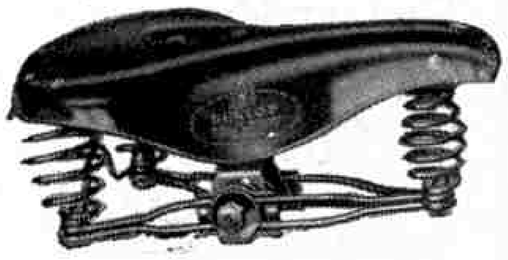
DUNLOP JUVENILE SIZE
(wired type)
22 x 1⅜ 24 x 1½
24 x 1⅜ 26 x 1½
Cover 5/6 Tube 2/6



DUNLOP SPORTS JUVENILE SIZE
(wired type)
24 x 1⅜ 24 x 1½
26 x 1½
Cover 4/6 Tube 2/-

and he will tell you that then, as now, DUNLOP were the best tyres for long, sure, non-skid mileage. Pick your favourite. 'Roadster' for hard touring work; red-treaded 'Sports' for flashing speed! Tyres you'll be proud to ride on!

DUNLOP RUBBER CO. LIMITED, Fort Dunlop, Birmingham.
Branches throughout the World.



Be sure your new cycle is fitted with a DUNLOP SADDLE

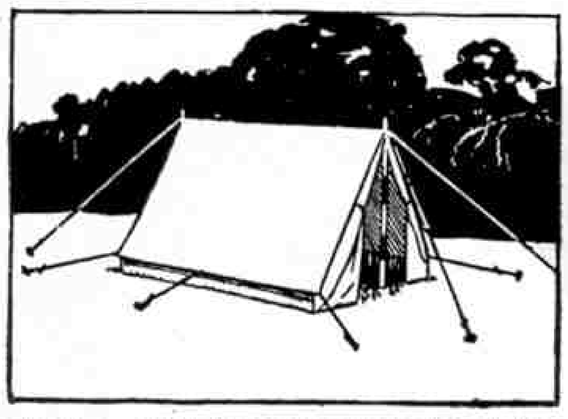
Dunlop saddles are absolutely waterproof. Your Dad will tell you how important that is. They are comfortable, they never sag nor lose their shape, and they require no 'breaking-in.'

1888-1932 The best tyres have always been DUNLOP

2H/146 C.F.H.

CYCLES & CAMPING KIT FOR TOURING

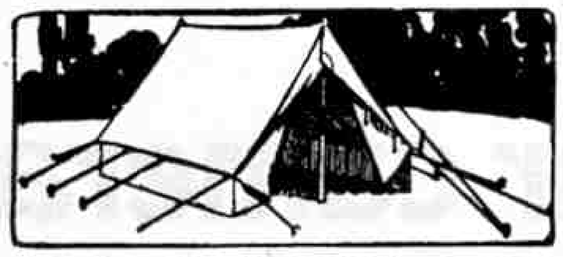
Apply for our Cycle and Camping Lists



THE "LIGHTWEIGHT"

6 ft. long, 4 ft. 3 in. wide, 3 ft. 6 in. high, 6 in. walls, overhanging eaves, genuine weatherproof white tent cloth, jointed poles, pegs, etc., packed in carrier, net weight 4 lb. **Jas. GROSE Ltd.** **10/6**

GREEN ROTPROOF CANVAS 18/- Car. paid.



THE "EASIPITCH"

7 ft. long, 5 ft. wide, 4 ft. 6 in. high. 1 ft. walls, overhanging eaves, ventilators, jointed poles, pegs, etc., proofed white tent cloth, weight 10 lb., packed in carrier. **Jas. GROSE Ltd.** **20/-**

GREEN ROTPROOF CANVAS 25/-
Carriage paid.

J.G.L. SLEEPING BAGS

Absolutely Damp Proof, Rubber Protected Ground, Green Rotproof Top, Lined good Warm Fleece. **11/6**

SUPERIOR HEAVY FLEECE LINED 15/-

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The Original Motor cycle and Accessory Firm.
Cycles and Accessories
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THE CYCLE FOR YOUR TOURING HOLIDAY!

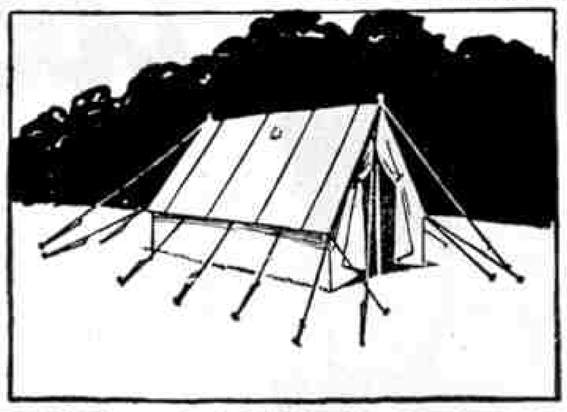
FREE INSURANCE! FREE ACCESSORIES!

Fully Guaranteed **50/-**

THE "J.G.L." ROADSTER CYCLE

Strong. Light. Easy Running.
Built under personal supervision in our **Euston Road Works.** **Guaranteed 50 Years.**

Cash, C.O.D. or Hire Purchase arranged.



THE "LIGHTPARTY"

6 ft. 6 in. long, 6 ft. wide, 6 ft. high, 2 ft. walls, overhanging eaves, ventilators, **Ridge Pole,** pegs, runners, etc., white weatherproof tent cloth, packed in neat carrier, net weight, 18½ lb. **Jas. GROSE Ltd.** **32/6**

GREEN ROTPROOF CANVAS 42/-
Carriage Paid.

THE "LIGHTBELL"

Extra strong white duck bell tent, circumference 30 ft., 8 ft. high, 2 ft. 3 in. walls, when packed in container 18 in. by 10 in. by 10 in. weight 15 lbs., complete with pegs, mallet, runners, etc. **Jas. GROSE Ltd.** **63/6**

EXTRA STRONG GREEN WILLESDEN 70/-
IDEAL FOR CUB OR SCOUT TROOPS.
Carriage paid.

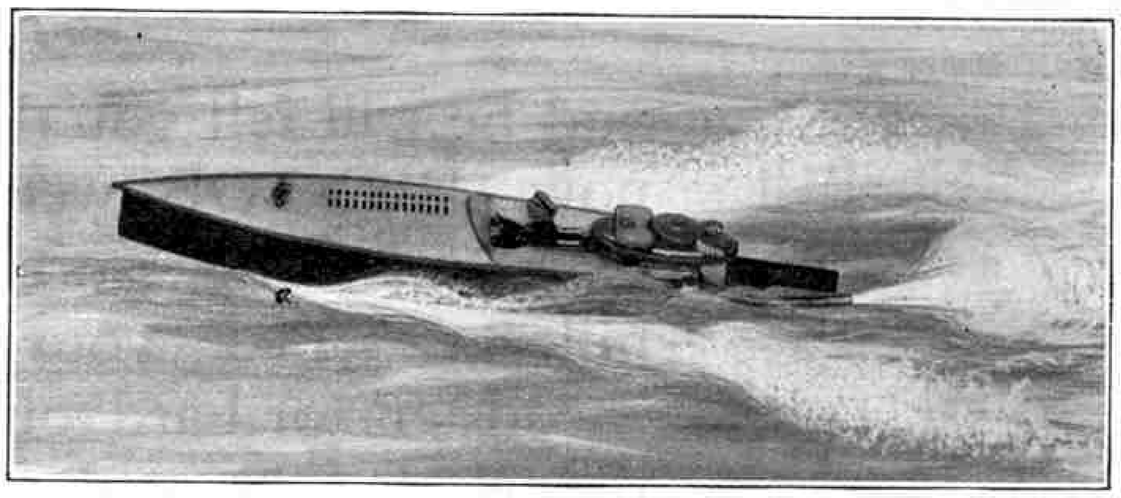
Camp Stools. Collapsible. Tubular Steel. British. Polished Wood Seat. each **2/6**

BOYS! The Very Latest Scientific "SKYIT" KITES

The "SKYIT" KITES are strongly made of best quality material and superior workmanship, compact and portable, easily set up. Bright attractive colours. The "Adjustable Bridle" is a special feature on all "SKYIT" KITES. There is no difficulty to get them to rise, no need to run about, providing there is enough wind they simply leap into the air.

"SKYIT" No. 1. 33" x 27", **4/6** each. No. 2. 36" x 30½", **6/-** each.
No. 3. 41" x 34", **8/6** each.

IT MUST BE A "SKYIT"—NO OTHER WILL DO.



Pop! goes the "WEASEL"

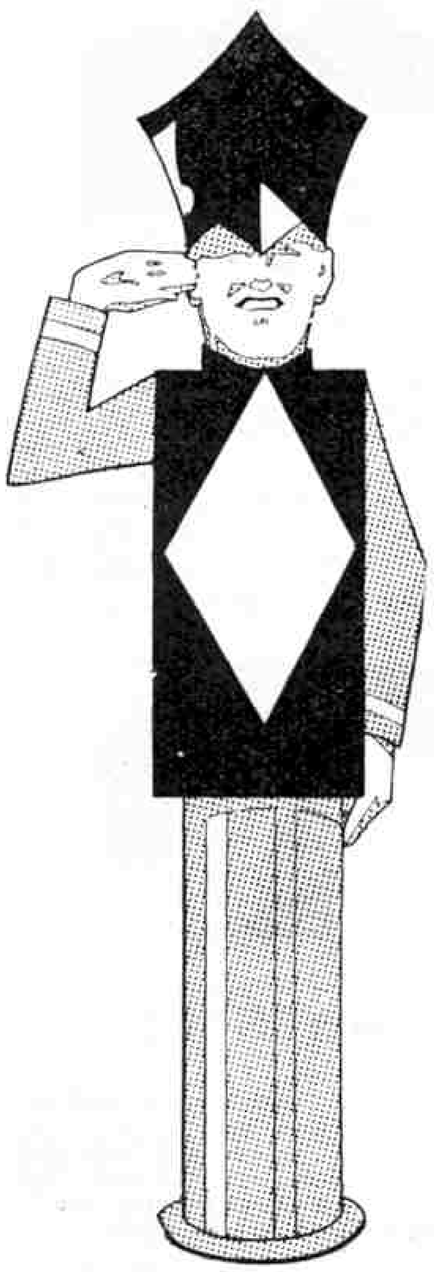
OUTBOARD MOTOR BOAT

No Danger. An Absolutely Safe Toy. Runs for about 15 minutes with one filling of "Meta" Fuel.
Complete with detachable outboard Motor and Meta Fuel, Price **2/6** each.
Driven by Hot-Air. The loud motor exhaust gives the merry "Pop! Pop! Pop!"

KITE WINDERS, superior finish, complete with 300 feet extra strong cord.
No. 1. 14" Spindle. Frame 4¾" x 7½" **1/9** each
AUTO KITE PARACHUTE RELEASE with Stop and 3 Parachutes ... ... **1/-** set
Extra PARACHUTES in packets of 6 ... Price **6d.**

If unable to procure from your dealer write :

A. J. HOLLADAY & CO. LTD., 3, ALDERMANBURY AVENUE, LONDON, E.C.2.



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...and be as "snappy" as the day is long!

FOR EVERY SIZE AND MAKE OF CAMERA

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HOBBIES—BOWMAN BOAT FORTNIGHT, JULY 23 to AUG. 6

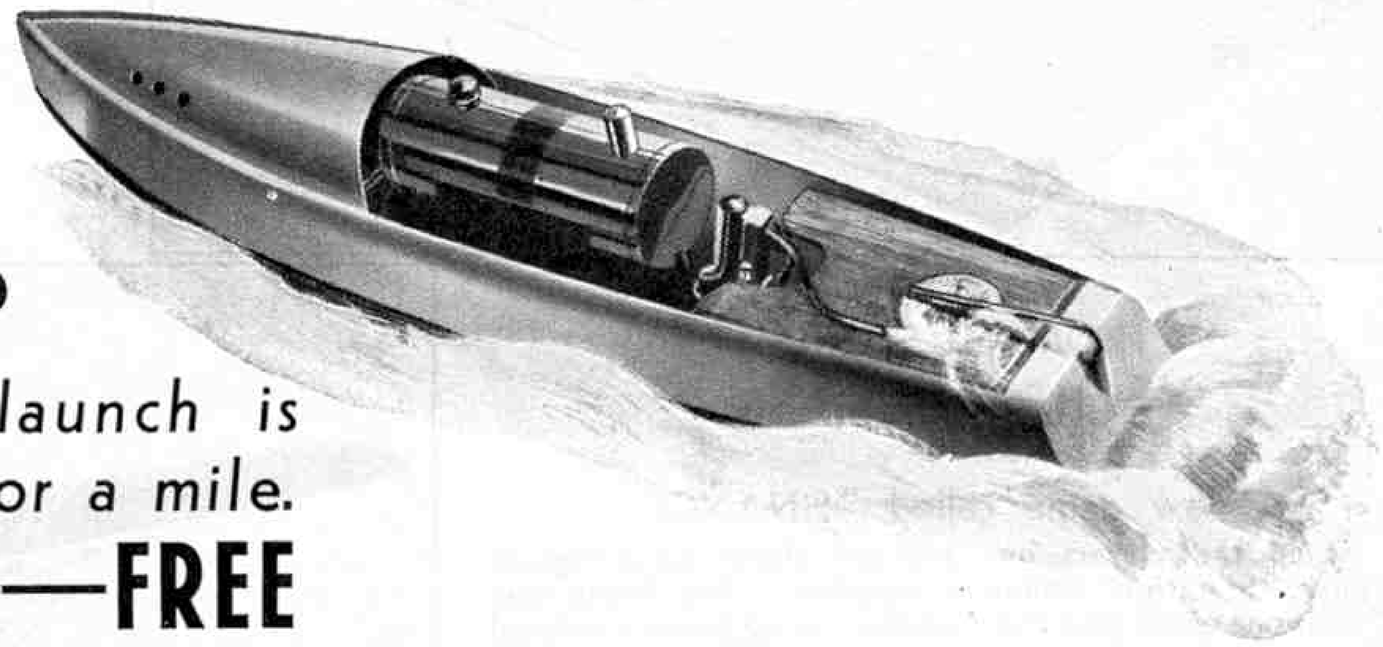
AMAZING PRIZE SCHEME

1 in EVERY 3 ENTRANTS RECEIVES A PRIZE!

THE SWALLOW STEAM LAUNCH

Steams for 20 minutes. Patent wood hull 20ins. long. Bowman "double power" engine; polished brass boiler 4½ins. x 1½ins. with safety valve and safety lamp.

17/6



This beautiful steam launch is 20in. long and steams for a mile.

IT MAY BE YOURS—FREE

It's an absolute fact! Any boy who buys a Hobbies-Bowman boat from now till closing date has a 1 in 3 chance of winning a valuable prize up to 21/-.

For every 5/- you spend on Hobbies-Bowman boats you get a separate and distinct entry form on which to fill in the number of separate parts you think there is in each of the Bowman models mentioned. Thus, you get 4 guesses if you buy a Snipe (22/6); and 8 if you buy a Seahawk (42/-). The nearest correct answer in every 3 purchasers receives one of the prizes shown opposite. You can examine all these Bowman Models and obtain your entrance forms at any Bowman stockist.

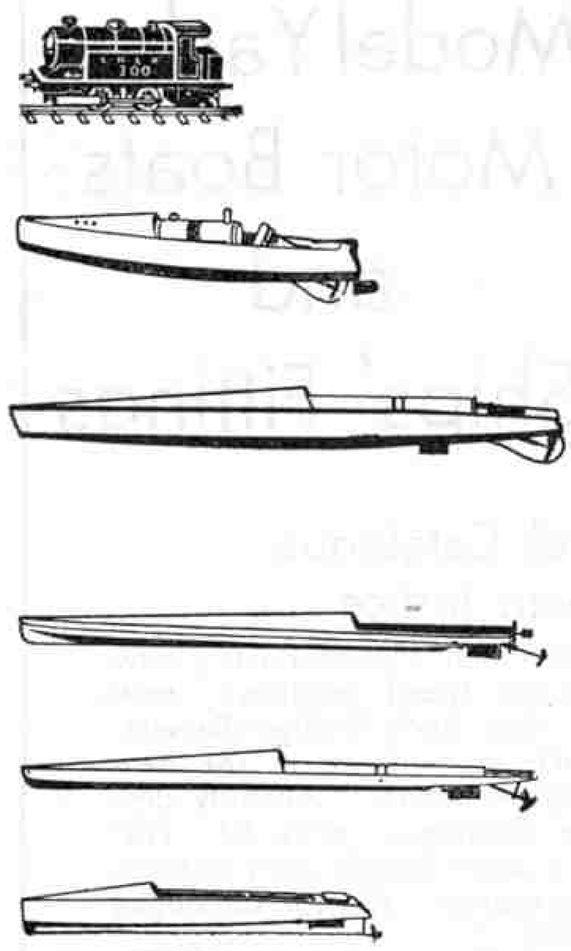
If the prize is not the exact model you like, you will be allowed the value of your prize model off the price of any other Bowman model in the shop.

If 2 boys share the cost of buying a boat they are quite likely to obtain another **FREE—i.e. ONE EACH!**

Boys who cannot get Bowman Boats at their local shop should order direct from us. We will send your entry forms with your purchase and award prizes in exactly the same way as our retailers. **Send your entries now.**

This prize scheme is featured by all the main toy shops and stores including Hobbies, Hamleys Ltd., etc., etc.

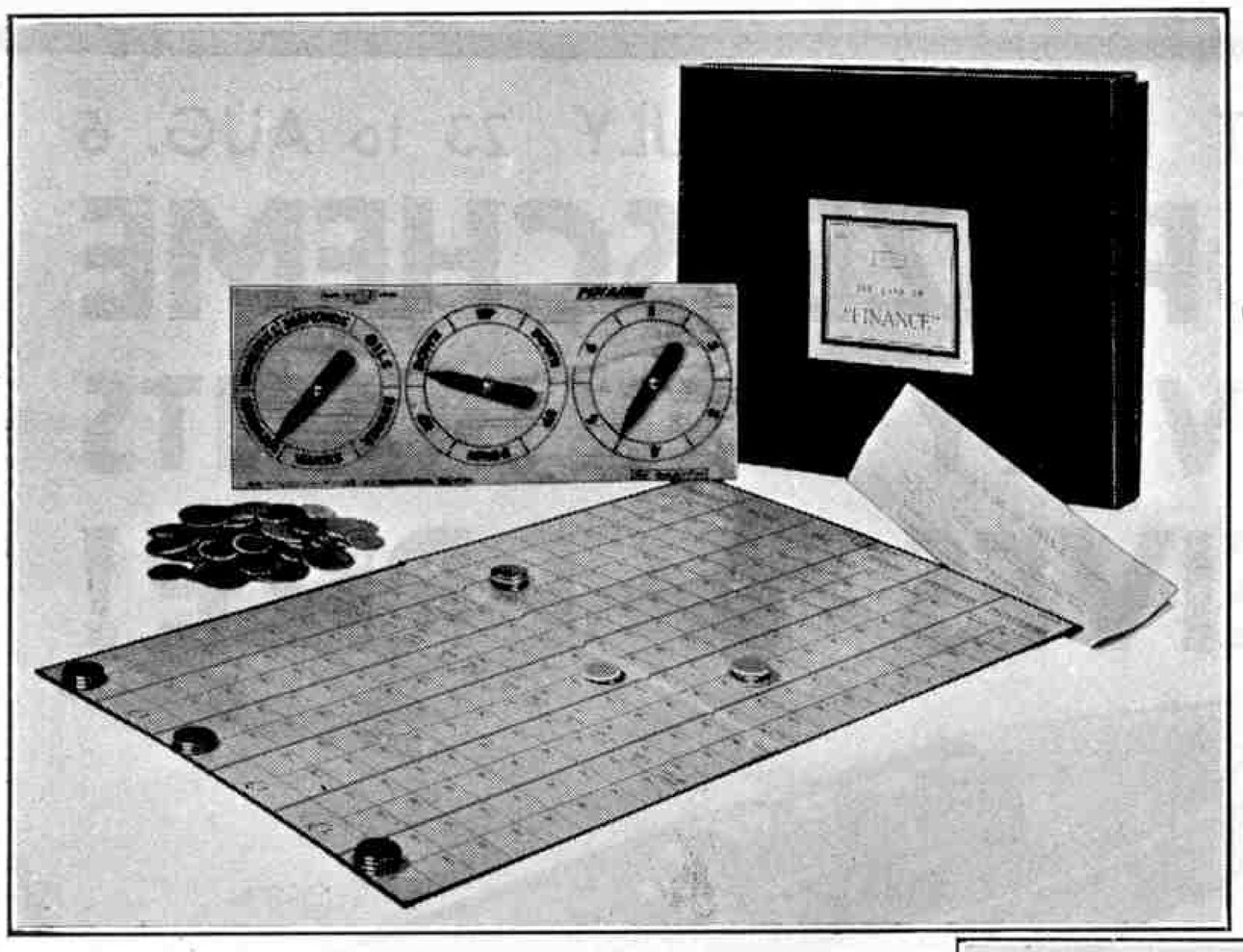
PRIZES OFFERED BY EVERY KEEN BOWMAN STOCKIST



LOCO 300 Length 8½". 'O' gauge. Steams non-stop ¼ mile.	**21/=**
SWALLOW Length 20". Double power steam engine. 20 mins. on one filling.	**17/6**
AEROBOAT I Length 32½". Runs 12-15 mins. Special "Easi-wind" rubber motor.	**17/6**
WHIPPET Length 29". Runs 5 mins. Special "Easiwind" rubber motor.	**9/6**
GREYHOUND Length 30". Runs 2-4 mins. with rubber motor.	**8/6**
FIREFLY Length 20". Fast running rubber motor.	**1/11**

BOWMAN MODELS

Dept. MM15
DEREHAM
NORFOLK



XACTUS CONSTRUCTION BOAT

Price 2/6 (Postage 4d.)

All parts cut to shape, with diagram and instructions.

The "PUSS MOTH"

has been added to the number of "Xactus" 1/40th scale model construction sets.

The sets obtainable now are as follows: "D.H. Moth," "Westland Widgeon," "Blackburn Bluebird," "Desouter Coupe," "Supermarine S.6," "Avro Avian," "Gloster Fighter," "Fairy Fox," "Puss Moth."

Start your collection to-day.

Obtainable from all Stores,

Price 2/6 (Postage 4d.)

Completed Models can now be obtained.

FROM ALL STORES

Xactus Productions

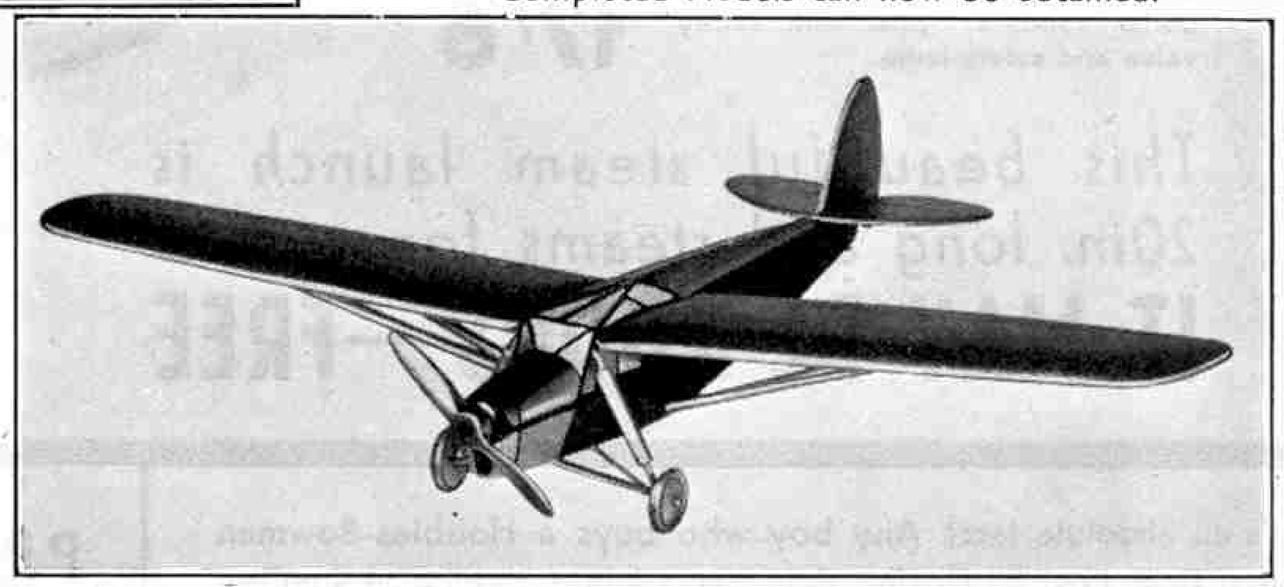
Reg. Trade Mark.

A new game called "FINANCE"

in which the players buy and sell shares in a regular manner. Imitation money is supplied. The Trade says "This is one of the best and most fascinating games produced for a number of years." You will play it for hours.

Price 3/11 (Postage 4d.)

(Xactus Models), W. H. Lane, 404, Sydenham Rd., Croydon.



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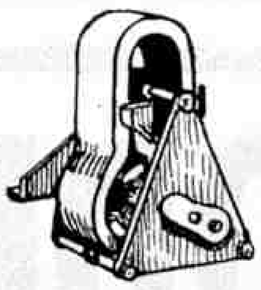
A Wonderful Catalogue to do them justice

NEW DESIGNS in Yachts and Motor Boats; new power plants and high speed engines; new merchantmen and men o' war, deck fittings—Bassett-Lowke quality is very much in evidence in the new arrivals from the Northampton factory. All fully described in the new 94-page Catalogue, price 6d. Not a dry-as-dust price list, but a book packed with pictures and thrills for the model enthusiast. Ask for Catalogue S/17.

Fittings Prices Reduced

Increased output makes this possible without disturbing the quality. Get the Catalogue and save money.

Boat Leaflet Free on receipt of Postcard.



Permanent Magnet Boat Motor working off pocket dry battery. Price 7/6

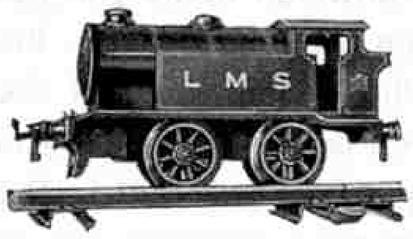
Bassett-Lowke Ltd., Northampton

London Branch: 112, High Holborn, W.C.1

Manchester Branch: 28, Corporation St.

Edinburgh: At Anderson's, 105, Princes Street

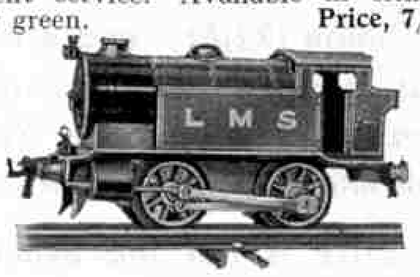
HORNBY TANK LOCOMOTIVES



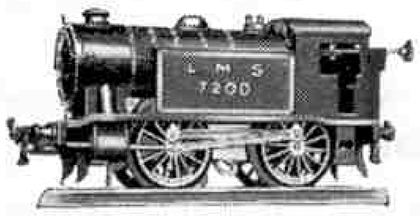
M3 Tank Locomotive

M3 TANK LOCOMOTIVE. This is the powerful Locomotive (reversing) supplied with the Hornby M3 Tank Goods Set. It is a handsome and extremely reliable model that will give long and excellent service. Available in either red or green. **Price, 7/6**

No. 1 TANK LOCOMOTIVE. This strong and durable Locomotive is capable of any amount of hard work. It is fitted with brake mechanism and reversing gear, and is supplied in colours to represent L.M.S.R., L.N.E.R., G.W.R. or S.R. Locomotives. **Price, 13/6**



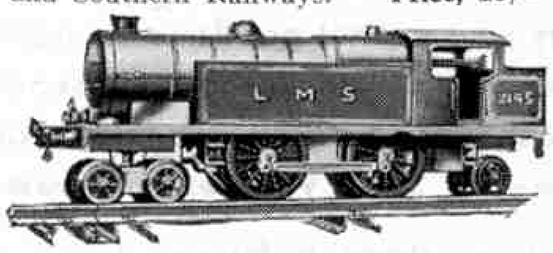
No. 1 Tank Locomotive



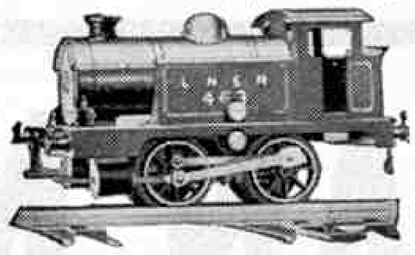
No. 1 Special Tank Locomotive

No. 1 SPECIAL TANK LOCOMOTIVE. This splendid Locomotive which is fitted with brake mechanism and reversing gear, has remarkable power and gives a very long run. It is available in the colours of the L.M.S., L.N.E., G.W. and Southern Railways. **Price, 18/-**

No. 2 SPECIAL TANK LOCOMOTIVE. This Locomotive has great length of run and exceptional pulling power. It is fitted with brake mechanism and reversing gear. In every respect it is a perfect model, beautifully finished in the colours of the L.M.S., L.N.E., G.W. and Southern Railways, **Price, 25/-**



No. 2 Special Tank Locomotive



No. 1 Electric Tank Locomotive

No. 1 ELECTRIC TANK LOCOMOTIVE. This Locomotive is of the permanent magnet type, and may be run from a 6-volt accumulator. It can be stopped, re-started, reversed and the speed varied by the operation of levers at the side of the track. It is supplied with a terminal connecting plate, speed and reverse control switch and 3 feet of flex, and it is available in the colours of the L.M.S., L.N.E., G.W., and Southern Railway Locomotives. **Price, 32/6**

This Locomotive cannot be run from the mains supply.

MECCANO LTD. - OLD SWAN - LIVERPOOL

A SCIENTIST
has arranged these experiments for YOU

In the "lab." you don't often get the chance of tinkering about on your own. That's why we know you will be keen on Lott's Chemistry. A Doctor of Science has selected and arranged many interesting chemical experiments for you—all of which will provide you with a lot of fun and scientific knowledge.

These are some experiments :—Growing Chemical Trees ; Big Crystals ; making coloured flares, etc., etc.

Lott's Chemistry is supplied in 3 sizes —larger boxes are being prepared.

BOX 1 with 18 Chemicals, accessories and book of 42 experiments. **Price 3/6**

BOX 2 with 22 Chemicals, Bunsen Burner, accessories and book of 80 experiments. **Price 6/-**

BOX 3 with 30 Chemicals, Bunsen Burner, extra accessories and book of 131 experiments. **Price 10/6**

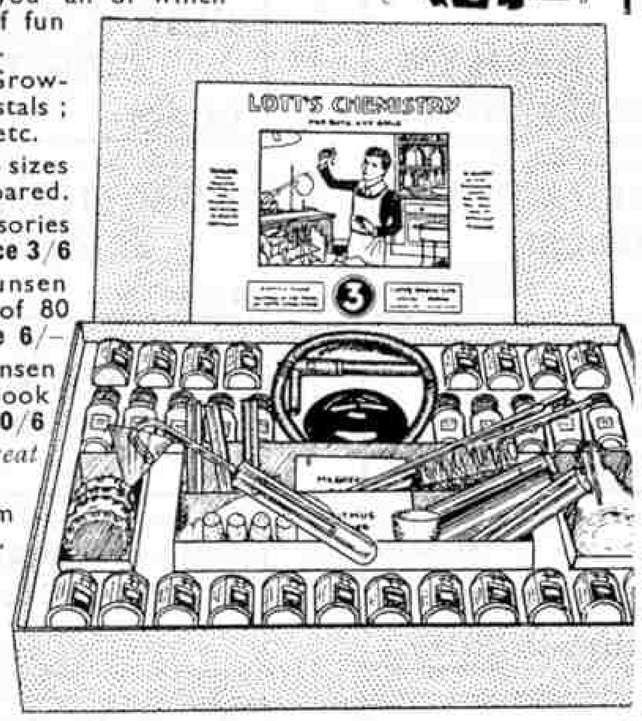
The above prices apply in Great Britain only.

Spares supplied. Obtainable from leading toy dealers and stores.

Lott's Chemistry is perfectly safe to handle.

Write for descriptive booklet to Dept. M.M.,

LOTT'S BRICKS LIMITED, WATFORD, HERTS.



LOTT'S CHEMISTRY

BOYS ! You should ride a B.S.A Bicycle

Can't you imagine how proud you would be to own a famous B.S.A. Bicycle ?—a bicycle that will delight the heart of every healthy boy. Look at these fine features :—"D" to round forks ; Dunlop Cord Tyres ; B.S.A. Free Wheel ; Two B.S.A. Brakes or Eadie Coaster Hub and Front Brake.

B.S.A. Bicycles are built in a factory famous for over 70 years for high quality, and will give years of trouble-free cycling.

Take the first step now. Just fill in and post the Coupon, the B.S.A. Catalogue will be sent to you by return.

Prices from £4.12.6 or 2/- a week

Post the Coupon

B.S.A. CYCLES LTD.
92, Small Heath,
BIRMINGHAM.

Please send
B.S.A. Bicycle Catalogue

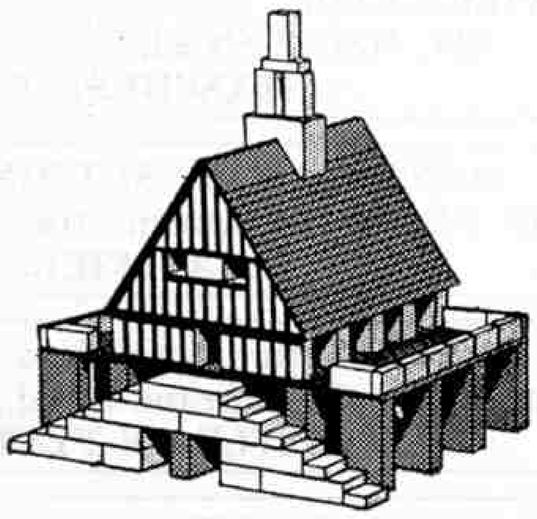
Name .....

Address

For your Model Railway

It's great fun loading up your trains with bricks and sending them off by rail to the sites chosen for the buildings. What realistic models, too, you can build with Lott's Bricks :—Houses, Bridges, Towers, Railway Stations, Garages—in fact, all the buildings you see about you every day. The Tudor Series contains many designs of Old English half-timbered buildings. Lodomo sets are complete with bricks embossed with designs of Doors, Windows and Bonded brickwork. All the sets contain illustrations of the models printed in colours.

COTTAGE. Box 1, Lodomo



CRICKET PAVILION. Box 3, Tudor Blocks

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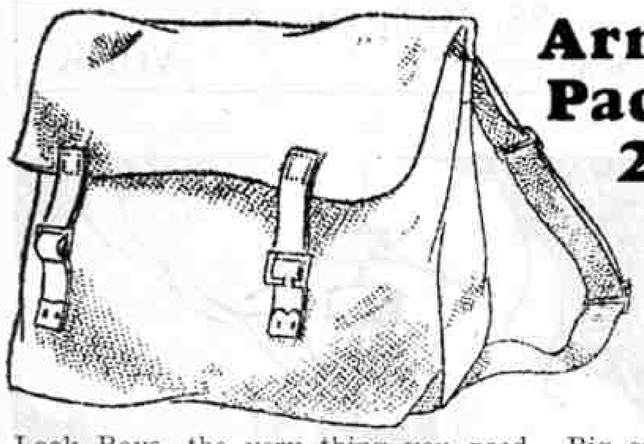

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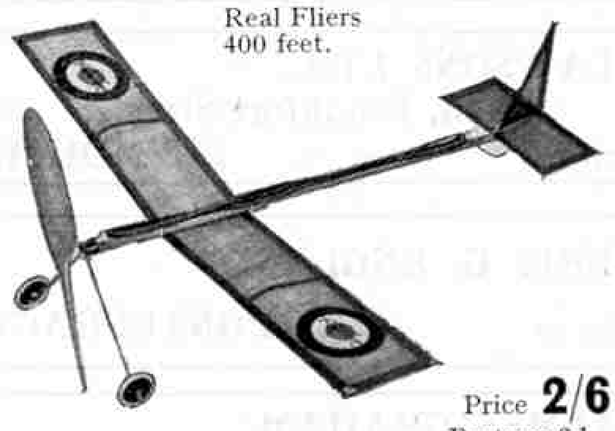

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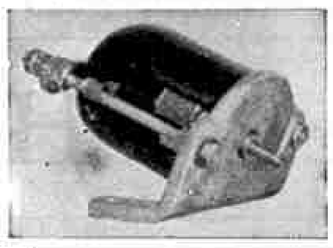

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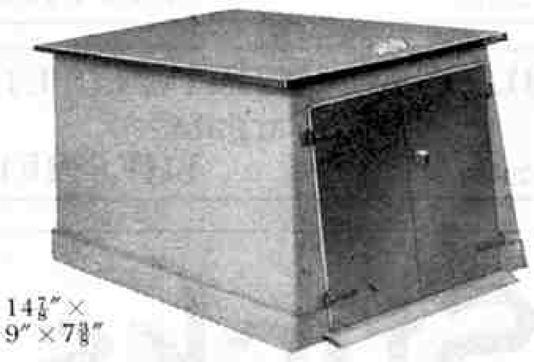

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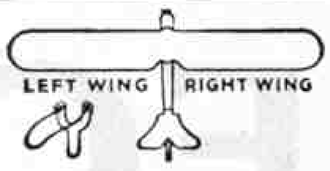

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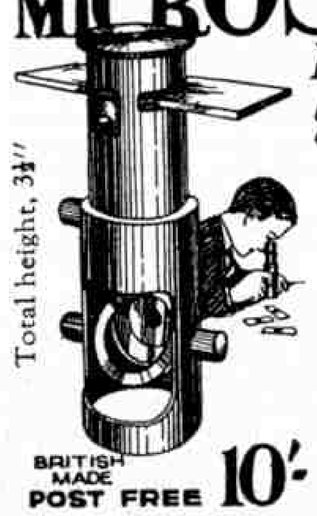

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Violin, complete with Bow and Case, in excellent condition (size ¾), 35/–.—Forsyth, Valleyfield, Ervie, Wigtownshire.

Desired exchange. 20th Century Foreign and British Colonies. Age 15 to 25.—F. Kilpert, 83, Main Road, Strand, South Africa.

Sale. 39 "Meccano Magazines," 1927-30. Five Volumes "Model Railway News," bound, Jan. 1925-Dec. 1929. Offers ?—Vincent, 43, Boston Road, Ipswich.

"Meccano Magazines," June, 1923 to June, 1927. Perfect condition, 6d. each.—Ross, "Newlands," Chilsworthy, Cornwall.

Miscellaneous lot of Train Accessories, also Houses for Farm, slightly damaged. Lot 12/–. Also Doll's Settee, Cot, High Chair, Two Dolls, and various other toys, perfect condition, 12/–.—Mitchell, 37, Beach Avenue, Gatley, Ches.

Sale. B.T.H. £3-3s. Universal Electric Gramophone Motor, also 25/– 4-4-4 Gauge 0 Clockwork Locomotive. Both as new. Best offer secures.—Colin Sharpe, 12, Spencer Road, Chiswick.

HOBBIES-BOWMAN BOAT WEEK AND
COMPETITION !
The wonderful Competition described on page 565 **is now on.**
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Railway Photographs, 23, Hanover St., Liverpool.

Junior Section—(*Continued from page 551*)

since grouping its use has been extended to the "Sou-Western" also. This indicator was referred to in the "*M.M.*" for December last, but we may recall that it consists of two small semaphore arms pivoted so that they may assume various positions in a similar manner to the hands of a clock.

A miniature one attached to a Hornby Locomotive looks very distinctive, as is seen in one of our illustrations, and it can easily be made from white card. The two arms should be cut out practically to the shape of a keyhole, that is to say, with one end rounded and the projecting semaphore portions slightly wider at their outer ends. The arms should have an overall length of ½ in., with a width at their outer ends of ⅛ in. When cut out they should be placed on top of one another and have a hole pierced with a stout pin through them both at the rounded end. To fix them together a very small paper fastener should be used, and the two "wings" of this should be bent flat behind the semaphore and then doubled back so as to enable them to pass over the lamp bracket of a Hornby Locomotive. Probably one or both of these "wings" will have to be cut through, to allow this bending to be carried out satisfactorily. The head of the fastener should now be touched up with white paint, and the semaphore is ready for use. The arms will stay in any position, and enable the correct indications to be given.

Semi-circular train nameboards, as used on the locomotive of the "*Flying Scotsman*," have already been mentioned, and the same methods may be employed to reproduce the smaller destination boards used on the N.B. section.

How to Get More Fun—(*Continued from page 547*)

left to gravity.

A further application of the same scheme would be a miniature representation of the L.M.S.R. Willesden Junction to Earls Court electric trains. These neat sets might be reproduced by Hornby L.M.S.R. Saloon Coaches, which have vestibule ends and centre corridors in much the same manner as the actual vehicles. The motor coaches cannot be arranged for in such a realistic manner as with Metropolitan Composite Coaches, but not many readers will consider this an objection. The fun of operating interesting and varied trains of the kind we are describing is usually sufficient to outweigh the fact that one or two details are not quite true to the originals. Small destination "boards" might be made of paper or thin card and placed at each end of these "electric" trains, the Metropolitan representative being labelled "Edgware Rd." at one end and "Addison Rd." at the other, corresponding indications for the L.M.S.R. train being "Willesden Jn." and "Earls Court."

Just as the Metropolitan trains are dealt with at one end of the station, so the S.R. operate a service from Clapham Junction into the other end of Addison Road. For hauling these trains in miniature any of the small Hornby S.R. Tanks will be suitable, and as regards rolling stock the No. 1 Coaches may be used. For convenience in operation these may be close-coupled as suggested recently, thereby enabling a certain amount of space to be saved in the placing of the points for running round purposes.

MECCANO MAGAZINE

Registered at G.P.O., London, for transmission by Canadian Magazine Post.

EDITORIAL AND ADVERTISING OFFICE :—
OLD SWAN, LIVERPOOL, ENGLAND.
Telegrams : "Meccano, Liverpool."

Publication Date. The "*M.M.*" is published on the 1st of each month and may be ordered from any Meccano dealer, or from any bookstall or newsagent, price 6d. per copy. It will be mailed direct from this office, 4/– for six issues and 8/– for twelve issues.

To Contributors. The Editor will consider articles and photographs of general interest and payment will be made for those published. Whilst every care will be taken of articles, etc., submitted, the Editor cannot accept responsibility for any loss or damage. A stamped addressed envelope of the requisite size should be sent where the contribution is to be returned if unacceptable.

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The U.S.A. price is 15c. per copy, and the subscription rates $1 and $2 for 6 and 12 months respectively (post free).

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SOUTH AFRICA : Mr. A. E. Harris (P.O. Box 1199), 142, Market Street, Johannesburg.
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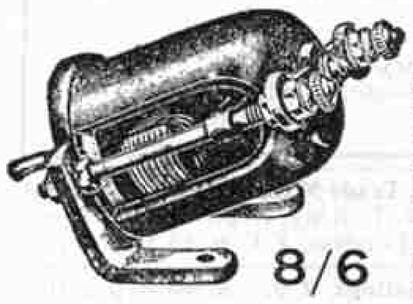

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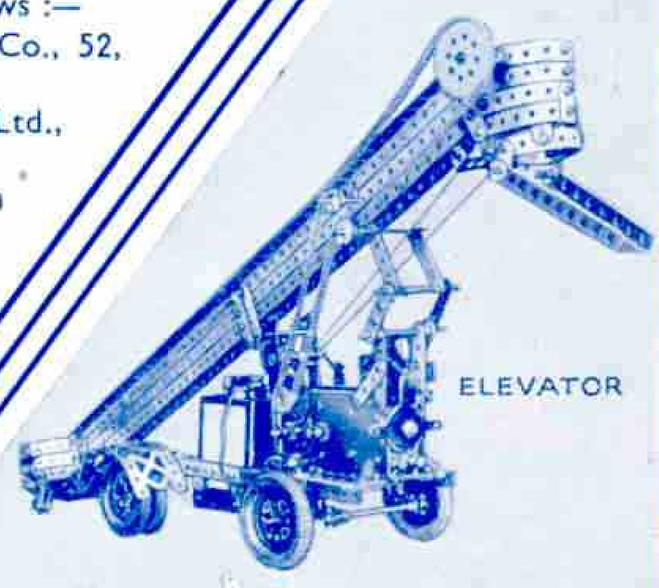
FLOATING CRANE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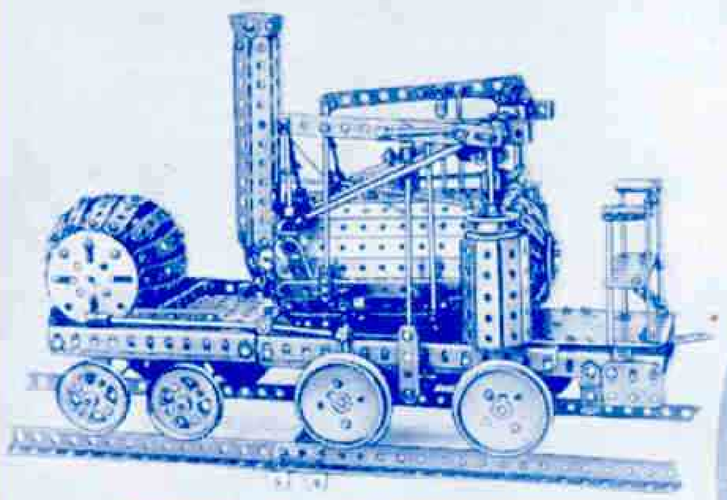
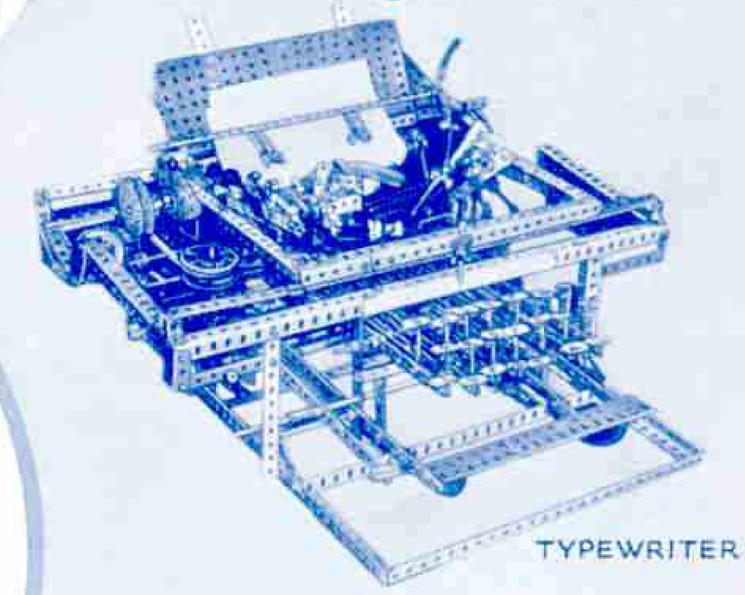

"PUFFING BILLY" LOCOMOTIVE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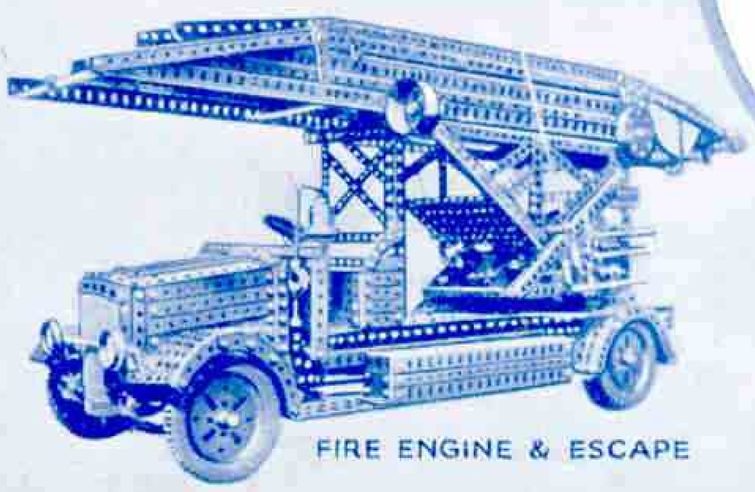
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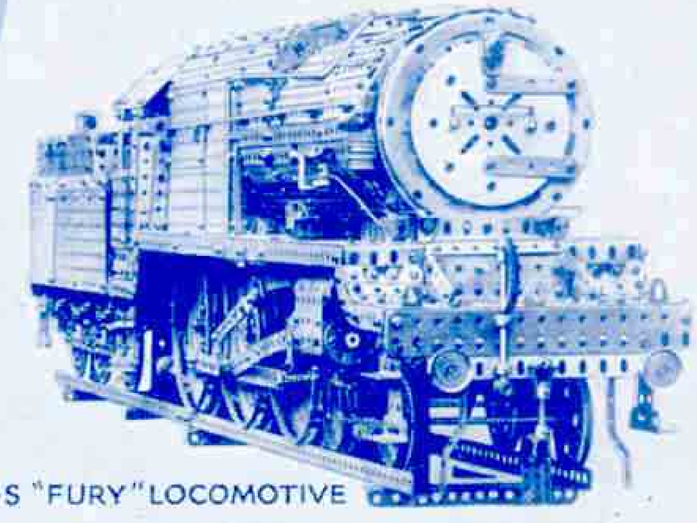
L·M·S "FURY" LOCOMOTIVE

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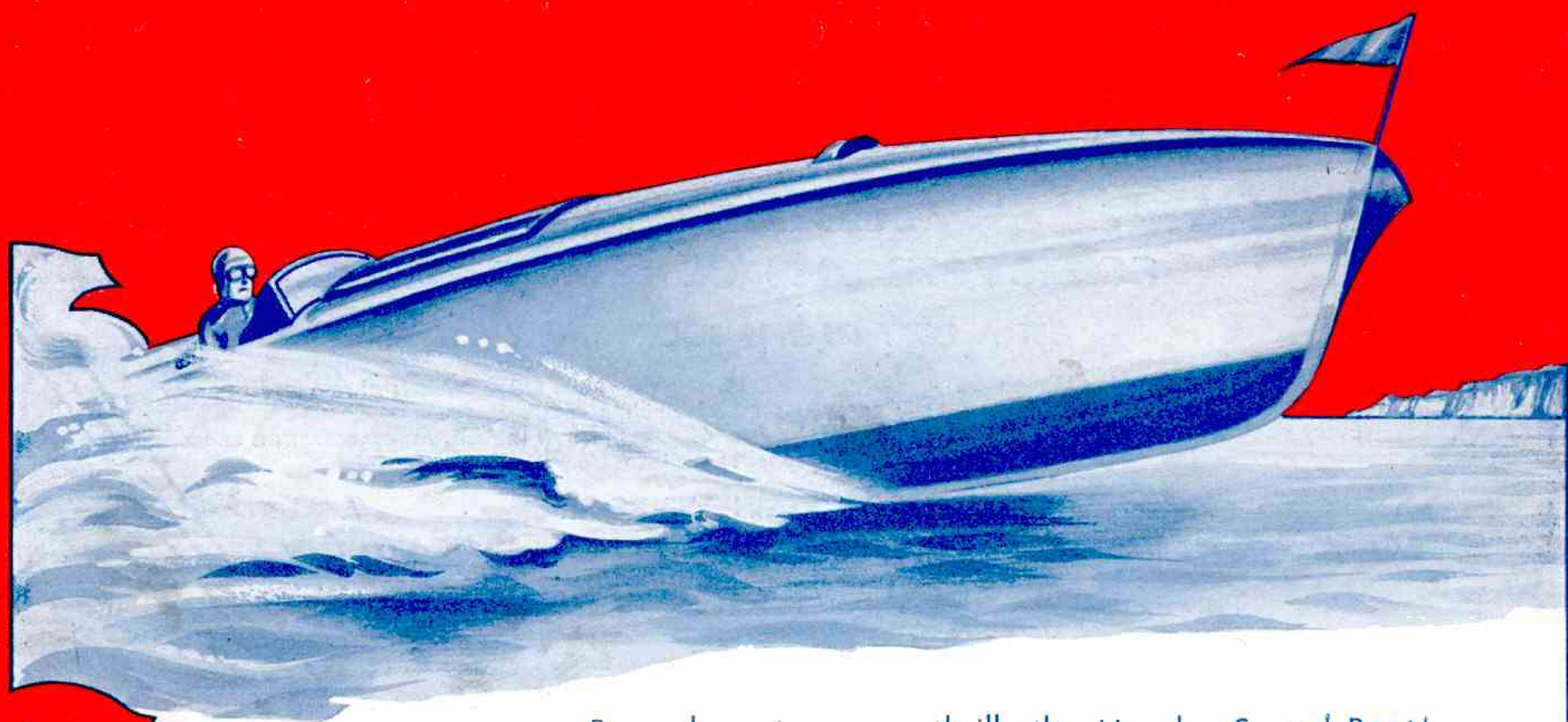
500 feet on one winding!



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Ask your dealer to show you this fine Speed Boat

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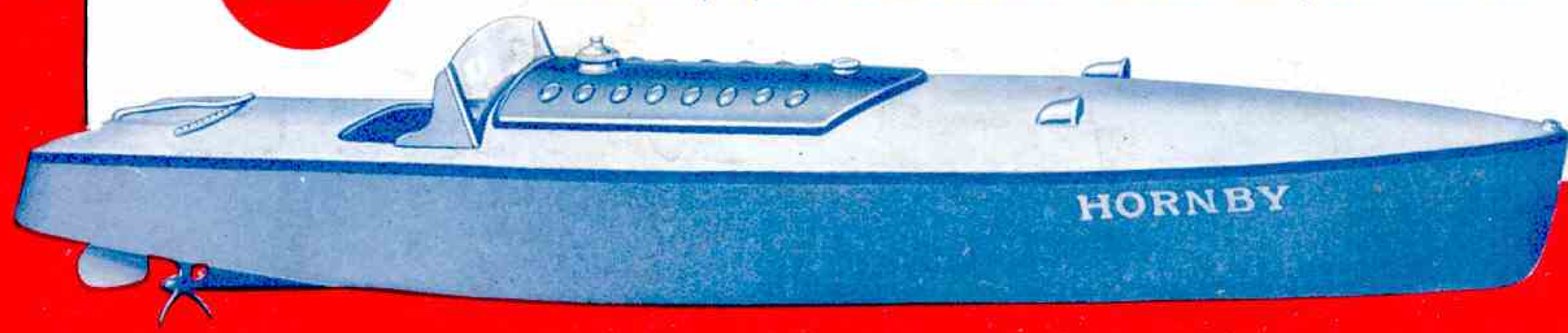

HORNBY SPEED BOAT

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