VOL. XVII. No. 8

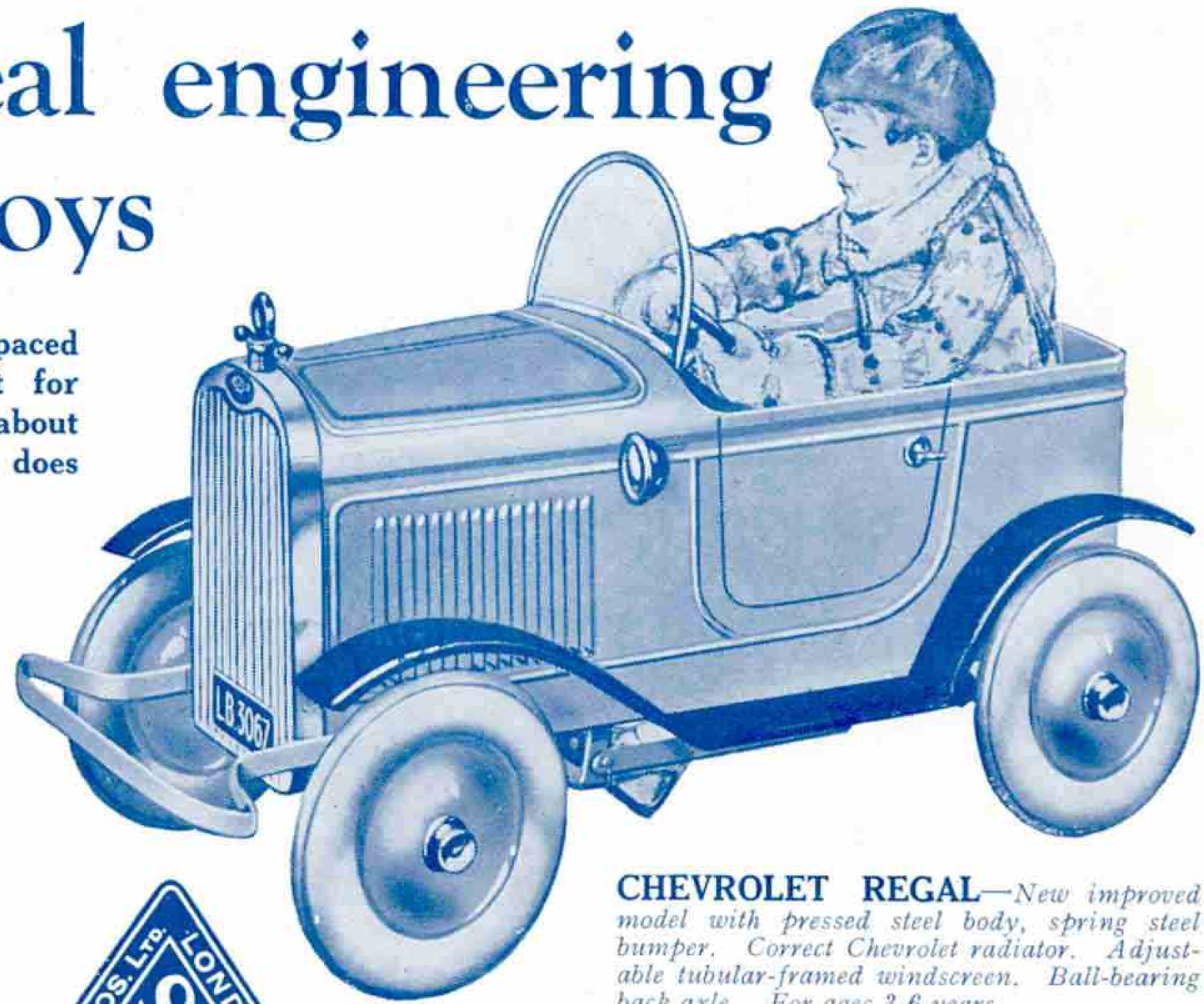
AUGUST 1932

MECCANO MAGAZINE

"GREAT EXPECTATIONS!"
(see page 576)

6D.

There's real engineering in these toys



Tri - ang Toys are thorough - paced engineering jobs. Made not just for show, but for work. Everything about them that can be made to work, does work. For their makers, Lines Bros. Limited, very well know that nothing less than that is enough for the stern young realists of the rising generation. Consider these cars, for instance. Pressed steel bodies, adjustable wind-screens, ball - bearing back axles, half - elliptic springs—bonnets that open, lamps that light: isn't this the sort of thing the young idea talks in his sleep about? Get in touch with the Tri - ang agent and hear all about the whole Tri - ang range.

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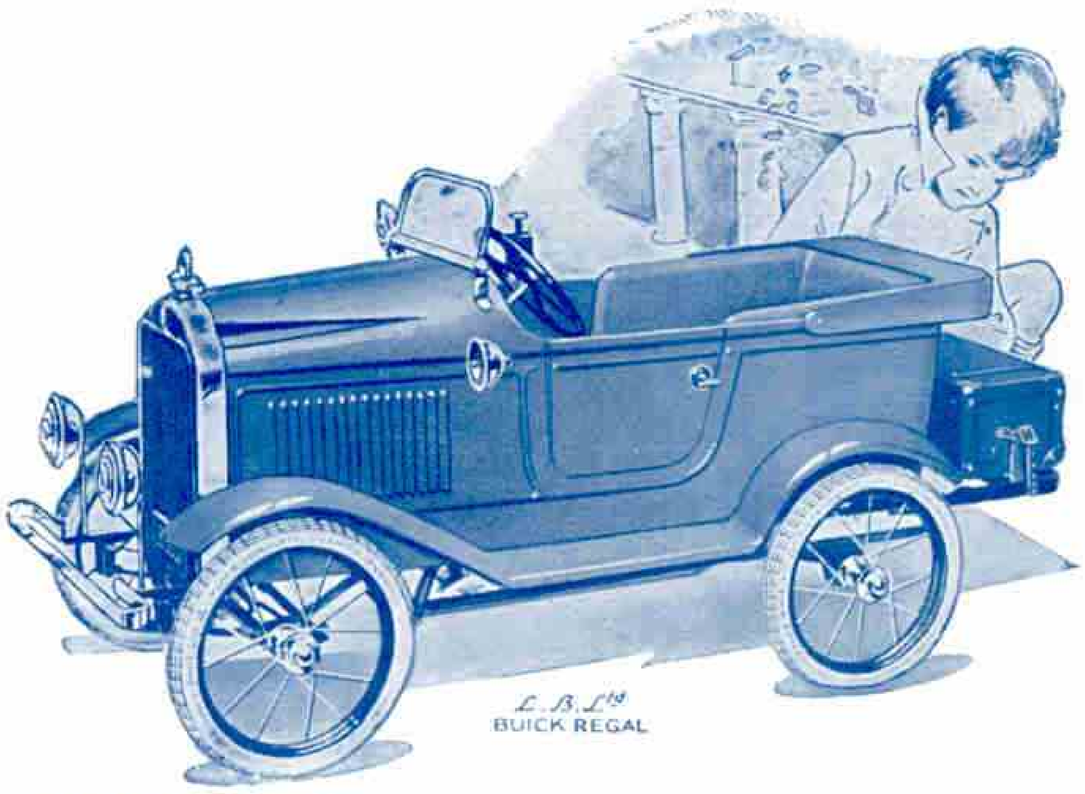
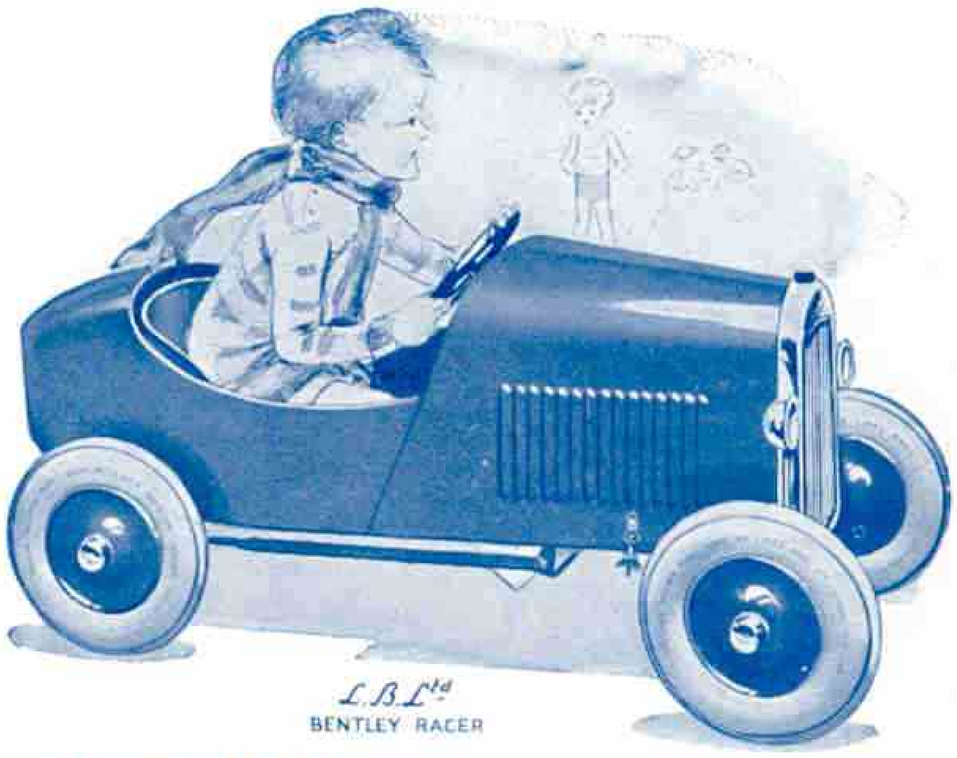
CHEVROLET REGAL—*New improved model with pressed steel body, spring steel bumper. Correct Chevrolet radiator. Adjustable tubular-framed windscreen. Ball-bearing back axle. For ages 3-6 years.*

CHEVROLET MAJOR *is longer. For ages 4-8 years.*



BUICK REGAL—*Pressed steel body on half-elliptic springs. Ball-bearing back axle. Adjustable tubular-framed windscreen. Fitted for two electric lights. 1 1/16 in. white auto tread tyres on tangent spoked wheels. Luggage grid and trunk. For ages 4-8 years.*



BENTLEY RACER—*All steel body, lift-up bonnet. Adjustable seat. Plated model Bentley radiator. 9 in. steel balloon wheels, ⅝ in. rubber tyres. Rubber pedals. For ages 3-6 years.*

BENTLEY RACER MAJOR *is longer. For ages 4-8 years. Ball-bearing back axle, 11 in. balloon wheels.*

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NEXT MONTH: "THE FUTURE OF ENGINEERING." PUBLISHING DATE: 1st SEPTEMBER

MECCANO MAGAZINE

Editorial Office:
Binns Road
Liverpool
England

Vol. XVII. No. 8
August, 1932

With the Editor

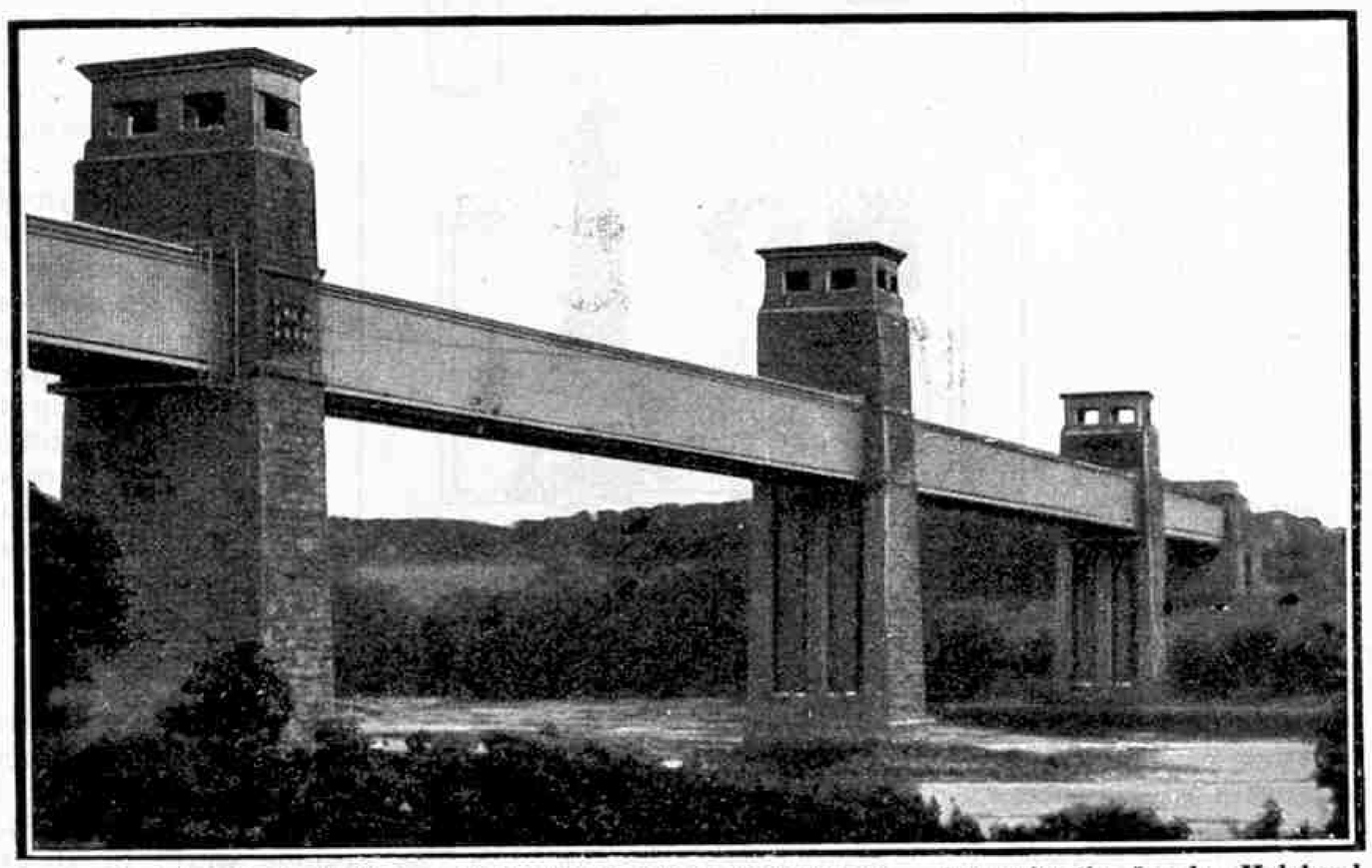
Bridge-Building Old and New

I often wonder whether most of us have any conception of the enormous amount of bridge-building that is now taking place. A gigantic bridge, such as the one recently completed across Sydney Harbour, focusses the attention of the whole world for years, but we hear little or nothing of the smaller bridges that are being constructed day by day to facilitate and speed-up our transport.

The bridge is perhaps the oldest of all engineering structures, and probably the idea originated in a tree uprooted by the wind and thrown across a stream, or in a more or less regular series of boulders occurring naturally across the bed of a river. The great modern phase of bridge-building, however, may be said to date back only to the coming of cheap steel. Even in the construction of the simplest type of bridge steel has points of superiority over masonry, but this superiority is most striking in the spanning of big distances at high levels, and often in difficult situations.

Take for example the bridge across the gorge of the Zambesi River below the Victoria Falls in South Africa. Here the engineers had to solve the problem of spanning a distance of 500 ft. at a height of 420 ft. above the foaming waterway in the centre of a wild district far from any source of supply. One by one the difficulties were surmounted, however, and ultimately there came into being the great steel arch that carries the railway across the gorge. In a very real sense this bridge may be said to have been built, not at the Zambesi River, but at Darlington; for the contractors, the Cleveland Bridge Co. Ltd., erected all the members in their yards before sending them out to the site on which the actual structure was to be erected.

What a contrast there is between the building of the Victoria, the Sydney Harbour and other modern steel bridges and the wrought iron structures erected by such engineers as Telford and Robert Stephenson. Nowadays the bridge designer has at his disposal an enormous mass of scientific data from which he can calculate exactly the stresses and strains a new structure will be called upon to bear, and the strength that must be possessed by the various steel members in order to withstand these forces. Steel members of practically any size can be ordered according to the most minutely detailed specification, and the steel-maker will produce them with an exactness nothing short of marvellous. Thus the engineer combines with the steel-maker and the scientist, and a great modern bridge is a triumph of team work.



The Britannia Tubular Bridge, built in 1849 by Robert Stephenson. It carries the London-Holyhead railway across the Menai Straits, and was the first large wrought iron girder bridge erected in this country. The length of its central span is 460 feet and each side span is 230 feet in length.

Difficulties Overcome by Pioneers

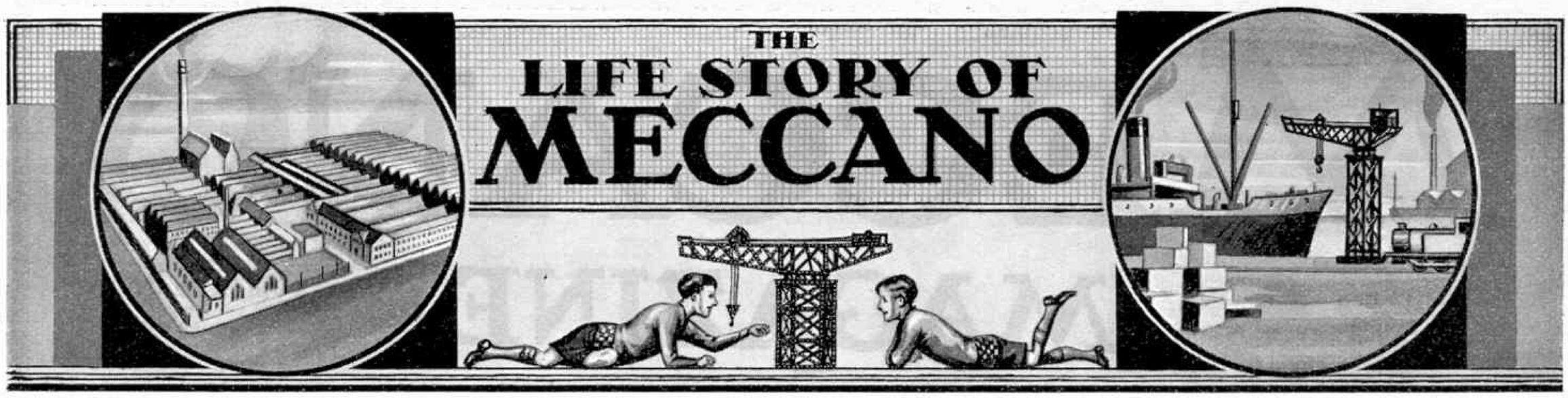
The position was different in 1826, when Telford built his famous suspension bridge across the Menai Straits. Telford had received no special engineering training and he had to make his plans with little previous experience to guide him, while the range of iron and steel products with which modern engineers work was not then available. The wrought iron he employed was variable in quality, and if he wished to be sure that it was strong enough for his purpose he had to devise and carry out the necessary tests himself.

Similar difficulties were encountered by Robert Stephenson when he built the tubular bridge that carries the railway to Holyhead across the Menai Straits. The plan he adopted was novel and he made countless experiments before venturing to put it into practice. There is no doubt that the necessity for relying entirely on himself in designing and erecting bridges and other structures helped to develop his powers, however, and this applies also to Telford and other great engineering pioneers. The problems that confronted them only seemed to rouse them to great efforts and they overcame unexpected difficulties that threatened disaster by the exercise of sheer engineering genius and originality.

Modern Treasure Hunting

In reading the story of the recovery of the gold of the "*Egypt*," the P. and O. liner sunk in the Bay of Biscay in 1922, to which reference is made on page 584, it is difficult to know which to admire most, the persistence with which the enterprise was carried on or the courage and endurance of the divers of the "*Artiglio*," the salvage vessel engaged on the task. The difficulties of the task were very formidable, for the wreck was at a depth of 400 ft., thus being far below the limits of ordinary diving operations, and the work could only be carried on in favourable weather during the summer months.

The divers were lowered to the sea floor in heavy steel shells provided with windows of glass 12 in. in thickness. They were unable to move hand or foot, and their part in the salvage work consisted of swinging in their steel casings for a spell of four hours, suspended a few feet above the wreck, and directing by telephone the efforts of the men on the salvage vessel itself to lower explosives with which to blow in the decks of the "*Egypt*," or to pick up the contents of the strong room by means of a giant grab.



VIII.—By Frank Hornby

LAST month we told the story of the growth of the Meccano Guild, the first of the service organisations connected with the Meccano hobby, and of the development of the Hornby Railway Company, which brought together Hornby Train enthusiasts in all parts of the world in the same manner as the Guild united Meccano boys. The greatest of all service organisations, however, is the "*Meccano Magazine*," which made its first appearance in the modest form of a four-page leaflet that was distributed free, postage only being charged. Its expansion into a 6d. monthly with a net sale of more than 70,000 copies is one of the romances in the Life Story of Meccano.

The Magazine owes its wonderful success partly to its position as the organ in which Meccano boys and Hornby Train enthusiasts throughout the world find the connecting link between their hobbies and true engineering, and partly to the opportunities it affords its readers of discussing not only their models, but also their own aims and ambitions, with the Editor and his staff, whose interest in their lives has given the Magazine great social importance.

The beginnings of the Magazine can be traced to the letters that boys who possessed Meccano outfits were encouraged to write to Headquarters. These letters dealt with model-building problems and difficulties, and for some time readers showed little or no interest in the activities of others. Then gradually there came a change. Boys who had built models of particular machines began to show curiosity as to whether other boys had built such models, and how these compared with their own. This spirit developed rapidly, and there arose a widespread demand for the publication in some form of a series of photographs and descriptions of models of special interest for circulation among Meccano enthusiasts generally. It became evident that something had to be done to satisfy this demand, and eventually it was decided to publish experimentally a paper under the title of the "*Meccano Magazine*."

The first number appeared in September 1916, and consisted of four pages. Its success exceeded all expectations, and a second number was published two months later. From that time the Magazine appeared regularly every two months until July-August 1922, by which time it had grown to eight pages and had attained a steady circulation. It continued to be issued free, postage only being charged, until 1920, when a price of 1d. per copy was fixed. In September 1922, it was decided to publish the Magazine monthly and it has appeared monthly ever since.

By the end of 1923 the number of pages had increased to 28, and in January 1924, the price was raised to 2d. In May of that year the Magazine appeared in the first of the series of coloured covers that still continues. These three-colour covers, each representing some engineering feature of outstanding interest, are unique and they give the Magazine a strikingly individual appearance. A further increase in size to 52 pages was made in January 1925, and at the same time the price was raised to 3d.

So far the increases in price had been gradual, but in January 1927, the bold step was taken of doubling it. It is always a risky proceeding to make so great a change in the price of a publication, and there have been instances where such a policy has proved disastrous. The position in regard to the "*Meccano Magazine*" was that there was an insistent demand on the part of readers for developments in various directions; that these demands could not be satisfied without the addition of a considerable number of pages; and that this necessitated an increase in price. It would have been possible, of course, to raise the price to 4d., but after consideration it was decided to make it 6d., and to give correspondingly increased value. This experiment proved fully justified. An immediate drop in circulation was expected and occurred, but after a few months the circulation rose steadily to its former level and then went beyond it. To-day, still at the price of 6d., the Magazine consists of a minimum of 80 pages, rising to over 100 pages for the December number; and its net sales are over 70,000 copies per issue. Some indication of what this means is obtained from the fact that for a December issue some 20 tons of paper are required; one month's issue, if stacked in one pile, would rise higher than the Eiffel Tower.

The cover of the "M.M." when its price was 1d.

The early issues of the Magazine were devoted entirely to Meccano. New models were illustrated and described, suggestions from readers were commented upon, and brief extracts of general interest from readers' letters were published with suitable replies. These early issues were, in short, designed solely to show Meccano boys how to get more fun out of their hobby and to encourage them to build new models of their own invention.

Until 1921 the character of the Magazine remained practically unaltered, but in that year a change came about. Boys who had built models of large machines began to express a desire for information about their prototypes. They wanted photographs of these machines and descriptions of their construction and operation written in simple language. At that time information of this kind was not available. There were, of course, the engineering papers, but these were far too technical, and their general style was unattracfive to boys. At the other extreme were articles on big engineering undertakings published from time to time in various popular papers. These were almost entirely devoted to picturesque descriptions of the spectacular side of such work, and gave no details of the machinery employed. It seemed clear that here was a wide field for exploitation, and as an experiment an article was published giving a photograph and a brief description of a large pontoon crane belonging to the Admiralty. This article met with general approval, and it formed the starting point of the long process of development that has resulted in

An early French issue.

the "*Meccano Magazine*" becoming recognised as the boy's Magazine of engineering—the only one of its kind in the world.

In comparing the "*Meccano Magazine*" with other boys' papers one is immediately struck by the entire absence of the familiar tales of adventure and school life. At one time well-wishers of the Magazine urged the inclusion of fiction, on the ground that no boy's paper had ever succeeded, or could succeed, without it. This view had been proved to be completely wrong for when one or two short stories were published with the object of ascertaining the views of readers, a deluge of letters arrived protesting strongly against valuable space being wasted on fiction. Nowadays the only fiction that is published is an occasional story with a strong engineering interest, or still less frequently, one with natural history interest.

The first cover after the price became 2d.

A special feature of the Magazine is that every possible encouragement has been given to readers to write to the editor, and to regard him as a personal friend interested in their daily life. To-day the editorial correspondence is immense—the editor's average is over 200 letters a day all the year round—and unique in its intimate character. Correspondents are of all ages, living in all parts of the world. Many of them write monthly, or even weekly, and their letters make it clear that this correspondence plays an important part in their life. Naturally, many of the letters are written with the object of seeking definite information or advice on some particular matter; but a large proportion of the letters have no such practical purpose. They are written simply in the spirit in which one writes to a friend—that is, to tell of one's everyday doings, and of little personal incidents that may be of interest.

A typical present-day "M.M." cover in three colours.

Many of these "correspondence friendships" have gone on for years; and some of them have been converted into personal friendships by a visit to the editorial office. The secret of this wonderful correspondence is simple—an individual reply to each letter. Each boy is replied to in the spirit in which he writes—and, equally important, in his own language—no matter whether it be to ask for advice in some difficult situation that has arisen, or merely to announce the arrival of a family of baby rabbits!

In addition to forming friendships between writers and editor this correspondence has the important result of indicating the views of readers upon the various contents of the Magazine. Many of the features that are now most popular have been introduced directly as the result of readers' suggestions, and other features that were less popular have been modified, or in some cases dropped altogether.

The secret of the success of the "*Meccano Magazine*" lies in the fact that it deals with subjects that are of interest to all intelligent boys, and deals with those subjects seriously. It provides articles that, whilst technically accurate, are at the same time written in an interesting style, free from all unnecessary complications and technicalities. Month by month it surveys the engineering undertakings in progress in different parts of the world, and gives detailed and fully illustrated descriptions of the most interesting of them. The history, construction and operation of machines of all kinds are dealt with, along with biographies of great engineers and inventors, past and present.

The value of the Magazine from an engineering point of view has been freely recognised by leading engineers, whose general attitude may be summed up in the following extract from a letter from Dorman Long & Co. Ltd., the famous engineering firm who undertook the colossal task of constructing the Sydney Harbour Bridge: "We know your Magazine well and appreciate its educational value to those who, as you rightly remark, will become the engineers of the next generation."

It may be said without hesitation that the influence of the "*Meccano Magazine*" on the next generation will go far beyond this, however. The intimate contact that has been established between the editor and his readers provides countless opportunities of giving boys helpful advice and encouragement at important periods of their lives. Full advantage is taken of these opportunities, the most direct example being the introduction of a section under the heading; "*What Shall I Be?*" The articles in this section deal month by month with the different branches of various professions; the prospects in each are reviewed, and advice is given as to the best method of entering upon it as a career. This feature has been greeted with great enthusiasm, and of it Lord Baden-Powell wrote recently: "With your widespread influence on youth you have an unrivalled opportunity of giving sound advice to boys as to shaping their futures. I am therefore glad to see that you are doing this and cordially wish you a full measure of success."

As it is impossible to deal with individual cases in the course of a general article, it often happens that readers interested in any particular profession are in need of further details on some point. These may be obtained by simply writing to the editor, and the manner in which readers in all parts of the world have written to seek advice suited to their particular circumstances is the best evidence that the articles are really helpful. The correspondence arising from them is dealt with by members of the staff who, during the past three or four years have been steadily accumulating information regarding occupations suitable for boys and are thus in a position to answer the many questions that are asked.

Although the Magazine circulates chiefly in the United Kingdom, many thousands of copies go overseas every month, in particular to Australia, New Zealand and South Africa. The Magazine has, in fact, readers in every civilised country in the world, even in such far away places as Siberia, Labrador, Fiji and Tierra del Fuego.

Naturally the early issues of the "*M.M.*"—four pages devoted entirely to Meccano model-building—did not often attract "grown ups." Now, all that is changed and in many thousands of homes the "*M.M.*" is welcomed and appreciated as much—sometimes even more!—by adults as by the most enthusiastic Meccano boy. Indeed, we receive many letters from boys complaining that father gets hold of the Magazine first, and keeps it until he has read it from cover to cover! Others complain that on the first of the month they notice they are always sent to bed early, so that father can have the "*M.M.*"! In such cases we point out that as "Dad" usually pays the subscription he is entitled to "first whack" at the Magazine and that in any case there is always a remedy for this state of affairs—to order two copies!

Almost from the first the "*Meccano Magazine*" had a small circulation in certain foreign countries. It was not long before many foreign readers began to clamour for a Magazine in their own language and the first step towards meeting their demands was taken when publication of a French Magazine was decided upon. This also began as a four page leaflet issued every two months. It progressed steadily and now it appears every month and consists of at least 24 pages, with a coloured cover on similar lines to that of the English issue. Later a further step forward was made by the publication of a "*Meccano Magazine*" in Spanish to circulate through Spain and South America. This has already achieved marked success, and gives every indication of becoming as popular in its own sphere as its English and French contemporaries are in theirs.

Meccano boys keenly interested in the special Christmas number of the "M.M."

The development of the "*Meccano Magazine*" from a mere leaflet to a well-established sixpenny monthly added a new branch to the activities of Meccano Limited and next month we shall explain how the Magazine is prepared and printed, and finally despatched to its thousands of readers in all parts of the world.

The OUTDOOR WORLD

AND ITS HIDDEN BEAUTIES

STREAM AND POND LIFE

FEW things are more fascinating than a small pond or a small stream. The element of smallness is important, because it is this that enables us to come to intimate terms with the water and to see something of its inner life. We cannot do this with a big river or lake; the mass of water keeps us at arm's length.

The average small pond is a deceiver, for its placid surface gives no hint of the teeming life that exists below. A few minutes' investigation with a net, however, will reveal something of the activities of the watery underworld. A net of the ordinary circular type is very suitable for pond hunting, and it may be purchased quite cheaply, or made at home if desired. For the temporary reception of the creatures dragged reluctantly from their haunts by the sweep of the net several small jars are more satisfactory than a single large one. Many aquatic creatures are not only carnivorous, but are possessed of a ferocity that seems out of all proportion to their size. If such creatures are dumped into the same jar as their meeker brethren, the "catch" is certain to decrease in numbers on the way home. Some trouble of this kind is inevitable until we learn to recognise the fierce creatures at a glance, but in the meantime the chances of a reasonable number of our captives reaching home safely increase in accordance with the number of our jars.

For the final disposal of our day's "bag" almost any glass or earthenware vessels of convenient size will serve, and a suitable place for them is a shelf in a good light, but shielded from the direct rays of the sun. If fishes are to be kept, however, something in the nature of a tank will be necessary. A rectangular tank with two sides of glass is the ideal form, but in the absence of this an inverted bell glass is very useful. The worst possible vessel for the purpose is the popular fish-globe, in which it is rank cruelty to keep any fish. Every year thousands of unfortunate gold-fishes are confined in such globes and condemned to a lingering death from excess of light and insufficiency of air. The two main requirements of a vessel intended to provide a home for fishes are a large extent of water surface relative to depth, and a comparatively small amount of light admitted. An inverted bell glass provides a good water surface area, and the amount of light that reaches the inhabitants may be regulated easily by means of two semi-circular screens of paper.

Now let us return to our pond and examine some of the creatures we are likely to capture in our net. It is almost certain that these will include the Water Boatman or Boat Fly. This insect is given its picturesque name on account of its being provided with two long oar-like legs, by the aid of which it sculls its way rapidly through the water. No more interesting creature can be found. It is rather more than half-an-inch in length and its colour is yellow with the exception of a black triangle upon the back. For its size the Water Boatman is quite a ferocious creature and its beak is able to inflict a distinctly painful wound on the hand. As might be expected, it readily attacks other aquatic creatures and in an aquarium it should never be placed in the same company as small fishes, otherwise these are likely to be eaten.

The Boatman looks very attractive in the aquarium and is an ideal creature for study, but it will escape if the vessel in which it is placed is left uncovered. Under its wing-cases is concealed a pair of large delicate wings, by means of which it makes nocturnal flights, returning to the water at dawn.

There are also many aquatic beetles to be found in nearly all pools. Probably the most common are of the horny-winged type, ranging in size from about ½ in. to well over 1 in. Their bodies are smooth and are very efficiently "streamlined," so that they are able to dart about in the water at great speeds. When the horny wings that may be seen folded on the backs of the insects are gently lifted up, thin and efficient flying wings are revealed.

Critical moments during operations for restocking the aquarium. This photograph was taken by H. T. Comerford, and was awarded a prize in our May Photographic Contest.

The habits of the water beetles are very interesting, for although they remain in their ponds during the day they frequently fly great distances at night. They fly at a fairly high altitude and immediately on seeing a stretch of water below them, fold their wings and drop straight down into it. They are frequently deceived by the appearance of a stretch of glass, such as the roof of a greenhouse!

The largest of the beetles likely to be dredged from a wayside pond is the Great Water Beetle. When safely installed in an aquarium this can be recognised by its habit of resting at the surface with its head pointing toward the bottom of the pond or aquarium and the tip of its abdomen sticking out of the water. This attitude enables it to breathe while waiting for insects on which to prey. When swimming below the surface of the water, its air supply is derived from a small bubble trapped below the abdomen.

Great Water Beetles should be handled with care, for they are provided with a pair of sharp spines underneath the abdomen. If one of the beetles is picked up it will try to escape backwards, and in this manner dig its spines into the hand. An extremely disagreeable secretion also may be discharged by the insect.

While we are dredging for members of the beetle family our attention may be drawn to a speck on the surface of the water that constantly moves in circles and in curves. This curious creature is known as the Whirligig Beetle, a name given to it on account of its method of locomotion. The beetle is about ¼ in. in length and glossy blue-black in colour. It is a good flier, and therefore the tank in which it is kept should be covered. It is not difficult to feed, for it welcomes small pieces of raw meat or garden worms.

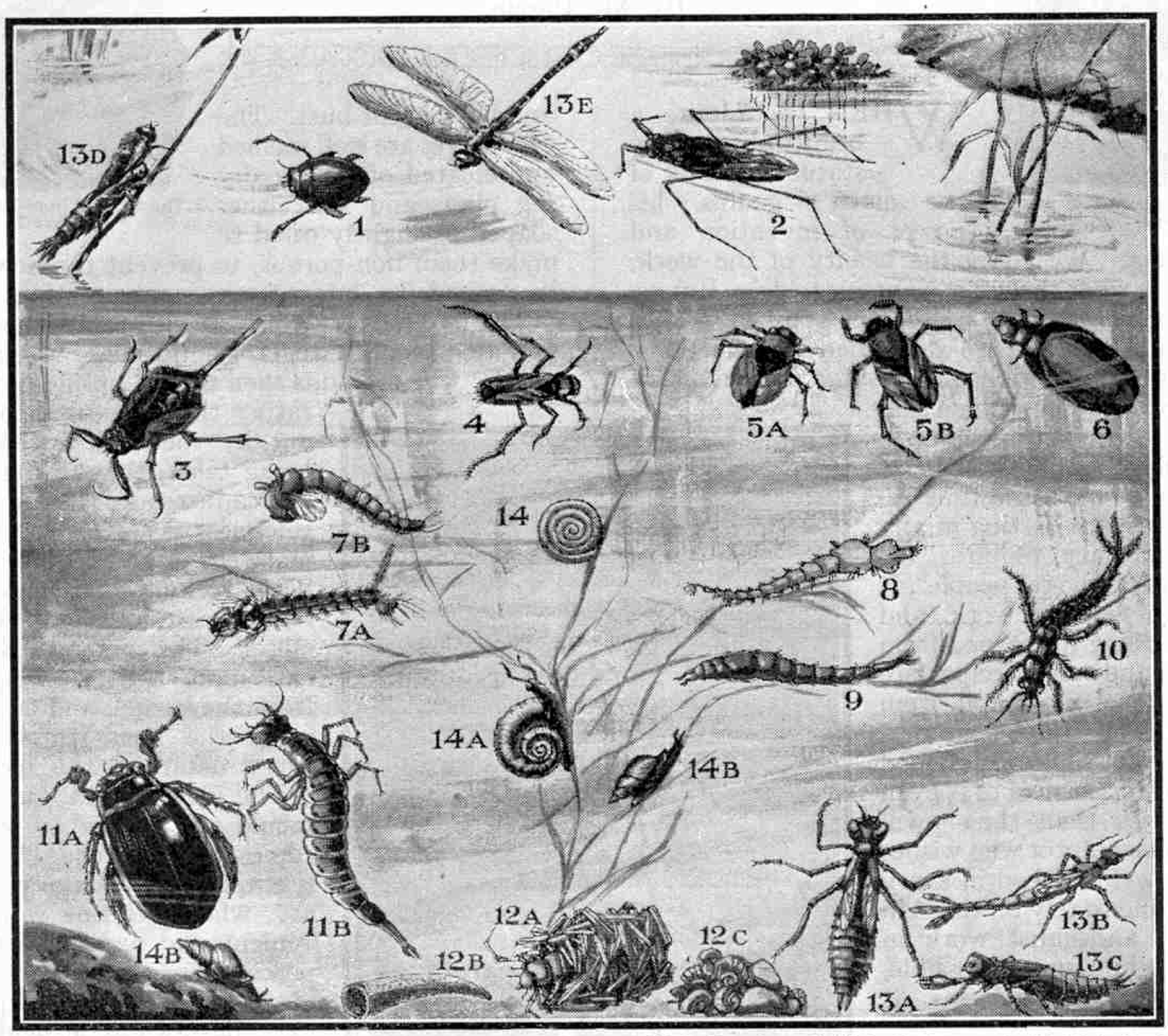
Many other small creatures may come into the net and it is extremely interesting to watch them and their habits. The Caddis Worm, the grub of the Caddis-fly, has a special interest. This quaint creature will be found crawling along the bottom of the pond, safely housed in its tube-like dwelling. This portable house is constructed by the creature from tiny pieces of plants, shells, sand, etc., and it alone saves him from being devoured by the other inmates of the pond, for his plump soft body is a tempting morsel! The various building materials are fastened together by the help of

a sticky secretion that hardens to a kind of silk on exposure to the air, the owner clinging tenaciously to the inside of his house by means of small hooks at the extremity of his body.

It is an interesting fact that, whatever material is used, the creature usually manages to make its house of the same specific gravity as the water, so that it has no difficulty in moving about the pond. When the time of change arrives, the worm abandons its house and seeks the shore. The skin then splits and the perfect fly emerges. This is not swift on the wing, but it runs quickly.

Provided that sufficient plant life is present, the Caddis-Worm will live well in the aquarium and if taken out of its case will promptly proceed to build a new one. It is no use trying to haul it out by the head as this is certain to result in serious injury; and the only way is to attack it from the rear with a piece of straw, when it will usually leave its home without much argument.

The Dragon-fly is one of the most remarkably beautiful of all pond creatures and it is familiar to even the most casual observer. It has been described as the hawk of the insect world, and certainly its rapidity when in search of food is really astounding. The swiftness of its stroke and its unfailing accuracy of aim make it a deadly hunter, and no matter how the victim dodges, the Dragon-fly is equal to the occasion.

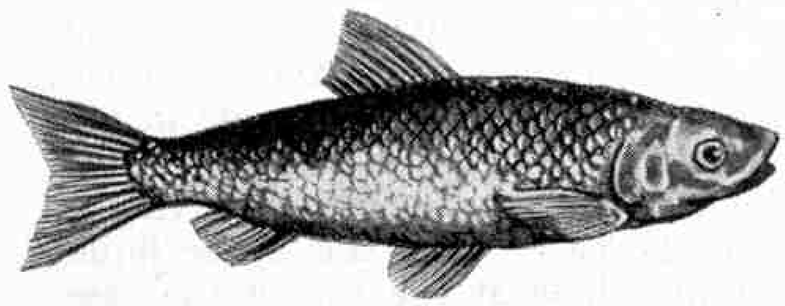


Typical specimens of pond life. 1. Whirligig Beetle. 2. Pond Skater. 3. Water Scorpion. 4. Water Boatman. 5a, 5b. Water Bug. 6. Water Caterpillar of China Mark. 7a. Larva of Gnat. 7b. Pupa of Gnat. 8. Phantom Larva of Corethra. 9. Larva of Chameleon Fly. 10. Larva of May Fly. 11a. Carnivorous Water Beetle. 11b. Larva of Water Beetle. 12a. Caddis Worm. 12b, 12c. Caddis Worm Cases. 13a, 13b, 13c. Larva of Dragonflies. 13d. Dragonfly Emerging. 13e. The Perfect Insect. 14. Planorbis Vortex (Snail). 14a and 14b. Other Snails useful as aquarium scavengers.

The Dragon-fly is frequently spoken of as the "Horse Stinger." The creature certainly has a savage appearance, but it is perfectly harmless and is absolutely incapable of injuring horses or cattle.

Its life-history is one of great fascination and is well worth study. The female deposits her eggs on the water of a quiet pool or on the leaves of some aquatic plant. When the eggs hatch, the larva that emerge are usually dark-brown in colour, thus matching the mud in which they live. They have decidedly healthy appetites and they secure their prey by means of a curious apparatus known as the "mask." This peculiar organ partly covers the lower part of the head and acts as a sort of insect trap. When the larva wishes to seize its prey it suddenly thrusts out the mask, grasps its victim by means of a pair of strong curved hooks or claws, and all is over.

The larva moults several times and finally loses its appetite and climbs some convenient water plant, to which it clings tightly by means of its hooks or claws. Presently the old body-covering splits and the perfect Dragon-fly emerges. At first the insect is helpless, but as it rests its wings dry and expand, and before long it takes to flight, appearing to revel in its new power of movement.



Chub.

The larva of Caddis, Dragon and other flies should be kept in a shallow pan or tank of water in which are growing plants that raise their heads above the water, such as watercress, forget-me-not, or crowfoot. Plants of this type are necessary in order that the creatures may climb the stalks above water to complete the final stage of their exceedingly interesting metamorphosis.

It is regrettable that the Dragon-fly is becoming rarer, and indeed certain species seem likely to disappear entirely before very long.

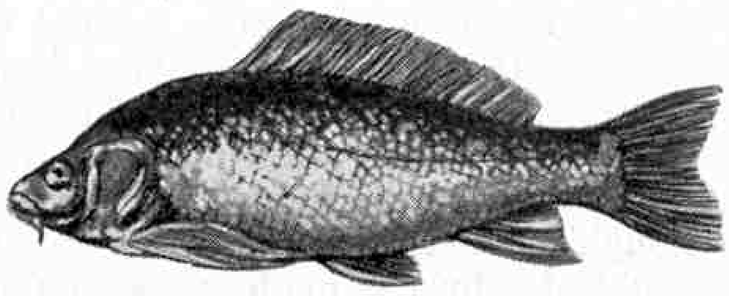
While endeavouring to find insects in a pond on a fine summer's day, it is almost certain that some of the insects will find the naturalist! Most unwelcome of these will be the Gnat, a near relative of the Mosquito, which makes itself felt by conducting engineering operations in search of food. It is only the female Gnat that has this annoying habit. She does not actually bite but, having selected a tender place to begin operations, quickly makes an incision in the skin by means of her boring apparatus. The hole thus produced is not yet large enough for her purpose, and so she sets to work with an implement that may be described as a minute saw, and enlarges the hole. Having obtained the necessary diameter she then inserts a tube through which she extracts the blood of her victim.

The effects of attacks by Gnats vary greatly with different individuals, but in every case the resulting pain and swelling is not due to any kind of poison injected by the creature, but to irritation caused by the engineering operations just described.

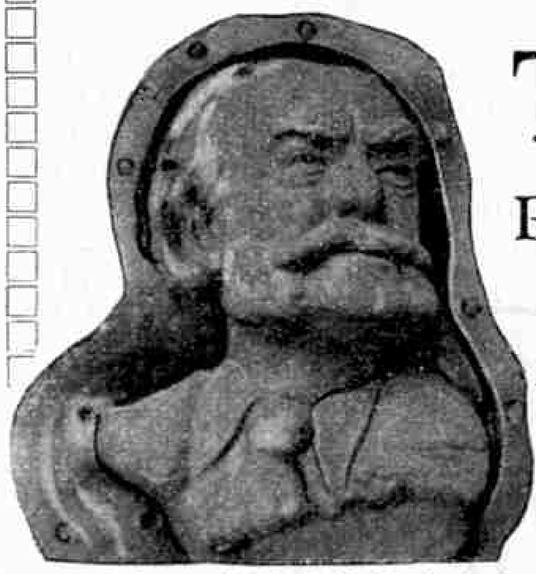
The life-history of the Gnat is very interesting. The female when laying her eggs settles on a piece of floating stick, leaf or grass, and builds up the eggs into a sort of raft, joining each egg to the next by means of a sticky substance. The raft may consist of from 100 to 300 eggs and is so perfectly arranged and balanced that it is unaffected by even the most violent disturbances of the water. Showers of rain will not sink it, and if it is deliberately pushed below the surface of the water it rises again immediately. The eggs, which are shaped something like a cigar, hatch in a few days. A tiny door in the egg then opens and the Gnat larva drops out into the water below.

The Gnat larva is a curious looking little

(Continued on page 649)



Common Carp.

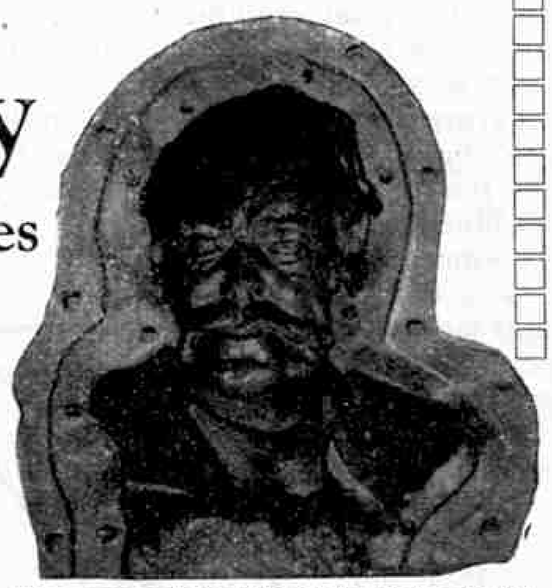


Portrait-bust with back-half of plaster-mould.

The Casting of Statuary

Processes that have Survived for Centuries

By M. Petrie



The removed front-half showing negative of face in gelatine.

WHEN we admire a beautiful bronze statue we think of the artist's genius, his power of invention and skill in modelling. We enjoy the beauty of the work, which of course is what the artist wants us to do. But we can look at it also from quite a different point of view, a purely technical one; and we shall then be amazed to find what a slow and laborious process it is to turn a clay model into bronze, and how much skill and experience is needed in the task.

Very few sculptors know how to do this themselves, or have the time required for it; and the casting of any big piece of statuary requires the combined efforts of several people. It is difficult, highly-skilled work, and special ways of doing it, learned from long experience, and secret recipes, are passed on from master to pupil, from father to son. The Italians in particular carry on the traditions of good casting, and do a great deal of it even in other countries than their own. The conscientious sculptor who wishes to see his work well finished in every detail must be able to rely on the skill of his founder, and must work in conjunction with him and, if possible, retouch the work himself as it proceeds.

Let us now follow through its different stages the casting of a bust, which is a far easier thing to cast than a statue. The bust has been modelled in clay over a support of iron and wood, called an armature. Before it can be converted into metal it has to be turned into plaster, for clay is too soft and perishable to work from. We shall have to consider at length the taking of plaster casts, as this will help us to understand the metal-casting. There are three different methods of plaster-casting—the waste-mould, the piece-mould and the gelatine-mould, which serve different purposes.

Strengthening a big mould with irons.

When only one copy of the model is needed, as is usually the case when bronze copies are taken later, a waste-mould, that is a mould that is destroyed in making the cast and cannot be used a second time, will serve the purpose. It is the easiest and quickest form of moulding. Plaster of Paris is mixed with water in equal parts, and as it sets hard within a few minutes, it has to be poured or splashed on to the model quickly while it is still liquid enough to run into all the crevices of the modelling. The mould of a bust is made in two halves, front and back, about 1 in. thick, and giving exact negatives of the front and back of the bust. The two halves are well washed and cleared of all remaining clay, and are either soaped or slightly oiled to make them non-porous, to prevent the new plaster that is poured in later from amalgamating with them.

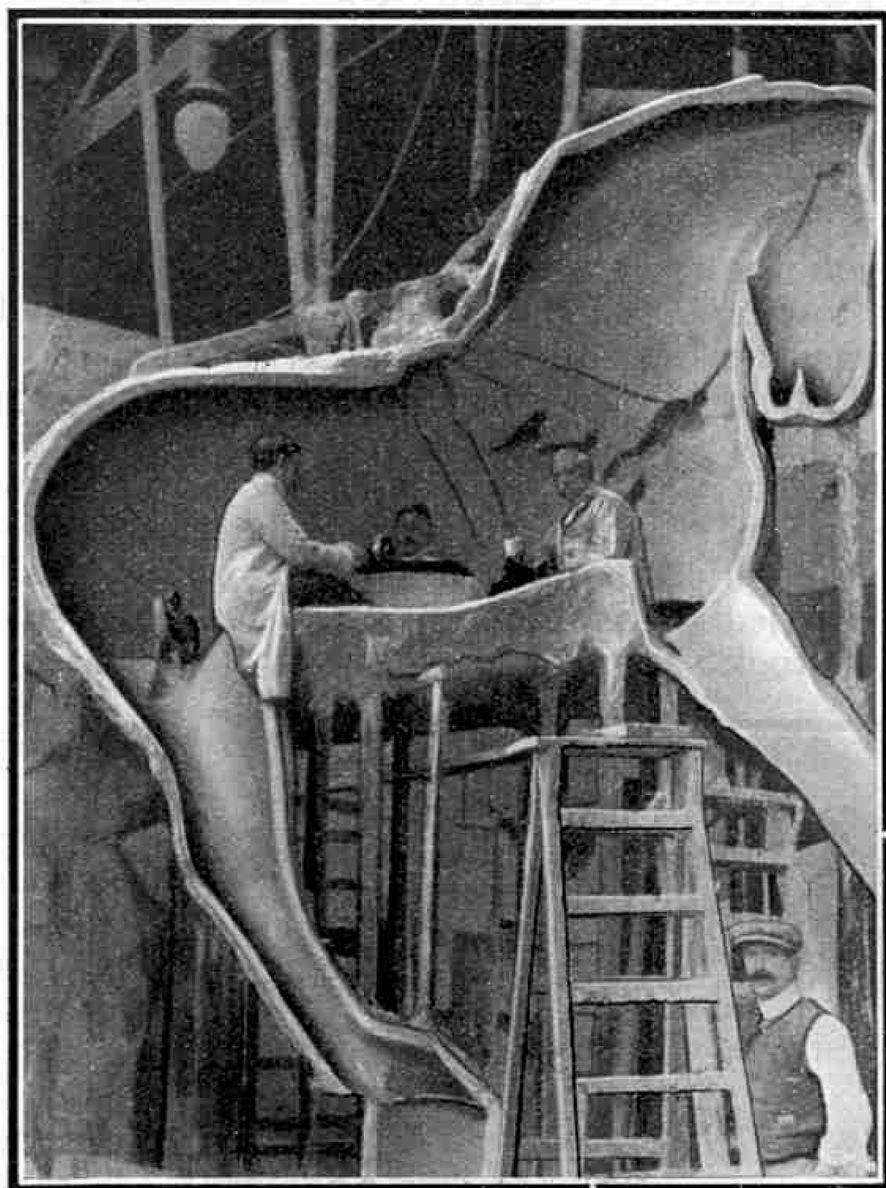
The two halves, which fit into each other exactly, are now tied securely together and made water-tight at the seam. The mould is then turned upside-down and fresh, rather thin, plaster is poured in and out by the neck a few times, care being taken that it runs everywhere and adheres to the walls in equal thickness as it sets. After a few hours, when the plaster is quite hard, one can begin to knock off the outer shell or mould carefully with hammer and chisel. This outer shell, being older and more brittle, jumps off easily from the kernel, and as the chips fall away the bust stands revealed in every detail of the moulding.

The piece-mould and the gelatine-mould are used when several plaster copies are required. The piece-mould is employed for large pieces of statuary, where gelatine would be inconvenient and expensive to use. The process consists of a laborious making of the mould in many separate pieces, like a jig-saw puzzle, held in place by a plain outer case in two halves. The separate pieces have to be made so that they all pull away easily and cannot get locked by any undercut in the modelling. Moreover they have to be keyed and fitted well into each other at their seams, which are oiled so as to separate one from the next. After one cast has been poured into a mould thus made, and has hardened, the piece-mould can be taken off bit by bit when the outer case has been removed, and can be refitted and used again and again, instead of being destroyed like the waste-mould.

Gelatine-moulding cannot be done over clay, but must be done over a plaster model made from a waste-mould or over shellacked Plasticine. In gelatine-moulding an outer case of plaster is made for the bust or statuette, on which a layer of clay has first been loosely laid, covering all modelling to a depth of half-an-inch, and leaving a smooth surface from which the outer case, again made in two halves, will pull off easily. The layer of clay is then removed and the case put back over the model, leaving an empty space between the two. Into this space liquid gelatine is poured from a hole at the top of the case.

When the jelly has set, first the case and then the jelly

are pulled off the model, the jelly being pliable and allowing itself to be pulled away from the undercuts where plaster would be locked. The jelly, which represents the exact negative of the model, and is done in two halves like the case that gives it support, is replaced in the plaster case, which is fitted and tied together and is then ready to be filled with plaster in the same manner as previously described. When the plaster is set, the case is untied and taken apart, and the gelatine is pulled away from the new copy of the bust. Many more copies can be taken by repeating this process.



A tea-party inside half a horse.

Casting in bronze or other metals is still more complicated. It is done at foundries in a pit in the earth, conveniently near the furnace in which the metal is melted. Bronze has been found to be the metal most suited to sculpture and best able to withstand the influence of the open air, and it has been employed by the Egyptians and Greeks, and through all the ages. Even the process of casting has hardly changed, and although in the 19th century another method came to be employed universally, founders have since gone back to the old methods known as the "Cire perdue," or wax process. This gives a much more exact copy than the moulding in sand, which leaves a rough surface and needs more chiselling and burnishing, resulting in the destruction of all beauty of surface treatment.

Bronze is an alloy of 90 parts copper, seven parts tin and three parts zinc. The chief differences between the plaster cast and the bronze cast—the latter, for reasons of weight and economy, having to be hollow and as thin as possible—is that liquid metal cannot be poured into the mould, shaken round and poured out again like liquid plaster. It is too dangerous to be handled in this manner, and it cools and hardens too quickly. For metal-casting, therefore, a core has to be introduced inside the mould, leaving an equally thin space everywhere between the two, into which the liquid metal is poured.

I will begin by describing sand-moulding, the process still in use for casting monuments or any large pieces of statuary, where surface finish is not of very great importance. The moulds, instead of being made of plaster as previously described, are made of a special kind of fine red sand that cakes fairly hard when pressed. Any protruding arms or legs of statues are usually cut off in the plaster, cast separately, and welded to the body later in the bronze.

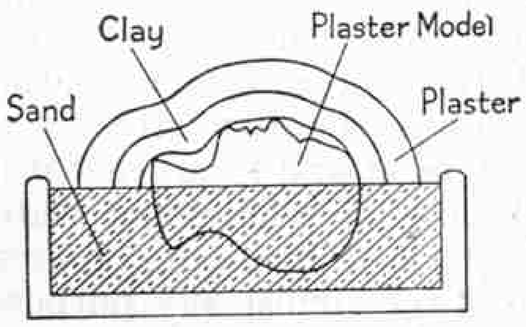


Fig. 1.

Let us suppose a bust has to be cast by the sand process. It is laid down in a metal box of appropriate size, containing sand, and is pressed into it halfway as shown in Fig. 1. A piece-mould is then built up patiently over the protruding half, with the pieces keyed and fitted into one another exactly as described in the plaster piece-moulding, except that now the pieces are made of damp sand, covered and held together by an outer case of plaster. The plaster and the sand-pieces set, and the whole is covered by a box of sand and turned upside-down. The first case with its sand, now uppermost, is removed, and the back of the plaster bust revealed. This is also built over by separate sand-pieces and a plaster case in the same way.

The next step after thus carefully making the piece-mould in sand is to take it apart and to remove the plaster model. Once more the mould is pieced together, and filled from below with sand to form a core. After the mould is removed a second time, this core has about half-an-inch scraped off its entire surface. The mould is now put together over it again, leaving an empty space between core and mould for the metal to fill. The core has to be secured to the mould by prongs, so that it cannot move inside it, and air-vents have to be provided at suitable places, otherwise air-bubbles and pockets would be formed, and the metal would not run everywhere. Finally a pour-hole has to be made in the highest part of the mould, and at last the mould is ready for filling.

Inside view of a plaster-mould.

When the metal inside it has cooled off, the mould is taken off again. The core is scraped out from below, the air-vents and pour-hole, which now have become projections in bronze, are sawn or chiselled off, and the rough cast is finished.

The "Cire purdue" or wax process gives a more faithful copy of the model, and the surface of the bronze needs scarcely any retouching. Its first stage is that of making a gelatine mould in exactly the same manner as described in the taking of plaster casts. The gelatine is then brushed over with a thin layer of liquid red wax. After iron supports for the core have been introduced and the two halves of the mould tied together, a core of brick-dust and plaster is cast into the mould, and we now have the (Continued on page 590)

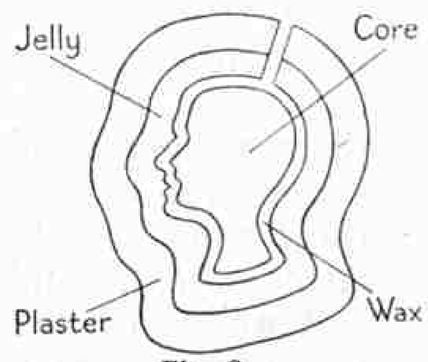


Fig. 2.

The Story of Water Engineering

IV.—The Artesian Wells of London

By L. A. Iggulden

THE value of deep wells for procuring water supplies has long been known to mankind, although the beginnings of well sinking and drilling are lost in antiquity. It is not known which country was the first to make use of such a means, but Egypt and China certainly have fairly strong claims. Records exist of ancient Chinese wells of considerable depth, some of them as much as 3,000 ft. deep and averaging 5 in. to 6 in. in diameter. The method of boring, though simple, was extremely slow, and was usually carried on both day and night. Some of the deeper wells took as long as three years before they penetrated far enough to reach the springs of water lying at great depths beneath the surface. Wells are mentioned in many books of the Bible, and we read of Moses striking a rock and of water rushing out as a result. In ancient Greece wells were extensively used to supply the great public baths with water.

The source of all water is the sea which, by means of the natural process of evaporation, supplies the clouds with water. The clouds in their turn, by the process of condensation, rain down supplies of water upon the earth, and the water is seen on land in the form of streams and rivers, ponds and lakes. Most of the water in streams and rivers finds its way back to the sea again, and so completes a natural circle. Of the remaining water some evaporates directly into the atmosphere, while a certain proportion of it sinks or percolates into the ground, when this is of such a nature to permit it. It is with this last-mentioned water that we are now concerned, because deep wells, almost without exception, are fed by rain water that has found its way underground by many devious routes.

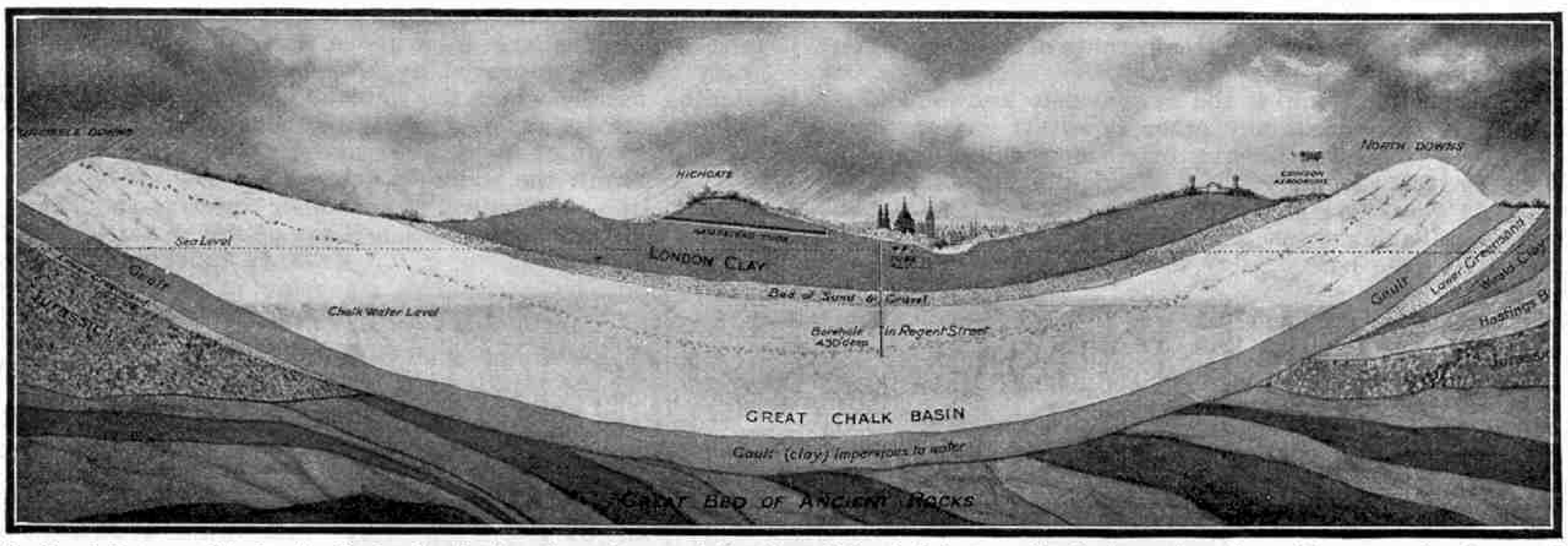
An artesian well overflowing. For the illustrations to this article we are indebted to Le Grand, Sutcliff & Gell Ltd., London.

Broadly speaking, the crust of the earth is divided into two kinds of rock, the term rock being applied comprehensively by geologists to all the different kinds of material that form the land and the sea bed. First, there are the impervious rocks, that is, rocks that will neither permit the passing of water through them, nor allow it to accumulate in their mass. Second, there are permeable rocks that will allow the passage of water and will retain it in their mass. Examples of the former are clay, granite, marble, etc.; and of the latter, chalk, sand, sandstone, shale, etc.

A well is a hole in the ground constructed with a view to obtaining supplies of whatever liquid substance may be held in the mass of rock in which the well is bored, the liquid usually being water. Wells may be of two kinds—shallow dug wells a few feet deep and wide sunk into the soils or deposits near the surface; and deep wells usually known in this country as artesian wells, drilled many hundreds of feet into deep-seated rocks to tap supplies of water known or presumed to exist beneath a particular site. The application of the term "artesian" to most wells is really incorrect, as the name is properly only applicable to wells from which the water overflows at the surface. During the year 1126 a deep well was being constructed in the Province of Artois in France. When a certain depth had been reached a great volume of water was struck, and this rushed up the bore and overflowed at the surface. Thus originated the term "artesian," which is now almost universally applied to any deep boring for water, whether there is an overflow or not.

London obtains many million gallons of water each day from artesian wells sunk through some hundreds of feet of clay and sand to tap the great chalk formation that extends for miles in all directions beneath the city, its depth varying according to the locality. Wells in London nowadays rarely overflow, but a well drilled not long ago at Slough struck a supply of water in what is known as the Lower Greensand at 1,116 ft. below ground level, resulting in an overflow of some thousands of gallons per hour. The water was of very fine quality, and no pumping plant is necessary.

One of our illustrations shows a section of the London basin, and gives a good idea of what could be seen if half London could be removed down to a depth of, say, 1,000 ft. The chalk outcrops or is exposed at the surface—except for a foot or so of soil—on the hills of Hertfordshire and Bedfordshire to the north, and passes right beneath the city towards its southern outcrop on the hills forming the North Downs of Surrey. Rain that falls on these chalk hills to the north and south percolates downward towards the centre of the formation through millions of fissures until the two streams of water, if they may be so called, meet and form what is in reality a vast underground lake of wholesome water which, having been naturally purified during its progress through the chalk, can be used for almost any purpose. Beneath the chalk, forming a barrier to the further



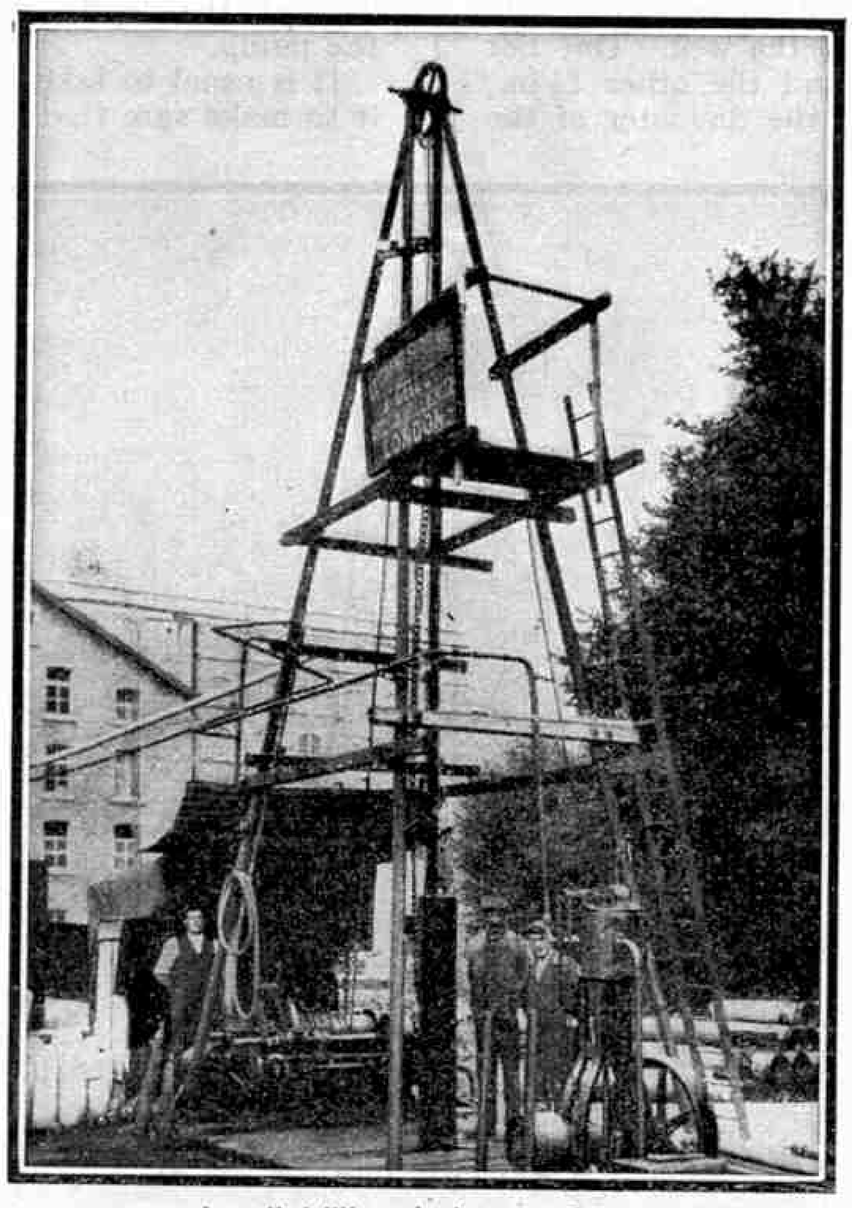
Sectional diagram of the London Basin, showing how the water percolating through the chalk is stopped by the impervious clay and forms a vast underground lake of pure water. In some localities the chalk is over 700 ft. thick.

downward progress of the water, is a thick bed of clay called the Gault. Thus the water is encased in the chalk between the London clay and sand beds above and the Gault below.

The production of a modern well involves a series of varied and interesting operations. Generally speaking, a well may be of any diameter from 6 in. to 6 ft., and of any depth from 20 ft. to 500 ft. or more. A well drilled some years ago at Bimerah in Queensland, Australia, reached a depth of 5,045 ft. The drilling rig consists mainly of a derrick of some kind to facilitate the manipulation of the various tools used; a winch for raising and lowering the tools in the well as the drilling proceeds, and a variety of tools and other items. As a rule each well presents a set of problems peculiar to itself, and the tools employed must be selected accordingly.

Drilling is usually carried out by one of two methods, or by a combination of both, according to local conditions.

The first method, used when the stratum is soft, is known as the percussion method. In this, heavy drilling tools are raised and lowered in the well with varying rapidity, the effect of this continual percussive action being to pound the stratum into a thick paste called "slurry." After a few feet have been drilled, the tools are withdrawn and a "bailer" is lowered in their place in order to remove the slurry, thus leaving a clean hole. The tools are again inserted and drilling proceeds, and the alternate operations of drilling and bailing are continued until the well is sufficiently deep.



A well drilling rig in operation.

In a soft stratum the sides of the well are liable to cave in or collapse unless they are protected in some manner, and this is done by the insertion of a suitable quantity of steel tubing screwed together in 10-ft. lengths. In London, the lining tubing is carried down to 10 ft. into the chalk, to make a seal between the chalk and the overlying sand and clays, which may contain impure water. The chalk is of sufficient hardness to "stand up," but when tubing has to be carried down into sand beds, it is usual to perforate it with small holes, suitably spaced, to permit the inflow of water, and at the same time hold back the sand.

The tools are usually suspended at the end of a wire cable hundreds of feet in length, one end of which is fastened to a winch. This cable passes up to the top of the derrick and over a pulley, and then hangs down over the centre of the well in a manner similar to a plumb-bob and line. This wire cable system of drilling is rapidly superseding the older method of rod drilling, in which steel rods were screwed together in 10-ft. lengths, so that the method resembled in some respects that of a chimney sweep at work.

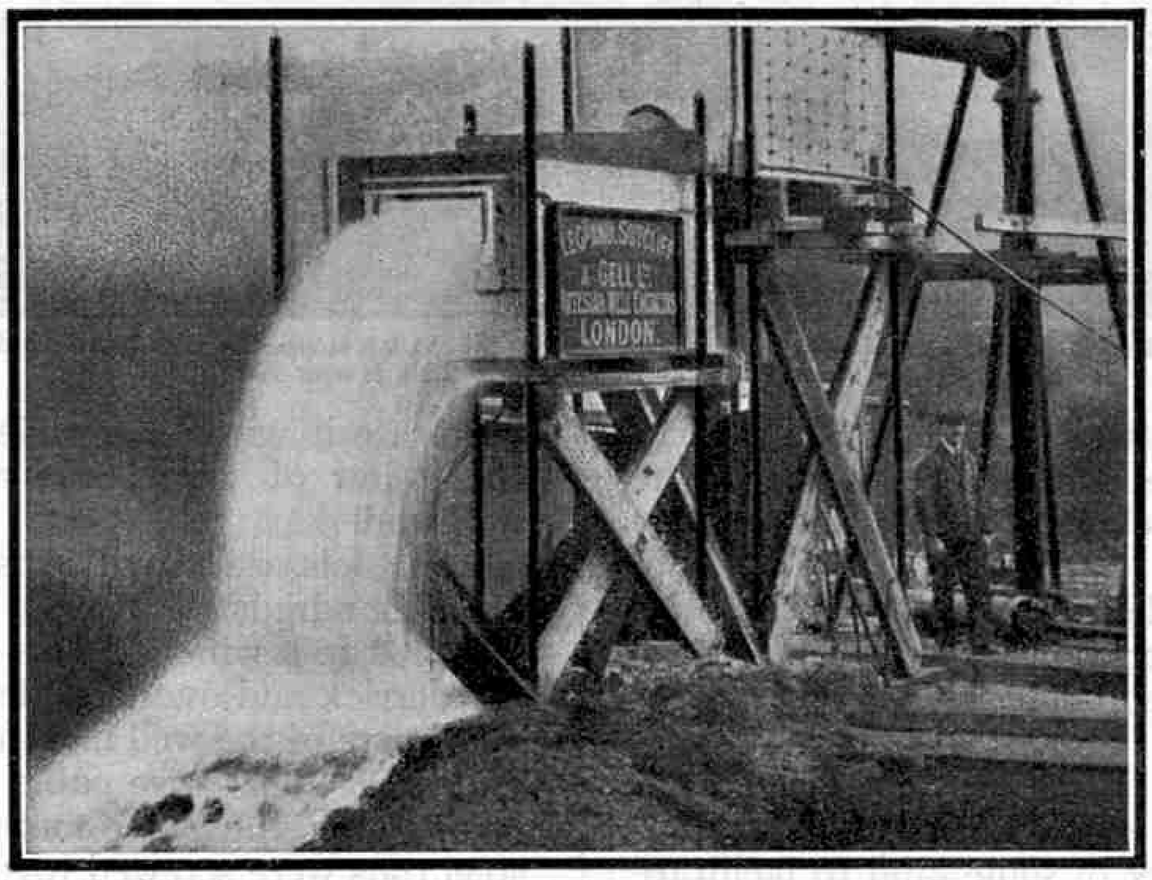
The other method of boring is known as the rotary system, and is used when hard sandstone or granite has to be penetrated. Briefly its operation is as follows. The rotary tool, which is a hollow tube, is revolved mechanically on chilled steel shot, the effect being to wear an annular groove as it progresses down into the stratum. By this method it is possible to extract a solid core of rock. During the drilling operations water is fed down through the centre of the hollow tool, to wash to the surface the material ground away by the steel shot. By a somewhat similar method oil wells in certain American oilfields have been drilled to depths of more than 10,000 ft.

When the well has been drilled to a depth calculated to give the supply needed, a test is made to ascertain the amount of water that can actually be pumped, and upon the data thus obtained the permanent pumping plant is specially designed. It is most important to ensure that the well is truly vertical—which is by no means an easy task—otherwise certain types of pumps will not operate efficiently.

If the well is a success, and assuming that the water does not overflow at the surface, one of four different types of pumping plant may be installed. These are the deep well bucket and valve pump, the air lift pump, the vertical spindle borehole centrifugal pump, and the endless chain pump. The type decided upon will depend on the amount of water the well is capable of

yielding, and also on the level of the water, and upon the general conditions prevailing at the site. Space permits of the description of only two of these types.

The bucket and valve pump is the most widely known, and is generally quite as efficient as any other type. It consists of a frame to which is connected a series of wooden rods, square in section, their lengths varying as a rule according to the depth of the well. At the lower extremity of the rods is the barrel, a brass or gunmetal cylinder inside which is the bucket with a ball valve. Screwed to the base of the barrel is the lower valve, not unlike the bucket, and also fitted with a ball valve. The whole of the apparatus situated beneath the surface is raised and lowered in the well by the rotation of the crankshaft, and the action is briefly as follows. On the down-stroke, water is forced in through the ball valve of the bucket and lower valve, and on the up-stroke it is forced up the rising main into the surface delivery and so to the storage tanks. A properly designed and constructed deep well pump is really a very efficient means of raising water, and although the general idea is somewhat antiquated, it is very much in demand. Power is supplied either by a steam or petrol engine or by an electric motor.

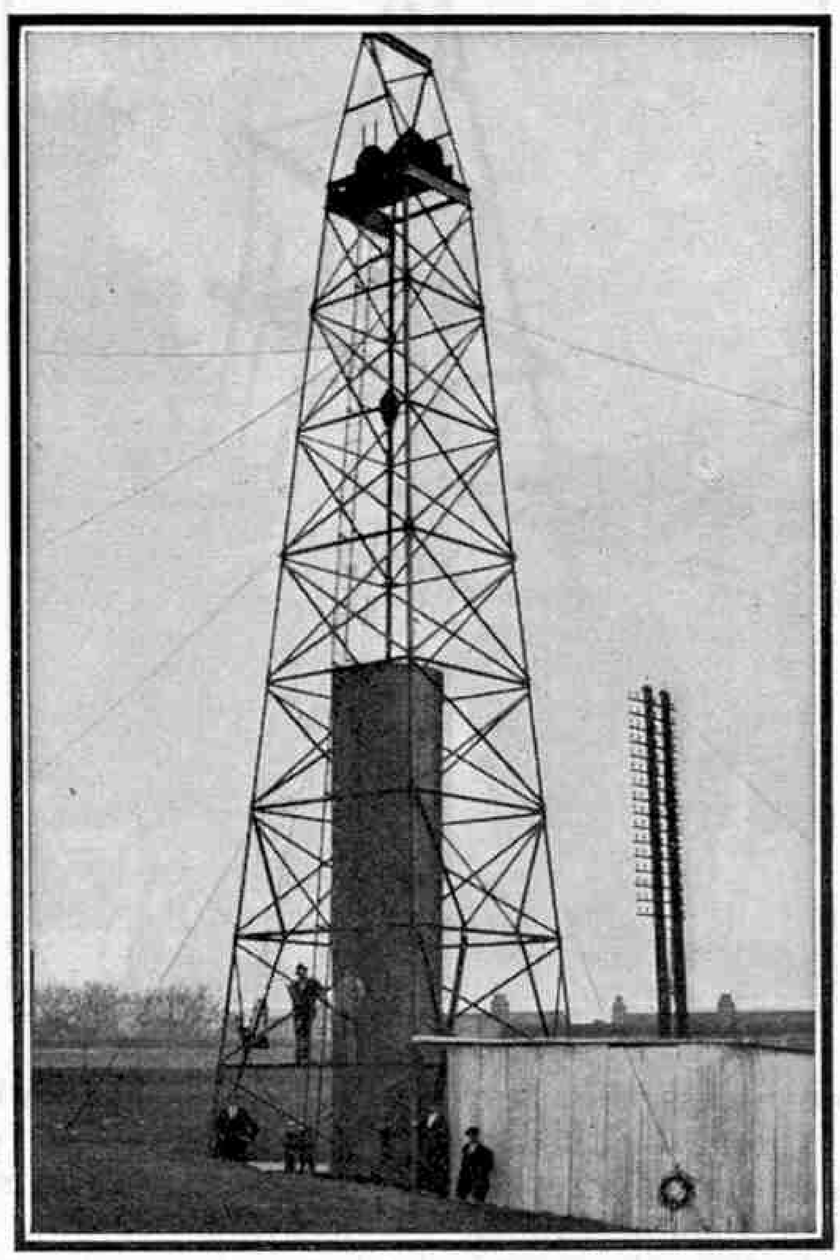


Pumping 100,000 gallons of water per hour by means of an Air Lift Plant, from a well 150 ft. deep in the chalk formation in Kent.

The next most generally used pumping apparatus is known as the air lift pump. This consists of an air compressor driven by an electric motor, or by a steam or petrol engine; an air receiver, and a set of two tiers of steel tubing extending side by side for nearly two-thirds of the depth of the well. One tier might be, for instance, 4 in. in diameter, and the other 1½ in., these sizes varying, of course, according to the diameter of the borehole. The tubing is inserted in the borehole in 10-ft. lengths, and the two tiers are the same length, and are clipped together at intervals. At the bottom is an ejector, into which the two tubes are screwed. The principle of the air lift is as follows. Air is forced down the smaller pipe by the compressor, first passing through the receiver on the surface. The purpose of the receiver is to stabilise the pressure, so that the air reaches the bottom of the tubes in a more or less steady flow. There it enters the ejector, which is suitably perforated with small holes to ensure thorough mixing of the air with the water. The water thus charged with air is now of less density than that of the water outside the larger tube, known as the rising main, and thus an upward movement is created. This causes the water to rise to the surface, where it is delivered into storage tanks for distribution.

A common practice in modern well sinking is to drill two or more wells side by side, and couple the separate pumping units in such a manner that all may be pumped together, or any two or even one operated according to the demand for water. The duplication of wells also provides a standby set in case one should happen to be out of operation at any time.

It is possible in many localities to greatly increase the supplies from boreholes by several other methods, which may be briefly reviewed. Sometimes a well that has been bored a good many years becomes silted up with fine debris from the surrounding strata; the procedure then is to shell or bail out this debris to clean the bottom of the bore, so as to give the water free access to the cavity once more.


A large well drilling derrick in operation, showing the insertion of 6 ft. 6 in. diameter lining cylinders.

Occasionally a newly-bored well fails to yield the quantity that is required, and assuming the well has been bored of sufficient size to permit a large quantity of water to be pumped, the supply may often be improved by firing off explosive shots at selected depths, usually where the water is known to be entering the well. The effect of a series of say three shots, fired at different depths, is to break up or fracture the underground strata to some extent, and so permit the water to flow more freely. The strata of the British Isles, and indeed of any other country, are of many types and characteristics, and while some permit water to flow through fairly quickly, others are very slow in parting with the water held in their mass. The firing of explosives is designed to free the fissures, crevices and pores to some extent.

A third and very ingenious device is to make what are known as deflected or side tracked bores, that is, boreholes drilled at an angle from the main hole to varying distances. If the reader will imagine a three-legged music stand such as is used by orchestral players, he will have some idea of a deflected boring. This method is quite new, and is a somewhat difficult operation; but it has been successfully adopted by one of the most important waterworks in England, with very surprising results.

A London well may yield anything from 2,000 to 20,000 gallons per hour, or more, some wells having been known to yield over 200,000 gallons per hour. The actual delivery depends upon the nature of the chalk from which the water is derived, the depth and diameter of the well, and the design of the pump.

It is usual to take a sample of the water pumped and analyse it to make sure that it is fit for consumption.

From what has been said it will be clear that the procuring of water supplies from the earth by means of deep wells is more interesting than might be thought; and that the construction of an efficient pumping installation is really a highly technical piece of engineering work, involving a wide knowledge of geology and mechanics. Particular skill and care are necessary on the part of the driller and his assistants. The tools may easily become lodged in the boring hundreds of feet below the surface, and then much money may be wasted in recovering them, or, as sometimes happens, failure to recover them may mean an abandoned boring and a fresh start.

The water from deep artesian boreholes, apart from being very cheaply produced, has other advantages as compared with water from the ordinary mains. It is usually very soft, the hardness depending, of course, upon the locality. In London the average hardness is only 7 deg., as against the 18 deg. of the ordinary water from the mains. The passage of the water through varying strata has the effect of purifying it, so that a filter is rarely necessary; and the temperature is the same in summer as in winter, never rising above 54 deg. F. It is unaffected by drought and other restrictions, and it often contains minute quantities of mineral matter that are beneficial.

We may conclude by answering a question that is nearly always asked in connection with deep wells: "How can you tell how deep to bore the well?" Frequently it is a matter of boring and testing until the required amount has been found, but it is of great help to consult and compare the details of other wells in a particular district, and drill accordingly.

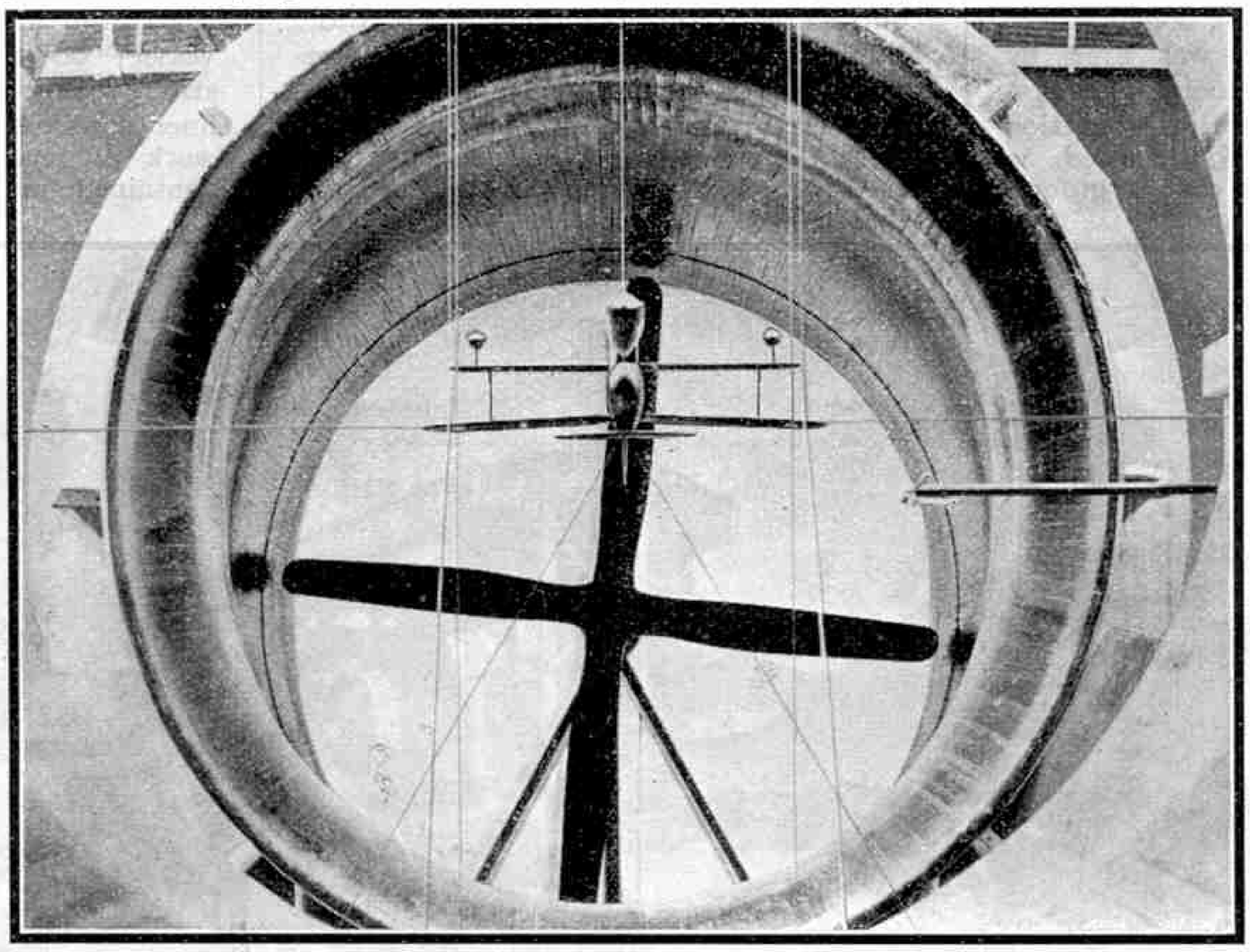
Models to Test Aeroplane Designs

Experiments in Wind Tunnels

IN producing a new aeroplane the designer makes use of general principles of construction already worked out by aeronautical engineers; and even before his machine is built he is able to calculate the greatest speed it should have, and to predict various other details of its performance. The only really complete test, however, is an actual flight; and naturally the designer is eager to learn how a machine for which he is responsible will behave when in the air.

Fortunately it is not necessary to wait until an aeroplane has been completed in order to obtain some idea of the manner in which it will fly, for a scale model may be tested in conditions similar to those in which the finished machine will operate. The tests are carried out in what are known as "wind tunnels." In these tunnels the usual procedure in flying is reversed. An aeroplane in flight is propelled at high speed through the air, but in wind tunnel tests the model is fixed and a stream of air is driven past it by means of a powerful fan. It is interesting to note that small wind tunnels were used by the Wrights, the famous pioneers of flying, for testing their crude models of gliders and aeroplanes.

Two main types of wind tunnel have been developed. In the first type the airstream simply passes down a long wide tube, in the middle of which is suspended the model to be tested. This simple form does not reproduce with sufficient exactness the conditions under which aeroplanes fly; and to a large extent it has been displaced by a tunnel that is built in two sections placed end to end, with a space between them in which the model is hung. A large propeller is fixed at the outer end of the second section, in order to suck air through the tubes, and the airstream thus produced flows across the space in which the model is suspended.



A model flying boat ready for test in the wind tunnel described in this article. Our photograph is reproduced by courtesy of the General Electric Company of New York.

The shape of each section of the tunnel is carefully designed in order to ensure that the airstream across the space shall be uniform; and with the same object the blast of air in certain wind tunnels is divided into a number of smaller parallel streams by means of a screen of similar design to the honeycomb radiators fitted on motor cars. Measuring instruments show how the model behaves in the airstream, and the tests made in the tunnel tell the designer what he may expect when his full-scale machine is flown.

Large wind tunnels are costly to build and operate, but their value is undoubted; and both in this country and in the United States interesting examples are already in use, and others are under construction. The most important of them are being employed for investigating the manner in which the airstream passes the wings, engine cowlings and other parts of a machine in motion, and the results of experiments of this kind are very useful to the designer. Tunnels are proving valuable also in showing how greater speed and improved climbing power may be obtained.

What is claimed to be the largest commercially-operated wind tunnel in the world has recently been completed in the factory of the Berliner-Joyce Aircraft Corporation, near the municipal airport at Dundalk, Maryland, U.S.A. It is housed in a large brick building specially erected for the purpose. The propeller that provides the blast of air is four-bladed, and is 12 ft. 6 in. in diameter. It is driven by an electric motor that develops 224 h.p. at 850 r.p.m., and when it is switched on the air roars through the tunnel at a speed of 110 m.p.h. In addition to the driving motor there is a motor generating set, and an ingenious control system enables the speed of the motor to be varied over a wide range in order that experiments may be made at different air speeds. The electrical equipment has been designed and manufactured by the General Electric Company of New York.

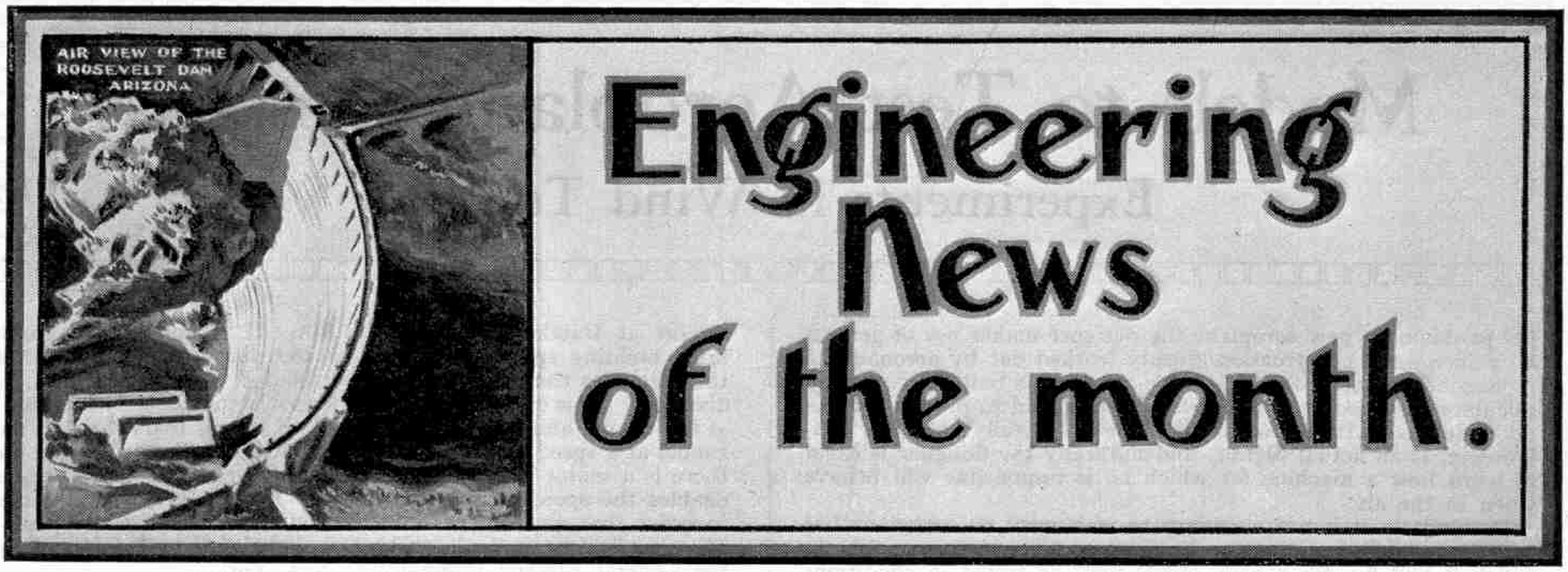
The tunnel itself is constructed of poplar, and consists of two cones. The entrance cone has a square mouth, each side of which measures 16 ft.; and it narrows down to a circular throat 7½ ft. in diameter, through which the air rushes at its greatest speed. The model to be tested is hung just beyond this throat, in what is called the experimental chamber. The air streams past the model, and then enters the expanding exit cone at the end of which is the fan.

The blast of air emerging from the tunnel is not allowed to escape, but is led through curved ducts into side passages through which it returns to the other end of the structure, where the two streams reunite and re-enter the tunnel. Elaborate precautions have been taken to ensure that there is the least possible interference with the air flow. The walls of the passages are curved in order to guide it, and are finished with smooth plaster with the object of reducing surface friction. The result is that the airstream flows swiftly through the tunnel and then returns smoothly and easily to the entrance in readiness for another circuit.

The miniature aeroplane used in work in a wind tunnel must be an exact scale reproduction of the actual machine that it represents. It is hung upside down, so that its movements may be registered on the sensitive instruments by tension instead of by compression, and in this manner the use of large rods is avoided.

The balances by means of which the forces acting on the model are registered are contained in an observation room above the experimental chamber. Six distinct aerodynamic components of the force exerted are measured for each model under test; these being the lift, drag and side forces, and the pitching, rolling and yawing moments. So sensitive are the balances that the measurements are correct to within two ten-thousandths of one pound weight. The exact knowledge obtained in this manner is of the greatest value in determining the performance and stability of an aeroplane in course of design, for the effects of any changes suggested by the tests may be studied in the scale model instead of in a costly full-sized trial machine.

In order to ensure that trials of this kind are of value, it is necessary that the scale models employed shall be very carefully prepared. Strictly speaking the results of such trials only show the stresses that machines will undergo when gliding freely in the air, but in larger wind tunnels propellers turning at proportionate speeds may be fitted to the scale models tested.



Engineering News of the month.

"Colloidal" Fuel on Cunard Liner

During a recent trip from Liverpool to New York, one of the six boilers of the Cunard liner "*Scythia*" was fired by means of a new type of fuel. This is a mixture of oil and coal in the proportion of three to two, and is described as "colloidal," for the solid coal is ground into very minute particles that remain suspended in the liquid oil instead of sinking to the bottom of the containers.

The use of this mixture is expected to lead to considerable economies, and if the trials are successful its manufacture will provide a new outlet for British coal, the proportion of which may possibly be increased. It is believed that Diesel engines could be adapted for the use of colloidal fuel, and thus motor vessels as well as oil-fired steamships could be run on fuel partly produced in this country instead of being almost entirely dependent on imported oil, while the introduction of road vehicles with Diesel engines suggests a further application.

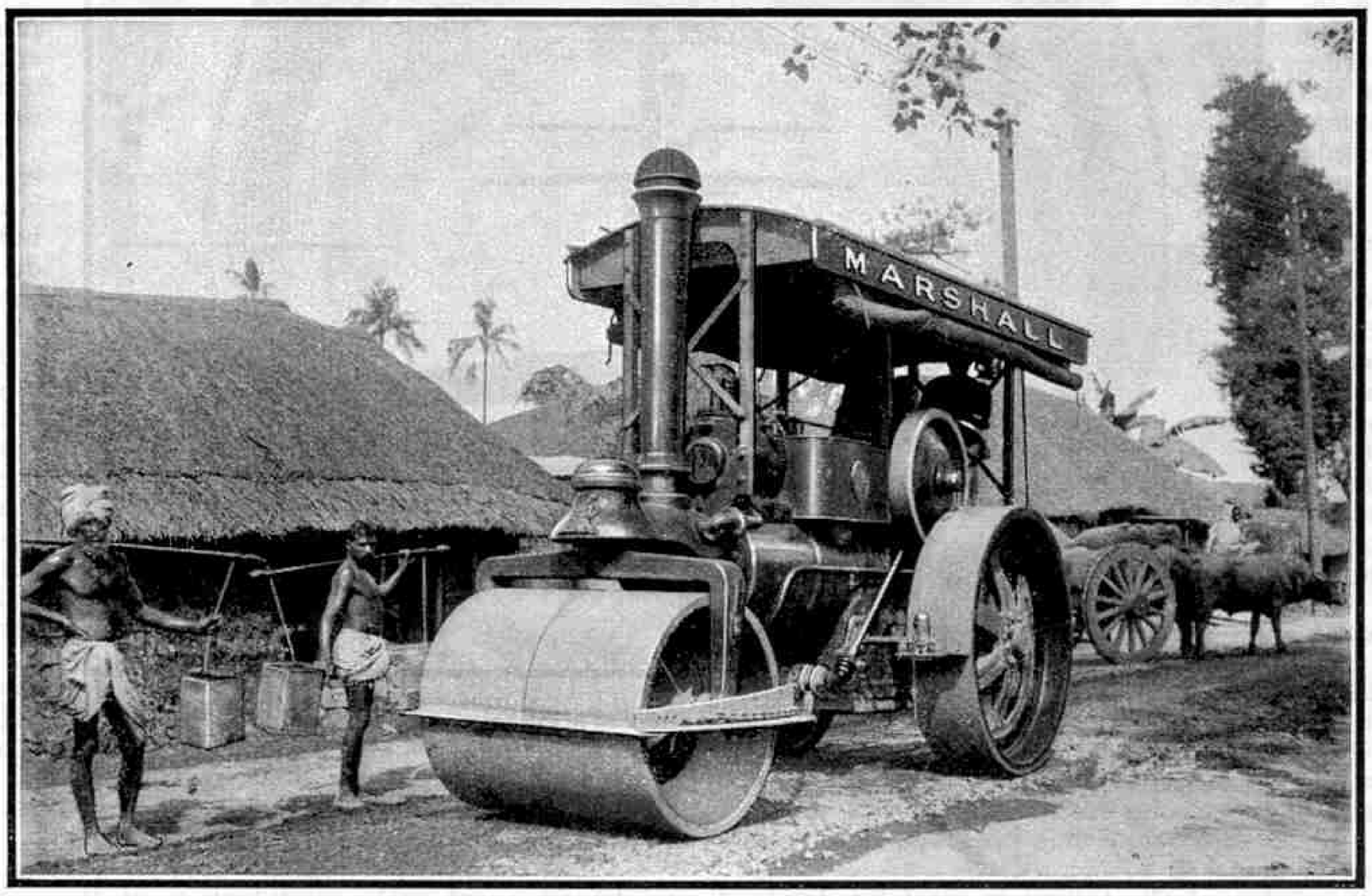
Longest Suspension Bridge in France

A suspension bridge that is claimed to be the longest of this type in France has been constructed over the River Durance at Cavaillon, in the Dordogne, in place of a structure that was swept away by severe floods. The old bridge was carried on piers erected on the bed of the river, but those on which the new bridge is supported are on the banks, and are 42 m. (138 ft.) in height. The structure has a span of 308 m. (1,031 ft.), and the platform is supported by 32 cables, each of which is 10 cm. (4 in.) in diameter and 450 m. (1,507 ft.) in length. The deck is 8 m. (26 ft.) in width.

British Firm to Build Bridges in China

The Chinese Government have placed a contract with Dorman Long & Co. Ltd., Middlesbrough, for the construction of two approach bridges for the Nanking-Pukow train ferry referred to in these pages last month. Each approach will consist of four spans 154 ft. in length, and will be 20 ft. in width, widening out to 44 ft. on the river span in order to provide accommodation for the three tracks leading to the ferry boat.

The Yangtse River at the ferry crossing has an extreme variation in water level of 28 ft. with a daily variation of from one to three feet. The approach spans on each bank will be carried on long screws that will be electrically operated and by this means they will be moved to give a suitable gradient at any state of the river, the machinery for operating the screws being situated on the top of steel towers over the bridge piers. An adjustable apron connecting the ferry boat with the ends of the river spans will take up minor variations in the levels of the decks of the ferry boat and of the bridges during loading operations.



A steam roller at work on the road in an Indian village. Our photograph is reproduced by courtesy of Marshall, Sons & Co. Ltd., Gainsborough.

The "*Egypt's*" Gold Recovered

After operations extending over five years, the divers of the Italian salvage vessel "*Artiglio II*" penetrated to the strong room of the "*Egypt*," the P. and O. liner sunk off Ushant in 1922, and the work of recovering the gold and silver contained in it was then commenced. The wreck is lying on the bed of the Bay of Biscay at a depth of about 400 ft., and the divers directed the operation of a grab that picked up gold bars and boxes of coin and hoisted them to the surface. On the afternoon when the gold was reached 25 bars of the metal were raised, their total value being £160,000, and during the following two days 25 additional bars of gold and 1,414 loose sovereigns were recovered.

The treasure carried in the holds of the "*Egypt*" included 1,089 ingots of gold weighing about 4½ tons. In addition there were 37 boxes of sovereigns, with a total value of £164,979, and 33 tons of silver, made up of 1,229 bars.

The total value of the gold and silver sunk with the liner was more than £1,000,000, and since 1928 continuous efforts have been made to recover it. Difficulty was first experienced in finding the exact position of the wreck, and then work on her was only possible in good weather in summer. The "*Artiglio*," the first salvage vessel employed, was herself lost in a storm. The task was continued in a second ship to which the same name was given, however, and the persistent efforts of the Italian divers have been successful. It was necessary to cut through four decks before the strong room, which was on the lowest deck, could be reached.

Zuider Zee Cut Off from North Sea

The huge dam or dyke erected from North Holland to Friesland in order to shut off the Zuider Zee from the North Sea has now been completed. The dyke has taken about five years to build and is 18½ miles in length. It has a width of 400 ft. at the sea bed and the top, which is 120 ft. in width, eventually will carry a road and a railway.

The Zuider Zee reclamation scheme provides for the making of four huge polders, as meadows reclaimed from the sea are called, the water being pumped out of areas enclosed by huge dykes. One polder has already been made and the completion of the great dyke will enable the task of reclaiming the remaining polders to be carried out, but the beginning of the work has been postponed owing to the financial situation.

The polder already formed is known as the North West or Wieringermeer, and has an area of approximately 500,000 acres. A quarter of the reclaimed land is already under cultivation, the crops grown being rye and oats, and a large part of the remainder of the area is covered with grass, on which cattle and sheep are being put out to graze. A number of villages also are under construction, the largest of which will start with 30 houses and one church.

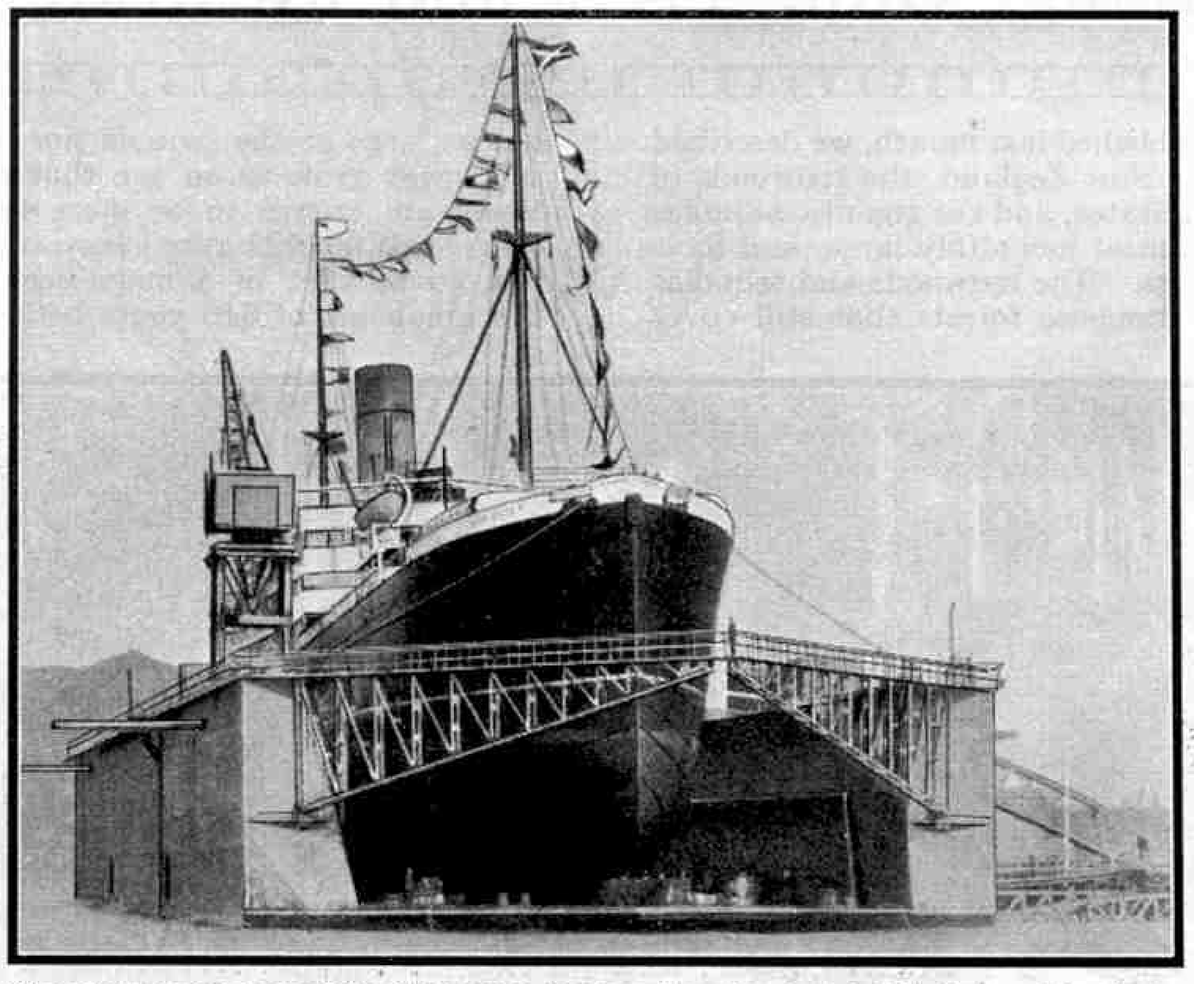
Largest British Motor Vessel

The White Star Line's new motor liner, "*Georgic*," built by Harland & Wolff Ltd., of Belfast, has now taken her place in the Liverpool-New York service. The "*Georgic*" was the largest British-built vessel to be launched in 1931 and she is the largest British motor ship. She is 680 ft. in length between perpendiculars, and has a moulded breadth of 82 ft. and a moulded depth of 43 ft. 9 in. Her gross tonnage is about 27,000 tons and she has a designed sea speed of between 16 and 17 knots. Accommodation is provided for 479 passengers in the cabin class, 557 in the tourist class, and 596 in the third class, a total of 1,632.

An interesting feature of the vessel is the great economy in operation. In order to demonstrate this, a small glass tube, ½ in. in diameter and containing fuel oil to a depth of 1½ in., is mounted near the entrance to the main engine room top platform, and below it is placed a notice stating that the quantity of the oil shown generates sufficient energy to transport a load of one ton for a distance of one mile at full speed!

* * * *

A dam that is being built across the Volga in Russia will impound sufficient water to irrigate more than 4,000,000 hectares, or about 9,884,000 acres, of arable land in the Middle Volga district.



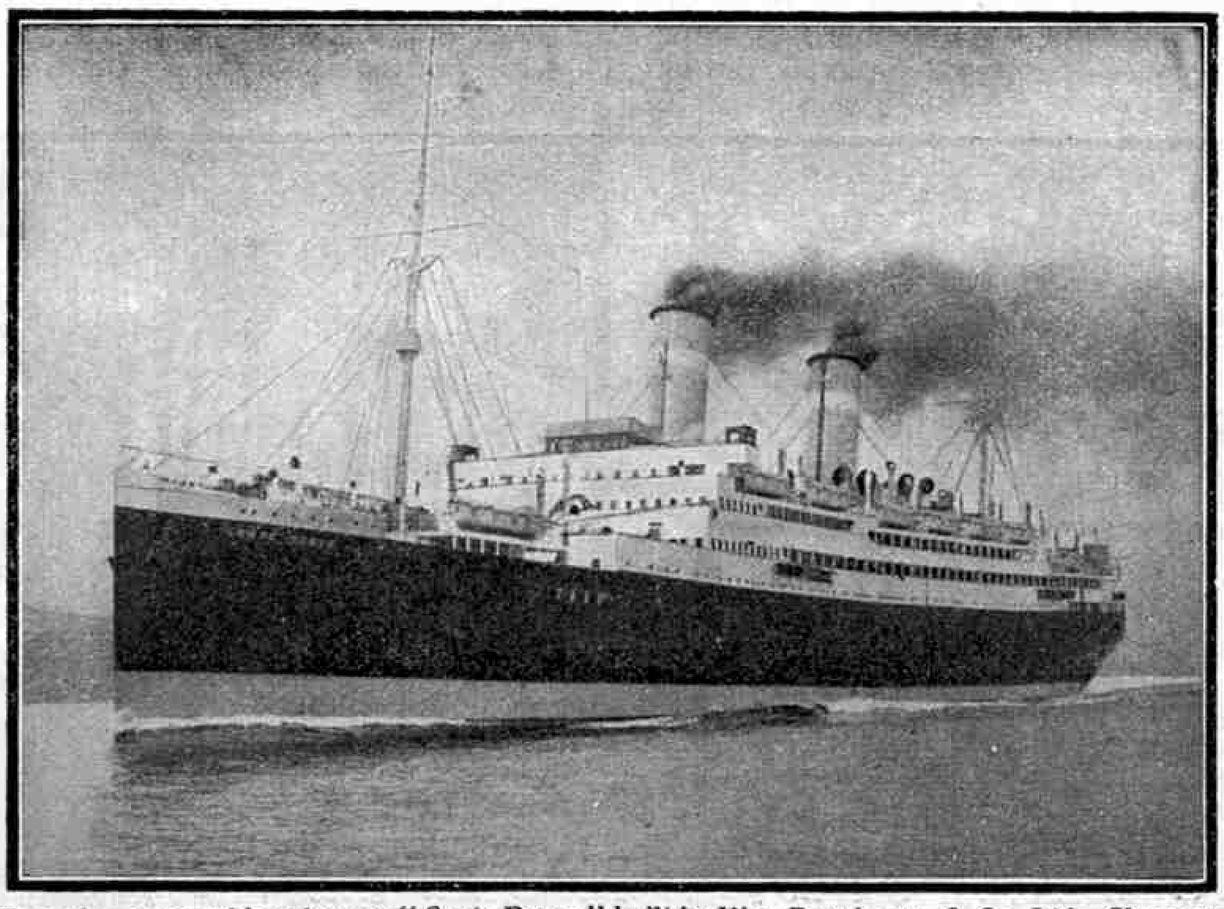
The new floating dock of the Wellington Harbour Board undergoing its first working test. The vessel in the dock is the New Zealand Shipping Company's "Ruahine." Photograph by our reader I. G. G. Mackay, Wellington, N.Z.

Larger Cars for P.O. Tube Railway

On page 463 of our issue for June 1930 we described the Post Office underground railway, which carries mails between Paddington and Whitechapel. A new type of car has now been designed for service on this railway and it has entirely replaced those formerly in use.

The new cars resemble the old ones in being driverless, and they are controlled from switch cabins in a similar manner, but they are nearly twice as large, and only 50 have been required to replace the old fleet of 90 vehicles. They are 27 ft. in overall length and are capable of attaining a speed of 35 m.p.h. when carrying four mail bags.

Each car is driven by means of two 22 h.p. English Electric motors arranged in series, and the brakes are automatically applied by powerful springs immediately the current is cut off, electro-magnets lifting up the springs when the current is switched on.



The twin screw turbine steamer "Conte Rosso," built by Wm. Beardmore & Co. Ltd., Glasgow, for the Italian Lloyd Sabaudo Company. The vessel is 570 ft. long, 74 ft. wide and 36 ft. deep.

New Oil Engine for Motor Cars

A new type of oil engine for which great economy in operation is claimed has been introduced in the United States. It is of the four-cylinder type and is capable of developing 118 b.h.p. at 2,300 r.p.m. Its chief feature is that the fuel is delivered to the injectors at low pressure and is there pre-heated, with the result that it enters the combustion chamber in a gaseous state instead of in the form of a jet of liquid.

Some idea of the comparatively small amount of fuel that is required to operate an engine of the new type may be gained from the fact that in the United States a motor car equipped with one completed a 500-mile course at an average speed of 86 m.p.h. without having to stop once in order to refuel. A car with one of the new engines has been demonstrated in this country and on the Continent, where a distance of more than 400 miles were covered. The total cost of the fuel for the Continental tour was less than £2, the fuel consumption being one gallon for 36 miles.

World's Fastest Oil Tanker

A motor tanker constructed in Japan claimed to be the fastest oil-carrying motor vessel in the world. She has been named the "*Fujisan Maru*" and is intended for service between Japan and the United States of America. An M.A.N. double-acting two-stroke airless-injection Diesel engine of 7,200 b.h.p. at 113 r.p.m. has been installed, giving the vessel a service speed of 16 knots, but she attained a speed of 18.8 knots on her trials.

The "*Fujisan Maru*" is 512 ft. in overall length and 490 ft. between perpendiculars. She has a moulded breadth and depth of 65 ft. and 37 ft. respectively, and a displacement of 18,780 tons. The oil tanks have a capacity of 542,500 c. ft., while in addition the vessel has a general-cargo capacity of 105,000 ft.

Electric Light and Power Output in Canada

During 1931 Canadian central electricity stations had an output totalling 16,610,000,000 k.w.h., of which 16,078,653,000 k.w.h. was generated by means of water power and 312,857,000 k.w.h. in stations burning coal. In addition 1,374,000,000 k.w.h. was generated by electrical railways and in factories, the total production thus being about 19,468,000,000 k.w.h.

The use of electricity in Canada is rapidly extending, particularly in rural districts, and to-day there is scarcely a hamlet in the Dominion that has no current supply. An interesting feature is that 7.4 per cent. of the total Canadian output is exported to the United States.

The World's Most Wonderful Trees

II.—Australian Gum Trees and Mexican Cypresses

IN the first article in this series, published last month, we described the magnificent kauri pines of New Zealand, the redwoods of the Pacific Coast of the United States, and the gigantic sequoias of California, some of which are almost incredibly large, and have reached the great age of 3,000 years. The redwoods and sequoias are not the only marvels of the immense forests that still cover thousands of square miles in North America, however, for many wonderful trees may be found in Mexico in the south, and in Canada where the forest region penetrates far northward towards the Arctic Circle.

The moist climate of the Pacific Coast provides ideal conditions for the growth of large trees, and in the forests of British Columbia there are many that are almost as remarkable as the venerable giants of California. The best known tree in these forests is the Douglas fir, which ranges from the eastern slopes of the Rocky Mountains to the Pacific Coast. This splendid tree averages 180 ft. in height, but in specially favourable conditions it may tower to 350 ft., a giant of this size having a diameter of about 10 ft. Its remarkably straight trunk is covered with deeply furrowed bark that may be from 10 in. to 12 in. in thickness, and is free from branches up to a height of 70 ft. or even more. This ensures a great length of stout timber free from knots and other defects, and because of this the Douglas firs of British Columbia have supplied tall masts for many of the world's most famous sailing vessels. The coming of the steamship and the use of iron in shipbuilding practically put an end to this use of the tree. The wood is employed to-day in enormous quantities, however, for its strength, stiffness and durability make it invaluable for many structural purposes such as the erection of bridges, docks and large buildings; and it is suitable also for making paving blocks and for any employment in which a very hard and resistant wood is required. In addition it is now largely used for interior decorative work, for its grain is very pleasing; and practically the only obstacle to its almost universal employment is to be found in its most valuable quality, its toughness when thoroughly seasoned making it difficult to work.

Hauling logs in the karri forests of Western Australia. The two photographs on this page, and the lower one on the opposite page, are reproduced by courtesy of the State Saw Mills Department, Western Australia, to which we are indebted for interesting information.

The fall of a giant karri at Pemberton, Western Australia. The karri tree is remarkable for its great length of trunk free from branches.

In the comparatively arid regions of Arizona and New Mexico the yellow pine flourishes in conditions greatly inferior to those enjoyed by the giant sequoias and the Douglas firs. The yellow pine does well in the sandy soil of these regions, its thick bark preventing evaporation of moisture from the trunk and enabling it to thrive where other trees would starve for lack of water. It is not as large as the sequoia nor does it live as long, but favoured specimens grow to an age that must be regarded as remarkable. Many are known to be more than 500 years old, and a stump discovered in 1923 near Flagstaff, Arizona, was found on examination to be that of a magnificent yellow pine that had reached the great age of 640 years before being cut down.

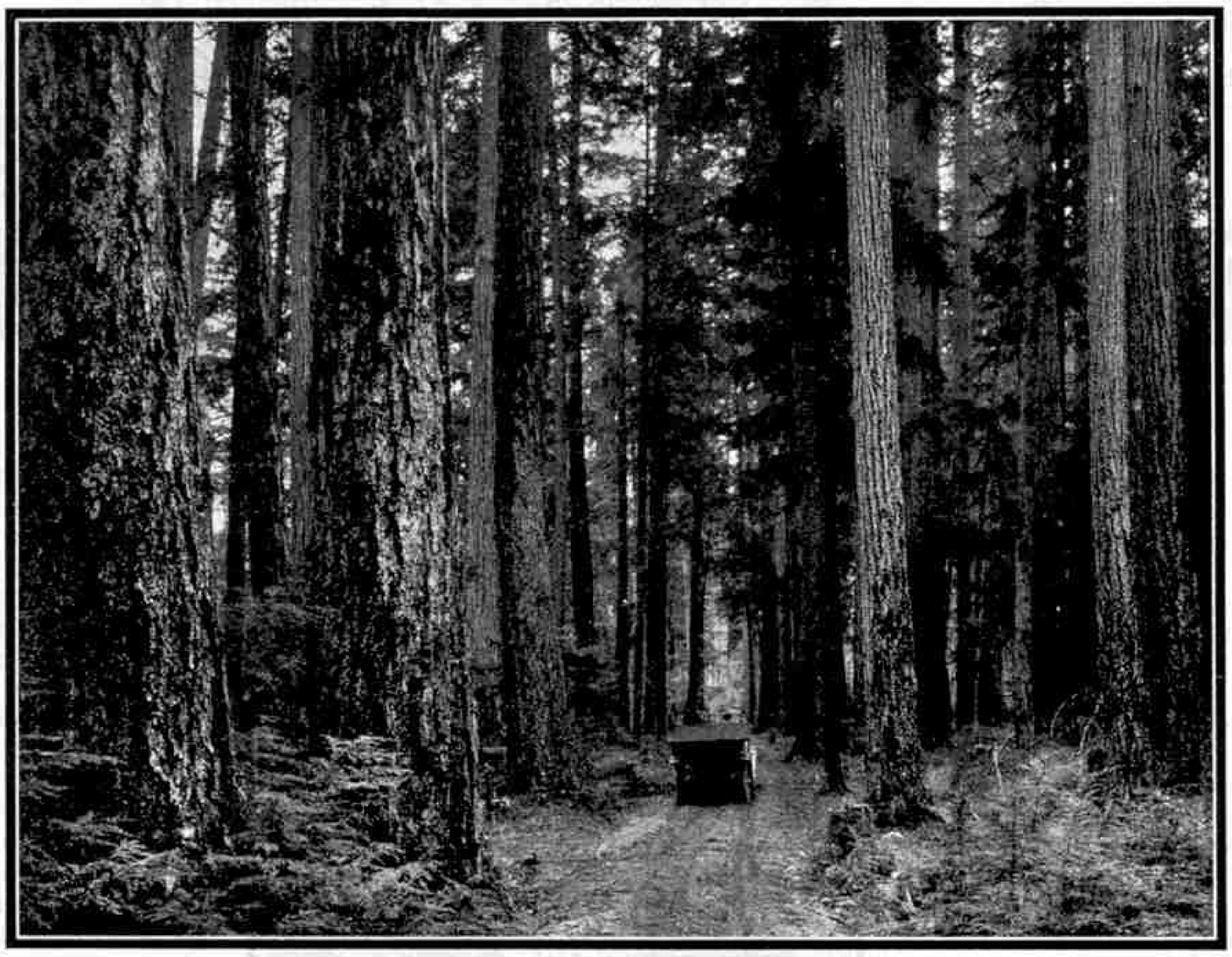
This ancient stump has a wonderfully interesting story to tell us. Close examination when it was discovered seemed to show that its centre had been injured in some manner, for it had made very scanty growth for several years before 1284, the date of the earliest normal ring counted. Later it was discovered that equally scanty rings had been formed during the years from 1276 to 1284 in trees that had been cut down centuries ago for use in building ancient Indian villages in Arizona; and it was then realised that the supposed injury actually was the record of a great drought that appears to have lasted from 1275 to about 1299.

The rings of many other pine trees grown in the district, and those still showing in beams that for hundreds of years have supported the roofs of the houses of the Indians of Arizona and New Mexico, form a wonderfully reliable tree diary. They are white and soft if they were grown in years when rain was plentiful, while the lean years when the trees were thirsty are represented by rings that are hard and narrow. It is possible to trace in them climatic changes over an immense area for hundreds of years, and comparison with the equally fascinating story written in the rings of the ancient sequoias of California has enabled the record to be extended backward for many centuries. Cross sections of these venerable trees therefore provide a calendar by means of which definite dates already have been given to events that happened in America before history was written, and trees and beams retrieved from the past in other parts of the world eventually may help to clear up many doubtful points in world history. We hope to explain in an early issue how the story written in the trees has revealed important secrets of North America's remote past.

Farther south, many magnificent trees are met with in certain parts of Mexico, where high temperatures and heavy rainfall provide warmth and moisture, their chief needs. Of these the most outstanding is the bald cypress, sometimes referred to as the swamp cypress because it flourishes in moisture-laden ground. It is a lofty tree, often reaching a height of 170 ft., and is a native of the

southern portions of the United States as well as of Mexico. When it grows in or near an ample water supply it may attain a diameter of more than 15 ft., and in these conditions the lower portion of its trunk is masked by enormous buttresses, each of which ends in a branching root that reaches outward to a great distance. These roots give the tree a remarkable and characteristic appearance, for they develop enormous "knees," rising above the ground, that consist of soft and spongy wood and actually are breathing organs for the roots, for they rise above the level of the water covering the root tips and preventing the free access of air to them.

One of the best known cypresses in Mexico grows near Oaxaca. It is 126 ft. in height and its enormous buttresses give it a girth of 51 ft., while the spread of its branches is about 137 ft. A tree that was famous more than 400 years ago is the Cypress of Montezuma, which grows in the gardens of Chapultepec. This is taller than the tree near Oaxaca, for it grows to a height of 167 ft., and it is believed to be at least 700 years of age. Even this ancient tree is not the oldest of the Mexican cypresses, however, for there is little doubt that many of them flourished for centuries before Columbus led the way to America and the Spaniards under Cortes conquered the Aztecs to add Mexico to the Spanish Empire.



Douglas firs 300 to 400 years of age in the forests of British Columbia. For our photograph we are indebted to the courtesy of the High Commissioner of Canada.

Whenever large and wonderful trees are being discussed attention naturally turns to the famous gum trees of Australia. These belong to the eucalyptus family, which is almost peculiar to Australia, for in other parts of the world it is represented only by a few small trees. The members of this family have leathery leaves studded with glands containing fragrant oil, and they grow very rapidly.

The gum trees of Australia include one that usually is regarded as the world's tallest tree. This is the giant or peppermint gum, and is a native of Victoria, New South Wales and Tasmania. In favourable circumstances it has been said to attain the enormous height of 480 ft., and a girth of 81 ft. In size it is a rival of the giant sequoia, and it is claimed that the largest specimens of this tree contain a greater volume of timber than is to be found in any other tree in the world. Other Australian gum trees grow to heights of from 100 ft. to 150 ft.; and the blue gum of Victoria and Tasmania, the average height of which is 200 ft., may attain a height of 375 ft.

The species also is remarkable for the inclusion of many trees that provide timber possessing special features. For instance, one of them, a gum tree that averages 100 ft. in height and often reaches 150 ft., yields jarrah, a red timber that is very hard and resistant. Jarrah has been found particularly useful in tropical climates, where it has been largely employed in building jetties, piers and other marine structures because of its power of resisting the attack of the teredo, a little marine worm that rapidly bores its way into ordinary woods when these are immersed in sea water.

Felling a giant karri in the State forests at Pemberton, Western Australia.

An even taller eucalyptus that to-day is one of the most important timber-producing trees in the world is karri, the largest tree in the forests of Western Australia. The tree is found only in the south-western portions of that State, and it is superior even to the Douglas fir in the length of trunk free from branches, for karris 200 ft. in height with their first limb at a height of 120 ft. above the ground are quite common. A few years ago a giant 278 ft. in height was discovered, while the trunk of a magnificent specimen felled recently was 160 ft. in length from the ground to the first limb, and tapered gradually from a girth of 34 ft. near the ground to one of 14 ft. at the point where the lowest branch spread out from it. The full height of this splendid tree was 230 ft., and it has been calculated that its bole, or the timber-yielding portion from the ground to the first limb, contained about 7,334 c. ft. of wood and weighed no less than 236 tons.

Karri is a hardwood varying from almost white to reddish brown in colour when first cut, and becoming darker with age. Its strength and stiffness have earned for it the name of the beam timber, and it gives satisfactory results when used in building wharves, in the construction of railway rolling stock, and for any purpose in which strength is an essential feature. The extraordinary lengths of sound timber that may be obtained make karri suitable for the keelsons of ships built of wood, and also for working up into massive beams capable of taking enormous loads. The State Saw Mills of Western Australia provide an interesting example of its value for structural purposes, for the roof of one mill is carried by a truss having a tie-beam consisting of a piece of karri 80 ft. in length, 12 in. in width and 12 in. in depth.

Another interesting use for karri is in the manufacture of wooden waterpipes. It has been found very satisfactory for this purpose, and in one Australian water-power system karri pipes are still giving efficient service after having been in use for many years, although the pressure is considerably greater than is usually considered advisable for wood stave piping.

No article on the world's wonderful trees would be complete without some reference to the baobab of South Africa and the banyan tree of India and Ceylon. The baobab is a very large tree, for its trunk often has a girth of more than 70 ft., and it attains a very great age. It has been described as a monstrosity of the plant world, for its enormous pinky white trunk is covered with a paper-like bark, and its branches end abruptly, instead of tapering gradually as do those of other trees. In spite of its strange appearance the baobab is very useful to the natives of the districts in which it grows, for they use its fibrous bark in making ropes, and even clothes, and greatly relish the acid pulp in its fruit, which is about the size of a large lemon and is surrounded by a woody shell.

The banyan is even more remarkable than the baobab, for when well developed it resembles a forest rather than a single tree. Its woody stem branches freely and every limb throws out its own aerial roots. At first these roots are small fibres, but they grow thicker and longer and ultimately reach the ground, into which they penetrate. The portion remaining above the surface then becomes an additional trunk from which new branches spring, and these in turn send down more roots. Thus the tree continually acquires new trunks until eventually it covers an immense area. A famous banyan on the banks of the Nerbudda, in Central India, had more than 3,000 trunks and is said to have covered so much ground that at one time 7,000 men could stand under it.

XXXIV.—A SOLDIER

A CAREER in the Army possesses attractions for many boys, and its advantages appeal both to those who are able to take up a commission and those who must enlist for service in the ranks. Whatever the position held, life in the Army is strenuous, for efficiency in drill and routine, and also in the application of science in one or more of many forms, is demanded, but there are compensating features for active and intelligent men. For instance, there is ample leisure in which to enjoy sports of all kinds, and this is supplemented by generous annual leave, while a further important advantage for many of the rank and file is that they are automatically trained in various trades and occupations that fit them to take a place in civil life on leaving the Army.

Many of the worries of civil life are avoided in the Service, for soldiers of all ranks are fed, housed and clothed. They are cared for in illness, and a certain proportion are granted retiring allowances and pensions that continue to be paid until the end of their lives. They spend the greater part of their Army career in healthy open air activities, and as about half of the regular Army is stationed overseas, they have magnificent opportunities for seeing the world.

It is true that soldiers cannot expect to make fortunes, for military life does not offer such glittering money prizes as may fall to those engaged in commerce and industry. On the other hand, the officer is assured of a competence, and as already pointed out, every effort is made to secure employment for men from the ranks when they return to civil life, and training in certain skilled trades is available.

The privileges of a soldier's life carry responsibilities with them, particularly for the officers, who must be capable of taking command and prepared to study the interests of their men and to do everything possible to ensure their efficiency and comfort.

The means of approach to an Army life depend on the rank aimed at and on the financial resources available. Commissioned rank is open to all well-educated men who are able to afford the cost of the necessary training, and exceptionally efficient soldiers also may attain it by means of promotion. It must not be thought that it is expensive to obtain a commission, however, or even to carry on in such a position when attained. Formerly a commissioned officer could not live in the Army without private means, for the pay was poor and the high social standing of the profession added to the expense. The possession of a private income is still necessary in certain regiments, but the higher pay of the present day, and the restriction of mess subscriptions and other expenses, have made it possible for even junior officers in most regiments to live on their pay.

Five methods of gaining commissioned rank are available. The first is to become a cadet at the Royal Military Academy, Woolwich, or the Royal Military College, Sandhurst, this being the course followed by those who make up their minds on or before reaching the age of 16 years that they wish to become soldiers, and possess the necessary means to pay the fees required. University graduates also may be granted commissions, while those who cannot afford either to enter one of the cadet colleges or to take a degree course at an university, may enter the Army through the Supplementary Reserve or the Territorial Army. Finally, exceptionally capable men may work their way up from the ranks.

General Sir Ian Hamilton, G.C.B., G.C.M.G., C.B., D.S.O., A.D.C., entered the Army in 1873, and first saw active service in campaigns in Egypt between 1878 and 1885. He was promoted to the rank of Colonel in 1891 and served with great distinction in South Africa during the Boer War, 1899 to 1901. Later Sir Ian held important military commands at home, attaining the rank of General in 1914. During the Great War he commanded the Mediterranean Expeditionary Force, which carried out the attack on the Dardanelles in 1915.

The cadet colleges are intended exclusively for those who desire to take up a military career as a definite profession. Woolwich is the training centre for cadets who intend later to join the Royal Artillery, the Royal Engineers, or the Royal Corps of Signals, while those who are to enter the Infantry, the Cavalry or the Royal Tank Corps proceed to Sandhurst. It is necessary therefore to make early choice of the branch of the Army to be entered, a choice that depends on the abilities and inclinations of the candidate himself. If he possesses more than average mathematical or scientific ability he may be attracted to the Engineers or the Corps of Signals, while he will find scope for mechanical skill in the Tank Corps, or the Royal Army Service Corps. Similarly an interest in horses will suggest his joining the Artillery or Cavalry, while in the absence of any special inclinations he may join the Infantry.

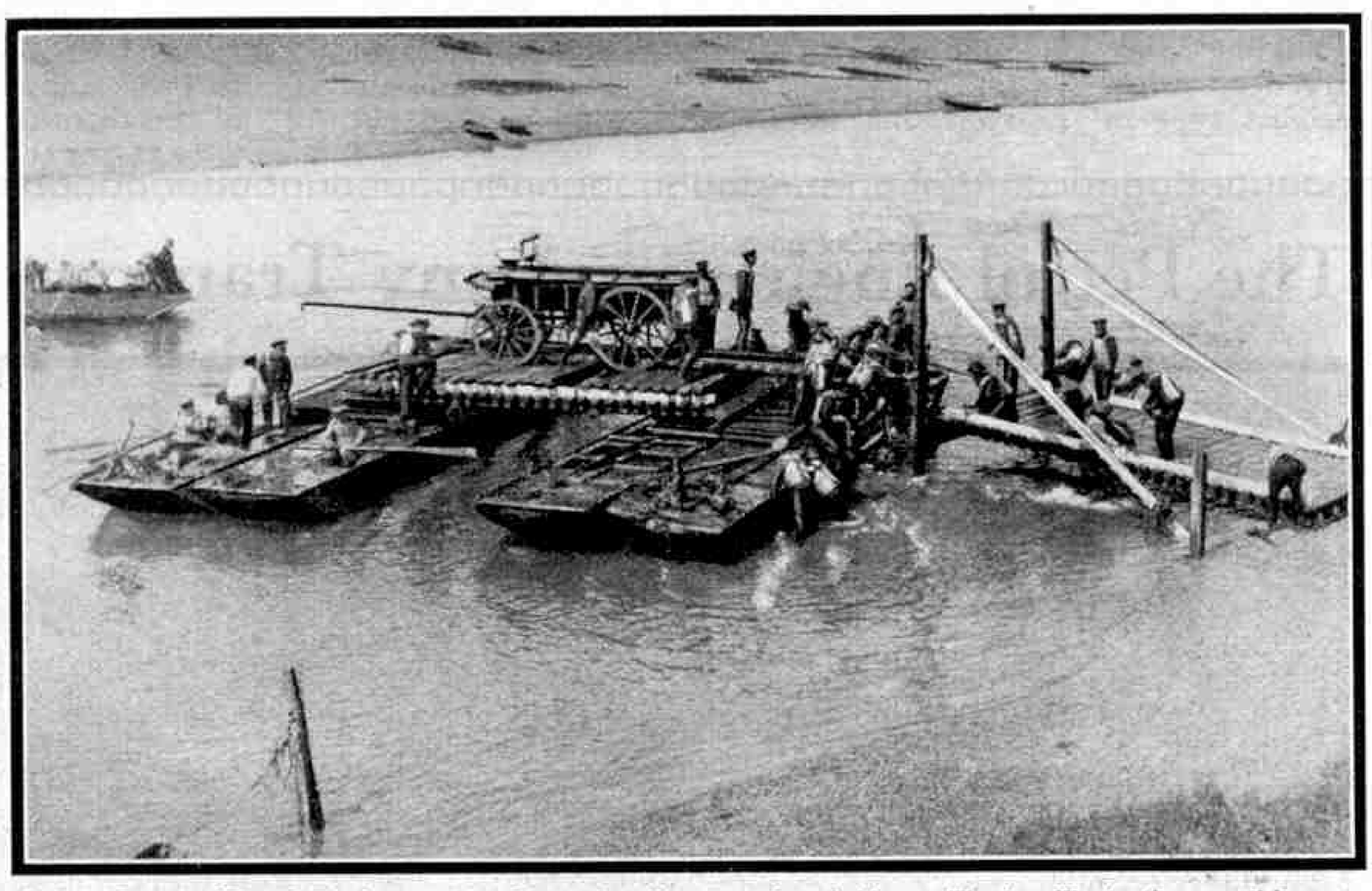
The conditions of entry to the colleges at Woolwich and Sandhurst are similar. Candidates must be unmarried and between the ages of 18 and 19 years, and before they can be admitted they must be successful in a competitive examination usually known as the Army Entrance Examination. Application forms are obtainable from the Secretary, Civil Service Commission, Burlington Gardens, London, W.1. Candidates usually must have secured a School Certificate before they are allowed to enter. In exceptional cases boys from approved schools who have not obtained such a certificate, but are otherwise suitable, may be nominated by the Army Council.

Examinations are held in London and at provincial centres twice a year, in June and November, and the lists are closed about two months in advance, the exact date being published in notices in the principal newspapers. The subjects that may be offered cover a wide range and there are slight differences in the requirements for the two colleges, those expecting to enter the Royal Military Academy at Woolwich being expected to show a high standard of proficiency in mathematics and science. The usual practice of candidates is to take their School Certificates early and then to follow a course of preparation for the Army Entrance Examination itself. It is no longer necessary to "cram" in a special army class, however, for

the examination is of a more general character than was formerly the case. In addition to sitting for the actual examination, candidates are required to submit a good record and to attend an interview, while a medical examination also is necessary.

The fees payable at the college by those who secure cadetships amount to £100 per term, and the full course covers three terms. This is exclusive of the charges for uniform, books, etc., which are £80 at Woolwich and £70 at Sandhurst. The total cost of training therefore may be put at £380 or £370, according to the choice of college. Reductions are made in certain cases. The sons of officers of the regular naval, military and air forces may be admitted at a fee of £60 a term, and in a limited number of cases substantial reductions are made on grounds of pressing need, the fee in certain circumstances being as low as £25 a term.

A further method of reducing the cost of training is to secure one of the prize cadetships awarded to the most successful candidates at the Entrance Examination. About 25 of these Cadetships are awarded annually, and each is of the value of £25 a year. Certain scholarships awarded at the end of the first term are competed for by cadets satisfying certain special conditions, and in addition, valuable leaving scholarships are offered.



A detachment of Royal Engineers at work constructing a pontoon bridge. The two illustrations on this page are from "General Guide to a Commission in His Majesty's Land Forces," and are reproduced by permission of the Controller of H.M. Stationery Office.

King's Cadetships also may be granted to a limited number of sons of officers who have been killed in action or have died as the result of wounds or disease contracted on service, and whose families have been left in reduced circumstances. Applicants are granted cadetships either during school days or after entering one of the cadet colleges, appointments being made when vacancies occur. King's Cadets pay no fees or charges at the Cadet Colleges, and if appointed during school days they receive an educational allowance of £40 per year while between the ages of 13 and 18 years.

While at college, an allowance of 3/8 per day is paid from public funds for each cadet in aid of the cost of messing, etc. This sum, together with the charges for uniform, etc., referred to above, covers the greater part of the necessary expenditure (excluding pocket money) during residence at a cadet college. On receiving his commission an Outfit grant (at present £50) is paid to the officer.

Complete information in regard to admission to the cadet colleges is contained in a pamphlet that may be obtained post free from the Under-Secretary of State, The War Office, London, S.W.1,

Officers and men of the Royal Corps of Signals, in charge of a mobile wireless set, enjoying a brief rest.

When a cadet passes out of his college he is appointed to a commission in a regiment of the branch of the Army he has chosen. Appointments are governed by the occurrence of vacancies, and first consideration is given to the cadets who pass out highest on the list. A cadet who wishes to join a particular regiment is usually allowed to do so, and there is keen competition for commissions in certain favoured units.

Candidates from universities who wish to enter military life may be granted a commission in any branch of the Army if they have secured a degree after a course covering three years, and have given satisfaction during a probationary period of three months, in which they are attached to a regular unit. This period is reduced to six weeks for proficient members of the officers' training corps. The age limits for this means of entry to commissioned rank are from 21 to 24 years, and nomination must be made by a Board appointed by each university. Commissions of this kind are ante-dated approximately 18 months, and thus university-trained officers take the same seniority as those of their own age who have passed through Woolwich or Sandhurst.

A young man who has not attended a cadet college or a university may join the Army by first entering the Supplementary Reserve or the Territorial Force. No examination is required from candidates for commissions in these, and after 18 months' service officers in them are allowed to sit for the passing out examination at Sandhurst. The age limits are 21 to 25 years, and commissions may be obtained in any branch of the service except the Royal Engineers, the Royal Corps of Signals, and the R.A.S.C.

These two avenues of entry into the Army are useful to those who decide in favour of a military career too late to enter a cadet college, and also to those who are unable to meet the expenses of the ordinary course. In order to comply with the regulations, Territorial officers must be attached to a regular unit for six weeks and also attend annual training in summer. Their 18 months' qualifying service may be put in while they are engaged in business and they receive an outfit grant on joining the Territorial Forces.

An officer of the Supplementary Reserve is attached to a regular unit for up to four months' preliminary training during his first year and carries out three weeks' annual training in succeeding years, this time usually being spent with the regiment he wishes to join as a regular officer. When his total length of service amounts to 18 months he is eligible for the passing out examination at Sandhurst, and success in this is followed by the granting of a commission.

The remaining method of obtaining a commission is by promotion from the ranks. Candidates are selected from non-commissioned officers of about eight months' standing who are under 23 years of age, well-educated and capable of leadership. Those possessing the necessary qualifications may be sent to Woolwich or Sandhurst to undergo a free course of training. They rank with cadets entered direct from public schools, and on passing out are given commissioned rank in the usual manner. Competition for selection is extraordinarily keen, for only about 13 places are available each half year, three at Woolwich and 10 at Sandhurst.

The pay and prospects of an Army officer may be regarded as good, and the advantages of the life have already been pointed out. On being commissioned as a Second-Lieutenant, the young officer receives pay and allowance amounting at present to £260 a year, the actual cash payment being £180. Promotion at first is by seniority, but above the rank of Major is by selection, while special merit may accelerate promotion (*Continued on next page*)

What Shall I Be ?—(*Cont. from previous page*)

from the rank of Captain. Pay and allowances in higher positions is excellent, a Lieutenant-Colonel receiving about £1,150, a Major-General about £2,050, and a General Officer Commanding-in-Chief about £3,610 a year. In addition, there is an excellent scheme of retiring pay, while the widows and other dependents of deceased officers also may be granted pensions or compassionate allowances.

In addition to officers holding commissions of the kind already dealt with, there are many of the specialist type in the Army. These include officers in professional corps such as the Royal Army Medical Corps, the Army Dental Corps and the Royal Army Veterinary Corps, and also members of the Royal Army Ordnance Corps, which is responsible for supplying equipment and for maintaining it in repair.

The directing staff of the R.A.O.C. is recruited from selected officers in other branches of the Service, and only those with several years' experience may apply for the necessary transfer. Special training in the technical and business methods necessary is given and a probationary period must be served before a transfer is ratified. The pay of an officer in this corps is a little higher than that of one of the same rank engaged in ordinary service, and he is certain of employment until he reaches the retiring age. It should be noted that detailed accountancy work in this branch is carried out under the supervision of officers promoted from the ranks, while technical duties in connection with armaments and mechanical transport are performed by fully-qualified mechanical engineers recruited direct from civil life.

The openings for medical, dental and veterinary officers in the Army have been dealt with in the articles on these professions already published in this series in March 1931, January 1932, and December 1931 respectively. Preparation for careers of this kind is purely professional in character, and only those regularly qualified for practice are granted commissions.

Turning now to careers in the non-commissioned ranks, it should be noted that while the infantry as yet constitutes 60 per cent. of the Army, there have been striking changes in the constitution of the force, and owing to the great developments of mechanisation there is now ample scope for exercising skill in various trades, and also for acquiring further training during service.

The infantryman enlists for a term of seven years with the colours and five years in the reserve. Thus he is assured of pay for 12 years, for while in the reserve he receives from 5/3 to 8/9 weekly, while pay in the Army itself varies from 14/– to 21/– per week for privates and troopers, and from 24/6 to 84/– per week for non-commissioned officers, the sums paid to men actually serving being exclusive of food, lodging and clothing. To a certain extent, recruiting is territorial, to correspond with the organisation of the Army itself, and applicants must satisfy certain standards of age, height and weight. Generally speaking, recruits must be between the ages of 18 and 25 years, and the minimum height is 5 ft. 3 in. Requirements vary from time to time and with different regiments, however, and full details may be obtained from any recruiting office. As already pointed out, men may be trained in various occupations likely to be useful to them in civil life and Army Vocational Training Centres have been established where they may receive instruction during their last six months of service.

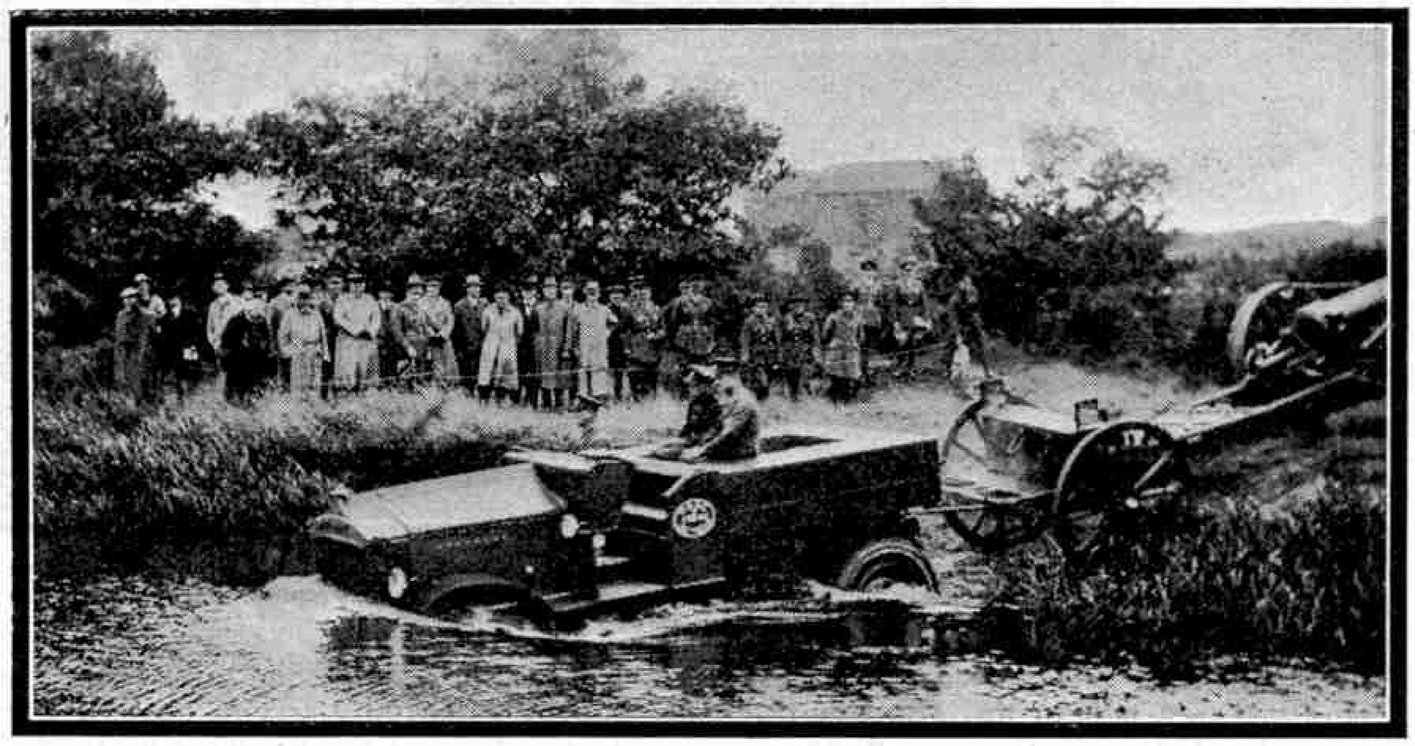
Other branches of the Army offer greater opportunities for the exercise of skill and knowledge than are available to infantrymen. Thus the Royal Engineers includes such a great variety of tradesmen that they have been called "the fighting tradesmen." Other specialist branches of the Army also require men with particular knowledge, and those who are thinking of joining any one of them should first make themselves familiar with the requirements in order to ensure being drafted into a corps in which they can make the best use of their abilities. The necessary details are given in a booklet entitled "*The Army of To-day*," which may be obtained free from most post offices, all Army recruiting depots, or direct from the Under-Secretary of State, the War Office, Whitehall, London, while the Editor of the "*M.M.*" will be pleased to answer enquiries from interested readers.

The changing character of the Army has made it necessary to maintain a large number of men skilled in various trades, and in order to keep up the supply a scheme for the enlistment and training of boys has been introduced. Generally speaking, the age limits for entry are from 14 to 15 years, and a special examination, including an intelligence test, must be passed. A medical test is held before the examination is taken, and except in the case of boys in certain military schools, a fee of 2/6 is required from candidates.

Those successful in the examination are enlisted for training at one of several centres, each of which is devoted to special trades or occupations, the period of training occupying from four-and-a-half to five years for artificers in the Royal Artillery, or Armourers in the Royal Army Ordnance Corps, and three years in other trades, except bricklaying, the course for which covers only two years. Pay during the training period varies from 11d. to 1/7 a day, according to proficiency, and the general education of the recruits is continued, special attention being paid to physical training and to sport. At the conclusion of the course of training the boys are posted to a corps, where they have splendid opportunities of making use of the knowledge they have gained.

It is impossible to give details of every trade covered by this scheme. Boys about to leave school, or those who have just left, and are particularly interested in it, should obtain a copy of the pamphlet "*Careers for Boys*," which may be obtained post free from the War Office and from all recruiting centres, while further information may be obtained by writing to the Editor of the "*M.M.*"

The Petrol Engine in Army Transport



The petrol engine threatens to replace the horse in army transport and modern forces include a large proportion of trained mechanics. Our photograph, reproduced by courtesy of J. I. Thornycroft Ltd., shows a Thornycroft "Hathi" tractor hauling a heavy howitzer through a deep stream.

The Casting of Statuary—(*Cont. from page 579*)

different layers shown in Fig. 2. The gelatine-mould and its case are next removed, revealing the model in wax. Air-vents and pour-hole are now modelled in wax at suitable places, after which a mould of plaster and brick dust is cast round the model. The whole is then placed in an oven and the wax is melted out of it, leaving an empty space between the mould and the core, into which the metal is finally cast. The mould and core are removed, and the necessary retouches made.

The final process is the colouring or patina, which is put on by applying different kinds of acids, according to the tone of brown or green desired.

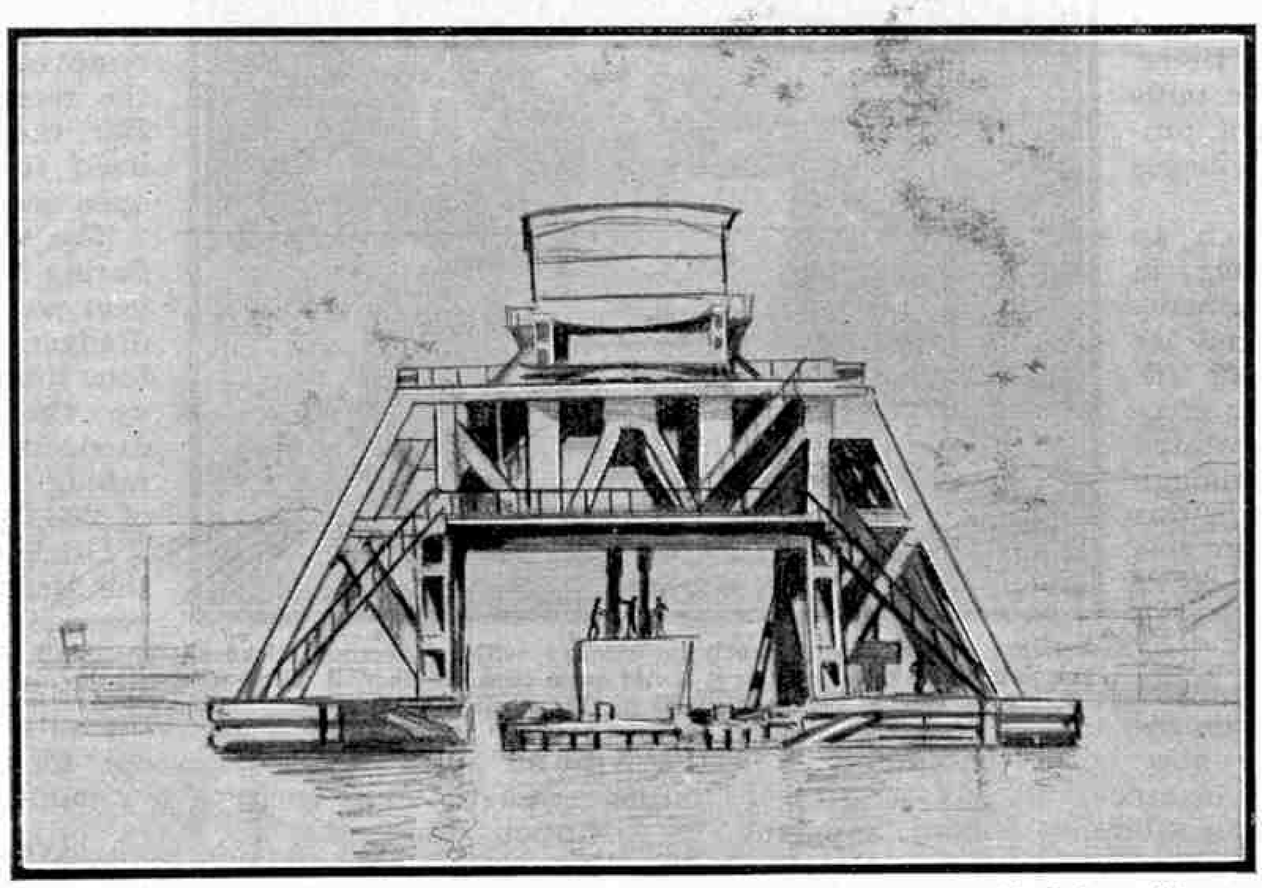
It will be seen that great skill and patience are needed in the casting of statuary, but it is by no means a dull and unexciting process to carry out. Anyone who has read Benvenuto Cellini's autobiography will know that casting has its intensely dramatic moments. The managing and handling of big statues in a deep pit, and the releasing of the flow of liquid metal at the supreme moment, are in fact so thrilling and sensational that in the 18th century it became the fashion for the French Court and society to attend the casting of important works. Although to-day statuary casting may not excite so much public interest, the work is as important to-day as it was 200 years ago.

An Interesting 450-Ton Floating Crane

Block-Setting at Algiers Harbour

WE illustrate on this page an interesting floating gantry crane built by Messrs. Schneider & Co. for service in connection with the Port of Algiers extension scheme, which consists of the construction of two moles, one 394 ft. in length, and the other 276 ft. The contractors for the Algiers harbour extensions included in their plans blocks 450 tons in weight, the length of each one being equal to the whole width of the mole, 33½ ft., and the other dimensions in proportion to avoid risk of the blocks breaking during handling as a result of their own weight.

The placing in position of such heavy masses of concrete necessitates very powerful equipment for lifting, transporting, and loading the concrete blocks on to lighters, which in turn convey them to the floating crane that is the subject of this article. This crane is of a special type, in which the central upper structure, containing the hoisting machinery, pivots centrally, so that the blocks may be turned as required without the necessity of moving the whole structure.



The 450-ton floating gantry crane at Algiers Harbour, setting a concrete block in position.

The crane consists of two twin pontoons, connected together by, and supporting, the gantry. The spread is sufficient to allow the entry between the pontoons of the lighters carrying the cement blocks, and also to permit the blocks being turned in any direction required when suspended from the crane. The pontoons are fitted with auxiliary machinery for manœuvring, and in addition one of them is equipped with a steam-driven electrical generating plant, and all the apparatus necessary for feeding the various electric motors of the hoisting and manœuvring machinery.

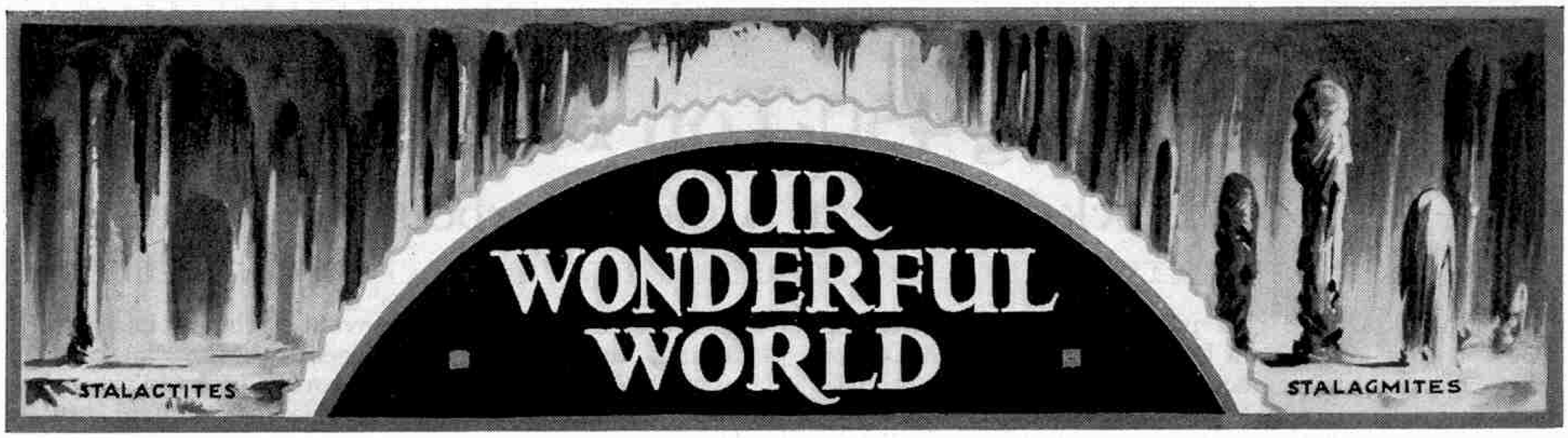
On the upper part of the gantry is fixed a circular runway carrying the rotating framework, and on this rest in turn two similar trolleys from which is hung the system of pulley blocks for hoisting the load. Each trolley has its own main hoisting winch, secondary hoisting winch for canting the concrete blocks to the desired angle, and its own traversing winch. These are arranged in such a manner as to allow the two trolleys to be operated together or independently, and to handle the different-sized concrete blocks, which may have a spread between the lifting hooks of from 12 ft. to 23 ft. The hoisting gear thus comprises two winches, each driven by its own motor. The braking effect for lowering the load is obtained by the regenerative process, giving absolute security and extreme precision. Magnetic solenoid brakes hold the load when at rest and in the event of the electric current failing; and a further emergency brake can operate instantly in case of need, or be worked by hand through a clutch arrangement if the electrical equipment breaks down.

The concrete blocks are slung by means of four lifting hooks hung in pairs from balanced yokes. Each lifting hook consists primarily of two hinged claws working in two stout shields, and a counterweight either spreads these claws or holds them in contact with the concrete blocks. The shields assist the working of the claws and their introduction into the recesses in the blocks, and they also limit the opening of the claws so that no side thrust, due to the action of the counterweights, is transmitted to the blocks. The whole can be tilted from the perpendicular, so as to ensure even distribution of the weight at any angle of the load. Each lifting hook yoke is fitted with two struts, bearing on the upper surface of the blocks, to allow free movement of the claws in the recesses.

In order to enter and withdraw the claws from the recesses the lifting hooks are closed, this being done electrically by two special winches. When the closing is completed the cables carrying the yokes are pulled taut, and produce an overload strain, utilised to operate an automatic check, stopping all further movement and at the same time extinguishing the control signal lamps. The opening of the lifting hooks is carried out by the gravity action of the counterweights, which are released when the winches are run back. During the operation of the main hoisting winches, both lifting and lowering, the lifting hook weights are continuously under power, so as to take up the slack of their cables, which is wound on auxiliary drums, the movement of which synchronises with that of the main winding drums.

The movement of the rotating framework is controlled by two electric winches. The framework rests on a roller bearing having two sets of rollers, one horizontal to take the weight, and the other vertical to keep it central. The two trolleys work on rollers, and are controlled by rack and pinion gear. When the two rollers approach too close together, or to the sides of the framework, automatic switches prevent further movement.

The control cabin is hung from the rotating framework and turns with it. Only one operator is required and he has a clear view of the load at all times.



Seeing an Earthquake !

It is believed that only one man has ever seen an entire earthquake. He was an American who on one occasion was standing on the top of a hill, looking out over an extensive stretch of level land, when he saw ripples spread over the surface of the earth below him, while at the same time little puffs rose into the air. He himself was thrown violently to the ground three times, and later he discovered that the puffs he had seen were clouds of dust produced by the destruction of villages in the path of the earthquake.

It is scarcely likely that such an experience awaits anyone living in Great Britain, for here earth movements that attract attention are rare and are not violent. The earthquake of 7th June last year was very feeble in comparison with those that have devastated Japan and other countries, although it was the most severe recorded in this country since instruments for this purpose were first installed. Millions of years ago this country was subject to earthquakes of a very violent character, however, and indications of these are seen in the gigantic "faults," or downward slips of rocks, that may now be traced in certain districts. For instance, there is a fault at Pendleton, Lancashire, and movements of the rock strata on one side of this are the cause of slight earthquakes that affect the Manchester area. There is another gigantic crack in the Pennine range where the rocks on one side are thousands of feet below their original level, and the disturbances caused ages ago by the movements of millions of tons of rock concerned must have been very severe, even if the fall took place in stages spread over a long period.

Volcanoes usually are found in regions subject to severe earthquakes, but they are not themselves the cause of earth tremors. Instead they may be said to act as safety valves that in many instances prevent disturbances becoming more serious, and it is believed that the freedom of Great Britain from earthquakes is partly due to the action of the volcanoes of Iceland in releasing underground pressure.

Asbestos Rope Used in Oil Well Fires

An asbestos rope stretched across the blaze plays an important part in extinguishing a fire at the head of a gas or oil well. A bomb slung on the rope is hauled into the flames and there exploded by means of a detonator, the violent explosion blowing out the fire. A rope made of asbestos is the only one that can withstand the terrific heat.

New Alloy as Substitute for Lead

The remarkable effect of the presence of small proportions of certain metals in alloys is illustrated by the discovery that the addition of traces of tin and cadmium to lead gives an alloy that has a greater tensile strength and is more resistant to corrosion than the pure metal itself. The alloy, which contains 1.5 per cent. of tin and only 0.25 per cent. of cadmium, has been discovered in this country, and the small extra cost of making it is more than counterbalanced by the fact that pipes with much thinner walls may be made from it without risk of a breakage. It is believed that eventually this alloy will take the place of lead in practically all plumbing work.

A llama at the Bristol Zoo being cleaned with a vacuum cleaner. The animal looks as though it is not quite sure whether it likes the idea of being groomed in this manner or not.

A Shetland pony appears to be better pleased with vacuum cleaner grooming than the llama in our upper illustration. Photographs by courtesy of Electrolux Ltd.

Dredging the Mersey

During the year ending 1st July, 1931, 15,200,580 tons of sand were removed from the Bar and shoals in the shipping channel of the Mersey. Dredging operations in the estuary of this river began in 1890, and since that time no less than 460,609,060 tons of sand have been taken out. Of this enormous quantity, 356,562,920 tons have been removed from shoals in the channels, the remainder having come from the Bar, the ridge that divides the estuary itself from the deeper waters of the open sea.

The vast quantity of sand removed during the year ending 1st July last year was taken out by four sand pump dredgers. These also removed 3,579,750 tons from the entrances to docks higher up the river, while bucket ladder dredgers have been responsible for taking away an additional quantity of 298,242 tons.

Dredging is essential if the channel of the Mersey is to be kept open for the passage of liners and cargo vessels making use of the ports of Liverpool and Manchester, for if it were to cease the waterway would become impassable, except for vessels of small draught, in a few months.

Weighing Heat and Light

Modern science has revealed that heat actually has weight. A pint of water heated from freezing point to boiling point increases in weight, but the increase is too small to be expressed in figures, for even a million tons of the liquid would show a gain of only five tons in these circumstances. Similarly the heat lost when the water of a pond freezes causes a decrease in weight of about three parts in a million million, but this weight is regained when the thaw comes.

Our chief source of heat is the Sun, and it has been found that this body sends out heat at the rate of 4,200,000 tons every second. When we consider that one lb. of heat is sufficient to change 30,000,000 lb. of rock into molten lava, we are able to realise how prodigally the Sun wastes his tremendous store of energy. Fortunately he is so large that the heat lost in a second is scarcely missed, and even in 10,000,000 years of wastefulness he will only lose one millionth of his present weight, a proportion that will scarcely be missed.

Light also has weight, and it is sold by electric light companies at the enormous rate of about £150,000,000 per lb.; but an ounce of light would be sufficient to illuminate an average house for 500,000 years.

Buildings Explode in Tornado

The tornado is a whirling funnel-shaped storm that expends its immense energies on a very small area, and is therefore extremely destructive. Such a storm is usually short-lived, the path of a tornado averaging only from 30 miles to 50 miles in length; but so fiercely is the air whirled round that small houses and even human beings and animals may be blown to considerable distances. Cases have been known in which splinters of wood have been driven through the heavy beams from which they were torn, and during a tornado at Calcutta a bamboo cane is reported to have been driven through a mud wall, 6 ft. in width, that was lined on each side with a course of bricks.

A building wrecked by a tornado is not blown down, but may be said to explode. The effect of the centrifugal action of the rapidly whirling air particles is to create a vacuum at the centre of the storm, and the pressure of the air inside a building over which this passes blows the walls and roof outward.

The United States seem to be the chief home of the tornado, for there are about 100 storms of this kind a year in that country. Practically all of these occur in what may be described as a regular tornado belt across the States of the Middle West, and the average number of people killed by them annually is 300. In 1923 a tornado killed 85 people and injured 1,300 in five minutes in St. Louis, the largest city in the usual track of the storms; and two years later nearly 700 people were killed, and more than 2,000 injured, in a tornado that swept across Missouri and Illinois.

Little is known of the manner in which a tornado begins its destructive career. Possibly these storms are created in eddies formed by two masses of air moving in opposite directions at high speed. The tornadoes of the United States appear to be formed in this manner, for they usually commence on the prairie east of the Rocky Mountains, and there the north winds on the eastern slopes of the range brush past the south winds of the Mississippi Valley.

Novel Use for Liquid Air

An interesting use for liquid air is in placing metal bushings in their seatings. The bushings are made slightly oversize and are then placed for about five minutes in liquid air, the temperature of which is 194.4°C. below the freezing point of water. They contract to such an extent that they slip easily into position, and on regaining their normal temperature are found to fit tightly. The shrinkage allowance for bronze bushings is less than four thousandths of an inch, and even smaller allowances have been found satisfactory for steel tubing.

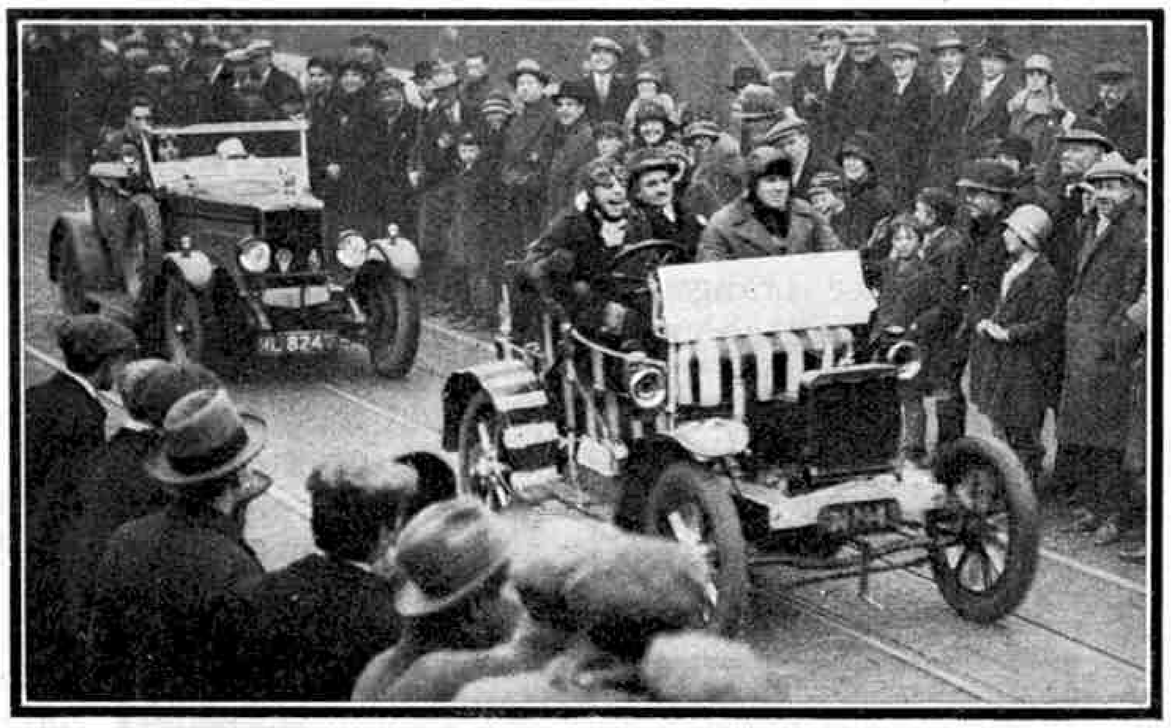
An effort was made to press out a steel bushing, about 3 in. in diameter, that had been fitted with the aid of liquid air. It was found necessary to apply a pressure of 30 tons in order to make the bushing move, and a continuous pressure of 20 tons had to be exerted in order to complete the movement.

Can the Gulf Stream be Dammed?

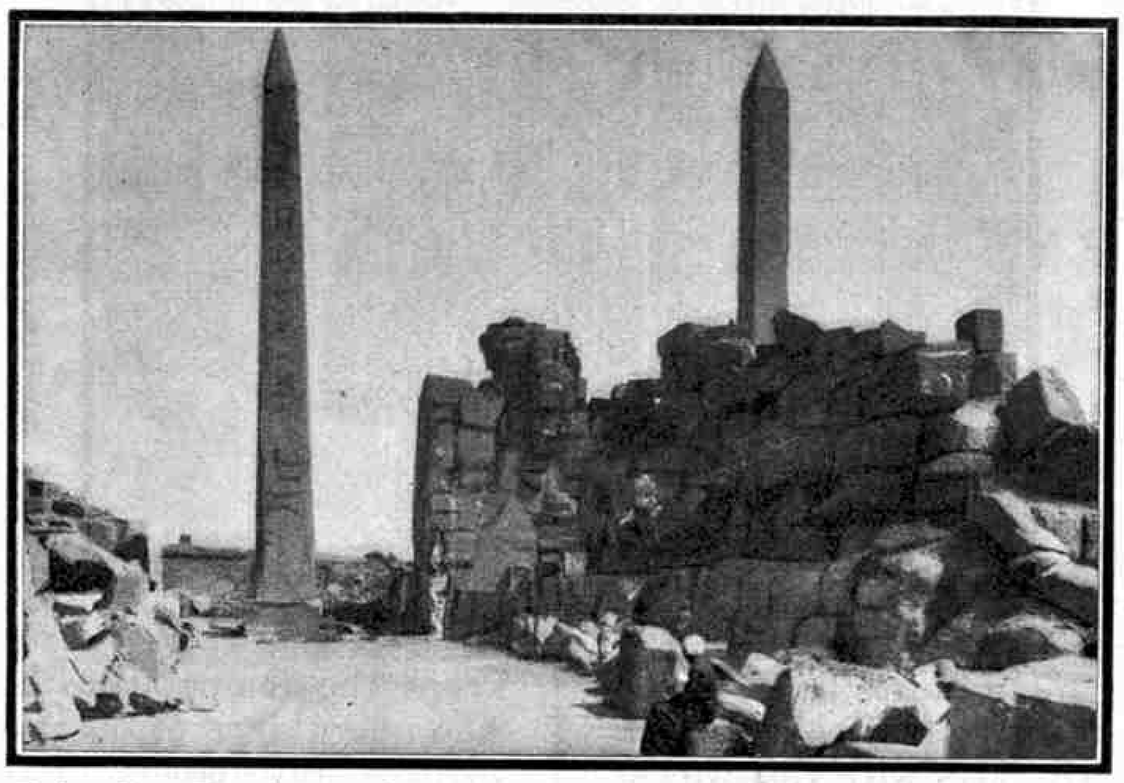
To the people living in Great Britain the Gulf Stream is of the greatest importance, for if deprived of the mellowing influence of its warm waters, this country would have a much lower average temperature, and its climate probably would be as severe as that of Labrador.

The Gulf Stream is merely a part of a great whirlpool that occupies almost the whole of the North Atlantic Ocean. Warm water from the region between the Equator and the Tropic of Cancer sweeps northward in a great curve that carries it past the coast of Florida, and colder water from the north flows southward past the shores of Spain and Northern Africa to take its place. The warm current from Florida and the Bahamas towards Northern Europe completes the whirlpool. A similar circular current is found in the North Pacific and there are other whirlpools, reversed in direction, in the southern sections of both the Atlantic and the Pacific Oceans.

Mild scares occasionally have been caused by proposals to erect a huge dam from Florida to Cuba, across the mouth of the Gulf of Mexico, from which the Gulf Stream derives its name. It has been thought that a structure of this kind would prevent the flow of the warm current. Even if the proposed dam were built, however, the stream of warm water that forms its northern sector would continue to find its way across the Atlantic Ocean.



A parade of veterans. A scene during a display of cars more than 30 years old.



Ruins of an Egyptian temple. The blocks of stone used in erecting this building are of enormous size.

Lost Greek City at Bottom of Black Sea

A little more than a year ago a diver off the coast of Crimea discovered the ruins of an ancient house now covered by 50 ft. of water. Further exploration of the site showed that this was part of an entire city that had sunk beneath the Black Sea. It is believed that the city flourished in the 4th century B.C. and was overwhelmed during an earthquake that caused a sudden fall in the level of the land, for a disaster of this kind is mentioned by Greek historians.

In exploring the long-lost city, the surface of the sea was marked out into small areas. In each of these areas a boat equipped with diving machinery was stationed, and the divers sent down telephoned complete descriptions of the parts of the city in which they worked. A complete map of the ruins was compiled from this information and from photographs taken by means of a water-tight camera operated electrically. The city appears to have been half a mile in length and a quarter of a mile in width, and a wall with 18 or 20 towers served as a protection. The buildings are sufficiently well preserved to enable a reconstruction of this interesting relic of early Greek civilisation to be made.

World's First Pound of Indium

The first pound of indium, one of the world's rarest metals, recently was prepared electrolytically by an American chemical company. Indium is a soft white metal that melts at the low temperature of 155°C., or only 55°C. above the boiling point of water, and boils at 1,450°C.

At present indium is only a chemical curiosity, for its value is nearly £2,000 per lb., or nearly 10 times that of platinum. Discoveries of new sources of ores of the metal and of cheaper methods of extracting it may make it more plentiful, and then uses may be found for it in industry. If this is the case, indium will follow in the footsteps of aluminium, chromium, nickel, and other metals that less than 50 years ago were comparatively rare, but now find many applications in industry.

The outstanding example of a rare element that has become of great importance is helium, a gas that 20 years ago was merely of scientific interest. Then the only known samples of the gas were contained in narrow glass tubes used for scientific experiments, but it is now so plentiful that it is used in giant airships. It is particularly suitable for this purpose, as it is light and non-inflammable. No less than 6,500,000 cu. ft. of the gas are employed in the gas bags of the United States Naval Airship "*Akron*," which recently made several successful flights, and an equal quantity will be required for the sister vessel now being built. The gas is obtained from the air above certain springs in Texas, and so far the United States has almost monopolised the supply.

The Orange Groves of California

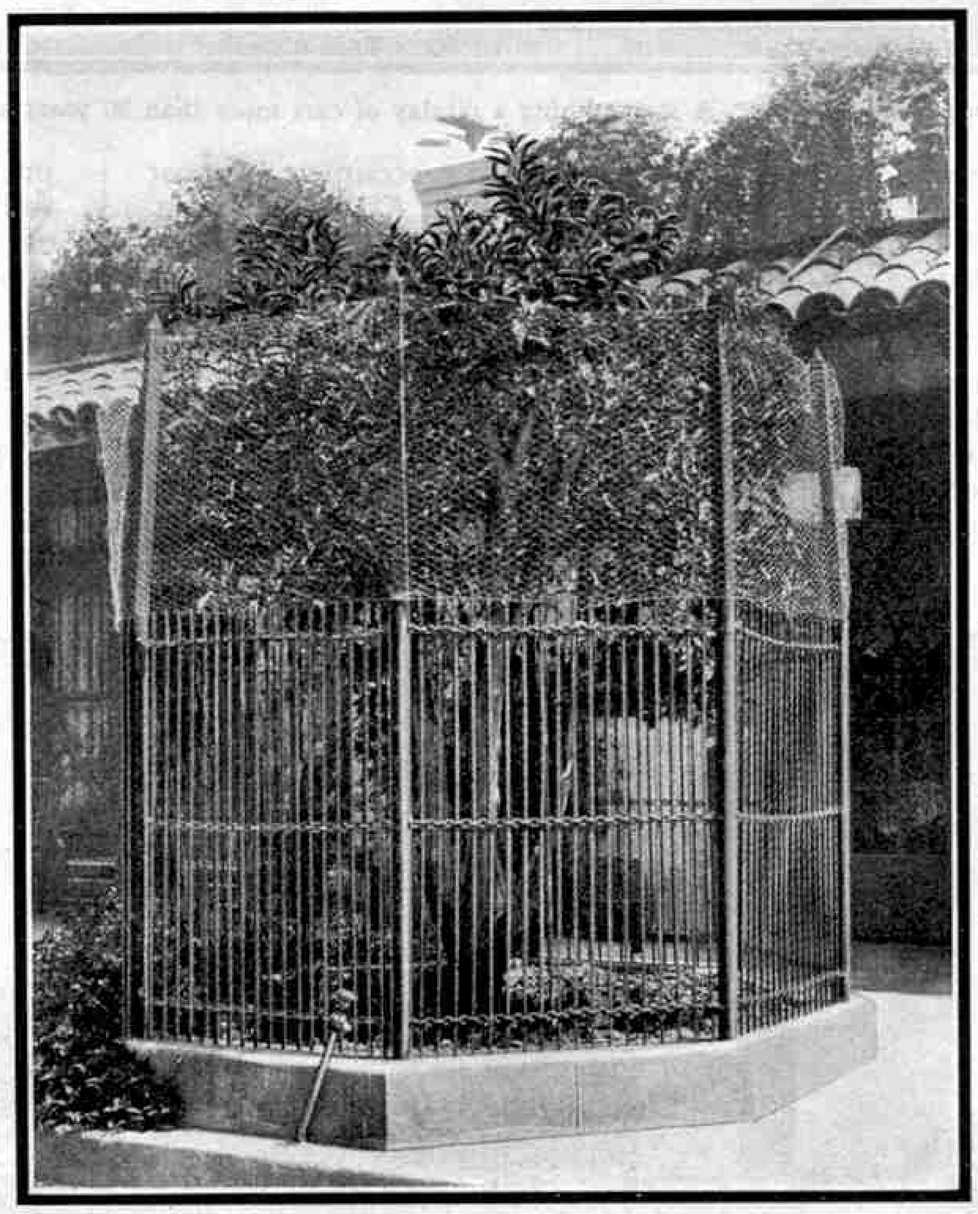
Fighting Frosts and Insect Enemies

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

THE orange affords one of the most striking examples of a fruit that has leaped into prominence and importance as the result of cultivation in many different parts of the world, and on strictly scientific lines. It is not very many years ago since oranges were seldom seen in this country except round about Christmas-time, and even then they were dear and not too plentiful. To-day oranges of good quality may be obtained cheaply practically all the year round.

The plant that produces the orange is closely allied to the citron, the lemon, and the lime, and it has a long history. It appears to have originated in Eastern Asia, from where it spread to Western Asia, and eventually was introduced into Europe, probably by the Portuguese in the 16th century. From very ancient times it has been grown throughout China and Japan, and when the first Europeans visited the Indian Archipelago they found the tree widely diffused there. Its range to-day is very wide. It flourishes in Italy, Spain, Portugal, and Southern France; in India, Australia and Africa; in the Azores, and West Indies, South America, Brazil, Florida and California.

At the delightful little town of Riverside in California may be seen an old orange tree carefully protected by iron rails and wire netting to safeguard it from the attentions of souvenir hunters. This is one of two trees, planted in 1873 by Mrs. Eliza C. Tibbets, which may be regarded as the parents of the present-day orange groves of California. Mrs. Tibbets received her two trees from William Saunders, of the United States Department of Agriculture, who obtained them from Bahia, Brazil. She tended her trees in their early days with the utmost care, and ultimately they came to flourishing maturity. Mrs. Tibbets has been called the "Mother" of the California orange industry, and her pioneer efforts are commemorated by a bronze tablet.



One of the two Navel orange trees planted at Riverside in 1873, from which have sprung the present orange groves of California.

The cultivation of the orange tree has been brought to a very high pitch of perfection, and the acreage has increased rapidly. The method of cultivation adopted in California, where there are about 198,000 acres of groves, producing more than half-a-million tons of fruit, may be taken as typical. The trees are all grown from carefully selected seedlings of a hardy type. The seeds are planted in close rows in a seed bed, and the seedlings are left until they reach a height of about 12 inches. The best of them are then transplanted to a nursery, where they are set out in rows and remain for a year or two until they have gained the necessary height and strength. They are then budded or grafted. The buds used are cut from older trees that are in full bearing, and are selected from the very best available stock. A slit is made in the bark of each young tree at a height of about four inches from the ground, and into each slit a bud is inserted and secured in position by a wrapping of tape. If all goes well the bud grows into a shoot, and this is made to form the top of the new tree, the original top being removed. After a further period of care in the nursery the budded trees are planted out in the orchard. The usual method is to arrange the trees symmetrically in rows, the number of trees per acre varying from about 76 to 100. The trees produce commercial crops after about six years, and are at full-bearing age at ten years.

Each month from May to October the orchards are irrigated by means of furrows ploughed between the rows of trees, and in order to conserve the moisture the ground is broken up by petrol-driven cultivators at each watering period. During the winter months frost is the great enemy of the orange grower. In order to prevent damage to the fruit fires are made in smudge pots placed between the rows, and constant vigilance is called for on the part of the growers to ensure the maintenance in the orchards of a sufficiently warm temperature. The fires produce a warm smoke blanket that keeps the temperature above the fatal freezing point. The importance of observing the temperature whenever there is any danger of frost is so great that in some places systems of automatic bells, operating in conjunction with thermometers of a special type, have been installed to give the alarm immediately the danger point is reached. On many occasions carelessness regarding weather conditions has resulted in disaster to orchards and financial ruin to the fruit farmer.

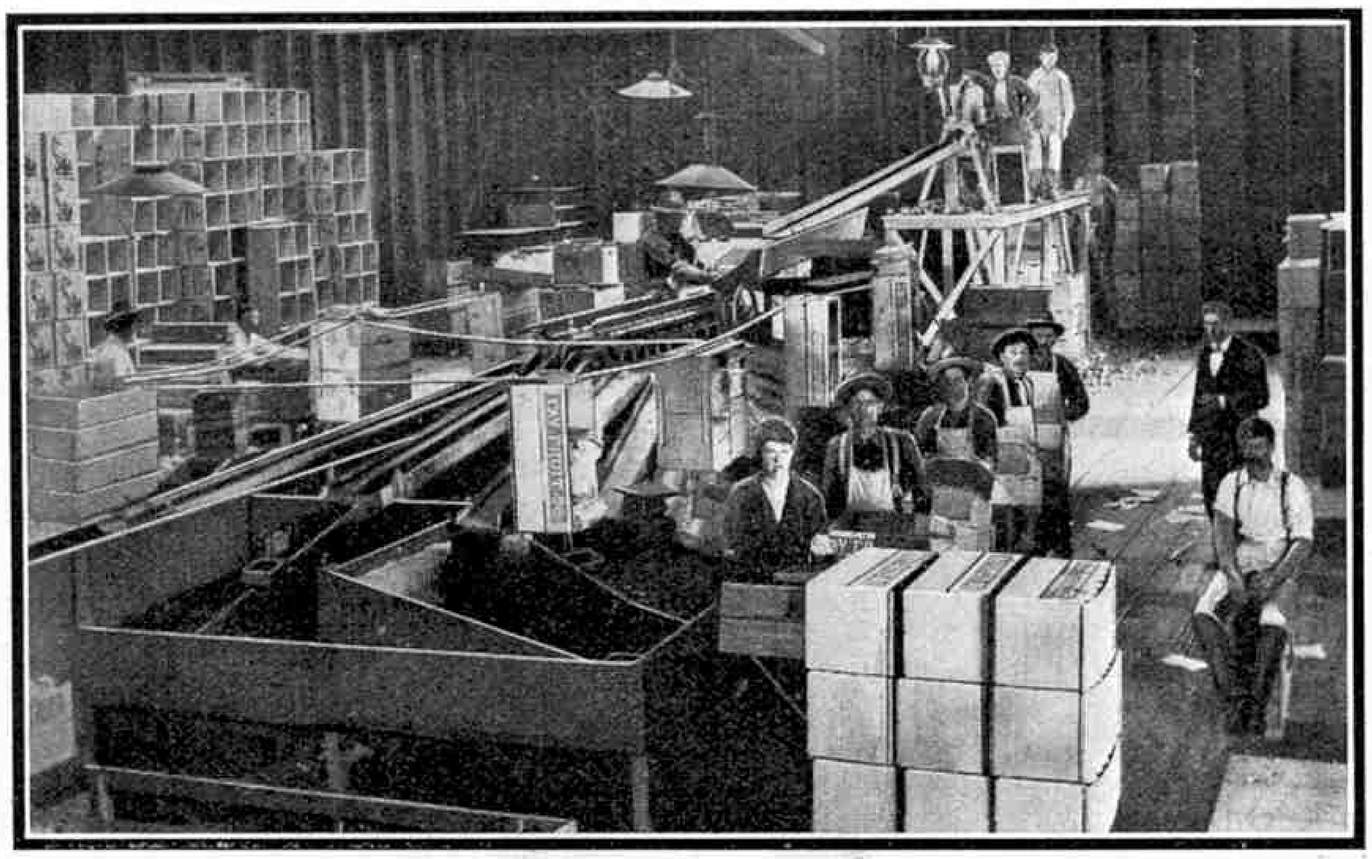
Orange trees are particularly subject to the attacks of insects, especially scale insects, which are very destructive and difficult to destroy. Various means of attacking these pests have been adopted with varying success. In 1868 California was mysteriously invaded by a scale insect known as the Cottony Cushion-Scale or Fluted Scale. This insect spread rapidly and caused

enormous damage, and all efforts to destroy it failed so completely that a year or so later the United States Entomologist expressed his opinion that no human endeavour could exterminate the pest. Others were not so hopeless, however, and the struggle continued. Presently it was discovered that Australia was the native home of the insect, and a search was made there for its natural enemies. It was found that a certain red and black Ladybird attacked the Fluted Scale successfully, and consignments of this beetle were brought to California and placed on trees infected by the insect. The beetle quickly settled down in its new home, multiplied rapidly, attacked the Fluted Scale and destroyed it wholesale.

Other scale insects have been controlled by fumigation with hydrocyanic acid gas, the operation being carried out under a tent-like covering. This treatment, while largely successful, has had the remarkable effect of developing races of scale insects capable of resisting the deadly cyanide gas in such strength as can be employed without injury to the trees.

Even when the crop has been successfully guarded and is ready for harvest, its gathering demands the greatest care. The oranges must not be plucked roughly from the tree, but each one must be carefully clipped off in such a manner as not to cut either the skin of the fruit or the buttons on the stem centre. The utmost care has to be taken to avoid scratching the fruit or the limbs of the tree, as skin punctures result in very rapid decay. The pickers place the oranges carefully in bags, from which they are transferred to field boxes and carted to the packing houses that are established in every fruit-growing area.

A visit to a Californian fruit-packing house is a fascinating and instructive experience. First of all the fruit is passed through a washing machine equipped with soft brushes which, working in hot water baths, remove all surface dirt. A cold shower is then played upon the fruit, which next passes to the drying plant where it is quickly dried by means of an air blast. The next operation is that of examination and grading. An endless belt leads to the sizing rollers where the fruit is automatically sorted into different bins according to size.



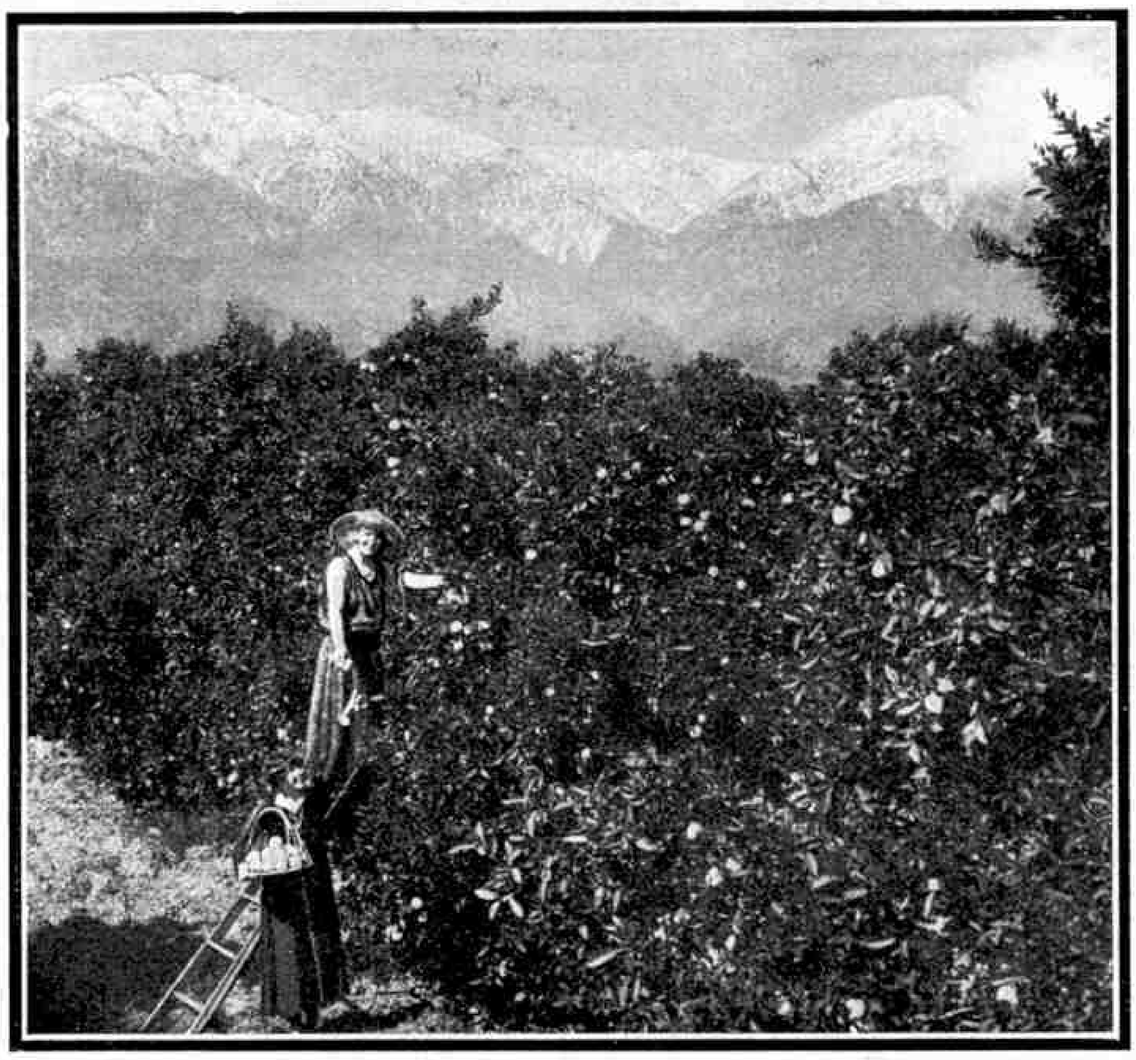
Grading and boxing department of a packing house. The oranges pass along the conveyor in the centre of the picture, and are individually examined by skilled workers of long experience.

Wrapping and packing follow, and the oranges are then ready for despatch to the consumer.

It is important to note that the Californian orange is never touched by hand either in the grove or at the packing house. Pickers and packers alike wear gloves in order to prevent any possibility of scratching the fruit, and in this manner the arrival of the oranges at market in perfect condition is assured. In the packing house scrupulous cleanliness is observed throughout, and the buildings are light, airy structures designed on modern lines. In the picking, washing and drying departments male labour is usually employed, but for packing skilled women workers replace men as they appear to be peculiarly fitted for this class of work.

The fruit is despatched in special railway cars, which are maintained at a temperature of about 45 degrees by means of a draught of cold air driven through the vehicle for four hours at the rate of 6,000 ft. per minute. Ice is also employed, and at intervals along the route the cars are re-iced as may be necessary.

The two principal types of oranges grown in California are the Washington Navel and the Valencia. The former ripens so that it can be picked, packed and distributed from November to May; while the latter can be marketed from May to November. Thus the California producers are able to provide fresh oranges throughout the whole year. The Navels flourish largely in the warmer inland valleys, and ripen earliest in the San Joaquin Valley. The Valencias, on the other hand, grow best in the cooler regions along the coast.



A typical Californian orange grove bathed in sunshine. In the distance are the snow-covered mountains of the Sierra Nevada Range.

In normal circumstances the orange tree has a long life. Usually it attains to the age of over 100 years, and during a considerable portion of its life it produces many thousand oranges every year. The white, almost wax-like orange blossoms have an extraordinarily powerful fragrance, and an orange grove can be smelled half-a-mile away.

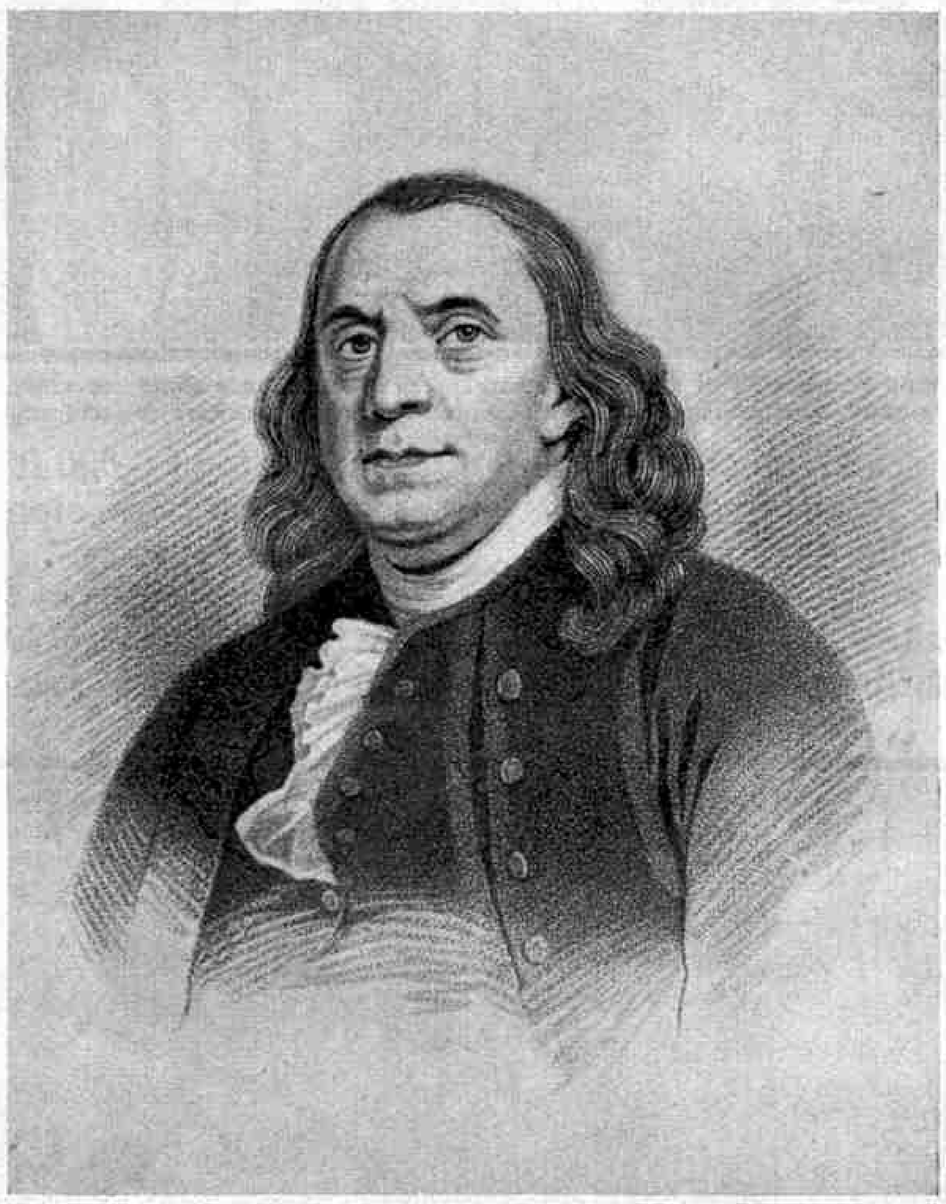
In addition to the cultivation and sale of the fruit itself an important business has sprung up in recent years in connection with the by-products from ill-shaped and damaged fruit. The most important of these are orange oil, citric acid, orange marmalade, and vinegar.

Producing Artificial Lightning

Electric Discharges from 4,000,000-volt Generator

ALTHOUGH lightning has been familiar to Man from the earliest times, less than 200 years have elapsed since it was definitely shown to be an electrical discharge in the atmosphere. Soon after frictional electric machines came into use, the resemblance between the sparks they produced and lightning flashes was noticed, but the proof that the two were identical in origin was not given until 1752 when Benjamin Franklin, the famous American statesman and scientist, supplied it in a series of interesting experiments.

Franklin was born on 17th January, 1706, in Boston, in what is now the United States of America, but was then a British colony. The boy was studious and fond of books, and therefore he was apprenticed to a printer. Unfortunately he was harshly treated during this period, and after five years he ran away. He reached Philadelphia, 400 miles distant, practically penniless, having sold his books to raise money for the journey. He quickly found work as a printer, however, and steadily made his way towards success. After a brief visit to England, during which he worked for a time as a compositor in London, he returned to Philadelphia and set up in business for himself. Later he established a newspaper, and eventually he became one of the foremost statesmen of his country.



Benjamin Franklin (1706—1790). This portrait is reproduced from the Editor's book, "Pioneers of Wireless," by permission of the publishers, Methuen & Co. Ltd.

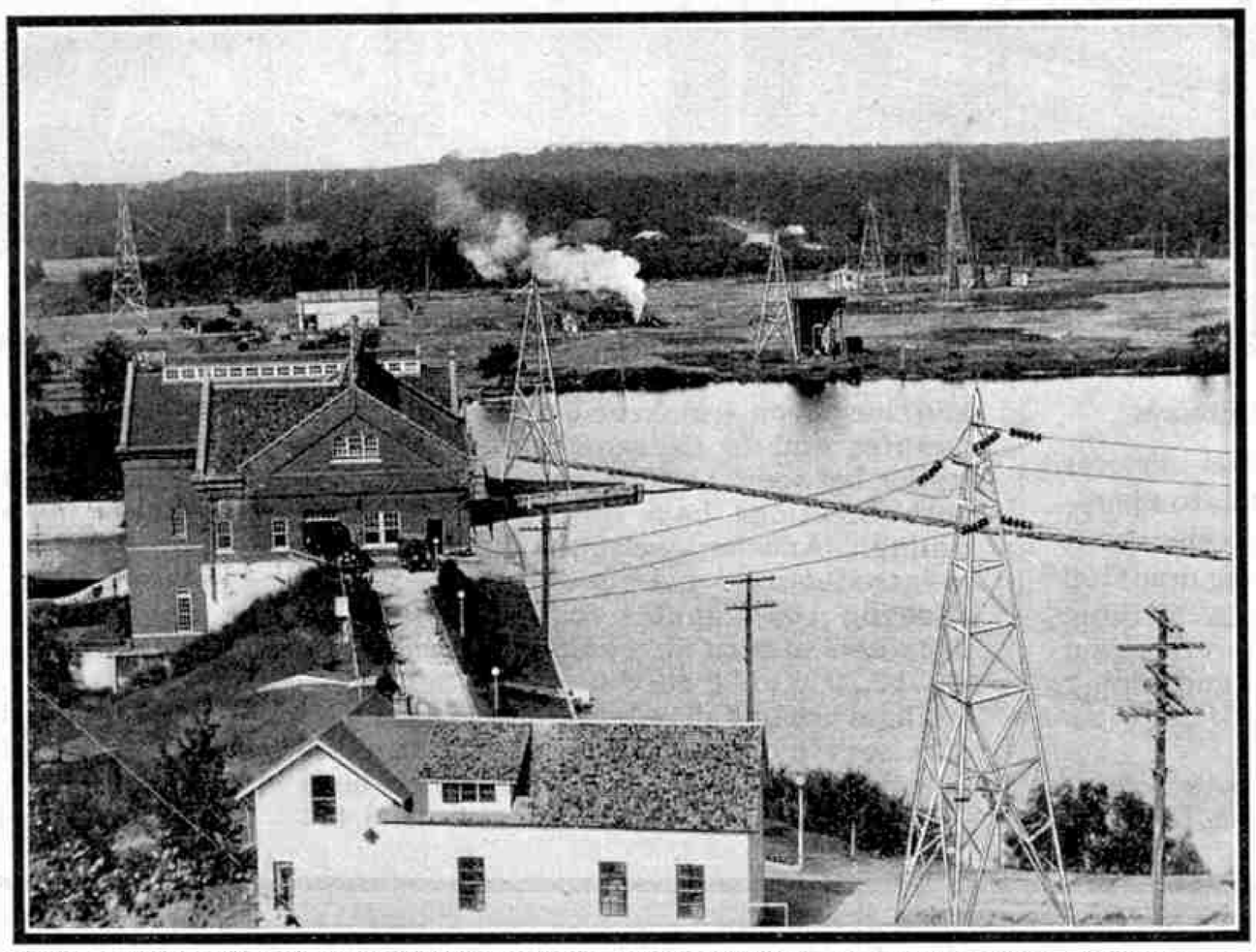
Franklin was of an enquiring turn of mind, and he was particularly interested in electricity. He repeated a series of electrical experiments that he had seen performed, and as a result he put forward the suggestion that lightning and electricity were identical. He proposed to put the matter to the test by using pointed iron rods as conductors to draw lightning from the clouds. There was no building in Philadelphia high enough for such an experiment, however, and Franklin hit upon the idea of using a kite instead. One thundery day this kite was flown high in the air, and the string holding it was connected by means of a silken thread to a metal key. When the cord of the kite became wet, Franklin was able to draw sparks from the key. He afterwards succeeded in charging a Leyden jar from the key. Various experiments performed with this jar gave exactly similar results to those obtained when the jar was charged by an electrical machine; and thus it was proved beyond doubt that lightning and electricity were identical.

Lightning is simply an electric spark on a gigantic scale, taking place between a cloud and the earth, or between two clouds. The flash is accompanied by the sharp cracking noise known as thunder. This is echoed and re-echoed from cloud to cloud, and thus is produced the familiar rolling and rumbling effect that may last some considerable time, although the flash itself probably does not last on the average more than one ten-millionth of a second. The electrical pressure behind the flash may amount to millions of volts, and any object such as a building or a tree that happens to be in the path of the discharge on its way to earth may be shattered or set on fire. At the time of Franklin's experiment the damage caused by lightning was very great. Franklin suggested the possibility of protecting buildings by means of a rod of some conducting material, ending in a point at the highest part of the building, and leading down outside the building into the earth. The effectiveness of this method of protection was soon shown, and to-day all large buildings are protected by lightning conductors on Franklin's principle, but of more efficient design.

Lightning became a more serious menace when the invention of the telegraph and the telephone led to the fixing of long lines of overhead wire in all civilised countries. Such overhead transmission lines are particularly liable to be struck by lightning, and when this occurs the heavy currents may damage the wires and the poles on which they are carried, and cause serious disturbance to the generators, transformers, and instruments installed in telegraph or telephone offices. Unfortunately the destructive power of a current caused by lightning appears to be multiplied on reaching an instrument room or a power house at the end of an overhead line. The reason is that it passes through the conducting line in the form of a wave; and just as a water wave dashes up to a greater height on reaching a wall, so this electric wave along a wire surges up to greater intensity on reaching the end of the conductor. The best means of arresting this surging current is to place in its path condensers, which consist of two plates or discs of conducting material, one connected to the line and the other to earth, and separated by a non-conductor such as mica. A lightning discharge prefers to flash direct to earth across a condenser of this kind than to pass through the coils and

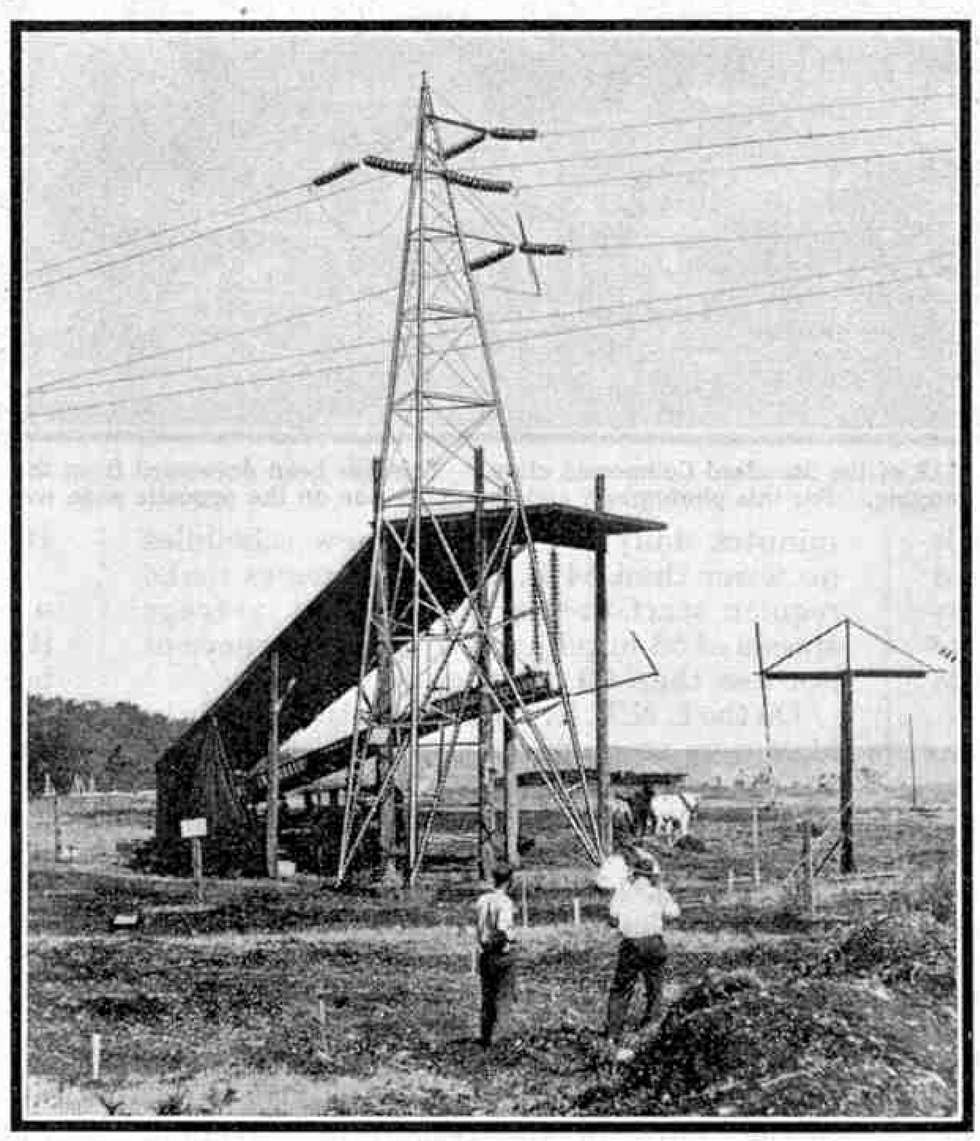
long circuits in a power house or instrument room.

Overhead wires are now used to an enormous extent for conducting high-voltage current for long distances. In America and various other countries this system is largely employed in connection with hydro-electric schemes. It is now being used also in Great Britain, the schemes of the Central Electricity Board providing for a great network of overhead wires to distribute to all parts of the country the current produced at central generating stations. The importance of protecting this ever-growing network of transmission lines has made it necessary to examine more closely what happens when a lightning discharge strikes an overhead conductor.



North end of a 40-mile overhead transmission line in Michigan to which artificial lightning discharges of 1,500,000 volts were given in order to study their effect. The generator is under the canopy on the opposite bank of the river.

Research of this kind is of peculiar difficulty because thunderstorms cannot be controlled in any way, and the lightning flashes occur unexpectedly and are of such brief duration that they are over almost before anything can be done. As a matter of fact, if a flash occurred at a distance greater than 100 ft., an observer would not see it until it was over; for the light from it would require one ten-millionth of a second to travel that distance, and this time is about the average duration of a flash. The discharge appears to last longer, but this is due to the fact that the intensity of the flash makes such a vivid impression on the retina of the eye that an observer continues to see an image for an appreciable time after the reality has disappeared. Fortunately we are no longer dependent on catching the erratic lightning flash, for thunderstorms may now be produced artificially, These, of course, are on a much smaller scale than actual thunderstorms, but in other respects they are identical and therefore suitable for experimental purposes.



Close-up view of the artificial lightning generator. For the two photographs reproduced on this page we are indebted to the General Electric Company of New York.

The engineers of the General Electric Company of New York have devoted much time and energy to the production of artificial lightning, and have succeeded in designing a generator that gives sparks produced by a pressure of nearly 4,000,000 volts, which is the greatest voltage ever produced by any generator. In this apparatus giant condensers act the part of thunder clouds, and the charge from the generator is accumulated until it finally dissipates itself in a blinding flash.

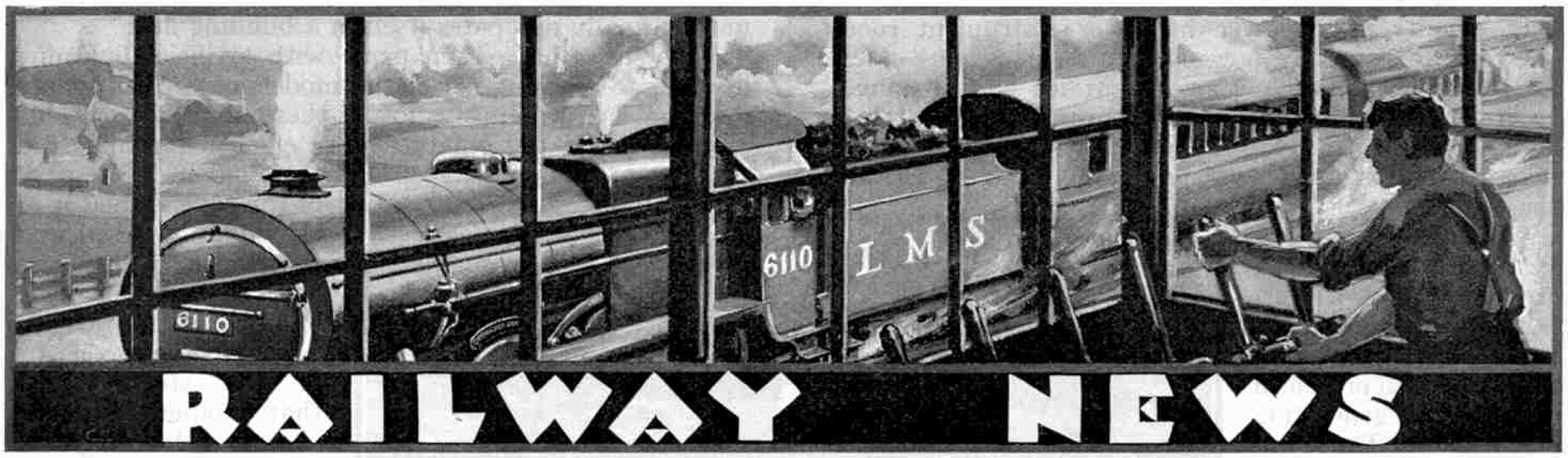
Many tests have been made with artificial lightning in order to study its effects on models of various shapes representing buildings. From these it has been discovered that a tall building or an efficient lightning rod protects a conically-shaped space around it. The peak of the cone is the top of the building or rod, and the width of its base may be twice or even four times its height, depending on the height of the storm cloud that produces the discharge. A building that is entirely within a protected space of this kind is much less liable to be struck by lightning than one that is outside it.

Although small-scale experiments with artificial lightning are interesting and useful, it was soon seen to be necessary for more extensive work to be undertaken if protective measures for overhead transmission lines were to be discovered. Fortunately there was available in Michigan, U.S.A., an overhead line extending 40 miles from Croton Dam to Grand Rapids, which was not being used for actual power transmission. This line is of special interest as being the first over which current at 110,000 volts was transmitted.

The next step was to produce the lightning. A generator of the type already used in laboratory experiments, with a capacity of 1,500,000 volts, was available, and it was mounted on a heavy trailer chassis so that it could be moved where required. It was controlled by a special clock that allowed it to discharge its artificial lightning with absolute regularity once every minute.

This lightning producer was set up at the north end of the 40-mile transmission line, and protected from rain and storm by means of a canopy. The various operators were connected by telephone so that they were able to study and report the effect of the lightning discharges on the transmission line, and on the various instruments that were installed along it.

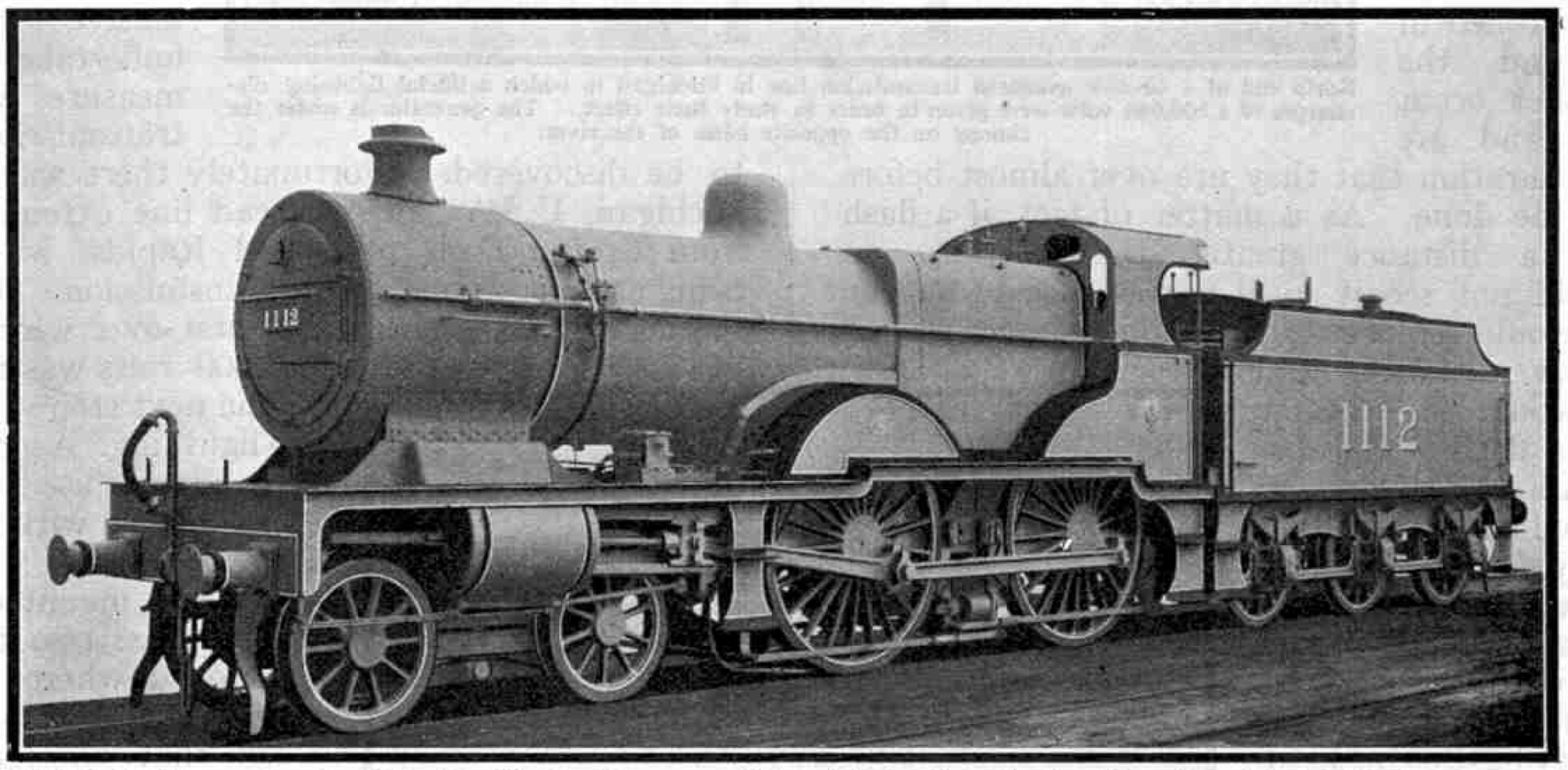
In order to obtain the information necessary for the designing of efficient lightning arresters and other means for the protection of transmission lines and electrical plant, it is important to know how the currents produced by lightning vary from point to point along the line itself. (Continued on page 649



Speeding Up on British Railways

The introduction of the summer services on Monday, 18th July, brought into operation some further remarkable accelerations on the British railways. The long non-stop runs which have been such a striking feature for several years past were again put on, but with shorter times and higher speeds, as described in the "*M.M.*" for June.

The most startling of the new accelerations are those of the L.M.S.R. The express that formerly left Liverpool at 5.20 p.m. now leaves five minutes later, but arrives at Euston at 8.45 p.m., or 20 minutes earlier, giving an overall time of 200 minutes for 193½ miles, including stops at Crewe and Willesden. The 152½ miles from Crewe to Willesden are covered in 142 minutes, start to stop, at an average speed of 64.4 m.p.h. It is claimed that this is a new European speed record for the fastest start-to-stop journey of over 150 miles. From passing Stafford to stopping at Willesden, a distance of 128 miles, the average speed is 66 m.p.h.



L.M.S.R. 4-4-0 locomotive No. 1112 of the Standard Compound class. This has been developed from the original Midland design, and is an efficient and economical engine. For this photograph and the upper one on the opposite page we are indebted to the L.M.S.R.

Another notable timing is that of the up "*Mancunian*" which, leaving Manchester at 9.45 a.m. now reaches Euston at 1 p.m., an acceleration of ¼ hour. The non-stop run of 177 miles from Wilmslow to Euston is made in 172 minutes, requiring an average speed of 61.7 m.p.h. The up "*Merseyside Express*" is now allowed 3½ hours from Liverpool to London and makes the break of 189.7 miles from Mossley Hill to Euston in 200 minutes, an average speed of 56.9 m.p.h. The express from Birkenhead, Blackpool, etc., which now reaches Euston at 1.15 has been accelerated by 10 minutes and boasts the tightest timing ever booked from Crewe to Euston, only 160 minutes being allowed for the 158.1 miles—an average speed of 59.3 m.p.h.

On the Midland section, the "*Thames-Clyde Express*" now leaves at 11.55 a.m. and has been quickened to Leeds by 11 minutes and to Glasgow by 14. Several trains between London and Yorkshire, in both directions, have been given a shorter timing. Another welcome feature is the re-introduction of a pre-War schedule in allowing 105 minutes for the 99.1 miles from Leicester to St. Pancras in the case of the 12.20 p.m. train from Manchester.

These are but a few outstanding examples of a very comprehensive speed-up on the L.M.S.R. Altogether 2,026 trains have been accelerated by a total amount of 6,424 minutes daily. Under the new schedules no fewer than 54 L.M.S.R. expresses make regular start-to-stop journeys at average speeds of 55 m.p.h. and over for journeys of not less than 60 minutes duration.

On the L.N.E.R. the accelerations made in May were so numerous, that less remained to be added in July. Nevertheless the improvements included in the July timetables are so widespread as to save in the aggregate no less than 94 hours daily. The 1.10 a.m. sleeping car express from King's Cross has been accelerated to reach Aberdeen 22 minutes sooner.

A number of the expresses on the Great Central section, which were already very sharply timed, have been subjected to further cuts for the benefit of travellers between Marylebone, Leicester, Nottingham, Sheffield, Manchester, Bradford and numerous other places. East Anglian trains have also been included in the general speed-up. The new buffet car service between King's Cross and Cambridge in both directions has been given a reduced schedule of 75 minutes for the overall journey, including stops.

As was to be expected the G.W.R. have also contributed some noteworthy schedules. Twelve main line expresses now daily cover 1,176 miles in 1,150 minutes at start-to-stop speeds of from 60.1 to 69.18 m.p.h. The 1.15 p.m. express from Paddington is now timed to cover the 118¼ miles to Bristol in 116 minutes, an average of 61.1 m.p.h., while for the Bath slip coach off that train, only 102 minutes are allowed for the 106¾ miles, requiring an average speed of 62.8 m.p.h. The 11.15 a.m. has 118 minutes to Bristol and 104 to Bath, yielding speeds of 60.1 m.p.h. and 61.6 m.p.h. respectively.

In addition to improvements in main line services, many savings have been made in branch and local lines, with the result that the services now offered by the G.W.R. are in the aggregate 10,633 minutes quicker daily than a year ago.

The Southern Railway is again operating a very extensive holiday service. Although it reveals no startling innovations, it has been generously planned to meet all needs and will be found more efficient than ever. Trains generally are made up of improved and more comfortable stock, while the locomotives that draw them are fully adequate to their duties. Such famous trains as the "*Southern Belle*," the "*Bournemouth Limited*" and the "*Atlantic Coast Express*" are all on running their usual fast schedules and maintaining their popularity.

Record Run by "*Queen of Scots*"

On 22nd June, the "*Queen of Scots*" Pullman express covered the distance of 185.7 miles between Leeds and London in exactly three hours, the engine being "Atlantic" No. 4433. The express left Leeds 15 minutes late, a freight train having caused a delay in its departure. King's Cross was reached on time, however, and for the 156 miles from Doncaster only 144 minutes were taken.

Pioneer G.W.R. Locomotive Scrapped

The ten new engines of the 4–6–0 "Castle" class have been completed at Swindon and most of them, after extensive trials, have been passed into service.

New 0–4–2 tank engines are now in hand. They will have coupled wheels of 5 ft. 3 in. diameter. Their cylinders, valve gear and minor fittings will be similar to those of the 5400 class, but their cabs and tanks will be smaller. The number on order is 40, and of these 10 are building at present. They will be numbered from 4800 upwards and the first should be out by the end of August.

Perhaps the most interesting happening at Swindon works during July was the cutting-up of that famous passenger locomotive No. 2900, "*William Dean*," the pioneer of the big, powerful engines that have given the express services of the G.W.R. a foremost place for speed among the railways of the world. Turned out of Swindon in 1902, this was the first 4–6–0 express locomotive to be built by the G.W.R. Its advent marked a bold advance in locomotive design, which subsequent experience has fully justified. Its original number was 100. The name "*Dean*" was later given to it in honour of the eminent G.W.R. engineer who had designed it, and this was altered afterwards to "*William Dean*." It is worthy of note that the original cylinders—which were the first on the G.W.R. to be given a stroke of 30 inches—have lasted throughout the whole of the engine's career.

Swindon's annual holiday began on July 7th and continued for 10 days, 32 special trains being required to convey the holiday makers to the 325 different resorts they had chosen.

L.N.E.R. Locomotive News

Nine of the 15 3-cylinder 4–4–0 locomotives of the new "Hunts" series have been completed at Darlington and are in service. Their numbers and names were given in last month's "*M.M.*"

Two further 0–6–0 freight engines of the "J38" class have been built at Darlington and are numbered 2976 and 2977.

Doncaster works are engaged on a batch of eight 3-cylinder 2–8–0 standard mineral locomotives. They have cabs of the latest design with double windows at each side. Their numbers run from 2954 to 2961. The first four have already been put into traffic.

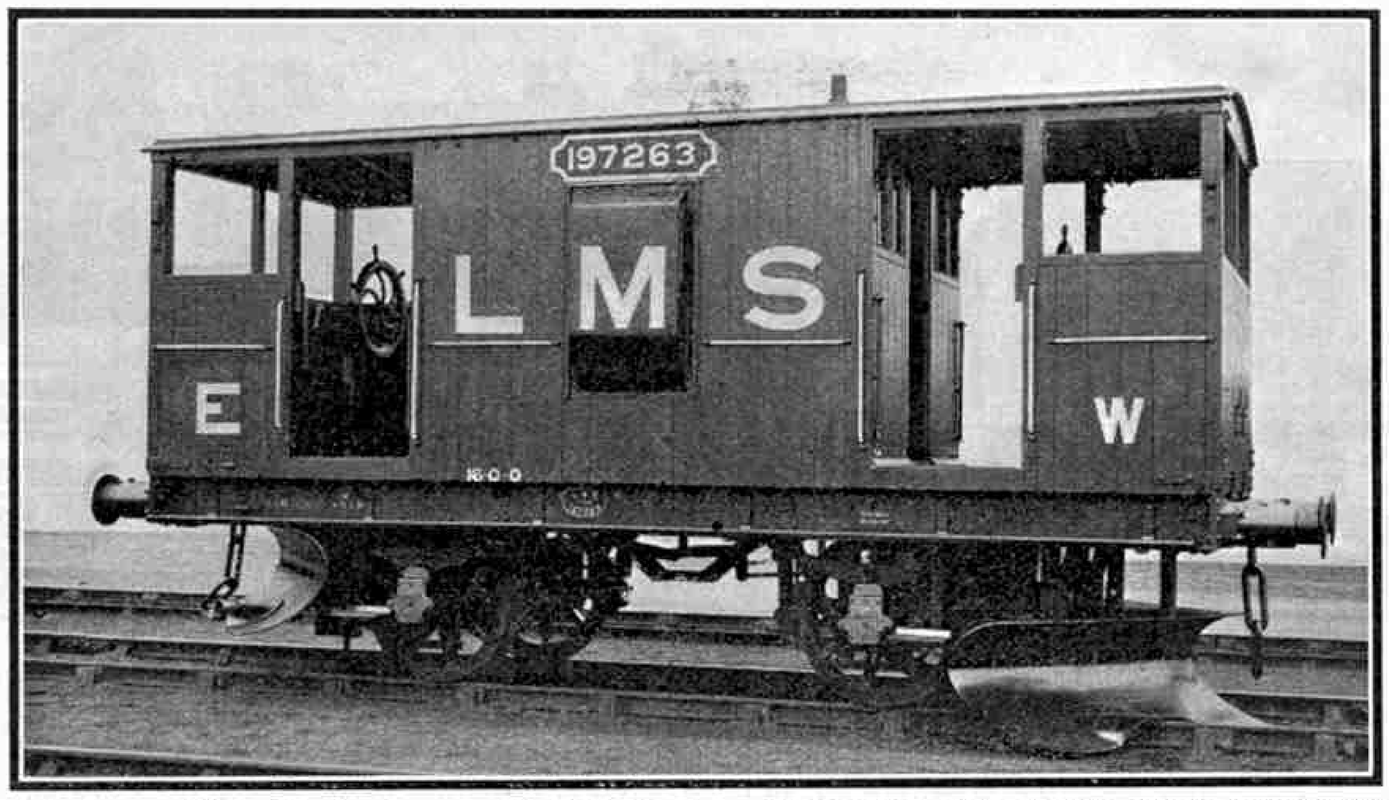
The L.N.E.R. announce that in view of decreased traffic, and in order to effect economies, they are reluctantly compelled to close their locomotive works at Gateshead. For the future, repair work on locomotives for the North Eastern area will be concentrated at Darlington. About 1,100 men have been employed at Gateshead works and although as many of them as possible will be transferred to Darlington, it is inevitable that a large number will be thrown out of employment.

L.N.W.R. Engines in Midland Division

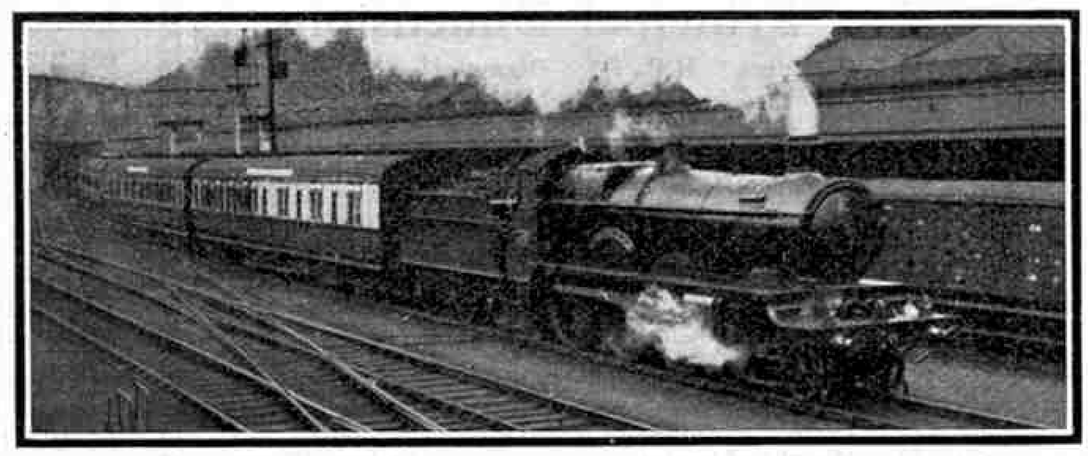
The steady output of standard 0–8–0 freight engines from the works at Crewe has been continued and Nos. 9666-8 are now in traffic. When the present batch of these engines has been completed, an order for fifteen 4–4–0 passenger tender engines of Class 2 will be proceeded with.

Some of the standard 2–6–4 tank-engines are now working on the suburban services between London, Watford and Tring, superseding the "Precursor" 4–4–2 tank-engines that formerly performed these duties. They have also been noted hauling freight trains on the old North London line between Willesden and Broad Street.

A considerable number of former L.N.W.R. locomotives have been fitted with reduced cabs and other details to enable them to work on the Midland division. Included in these are passenger locomotives of the "Claughton," "Prince of Wales" and "George the Fifth" classes, and 0–8–0 freight locomotives of the "G1" and "G2" classes.



A brake van fitted with ploughs as used in ballast trains. The function of the ploughs, which can be raised or lowered from the van, is to distribute newly-tipped ballast evenly on the track.



The "Cornish Riviera Express" in 1923. The engine occupying the position now usually allotted to a "King" is "Princess Maud," one of the earlier 4-cylinder engines. Photograph reproduced by courtesy of the G.W.R.

Among the engines withdrawn for scrapping have been two more 2–4–0 "Jumbos"—No. 5014, "*Murdock*" and No. 5021, "*Princess*"—and also two 4–4–0 "Precursors"—No. 5192, "*Cossack*," and No. 5229, "*Servia*." As the engines of the "Prince of Wales" class become in need of heavy repairs, they will be withdrawn and scrapped.

The engine involved in the fatal derailment of the Birmingham express, near Stafford, on Friday evening, 17th June, was No. 5278, "*Precursor*." It was built at Crewe in 1904 and was the first of the well-known class to which it gave its name. Its L.N.W.R. number was 513.

Pooling Railway Traffic

Negotiations are proceeding between the L.M.S.R. and the L.N.E.R., and also between the L.M.S.R. and the G.W.R., with a view to pooling their traffic receipts at places where hitherto they have been in competition. The object of the schemes is to secure economy of expenditure by eliminating unnecessary competition. The companies assert that this can be done without any serious reduction of the facilities they offer to the public.

Twelve Years' Work in a Railway Tunnel

Over 8,000,000 bricks and more than 6,000 tons of cement and sand have been used in repairs to Morley Tunnel, Yorkshire, the sixth longest tunnel on the L.M.S.R. system.

The tunnel, which is 1 m. 1,614 yds. in length, is situated between Dewsbury and Leeds on the main Manchester-Leeds route. The task of repairing it was begun in September, 1920, and has taken more than 12 years, for owing to the necessity of avoiding interference with traffic, work could only be carried out at certain times and some of the most important operations were therefore performed on Sundays.

The materials used in the repair work included 8,016,690 bricks, 1,912 tons of Portland cement, 4,744 tons of sand, 50 tons of steel rails, 36,306 cubic feet of timber, and 1,425 yards of drain piping. The total amount of stone and rock cut out of the tunnel was 25,000 tons.

A length of 1,400 yards of the tunnel has been repaired, most of the work consisting of cutting out the lining entirely and replacing it with six rings of brickwork over 2 feet thick. The cutting out and rebuilding was done in lengths of 9 feet, and to complete one length took from two to three months, which is considered rapid work. Four steel rail "ribs" were fitted as supports, the erection of these being done on Sundays from specially prepared vehicles, and seven separate stages of work were required to complete each of these 9 feet lengths.

New L.M.S.R. Station

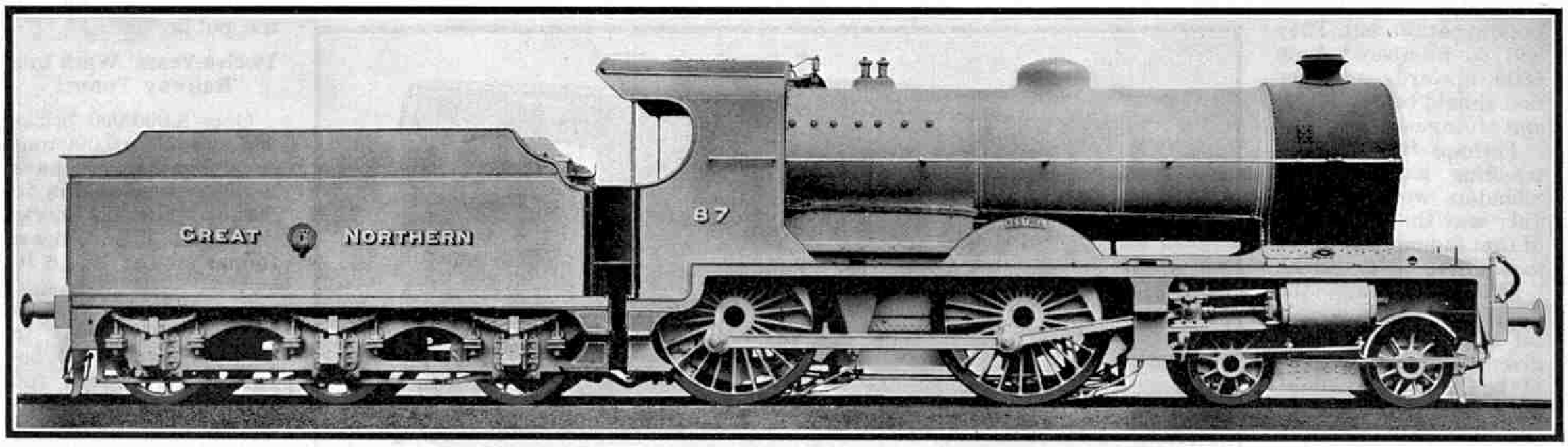
The L.M.S.R. have decided to erect a new station on the London-Watford line. It will be midway between the present North Wembley and Kenton stations and will be called South Kenton. It will serve a rapidly developing area and no doubt will be a means of attracting much traffic.

Piccadilly Railway Extension Opened

The first section of the western extension of the London "Underground" Piccadilly line, was opened for public service on Monday, 4th July. Through trains are now in regular operation from Finsbury Park via Hammersmith to South Harrow. An improved connecting service has also been put on between South Harrow and Uxbridge.

New Locomotives for G.N.R. of Ireland

Compounds for Accelerated Services



IN the "*M.M.*" for February last it was stated that five 4–4–0 express engines were under construction for the G.N.R. of Ireland, and in view of the incorporation of the compound principle, and the adoption of a boiler pressure of 250 lb. per sq. in., their appearance has been awaited with considerable interest. By the courtesy of the railway company and of the builders, Beyer Peacock & Co. Ltd., of Gorton, Manchester, we are able to illustrate one of these engines (No. 87 " Kestrel ") and to give particulars of their dimensions and chief characteristics.

The planning of accelerated services, now in operation between Dublin and Belfast, and the necessity for keeping locomotive power abreast of modern practice, have caused these new engines to appear. Larger engines than the fine superheated 4–4–0 simples of the well-known " Carrantuohill " type introduced in 1913 have been impossible until recently, owing to the limitation of weight imposed by the Boyne Viaduct at Drogheda. Reconstruction of this, and of the viaduct of Malahide, has enabled heavier engines to be put into service, with the result that these new 4–4–0s turn the scale at 65 tons in working order without their tenders. Mr. G. T. Glover, Locomotive Engineer of the G.N.R. of Ireland, is responsible for the design.

A feature of Mr. Glover's practice has been the extensive application of superheaters, not only to new engines, but also to many of the older classes, 75 per cent. of the locomotive stock of the company being so fitted. In Ireland there is no coal produced having the qualities necessary for locomotive work, so that economy in consumption is of great importance. Hence the wide use of the superheater which, with pressures up to 200 lb. as in the simple 4–4–0s just referred to, has given every satisfaction. Following up the modern principles of higher pressures to obtain still further fuel economy, a working pressure of 250 lb. per sq. in. was decided upon in the new design, and in order to make the fullest use of this higher pressure, coupled with superheating, compound working or two-stage expansion has been incorporated. The system followed, involving one high-pressure cylinder inside and two low-pressure cylinders outside the frames, is similar to that developed so successfully on the former Midland Railway and more recently on the L.M.S.R., the latter company now having 235 compound 4–4–0s.

The plan adopted was originated by Mr. W. M. Smith of the former North Eastern Railway, and was first applied in 1898 to a 4–4–0 locomotive previously built as a two-cylinder compound on the Worsdell-von-Borries system that had some vogue on that line. The engine No. 1619, now withdrawn from service, was probably the only example that had ever been operated on two separate and quite distinct systems of compound working.

This locomotive, and the first five Midland engines built by Mr. Johnson in 1902 and 1903, could be worked according to the needs of the moment as complete simple engines, or as full compounds by means of a reducing valve; while there was also an intermediate stage of working that could be termed semi-compound. This reducing valve was placed on the side of the smoke-box, and could be controlled within certain limits by the driver, although the admission of high-pressure steam to all three cylinders immediately on starting was automatic. This arrangement was dispensed with by Mr. Deeley in the later Midland engines, however, and the earlier ones were altered accordingly, hence the application of the name " Deeley " compounds. The method employed in these and the L.M.S.R. engines built subsequently is to make use of the movement of the regulator handle to operate a small jockey valve. This supplies steam direct to the low-pressure cylinders when starting, and the high-pressure piston is kept in equilibrium with steam on each side of it by means of an equalising arrangement, which was also a feature of the original " Smith " system. When the regulator handle is given more than 32 degrees of opening, fully compound working commences; and complete closing and re-opening is then necessary to restore the arrangement in force at starting. By permission of Sir Henry Fowler and Mr. E. J. Lemon of the L.M.S.R., this arrangement of regulator has been adopted for these new Great Northern engines. It has the advantage that no special skill in handling the engine is required, for the change to fully compound working is automatic, depending on the movement of the regulator handle.

The employment of three cylinders, with the improved balance that results, has enabled the maximum axle loading to amount to 21 tons. The low " hammer blow," and the fact that the track is chiefly of 90 lb. British standard bullheaded rail, make excessive track wear unlikely. Each of the three cylinders has a separate set of Stephenson link motion for steam distribution, and the connecting and coupling rods are of special " Tormel " steel. The engines have a very fine straightforward appearance, and follow the traditional British neatness of outline to a far greater extent than do many engines of recent build.

The tenders, which were built at the Dundalk Works of the railway company, are larger than previously, and hold 3,600 gallons of water and six tons of coal. The locomotives are finished in the company's standard black livery with red lines, and their numbers and names are as follows: 83, " *Eagle* "; 84, " *Falcon* "; 85, " *Merlin* "; 86, " *Peregrine* "; 87, " *Kestrel.*"

The gradients of the line are by no means easy, as those readers who followed Mr. Cecil J. Allen's article " *The Limited Mails of Ireland,*" in the "*M.M.*" for October, 1928, will remember. There are in addition numerous speed restrictions, of which the principle five range from 10 to 45 m.p.h. over distances up to one mile; and these do not add to the ease of the locomotive work.

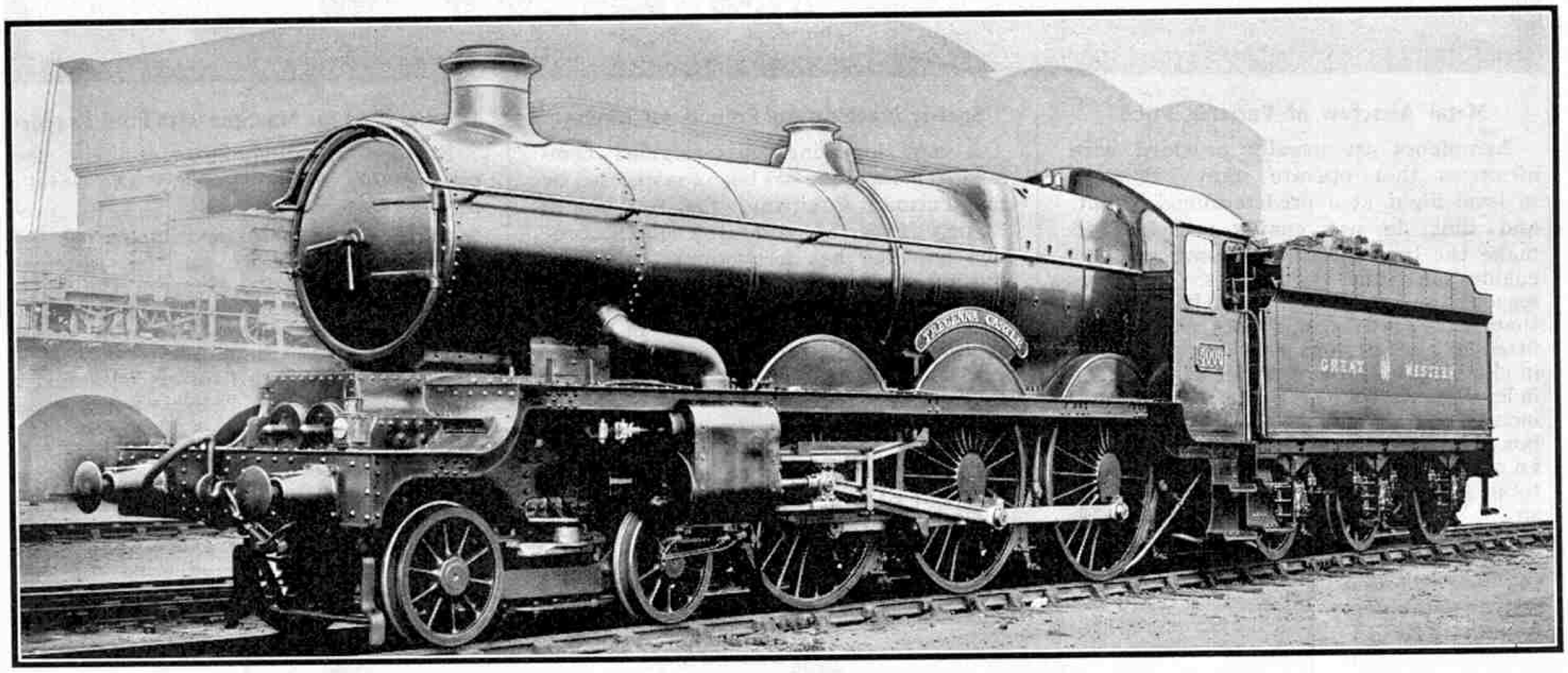
Principal Dimensions

Cylinders	H.P. (1)	Diameter	17¼ in.
		Stroke ...	26 in.
	L.P. (2)	Diameter	19 in.
		Stroke	26 in.
Driving Wheels			6 ft. 7 in.
Heating Surface :			
Tubes			1089.0 sq. ft.
Fire-box			162.0 ,,
Total			1251.0 ,,
Superheater			276.5 ,,
Grate area			25.22 ,,
Working pressure			250 lb. per sq. in.
Water capacity of tender			3,600 gals.
Coal ,, ,, ...			6 tons
Weight of engine in working order			65 tons 1 cwt.
Weight of tender ,, ,,			38 tons 10 cwt.
Total weight in working order			103 tons 11 cwt.

The Fastest Train in the World

Record Run by G.W.R. "*Cheltenham Flyer*"

By "Observer"



The above illustration shows G.W.R. locomotive No. 5006, "Tregenna Castle." This well-known member of a famous class was the engine concerned in the record-breaking trip of the "Cheltenham Flyer" on 6th June last, as described on this page. For the photograph we are indebted to the courtesy of the G.W.R.

SINCE Monday, 14th September, 1931, the "*Cheltenham Flyer*" has been known as the world's fastest train, for it is timed to cover the 77¼ miles from Swindon to Paddington in 67 minutes, the average speed being 69.2 m.p.h. start to stop. The scheduled speed has been maintained without difficulty, and on 6th June of this year, the famous express achieved a truly marvellous record, running from Swindon to Paddington in 56 min. 47 sec., at an average speed of 81.6 m.p.h., start to stop. A brief announcement of this great run appeared in the "*Railway News*" pages of the "*M.M.*" for last month, and we are now able to give further details.

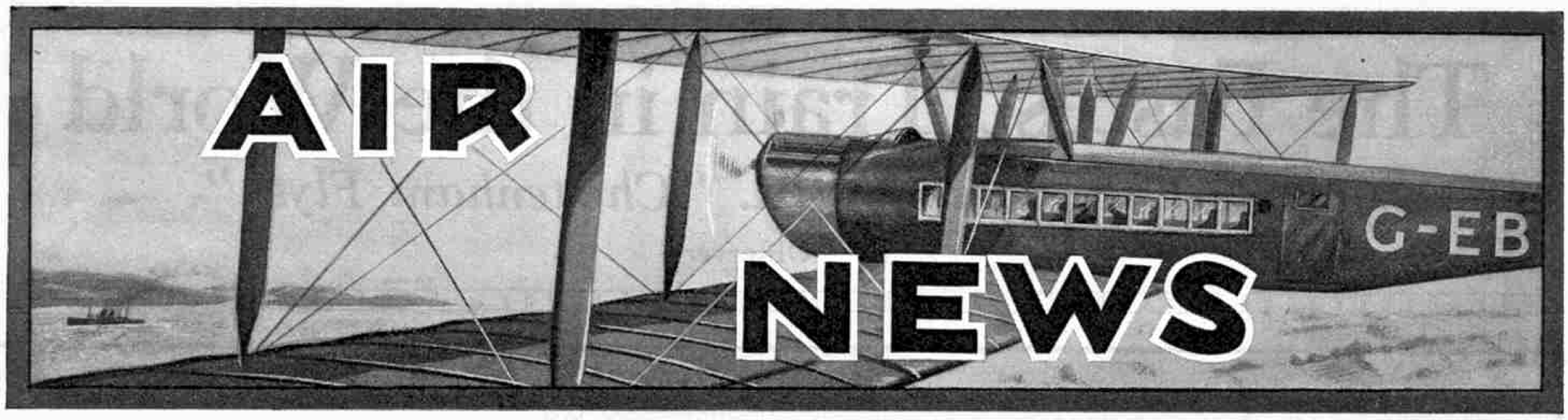
The engine at the head of the train during its record run was "*Tregenna Castle*," in charge of Driver Ruddock and Fireman Thorp. Within two miles of the start a speed of 60 m.p.h. was attained, in three miles, 70 m.p.h. was reached, while within five miles the speed had risen to 80 m.p.h. "Even Time," when the minutes and miles of running became equal, was reached in less than eight miles from Swindon, and at Wantage Road, 16.9 miles, the speed was more than 90 m.p.h. The maximum reached was 92.3 m.p.h. and an average of 90 m.p.h. was maintained for no less than 39 miles. The 70 miles between mile-posts 72 and 2 from London were run in precisely 48 minutes, or at an average speed of 87.5 m.p.h. and the train came to a stop at Paddington exactly 56 min. 47 sec. after leaving Swindon. Beyond question, these timings constitute a world record.

On the same day a brilliant run was made in the opposite direction from Paddington to Swindon. This trip was made on the Cheltenham Spa express, which leaves Paddington shortly after the arrival of the "*Cheltenham Flyer*" and the times were recorded by the observers who checked the record run of the world's fastest train. The engine was No. 5005 "*Manorbier Castle*" and the train reached Swindon, where a special stop was made, in 60 min. 1 sec. This was a record for the down journey and as there is a slightly rising gradient for a considerable part of the way, the work of the engine and its crew—Driver Burgess and Fireman Gibson—was not a whit behind that accomplished on the record up journey. At Acton, 4.3 miles from Paddington, the speed was 70 m.p.h. and a maximum of 86½ m.p.h. was reached at Slough. For the 70 miles from mile-post 6 to mile-post 76, the speed averaged 82 m.p.h., while for the whole distance the average speed was 77.28 m.p.h., start to stop in spite of the upward tendency of the road.

To complete a memorable day's work, and to enable the observers to make an expeditious return to London, the G.W.R. authorities specially stopped the 5.15 p.m. Bristol two-hour express at Swindon. In spite of that stop, such was the running made by engine No. 4091, "*Dudley Castle*," that Paddington was reached 2½ minutes early, the 77¼ miles from Swindon having been covered in 66 min. 33 sec. It scarcely need be said that these magnificent runs, especially the record of the up "*Cheltenham Flyer*," have aroused much enthusiasm and brought the heartiest congratulations to the G.W.R. The splendid "Castles" and their skilful crews have gained for themselves new glory, but it is only fair to add that on Monday, 6th June, a "King" played a part in carrying out the plans for the record run, for engine No. 6024, "*King Edward I*," brought the "*Cornish Riviera Express*" into Paddington seven minutes early in order to ensure a clear road for the swiftly following record-breaking train, a feat that required good locomotive work.

In the article on "*The Fastest Train in the World*" that appeared on page 882 of the "*M.M.*" for November last year, it was remarked that when the schedule of the "*Cheltenham Flyer*" had been cut by just one minute more, it would mean a start-to-stop run at more than 70 m.p.h., and, again, that when the best time so far achieved had been reduced by only half-a-minute, it would give an average speed of fully 80 m.p.h., start to stop. The second of the two suggestions has now been realised; it may be safely added that the former will not long be delayed.

In addition to the daily performances of the kind that we have come to associate with the "*Cheltenham Flyer*," this section of line from Swindon to Paddington has seen some remarkable running at different times in the past. Brunel laid out his main line for speed, and as early as 1845 an up express was required to run from Swindon to Didcot at an average speed of 47 m.p.h. Then again, in the classic "Ocean Mail" record run of 1904, the special ran into Paddington in nine seconds over the hour after passing Swindon. More recently in 1923, when the "*Cheltenham Flyer*" with an average speed of 61.8 m.p.h. became the fastest train in Great Britain, the first run was performed in three minutes under the scheduled time of 1¼ hrs.

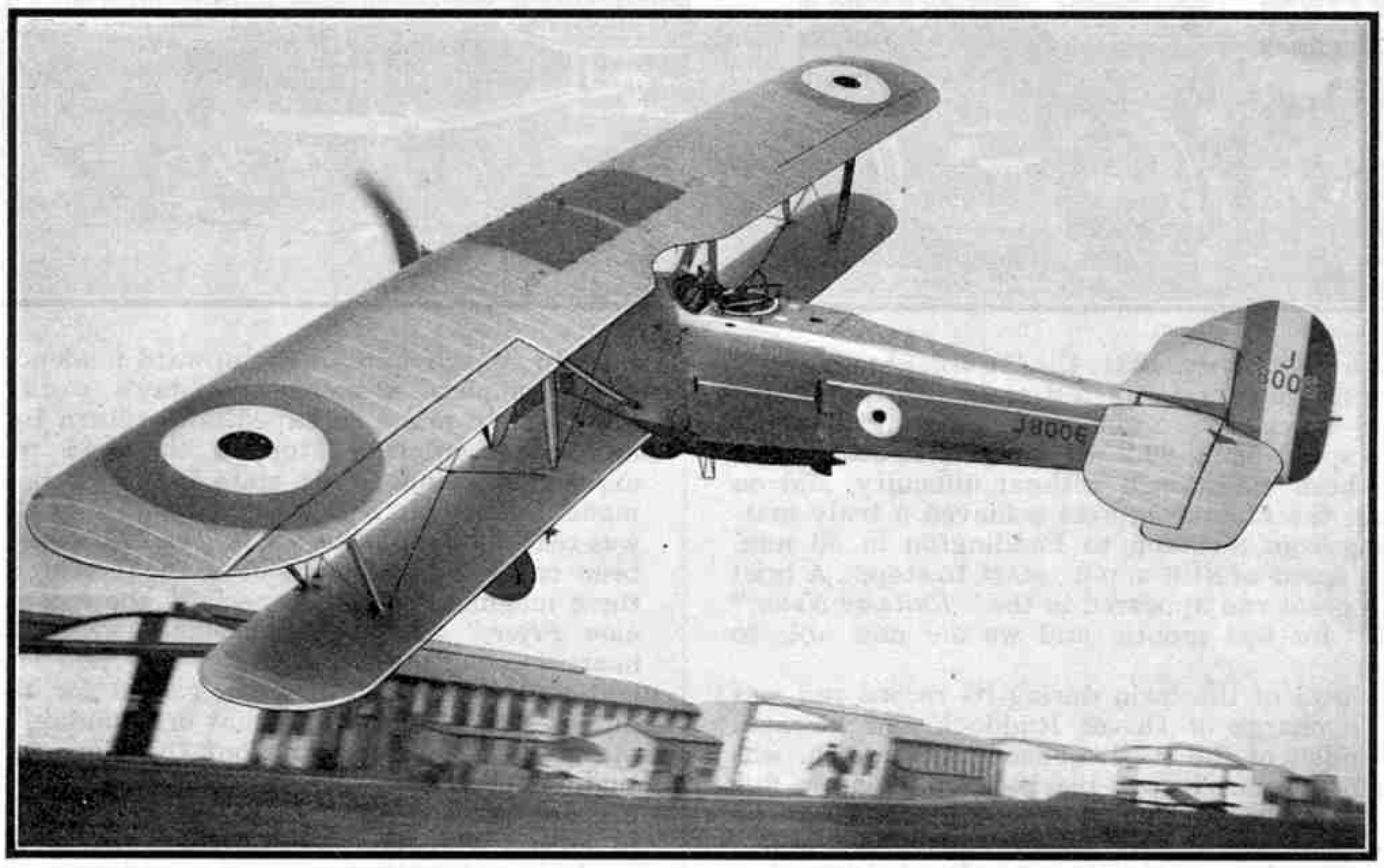


Metal Airscrew of Variable Pitch

Aeroplanes are usually provided with airscrews that operate most efficiently in level flight at a predetermined height, and thus do not enable machines to make the best use of the power of their engines in other conditions. For this reason the suggestion has been made that two-speed gear boxes should be fitted in aircraft, one gear being for use in climbing, and the other for employment in level flight. The inclusion of a gear box would greatly increase the total weight of an aeroplane, however, and it is believed that the best solution to the problem would be the introduction of an airscrew of variable pitch, that is, one so arranged that the angles of the blades may be altered during flight.

Airscrews of variable pitch have been made in England for many years, but in most cases they have been made of wood. A new metal variable pitch airscrew recently has been produced in America in which aluminium alloy blades are attached to a special steel hub in such a manner that they may be rotated through any angle up to 90° while revolving at high speed. The change is made by means of spur gearing driven by an electric motor of ½ h.p., for which current is supplied by a 12 volt accumulator. The pitch of the airscrew is changed at the rate of one degree in three-quarters of a second.

In machines fitted with two or more engines, failure of one of these provides an interesting use for a propeller of variable pitch, for its blades could then be turned to the angle at which they would offer least resistance to the air-stream. This would greatly assist the performance of the remaining engines and would enable the aeroplane either to fly at a higher speed, or to have a greater endurance, than if ordinary propellers were fitted, a feature of particular value when flying over water.



A Hawker "Horsley" machine banking near the ground. This aeroplane is fitted with a Rolls-Royce "Condor" engine, and may be used either for bombing or for launching torpedoes. The outline of a torpedo may be seen below the fuselage of the machine in our illustration. Photograph published by courtesy of "Flight."

Speedy Machine for French Air Liners

A new low-wing single-engined commercial monoplane has been constructed by the Farman Company, the well-known French firm of aircraft constructors. The machine has a maximum speed of 155 m.p.h. at ground level and is capable of cruising at 135 m.p.h. and its performance therefore is considerably in excess of that of most aircraft at present in service on air lines. The aeroplane is known as the Farman 250 and is equipped with a Gnôme-Rhône 380 h.p. "Jupiter" engine. It has accommodation for four passengers, and baggage compartments also are provided.

The machine is of all-wood construction throughout and employs wings of the semi-thick type. These taper slightly towards the tips, which are cut off square, and the centre section forms an integral part of the fuselage. The two fuel tanks are carried in the centre section of the wing. Each has a capacity of 60 gallons and there is also an auxiliary fuel tank capable of carrying 20 gallons. The whole of the fuselage is covered with plywood, while the tail unit is of normal construction. The undercarriage is of the split axle type, and the wheels are wide apart.

It is expected that the new machine will be put into operation on the Farman Air Lines, which extend from Paris to Brussels, Amsterdam and Berlin, and on to Denmark and Sweden.

Dornier Air Line Machine with Four Engines

Dornier Metallbauten G.m.b.H., the constructors of the "*Do.X.*," the world's largest flying boat, have recently produced a new landplane, known as the "*Do.K.*," for service on the air lines of Deutsche Luft Hansa. The new machine is a high wing monoplane equipped with four engines. These are mounted in pairs, as are those on the "*Do.X.*," but they are carried in nacelles under the wing instead of above it. The machine has accommodation for 10 passengers in a roomy cabin fitted with recessed windows, and there are two luggage holds, one behind the cabin and the other immediately below the cabin floor.

The overall span of the "*Do.K.*" is 82 ft. and its overall length is 54 ft. It weighs 7,850 lb. when empty and 13,671 lb. when fully loaded, and its maximum speed is 124 m.p.h. With one engine out of action, the aeroplane is capable of climbing or maintaining height up to an altitude of 11,000 ft., and of flying level at a height of about 3,000 ft. even if any two engines should fail.

The Largest British Wind Tunnel

Work is now proceeding rapidly at the Royal Aircraft Establishment on a full scale wind tunnel that, when completed, will be the largest in the British Isles. It will consist of a curved steel tube nearly 500 ft. in length, the ends being brought together in order to form a closed circuit round which a fan operated by engines of 2,000 h.p. will circulate air at a speed of 100 m.p.h. A portion of the tube 45 ft. in length will be cut away to accommodate the working chamber, in which full-sized sections of aeroplanes will be suspended from delicate balances in order to measure the strains and stresses set up in them. At this point the tube will be 25 ft. in diameter. The tunnel and the necessary accessories will be housed in a building 230 ft. in length, 140 ft. in width and 90 ft. in height.

New Canadian Air Services

Canadian Airways Ltd. have recently inaugurated new fast passenger and mail services between important business centres in eastern and western Canada, replacing others that were temporarily discontinued when the air mail contracts were cancelled by the Dominion Government. The first of the new services was started on 1st May, between Calgary and Edmonton. It is operated twice daily and provides for the carriage of both passengers and mails, the one way trip of approximately 200 miles occupying about two hours.

A daily service between Toronto and Windsor, with intermediate stops at Hamilton, Brantford and London, was commenced about a fortnight later. On arrival at Windsor passengers may proceed in other aircraft to Chicago, which may be reached in five hours more, or to Winnipeg, a journey that occupies a further period of 19 hours.

Montreal and Quebec also are connected by a passenger and mail service. This is operated by Fairchild cabin monoplanes, and the trip between the two places is made in 90 minutes. At St. Hubert Airport, Montreal, connection is made with the air mail machines operated by Canadian Colonial Airways Ltd. between Montreal and New York.

A Safety Control Stick

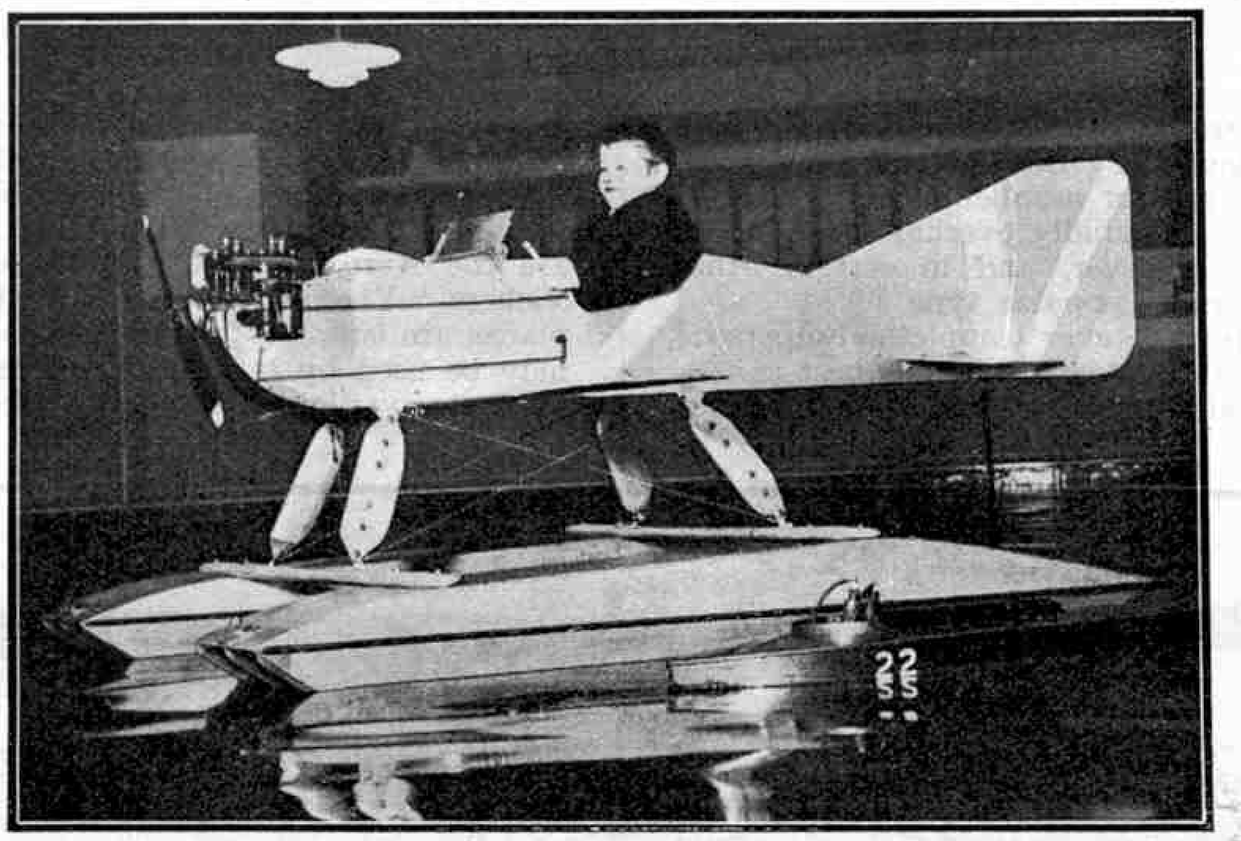
The controls of an aeroplane travelling at very high speeds must be handled delicately in order to avoid setting up high stresses that may wreck the machine, and various means of preventing pilots from mishandling machines have been suggested. For instance, it has been proposed that the controls should be so fixed that they cannot be pulled beyond the safety point. This is not advisable, however, for an occasion may arise when a pilot would find it necessary to take drastic action, that may result in damage to his machine, in order to avert a more serious accident.

A much better method of overcoming the difficulty has been devised by Mr. A. E. Wimperis, Director of Scientific Research at the Air Ministry. In this a control column provided with a special handle is employed. Normally the handle is rigidly secured to the control column, but when the stick is moved beyond safe limits, it is released by means of a simple mechanism, and only the handle moves when the pilot attempts to move the stick further. The handle only "gives" a few inches, however, and the stick then may be moved as far as is desired, the break warning the pilot that he is taking the risk of injury to some part of his machine. The mechanism is so constructed that it does not operate when the machine to which it is fitted is landing or taking off, except in the case of a landing bad enough to break the undercarriage.

Transatlantic Air Route to Cross Canada

Negotiations are being carried on for the establishment of an air line between Detroit and Denmark. The route to be followed crosses Ontario and Quebec, and Denmark will be reached by way of Greenland, Iceland and the Faroe Islands.

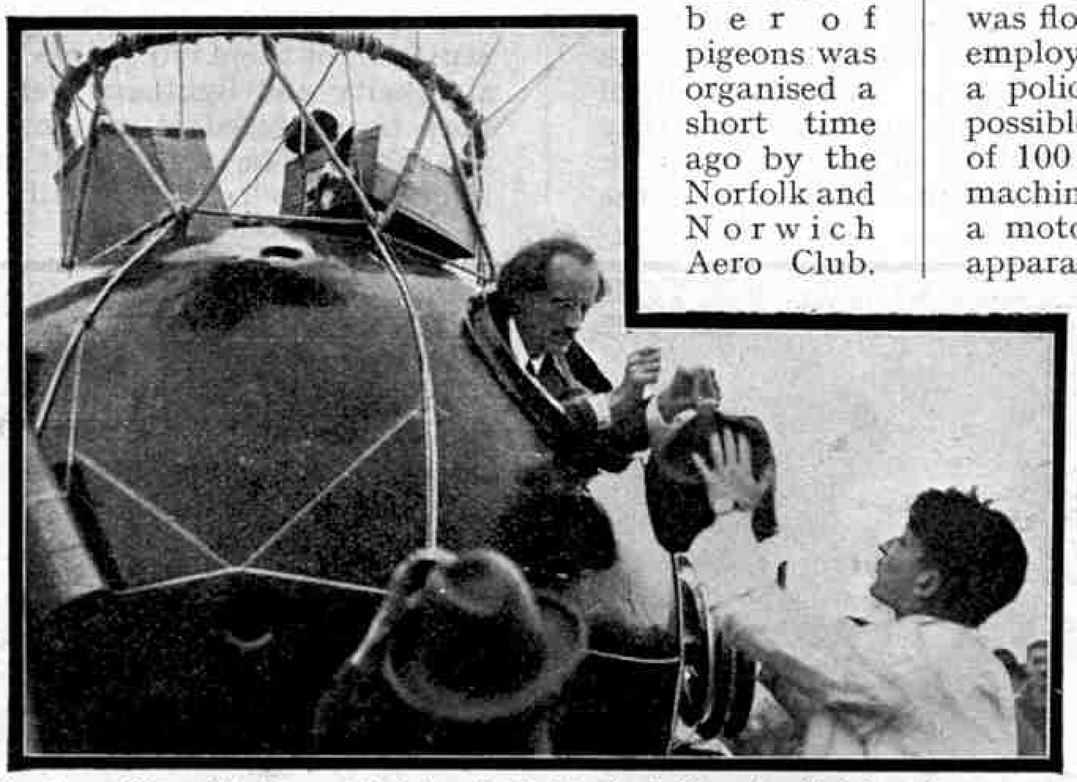
Twelve stations along the route are contemplated, the longest water crossing being that from Iceland to the Faroes, which is less than 500 miles in length. Both machines and crews will be changed at each station, and thus each pilot will be familiar with a particular section of the route.



A youthful aeroplane enthusiast in his model seaplane. He cannot fly, but is able to taxi about on the surfaces of small lakes.

Airman Races Homing Pigeons

An interesting race between an airman and a number of pigeons was organised a short time ago by the Norfolk and Norwich Aero Club. The airman was Sq. Ldr. C. A. Rea. Accompanied by 12 pigeons, he was taken in a closed car to a point about 70 miles from the aerodrome at Norwich, from which the birds were then released. After an interval of 15 minutes Sq. Ldr. Rea, who was unaware of his exact position, was allowed to enter an Avro "Avian" awaiting him and he then endeavoured to find his way back to Norwich. He was not allowed to use maps or a compass, nor was he allowed to fly low over railway stations in order to read the name boards, but he arrived home 15 minutes before the first pigeon was clocked in.



Professor Piccard in the metal globe attached to the balloon in which he set up a new world's altitude record of 51,460 ft. in 1930. The Professor intends very shortly to undertake a second ascent in another balloon that he has constructed.

The Pratt & Whitney "Twin Wasp-Junior"

A new aero engine known as the "Twin Wasp-Junior" has been produced by the Pratt & Whitney Aircraft Co., of Hartford, Connecticut, the constructors of the world-famous "Wasp" and "Wasp-Junior" engines. The new engine is of the 14-cylinder two-bank radial air-cooled type and is the first of the company's products to be constructed with more than a single row of cylinders. The engine may be fitted with a supercharger or reduction gears.

The cylinders of the "Twin Wasp-Junior" have a bore and stroke of 5-3/16 in. and a displacement of 25,130 c.c. The engine is comparatively small in overall diameter, this being only $43\frac{7}{8}$ in. and its total length is $48\frac{1}{4}$ in. The compression ratio is 6 to 1, and the total weight is 830 lb. The direct drive version develops 625 h.p. at 2,100 r.p.m., and has been fitted in a Vought "Corsair" two-seater Naval reconnaissance machine employed by the U.S. Navy Department.

The "Wasp" and "Wasp-Junior" engines were described on page 524 of our issue for July, 1930.

Traffic Control from Autogiro

A Cierva "Autogiro" was employed by the Metropolitan Police in directing road traffic on the routes leading to Epsom on Derby Day. In previous years an ordinary aeroplane has been used for this purpose, but the "Autogiro" was selected this year because of its ability to cruise and manœuvre at a slower speed. The machine was flown by Flt. Lt. Allen, a pilot who is employed at Scotland Yard, and carried a police wireless operator. It was thus possible for communication on a wavelength of 100 m. to be maintained between the machine and a ground station consisting of a motor van fitted with special Marconi apparatus.

The information transmitted from the "Autogiro" enabled the police to divert traffic along the least congested routes, and there is no doubt that aeroplanes may usefully be employed in this manner. We hope to include an article on traffic control from the air in an early issue of the "*Meccano Magazine*."

"Cutty Sarks" in the Far East

Two new "Cutty Sark" amphibians recently have been produced by Saunders Roe Ltd. The first of these is equipped with a single engine of the Armstrong Siddeley "Lynx" type, which develops 200 h.p., and has been built for Mr. Yoshihara, a well-known Japanese pilot who hopes to make a flight from San Francisco to Japan by way of Alaska and the Aleutian Islands.

The second new "Cutty Sark" employs two Armstrong Siddeley "Genet Major" engines developing 135 h.p., and two machines of this type were ordered by the Far Eastern Aviation Co. Ltd. for service in China. They are capable of carrying four people and the large fuel tanks fitted give a range of seven hours.

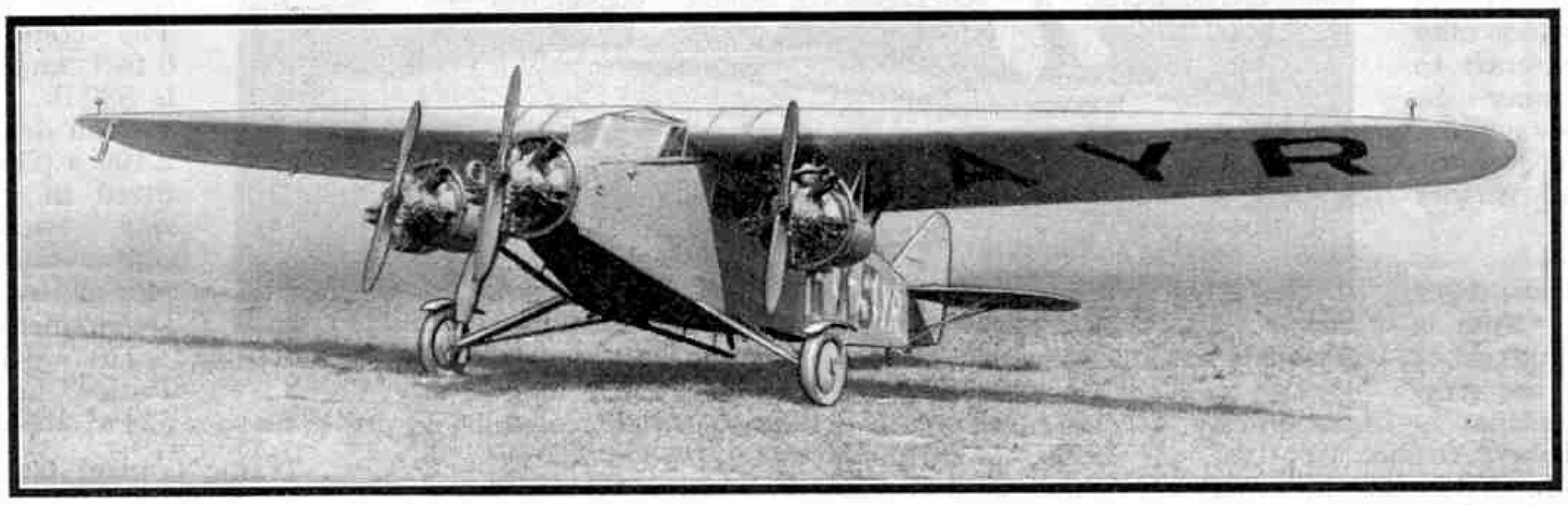
British Aircraft Developments

II.—High Wing Monoplane Passenger Carriers

A STRIKING feature of the growth of aviation during the past few years has been the increasing interest in monoplanes.

Ten years ago by far the greater number of aeroplanes in use were biplanes. Monoplanes are rapidly overhauling biplanes in popularity in this country, however, and in certain other countries they are already the more popular type.

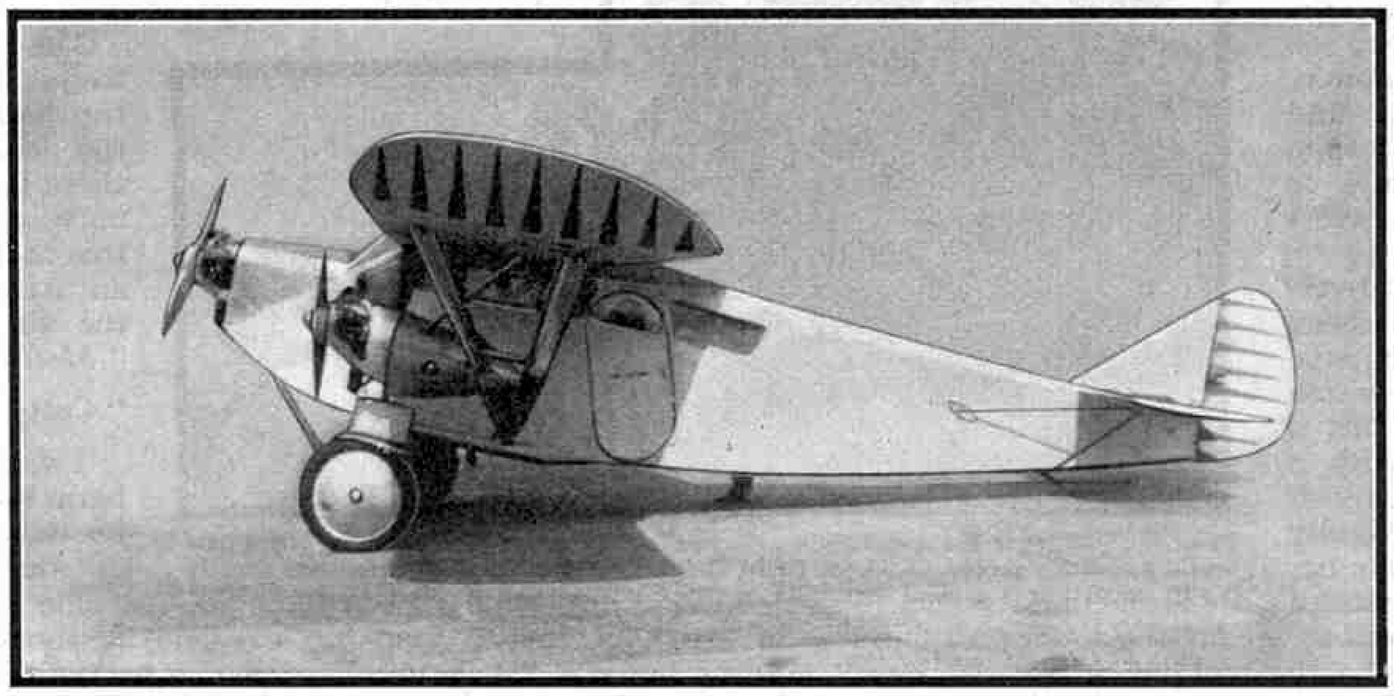
It is unlikely that either type will ever completely supersede the other, for each has special duties for which it is best suited. For instance, biplanes are ideal for training purposes and for elementary flying, owing to the fact that they are a little easier to control than monoplanes, are more stable in the air, and in most cases are able to land at lower speeds. It is probable that biplanes also will continue to be more favoured for military purposes, for although a certain amount of speed is sacrificed by the provision of two planes, a machine of this type usually is able to carry a greater military load than a monoplane of the same size and power.



The Avro "Six," in which side-by-side dual control is provided for two pilots. This photograph, and the lower one on the opposite page, are reproduced by courtesy of A. V. Roe & Co. Ltd.

In view of the fact that there are leading authorities who insist that one type or the other is the more suitable for all purposes, the Air Ministry recently ordered two machines of equal dimensions, weights and engine powers to be constructed, one to be fitted with a single plane and the other to be a biplane. A comparison of the cruising and maintenance records of these machines after they have been flying for a few years should be of great interest for it should help to answer the question as to which type is the more efficient for general use.

In this country the biplane has always been favoured for passenger - carrying purposes, and all the aircraft at present in regular operation on the lines of Imperial Airways are of this type. As mentioned on page 367 of our issue for May 1931, however, the policy of the company in this respect has been modified recently, and a fleet of large high wing monoplane air liners, to be known as "Atalantas," is now under construction by the Sir W. G. Armstrong Whitworth Aircraft Co. Ltd. These machines are rapidly approaching completion, and are expected to be ready for service by the end of this year. They will be illustrated and described in this series.



The Navarro "Chief," a three-engined monoplane with many interesting features. We are indebted to Mr. J. G. Navarro, A.M.I.C.E., for permission to reproduce this illustration.

A great advantage possessed by monoplanes is that they give a better view than that obtainable from a machine with two wings. The absence of struts and rigging greatly reduces the time and cost of making them, and with high wing monoplanes there is no danger of the wings being damaged when landing or taxying in rough country. For these reasons high wing monoplanes are particularly suitable for use on air lines in countries where skilled attention may not always be available, and for service on "feeder" air lines and for air taxi work generally.

Several machines of this type have been produced recently by various British firms. The most outstanding of these probably are the Avro "Five" and "Six," the Navarro "Chief," the Vickers "Viastra," and the Westland "Wessex." These aeroplanes are suitable for the purposes already mentioned, and also may be used by business men whose duties necessitate frequent journeys over long distances to different parts of the world. With one exception, the typical high wing monoplanes already mentioned are described in this article. The exception is the Vickers "Viastra," with which we hope to deal in a special article next month.

The Avro "Five" is a triple-engined cabin machine of medium power, possessing accommodation for five people, including the pilot. It has a cruising speed of 95 m.p.h. and can fly on any two of its three engines without losing height. It is particularly suitable for civil work, being easy to fly and requiring only one pilot, and its wheelbrakes enable it to come to rest after a run of only 200 yds. The general principles followed in the construction of the Avro "Five" give it the advantages of durability, simplicity and lightness, very necessary qualities in aircraft that may be operated in regions where skilled attention will not be available. The wing is of the wooden cantilever type, as this is claimed to be more easily repairable than a metal wing, and only requires a coat of varnish at regular intervals in order to avoid deterioration. Repairs to the fuselage may be carried out easily with the aid of ordinary mechanic's tools, while repairs to the wing may be made satisfactorily by anyone with a general knowledge of carpentry.

The fuselage is a fairly large welded steel tube structure. The construction is triangulated to the luggage compartment, behind which the fuselage is braced by double steel tensile wires. The cabin is very roomy and is provided at the back with a fixed seat for two passengers, the other two being accommodated in easy chairs. Long windows are fitted along each side of the cabin, and these allow an excellent view to be obtained. Entrance is by means of a door on the left-hand side of the fuselage, while the cabin is connected by means of a door to the pilot's cockpit, which is entirely enclosed and is fitted with triplex glass windscreens.

Three Armstrong Siddeley "Genet Major" engines, each developing 100 h.p., are employed in this machine. The central one is nested in the nose of the fuselage and the two outboard engines are mounted in streamlined nacelles under the wing spars,

while behind each nacelle is an oil tank, from which comes the supply for the corresponding engine. The fuel tanks are situated in the wing, the petrol being fed from them under gravity.

The Avro "Five" has a wing span of 47 ft. and is 35 ft. 9 in. in overall length. Its tare weight is 2,850 lb. and it is capable of carrying a pay load of 980 lb. The all-up weight is 4,630 lb. The machine is capable of attaining a maximum speed of 113 m.p.h., and of cruising at 95 m.p.h., the range at cruising speed being 400 miles. It takes off after a run of 220 yds. and has a rate of climb at sea level of 600 ft. per minute. The service and absolute ceilings are 10,750 ft. and 13,000 ft. respectively.

The Avro "Six" is a development of the Avro "Five," which it closely resembles, the principal difference being that in the Avro "Six" side-by-side dual control is provided for a crew of two. The fuselage is slightly wider than that of the "Five," and the passengers' cabin is therefore a little more roomy. The cabin accommodates four passengers, with ample stowage for suit-cases and racks for hats. The wing span of the Avro "Six" is 50 ft., and it has a tare weight of 2,980 lb. and a pay load of 1,050 lb. The maximum permissible weight is 5,000 lb., and its performance is similar to that of the Avro "Five."

The chief claim to fame of the Navarro "Chief" is that it is what may almost be termed a miniature air liner, for it is built in four different sizes to seat one, two, three or five persons. Even a single-seater may be equipped with three engines. This type of machine is sold at the remarkably low price of £450, and almost certainly is the smallest and cheapest multi-engined aeroplane in the world.

This interesting aeroplane has been designed by Mr. J. G. and Mrs. M. A. Navarro, and in it particular attention has been paid to safety. It is for this reason that three engines are employed, but the machine is very stable and is equipped with special controls which, it is claimed, prevent side-slips, stalls, spins or nose dives. Side-slip is checked in a very simple manner, the wing tips being turned up very slightly. Another particularly interesting feature is that the rudder may be "split" into two halves when taxying, and the halves then may be swung round for use as air-brakes, or to prevent the machine from nosing over on the application of the wheelbrakes, which are standard fittings.

The view of the passengers in the machine is unrestricted in all directions, this having been ensured by fitting long panelled windows on each side of the saloon. The windows may be opened for ventilation purposes if required. The forward view, which is said to be particularly good, is obtained through a sloping windscreen fitted with a windscreen wiper, while a large skylight is provided in the roof. The fuselage, rudders, ailerons and undercarriage of the machine are of steel tube construction, but are covered with fabric. The wing is a built-up wood structure, reinforced by stainless steel tubing where necessary, the whole being covered with three-ply wood and fabric. The wing may be folded back if required for garaging purposes, and the machine then occupies a space 27 ft. in length and 11 ft. in width.

The three-seater version of the Navarro "Chief" is equipped with three engines of any type that develop a total of about 110 h.p. These should give a maximum speed of 110 m.p.h., and cruising and stalling speeds of 98 m.p.h. and 54 m.p.h. respectively. When flying at cruising speed the machine is able to carry sufficient fuel to enable it to remain in the air four hours, during which time nearly 450 miles could be covered. The aeroplane has a wing span of 38 ft. 10 in. and is 24 ft. 6 in. in length. Its tare weight is 1,050 lb. and when fully loaded it weighs 1,900 lb. If desired it may be fitted with floats, when the performance is slightly lower. If a higher performance is required, either in the land or water version, more powerful engines may be employed.

The photograph at the head of the page is a three-quarter front view of the Westland "Wessex" and is reproduced by courtesy of Westland Aircraft Works. The lower illustration shows the Avro "Five," a three-engined cabin machine with accommodation for four passengers in addition to the pilot.

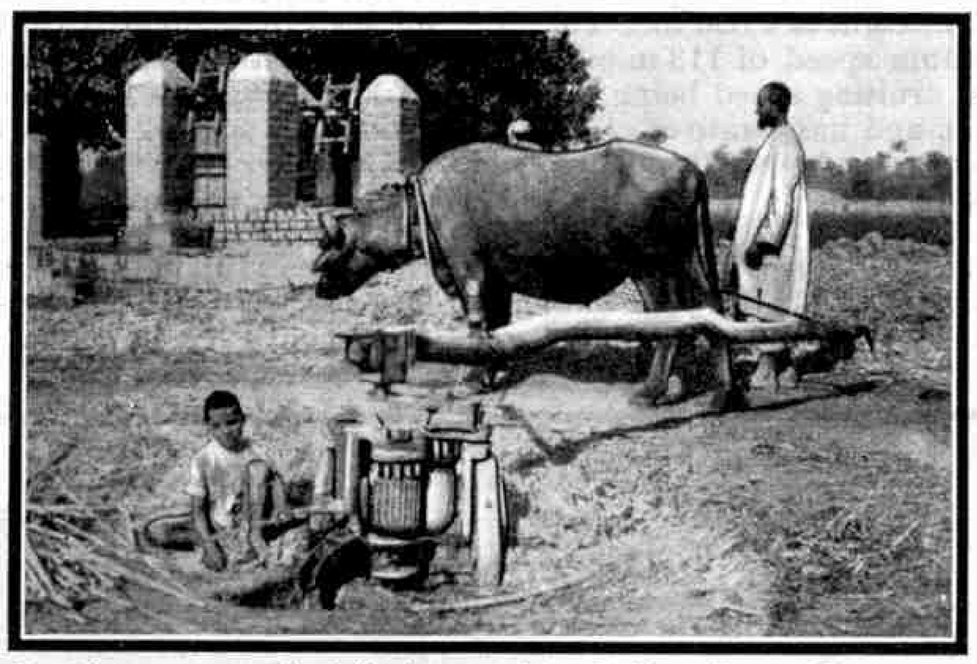
The Westland "Wessex," the third high wing monoplane dealt with in this article, is a six-seater semi-cantilever cabin monoplane fitted with three Armstrong Siddeley "Genet Major" engines, each of which develops between 100 and 110 h.p. The fuselage is constructed partly of metal and partly of wood, but the cabin is of wood throughout. The wing structure is of wooden construction and is provided with rigid type external bracing. It carries two 52-gallon fuel tanks. The fin and the tail plane also are constructed of wood, but the ailerons, rudder and elevators are of tubular duralumin spars and sheet metal ribs. This machine has a span of 57 ft. 6 in. and a length of 38 ft. It weighs 5,750 lb. when fully loaded, and at ground level has a maximum speed of 108 m.p.h. and a cruising speed of 95 m.p.h. The initial rate of climb is 530 ft. per minute, while the service and absolute ceilings are 10,000 ft. and 12,000 ft. respectively.

This type of Westland "Wessex" aeroplane has been used extensively by Imperial Airways Ltd., and "Sabena," the well-known Belgian Air Line Company. A slightly different version has been produced for use by the Isle of Wight Aviation Ltd. who, as mentioned on page 330 of our issue for May 1932, are to operate an aerial ferry between Portsmouth (*Continued on page 652*)

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

Sugar Making in an Indian Village

Recently I watched natives in an Indian village making brown sugar from sugar cane, and the simplicity of the process fascinated me. The crushing plant they use consists of three vertical cast-iron rollers carried on a wooden frame firmly fixed into the ground. To the axis of the middle one is attached a long wooden arm, usually nothing more than the trunk of a small tree, and at the outer end of this is harnessed a bullock that tramps round and round in order to turn the roller, which in turn drives the others by means of gear wheels.



Crushing sugar cane by bullock power in an Indian village. Photograph by A. Kumar, Delhi.

A pit is dug in the ground near the wooden frame and in this sits a boy who feeds the sugar cane to the rollers, each cane being crushed twice before it emerges. The boy must squat down in his pit, otherwise his head would be struck by the rotating arm by means of which the crude mill is driven.

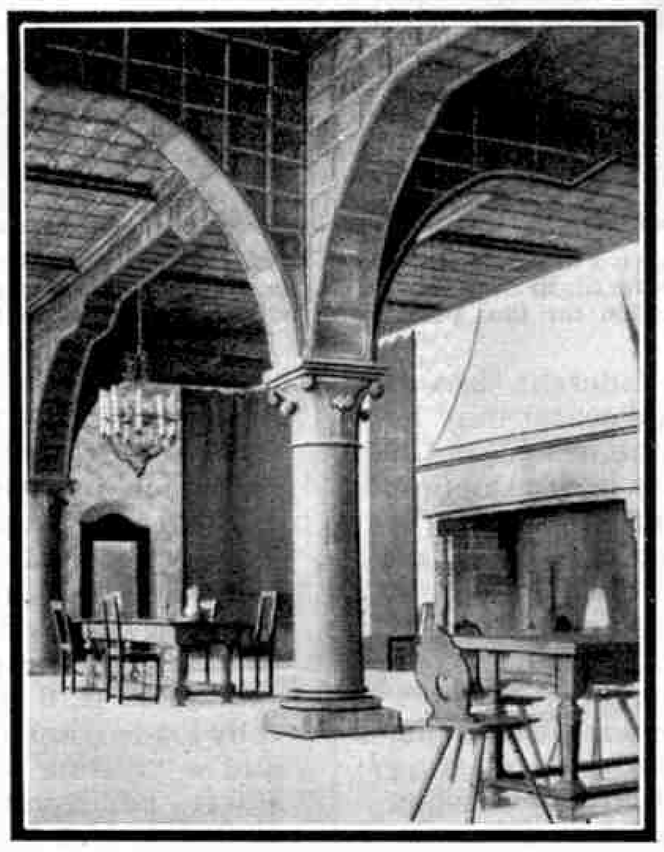
The brown juice from the cane flows into a tray and thence into an earthen jar kept in the pit. When a sufficient quantity has been collected the juice is boiled in a large earthen bowl over an open fire, the scum that rises to the surface being skimmed off with a ladle. The evaporation is continued until the liquid is on the point of becoming a plastic mass. It is then allowed to cool, but before becoming thoroughly set it is moulded into round cakes weighing about 4 lb. each.

Sugar making is a winter occupation for farmers, and many native villages have four or five crushing mills at which each villager takes his turn to extract sugar from his crop. The mill forms also a social centre, where the inhabitants assemble to talk and to drink the fresh raw juice. After taking the accompanying photograph I was offered a glassful of juice and found it very refreshing. A. KUMAR (Delhi, India).

The Castle of Chillon

While staying at Montreux last year I seized the opportunity of visiting the Castle of Chillon, which is situated on the shores of Lake Geneva. This ancient Swiss fortress probably dates from the 8th century, but was partly rebuilt in 1238.

On approaching the Castle, I noticed that it occupies a splendid stragetic position near the head of the lake, for it commands one of the many routes to Italy. The rocky islet on which it stands is twenty yards from the shore at a point where the precipitous mountain sides scarcely leave room for both road and railway, and in mediæval times this position must have been of wonderful advantage to the owners of the historic stronghold.



The Knight's Hall in the Castle of Chillon. Photograph by G. S. Allen, Dover.

I crossed the bridge over the deep moat and entered the Castle. There the Knight's Hall seemed to me to be one of the most interesting features, for the antique furniture, chandeliers and panelled ceiling give it a very attractive appearance. There are window seats in its immensely thick walls, and from these a marvellous view is obtained across the blue waters of the lake to the snow-covered Dents du Midi.

I then went down to the famous dungeons. These are feebly lighted by means of small gratings fitted high up on their walls, and their floors are the cold bare rock of the foundations of the Castle. Massive chains embedded in stone pillars are reminders of the unhappy men, who like Bonivard, Byron's Prisoner of Chillon, "have been a dungeon's spoil." Bonivard really was a political prisoner, who was incarcerated in the Castle from 1530 to 1536. G. S. ALLEN (Dover).

An Austrian Archbishop's Garden

Near Salzburg, in Austria, there is a palace known as Schloss Hellbrunn, which was built in 1613 as a summer residence for the Archbishop of Salzburg of that time. This cleric was humorously inclined, and prepared a number of "water surprises" for the amusement of his guests. The Palace is now a showplace and I visited it last summer.

On entering the gardens I was taken by my guide towards a large grotto, passing on the way a number of working models driven entirely by water distributed by means of small canals at the sides of the paths. The models include men sawing wood and pushing mine-trucks, and there are also several fountains, single columns of water, on which rubber balls are balanced. There are more models inside the grotto itself, among them being a frog swimming round a pond; a gnome who rolls his eyes and pokes out his tongue; and a cone that suddenly rises to the ceiling on a thin jet of water.

An Archbishop's joke in the 17th century. Turning a tap caused jets of water to spring from the seats occupied by his guests at the stone banqueting table in the grounds of the Schloss Hellbrunn, near Salzburg, in Austria. Photograph by A. G. North, Cardiff.

When I tried to leave the grotto my way was barred by streams of water that emerged from holes over the doorway, and from the tips of antlers carved in stone on each side of the exit. This was my guide's little joke, for he had turned on a tap concealed in the wall, just as the Archbishop did when in days gone by he entertained his guests.

Next I was shown a large stone table surrounded by chairs of the same material, each with an ornamental pattern carved upon it. The Archbishop used the table for open-air banquets, and my guide demonstrated how the turning of a tap caused a jet of water, about the thickness of a lead pencil, to rise with considerable force from each chair, the water mingling with that from other jets sunk in the ground around the table. I noticed that no water came from the chair at the head of the table, for that would be occupied by the host who originated the joke, and I could imagine his delight when he deluged his guests, who could scarcely be expected to appreciate the fun.

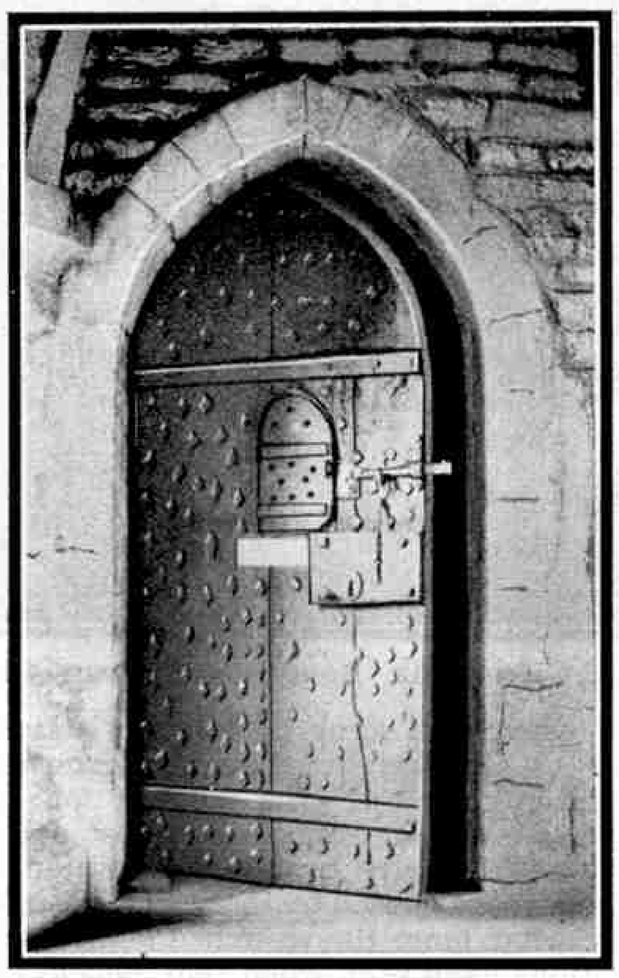
A. G. NORTH (Cardiff).

A Quaint Chemist's Shop

Alongside the Cathedral Gateway at Peterborough is a small building that originally served as the King's Lodging, English monarchs of about 800 years ago staying there when visiting the monastery of which it formed part. In later years the building became the Abbott's gaol, and it remained a prison until last century. Strange to say, it is now a chemist's shop, with scarcely any frontage and no display window. Customers enter by descending a few steps, for the floor of the shop is at the original level of the street, the roadway having been raised 30 in. in the last 800 years.

A walk through the shop is of great interest, and to see glass flasks and phials and chemical apparatus in a mediæval building gives visitors the impression that they are entering an alchemist's laboratory. A studded doorway in the shop itself occupies the position in which it was originally placed about 500 years ago, and for many years the room into which it opens was the condemned cell. The shop itself is remarkable for its massive pillars and its groined ceiling, and behind it are cellars now used as stores, but formerly employed as dungeons.

C. STOTT (Peterborough).



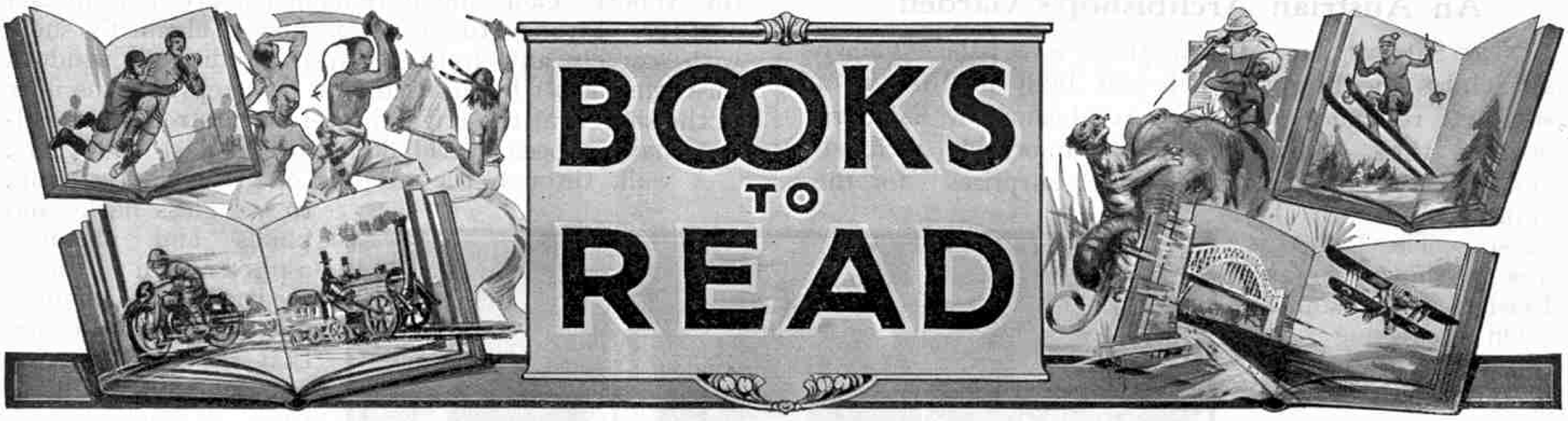
An antique studded door in the former King's Lodging at Peterborough. Photograph by C. Stott, Peterborough.

Testing a Flame-Proof Electric Motor

When visiting a specially-constructed research station I had the interesting experience of watching a test of an electric motor built in such a manner that it was flame-proof. The motor is designed to work in a coal mine, and although of the totally-enclosed type, its cover must be provided with vents in order to allow air to enter and circulate round the windings. Methane or fire-damp may be present in a coal mine, however, and as this gas is inflammable, the vents must be so designed that a hot bearing or the burning out of the windings cannot give rise to a disastrous explosion. For this reason the holes in the motor casing are covered by a series of plates, the gaps between which are only 0.02 in. in width. These plates have the same effect as the wire gauze used in the old type of miner's safety lamps, and prevent the passage of a flame from within the motor to the atmosphere of the mine itself.

The electric motor was tested in a chamber filled with an explosive mixture of fire-damp and air. The top of the chamber was made of brown paper that had been treated with linseed oil in order to make it gas-tight. This unsubstantial cover was intended to serve as a safety valve, for explosion of the mixture would immediately blow it out instead of wrecking the chamber. When all was ready we retired to a safe distance, and a spark was fired by means of a plug fitted inside the motor casing. There was a muffled report, but the narrow vents fulfilled their task of confining the explosion to the interior of the casing.

L. ANDERSON (Whitefield).



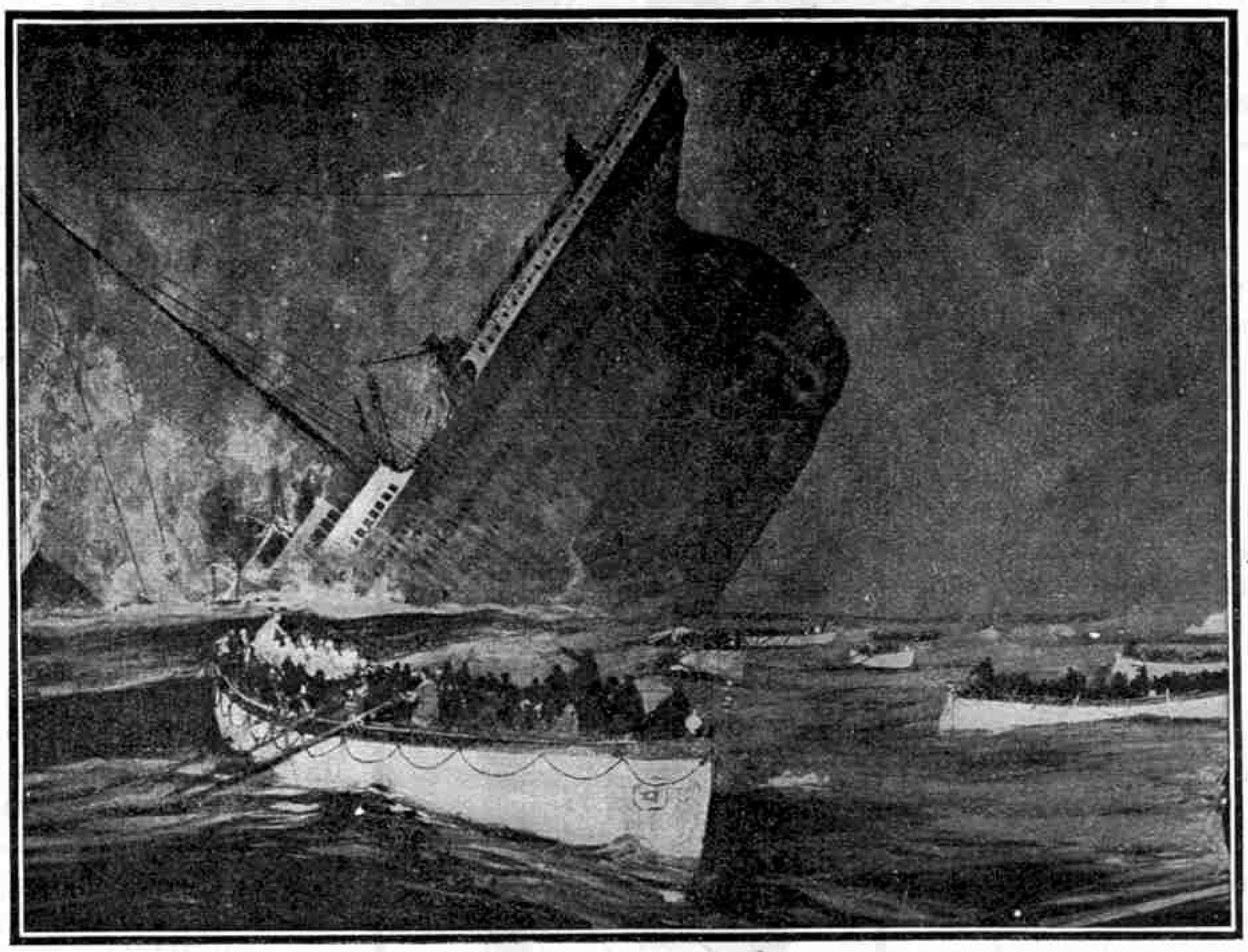
Here we review books of interest and of use to readers of the "M.M." We can supply copies of these books to readers who cannot obtain them through the usual channels. Order from Book Dept., Meccano Limited, Old Swan, Liverpool, adding 1/- for postage to the price. Postages on different books very, but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

"Great Disasters of the World"

By H. S. Banner, B.A. (Hurst & Blackett, 12/6)

Great disasters seem to come with terrifying suddenness every now and then, and to deal in one book with all that have occurred would be impossible. In this volume, therefore, the author has confined himself to some of the more outstanding events. Some have been included because of the immense toll they took of human lives, others for the vast material damage involved, and others again for the intensity of their drama. Representative chapters include accounts of the Tay Bridge disaster; the loss of H.M.S. "*Eurydice*"; the great Krakatoa eruption; the ramming of H.M.S. "*Victoria*"; the end of the "*Titanic*," the earthquakes at Messina, and so on.

In each case the story is clearly and dramatically told, and from the amount of information included it is evident that long and laborious research has been necessary in newspaper files and in authentic records of all kinds.



The "Titanic" plunging beneath the waves in 1912. From "Great Disasters of the World," reviewed on this page.

One of the most appalling disasters, probably here described fully for the first time, is the troop train smash on the 22nd May, 1915, at Quintinshill, near Gretna Green. This terrible accident, which occurred during the War, so that at the time a full account was naturally suppressed, is by far the worst disaster that has ever happened on a British railway. The horror of the disaster was magnified by the placid beauty of the surroundings in which it took place, the pleasant countryside being bathed in the sunshine of a perfect spring morning.

The disaster occurred through the negligence of a signalman, who "forgot" the presence of a local train that had been switched over from the up to the down line to allow the midnight express from Euston to Glasgow to pass. The troop train from the north was accepted by the signalman and it crashed into the waiting local train with terrific force, for it had just descended a long gradient and was running at top speed.

After the impact the first thought of those unhurt was to rescue those who had been less fortunate and "within a few seconds there were parties of men working with furious energy all along the train to free their imprisoned comrades. It was just when this scene of feverish activity was at its height that the crowning tragedy happened—the advent of the Scottish express. Shocked almost out of their wits already by the devastation all around them, caused by their own forgetfulness, what must the wretched signalmen's emotions have been when they beheld this second and infinitely more terrible instrument of wholesale destruction charging along the metals, straight for the tumbled mound of debris that lay tossed pell-mell across its path? Shouting at the top of his voice and waving his arms like a maniac, the driver of the 'local' rushed forward along the line in a frenzied attempt to warn the express in time to let it pull up. Too late! With a rattle and a roar and a stupendous crash that was heard miles away, the two monster engines struck the troop-train's tender like a titanic battering ram, ploughing their way right into the heart of the wreckage, grinding and smashing the already terribly mutilated troop-train into matchwood."

When the roll call came to be taken by the railside in the afternoon, out of the train-load of Scottish soldiers who were on the way to active service, only 58 were able to answer their names, over 200 having been killed and 200 injured.

Disasters and tragedies do not form pleasant reading at any time, but a certain amount of knowledge of them is a necessary part of history. There is also the point that by knowing how accidents have occurred, we are better able to prevent a repetition—we learn by experience in all walks of life. Bearing these things in mind it will be realised that this book is well worth reading, and particularly so because it also shows how a story of tragedy can be told in a dramatic and realistic manner.

"Stamps of Great Price"

By Nevile Lacy Stocken (A. E. Hopkins. 6/-)

To the sceptic whose view of stamp collecting hitherto has consisted of pity for the half-wit whose passion runs to hoarding bits of coloured paper, Mr. Nevile Stocken's work will come as a revelation. He will discover that this hobby of school children is also the pursuit of millionaires, and that Chippendale chairs and Ming vases can give nothing in point of interest to philately.

Mr. Stocken has set out to give his readers an exhaustive list of all postage stamps valued at not less than £100. He goes further than the normal catalogue, for he attempts to place a true value upon the many rare stamps concerning which "catalogue editors maintain an irritating reticence." The list includes all stamps catalogued at £100 or more, and those that have been recorded as reaching this figure at public auction or private sale. Much of the material of the book has already appeared in serial form in "*Stamp Collecting*," and within the limits necessarily imposed by dealing with countries in alphabetical order, the production is in

narrative form that adds greatly to the pleasure of the ordinary reader.

The story of stamp collecting is punctuated throughout by unexpected discoveries of great rarities, and Mr. Stocken has many such "finds" to record. The United States—the home of "tall" stories—provides several the truth of which can be vouched for. The discovery of an unused block of 80 of the 1851 1c. issue was made in very amusing circumstances. The stamps were "brought into a New York stamp dealer's office by an old lady who asked if they would mind exchanging them for a similar number of the current issue, as she wished to use them for the purpose of mailing her correspondence, but feared that the Postal Authorities might object to stamps so ancient. The firm was so kind as to oblige her—without demur." Each of those specimens is worth £120 to-day!

"A nice little fortune was passed by in 1869 when a licensed stamp vendor (for ordinary postage purposes) discovered amongst his indent of the new issue a whole sheet of the 15 cents. with the centre inverted. He found his customers averse to being fobbed off with these imperfect labels, only one—a budding philatelist—having the acumen to purchase one; so this benighted merchant returned the other 99 to headquarters to exchange for something more to the public liking!" Those 99 stamps would command £1,000 each at present prices!

The disposal of the great Ferrari collection, undoubtedly the greatest private stamp collection ever formed, provided much information to guide the author in the fixing of values for many rarities, and it is specially interesting to have his views on some of the prices achieved at those auctions: "A copy of the (Western Australia, 1854) 4d. blue, error with frame inverted, realised a very high price in the Ferrari sale (£1,065), but although it is of the greatest rarity and a much sought-after variety, it is hardly likely to bring quite so high a price again. I have therefore put the valuation figure (£750) somewhat below this. There is a very fine copy in the collection formed by Mr. H. L. White of Australia, for which he paid £400 some years ago. Until last year only nine copies of the error with inverted frame were known to exist. A tenth had its hiding place in a collection formed by the late Dr. Le Quesne of Tring, Hertfordshire. This gentleman apparently was quite unaware that he possessed the gem. It was reposing in the space in his album allotted to the normal stamp, and his executrix, by whose orders the collection was sold, knew nothing about it. . . . It was sold by Messrs. Plumridge & Co., on May 30th, 1930, for £550."

The rare stamps enumerated in the book total 1,013 varieties, 465 in the British section, 495 for foreign countries and 43 war provisionals, with a total approximate value of £244,665. Wherever possible details are given of the circumstances in which the surviving examples of the rarest stamps have been discovered, and these details have been amplified with such particulars as are within the author's personal knowledge. The amount of information regarding the varieties dealt with is in fact astonishing, and one can readily believe that, as the publisher's note states, the book is the result of 40 years of specialised study.

The ardent stamp collector will find "*Stamps of Great Price*" a treasure house of lore concerning his hobby, while the non-philatelist will find more than sufficient to create in him, if not enthusiasm, at least interested tolerance for the most popular of all collecting hobbies.

The horror of Messina, 1908. The panic-stricken inhabitants in mad flight from earthquake and flood. From "Great Disasters of the World" reviewed on the previous page.

"Wire Splicing"

By R. Scott Skirving
(Brown, Son & Ferguson Ltd. 2/- net)

Rigging plays a smaller part in the modern ship than in the old-time sailing vessel, yet it is still important, and it is an advantage for both the professional seaman and the amateur yachtsman to be acquainted with the various methods of working the multi-stranded wire rope from which rigging is made.

The art of wire splicing is not easy to acquire, and this handy little book has been written with the object of providing instructions that will simplify the process. The first chapter is devoted to general information on wire rope and the tools that are needed to manipulate it; the remainder of the book consists of a detailed description of the method of making different types of splice. The instructions are given in simple and straightforward language, assisted by a series of excellent photographs and drawings.

"Plants: What They Are and What They Do"

By A. C. Seward, F.R.S., D.Sc.
(Cambridge University Press. 4/6 net)

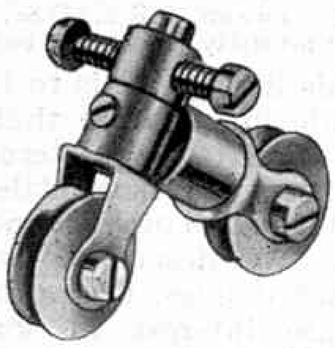
The aim of this little book is to tell the story of plant life in language that is as free as possible from technical terms, for the benefit of readers who have little or no knowledge of botany or of other branches of natural science. By describing what a plant is and what it does, the author attempts to arouse interest in some of the principles of biology.

The book opens with a comparison of plants and animals and shows that both are living creatures obeying the same natural laws, at the same time explaining the differences in their methods of growth. A particularly interesting account is given of the response that plants make to outside influences such as light and moisture. From this we pass on to the story of plant life itself, and learn how the cells and tissues, leaves and roots, play their part in the manufacturing processes carried on in the plant. The descriptions are made more interesting by means of simple experiments.

The author explains how plants obtain their food; how the cells of their tissues grow and multiply, and how the leaves inhale carbon dioxide, which is transformed into sugars and starches by the action of the mysterious chlorophyll, the pigment that gives vegetation its characteristic green colour. We are shown how certain bacteria build up complex chemicals from the nitrogen of the air, while others convert decayed vegetation and animal refuse into nitrates, which are absorbed by growing plants. The action of the bacteria concerned in these operations is one of the most remarkable examples of "team work" in nature.

After dealing with the growth of seeds and the means by which a parent plant stores up food to support the tiny plants that begin to grow when the seeds germinate, the author returns to the simple cell, the unit of plant structure. The simpler forms of plants consist of single cells and are microscopic in size, but the plants with which we are most familiar contain millions of cells. How complicated they are may be judged from the calculation that in his lifetime a man could only count the cells in a section about one-third of an inch in height of an average tree, even when counting at the rate of more than 100 million a year!

The book is well illustrated by a large number of specially interesting diagrams that make the author's various descriptions perfectly clear.



Motor-Cycles in Meccano

Models of the T.T. Racing Machines

AMONG the many motor-cycling racing events that take place annually all over the world, it is doubtful if any provide as much excitement and interest as the Tourist Trophy Races run in the Isle of Man during June. These famous races take place over a special 264-mile road circuit that includes numerous "S" and hairpin bends and difficult corners. In spite of these, however, the course is lapped at amazingly high speeds, and new lap records are made each year. These speeds are not achieved without the competitors taking tremendous risks, and the sight of the riders tearing down the Mountain Road at 100 m.p.h. or taking one of the difficult corners at 50 m.p.h. or more with a deafening exhaust roar, provides a thrilling experience that is not soon forgotten.

The event is divided into three separate races known respectively as the Senior, the Junior and the Lightweight. The Senior Race is for machines having engines not exceeding 500 c.c. in capacity, the Junior for machines in the 350 c.c. class, and the Lightweight for machines fitted with engines not exceeding 250 c.c. This system adds greatly to the popularity of the races, for the owner of each type of machine may follow the fortunes of its racing counterpart in the respective race.

Apart from the interest of the races from the purely spectacular point of view, they also play an important part in the development of the motor-cycle. The varied conditions under which the machines have to operate in lapping the course, and the gruelling effect of the sustained high speeds, provide an unparallelled opportunity for testing the practical merits of new ideas and modifications in the design of the normal touring machines. Much valuable information has been obtained by manufacturers from the results of the races in the past.

The progress that has been made is shown by the tremendous increase in speed since the races were first organised.

In the first race, run in 1907, the winner achieved an average speed of 36.2 m.p.h. In this year's Senior Race the winner, Stanley Woods, riding a Norton machine, averaged 79.38 m.p.h.; while even the Lightweight Race for 250 c.c. machines was won at an average speed of 70.48 m.p.h., the winner being L. H. Davenport, riding a New Imperial.

This year each of the three races produced record speeds, and many thrilling feats of high speed riding and cornering were witnessed by the crowds that lined the course at Douglas and Ramsey and at the various famous corners, hairpin and "S" bends round the circuit. The Junior Race run on 6th June was a severe tussle between the Norton and Rudge-Whitworth teams and resulted in a Norton obtaining the first place, while Rudge-Whitworths occupied second and third places. The winner, Stanley Woods, completed the course at an average speed of 77.16 m.p.h., making one lap at the record speed of 78.62 m.p.h.

The Lightweight Race run on 8th June provided an exceptionally gruelling test for the comparatively small and light machines. Record lap speeds were achieved early in the race, but the pace told heavily on both riders and machines, and only eight out of the original 23 entrants were able to complete the course. The race was won by L. H. Davenport riding a New Imperial, while Rudge-Whitworth machines took second and third places respectively.

The Senior Race, the "Blue Riband" of the motor-cycling world, run on 10th June, was won at record speed by Stanley Woods riding a 490 c.c. Norton. By winning both the Junior and Senior Races, Woods thus completed a remarkable double. The race provided a triumph for the Norton team, the second and third places also going to this make. In addition to the race being won in record time, a new lap record was set up by J. H. Simpson (Norton), who completed the second lap of the race at the amazing speed of 81.50 m.p.h. Unfortunately after this fine performance the machine developed clutch trouble and Simpson was compelled to ride the rest of the race without his clutch working. In spite of this he finished third at a speed of 78.38 m.p.h.

Meccano model-builders who are also motor-cycle enthusiasts may obtain a great deal of amusement and instruction by building models of the latest racing machines. In this article will be found details of interesting examples that have already been constructed, together with suggestions for building other models of this type.

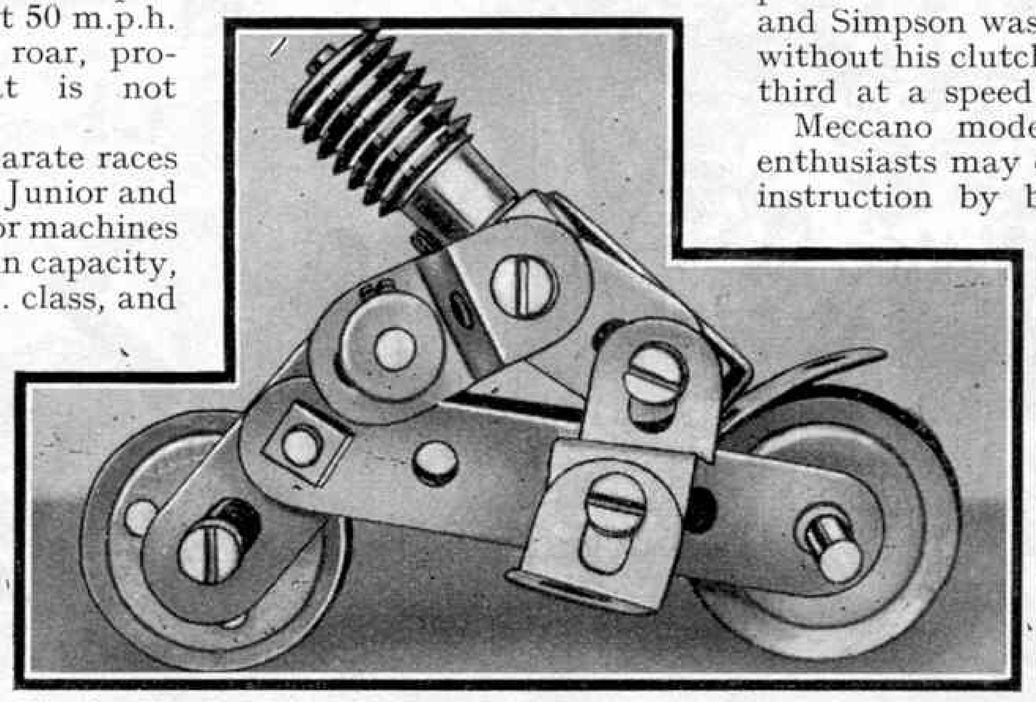


Fig. 1. Few parts but plenty of action! A striking "Simplicity" model machine and rider. At the top of the page is shown the "world's smallest motor-cycle"!

One of the finest examples of motor-cycle construction in Meccano is the model shown in Fig. 3 on the opposite page. This model represents a large bore overhead camshaft machine complete with robot rider. The fittings have been carefully thought out, and the complete machine is well proportioned. The steering head is equipped with a damper that can actually be adjusted so as to retard the movement of the steering column. The damper is controlled by a wing nut that can be seen fitted to the top of the frame between the handle-bars, and is composed of a Threaded Boss and two Threaded Pins. A length of Threaded Rod is secured in the threaded boss, and on rotating the latter, the bearings in which the steering column is pivoted are drawn together, thus producing friction and damping the sideways movement of the front wheel. The front forks are sprung from the frame in a manner very similar to that employed in an actual machine.

The main portion of the frame is designed on the cradle pattern, the upper portion including a representation of a saddle tank. Considerable ingenuity has been shown in representing the engine. This is of the large bore single cylinder type, with the camshaft that operates the inlet and exhaust port tappets placed at the top of the cylinder. The cylinder proper is built up from a number of 1" loose Pulley Wheels secured together on a Threaded Rod, while the crankcase consists of two Bush Wheels spaced apart by a number of Double Brackets. The Rod that can be seen passing up the side of the cylinder in the left-hand view represents the secondary shaft connecting the crankshaft with the camshaft by means of Bevel Gears. A 1" Triangular Plate fitted with two Collars is secured to the top of the Rod to represent a cover encasing the top bevel drive. The right-hand view of the model shows the primary and secondary chains, the exhaust pipe and saddle. The rear wheel sprocket is spaced away from the face of the 3" Pulleys by means of Collars; Pivot Bolts are used to hold the sprocket to the rear wheel. The racing-type handle-bars and the centre stand will also be noted.

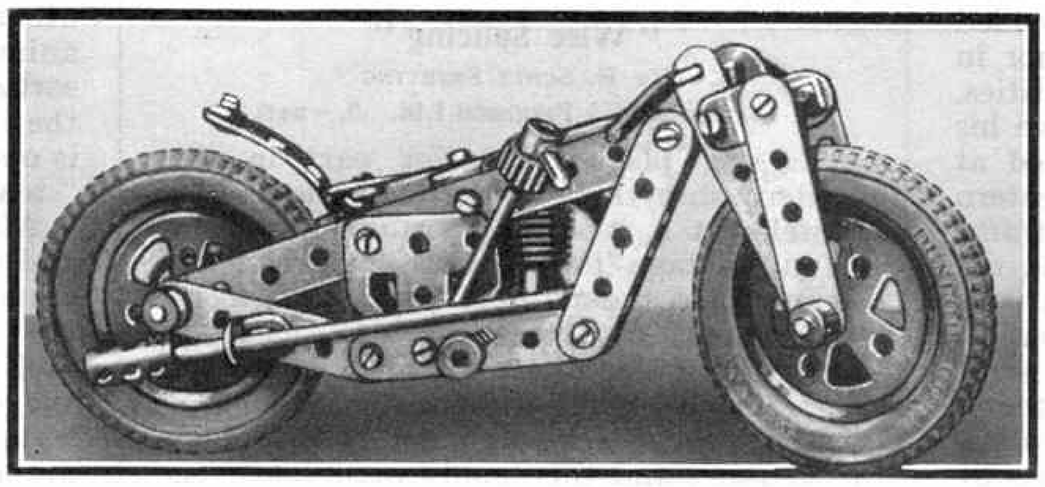


Fig. 2. A neat model of a racing machine.

Mention must also be made of the model rider shown fitted to the machine in the left-hand view. Although constructed entirely

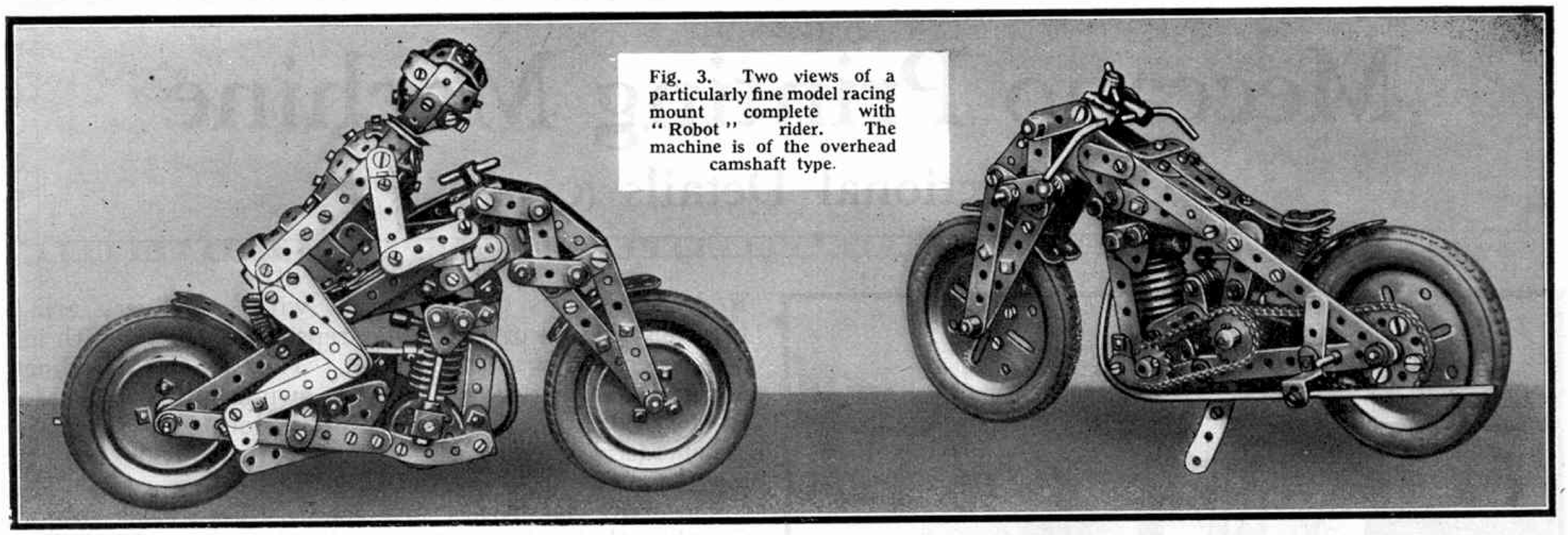
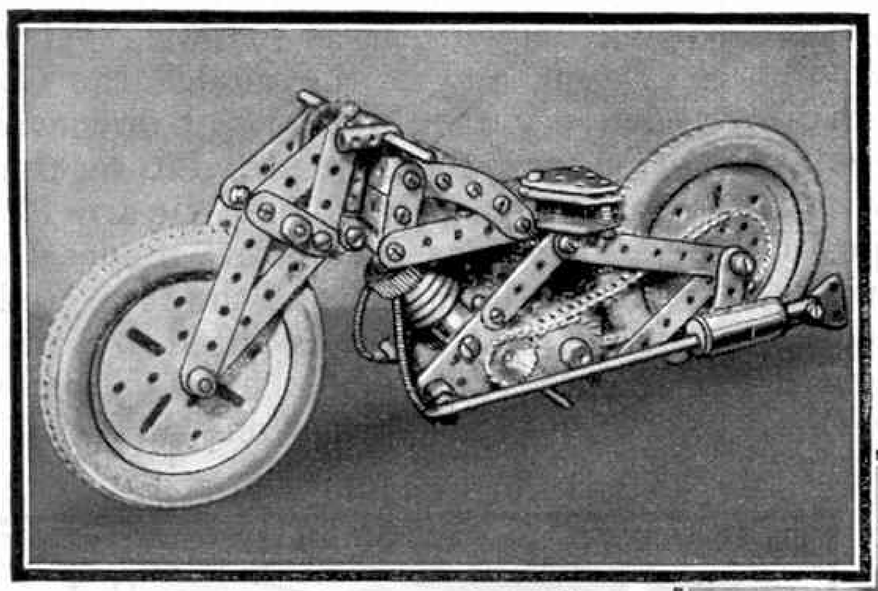


Fig. 3. Two views of a particularly fine model racing mount complete with "Robot" rider. The machine is of the overhead camshaft type.

from standard Meccano parts the figure is remarkably lifelike. The rider, in addition to possessing a workmanlike crash helmet, is jointed in no less than nine places! He can thus assume many attitudes in addition to the one that he appears to have taken up in the photograph—that of grim determination to break the record!

Another interesting example of a speed machine is shown in Fig. 4. This model is of the two-port pattern and two separate exhaust systems are fitted. The base of the cylinder consists of a Chimney Adaptor and the upper portion is composed of three 1″ loose Pulley Wheels surmounted by 1″ Gear Wheels the teeth of which represent the vertical fins that in certain cases are cast on the head of the actual cylinder.

The dual exhaust system in the model has been ingeniously designed. The curved pipes from the cylinder ports are represented by Meccano Springs (part No. 43) attached to the cylinder by their loops, which are clamped between the 1″ Gear Wheel and the 1″ loose Pulley. Axle Rods are used to represent the horizontal sections of the exhaust pipes, and the ends of the Springs are slipped over the front ends of these Axle Rods. Silencers, each consisting of an expansion chamber terminating in a "fish-tail," are fitted to the ends of the exhaust pipes. The expansion chambers are composed of Sleeve Pieces fitted with two Chimney Adaptors. Strip Couplings are secured to the projecting ends of the Rods, and 1″ Triangular Plates are placed in the slots in the Strip Couplings, forming excellent "fish-tails." The saddle tank of the model has been built up from straight and curved Strips spaced apart by a number of $1\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips. The saddle, which is correctly sprung, is composed of Flat Trunnions.



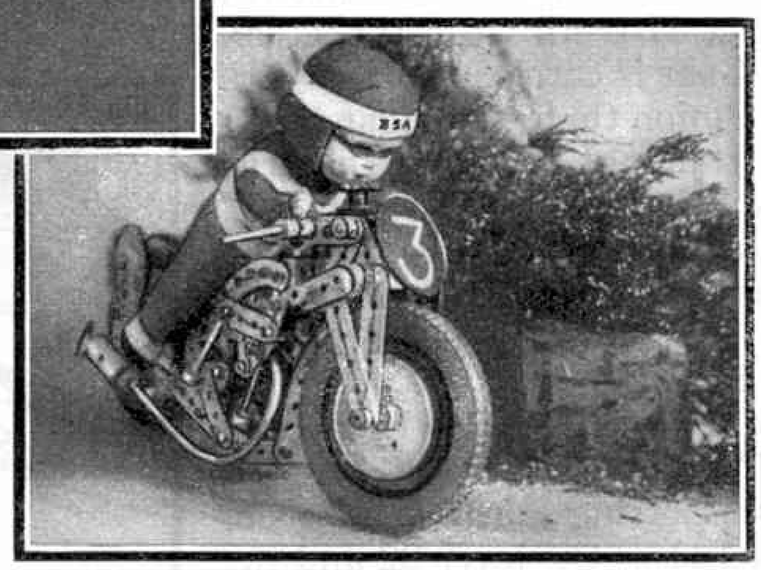


Fig. 4. (Above) A model two-port machine incorporating many novel constructional features. Fig. 5 (Right) Rounding the bend! A splendid example of realistic photography.

The model shown in Fig. 1 provides a big contrast with the two models described previously. This example is, of course, of the famous "Simplicity" type of model, and it possesses a remarkably realistic appearance although very few parts have been employed in its construction.

The frame of the model consists of a $2\frac{1}{2}''$ Strip, and a pair of Flat Brackets form the front forks. A 1″ loose and 1″ fast Pulley serve as the front and rear road wheels respectively, while the handle-bars consist of a 1″ Axle Rod. The rider's body consists of $1\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips, and a most amusing effect has been given to the model by fitting a Worm to the top of the Angle Strip to perform the treble duty of head, neck and crash helmet!

Owing to the small size of this model it could be used with excellent effect as a cycle or car mascot; it would only be necessary to attach a short Strip to the centre of the model so that it could be secured rigidly to the handle-bars of the cycle or to the radiator cap of the car. Meccano 1″ Dunlop Tyres fitted to the wheels would improve the appearance.

Although the model just described is remarkably small, it must not be thought that this is the smallest "speed bike" that can be made with Meccano parts. This honour must surely go to the ingenious little model included in the heading on the opposite page. It is composed of nothing more than two small Fork Pieces, two $\frac{1}{2}''$ loose Pulleys and a few Nuts and Bolts! A Meccano boy who can devise a realistic model motor-cycle with fewer parts will certainly have achieved a remarkable result!

A particularly interesting branch of motor-cycle construction is the arranging of scenic effects around the finished models. Sections of road may be represented by gravel; walls may be "faked" by painting strips of stiff cardboard with water colours; and trees and shrubs to complete the background may be made from green loofah, sponge, etc. A small doll suitably disguised may be fitted to the Meccano machine, and if a photograph is now taken of the complete scene a most realistic and interesting effect will be obtained. A particularly fine example of this type of work is shown in Fig. 5, which represents "No. 3" "straightening out" after taking a difficult corner! The realistic attitude of the rider on his machine, and the design of the Meccano model itself, are quite remarkable. The frame of the machine is built up from Strips and Angle Brackets, and the saddle tank is represented by Curved Strips and Double Angle Strips. The forks are also built up from Strips and an interesting feature is the adjustable damper fitted to the steering head. This consists of a short length of Screwed Rod working in a Threaded Boss. A $\frac{3}{4}''$ Sprocket Wheel is secured to the top end of the Threaded Rod, and by turning the Wheel the steering column bearings may be tightened, thus limiting the side wobble of the front wheel on rough ground. The use of a Meccano Sprocket for the damper control wheel is a particularly happy choice as this part bears a very close resemblance to the serrated nut used in actual practice. The engine fitted to the model is of the overhead valve two-port pattern, the push rods controlling the rocker arms, that in turn open and close the valves at the top of the cylinder being visible at the side of the cylinder of the model. One of the exhaust pipes may also be seen in this illustration together with one silencer unit, the pipe consisting of a long Axle Rod suitably bent at one end so as to fit to the cylinder "head."

In Fig. 2 is shown a further interesting example of motor-cycle construction, the model forming a creditable attempt to design a motor-cycle to a comparatively small scale. The road wheels in this model are 2″ Pulleys fitted with 2″ Dunlop Tyres, and the frame has been built up from Short Strips and a pair of Flat Trunnions. The single cylinder engine of the machine is represented by a Worm, the threads of which give an excellent impression of the "finning" that is formed round an actual cylinder. The machine is also fitted with an exhaust system consisting of an Axle Rod carrying a Coupling at one end to represent the expansion chamber.

Meccano Printing Machine

Constructional Details (Continued)

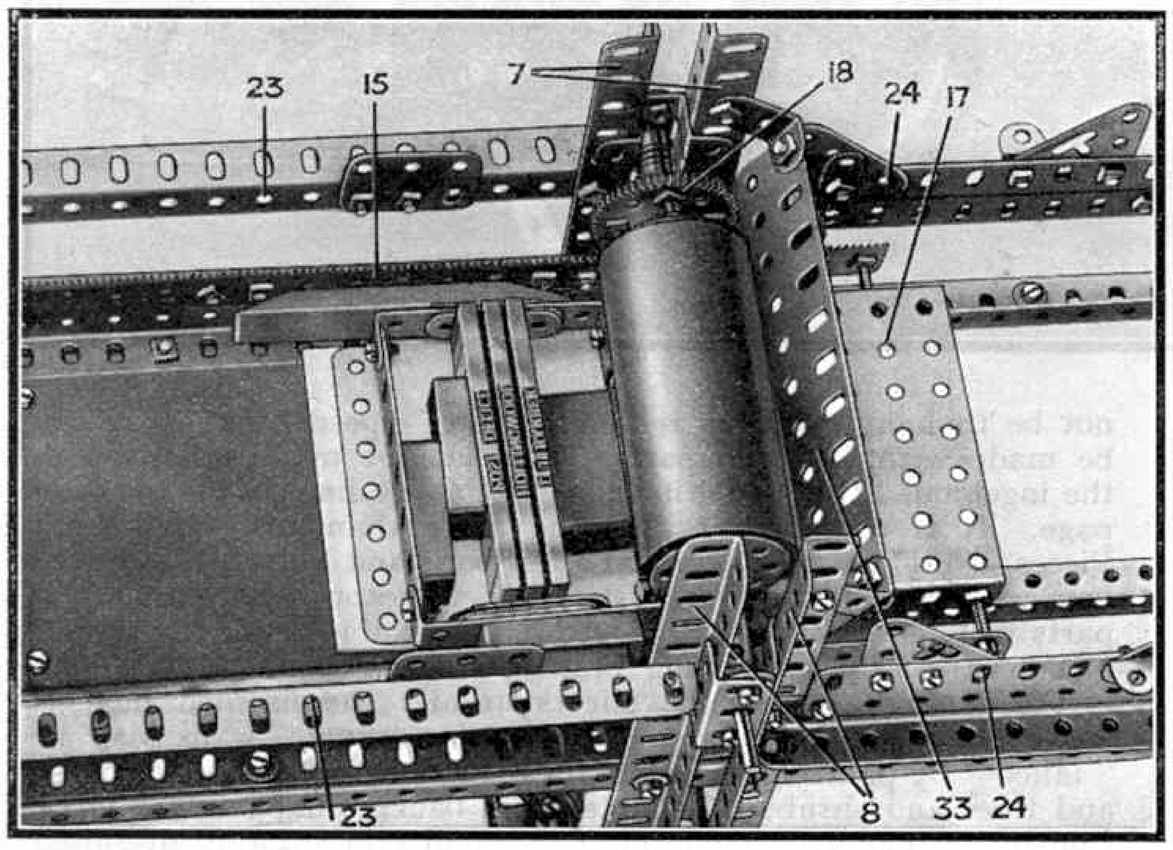


Fig. 1. Plan view of the platen, showing the forme with type in position.

LAST month we described the construction of the impression roller. When this is secured in place, and the 57-teeth Gears 18 have been found to mesh correctly with the entire length of the Rack Strips 15, the Motor may be installed on the Angle Girders 3. This Meccano E1 Electric Motor, Fig. 2, drives the main mechanism of the model and is controlled by a rheostat 27. The pinion on the armature shaft engages with a 57-teeth Gear Wheel carried on a $2\frac{1}{2}''$ Rod, the opposite end of which is fitted with a $\frac{1}{2}''$ Pinion that meshes with a second 57-teeth Gear Wheel carried on the $4\frac{1}{2}''$ Rod 28. This Rod, carried in two $2\frac{1}{2}'' \times 2\frac{1}{2}''$ Flat Plates secured by four $\frac{3}{8}''$ Bolts to the Motor side plates, is fitted with a $\frac{1}{2}''$ Pinion meshing with a 57-teeth Gear Wheel 29. The Rod on which this Gear is carried is fitted with a $\frac{3}{4}''$ diameter, $\frac{3}{4}''$ width Pinion that is in engagement with two $3\frac{1}{2}''$ Gears. It should be noted that the extra wide Pinion may be replaced by two $\frac{3}{4}''$ diameter $\frac{1}{4}''$ face Pinions if necessary, but the Pinion used forms a very strong part at this stage of the transmission. The two Gears rotate in the direction indicated in Fig. 2.

The two large Gears are carried on $2\frac{1}{2}''$ Rods each of which carries a Bush Wheel, fitted with a Threaded Pin, between its two supporting Girders. One of these Bush Wheels 30 actuates the lever 32 and the other the lever 31. The Rod carrying the latter Bush Wheel supports on its outer end a Coupling (see Fig. 1 of the previous article) that carries a $1\frac{1}{2}''$ Rod in its longitudinal bore. This Rod is attached pivotally, by a Threaded Pin and Collar, to a connecting rod built up from two $4\frac{1}{2}''$ Strips and a $2''$ Slotted Strip. The slot in this Strip carries a sliding $\frac{3}{8}''$ Bolt that is secured rigidly to a Crank mounted on a $1\frac{1}{2}''$ Rod the other end of which is provided with a second Crank. This Crank is set at 180° to the first Crank, and it has a Rack Segment secured to it that meshes with a $1''$ Gear. A $6\frac{1}{2}''$ Rod carries this Gear together with a delivery arm, the construction of which was reproduced last month in the general view of the model. Thus as the Coupling is rotated the delivery arm is swung from one side to the other, and the slot in the $2''$ Slotted Strip allows a considerable pause to be made at the end of each movement.

The two $3\frac{1}{2}''$ Gears are connected together by a Coupling that is free to turn on its two supporting bolts. The centre hole of the Coupling is fitted with a $4\frac{1}{2}''$ Rod attached at its lower end to the bottom holes of the $5\frac{1}{2}''$ Angle Girders of the Girders 6. The upper end of the Rod carries a Coupling that is attached by two $12\frac{1}{2}''$ Strips to the square girder 13. The rotation of the $3\frac{1}{2}''$ Gears in this manner imparts a quick return motion to the platen.

The movement for operating the impression roller is actuated by the Bush Wheel 30, a Threaded Pin in which causes the member 32 to be rocked backward and forward alternately. The upper end of 32 carries an End Bearing that is provided with an $11\frac{1}{2}''$ Axle Rod, and this is connected at its opposite end to the Coupling 21 by a Swivel Bearing and $2''$ Rod.

The action of the three movements, platen, impression and delivery, is as follows. When the platen is at the driving end of the model, the Coupling, actuating the delivery arm, must point downward in a vertical direction, and the Threaded Pin on the Bush Wheel 30 must just be starting to force the arm 32 forward. With these positions, as the platen moves forward the impression roller is lifted clear of the type, and the last paper passed under the roller is lifted by the delivery arm on to the delivery pile.

The guide strips, one of which is shown half size in

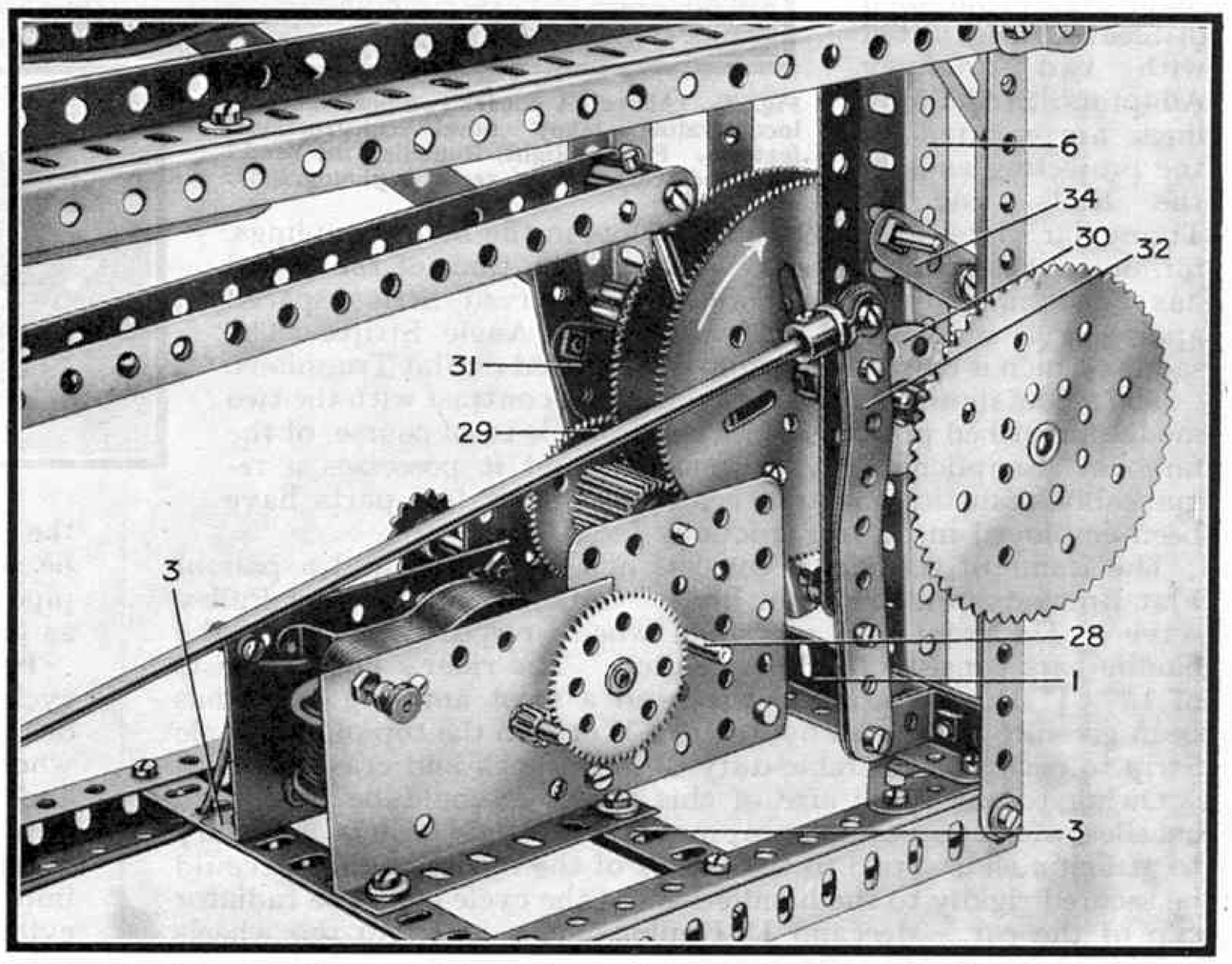


Fig. 2. This view gives a good impression of the robust construction of the motive unit.

Fig. 4, are now made. Each of these consists of a strip of thin sheet metal $\frac{1}{2}''$ in width and, by enlarging Fig. 4 to full size, the exact shape of the strip will be gained. At the point where the strip passes through the delivery rollers it is reduced to half width for a distance of half an inch. The gap so formed accommodates a portion of the delivery rollers and by this means the paper, on passing through the machine, is accurately guided into the delivery arm without smudging the recent impression. The two strips are carried on two 8″ Rods 25 and 26. The Rod 25 is journalled in the two holes 23 of the upper girders of the machine, and the Rod 26 is similarly supported in the holes 24, on the opposite side of the impression roller. Care should be taken to see that the strips are spaced apart sufficiently to miss the face of the type, but they must not press too hard on the underside of the impression roller, as this is liable to mark the smooth surface of the rubber.

The paper is guided under the impression roller by a $5\frac{1}{2}''$ Flat Girder 33 attached to the vertical girders 7 and 8 by $1'' \times \frac{1}{2}''$ Angle Brackets. The Angle Brackets are pulled out to the extremity of their slots, and the Flat Girder is so arranged that its inner edge almost touches the roller. By means of this fitting, the paper, on entering the machine, is forced down on to the type.

It is now advisable to make the forme and set up the type. While carrying out this stage of the construction the Crank 34 carrying a Threaded Pin is forced into a horizontal position. In this way the impression roller is permanently raised while the machine is in operation.

The forme is a frame in which the type is set for printing, and in the model it consists of two $3\frac{1}{2}''$ Angle Girders placed parallel to each other, and connected together by two $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips. The type shown used in Fig. 1 is linotype, which is cast in the form of slugs on a linotype machine. It is the simplest type to use for the model, and is very suitable for printing visiting cards. The printing face is mounted on a white metal block measuring about $3\frac{1}{2}''$ in length and $\frac{7}{8}''$ in depth, with a width corresponding to the size of the type. For visiting cards, what is known as " 12 point " type is most usual. Slugs with the required lettering may be obtained from any printer who has a linotype machine.

The three slugs used in the model are spaced apart by thin strips of metal known as " leads," and the complete block of type is placed in the forme. The type is then fixed firmly in position by means of small wedge-shaped pieces of wood, and the spaces between the ends of the slugs and the forme are filled in with short Strips in order to prevent side movement.

The forme, which may now be moved into any desired position without fear of the slugs falling out, is now placed on to the cardboard face of the platen, and a length of narrow " furniture " is placed between one of its ends and the side of the platen. The other end forms a pressure surface for two keys that are forced tightly into the space between the platen and the forme. The keys must be tightened up as firmly as possible so that the forme will not slip when it is passing under the impression roller. It may be found necessary to cut the length of furniture securing the forme because of a number of Nuts and Bolts in the side girders of the platen. This should be carried out carefully with a file, for on no account must the wood be split.

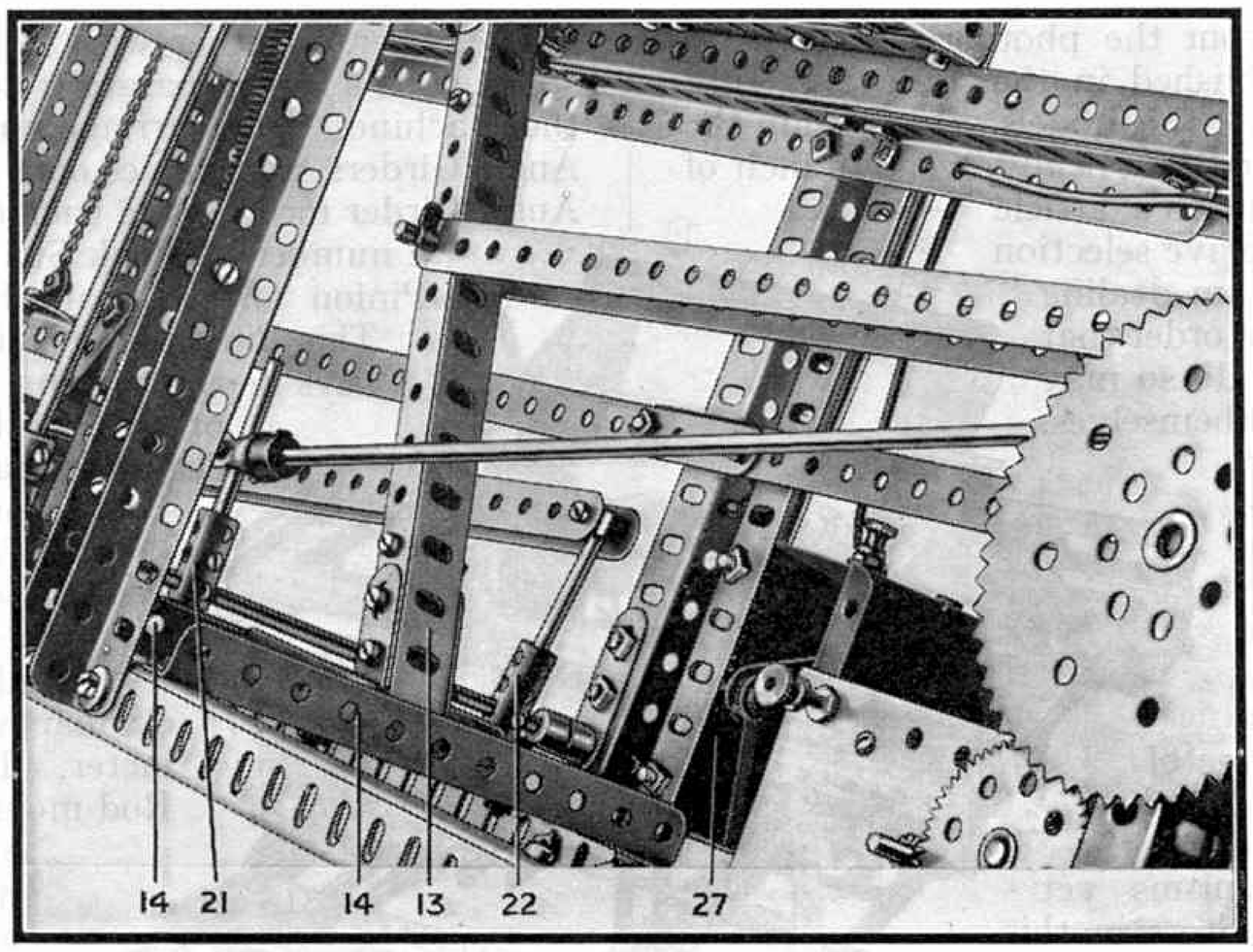


Fig. 3. Sectional view showing the connecting rods to the various movements.

A trial impression may now be taken before proceeding with the remainder of the machine. This is accomplished by smearing printing ink over the face of the type with the aid of a rubber roller, and care must be taken to see that this is done evenly without using too much ink. The Crank 34, Fig. 2, may now be released and a sheet of paper held so that its leading edge is under the impression roller. The electric Motor driving the model is then switched on so that the platen commences to travel toward the roller at its maximum speed. At this point it is advisable to rest the paper on the guide strips in order to prevent smudging, for as the type face passes under the impression roller the paper is taken with it, and as it emerges on the opposite side it is lifted off the type by the curve of the guide strips. The Motor is then stopped and the paper carefully lifted, and if everything has operated correctly a perfect impression will be seen.

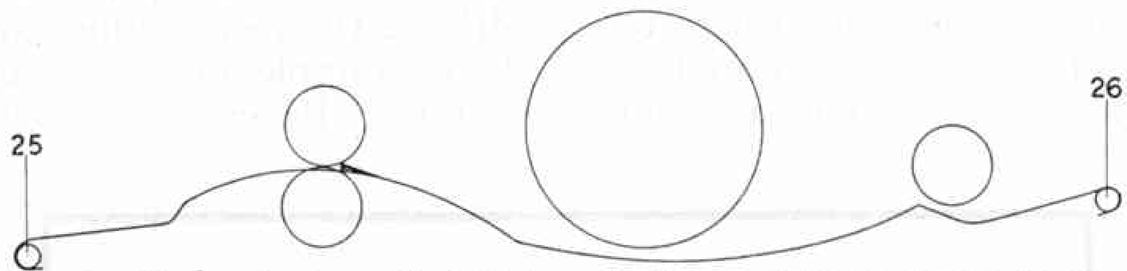


Fig. 4. This drawing is exactly half-size and will be useful when shaping the two guide strips for the model.

It is possible that the impression is clearer on one side than on the other, and this may be rectified by placing thin sheets of paper under the slugs at that point. If this is not found to correct the fault, the impression roller must be examined by holding the edge of a ruler along the rubber covering at different points. Any deep depressions will be easily located in this manner, and must be filled in. This is accomplished with the aid of rubber solution, similar to that used in mending cycle punctures. Fine grade glass paper will also be useful for giving a smooth finish.

Care must also be taken to see that the pressure of the Springs on each side of the impression roller is equalised. This is necessary in order to produce an evenly inked impression. The tension of these springs should be sufficient to prevent the roller from being lifted by hand without considerable effort.

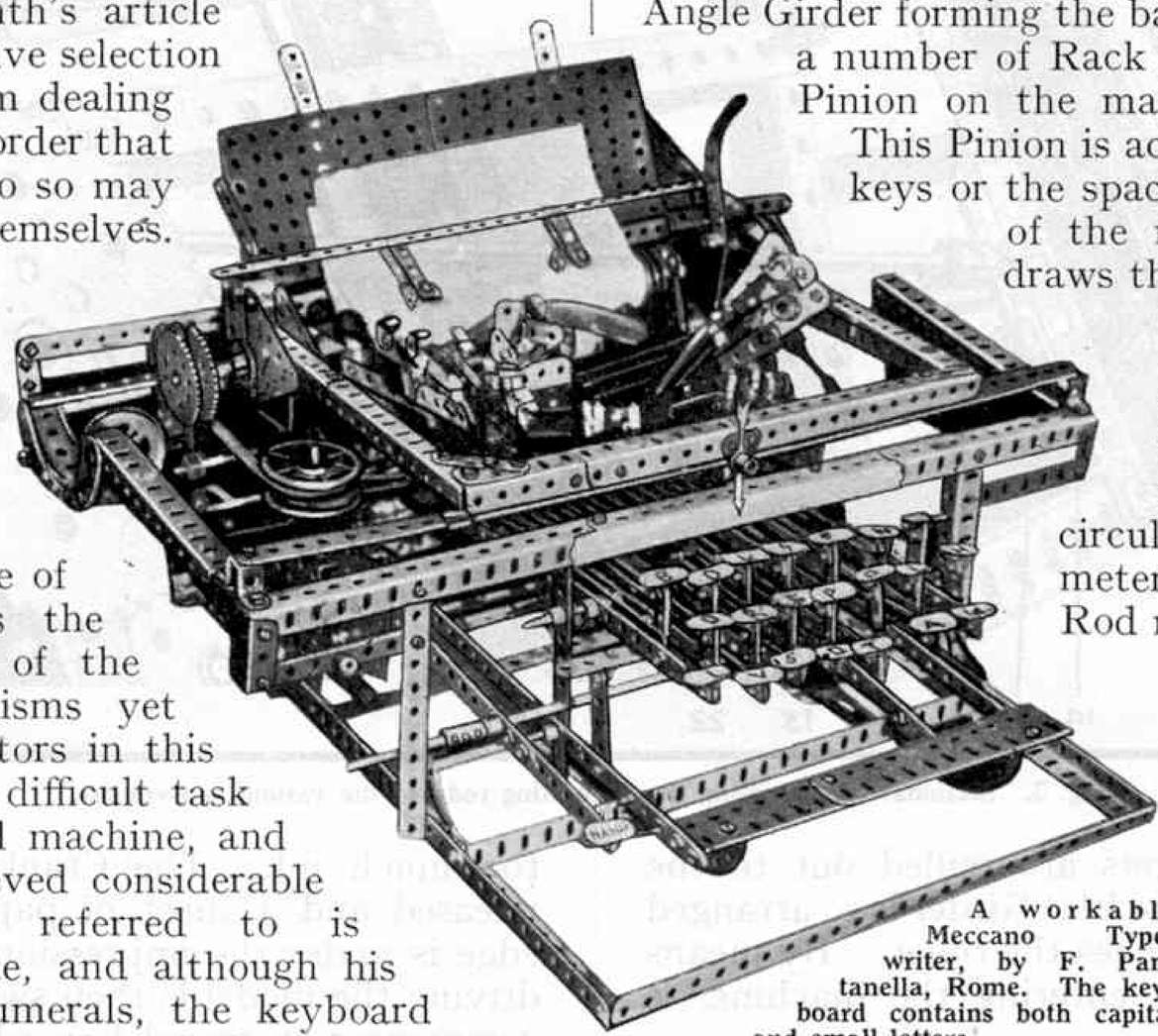
The International Model-Building Contest

More Comments on Prize-Winning Models

By Frank Hornby

As will be gathered from the photographs of prize models already published in the June and July issues of the "*M.M.*", the models submitted in the £500 Competition embraced practically every branch of engineering. For this month's article I have chosen a representative selection of general models, and I am dealing with them in some detail in order that constructors who wish to do so may build these fine models for themselves.

Although there are very few mechanisms that cannot be reproduced in Meccano, there are one or two machines that until the £500 Contest was organised had not been constructed with any degree of success. One of these is the typewriter, which is one of the most complicated mechanisms yet invented. Several competitors in this competition undertook the difficult task of modelling this wonderful machine, and at least one of them achieved considerable success. The competitor referred to is Francesco Pantanella, Rome, and although his model does not include numerals, the keyboard is fitted with a full alphabet of capital and small letters.



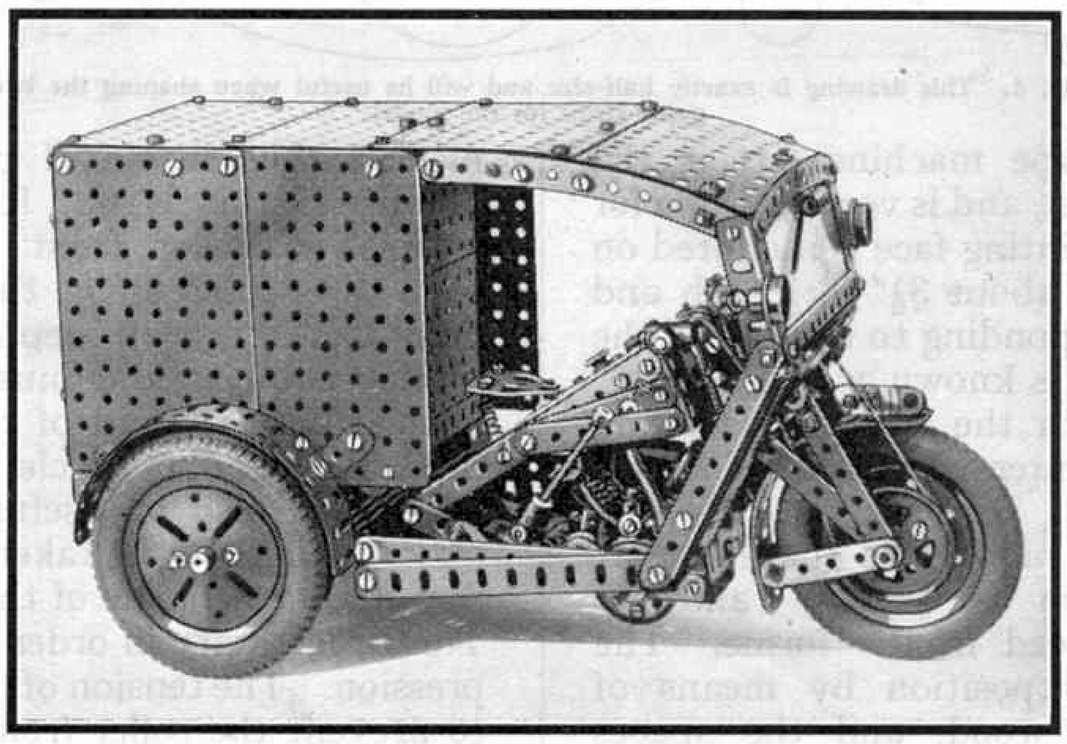
A workable Meccano Typewriter, by F. Pantanella, Rome. The keyboard contains both capital and small letters.

The model is illustrated here and it will be seen that it represents one of the well-known Remington machines. The frame of the model has an overall length of 18½" and a similar overall width, and the total height is 7". It is built in two separate units, the main frame being constructed in the form of an oblong resting on four legs, to which is bolted the key frame. The keys are mounted on a single 11½" Rod, and the inner end of each key arm carries a short Strip that connects the arm with its respective type holder. The type holders are represented by Strips of different sizes, and the two type letters allotted to each holder are carried in ½" × ½" Angle Brackets. The inner ends of the type holders are held on a curved Rod so that all the types hit the paper at the same point. A length of inked typewriter ribbon is constantly being drawn across the space between the point of contact of the type and the paper. Ribbon may be obtained from any stationers who supply office requisites.

The roller, together with its moving carriage, is constructed as a unit separate from the main framework of the machine. The carriage consists of a framework of Angle Girders, and moves on a set of small rollers. The Angle Girder forming the back of the frame is fitted with a number of Rack Strips that engage with a ½" Pinion on the main frame of the typewriter. This Pinion is actuated by pressing either the keys or the spacing bar situated in the front of the machine, and its movement draws the carriage forward the space of one letter.

The roller, round which the paper is passed for receiving the impression, is specially made for the model from a circular wooden rod 1½" in diameter. It is carried on an 11½" Rod mounted in suitable bearings, and a pawl and ratchet mechanism is fitted to one end. The ratchet enables the roller to be rotated a specified distance at the end of each line of type. This model won a second prize in Section B.

A model that differs greatly from Pantanella's typewriter is the neat motor-cycle delivery van also illustrated here. It was entered in Section "C" and won a third prize for its builder, Victor White, London, W.3. This vehicle consists essentially of a motor-cycle to which a small van mounted on two wheels is attached. The engine has a low petrol consumption and is capable of driving the van at a high speed. The model is an excellent example of the remarkable realism that may be obtained by careful choice of parts. The tank of the motor-cycle is built up from Strips bolted at each end to Double Angle Strips, and the front forks also are built with Strips. The engine is of the twin-cylinder type, each cylinder being composed of five 1" loose Pulleys held on a short Rod. A Threaded Rod secured at its lower end in a pivoted Coupling represents the gear-change lever. One of the most interesting features of the model is a windscreen wiper made from a piece of wire twisted round a bolt passed through a Flat Bracket bolted to the outer side of the windscreen frame.

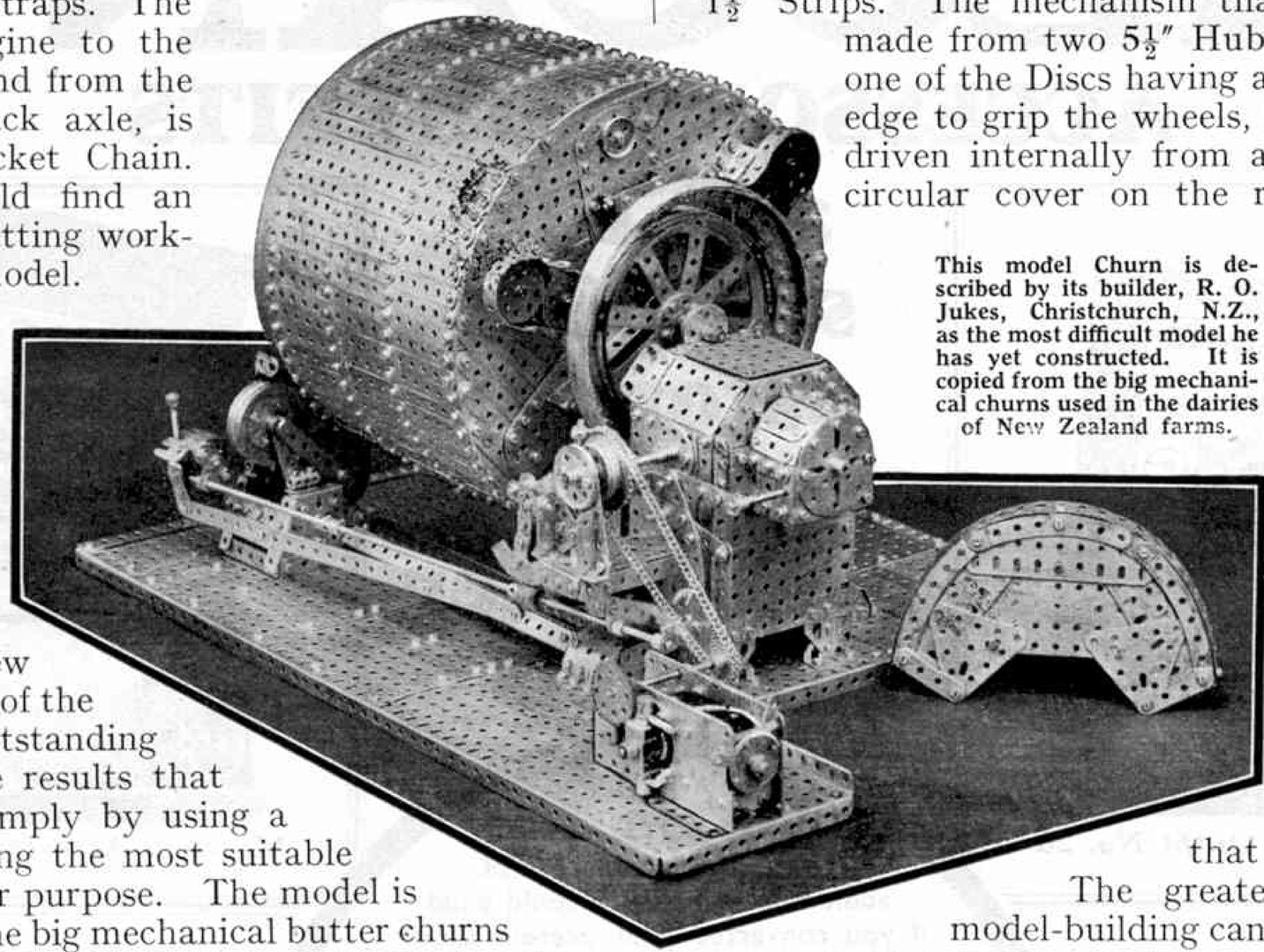


Victor White, London, won a prize with this neat model of a Motor-cycle Delivery Van.

The two rear wheels are

each fitted with contracting band-type brakes, and there is also a similar brake on the front wheel, the brake drums in each case consisting of 2″ Pulleys. Meccano Cord is used for the brake straps. The drive from the engine to the dummy gear-box, and from the gear-box to the back axle, is by means of Sprocket Chain. Model-builders would find an interesting task in fitting workable gears to the model.

I come now to a model that possesses particular charm and interest, the remarkably neat mechanical butter churn constructed by R. O. Jukes, Christchurch, New Zealand. The barrel of the model is an outstanding example of the fine results that may be obtained simply by using a little care in choosing the most suitable parts for a particular purpose. The model is copied from one of the big mechanical butter churns used in the dairies of New Zealand farms. It is based on a popular churn known as the "Anderson" Internal Worker, and those who like building intricate models will find it a splendid subject for their attention.



This model Churn is described by its builder, R. O. Jukes, Christchurch, N.Z., as the most difficult model he has yet constructed. It is copied from the big mechanical churns used in the dairies of New Zealand farms.

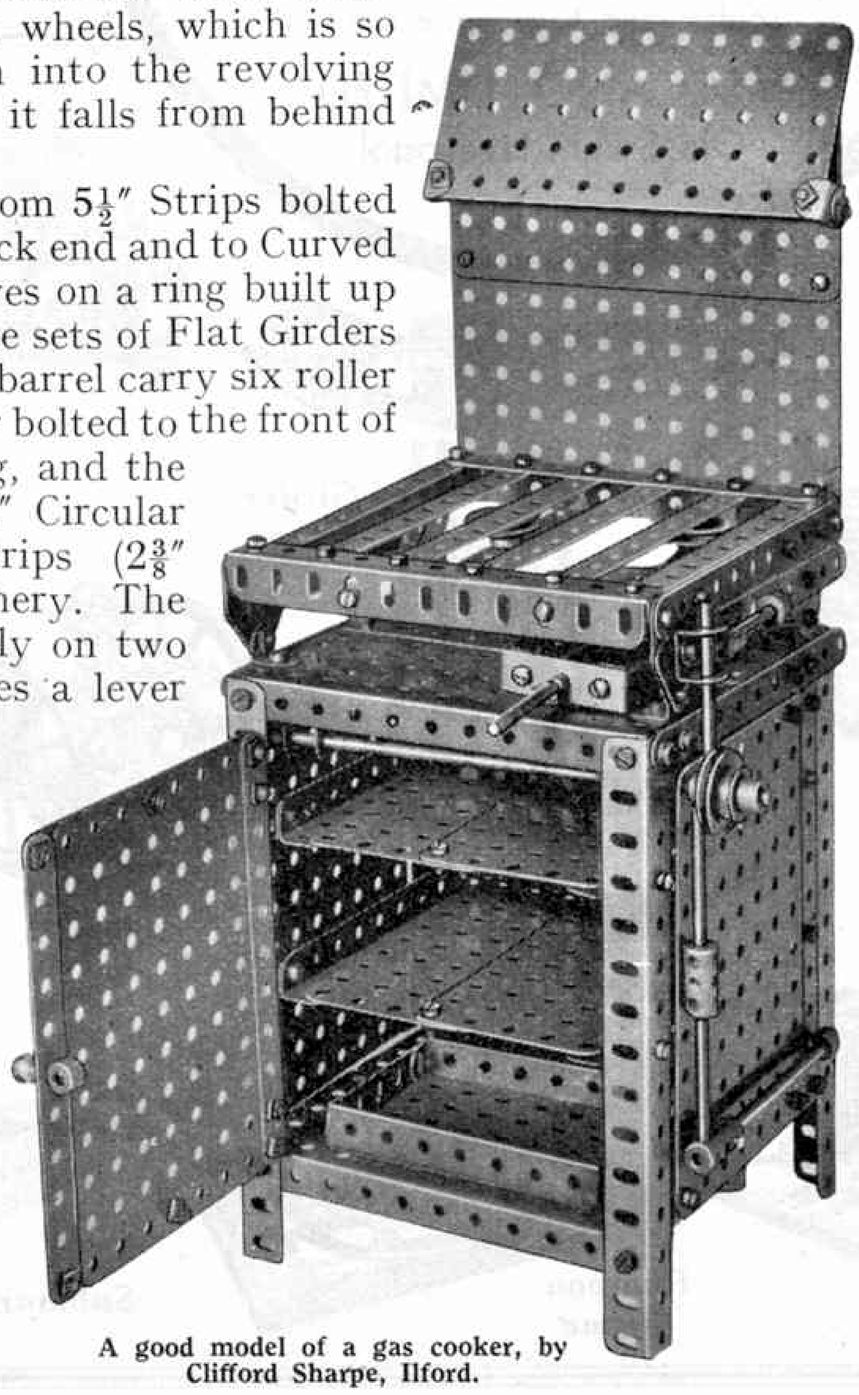
The machine consists of a large barrel arranged to rotate on trunnions, inside which is a set of revolving rollers. Cream is placed in the barrel, which is then set in motion. The revolving rollers beat up the cream, and after a while the butter is collected on a semi-circular platform mounted on wheels, which is so designed that it may be run into the revolving barrel to catch the butter as it falls from behind the churning rollers.

The barrel is constructed from $5\frac{1}{2}''$ Strips bolted to Channel Segments at the back end and to Curved Strips at the front, and revolves on a ring built up from Channel Segments. Three sets of Flat Girders bolted on the front end of the barrel carry six roller bearings. A $5\frac{1}{2}''$ Circular Girder bolted to the front of the barrel forms the door ring, and the door itself is made from a 4″ Circular Plate with $2\frac{1}{2}''$ Curved Strips ($2\frac{3}{8}''$ radius) bolted round its periphery. The trunnion rollers can rock freely on two pedestals, one of which carries a lever frame for the control gear. It is fitted with a quadrant made from a 2″ Flat Girder, the slotted holes of which are cut out to hold the gear lever in the different gear positions.

The rear end of the barrel consists of three $4\frac{1}{2}'' \times 2\frac{1}{2}''$ Flat Plates to which Curved Strips are bolted to represent cast-iron plates carrying an outer gear wheel. This wheel is made from a $7\frac{1}{2}''$ diameter Circular Strip with $\frac{1}{2}''$ Angle Brackets bolted round it and a strip of rubber placed over the outside to provide a good grip. The rollers are geared together by 57-teeth Gear Wheels supported on bridge pieces made from $\frac{1}{2}''$ Reversed Angle Brackets and $1\frac{1}{2}''$ Strips. The mechanism that drives the rollers is made from two $5\frac{1}{2}''$ Hub Discs bolted together, one of the Discs having a rubber band round its edge to grip the wheels, while the other Disc is driven internally from a gear-box. The semi-circular cover on the right-hand side of the illustration is a guard for the $7\frac{1}{2}''$ outer gear wheel. The 1″ Pulley Wheel screwed to the back of the barrel represents the filling door.

The manner in which Jukes has condensed the intricate mechanical features of the actual Churn into so small a space is worthy of every praise, and the resulting model is one that does him great credit.

The greatest joy that Meccano model-building can offer to the constructor is, after he has carefully built up a mechanism, to see it function exactly as he has designed it. It is therefore only natural that the majority of model-builders should devote their attention to the construction of working models, but it should be remembered that Meccano is also ideal for building up models of a non-mechanical type. A good example of this kind of work is the household gas cooker, constructed by Clifford Sharpe. The model has a fine appearance of solidity, which has been obtained by judicious use of the few parts used in building it. The judges were highly pleased with the novelty of the model and rewarded its builder with a prize in Section D.



A good model of a gas cooker, by Clifford Sharpe, Ilford.

Four $7\frac{1}{2}''$ Angle Girders are used for the corner members of the model, and the top and bottom of the oven each consists of two $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flat Plates placed side by side and secured together by bolts passed through their Flanges. The sides and back of the oven are filled in with Flat Plates and Strips, and rests for the oven plates are made from two $4\frac{1}{2}''$ Angle Girders bolted to each side by Reversed Angle Brackets. Two $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flat Plates overlapped two holes are used for the shelves, and the gas burners are 1″ Fast Pulleys fixed to Strips by $\frac{3}{8}''$ Bolts. A $5\frac{1}{2}'' \times 3\frac{1}{2}''$ Flat Plate extended by a $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flat Plate is bolted at the back of the stove, and carries two Angle Brackets to which are pivoted further Angle Brackets attached to the plate rack, so that the rack can be let down or folded back as desired. Realistic gas pipes formed by Axle Rods are attached to the side of the stove, and a grill tin is built up from $1\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips bolted together and fitted with a $1\frac{1}{2}''$ Axle Rod for the handle.

MECCANO

ACCESSORY OUTFITS

Meccano Accessory Outfit No. 2a

are the stepping stones to bigger and better models

Meccano Accessory Outfit No. 3a

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

MECCANO LIMITED
Old Swan, Liverpool

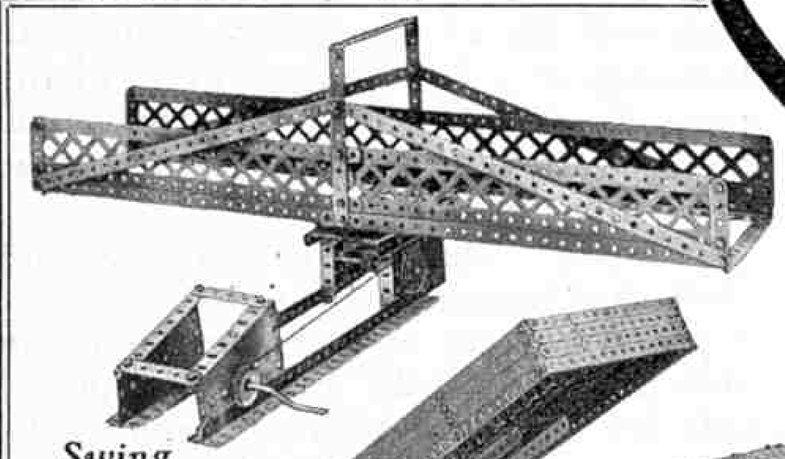
Price List of Meccano Accessory Outfits

No. 00a converts a No. 00 Outfit into a No. 0	1/6
No. 0a converts a No. 0 Outfit into a No. 1	5/6
No. 1a converts a No. 1 Outfit into a No. 2	7/-
No. 2a converts a No. 2 Outfit into a No. 3	12/6
No. 3a converts a No. 3 Outfit into a No. 4	26/-

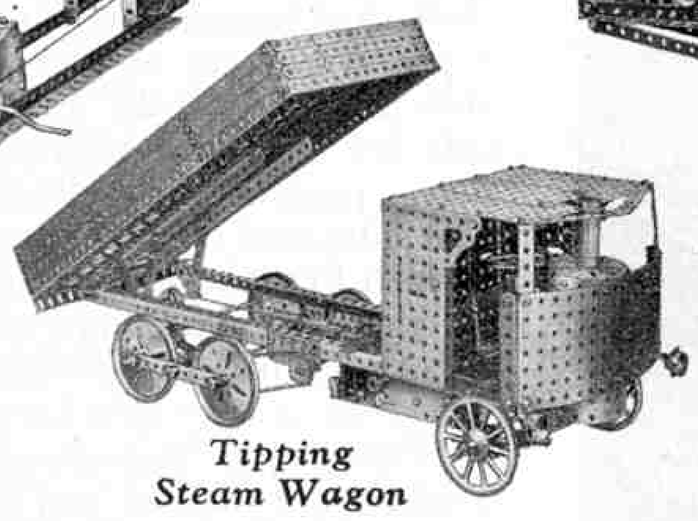
Price List of Meccano Accessory Outfits

No. 4a converts a No. 4 Outfit into a No. 5	17/6
No. 5a* converts a No. 5 Outfit into a No. 6	55/-
No. 5a† converts a No. 5 Outfit into a No. 6†	97/6
No. 6a† converts a No. 6 Outfit into a No. 7	235/-

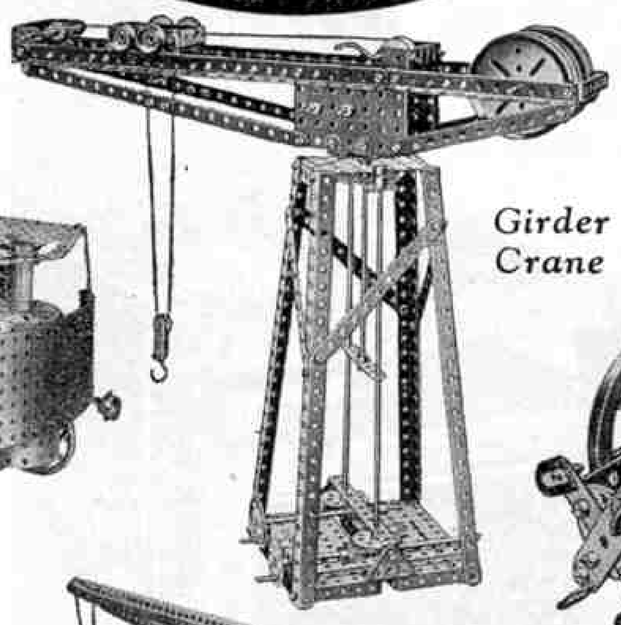
* Carton. † Enamelled cabinet.



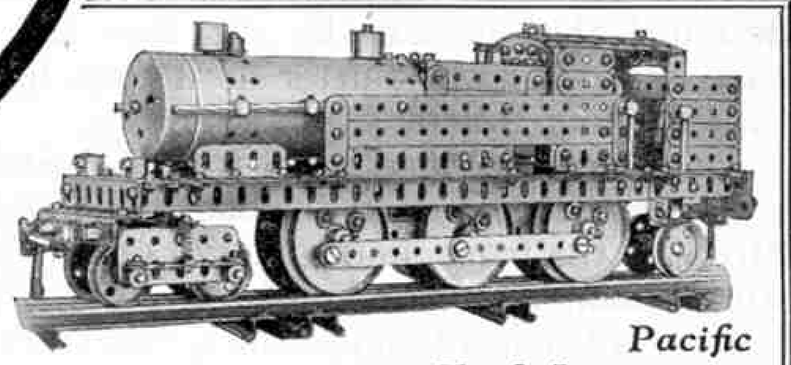
Swing Bridge



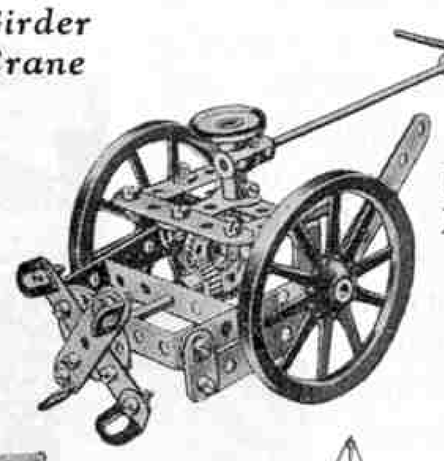
Tipping Steam Wagon



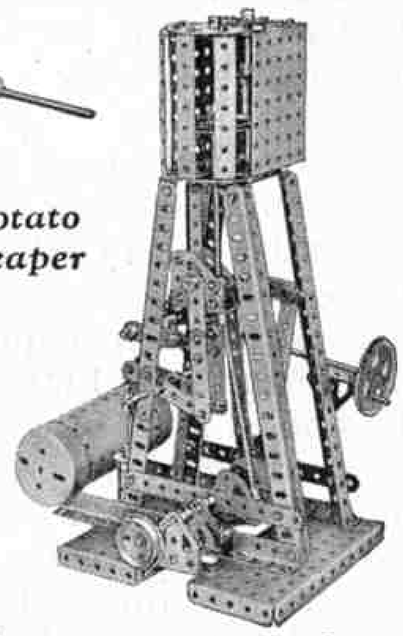
Girder Crane



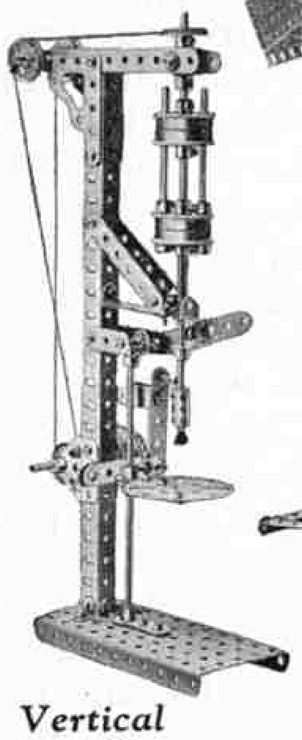
Pacific Tank Locomotive



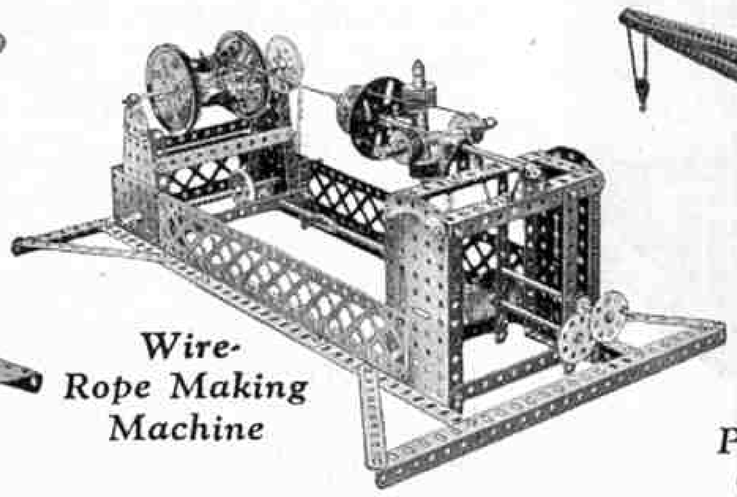
Potato Reaper



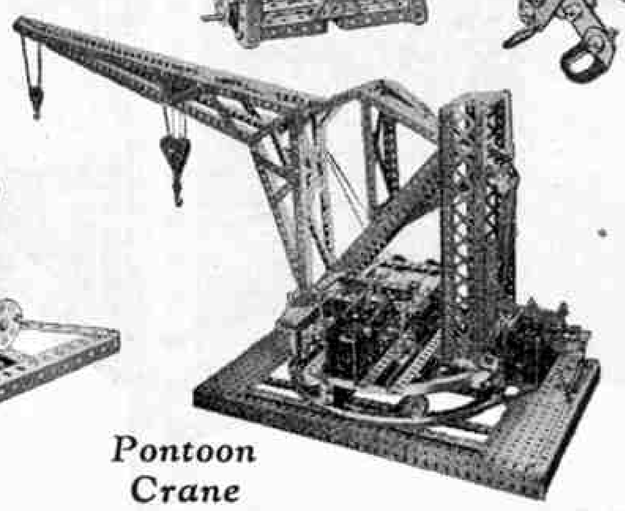
Vertical Marine Engine



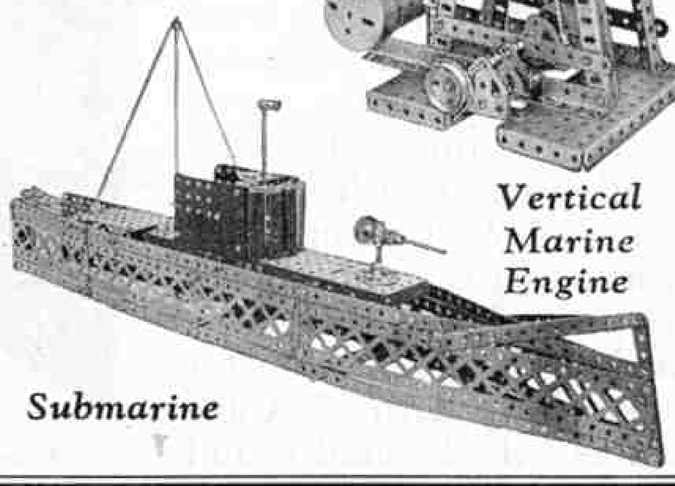
Vertical Drill



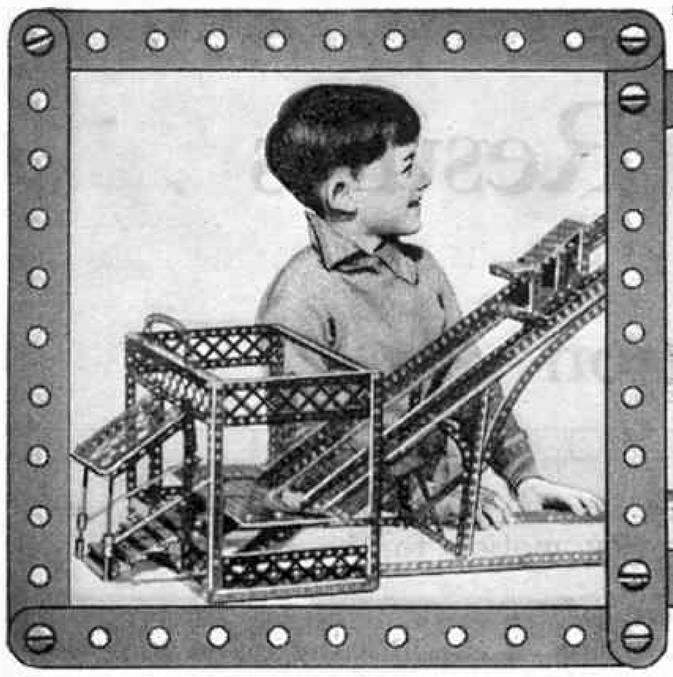
Wire-Rope Making Machine

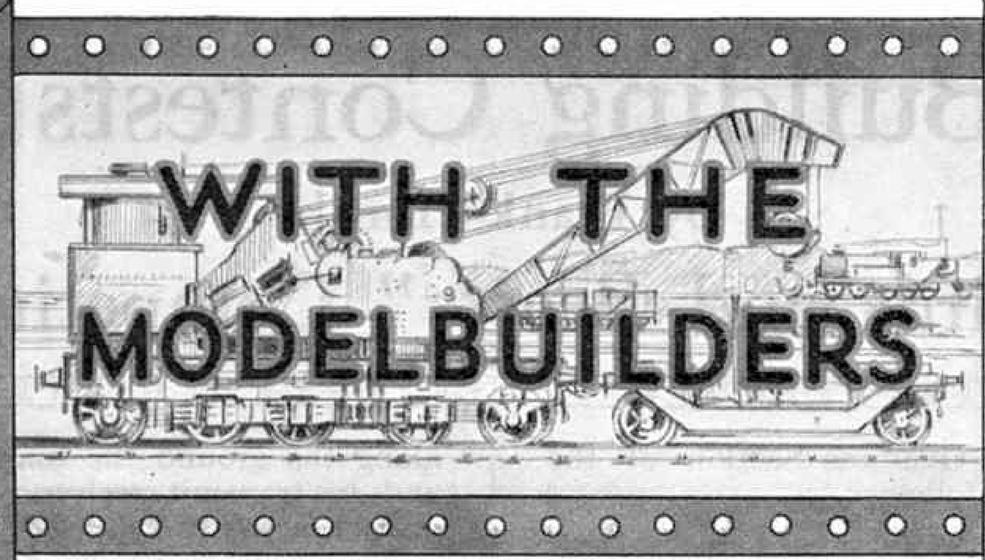


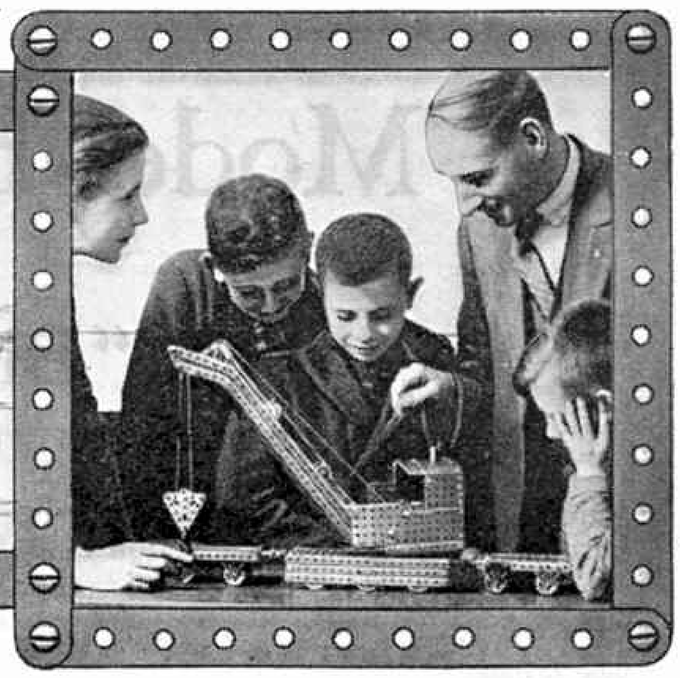
Pontoon Crane



Submarine







A NOVEL MOTOR-CYCLE TOY

Meccano may be used in the construction of all kinds of amusing toys, which may be either hand or motor-operated. Some very interesting and amusing effects may also be obtained by animating the toys on the "gravity" principle, and an outstanding example of this is the Meccangaroo that forms the subject of model No. 3.26 in the 00–4 Manual. When placed on an incline, this weird animal will travel forward with a remarkable hopping action. This month we illustrate an interesting model motor-cycle that operates on the gravity principle.

The model consists of a diminutive motor cycle and rider fitted with a pendulum so that it may be balanced on a length of cord. The cord is stretched between two vertical standards that may be placed at opposite sides of the room. One of the standards should be mounted higher than the other so that the cord forms an inclined track. If the cyclist is placed on the cord at the upper end he will "speed" down towards the lower standard in a most realistic fashion. Good fun may be obtained by building two or three of these models and racing them on inclined tracks arranged parallel to each other.

The frame of the cycle consists of two 2½" Strips, and two 2½" Curved Strips are secured to the frame by means of a ⅜" Bolt fitted with three Nuts. This Bolt also forms a pivot for the pendulum, which consists of a 5½" Strip fitted with four 1" Fast Pulleys, mounted on 1½" Axle Rods. The forks consist of a pair of 1½" Strips, while a 1½" Rod fitted with two Spring Clips and four Washers forms the handle-bars. The Washers are placed between the 1½" Strips for spacing purposes. The rider's arms are 1½"×½" Reversed Angle Brackets and his head is a ½" Loose Pulley mounted on a ⅜" Bolt. The road wheels of the machine consist of 1" Loose Pulleys pivoted on ⅜" Bolts fitted with locknuts.

Each vertical support is built up from two 12½" Angle Girders bolted together at the top and braced at the lower ends by means of two diagonal 5½" Strips and a 2½" Strip. Two 5½" Strips are secured to the lower ends of the Girders, and Angle Brackets are in turn attached to these so that each standard may be screwed rigidly in position. A composite strip composed of a 5½" and a 2½" Strip overlapped and bolted together is attached in a vertical position to each standard, and two Angle Brackets are bolted to each Strip. The ends of the cord on which the motor-cycle travels are fixed to the outer Angle Brackets.

EPICYCLIC GEARING

Most Meccano boys are interested in the design and construction of the various types of gear-boxes. The patterns making use of sliding gears and dog clutches present little difficulty in construction, and it is possible to reproduce these perfectly with the existing range of Meccano gears, the Socket Coupling, and the Dog Clutch unit. When the epicyclic or planetary type of gear-box is to be reproduced, however, construction is not so straightforward owing to the specialised nature of the parts.

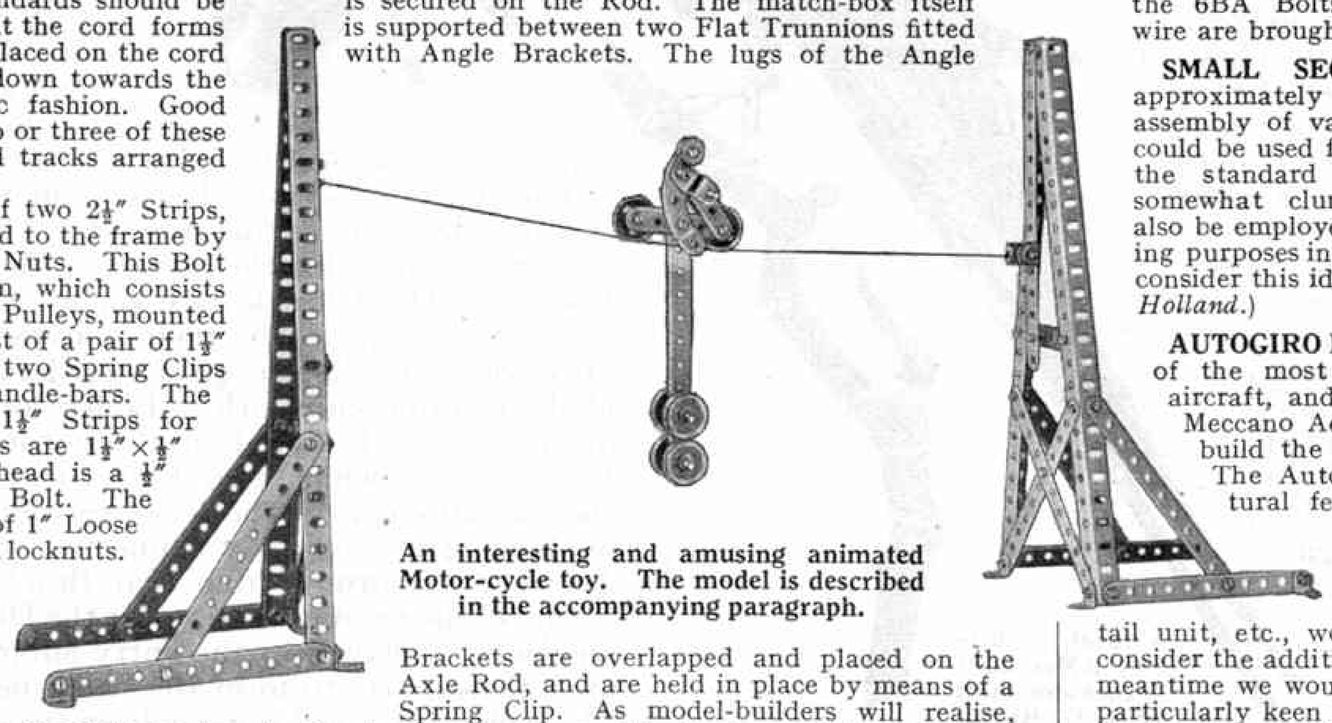
Several readers have attempted to build models showing the principle of the well-known Armstrong-Siddeley Self-Changing gear-box. This change-speed system operates on the epicyclic principle, a number of separate "sun and planet" gears being kept permanently in mesh and engaged with the propeller shaft as required by means of clutches. In representing a gear of this type a large internal tooth gear wheel is required. There is not a standard Meccano part of this type, but an internal gear may be improvised by securing a Meccano Pinion or Gear Wheel rigidly to the face of a large Gear Wheel (a 3½" or 2½" Gear) by means of a length of Screwed Rod. As the Pinion is locked in position to the face of the Gear, the latter acts as an internal gear with teeth formed on a very small section of its internal circumference. A two-speed and reverse epicyclic gear-box using this form of construction is described on page 17 of the Standard Mechanisms Manual.

Epicyclic or planetary gearing is of considerable utility in a number of different types of models in addition to motor car chassis. For instance it is possible to obtain a step-up ratio of 2 : 1 between two shafts in the same straight line by building a planetary gear consisting of two 1½" Contrate Wheels and a ¾" Pinion.

FURTHER PRACTICAL USES FOR MECCANO

In this page of the May "*M.M.*" we referred to the application of Meccano to the construction of articles of direct practical utility. The Meccano boy who makes use of his ingenuity will be able to find numerous uses for the parts in the assembly of all kinds of "gadgets" and fittings outside the range of pure model-building. The lower illustration on this page shows a useful smoker's stand assembled from Meccano parts. The construction of the stand is so simple that it may be built with a No. 00 Outfit.

The base of the stand consists of a 5½"×2½" Flanged Plate, and two 2½"×½" Double Angle Strips are secured in between the flanges so as to divide the Plate into two "ash trays." A Trunnion is secured to each Double Angle Strip and a Bush Wheel is bolted to the Trunnions in a central position. A 2" Axle Rod is mounted in the Bush Wheel and a 1" Fast Pulley is secured on the Rod. The match-box itself is supported between two Flat Trunnions fitted with Angle Brackets. The lugs of the Angle Brackets are overlapped and placed on the Axle Rod, and are held in place by means of a Spring Clip. As model-builders will realise, the "ash trays" formed in the base of the stand will not be very efficient if left as shown in the illustration! They should be fitted with shallow trays made from tin plate.



An interesting and amusing animated Motor-cycle toy. The model is described in the accompanying paragraph.

ROTARY COLLECTOR SYSTEM

When electric current is to be conveyed to the oscillating or rotating portion of a model, some form of current collector must be used. In small models, where the moving portion does not rotate over a complete circle, a length of flexible wire may be used to convey the current, sufficient slack being allowed in order to prevent a strain being imposed on the wire in the extreme positions of travel. Where the moving portion has a continuous rotary action, however, a rotary collector system must be built up. This may be assembled from Meccano parts in the following manner. A Bush Wheel is first of all mounted on the pivot rod of the structure and a Wheel Flange is secured to the Bush Wheel by means of 6BA Bolts and Nuts. An Insulating Bush is fixed under the head of each 6BA Bolt, and an Insulating Washer is placed against each 6BA Nut so that the Wheel Flange is insulated electrically from the pivot shaft of the model. A Terminal is placed on the projecting end of the shank and one of the 6BA Bolts to serve as an anchoring point for the wire from the lamp, electro-magnet, etc.

Several types of "brushes" may be built up for use with this collector, but perhaps the simplest method is to use a Pendulum Connection secured on a 6BA Bolt. The Bolt should be mounted in Insulating Bushes and Washers so that it is insulated from the fixed frame of the model, and a Terminal should be fitted so that the brush may be connected with the battery. The top of the Pendulum Connection is bent so that it rubs smoothly against the edge of the Wheel Flange as the latter rotates. An even better rubbing contact may be obtained by using a brush composed of a Meccano Spring Buffer (part No. 120a) mounted on a short Strip. The Buffer is secured to a 1½" Strip by means of its screwed shank. The 1½" Strip is then attached to the fixed frame by means of a 6BA Bolt and Nut, an Insulating Bush and Washer being employed so that the Strip and Buffer are insulated from the fixed frame of the model. A Terminal should be screwed on to the 6BA Bolt so that the battery lead may be secured in place.

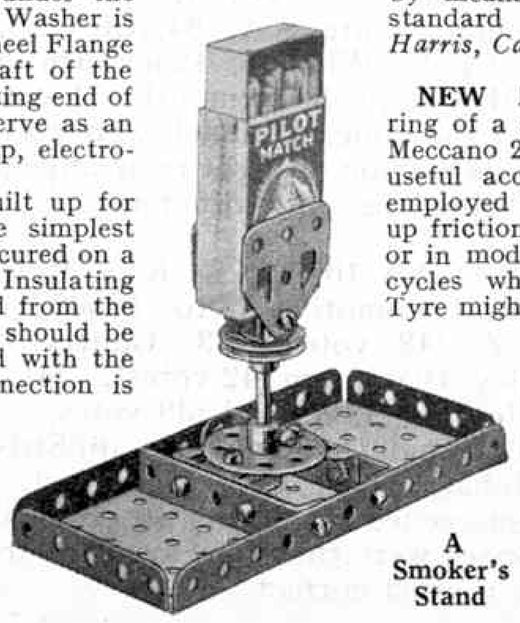
This type of contact brush may be used in a Motor controller consisting of a tapped resistance element arranged in circular formation. The controller arm consists of a Double Arm Crank, one end of which is fitted with a Threaded Pin to act as a handle, while the other carries the Spring Buffer forming the movable contact point. The resistance element consists of lengths of Spring Cord anchored to 6BA Bolts placed in a Bush Wheel. The Double Arm Crank is pivoted on a Rod mounted in the Bush Wheel. When the switch arm is rotated, the Buffer makes contact with the 6BA Bolts and different lengths of resistance wire are brought into circuit.

SMALL SECTOR PLATE.—A sector plate approximately 2½"×1½" would be useful in the assembly of various types of models. The plate could be used for filling in awkward corners where the standard rectangular plates would prove somewhat clumsy. Your proposed part could also be employed as a large T-plate for strengthening purposes in large girder frameworks. We shall consider this idea. (*Reply to J. Neijts, The Hague, Holland.*)

AUTOGIRO PARTS.—The Cierva Autogiro is one of the most unconventional types of modern aircraft, and many model-builders who possess Meccano Aero Constructor Outfits are keen to build the "windmill" plane with their sets. The Autogiro incorporates numerous structural features that are not found in an ordinary aeroplane, and in order to build a perfect model several new parts such as rotor blades, pylon supports, special tail unit, etc., would have to be added. We shall consider the addition of these special parts, and in the meantime we would suggest that those boys who are particularly keen to build models of this type should devise the special parts from standard Meccano accessories. The Aeroplane Parts are interchangeable with standard Meccano parts, and there will therefore be no difficulty in fitting these in place. (*Reply to J. A. Fisher, West Bridgford; Evan Hulme, Masterton, N.Z.; R. O. Marsack, Masterton, N.Z.; and others.*)

PLYWOOD PANELS.—The covering of girder frameworks in large models often presents a difficult problem as a somewhat patchy effect is obtained if large numbers of Flat Plates are used. Your suggestion that a range of thin plywood sheets having perforations around their edges should be introduced would go a long way to solve the trouble, but the drawback to these parts would be their comparative inadaptability, and a large range would have to be introduced to fulfil all requirements. A system that proves satisfactory in many instances is to obtain sheets of very thin tin plate and cut these to the sizes required for the particular model. The plates thus formed may be easily perforated round their edges by means of a punch made from a standard Axle Rod. (*Reply to R. Harris, Carlisle.*)

NEW RUBBER RING.—A rubber ring of a suitable size for fitting to the Meccano 2" Pulley Wheel might rove a useful accessory. The ring might be employed when it was required to build up friction gearing using the 2" Pulleys, or in models of motor-cycles and push-cycles where the existing 2" Dunlop Tyre might appear rather large. The 2" Dunlop Tyre works remarkably well in friction gearing when used in conjunction with a Flanged Wheel, Pinion, etc., the studs of the tread providing a good grip. (*Reply to S. T. Downes, Farncombe; J. R. Ellington, Manchester; A. Robertson, Stafford, and others.*)



A Smoker's Stand

Model-Building Contests Results

By Frank Hornby

"Birds and Beasts" Competition

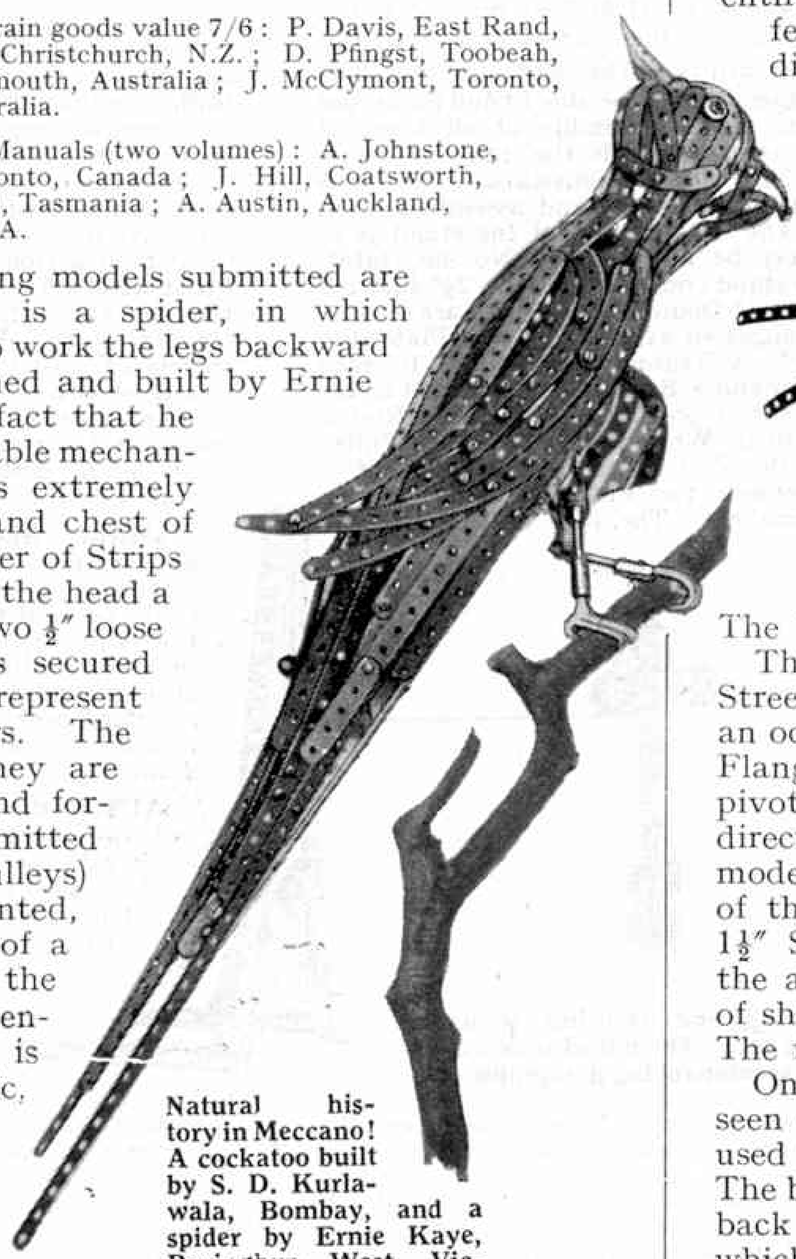
The full list of prize-winners in the Overseas Section of the "Birds and Beasts" Competition is as follows :—

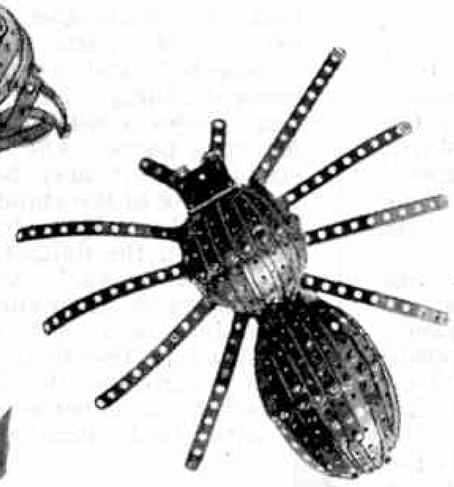
First Prize, Meccano or Hornby Train goods value £3-3s. : Ernie Kaye, Baringhup West, Victoria, Australia. Second Prize, goods value £2-2s. : S. D. Kurlawala, Bombay, India. Third Prize, goods value £1-1s. : D. Johnston, Wellington, New Zealand.

Six Prizes of Meccano or Hornby Train goods value 7/6 : P. Davis, East Rand, Transvaal ; W. Jones, Papanui, Christchurch, N.Z. ; D. Pfingst, Toobeah, Australia ; D. Menzies, New Plymouth, Australia ; J. McClymont, Toronto, Canada ; J. Street, Sydney, Australia.

Six Prizes of Meccano Instruction Manuals (two volumes) : A. Johnstone, Piora, N.S.W. ; W. Govan, Toronto, Canada ; J. Hill, Coatsworth, Canada ; R. Tennant, Launceston, Tasmania ; A. Austin, Auckland, N.Z. ; S. Bernstein, Capetown, S.A.

Two of the most interesting models submitted are illustrated here. The first is a spider, in which mechanism is incorporated to work the legs backward and forward. It was designed and built by Ernie Kaye, of Victoria, and the fact that he has been able to arrange suitable mechanism in so small a space is extremely interesting. The abdomen and chest of the spider consist of a number of Strips cleverly interwoven, and for the head a Channel Bearing is used. Two ½″ loose Pulleys and two 2″ Strips secured to the Channel Bearing represent the insect's eyes and feelers. The legs are 5½″ Strips, and they are made to move backward and forward by a drive that is transmitted from the road wheels (½″ Pulleys) on which the model is mounted, to an Eccentric, by means of a ½″ Pinion on the Rod of the road wheels. The Pinion engages a ¾″ Contrate that is connected to the Eccentric, and the legs are attached to a pivoted ring made from Curved Strips and connected by a 4½″ Strip to the arm of the Eccentric. As the model is drawn along the ground the road wheels cause the Eccentric to rotate and to transmit reciprocating motion to the 4½″ Strip, which in turn actuates the legs.





Natural history in Meccano! A cockatoo built by S. D. Kurlawala, Bombay, and a spider by Ernie Kaye, Baringhup West, Victoria.

The cockatoo shown here is the work of S. D. Kurlawala of Bombay, and with the exception of the feet and claws it is built entirely from Meccano parts. It is interesting to note that very few of the parts used have been mutilated, although many difficult curves have had to be reproduced. By using both coloured and nickelled parts Kurlawala has introduced a most realistic touch of colour into his model.

Third Prize was won by D. Johnston with a model of a goose. Owing to its peculiar shape this is a very difficult subject to reproduce in Meccano, but by building to a sufficiently large scale Johnston has managed to obtain quite a realistic result.

A "Cheshire cat," whose head is a 3″ Pulley, with Strips for ears and a Curved Strip for the mouth, is the subject of P. Davis' model. The body is a Sector Plate and Strips are used for the limbs.

The most fearsome "beasts" in the Contest were sent by J. Street and James McClymont. The former competitor built an octopus in which the body is a Face Plate bolted to two Wheel Flanges. The tentacles are each composed of two Curved Strips pivoted together with their convex edges pointing in opposite directions, in order to give a spidery appearance. McClymont's model is a dinosaur with a Boiler for its body ! A good feature of this model is found in the construction of the head from a 1½″ Strip, to which two Flat Brackets are bolted to represent the animal's ears. The legs are well thought out, and are built of short Strips pivotally connected end to end to give flexibility. The feet are formed from Flat Brackets.

One of the most novel uses for the Dredger Bucket that I have yet seen was displayed in the entry submitted by W. L. Govan, who used these parts to form the head, neck and wings of a sparrow ! The body of the bird is made from two Wheel Flanges held on a Rod back to back, and each fitted with a Boiler End, the closed ends of which face outward. The Dredger Buckets are fastened to the body by means of their clips.

"The Year's Best Model" Voting Contest

The voting in the Home Section of "The Year's Best Model" Competition resulted in the following models being chosen as the six best illustrated in the "Contests Results" pages of the "*M.M.*" during 1931. The order in which the models are placed is as follows :—

(1) L.N.E.R. Locomotive "No. 10000," by R. S. Miller, Newark (142 votes). (2) L.N.E.R. Locomotive "No. 10000," by R. O. Jukes, Christchurch, N.Z. (122 votes). (3) "Demag" Floating Crane, by K. Holland, Liverpool (72 votes). (4) Swiss Railway Bridge, by A. Robert, Johannesburg, S.A. (64 votes). (5) Gantry Crane and Locomotive, by E. Whalley, Blackburn (60 votes). (6) 50-ton Crane, by A. M. Campbell, Exmouth (54 votes).

By a curious coincidence the same six models were also chosen by competitors in the Overseas Section, a slight re-arrangement in the placing of the models being the only difference in the result, which is as follows :—

(1) L.N.E.R. Locomotive "No. 10000," by R. S. Miller, Newark (68 votes). (2) L.N.E.R. Locomotive "No. 10000," by R. O. Jukes, Christchurch, N.Z. (48 votes). (3) Gantry Crane and Locomotive, by E. Whalley, Blackburn (42 votes). (4) "Demag" Floating Crane, by K. Holland, Liverpool (38 votes). (5) 50-ton Crane, by A. M. Campbell, Exmouth (36 votes). (6) Swiss Railway Bridge, by A. Robert, Johannesburg, S.A. (34 votes).

No single competitor succeeded in placing all six models in the correct order, and the prizes were therefore awarded to the competitors whose lists were nearest correct.

The prize-winners in each Section are as follows :—

Home Section.

First Prize, Meccano goods value £2-2s. : Victor Kaile, Mayford. Second Prize, goods value £1-1s. : R. F. Nicholas, Portsmouth. Third Prize, goods value 10/6 : W. L. Maclean, Stornaway, Isle of Lewis.

Six Prizes of Meccano goods value 5/– : R. R. Pearce, Kingswood, Bristol ; Victor Knill, Thorpe Bay, Essex ; C. E. Wrayford, Moretonhampstead, Devon ; D. R. Cox, Romsey, Hants. ; A. M. Campbell, East Kilbride, Lanarkshire ; L. E. Copeland, London, S.E.24.

Twelve Prizes of Meccano Engineer's Pocket Books : T. Smith, Edinburgh ; R. Stevenson, London, N.W.9 ; H. Scarsbrook, Tilehurst, Berks. ; G. Marsh, Blackpool, Lancs. ; G. Lowe, Eastwood, Notts. ; H. Everitt, London, S.W.16 ; K. Bak, Leicester ; H. Hall, Wigan, Lancs. ; R. Langmuir, Glasgow, S.1 ; A. Warren, Norwich, Norfolk ; H. Barnfield, Plymouth ; R. Green, London, N.16.

Overseas Section.

First Prize, Meccano goods value £2-2s. : Horace Guallart, Buenos Aires, Rep. Argentine. Second Prize, Meccano goods value £1-1s. : D. J. White, Dunedin, N.Z. Third Prize, Meccano goods value 10/6 : Trem Watson, Leichhardt, N.S.W.

Six Prizes of Meccano goods value 5/– : D. Atkinson, Nowra, N.S.W. ; J. Rodriguez, Montreal, Canada ; Miss Maureen Dias, Bombay, India ; E. Bunt, Capetown, S.A. ; B. Choksi, Karachi, India ; J. Oleaga, Buenos Aires, Rep. Argentine.

Meccano Engineer's Pocket Books : F. Brown, Christchurch, N.Z. ; R. Russell, Whangarei, N.Z. ; D. Johnston, Wellington, N.Z. ; C. Humm, Geraldine, N.Z. ; A. Dickie, Mataura, N.Z. ; C. McCain, Sydney, N.S.W. ; R. Wragg, Rajputana, India ; R. Garcia, Trinidad, British West Indies ; E. Stonyer, Pleasant Point, South Canterbury, N.Z. ; A. Dempster, Warwick, Queensland.

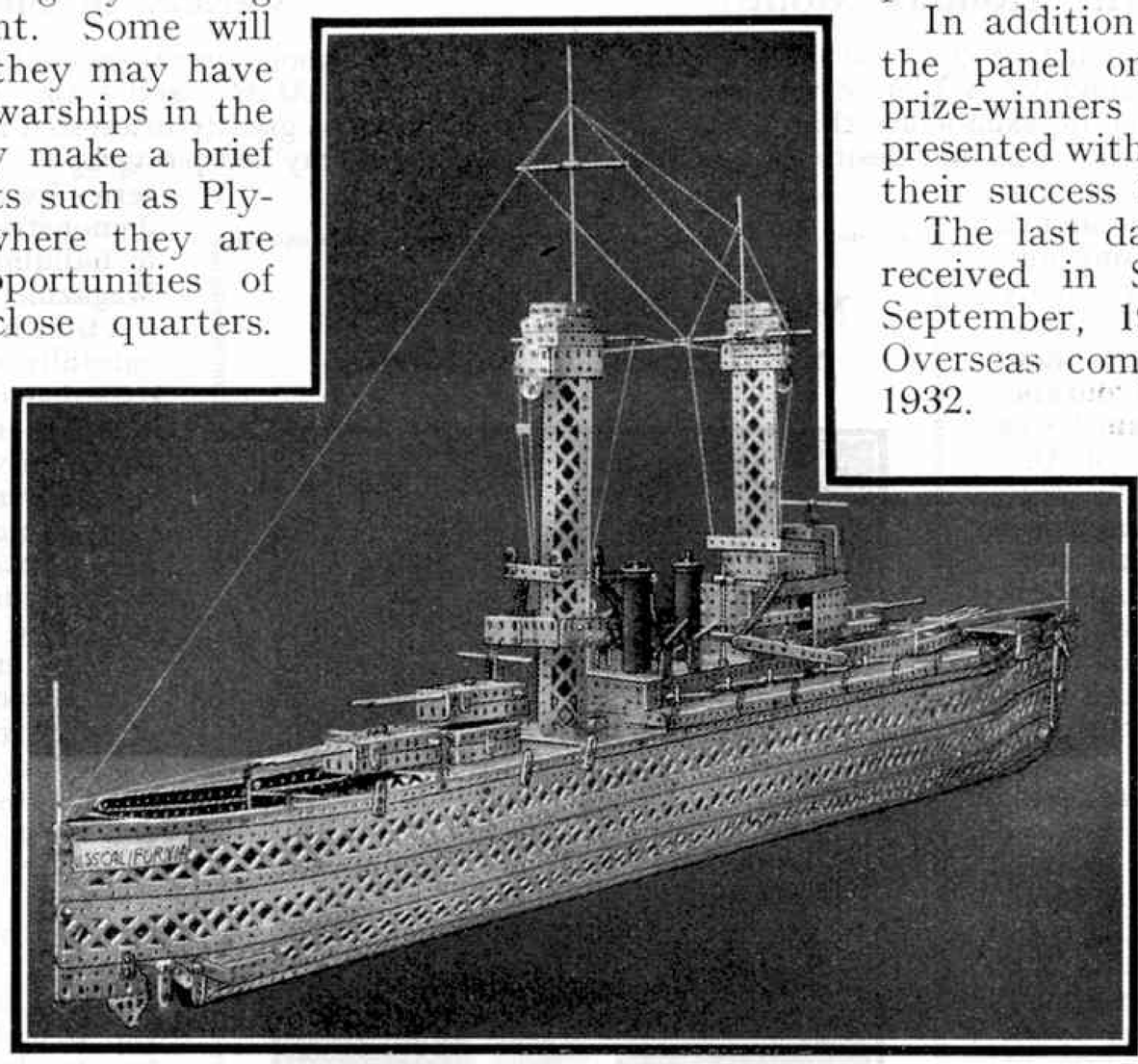
The builders of each of the six models chosen as the best illustrated during 1931 have each been awarded a prize of Meccano goods value 5/–.

"Warships" Model-Building Contest

More Fine Prizes to be Won

As the subject of this month's Contest we have chosen "Warships," and under this general heading we include battleships, cruisers, destroyers, submarines, aircraft carriers, and all the small craft used as auxiliaries to fighting ships.

At this time of the year most Meccano boys are either away on holidays or will be eagerly looking forward to the great event. Some will visit seaside resorts where they may have the good fortune of seeing warships in the harbours, while others may make a brief stay at one of the big ports such as Plymouth and Portsmouth, where they are almost sure to have opportunities of examining warships at close quarters. With the aid of a notebook and pencil they will be able to make sketches that will be helpful in designing entries for this Contest, so that when the holidays are over they can set to work on their models immediately. On the other hand, those model-builders who are not so fortunate as to be able to base their models on ships they have actually seen can easily obtain pictures of almost any kind of war vessel. Many illustrations of all kinds of naval craft have appeared from time to time in the "*M.M.*"



A big Meccano model of the U.S.S. "California," built by Clarence Robinson, Otago, New Zealand. The hull is 6 ft. in length.

To enter the competition it is only necessary to build a neat model of any of the various kinds of war vessels. Models representing subjects other than warships are not eligible for entry. Models may be built from any size of Outfit or number of parts, and more than one entry may be submitted if desired. A photograph or a drawing of the completed model is to be sent to this office, together with any description of its construction that may be considered necessary. Actual models must not be sent. The competitor's age, name and full address must be clearly written on the back of each photograph or drawing submitted, and the entry should be enclosed in an envelope addressed to "Warships Contest," Meccano Ltd., Binns Road, Old Swan, Liverpool.

Competitors should note that photographs of unsuccessful entries will be returned to the senders provided that a stamped addressed envelope of a suitable size is enclosed with the entry. Photographs of prize-winning models become the property of Meccano Ltd.

To ensure that each competitor has an equal chance irrespective of his age, the Contest will be divided into three Sections as follows:—A, for competitors over 14 living in the British Isles; B. for competitors under 14 living in the British Isles; and C, for competitors of all ages living Overseas.

In addition to the prizes announced in the panel on this page, the principal prize-winners in each Section will be presented with a Certificate commemorating their success in this Contest.

The last day on which entries will be received in Sections A and B is 30th September, 1932. The closing date for Overseas competitors is 30th November, 1932.

In choosing a subject the competitor should take into consideration the size of the Meccano Outfit at his disposal. If he possesses only a small Outfit, it is unwise to try to model a battleship or a cruiser. He will stand a greater chance of success if he confines his efforts to building a simple but effective model of a subject that is well within the capabilities of his Outfit, as for example a small naval pinnace.

The majority of prize-winning models in "*M.M.*" Contests owe their success largely to the skilful manner in which the various Meccano parts are used. It is a good plan therefore in building models for entry in this Contest to endeavour to devise new uses for the parts, and also to strive to secure good sturdy construction. These features will weigh heavily in a competitor's favour.

Many Meccano boys are restrained from entering Model-building Contests by the idea that the more parts put into a model the bigger the chance one has of carrying off a prize. This is quite a mistake. Every competitor is on a level footing, whether he owns a small or a large Outfit. In fact the owner of a small Outfit has an advantage over the owner of a No. 7, in that any really clever idea contained in his model will stand out prominently, whereas in a larger model the good points are often spoilt by poor design and construction.

Each model is considered entirely on its merits after allowing for the quantity and assortment of parts used in its construction.

Prizes Offered in this Contest

The Prizes to be awarded in Sections A and C are as follows:—
First Prize, Meccano or Hornby Train goods value £3 3s. 0d.
Second Prize, Meccano or Hornby Train goods value £2 2s. 0d.
Third Prize, Meccano or Hornby Train goods value £1 1s. 0d.
Six Prizes of Meccano or Hornby Train goods value 5/-.
Twelve Prizes of "Famous Trains" by C. J. Allen.

The Prizes in Section B are as follows:—
First Prize, Meccano or Hornby Train goods value £2 2s. 0d.
Second Prize, Meccano or Hornby Train goods value £1 1s. 0d.
Third Prize, Meccano or Hornby Train goods value 10/6.
Six Prizes of Meccano or Hornby Train goods value 5/-.
Twelve Meccano Engineer's Pocket Books.

Making the Best of the Holiday Month

In many clubs August is not a month of great activity indoors, for many members are away on holidays and those who stay at home usually are more interested in excursions than in other aspects of club life. There is no reason why this desire for outdoor activities should not be encouraged, and it is an excellent plan to devote the month entirely to cricket, tennis, swimming and other sports, or to rambles and more highly organised excursions to places of special interest to members. Unfortunately there is always the possibility of unfavourable weather to contend with. Meccano boys are not dismayed by obstacles of this kind, however, and games in the club room make excellent substitutes for cricket matches abandoned owing to rain.

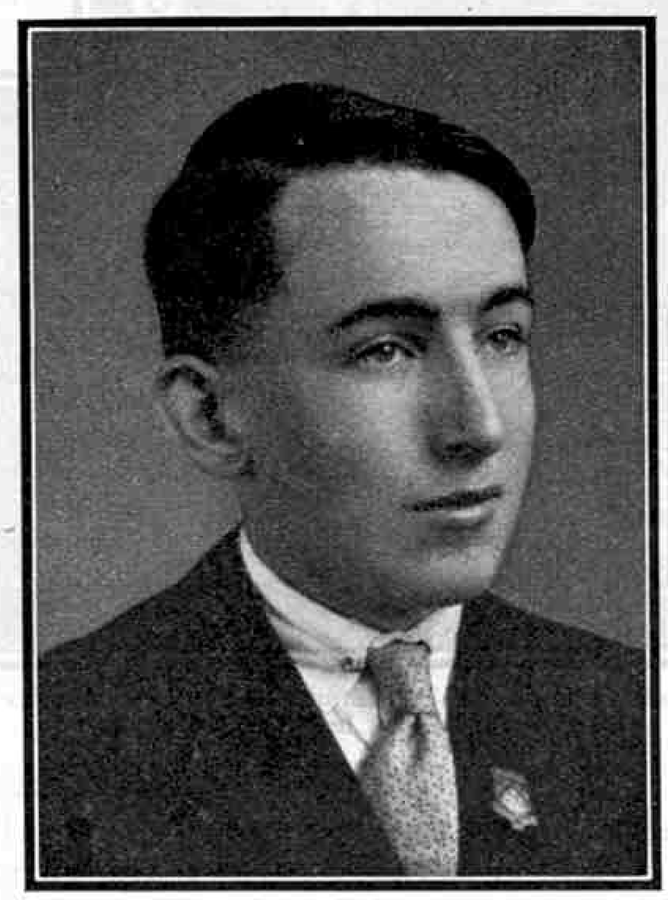
In such circumstances, an excellent alternative to indoor games is the pleasant task of overhauling club material and carrying out improvements in the club room that will make the work of the coming winter sessions more enjoyable. To begin well is the best means of ensuring a successful season, while on the other hand, nothing is more disheartening to members than to find the dark nights creeping upon them before a syllabus has been arranged, or the affairs of the club placed in order. For this reason a little time should be spared in August or early in September, even in fine weather, for preliminary work of this kind.

The "M.M." in Club Programmes

Several Leaders have written to welcome the suggestion I made last month that they should give details of any novel meetings they devise, and thus help other clubs to keep in touch with their progress and enable them to add variety to their programmes. One Leader makes the interesting comment that in many clubs insufficient use seems to be made of the "*M.M.*" If each issue is carefully studied, many valuable suggestions for competitions, lectures and talks may be gleaned from its pages.

In one very successful club, the use made of the "*M.M.*" goes much further than this, for its contents are made the base of a series of weekly competitions. These competitions usually take the form of questions and give members excellent opportunities for using their powers of observation and judgment. For instance, one week they were asked which club mentioned in the "*Club Notes*" page of the current issue they would like to join, and in another contest they were required to name the persons mentioned in the "*M.M.*" with whom they would prefer to change places. The reasons given by competitors for their selections in these novel contests were of the greatest interest to the Leader and helped him to realise the hopes and ambitions of the members of the club. Another contest took the form of an enquiry as to the number of different means of transport mentioned in a particular number of the Magazine. The result gave evidence of careful scrutiny of the articles and other features contained in that issue, for the winner discovered references to no fewer than 41 methods.

Meccano Club Secretaries
No. 23. W. J. T. Watson



Mr. W. J. T. Watson is secretary of the Sydney Meccano Club, and is so enthusiastic and energetic that he is secretary also of the associated Branch of the Hornby Railway Company. The Meccano Club was affiliated in January of this year, and has made splendid progress. The members attended the opening ceremony of the Sydney Harbour Bridge on 19th March. Afterwards they walked across the structure and back again, and now claim the distinction of being the first Meccano boys to have crossed the Bridge !

Variety in Simple Contests

Many ingenious questions could be based on the articles in each issue of the "*M.M.*" and I am quite sure that members of every club would be greatly interested in a series of contests of the kind described in my last paragraph. Variety could be added to such a series by asking members to give practical demonstrations of their constructional skill in building simple models described in the Magazine. Greater excitement is aroused if a time limit is imposed, but this should be carefully worked out by actual trial by an experienced member.

Another type of meeting that is popular is one in which all the members are asked to construct examples of a specially interesting model. An outstanding instance of a contest of this kind comes from an Australian club, the Leader of which suggested that each member should construct a model lighthouse. He stipulated that a candle was to be placed at the top of each structure, and that this was to show a flash in imitation of that given by a real lighthouse. Members entered eagerly into the spirit of the contest and showed great ingenuity in devising simple mechanisms to enable their models to fulfil the true purpose of a lighthouse, namely, showing a guiding light to distant seamen.

The Leader of the club wrote to express the wish that I could have been present to see how enthusiastic members were and to enjoy the wonderful effect when the Meccano lighthouses were lit up and the electric light in the club room was turned out. The members were so delighted with the display that most of them carried their models home with the candles still lit, to the combined astonishment and admiration of the people they met on the way !

Coming Events

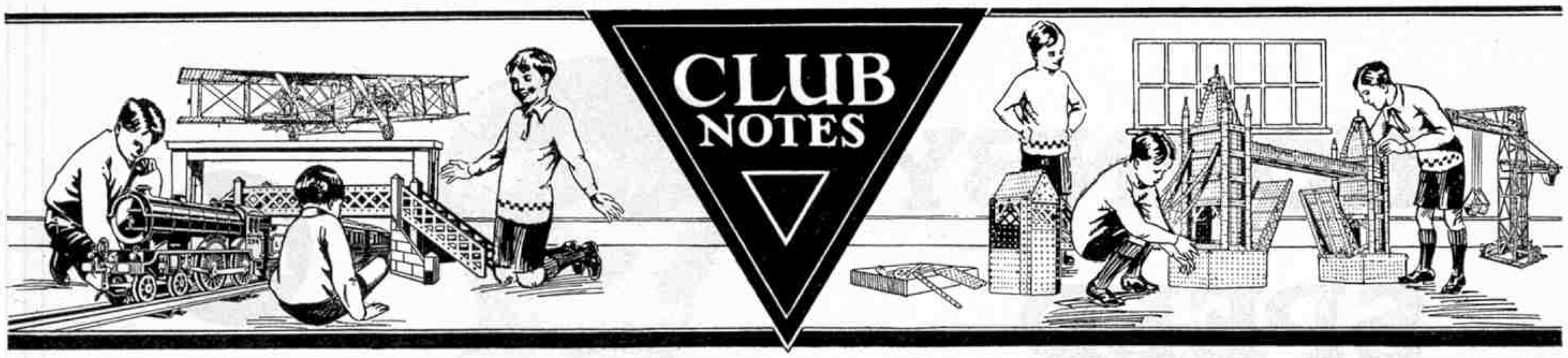
The Sydney (Australia) M.C. is holding an Exhibition in the club room 23a, Barker Street, Lewisham, Sydney, on 23rd and 24th September, to be opened on the first day at 4 p.m., and on the second at 2.30 p.m. The price of admission is 3d., Children 1d.

A sports meeting organised by the Meccano clubs of Bury St. Edmunds and the surrounding district is to be held on 18th August. Full details may be obtained from H. J. Minns, 35, Melbourne Villas, Out Risbygate, Bury St. Edmunds.

Proposed Clubs

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

AUSTRALIA—M. Davies, 178, Eleanor Street, Geraldton, W. Australia.
DUNDEE—Walter Coupar, 12, Arklay Terrace, Dundee.
ITALY—Mr. G. B. Tioli, 19, Via St. Anselmo, Rome.
LONDON—L. A. Hornsby, 83, Arnold Road, S. Tottenham, N.15.
SEVENOAKS—J. Kemp, 82, Granville Road.



Dagenham M.C.—This newly-affiliated club is making excellent progress. Meetings have been devoted chiefly to Model-building, but in addition members have read papers, and excellent lectures have been given. Country rambles have been arranged. Club roll: 14. *Secretary:* S. A. Pashley, 84, Holgate Road, Dagenham.

St. Peter's (Wolverhampton) M.C.—The chief recent event has been the appearance of the first issue of the club's Magazine, an excellent publication containing the story of the club's progress, in addition to reports of proceedings. A lecture on the "*York Railway Museum,*" illustrated by slides kindly loaned by the L.N.E.R., was given by the secretary, and outings have included visits to the Fire Station, the Bushbury Sheds and Sidings of the L.M.S.R., and Dudley Castle. Other interesting features have been Debates and Model-building Evenings, including Contractors' Nights. Club roll: 26. *Secretary:* R. F. Mann, 25, Queen Street, Wolverhampton.

Sid Vale M.C.—Interest in large models built by groups of members continues, and individual Model-building Contests also have been held, the subjects for these being unrestricted in order to encourage originality. The models constructed have included Motor Tank Wagons, Steam Wagons and Trailers, Searchlights and Workshops of a variety of designs. Cricket is played regularly, games in the club room being substituted when the weather is unfavourable, and a particularly attractive excursion consisted of a walk round the bounds of Sidmouth. Club roll: 25. *Secretary:* R. Gliddon, Sheffield House, Sidmouth.

Ipswich M.C.—The second Annual Exhibition was a great success, the receipts amounting to nearly £5, and many new members being recruited. The Exhibition was followed by an "American Tea" to celebrate the success of members' efforts. Interesting excursions and cycle runs are being enjoyed by members, and an attractive new venture is the introduction of gymnastic work and physical training. A room at the local Toc H. headquarters has been placed at the club's disposal, and members are now busy fitting it up with benches and shelves. A Club Camp has been organised, and it is hoped to arrange a second camping holiday at Aldeburgh during this month. Club roll: 16. *Secretary:* P. Samson, 81, Tuddenham Road, Ipswich.

Middlesbrough M.C.—Following on "Ghost Evening," an enquiry was made in order to find who was responsible for the hoax, and a member was found guilty of acting as the ghost's accomplice. Many interesting Model-building Competitions have been arranged, in addition to table tennis tournaments and Hornby Train nights. The winning paper in a special competition was on "*Events in the life of the Stationmaster at King's Cross.*" Mr. Thomas, Secretary of the Y.M.C.A., has kindly accepted the position of President. Mr. Thomas gave a talk on "*Pictures*" and took part in a games evening, when Y.M.C.A. members played an exhibition match of table tennis. Club roll: 40. *Secretary:* R. E. Rowlatt, 3, Blenheim Villas, Longlands Road, Middlesbrough.

Wembley M.C.—Keen interest was displayed in a Model-building Competition in which Mr. J. Cox, the local Meccano dealer, presented three prizes. On Woodwork Evenings, a model of King's Cross Station has been constructed, and in addition platelayers' huts, tunnel mouths and other railway accessories have been constructed. A group of members attended a meeting of the Harlesden M.C. at which a lantern lecture was given on "*The Production of a Daily Newspaper.*" A visit also has been paid to the Wealdstone M.C., members of the Harlesden M.C. accompanying the representatives of the Wembley Club. Club roll: 28. *Secretary:* E. Burns, 31, Oakington Manor Drive, Wembley Hill.

Heywood Regent Street School M.C.—A series of displays of models held during the last winter ended with a special Exhibition, at which Mrs. L. Standring, J.P., kindly presented the Merit Medallion to A. Griffiths. Mrs. Standring expressed appreciation of the splendid work of the club, in which she is greatly interested. A lecture has been given on "*Old Bury*" by Miss Edith Mahon, who is also a great friend of the club. Interesting visits to local places of interest have been arranged, and a day recently was devoted to an excursion as far afield as London. Club roll: 50. *Secretary:* William Mills ,31, Gooden Street, Heywood, Lancs.

Mall School M.C.—The programme includes Treasure Hunts, Cricket Matches and interesting excursions. On one outing members were shown round Bowater's Paper Mills at Dartford, the paper-making industry being fully explained and samples distributed. Model-building is the most popular feature, and races with Motor Cars have recently attracted special attention. Club roll: 48. *Secretary:* K. Harrison, 51, Newry Road, St. Margarets, Twickenham, Middlesex.

St. Feock M.C.—The most important recent event was the Annual Exhibition, which was opened by Canon Hardman, who gave a short address on "*The Story of Meccano.*" This was followed by the presentation of prizes, and afterwards visitors inspected the exhibits, which included Meccano models and Fretwork and Leatherwork. The proceeds amounted to more than £2. Renewed attention is being given to Model-building and entries in recent competitions have been larger and of better design and construction than before. Miss Jollief, the former Leader, has kindly presented new material for Leatherwork. Club roll: 11. *Secretary:* J. Rogers, West Trevilla, St. Feock, Nr. Truro.

Park Modern (Barking) M.C.—General Model-building nights have been varied by interesting Contests. In one of these Commercial Transport vehicles were built, and the excellent models on view included an Articulated Lorry and a Clockwork Tractor, both of which won prizes. Lectures have been given by Mr. J. Bright, Leader of the club, on "*Wireless Telephony,*" illustrated by means of the episcope, and by J. Clapham on "*Coins,*" a display of this member's excellent collection accompanying his talk. The club's recent Exhibition was very successful, the Cranes, Bridges and other models on view being supplemented by an extensive Hornby Train layout and a dockyard scene that greatly attracted visitors. Club roll: 18. *Secretary:* F. Tingey, "Hillcrest," 11, Shirley Gardens, New Barking, Essex.

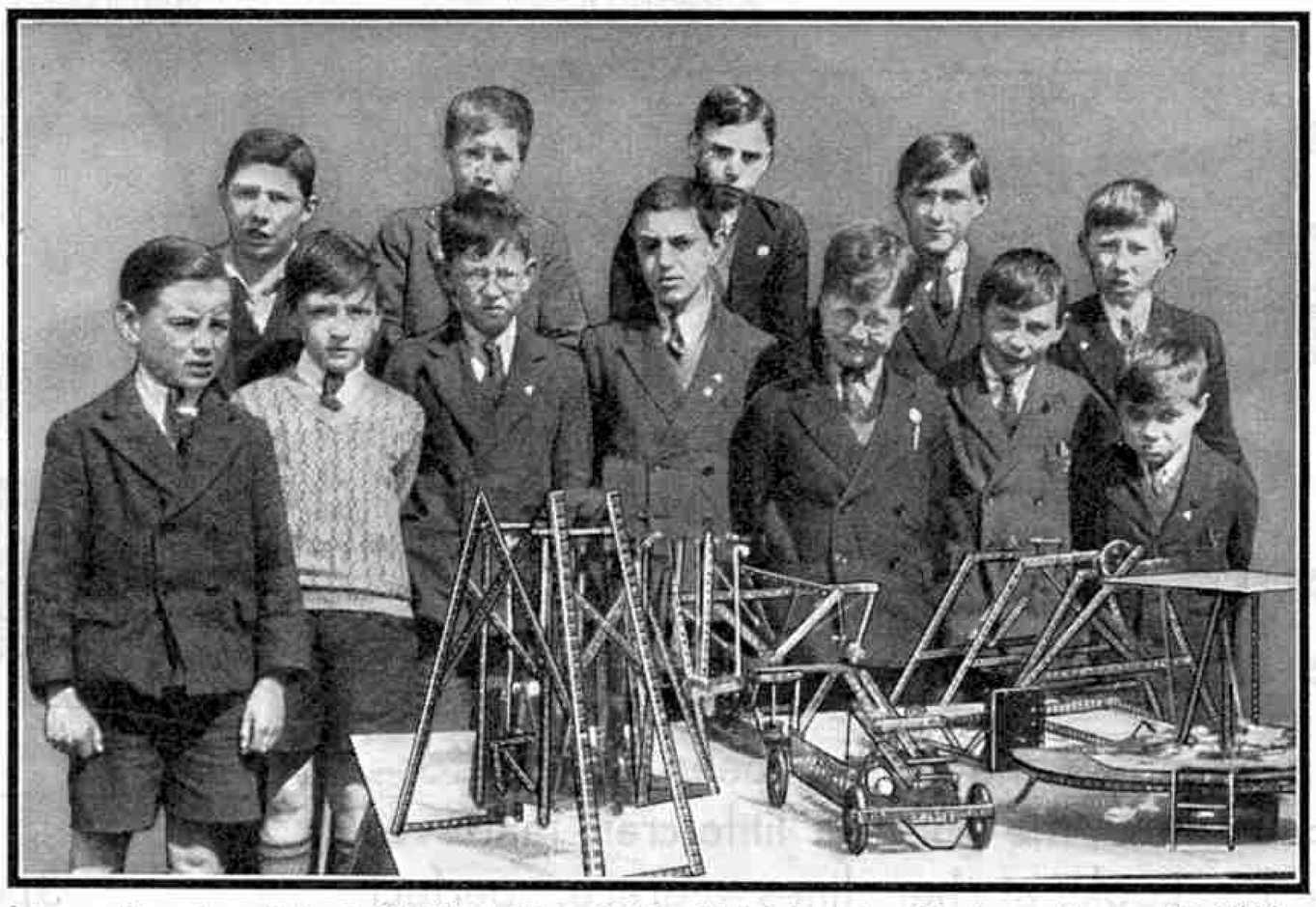
Harrogate and District M.C.—A party of members, accompanied by parents and friends, visited Liverpool recently, where they inspected the docks and were shown over the White Star motor liner, "*Britannic.*" A visit to the Meccano Factory followed, where an enjoyable time was spent in watching the making of Meccano Parts, Hornby Trains and other products. Club roll: 50. *Secretary:* F. Brown, 31, St. Nicholas Road, Harrogate.

AUSTRALIA

Sandgate (Queensland) M.C.—An interesting visit has been paid to the General Post Office, Brisbane, where members followed the progress of a letter from the post box to ts despatch. They also used the electric stamping machines and assisted in sorting newspapers. In the club room lectures on "*Stamps*" and "*Electricity*" have been given, and Model-building Contests and games arranged. Models built by members are exhibited regularly in dealers' windows, where they attract great attention. Club roll: 12. *Secretary:* J. R. Sheridan, Sandgate Street, Deagon, Brisbane.

Unley M.C.—Interesting combined Model-building schemes have been arranged, and for several meetings the club's Hornby Train layout was surrounded with Excavators, Cranes and other requisites for the construction of new lines and the necessary station buildings. A "Fire Engine" Evening provided an interesting competition, members building their models at one end of the room and pushing them to the scene of an imaginary fire at the opposite end, the first to arrive being awarded a prize. A Museum has been established, and visits to a local Fire Station, a Picture House and various factories have been arranged. Club roll: 7. *Secretary:* J. B. Edge, 62, Frederick Street, Unley, South Australia.

Woodville M.C.—Models built by members have included Lathes and Cranes, and the Sydney Harbour Bridge also has been a favourite subject. The club recently held its first Demonstration Evening, when parents and friends of members were invited. Models designed by members were exhibited, and prizes won during the session were presented. A Library has been formed, and the bound volumes of the "*M.M.*" and Meccano Manuals contained in it are of great assistance in Model-building. Two members were awarded model yachts as prizes in an Essay Competition organised locally. Club roll: 15. *Secretary:* D. R. Patrick, 22, The Grove, Woodville, South Australia.



A group of members of Macclesfield Central School M.C. with fairground models shown at a recent Exhibition. Under the energetic guidance of Mr. J. L. Camps, the Leader, and V. G. Walmsley, the secretary, this club has made excellent progress since its affiliation in February of this year, and an enthusiastic party of members recently visited Liverpool, where they inspected a liner in the docks and made a tour of the Meccano Factory.

Clubs Not Yet Affiliated

CANADA

Westmount M.C.—A club room has been secured at Victoria Hall. The programme includes Model-building, Lectures, Music Nights and indoor games. All Meccano boys in the district are cordially invited to the meetings, and the secretary would be glad to hear from those who wish to become members. *Secretary:* F. S. Thomson, 695, Grosvenor Avenue, Westmount.

NEW ZEALAND

Geraldine M.C.—Hard work on the part of the secretary and other keen pioneers has led to the formation of a strong organisation, members meeting regularly on Saturday mornings for Model-building purposes. The club's exhibit of models at a local show achieved a great triumph. A complete model railway was included in the display, which was arranged inside a special tent, and more than 400 visitors showed great appreciation. The receipts were £8 5s. 0d. Various interested supporters have presented a stove and coal with which to warm the club room, and also a petrol lighting outfit, and the prospects of the club are excellent. *Secretary:* E. C. Stonyer, Hilton, via Geraldine, South Canterbury.

HORNBY SPEED BOAT

500 feet on one winding!

Boys! This is what you have long been waiting for—the ideal Speed Boat, the smartest little craft that ever was launched. Look at her lines – grace, perfect symmetry, and speed written in every inch of her stream-lined hull. She's built to stay, too – 500 ft. on one winding! So here's your chance to smash all previous records!

The Hornby Speed Boat is equipped with powerful Spring Motor, Adjustable Rudder, Windscreen, Cockpit, and Ventilators. She is beautifully finished in three colour combinations:—Green and Ivory; Red and Cream; and Blue and White.

Buy a Hornby Speed Boat to-day, and win all the races on your local pond.

Special Features

500 ft. on one Winding.

Unsinkable.

Powerful Motor based on the experience that has made Hornby Trains famous.

Adjustable Rudder.

Overall measurements 16½ ins. from bow to stern and 3½ ins. wide in beam.

MECCANO LTD. - OLD SWAN - LIVERPOOL

Branch Notes

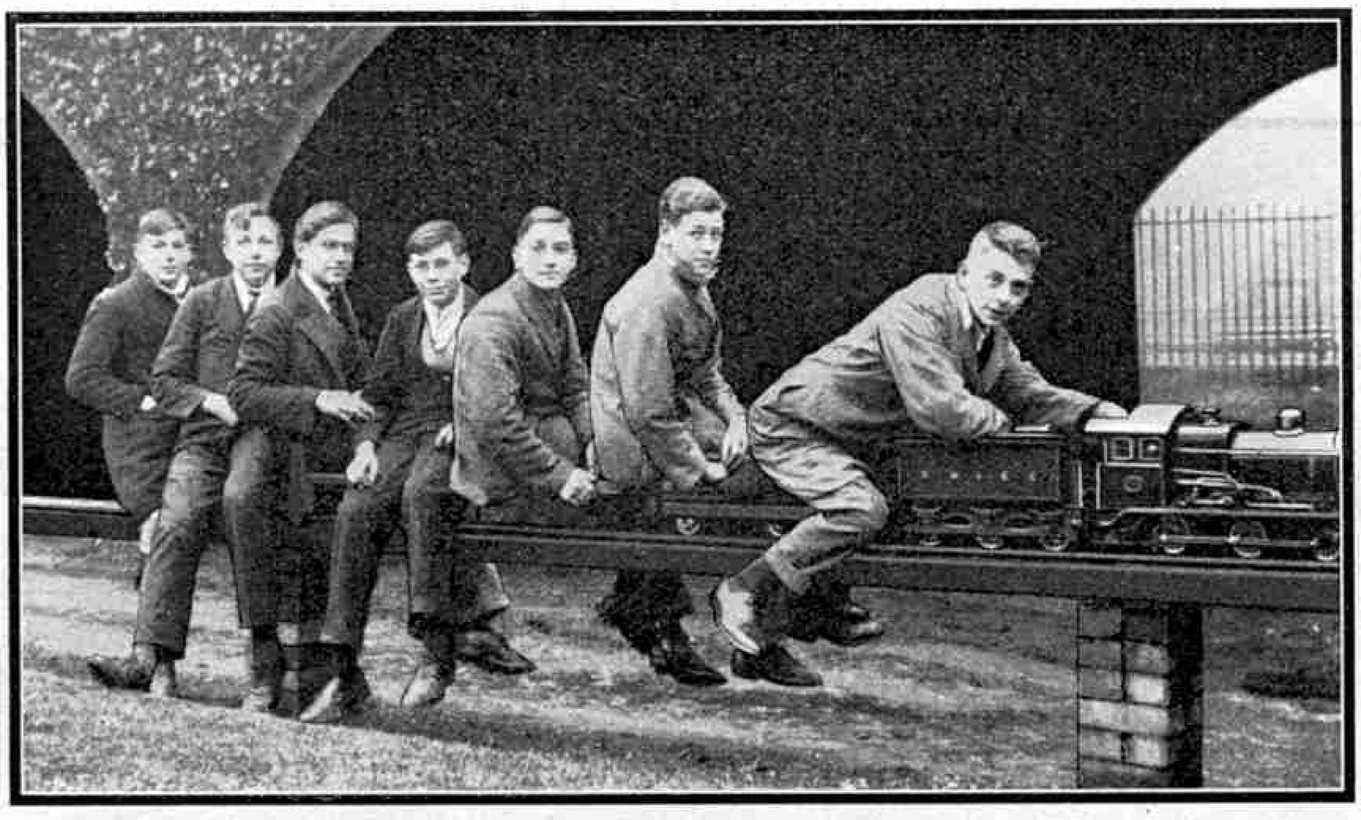
ST. ALBANS.—The ayout has been extended by the addition of further sidings and a large turntable in order to accommodate additional locomotives and rolling stock now available. A Meccano model of a Breakdown Trolley, to run on the Branch layout, was built by a member, and interesting use was found for it in dealing with derailments on the track. Special operations to time-table were carried out on one evening, when a number of visitors were present, and these expressed the greatest interest in the proceedings. Secretary: A. West, 6, Oswald Road, St. Albans.

HEYWOOD.—Successful track nights have been held, and parts of several meetings have been devoted to Games. Interesting lantern slides shown on one evening enabled members to compare pioneer locomotives and coaches with those in use to-day, details of each engine shown being read out by one of those present. Additional rolling stock has been secured and the re-building and extension of the track is being planned. Secretary: Miss V. W. Bennett, 7, Pym Street, Heywood.

ST. ANDREW'S CHURCH (COBHAM).—Track work has been carried on with various layouts planned to make shunting operations interesting. In a special competition prizes were awarded to the members who were able to make their locomotives stop nearest to a given point after covering a measured distance marked out on the track. A visit has been arranged to the home of a local railway enthusiast in order to inspect his broad gauge model railway. Secretary: A. E. J. West, "Fernlea," 13, Freelands Road, Cobham, Surrey.

STREATHAM COMMON.—A remarkably successful Exhibition was held in the large workshop of Mr. W. H. Hart, General Manager, and as this is under a railway arch, members claimed that they were in the right atmosphere. The 3½" Gauge railway, 120 ft. in length, illustrated on this page, was a great attraction to visitors, and inside the room there was a splendid display of locomotives and rolling stock and an excellent layout planned on a large scale. Engines, coaches and wagons built by members were shown at various stages of construction. The walls of the room were covered with interesting railway pictures and photographs. Secretary: L. J. Ling, "Brooke House," Rotherhill Avenue, London, S.W.16.

SKEGNESS.—As the track mainly consists of a single line, the special signalling and other arrangements for a layout of this kind are being fitted under the guidance of Mr. W. B. Roberts, who has succeeded Mr. C. R. Clarricoats as Chairman of the Branch, and is an experienced railway official. Accessories lent by individual members are being marked with their owner's initials. Visits have been paid to the Station and the local Gas Works, and an exciting debate on "*Rail v. Road*" has been held. Secretary: A. G. Osborn, "Lumley Lodge," Skegness.



Members of the Streatham Common Branch, No. 204, enjoying a run on the 3½" Gauge railway kindly lent by Mr. W. B. Hart, father of the General Manager, that formed an attractive feature of their recent Exhibition. This Branch was incorporated in November, 1931, with Mr. C. H. Stevens as Chairman and L. J. Ling as secretary, and members specialise in constructional work.

AUSTRALIA

MELBOURNE.—This newly incorporated Branch meets on Tuesdays at 7.45 p.m. at the address given below, and has been organised in conjunction with the Melbourne M.C. Members took part in an Exhibition organised by the Meccano Club, more than 1,000 visitors attending the display, which included two splendid model railway layouts. The net proceeds were £17 17s. 10d., part of which will be spent on railway material for the use of Branch members. A splendid programme of lantern lectures, debates and visits to works and steamships, in addition to track nights, has been arranged, and regular visits of inspection are being paid to passenger and goods stations. Secretary: L. Ison, 8, Hayes Street, Northcote, N.16.

SYDNEY.—Operations on the Branch layout are carried on regularly according to prepared timetables. Members must qualify by examination for such responsible positions as engine driver and foremen. A gramophone circle has been formed and other interesting events have included a visit to the P. & O. liner "*Strathaird*," and talks on "*The Romance of Meccano*" by Miss Hellewell of E. G. Page & Co., agents of Meccano Limited in Australia, and by Mr. F. G. Wallis, of the Melbourne Branch, on "*A Trip to the Brown Coal Works at Yallourn.*" Secretary: W. J. T. Watson, 595, Parramatta Road, Leichhardt, N.S.W.

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:—

CANADA—D. Taylor, 46, Manor Road, W. Toronto.

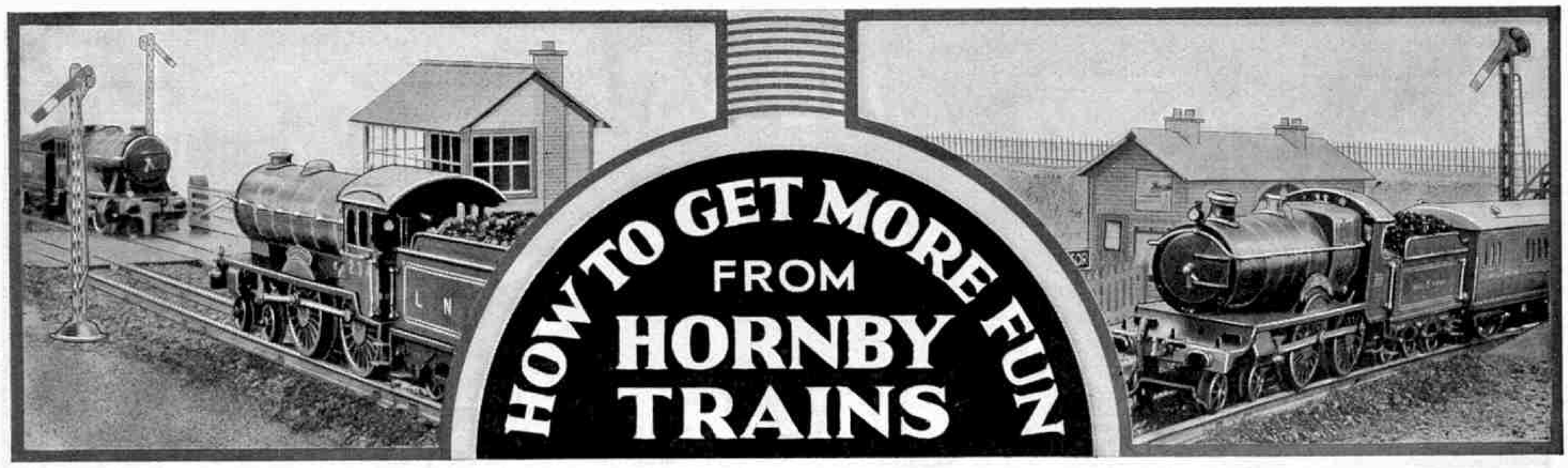
CANADA—A. Wallace, 2170, Trutch Street, Vancouver, B.C.

PRESCOT—J. Reynolds, "Nirvana," Eccleston Park, Prescot.

NEW ZEALAND—J. E. Barnsley, Newport Terrace, Seatoun Heights, Wellington.

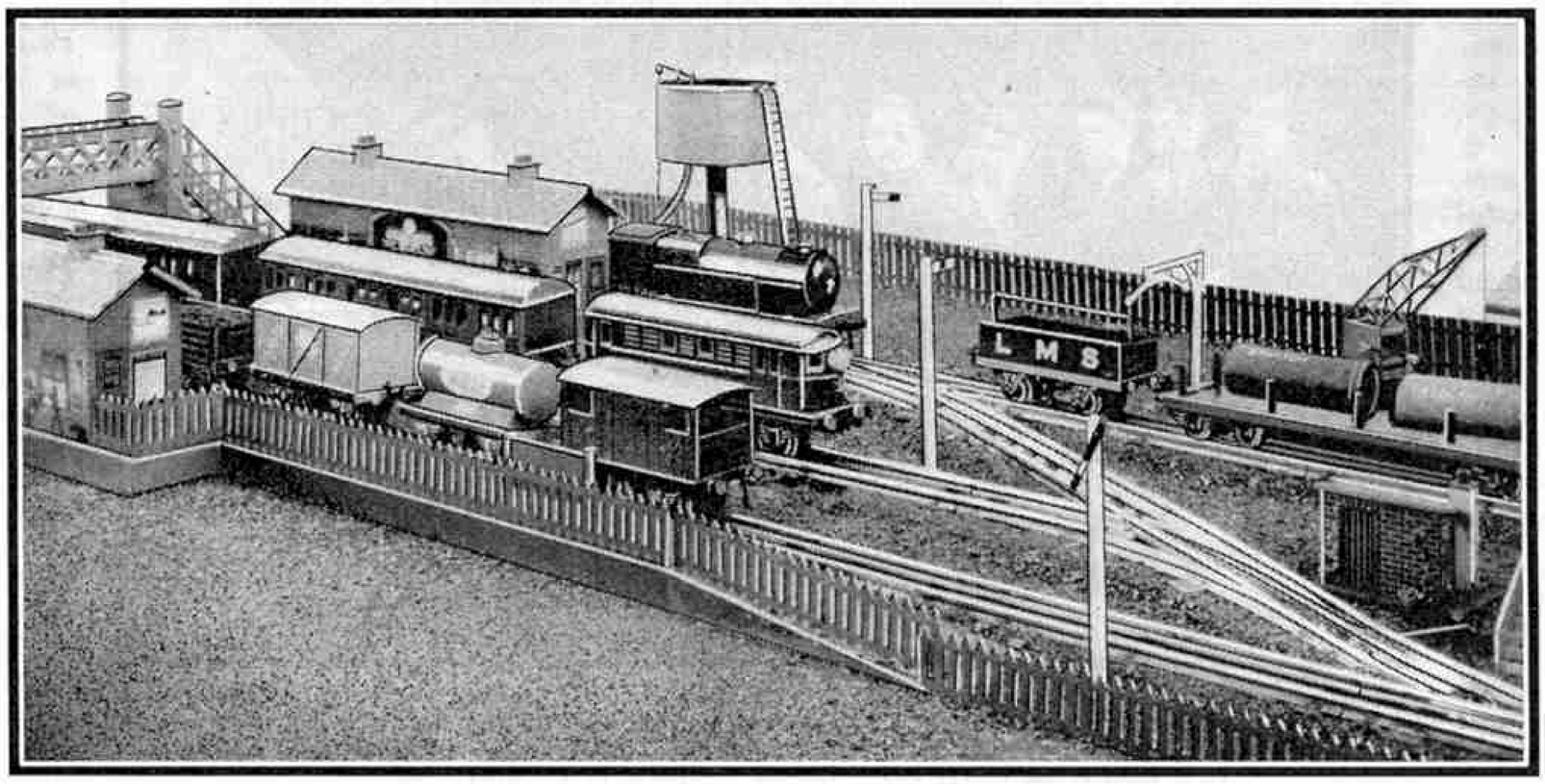
Branches Recently Incorporated

225. COLAC (AUSTRALIA)—D. H. M. Clarke, 13, Queen Street, Colac, Victoria.
226. LORDSHIP LANE SCHOOL (LONDON)—R. Carrington, 49, Russell Avenue, Noel Park, N.22.
227. SOUTH WIGSTON—H. H. S. Mansfield, 35, Westminster Road, Stoneygate, Leicester.
228. SAFFRON LANE (LEICESTER)—J. Goodman, 128, Saffron Lane.
229. CHRISTCHURCH—J. C. Fleming, 52, Cowlishaw St., Christchurch, N.Z.
230. SOUTHAMPTON—P. Atkinson, 27, East Park Terrace, Southampton.



XLVI.—PLANNING A "METROPOLITAN" LAYOUT

THERE is little doubt that the popularity of electricity as a motive power for miniature railways continues to increase, and more and more enthusiasts are converting their clockwork systems into electric ones. Useful aids in this conversion are the Centre Rails, Clips and Insulators introduced in the Hornby Series to enable existing clockwork track, of the type in which the sleepers have two central longitudinal slots, to be transformed for use with electric locomotives; and the Part Exchange Scheme, whereby the new locomotives required may be obtained by returning a corresponding number of old ones, together with the necessary remittance according to the conditions of the scheme. Miniature locomotive superintendents have not been slow to take advantage of the opportunities thus presented.



An interesting station layout suitable for engine changing. The "steam-outline" locomotive is preparing to take over the train from the electric engine as soon as the latter is uncoupled.

Those who favour the "steam-outline" type locomotive, but prefer electricity on account of the ready means of control that it affords, have a wide choice of locomotives in the Hornby Series. There are the No. 3E Locomotives, representing the chief express types of the four British groups, in addition to the "Riviera Blue" Locomotive. These may perform long non-stop runs, as do their prototypes, and are particularly intended for important express traffic. The No. 2 Electric Tank is suitable for heavy suburban and residential traffic, and also for hauling goods trains, while the No. 1 Permanent Magnet Tank Locomotive, on account of its great mobility, is a splendid engine for shunting and local passenger or goods work.

A more "electrical" atmosphere is given to a line by using the Hornby Metropolitan Electric Locomotive. This is a representation of the well-known electric engines that haul through trains between London and the country area served by the electrified section of the Metropolitan Railway. Some enthusiasts conduct the services of electric layouts entirely by this type of engine; but most prefer to use "steam-outline" locomotives on certain sections, true electric haulage being in operation over the remainder. This plan reproduces very closely the conditions of actual practice, and as it introduces more variety the scheme is perhaps the more interesting one on miniature layouts.

A problem that faces the owner of an electric layout who desires to operate perhaps several locomotives, but not necessarily at one time, is the fact that a simple electric circuit is continuous. That is to say, if there were two electric locomotives on the same track and the current were switched on, both would move slowly, no matter what their position. For this reason the line should be divided into sections in such a manner that the circuit may be continuous if necessary, while certain sections of the line, such as sidings, may be isolated. It should then be possible to run one of our locomotives with a train, while the other is halted on a siding, or is standing by in the engine shed.

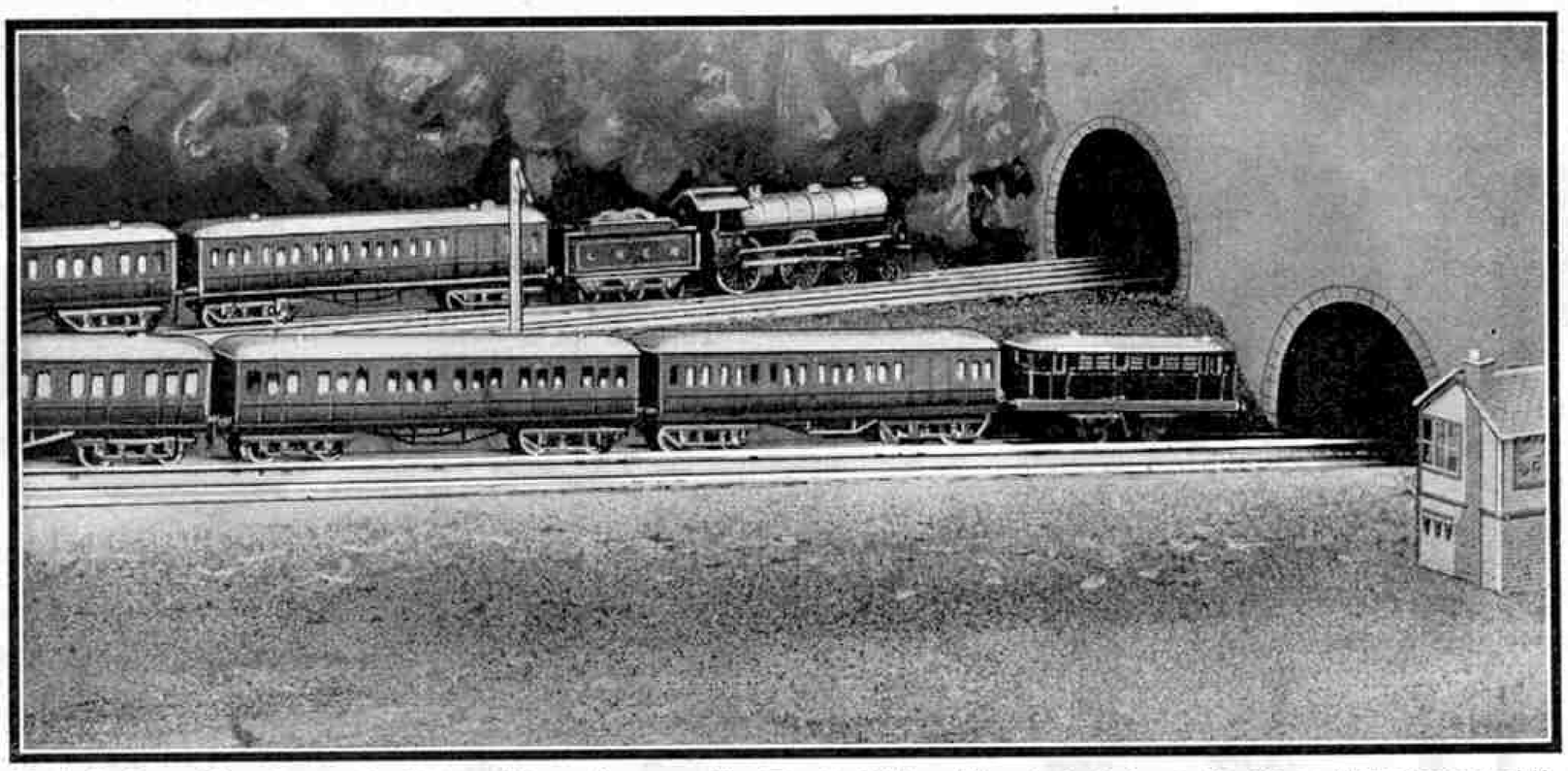
If it is desired to operate two or more locomotives simultaneously, additional Transformers or Accumulators are necessary, as each of these is intended to operate one locomotive only.

In order to isolate sections of the track, all that is necessary is to leave gaps in the centre rail at certain points, and this may be done satisfactorily by two methods. The first of these is to withdraw the spike at one end of a length of the centre rail at the selected places. As a result of this, a gap is left between the ends of adjacent centre rails and two such gaps cut off a section. The spikes in the running rails must not be disturbed, as these keep the rails in correct position.

When the track is connected up by means of the Connecting Plates the Centre Rails are so near together that there is a danger of their touching, and the gaps should be filled with a suitable insulating material. For this purpose, one of the Insulators used for the conversion

of the track is cut and folded, and then placed between the adjacent centre rails before fitting the Connecting Plates. When all is connected up, the piece of insulator is gripped tightly in position between the Centre Rails.

The second method of securing the required isolation is to insert in the required portion a quarter length rail of the ordinary clockwork type. If this method is adopted it may be found that the collector shoes of the locomotive strike the end of the centre rail at each gap. This difficulty is overcome by inserting a spike in one end of the centre rail and bending it down slightly. This acts as a ramp, up which the collector shoe slides easily on to the centre rail.



Part of a layout based upon the Metropolitan railway. The Hornby Metropolitan train is descending to an " Underground " section, while the L.N.E.R. express proceeds to its own terminus at the normal level.

The Accumulator and Resistance Controller are connected to the track at any convenient point by means of the Terminal Connecting Plate. The centre rails on each side of the gap must now be wired up to a simple switch, so that the gap may be bridged electrically when required, and the current distributed to the sections. The best method of joining the wires to the centre rails is by means of a Terminal Connecting Plate. For this purpose only the terminals on the fuse side of the Plate are required, as the connection is made to the centre rail only. Fuse wire should be arranged on each Plate in the usual manner to guard against any short circuit that may occur. Thus one side of the gap is connected from its Terminal Plate to one side of the switch, and the wire from the other side of the Plate to the other side of the switch.

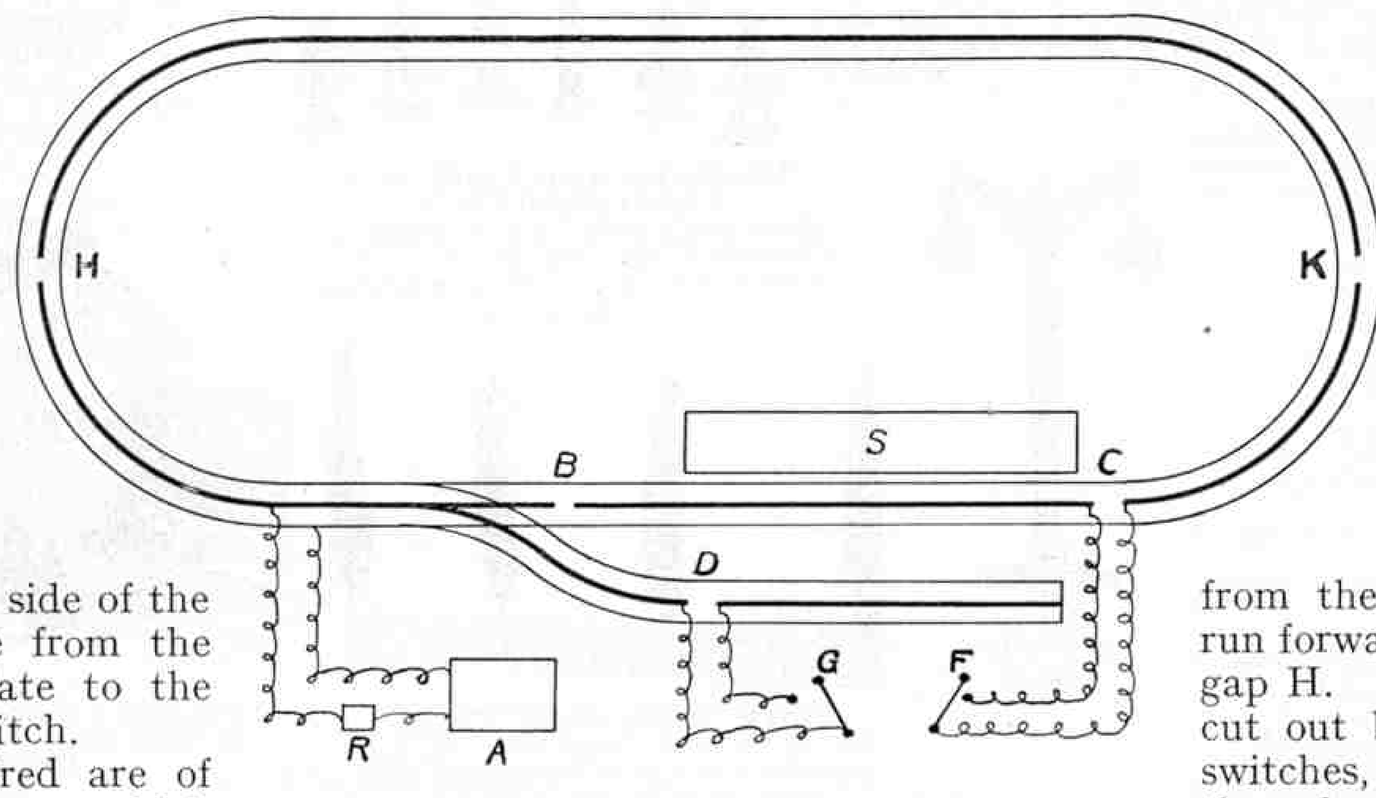


Diagram of an electric layout as described in this article. Gaps are arranged in the third rail to form different sections, each controlled by a switch. For convenience in the illustration only two switches F and G are shown.

The switches required are of the single-throw pattern, which may be obtained from any electrician for a few pence. Those who prefer to do so may make their own switches from Meccano parts. By using a larger baseplate two or more switches may be mounted side by side to form a switchboard, which is a great convenience in actual working.

Dividing the line into sections gives to an electric railway a remarkable degree of realism, particularly when the stock is fitted with automatic couplings. Thus on a miniature system where a Metropolitan Locomotive and a " steam-outline " electric locomotive are in service, suitable arrangements may be made to enable these to be exchanged at a suitable point, the " steam " locomotive hauling the train over the country section, and the electric one completing the journey through the suburban area and underground, exactly as in actual practice.

A useful arrangement for this is illustrated in the accompanying diagram. The layout shown includes a station and siding where the exchanges may be carried out. The main line is single track, and is divided into four electrical sections, the siding itself forming an additional section. Gaps in the centre rails are arranged at the points B, C, H and K on the main line, and D in the siding. Although only the gaps C and D are shown wired up to the switches G and F, each gap must be wired to its corresponding switch in the same manner, and all the switches may be mounted upon one base, as suggested previously. For the sake of clearness in the illustration, however, the wiring of the gaps B, H and K is not shown.

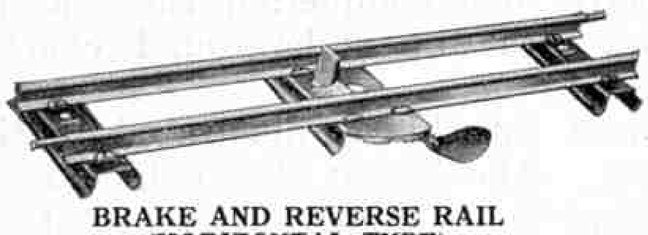
We will assume that a train drawn by a Metropolitan Electric Locomotive is travelling along the main line in a clockwise direction. The switches for all sections, except that for D, are closed, so that current is being supplied to the whole of the main line, and a No. 2 Electric Tank Locomotive is standing in the siding. The Metropolitan train reaches the station and is stopped on the section BC, after which the engine is uncoupled from the train, and allowed to run forward until it is clear of the gap H. The section HK is next cut out by manipulation of the switches, and the switch G is then closed. This puts the siding into circuit, and the " steam-outline " locomotive is run out of the siding on to the section BH of the main track. When it is clear of the points it is stopped, and the reversing lever in the cab is operated. The points are then set for the straight and the locomotive is backed on to the train in the section BC.

The Metropolitan Electric Locomotive must now be shunted out of the way. The section BC therefore is cut out by opening the necessary switches, and the section HK put into circuit again. The Metropolitan engine is then reversed, and backed into (Continued on page 652)

HORNBY ACCESSORIES

HORNBY SERIES

GAUGE 0



BRAKE AND REVERSE RAIL (HORIZONTAL TYPE)
This special rail is designed on an entirely new principle. It has independent catches for reversing or stopping the train. These are operated quite simply by means of one control lever. Price **1/6**

The range of Hornby Accessories, already comprehensive, has now been increased by the addition of a number of splendid new items. A selection of these is illustrated and described below. If you are a Hornby enthusiast you will appreciate at once the extent to which the new Tunnels, Cuttings, etc., will enhance the realism and effectiveness of your Hornby railway layout.

Ask your dealer to show you these new goods.

MECCANO LTD., OLD SWAN, LIVERPOOL

STATION HOARDING
This is a realistic accessory, suitable for the station platform. Price **8d.**

Station Hoarding

POSTER BOARDS to carry Hornby Miniature Posters. Provided with lugs for attachment to paled fencing, etc. Packet of 6 (3 large, 3 small), Price **6d.**
POSTERS IN MINIATURE are reproductions of familiar national advertisements. They are intended to be pasted on the Station Hoardings or the Poster Boards described above, and are beautifully printed in full colours. Packet of 51 .. Price **6d.**

TUNNEL No. 0 (Straight)
Length 6 in., width $6\frac{1}{8}$ in.
Price **1/6**
TUNNEL No. 1 (Straight)
Length 7 11/16 in. Width $6\frac{1}{4}$ in. (as illustrated).
Price **2/-**
TUNNEL No. 2 (Straight)
Length $15\frac{5}{8}$ in. Width $9\frac{1}{2}$ in. Price **4/-**

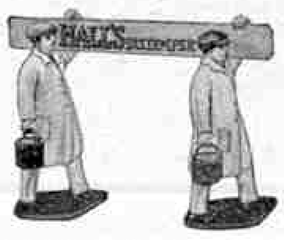
TUNNEL No 3. (Curved)
Length 13 in. Price **4/6**
TUNNEL No. 4 (Curved)
(as illustrated)
Length 20 in. For 2 ft. radius tracks only. Price **5/6**

TUNNEL No. 5 (LEFT-HAND, CURVED)
(as illustrated)
This tunnel is in the form of a small hill, through which the track runs obliquely. For 2 ft. radius tracks. Base measurement: $15\frac{7}{8}$ in. × $14\frac{3}{4}$ in. Length of track $17\frac{1}{4}$ in.
Price **7/6**
TUNNEL No. 6 (RIGHT-HAND, CURVED)
Similar to No. 5 Tunnel, but with track in the reverse position. For 2 ft. radius tracks only. Base measurement $15\frac{7}{8}$ in. × $14\frac{3}{4}$ in. Length of track $17\frac{1}{4}$ in. Price **7/6**

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

CUTTING No. 1 (END SECTION)
(Illustrated)
Base measurement: Length 7 11/16 in., width 6 in. Price, per pair **3/-**
CUTTING No. 2 (CENTRE SECTION, STRAIGHT)
(Illustrated)
The addition of these centre sections enables a Hornby Railway cutting to be extended to any length. They are intended to be used in conjunction with the End Sections (Cutting No. 1), between which they are fitted.
Base measurement: Length $10\frac{1}{4}$ in., width 6 in.
Price **2/-**
CUTTING No. 3 (CENTRE SECTION, CURVED)
This is used for curved tracks in the same manner as the straight centre section, described above, is used for straight tracks. It is suitable for both 1 ft. and 2 ft. radius tracks. Price **2/-**

MODELLED MINIATURES No. 1 STATION STAFF
These splendid models, which are beautifully enamelled in colours, add the final touch of realism to Hornby Station Platforms. Price **2/-** per set.



MODELLED MINIATURES No. 13 HALL'S DISTEMPER ADVERTISEMENT
This miniature of a well-known line-side advertisement is intended to be placed in the fields adjoining the railway track. Price **1/-**

Cutting No. 4

CUTTING No. 4 (STRAIGHT)
This is a double cutting, mounted on a base over which the railway track is laid.
Base measurement: Length $15\frac{3}{8}$ in., width 15 in. Price **6/-**

MODELLED MINIATURES No. 21. TRAIN SET
This new miniature train set is a very attractive model. It includes die-cast Locomotive, Wagon, Crane Truck, Lumber Wagon and "Shell" Petrol Tank Wagon. Price **3/-**

MODELLED MINIATURES No. 4 ENGINEERING STAFF
This set comprises six figures representing Electrician, two Fitters, Storekeeper, Greaser and Engine Room Attendant.
Price **2/-** per set.

MODELLED MINIATURES No. 5 TRAIN AND HOTEL STAFF
Five figures are included in this set, including Pullman Car Conductor, two Pullman Car Waiters and two Hotel Porters.
Price **2/-** per set.

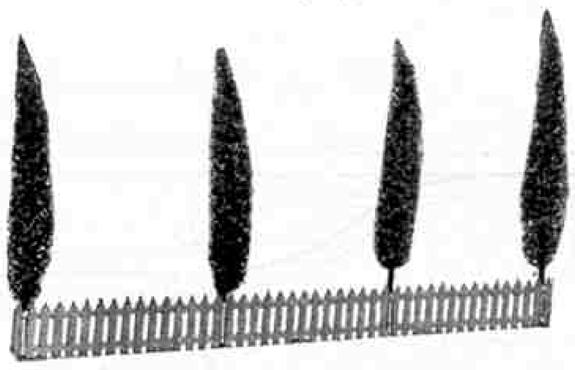
TRAIN NAME BOARDS
These name boards are for No. 2 Pullman Coaches and add greatly to the realistic appearance of the coaches. Details are as follows:—

No. 1 The Flying Scotsman.
No. 2 The Scarborough Flier.
No. 3 The Royal Scot.
No. 4 The Merseyside Express.
No. 5 The Golden Arrow.
No. 6 The Bournemouth Belle.
No. 7 Cornish Riviera Express.
No. 8 Torbay Limited Express.
No. 9 King's Cross, York and Edinburgh.
No. 10 King's Cross, Edinburgh and Aberdeen.
No. 11 London (Euston) and Liverpool (Lime Street).
No. 12 London (Euston) and Glasgow (Central).
No. 13 Victoria and Dover.
No. 14 Waterloo, Salisbury and Exeter.
No. 15 Paddington, Exeter and Plymouth.
No. 16 Paddington and Bristol.

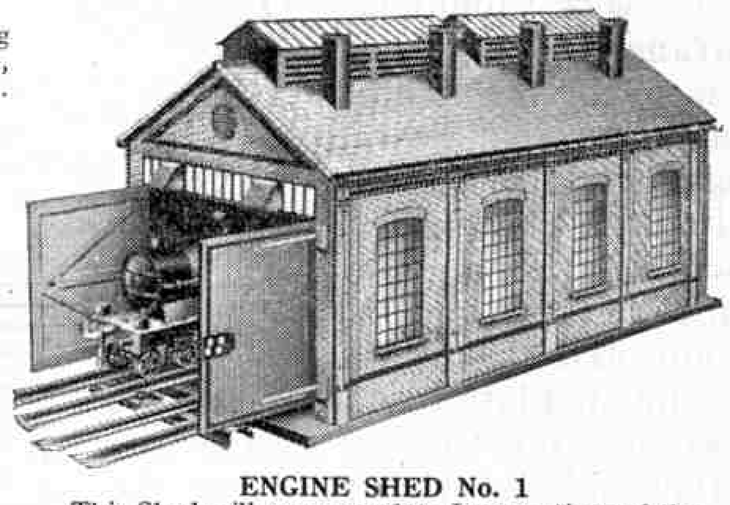
Price per packet of four of a kind, **4d.**

CLIPS FOR TRAIN NAME BOARDS
These clips are for use with coaches that are not fitted with brackets to take the Name Boards. There are two types: No. 2S, for No. 2 Special Pullman and No. 2 Special Pullman Composite Coaches; and No. 2, for No. 2 Pullman and No. 2 Saloon Coaches. Price per packet of twelve, **1/-** (either kind).

LAMP STANDARD No. 2
(Double)
Price **4/6**



FENCE WITH FOUR TREES
This is the well-known Paled Fencing, provided with four detachable miniature trees fixed in special sockets.
Price, per pair **2/6**



ENGINE SHED No. 1
This Shed will accommodate Locomotives of the M Series, No. 0 and No. 1 types. Price **15/-**
ENGINE SHED No. 2
(as illustrated)
This Shed will accommodate any of the Hornby Locomotives and Tenders. Price **22/6**

MODELLED MINIATURES No. 3 PASSENGERS
This set contains figures as illustrated, representing various types of railway passengers. Price **2/-** per set.

HORNBY ACCESSORIES FITTED FOR ELECTRIC LIGHTING. The following Hornby Accessories will in future be available suitably wired and fitted for electric lighting. These items are additional to the ordinary range.

Engine Shed No. E1E, Electrical	Price	18/6	
Engine Shed No. E2E, Electrical	,,	26/-	
Station No. 2E	,,	12/6	
Island Platform E	,,	9/-	
Goods Platform E	,,	15/-	
Signal Cabin No. 2E	,,	5/6	
Signal No. 2E	,,	4/6	
Double Arm Signal No. 2E	,,	6/6	
Junction Signal E	Price	10/-	
Signal Gantry E	,,	18/-	
Level Crossing No. E1E, Electrical	,,	7/-	
Level Crossing No. E2E, Electrical	,,	11/-	
Buffer Stops No. 1E	,,	2/-	
Buffer Stops No. 2E	,,	7/-	
Water Tank E	,,	10/-	

In order to facilitate the electrical connection of the above range of accessories, we have introduced a series of flexible leads, fitted with plugs at one end and sockets that fit the accessories at the other. These leads are available in 3 lengths:—9 in., 18 in., and 36 in.—prices—**1/4, 1/5, 1/6** respectively.

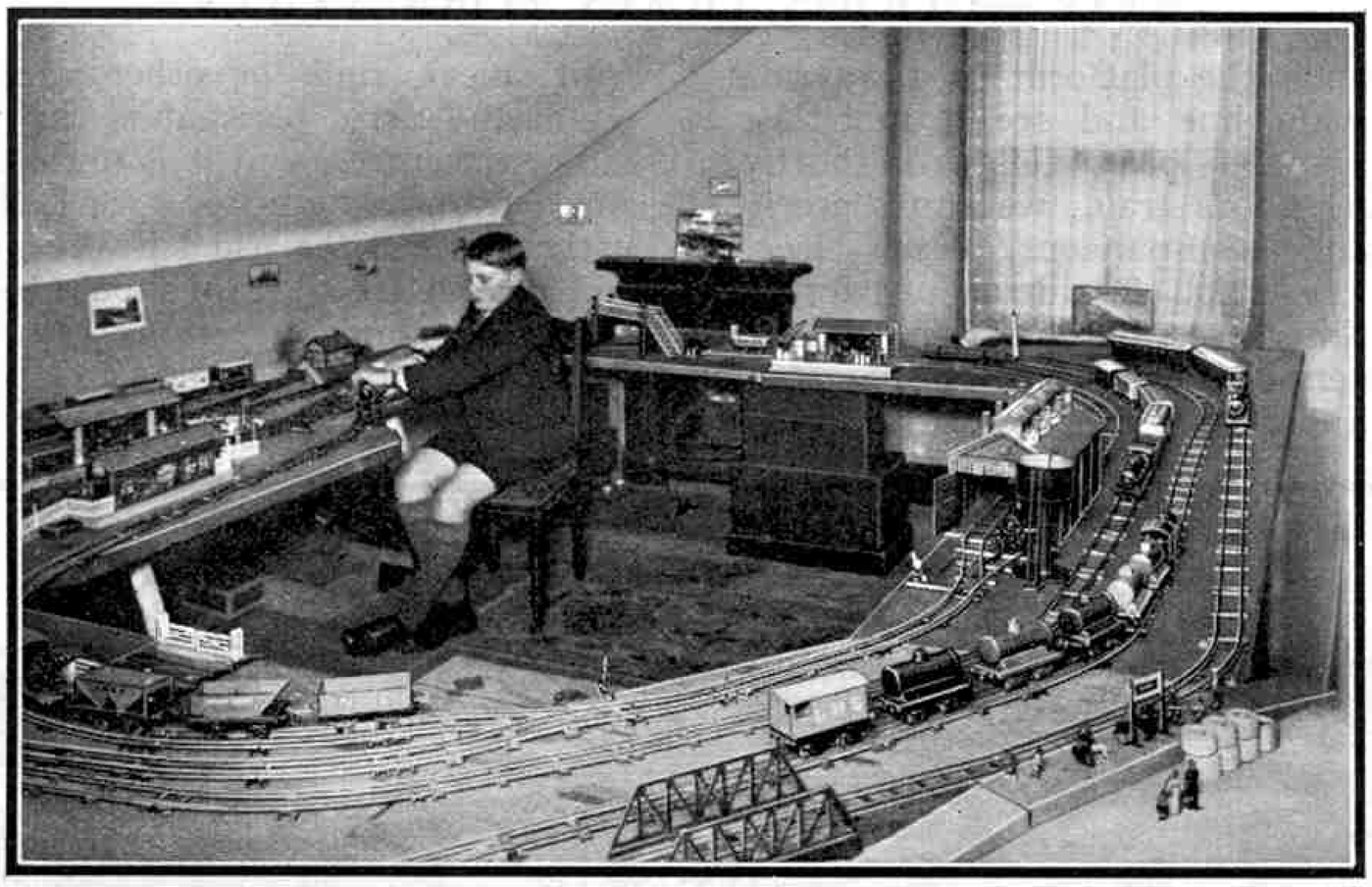
We have also introduced a special Distribution Box to enable two or more accessories to be lighted simultaneously. This appliance is fitted with a pair of plugs, for connection to the transformer or accumulator, and also with five pairs of sockets to accommodate the flexible leads described above. Price of Distribution Box **2/6.**

An Interesting "Continuous" Layout

G. R. Ingham's Hornby Railway

THE charm of operating a miniature railway system is recognised by all "*M.M.*" readers, so that they will be interested in the following details of a fascinating "continuous" track. This is owned and operated by G. R. Ingham, of Southport, whose system started in a simple manner about nine years ago. A few minutes' study of the diagram on this page will show that, although the line appears to be elaborate, the general scheme is really quite straightforward. Four tracks are available most of the way, and it is possible to reach practically any line from any other with little trouble.

Taking the various lines in order, Line A is on the extreme outside as the diagram shows, and a train running on it may traverse the track as many times as required. In the course of its journey, assuming that it leaves the passenger platform, it passes a Viaduct, Level Crossing, and several signals. It may travel in either direction, and on reaching the points may be diverted to Line B. Having completed on the main line a circuit, or several if desired, we will suppose that the train is travelling in an anti-clockwise direction, and is approaching the facing points by the Signal Cabin. By means of these points it may be diverted to any of three platform roads. After having been dealt with at the platform the train may still be passed on to Line E by means of the points 10 and 11.



An interesting photograph showing the layout of G. R. Ingham, of Southport, who is seen controlling operations. Four tracks are available almost throughout, and through running from one to the other is readily possible.

The Goods Platform, G.P.1, is usually used for through fast goods traffic, for trains may be dealt with easily on both roads, so that they may be readily got away. Slow goods traffic is accommodated at the other Goods Platform, G.P.2. Trains on line C requiring to proceed to G.P.2 are brought to a stand beyond the points 13. A small locomotive proceeds from the Engine Shed on to the tail of the train and, after the main line engine has been detached, hauls the train backward alongside the platform. The main line engine, by means of points 6, 7 and 8, can reach line E and proceed to the Engine Shed without any interference with main line traffic. The provision of a through line in the Shed is thus a useful feature, as engines may readily be worked in or out in either direction.

As continuous working is the chief feature of the layout, only two dead-end sidings are included. The one near the station is used as a carriage siding, and its position is very suitable for the purpose. Engines can easily bring coaches from the siding into the station and commence the service, and of course the vehicles may be disposed of rapidly at the end of their turn of duty. The other siding, which is actually a prolongation of one of the shed roads, is generally reserved for the storage of wagons that are not in use.

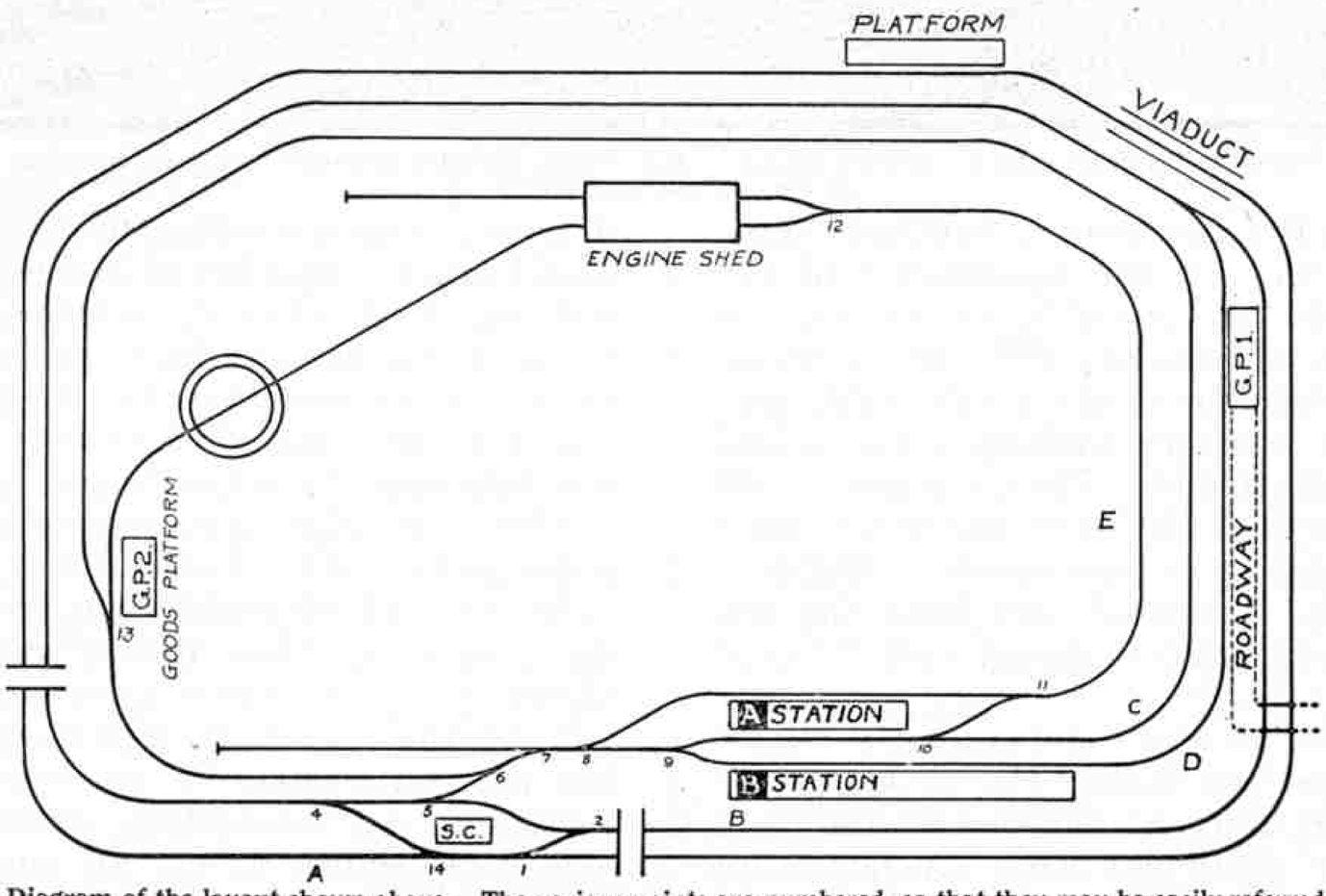
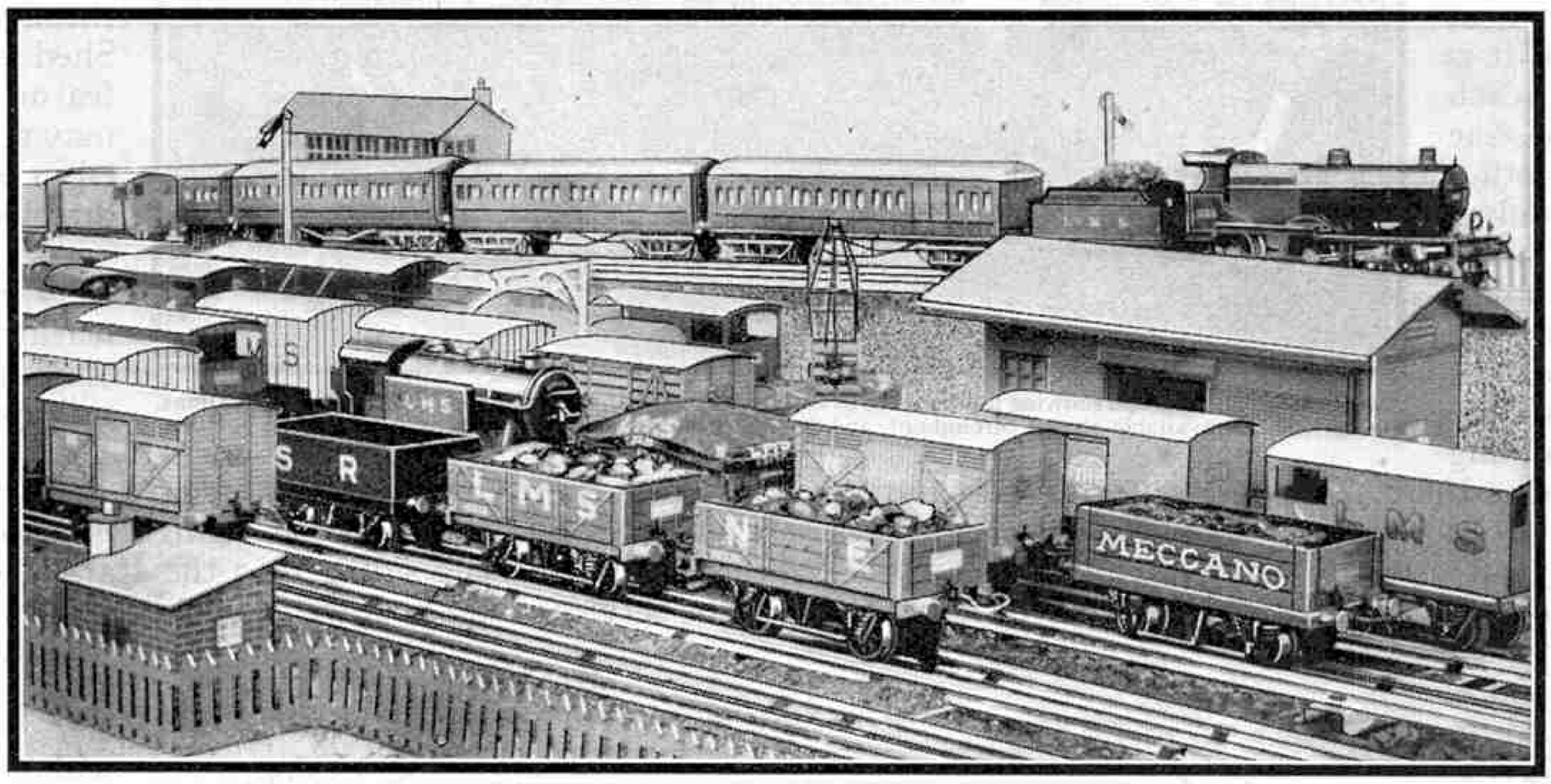


Diagram of the layout shown above. The various points are numbered, so that they may be easily referred to in connection with the description of operations that are possible.

Many useful accessories are found on the layout. Footbridges span the track in suitable places, and the necessary Loading Gauge is provided in each goods yard. The Engine Shed has the usual Water Tank, and a Turntable also is included. A good selection of rolling stock is in use, as may be seen from the photograph. Clockwork locomotives are employed, and the continuous nature of the layout is of great advantage when carrying out long-running tests.

XLIV.—GOODS TRAIN FORMATION

WHEN we stand upon the platform of a wayside station on a main line and see a first-class express train thunder past, followed shortly by a slow and rumbling goods train, we can scarcely fail to draw interesting comparisons. Each locomotive may belong to the latest class developed for its particular work, but differences in details of design, such as wheel arrangement and driving wheel diameter, will be readily noted. In addition, the black coat of the goods engine will have a far less trim appearance than the brilliant livery sported by the locomotive of the express, but in spite of this and other variations, the general likeness between the two types or classes will be apparent. In the case of the rolling stock of the two trains, however, there will be a great difference, for the appearance of the passenger express, made up probably of vehicles of the same size and general design, will offer a sharp contrast to that of the wagons of the goods train, particularly if it is of the ordinary pick-up variety, and is conveying a varied freight. These wagons will be of nearly every type and size, and the goods train will almost certainly have a comparatively "untidy" appearance, but this is inevitable and from the enthusiast's point of view only adds to the interest obtained in watching it pass.



A variety of wagons in the goods yard of a Hornby railway. The vehicles are being shunted into correct formation, as described in the accompanying article.

It is when we come to run goods trains upon a miniature railway layout that we realise the necessity for assembling a number of different vehicles into a train with reference to their particular uses. A miniature passenger train does not permit of a great deal of variation in its make up, of course, and if it is to follow real practice, it should as far as possible have as neat an appearance as a real train. To a certain extent this also is the case with through express goods trains of fruit, meat, milk or other vans, for complete trains regularly carry perishables in this manner between different centres, and it is quite correct in miniature to run a train made up, say, of L.N.E.R. Fish Vans only, with of course the usual Brake Van in the rear.

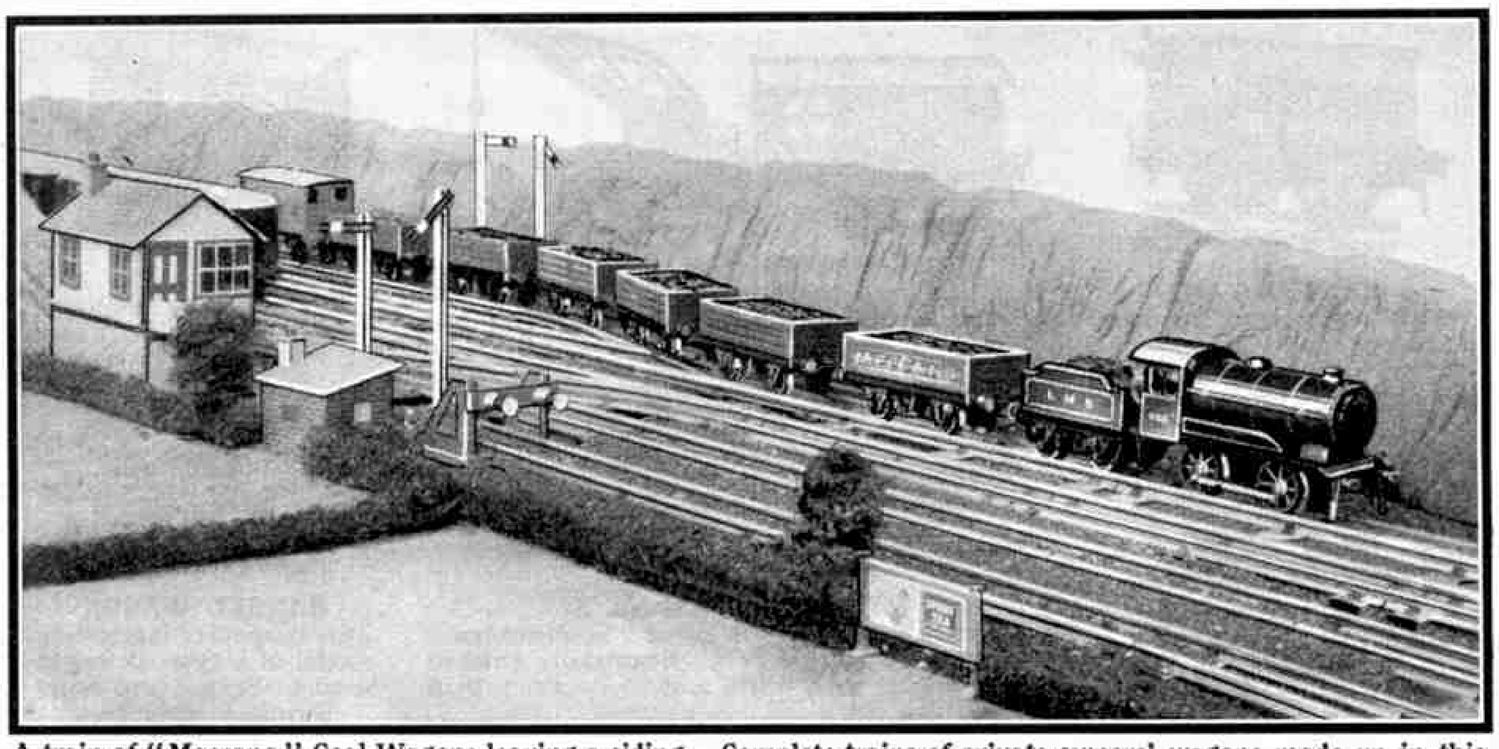
A complete coal train should be made up of a mixture of the wagons of various railways with the private owner element represented by the "Meccano" wagons. The owning company will usually predominate, or at all events should do so in miniature. A train consisting of open wagons all bearing the initials L.M.S., N.E. or G.W.R. would not look very realistic and effective, however, for it is rare to see a train of coal wagons all lettered in the same manner. One exception to this is found in the trains that bring the supplies of locomotive coal to the depots, although even then the wagons do not necessarily all belong to the same railway company. It certainly looks strange to see one company's wagons engaged in carrying coal for the engines of another line, possibly a rival, but this may be actually seen on occasions.

There are other instances of similar wagons forming a complete train. For instance, if a colliery produces sufficient coal to enable one or more full trains to be made up daily, then all the wagons will be practically identical, at all events as regards lettering; and this will be the case with a big engineering concern that has its own wagons for the conveyance of coal for its furnaces. An interesting example of these circumstances is shown in one of our illustrations, where a train of the familiar "Meccano" Coal Wagons is leaving a siding in charge of a Hornby No. 0 L.M.S.R. Locomotive.

In the assembly of goods trains in the yard or siding, the circumstances governing the running of each train

should be remembered, so that the formation adopted does not make shunting at a wayside station difficult, or involve the use together of unlikely types of wagons. Thus coal wagons are scarcely likely to find a place in a train made up chiefly of vans containing perishables or similar articles. Further, if a miscellaneous train is made up, the vans should not be kept together, but should be distributed among timber, lumber and similar wagons that are low in height. The opposite arrangement gives an odd effect, and although it is seen in actual practice on occasions, a miniature goods train is not made up of enough wagons to give it a correct appearance when marshalled in this manner.

A pick-up goods train leaving a siding that is to put off wagons at various stations on its journey should have the first batch marshalled next to the engine, in order to avoid manœuvring a more or less unwieldy length of train over the reverse curves of points or crossovers when shunting.

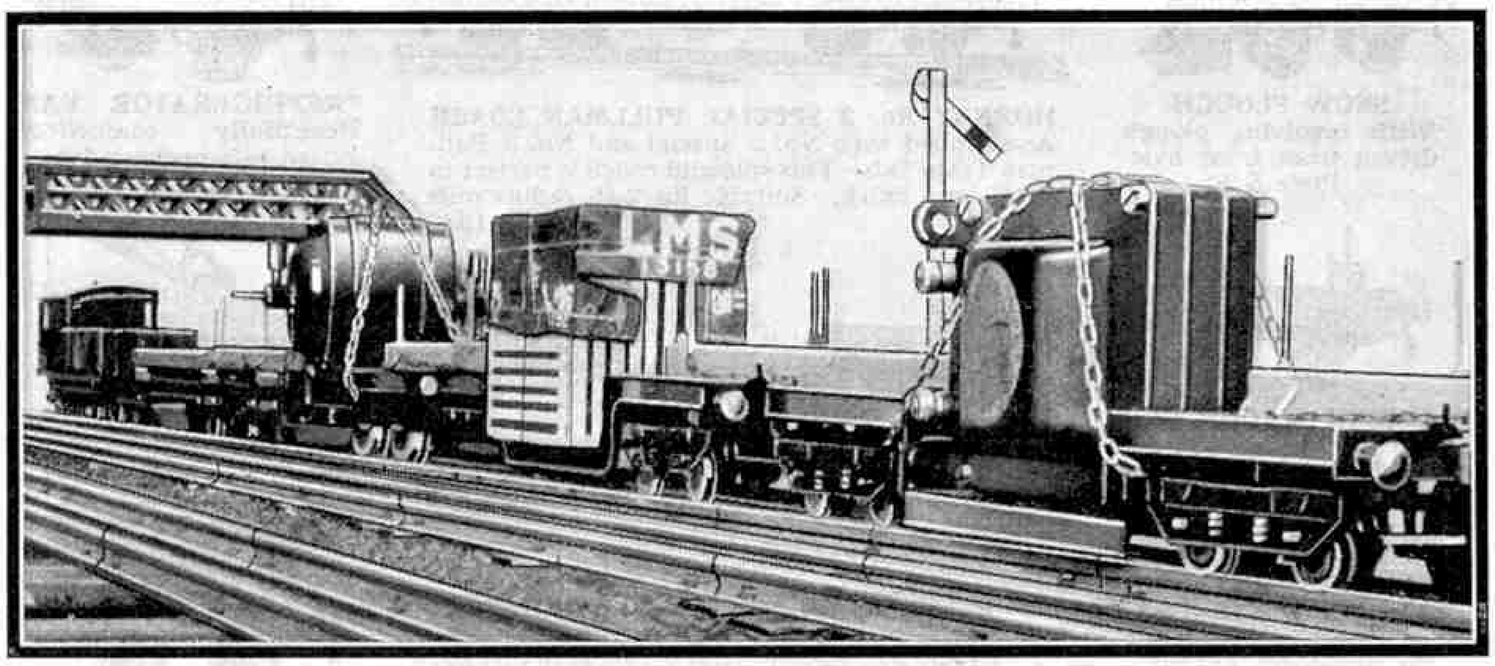


A train of "Meccano" Coal Wagons leaving a siding. Complete trains of private owners' wagons made up in this manner are frequently seen in actual practice.

A pleasing variety is given to freight trains of a general nature made up of four-wheeled wagons or vans by the inclusion of one or two No. 2 type bogie vehicles. The No. 2 Lumber and Timber Wagons are useful for this purpose, as they carry effective loads, the handling of which at the goods yard necessitates careful use of the platform crane. The No. 2 Luggage Van has a variety of uses, and the corresponding Cattle Truck should be used on lines that serve farming districts.

Where Petrol Tank Wagons are in use, and are considered loaded, they should be marshalled as far away from the engine as possible, so that the least risk of trouble is incurred. Similar precautions should also be taken with Gunpowder Vans, the strikingly red colour of which is a sufficient reminder of the dangerous nature of their contents. It should be remembered that these can only be dealt with at certain places and that shunting has to be carried out with extreme care so as not to disturb the load. Actually fly-shunting is forbidden with these vans, so that their miniature representations should be treated with great respect.

Unless being forwarded for a particular purpose, crane vehicles should be included only in the make-up of Engineering Department work trains or breakdown trains.



An interesting example of a special train formation for carrying heavy machinery. The Hornby Trolley Wagons carry a Meccano Transformer, a dummy crate made of cardboard and a model dynamo.

Trains of the second of these types are usually kept near locomotive sheds, and the men attached live in the neighbourhood in order that they can be speedily summoned, and the train despatched without delay if a mishap requiring its services occurs. Vans for tools and appliances of all kinds, and for the accommodation of the men if out for a prolonged period, are included in these trains, and Hornby Vans and the No. 1 Guard's Van therefore may be used in their miniature representations.

The formation of trains carrying loads of exceptional dimensions depends upon the nature of the loads themselves. Trolley wagons are largely used for this purpose, and special vehicles of this type have been built by our railways in recent years. It is scarcely possible to reproduce all of these in the Hornby Series, for many of them are of limited application, but the Trolley Wagon included in the eries is a very useful vehicle. It is of the well pattern and offers interesting possibilities in the matter of loads, suggestions for which are contained in one of our illustrations. Occasionally the overhang of a long load makes it necessary to employ similar additional wagons at each end of the one carrying the load, in order that the assembly and journey of the train may be effected in safety. One or two open wagons may accompany the train if required to carry appliances that might become necessary during the run owing to any minor mishap having occurred.

The various tipping and hopper wagons are found only on particular types of trains as a rule, so that their use on a miniature goods train requires careful consideration. The Hornby Side and End Tipping Wagons may form part of construction trains operated for the Engineer's Department of the line. Hopper wagons may be used in ballast trains, the discharge of their contents below the wagons and between the rails being a useful feature. Coal for shipment, or locomotive purposes, is often carried in such trucks, for their quick discharge in conjunction with the mechanical handling of coal now extensively practised enables the operations to be carried out with great speed. Hornby Hopper Wagons, therefore, may be used in connection with Meccano coaling plants in an interesting manner. Ore and stone traffic, too, may be dealt with in similar fashion.

HORNBY SERIES

HORNBY ROLLING STOCK

GAUGE 0

Hornby Rolling Stock includes almost every type in use on the big railways, and a selection of the splendid range available is illustrated on this page. The various items are modelled on realistic lines, strongly built and beautifully enamelled.

Ask your dealer to show you the full range of Hornby Rolling Stock.

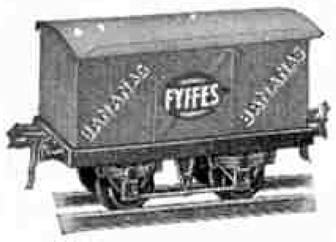
OIL TANK WAGON "MOBILOIL"
Finished in battleship grey. Price **2/6**

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

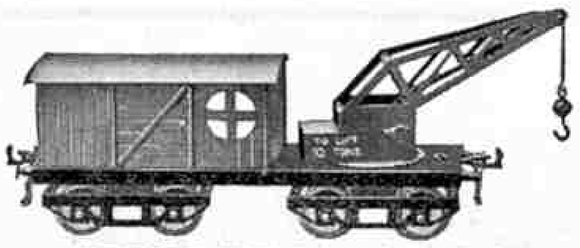
PETROL TANK WAGON "SHELL"
Finished in red. Price **2/6**

OIL TANK WAGON "CASTROL"
An attractive model. Enamelled green with lettering in red. Price **2/6**

BRAKE VAN (French Type)
Lettered "Nord." Beautifully finished in colours. Opening doors. Price **4/–**

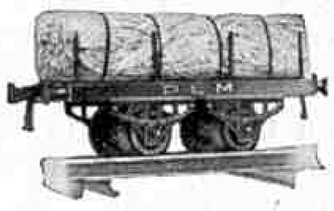


BANANA VAN
An attractive model, finished in yellow and green. Price **3/–**



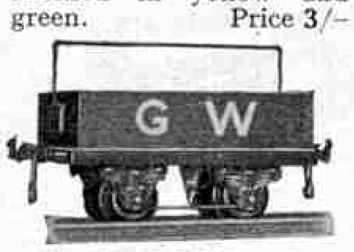
***BREAKDOWN VAN AND CRANE**
Beautifully coloured in brown and blue, with opening doors. Suitable for 2-ft. radius rails only. Price **6/3**

MEAT VAN
This is a very realistic model. Available lettered L.M.S. only Price **2/6**



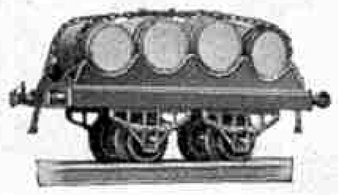
FIBRE WAGON
This is an interesting model of a type of wagon used in France and other European countries. Price **1/9**

MILK TRAFFIC VAN No. 1
Fitted with sliding doors. Complete with milk cans. Price **3/–**



***OPEN WAGON "B**
Similar to Hornby Wagon No.1, but fitted with centre tarpaulin supporting rail. Price **2/3**

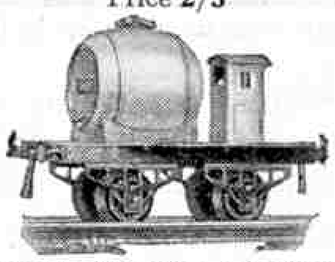
MITROPA COACH No. 3
Lettered "Mitropa," with either "Speisewagen" or "Schlafwagen" in gold. Beautifully finished in red enamel with white roof. Price **15/6**



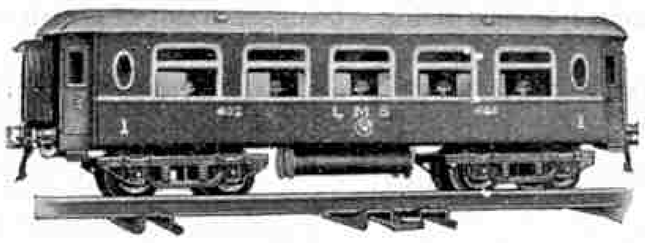
BARREL WAGON
This is another interesting model of a type of wagon used in France and other European countries. Price **2/9**

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

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



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

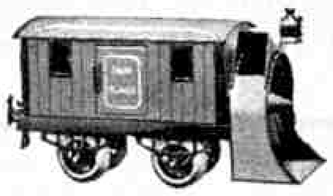


No. 2 SALOON COACH
Realistic in design and beautifully finished. Two types are available: L.M.S. (as illustrated) enamelled maroon, and L.N.E.R. enamelled brown. Suitable for 2-ft. radius rails only. Price **11/6**

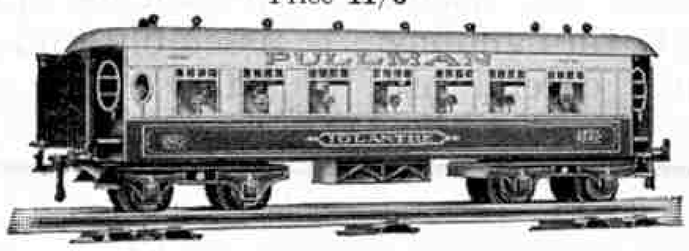
COVERED WAGON (French Type)
This wagon is fitted with frame and sheet. French type lettered "Nord." Price **3/–**

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

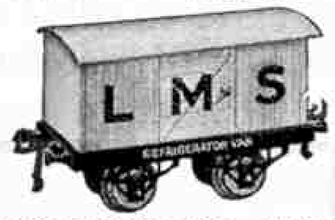
TIMBER WAGON No. 1
Beautifully enamelled in green and red. Price **1/9**



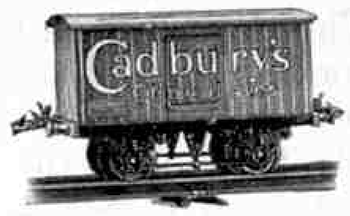
SNOW PLOUGH
With revolving plough driven from front axle. Price **5/6**



HORNBY No. 2 SPECIAL PULLMAN COACH
As supplied with No. 2 Special and No. 3 Pullman Train Sets. This splendid coach is perfect in detail and finish. Suitable for 2-ft. radius rails only. Price **15/–**

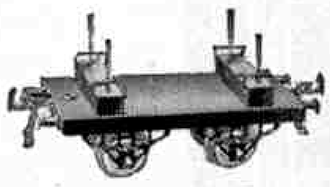


***REFRIGERATOR VAN**
Beautifully enamelled. Fitted with opening doors. Price **3/–**



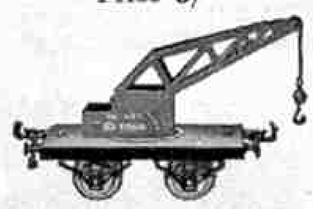
CHOCOLATE VAN "CADBURY'S"
This new van is beautifully enamelled in blue with orange roof. Price **3/–**

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

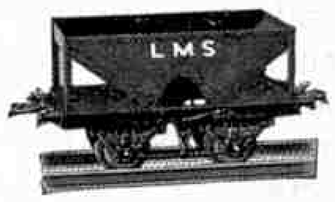


LUMBER WAGON No. 1
Fitted with bolsters and stanchions for log transport. Price **2/–**

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



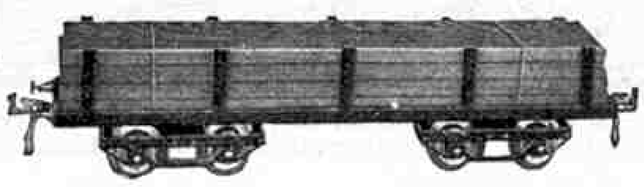
CRANE TRUCK
Finished in brown and blue. Price **3/6**



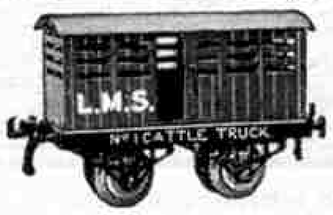
***HOPPER WAGON**
Mechanically unloaded. Finished in green. Price **3/6**

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

MITROPA COACH No. 0
Finished in red with white roof. Lettered "Mitropa," with either "Speisewagen" or "Schlafwagen" in gold. Price **1/6**

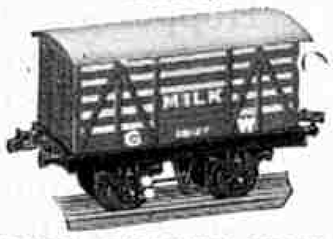


TIMBER WAGON No. 2
Beautifully enamelled in green and red. Suitable for 2-ft. radius rails only. Price **3/6**



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

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

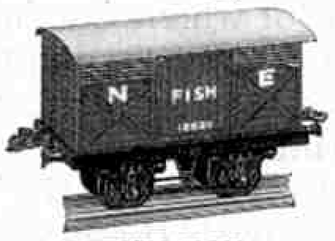


MILK TRAFFIC VAN No. 0
An attractive model. Available lettered G.W. only. Price **2/6**

COAL WAGON
This is similar to Hornby Wagon No. 1. It is fitted with embossed representation of coal. Price **2/3**

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

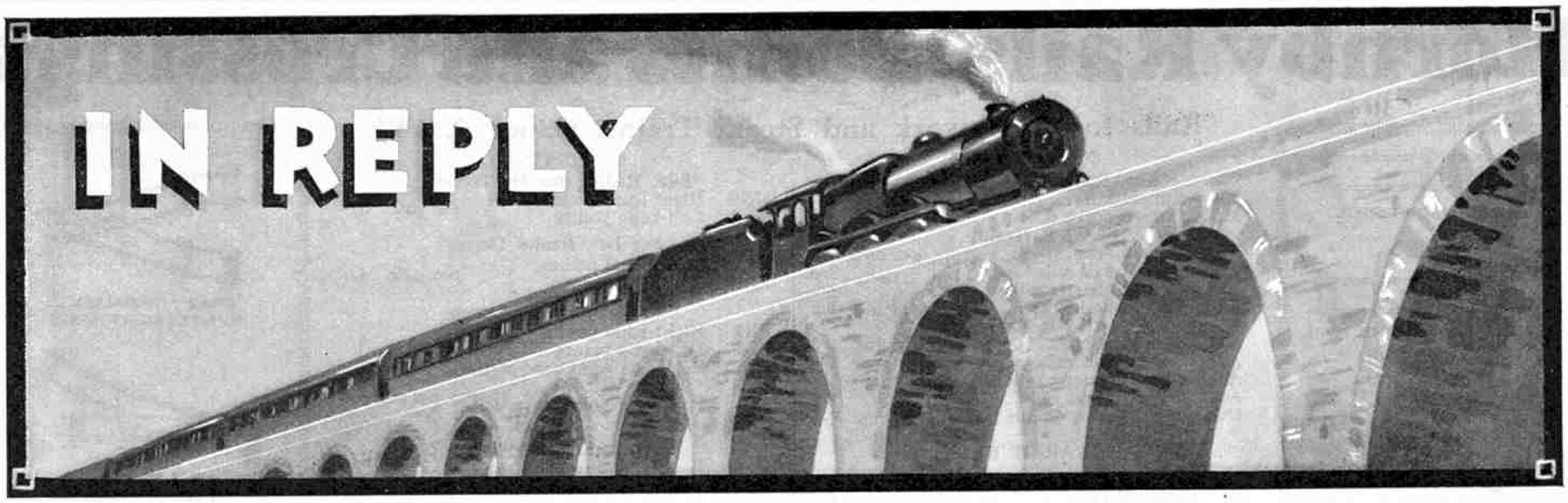
**In L.M.S., L.N.E.R., G.W. or S.R. lettering.*



FISH VAN
This is a distinctive model. Available lettered N.E. only. Price **2/6**

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

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



Suggested Hornby Train Improvements

MINIATURE LIVESTOCK TRAFFIC

Freight traffic operation is a most important branch of railway working and on account of its great variety it is extremely interesting. Different wagons necessary for different loads and the special vehicles occasionally required together with the arrangements for handling freight at loading and terminal points make the whole problem very fascinating to the railway enthusiast. The model railway owner must devote some attention to the subject in order to make his line reproduce actual practice as faithfully as possible. Ordinary freight, general merchandise, and minerals have been dealt with in the "*M.M.*" at different times and suggestions have been made for the suitable reproduction of such loads for Hornby Wagons.

Further consideration of goods working suggests another phase of the subject in the transport of livestock; for realistic farmyard animals are now available for lineside and general use. For their conveyance, suitable vehicles are the No. 1 and No. 2 Cattle Trucks and these were described together with other Hornby Vans in the "*M.M.*" for February last. There remain to be considered the arrangements necessary for the accommodation of the animals before and after their actual journey. In real practice, cattle docks or pens are familiar objects on the premises of most stations. They consist of a raised platform to enable the beasts to be transferred easily into or out of the vehicle, access to this platform from the ground level being provided by a sloping ramp similar to the ramps at the ends of a passenger platform. Suitable railings pen the animals in and gates are placed at convenient points.

Frequent requests have been made for the addition of a cattle pen to the Hornby Series, but for various reasons it is doubtful whether this step would be advisable. Space in a miniature goods yard is not particularly plentiful as a rule and it would be difficult to devise a cattle pen of a size and shape that would be generally useful. Many readers construct their own cattle pens from a variety of material that happens to be available. It is quite possible, however, to arrange an effective accessory of this kind by using existing Hornby material with a little modification, provided that sufficient space is available.

First of all, two Hornby Passenger Platforms and two Ramps are required to form the base of the cattle pen. If the layout is portable, these must be joined together side by side. Holes are drilled in one side of each platform in corresponding positions, three holes equally spaced being advisable so that no gap appears between the platforms. The holes should be drilled to such a size that the platforms may be joined together by means of Meccano nuts and bolts. The two ramps also should be joined together along their sides and secured to one end of the platform so that rigidity is ensured. In the case of a permanent layout where the pen, once completed, will remain undisturbed, joining in this manner is not necessary.

For the railings round the pen, Hornby Paled Fencing as supplied with the Platforms will be found most suitable, but more will be required for the ends of the pen as they now become. The fixing of this Fencing is very simple owing to the flange already provided with bolt holes. A few special holes will probably be required in the Platforms. Openings may be arranged at convenient places to correspond with the position of the cattle trucks when they are run alongside for loading or unloading, the actual arrangements depending on the ideas of the individual enthusiast. It will be necessary to cut the Fencing in places to allow for gates, and this should be done with tin shears or old scissors. Those who are keen on making a really finished job may divide the pen into three or four sections, each of which can be used for the different classes of animals that are to be conveyed. When the railings and gates have been fixed, the floor of the pen and the ramps should be painted white. This will give a very pleasing touch to the finished article, and will imitate the limewashed appearance of the original.

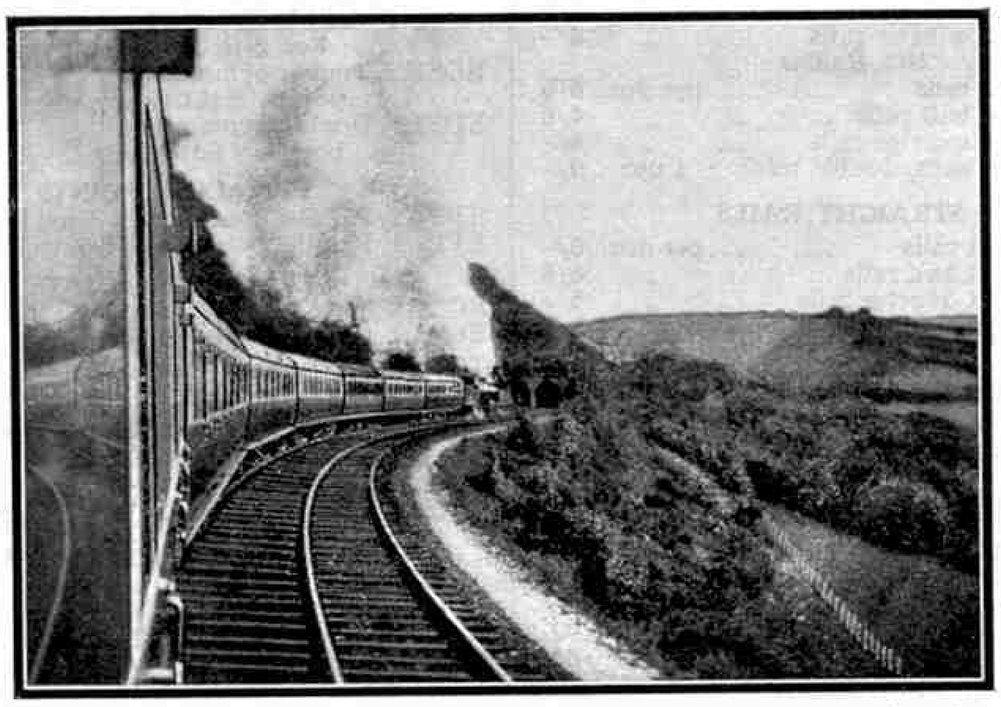
Readers who carry out this scheme will be very pleased with the effect obtained, and will find their freight traffic invested with a new interest as a result.

BOGIE TANK WAGONS

The Tank Wagons of the Hornby Series are well known and are available in a variety of different styles. They are extremely effective pieces of Rolling Stock, and are very popular among Hornby Railway owners, many of whom include several of them in their equipment. Following the usual British practice, they are four-wheelers, and they incorporate the latest improvements in the Hornby Series in the shape of the now standard underframe and automatic couplings. Suggestions reach us from time to time that we should include a larger vehicle of this kind running on bogies, in the same way as the No. 2 Rolling Stock. We are not in favour of their introduction at present, for such vehicles are not yet typical of actual practice in this country, although they are extensively used abroad. However, those Hornby Railway owners who are keen to operate such a wagon might care to take advantage of the following scheme.

A Hornby No. 2 Timber Wagon is necessary, and this forms the essential underframe, complete with bogies and other fittings. Readers will be familiar with the supports formed on this wagon to secure the load of sawn timber with which it is provided. These now become tank supports, the "tank" itself being a cardboard tube, such as is used for postal purposes, of suitable diameter and length. The diameter should be such that the tube is held securely by the vertical supports, or it may be a little larger so that it rests slightly above them. Its length should be rather under 12 in., the exact dimensions being settled by individual choice. In any case suitable lengths of wood should be glued across the underneath of the tube to form supports between it and the floor of the truck. Two circular pieces of cardboard should be cut out and stuck on to the ends of the tube with Seccotine. Suitable fillers and other mountings may be improvised from odds and ends, and further details added as desired according to the skill of the model railway engineer doing the work.

The tank should now be painted and lettered as fancy dictates, the colour scheme and decorations of an existing Hornby Tank Wagon being perhaps used as a guide. This should be done with the tank separated from the wagon, unless the latter requires to be painted in the same colour as the tank. Much detail may be incorporated if the painter's skill permits, and patience in this part of the work will be well rewarded by the effective appearance of the finished wagon. When all is thoroughly dry the tank should be mounted and secured to the base by small elastic bands passed round it and the floor of the wagon, these will imitate quite effectively the metal straps used for the same purpose in actual practice. Readers interested in the scheme should turn to page 288 of the April 1930 "*M.M.*" where a fine example of this type of tank wagon is shown. This no doubt will be found useful in suggesting possible embellishments.



An interesting photograph taken from the window of a railway carriage by our reader R. H. Rickett of Paignton. The train, headed by two locomotives, is negotiating the steep 1 in 36 incline that extends for more than two miles out of Ilfracombe.

EXTENSIONS TO BRIDGES

Of the various bridges in the Hornby Series the Lattice Girder Footbridge No. 3 is notable for being designed on the constructional plan; that is to say, it follows Meccano principles and can be taken to pieces and reassembled as often as may be desired. With this bridge, therefore, as with a Meccano model, additional features may be introduced, if necessary, without any difficulty. This is a feature that is specially valuable to those who have elaborate systems or have numerous siding lines in addition to the main track. The standard Footbridge is arranged to span two tracks, or one if this is all there is; but the difficulty is sometimes experienced that another track, possibly a siding or loop line is running parallel, so that the Footbridge cannot ordinarily be used.

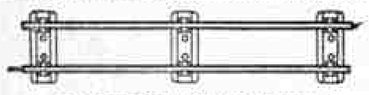
This is where the utility of the design is shown, for the span portion of the bridge may be extended as required. For this, additional lengths of span may be obtained by ordering them specially at 2/3 each, in addition to 3d. for postage. The alteration of the bridge is effected by disconnecting the span portion from one of the end pieces, which is easily done with the aid of the Meccano Screwdriver and Spanner; and fitting the additional span portion to the detached end piece. The adaptability of the Meccano system now shows to great advantage, for the span portion is exactly like the Meccano Braced Girders and there are standard holes at the standard spacing pierced in the top and bottom edges. Thus the two span portions may be butted together, and by means of Meccano strips overlapping the joint may be easily secured with nuts and bolts. The complete bridge made up in this manner will be found very useful and effective and a welcome change to the standard article.

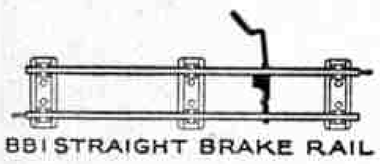
In certain circumstances it may be desirable to provide a centre support for the two span portions. This may be made up in cardboard, following the hints given several times in the "*M.M.*," and as far as possible it should be in the same style and colouring as the end pieces. The exact scheme to be followed is best left for each model railway engineer to decide according to the requirements of the particular situation.

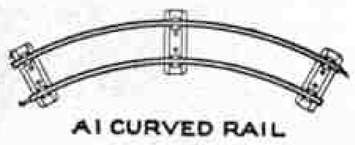
CURVED STATIONS.—We are interested in the idea that curved stations should be introduced into the Hornby Series. There are many objections to this scheme, however. It would be necessary to manufacture such stations with different curvatures suitable for the inner and outer sides of curved rails. Such stations necessarily would be expensive and therefore we doubt whether they would be very popular. In any case the placing of stations on a curve gives rise to so many practical difficulties that as a rule it is not to be recommended. (*Reply to E. W. Reynolds, Derby.*)

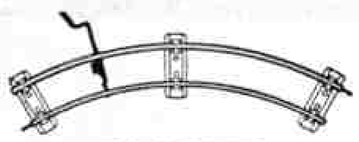
INSPECTION COACH.—Coaches of this type are interesting but they are seldom seen on the railway so that they are not likely to be known to more than a small proportion of our readers. In addition the coaches in use vary so greatly that there is no design sufficiently general that can be satisfactorily reproduced to serve for all four groups. Why not use a Hornby No. 1 Pullman Coach? (*Reply to F. Shaw, Rugby.*)

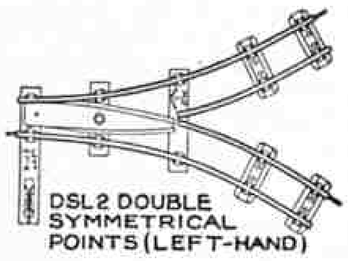
Hornby Rails, Points and Crossings

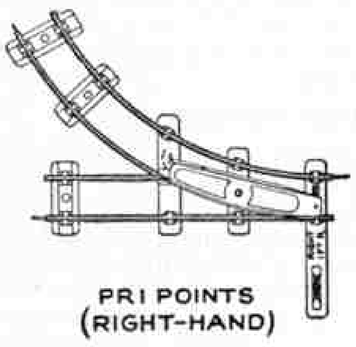

B1 STRAIGHT RAIL

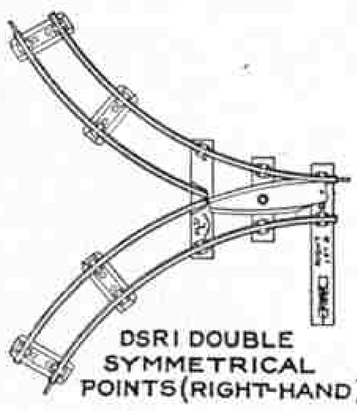

BB1 STRAIGHT BRAKE RAIL

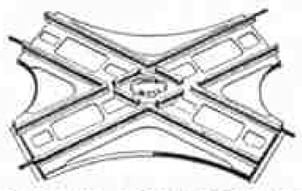

A1 CURVED RAIL


AB1 CURVED BRAKE RAIL


DSL2 DOUBLE SYMMETRICAL POINTS (LEFT-HAND)


PR1 POINTS (RIGHT-HAND)


DSR1 DOUBLE SYMMETRICAL POINTS (RIGHT-HAND)


CA2 ACUTE-ANGLE CROSSING

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

CURVED RAILS

9-in. Radius (for M0 Trains)

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

1-ft. Radius

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

2-ft. Radius

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

STRAIGHT RAILS

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

CROSSINGS

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

POINTS

9-in. Radius (for M0 Trains)

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

For 1-ft. Radius Curves

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

For 2-ft. Radius Curves

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

PARALLEL POINTS

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

DOUBLE SYMMETRICAL POINTS

For 1-ft. Radius Curves

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

For 2-ft. Radius Curves

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

CROSSOVER POINTS

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

Rails for Electric Trains, Gauge 0, 1¼″

CURVED RAILS

1-ft. Radius

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

2-ft. Radius

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

STRAIGHT RAILS

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

POINTS

For 2-ft. Radius Curves

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

CROSSINGS

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

DOUBLE SYMMETRICAL POINTS

For 2-ft. Radius Curves

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

PARALLEL POINTS

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

CROSSOVER POINTS

ECOR2	Crossover points, right-hand	per pair	24/–
ECOL2	Crossover points, left-hand		
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

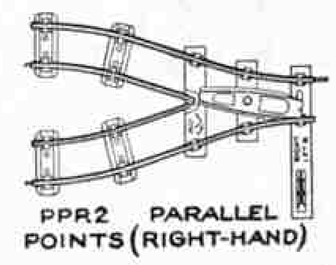
AC2	Curved centre rails ...	per doz.	1/–
AC2½	Curved centre half rails ...	"	9d.
AC2¼	Curved centre quarter rails	"	6d.

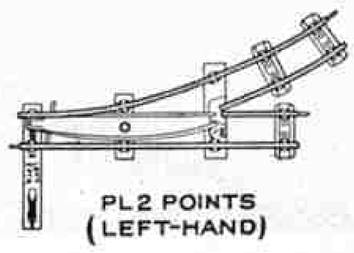
STRAIGHT CENTRE RAILS

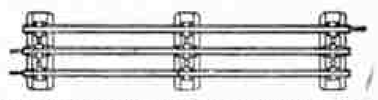
BC1	Straight centre rails ...	per doz.	1/–
BC½	Straight centre half rails ...	"	9d.
BC¼	Straight centre quarter rails	"	6d.

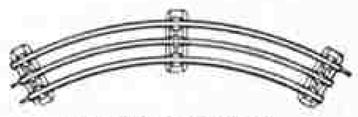
ICR	Insulators for insulating centre rails	per doz.	3d.
CCR	Clips for fixing centre rails	"	6d.

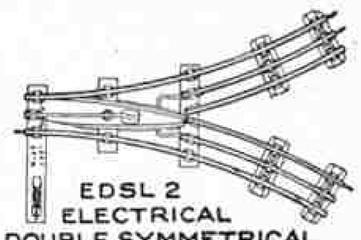
The realistic miniature railway layout shown below is only one of many that can be constructed with Hornby Rails, Points and Crossings. Many interesting illustrations and much useful information is given in a booklet entitled "How to plan your Hornby Railway." This booklet is obtainable from your dealer,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

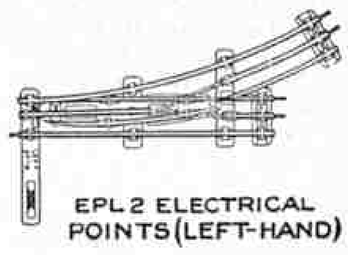

PPR2 PARALLEL POINTS (RIGHT-HAND)

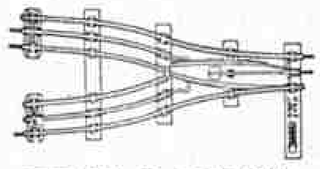

PL2 POINTS (LEFT-HAND)

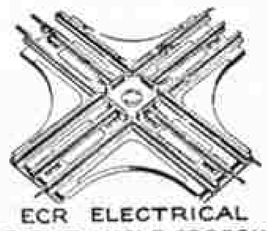

EB1 ELECTRICAL STRAIGHT RAIL

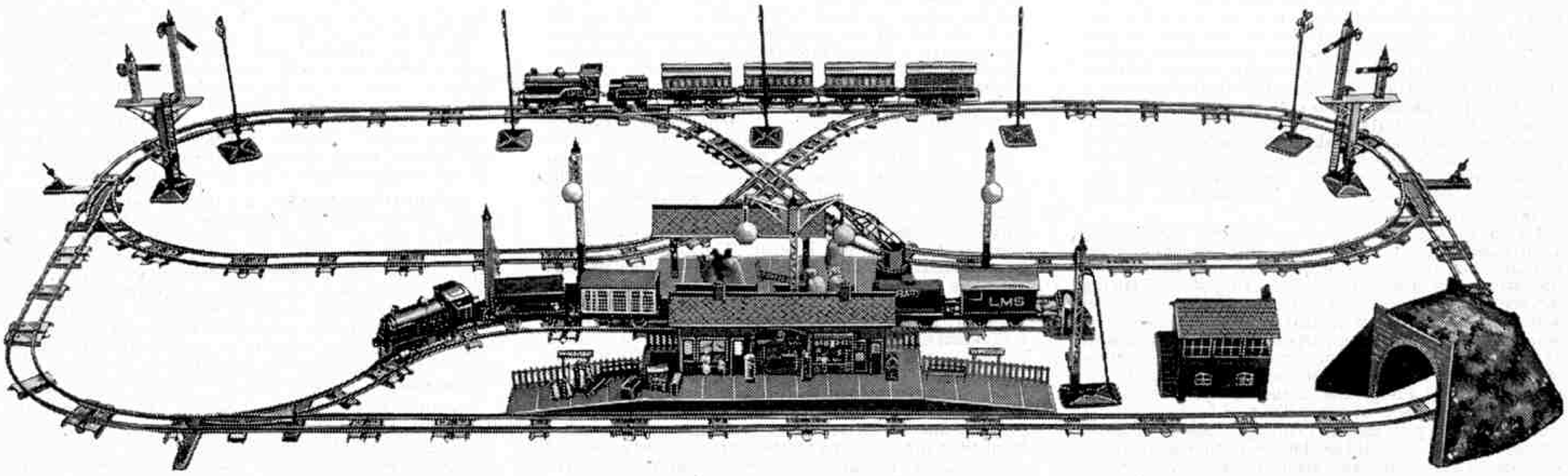

EA1 ELECTRICAL CURVED RAIL


EDSL2 ELECTRICAL DOUBLE SYMMETRICAL POINTS (LEFT-HAND)


EPL2 ELECTRICAL POINTS (LEFT-HAND)


EPPR2 ELECTRICAL PARALLEL POINTS (RIGHT-HAND)


ECR ELECTRICAL RIGHT-ANGLE CROSSING



Manufactured by MECCANO LIMITED - OLD SWAN - LIVERPOOL

H.R.C. COMPETITION PAGE

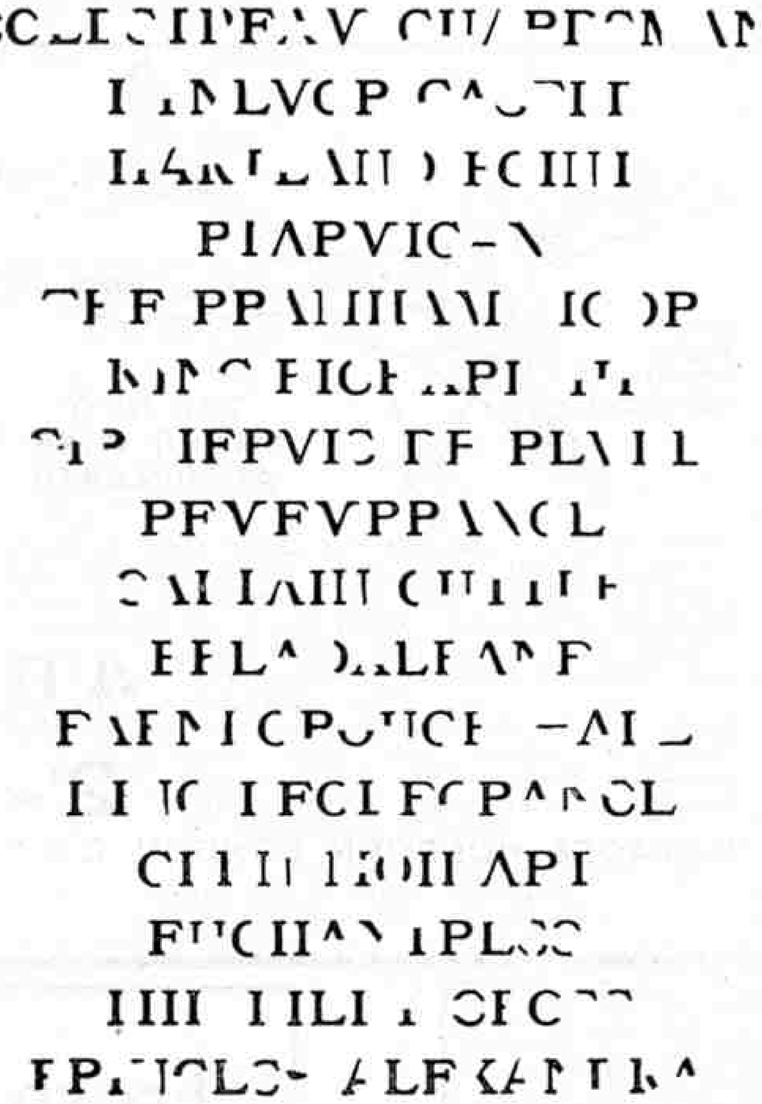
Competitions appearing on this page are open only to members of the Hornby Railway Company. Envelopes containing entries, should have the title of the competition clearly written in the top left-hand corner and should be addressed to the Hornby Railway Company, Binns Road, Old Swan, Liverpool. The name,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

MUTILATED NAMES CONTEST

This month, by special request, we announce another "Mutilated Names" contest on similar lines to the extremely popular one that appeared in our issue of October last. This competition demands a combination of sharp eyes and a knowledge of the names of railway locomotives, and for this reason it seems to us an ideal one for H.R.C. members. In addition, the problem is one that can be worked out in the open air just as well as indoors, so that it is very suitable for this time of year.

The accompanying panel contains the names of 16 well-known locomotives, each belonging to one of the four great British groups. The letters that make up each name have been mutilated in such a manner as to make them resemble ancient hieroglyphics, and we think it will tax the ingenuity of readers to discover the 16 names.

When all the names, or as many of them as possible, have been deciphered, they must be written down in a list in the order in which they appear in the panel, the place of any name that cannot be discovered being left blank. Then opposite each name should be set the number of the locomotive, its wheel arrangement and the name of the group to which it belongs. On each entry—which may be conveniently submitted on a postcard—must be written clearly the competitor's name, address and H.R.C. membership number.



The Contest will be divided as usual into two sections—Home and Overseas. 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 four competitors in each section who submit lists containing the highest number of correct solutions. A number of consolation prizes will also be awarded, and competitors should send in their entries even if they have been unable to find the correct names and numbers in every case. In the event of a tie for any prize, neatness will count in making the final decision.

Entries should be plainly addressed to "*H.R.C. Mutilated Names Contest No. 2,*" Meccano Ltd., Binns Road, Old Swan, Liverpool. The closing date for the Home Section is 31st August. Entries from Overseas competitors must be received not later than 30th November.

Questions Contest No. 4

"Questions Contests" have always been popular with members of the Hornby Railway Company, and this month we are holding a further competition of this kind that will be an attractive test of their knowledge of railways and railway working. Below we give 15 questions and competitors are required to give brief answers to as many as possible of them. Their chief endeavour should be to give clear and exact replies, and provided the conditions are satisfied, the shorter these are the better.

(1) Which is the second longest tunnel in Great Britain and Ireland? (2) What is the length of the longest platform at York? (3) Which is the world's longest tunnel and what is its length? (4) What is the total length of the platforms at Waterloo Station? (5) Which is the largest L.M.S.R. signal box in England? (6) Which of the four British railway groups reaches the highest altitude and where? (7) Where is the longest stretch of four-track main line situated? (8) When was the L. & Y.R. amalgamated with the L.N.W.R.? (9) When were Pullman cars introduced on the G.W.R.? (10) Where was the first wooden railway laid? (11) When was the present Paddington Station opened? (12) What are "compound" locomotives? (13) How is the motion communicated to the wheels when inside cylinders are used? (14) Why do goods engines usually have a greater number of driving wheels than passenger engines? (15) Does any British railway now employ "Single-Drivers"?

The contest will be divided as usual into two sections—Home and Overseas—and the senders of the four best sets of answers received in each section will be awarded Hornby Railway material (or Meccano products, if preferred) to the value of 21/–, 15/–, 10/6 and 5/– respectively. In addition, a number of consolation prizes will be awarded. Each sheet of paper used must contain the competitor's name, full address and also his H.R.C. membership number. Envelopes containing entries must be clearly marked "*H.R.C. Questions Contest No. 4*" and posted to reach Headquarters at Meccano Ltd., Binns Road, Old Swan, Liverpool, on or before 31st August. The closing date for the Overseas Section is 30th November.

It must be remembered that the omission of the H.R.C. number from any entry will cause it to be disqualified. This is an important condition to which members should pay special attention. Members should also take care to ensure that their name and full address is clearly written on each sheet of paper submitted, as numbers of entries are still sent in each month not bearing any name and address.

COMPETITION RESULTS

HOME

May "Rolling Stock Contest No. 2."—First: R. C. Storrar (8625), Letham Ladybank, Fifeshire. Second: J. H. Owen (25954), Radford, Coventry. Third: K. Costain (5108), Bolton. Fourth: A. R. Holmes (17022), Peterborough. Consolation Prizes: L. A. Stamer (161), Cam, Glos.; L. C. Smith (29385), Morley; H. J. Risk (685), Sale; A. W. Gadd (7670), Ashford, Kent; J. D. Davey (16102), Cultra, Belfast; I. D. M. Simpson (21661), Glasgow, W.2; M. Swansborough (26426), Enfield Wash; F. Mills (31), Kearsley, Nr. Bolton; S. L. Dorman (5711), Sedbergh; R. F. W. Redman (1381), Tonbridge; J. W. C. Lowe (25627), Clacton-on-Sea; R. Barbary (5580), Mevagissey, Cornwall.

May "Missing Words Contest."—First: W. S. Hulton (4368), Bolton. Second: T. C. Allen (22061), Chelsea. Third: H. Nunn (26094), Woodbridge, Suffolk. Fourth: J. L. White (9240), Hendon. Consolation Prizes: C. M. Furst (451), Joppa, Midlothian; K. J. Wallace (15121), Bromley, Kent; A. J. Neal (1210), Cambridge; H. Sosnowick (11640), Cheetham, Manchester; M. G. Paterson (26179), London, S.E.23; L. S. Cooper (16017), N. Finchley; G. B. Hutton (29773), Newcastle-on-Tyne; J. Gover (13620), Wallington, Surrey; G. Robertson (22098), Bedford; E. R. Levitt (27335), Blackheath; P. F. Dodd (3431), Didsbury, Manchester; J. A. Saunt (2264), Stoke, Coventry.

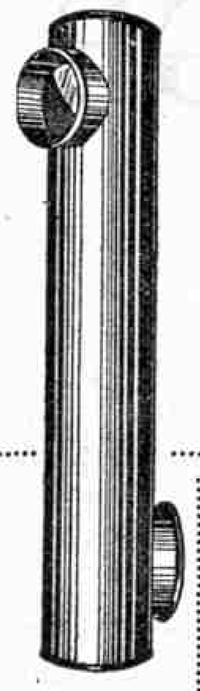
OVERSEAS

February "Tenders Contest."—First: H. J. Borgman (29579), Maastricht, Holland. Second: F. L. Bingen (28995), Wijk Maastricht, Holland. Third: M. Balfe (28661), Vancouver, B.C., Canada. Fourth: J. Buckland (28780), Victoria, Australia. Consolation Prizes: A. V. A. Hing (13801), Bendigo, Victoria, Australia; H. Turner (10034), Subiaco, West Australia; A. H. Bennett (10615), Auckland.

February "Questions Contest No. 3."—First: R. A. Wragg (7913), Bandikui, Rajputana, India. Second: N. T. Clegg (10393), Pahartali, India. Third: T. Watson (18065), Leichhardt, N.S.W., Australia. Fourth: G. Hallack (17578), Capetown, S. Africa.

GAMAGES

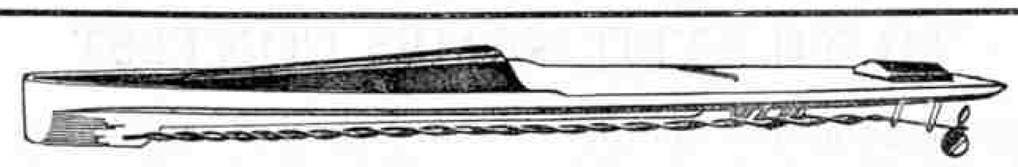
The Boys' Own Store



PERI-SCOPES

A novel, inexpensive instrument which will give hours of amusement to Boys. Length 17". Diam. 2¼" Price **1/11** Post 4d.

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

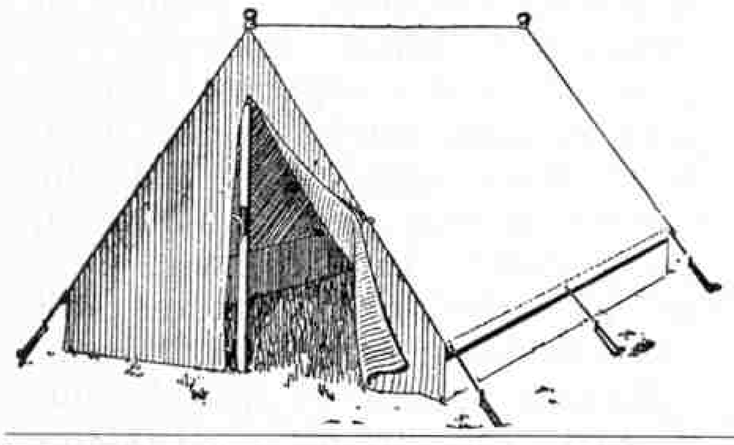


THE WHIRLWIND ALL-BRITISH WOODEN RACING BOAT

26" long. Runs at high speed by powerful Elastic Motor. Fitted with rudder and spray hood. Beautifully finished in three colours. Really wonderful value. Price (post 6d.) **1/3**

BOYS! THIS SPLENDID TENT COSTS ONLY 10/6

Durable, light in weight and thoroughly proofed. Reinforced in every way. Size 6' long, 4' wide, and 3' 6" high and fitted with a 6" wall. Guy Lines, 2 Poles in Sections and Brass Sockets, Pegs, etc. Special Valise for carrying this tent included. Total weight 4½ lb. Price complete **10/6** (Carriage 1/-)



Longer Flight. Improved Appearance

THE NEW "SILVER WING" AEROPLANES

These models incorporate the 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'. Price (Post 6d.) **4/6**

Model No. 0. Exclusive to Gamages. Length 15½". Wing 16". Silver Silk. Plain wood Propeller. Distance 250'. Without under fuselage. Not illustrated. Price (Post 4d.) **2/-**

GAMAGES, HOLBORN, LONDON, E.C.1

Telephone: HOLBORN 8484.
City Branch: 107, Cheapside, E.C.2.

GAMAGES SPECIAL SERIES OF SHAMROCK TYPE SAILING YACHTS

The hull is correct to scale in dimensions and profile of the latest "Shamrock." Deck is cambered, hull carved from best yellow Pine, "Marconi Rig." Sails made from Spinnaker cloth. Hull of the Yacht is enamelled sea green. Deck is lined and varnished. Stand supplied with each Yacht.

No. 1.

Length	Beam	Depth	Weight	Price
27"	4½"	5½"	2½ lb.	Carriage Paid **30/-**

Larger sizes available.

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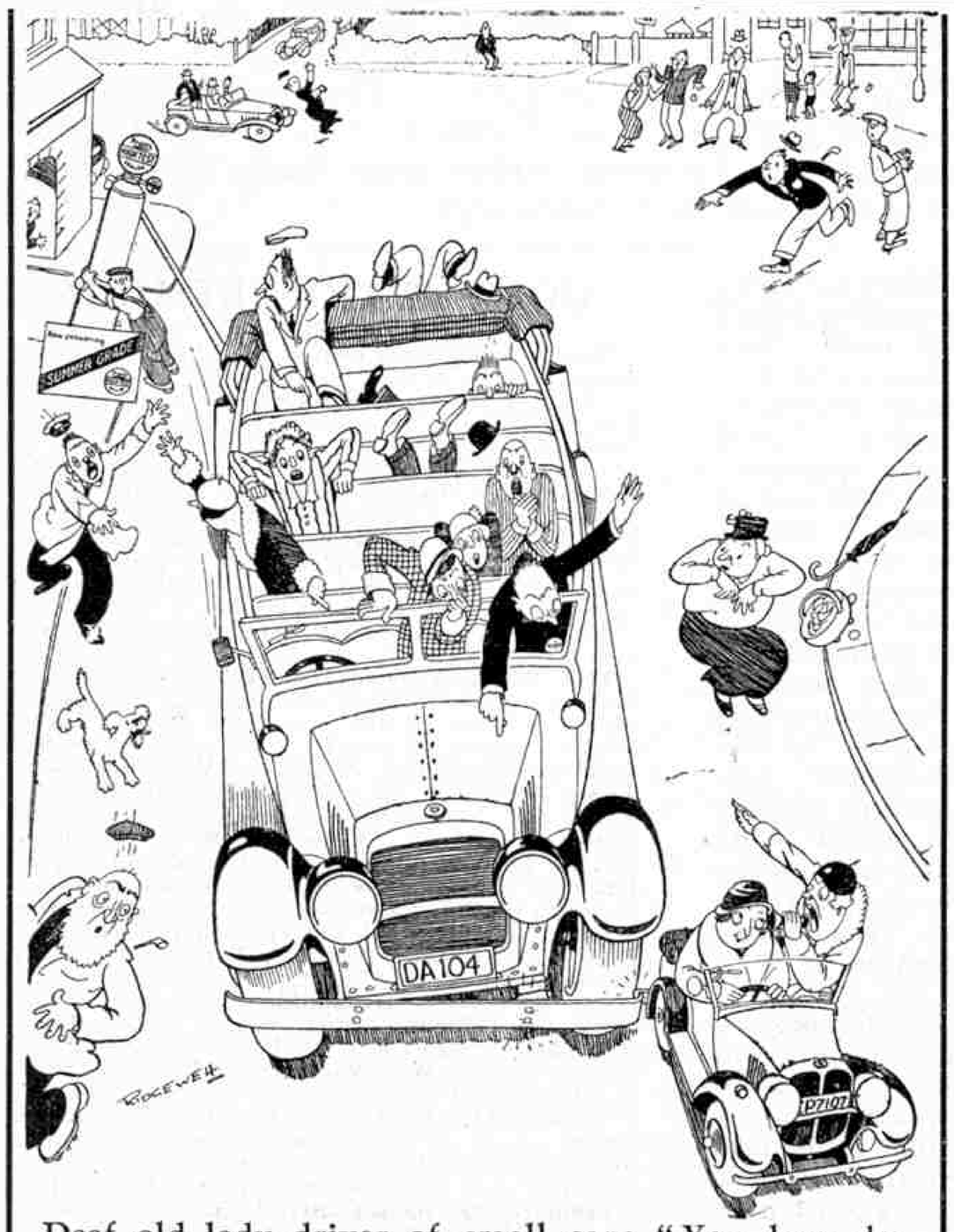

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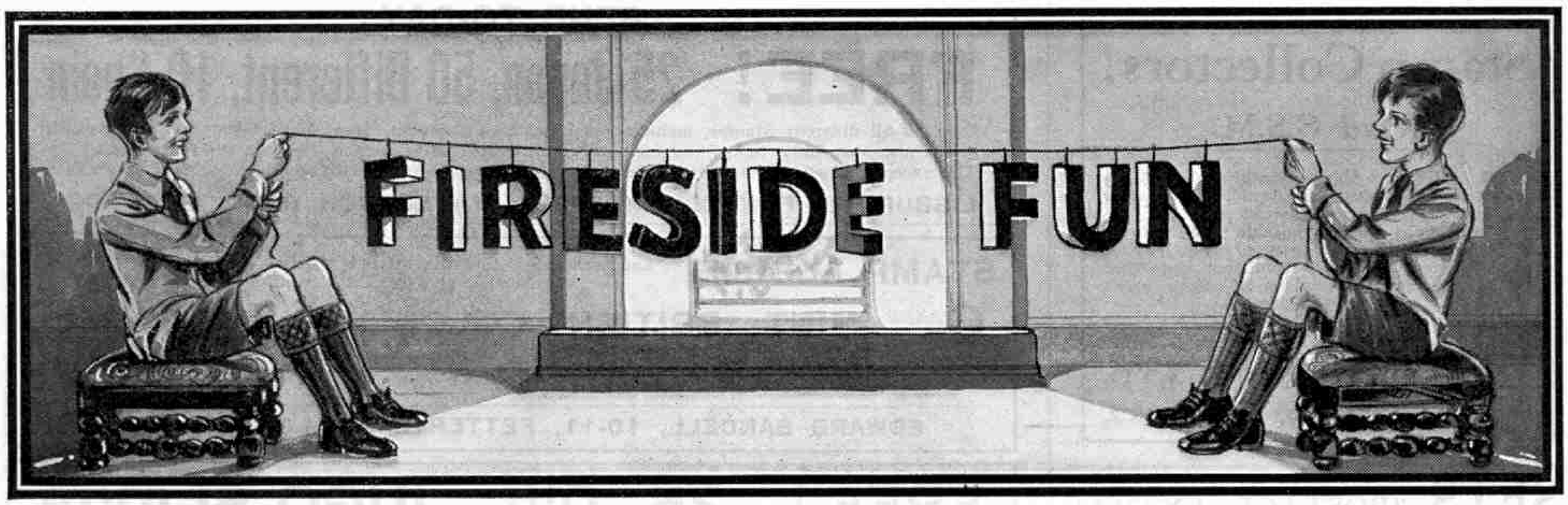


A TRYING CUSTOMER

"This is the only pair that I should think of wearing," said the lady customer, after trying on nearly every pair of shoes in the shop, "and the soles of these are really too thick."

"Is that the only objection you have to them?" inquired the exhausted assistant.

"es," said the customer.

"Well, Madam," continued the assistant, "I can assure you that if you take the shoes, the objection will gradually wear away."

* * * *

The farmer's son, who was home on holiday from an agricultural college, was amused at many of his father's old-fashioned ways.

"Look, Dad," he said, "I've bought some up-to-date books on farming for you to dig into."

"Yes," said the farmer, quite unimpressed; "and I've bought another 80 acres for you to dig into."

* * * *

"As I was going over the bridge the other day," said an Irishman, "I met Patsy O'Brien."

"O'Brien," I says, "how are you?"

"Pretty well, thank you, Brady," says he.

"Brady?" says I, "that's not my name!"

"Faith," says he, "and mine's not O'Brien!"

"With that we looked at each other, and sure enough t was nathur of us!"

* * * *

"Now, then, wake up!" shouted the stage manager. "Everything's ready. Run up that curtain!"

"Run up the curtain yerself," replied the new stage hand. "I'm a stage hand, not a squirrel!"

* * * *

"The fish was so big," boasted the first angler, "that the others would not let me haul it into the boat, for fear it would swamp us."

"The same thing happened to me once," said a quiet little man in the corner, "when I was on the '*Mauretania!*'"

* * * *

Little Boy (in toy shop at seaside): "Yes, father, this sailing ship will do fine. And now, where do I go to get tattooed?"

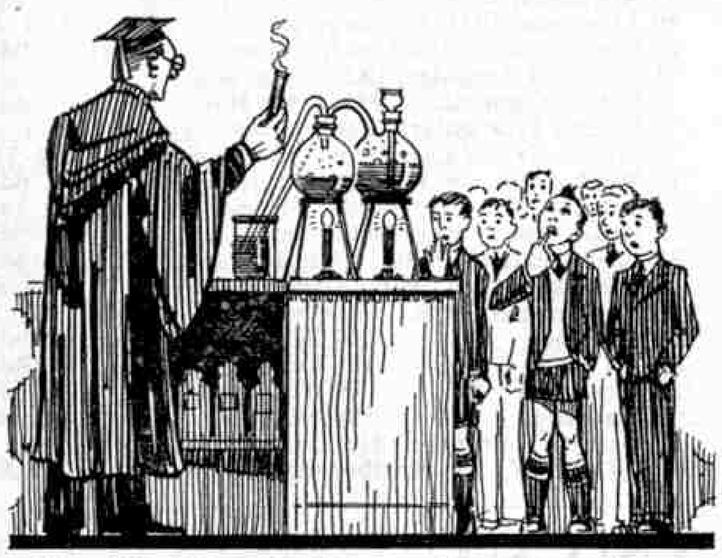
* * * *

Policeman: "Don't you know you can't turn round in a one-way street?"

Lady Motorist: "Oh, I think I can manage it, thank you."

* * * *

THEIR COMMON AIM



Chemistry Master: "I am about to perform an exceedingly interesting, but somewhat dangerous experiment. If I should do anything wrong, the whole class, including myself, might be blown through the roof. All please step nearer, so that you can follow me better."

* * * *

"Is there any truth in the report that Angus MacTavish has bought the filling station?"

"Well, I don't know for sure, but the 'free air' sign has been taken down."

HARD LUCK

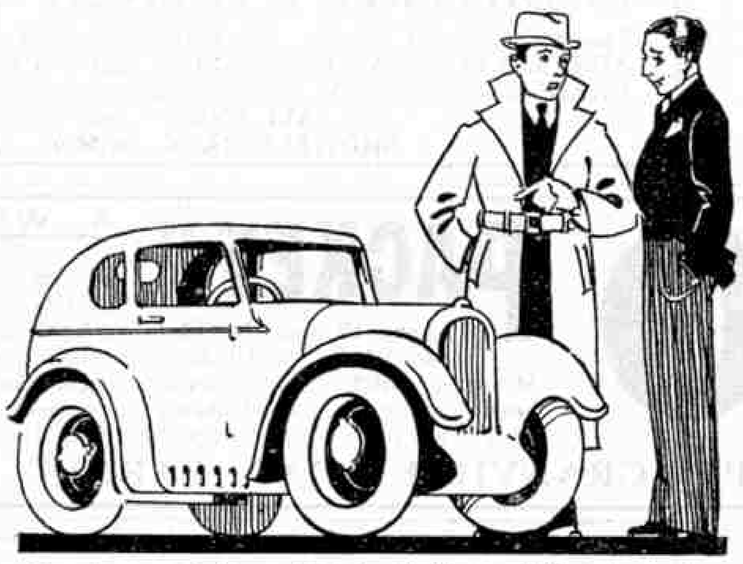
The doctor was lecturing a patient who was just recovering from a severe illness.

"You will have to take things easy," he said. "As for food, you can have anything that you fancy, within reason, of course. Above all eat plenty of fruit, and particularly the skins of the fruit. The skin contains far more vitamins than the whole of the actual fruit. By the way, what is your favourite fruit?"

"Coconuts," replied his patient, dismally.

* * * *

A TIGHT FIT



Purchaser of New "Baby" Car: "Er, how do I get in?"

Salesman: "You don't get in these cars, you put them on!"

* * * *

Little Johnny, aged seven, had been taken to the Zoo to see the animals. He stood before the leopard's cage for a few minutes staring intently. Then, turning to his mother, he asked: "Mother, is that the Dotted Lion that everybody wants Dad to sign on?"

* * * *

Jimmy was eating his apple tart when he discovered a clove.

"Oh, look, mother," he said, "one of the nails you fastened the pastry on with has come loose!"

* * * *

Teacher: "If you had ten potatoes to divide between three people, what would you do?"

Voice: "Mash them."

* * * *

"Give me a quart of oil, three gallons of petrol, a couple of sparking plugs, a five-gallon paraffin can and four pie tins," demanded the tourist, as he rushed into the village shop.

"Right you are," replied the smart assistant. "You can assemble 'er in the back room if you want to."

* * * *

Kind Old Lady: "Still looking for the money you lost, my little man?"

Little man: "No, my small brother found it."

"Then what are you looking for now?"

"My small brother."

* * * *

The referee had not turned up for a football match between teams from rival villages that usually introduced rough tactics into their encounters. After waiting for some time, the captain of the home team approached a likely spectator.

"Excuse me, sir," he said, "but our referee has not turned up. You know enough about football to referee for us, don't you?"

"On the contrary," he said, "I know enough about it not to."

* * * *

Schoolmaster: "Now, William, tell me what the word 'deficit' means?"

William: "Please sir, it's what you have got when you haven't as much as you had when you had nothing."

NOT A RECORD

Mother (detecting small boy in pantry): "What are you up to in there?"

Son: "The tenth tart, mother, but they're only little ones."

* * * *

The old gentleman went into the village baker's shop to buy some cakes.

"How nice it must be to work beside so many cakes," he exclaimed to the little boy who was in sole charge at the time. "I'm sure you must often feel that you would like to eat some of them."

"Oh, no, sir," said the boy, "that would be stealing—but I do just give them a lick now and again."

* * * *

Dandy (in village general store): "Please give me some peppah!"

Owner: "What sort do you require, sir? White, black or cayenne?"

Dandy: "You don't understan' me, my friend. I want peppah—writin' peppah!"

* * * *

Mr. Newlywed: "Can't I smell something burning in the oven?"

Mrs. Newlywed: "Yes, it's a cake I'm making."

Mr. Newlywed: "Well if it's burning why don't you take it out?"

Mrs. Newlywed: "I can't. The cookery book says it must be left in for 35 minutes."

* * * *

New resident: "Do you have much trouble in this neighbourhood with borrowing?"

Old one: "Yes, I'm afraid I do. None of my neighbours ever seems to have anything I want."

* * * *

"How long have you been working for this company?" the newly appointed clerk asked his neighbour.

"Oh, ever since the chief threatened to sack me for slacking," came the reply.

* * * *

Annoyed Customer: "That cake of soap I bought yesterday is no good at all."

Shopowner: "You're lucky, madam. You only bought one cake. I bought 50 cases!"

* * * *

Foreman (angrily, to workman sneaking in through gates): "Hi, there! D'you know the buzzer's gone?"

Workman: "Er,—I'm not surprised—they'd take anything round 'ere!"

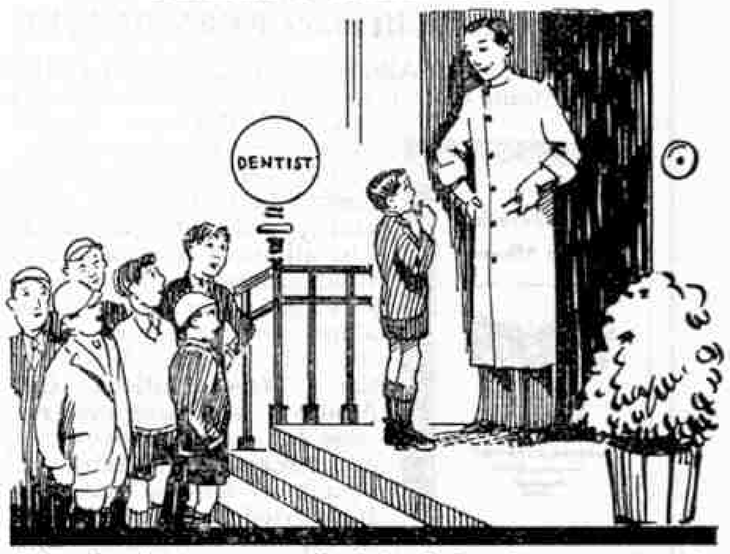
* * * *

"I seem to recognise your face. I wonder if I have met you at a party here before."

"Very likely—it's my house!"

* * * *

MAKING PAIN PAY



The dentist was surprised to find a large party of small boys outside his door when he answered a ring.

"What do you want?" he asked the boy nearest him.

"Please, sir," said the boy, "I want a tooth out."

"Come inside, then," said the dentist; "but what do these other boys want?"

"Oh, they're my pals," said the lad. "They've each paid me a penny to see it done."

Stamp Collectors!

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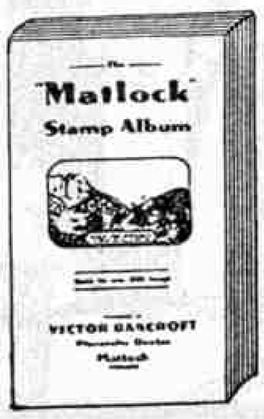

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For further Stamp Advertisements please see page 649

Stamp Gossip

and Notes on New Issues

Montserrat's Tercentenary Commemorative

Following Antigua's example, the tiny West Indian island Montserrat is celebrating its tercentennial year with a special stamp issue. Settlement on Montserrat was made by Sir Thomas Warner in the course of the same voyage that resulted in the creation of the colony of Antigua in 1632, to which we referred in the stamp article in the *"M.M."* for May last.

A full set of 10 values ranging from ½d. to 5/- has been issued, but only one design, illustrated here, is employed. This shows New Plymouth, the capital of the island, famous for the nectar-like quality of the lime juice it exports.

Forthcoming Egyptian Air Stamps

It has now been decided by the Egyptian authorities that the new air stamp issue shall consist of a full range of 20 values from 1 to 200 mils. The original intention was to introduce only nine values, but the accepted design, a view of an aeroplane passing over the Pyramids at Gizeh, being rather large, the full range of values is to be employed to remove the possibility of the public being required to plaster their envelopes with stamps to prepay the correct fee.

We understand that the new issue will appear in October, or very shortly afterwards.

Additions to the Stamp Zoo

Italian Somaliland's latest stamp series includes several very interesting natural history designs, including a mound of termites, an ostrich, a hippopotamus and an African antelope.

The full series consists of 15 values ranging from 5c. to 20L., with designs as follows:—5c. and 7½c., Francesco Crispi lighthouse, Cape Guardafui; 20c., 25c. and 30c., Tower at Mnara-Ciromo; 35, 50 and 57c., Governor's Residence, Mogadiscio; 1L. 25c., 1L. 75c., and 2L., Mound of termites; 2L. 55c. and 5L., Ostrich; 10L., Hippopotamus; 20L., African antelope.

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

Native Life in the Congo

This new issue deserves a place in every stamp collector's album. The 16 stamps comprising the series—in company with the Ruanda Urundi set of 15 issued last year—provide an unsurpassed pictorial record of African native life.

A different design is used for each value, as follows:—10c., View of the Sankuru River; 15c., Native kraal; 20c., Rapids on the Sankuru; 25c., Another type of Native kraal; 40c., Native musicians; 50c., Basket workers; 60c., Native drummers; 75c., A woman of the Mangebuthu Tribe (note the remarkable style of hairdressing); 1fr., A young elephant used for transport; 1fr. 25c. (illustrated), A Mangebuthu Chief; 2fr., A village on the banks of the Congo River; 3fr. 25c., An Okapi; 4fr., Another view of the Sankuru River; 5fr., Native woman pounding manioc; 10fr., A male native dancer in full ceremonial dress; 20fr., A young native girl.

The most interesting stamp is the 3fr. 25c. value, for the Okapi is among the world's rarest animal species. Found only in the depths of the Congo forests, it is related to the giraffe family, although some zoologists consider it a cross between the zebra and antelope.

The 60c. is also of special interest, for it shows a drum such as is used by native tribes to send messages from one village to another. This drum, in the stamp design, is being carried by the native on the left. The drum carried by the native on the right is an ordinary tom-tom.

Cook Islands Combined Issue

The new issues for the Cook Islands and Niue, to which we referred in our Stamp Gossip notes in the February *"M.M."* have now made their appearance. The central designs are identical in both sets, and with minor differences are exactly as listed in February.

The outstanding stamp of the issue is the 2d. value illustrating the discovery of New Zealand by the Maoris in 1350. In that year a small fleet of six double-hulled war canoes set out from Polynesia, the native home of the Maoris, on a voyage of discovery, and ultimately reached New Zealand. The stamp design shows one of the canoes with its two carved prows, on one of which stands the lookout man, pointing toward the land he has just sighted.

Famous Stamp Collection Sold

Recently the stamp collection of the late Mr. W. Dorning Beckton, of Manchester, a past president of the Royal Philatelic Society, was sold to two London stamp dealers for a sum reputed to run well into five figures. Mr. Beckton commenced his stamp collecting career as a boy of 14 in 1879 when his father made him a present of a simple packet of stamps, and he continued an ardent pursuit of the hobby up to the time of his death in 1930.

An interesting feature of Mr. Beckton's collection was his strict adherence to method. An anecdote that reveals how closely allied in spirit are the eminent philatelist and the boy stamp collector is told of him in this connection. Each New Year's Eve, a few minutes before midnight, no matter how he was engaged, Mr. Beckton would steal away to the quiet of his study and enter in the fly leaf of his first album the total number of stamps in his collection to date. The first entry on that fly leaf was made on 3rd April, 1880, and the total then shown was 534. At the end of that year it was 1,800. Year by year the figure grew—sometimes by hundreds only, sometimes by as many as 10,000—until at the time of his death the collection totalled no less than 154,021 stamps!

* * * *

Stamp Collecting reports that the 1/- South African air mail stamp was sold out on 4th May, and that no further printings are to be made.

It is probable that South Africa will discontinue the issue of special air mail stamps when the stock of the current 4d. value is also exhausted.

A New Industrial Series

Stamp propagandists have received a fresh impetus to their enthusiasm in the shape of a definite industrial publicity issue from Colombia. This new series comprises five stamps, each depicting one of the country's leading industries. We illustrate the 2c. value which shows a group of wells in the great Colombian oilfield. The remaining values and designs are:—1c. (green), Emerald mining; 5c. (brown), Coffee cultivation; 8c. (deep blue), Platinum mining; 10c. (yellow orange), Gold mining. The choice of colours is very interesting.

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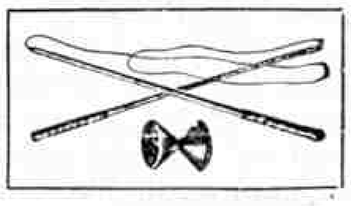

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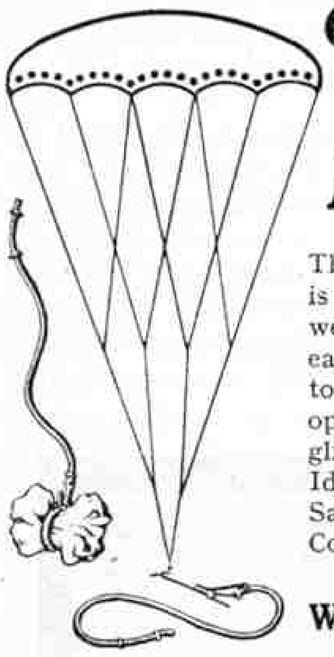

Great fun this self-opening Parachute

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Affords keen delight and valuable instruction. Fitted with metal type (not rubber). Complete with black and red ribbon. This easily worked machine prints 68 characters clearly. Full alphabet (capitals and small letters), figures, stops. Paper 3½ ins. wide, any length. Strongly constructed and finished in Japanned metal. Size 9 ins. × 8 ins. × 5 ins. Satisfaction guaranteed or money refunded if returned within 3 days. The only machine of its kind in the country.

Only **15/-** Postage & Packing 1/-

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Handsome spring-back cases specially prepared for the "*M.M.*," with the name blocked in gold letters on the front cover, can be obtained from Meccano Limited, Binns Road, Old Swan, Liverpool, price 3/- and 4/6 for sizes large enough to hold 6 and 12 copies of current issues respectively.

Permanent binding cases for back numbers of the Magazine can be supplied by Messrs. O. H. Bateman and Co., 23, Hanover Street, Liverpool. These cases are supplied in two sizes (1) for six copies, price 3/6 and (2) for twelve copies, price 5/3, post free in each case.

These binding cases are supplied so that readers may have their Magazines bound locally, but where desired, the firm mentioned above will bind Meccano Magazines at a charge of 6/6 for six issues or 8/6 for twelve issues, including the cost of the binding and also return carriage.

Readers desiring to have their Magazines bound need only make a strong parcel of them, include a note of their name and address together with the necessary remittance, and send the parcel direct to Messrs. O. H. Bateman and Co., carriage paid.

THE

RAILWAY MAGAZINE

Principal Contents - August Issue

Some Southern Byways in East Devon.

The Great Western World-Speed Record.

Notes on Scottish Locomotives and Railway Working, 1895-1910.

Great Western Locomotives in 1931.

The Brighton Electrification.

The above, all fully illustrated, are in addition to the regular features such as "British Locomotive Practice and Performance" and "The Why and the Wherefore."

THE RAILWAY MAGAZINE

MONTHLY Illustrated ONE SHILLING

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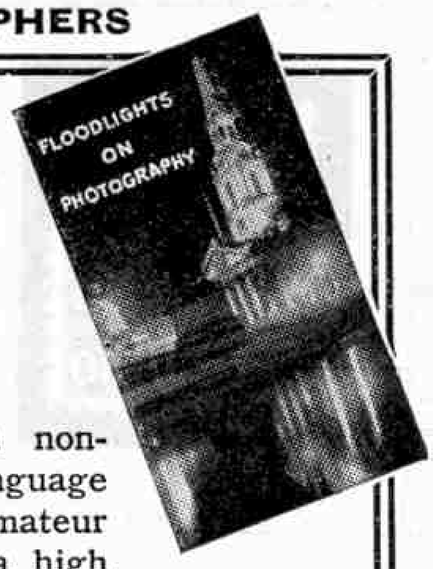

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Beautifully illustrated in colour

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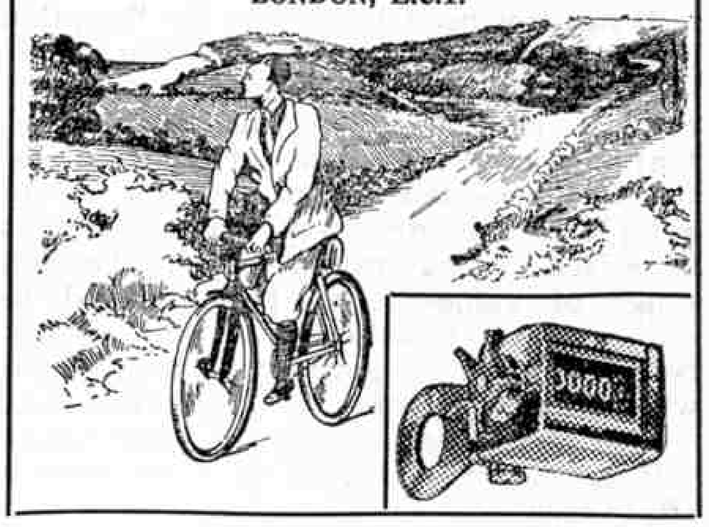

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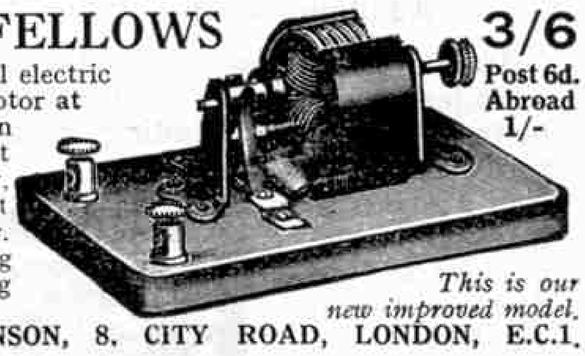

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This is our new improved model.

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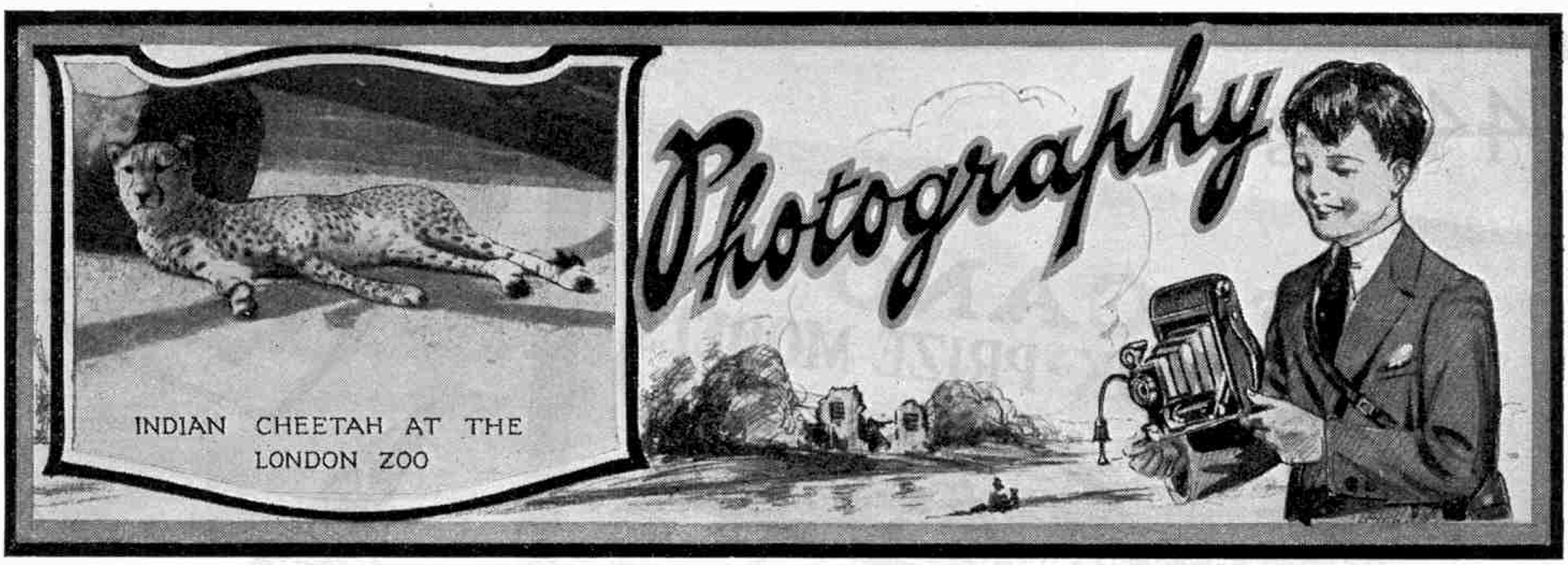
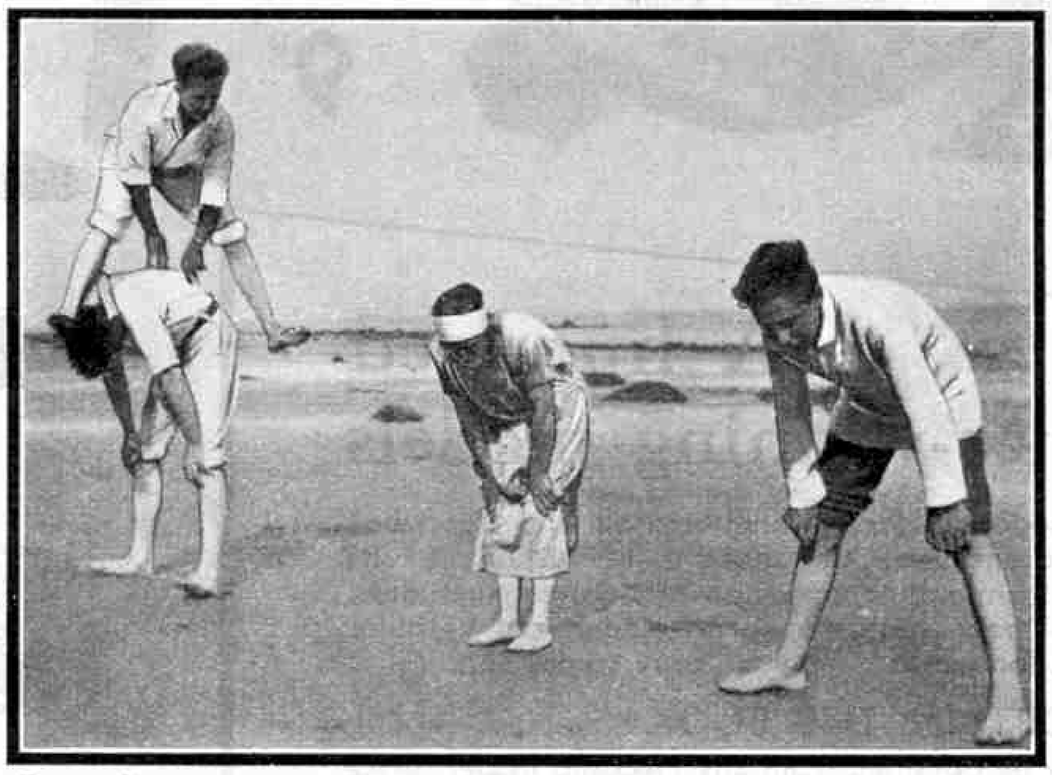


PREPARING THE HOLIDAY ALBUM

IN our two previous issues we have dealt with various aspects of holiday photography; this month we come to the resulting prints. We do not propose to describe the actual making of the prints. By far the largest number of these are made on either gaslight paper or self-toning paper, and both processes are quite straightforward if the makers' instructions are followed with reasonable care. Both these kinds of paper give excellent results with fairly good negatives, and the choice between them often depends entirely on whether printing is to be done during the daytime or at night. There is no doubt, however, that the "contrasty" grades of gaslight paper score over self-toning paper for prints from very thin or weak negatives.

Another advantage of prints on gaslight paper is that they may be toned or stained to a variety of interesting and artistic colours. Readers who have never tried these processes are strongly advised to make the experiment. The toners and stains supplied by Messrs. Burroughs Wellcome & Co. enable a wide range of colours to be obtained without difficulty. Seascapes look very effective toned blue or green, and green is suitable for landscapes. Evening landscape scenes look particularly well if stained to a light yellow.



Courtesy] [*Kodak Ltd.*

Leap-frog on the sands; an interesting holiday snapshot of the type that arouses leasant recollections.

As soon as our holiday prints are ready they should be mounted in an album. If they are left lying about loose they quickly become dirty and crumpled and cease to give pleasure. Another reason for the album is that loose prints are a source of temptation to our friends, who are apt to worry us for this print or that, until before long we find that we have few left for ourselves!

Albums are of two kinds, "slip-in" and "paste-on." The former are the easier to fill, but they have the great drawback that the prints must all be of the same size and shape. The paste-on album allows us to trim our prints to the most effective proportions, and to get rid of uninteresting expanses of sky or foreground, thus bringing into prominence the best part of the picture. Trimming should not be done with scissors, but with a sharp pocket knife, guided by a steel straightedge. The best material for cutting on is a piece of old linoleum or thick cardboard. A sheet of glass is often recommended for this purpose, but it quickly turns the edge of the knife, and unless great care is taken the print or the straightedge is apt to slip during cutting.

Courtesy] [*Ilford Ltd.*

An ever-popular subject; the sentries coming off guard at Whitehall.

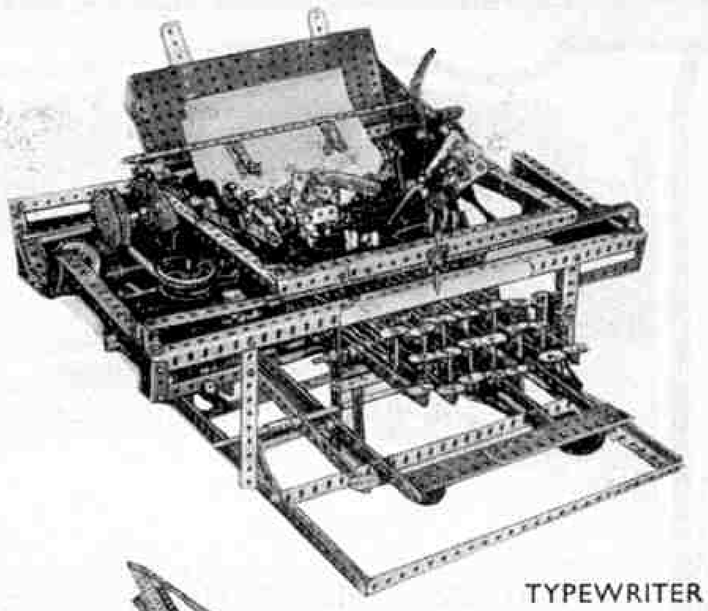
An old and useful device to help in deciding how to trim a print consists of two pieces of cardboard cut to the shape of the letter "L." These are slid over one another so as to enclose a rectangular space, and this is moved about and varied in size until the best portion of the print is found. In trimming, care should be taken that the edge of the print is parallel with the horizon, or with any buildings that happen to be in the picture. Nothing looks worse than a seascape with the horizon running uphill, yet one often sees quite good prints utterly ruined by this defect. Prints should not be trimmed until they are quite dry, or they will tear in the process.

There are various methods of making paste for mounting, but the best way and the cheapest in the end is to use one of the ready-made mountants to be bought from any photographic chemist. The print should be placed face downward on a sheet of newspaper, and the mountant spread over its back with the finger tip. Every portion of the print should be covered thinly and evenly, care being taken not to leave any excess mountant at the edges. The print is then placed in position on the page of the album and pressed firmly into contact with a piece of blotting paper. Any mountant that has oozed out at the edges of the print should be wiped off immediately, a piece of clean rag being useful for this purpose. When all the prints that are to be mounted at the time are finished, the album should be placed under light pressure, such as that of a few books.

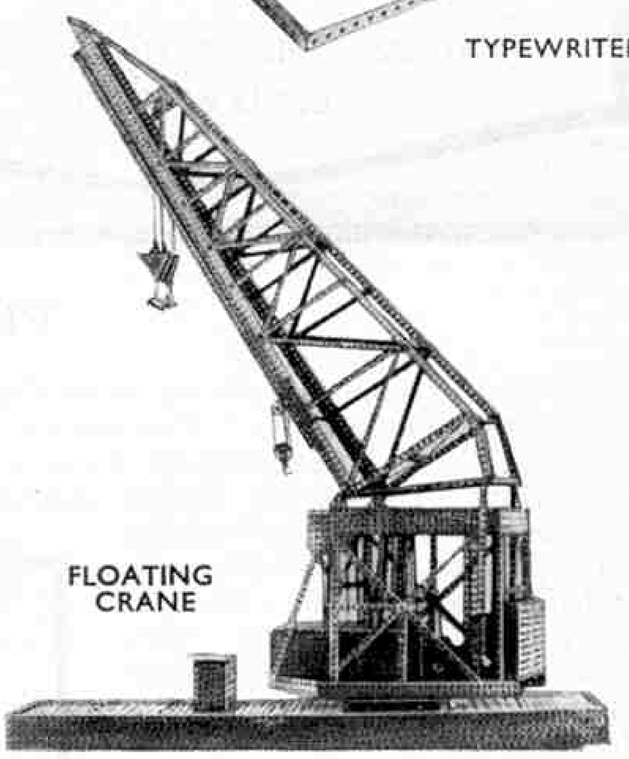
A holiday album prepared in this way is a lasting source of pleasure both to ourselves and our friends. Its attractiveness is increased if the title is neatly written beneath each print.

When the holiday album has been completed, the photographs it contains should be considered with a view to their suitability as entries for one of the photographic competitions announced from time to time in the "*M.M.*" and other papers. The advice already given in regard to the preparation of prints for the album applies equally here, but more careful attention should be given to the choice of a suitable title. A short "snappy" title, expressing exactly the spirit of the photograph, adds greatly to its prize-winning possibilities. Of course such a title will not make a poor photograph into a good one, but it will certainly help when the print is being considered among others of equal quality. In most competitions it is not absolutely necessary for the print to be mounted, but if this is not done a piece of stiff cardboard a little larger than the print should be placed in the envelope to protect the edges of the print from damage in the post.

44 Pages



TYPEWRITER



FLOATING CRANE

A hundred magnificent prize-winning models

designed by the world's expert model-builders, are illustrated and described in this splendid book. No Meccano enthusiast can afford to be without it. Its 44 pages are packed full of interest from end to end—new models, original ideas, new mechanisms, and full details of how these wonderful models can be built. There are new ideas in it for you, so get your copy to-day !

HOW TO OBTAIN THE BOOK

The 1932 Book of Prize Models may be obtained from any Meccano dealer, price 9d., or direct from Meccano Ltd., Old Swan, Liverpool, price 10½d. post free. There are special editions for Australia, New Zealand, South Africa and Canada and details of the prices of the book in these countries are as follows :—

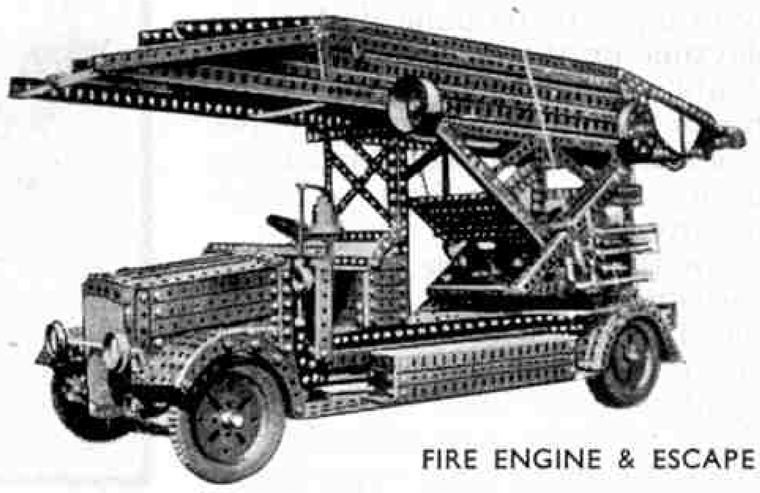
AUSTRALIA : Price 2/– from dealers or 2/2 from E. G. Page & Co., 52, Clarence Street, Sydney. (P.O. Box 1832K.)

NEW ZEALAND : Price 1/– from dealers or 1/2 from Models Ltd., P.O. Box 129, Auckland (Kingston Street).

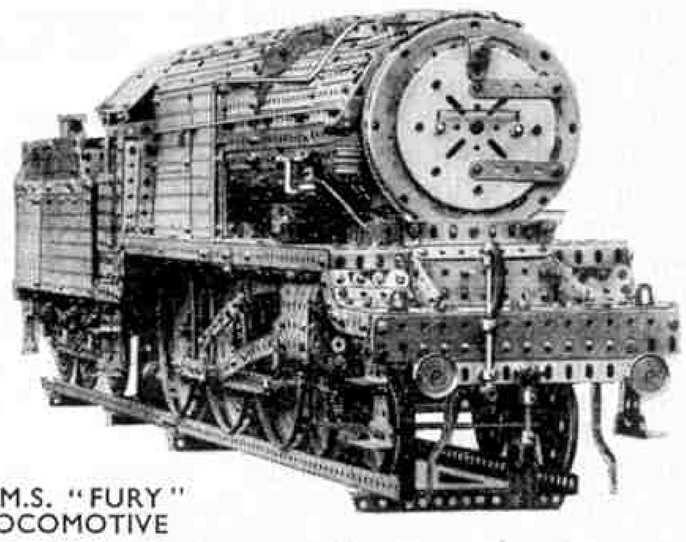
SOUTH AFRICA : Price 1/– from dealers or 1/2 from Arthur E. Harris, 142, Market Street, Johannesburg. (P.O. Box 1199.)

CANADA : Price 25 cents from dealers or 30 cents from Meccano Ltd., 34, St. Patrick Street, Toronto.

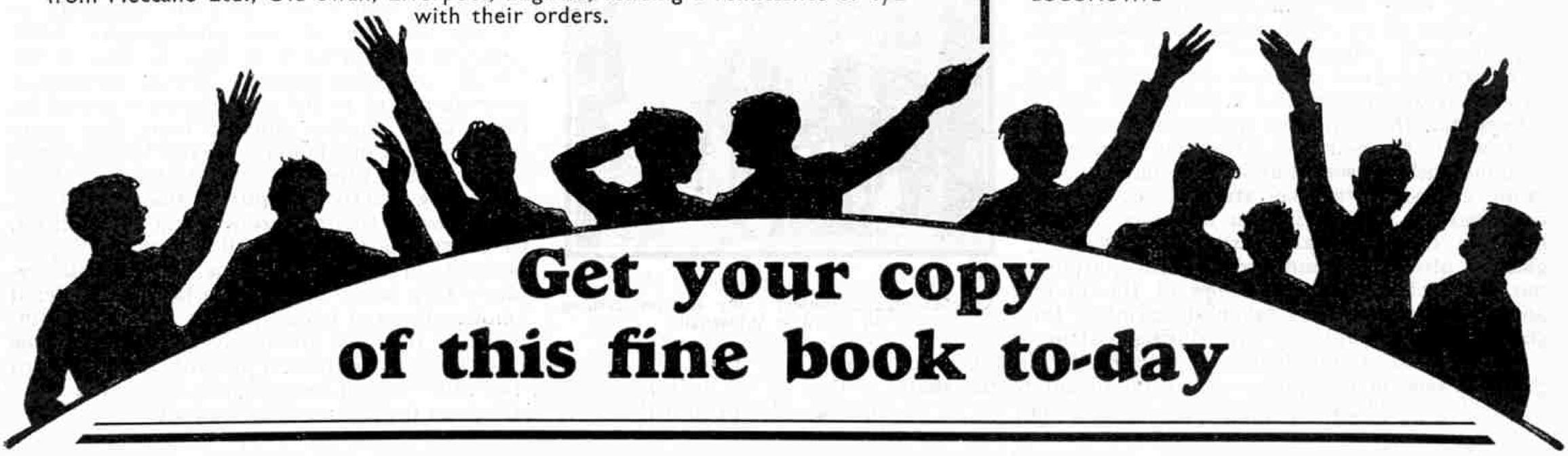
Readers living in countries other than those mentioned above should order from Meccano Ltd., Old Swan, Liverpool, England, sending a remittance of 1/2 with their orders.



FIRE ENGINE & ESCAPE

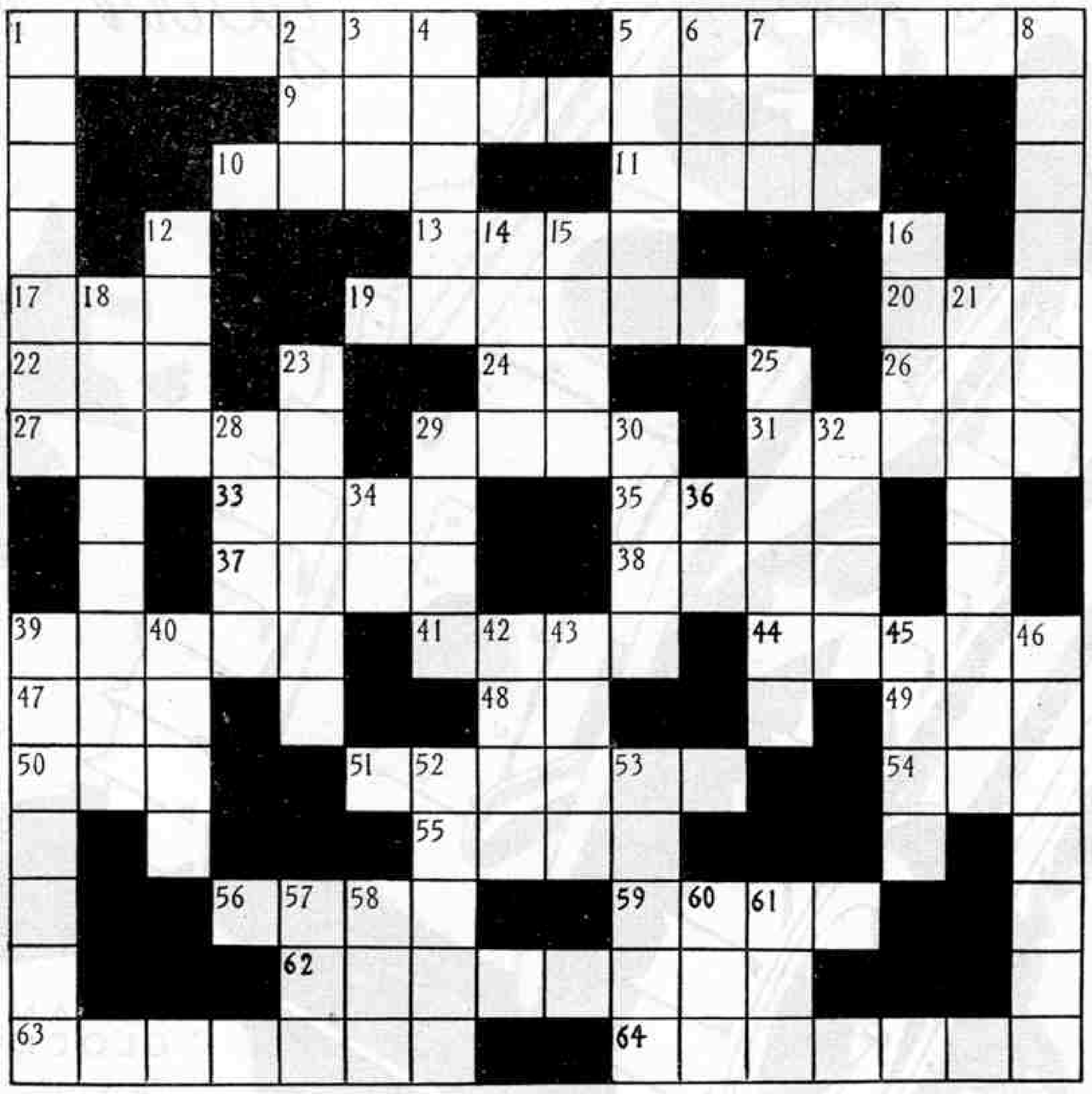


L.M.S. "FURY" LOCOMOTIVE



Competition Page

AUGUST CROSSWORD PUZZLE



CLUES DOWN

1. Drapery
2. Unit of work
3. Thrice
4. Gibe
5. Aches
6. Bring together
7. Sign of the Zodiac
8. Blunts
12. Notice
14. Musical composition
15. Weird
16. Details
18. Splendour
21. Thought
23. Bodily disease
25. Over
28. Figure
29. Betray
30. Covered portico
32. Ancient court
34. Father
36. Exclamation
39. Scottish Royal Steward
40. A fruit
42. Unemployed
43. Lounge
45. Genus of plant
46. Sharply
52. Musical play
53. Coral island
57. Concreted sugar
58. Evil
60. Climbing plant
61. Stray

CLUES ACROSS

1. Summer houses
5. Talk
9. Deserter
10. Monster
11. Image
13. Paradise
17. Great period of history
19. Most exact
20. Liable
22. Resentment
24. Hesitant exclamation
26. Part of foot
27. Lowest point
29. A mythological river
31. Tribes
33. Contend
35. Quick
37. Precious stone
38. Article of apparel
39. Method
41. Cheerful
44. Leaders
47. Bird
48. Act
49. Permit
50. Mineral
51. Capture
54. Song
55. Hide
56. Taunt
59. Free
62. Singer
63. Ancient Sanskrit book
64. Theft

Few of our readers will care to spend much time indoors this month, but we are providing a crossword puzzle in the belief that it will provide an amusing occupation for those odd hours of rain that are inevitable.

The competitions in the "*M.M.*" are set for the amusement of readers, and in the crossword puzzles every effort is made to avoid unfair traps in the form of alternative solutions. On the other hand, because prizes are offered, we must endeavour to provide one or two difficulties in order that the best entries may reveal themselves by successfully surmounting the obstacles.

It will be found that none of this month's difficulties is unfair. All the clues are perfectly straightforward, and every word used will be found in Chambers' or any other good dictionary. Beyond this it is unnecessary to make any explanation of the requirements of the competition.

Prizes of Meccano or Hornby Train goods (to be chosen by the winners) to the value of 21/–, 15/–, 10/6 and 5/– respectively, will be awarded to the senders of the first four correct solutions, in the order in which they are opened on the morning following the closing date. In addition there will be a number of consolation prizes, and, in awarding these, neatness and style of presentation will be taken into consideration. These prizes will be duplicated for Overseas competitors.

Entries should be addressed "August Crossword Puzzle, Meccano Magazine, Binns Road, Old Swan, Liverpool," and must be sent to reach this office not later than 31st August. Overseas closing date, 30th November.

Competitors who wish to preserve their "*M.M.'s*" intact need not cut out the crossword illustration. It will be in order to make a copy of the square and fill that in.

August Photo Contest

Our monthly photographic contests are open for photographs of any subject. The only restrictions are that each print must bear a title and that the exposure shall have been made by the competitor.

The entries will be divided into two sections, A for those from readers aged 16 and over, B for those under 16, and in each section there will be prizes of Photographic Materials, or Meccano products, to the value of 21/– and 10/6 for the best and second best entry respectively.

Entries to this month's contest must be addressed "August Photo Contest, Meccano Magazine, Old Swan, Liverpool," and must reach this office not later than 31st August. Overseas, 30th November.

Unsuccessful entries will be returned if a stamped addressed wrapper is enclosed.

Holiday Drawing Contest

During the course of the next two months the majority of our readers will spend some portion at least of their holidays at the seaside, and there could be no more suitable holiday drawing competition than "*A Sailing Vessel.*"

The contest will be divided into two sections, A for readers aged 16 and over, B for those under 16, and prizes of Meccano Products, or Artists' Materials if preferred, to the value of 21/– and 10/6 respectively, will be awarded in each section.

Each competitor should take care to place his name, age and address on the back of his entry, which should be addressed to "Holiday Drawing Competition, Meccano Magazine, Old Swan, Liverpool," and sent to reach us not later than 30th September. Overseas, 31st December.

COMPETITION RESULTS

HOME

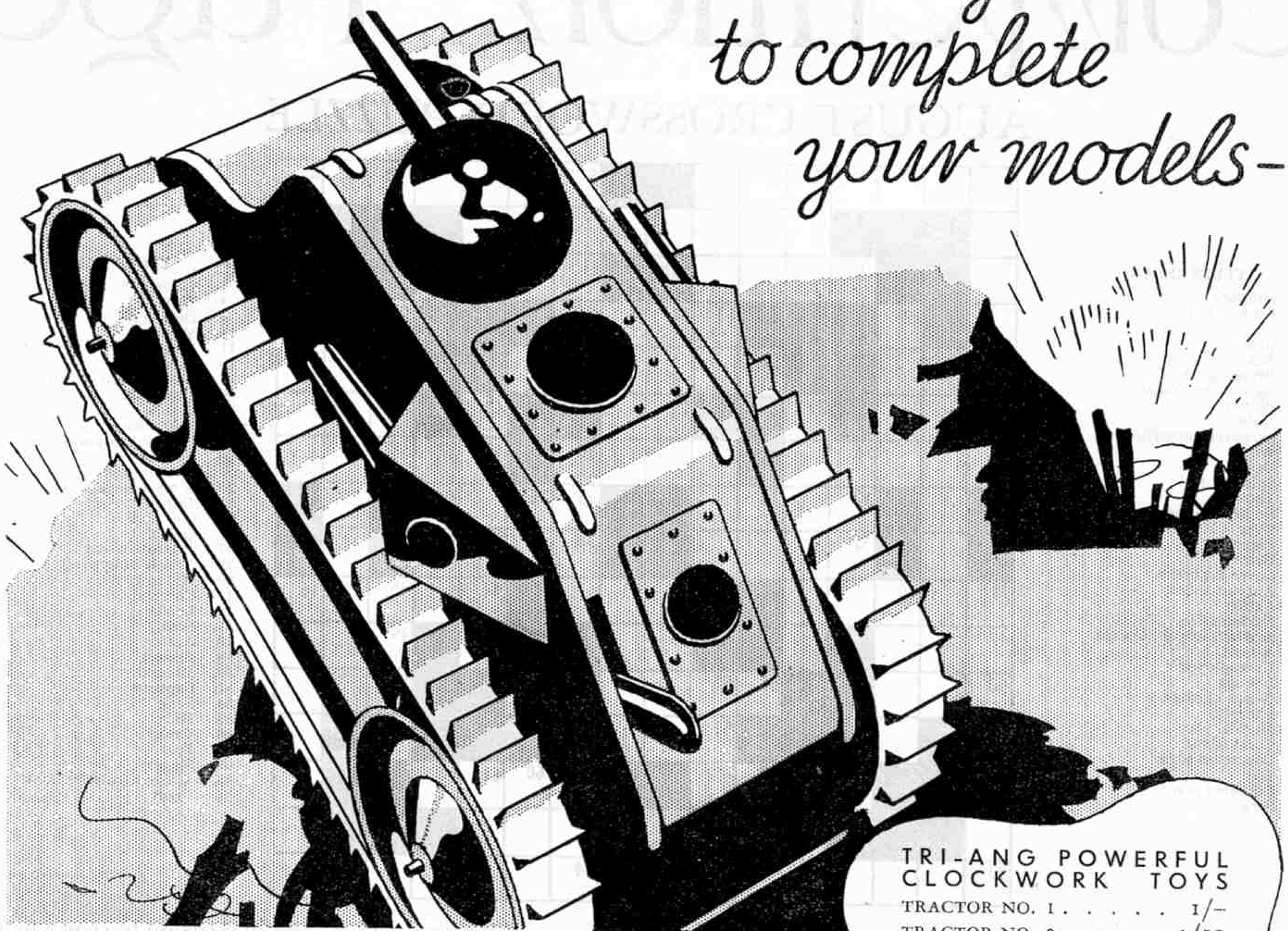
Type Designs.—1. N. Weight (Whitstable); 2. M. C. Jones (Barking); 3. S. S. Heaton (Leicester); 4. A. H. Clough (Folkestone). Consolation Prizes: B. Bramall (Urmston); F. Downing (Silverdale); J. H. G. Ford (Stourbridge); B. Jennings (St. Albans); D. Jones (Bury); D. G. Jones (Dolgelley); R. Murrish (Seaham Harbour).

May Photo Contest.—Section A: First and Second Prizes added and divided between: Miss D. Burton (Caterham Valley); H. T. Comerford (Islington, N.1); and F. H. Culverhouse (Sheffield). Section B, First Prize: L. D. Angell (West Wickham); Second Prize: V. Howard Craig (Dublin). Special Third Prize: John MacNaughtan (Kirkcaldy). Consolation Prizes: A. B. Bishop (Bristol); B. M. Caines (Bristol); A. Chesney (Huntington); N. L. Dodd (York); J. Durey (Alnwick); R. B. Foster (Edinburgh); A. Martin (Erdington); J. L. Rice (Northampton); J. F. Roper (Cirencester).

OVERSEAS

February Drawing Contest.—First Prizes: Section A, D. Adams (Sydney); Section B, R. Kay (Gisborne, N.Z.). Second Prizes: Section A, C. Moyle (Johannesburg); Section B, M. Lester (Taranaki, N.Z.).

New toys to complete your models—



TRI-ANG POWERFUL CLOCKWORK TOYS

TRACTOR NO. 1	1/–
TRACTOR NO. 2	3/11
TRACTOR NO. 3 (6 wheel)	10/6
WHIPPET TANK	1/3
TIGER TANK	5/11
MAGIC RACING CAR	12/6
MAGIC SPORTS CAR	12/6
MAGIC SALOON CAR	12/6

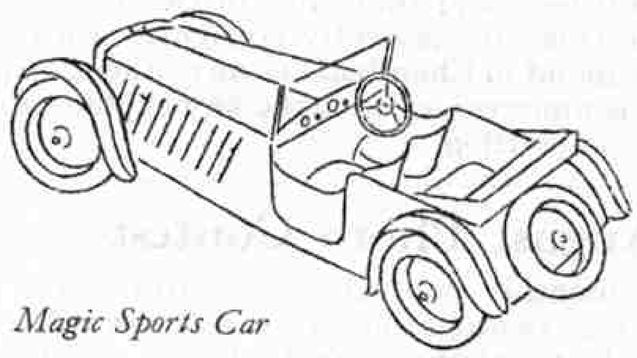
Tri-ang Clockwork Toys

Regd Trade Mark

Have you seen the new TRI-ANG tractors ? Tractors that climb up steep gradients. Tractors to pull your wagons or work your derricks. Tractors to cover the roughest ground. Made in three sizes, Nos. 1, 2 and 3 (No. 3 with six wheels and reversing gears).

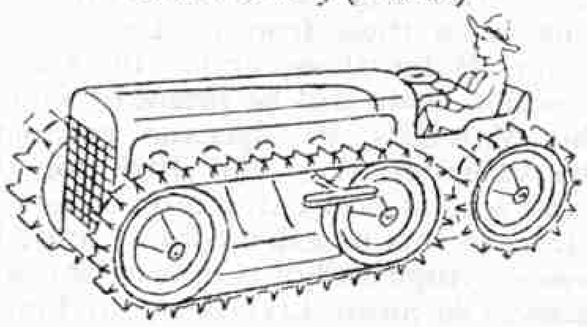
And have you seen the Magic Sports Car ? There never was such a really speedy realistic model of a sports car. What grand races you could have ! What thrills ! Then there's the Whippet Tank and the Tiger Tank (shown above). You'll have great fun with them, smashing up the barbed wire and the trenches which guard your fort.

You can see the TRI-ANG clockwork toys at any good toyshop. Test them out. See how strongly made they are, what powerful motors. You need these to get the best out of your models.



Magic Sports Car

Tractor No. 3 (6 wheel)



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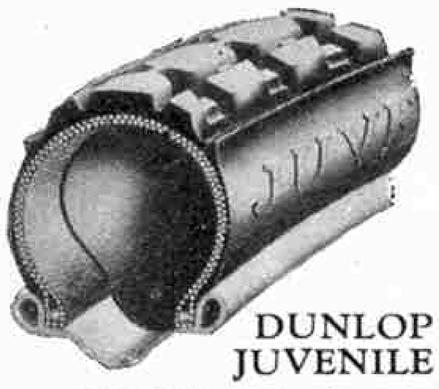


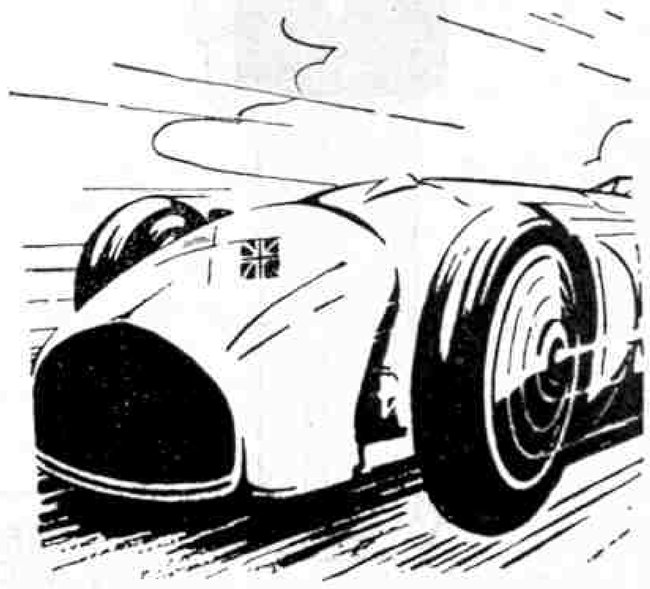
DUNLOP JUVENILE

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/-

You may not drive a 'Bluebird'—but Dunlop cycle tyres for that new machine you received on your birthday are the best tyres for you.



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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.** **9/11**

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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.** **19/-**

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GREEN ROTPROOF CLOTH 16/9

LIGHTWEIGHT GROUNDSHEETS

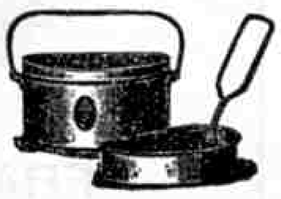
Best rubber proofed, brass eyelets ... ... 6′×3′ **3/-** 7′×5′ **6/6**

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/-

CAMPING MESS TINS



Army pattern, as illustrated... ... **1/3**

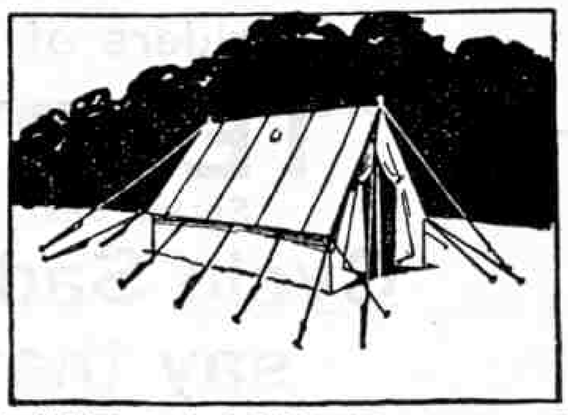
The **"CADET,"** consisting of 4 separate pieces and packed into one **1/11**

The **"JAARKEY."** A compact flat type, easily carried in ruc-sac **2/3**

Camp Stools. Collapsible. Tubular Steel. British. Polished wood seat. Each **2/6**

Camp Beds. Extra strong, superior special white cloth, folding birchwood frame. Packs up into a small space. Each **10/11**

Kit Bags. Extra strong white duck. Brass eyelets. Size 27 in. × 17 in. Ideal for camping. Each **2/6**



THE "LIGHTPARTY"

Jas. GROSE Ltd.

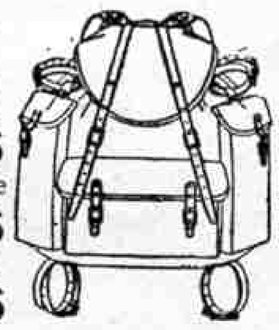
6 ft. 6 in. long, 6 ft. wide, 6 ft. high, 2 ft. walls, overhanging eaves, ventilators, **Ridge Pole,** pegs, runners, etc., white weatherproof tent cloth, packed in neat carrier, net weight, 18½ lbs. **31/6**

GREEN ROTPROOF CANVAS 42/-

FLYSHEETS, to fit THE "LIGHTPARTY,"
White tent cloth, pegs and lines **16/6**
GREEN ROTPROOF CLOTH **21/-**

SUPERIOR WATERPROOF RUC-SACS

Fawn Waterproof Twill, 2 pockets, stout shoulder straps, special value **2/6**
Double texture Twill, 2 pockets **5/6**
Super quality ditto, 3 pockets **6/6**



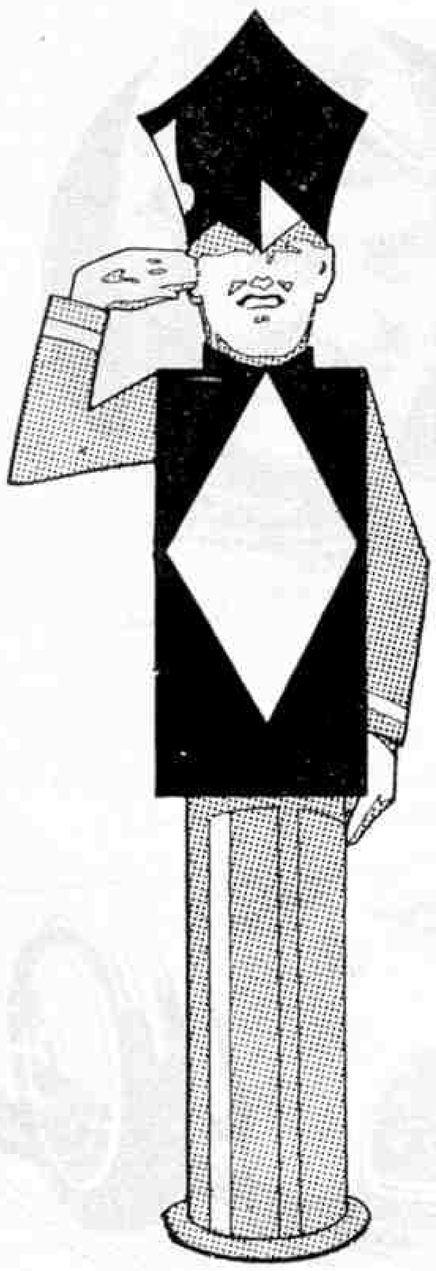
SUPERIOR FRAMED RUC-SACS

15 in. frame one pocket. **12/-**
16 in. frame three pockets. **16/9**
18 in. frame three pockets. **19/-**

CANVAS WATER BUCKETS

(LIGHTWEIGHT)

Superior quality green canvas, rope handle **1/6** each
Wedge shape, tan canvas, cane handle **2/3** ,,
Extra large, round shape, very strong **2/11** ,,



Use

SELO

The fast FILM

BRITISH MADE

in your camera

...and be as "snappy" as the day is long!

FOR EVERY SIZE AND MAKE OF CAMERA

MANUFACTURED IN ENGLAND BY ILFORD LIMITED - ILFORD - LONDON

WHAT A SADDLE!

All riders of the

"TERRY"

Spring Seat

Cycle Saddle say that

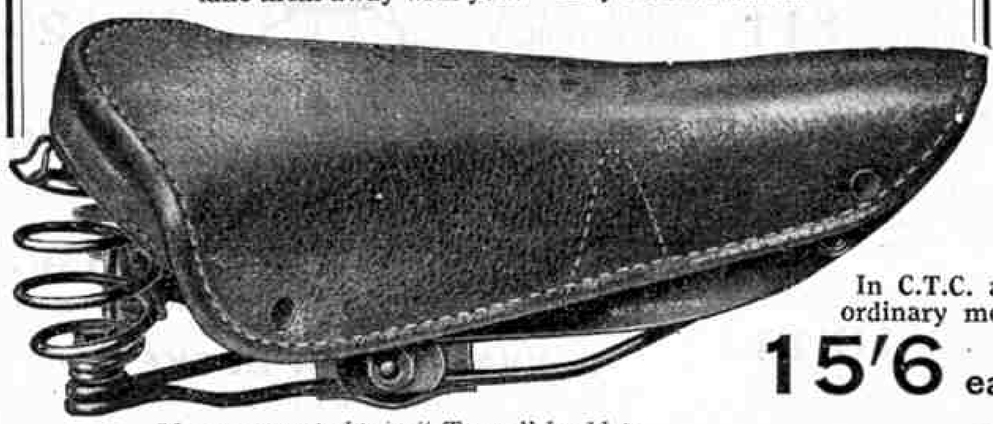
—and well they may.

You will when you take your first run on a "Terry."

Greater speed, greater distances, on any old road—by-ways or highways, in perfect comfort without fatigue.

That is what the "Terry" gives you.

Ask to see one at your dealers. And if he has the "Terry" booklets take them away with you. They are invaluable.



In C.T.C. and ordinary models

15/6 each

If you cannot obtain "Terry" booklets of specialities, please write us.

HERBERT TERRY & SONS LTD., Manufacturers, REDDITCH, Eng. Est. 1855.

TRADE MARK

Champions Both!

FRACTIONAL H.P. MOTORS

are sturdy, "Game for anything"—and possess plenty of stamina.

Instal one in your workshop, for driving tools or models—it will not let you down.

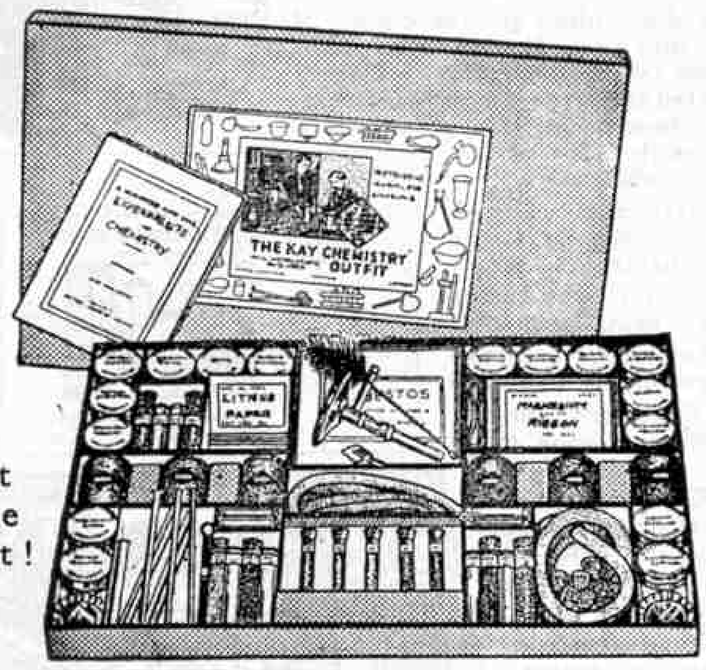
Write for illustrated leaflet AG. 356.

THE BRITISH THOMSON-HOUSTON CO. LTD.
Head Office and Works - - - - - - - - Rugby

A1245N

FOR THE BOY WHO WILL HAVE THE BEST!

KAY CHEMISTRY OUTFITS



The Outfit for the Student!

Thousands of different experiments, all interesting and intriguing, certain to delight the heart of any modern boy, can be performed with the materials supplied in the KAY CHEMISTRY OUTFITS. There are splendid outfits for students at all prices :—1/–, 2/6, 5/–, 7/6, 10/6, 15/–, 21/–, 35/–, 63/– and 105/– each, and every set above 2/6 each includes a splendid BUNSEN BURNER.

In the 10/6 outfit, illustrated above, there are 34 different chemicals, and a splendid assortment of glass tubing, filters, test tubes, rubber tubing, corks, asbestos papers and millboard, Bunsen Tubing, trays, scoops, test tube holder, test tube brush, Bunsen Burner and a splendid book full of experiments and instructions.

What a wonderful difference that magic word KAY makes. It is the hallmark of quality and usefulness. The boy who gets a KAY outfit gets the best possible value at the price; an outfit packed full of interest and amusement.

ASK FOR A KAY OUTFIT!

British Made

6 SPLENDID OUTFITS GIVEN AWAY

every month until the end of 1932.

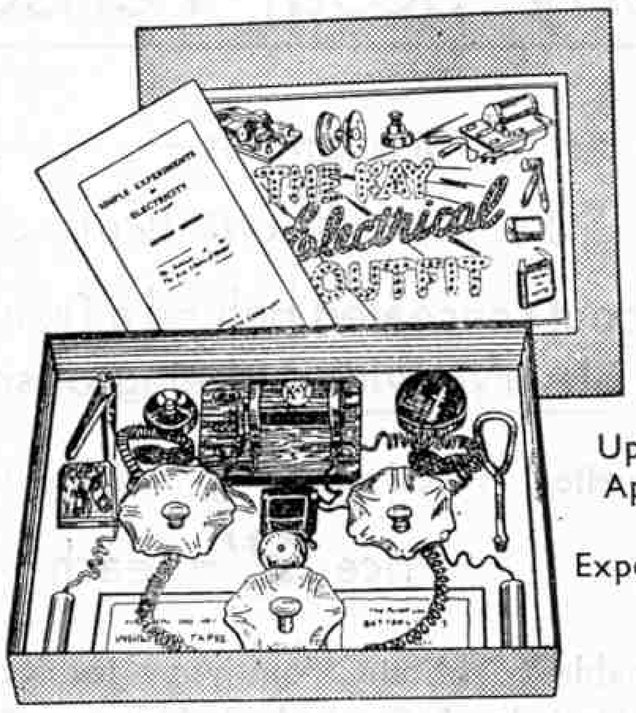
Three Kay Electrical Outfits value 21/–, 15/– and 10/6 each, and Three Kay Chemistry Outfits value 21/–, 15/– and 10/6 each, will be given away to the boy or girl who sends the best answer, in not more than 25 words, to the question :—

"WHY ARE KAY CHEMISTRY AND ELECTRICAL OUTFITS THE BEST?"

Entries for each month must be received before the 28th of the month. Send your answer with the name and address of your local dealer to :—

THE KAY SPORTS CO.,
Competition Dept.,
Pembroke Works, LONDON, N.10.

KAY ELECTRICAL OUTFITS



Up-to-date Apparatus and Experiments!

The wonderful science of Electricity has a great appeal to every boy. The Dynamo, the Electric Motor, the Induction Coil, the Dynamotor, even the Electric Bell or the Electric Lighting Circuit are never ending sources of interest and experiment. There are outfits at 2/–, 3/6, 5/6, 7/6, 10/6, 12/6, 15/–, 21/–, 30/– and 50/– each, and each set is complete in itself with full instructions.

In the 10/6 outfit, illustrated above, there are 3 bulb holders, 3 shades, 3 bulbs, a splendid double-coil Electric Bell, a bell push, battery tester, turnscrew, 1-way switch, a wonderful Electric Induction Coil, battery clips, insulated staples, a supply of bell wire and twin flex, a tin of Kay insulating tape and a splendid book full of experiments and instructions.

Obtainable from all leading Stores, Toyshops and Sports Shops. If you have any difficulty, please send direct to the manufacturers :—

THE KAY SPORTS CO. PEMBROKE WORKS LONDON, N.10

It just beats anything!

Hobbies

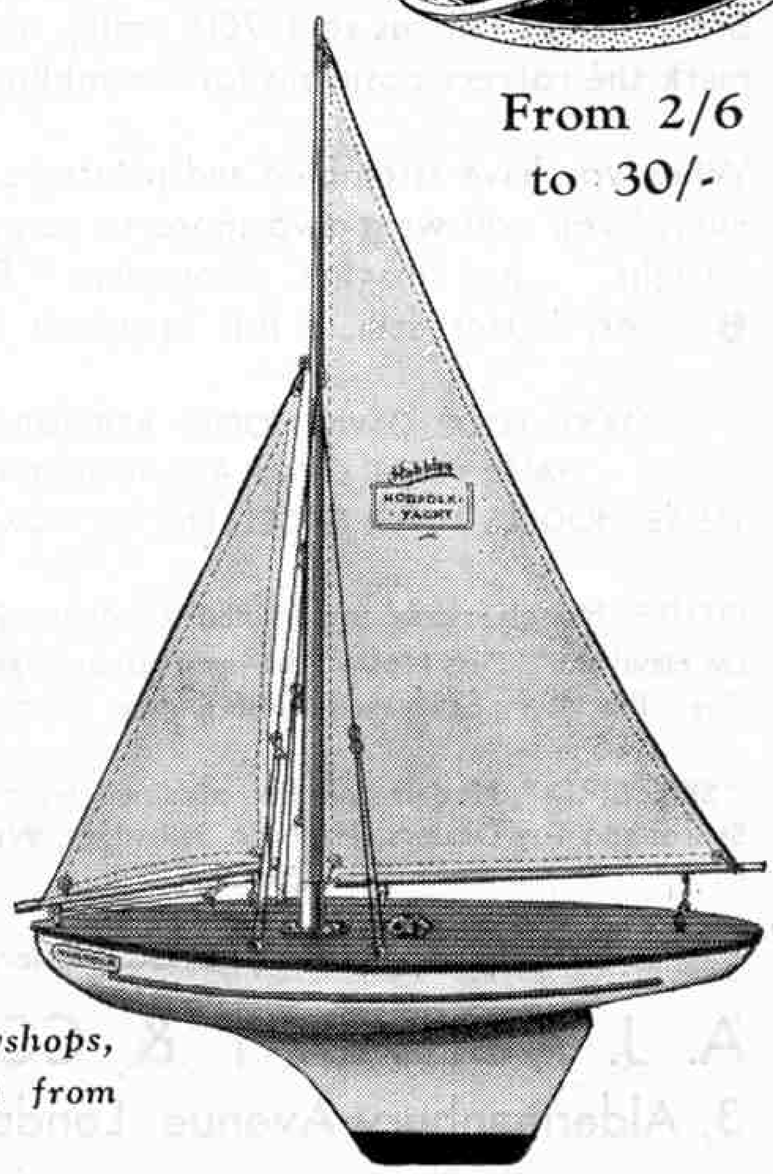
From 2/6 to 30/-

See her cut the water in a stiff breeze, heeling over at a rakish angle, but never upsetting or giving up. Then you know the joy of model yacht sailing. Better than anything you've seen sail. Designed by a boat builder, and guaranteed to sail. Just like the real thing, with hollow hull, waterproof paint, clean-cut white sails, and strong running lines.

BUY A BOAT WITH A NAME BEHIND IT!!

ASK FOR

HOBBIES "NORFOLK" YACHTS



Obtainable from good class stores and toyshops, all Hobbies Branches and direct by post from Hobbies Ltd., Dereham, Norfolk

FREE LIST

An interesting wallet with details and illustrations of sailing boats, steam launches, etc., sent free on request to Dept. 96, Hobbies Ltd., Dereham, Norfolk.

The "GIVJOY"

Boy Scout Periscope

The art of Scouting is:—

"To see without being seen"

A Scout concealed behind a Tree or Corner can observe without being observed.

Enamelled Metal (oblong shape), 17" x 2" x 2"

Price **2/-** each

If unable to obtain from your local dealer, write A. J. Holladay & Co. Ltd., 3, Aldermanbury Avenue, London, E.C.2

HAVE YOU HAD YOUR FIRST

SKY BIRD?

A SKY BIRD constructional aeroplane costs only **2/-**

Start your collection with a "Hawker Fury Interceptor Fighter." Made of Mahogany, with Brass fittings (all cut to 1/70th scale), and holes to mark the correct positions for assembling.

When you have assembled and painted a "Hawker Fury," you will want two more to complete your "Flight." Just imagine, a complete "Flight" for **6**/–, or, better still, a full squadron for **18**/–.

MAKE YOUR OWN MODEL AERODROME!
HAVE YOUR OWN AIR PAGEANT!
THESE MODELS MAKE EXCELLENT MOTOR MASCOTS.

OTHER Models ready for immediate delivery:—
De Havilland "Puss Moth," the most famous light aeroplane.
The "Blackburn Seagrave" Twin Engine, Sports Monoplane.

"SKY BIRD" Models can be obtained from the leading Stores and Toy Dealers, Harrods, Selfridges, Wm. Whiteley, &c.

If unable to obtain from your local dealer, write

A. J. HOLLADAY & CO. LTD.
3, Aldermanbury Avenue, London, E.C.2

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**

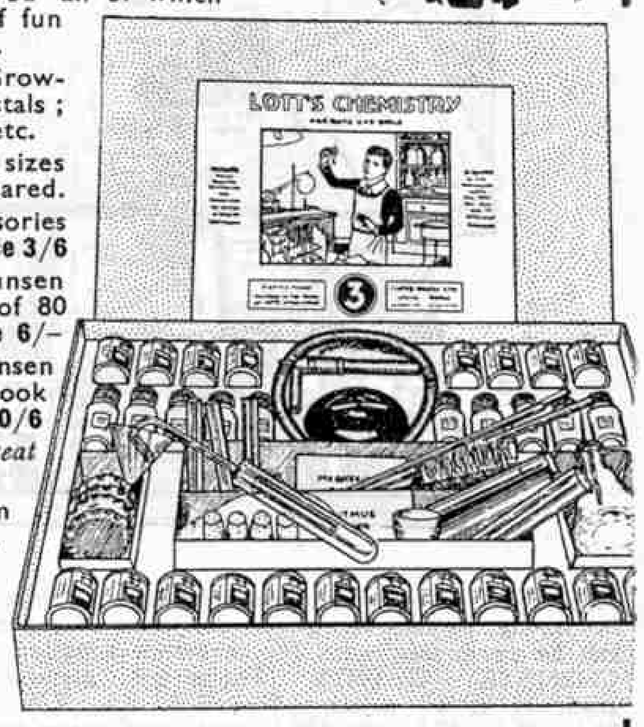
The above prices apply in Great Britain only.

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.,

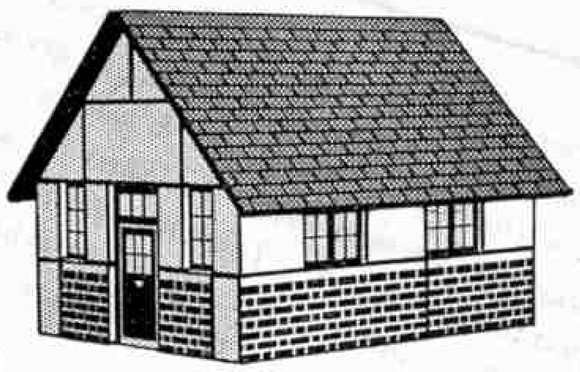
LOTT'S BRICKS LIMITED, WATFORD, HERTS.



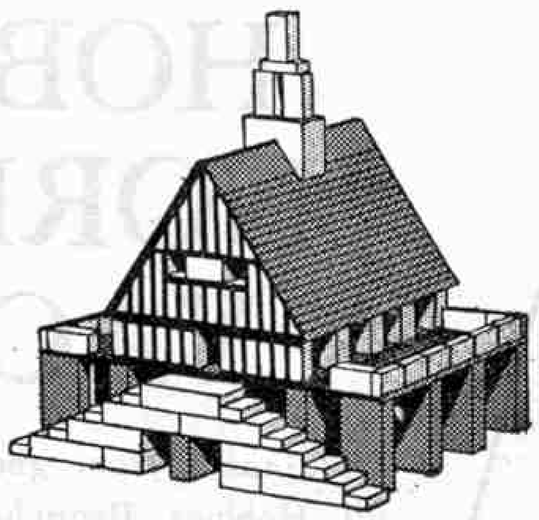
LOTT'S CHEMISTRY

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

LOTT'S BRICKS

A few particulars of some of the sets:—

BOX 1. Contains bricks, roofs, trees and fences, and plans for 30 models. **Price 5/–**

BOX 2. Complete with bricks, roofs, trees and fences, and plans for 48 models. **Price 10/–**

BOX 3. Containing bricks, roofs, and plans for 72 models. Contains twice as many bricks as Box 2 and builds proportionately larger models. **Price 17/6**

TUDOR BLOCKS at 3/6, 7/6, 21/– per box.

LODOMO at 3/6, 7/6, 12/6 per box.

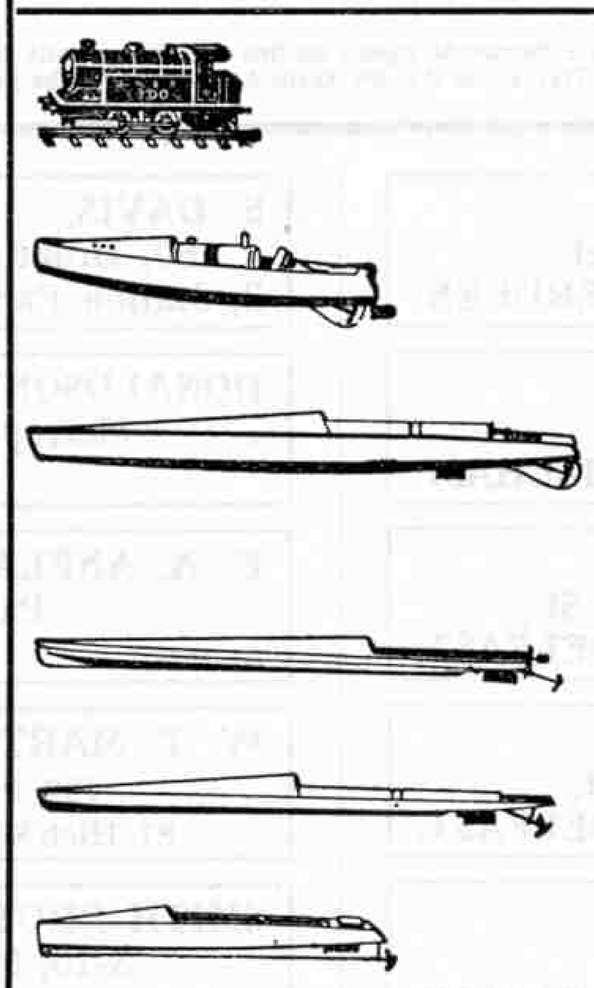
RAILWAY BOX. With this set especially fine models of Stations and Signal Boxes can be built. Contains large numbers of embossed Door and Window bricks; also roofs and platform sections. **Price 17/6**

Write for complete list illustrated in colours.
Dept. M.M., LOTT'S BRICKS LTD., WATFORD, HERTS.

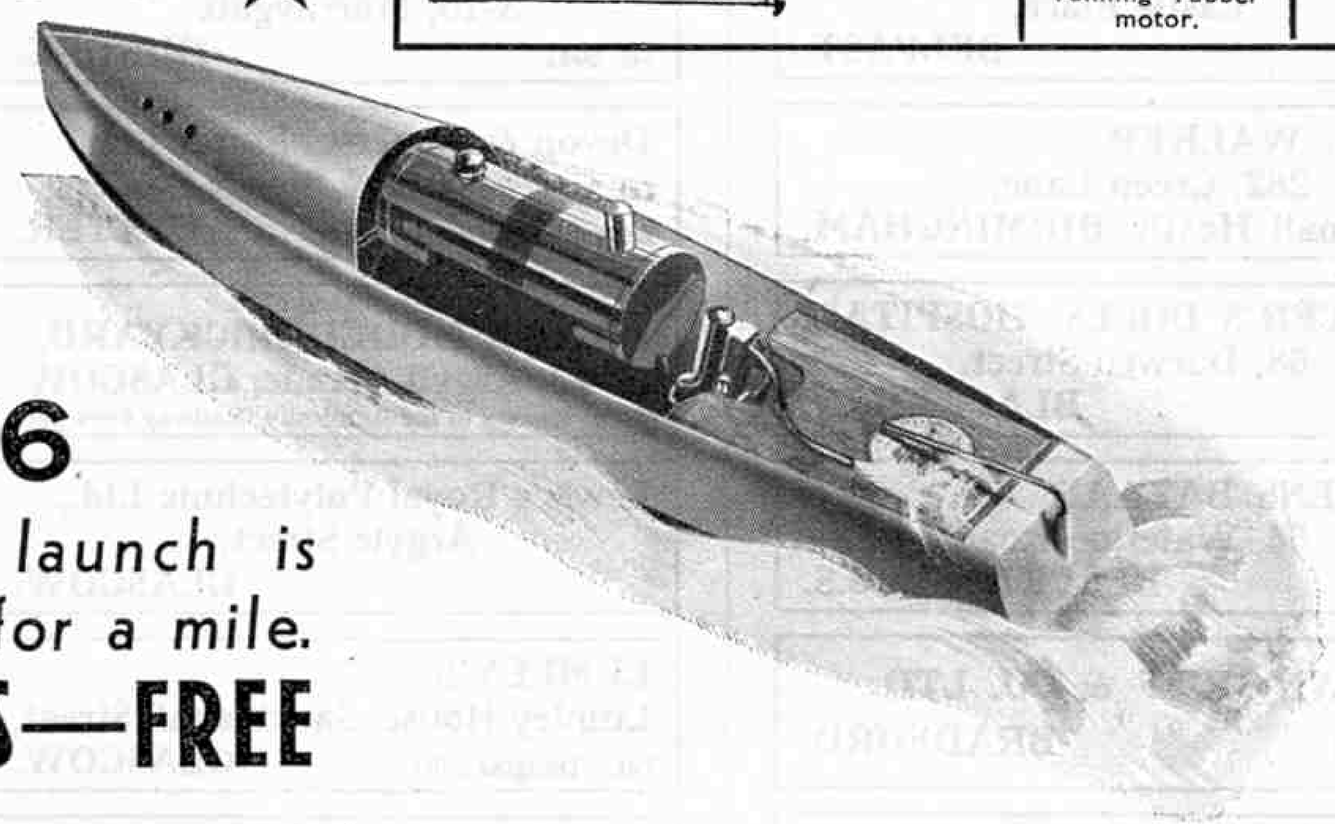
LAST WEEK
OF THE HOBBIES-BOWMAN
AMAZING
PRIZE SCHEME
1 in EVERY 3 ENTRANTS
RECEIVES A PRIZE!

★ CLOSING AUG. 6 ★

PRIZES OFFERED BY EVERY KEEN BOWMAN STOCKIST



LOCO 300 Length 8¾". 'O' gauge. Steams non-stop ¾ 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**



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

There's just one more week in which to win one of these wonderful Bowman prizes. If you don't know all the particulars ask your Bowman stockist to-day. He will give you details and special entry forms. And while you are there you can inspect all the Bowman models, including those offered as prizes. But remember, August 6th is the very last day; it's a chance you cannot afford to miss!

AEROBOATS

The wonderful Bowman Aeroboats are already famous for their great speed and fine sleek lines. There are two models—Aeroboat I, a super racing craft with patent wood hull, fitted with cockpit and spray hood. Beautifully finished in three colours. Length 32½". Beam 4½". Runs 12-15 mins. Bowman special rubber motor with gearing, control lever and pro-patent "Easi-wind." **17'6**

Aeroboat II is similar. Length 31". Beam 3½". Runs 9 mins. **15'6**

BOWMAN MODELS

Dept. MM16
DEREHAM
NORFOLK

Meccano & Hornby Train Supplies

All the dealers whose advertisements appear on this and the opposite page carry full stocks of Meccano Outfits, Accessory Outfits, and Meccano parts. Hornby Trains and Hornby Train Accessories all the year round. The names are arranged in alphabetical order of town.

JOHN N. PIPER,
118, Union Street,
Tel. 2797 ABERDEEN.

HARRY BROWN,
1, Cross Street,
Tel. 2221 ALTRINCHAM.

J. BELL,
10, Lower Garfield St.,
Royal Avenue, BELFAST.

PATTERSONS,
of Bridge Street,
BELFAST.

J. ROBB & CO. LTD.,
Castle Place,
BELFAST.

L. W. WALKER,
262, Green Lane,
Small Heath, BIRMINGHAM.

MERCER'S DOLLS' HOSPITAL,
68, Darwen Street,
BLACKBURN.

SELLENS BAZAAR,
54, Waterloo Road,
BLACKPOOL, S.S.

BROWN MUFF & CO. LTD.,
Tel. 2890 BRADFORD.

RUSHWORTHS LIMITED,
Kirkgate,
BRADFORD.

JOHN TAYLOR,
28, Preston Street,
Tel. : Brighton 1357 BRIGHTON.

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11 & 12, Lower Arcade, BRISTOL.
15 & 16, Narrow Wine Street, BRISTOL.
Tel. 511

C. E. CONEYBEARE,
470-2, Stapleton Rd., Eastville,
BRISTOL.

M. W. DUNSCOMBE LTD.,
5 & 7, St. Augustine's Parade,
BRISTOL.

SALANSON LTD.,
20, High Street, BRISTOL.
Optic House, 119, Queen St., CARDIFF.

S. DAVIS,
50, Broad Street, CHESHAM.
3, Station Parade, Croxley Green.

DONALDSON'S CAMERA HOUSE,
Metropole Buildings,
CORK.

E. A. ANELAY,
Parkgate,
Tel. 2925 DARLINGTON.

W. T. MARTIN, Tel. 4578
199, Princes St., 68, Wellgate,
87, High Street, Lochee, DUNDEE.

SMITH BROTHERS,
3-15, Murraygate,
Tel. 5041 DUNDEE.

Devon & Somerset Stores Ltd.,
Tel. 2638 Toy & Sports Dealers,
Telegrams : Stores, Exeter EXETER.

Established 1789.
CLYDE MODEL DOCKYARD,
22-23, Argyll Arcade, GLASGOW.
Model Makers to the Admiralty, Railway Coys., etc.

Lewis's Royal Polytechnic Ltd.,
Argyle Street,
GLASGOW.

LUMLEY'S,
Lumley House, Sauchiehall Street,
Tel. : Douglas 2701 GLASGOW.

R. WYLIE HILL & CO. LTD.,
20, Buchanan St. & Argyll Arcade,
GLASGOW, C.1.

G. WATSON,
Guildford Doll's Hospital,
Swan Lane, GUILDFORD.

H. POULTON, Toyland,
75 & 77, High Street,
HOUNSLOW, Middlesex.

YE OLDE TOY SHOPPE,
Chariot Street,
Tel. : Central 35031 and 533y1 HULL.

TOWNLEY & TAYLOR,
Tel. 570 KENDAL.

BENTALLS LTD.,
KINGSTON-ON-THAMES.
Tel. 1001 Kingston

GIBB & WATSON,
270-274, High Street,
Tel. 2528 KIRKCALDY.

ROBOTHAM'S LIMITED,
32/4/6/8, Belvoir Street,
Tel. 60809 LEICESTER.

J. T. WEIGHTMAN,
198, Charnwood Street,
LEICESTER.

Leith Provident Co-operative Socy. Ltd.,
Drapery Dept., 174, Great Junction St.,
LEITH.

A. & B. BLACKMAN & SONS,
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Tel. : Mount View 4310 LONDON, N.W.5.

Bon Marché Ltd.,
Brixton,
Tel. : Brixton 6201 LONDON, S.W.9.

H. HOLDRON LTD.,
Rye Lane,
Tel. : New Cross 4041 PECKHAM, S.E.15.

W. HUMPHRYS & SON,
269/271/273 & 275, Rye Lane,
Estab. in 1840 PECKHAM, S.E.15.

LEDWITH BROS.,
42 & 44, Walworth Road,
Nr. ELEPHANT AND CASTLE LONDON, S.E.17.

H. G. PARTRIDGE & CO.,
10, Chapel Street,
Tel. 234 LUTON.

A. INMAN, MANCHESTER.
105, Lapwing Lane, Didsbury. Tel. 1518.
179, Dickenson Rd., Rusholme. Tel. 2241.

H. WILES LTD.,
124, Market Street,
MANCHESTER.

THE MANSFIELD & SUTTON CO-OP. SOC. LTD., Queen Street,
Tel. 583 MANSFIELD.

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13, Frankfort Street,
Tel 398 PLYMOUTH.

ERIC G. ENGLAND,
Tel. 68 PONTEFRACT.

JAMES GRAHAM,
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ROTHESAY.

CURRYS LTD.,
2, Prospect Place, Above Bar,
SOUTHAMPTON.

OSBORN & CO. (So'ton) Ltd.,
9, High Street,
SOUTHAMPTON.

TYRRELL & GREEN LTD.,
Above Bar,
SOUTHAMPTON.

RAVEN'S STORE,
90-92, High Street,
Tel. 67665 SOUTHEND-ON-SEA.

Ask your Dealer to show the new Hornby Speed Boat

REDMAYNE & TODD LTD.,
Carrington Street,
Tel. 41604 NOTTINGHAM.

THE ATHLETIC STORES,
Opposite Town Hall,
Tel. 1238 OLDHAM.

E. DE LA MARE,
9/13, George Street,
Tel. 3456 OXFORD.

COLE BROTHERS LTD.,
Tel. 21071 SHEFFIELD.

SHEFFIELD PHOTO CO. LTD.,
6, Norfolk Row (Fargate),
Tel. 23891 SHEFFIELD.

WILSON, GUMPERT & CO. LTD.,
57, Fargate,
Tel. 20489 SHEFFIELD.

DAN MORGAN, The Meccano Centre,
218, Oxford St.,
Tel. 2346 SWANSEA.

L. MYERSCOUGH, 57, South Rd.,
WATERLOO.
Branches : Crosby & Litherland.

PICKERINGS,
28, High Ousegate,
Tel. 3678 YORK.

Stamp Advertisements cont. from p. 636

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

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

250 BRIT. COLS., 9d., 1,000 Stamps 8d., Postage 1½d.—Adams, 51, Barnfield Rd., Harpenden, Herts.

GREAT ININI PACKET FREE ! ! Contains 379 Foreign Stamps, many scarce from Inini, Ethiopia, Malmedy, Philippines, Fr. Guiana, N. Caledonia, Kg. Tcheou, etc. **Free** to Postal requests for our **Extra Large Discount Approvals.** Send 2d. postage (abroad 6d. P.O.).—**Longbottom & Eastick, 329, Holdenhurst Rd., Bournemouth.**

DO YOU COLLECT Fine Used British Colonials? Then ask to see my collection of 600 different at ½d. each Stamp, the best value at the lowest cost. Sent on request. A good selection at 1d. each and upwards if desired. Duplicate Stamps Bought or Exchanged. **BICKERS, Elveden, Lordswood Avenue, Southampton.**

AIR STAMPS
25 diff., **1/-**,
50 diff., **2/9**,
100 diff., **9/6**.

RARE STAMPS. We solicit inquiries for old "classic" rarities—British Line-engraved, Cape triangulars, early B.N.A., N.S.W. Sydney Views, etc., always available at bargain rates. **Full Lists Free. Superb Approvals** (any country) against references. **Norris & Co. (Dept. M), Norwood, London, S.E.19.**

PAPUA **PICTORIAL SET FREE**
A new set of Stamps from this British Possession sent free of charge to bona-fide applicants for selections of duplicates on approval. 16 Old English Revenue Stamps, 1/- to 5/-, post free **4d.**
HENRY TURNER,
110, Barnett Road, Preston, Brighton, Sussex.

1000 DIFFERENT STAMPS 1000
ON APPROVAL
from which you may select any 100 for **3/-**. This selection is **not** made up of the thousand commonest stamps, but contains specimens priced by Stanley Gibbons up to 1/- each. For 3/- you have the opportunity of choosing 100 stamps of the catalogue value of 20/- or more.
H. HARDY,
39, Rosebery Gardens, Hornsey, London, N.8.

Producing Lightning—(*Continued from page 597*)

Ordinary voltmeters and ammeters are useless for measuring electrical impulses that last for less than one millionth of a second; and instead an instrument known as the cathode ray oscillograph is used, in which a stream of electrons, or negatively charged particles, acts as a pointer. The instrument consists of a vacuum tube with two terminals or electrodes, supplied with current at from 30,000 to 60,000 volts from a transformer. When the tube is excited by this high-voltage current, the cathode or negative electrode emits a stream of electrons that traverse the length of the tube and impinge upon a photographic film. When a lightning flash takes place, the electron stream is turned slightly from its normal path, and the amount of the deviation is recorded on the film. After the film has been developed, very accurate measurements of these deviations may be made. The electron stream is invisible, but its position may be revealed by placing in its path a screen coated with calcium tungstate, which glows when bombarded by electrons.

The cathode ray oscillograph used at Croton Dam was mounted on a truck so that it could be moved to any point along the line, and the whole of last summer was spent by a group of experts in studying the effects produced by the artificial lightning generator.

Games for Small Gardens

The recent spell of glorious weather has forced everyone out of doors, and garden games have enjoyed a far greater popularity than in recent years.

Readers in search of new ideas for garden games would do well to secure details of the specialities marketed by British Games Ltd. They include the popular Tutor Tennis—a tennis training device with many outstanding features; Springbak, a game that will make a strong appeal to the cricket enthusiast, and Junior Badminton, an outfit that will give all the thrills of full scale Badminton in a garden measuring no more than 10 feet in width. "Fifteen" is a new and safe shooting game that will appeal to adults as well as to boys, while "Garden Pool" is a most ingenious combination of bowls and snooker pool that can be played on lawns of any size.

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The Outdoor World—(*Continued from page 577*)

Presently it comes to the surface, the pupa case splits and the perfect Gnat emerges. After a short rest on the floating skin in order to dry its wings, it takes to flight—possibly to the subsequent annoyance of some unfortunate human being in the vicinity!

Our pond will not provide many fishes for the aquarium. For these we must turn to a running stream, the reason being that fish require clean and fresh water in which to live, and our cover, which is based on a prize-winning photograph submitted in our March "Happy Snaps" Contest by A. Martin, Birmingham, shows a group of young naturalists searching a suitable brook.

There are many kinds of fish that are suitable for an aquarium, but experience should first be gained with the more hardy specimens, such as the Minnow, and the Golden, Common, and Prussian Carp. Those who do not live near streams and therefore are unable to catch their own fish, should purchase them from a reliable dealer. The fish must of necessity be small and few in number, for any attempt to crowd the tank is certain to result in failure. Later, when the first fishes have settled down comfortably and made themselves at home, and if there is still room to spare, a couple of Golden Orfe might be introduced.

Fishes need very little food. Some of them are more particular than others, but generally speaking ants' "eggs"—which are really the pupa of the ants—are welcome, and form excellent food. Other suitable foods are finely chopped shrimp, raw meat, hard-boiled egg, small worms, or finely broken vermicelli. Small crustaceans and larva and pupa of water flies from ponds and ditches are a luxury; but they are not a necessity. The eggs and fry of the water snails living in the tank also provide wholesome food.

On no account must small particles of food be left in the tank to decay. These particles may be removed quite easily, without disturbing the occupants of the tank, by means of a narrow glass tube, used as a "pipette." The top end of the tube is closed by pressure of the finger and the other end is lowered into the tank until it is just above the particle to be removed. The finger is then lifted and water rushes up into the tube carrying with it the offending particle. The top of the tube is again closed with the finger and the tube, with its contents, are then withdrawn from the tank.

If a tank is of sufficient size to warrant the step, greater pleasure may be obtained and more creatures kept in healthy condition by laying on town's water. The jet, which need be no larger in diameter than a darning needle, may be turned downwards so as to impinge upon the surface of the water. This tiny pressure jet will drive a stream of silvery air bubbles far beneath the surface of the water and the Minnows will gambol and rush up the glistening track in the most delightful manner. The downward jet may be removed and a fountain jet screwed on at will.

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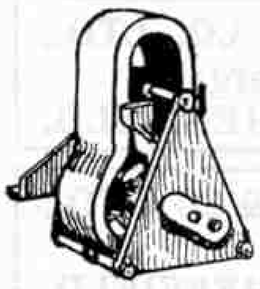

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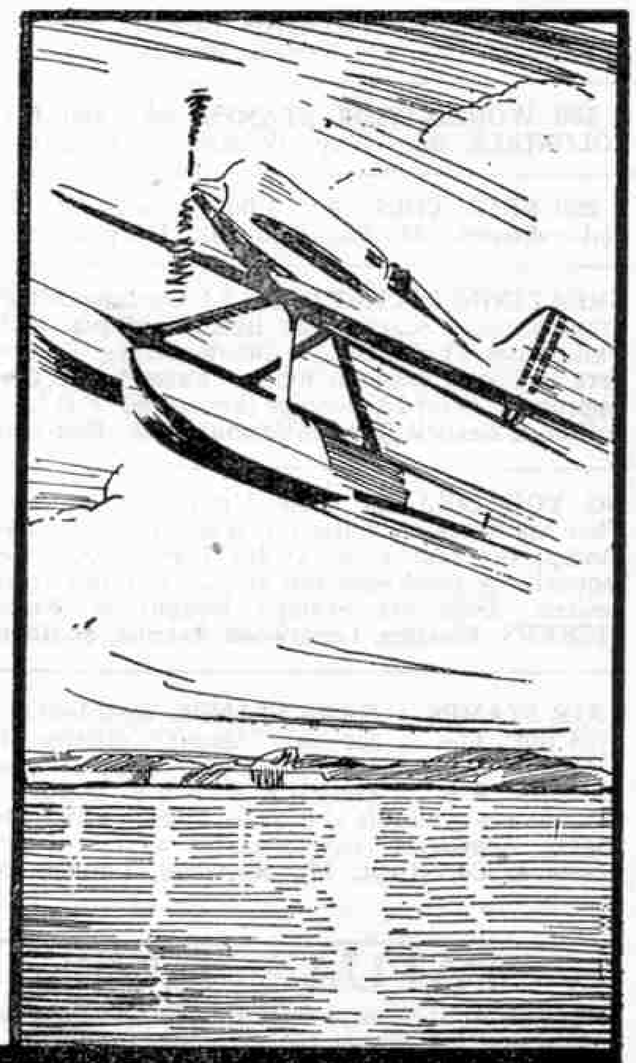

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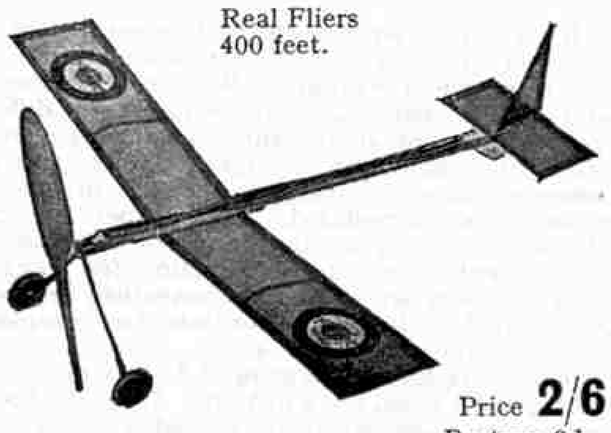

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South African Models and Hobbies Exhibition

An exhibition of models, hobbies and handicrafts—the first of its kind in South Africa—will be held in the City Hall, Johannesburg, on October 13, 14 and 15. It is being organised by the "*Johannesburg Star*" and is receiving the support of the local education authorities, while the management of the South African Railways is co-operating by agreeing to convey exhibits at special rates. Sections of the exhibition will be allocated to photographs, model engines and ships, wood carving, etc., and a trophy will be offered for inter-school competition.

A Successful Canadian Competition

The recent model-building competition organised by our Canadian dealers, Messrs. Barber & Holdcroft, 1623, Douglas Street, Victoria, B.C., created a great deal of interest, and many splendid models were submitted. Our dealers tell us that competition for the prizes was exceedingly keen. The following are the prizewinners, to whom we offer our hearty congratulations:—Class 1, Boys over 12 years—1. PETER G. HARTNELL; 2. FRED J. COX; 3. GEORGE P. KIDD. Consolation Prizes, ROY W. BURGESS, RUDOLPH HOLSTEIN-RATHLOU. Hon. Mention, LOUIE ALEXANDER, J. BARBER-STARKEY, PATRICK J. PATERSON. Class 2, Boys over 9 years—1. COLIN STEWART; 2. BILLY F. WALKER; 3. DAVID J. ROSE. Hon. Mention, BERT MORRIS, ROBERT BOWN, ALBERT HARDY, KENNETH SCHARFF. Class 3, Boys under 9 years—Special Prizes, ALFRED EVANS, CAMVILLE LAYARD.

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Aircraft Developments—(*Cont. from page 605*)

and Ryde. This service will be inaugurated as soon as the aerodrome at Ryde is suitable for use.

The new type of Westland "Wessex" uses the same engines as the earlier one, but the fuselage is different, being wholly of metal construction, with a covering of fabric. The cabin also is slightly larger, and eight passengers may be carried instead of the five previously accommodated. Both types are fitted with tail trimming gear, by the use of which an aeroplane is kept flying in the direction for which the rudder has been set. The pilot may then remove his hands and feet from the controls for considerable periods in order to obtain a rest.

The new machine has a span of 57 ft. 9 in., a length of 39 ft., and a wheel track of 15 ft. It weighs 3,923 lb. when empty, and when fully loaded 6,300 lb. At ground level it is capable of attaining a maximum speed of 120 m.p.h., and of maintaining a cruising speed of 105 m.p.h., an appreciable improvement on the performance of the earlier model. The initial rate of climb is 600 ft. per minute, and the service ceiling is 11,200 ft. The absolute ceiling is 13,500 ft., while with any two engines in operation an altitude of 4,500 ft. may be maintained. A modern feature is that the undercarriage of the "Wessex" is fitted with balloon tyres, or "doughnuts" as they are sometimes termed, and there is a tail wheel in place of a skid. The engines are equipped with Townend rings, and it has been found that these increase the speed by as much as four miles per hour.

How to Get More Fun—(*Continued from page 625*)

the siding, where it is stopped. The siding section is then isolated by switch G, and the section BC is put into circuit. After the No. 2 Tank has been reversed the train resumes its journey along the main line, the electrical conditions thus being restored to their original state.

This scheme shows only the elements of the plan, and it may be developed on a more extensive scale, particularly on double track systems having separate power supplies for the "up" and "down" roads. Readers interested in electric railways, and especially in the Metropolitan Railway, will find that experiments of this kind are well worth while, for they add considerably to the fascination of operating their layouts.

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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Press Day, etc. Copy should be sent as early in the month as possible for insertion in following issue. We usually close for press on or before 6th of each month for following issue. Half-tone blocks up to 100 screen.

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Ordering the "M.M." Overseas

Readers Overseas and in foreign countries may order the "*Meccano Magazine*" from regular Meccano dealers or direct from this office. The price and subscription rates are as above, except in the cases of Australia, where the price is 1/5 per copy (postage extra), and the subscription rates 9/6 for six months and 19/- for 12 months (post free); Canada, where the price is 15c. per copy, and the subscription rates 75c. for six months, and $1.50 for 12 months (post paid).

The U.S.A. price is 15c. per copy, and the subscription rates $1 and $2 for 6 and 12 months respectively (post free).

Overseas readers are reminded that the prices shown throughout the "*M.M.*" are those relating to the United Kingdom and Northern Ireland. Current Overseas Price Lists of Meccano Products will be mailed free on request to any of the undermentioned agencies. Prices of other goods advertised may be obtained direct from the firms concerned.

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SOUTH AFRICA: Mr. A. E. Harris (P.O. Box 1199), 142, Market Street, Johannesburg.

INDIA: Karachi: Bombay Sports Depot, Elphinstone Street, Bombay; Bombay Sports Depot, Dhobi Talao. Calcutta: Bombay Sports Depot, 13/C, Old Court House Street.

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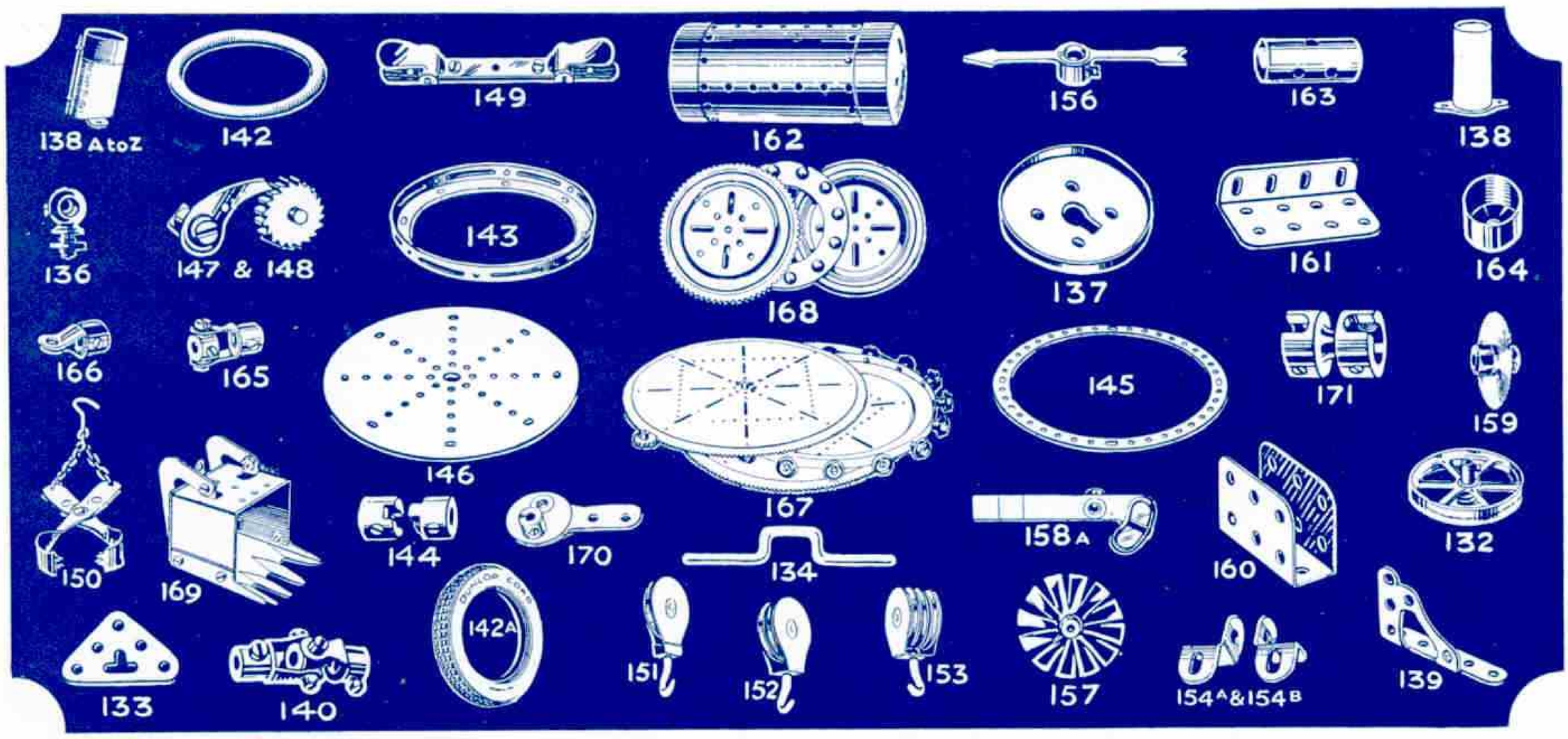

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143.	Circular Girders, 5½" diam. ... ... „	1	0
144.	Dog Clutches ... ... „	0	6
145.	Circular Strips, 7½" diam. overall ... „	0	9
146.	„ Plates, 6" „ ... ... „	1	0
146a.	„ „ 4" „ ... ... „	0	6
147.	Pawls, with pivot bolt and nuts ... „	0	3
147a.	Pawls ... ... „	0	2
147b.	Pivot Bolt with 2 nuts ... ... „	0	2
148.	Ratchet Wheels ... ... „	0	6
149.	Collecting Shoes for Electric Locos „	1	6
150.	Crane Grabs ... ... „	0	7
151.	Pulley Blocks, Single Sheave ... ... „	0	8
152.	„ „ Two „ ... ... „	0	9
153.	„ „ Three „ ... ... „	1	0
154a.	Corner Angle Brackets, ½", right hand ½ doz.	0	6
154b.	„ „ „ ½", left hand „	0	6
155.	Rubber Rings, ⅝" ... ... each	0	1

No.		s.	d.
156.	Pointers, 2½" over all, with boss ... each	0	4
157.	Fans, 2" diam. ... ... „	0	4
158a.	Signal Arms, Home ... ... „	0	5
158b.	„ „ Distant ... ... „	0	5
159.	Circular Saws ... ... „	1	0
160.	Channel Bearings, 1½" × 1" × ½" ... „	0	2
161.	Girder Bracket, 2" × 1" × ½" ... ... 2 for	0	3
162.	Boiler, complete with ends ... ... each	1	0
162a.	Boiler ends ... ... „	0	3
162b.	Boiler without ends ... ... „	0	6
163.	Sleeve Pieces ... ... per pair	0	6
164.	Chimney Adaptors ... ... each	0	2
165.	Swivel Bearings ... ... „	0	6
166.	End „ ... ... „	0	3
167.	Geared Roller Bearings ... ... „	20	0
167a.	Roller Races, geared, 192 teeth ... „	4	6
167b.	Ring Frames for Rollers ... ... „	3	0
167c.	Pinions for Roller Bearings, 16 teeth „	1	0
168.	Ball Bearings, 4" diam. ... ... „	3	0
168a.	Ball Races, flanged disc ... ... „	0	6
168b.	„ „ toothed „ ... ... „	0	9
168c.	Ball Casings, complete with balls „	1	9
169.	Digger Buckets ... ... „	2	0
170.	Eccentrics, ¼" throw ... ... „	0	9
171.	Socket Couplings ... ... „	0	9
172.	Pendulum Connections ... ... „	0	1
173.	Rail Adaptors ... ... per pair	0	6
174.	Grease Cups ... ... each	0	3
175.	Flexible Coupling Units ... ... „	0	6
176.	Anchoring Springs for Cords ... per doz.	1	0
177.	Shafting Standards, Large ... ... each	1	0
178.	„ „ Small ... ... „	0	8
179.	Rod Sockets ... ... „	0	3

The Meccano system is composed of some 250 real engineering parts, mostly made of steel or brass, each one of which has a definite mechanical purpose. These parts combine to form a complete miniature engineering system that enables practically any movement known in mechanics to be duplicated. All the parts are interchangeable and each one may be used in hundreds of different models.

New parts are always being introduced in order to keep Meccano model-building in line with the most modern engineering requirements. The greatest care is taken in the designing of these parts to ensure that they function exactly as their counterparts in actual practice.

The above is the third and final group composed of parts 132 to 179 inclusive. The preceding groups appeared in the February and June 1932 issues of the "M.M."

A complete list of all the parts in the system may be obtained from any Meccano dealer on application.

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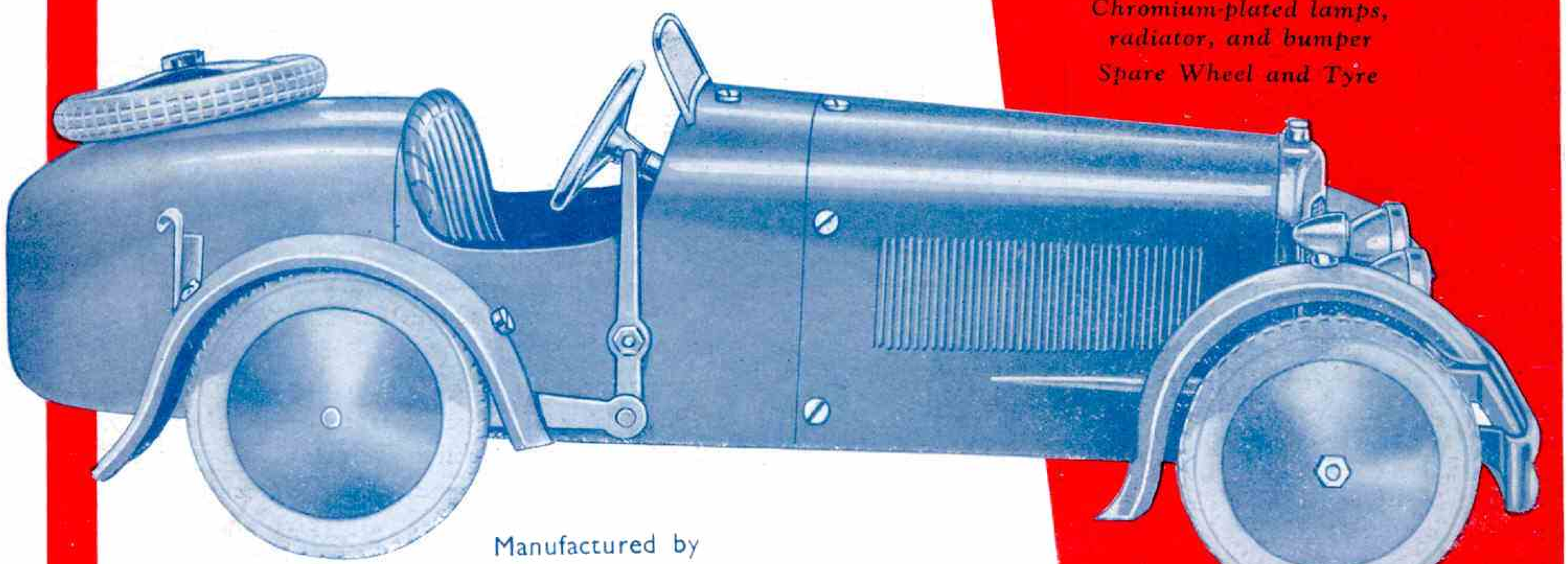

Manufactured by

MECCANO LIMITED, OLD SWAN, LIVERPOOL

PUBLISHED BY MECCANO LTD., OLD SWAN, LIVERPOOL, ENGLAND.
Printed by John Waddington Ltd., Leeds and London.