VOL. XX. No.6 JUNE 1935

MECCANO MAGAZINE

A GIANT BUCKET DREDGER
(see page 330)

6D.

This is the giant Fairey Long-range night bomber, a well-known type of low-wing monoplane used for long distance flying.

Buy a Meccano Aeroplane Outfit

and build realistic models of the World's leading aircraft

Every boy should know how aeroplanes are designed and constructed, and should be able to recognise at a glance the different types of machines in order to understand the purposes for which they have been developed.

The Meccano Aeroplane Constructor Outfits enable boys to design and build their own Aeroplanes quite easily, for these Outfits make possible aeroplane construction on sound engineering lines. All the parts are interchangeable on the famous Meccano principle.

The beautifully illustrated Manual of Instructions included in each Outfit shows how to build wonderful models of high and low-wing Monoplanes, Biplanes, Seaplanes and giant amphibian machines. In fact, models of almost every type of aircraft can be made with these splendid Outfits. Ask your dealer to show them to you.

PRICE LIST

STANDARD SERIES

No. O AEROPLANE OUTFIT

An interesting range of models can be built with this Outfit, including high and low wing monoplanes. Price **5/-**

No. O1P AEROPLANE HANGAR OUTFIT

This novel Outfit consists of the complete range of No. O Aeroplane Outfit parts packed in a No. O1 Aeroplane Hangar. Price **9/6**

Note.—The parts in the No. O and No. O1P Aeroplane Outfits are not intended for use with any of the other Outfits.

No. 1 AEROPLANE OUTFIT

Magnificent models of high and low wing monoplanes, and interesting model biplanes can be built with this fine Outfit. Price **9/-**

No. 2 AEROPLANE OUTFIT

This Outfit enables a splendid range of models to be built including triple-engined monoplanes and biplanes and a racing seaplane. Price **16/6**

SPECIAL SERIES

No. 1 SPECIAL AEROPLANE OUTFIT

The parts in this Super Aeroplane Outfit will build over 20 realistic models of different types of aircraft. Price **15/-**

No. 2 SPECIAL AEROPLANE OUTFIT

This is the finest Aeroplane Constructor Outfit on the market. It contains a big range of aircraft parts, with which numerous models of practically any type of machine may be built—44 examples are shown in the Manual of Instructions that is included. Price **25/-**

All Meccano Aeroplane Outfits are available in three different colour combinations—Red and Cream, Blue and White and Cream and Green.

Manufactured by

MECCANO LIMITED

Binns Road - Liverpool 13

This fine model of a low-wing monoplane is made with Meccano No. 2 Special Aeroplane Outfit.

No. O Meccano Aeroplane Outfit. Price **5/-**

No. 1 Meccano Aeroplane Outfit. Price **9/-**

No. 2 Special Meccano Aeroplane Outfit. Price **25/-**

MECCANO

AEROPLANE CONSTRUCTOR

Hamleys News

· HAMLEY · BROTHERS · LTD · ESTABLISHED · 1760 ·

200-202, REGENT STREET, LONDON, W.1 **OUR ONLY ADDRESS**

Number Twenty-six *June, 1935*

IT'S GOING TO BE AN OUTDOOR SUMMER

The weather experts tell us that we've another fine summer ahead, so be prepared with the right equipment. We specialise in everything for the open-air and shall be pleased to give you help and advice.

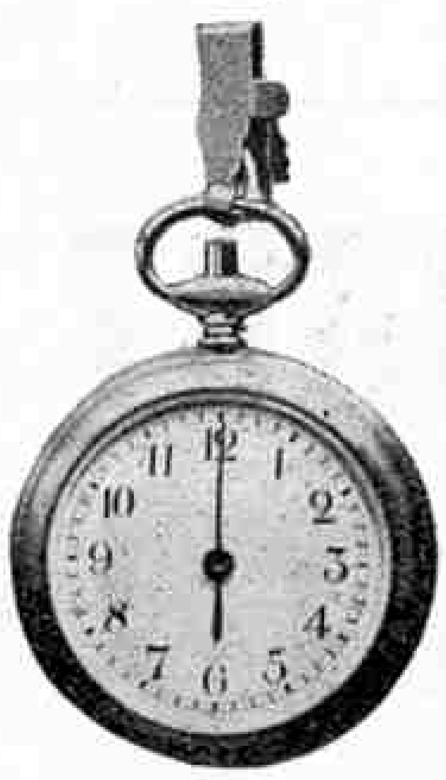
Write for our 1935 Summer List sent post free on request.

SHEATH KNIFE

The boy's knife. Wooden handle. Good quality steel blade. Complete in leather sheath. Price **2/3**. (Foreign.) Post 4d.

CYCLOMETER

A useful addition to the cycle, registers up to 10,000 miles. British made. State whether 26 or 28 inch wheels. Price **3/6**. Post 3d.



PEDOMETER

Registers in yards and miles up to 100 miles exactly how far one walks. Price **19/6**. Post 4d.

BIKE TENT

The very tent to take with you on your week-end tour. Weight only $6\frac{1}{4}$ lbs. Size 6 ft. x 4 ft. x 3 ft. Price **12/9**. Post 1/-. We stock tents suitable for all occasions. Prices and sizes on request.

TYRE BELL

A novelty for the cycle, giving a penetrating note. Price **2/6**. Post 6d.

CORBALLO

Most thrilling and exciting of games. The rules are simple and the game can be played on the beach, at home in your garden or in the playing fields.

Junior set, Price **9/10**. Senior set, Price **21/-**. Post 9d.
Senior set in box complete with goals and centre net. Price **42/-**.

BOOMERANG

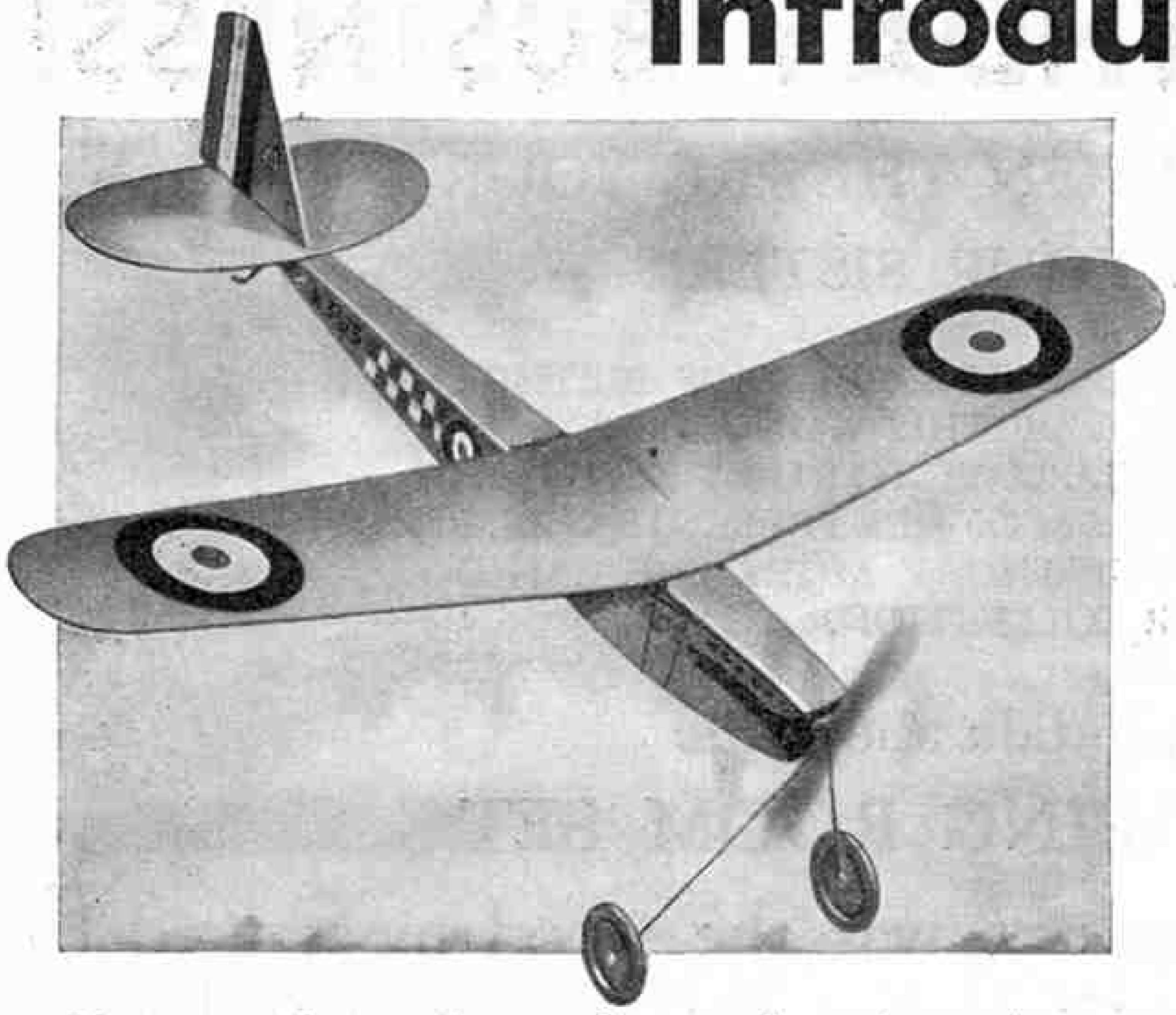
Will cause endless enjoyment. Guaranteed to fly. Price **3/11**. Post 6d.

RUC SAC

A strong lightweight ruc sac made from stout khaki proofed canvas. Price **4/11**. Post 9d.

Introducing the METEOR

A new "FROG" aeroplane

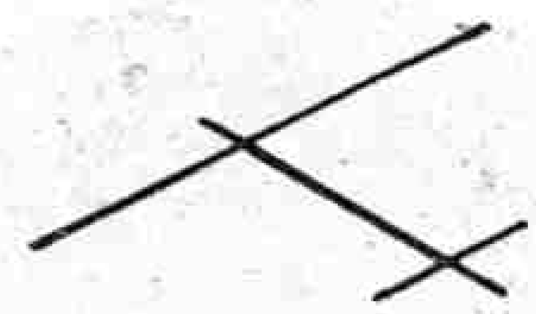


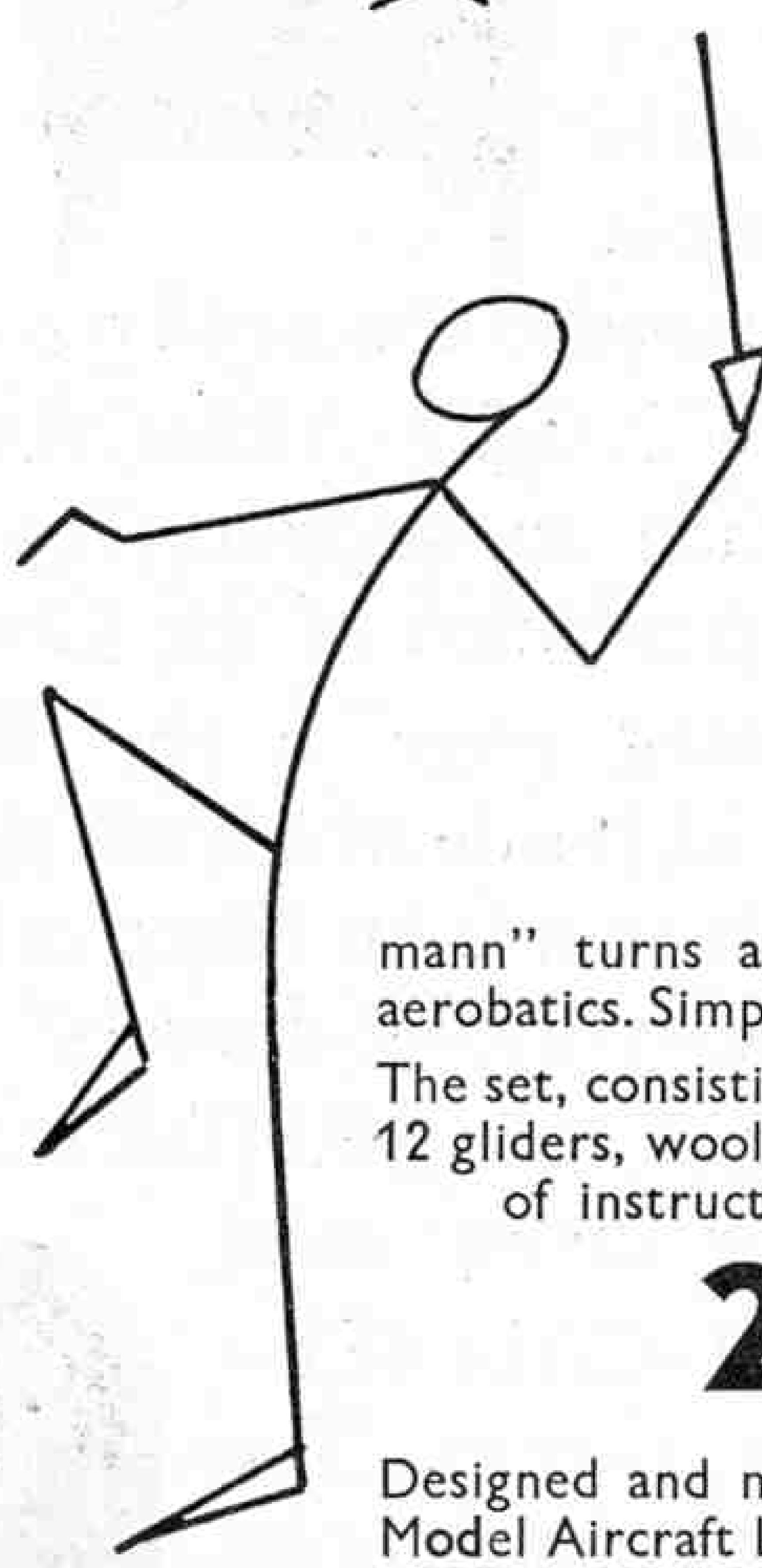
Here is a fast and sure flier—safe and steady in the air—easy to manipulate and with practice **will fly at least 100 yards.** Wing span approximately 15 in.

PRICE **5/-** COMPLETE

The "ELECTROSTATIC" AEROPLANE

Made by the "F.R.O.G." People





The makers of "Frog" aircraft are delighted to be able to tell you of a thrilling new invention, the "Electrostatic" aeroplane.

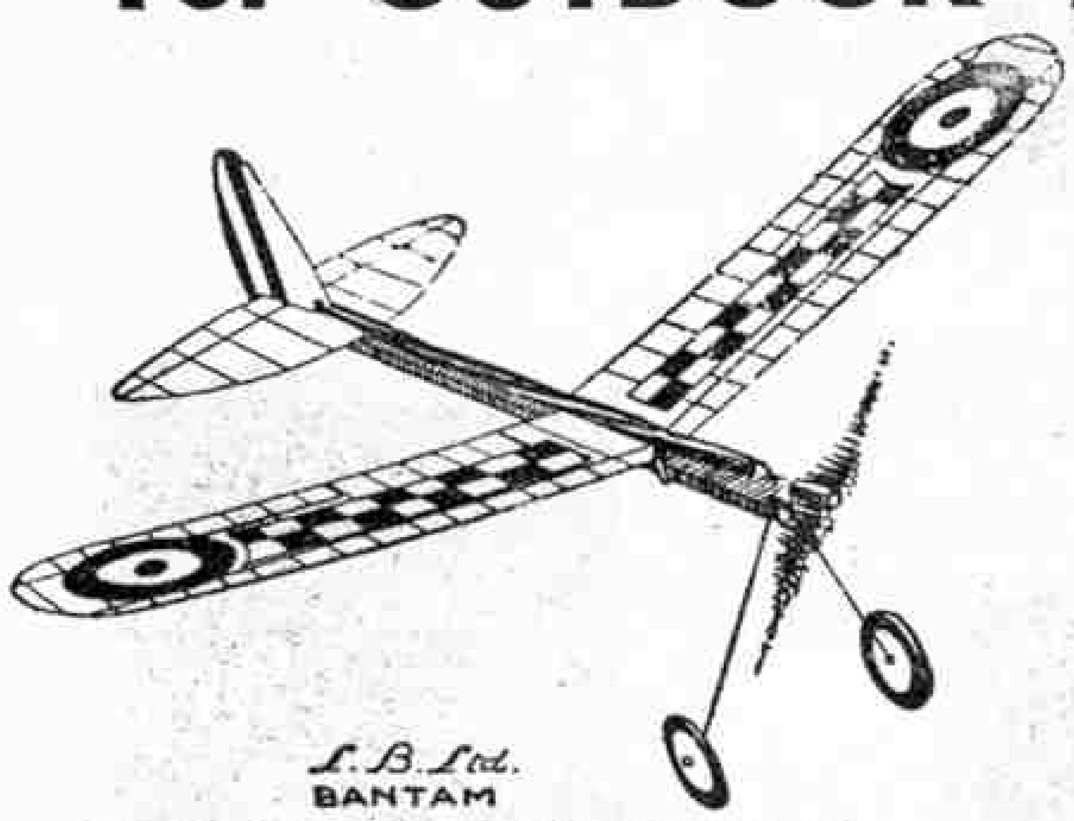
By rubbing the Vulcanite wand supplied with the set, these little gliders can be made to "loop-the-loop," do "Immelmann" turns and all kinds of real aerobatics. Simple—and very good fun.

The set, consisting of Vulcanite wand, 12 gliders, woollen cloth and booklet of instructions, costs only

2/6

Designed and made by International Model Aircraft Ltd., London, S.W.19.

For OUTDOOR Flying



2/6

Including spare motor, lubricant, flying hints and high-speed winder-box. Wing Span 9 in. Flies 200 ft. with experience.

THE "BANTAM"

This splendid new model flies anywhere out of doors. Remarkable performance. The wings are printed in the colours of a famous squadron. Special High-Speed Winder with each model.

WILL FLY IN A WIND.

FROG FLYING CLUB

FROG and PUSS MOTH owners are eligible for membership of the FROG Flying Club. The badges illustrated are obtainable by those members who pass proficiency tests. Write for particulars. Price 6d. each.

ON SALE AT ALL GOOD TOY SHOPS AND STORES.

MADE IN ENGLAND BY INTERNATIONAL MODEL AIRCRAFT LTD.

Sole Concessionaires:

LINES BROS. LTD., Tri-ang Works, London, S.W.19


The same man – but
a new record
The same oil – but
with new advantages
WAKEFIELD
PATENT
Castrol
MOTOR OIL
"This *is* a better oil
so I use it"
Malcolm Campbell

MECCANO ELEKTRON

ELECTRICAL OUTFITS

No. 1 Elektron Outfit Price 6/6

In these days of radio, X-rays, and electric trams and trains, every boy should have a knowledge of electricity. The only way to gain this knowledge is by means of experiments, and the Meccano Elektron Outfits have been produced for this purpose.

These Outfits contain all the materials for carrying out a splendid series of fascinating experiments, commencing with Magnetism and passing on through Frictional Electricity to Current Electricity. In addition many interesting mechanisms can be constructed, including a Reading Lamp, an Electric Bell, a Telegraph, a Shocking Coil that gives real shocks, and Electric Motors.

No. 2 Elektron Outfit Price 21/-

No. 1 MECCANO ELEKTRON OUTFIT

Magnetism and Static Electricity

The No. 1 Outfit contains two powerful Bar Magnets and a reliable Magnetic Compass, together with everything necessary for the carrying out of a series of fascinating magnetic experiments. In addition there are materials for experiments in frictional or static electricity, and for the construction of an Electric Compass and two forms of Electroscope. Price **6/6**

No. 2 MECCANO ELEKTRON OUTFIT

Magnetism, Static and Current Electricity

The No. 2 Elektron Outfit contains all that is included in the No. 1 Elektron Outfit, with additional parts that enable a splendid series of experiments in current electricity to be performed. Among these parts are a Horseshoe Magnet, and Coils and Yokes for the construction of Electro-Magnets that can be used in building a real Electric Bell, and a Buzzer for use in an electric telegraph system. A specially-wound coil and other necessary parts are supplied for assembling into a splendid Shocking Coil that will give hours of fun and excitement. Price **21/-**

No. 1A MECCANO ELEKTRON ACCESSORY OUTFIT

An Accessory Outfit that converts a No. 1 Elektron Outfit into a No. 2 is also available. Price **14/6**

The apparatus and chemicals included in the Meccano Elektron Outfits can be obtained separately. Ask your dealer for the Elektron Folder giving a list of Elektron parts, or write for a copy to the address below.

MECCANO LTD., BINNS ROAD, LIVERPOOL 13

Electricity is the most wonderful force of the age in which we live.

Learn some of its marvels by means of experiments with a Meccano Elektron Outfit.

An Elektron Outfit will open up to you a fascinating hobby of endless variety.

Visit your dealer to-day and ask him to show you one of these wonderful Outfits.

MECCANO KEMEX

CHEMICAL OUTFITS

HOURS OF FUN AND INTEREST

The Meccano Kemex Outfits contain all the apparatus and materials required for a series of fascinating chemical experiments. They provide hours of fun, and enable you to learn some of the marvels of the wonderful science of chemistry. There is no difficulty and no danger. The chemicals are all non-explosive and non-poisonous, and conform with Home Office requirements.

With these Outfits you can perform for yourself hundreds of interesting chemical experiments—from producing invisible inks and preparing gases, to making a wonderful under-water "garden" in which chemical "plants" of different colours actually grow from crystals! Every experiment is fully described in a splendidly-illustrated Manual of Instructions.

No. O Meccano Kemex Outfit

75 Experiments

This Outfit includes a supply of specially selected chemicals, together with a length of Magnesium Ribbon, sufficient to perform 75 attractive experiments. The apparatus provided includes Test Tubes, Test Tube Brush, Delivery Tubes and Corks, and a simple and highly efficient Spirit Lamp.

Price 5/-

No. 1 Meccano Kemex Outfit

130 Experiments

This Outfit includes the whole of the contents of the No. O Outfit, together with further chemicals that increase the number of experiments that can be performed to 130. The additional apparatus includes a Test Tube Holder, Glass Stirring Rod, Funnel and Filter Papers.

Price 7/6

No. 2L Meccano Kemex Outfit

250 Experiments

This Outfit includes the whole of the contents of the No. 1 Outfit, and further chemicals that increase the range of experiments up to 250. The additional apparatus includes a porcelain Evaporating Dish, Special Test Tubes, a handsome Test Tube Stand, and an Evaporating Stand including a Ring, with Wire Gauze.

Price 15/-

No. 2B Meccano Kemex Outfit

This is exactly the same as the No. 2L Meccano Kemex Outfit, except that a highly efficient Bunsen Burner, with the necessary length of rubber tubing, is included in place of the Spirit Lamp.

Price 15/-

Hundreds of interesting experiments.

A fascinating hobby of endless variety.

No. 3L Meccano Kemex Outfit

350-400 Experiments

This splendid Outfit provides a boy with all he requires to carry out between 350 and 400 experiments and thus enables him to acquire a sound knowledge of the fascinating principles of chemistry The Outfit includes the contents of the No. 2L Outfit, with additional chemicals and apparatus, consisting of a large Wide-necked Flask with Thistle Funnel and Delivery Tubes, and a Blowpipe and a Charcoal Block.

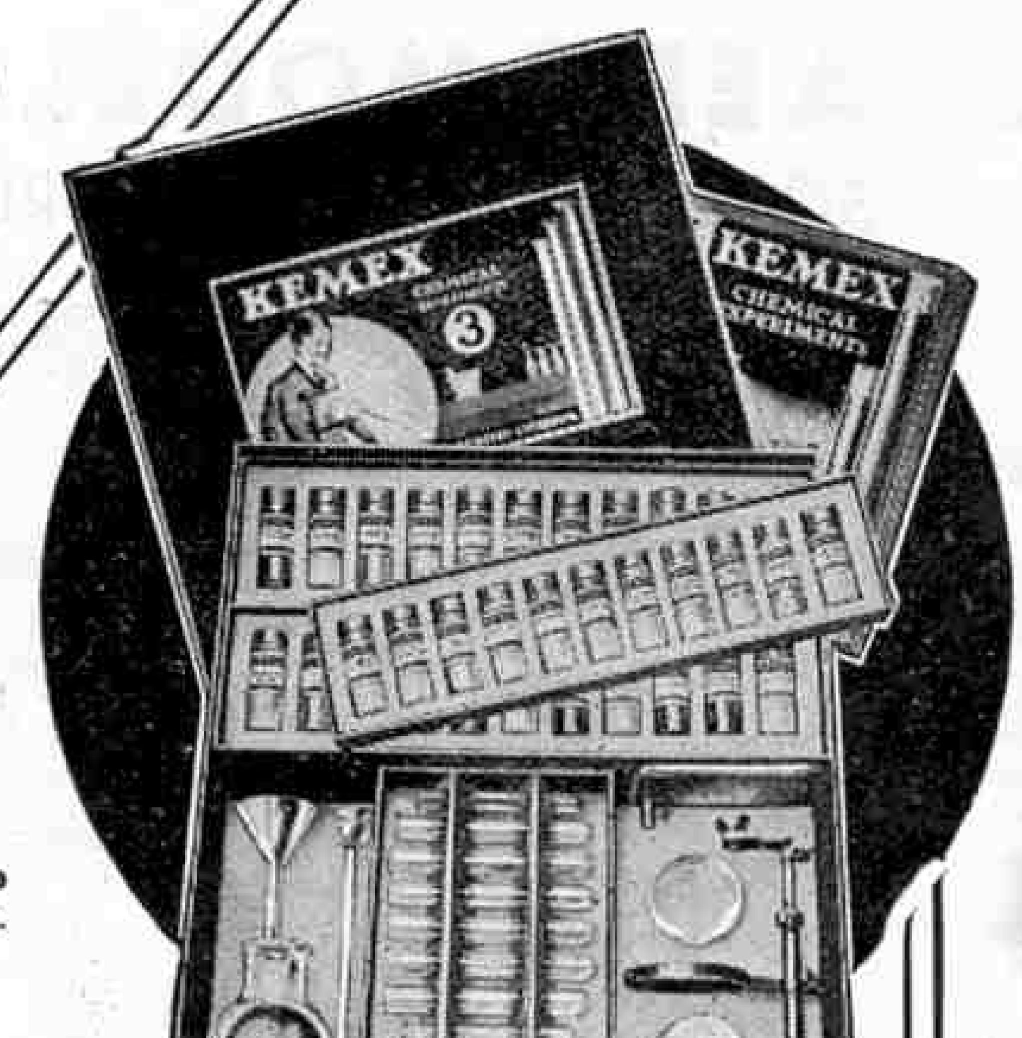
Price 25/-

No. 3B Meccano Kemex Outfit

This is exactly the same as the No. 3L Meccano Kemex Outfit, except that a highly efficient Bunsen Burner, with the necessary length of rubber tubing is included in place of the Spirit Lamp.

Price 25/-

No. 2 Meccano Kemex Outfit.



No. 3 Meccano Kemex Outfit.

Ask your dealer for the leaflet giving a list of Kemex parts and their prices, or write for a copy to the address given below.

The apparatus included in Kemex Outfits and refills of Kemex chemicals can be obtained separately

Manufactured by
MECCANO LTD.
Binns Road
LIVERPOOL 13

Manufactured by
MECCANO LTD.
Binns Road
LIVERPOOL 13

A new and fascinating building hobby for boys and girls

MECCANO DINKY BUILDER

The Meccano Dinky Builder Outfits are ideal for all young boys and girls who are interested in model-building. The parts, tastefully enamelled, are fitted together in the most simple manner without the use of any nuts and bolts, giving results that are attractive and of exceptional interest. Two Outfits are available: No. 1 for general construction, including wheel toys, and No. 2 for making groups of furniture. A brightly coloured Instruction Folder, that shows how extremely interesting are the models that can be built, is included with each Outfit. Your dealer will be pleased to show you these fine new Meccano Dinky Builder Outfits.

No. 1 DINKY BUILDER OUTFIT

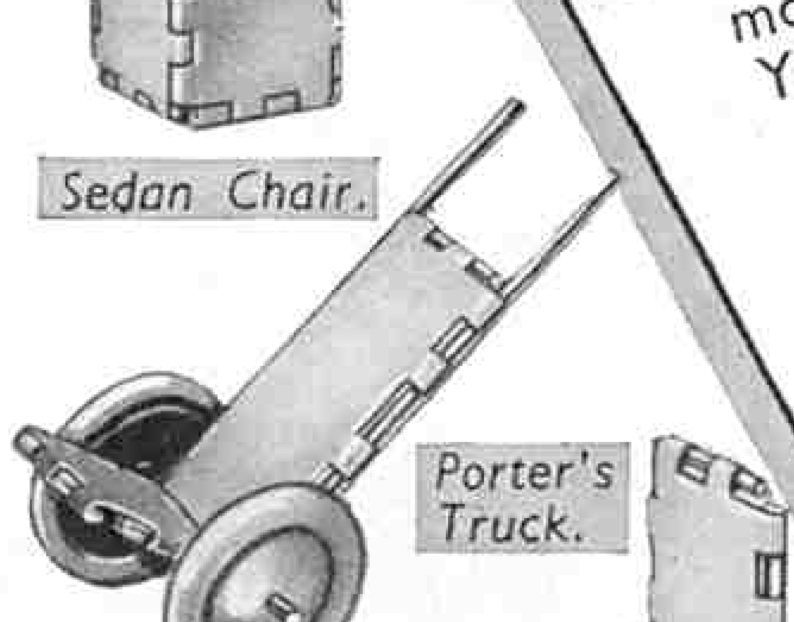
This Outfit contains a good selection of parts with which a large number of models can be made. It includes two trees on die-cast stands that lend the correct atmosphere to models of farm buildings, churches, etc. A further attraction are the wheels, finished in blue with white tyres, for constructing miniature wheel toys. The beautifully coloured instruction leaflet included in the Outfit illustrates a total of 44 models that any boy or girl can build. Price **5/-**

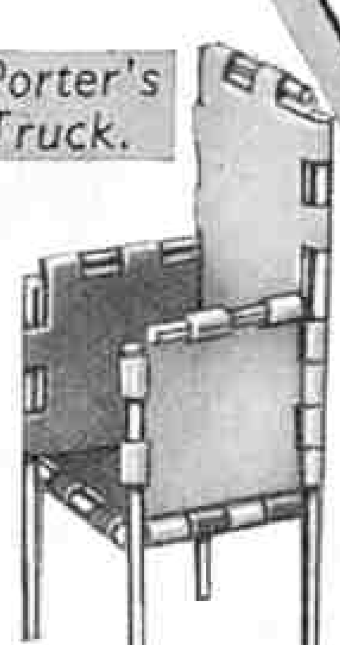
No. 2 DINKY BUILDER OUTFIT

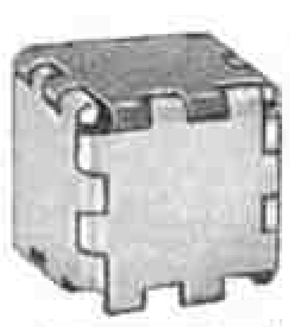
The No. 2 Dinky Builder Outfit contains a wide selection of parts primarily intended for the construction of realistic groups of miniature modern furniture. The small table lamp and shade that are included add greatly to the realism of these groups, particularly as the lamp can be lighted from an ordinary flash lamp battery. The coloured instruction leaflet gives examples of 7 furniture groups, but to an enthusiastic model builder the possibilities of the Outfit are practically inexhaustible. Price **7/6**

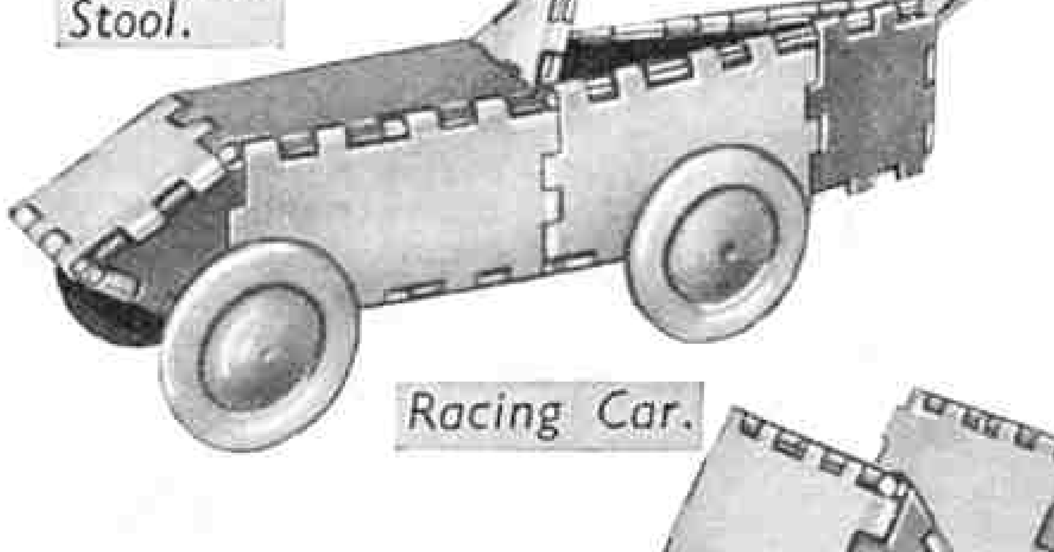
Manufactured by
MECCANO LTD.
Binns Rd.
LIVERPOOL 13

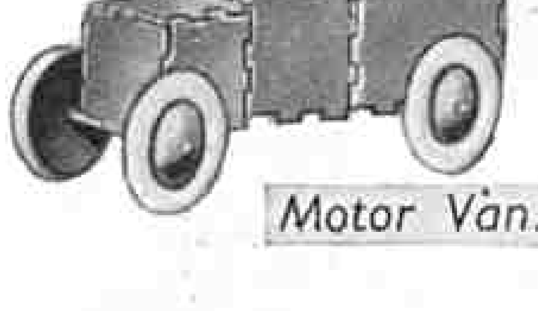

Sedan Chair.

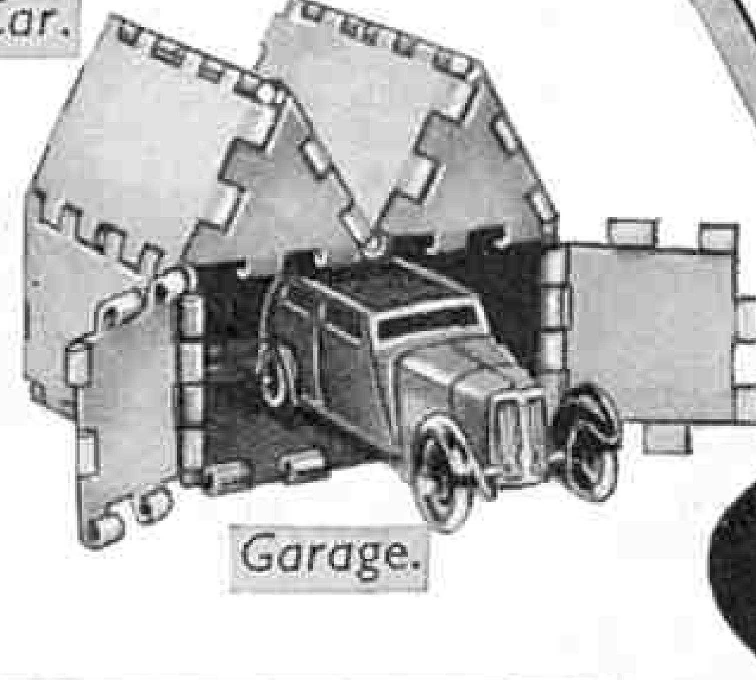

Porter's Truck.


Arm Chair.


Dressing Stool.


Racing Car.

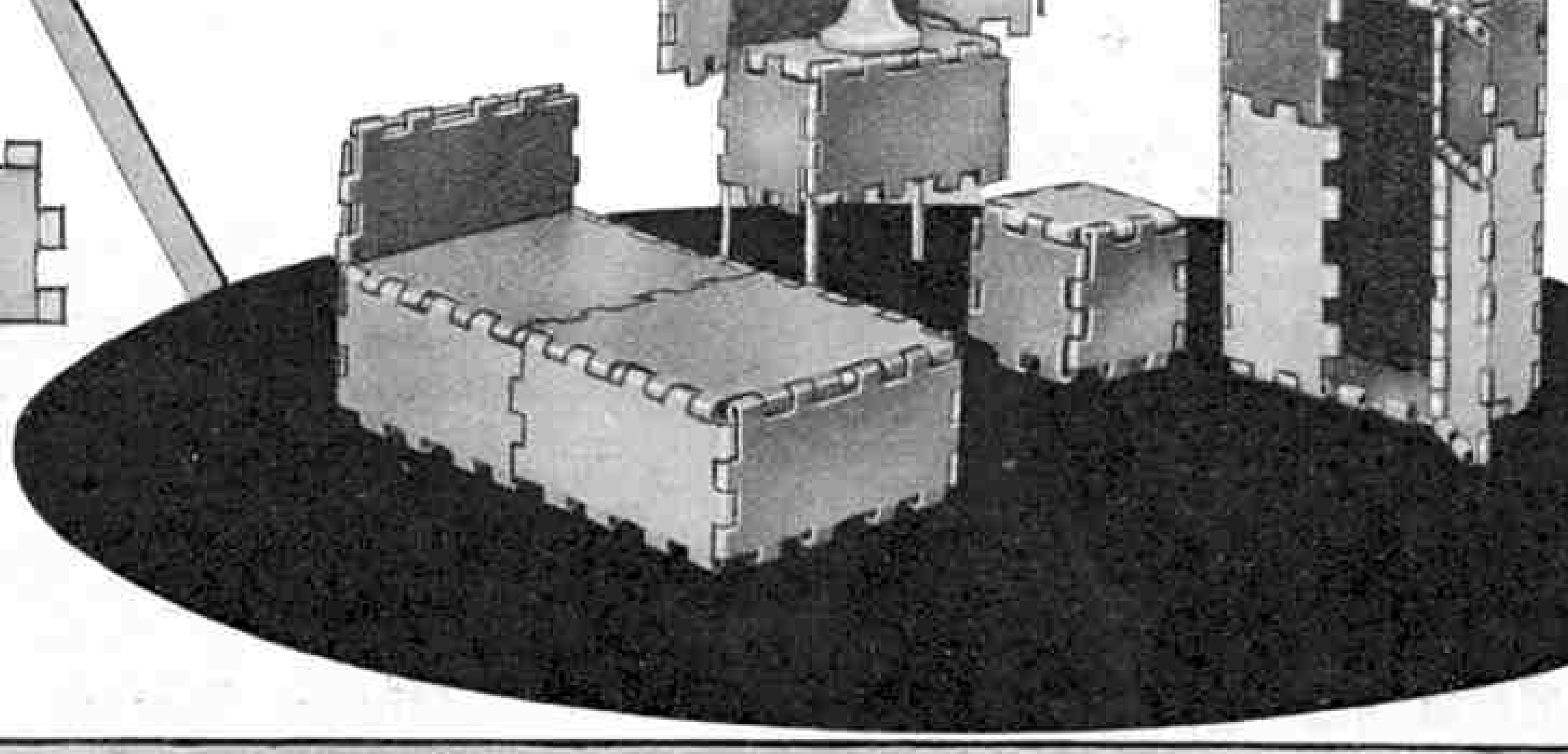

Motor Van.

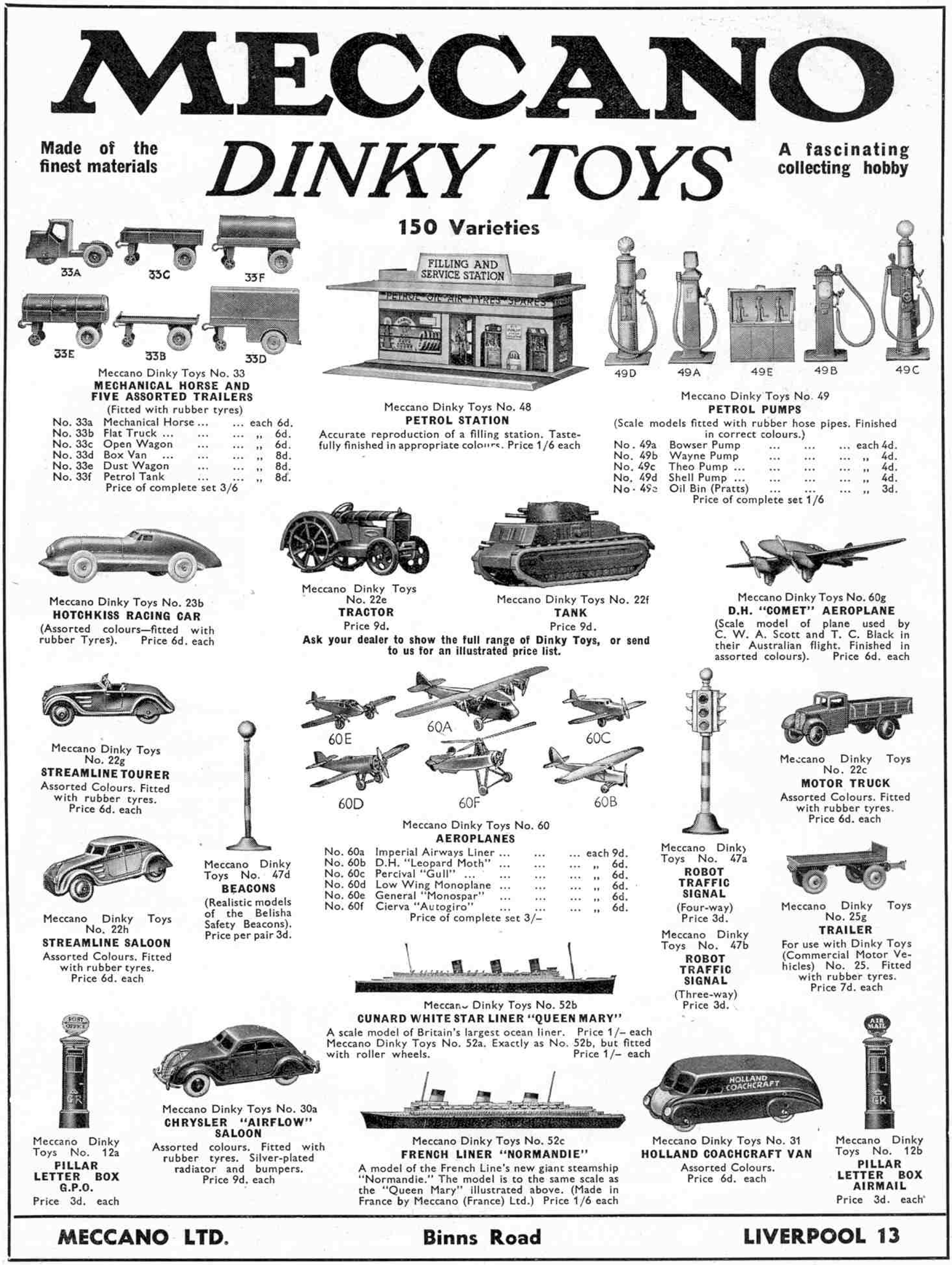

Garage.

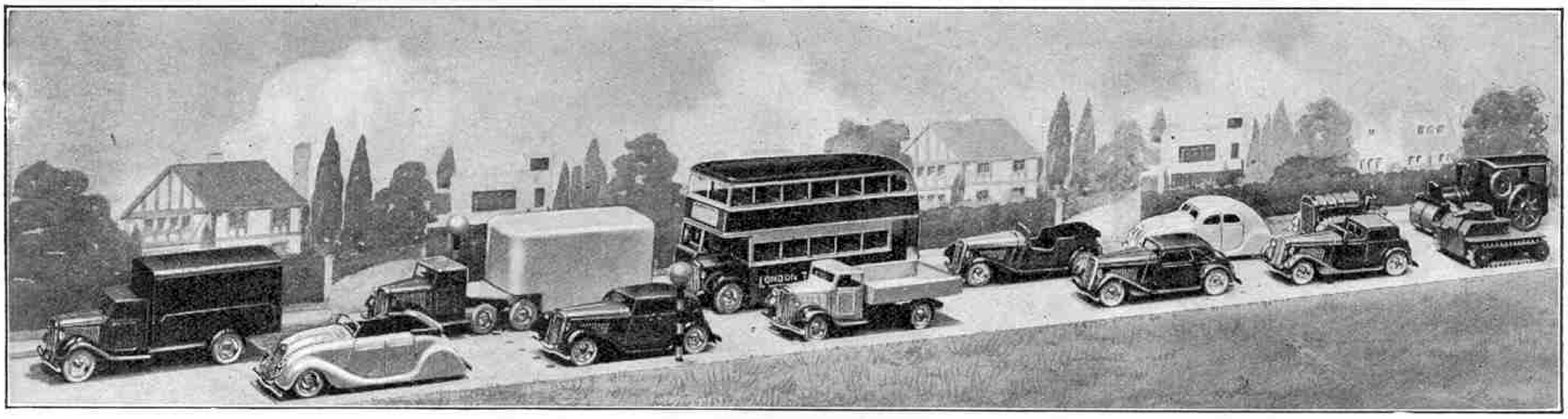
All the above models, and many others, can be made with No. 1 Dinky Builder Outfit.

No. 1 Dinky Builder Outfit.

No. 2 Dinky Builder Outfit.


Group of Bedroom Furniture made with No. 2 Outfit


MECCANO
Made of the finest materials
DINKY TOYS
A fascinating collecting hobby
150 Varieties
33A 33C 33F
33E 33B 33D
Meccano Dinky Toys No. 33
MECHANICAL HORSE AND FIVE ASSORTED TRAILERS
(Fitted with rubber tyres)
No. 33a Mechanical Horse ... ... each 6d.
No. 33b Flat Truck ... ... „ 6d.
No. 33c Open Wagon ... ... „ 6d.
No. 33d Box Van ... ... „ 8d.
No. 33e Dust Wagon ... ... „ 8d.
No. 33f Petrol Tank ... ... „ 8d.
Price of complete set 3/6
FILLING AND SERVICE STATION
Meccano Dinky Toys No. 48
PETROL STATION
Accurate reproduction of a filling station. Tastefully finished in appropriate colours. Price 1/6 each
49D 49A 49E 49B 49C
Meccano Dinky Toys No. 49
PETROL PUMPS
(Scale models fitted with rubber hose pipes. Finished in correct colours.)
No. 49a Bowser Pump ... ... each 4d.
No. 49b Wayne Pump ... ... „ 4d.
No. 49c Theo Pump ... ... „ 4d.
No. 49d Shell Pump ... ... „ 4d.
No. 49e Oil Bin (Pratts) ... ... „ 3d.
Price of complete set 1/6
Meccano Dinky Toys No. 23b
HOTCHKISS RACING CAR
(Assorted colours—fitted with rubber Tyres). Price 6d. each
Meccano Dinky Toys No. 22e
TRACTOR
Price 9d.
Meccano Dinky Toys No. 22f
TANK
Price 9d.
Ask your dealer to show the full range of Dinky Toys, or send to us for an illustrated price list.
Meccano Dinky Toys No. 60g
D.H. "COMET" AEROPLANE
(Scale model of plane used by C. W. A. Scott and T. C. Black in their Australian flight. Finished in assorted colours). Price 6d. each
Meccano Dinky Toys No. 22g
STREAMLINE TOURER
Assorted Colours. Fitted with rubber tyres.
Price 6d. each
60E 60A 60C
60D 60F 60B
Meccano Dinky Toys No. 60
AEROPLANES
No. 60a Imperial Airways Liner ... ... each 9d.
No. 60b D.H. "Leopard Moth" ... ... „ 6d.
No. 60c Percival "Gull" ... ... „ 6d.
No. 60d Low Wing Monoplane ... ... „ 6d.
No. 60e General "Monospar" ... ... „ 6d.
No. 60f Cierva "Autogiro" ... ... „ 6d.
Price of complete set 3/-
Meccano Dinky Toys No. 22c
MOTOR TRUCK
Assorted Colours. Fitted with rubber tyres.
Price 6d. each
Meccano Dinky Toys No. 22h
STREAMLINE SALOON
Assorted Colours. Fitted with rubber tyres.
Price 6d. each
Meccano Dinky Toys No. 47d
BEACONS
(Realistic models of the Belisha Safety Beacons).
Price per pair 3d.
Meccano Dinky Toys No. 47a
ROBOT TRAFFIC SIGNAL
(Four-way)
Price 3d.
Meccano Dinky Toys No. 47b
ROBOT TRAFFIC SIGNAL
(Three-way)
Price 3d.
Meccano Dinky Toys No. 25g
TRAILER
For use with Dinky Toys (Commercial Motor Vehicles) No. 25. Fitted with rubber tyres.
Price 7d. each
Meccano Dinky Toys No. 52b
CUNARD WHITE STAR LINER "QUEEN MARY"
A scale model of Britain's largest ocean liner. Price 1/- each
Meccano Dinky Toys No. 52a. Exactly as No. 52b, but fitted with roller wheels. Price 1/- each
POST OFFICE
AIR MAIL
HOLLAND COACHCRAFT
Meccano Dinky Toys No. 12a
PILLAR LETTER BOX G.P.O.
Price 3d. each
Meccano Dinky Toys No. 30a
CHRYSLER "AIRFLOW" SALOON
Assorted colours. Fitted with rubber tyres. Silver-plated radiator and bumpers.
Price 9d. each
Meccano Dinky Toys No. 52c
FRENCH LINER "NORMANDIE"
A model of the French Line's new giant steamship "Normandie." The model is to the same scale as the "Queen Mary" illustrated above. (Made in France by Meccano (France) Ltd.) Price 1/6 each
Meccano Dinky Toys No. 31
HOLLAND COACHCRAFT VAN
Assorted Colours.
Price 6d. each
Meccano Dinky Toys No. 12b
PILLAR LETTER BOX AIRMAIL
Price 3d. each
MECCANO LTD. Binns Road LIVERPOOL 13



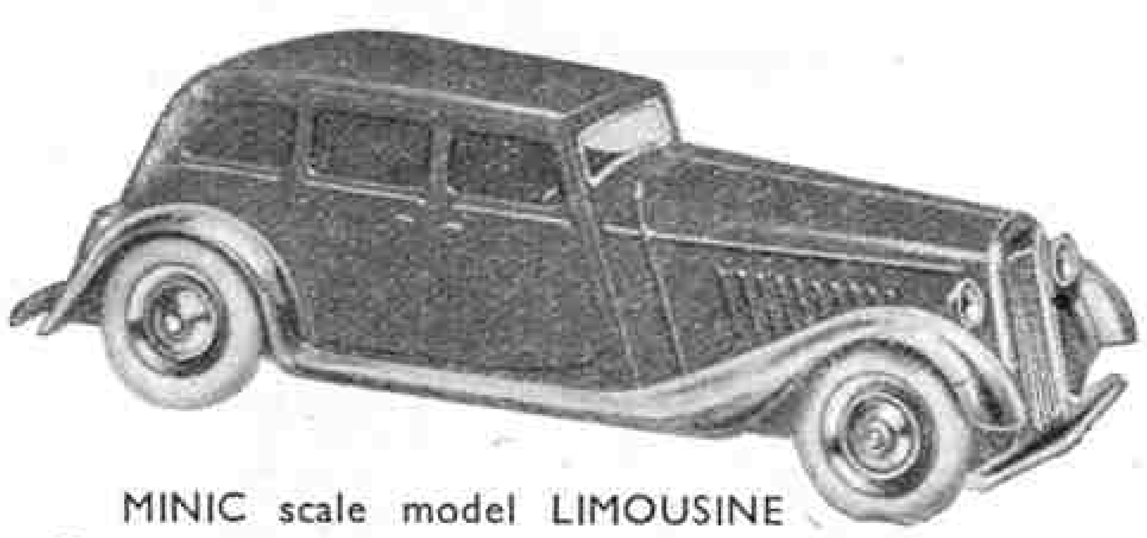
LOOKS LIKE A REAL ROAD DOESN'T IT?

Though it's difficult to believe, the traffic jam in this photograph is actually made up of MINIC scale model clockwork toys.

This unique clockwork series will contain almost every vehicle to be seen on the roads. Each model is true to scale so that the bus is exactly the right amount larger than the lorry and the limousine in the right proportion to the open tourer.

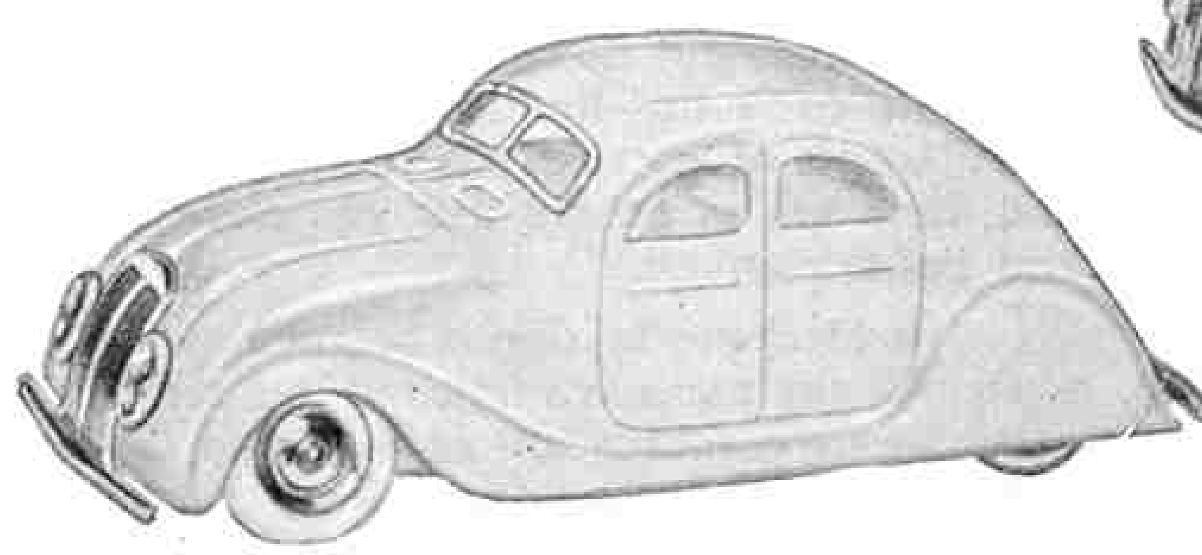
These MINIC vehicles are wonderfully built and have reliable long-running clockwork; they are most reasonably priced too, the smaller ones costing only 1/– each. They have a front wheel drive, so that they will run on carpet and can be used in any room.

Start collecting your road full now.



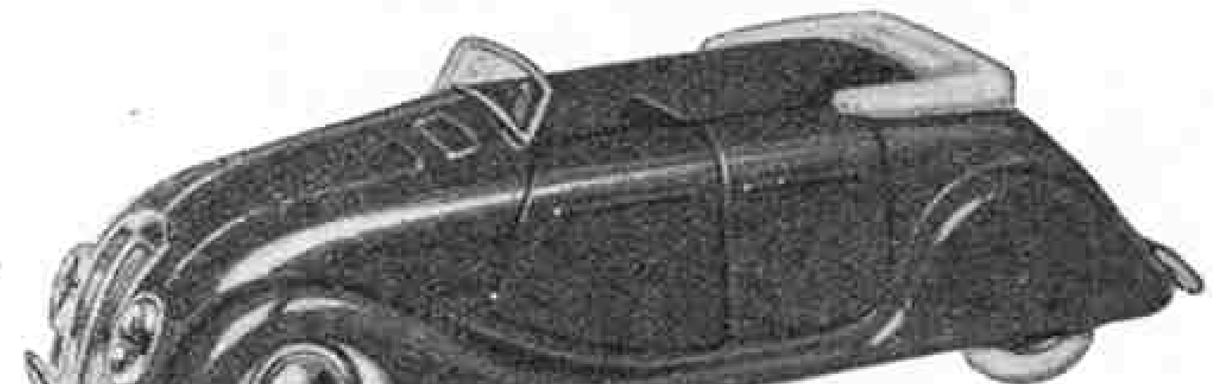
MINIC scale model LIMOUSINE

Strong construction, with powerful long-running clockwork motor. Colours: Dark Green, plated guards; Ivory, Red guards; New Blue, Ivory guards. Radiator and bumpers plated, also wheels, with rubber tyres. Length, $4\frac{3}{4}$ in. Price **1**/–



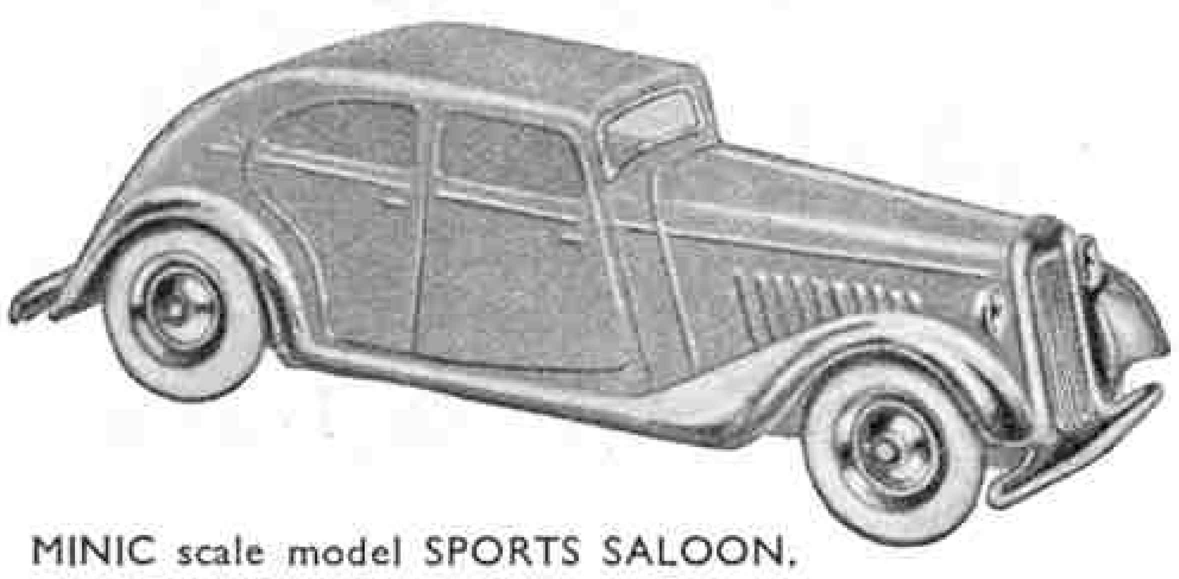
MINIC scale model STREAMLINE CLOSED.

Strong construction, with powerful long-running clockwork motor. Colours: Red, Ivory, New Blue. Plated bumpers, radiator, also wheels, with rubber tyres. Length, 5 in. Price **1**/–



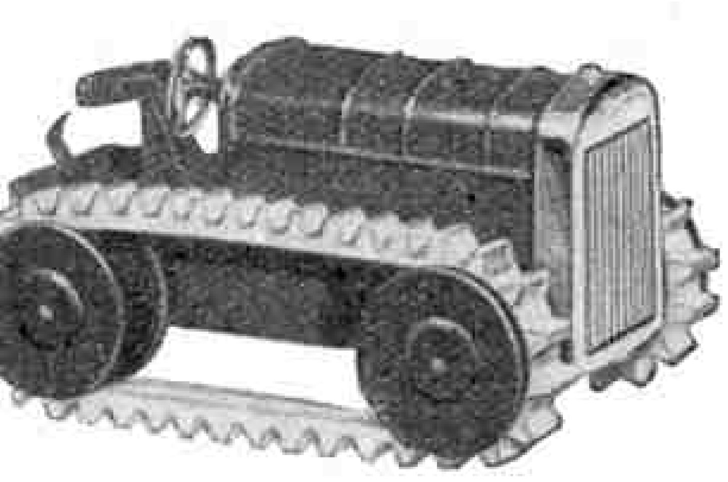
MINIC scale model STREAMLINE OPEN.

Strong construction, with powerful long-running clockwork motor. Colours: Ivory, Red hood; Red, Ivory hood; or Light Green, Ivory hood. Plated radiator, bumpers, also wheels, with rubber tyres. Length, 5 in. Price **1**/–



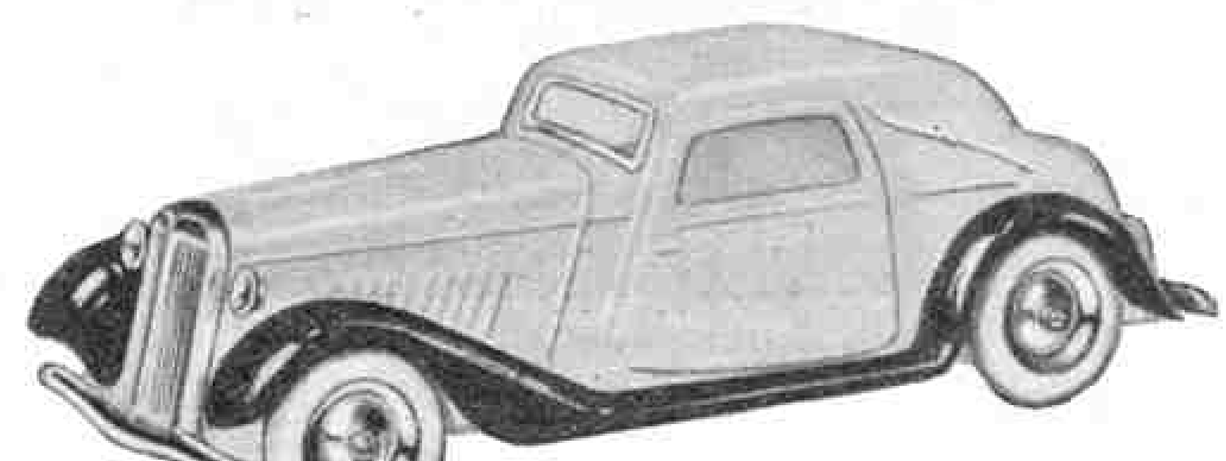
MINIC scale model SPORTS SALOON.

Strong construction, with powerful long-running clockwork motor. Colours: Ivory, New Blue, Primrose, with plated mudguards, radiator, bumpers, also wheels, with rubber tyres. Length, $4\frac{3}{4}$ in. Price **1**/–



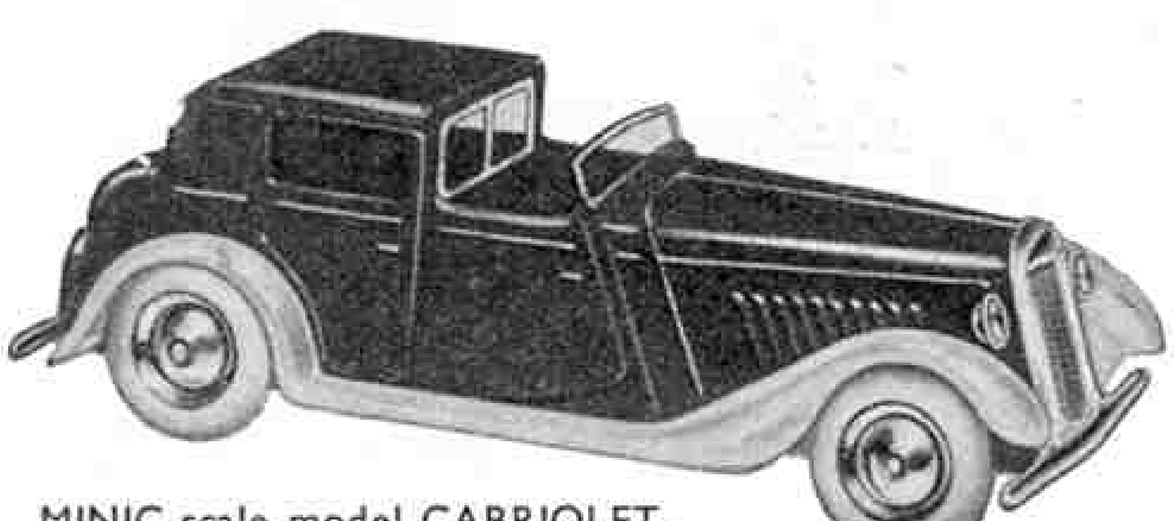
MINIC scale model TRACTOR.

Strong construction, with powerful long-running clockwork mechanism. Colours: Green with Red wheels, or Red with Green wheels. Length, 3 in. Price **1**/–



MINIC scale model TOWN COUPÉ.

Strong construction, with powerful long-running clockwork motor. Colours: New Blue, plated mudguards; Light Brown, Black mudguards; or Ivory, Red mudguards. Plated radiator, bumpers, also wheels, with rubber tyres. Length, $4\frac{3}{4}$ in. Price **1**/–



MINIC scale model CABRIOLET.

Strong construction, with powerful long-running clockwork motor. Colours: Ivory and Green with plated mudguards, or Red with Ivory mudguards. Radiator, bumpers, plated, also wheels, with rubber tyres. Length, $4\frac{3}{4}$ in. Price **1**/–

MINIC scale model OPEN SPORTS TOURER.

Strong construction, with powerful long-running clockwork motor. Colours: Green, plated mudguards, Ivory hood; Red, Ivory mudguards and hood; Ivory, Red mudguards and hood. Plated bumpers, radiator, also wheels, with rubber tyres. Length, $4\frac{3}{4}$ in. Price **1**/–

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MECCANO MAGAZINE

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June, 1935

With the Editor

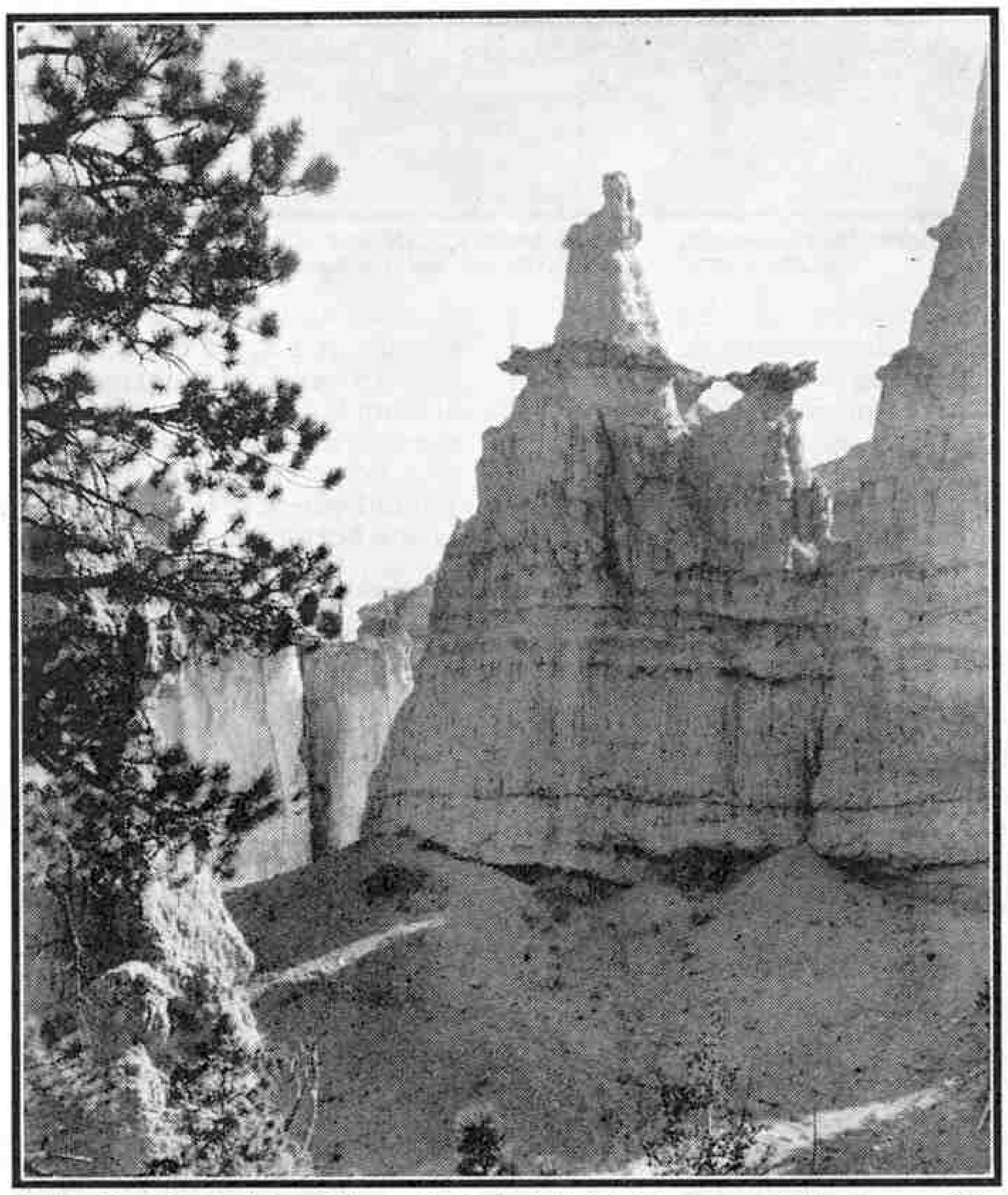
A Century of Invention

I am sure that my readers would be interested to learn from *"Our Busy Inventors"* on page 292 of last month's issue that Great Britain is the only large country in the world in which more applications for patents were received during 1934 than in the previous year. The number of applications registered in Great Britain and Northern Ireland was 37,429. All of these applications do not necessarily lead to practical results, but their number shows that our inventors are busier than ever.

It is safe to say that the majority of the inventions to-day are concerned with ideas that 100 years ago were undreamed of. This is made quite clear by a comparison of present-day inventions as seen, for instance, at the Annual Exhibition of the Institute of Patentees, and described from time to time in "Our Busy Inventors," with those on view at an Exhibition held in 1835 in London under the name of the "Gallery of Practical Science." The exhibits of a century ago were rather grandiloquently described as "Works of Art" and "Specimens of Novel Manufactures," and it is interesting to find that some of them showed the earliest stages of inventions that have now passed into national life. For instance, "Artificial Stone" was exhibited as a novelty. This was in fact the Portland Cement invented by Joseph Aspdin, a Leeds bricklayer, as early as 1810, and used on an extensive scale in the construction of the Thames Tunnel in 1828. At the time of the Exhibition it was still sufficiently new to attract special notice, but few of those who saw Aspdin's product then would realise that less than a century later it would be in use on a world-wide scale for erecting giant buildings and building immense docks and even great bridges.

Other striking exhibits in 1835 included a model of the electro-magnet, which had been invented about 10 years earlier by William Sturgeon. The electro-magnet shown seems to have been the first efficient magnet of this type ever made in this country, and none who saw it could have had the slightest idea of the extent to which electro-magnets, and the electrical industry generally, would be developed.

One invention to be seen at the 1835 Exhibition might almost be described as a pioneer effort at streamlining, in intention if not in reality. It was a vessel with two narrow hulls on which experiments had been made in America with a view to minimising resistance, and what was then the remarkable speed of 20 m.p.h. had been achieved.



A gigantic natural statue of Queen Victoria. This life-like representation is one of the weatherworn rocks in Bryce Canyon National Park, Utah, U.S.A. Photograph by courtesy of the Union Pacific Railroad.

The First Gas Cooker

An even more striking exhibit was the first gas cooker, on which demonstrations were given at intervals in quite the modern manner. Gas making was very crude in those days, and the flames were so smoky and inefficient that cooking was far from being the clean and simple thing that it is with the modern gas cooker. The idea was good, but for complete success it was necessary to wait for the invention, 20 years later, of the Bunsen burner, which transformed the dirty, smoky flame into a clean non-luminous one by mixing the gas with a proportion of air.

The Oldest Egg in the World

The oldest egg in the world has just been discovered in Texas. It is a fossilised, rusty looking object 3 in. long, that has been slightly distorted by the changes it has undergone, and it is not until we learn how old it is that our wonder is aroused. We have recently been celebrating the King's Silver Jubilee, commemorating the 25 years of his reign; but this fossilised egg actually has completed, not a mere 25 years, but 225 million years of existence! It is difficult to realise fully the extreme age of this wonderful fossil. A few years ago immense interest was aroused by the discovery in the Gobi Desert in Central Asia of dinosaur eggs that were believed to be about 100 million years old. These are relics of an age long before Man came into existence, but are "new laid" in comparison with the veteran that has now been discovered.

The egg is believed to be that of a large reptile resembling a lizard, for near it was found part of a fossilised skeleton of one of these creatures that must have been 6 ft. in length.

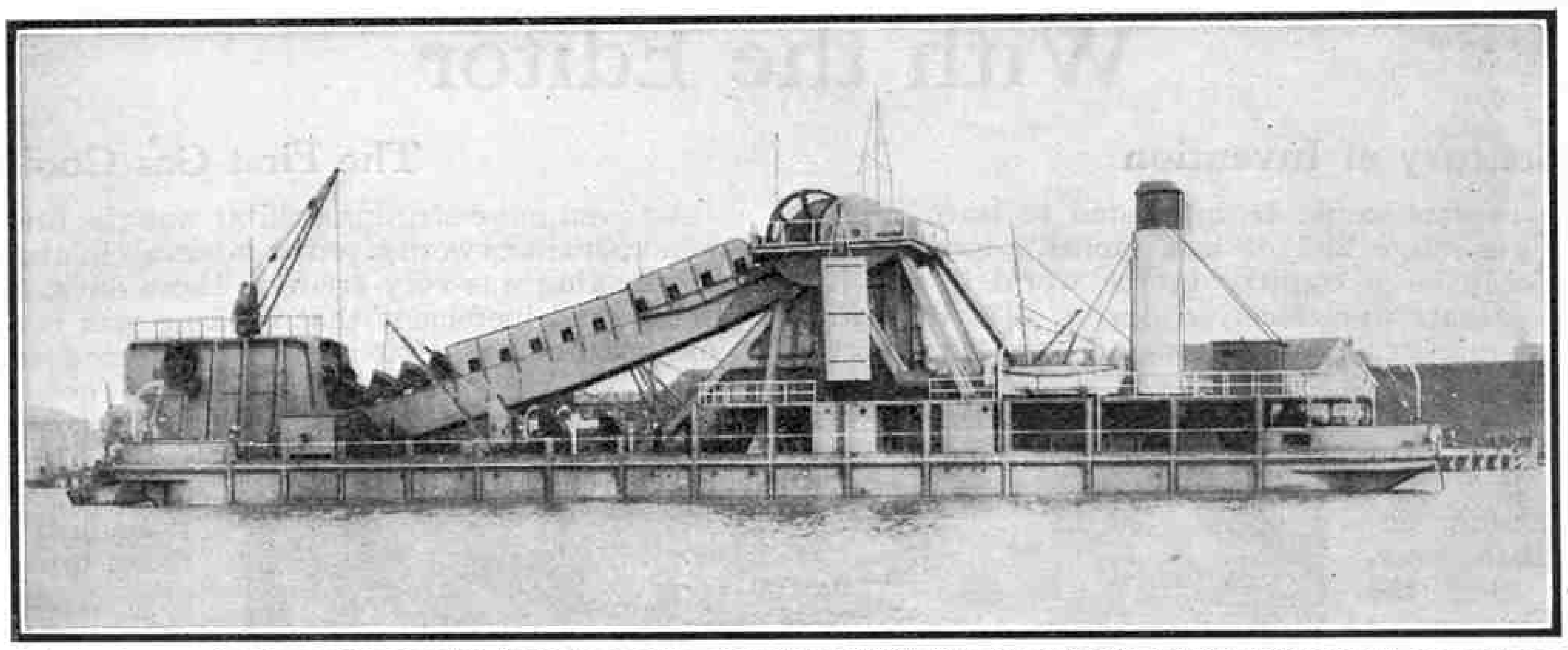
Nature as a Sculptor

The illustration on this page shows a remarkable example of Nature's sculpture that exists in Bryce Canyon, an immense horseshoe-shaped chasm in Utah in the United States. The great stone figure surmounting the gigantic rock resembles so strongly the figure of Queen Victoria that it might almost be thought to have been human handwork; but actually the carving has been carried out entirely by wind, rain and other natural agents. Bryce Canyon is famous for its amazing depth and the beauties of the splendidly-coloured and strangely-shaped rocks it contains, and is one of the finest of the National Parks of the United States.

Modern Dredgers and Their Work

Contrasts in Mechanisms

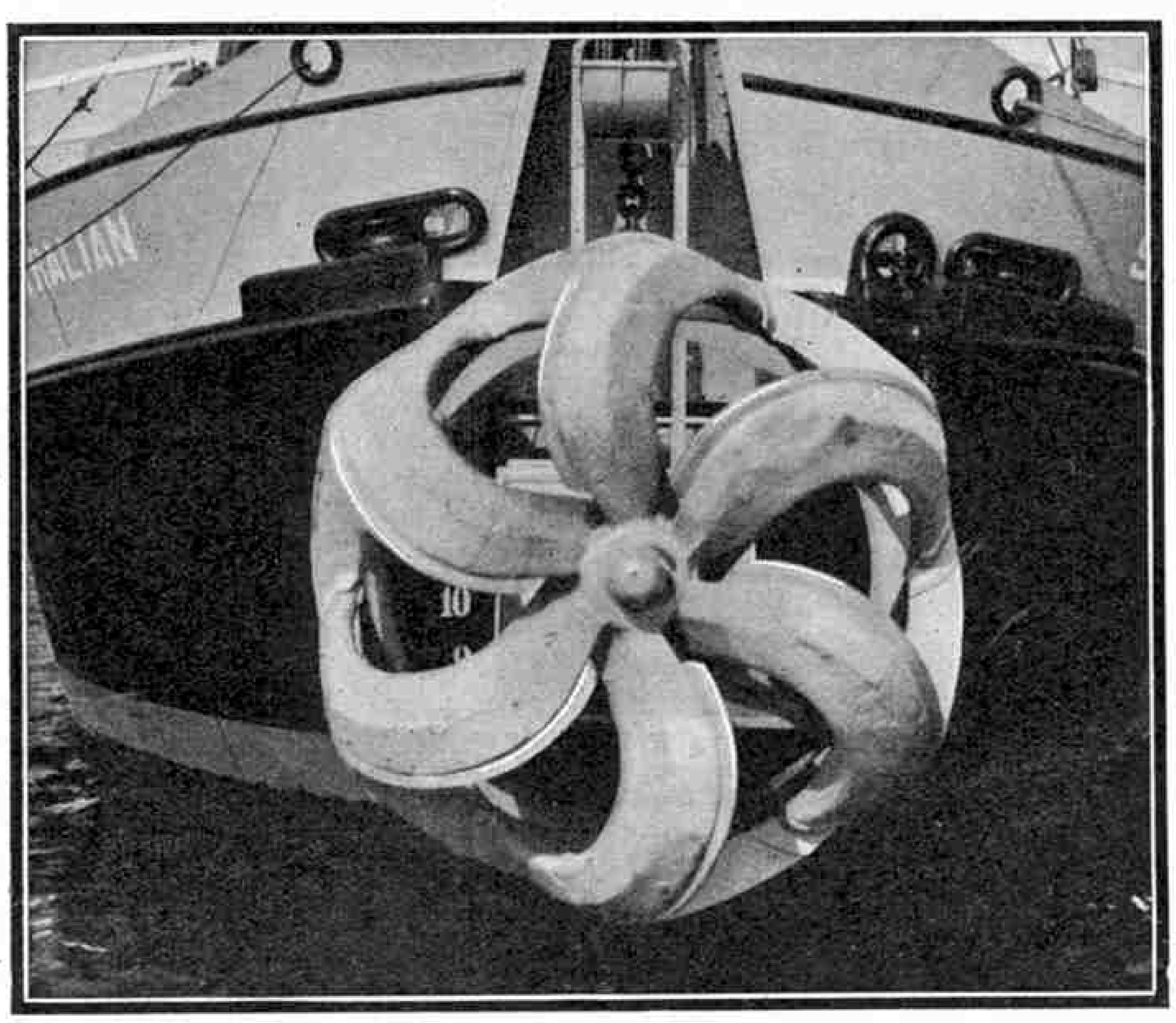
ONE of the most important duties carried out by dock and harbour engineers is that of keeping waterways free from silt and mud. For this purpose dredging vessels of various kinds are employed, and in this article we describe some of the commoner types of dredger and the work for which they are used.



A typical example of a modern bucket dredger, capable of dredging 1,500 tons of material per hour. Photograph by courtesy of the James Dredging, Towage and Transport Co. Ltd.

Many of the world's large ports are situated on rivers and estuaries where every tide sweeps into the channel vast quantities of sand and silt, and although part of this is carried out to sea again by the ebb tide, much of it is left behind to form a deposit on the river bed, thus reducing the natural depth of water and preventing the entrance of large ships. Many rivers also are naturally too shallow to admit large vessels, and in such cases it is necessary to dredge or dig out artificial channels in order to provide a sufficient depth of water. Dredging vessels are used also for widening or straightening rivers, and for preparing the foundations for bridges, lighthouses, quays and the like.

Probably the oldest and most common form of dredging vessel is the bucket type, an illustration of which appears on this page. In the bottom of the vessel there is a large opening or well, through which passes a strong girder or "ladder," suspended from a central superstructure. The upper end of the ladder is pivoted, while the other can be lowered down to the bed of the river to be dredged. At each end of the girder there is a heavy tumbler roller, round which passes a stout steel-linked chain bearing about 40 or 50 steel buckets fitted with a sharp cutting edge. When the dredger is in operation the outer end of the ladder is lowered to the bed of the river and the chain of buckets is set in motion by means of powerful machinery. As the buckets travel round the lower end of the ladder, they bite into the river bed and scoop out a load of spoil, and then return filled along the upper side of the ladder. On reaching the top end of the ladder the buckets turn over and tip their contents down a chute that leads either to a hopper in the hull of the dredger or into special barges lying alongside.



The rotating cutter of a large suction dredger at the Gusto Dockyard, Schiedam.

The first dredger of this kind was built and launched at Hull in 1778. The vessel was very crude and primitive and was fitted with only 11 buckets, the motive power being provided by two horses, which rotated a pair of horizontal beams on the deck of the dredger. The machine was able to work in 14 ft. of water and its output was about 30 tons of spoil per hour. Since that time the bucket dredger has been improved greatly in design and construction, and some of the finest modern dredgers are almost as large as ocean liners of 50 years ago, although the principle on which they work has remained exactly the same as it was in the earlier vessels.

Modern dredgers are divided into two classes, known as barge loading dredgers and hopper dredgers. The barge loading dredger is accompanied by special barges, the purpose of which is to collect the dredged mud or sand and take it away and discharge it out at sea. When the dredger is in action these barges are moored alongside underneath a chute. The full buckets are hauled up on the endless chain until they reach the top of the structure, when they are automatically tipped and emptied, the spoil falling down the chute into the hold of the barge.

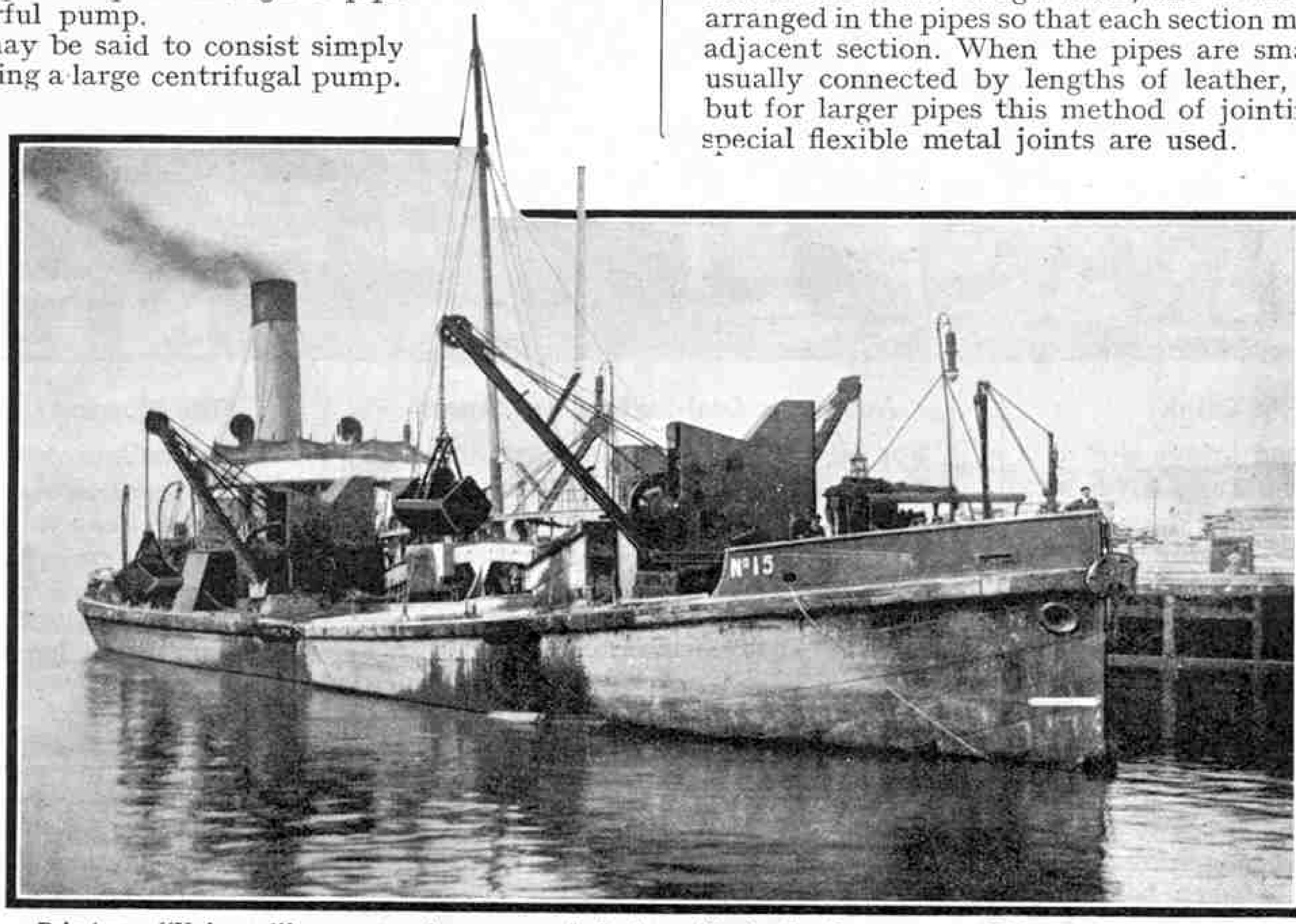
Barge loading dredgers usually are not fitted with engines for propulsion, and have to be towed by tugs to and from the dredging ground. A hopper dredger, on the other hand, invariably contains its own propelling engines, the same engines often being used for driving both the propeller and the dredging apparatus. This type of dredger does not discharge its spoil into barges, but loads it into its own holds; and when these are full carries it out to the depositing ground where it is quickly discharged through trap doors provided in the bottom of the hull. A great advantage of the hopper dredger is that it can be used in narrow channels or confined spaces, where a barge loading dredger and its barges would not have room to operate.

An interesting example of a bucket dredger is the "*Belomorskaya*," built for service in Russia. The vessel is 197 ft. long, 40 ft. broad, and 14 ft. 9 in. deep, and has a travelling speed of 8 knots. Power is provided by three triple-expansion engines each of 600 h.p., two of which drive the propellers and spoil pumps, while the third operates the bucket chain. The dredger is capable of removing 600 cu. metres of spoil per hour, and means are provided for discharging this either into barges moored alongside, or on shore by driving it through a floating pipe line by means of pumps.

When it is necessary to dredge in very deep water, for example in preparing the foundations for quays or bridge piers, a grapple or grab dredger is used. In this type a giant bucket composed of two great scoops hinged at the top, is dropped to the river bed from the end of a jib mounted on the deck of the vessel. The two halves of the bucket are then closed, and the hoisting machinery is set in motion to bring the bucket to the surface with its load. Some dredgers of this kind have what is known as an "orange peel" grab, which is composed of three or four triangular blades. This is dropped down to the bed of the river in the same way as an ordinary grab bucket, and the blades close over the materials to be raised in a somewhat similar manner to the fingers of a huge hand.

Bucket and grab dredgers are in common use in most of the world's big ports and harbours, but there is another important type of dredging machine known as a suction or hydraulic dredger, which is not so familiar around the coasts of the British Isles. This type does not scoop up material from the river bed like the bucket machine, but sucks up the spoil through a pipe by means of a powerful pump.

A suction dredger may be said to consist simply of a floating hull carrying a large centrifugal pump. The action of the pump is to suck up the material from the bottom of a river, dock or harbour through a suction pipe, and then discharge it through another pipe into hoppers on the vessel itself, into independent hoppers or barges, or on to adjoining land by means of a floating pipe-line. The last-mentioned way of disposing of the spoil is the most interesting of all. A large pipe built up in sections with flexible joints, and sometimes thousands of feet in length, is employed. This floats on the surface of the water like a veritable "sea-serpent," one end connecting with the pump on the dredger and the other with the shore or the dumping ground. Through this pipe the dredger pumps its sludge.



Priestman "Universal" excavators in use as grab dredgers. Illustration by courtesy of Priestman Bros. Ltd., Hull.

The centrifugal suction pump of such a dredger simply comprises a volute casing, within which operates an impeller having a number of curved radial blades, and an "eye" or opening at its centre into which the material sucked up by the rotating impeller, enters from a suction pipe. The material is drawn into the volute and led away through a discharge pipe.

A dredger typical of those arranged to discharge the dredged material, or "spoil," through a floating pipe-line, is illustrated diagrammatically on this page. A dredger of this kind is sometimes known as a "cutter suction dredger," because the pump is assisted in its work by a rotary cutter A, which breaks up the material before it is subsequently drawn into the suction pipe. The centrifugal pump, which is shown at B, is driven by an engine C, and the entire vessel is propelled by another engine D, at the after end of the vessel. The cutter is driven by an engine K, and is arranged on a shaft E that is mounted in bearings carried by the cutter-frame F. The cutter-frame is built up in girder fashion and fixed in a well O formed in the bows of the vessel and extending from the deck to the keel. In a plan view of the vessel the forward end takes the form of two forwardly projecting arms separated by the well.

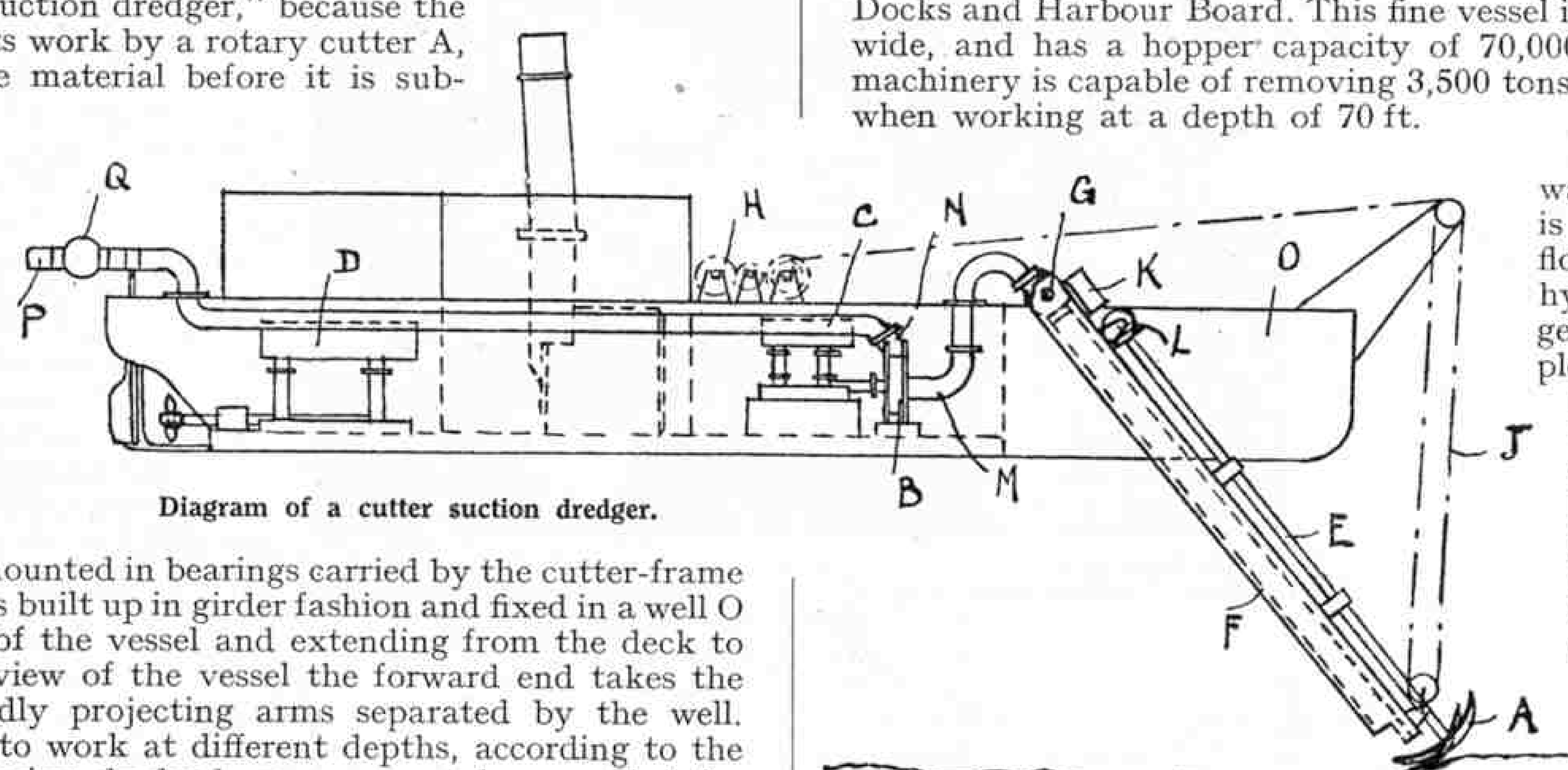


Diagram of a cutter suction dredger.

As the cutter has to work at different depths, according to the depth of the river being dredged, means must be provided for raising and lowering the cutter-frame. This is done by hinging the frame at G and employing a hauling winch H, which is connected to the cutter-frame through block and tackle gear. Means are provided also for driving the cutter-shaft at varying inclinations.

The centrifugal pump is provided with a suction pipe M and a discharge pipe N. The suction pipe is carried upward through the deck, and is connected by means of a ball and socket joint G to a continuation that extends from the inboard to the outboard end of the cutter-frame, and terminates close to the cutter. The discharge pipe N is led aft almost the length of the dredger and, after being led upward through the deck, is connected by a ball-joint to another pipe P, which is connected in turn to the floating pipe-line.

A floating discharge pipe-line is used when it is desired to discharge the spoil at some distance from the dredger, either on land or in sea. The pipe-line comprises merely a number of short pipes each supported by a pontoon. One form of pontoon consists of a pair of cylindrical metallic buoys arranged one on each side of the pipe and connected together by wooden beams and bolts. Owing to the movement of the dredger itself, and of the water, flexible joints are arranged in the pipes so that each section may move relatively to the adjacent section. When the pipes are small in diameter they are usually connected by lengths of leather, rubber or canvas hose, but for larger pipes this method of jointing is unsatisfactory and special flexible metal joints are used.

In cases where the floating pipe-line is not used, the dredger includes not only the propelling and dredging machinery, but also a storage hopper in which the spoil can be deposited and then carried to some place remote from the scene of the dredging operation, where it can be discharged safely. The hull is provided with trap doors that open outward in the same way as those of a bucket and ladder dredger. Opening and closing of the doors usually is controlled by means of chains connected to a winch, but in some cases large valves operated by hydraulic rams are used.

A large cutter suction dredger was employed in a big land reclamation scheme that was carried out in Bombay Harbour some years ago. Much of the material to be removed consisted of heavy clay. Having dug up and raised the clay, the dredger pumps drove it along 4,500 ft. of 42 in. dia. floating pipeline and discharged it on land. The suction of the pumps was so powerful that at times lumps of rock weighing 400 lb. or more were raised. The dredger could remove about 2,000 cu. yds. of spoil per hour when working at a depth of 70 ft.

Another large suction type hopper dredger, for dealing mainly with sand deposits, is the *"Hilbre Island,"* owned by the Mersey Docks and Harbour Board. This fine vessel is 330 ft. long and 54 ft. wide, and has a hopper capacity of 70,000 cu. ft. The pumping machinery is capable of removing 3,500 tons of sands in 50 minutes when working at a depth of 70 ft.

For dredging in tidal waterways, where there is a constant ebb and flow of the water, hydraulic erosion dredgers are sometimes employed. A vessel of this kind removes spoil by washing away the bed or banks of the river by means of powerful jets of water, the disturbed sand and silt then being carried out to the open sea by the tide. A small dredger of this type is in the service of the Somerset Rivers Catchment Board. The power is provided by two 75 B.H.P. Petter "Atomic Diesel" marine engines, one of which is used for propulsion and the other for working the water pumping plant, which consists of two specially designed centrifugal pumps. The pumps supply water at high pressure to six erosion jets, two of which point vertically downward, while another pair are placed just below the water line and are inclined downward at an angle of 12 deg. from the horizontal. A further jet is arranged below the water line at the bows, and the sixth jet is mounted in a swivel on deck and is used for bank trimming. Each of the submerged jets will work efficiently through a distance of about 15 ft. from the hull of the dredger, so that as the vessel has a 10 ft. beam a channel approximately 40 ft. in width can be eroded.

A Large Bridge for China

A large railway and road bridge is to be constructed over the Chien Tang River, at Zahow, some five miles from Hangchow, China. The new bridge will comprise 16 spans, and will be in the form of a two-deck structure, the upper deck of which will carry a 20-ft. road with footpaths, and the lower deck a single track of 4 ft. 8½ in. gauge railway.

The work is to be carried out by Dorman Long and Co. Ltd. About 4,125 tons of steel will be used and will be manufactured at the company's Middlesbrough works. The new bridge will form a connection between the Shanghai-Ningpo and Hangchow-King Shan Railways, and also will join the main road from See Shing to the south-east with the network of roads radiating from Hangchow.

A Giant Camera

In the basement of the Department of Commerce Building, Washington, D.C., there is a giant camera that is 31 ft. long and 20 ft. wide, and weighs 14 tons. It was designed by the Coast and Geodetic Survey of the United States to enable charts or survey sheets 50 in. square to be reproduced on a single negative, instead of four as was formerly the case, and does this work with an accuracy of 0.001 in.

A Great South African Dam

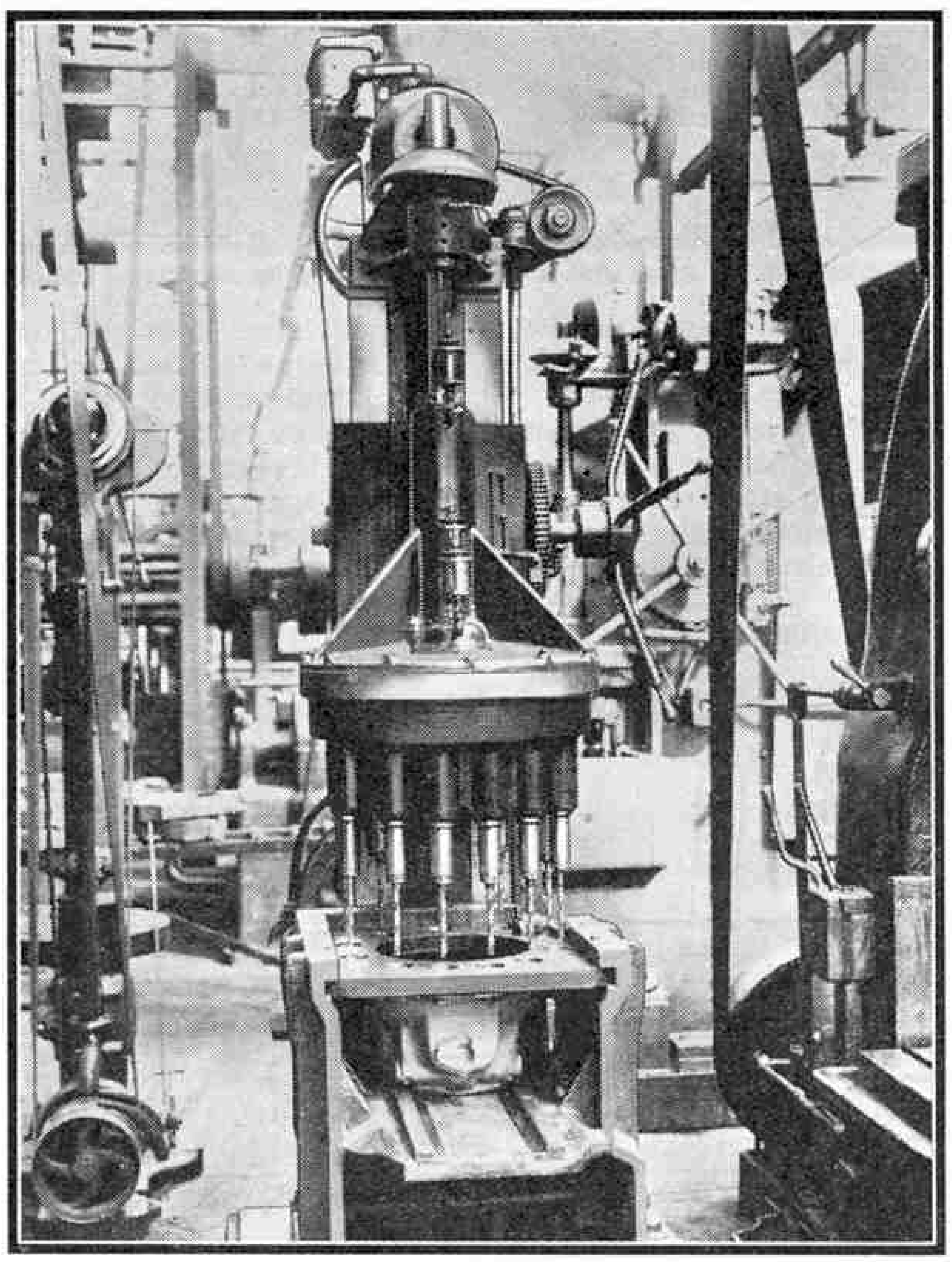
The first stage in the construction of the Vaalbank Dam, an immense structure across the Vaal River, on the southern border of the Transvaal, South Africa, has been completed. The site of the Dam is at Vaalbank, 17 miles upstream from Vereeniging. There an island divides the river, and diversion walls have been built across the two channels so that the stream can be directed into each as required by closing the appropriate sluices. Cofferdams are now to be erected below the island to exclude the water from each channel in turn, and the two sections of the Dam will then be commenced.

It is estimated that the completion of the Dam will take five years. When finished it will form part of a great engineering project that will provide, at a cost of £4,000,000, the water necessary for the Vaal-Hartz irrigation scheme, by which an immense desert area 300 miles downstream will be made productive. The Dam itself will be used to regulate the flow of the Vaal River, which at certain seasons now dries up, and thus convert it into a perennial stream. When completed it will be about 1,800 ft. in length and at its deepest point will measure about 180 ft. from top to bottom.

Automatic Coal-Sorting Appliances

For the purpose of grading coal into three different classifications according to size, the Southern Railway have installed at their Deptford Wharf automatic coal-sorting screens. Grading is beyond the resources of most coal merchants, and the S.R. have introduced the plant at their biggest Thames-side depot in order to provide a service link between the producer and the consumer.

The automatic coal screens, which are the first to be employed in London, were designed by Mr. George Ellson, chief engineer of the S.R., and can deal with 80 tons of coal per hour. After the fuel is removed by cranes from ships' holds it is dropped into a hopper, and then passed on to a moving belt that carries it to a series of sloping platforms fitted with screens of different mesh. Here the coal sorts itself out through the screens according to size, and falls into wagons. Other mechanical equipment at the Wharf includes 30 cranes and three 42-ton dial weighing machines.



In the mass production of motor cars many interesting machines are employed. This illustration shows a multiple spindle drilling machine drilling holes in a clutch housing.

The Moscow Underground Railway

The first line of the Moscow Underground Railway, which extends from the Sokolniki Park to Crimea Square, and connects Theatre Square in the heart of the hotel and theatre districts with two of the most populous suburbs, has now been completed. The line has a length of about 11 km., or nearly 7 miles, and there are 11 stations. A second line is now in course of construction.

The first sections of the tunnel now completed were commenced in 1931. At first construction progressed slowly, for the subsoil was so soft that tunnels collapsed as rapidly as they were built, and further difficulties were caused by caves and underground streams. In 1932 experienced experts actually advised that the project was impossible and should be abandoned. Every known method of tunnel construction was tried in efforts to overcome the difficulties, but success was not achieved until late in 1932, when means were discovered of treating the subsoil with chemicals in order to hold the tunnel walls together while they were lined with concrete.

Suggested Tunnel Under the Tyne

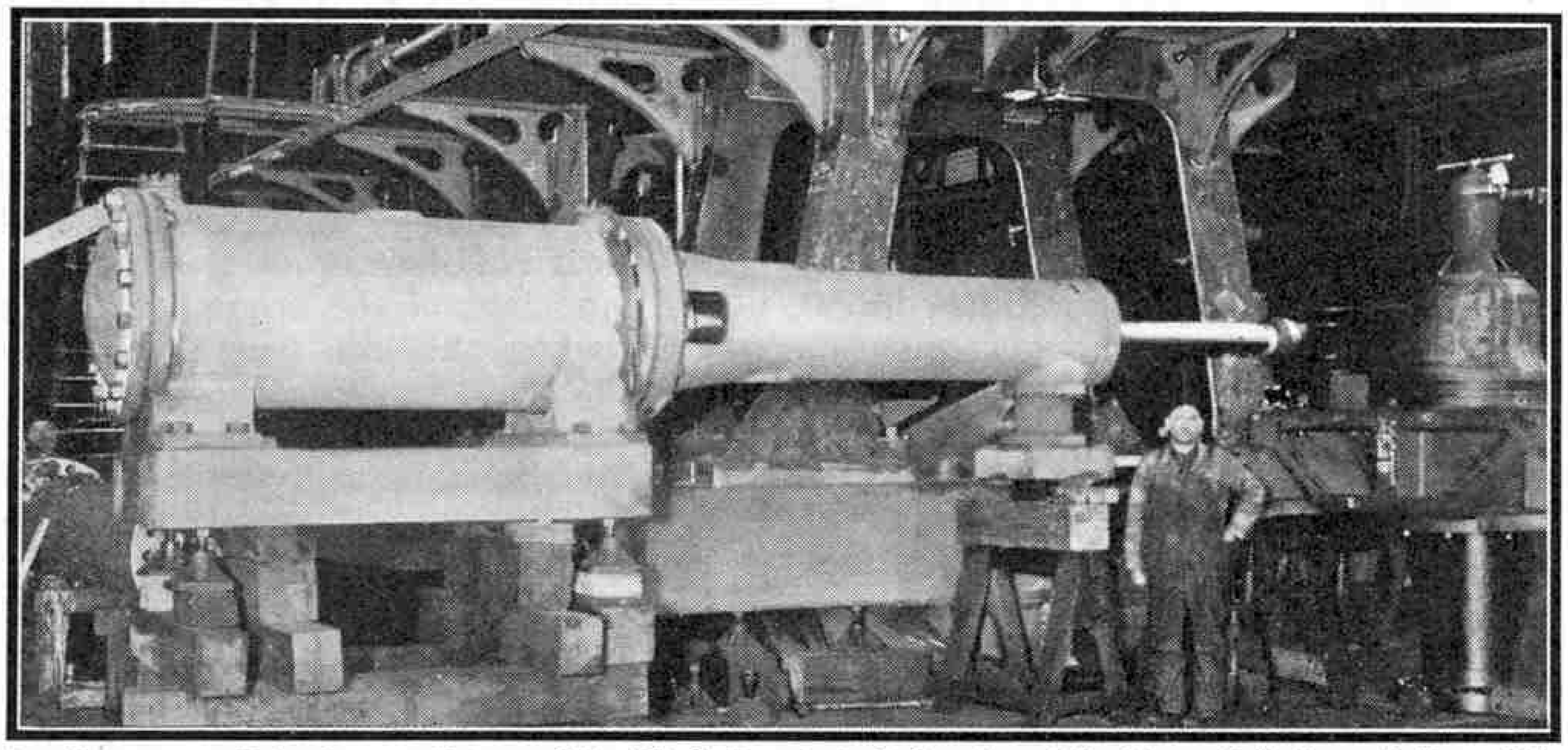
A suggestion that the north and south sides of the Tyne should be connected by a bridge near the estuary has been under consideration by the Tyneside local authorities for some years, but so far the cost has prevented the work from being started. It is understood that Mr. Malcolm Stewart, one of the Commissioners appointed recently for the depressed areas in England and Wales, is prepared to initiate a scheme for constructing an under-river tunnel connecting South Shields with Tynemouth at a cost of £1,500,000.

Automatic Control for Doors

An interesting device has been introduced in the United States for automatically operating a swinging, folding or sliding door through which trolleys and other vehicles pass. It is known as "Air-Lec," and is operated by means of compressed air and a powerful spring. A door fitted with the device is partially opened or closed by the compressed air, which then exerts a cushioning effect as the spring completes its work. The device is electrically controlled, and is set in motion by switches that are placed on the ground near the door to be opened or closed and are operated by the vehicles for which passage is required. The mechanism may also be set in motion by hand switches placed in convenient positions.

Shipping News

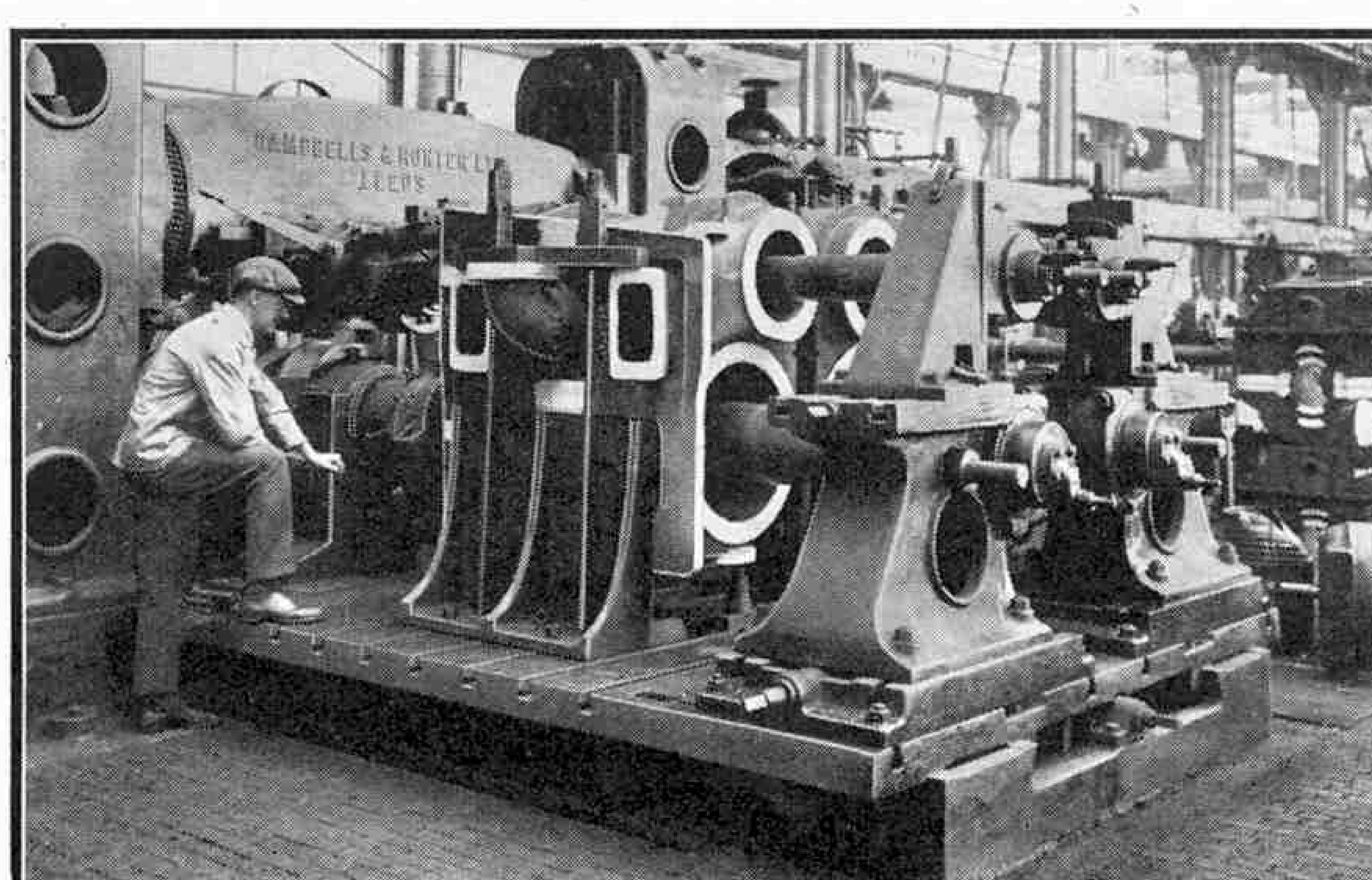
Preparations are now being made for the passage of the Cunard White Star liner *"Queen Mary"* down the Clyde to the sea when she is completed. The Clyde Navigation Trustees are carrying out a widening scheme at Rashielee, opposite Dalmuir. Owing to the fact that rock has been found 18 ft. to 20 ft. below low water it has been necessary to provide a special diving bell barge, which will cost about £11,000, in order to enable the necessary underwater blasting to be carried out.



An oil pressure cylinder for operating one of the 23½ ft. diameter butterfly valves at the Niagara Falls Power Station, which were described on page 284 of last month's "M.M." The cylinder works at a normal pressure of 150 lb. per sq. in. and the piston has a stroke of 78 in. Photograph by courtesy of the Allis-Chalmers Manufacturing Co., U.S.A.

The first oil-engine-propelled passenger ship to be built for pleasure service in the upper reaches of the Thames has just been completed. She has been named *"Princess Royal,"* and is to ply between Westminster Pier and Kew and Richmond twice daily during the summer months. The vessel has an overall length of 114 ft., a breadth over rubbers of 17.75 ft., and a draught of 6 ft. 6 in., and is designed to carry 350 passengers. She is equipped with a 125 b.h.p. Crossley oil engine, running at 450 r.p.m., and the main fuel tanks carry 2½ tons of oil.

Another interesting new boat shortly to be seen on the Thames is the fire-fighting float *"Massey Shaw."* This vessel was built at Cowes and is 78 ft. long and 13 ft. 6 in. broad. Her draught is 3 ft. 9 in. and she is equipped with oil engines giving her a speed of 12 knots. The float is so designed that she can pass under any of the Thames bridges at any state of the tide.



This illustration shows the cylinders and piston valve chests for a locomotive being machined at Crewe Works. Photograph by courtesy of the L.M.S.R.

A new passenger, cargo and live-stock carrying steamship the *"Duke of York,"* constructed by Harland and Wolff Ltd., Belfast, is to be used on the L.M.S.R. Heysham-Belfast service. The vessel has an overall length of 349 ft., a breadth of 52 ft. and a depth of 19 ft. 6 in. The *"Duke of York"* is equipped with mechanical stokers, and the "Grinnell" automatic sprinkler and fire alarm system is being fitted throughout the passenger accommodation. The designed speed of the vessel is 21 knots.

Two Union Castle liners constructed by Harland and Wolff Ltd., Belfast, are being equipped with the "Harlandic" electrical time system, which makes use of motor-driven synchronous clocks, the rate of which depends on the frequency of the alternating current supply. A frequency regulator is incorporated so that the clocks can be made to gain or lose any desired number of minutes a day. During a voyage the rate at which they are set is determined by the estimated speed and direction of the ship, and in consequence they always show true solar time. At present the clocks of vessels at sea are regulated by "spoking" them on or back, that is by putting them forward or backward at regular intervals. The new system will make the method obsolete.

Bearing that Requires No Oil

A bearing material that can be used without lubricants of the usual type has been produced by an American firm. It is a compound of asbestos, graphite and rubber, and is said to have high wearing value and a low coefficient friction. A specially interesting feature is that its efficiency is increased by the presence of moisture. The new material lends itself readily to machining, and can be employed in machines in paper mills and other factories where water may cause trouble.

* * * *

A 2½ million volt plant with which spark discharges up to 10 ft. in length can be obtained has been installed in a large Japanese engineering works for making insulation tests.

Shanghai Waterworks Extension

A new water main several miles in length has been constructed in Shanghai, together with a subterranean reservoir of a total capacity of 7¼ million gallons and a pumping station capable of delivering 1,320,000 gall. per hr. These works form an extension to the existing waterworks of the city, and have been planned to increase reserve supplies sufficiently to meet the peak demand of 1,980,000 gall. per hr. between the hours of 8 a.m. and 12 noon.

The subterranean reservoir has four basins and lies 21 ft. beneath the surface of the French Park (Koukaza Park). All the ground above the reservoir remains available for park use, and the work of construction was carried on only during the winter months in order that those who frequent the Park should be disturbed as little as possible. Each basin is 23 ft. deep and the total surface area of the four is 81,000 sq. ft.

The pumping station is equipped with three Sulzer centrifugal pumps, two of which are direct coupled to 400 h.p. electric motors, while the third is driven by a 750 h.p. motor. The station is designed to accommodate two additional pumps of 660,000 gals. per hour each should an increased demand in the future necessitate a greater pumping capacity.

A Giant Aerial Beacon

The Palmolive Building at Chicago is surmounted by a remarkable aerial beacon, which cost nearly £26,500 to build and install and is claimed to be the most powerful aerial beacon in the world. The light is provided by a 2,000 million candle power high intensity arc lamp fitted with a huge reflector, and is visible at a distance of nearly 250 miles. In addition to the main light there is a second and smaller lamp, which throws its light on the Chicago airport.

Novel Lifts in London

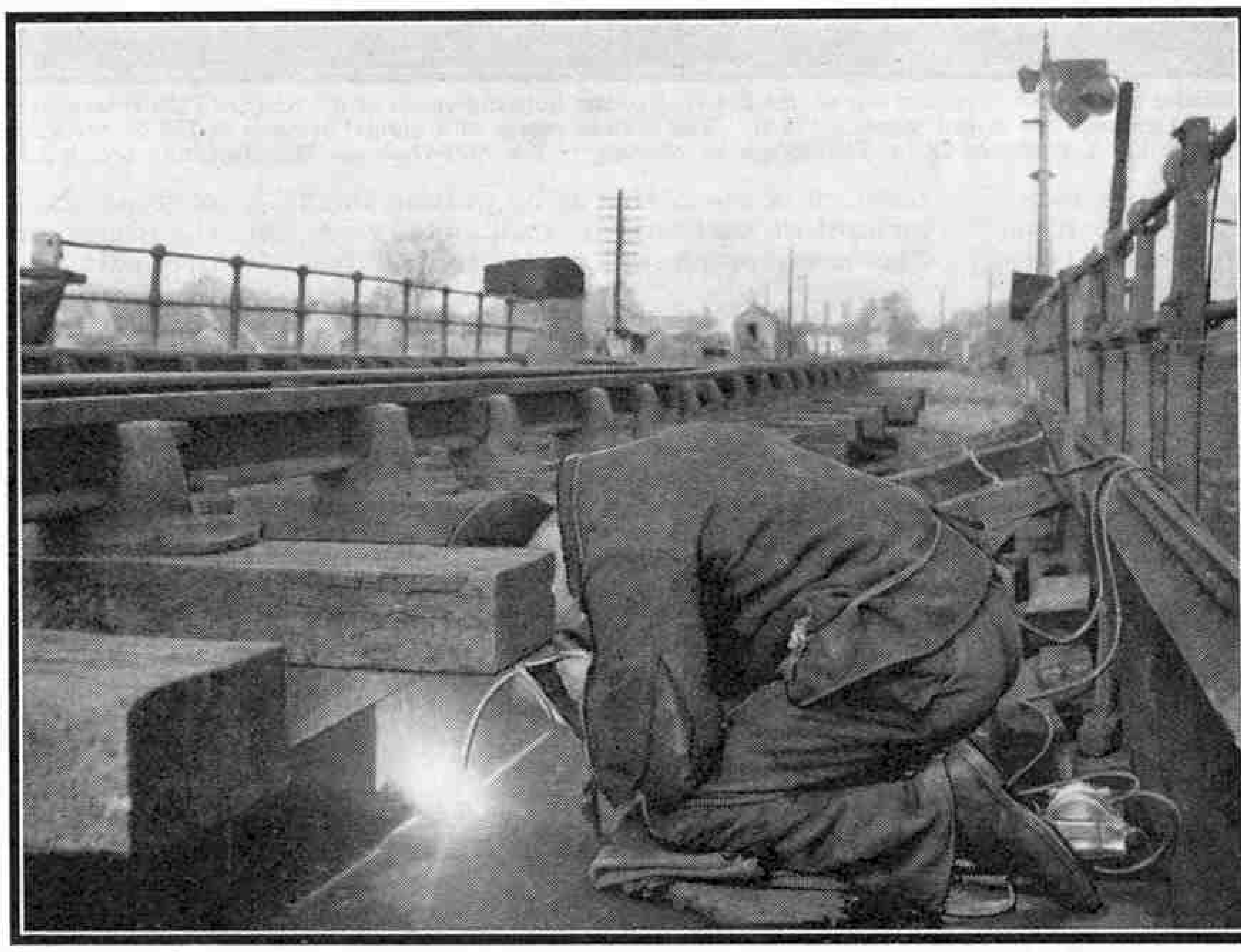
At the Strand Underground Station, London, three automatically controlled lifts that do not require attendants have been installed. Loud speakers are used to warn passengers to stand clear of the gates, and the lifts make the double trip in 110 seconds. Three of these lifts instead of the usual four are able to cope with all rush-hour traffic.

Arc Welding for Bridge Repairs

Its Application to Sharnbrook Viaduct

IN the development of railway traffic the tendency for many years has been for the weight of the rolling stock and of the locomotives employed to increase constantly. In addition, cuts in schedule times have been made, with the result that faster running is required. As regards the permanent way, increases in locomotive and train weights have been paralleled by track improvements in order to permit of the augmented load on the rails being moved at higher speeds. Further, it has been necessary on many routes to strengthen or to replace bridges that could not cope with the stress of modern traffic, having been installed in the days when locomotives and trains were lighter, and speeds lower, than is the case to-day.

If old bridges are allowed to remain on particular routes they have the effect of limiting the weights of locomotives that may be run over them. Such limitations may lead to the constant piloting of heavy trains, or the regular "thrashing" of small locomotives in order to keep time. Either of these courses is a source of uneconomical expense and, in order to permit of the passage of the most improved forms of motive power, bridge reconstruction programmes of considerable extent have been, and are still being, carried out by various lines.


Welding new floorplates to the main girders of Sharnbrook Viaduct. The sleepers and rails are supported on temporary timbers above the main girders, the ballast having been removed. The photographs illustrating this article are reproduced by courtesy of the L.M.S.R.

On the Eastern section of the Southern Railway, for instance, it was previously not possible for any heavier locomotive than a comparatively small 4–4–0 of the rebuilt Wainwright superheated class to be run on several routes. Thus much uneconomical working was pursued until, as a result of a boldly conceived programme of bridge strengthening, the largest locomotives so far developed by the Southern Railway can now be operated on three routes to Dover and on the Kent Coast lines.

Similarly, on the main line of the Midland Division of the L.M.S.R. there were various restrictions preventing for many years the use of large and powerful 4–6–0 locomotives. The reconstruction or replacement of various bridges therefore has been put in hand, and the programme is still being carried out. In one of the bridges thus dealt with—the well-known Viaduct over the Ouse at Sharnbrook—an interesting application of electric arc welding in place of the usual riveting has been made. This Viaduct is situated about a quarter of a mile south of Sharnbrook station, and was constructed in 1881 in place of the original timber viaduct erected in 1855 when the line from Wellingborough to Hitchin was made.

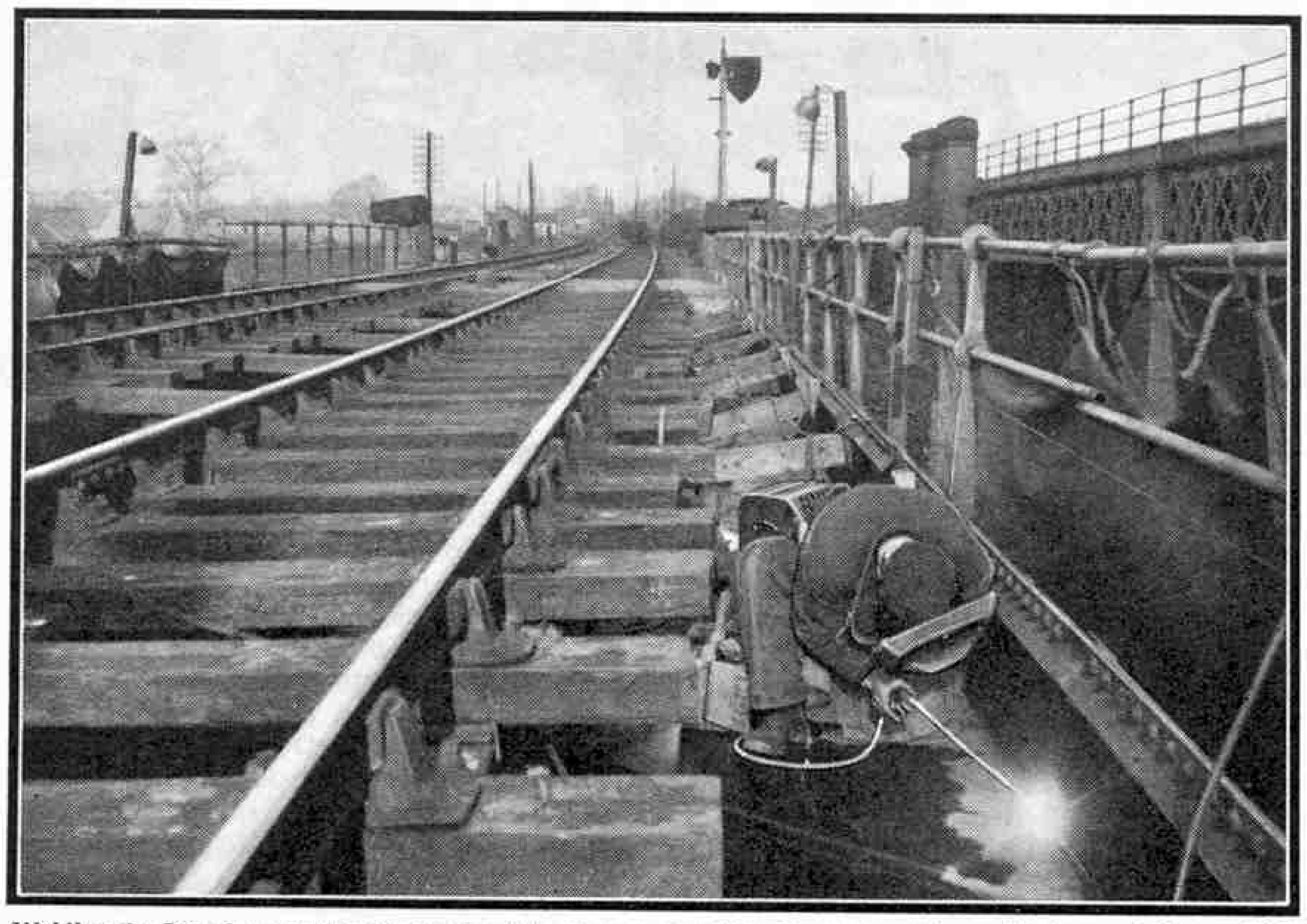
It carries the two passenger tracks of the Midland main line from St. Pancras to the North, and is composed of 10 spans. There are three square spans on land at the Northern end, three skew spans over the river, and four square spans again on land. Each span is composed of six girders, two of which are on the outside to support the parapets and the remaining four are directly under the rails. The goods lines are carried across the river on a separate viaduct alongside, consisting of nine spans.

At the point where the passenger Viaduct is situated, Southbound expresses are invariably moving at high speeds on a falling gradient of 1 in 100, in their headlong rush downhill after the difficult climb on the Northern side to the famous Sharnbrook summit. The result of the constant vibration of heavy trains passing at high speeds was to weaken the Viaduct and to cause the girders to wear down into the bedstones of the abutments and piers to an appreciable extent.

About three years ago it was decided to put in hand the strengthening and repair of the Viaduct, and as the floor timbers required renewal, the opportunity was taken of substituting steel floor plates between the top flanges of the girders, stiffened under the cross joints, to form a new floor in place of the existing timbers. To obviate a large amount of work on the spot in drilling the girder flanges, and the cutting out of a number of flange rivets for the connection of the new floor plates, it was decided to utilise electric arc welded connections instead of riveted work.

Work on the first span at the Northern end was undertaken during the months of June to September in 1932-3, during which the welding was undertaken by two operators. It was subsequently decided to proceed with the reconditioning of the remaining nine spans by welding, as it appeared to be an economical method of dealing with the work. Contracts were therefore placed for the supply of new floorplates, etc., and bearing plates, the weight of the new steelwork being approximately 140 tons.

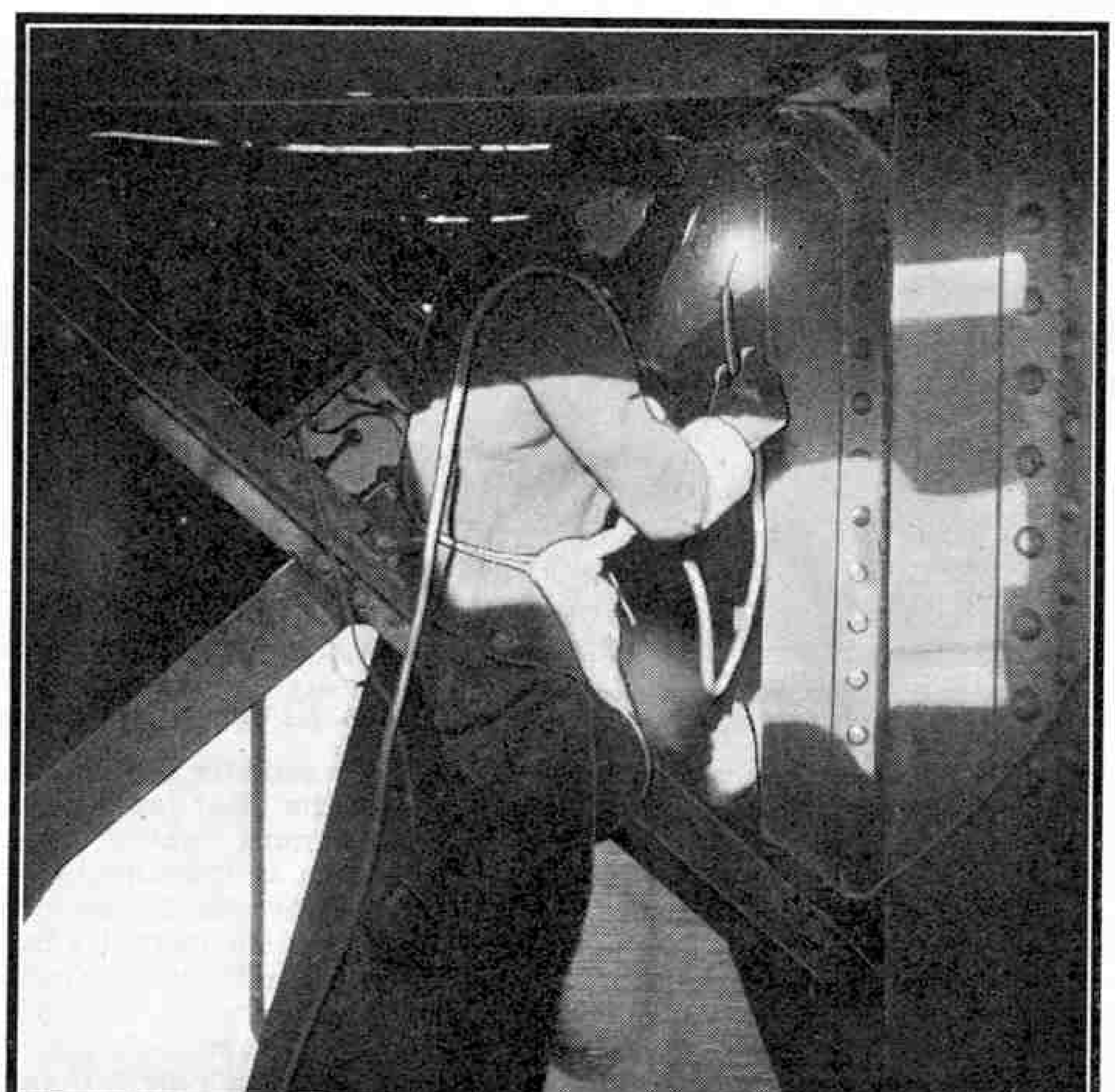
The first operation was the lifting of the girders out of the chases they had worked into the bedstones, and the insertion of steel plates 1 in. thick between the underside of the existing bearing plates and the top of the bedstones. These plates on the piers extended underneath the girders of the adjoining span, and in all cases were of greater width and length than the existing bearing plates, to allow of a better distribution of the loads from the girders over the bedstones and piers.



Welding the floorplates to the side girders. The viaduct at a higher level alongside carries the goods lines, which were used for passenger traffic also on certain Sundays when the passenger viaduct was occupied for repairs.

Part of the ballast on the Viaduct was removed to reduce the weight of each span to approximately 130 tons, and a speed restriction for trains passing over was put into operation. Temporary working stages slung from the underside of the girders were provided under several spans.

Between the girders on the North Abutment were placed timber packings that supported five hydraulic lifting jacks engaging, when operated, against 14 in. square oak or pine lifting beams provided between each two girders and situated underneath their top flanges. Lifting beams were also provided between the ends of the 12 girders resting on the adjoining piers between the first and second spans, and five hydraulic jacks were placed in readiness for lifting. On a Sunday, when all traffic was diverted over the adjoining goods lines, the girder ends over the abutment were lifted a distance of about three inches, and the new bearing plates were inserted underneath them. Bitumen sheeting was placed between the plates to take up any irregularities in alignment of the existing plates, and the main girders were then lowered again into position.



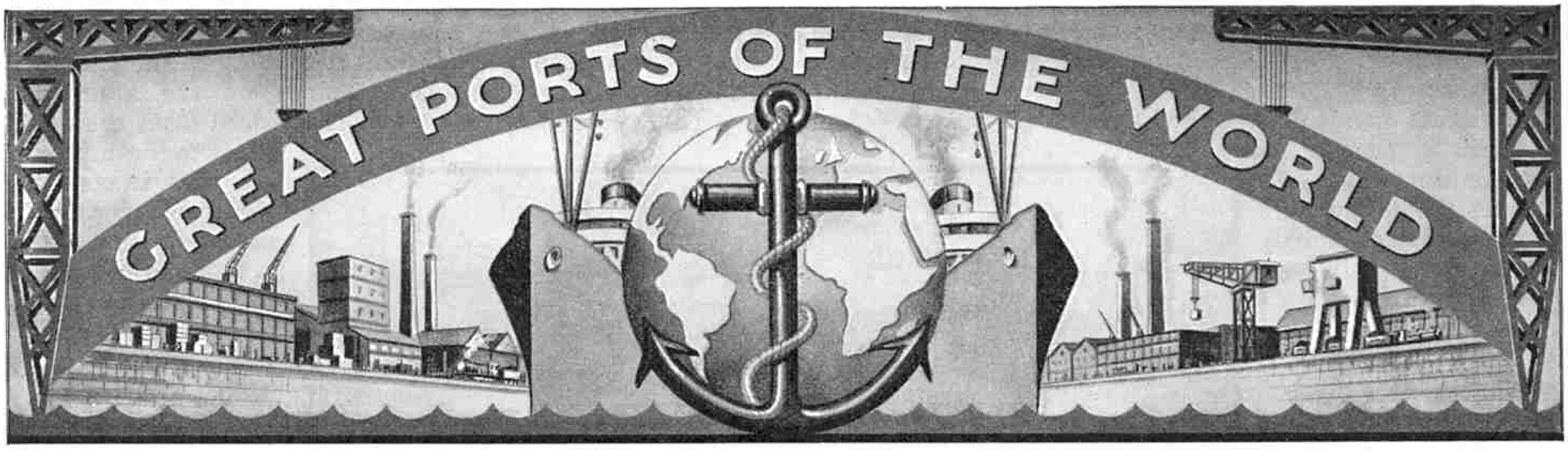
An interesting view showing a welder at work on the cross bracings and main girders below the floor level. He is standing on part of the staging slung beneath the girders during the period of the repairs, the staging being moved along as required.

Wedges were placed between the underside of the new bearing plates and the bedstones, and the new plates forced up tightly against the sheeting and the existing bearing plates. Irregularities underneath in the bedstones were then filled with a wet mixture of iron borings and cement in equal parts. The wedges were withdrawn after an interval of several hours, when the mixture was set, leaving the new bearing plates and girders solidly seated on the abutment.

The hydraulic jacks were then moved from the abutment to the adjoining pier and, in conjunction with the jacks already placed in position, the ends of the 12 girders resting on it were raised and the new bearing plates emplaced in a similar manner. On three further Sundays, with similar traffic arrangements, the bearings on the remaining eight piers and abutment were attended to. The working stages were moved under the various spans during weekdays, and on completion of the lifting operations they were left under the three southernmost spans for use during the welding of the floorplates.

The floorplates for these three spans were delivered in wagons at the site, and placed in proper sequence for unloading. Then, with Sunday possession by the engineers of the lines over the Viaduct, and all traffic again diverted over the goods line viaduct, the remaining ballast, permanent way and floor timbers were removed from the three spans. The tops of the 18 girders exposed were thoroughly chipped and cleaned of rust and scale that had formed underneath the timber floor. Two 7-ton steam cranes with long jibs were used in removing the floor timbers, and these also assisted in the unloading and erection of new floorplates. As several weeks would elapse before all the floorplates were welded to the girders, holes were provided in the floorplates for temporary bolts, and these were then inserted to prevent the plates from slipping off the girder flanges where a width of 2 in. was allowed for seating. Suitable expansion joints were provided at the ends of all spans.

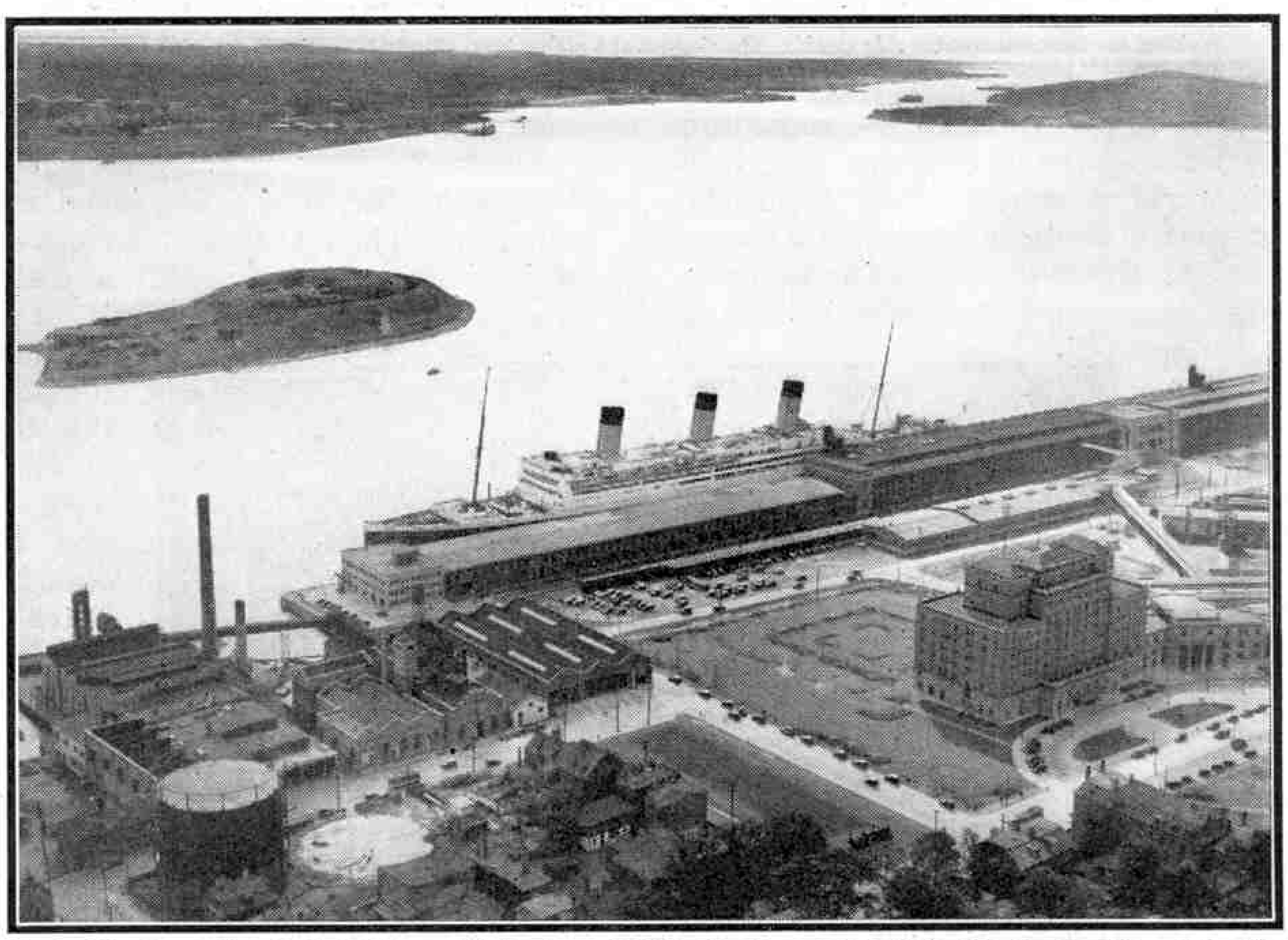
To support the sleepers and rails when reinstated over the spans, temporary longitudinal timbers resting on timber packings of varying thickness were provided directly over the centre of the girders. This left sufficient space for the welders to operate when making the welds between the floorplates and the top of (Continued on page 374)



XV.—HALIFAX

THE history of Nova Scotia during the century before Halifax was founded is mostly an account of the rivalry of the French and English colonists. In 1667 the province was ceded to France, under the terms of the Treaty of Breda, but conflicts between the rival colonists continued to occur periodically. Under the Treaty of Utrecht, signed in 1713, Nova Scotia was ceded to Britain, but France retained certain territories, including what is now Cape Breton, until 60 years later, when the Treaty of Paris was signed and the whole province was returned to British rule.

Although Nova Scotia was thickly wooded and therefore very valuable as a source of timber supplies, with an abundance of fish along its 1,000 miles of coast, England neglected its development for 36 years. Indeed it was not until France began to show renewed interest in the province that England awoke to the real value of this possession. Eventually the Government decided to establish a settlement and fort at Chebucto. The Board of Trade, under Lord Halifax, drew up the necessary plans and offered generous conditions to Britishers who would emigrate to Nova Scotia. The offer was accepted by 2,500 colonists who, with their families, were conveyed to the province in 13 transports in the summer of 1749. They were preceded by Col. Cornwallis, in the sloop of war "*Sphynx*," and he arrived there on 21st June 1749. The clearing of the thickly wooded territory was first begun near the extreme southern point of what is now Halifax, but owing to the exposed position it was discontinued, and the town, named after Lord Halifax, was laid out about two miles to the north.



Part of the Ocean Terminals, Halifax, with the Cunard White Star liner "Majestic" at Berths Nos. 20 and 21. The illustrations to this article are reproduced by courtesy of the Halifax Harbour Commissioners.

From the year that Halifax was founded there was a steady influx of New Englanders into the town and other parts of the province, and at the time of the American Revolution political feelings in Halifax were sharply divided. Enemy privateers, some little better than pirates except in their manner of disposing of their prisoners, swarmed all around the shore, capturing ships bound for Halifax, interfering with coastal trade and landing to pillage small settlements. In spite of threatened risings, however, Nova Scotia was the one colony on the Atlantic coast that remained loyal to Britain. When the Revolution succeeded, many of those who desired to remain under the British flag, and who were known as United Empire Loyalists, sought a haven in Nova Scotia, and as a result the population of Halifax was soon multiplied fourfold.

During the Napoleonic wars Halifax was again connected with privateering. From 1793 to 1815 the British fleet was preying on the commerce of the newly formed United States as thoroughly as the regular privateers, and all the prizes, whether captured by the fleet or by the privateers, were brought to Halifax, where a Court of Vice-Admiralty gave judgment upon them. This influx of prizes made it necessary to have warehouses in which to store the cargoes. In 1813, for instance, great quantities of prize goods were taken, chiefly from American vessels, and were sold at auction by order of the Court. An advertisement of one of these sales, dated 19th March 1813, mentions 12 fully-rigged ships, eight brigs, seven schooners, and 10 or 12 small vessels with their cargoes. The foundations of many fortunes were laid by merchants in the city who had the money to take advantage of these opportunities.

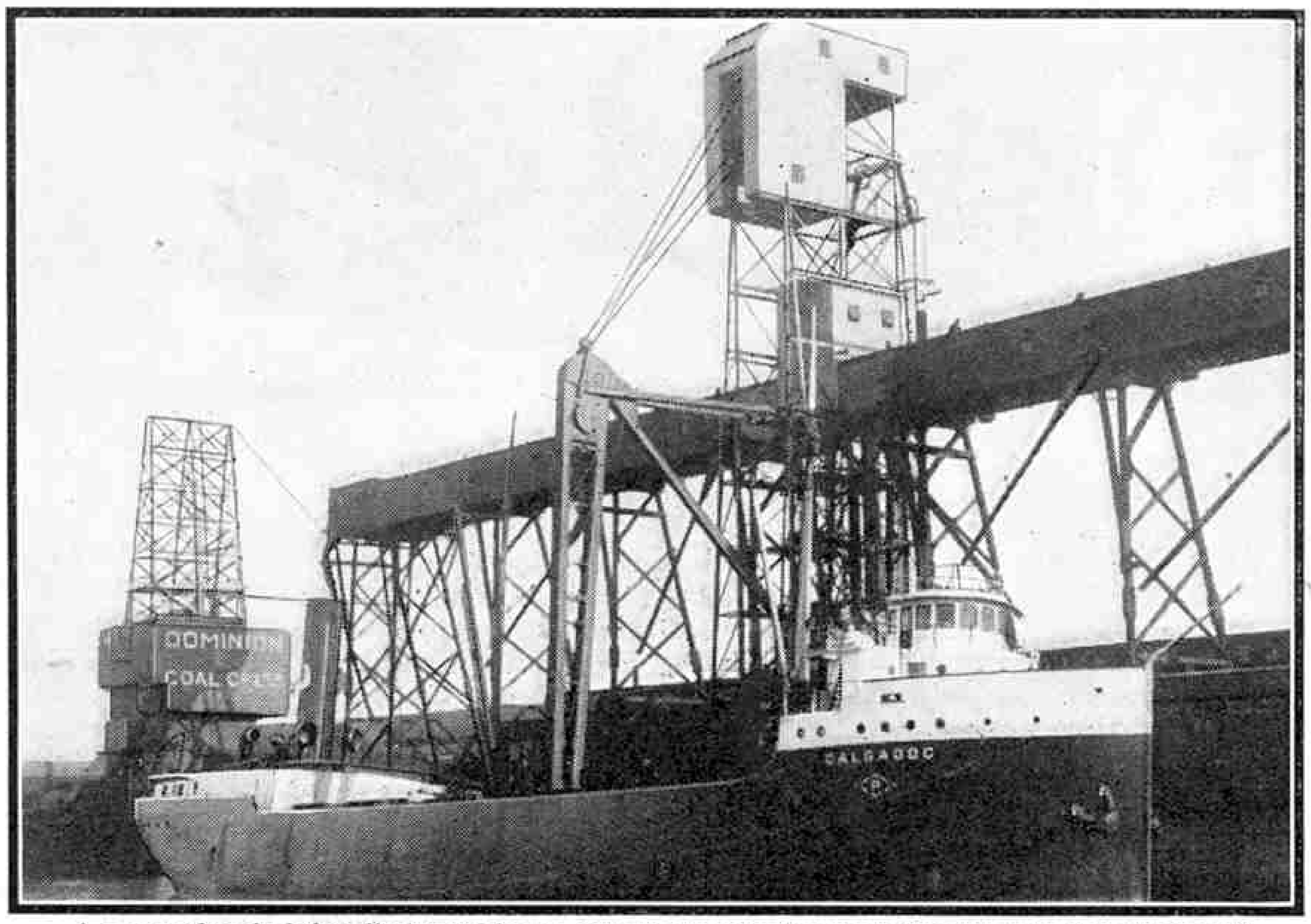
At the close of the Napoleonic wars the prosperity of Halifax for a time declined, but in 1818 the British Government was petitioned to make Halifax a free port so that foreigners might have access to take cargoes of the produce of the country or merchandise imported into it, and the petition was granted. Soon there came a great tide of immigration into the British North American provinces, and by 1828 the trade of the port had become very considerable. In that year the merchants in the city owned 73 square-rigged ships and 77 schooners, and of these 70 were employed in the West Indian trade, four in trade with Great Britain, six with Europe and Brazil, and the remainder in the coastal fishing industry.

One of the most famous Halifax merchants of that period was Samuel Cunard, whose father had migrated to Halifax from Philadelphia at the time of the American Revolution. To Samuel Cunard belongs the honour of being the first to bridge the Atlantic with a line of steamers. He had already successfully carried British mails between Halifax, Newfoundland, Boston and Bermuda by sailing vessels when, in 1838, the British Government invited tenders for a steam packet service to carry mails across the Atlantic. This was Cunard's great opportunity, and with David MacIver of Liverpool and George Burns and Robert Napier of Glasgow as his associates, he succeeded in obtaining the mail contract for seven years. He immediately founded the British and North American Royal Mail Steam Packet Company, and four new ships were built. The service was inaugurated on 4th July 1840 when the "*Britannia*," with Cunard himself on board, sailed from Liverpool. She arrived at Halifax on the 17th of the same month and at Boston, America, on the 21st. This company subsequently became known as the Cunard Steam Ship Company.

The new service was a great success. During the early years of the enterprise the Cunard steamers called regularly at Halifax, and this gave fresh impetus to the commerce of the port; but, as on more than one previous occasion, just when success seemed assured some other port favoured by particular circumstances forged ahead. New York had previously, by the construction of the Erie Canal, succeeded in taking the shipping of the Atlantic from her rivals.

Another circumstance had now to be considered. The railway age had arrived, and by constructing lines to interior cities and towns the United States ports again captured the trade from Halifax, owing to lack of transportation facilities in Canada.

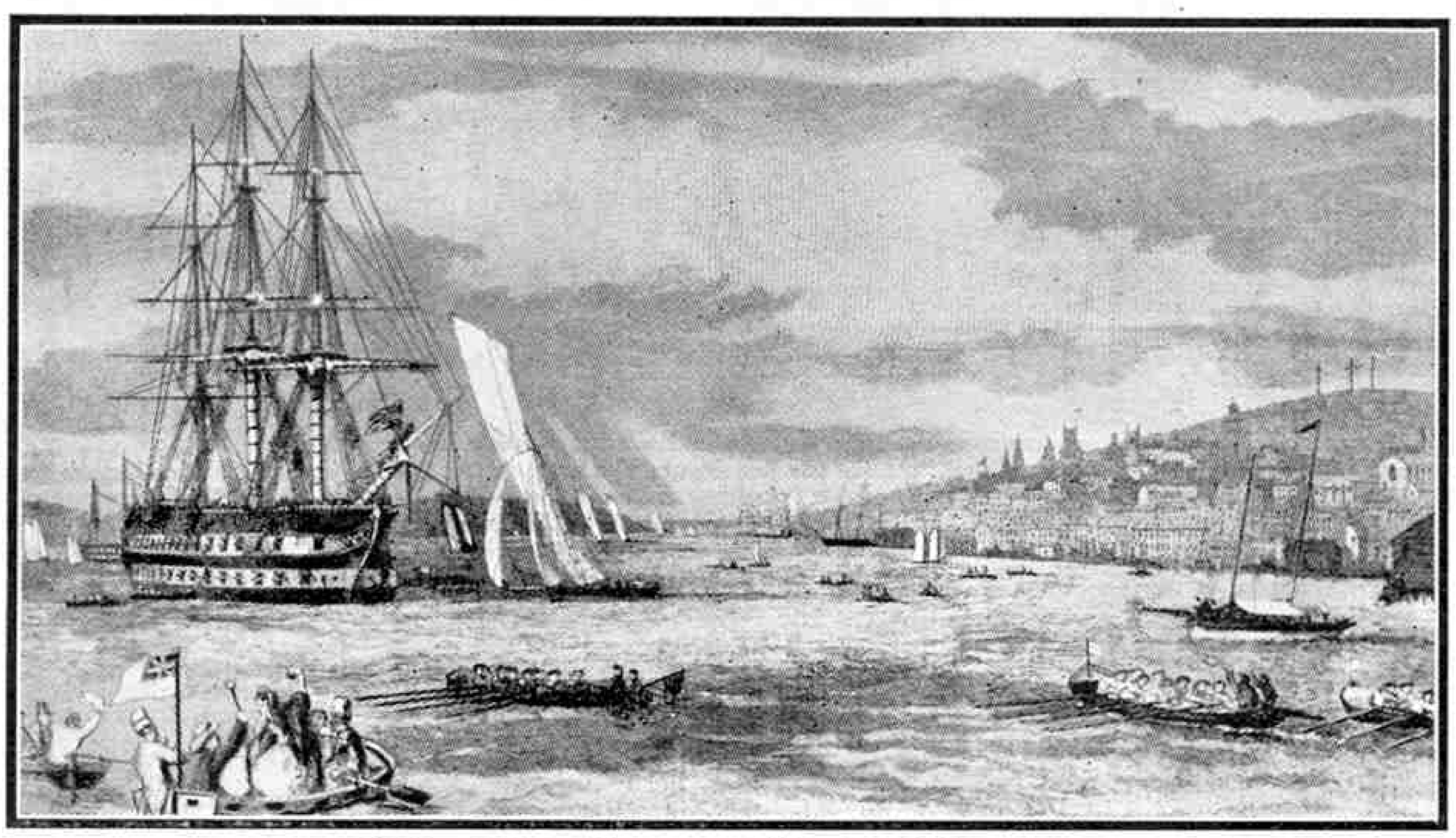
The first known proposal for the development of railways in Canada was in 1832, but it was not until 1854 that the Nova Scotia Railway was opened. On 1st July 1857 the British North America Act uniting the provinces of Canada into one Dominion came into force, and the Nova Scotia Railway passed into the control of the Dominion Government. Mr., later Sir Sandford, Fleming was instructed to make a survey of the line with a view to effecting the junction of the existing railways, but it was not until 10 years later that the whole of the Intercolonial Railway was opened.



A cargo of grain being discharged by a mechanical unloading device known as a "Marine Leg."

For a long time the port suffered from inadequate terminal facilities. The railway wharves and yards at Richmond, the north end of the city, were situated on a narrow and restricted shore, with no adjacent sites for warehouses and industries, and with altogether inadequate accommodation for modern railway and ocean steamship traffic. In 1876 a new railway station was opened at North Street to replace the old one at Richmond, and in 1879 a single line was run as far as the Deepwater Terminals, at the centre of the city, and the first pier there was completed in 1880, the construction of other piers following soon afterward. The first grain elevator was of timber and was built in 1833 at Deepwater Terminals; but it was destroyed by fire in 1894, and was replaced by another one built close to the old site.

At various times complaints were made that the terminal facilities at Halifax were inadequate. In 1913 the Government therefore embarked on an important development scheme at the southern end of the city, by the construction of what are now known as the Ocean Terminals. This scheme provided for the construction of 27 berths each about 600 ft. long, a grain elevator, adequate passenger and freight accommodation, and the reclamation of about 114 acres of land from the harbour beyond high water mark. Unfortunately the Great War intervened, and for many years the work remained only about half finished.


Halifax Harbour 74 years ago, with a Regatta in progress.

During the War period Halifax harbour provided shelter and safety for all classes of shipping carrying millions of tons of freight and over 300,000 troops across the seas. When Germany declared a submarine blockade of the British Isles in 1917, Halifax was made the port of examination for neutral shipping, and at one time there were as many as 110 steamers in Bedford Basin. On 6th December 1917 there occurred close to the Richmond Terminals a disastrous explosion following a collision between the Belgian Relief Commission ship *"Imo"* and the French steamer *"Mont Blanc."* The French ship caught fire and her cargo of about 2,300 tons of T.N.T. exploded. A large part of the city was devastated, and the known dead totalled nearly 2,000, and there were hundreds of other casualties.

In 1927 a Royal Commission enquired into certain claims of the Maritime provinces, and as a result recommended that statutory Harbour Commissions for the development of the Canadian Atlantic ports should be established at Halifax and Saint John. The Halifax Harbour Commission was therefore formed in 1928, and since that time the grain elevator and all the Government-owned piers at the port having rail connections have been administered by that body.

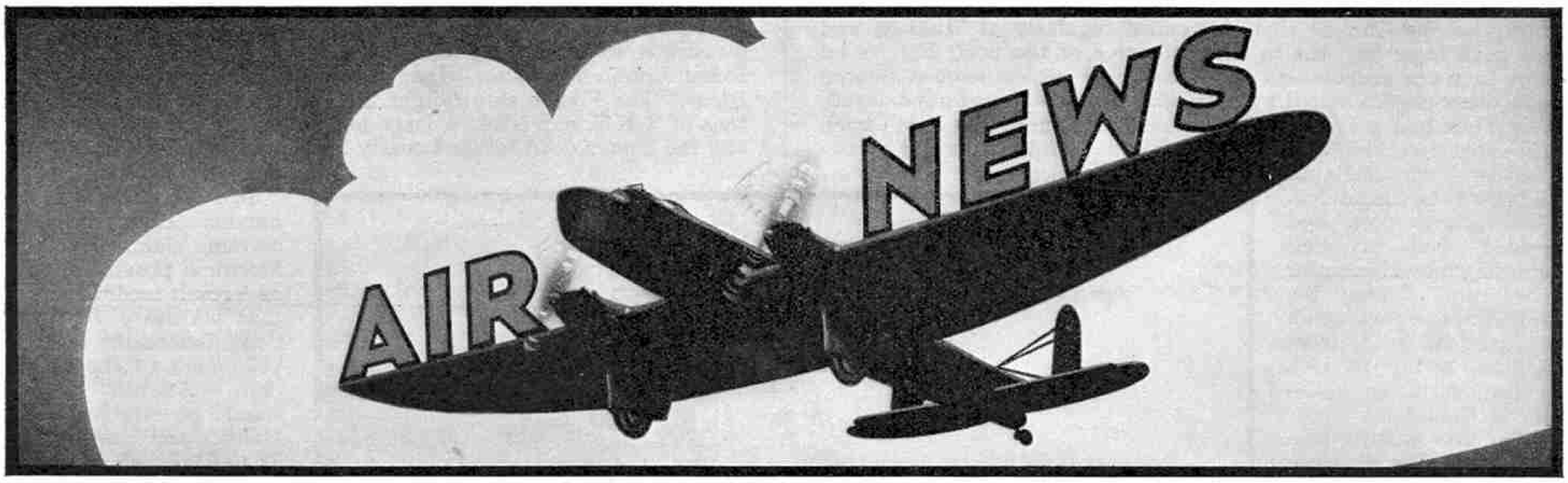
Another important event in 1927 was the resumption of the harbour development scheme at Ocean Terminals. There are now 13 modern berths there, 12 of which are equipped with transit sheds over 500 ft. long. Berths Nos. 20, 21 and 22 have a total length of 2,007 ft. The depth of water alongside these berths is 45 ft. at low tide. There are three piers at Deepwater Terminals, and these provide a total of six berths, four over 600 ft. long and two over 500 ft. long. At Richmond, No. 9 pier is mainly used for cattle loading and open storage and by industrial undertakings. To summarise the accommodation of the port, there are nearly 2½ miles of quayage and about 20 acres of transit shed accommodation, all with rail connections. The total storage capacity of the railway sidings is well over 5,000 wagons.

The grain elevator is at Ocean Terminals and has a capacity of 2,300,000 bushels. Grain arriving by rail is discharged by a mechanically - operated car dumper, and that brought by water is unloaded at Berth 25 by a marine leg capable of unloading 15,000 bushels per hour, and connected to the elevator. Grain cargoes can be loaded at five different berths, which are connected by overhead conveyors to the elevator. The cold storage plant is also situated at Ocean Terminals, and is a modern fireproof structure with a total refrigerated storage space of about 1,000,000 cu. ft. It provides complete refrigerator storage and packing facilities. The entire elevator system of the port has recently been thoroughly overhauled so as to give maximum efficiency and performance, and to ensure that it will be able to meet any calls made upon it.

The dock equipment of the port includes a floating crane with a lifting capacity of 75 tons, and a graving dock 569 ft. long.

Halifax is also an important passenger port, and the immigration quarters at Ocean Terminals are connected with the railway station, the facilities being designed to give the best and quickest despatch of passengers.

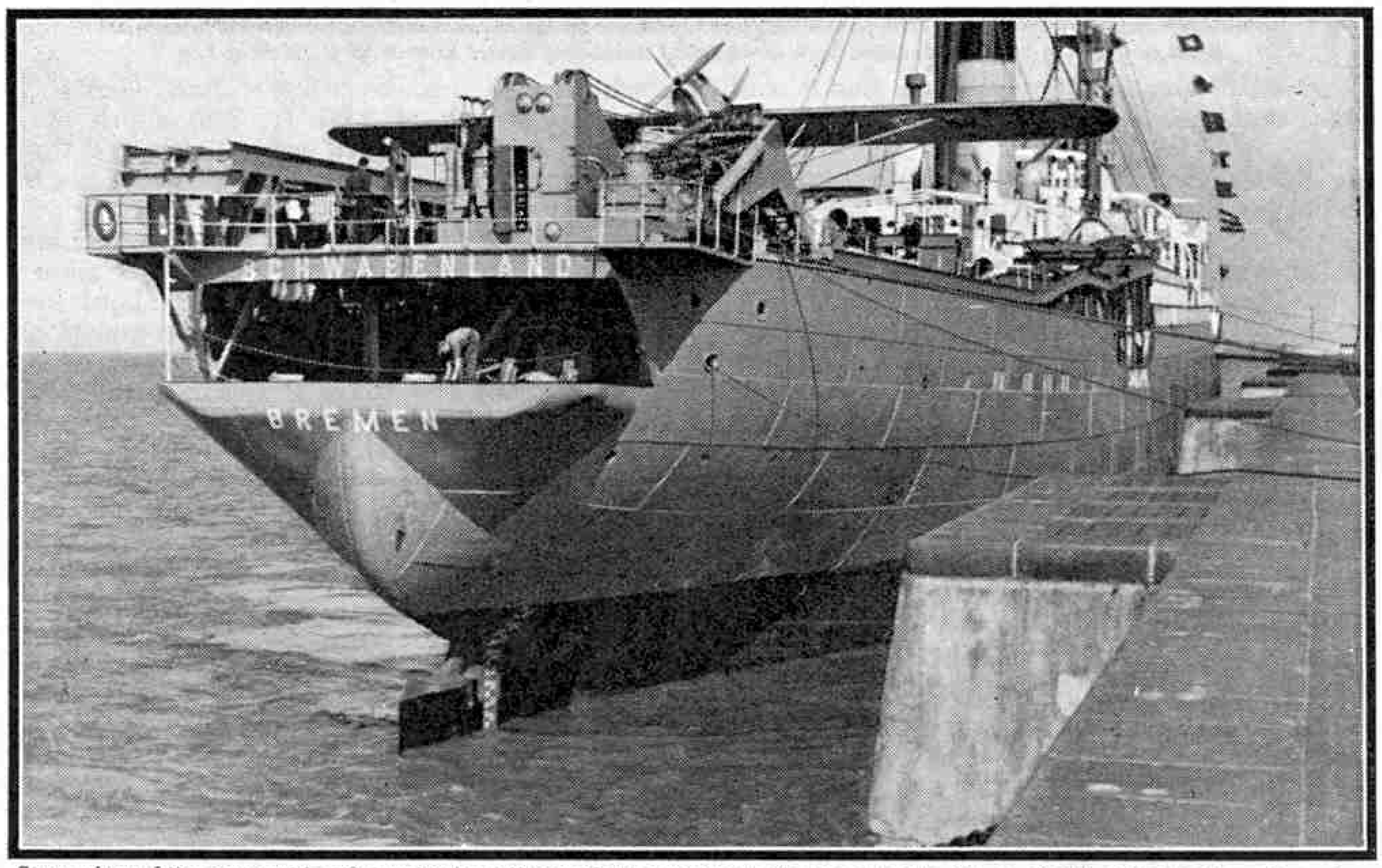
We are indebted to the courtesy of the Secretary of the Halifax Harbour Commissioners for the information in this article.



D.L.H. South Atlantic Air Mail Service

The South Atlantic Ocean mail service of Deutsche Luft Hansa has now been in operation for almost 18 months. It has proved a great success, and about 30,000 letters are now carried at each trip. The most interesting feature of the service is the transporting of the mail across the ocean by powerful flying boats that are catapulted from special ships used also as refuelling stations.

The German air mail for South America is collected at Berlin and is flown in a Heinkel HE.70 machine to Stuttgart, where it is augmented by air mail from England and other countries. The flight is continued to Seville, where the mail is transferred to a Junkers Ju. 52/3m machine that conveys it to Las Palmas or Cape Juby, and on to Bathurst, in Gambia. At Bathurst it is loaded into a Dornier Wal flying boat awaiting it on the deck of the depot ship *"Schwabenland,"* shown in the illustration on this page. When the ship is about 100 miles out to sea the flying boat is catapulted off and flies to Natal, Brazil. The distance covered in this long non-stop flight across the ocean depends of course on the position of the ship, but it is always from 1,500 to 1,800 miles.



Stern view of the motor ship "Schwabenland," one of the two depot ships used on the D.L.H. South Atlantic air mail service. The catapult is 136 ft. long and will launch a machine weighing up to 14 tons. This photograph and the upper one on the opposite page are reproduced by courtesy of "The Aeroplane."

At Natal the mail is again transferred, this time to a landplane belonging to the Syndicato Condor Limitada, a company affiliated to the D.L.H., and is flown to Buenos Aires. The air route from Berlin to Buenos Aires is approximately 6,200 miles, and the fast machines employed enable the mail to be carried the full distance in four days.

The mail for Germany and other European countries using the service is flown overland by the S.C.L. to Natal, where it is put aboard a Dornier Wal flying boat and transported to Fernando Noronha, an island off the Brazilian coast. The flying boat alights on a trailing apron at the stern of the depot ship, *"Westfalen,"* and is lifted on deck by a folding crane. The vessel then puts out to sea. A few hours later the flying boat is catapulted off, and after a non-stop flight of from 1,350 to 1,600 miles it reaches Bathurst. A Junkers Ju. 52/3m machine conveys the mail to Larache, where it is put aboard a Heinkel HE.70 machine awaiting it after delivering the eastward mail at Seville, and is carried on the last stage of its journey to Berlin.

We are indebted to *"The Aeroplane"* for our details of this air mail service.

New Zeppelin Company

A new Zeppelin company, under the name of Deutsche Zeppelin Reederei, has been formed in Germany to develop transoceanic Zeppelin services, chiefly over the North and South Atlantic. General Goering, the German Air Minister, is President of the company, and Dr. Hugo Eckener is President of the Board of Control. The capital has been subscribed by the Deutsche Luft Hansa and the Luftschiffbau Zeppelin of which Dr. Eckener is Chairman.

The *"Graf Zeppelin,"* which this summer is again engaged on a fortnightly service between Friedrichshafen, Germany, and Rio de Janeiro, Brazil, is flying under the house colours of the new company.

Interesting Record Flights

Several interesting new air records have been set up recently. On the 11th April one of the two D.H. "Comets" purchased by the French Government, as mentioned in these pages last month, created a record by flying from Croydon to Paris in 53 min. at an average speed of over 220 m.p.h. It was flown by Mr. H. Buckingham, one of the de Havilland crack pilots, and carried a passenger. The flight was made against a 22 m.p.h. wind. It is interesting to compare the time taken by the "Comet" with the fastest train and boat schedule of 6 hr. 40 min.

Another record flight made on the same day was by a three-engined Fokker air liner of K.L.M., which made the journey from Croydon to Rotterdam, a distance of 203 miles, in 55 min., at an average speed of 222 m.p.h.

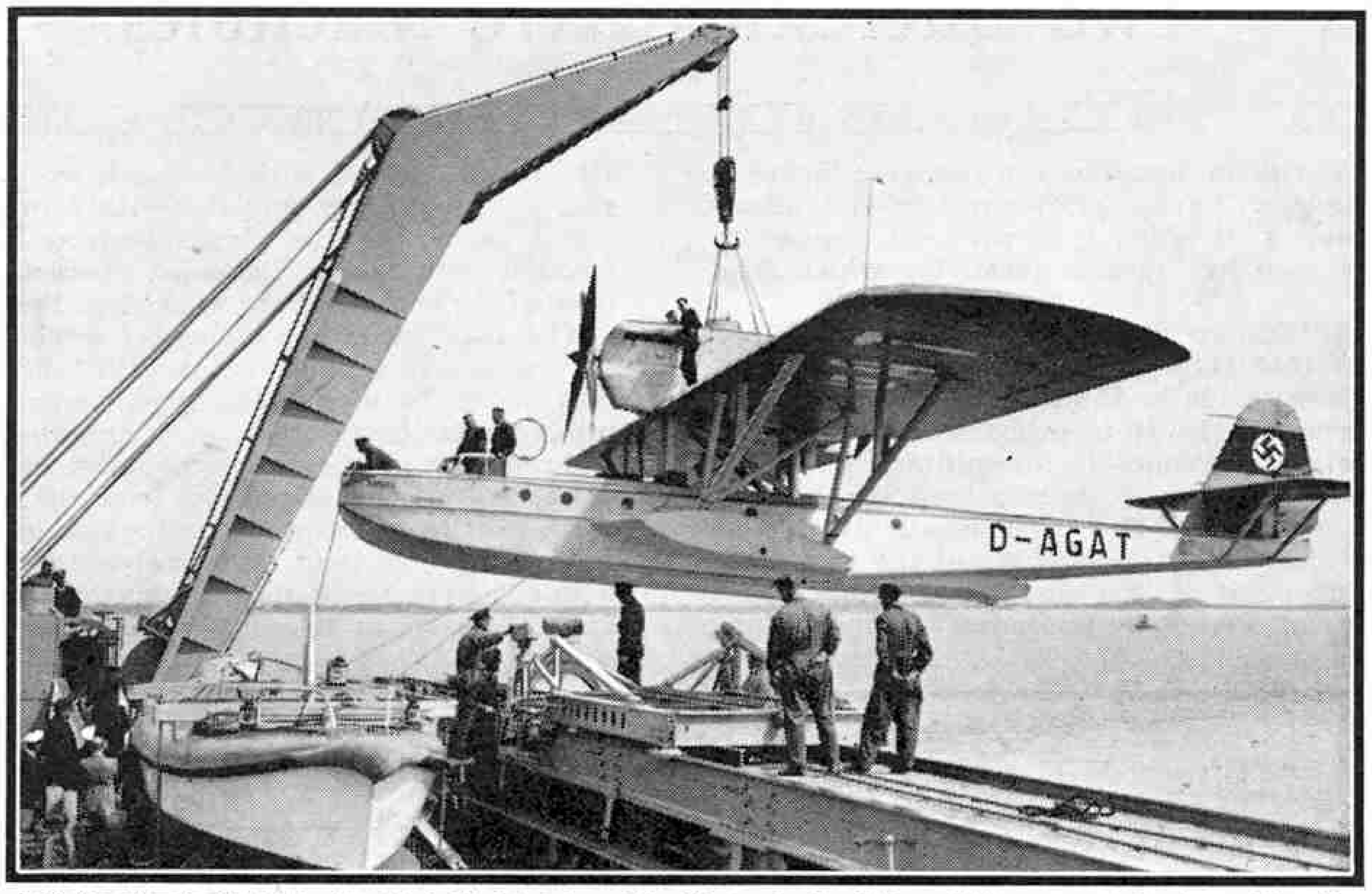
Mr. H. R. Brook, of Harrogate, in returning to this country in March last after competing in the MacRobertson races last year, flew from Port Darwin, on the northern coast of Australia, to Lympne, in Kent, in 7 days 19 hr. 50 min. This is 1 day 2 hr. 25 min. faster than the official record set up by Mr. J. Mollison in July-August 1931, and 13 hr. 10 min. faster than the unofficial record made last September by Mr. C. J. Melrose when he flew to England to take part in the races.

Mr. Brooks flew the first Miles "Falcon," and the 130 h.p. "Gipsy Major" engine of the machine was previously in the D.H. Puss Moth *"Heart's Content,"* in which he had attempted a flight to Australia but had crashed in France. The *"Heart's Content"* will be remembered by *"M.M."* readers as the machine in which Mr. J. Mollison made his first solo crossing of the South Atlantic from east to west, in February 1933.

A new Danish height record was achieved on 13th March last when the first Hawker "Nimrod" built in that country attained an altitude of 34,449 ft.

Imperial Airways' Summer Trips

The Summer timetables of Imperial Airways are now in full operation, and on the company's Continental routes there are frequent services to cope with the heavy seasonal traffic. Five flights daily are made to Paris on weekdays and four on Sundays, and there are four services daily to Cologne, three to Brussels, and two to Basle and Hamburg. Other daily services reach Amsterdam, Berlin, Copenhagen, Malmo, Zurich, Prague, Leipzig, Vienna and Budapest. The last four places are on the new Croydon-Budapest line, inaugurated on 1st April; and Budapest is reached in nine hours. Visitors by air to Switzerland, reached in a few hours, find awaiting them taxi-planes to bear them aloft to obtain magnificent aerial views of Mont Blanc and other Alpine wonders.



A 10-ton Dornier Wal flying boat being hoisted aboard the "Schwabenland" by a folding crane at the stern of the ship.

Week-end Summer air trips are being flown each Friday and Saturday to Le Touquet, returning on Monday, and there is also a Sunday excursion to this popular resort. A welcome privilege to passengers on these trips, and also to those taking week-end and day excursions to Paris, Brussels, Antwerp, Ostend and Le Zoute, is that passports are not required. At Ostend and Le Zoute there are facilities for trips by electric tramway to Zeebrugge and other points along the Belgian coast. Week-end flights to Germany include steamer excursions up the Rhine and motor coach trips amid picturesque mountain scenery.

These excellent facilities open up fascinating vistas for tourists and holidaymakers who want to go as far as they can and see as much as they can in any given period of time, and who wish to enjoy the thrill of looking down on the earth from a bird's-eye point of view.

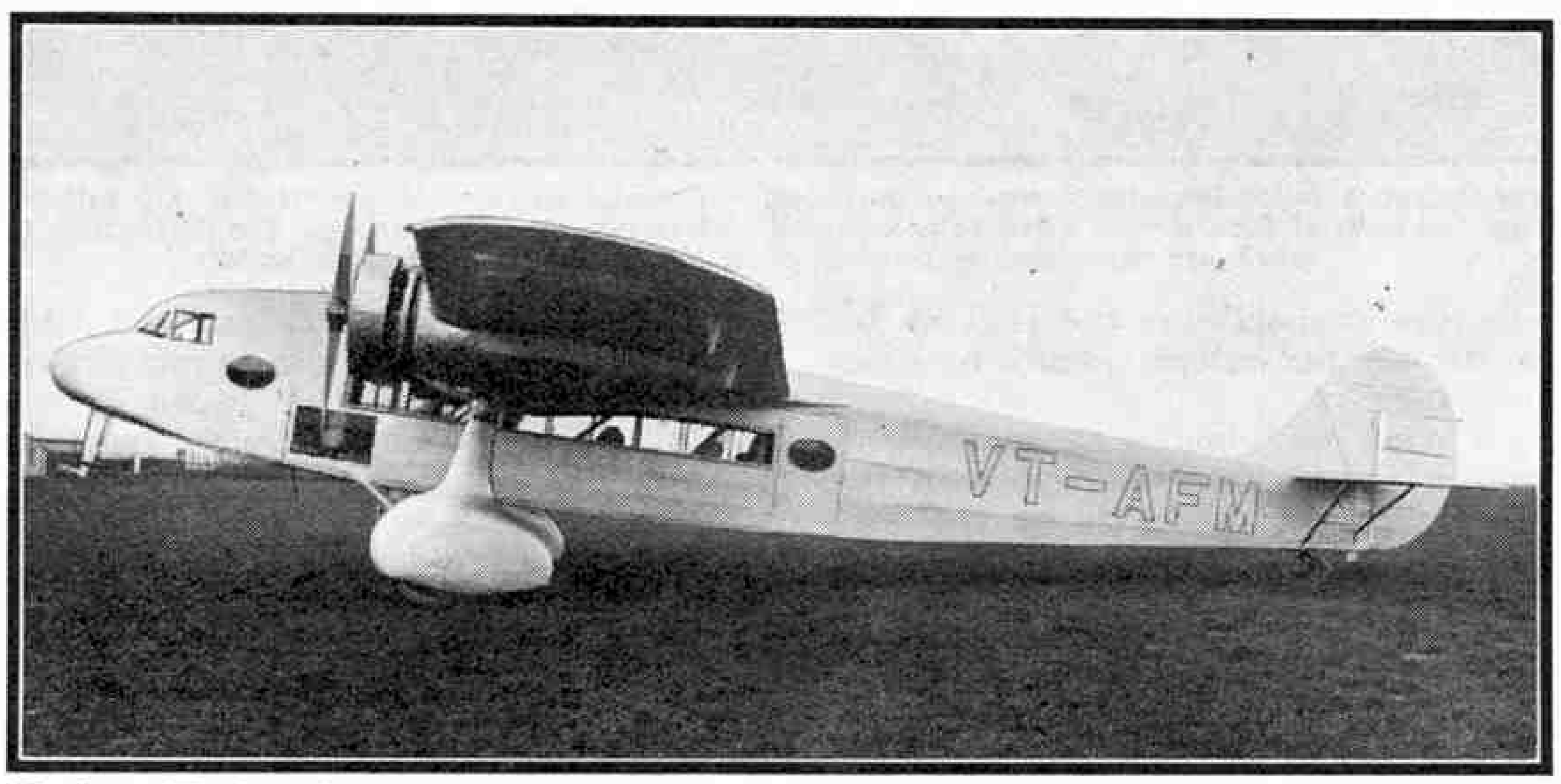
One of the most delightful forms of holiday is a combined tour of Europe by air and road, flying from capital to capital and at each place enjoying local trips and sight-seeing excursions by motor car and motor coach. The Continental airway system now comprises more than 60,000 miles of routes, and about 150 towns and cities throughout Europe can be reached from London by air.

On the Empire routes of Imperial Airways four services a week are now flown from London to Egypt, and two a week to East Africa and Johannesburg in South Africa, and to Calcutta, India; while one service a week operates from London to Capetown and from England to Brisbane, Australia. The first regular air service for passengers between London and Brisbane was put into operation on the 13th April last, and the corresponding service in the opposite direction began from Brisbane four days later. By these services passengers can make the journey of 12,745 miles in $12\frac{1}{2}$ days.

Sabena 18-Seater Air Liners

The Sabena company, of Brussels, are adding four new air liners to their fleet. The new machines are 18-seaters, of the type known as Savoi-Marchetti S.73, produced by the Savoia Company, of Milan. This type is powered by three 600 h.p. Gnome-Rhone 9 Kfr. engines and cruises at about 180 m.p.h. The passengers' cabin is warmed by liquid heating so that no fumes from the engine exhausts are drawn into it, and the heating is thermostatically controlled to maintain the required temperature. The pilots' cabin is well forward and has an excellent outlook, and is equipped with dual control. The wireless operator and the mechanic are accommodated behind the pilots, and four of the passengers occupy a raised compartment situated above the centre section of the wing.

Some of the new machines are already in service, and make the Croydon-Brussels flight in 75 minutes.



The Avro 652 high wing monoplane described in a special article on page 340. This broadside view of the machine gives a good idea of the excellent outlook from both the cockpit and the passengers' cabin. Photograph by courtesy of A. V. Roe and Co. Ltd.

New British Internal Air Services

The development of internal air services in this country continues steadily. A new company known as Crilly Airways Ltd. are operating a passenger service between Croydon Air Port and Doncaster, their headquarters, with a call at Birmingham, and a twice-daily service between Leicester, Norwich and Bristol. The recently licensed municipal aerodrome near Braunston, Leicester, is being used as a base. The Leicester-Bristol journey by air takes $2\frac{1}{2}$ hrs., a saving of about 5 hrs. over the time taken by train. The machines used on these air routes are D.H. "Dragons."

Railway Air Services Ltd., are operating a service between Manchester, Blackpool and the Isle of Man, and are co-operating with Blackpool and West Coast Air Services Ltd., in regard to timetable and fares. The new service is being run for the L.M.S.R. and the Isle of Man Steam Packet Co. Ltd. It provides connection at Manchester with the R.A.S. trunk service linking up that city with London, Birmingham, Liverpool, Belfast and Glasgow, and at Croydon connection is made with air services to the Continent. D.H. "Dragon" six-seaters are being used on the new line, and two trips in each direction are made daily.

Another new company, North-Eastern Airways Ltd., with Heston Air Port as their base, are running a service between London, Leeds and Newcastle, and are using Airspeed "Envoys" for the purpose. A detailed description of this interesting type of commercial monoplane was given in the "*M.M.*" of January last.

"Dragon Rapide" for Air Council

The Air Ministry have purchased a D.H. "Dragon Rapide" for the use of the Air Council. In addition to the usual equipment of this type of machine, it is provided with a Marconi receiving and transmitting set fitted behind the bulkhead of the pilot's cockpit, and the set will be worked by the pilot himself when no wireless operator is carried.

Silver Cup for Royal Aero Club

The MacRobertson air races last October were part of the Melbourne Centenary celebrations, and the Centenary Executive are presenting to the Royal Aero Club a silver cup valued at £50 in appreciation of the Club's work in connection with the races. The cup will be used in some future contest organised by the Club.

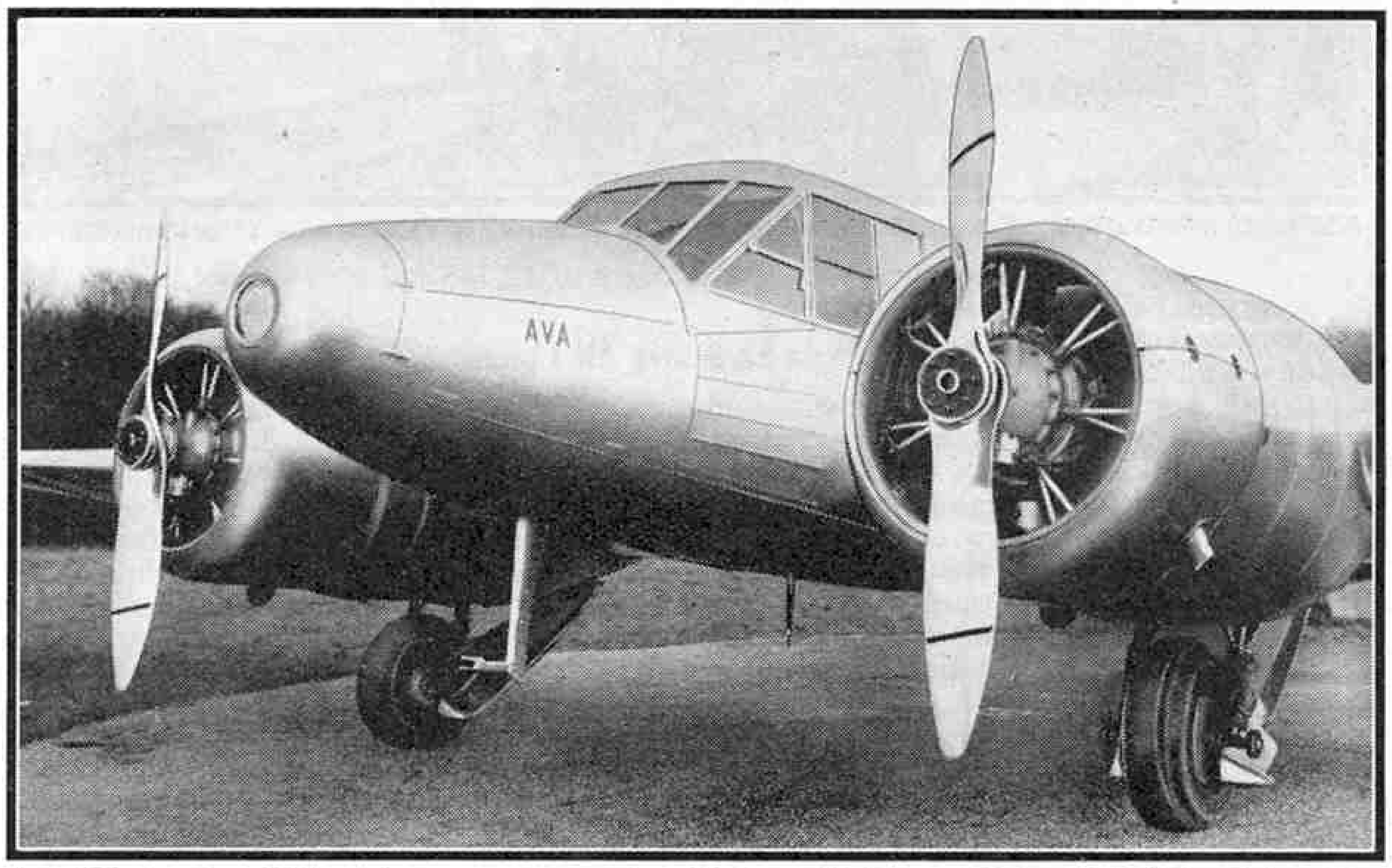
High and Low Wing British Monoplanes

Two Interesting Avro Machines

TEN years ago the majority of aeroplanes in use were biplanes, but since then monoplanes have rapidly overhauled biplanes in popularity. It is unlikely that either type will ever completely supersede the other, for each has special duties for which it is best suited.

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 favourable 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, an important point in the case of a troop-carrier.

On the other hand a great advantage possessed by monoplanes is that they give a better view than is obtainable from a machine with two wings. The absence of struts and rigging greatly reduces the time and cost of construction, 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" lines and for air taxi work generally. Low wing monoplanes have been for many years popular on the Continent, where the most famous exponents of the type probably are the Junkers and Klemm firms, in Germany, for all the aircraft built by these companies are low wing monoplanes.



One of the two Avro 652 low wing monoplanes purchased by Imperial Airways Ltd., for "feeder" line duties. They are the first units of the Company's fleet to be equipped with retractable undercarriages. The illustrations to this article are reproduced by courtesy of A. V. Roe and Co. Ltd., Manchester.

There are now many high wing and low wing monoplanes constructed in England, and in this article we deal with two interesting machines, one of each type, produced by the well-known firm of A. V. Roe and Co. Ltd., who were among the pioneers of the British aircraft industry. This firm have always specialised in the design and production of training aircraft of the biplane type, but during the last few years they have turned their attention also to the production of highly efficient commercial monoplanes. One of the earlier of these machines was the Avro 10, and two machines of this class were operated by Imperial Airways for many years. An Avro 10 was used by Sir Charles Kingsford Smith and Mr. T. P. L. Ulm on several Australia-England flights.

This and other early monoplanes produced by the firm were all high wing machines with cantilever wings made entirely of wood and with welded steel tube fuselages. This system of construction has proved so successful and economical in service, irrespective of climate, that it has been adopted for the company's new range of commercial monoplanes, the first two of which are the Avro 642 and 652 described in this article and illustrated here and on page 339.

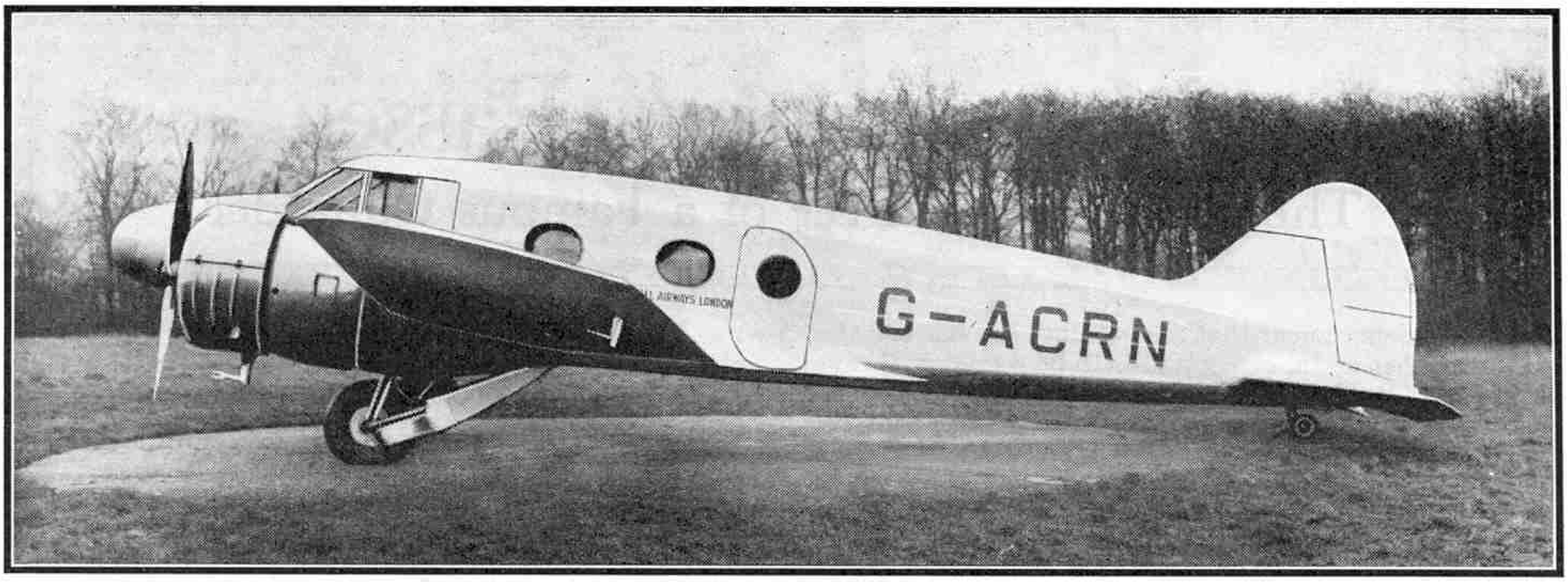
The Avro 642 has a span of 71 ft. 3 in., a height of 11 ft. 6 in. and a length of 54 ft. 6 in. It is a high wing machine and, as we have indicated, is of normal Avro construction. The wing is a one-piece structure of wood, the spruce and plywood spars and ribs being covered with plywood, except the portion behind the rear spar, which is covered with fabric and is detachable. The upper surface of the plywood-covered part of the wing also is covered with fabric. Balanced ailerons are fitted to the trailing edge of the wing, and are worked on the tie-rod control system.

The fuselage is a rectangular welded steel-tube frame braced with steel wires and covered with fabric. The empennage, or tail unit, is of the monoplane type, and is constructed on the same principle as the fuselage. It is equipped with balanced elevators and rudder, and a Servo-operated rudder trimmer, and the incidence of the tail-plane is adjustable from the pilots' cockpit. The undercarriage is in two separate units, one on each side of the fuselage. Each unit consists of a vertical telescopic leg of patented design, with oleo-type shock absorber and steel springs to take the taxying loads. The 26 in. Dunlop wheels have high-pressure tyres and Dunlop pneumatic brakes.

The pilots' cockpit is situated well forward and is totally enclosed, but the side panels can be opened by sliding them vertically. It has side-by-side seating and dual control. Behind this compartment is the passengers' cabin, which is 21 ft. long, 5 ft. wide, and has a mean height of 6 ft. 6 in. Comfortable seating is provided for up to 16 passengers. The cabin is airy and light, with large windows that provide an excellent outlook. It is attractively decorated and upholstered, and in addition to efficient heating and ventilating systems, it is equipped with electric lighting for use during night flying. Behind the cabin is a luggage compartment.

The standard power equipment of the Avro 642 is two Armstrong Siddeley geared "Jaguar" series VI.D engines, each developing 460 h.p. at 2,000 r.p.m.; but if required it can be fitted with two Siddeley "Panther VII" supercharged engines, which give it a top speed of 190 m.p.h. at 12,000 ft., with a load of 12 passengers. There is also a four-engined version of the machine that is powered by four 215 h.p. Armstrong Siddeley "Lynx" series IV.C radial air-cooled engines, and an Avro 642 thus equipped was recently supplied to the Viceroy of India. The engines are carried one or two, as the case may be, on each side of the fuselage, in nacelles attached to the front spar of, and neatly faired into, the wing. A fireproof bulkhead insulates each engine from the wing structure. Four-bladed wooden airscrews are used with the geared engines and two-bladed wooden airscrews with the ungeared engines. The petrol and oil tanks are constructed of welded aluminium and are carried in cradles suspended in the wing by flexible straps.

The "Jaguar"-equipped machine puts up a slightly better performance than the "Lynx"-engined version, as it has a higher total horse-power and is of less weight. It has a maximum speed of 160 m.p.h. and a cruising speed of 135 m.p.h., and lands at 64 m.p.h. The rate of climb is 970 ft. per min., and the service ceiling is 15,500 ft. With the full complement of passengers aboard it has a range of 360 miles, but a range of 600 miles can be obtained by reducing the pay load to 12 passengers and carrying a greater fuel load. The "Lynx"-engined machine can attain a maximum speed of 150 m.p.h. and has a cruising speed of 138 m.p.h. The rate of



climb is 850 ft. per min., and the service ceiling is 15,000 ft. The range of the machine is dependent on the number of passengers and the quantity of fuel carried. With 14 passengers the range is 345 miles, but with only 10 passengers and additional fuel it is increased to 560 miles.

An important characteristic of the Avro 642 is that it can be maintained and repaired cheaply without the employment of specially trained personnel and without the use of any complicated or expensive workshop equipment. At all essential lubrication points pressure grease gun fittings are provided in easily accessible positions. The fabric covering of the fuselage can be completely opened without difficulty to permit of the examination of the fuselage frame, and if necessary cleaning and re-painting, which is the only form of maintenance required. All parts of the structure likely to need frequent examination have inspection panels. Wing repairs can be done easily by a carpenter with bench tools.

The second new Avro commercial monoplane has been given the designation 652. It is a smaller machine than the 642, and differs from it chiefly in being of the low wing type and in having a retractable undercarriage. Two machines of this type have recently been supplied to Imperial Airways for "feeder" line duties. They have been named *"Avalon"* and *"Ava,"* respectively, and will be known in the Company's air fleet as the "Avalon" class.

The four-engined version of the Avro 642 high wing monoplane, as supplied to the Viceroy of India. At the head of the page is another view of the Avro 652. When the machine is in flight the undercarriage is drawn up into nacelles in the underside of the fuselage. It will be seen that the engines are mounted well forward of the passengers' cabin.

The Avro 652 has a wing span of 56 ft. 6 in., a length of 42 ft. 3 in. and a height, with tail lowered, of 9 ft. 8 in. The wing is of the cantilever type and is built in one piece. It is of simple and robust construction, and consists of two main spars of box section with laminated spruce flanges and plywood webs, joined together by means of closely spaced ribs of plywood and spruce, the whole frame being covered with plywood. This form of construction was used in the Avro 10 high wing monoplane mentioned earlier in this article. It has proved to be one of the easiest forms to maintain, and probably has seen more service in commercial aviation than any other type.

The fuselage is of standard Avro construction, and consists of a welded tubular steel frame with wood fairings and covered with doped linen fabric. The forward portion of the fuselage frame is braced by means of rigid struts and the rear portion is of the conventional box girder type with wire bracing. The empennage is built up of spruce frames and is covered with plywood.

The undercarriage is in two parts, one on each side of the fuselage, and arranged so that they can be retracted, or drawn up, into nacelles. The wheels are provided with shock absorbers and steel springs are used to take the taxying loads.

The pilots' cockpit is situated high up and forward of the wing, from which position an excellent view in all essential directions is obtained. The windows are of Triplex glass, the front ones being fixed and those at the sides arranged to slide back. It is totally enclosed, and is provided with side-by-side seating and dual control for the two pilots, with a gangway between the seats so that either pilot can move into the passengers' cabin if necessary.

This comfortable cabin is immediately behind the cockpit, and has six roomy seats for passengers. Fixed windows of Triplex glass are fitted along each side of the compartment. The cabin is heated by means of air scoops round the engine exhaust manifolds and the temperature can be controlled by a hand lever. Fresh air is introduced through air ducts just above the window frames, and opposite each passenger is a controllable outlet. Ventilators are also fitted in the roof, and these are of sufficient size to provide frequent change of air. In order to make the cabin as quiet as possible, it is lined with "Cepak" padding and leather and cloth upholstery.

The cabin can be arranged to take only four passengers, with a corresponding increase in the range of the machine, and the 652s supplied to Imperial Airways are of this arrangement. Each passenger has a small table, above which is a reading lamp. The main cabin door is on the port side, and another door, on the starboard side, gives access to a luggage compartment. There is also a forward luggage and mail compartment in the nose of the machine.

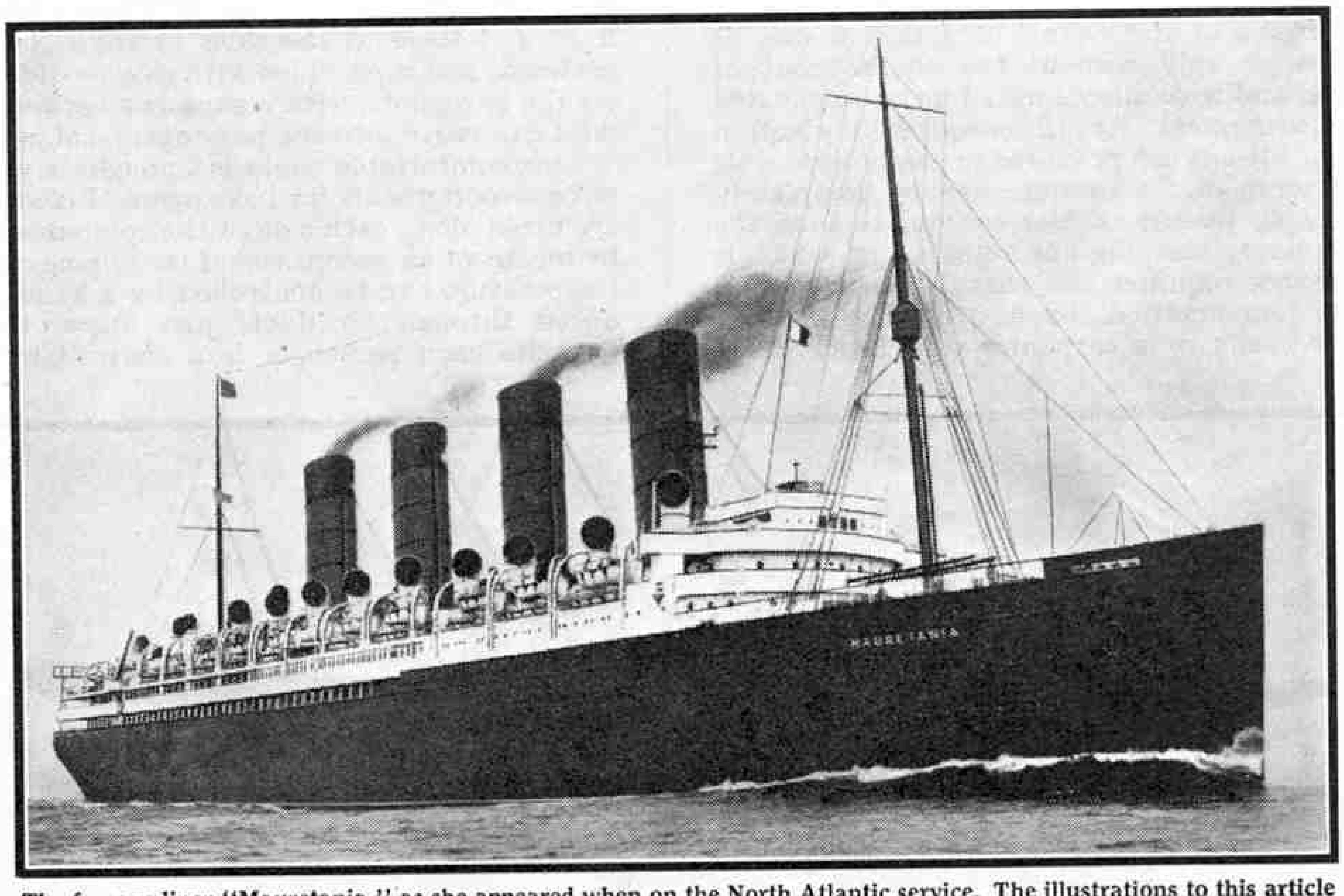
Normally the two engines are Armstrong Siddeley "Cheetah Vs" each developing 277 h.p. at 2,100 r.p.m., or "Cheetah VIs" of 290 h.p., as in the *"Avalon"* and *"Ava"* of Imperial Airways. The former engines give the machine a cruising speed of 150 m.p.h. and the latter of 165 m.p.h.; in both cases the maximum speed at sea level is 175 m.p.h.

The engines are carried on welded tubular steel frames situated one on each side of the fuselage and built out from the wing. They are mounted in a position well forward of the passengers' cabin so as to reduce the engine and airscrew noise in there. An improved form of ring cowling is fitted round each engine, and the nacelle is carefully streamlined so that it merges with the top and bottom surface of the wing. Armstrong Siddeley electric starters, which can be worked from the cockpit, are fitted to the engines, and current is supplied by a large accumulator that is also used for the wireless and lighting installations.

"Mauretania" Passes

The Wonderful Career of a Famous Cunarder

THE announcement that a great liner has reached the end of her useful career and is to be scrapped always brings with it a feeling of regret; but never has this regret been so great as in the case of the "*Mauretania.*" This famous Cunarder has been unique in many respects. For 22 years she held the Blue Riband of the Atlantic and made her crossings in fair weather or foul with the regularity of an express train; and was graceful in appearance, and luxurious in accommodation. Yet all these things together did not account for her remarkable popularity. The explanation lay in the fact that in some uncanny way she inspired not only admiration but real affection in all who were connected with her, either as passengers or crew. The sailor always maintains that a ship possesses a real personality, in fact a soul of her own; and certainly this was true of the "*Mauretania*" if of any ship.



The famous liner "Mauretania," as she appeared when on the North Atlantic service. The illustrations to this article are reproduced by courtesy of Cunard White Star Ltd.

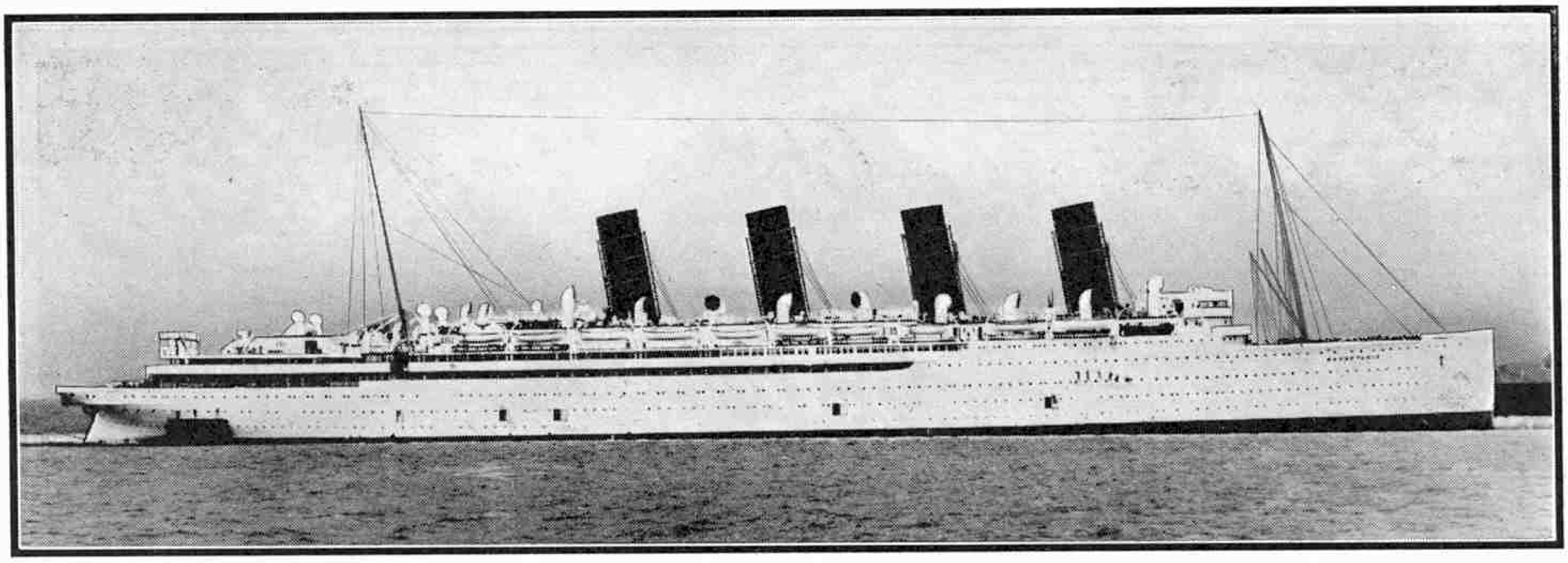
In 1898 the distinction of owning the fastest transatlantic steamship was gained by Germany with the "*Kaiser Wilhelm der Grosse,*" and by 1903 Germany had four vessels of greater speed than the then fastest British liners, the Cunarders "*Campania*" and "*Lucania.*" This state of affairs aroused great concern in this country, and the Government made an agreement with the Cunard Company for a loan of £2,500,000, with an annual subsidy of £150,000, in return for the construction of two large ships capable of a speed of 24½ knots in average weather, and subject to certain rights over the vessels in the event of war, and for the continuance of the British constitution of the company. This agreement resulted in the construction of the "*Mauretania*" and a sister ship the "*Lusitania,*" the latter being constructed by John Brown and Co. Ltd., of Clydebank. Both vessels took up their transatlantic service in 1907, and it was not long before both had exceeded the 23.68 knots that represented the best effort of the German vessel, "*Kaiser Wilhelm II,*" then the holder of the Atlantic record.

The "*Mauretania*" was built at the Tyne shipyards of Swan, Hunter and Wigham Richardson Ltd., the turbines and auxiliary machinery being supplied by the Wallsend Slipway and Engineering Co. Ltd. More than £3,000,000 was spent in her building and equipment, and it was a happy augury for her future that not a single life was lost in the whole course of the constructional work. Her main dimensions were as follows: Length overall 785 ft.; length b.p. 762 ft. 2 in.; beam 88 ft.; depth in hold 57 ft.; gross tonnage 31,938; designed S.H.P. 68,000, and designed speed 25 knots.

The propelling machinery consisted of four steam turbines driving quadruple screws. There were two high-pressure turbines on the two outer shafts, and the steam from these expanded into two low-pressure turbines on the two inner shafts, finally passing to the condenser to be converted again into boiler water. An additional astern turbine was fitted on each of the inner shafts. The boiler installation consisted of 23 double-ended boilers, each 17 ft. 3 in. in diameter by 21 ft. long, and two single-ended boilers. The furnaces numbered 192, eight being provided for each double-ended boiler. Steam was generated at a pressure of 195 lb. per sq. in., and was reduced at the turbines to 160 lb. The condensers had a total cooling surface of about 82,800 sq. ft., and the amount of circulating water was about 450,000 tons, or 100,800,000 gallons, per day. The scheme of water-tight sub-division was very extensive. Fifteen main water-tight bulkheads extended upward to beyond the water line, and in all there were 175 separate water-tight compartments.

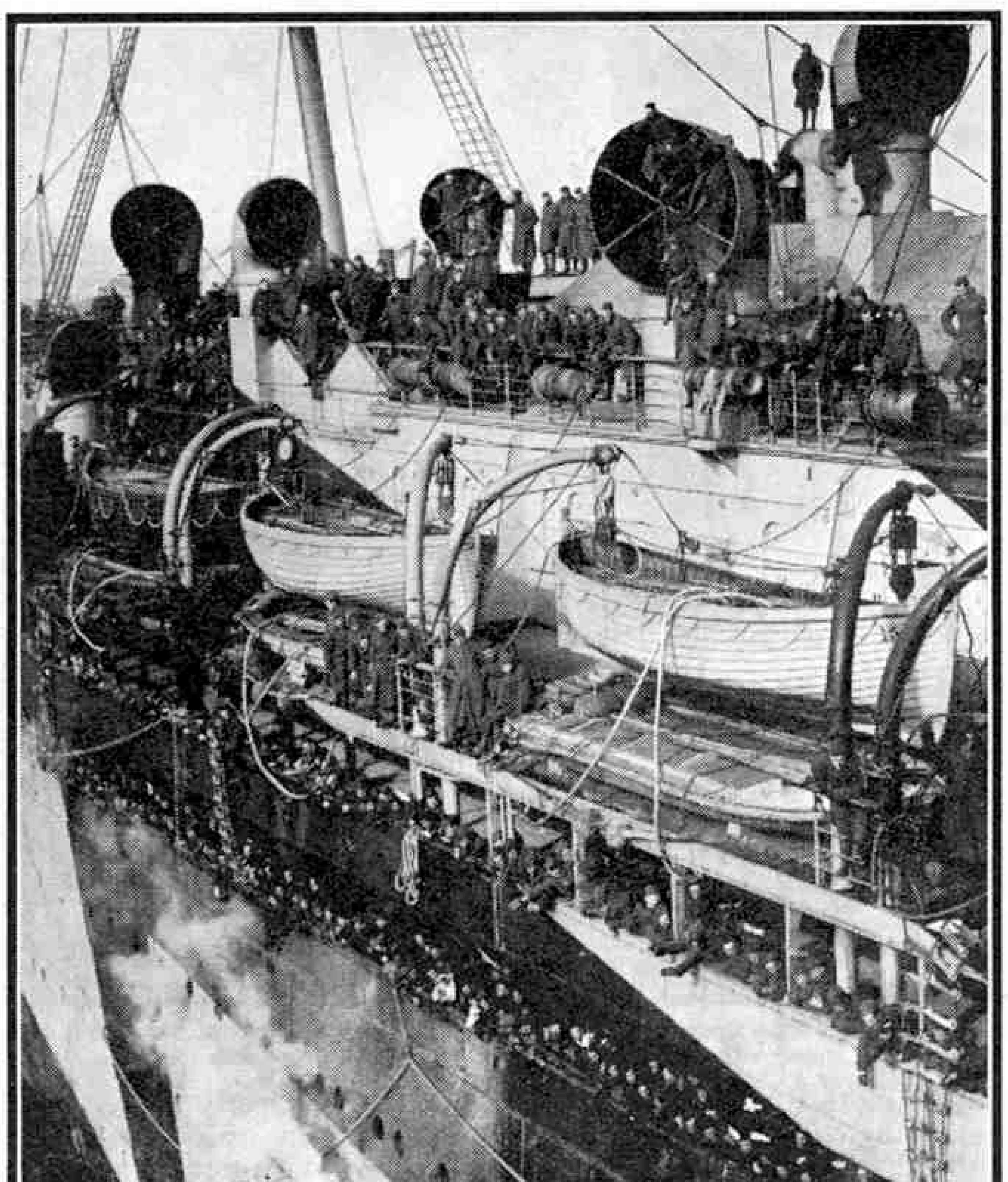
Although the "*Lusitania*" and the "*Mauretania*" were built to almost exactly the same specification, the "*Mauretania*" proved the faster of the two. In September 1910 she broke all her previous records and those of her sister ship by completing the Atlantic crossing from east to west in 4 days 10 hours 41 minutes, averaging 26.06 knots. On the return voyage her average was 25.61 knots. In December of the same year she crossed the Atlantic twice in a few hours over 12 days.

Shortly after the outbreak of war in 1914 the "*Mauretania*" was commissioned by the Admiralty and was by turn a troopship, a transport, a hospital ship and an auxiliary cruiser. Her first task was to carry troops from Liverpool to Gallipoli, after which she was converted into a hospital ship and brought many thousands of wounded soldiers from Mudros to England. In 1916 she became a troopship again and brought many thousands of



Canadian soldiers from Canada to Europe. Throughout all these trips she was able to escape the attentions of German submarines, which often were active close to her course. One of her narrowest escapes occurred about 30 miles from Mudros, when an officer on the bridge suddenly saw the periscope of a submarine break the surface of the water a short distance away on the starboard bow. A few seconds later foaming trails on the surface indicated that two torpedoes were rushing towards the vessel. Capt. Donald Dow, who was then in command of the ship, instantly ordered the helm "hard over" and the deadly torpedoes passed harmlessly under her stern.

When America entered the war large ships were required to transport the American troops to France, and the "*Mauretania*" and the White Star liner "*Olympic*" were chosen for the work. The "*Mauretania*" was equipped as an armed cruiser with six 6 in. guns and made seven voyages from New York, during which she carried a total of some 35,000 American soldiers. As an instance of the good fortune that attended the "*Mauretania*" throughout her career, it may be mentioned that during these voyages she completely escaped the terrible influenza scourge that raged in a great many ships at that time.



The illustration at the head of the page shows the "Mauretania" in cruising colour. The lower illustration is a close-up view of the vessel arriving at New York in December 1918 with returning American soldiers.

After the War the "*Mauretania*" went back to her original North Atlantic passenger and mail service, and in 1921 was sent to the yard of Swan, Hunter and Wigham Richardson Ltd., her builders, for an extensive refit in which her public rooms and accommodation were modernised and her furnaces were converted to burn oil instead of coal. She was given a capacity of about 5,400 tons of oil by altering 30 wing water-tight compartments, previously used as coal bunkers, into tanks.

The changes were completed early in March 1922 and on her first voyage as an oil burner, later in the same month, it was immediately apparent that the conversion was a great success. Her average speed showed a distinct improvement, and in August 1924 she again beat her previous Atlantic record by a voyage from New York to Cherbourg at an average speed of 26.25 knots. Apart from her wonderful speed records the "*Mauretania*" had other remarkable performances to her credit. Voyage after voyage was made in practically the same time, provided the weather were normal, and it is recorded that in one single year she made 27 consecutive trips across the Atlantic, covering 77,500 miles at an average speed of 25½ knots, a record that has never been equalled.

The vessel maintained her supremacy unchallenged until June 1929, when the German liner "*Bremen*" made her maiden trip. This vessel is much larger than the "*Mauretania,*" and her engines are far more powerful and embody the latest improvements in marine engineering. It was therefore scarcely surprising that she should wrest from her British rival the coveted "Blue Riband" by achieving an average speed of 27.83 knots on the run to New York, and 27.91 knots on her return voyage. As if stimulated to greater efforts by the "*Bremen's*" achievement, the "*Mauretania*" then accomplished the finest performance of her long career. Leaving New York on 16th August, she reached Eddystone Lightship in 4 days 17 hrs. 50 min., her average speed across the Atlantic having been 27.22 knots. This was the highest speed she had ever maintained throughout a whole voyage, and as if to show still further her capabilities she covered the distance from Eddystone to Cherbourg at an average of 29.7 knots, travelling at times at more than 30 knots. These were brilliant feats for a vessel almost 25 years old.

A World's Speed Record

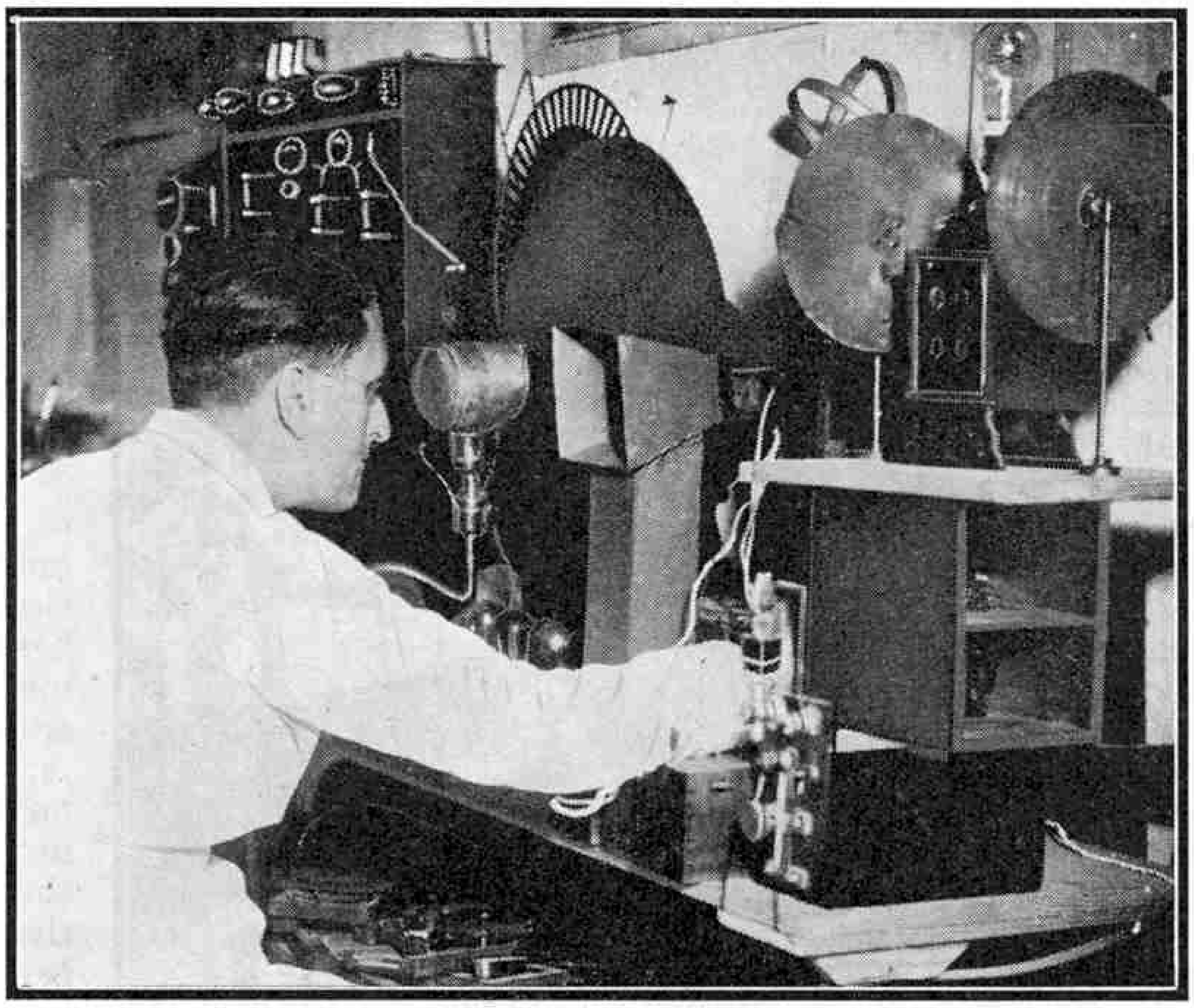
A tiny motor constructed by an American scientist has set up what surely must be a world's speed record by attaining the immense speed of 1,200,000 r.p.m. It is really an experimental centrifugal apparatus with a rotor, $\frac{5}{8}$ in. in diameter, spun by streams of hydrogen that impinge upon its flutings after passing through holes in the stationary part of the apparatus. If it could be laid on its side while spinning at its maximum rate it would roll along at the amazing speed of 1,390 m.p.h. Even more surprising is the power of the centrifugal force set up, for this is 7,600,000 times that of gravity, and under the influence of such a force a pin head would weigh considerably more than 2 cwt.

Centrifugal apparatus is used in many industries for such purposes as removing suspended solids from fluids, and is of special value in separating cream and in drying clothes in laundries. Needless to say, industrial centrifuges do not attain the speed of the experimental machine to which I have referred. Most of them seem to operate at about 500 r.p.m., but others have a rate as high as 15,000 r.p.m., and then generate a centrifugal force 13,000 times that of gravity.

A River of Ink

It is interesting to note the number of rivers that have been given the names of colours, usually because of the appearance of the water in them or of that of their surroundings. White rivers are common, Rio Blancos being found in all parts of South America; and there are several Red Rivers in North America, including one that flows into Lake Winnipeg and a large tributary of the Mississippi. Black rivers also are numerous. The Blackadder in Scotland owes its colour to its peaty contents, while the water of the Black River of Masailand, in East Africa, appears black because it flows over black rock. The most remarkable black river in the world is in Algeria, however. One of its tributaries contains iron salts in solution, while another absorbs gallic acid from the soil. The result is that when they meet genuine ink is formed, and the water of the river is the result of a chemical reaction carried out on a large scale!

In China there is the well-known Hoang-ho, or Yellow River, the colour of which is due to the sandy soil that it carries down to the sea. In contrast, the water of the Orange River, in South Africa, is not orange in colour, nor is there black water in the Niger, the great river that flows through West Africa. The former river was given its name by early Boer colonists in compliment to the Royal House of Orange, which has been closely associated with Holland for several centuries; and Niger is simply an English rendering of an African word meaning river.



Professor Barthet in his laboratory at Valletta, Malta, carrying out experiments with a device that makes sound vibrations visible on the screen of a television receiver.

Insect Engineers

It seems that civilisation among the termites, commonly but wrongly described as white ants, depends largely on their engineering capacities. There are 1,500 known species of these insects. Many are destructive wood borers, but others do useful work for mankind, and among the latter are the builders of the ant heaps of South Africa, northern Australia and elsewhere. These are builders on a gigantic scale for their size, and their homes, made of earth bound with their saliva, are the largest structures made by any animals except the corals. Ant heaps 15 ft. and even more in height are erected almost overnight, and each of these skyscrapers of the termite world swarms with workers and soldiers.

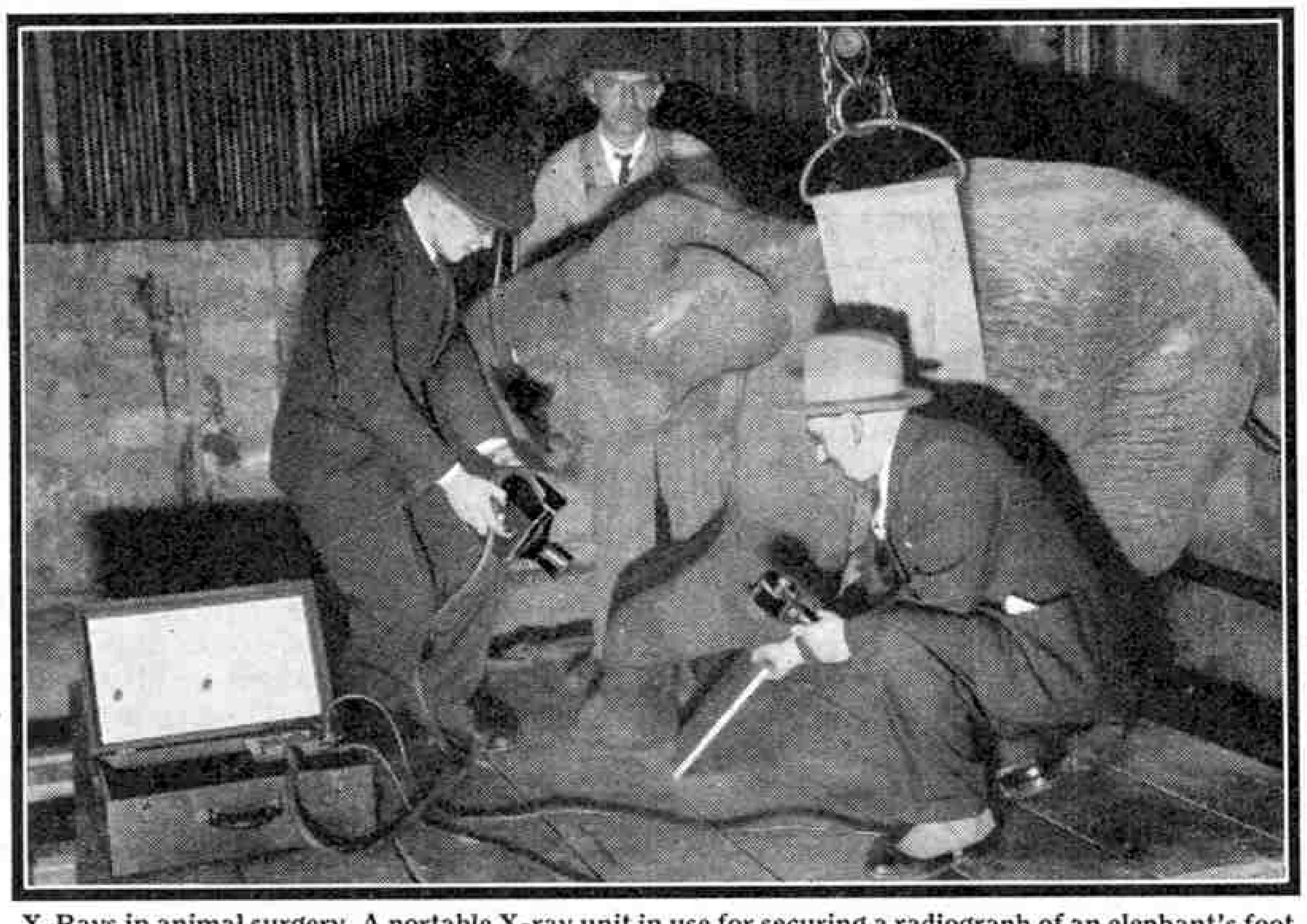
Termites even sink wells into the ground in times of drought in order to obtain supplies of water. This was discovered in South Africa during a prolonged drought many years ago, when sheep farmers realised that the homes of the termites contained water, in spite of the lack of moisture elsewhere, and sank wells alongside them. It is said that they discovered a shaft 50 ft. in depth, and of about the same diameter as a lead pencil, that had been excavated down to moisture level by the termites. In the shafts were two columns of workers, those of one column going down empty and the others returning with drops of water.

Certain species of these insects also are gardeners, for they are always associated with certain fungi, and the mould-building termites actually cultivate these fungi in finely divided wood, probably in order to satisfy some of their food requirements. Perhaps the most remarkable feature of the life of these insects is the association of the wood-devouring termites with certain parasites that find homes within their intestines. In return for the shelter they are given, these parasites appear to supply the means of digesting and assimilating the cellulose in the wood on which the termites feed. If they are eliminated, the termites die slowly of starvation, but recover health and strength if their tiny guests are brought back again before death occurs.

Termites even appear to have developed chemical warfare to a remarkable extent. Their chief enemies are ants, and the soldiers of the tribe secretes a milky juice that entangles and stupifies attackers, and an acid liquid that is so corrosive that it will etch metals and eat its way through mortar.

Half a Mile Under the Sea

Until recently the depths of the sea could be reached only by means of specially-designed traps that brought up a few of the strange creatures to be found there; and these died, and their bodies were shattered, on reaching the surface, owing to the fall in pressure that accompanied their ascent. Now it is possible to descend to a depth of more than half a mile, and to see these creatures in their homes.



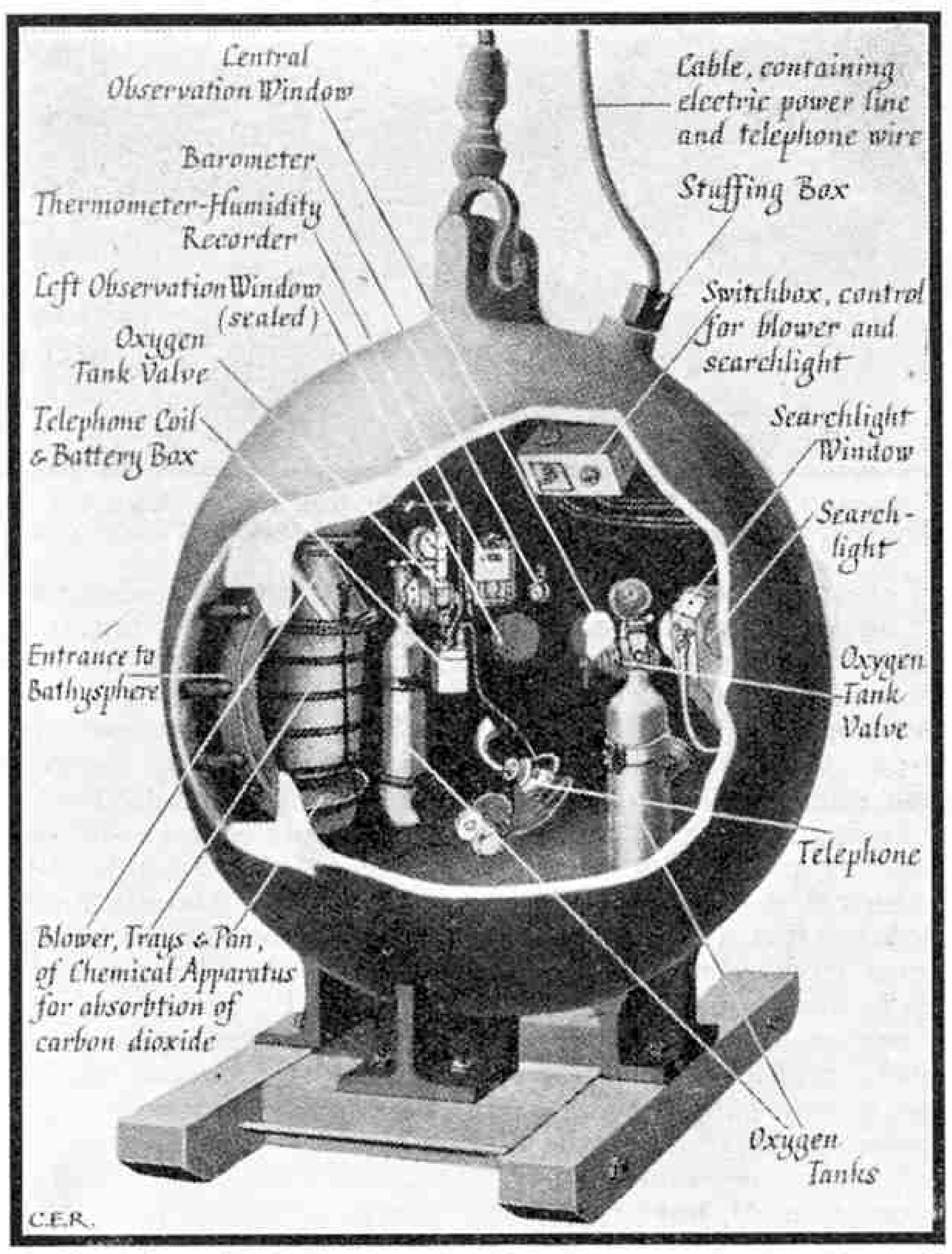
X-Rays in animal surgery. A portable X-ray unit in use for securing a radiograph of an elephant's foot at the Zoological Gardens, New York. Photograph by courtesy of the Victor X-Ray Corporation Ltd.

Quartz Windows

This feat has been accomplished by Dr. Beebe, a well-known American scientist, who reached a depth of 3,028 ft. in a huge steel globe, called a bathysphere, designed by Dr. Barton, of the New York Zoological Society. This has 1½ in. steel walls and fused quartz windows 3 in. in thickness. Ordinary glass thick enough to withstand the enormous pressures encountered at great depths in the sea would not be sufficiently transparent to enable anything to be seen through it, and it was not until the General Electric Company of New York produced the fused quartz required that the bathysphere became possible. Quartz is more transparent than glass and is six times as resistant to compression.

The bathysphere was lowered into the sea from a barge off the Bermudas, and Dr. Beebe and his companion remained under water for long periods, watching the inhabitants of the dark world into which they had penetrated for the first time. They were supplied with fresh oxygen from tanks, and the carbon dioxide produced in breathing was absorbed by chemicals placed on trays. Cable connections supplied electric current for the lights that revealed the mysteries of the ocean depths to them, and a telephone line enabled them to keep in touch with the attendants on the barge from which the bathysphere was lowered.

As the lower illustration on this page shows, there was little room to spare inside the bathysphere, and its occupants must have been severely cramped after wriggling through the manhole provided for their entry and spending some time in their narrow quarters. Their efforts were well rewarded, for many new species of deep sea fish were found. One of these monsters of the deep was 6 ft. long and was described as "glimmering like an ocean liner and trailing its own traffic lights."



Sectional view of the bathysphere, in which a descent to the record depth of 3,028 ft. under the sea was made by Dr. Beebe, an American scientist. Many new species of fish were dicovered in these previously unexplored regions. Photograph by courtesy of Burroughs Wellcome and Co.

Meccano for Scientific Research

My readers will remember an illustrated article on page 442 of the "*M.M.*" for June 1934 that described a wonderful Meccano model of a differential analyser, a special form of calculating machine designed and built by Dr. V. Bush of the Massachusetts Institute of Technology, in the United States of America. With the aid of the machine intricate and laborious calculations, which in the ordinary way might occupy many days, can be completed in a very short time once the machine has been set to deal with the particular problem to be solved. The Meccano model was built by Professor Hartree, of Manchester University, in order to illustrate the principle on which the invention was based, but in practice it proved itself capable of surprisingly accurate work, and actually is being used by its constructor in his scientific researches on the structure of the atom.

I am reminded of this by the news that Manchester University now possesses a full-sized differential analyser, constructed to Professor Hartree's requirements by Metropolitan Vickers Ltd. The machine was officially opened on 27th March, and inspection showed that it had many ingenious refinements that would make work with it easier and speedier for the scientists making use of it. For instance, in the original machine, and also in the Meccano model, the results of calculations were given in the form of curves from which the required numerical answers were taken. A mechanical device for printing the numerical results was incorporated later in the American machine, but in that built at Manchester these are given by a series of rotating dials carrying numbers that are photographed continuously as the machine is in action. A remarkable film camera designed by Newman and Guardia Ltd., is used for this purpose, and it contains an entirely new device for giving instantaneous exposures to any required interval. Development then gives the numerical results required.

It is interesting to find that the Meccano Differential Analyser is by no means superseded by the larger machine. It will continue to be used for certain problems for which it actually seems to be more suitable, and also in preliminary tests to enable the larger machine to be used to the greatest advantage. Its further advantages were indicated in the "*Manchester Guardian*" of 28th March, in which it was pointed out that "its use has already led to an important probable improvement in the large instrument. At present the task of guiding the pointer exactly along the curve with which it is being fed has to be done by hand, and though it is said to be a perfectly simple job, it would obviously be an advantage if it could be done automatically. On the model this has been found possible by the use of a photo-electric eye. Its application on the larger scale is only a matter of time."

A Library of Film Noises

One of the strangest libraries in the world contains records of sounds ranging from the tiniest chirp of a bird to the roar of a huge crowd and the rumbling of an earthquake. This collection has been formed at a Hollywood film studio, and is so complete that almost any noise required in making a film can be provided at a moment's notice. Its cost must have been enormous, and it is said that nearly £200 was spent in securing an effect described as "Mad Tomcat, with hisses," a sound record on the making of which four men worked five nights.

Every sound in the library is carefully indexed, and the headings include such items as "Frogs Croaking," "Hogs Grunting," "Elephants Trumpeting," "A Fall Through a Door," and "A Punch on the Jaw." There are two varieties of the last of these sounds, one made with gloves and the other without. Care has been taken to provide noises that are typically English where these differ from those of the United States. For instance, records of travelling American trains include the sounds of the warning bells carried on locomotives in that country, but these are absent from the records to be used in filming scenes of English life.

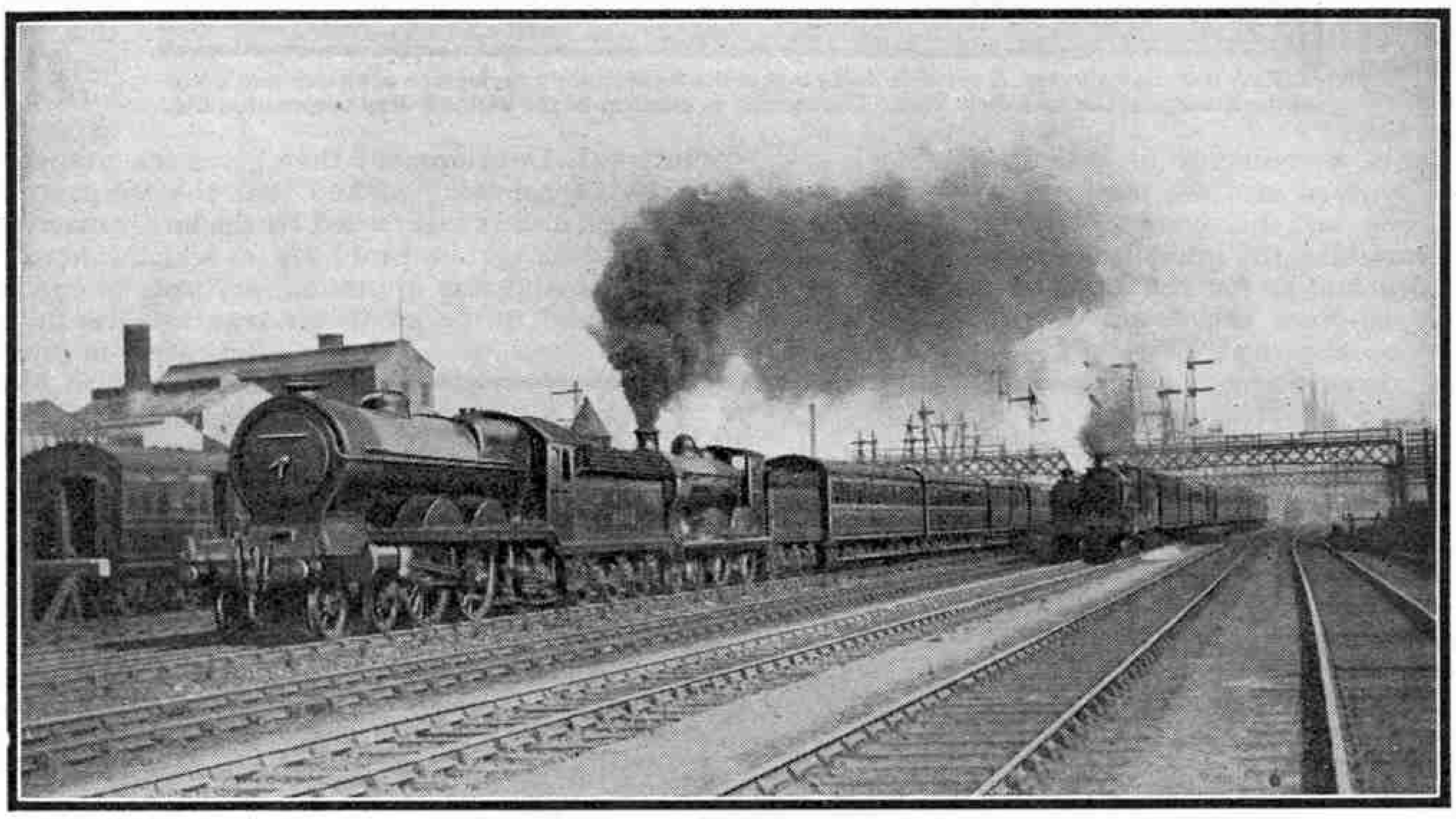
Some Footplate Runs on the L.N.E.R.

2.—North British "Atlantics"

By a Railway Engineer

In pre-grouping days, the premier engines of the North British Railway, like those of their East Coast allies the Great Northern and North Eastern, were of the "Atlantic" type. Unlike their English counterparts, however, and indeed unlike every other British example of the 4-4-2 type, the N.B. "Atlantics" were designed for hill climbing rather than high speed. It was on account of its more flexible wheelbase that the 4-4-2 type was adopted in preference to the 4-6-0, for the main lines abound in severe curves. As hill-climbers they are easily the most powerful "Atlantics" that have ever run in these islands, having two cylinders 21 in. diameter by 28 in. stroke; at the same time they can put up very fast running on favourable grades.

On the East Coast route between Edinburgh and Dundee, and also on the "Waverley" route from Edinburgh to Carlisle, they have been largely superseded by the "Pacifics." North of Dundee, however, the lion's share of the express traffic is still entrusted to them, and it is on this section that I was recently privileged to make some footplate trips. This is one of the hardest express routes in the British Isles. The general lie of the gradients may be easily grasped by reference to the profile on the next page and the merest glance is enough to show how very difficult are the starts out of Aberdeen, Stonehaven and Montrose, and also that from Arbroath when going north.



A double-headed L.N.E.R. express. Following the usual practice on the N.B. Section, the 4-4-2 "Atlantic," as the larger locomotive, is leading, the other engine being a 4-4-0 of the "Scott" class.

Over these steep grades the "Atlantics" are permitted to take unpiloted loads up to 340 tons, tare, in the southbound direction; but going north the worst banks are not quite so long and the maximum load is 370 tons. The corresponding "Pacific" figures are 420 and 480 tons. Above this two engines have to be used, and during the summer tourist season, when loads of 550 tons are common, the "Atlantics" and their pilots have some stiff jobs, for owing to weight restrictions the "Pacifics" are not allowed to be piloted. North British 4-4-0s of the "Scott" class are principally used for assisting, though sometimes Great Central 4-4-0s of the "Improved Director" class are requisitioned for this duty.

My first run was on the 12.45 p.m. express from Aberdeen, on which the load was 333 tons tare, nearly up to maximum, and 355 tons with passengers and luggage. The engine was No. 9869, "*Bonnie Dundee*," in charge of Driver Campbell and Fireman Taylor of Dundee shed. These engines have a fine roomy cab; they are driven from the left-hand side and the reversing gear is of the notched lever type. "*Bonnie Dundee*" is fitted with a speedometer—an instrument very rarely seen on British locomotives, but one of great value to the driver. Campbell started off up the stiff 1 in 96 ascent out of Aberdeen with regulator 3/5 open and 53 per cent. cut-off. The engine gathered speed steadily. About a mile out cut-off was brought back to 44 per cent., and on the easier length past Craiginches speed rose to 36 m.p.h. But there is only a brief respite, and cut-off was again advanced to 53 per cent. as we came out on to the cliffs overlooking Nigg Bay.

With magnificent views over the sea, we roared up through Cove Bay and speed fell to 30½ m.p.h. on the 1 in 100 grade. In these strenuous conditions the engine fairly throbbed under the thrust of the pistons, and the exhaust rose high and vertically into the air. The top of the bank, 7 miles from Aberdeen, was passed in 14½ minutes, and here the regulator was closed to about one-quarter open and cut-off reduced to 44 per cent. Speed rose to 62 at Muchalls and 64 prior to the stop at Stonehaven, which was made in 25 minutes from Aberdeen, dead on time.

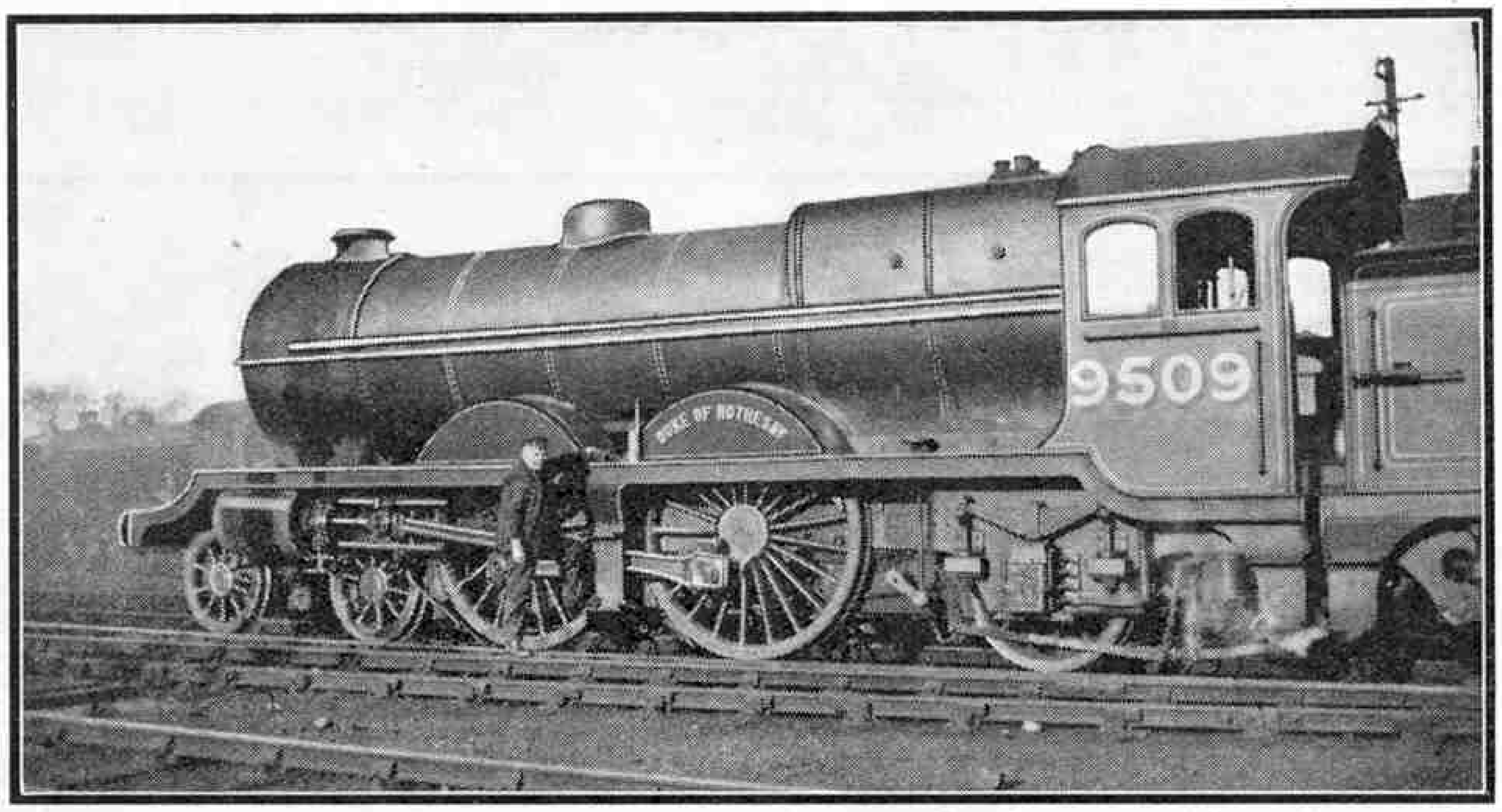
After a halt of a minute we got away again in good style up the second big bank. Full forward gear was used at first, and when the train was well on the move the lever was set in the third notch, 53 per cent. cut-off, the regulator being 3/5 open. On the 1 in 90 grade speed gradually rose to 30 m.p.h., and the summit, 4¾ miles from Stonehaven, was passed in 11 minutes. On the ensuing descent the regulator was nearly closed, and running under very easy steam we had got up to 65 m.p.h. when there came a slack for permanent way repairs. Immediately afterwards came the stop at Laurencekirk.

We made a fine restart, worked rapidly up to 70 m.p.h. down the Marykirk bank, and soon Kinnaber Junction lay ahead. Up to this point we had been running over L.M.S.R. metals, and this part of the run makes an interesting comparison with that of the "*Granite City*" express that I described in the April number of the "*M.M.*," particularly as the load was exactly the same. L.N.E.R. trains have to slow down to 15 m.p.h. over Kinnaber Junction. With his eye on the speedometer, Driver Campbell observed the slack carefully and then worked rapidly up to 55 m.p.h. down the steep descent into Montrose. The 10 miles from Laurencekirk had been run in 13¾ minutes, a smart performance considering the severe slack at Kinnaber.

There is a truly fearsome start out of Montrose. For the first two miles, to Usan, the line rises at 1 in 88, then eases to 1 in 111 for the succeeding two miles to the summit of the bank. Working on no less than 60 per cent. cut-off, and with the regulator three-quarters open, speed rose to 30 m.p.h. at Usan, a fine effort with a 355-ton train. On all these stiff ascents the fireman was having no trouble in keeping steam up despite the heavy drain on the boiler caused by necessarily long cut-offs; in fact the pressure gauge needle seemed to be a fixture at the red line that denotes full boiler pressure. Accelerating all the way up we passed the summit at 35 m.p.h., and on the descent past Lunan Bay touched 68. There was another permanent way check at Cauldcoats, but we had got up to 57 again beyond Letham Grange when there came the severe service slack to 25 m.p.h. over St. Vigean's Junction, which was carefully observed. In spite of this we reached Arbroath, 13¾ miles from Montrose, in 21½ minutes. Allowing for the slack at Cauldcoats, our net time was only 20 minutes, a gain of 2 minutes on booked time.

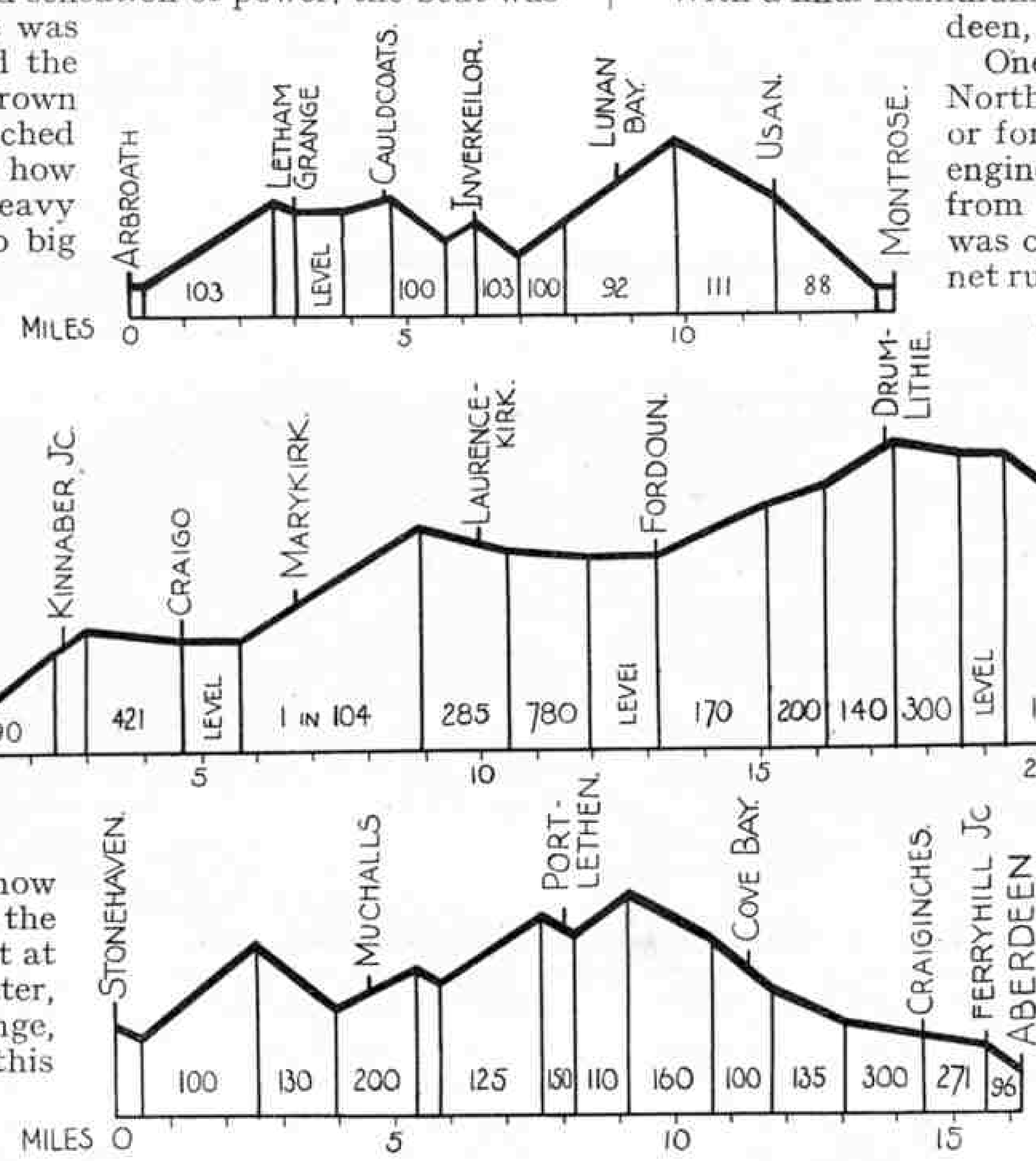
On the last stage into Dundee the line is dead level almost throughout, and here Driver Campbell used 3/5ths regulator and 44 per cent. cut-off. Speed was up to 60 m.p.h. in just over 7 miles from the start, and at this point the regulator was brought back a trifle and we kept steadily at the mile-a-minute rate until nearing Dundee. The 17 miles were run in exactly 22 minutes, and we arrived on time almost to the second. The 70¼ miles from Aberdeen had been covered in 111 minutes, including the four stops, and a running time of 105½ minutes. "*Bonnie Dundee*" now came off, and was replaced by a "Pacific" for the run to Edinburgh.

On the return trip, by the 3.35 p.m. Aberdeen express, I was treated to a really magnificent performance. This time the engine was No. 9509, "*Duke of Rothesay*," manned by Driver Moodie and Fireman Williamson, another Dundee crew. Once again the load was almost up to maximum, 359 tons tare, and 380 tons with passengers and luggage. This train is allowed 105 minutes, including three stops, the running time being only 100 minutes.



L.N.E.R. (N.B.) "Atlantic" locomotive No. 9509, "Duke of Rothesay." This photograph gives a fine impression of the general characteristics of these notable Scottish locomotives.

There is an awkward start out of Dundee, first of all through a short tunnel and then up a short length of 1 in 60 gradient; but except for a slip when the regulator was first opened we got away very smartly. Camperdown Junction, which marks the top of the bank, three-quarters of a mile out, was passed in 2½ minutes, and then, on 34 per cent. cut-off and the regulator nearly full open, "*Duke of Rothesay*" got away in tremendous style. Driver Moodie's method was different from that of Driver Campbell. For most of the way he was working with the regulator nearly full open, but with a considerably shorter cut off. Here, on the level, there was no easing the regulator as the speed rose. The engine was fairly "let go," with the result that we worked up to a steady 67 m.p.h., which, with a load of 380 tons, meant an output of no less than 1,700 horse power. On the footplate there was a vivid sensation of power; the beat was a deep toned roar, and so fierce was the blast that even at this speed the exhaust from the funnel was thrown high and clear of the cab. I watched the pressure gauge needle to see how the boiler would stand up to the heavy demands for steam of those two big cylinders; it remained stock still at the red line!



Gradient profile of the route from Aberdeen to Arbroath, showing graphically the difficult gradients to be surmounted.

Just as we approached Arbroath signals were against us, but in spite of the delay we kept dead time from Dundee, arriving in 22 minutes. On re-starting Moodie gave the engine full regulator and 44 per cent. cut-off for the 1 in 103 bank to Letham Grange. Awakening all the echoes for miles around, "*Duke of Rothesay*" accelerated to 27 m.p.h., and we passed the summit, 3 miles out, in 7 minutes. Cut-off was now brought back to 34 per cent., and the speed rose with such rapidity that at the viaduct over the Lunan Water, only 4 miles beyond Letham Grange, we were doing 71½ m.p.h. With this impetus we simply soared up the 1 in 90 bank that follows. Moodie was taking no chances, however, and at Lunan Bay station he advanced to 44 per cent. cut off. The engine verily thundered up the last mile and breasted the summit at 40 m.p.h. Here the line is right on the edge of high cliffs, and as one looked backward the graceful sweep of Lunan Bay with a brilliant blue sea made a perfect picture. Down the steep descent into Montrose the line is too winding for any high speed; we did not exceed 55 m.p.h., and completed the run from Arbroath in 19¾ minutes, 13¾ very difficult miles.

On restarting from Montrose, after half a mile of level comes the 1 in 90 climb to Kinnaber Junction. Here on 44 per cent. cut-off and almost full regulator we actually sustained 30 m.p.h. before easing carefully to 15 over the junction. Then the driver put his engine to it again with a vengeance. In 2⅓ miles of level speed rose from 15 to 56 m.p.h.! Marykirk bank, 3 miles at 1 in 104, was mounted at a minimum of 38 m.p.h., and in a few minutes we were swinging at 66 down the gentle descent from Laurencekirk to Fordoun. Cut-off was 44 per cent. for the final ascent to Drumlithie, the highest point of the route, and here speed fell to 39½ m.p.h. Down the steep descent into Stonehaven the regulator was pulled right back, giving the merest breath of steam, and speed gradually worked up to 71 m.p.h. Throughout the run the riding of the engine had been very steady, but here especially, taking swinging reverse curves at 70 m.p.h., she rode beautifully smoothly. We reached Stonehaven, 24½ miles from Montrose, in 33½ minutes.

We had left Dundee a minute late, and slight overtime at the intermediate stations, added to the loss of time caused by the signal stop outside Arbroath, had so far balanced the time gained in running by the engine, so that we left Stonehaven a minute late. But by a glorious concluding effort Driver Moodie succeeded in bringing the train into Aberdeen exactly on time. Sustaining 32½ m.p.h. on the 1 in 100 rise out of Stonehaven, we then touched 64 at Muchalls, and actually mounted the steep rise past Portlethen at a minimum of 50 m.p.h. With a final maximum of 66 m.p.h. at Cove Bay, we reached Aberdeen, 16¼ miles from Stonehaven, in 21 minutes.

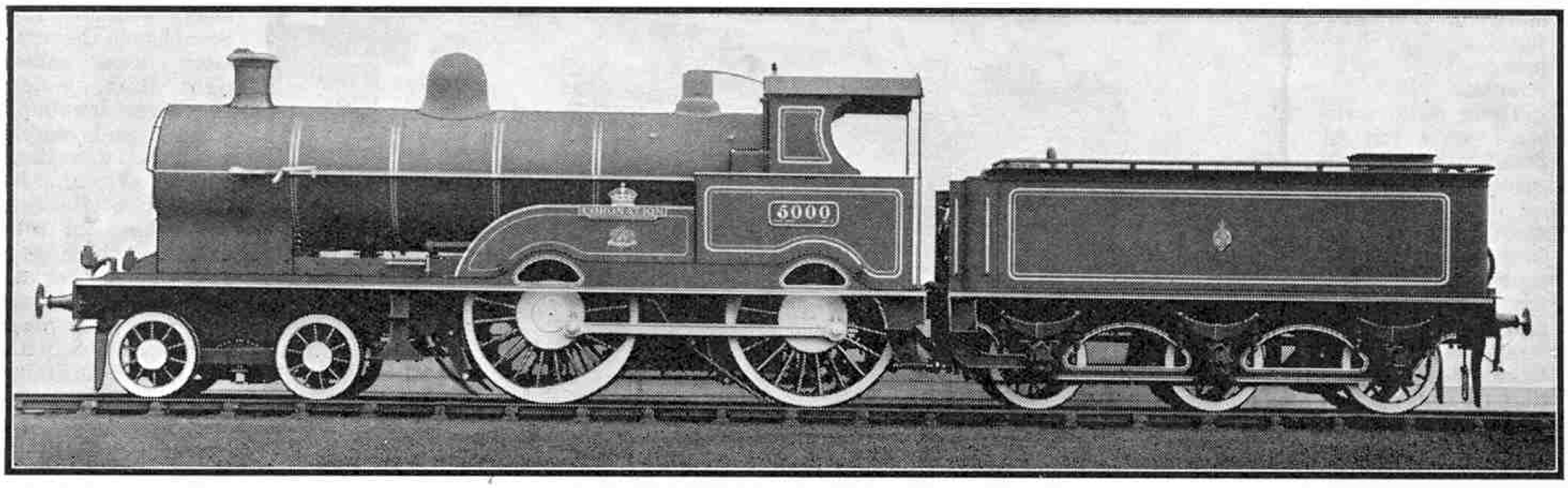
One could hardly wish for a finer example of North British "Atlantic" performance than this, or for that matter for a better display of skilful enginemanship There was certainly no hindrance from the weather on this occasion; the afternoon was calm and sunny, ideal for good running. The net running time from Dundee to Aberdeen on this remarkable trip was only 95 minutes, a gain of 5 minutes on schedule.

In conclusion, to complete the survey of their work, some brief notes of two double-headed runs are included. On the down "Aberdonian," 5.42 a.m. from Dundee, "*Duke of Rothesay*" was again the engine, in this case in charge of Driver Ogilvie and Fireman McDonald. The pilot was a "Scott," No. 9340, "*Lady of Avenel.*" In accordance with the usual North British practice the smaller engine was next to the train and the "Atlantic" leading. With only a small excess over maximum 4-4-2 load—the train weighed 401 tons tare and 420 tons full—no very great effort was needed. We left Dundee 4 minutes late, ran to Arbroath in 21½ minutes, from there to Montrose in 20 minutes, and covered the last 41 miles into Aberdeen in 55¼ minutes, reaching there 3 minutes early, an excellent piece of timekeeping.

On another trip the 7.35 p.m. up "Aberdonian" at a busy season was made up to no less than 523 tons tare, and being crowded with passengers and luggage, weighed 565 tons full. The engines were 9869, "*Bonnie Dundee,*" leading, and 9413, "*Caleb Balderstone.*" Stonehaven was reached in 23¾ minutes; thence to Montrose we took 33¾ minutes and then there came a magnificent ascent out of Montrose, speed rising to 39 m.p.h. beyond Usan. The final run from Arbroath into Dundee was smartly made in 21 minutes.

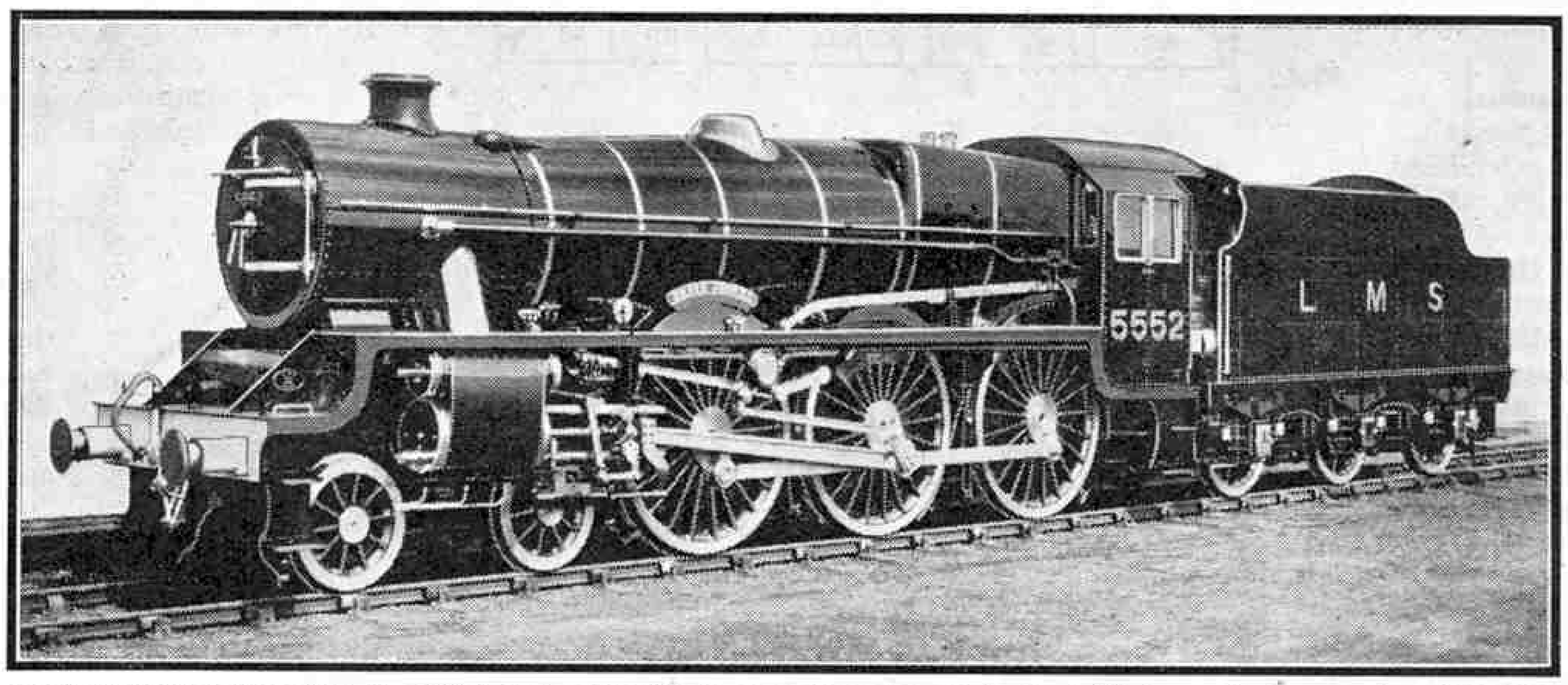
"Silver Jubilee" Exhibition at Euston

The Railway Progress of 25 Years



ON 2nd and 3rd May there was held at Euston Station, London, a special exhibition of locomotives and rolling stock arranged by the L.M.S.R. The various exhibits were selected to illustrate the progress made in railway equipment for passenger travel during the 25 years of the King's reign. One of the chief features of the assembly was the L.M.S.R. express passenger locomotive No. 5552, on which the name *"Silver Jubilee"* has been bestowed by permission of His Majesty. This locomotive is of the 3-cylinder 4–6–0 type of class "5X" introduced last year, and was shown with a train of modern rolling stock. As foretold in our May "Railway News" pages, it was specially finished in connection with the Royal Silver Jubilee, and now presents a very smart appearance in glossy black paint and with details in chromium plate.

The chief features of these locomotives will already be familiar to *"M.M."* readers, such as the tapered boiler and commodious cab with its double windows and extended roof; and the capacious high-sided tender, holding 9 tons of coal. There are already 113 locomotives of the class in service and 30 more are to be constructed during this year, the whole series now becoming known as the "Jubilee" class.



In the upper illustration is the L.N.W.R. locomotive "Coronation," as originally finished. The lower photograph shows L.M.S.R. No. 5552 "Silver Jubilee" specially prepared for exhibition at Euston recently. Photographs by courtesy of the L.M.S.R.

The corridor train shown with this locomotive was composed of the most up-to-date types of passenger rolling stock and included a brake-third coach, first-class luxury car, and composite vestibule car. Then came the first-class dining car with kitchen, and two further vestibule-type coaches, one a first-class vehicle and the other a brake-third. L.M.S.R. vehicles of these types incorporate all the latest refinements for travel comfort that have been made possible by scientific research and modern technical progress.

Representing the most up-to-date form of motive power that was working out of Euston some 25 years ago was L.M.S.R. No. 5348, built in June 1911, and appropriately named *"Coronation."* This belongs to the "George the Fifth" class introduced in 1910, a class that in their day shared the fastest and heaviest express duties on the former L.N.W.R. but now are confined to local and secondary express work.

To examine this locomotive and its representative train was to be carried back in imagination to the days before the Great War, when locomotives generally in this country were not such highly complicated-looking affairs as they have since become. The Royal associations of No. 5348 *"Coronation"* are suggested by the crown device that appears above the name on the special nameplate, and below is recorded the fact that it was the 5,000th engine built at Crewe. The engine originally ran with brightly-finished wheel bosses and tyre faces, an interesting anticipation of L.M.S.R. practice to-day. Special lining then decorated the locomotive and its tender, and the boiler bands were finished in red with bright brass edges. The engine carried the L.N.W.R. coat of arms and the tender that of the "West Coast Joint" Companies, the L.N.W.R. and Caledonian, over whose lines the King would travel to Scotland, *"Coronation"* being used on the Royal Train on several occasions. The first two engines of the class, *"George the Fifth"* and *"Queen Mary"* respectively, were used together to take the Royal Train from Euston in August 1910. *"Coronation"* was exhibited at Euston in the present standard livery of black with red lining, and the bands round the boiler casing were brassed up.

The changes between the internal and external characteristics of railway coaches of 1910 and 1935, as shown by the assembly of vehicles at Euston, were equally as striking as the comparison between the two locomotives. The typically British panelling and moulding, decorating the outsides of the coaches and the various external protuberances have given place to the sleek external contours of the latest L.M.S.R. flush-panelled stock. Steel sheets are now extensively employed for panelling the sides, and steel-plated roofs are used. The windows of present-day stock are wider and deeper than was formerly the case, allowing more light and affording better facilities for observation.

The third-class of 1935, as compared even with the first-class stock of 1910, looks more inviting. Three seats on each side of a corridor compartment are now provided, with arm-rest divisions between the seats. Electric lights are carefully positioned to avoid glare, and the air supply enters the compartment through intakes specially arranged to avoid draughts.

Locomotives Turn Themselves

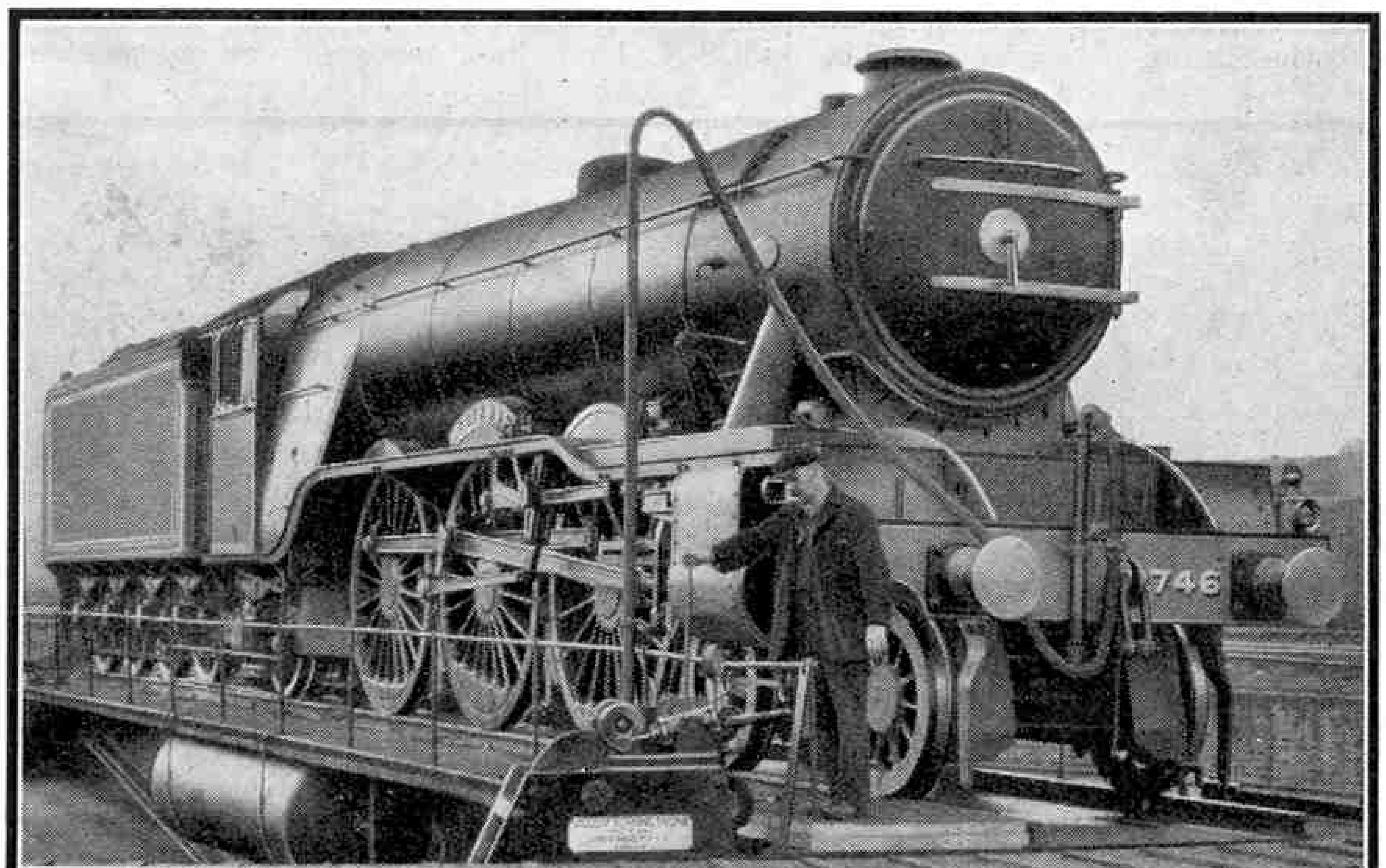
Turntable Developments on L.N.E.R. and L.M.S.R.

AT locomotive depots and at many terminal stations the locomotive turntable is a familiar object. Many readers of the "*M.M.*" no doubt have spent hours at one time or another watching engines being turned by the "pushing round" method, especially where the operation can be viewed easily from station platforms or from some point overlooking the railway premises.

They will have noticed how the enginemen frequently have to spend much time in adjusting the position of their locomotives on the turntable in order to secure good balance, otherwise it would be difficult to push them round. Older turntables, installed in the days when engines generally were smaller than they are now, are of insufficient length for the big engines of to-day, and frequently their replacement by larger turntables is prevented by their surroundings. Large engines cannot be balanced correctly on such turntables, so that power operation by means of an electric motor has been applied to some extent to avoid the slow and laborious pushing by hand.

An interesting application of electricity is found on the L.N.E.R. at Southend, where the turntable allows no room to spare for the balancing of a 4–6–0 engine and tender. An electrically-operated winch is provided close to the turntable pit, and one end of each of the main turntable girders is fitted with a loose shackle.

The winch is connected by a wire rope to one or other of these, according to the position of the table, and when the winch is operated the turntable is thus pulled round. Although a full turn through a semi-circle cannot be completed in this way, the men are relieved of the difficulty of starting the rotation of the unbalanced load, and can easily complete the movement of the table by hand in the usual way.



An L.N.E.R. "Pacific" locomotive being turned at King's Cross by means of the vacuum apparatus described on this page. This is connected by the flexible pipe shown, to the brake system of the locomotive, which thus provides the power for rotating the turntable independently of any outside source. Photograph by courtesy of Cowans, Sheldon and Co. Ltd., of Carlisle.

This is not considered an ideal method of turning locomotives, and the application of electric power to turntables has not proved altogether satisfactory, except where special operators have been employed, owing to the high cost of installation and maintenance.

In order to make the balancing operation superfluous with long modern turntables, the articulated, or non-balanced type of turntable has been introduced.

In this design, which is known as the "Vogele" system, and is manufactured in this country by Cowans, Sheldon and Co. Ltd., of Carlisle, the main girders are divided at the centre, the two halves being joined together by means of a patented flexible joint which, while allowing great flexibility in the vertical plane, is exceedingly rigid in the horizontal plane. This allows the weight of the locomotive to be shared between the end rollers and the main centre pivot. Thus, since balancing is unnecessary, any locomotive the wheelbase of which can be accommodated on the turntable can be easily turned.

Besides offering the advantage of rendering balancing of the load unnecessary, this design of turntable also has very shallow main girders requiring a much shallower pit than the balanced type of turntable.

Several turntables of this type may be seen working in the large railway depots in different parts of the country, the most recent being on the L.M.S.R. system at Glasgow, Derby, Walsall, Buxton, Manchester, Liverpool, Bath, Llandudno and Hellifield.

The most up-to-date development, and one of particular interest, is the introduction of a device whereby the locomotive itself supplies the power by which it is turned on the table.

The means by which this is effected is the Vacuum Power Operated Locomotive Turning Gear patented by Cowans, Sheldon and Co. Ltd., of Carlisle. This has been installed at King's Cross locomotive depot, where there is a 70 ft. turntable capable of dealing with the giant "Pacific" locomotives that weigh close on 150 tons in working order.

The device, which has proved completely successful, consists of a tractor hinged to the turntable girders, and driven by a small motor connected by a flexible pipe to the vacuum brake apparatus of the locomotive to be turned. The hinged attachment of the tractor to the girder ensures that even when the turntable rocks, or is loaded unevenly, the load on the tractor wheel does not vary.

The vacuum engine itself is of the reversing type with two oscillating cylinders having a bore of 4½ in. and a stroke of 6 in. It is provided with a single lever for controlling forward and reverse movements, and for regulating the speed. All bearings are of the ball or roller type, and the pistons are made of a light alloy. They are lubricated by means of a ring of soft cotton packing soaked in graphited oil, and expanded against the cylinder walls by the use of a light steel spring. Nipples are provided on the piston to facilitate recharging the packing with oil by means of an oil gun.

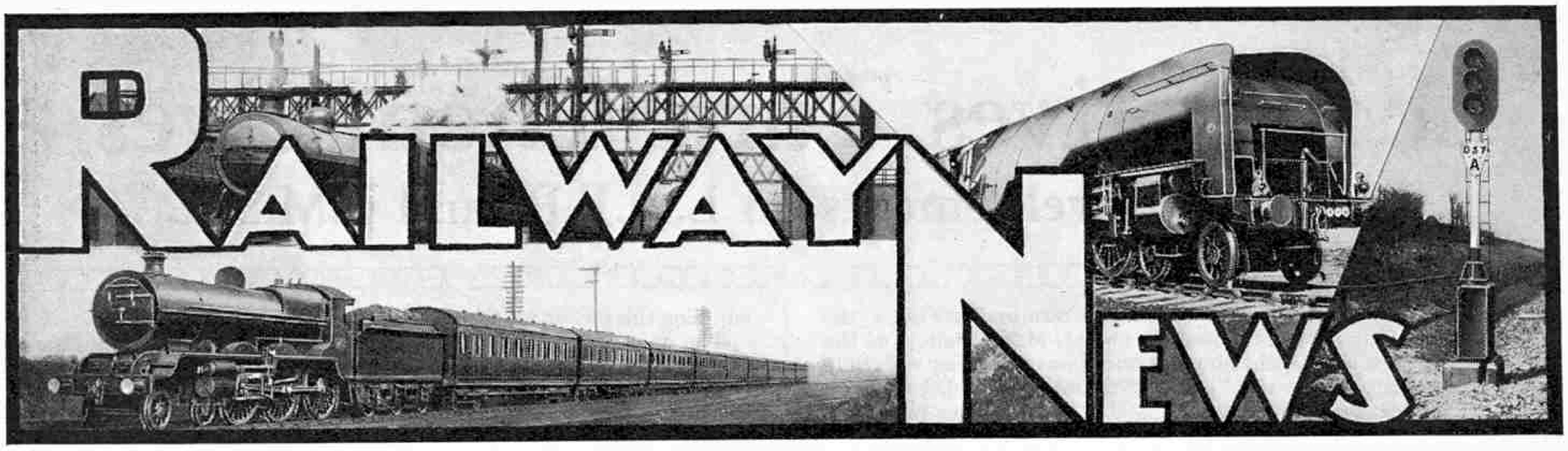
The rear cylinder covers are hinged and are held shut with a spring catch, in order to give easy access to the pistons. The piston rods are of high tensile stainless steel and are lubricated by means of splash type lubricators, integral with the front cylinder covers, similar to those fitted to the side and connecting rods of locomotives.

The engine is connected to the driving roller through two reductions of spur gearing. In one of these a clutch is incorporated that enables the engine to be thrown out of gear, and the table can then be turned by hand in the normal manner.

In the illustration on this page a large cylinder will be seen secured below the platform in the centre of the turntable girder. One of these is fitted on each side of the table, and they form a system for storing sufficient vacuum to enable a "dead" engine, that is one not in steam, to be turned, and also for rotating the empty table. These cylinders are charged automatically at the same time as a locomotive is connected to the vacuum engine.

A "Pacific" type of locomotive as illustrated, weighing about 150 tons, can be turned in about 1½ minutes, which is approximately twice as fast as can be achieved with the normal hand turning gear. This saving is valuable in times of heavy traffic pressure when numerous locomotives on special trains from other centres arrive in rapid succession at King's Cross. All of them require to be turned for their return journey and the ease and convenience with which this operation can now be performed facilitates their accommodation, as well as that of the engines engaged on regular services. The saving in time for each engine turned may appear small, but in the aggregate its speeding-up effect is considerable.

Another advantage of the device is that, as it is operated by the locomotive itself, it is applicable to any turntable in any location, even in remote parts, for no outside source of power is necessary.



L.M.S.R. "Silver Jubilee" Exhibition

In connection with the recent Silver Jubilee celebrations the L.M.S.R. last month arranged a special Exhibition at Euston. The exhibits consisted of the three-cylinder "5X" 4–6–0 locomotive No. 5552, named *"Silver Jubilee"* by permission of the King, and finished in a special style, together with a representative train of the latest stock. The object of the Exhibition was to demonstrate the progress in railway equipment for passenger travel that has taken place during the 25 years of His Majesty's reign. The motive power and equipment typical of 25 years ago were represented by the 4–4–0 locomotive *"Coronation,"* of the L.N.W.R. "George the Fifth" class introduced in 1910, and a comparable train of the period. A special account of the Exhibition and photographs of the locomotives concerned appear on page 348 of this issue.

A new turntable 70 ft. in diameter has been installed at Bath, and it is now possible to turn there the large 2–8–0 locomotives specially built in 1914 and 1925 respectively for work on the Somerset and Dorset Joint system. The 1914 lot originally had tender cabs in view of the great amount of running that they had to do "tender first" on account of the impossibility of turning them, but these are not now fitted.

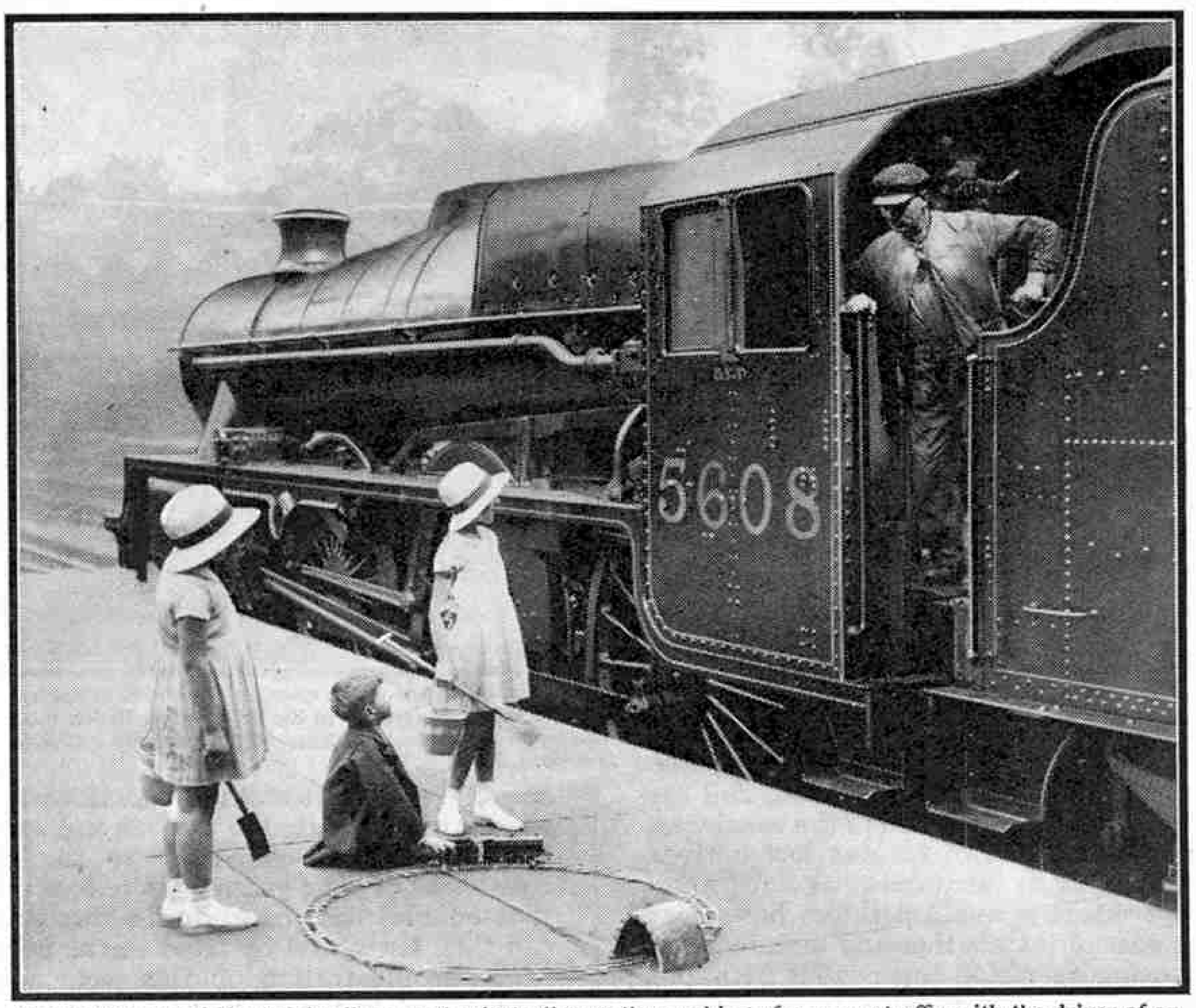
Stanier two-cylinder "5P5F" and three-cylinder "5X" 4–6–0 locomotives are now working on the L.M.S.R. West of England main line on passenger and fast freight traffic. Both classes are now commonly found on trains on the cross-country main line between Liverpool and Leeds. They appear to have ousted from these duties the "Prince of Wales" locomotives that were formerly so prominent on this difficult route. The Horwich pattern four-cylinder 4–6–0 engines still work into Lime Street from Yorkshire, however.

The 2–6–4 three-cylinder tank engines of the "2500" series are now working into Fenchurch Street. These locomotives, which were described and illustrated on page 391 of the May 1934, *"M.M.,"* were designed specially for such services as those between London and Southend, their speedy acceleration being of particular advantage on the frequent and tightly-timed trains on that route.

220 More L.M.S.R. Containers

The increasing use of rail-road containers for the conveyance of goods traffic is a striking feature of modern railway practice. The L.M.S.R. have long made use of these "suit cases of commerce," and are now increasing their stock of these handy units by a further 220, which will bring the total stock of L.M.S.R. containers up to 6,635. Of the new additions 50 will be of the insulated type for meat traffic; 20 for meat or fruit will be insulated and fitted with bunkers for chemical refrigerant; another 50 will be insulated and ventilated for Scottish meat traffic and fitted with water-ice bunkers. The remaining 100 will be of a new design for the conveyance of furniture.

For the conveyance of the insulated containers, 120 new wagon chassis are being built, and 150 wagon chassis already existing are being converted to make them suitable for the conveyance of either the new or the existing meat containers.



Comparing notes! Youthful railway enthusiasts discuss the working of summer traffic with the driver of an L.M.S.R. 3-cylinder 4-6-0 locomotive, No. 5608, of the "Jubilee" class, as these engines are now called.

New L.N.E.R. Restaurant Cars

Since 9th April, some new L.N.E.R. first-class restaurant cars have been running on the Anglo-Scottish services from King's Cross. They are very fine vehicles that strike a new note in their internal furnishing and decorations, the result of which is to give the traveller an impression of spacious comfort. Each passenger has an independent armchair seat of easy wing type, in the design of which ease in dining and relaxation have been specially studied. Diffused lighting is provided, with carefully planned warming and ventilating arrangements. The kitchen equipment is all-electric, a feature that has long been characteristic of L.N.E.R. restaurant service.

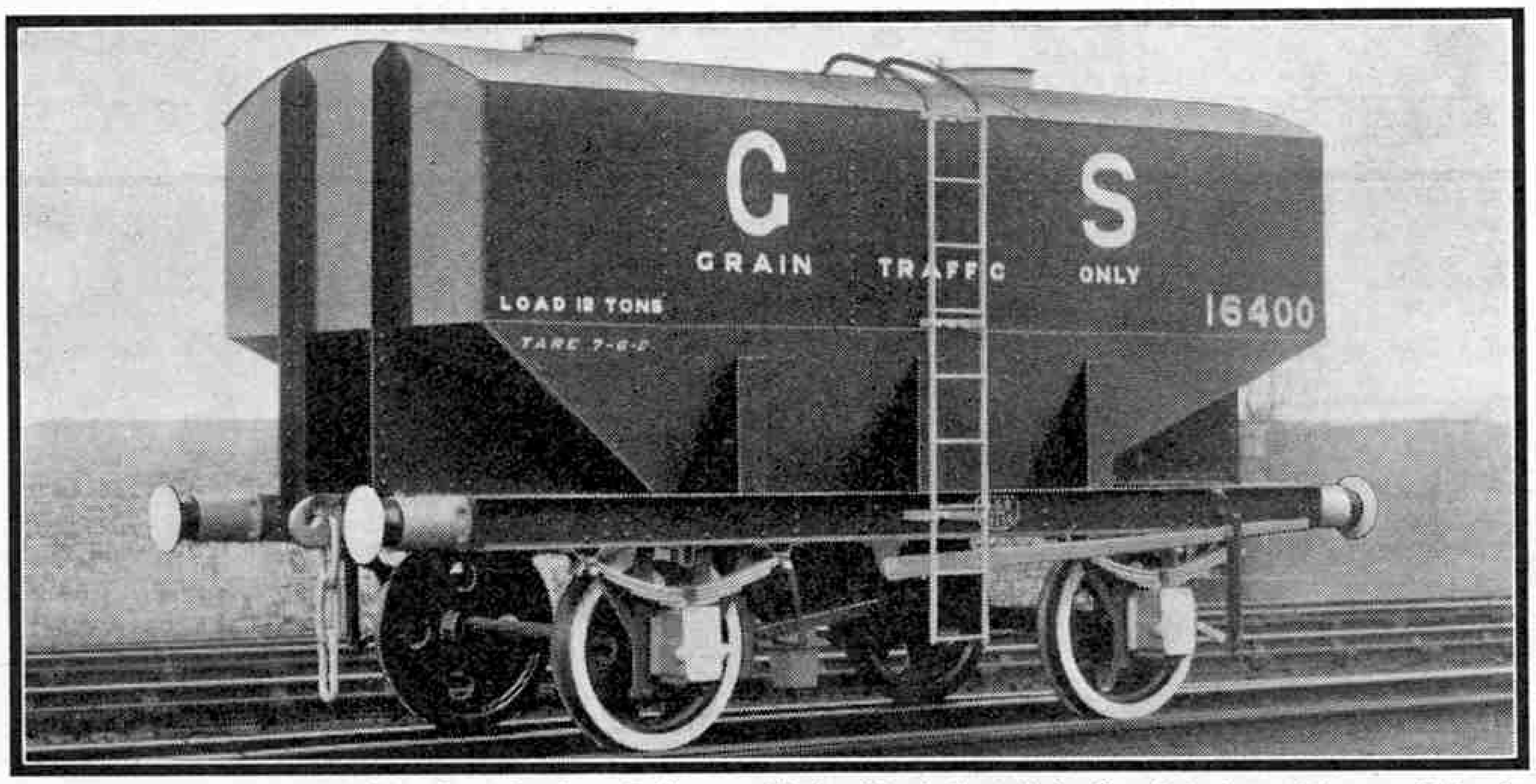
Higher Speeds in Germany

On 15th May the fastest regularly booked start-to-stop speeds in railway history came into operation on the German State Railways. In the comprehensive programme laid down by the summer timetables, the famous *"Flying Hamburger"* gives up its place as the fastest train in the world to a new Diesel-electric express that runs at an average speed of 82.25 m.p.h. from Berlin to Hanover, as part of the journey between Berlin and Cologne, which is covered at an overall average of 70.5 m.p.h. On the up journey the overall average is 67.5 m.p.h. Between Berlin and Frankfort there is another high-speed service that involves an average of 79.6 m.p.h. between Anhalter (Berlin) and Leipzig, the corresponding figure on the up journey being 80.9 m.p.h. A feature of these services is the excellent connections that they make on the way, and before the end of the summer it is intended to introduce similar high-speed services between Munich and Berlin, and Cologne and Hamburg.

Twin-articulated units of 820 b.h.p., and triple-articulated units of 1,200 b.h.p., supercharged, are employed. These are improved Diesel-electric vehicles of the same general design as those made familiar by the *"Flying Hamburger."* Accommodation is second-class only, with buffet service.

Bulk Grain Wagons for the G.S.R. (I.)

The Great Southern Railways of Ireland have recently put into service 12 covered hopper wagons of the type illustrated on this page, for bulk grain traffic. These vehicles have a capacity of 12 tons, and are loaded from above through two filling holes on the roof, which are fitted with hinged water-tight covers. A ladder is provided on one side for access to the roof during filling operations. The design is such that the load is self-trimming, and its discharge into suitable receptacles between the rails at terminal points is effected through an outlet at the bottom of the hopper, 6 in. square. The opening of this is governed by a screw and lever from the side of the vehicle. The bodies and underframes, which are 16 ft. 11 in. long, are constructed of rust-resisting steel, the body sides being 3/16 in. thick and the roof $\frac{1}{8}$ in. thick. The solebars and headstocks of the underframes are of channel section, and all joints in the body have been made by electric welding instead of riveting. Rivets, in fact, have only been used in the gussets and stays.



One of the all-steel wagons of the Great Southern Railways of Ireland for bulk grain traffic. A feature of these vehicles is the extensive use of welding in their construction. Photograph by courtesy of the G.S.R. of Ireland.

The vehicles run on four steel disc wheels spaced 9 ft. 6 in. apart, and have an empty or tare weight of 7 tons 6 cwt. The drawgear, brake, wheels and axles are made to conform with Railway Clearing House standards, and self-contained buffers are fitted. The vehicles have been constructed at the Inchicore Works of the Great Southern Railways to the designs of Mr. A. W. Harty, the Chief Mechanical Engineer of the Company.

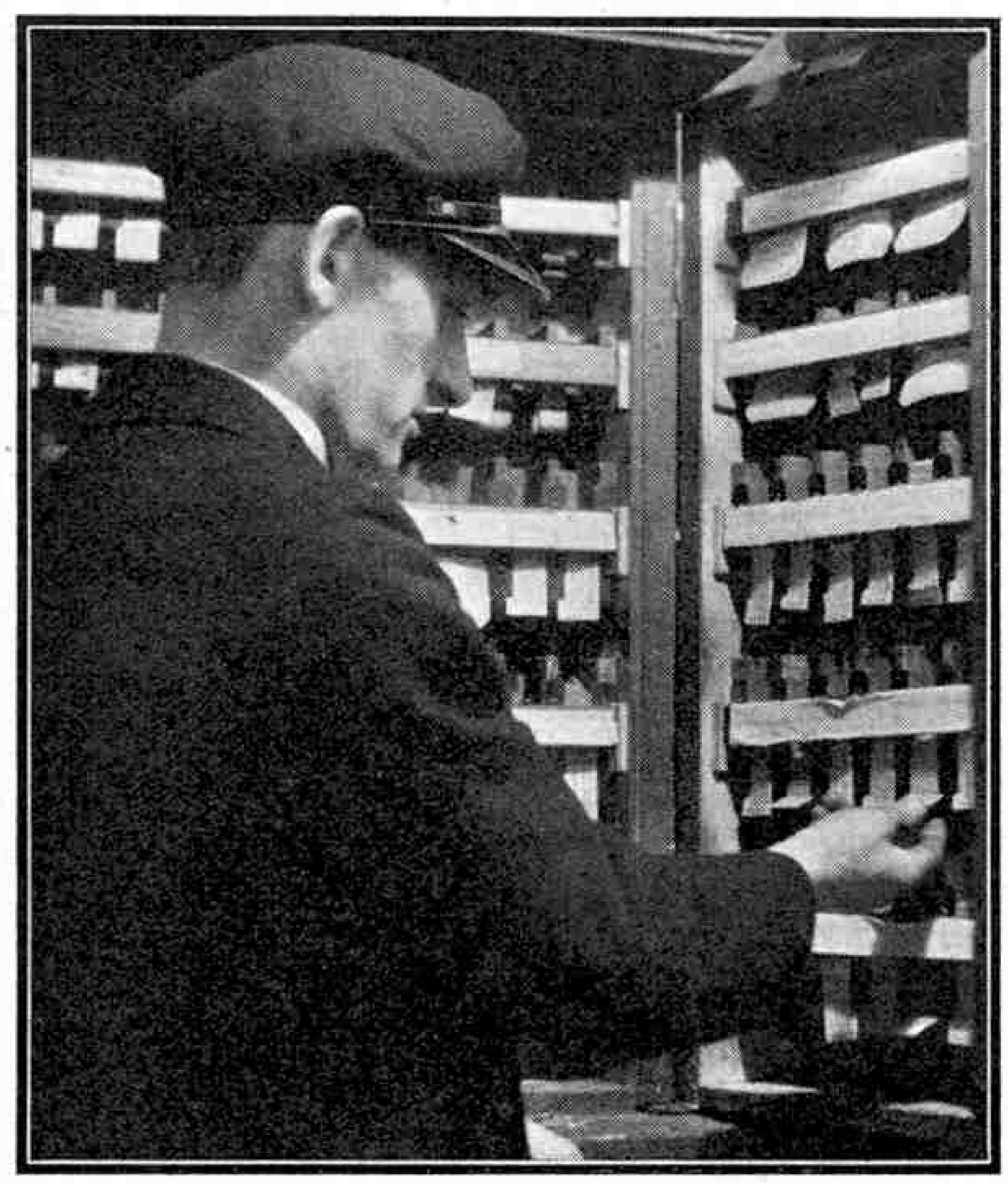
Railway Relics in Derbyshire

Relics, nearly a century old, of the earliest days of British railways, have been brought to light during the reconstruction of Burleigh Bridge on the L.M.S.R. main line from London and Derby to Manchester. They consist of a number of stone blocks, which have been identified as part of the original permanent way, laid down in 1838—1840, of the old North Midland Railway. The latter system used these stone blocks instead of wooden sleepers, and this type of "sleeper" was fairly common on early British railways.

The stone "sleepers" found near Derby have been identified by the marks still visible of the cast-iron chairs that had been bolted to them. Since their displacement by timber sleepers they had been used to form part of the abutments of the bridge, carrying the L.M.S.R. main line over the River Derwent, which is being replaced in the course of a bridge renewal programme to permit heavier engines to be used.

"*Twentieth Century*" Developments

By the 15th of this month the "*Twentieth Century Limited,*" the famous service of the New York Central, will have been in operation for 33 years. The fastest long-distance train in the world, the "*Century,*" as it is familiarly known to American railroad men, now observes a 17-hour schedule between New York and Chicago and vice-versa. This involves an average speed of 56.47 m.p.h. over the 960 miles between those two cities, including six stops on the westbound and five stops on the eastbound journeys.



In the booking office. The ticket being taken from the rack will next be stamped in the dating press. An H.R.C. prize-winning photograph by S. Garbutt, Altrincham.

This schedule has been in force since 28th April of last year, previous to which the time taken was $17\frac{3}{4}$ hours. A 20-hour schedule was in operation before April 1932, when a reduction to 18 hours took place. Thus in three years the timing has been reduced progressively by three hours.

Rail "Bus" for Platelayers

The largest platelayers' trolley ever built in this country is in service on the L.N.E.R. in Scotland. The trolley is like a small four-wheeled bus with open sides and plain wooden seats. It will carry 38 men and their equipment, and is intended to convey large construction gangs of workmen quickly to the scene of operations.

During its test run the trolley covered a measured mile at 35 m.p.h. on the flat while carrying a weight equal to that of 42 men. It can be driven from either end, and is fitted with a four-cylinder water-cooled engine developing 52 h.p., and a gearbox that gives three speeds in each direction. In order to keep the deck of the trolley clear, the radiator is slung beneath the chassis, where it cannot be damaged by the workmen's tools.

Recent G.W.R. Developments

The G.W.R. are now operating, on a new route, one of their oil-engined streamlined railcars as built for the Birmingham and Cardiff service. The car, which has buffet accommodation, runs between Birmingham and Stratford-on-Avon, intermediate stops being made at Earlswood Lakes and Henley-in-Arden.

All the 4–4–2 "County tanks" have ceased to run in the London area, where they have been familiar for so long. Their places are now taken by the new and more powerful 2–6–2 tanks of the "5100" and "6100" series.

Faster Service to Copenhagen

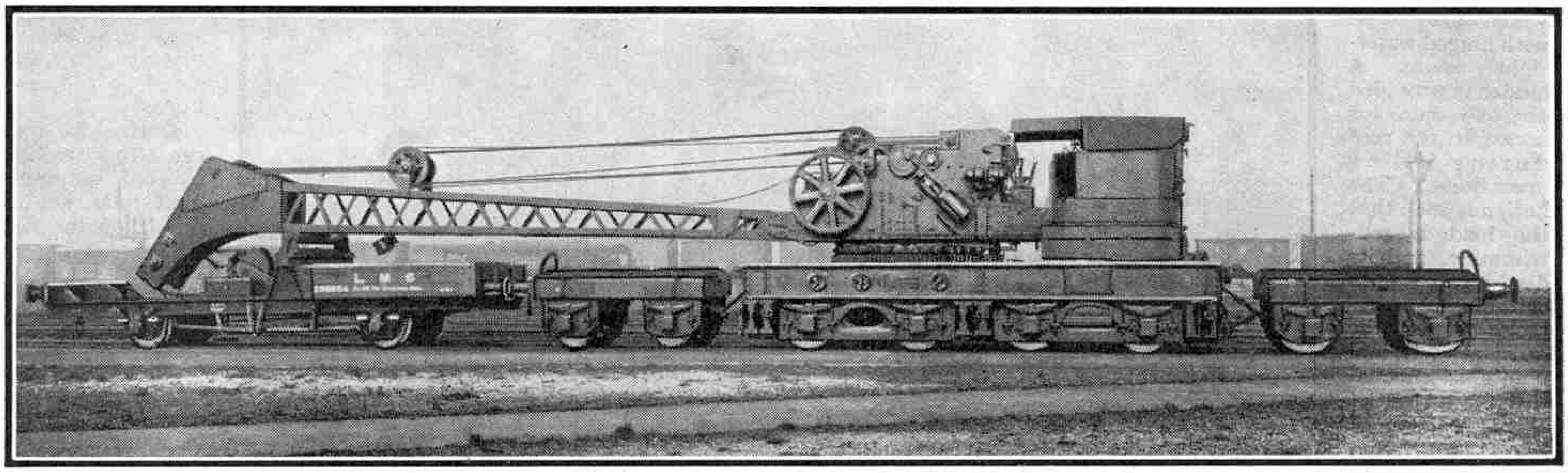
On 14th May, the "*Scandinavian*" boat express of the L.N.E.R. was altered to leave Liverpool Street at 4.10 p.m. instead of 7.42 p.m. This alteration is part of the acceleration by 4 hr. 40 min. of the L.N.E.R. service from London to Copenhagen via Harwich and Esbjerg. Copenhagen is reached at 11.30 p.m. the next evening by a Diesel express service from Esbjerg. In addition to the regular weekday services, Sunday services are to be operated in both directions during July and August, as a result of the increasing traffic on the Harwich-Esbjerg route.

German Railway Centenary Plans

The German State Railways are taking special measures to celebrate the centenary of the opening of the Nuremberg-Furth line, the first railway in Germany, which occurs this year on 7th December. The Railway Museum at Nuremberg will present an historical exhibition illustrating railway development. An interesting feature is that during the summer an exact copy of the original train will run over the same line.

New Breakdown Cranes for the L.M.S.R.

Interesting 36-Ton Vehicles



The photograph above shows one of three 36-ton breakdown cranes recently supplied to the L.M.S.R. Special relieving bogies run fore and aft of the main crane carriage while travelling, and the jib rests on its support on the match truck. Photograph by courtesy of Cowans, Sheldon and Co. Ltd., Carlisle.

THE safety of rail traffic, especially in Britain, is proverbial. For obvious reasons, however, it is necessary for the railways to be prepared for any mishaps that may occur, and to provide suitable means for dealing with them. As regards equipment for collisions or serious derailments, the services of a breakdown crane are required, and of course the attendant breakdown gang with their tools and special appliances.

A crane, together with several other vehicles for the accommodation of the gang, stores, and first-aid equipment, the whole forming a breakdown train, is stationed at every large locomotive depot. The breakdown gang is formed of men drawn from the staff at the depot, and they and their special train are ready day or night to proceed to the place where their services are required. The organisation is such that, within a very little time from the receipt of the summons for help, the train and its crew are on their way.

A clear road is essential, for delay may be very dangerous; and the breakdown train is hustled through as quickly as possible. It carries, in fact, the express train headlamp indication, and is passed from signalman to signalman under the same bell code rings as an express.

As the largest and most spectacular component of the train, the breakdown crane commands attention. For many years hand-operated cranes were in use, and some of this type are still to be seen, although steam cranes are now invariably provided as part of the breakdown equipment. The greatly increased weight of modern locomotives and rolling stock makes power-operated cranes a necessity if the line is to be cleared with reasonable speed after a mishap.

Pursuing their policy of providing the most modern and efficient equipment, the L.M.S.R. recently obtained three new steam breakdown cranes of 36 tons' capacity from Cowans, Sheldon and Co. Ltd., of Carlisle. This type of crane has been specially designed to clear the L.M.S.R. loading gauge and to comply with the specified axle loads. The cranes are provided with the makers' patent relieving bogies at each end of the carriage, as shown in the photograph.

These bogies are attached to the main crane carriage by means of a system of rigid levers. One of these levers carries a shackle to which is fastened the crane hook, and when the crane hoists, a part of the load carried by the main carriage is transferred on to the relieving bogies. Means are provided for locking the lever gear in this position, so that when the crane hook is detached from the relieving bogie, the dead weight of the crane is evenly distributed over the main carriage and the relieving bogies. With this arrangement the axle loads of the main carriage are relieved to the extent of reducing the axle load to the permissible limit when the crane is running in train on the permanent way.

When a crane is attending and working at a breakdown, these relieving bogies are lifted by means of the crane itself, and deposited on an adjacent track, in order that the crane may approach as close as possible to the breakdown.

Each crane is provided with lifting, revolving, derricking and travelling motions, all of which are operated from one set of steam engines attached to the superstructure girders of the crane. The cylinders have a bore of 8 in. and a stroke of 12 in., and are supplied with steam from a vertical boiler 6 ft. 8 in. high and 4 ft. 6 in. in diameter. The working pressure of the boiler is 100 lb. per square inch.

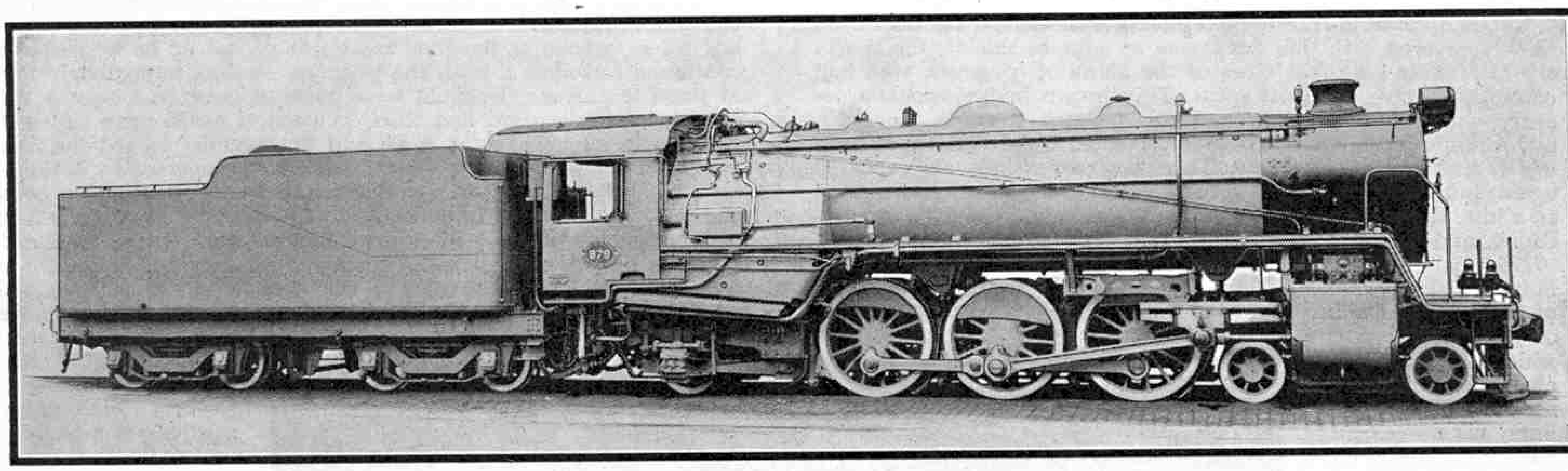
When the outrigger girders of the main crane carriage are jacked up, each crane will lift a load of 36 tons at a radius of 25 ft., and can deal with a load of 18 tons at a radius of 40 ft. When the crane is standing free on rails, and without the use of any rail clips, stability beams or other devices to steady it, it will lift a load of 12 tons at a radius of 20 ft.

Lifting can be carried out at a speed of 13 ft. per minute with a load of 36 tons, and with the same load the jib can be turned completely through one revolution in two minutes. The jib can be moved throughout the range of the derricking action of the crane (Continued on page 374)

Model Making in South Africa

The Work of Mr. Royal Street

By A. H. Betteridge



THE appeal of models is universal, and in recent years more and more interest has been taken in models in South Africa. One of the leaders in this development is Mr. Royal Street, who is a draughtsman in the railway offices at Kimberley. Mr. Street is a native of that place and it is interesting to note that one of his parents was a pioneer who remembers taking part in the famous rush to the diamond diggings in 1870. The history of transport in South Africa has therefore a special interest for Mr. Street and he has constructed in his workshop, with occasional aid of other railwaymen, models of all forms of transport used since the days of the *"voortrekkers"* more than a century ago.

Of particular interest are the models showing the progress in locomotive construction. They include a model, built to the scale of ½ in. to the ft., of the first locomotive to run in South Africa. The memorable event of the introduction of locomotive transport into the Cape Colony, as it then was, took place in 1860. As in England 30 years previously, this revolutionary form of transport caused considerable controversy at the Cape, for many farmers objected seriously to steam locomotives, and described them as monsters, "belching fire and disturbing the equanimity of their peaceful flocks."

The photograph above shows the prototype of one of the models referred to in this article. The engine is 4-6-2 No. 879 of the South African Railways built by Henschel and Sohn of Kassel, Germany, and differs from the other engines of class "16DA" in having Caprotti poppet valves and gear

A model of which the prototype will be familiar to readers is that of No. 879. This represents a 4–6–2 locomotive built by Henschel and Sohn of Kassel, Germany, and fitted with Caprotti valves and gear instead of the piston valves and Walschaerts motion of the other locomotive of class "16DA." A model of one of these locomotives, No. 877, is also included in the collection. Six of the original locomotives of class "16DA" are stationed at Kimberley and are used on the fastest long-distance de luxe trains.

The most remarkable model of the collection is undoubtedly that most recently built. This represents one of the giant 4–8–2: 2–8–4 "Beyer-Garratt" locomotives of the "G.L." Class and its construction occupied nearly twelve months. These "G.L." Class "Garratts" are the largest and most powerful locomotives in the world working on the 3 ft. 6 in. gauge. The first two were put into service in 1929, and as a result of their successful operation others were ordered soon after from the makers, Beyer, Peacock and Co. Ltd. of Manchester, England.

In spite of the wide experience gained in building smaller locomotives, it was found that special problems were involved in the construction of the model "Garratt." All of these were satisfactorily solved, however, and the model was eventually completed. This miniature locomotive giant is 45 in. long, 6½ in. high, and 5 in. wide. It is built to a scale of ½ in. to the foot and runs on gauge 1 track, the actual measurement between the rails being 1¾ in. It weighs 50 lb. complete, and is driven by an electric motor of one-eighth horse power, which also was constructed in Mr. Street's workshop.

The motor is placed in the fire-box of the model and the drive is conveyed to both the motive units, flexible shafts being used at the points where these are articulated to the frame of the boiler portion of the engine. After several experiments with various types of flexible drives, the outer casing of Bowden cable as used for motor cycle controls was found to be the most successful. The main frames of the locomotive are of steel plate ⅛ in. thick and welded at the joints. The axle-boxes are of brass, and the driving wheels, which are 2 in. in diameter, were turned up from iron castings. An interesting point is that the big ends of the connecting rods are fitted with floating bushes as on the original locomotive.

It is suggested that this model "Garratt" is a record for size and weight on a track gauge of 1¾ in. It certainly demonstrates the possibilities of Gauge 1 for it will barely negotiate a curve of 11 ft. 6 in. radius. When the first opportunity occurred of testing the engine on the track, the only rails available were of the small steel section, usually used for gauge O, soldered to steel sleepers which had been pressed out in Mr. Street's workshop. The "Garratt" travelled satisfactorily down a straight length of track but after taking a curve of 11 ft. 6 in. radius commenced to burst the road, and before current could be switched off the rails had been broken from 72 sleepers! This mishap brought home the fact that this massive 50 lb. locomotive would require much stronger track than that employed for the test.

In addition to these locomotives Mr. Street also has a set of coaches that reproduce in miniature the actual vehicles used on the crack *"Union Limited."* These include two articulated saloon units, a pair of dining cars, a brake composite vehicle and an observation coach. This train, however, was not built by Mr. Street himself, but by another South African railwayman, Mr. C. G. Allen of Kimberley.

Owing to the difficulties involved in the laying of a heavy track, particularly with regard to the space required and the expense, Mr. Street has decided to abandon the building of models of a scale of ½ in. to the ft. It is his intention to concentrate on Gauge O, which is the size used for Hornby Rails and which has a measurement between the inside of the rail heads of 1¼ in. Plans have been drawn up for the construction of an elaborate layout which is to be known as the "S" line. The curves on this system will be of 4 ft. radius.

In building miniature locomotives Mr. Street makes use of Meccano parts wherever these are suitable for the particular purpose in view. Meccano Motors are employed, also Meccano gears, and an experimental model of the L.N.E.R. Locomotive *"No. 10000"* embodying such parts is under construction.

Famous Explorer Writes for the "M.M."

V.—Mongo, the Great God of Hunting

A HISSING sound as vicious as that of ten enraged cats; a human moan of frantic pain issuing from beneath a large bush thickly covered with thin flat leaves as large as shields; the hoarse cry of Makulu-kulu, the chief of the Mambuti pygmies, who had instantly thrown his short spear. Tiny brown bodies appear from every clump of vegetation and run pellmell towards the chief, and a rain of spears and arrows is projected towards the spot from which that moan had come. Then the two sounds are repeated again, but this time with a reverse of tone, the moan transmuted to a hiss, the hiss to a moan. A few seconds, and the little scene is ended, and the oppressive silence falls once more over the forest.

Now, without a word, from beneath that thick-leaved bush a Mambuti slowly crawled. Only his eyes shining with the wild light of an infuriated animal, and his shoulder striped with blood, told of the embrace from which he had just escaped. His face was set in its usual stoical lines, his movements were slow, absolutely matter of fact, as helped by the others he dragged out from the bush the enormous leopard that had attacked him. Nine feet long from the head to the end of the tail—more than twice the stature of the pygmy—the leopard seemed now a grotesque sort of porcupine with all those spears and arrows bristling on his back and sides. How the pygmies had dared to throw their poisoned weapons at the animal without fearing to hit their companion pinned beneath it, both invisible in the dark vegetation; and how one of the arrows had been able to strike the leopard in the spine, causing instant death, were things that only Mongo, the great god of hunting, might have explained.

Makulu-kulu, sultani of the Mambuti pygmies, recounting his adventure with the big leopard, part of whose hide is shown in the right background.

And only Mongo could have told me what had become of the little okapi which, in the midst of that pandemonium, had darted out from his hiding place and galloped away at the heels of his mother, unobserved, and paying no attention either to the pygmies or to the leopard who, in unconscious competition, had been attempting to capture him. Evidently the huge feline, when he had noticed the intruders, had decided that one of their party could take the place of the small okapi that he had been watching so long, and which in all probability was now lost to him. So he had jumped on a pygmy who, ignorant of the danger, had crouched down under a bush near him.

But the intruders had won, and now with quick and well co-ordinated movements they were already skinning and cutting in pieces the prey whose flesh is so appetising to them, however distasteful it is to us. In the greedy joy of dividing the flesh, the Mambuti had already completely forgotten the risk they had run, and even the state of their companion, whose wounds continued to bleed copiously and unheeded. All the days spent in marching through the forest to find the tracks of a female okapi, then to select the footprints of a mother and to follow them to the distant hiding place where she had left her young; all my orders, my recommendations, my promises of salt and cloth and other things that for them are great treasures—all these had disappeared entirely from their childish minds before the dazzlement of the approaching banquet.

The cause of the mishap was the *fundi*, the native hunter whom I had put at the head of the little group of pygmies. Had he obeyed my order, as soon as the good track was picked up he would have continued to follow it with the pygmies, sending immediately one of them to call me. I should have come at once, and even if the episode of the leopard had then occurred, I could have ended it with a rifle shot while the *fundi* and the pygmies barred the way of the small okapi. But the *fundi* had been transported by enthusiasm, had followed the track to the end, and only when he had seen the mother disappear into the nest, and thought that the affair had become too serious for him to handle alone, had he decided to come himself to call me. Too late. And now the small okapi was far away, lost in the maze of the forest, and I must begin the search for another in that immense obscurity. There is an enormous number of okapis, but the trouble is to find them.

There are many methods of capturing an animal in the forest. Most of them I have studied since, having obtained the permit to capture two live okapis for the London Zoological Society, I began to prepare the expedition.

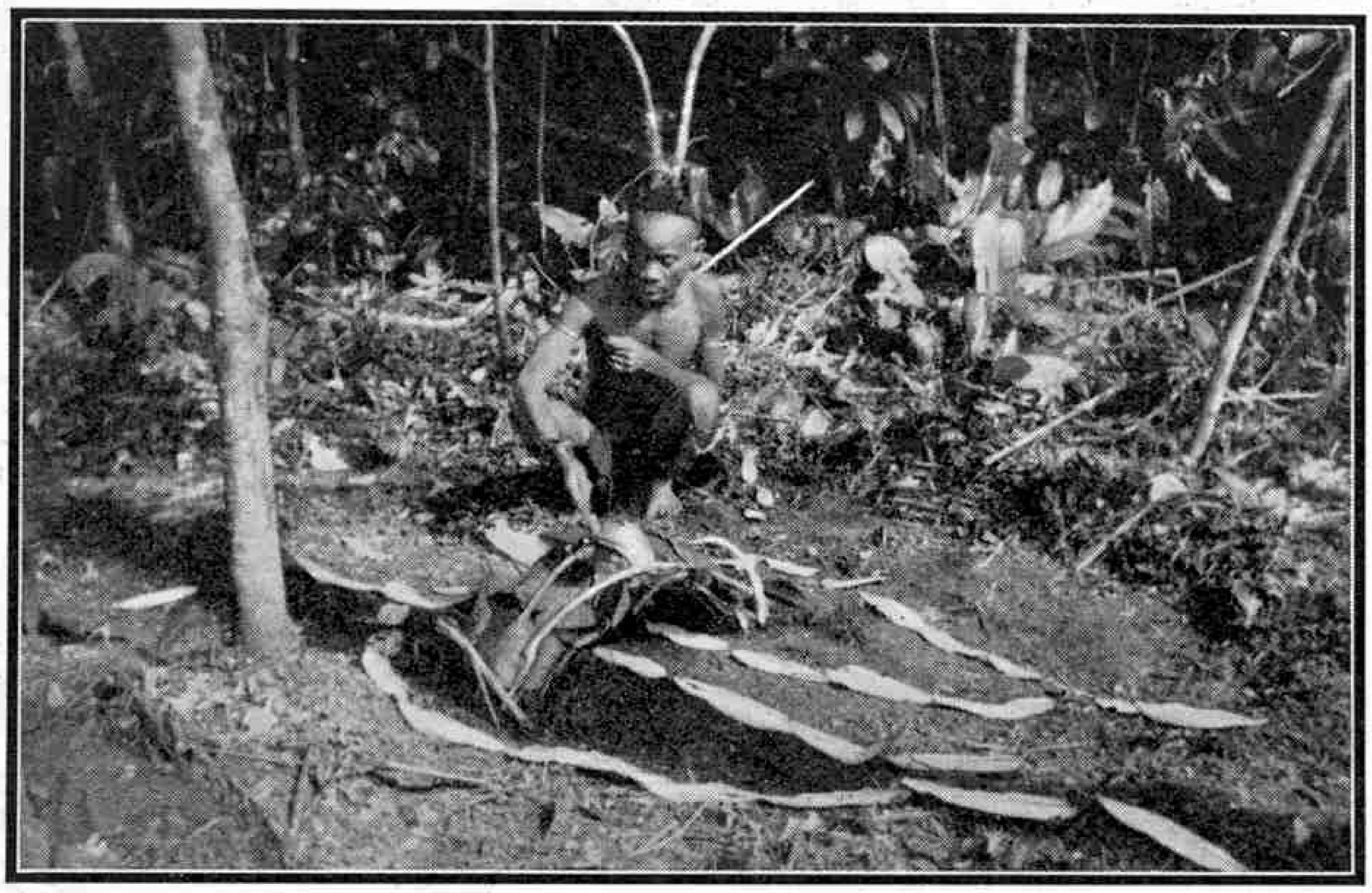
Some animals go every day to the same spot, either to feed or to drink. Once the paths leading to these spots are discovered and carefully examined, in the thickest part of the vegetation loops of rope can be concealed at the proper height, kept in position by sticks, and the other end of the rope tied to a strong tree. Some young, inexpert animal may without realising it put its head through one of these loops, and the noise it will make in trying to free itself will be more than enough to attract the attention of the natives left on guard, well hidden at strategical points. With this system, plenty of patience, and a long period of waiting, Colonel Percy Smith succeeded in capturing "Doreen," the beautiful bongo that is now in the Zoological Garden of New York.

For other animals the capture can be made by large, strong nets, suspended in the air along points of usual passage in such a way that, when the animal touches a rope stretched across the path, the net falls over him and imprisons him. Based on the same principle is also the system, as old as the world, of excavating along these paths deep holes covered with sticks and leaves with as much ability as possible, so that even the keenest eye cannot distinguish any difference between them and the surrounding ground.

These various methods have the great advantage that the animal so captured does not suffer in any way, and usually a few minutes after he is released loses every unpleasant memory of the capture.

There are also dozens of types of traps that the animal is induced to enter through the attraction of food; constructions of strong poles, the doors of which close instantly after the passage of the animal through some simple automatic device. This system is very successful with carnivora, particularly the leopard, as meat exercises an ultra powerful attraction over them. But for the herbivora they are almost useless. Salt is the only substance able to attract the latter towards a certain point, as there is an extraordinary abundance of their habitual food all over the forest; but it is difficult to find among these cunning inhabitants of the forest an animal ingenious enough to let himself be caught either in a palisade with an automatic door built around a spring rich in saliferous substances, or another in which each day salt is thrown.

All these systems I tried one by one as soon as I reached the forest. But the okapi, so irregular in his wanderings, and always so alert and sharp, soon showed me that not one was good enough for him. Not even the device of the pits of which I wrote in the previous article, as an adult is too strong and wild to be removed from the hole safely, transported and kept in captivity, while a small one will never fall in for the very good reason that he never moves from his hiding place.

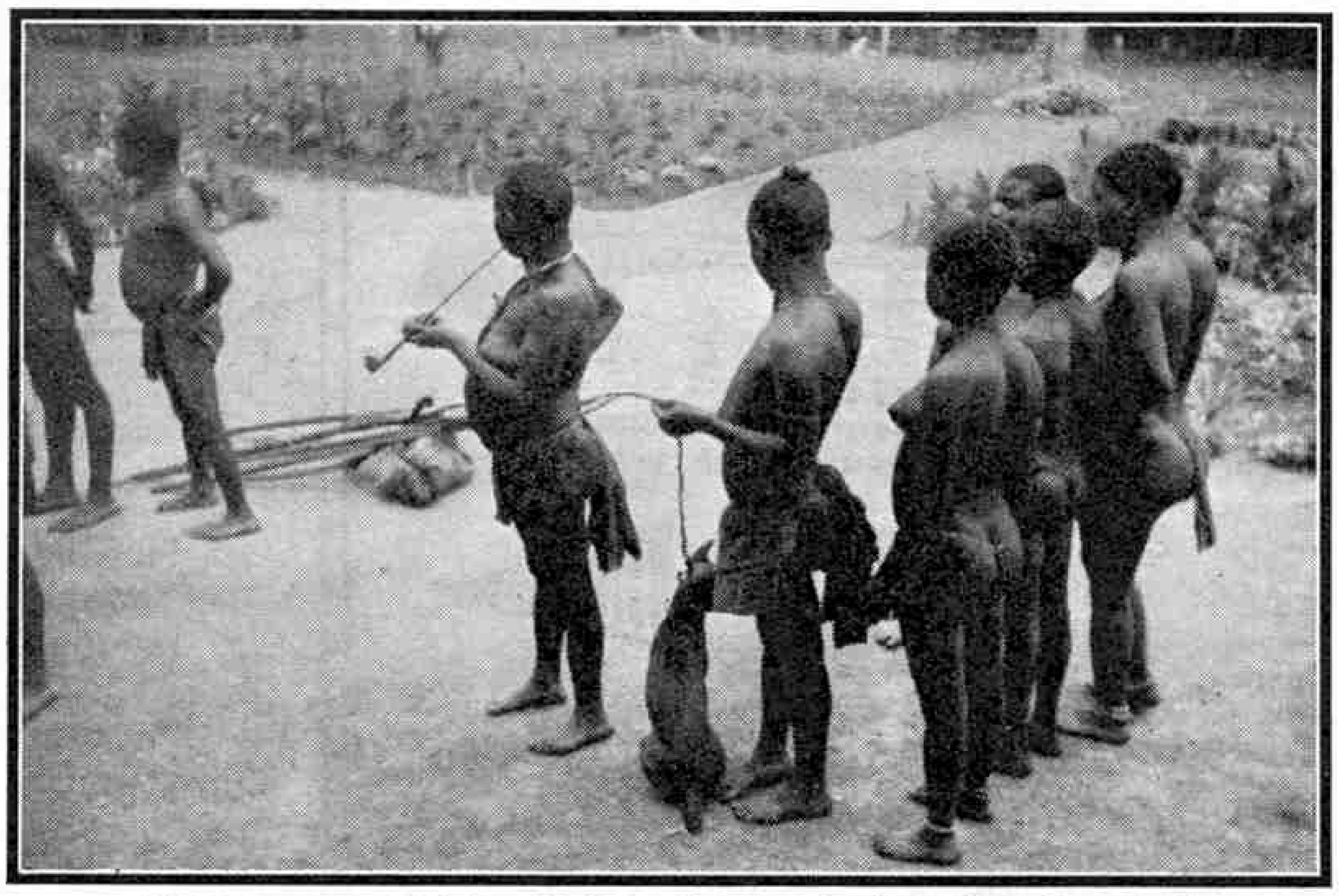


Invoking Mongo, the great god of hunting, before a tiny temple erected in his honour. Note the path of leaves laid down to make it easy for the god to find his way.

Other methods the pygmies and the *fundis* suggested to me with the greatest enthusiasm. The procedure they preferred was to take as many natives as possible, form an immense semi-circle, and advance noisily towards long nets or a strong palisade prepared between the two ends of the semi-circle. In the nets a baby, frightened from his hiding place, or a half-grown following his mother, could remain entangled, while the adult could escape. In the palisade both would be caught. However, as I well knew, the great enthusiasm of the natives was not based on the possibility of such a capture, but on the certainty that during the drive they would be able to kill several animals, irrespective of age or species, and this was just what I had the duty and the desire of avoiding at any cost.

Having discarded also the stupidly cruel plans of driving out and following with dogs a mother and young until the latter dropped exhausted, or of awaiting the dry season and setting fire to a part of the forest in the hope that a baby would be forced out of the flames, I ended by adopting the most simple and logical system which, as often happens, was the last one to occur to me.

The necessary preparations having been made, one morning towards the end of June I tried what seemed to me to be the last possible experiment. Eight patrols, each composed of a *fundi* and some pygmies, supplied with a canvas bag and ropes, left the base camp, each group taking the direction I had indicated to it by the aid of the sun, to search the forest for one of the mysterious hiding places of the young okapis. Three or four pygmy women followed every group, wives unbelievably loaded with bananas and maize, each armed with a burning faggot which, for the pygmies, is the equivalent, more cumbersome but also safer, of our cigarette lighters. It is good to light the green leaves of wild tobacco in their long pipes, and to kindle the inevitable little fire that the pygmies made to counteract the intense humidity of the forest every time they stop even for a few minutes.



At the base camp. Pygmies with their wives awaiting their daily ration of salt.

Half an hour later an animated voice reached me from the group of small characteristic half-huts at the edges of our clearing that I had thought deserted. Squatted on the ground there I found, not without surprise, Makulu-kulu, the sultani of the pygmies, whom I believed to be already far on his way. But there he was, and so deeply engrossed in the vivacious speech he was making that he did not even interrupt it at my arrival. He merely gave me a quick glance, accompanied by an even quicker raising of his eyebrows and a heavy sigh, eloquently indicating that he was extremely busy. His soliloquy flowed on. "Mongo, Mongo," I was able to extract from his torrent of words, "have I not made you rich offers?"

With his tiny, beautifully shaped hands, Makulu-kulu, whose least pre-occupation in this world certainly is cleanliness, was now carefully brushing the ground around a minute construction of sticks planted in the form of arches and covered with leaves. "Mongo," he was saying, turning towards the primitive little temple, "here there is a bone of the last elephant and one of the last leopard my spear has killed. All covered with beautiful rich meat. And here there is a leaf with a big piece of banana. And here an ant heap full of good fat white ants. Now, protect me, oh Mongo!"

To say the truth, had the spirit taken the trouble of looking closely, as I did, he would have noticed that the ant heap was full of ants, but that the leaf showed only the empty skin of the banana, while from the black shining bones the filed teeth of Makulu-kulu must have removed the last smell of meat several weeks before. But Mongo, the great spirit who created the Mambuti and died long, long ago, was evidently not of such a sordid nature.

The little sultani, who being also the witch doctor of his tribe, was expert in such matters, continued his invocation in a crescendo of entreaty. "Protect me, Mongo. Make me find the little okapis—little—little—*little!*—that the *Bwana* wants." The gesture accompanying the words indicated an okapi of the maximum stature of a cat, but with a confidential wink Makulu-kulu let me know that this was merely a small, innocent trick to make the spirit swallow the pill easily. Nothing could be more dramatic, more expressive, than those four feet of man, all grimaces and gestures of eyes and hands, all eloquent sighs and upraised brows, all extravagant inflections of voice from the most robust basso to the squeakiest of whispers.

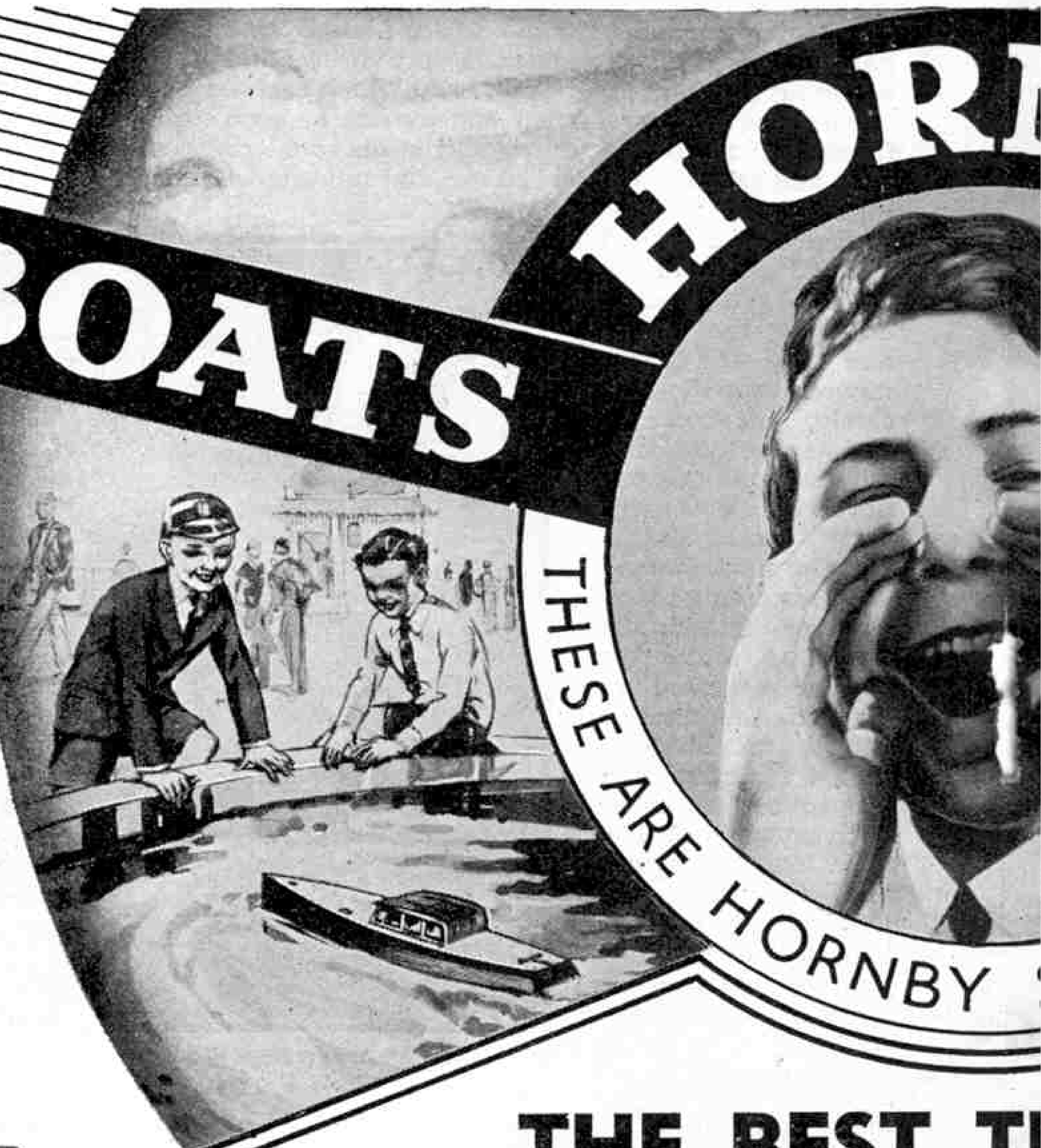
"When I find them, the *Bwana* will give me many presents. And of all of them I will give you a part as an offering. Salt as much as that; *tombacco* as much as this, and many francs. And a pipe like the one of the *Bwana*, and a "bi-lanketty" that keeps one so warm at night."

Here another wink to me. Obviously this time I was the one to swallow the pill. And before I could have the slightest opportunity of suggesting that I had never promised him the blanket and the pipe, he got up.

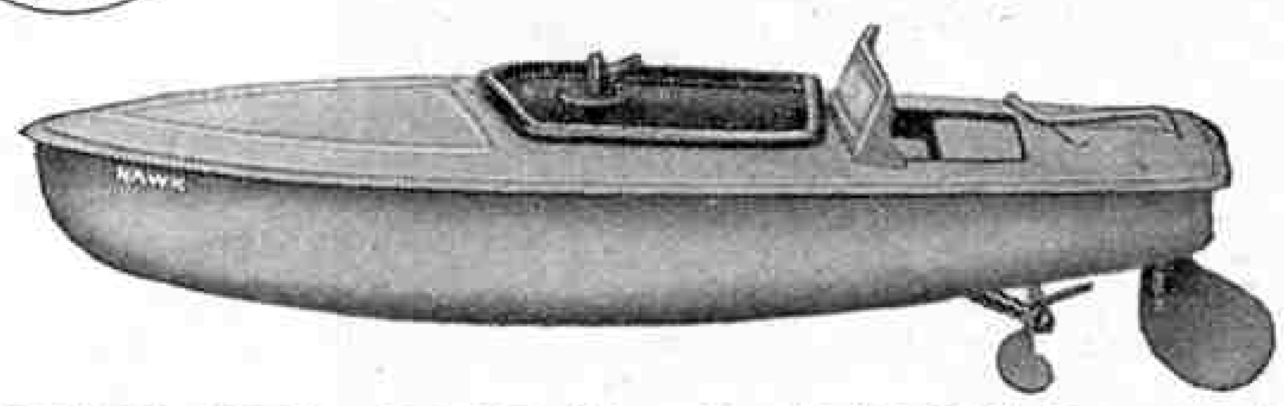
"*Bwana*," came a deep bass voice from the region of my belt, "*now* in less than a week you will find the okapis." And sure that I had well understood all the implications and inferences of that "now," away he went, strutting importantly and determinedly, gesticulating more than ever, to join his subjects, meanwhile continuing his sprightly conversation with the great Mongo.

Only four days later Makulu-kulu, among (*Continued on page 374*)

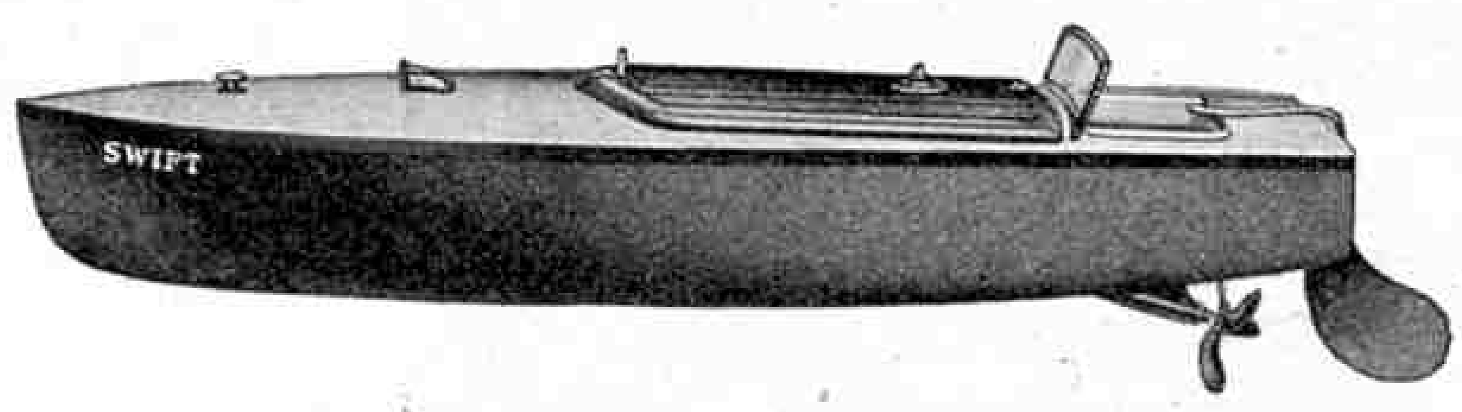
SPEED BOATS HOR



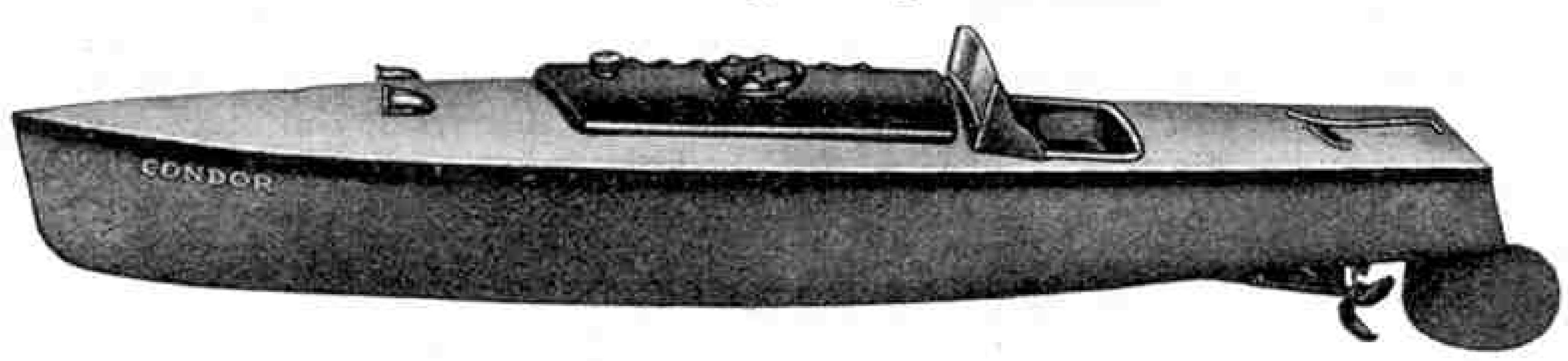
PRODUCT of MECCANO LIMITED LIVERPOOL



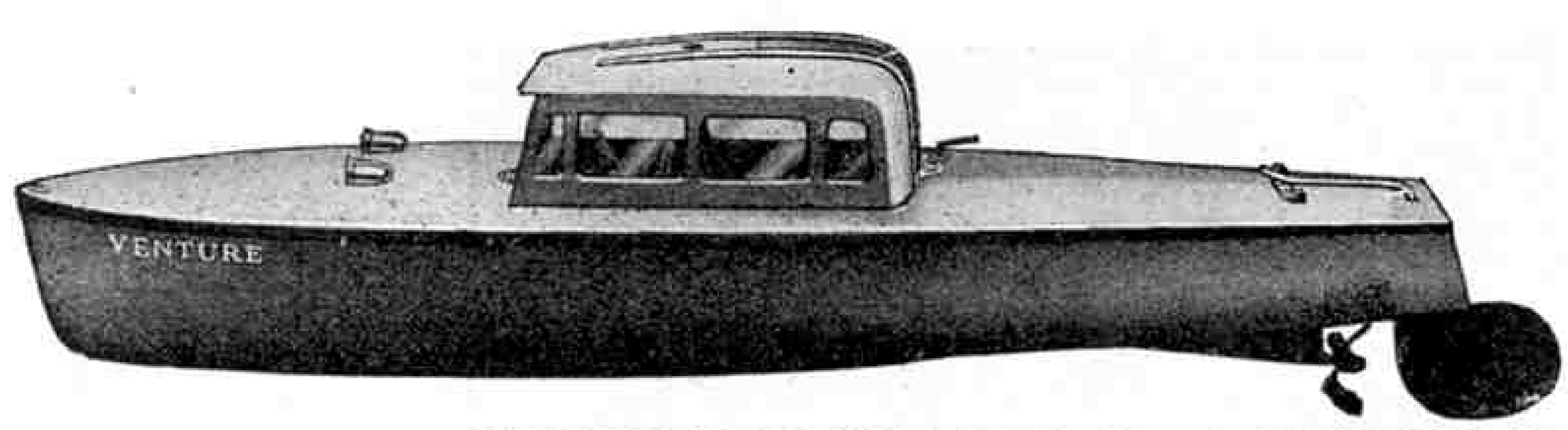
HORNBY SPEED BOAT No. 1. "HAWK." Price **2/11**
Travels over 100 ft. on one winding. Choice of three colour schemes. Dimensions: Length $9\frac{1}{4}$ in. Beam 3 in.



HORNBY SPEED BOAT No. 2. "SWIFT." Price **7/6**
Travels over 300 ft. on one winding. Choice of three colour schemes. Dimensions: Length $12\frac{1}{2}$ in. Beam 3 in.



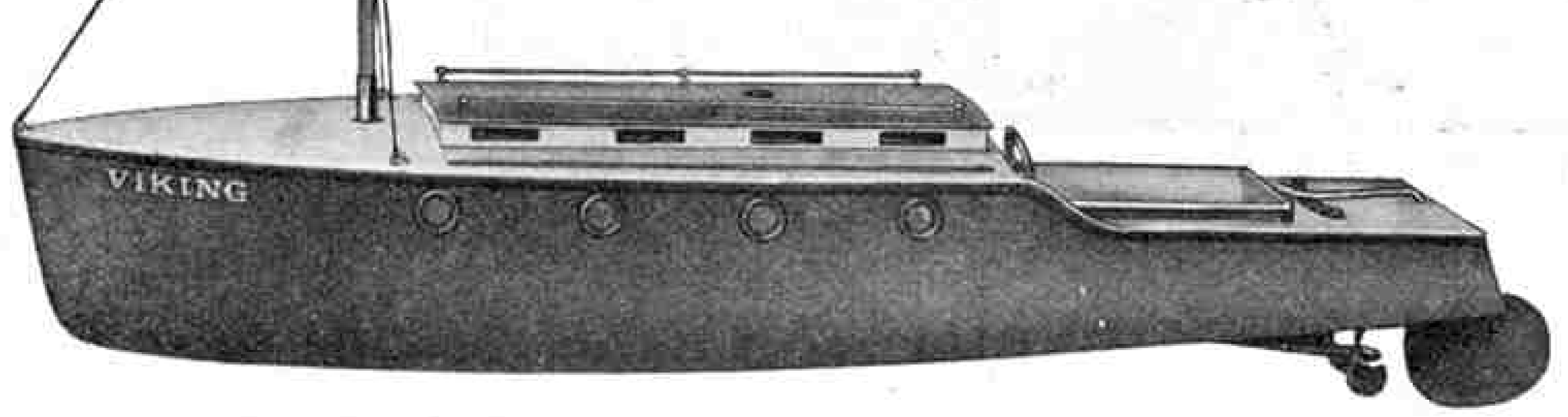
HORNBY SPEED BOAT No. 3. "CONDOR." Price **12/6**
Travels over 500 ft. on one winding. Choice of three colour schemes. Dimensions: Length $16\frac{1}{2}$ in. Beam $3\frac{1}{2}$ in.



HORNBY LIMOUSINE BOAT No. 4. "VENTURE." Price **15/6**
Travels over 500 ft. on one winding. Choice of three colour schemes. Dimensions: Length $16\frac{1}{2}$ in. Beam $3\frac{1}{2}$ in.

PENNANTS

Pennants for Hornby Speed Boats Nos. 3 and 4 may be purchased separately. Price **2**d. each.



HORNBY CABIN CRUISER No. 5. "VIKING." Price **16/6**
Travels over 500 ft. on one winding. Choice of three colour schemes. Dimensions: Length $16\frac{1}{2}$ in. Beam $3\frac{1}{2}$ in.

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Boys, model boating with a Hornby Speed Boat or Racing Boat is one of the most fascinating of all outdoor pastimes. If you want to experience the joy and thrills of running a boat of outstanding performance and remarkable efficiency, get one of these fine boats. There are eight splendid models from which to choose, all beautifully finished in attractive colours. Each one follows closely the design and general characteristics of a

HORNBY SP

When other boats are slowing up, the Hornby Speed Boats are still going strong. The special design of the propeller and the unique methods employed in the construction of the hull give each model exceptional speed and length of run.

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They steer well—a very important feature in any racing boat—and they possess the particularly good quality of being very steady in the water.

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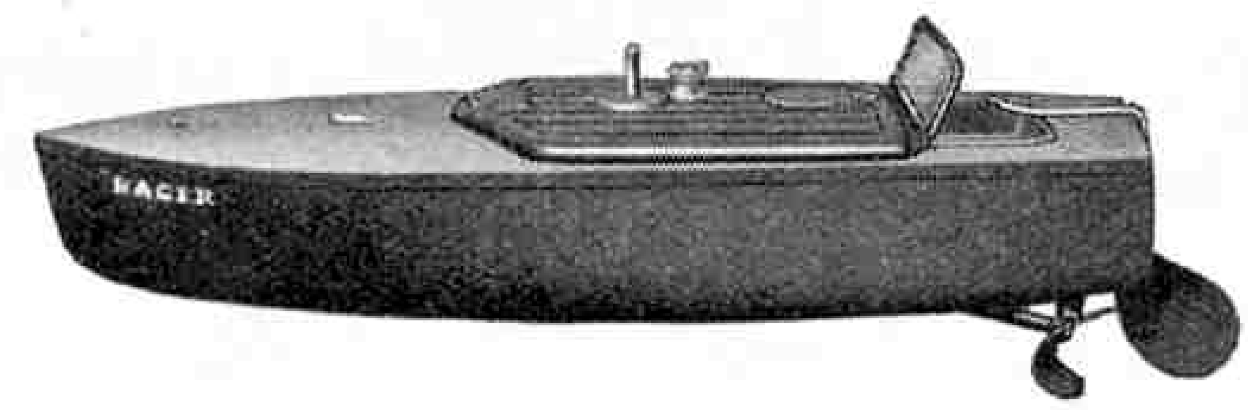
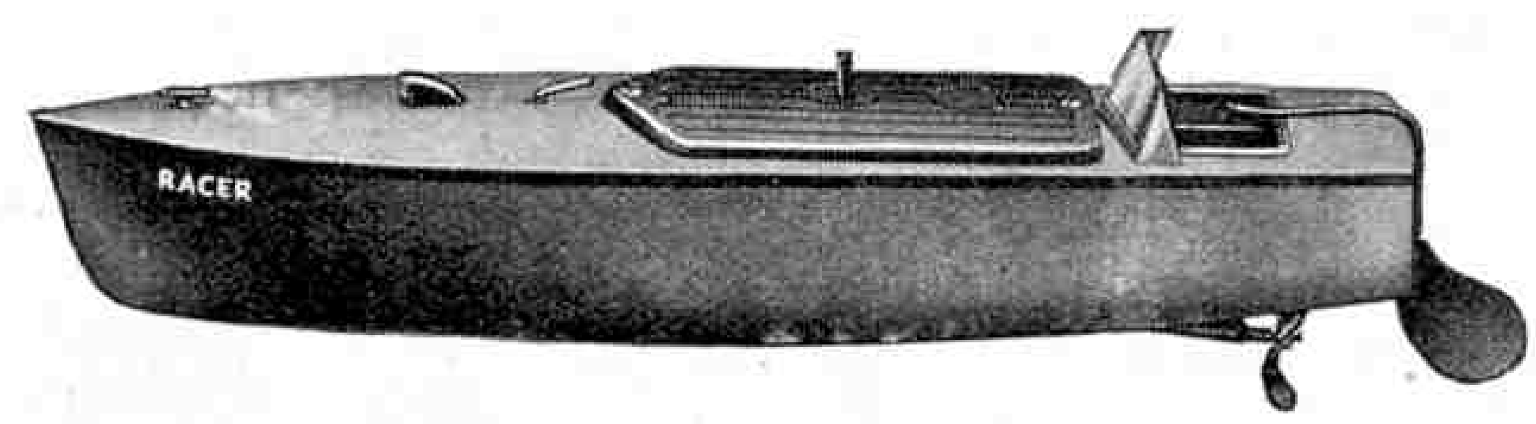
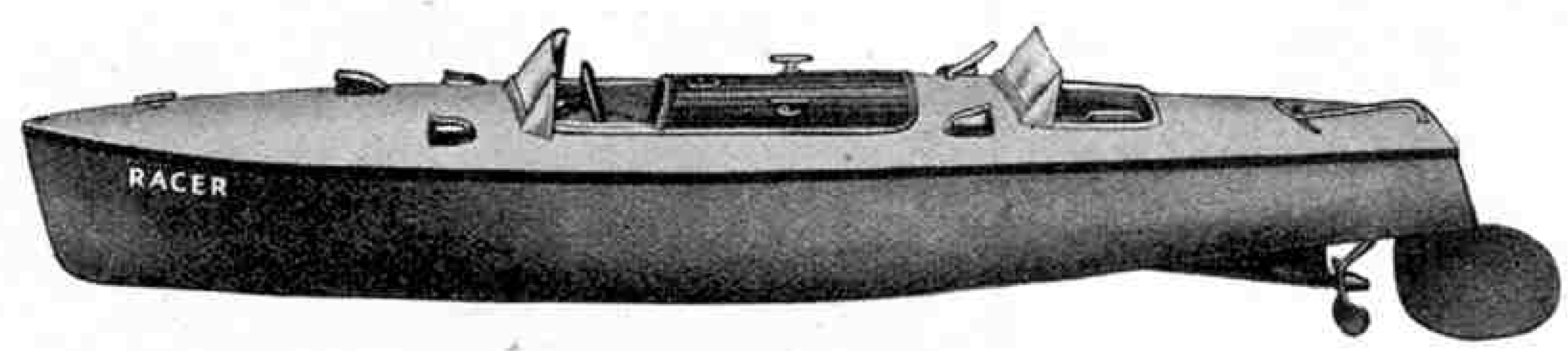


HORNBY RACING BOAT No. 1. "RACER I." Price **4/6**
Travels over 120 ft. at high speed on one winding. Finished in cream and green. Dimensions: Length $8\frac{1}{2}$ in. Beam $2\frac{3}{8}$ in.



HORNBY RACING BOAT No. 2. "RACER II." Price **8/6**
Travels over 200 ft. at high speed on one winding. Finished in Blue and Cream. Dimensions: Length $12\frac{1}{2}$ in. Beam 3 in.



HORNBY RACING BOAT No. 3. "RACER III." Price **14/6**
Travels over 300 ft. at high speed on one winding. Finished in Red and Cream. Dimensions: Length $16\frac{1}{2}$ in. Beam $3\frac{1}{2}$ in.

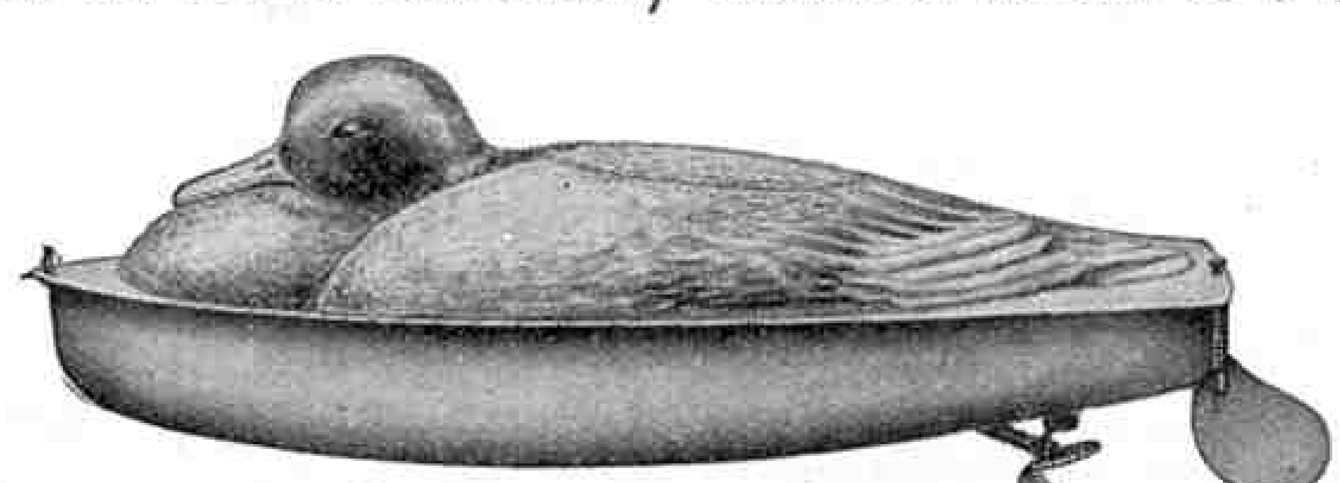
JOIN THE HORNBY SPEED BOAT CLUB

Every owner of a Hornby Speed Boat or Hornby Racing Boat should join the Hornby Speed Boat Club. This may be done by purchasing a special badge (illustrated here) from any Meccano dealer, or direct from Meccano Ltd., Binns Road, Liverpool 13. Prices: United Kingdom, **6**d., New Zealand, **10**d., South Africa, **9**d., Canada **20** cents.

HORNBY SPEED BOAT CLUB

HORNBY WATER TOY

This novel boat is particularly suitable for young children. The deck carries a realistically moulded model of a Duck.



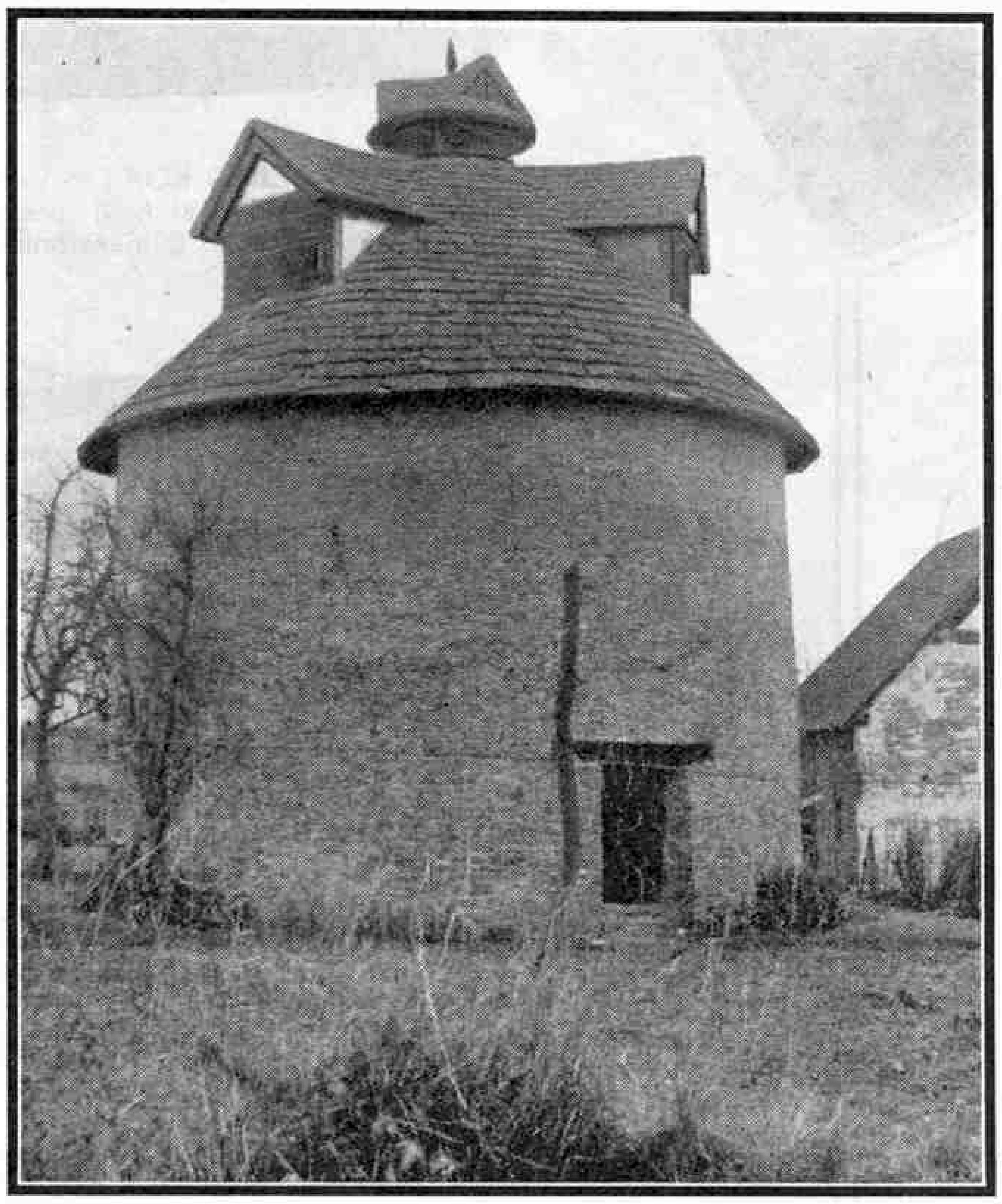
HORNBY WATER TOY (DUCK). Price **2/6**
Travels over 100 ft. on one winding. Finished in appropriate colours. Dimensions: Length $9\frac{1}{4}$ in. Beam 3 in.

FROM OUR READERS

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

England's Picturesque Pigeon Cotes

In the 16th and 17th centuries every large country house kept a supply of pigeons for food, and they were housed in great cotes that usually stood in adjoining fields. There is a fine example at Chastleton, near Moreton-in-Marsh. It is built of stone and is of square pattern with large archways on supporting pillars. At Newton-in-the-Willows, near Kettering, an immense cote with walls 3 ft. thick provides accommodation for 2,000 pairs of pigeons, and other interesting specimens are to be seen at Malpash, Dorset, and Bibury.



An excellent example of a 16th century pigeon cote at Richard's Castle, Herefordshire. Photograph by R. Harrison, Ludlow.

These fine old buildings are more numerous near the Welsh border and these are perhaps of greater interest. Some are built of red brick, with four-gable roofs, and others are carved and ornamented in black and white timber, resembling miniature Tudor manor houses. On the road from Leominster to Ludlow there is a circular pigeon cote in an excellent state of preservation. Its walls are nearly 3 ft. thick and it is built of stone throughout, except for the oak-beamed roof, in which there are four small gabled windows. Other interesting structures of this kind are a timbered cote at Canon Pyon, Hereford, and fine examples of cotes built of red brick at Eardisland and Burcher, in the same county.

Permission to enter or photograph these remarkable buildings usually is given readily and their interiors are well worth examination. All round the walls are niches in which the birds rested and roosted, and the number of these shows that the old pigeon cotes must have housed large populations. When looking at them one gets the idea that their owners must have appreciated a pheasant or a wild duck as a change from the pigeon pies that they afforded.

R. HARRISON (Ludlow).

Shooting at the Popinjay in Belgium

A favourite sport in certain parts of Belgium is shooting with arrows at artificial birds, known as popinjays, and the high poles that support these targets can be seen on many village greens. The feathers representing the bird are fastened to the ends of the projections of an arrangement resembling a seven-branched candlestick that is fixed to the top of the pole.

Indoor ranges have been erected in order to enable the sport to be carried on in bad weather. The range in Bruges is situated in the suburb of St. Andre. It is a tower about 110 ft. in height and its interior is divided into two parts by means of a wooden partition in order to provide two shoots. In each section is a pole 94 ft. in height and the competitors shoot almost vertically upward towards the target fixed on it. The arrows used have blunt ends, and those taking part in the sport are protected from these missiles as they fall by wire netting projecting inward from the walls of the building.

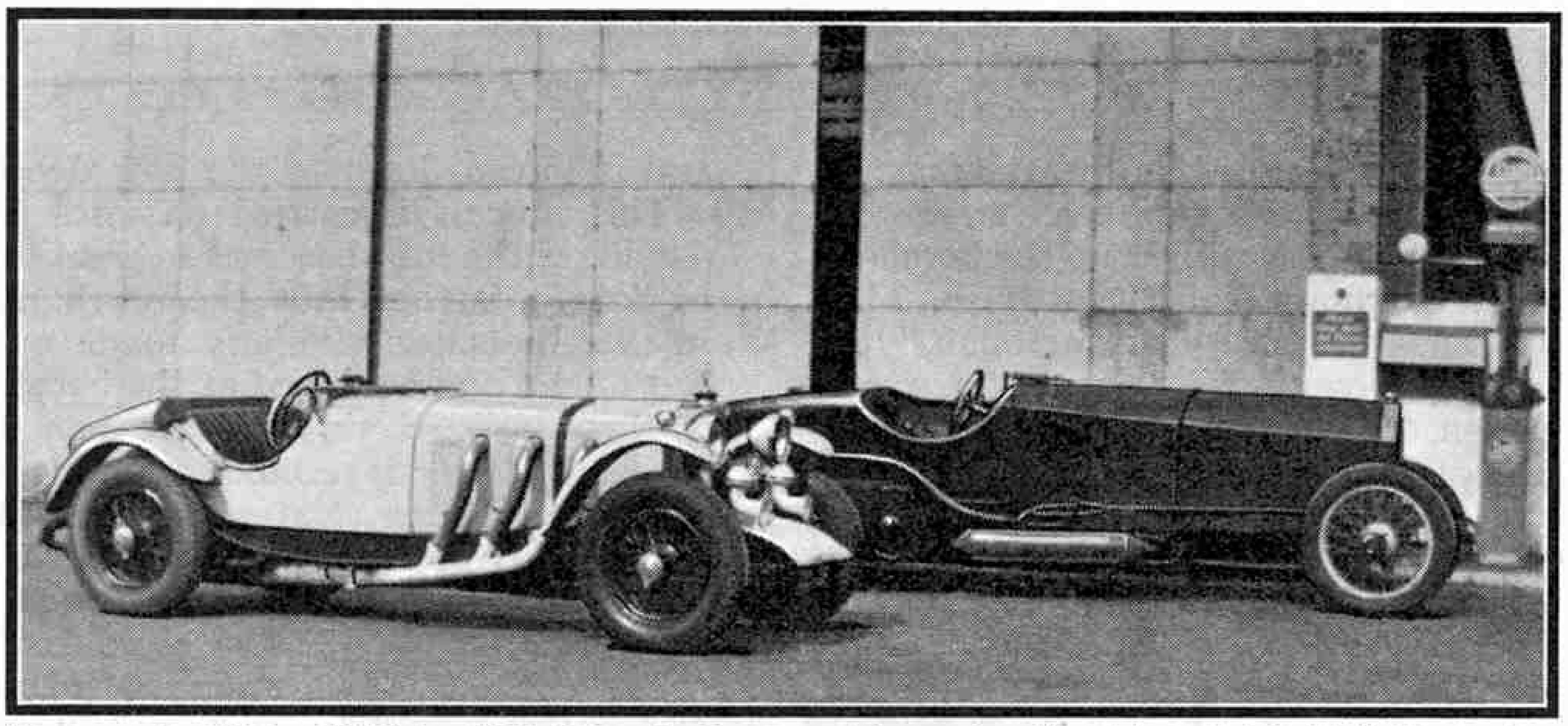
Shooting at the popinjay is an ancient pastime, and there are many reminders that in the past exiled Englishmen have indulged in it when living in Belgium. For instance, Charles II set up his court in Bruges after the Battle of Worcester and is said to have devoted a considerable proportion of his time to this sport. Among the relics preserved in Bruges is a volume in which the names of Charles and his brother, the Duke of York, are inscribed, together with a silver arrow presented by the then Duke of Gloucester.

It is interesting to find that the sport of archery is still pursued in Belgium. It is practised also in Great Britain, but no popinjay is used, the target being of the ordinary type, with zones marked by concentric circles.

S. W. E. KING (London, S.W.16).

Round Brooklands in a Racing Car

Most people place their first flight among their most cherished experiences. I certainly enjoyed my first trip in a de Havilland *"Moth,"* but my greatest ambition always was to travel at high speed round Brooklands track. This has now been realised, for recently I was invited to occupy the mechanic's seat of a 38-250 h.p. S.S.K. "Mercedes-Benz" sports two-seater about to make a run on the famous motor racing track.



The car on the left is a 38-250 h.p. S.S.K. "Mercedes-Benz" sports two-seater. Our photograph is by W. Boddy, London, S.E.27, who in an article on this page describes a run in the car at Brooklands.

We moved out of the Paddock and accelerated rapidly down the Railway Straight, with the super-charger screaming like a siren. The big white car seemed literally alive, and I held on tightly with both hands as we swept on to the steep banking. The wind pressed like a solid wall against my face, and as I had been unable to borrow a helmet and a pair of goggles, my eyes were soon swimming so much that I could scarcely see. A glance sideways showed me the stern face of my driver, concentrating on the task of controlling the car, and I suddenly realised that the speedometer needle was flickering at the 120 m.p.h. mark. We covered three laps, about $8\frac{1}{4}$ miles, before coasting quietly back to the Paddock, where I discovered that I was almost deaf, while my face was suffering from an acute attack of "pins and needles" as a result of the high wind pressure.

Later I spent a practice day with the well-known driver of a special "Mercedes" car, a rakish black and yellow racer. On this occasion the speed did not exceed 90 m.p.h., but there was no protection from the wind, so that although for this run I had obtained goggles, these were pressed hard against my face and the wind tore violently at my cheeks. Hot air rose in gusts from the engine, and the cockpit was uncomfortably hot. To add to my discomfort, my seat was devoid of the usual cushion, and the bumps on the track seemed to have doubled in number as we flew round the rim of the 28 ft. bank. The driver merely smiled as we rushed along, and signed to me at intervals to peer through a hole in the dashboard to see if all was well with the oil pressure.

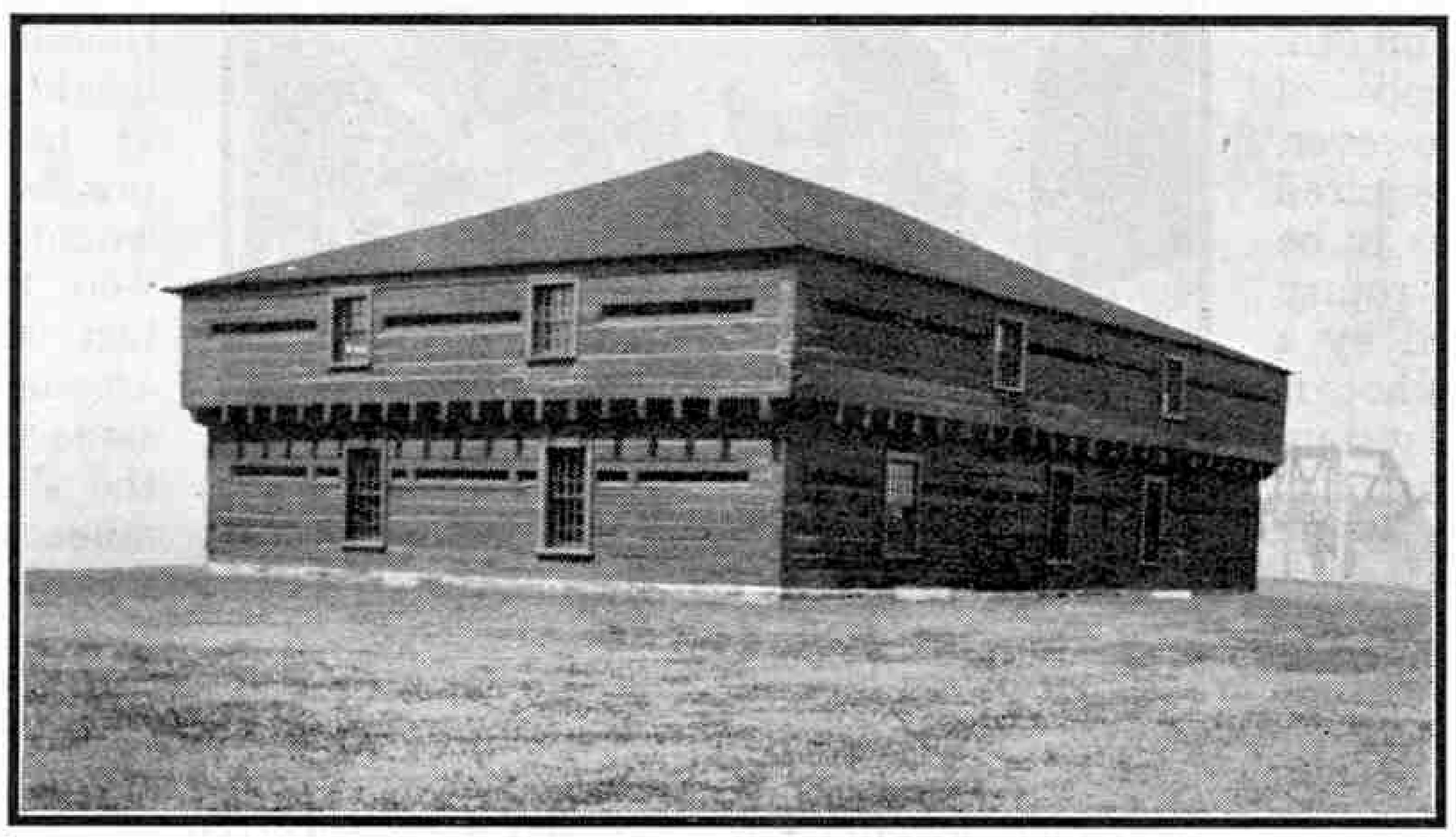
W. Boddy (London, S.E.27).

An Historic Canadian Fort

The accompanying photograph shows Fort York as it was when built in 1793 to protect the newly founded settlement, then known as York, that since has grown into the large city of Toronto. The Fort then stood on the shore of Lake Ontario. The edge of the water has been pushed back steadily as modern industry has demanded more and more land, however, and the Fort is now in the heart of the city, surrounded by railway sidings and factories.

Fort York earned no special distinction during its first 20 years of existence. Then came the American War of 1812, and in 1813 its weak garrison, outnumbered by four to one, was overpowered by invaders from the United States in spite of a stubborn resistance. The Fort was practically in the hands of its assailants when the magazine accidentally exploded, mortally wounding General Zebulon Pike, one of the American leaders. The town of York capitulated and its Parliament Buildings were destroyed, while the Speaker's mace was carried off as a trophy of war.

In 1834 York became the city of Toronto, and the centenary celebrations of last year were marked by the restoration of the Fort to its original condition and the erection within it of the Pike Memorial Cairn, on which were placed two tablets, one in memory of General Pike and his victorious American forces and the other in honour of the British defenders.



Blockhouse No. 2 in Fort York, Toronto, which was built in 1793 and has now been restored to its original condition. Photograph by E. Flinn (Toronto).

I visited the Fort on 4th July, 1934, when for the first time since the conclusion of the war of 1812 American soldiers and sailors bearing arms and colours marched on to Canadian soil. They were joined by a guard of honour from the Toronto Regiment, and with flags flying and drums beating all marched into the Fort. There a hollow square was formed about the Memorial Cairn, and with impressive ceremony the historic mace, which had lain in captivity for more than 100 years, was presented to the Lieutenant-Governor of Ontario. I felt that this magnificent spectacle was a brilliant climax to 120 years of peace between Canada and the United States, for the two nations now met in friendship inside the earthworks of old Fort York, where once they had met in war. E. Flinn (Toronto).

Sinking Deep Wells in the North Downs

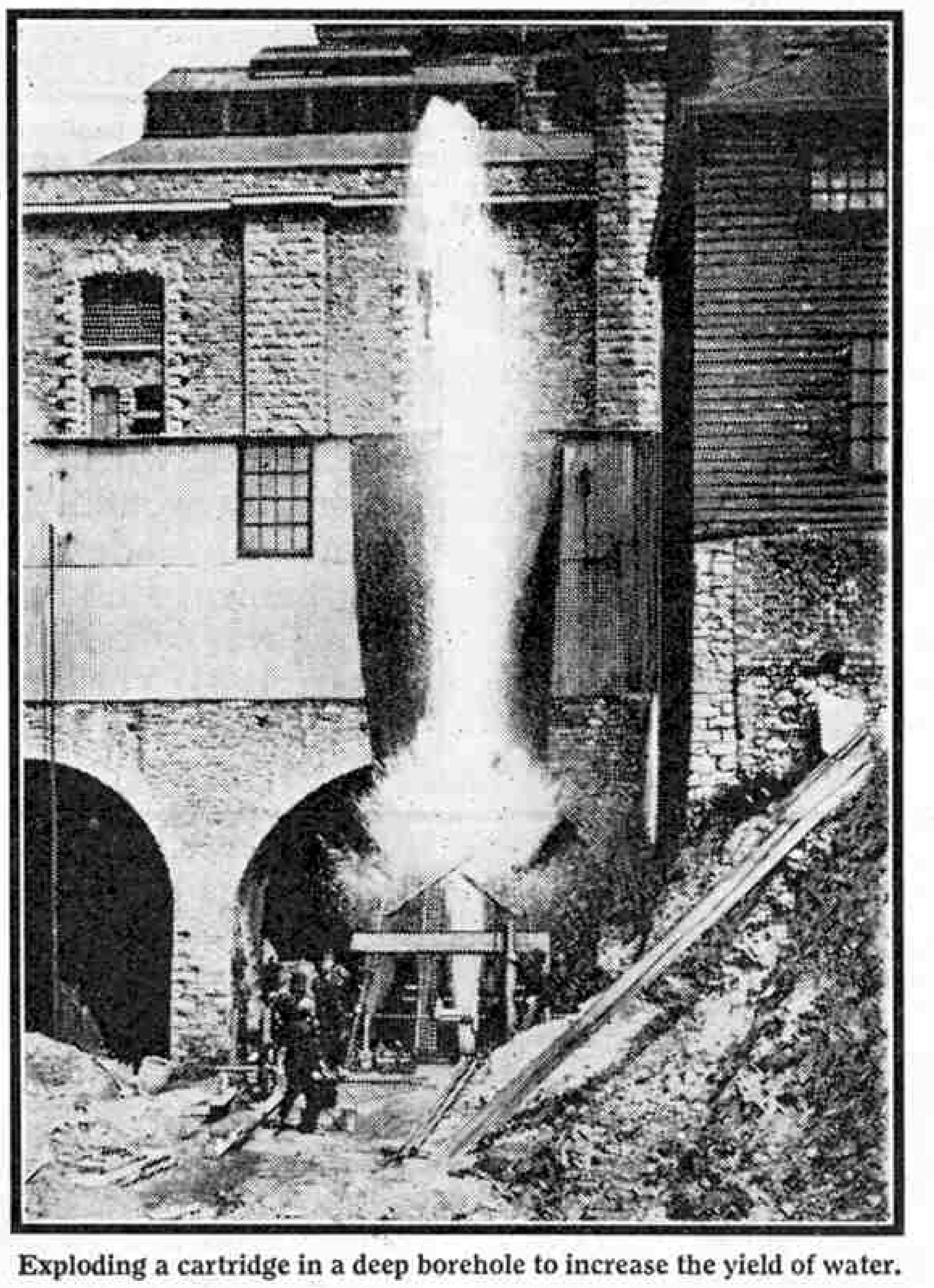
III.—Penetrating the Lower Greensand

By W. Coles Finch, M.Inst.C.E.

IN 1123 a deep well was being sunk in the Province of Artois, France, when suddenly a subterranean water-course was penetrated. The water rushed up the borehole in great volume and overflowed at the surface. This abundant well is recalled in the term "artesian," by which wells producing an overflowing supply of water have since been known. The term is used more loosely nowadays, and is applied also to deep wells that do not overflow.

An artesian well is a perpendicular borehole up which the water rises to its rest-level, called the "artesian rest-level," and not necessarily at the surface, producing a constant flow of water. Natural hydrostatic pressure forces the hidden water upward when the boring tool pierces the overlying impermeable strata and provides the water with an outlet. I am assuming of course that there is no natural flaw in either the upper or the underlying strata, by which the water might escape and disappear into some other stratum.

The preliminary arrangements for sinking an artesian well are similar to those necessary for sinking a well by percussion boring as described last month. There are various methods of making the borehole, however, and different tools are required for them. If the boring has to be done through hard rock, a rotary system of boring, invented by a Swiss engineer named Leschot, is sometimes adopted. In this system rows of Brazilian black diamonds are embedded in the edges of the tool, projecting so as to cut through the rock. The diamond rock drill is now largely supplanted by the shot drill, however, in which the diamonds are replaced by hard steel shot running loose underneath the crown of the drill. The pressure on the shot by the weight above causes them to cut a ringed-shaped groove in the rock, leaving a solid core that is brought to the surface. The "slurry," or rock ground away by the shot, is washed up to the surface by water passed down inside the tool.


Exploding a cartridge in a deep borehole to increase the yield of water.

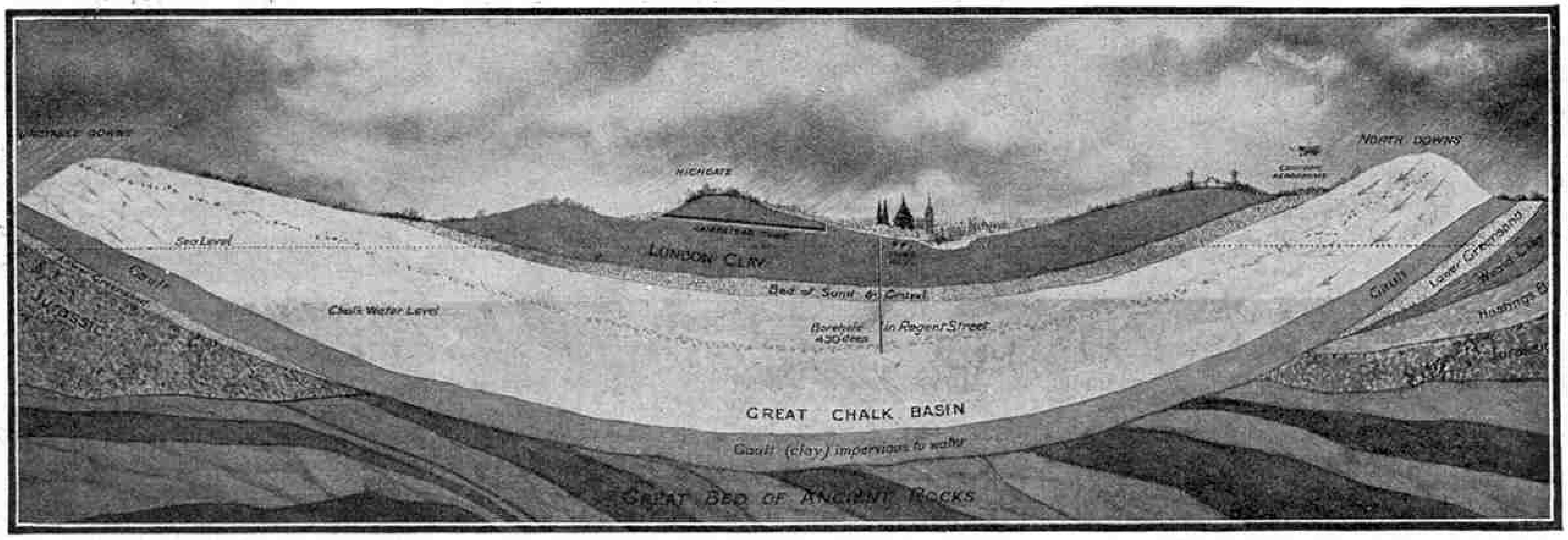
As the borehole increases in depth, the sides, whether of chalk rock, clay or sand, may begin to fall in. Boring is then stopped, and a steel tube made up of long lengths screwed together end to end is inserted into the hole. The bottom end of the tube is equipped with a steel shoe to assist in cutting off any obstructions to its descent. Boring is then continued through the tube until a few more feet have been cut, when there is a pause while the slurry is removed and the tube is increased in length and is forced down to the new depth.

This process is carried on until the friction on the outside of the tube becomes so great that the tube cannot be forced farther into the earth. A tube of slightly smaller diameter, similarly made up of lengths joined end to end and equipped at the bottom end with a shoe, is then inserted through the one already lining the borehole. Boring is resumed and is continued until at last the water-bearing stratum is penetrated and the water rises quickly up the tube. A perforated pipe is then forced down the well into this stratum. The holes in the pipe allow the water to enter, but prevent the admission of sand or rock.

In order to increase the yield of a well a powerful explosive is sometimes lowered down the borehole and ignited by electricity. The explosion fractures the water-bearing stratum and widens existing crevices and fissures in it, often with remarkable results as regards increasing the water supply.

The Passy borehole at Paris is a notable example of an artesian well. It was begun on 15th September 1855, and is 1,923 ft. deep and 28 in. in diameter at the bottom. The well emits a continuous stream of water to a height of 54 ft. above the ground, at the rate of 5½ million gallons per day, but its enormous output would be diminished if other wells were to be sunk near to it. This fact was proved at the Grenelle artesian well, which pierces the same stratum as the Passy, when the sinking of another well two miles away greatly reduced the flow of water. The water-bearing stratum penetrated by these deep wells is 1,798 ft. below the surface of Paris. It is known as the Lower Greensand, and is imprisoned by an overlying stratum of a clay called Gault, above which are the Upper Greensand and chalk, and finally a stratum known as the Tertiary formation.

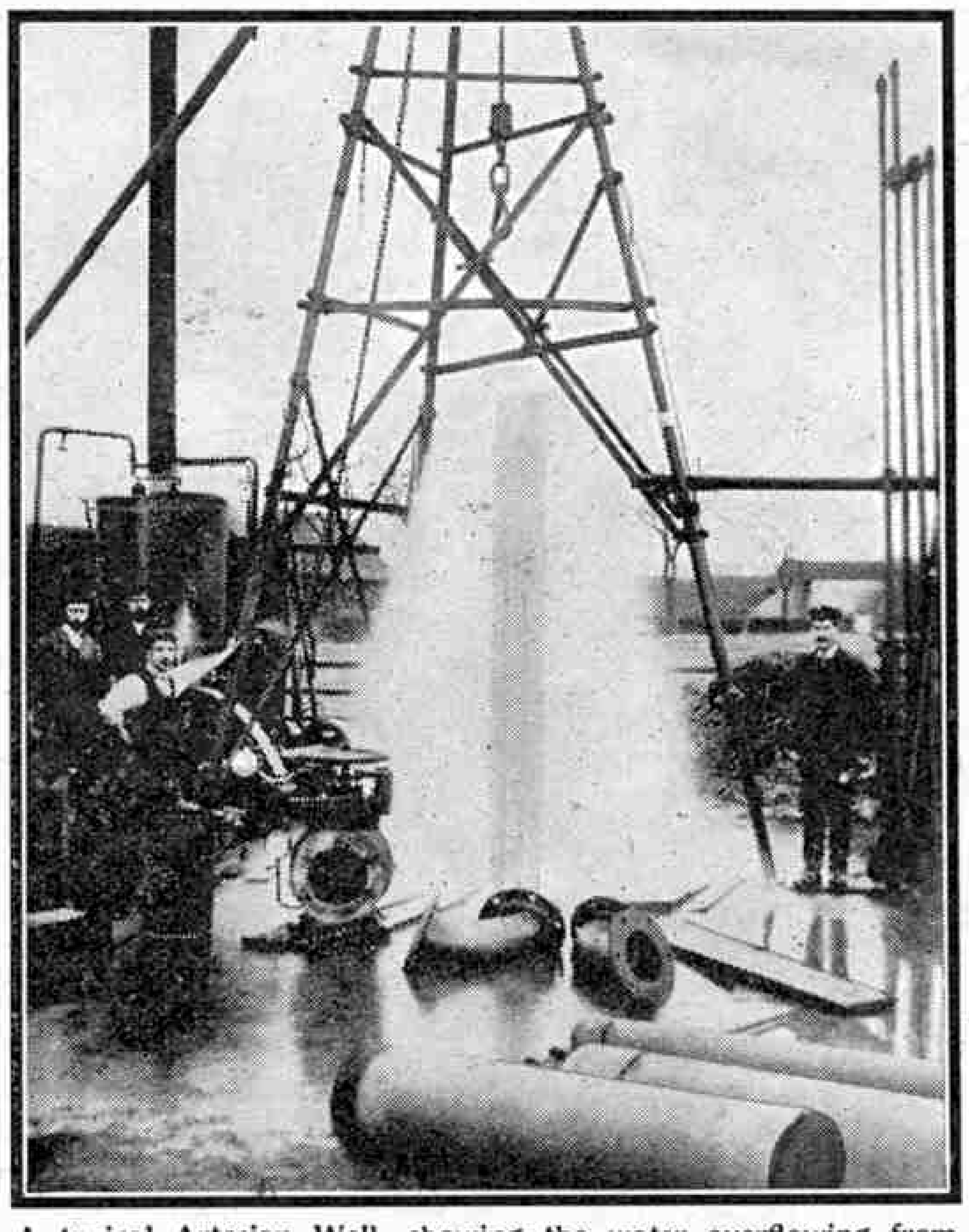
The Lower Greensand is one of the important water-bearing series of the cretaceous or chalk system. It derives its name from the presence in some of its sands of tiny grains of a green mineral called glauconite, which in places is present in such enormous quantities that it gives the stratum a decided green appearance. The water of the Lower Greensand has the peculiar property of being remarkably soft. This term is used when the water contains only a very small proportion of the salts of the earth, such as sea-salt, gypsum, and chalk, or lime. Water that is highly charged with these salts is referred to as hard.



London obtains many million gallons of water daily from numerous artesian wells sunk deep into the chalk formation of the London Basin. A study of the accompanying illustration of a section of this Basin will show that rain falling on the chalk outcrops percolates downward to the chalk formation, which lies between two impermeable beds, the upper one of London clay and sand and the lower of Gault clay. The water obtained from the wells is clear and sparkling, but is hard.

It may be wondered how it comes about that rain water, which is soft, is only slightly harder when obtained from the Lower Greensand under Paris, but is very much harder when obtained from the chalk formation of the London Basin. Referring again to the drawing of the London Basin, and tracing the passage of the water, it will be seen that its journey, from the time it falls as rain until it issues from the well, is entirely through the chalk. Thus it picks up and holds in solution the properties that result in its increased hardness. The water in the Lower Greensand under Paris percolates through sand beds, however, and on this account is entirely free from the lime properties of the London water.

The ideal conditions for artesian wells are not always of the basin type. The North Downs are an example of a continuous dip or slope in the beds of rock, sand, etc., providing the necessary condition for artesian wells. In the Medway Valley it is possible to obtain, as the product of the same shower of rain, both hard water from the chalk and soft water from the bed of the Lower Greensand far beneath it. The water-bearing strata are separated by an impervious bed of Gault clay some 200 ft. thick, and the water from the deeper source, having never come into contact with the chalk rock, remains soft.



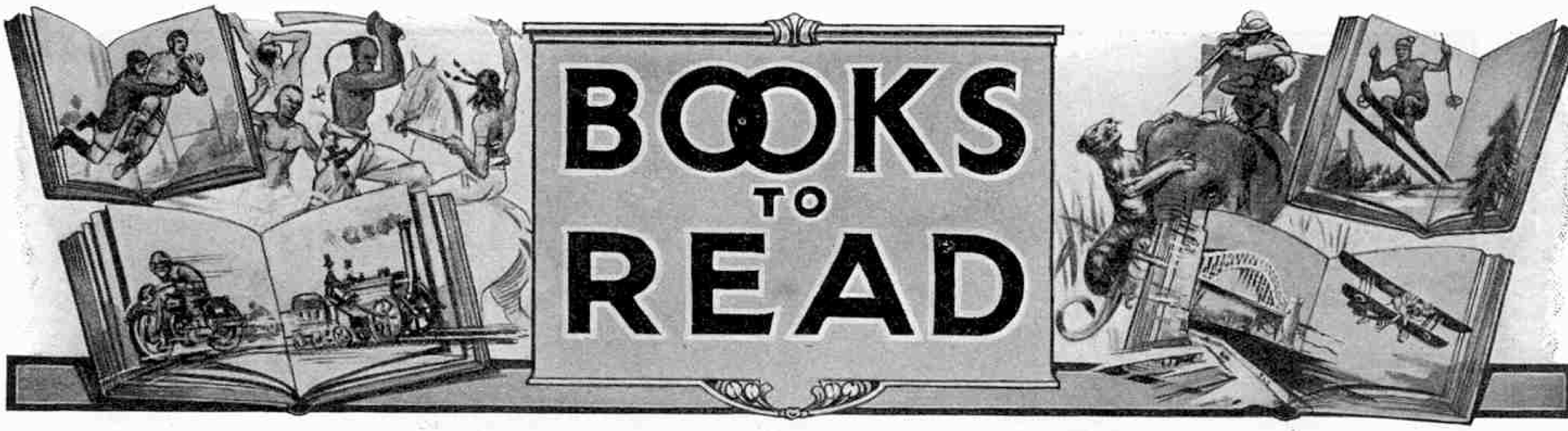
A typical Artesian Well, showing the water overflowing from the top of the tube that conducts it from the water-bearing strata far below to the surface.

(Top) Sectional diagram of the London Basin, showing how water percolating through the chalk is stopped by the impervious clay. Our illustration is reproduced by courtesy of Le Grand, Sutcliffe and Gell Ltd., London.

Artesian wells sunk into the chalk formation provide a simple source of water supply and are much more reliable than those sunk into the sand beds, which require very careful handling and are often a great anxiety to the water engineer. I recall an artesian well of the latter kind that caused me much anxiety, and on which a large amount of money was expended in vain, for it defeated all my ingenuity and resource and eventually ceased to yield any water. The well terminated in the upper stratum of the Lower Greensand. It had been in operation a few years when the yield began to decrease, and investigation revealed that the artesian rest-level of the well was about 30 ft. lower than it was originally. I therefore removed the top 30 ft. of tube, and the well immediately resumed its normal yield, but at the new rest-level. A year or two later the yield diminished again, and once more the normal supply was restored by the method just described. Then a further failing of the yield occurred, and as no sand troubles had arisen it was evident that the water-bearing stratum pierced by the well was showing signs of depletion. I therefore deepened the well, but the quantity of water then obtained was considerably less than it had ever been—a very discouraging state of affairs.

At this stage a remarkable discovery was made. It was found that 400 tons of sand had blown into the pipe, and had been carried up it by the rush of water under pressure and deposited in the chalk formation, filling up the chalk adits, which were 9 ft. high. Curiously enough this had taken place without choking the pipe. The task of clearing it was put in hand and soon all that could be picked up from the bottom of the pipe were nodules of rock. They were from the bed of rock that separates the overlying treacherous Gault clay from the water-bearing formation of the Lower Greensand. In the ordinary sense the bed is not a solid mass, but is rather a thick layer of loose rocky nodules.

As the sand disappeared up the well, the nodules, under pressure of the overlying 200 ft. stratum of clay, fell into the gap. Their fall released the clay, and this collapsed to such an extent that eventually it encircled the perforated pipe. The water obtained from the well was no longer clear, but was a thick, dark grey stream, owing to having passed through the fallen clay before entering the well. Then another fall of clay occurred, and the yield of water ceased entirely.



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, Binns Road, Liverpool 13, adding 1/- for postage to the price. Postage on different books vary, but any balance remaining will be refunded.

"Deep-Sea Diving"

By David Masters. (Nelson. 2/6 net)

No stories are more thrilling than those of the salvaging of wrecks, the recovery of sunken treasure from the bottom of the sea, or the rescue of the unfortunate men trapped in sunken submarines. Those who enjoy such stories will welcome Mr. Masters' account of deep-sea diving. It covers every phase of the subject, and is written by one who is himself a successful and experienced diver, and thoroughly understands the technical aspects of every problem that diving can present. In addition the author is able to describe in a satisfactory manner the methods employed and to recount the adventures met with by divers so that readers can share the thrills.

The first chapter traces the development of diving from the days of native pearl fishing and Greek sponge diving to the invention of the flexible diving dress in 1819 by Siebe, and is followed by a description of the splendid equipment now at the disposal of the diver and an account of the manner in which his work on the sea floor is carried out. One of the most important of the diver's tasks is the examination of wrecks and the preparation for raising them or for recovering valuables lost in them. Among the many interesting stories of this kind told in the book is that of the recovery of the gold sunk when the "*Laurentic*" was wrecked off the northern coast of Ireland early in 1917. Atlantic gales had broken up the vessel and the gold had vanished into the sea bed below the ship. Divers wrestled with a vast tangle of torn plates, splintered wood and twisted pipes, all covered by silt, and were continually interrupted by storms that buried the gold deeper; but they toiled with astonishing perseverance until they recovered 2,945 of the 3,000 bars that had gone down with the ship. Equal skill has been shown in the salvage of the German warships scuttled in Scapa Flow, where the "*Bayern*," a heavy 28,000-ton battleship, has been raised to the surface after many months of heart-breaking work.

Other thrilling hunts for treasure in various parts of the world are described, and the stories recount many hairbreadth escapes of divers threatened with death by mishaps to their equipment, attacked by sharks, whales and other creatures of the deeps, or faced by pirates eager to loot their recovered treasures. The rescue of the crew of K22, and the subsequent salvage of the vessel, reveal the skill, daring and persistence of divers who groped in darkness in the mud and ooze at the bottom of the sea to release their imprisoned comrades; and a full account of the recovery of the gold of the "*Egypt*" includes a detailed description of the steel cylinder in which the diver directing the working of the grab was suspended 400 ft. below the surface. The story of the search for the "*Egypt's*" gold is one of the greatest romances of deep-sea diving.

The four plates include a photograph of the author about to make a descent at Scapa Flow to examine a sunken German warship, and together with a series of explanatory drawings in the text add to the attractions of a book that has both scientific and human interest.

Mr. D. Masters getting ready to examine one of the German battleships sunk at Scapa Flow. (From his book, "Deep-Sea Diving," reviewed on this page.)

"Dinghy Sailing Simply Explained"

By Geoffrey Prout
(Brown, Son & Ferguson. 1/- net)

Although it is true that only by practical experience can the art of sailing be mastered, yet it would be foolish to plunge straight into practice without first acquiring some knowledge of theory. As the author says: "Most young people learn to sail by pushing off and messing about in a sailing boat. They learn, right enough, but not in the best way. The best way is to study the theory of sailing, then put out in a safe, lightly-canvassed sailing boat, and apply all you have learnt by study in actual practice." In this small book the author explains in simple language everything that is necessary to the successful handling of a sailing dinghy. Anyone who masters the contents of the five short chapters will be in a position to commence practical operations with confidence, and will be saved from many disagreeable experiences that otherwise might be his lot.

"Scale Model Aircraft"

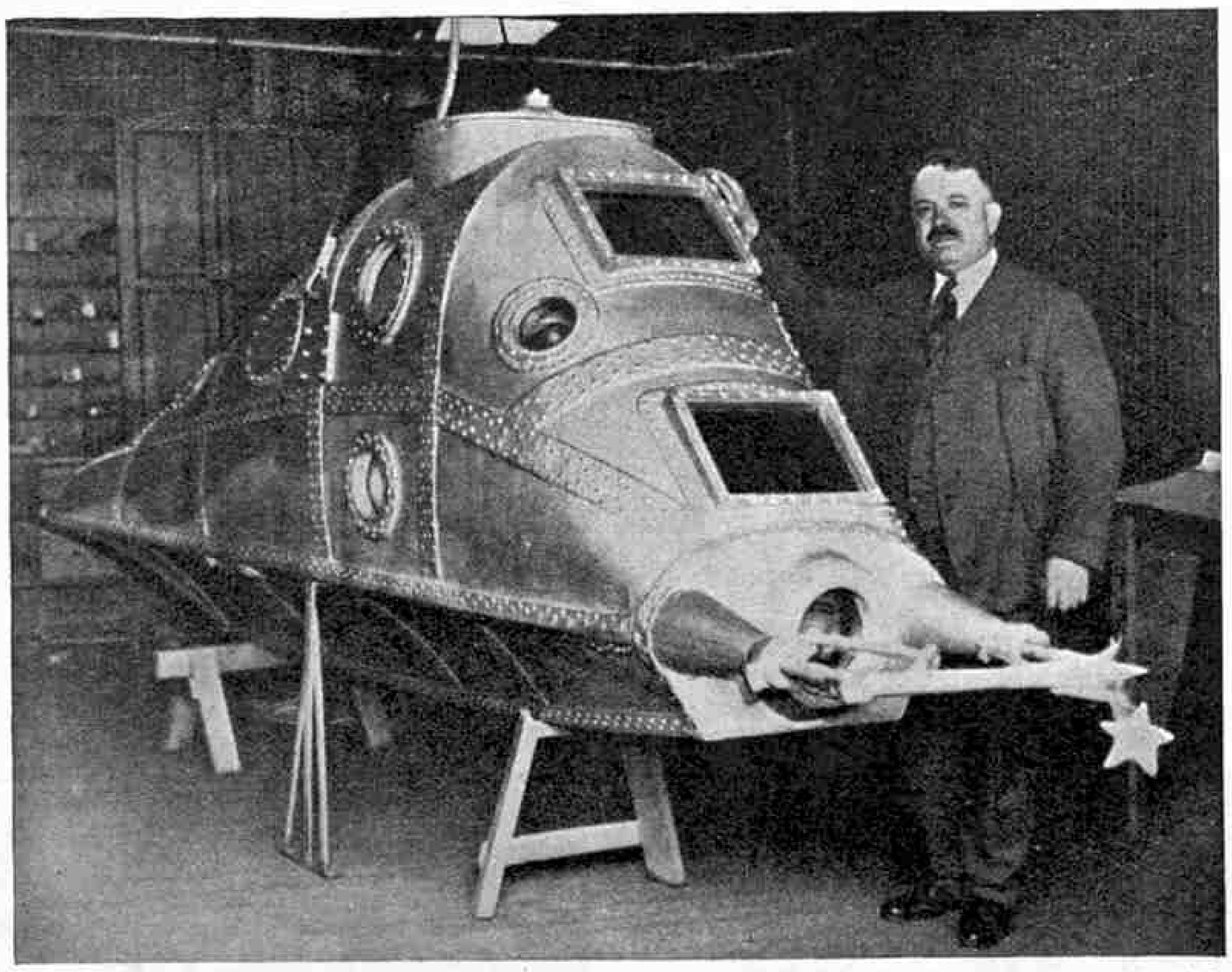
By James H. Stevens
(John Hamilton Ltd. 5/-)

There is something very fascinating about the building of a miniature replica of any object. The author of this book has experienced the fascination since he was twelve years old, and he now makes available to all model-builders the results of his experience in constructing scale model aircraft. He gives detailed instructions and scale drawings for the building of the Hawker "Hart" day bomber, and directions for the painting of the model. He gives in addition general instructions, also with scale drawings, for the construction of several other types of famous machines of varied design. The instructions are clear and easy to understand, and in conjunction with the scale drawings and numerous small line drawings make the model aircraft constructor's work comparatively easy.

"Recent Inventions"

By A. M. Low, D.Sc. (Nelson. 3/6 net)

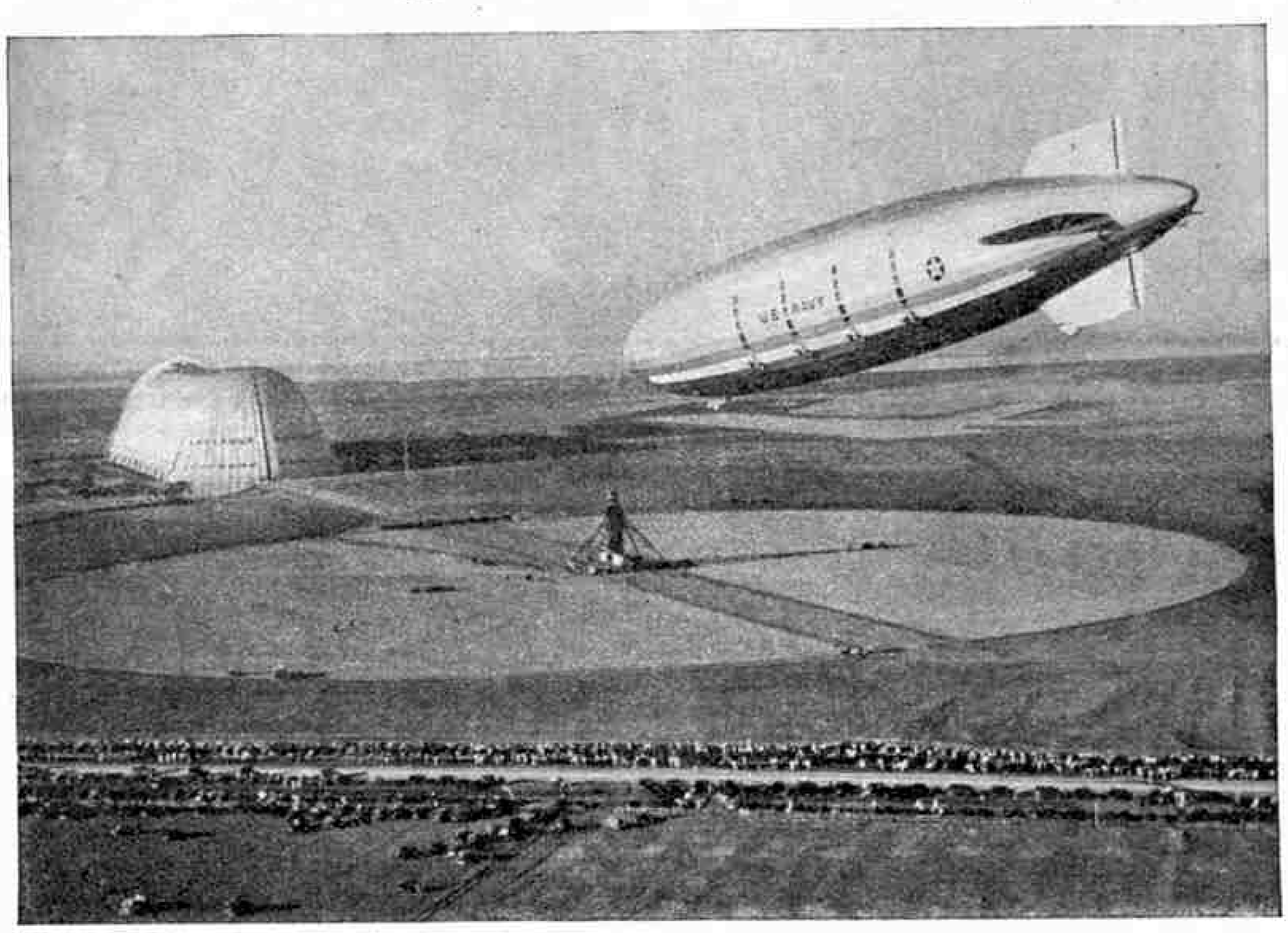
We have only to imagine a world without motor cars, cheap printing or wireless, to name only three of the great inventions of the last 50 years, to realise how backward and uncomfortable life would be without the products of the inventor. Apart from their importance in this respect, inventions fascinate all of us, and a book that tells the story of recent inventions is bound to be attractive. Dr. Low has undoubted qualifications for writing such a book, for he is himself an inventor and Vice-President of the Institute of Patentees; and he has produced concise but adequate accounts of work in practically every field in which inventors are busy.



The one-man submarine invented by E. Kulik. Steel claws in front of the device can easily pick up objects. (From "Recent Inventions" reviewed on this page.)

The author points out that only in very rare cases can one man claim an important invention, and that this usually is the work of a large number of pioneers, each of whom adds something, or improves a part already in existence, until at last an efficient piece of apparatus results. Consequently his book deals with invention, rather than inventors, and shows how in some cases crude experiments have been carried to successful conclusions, while in others inventions have awaited a single discovery, often from an entirely different sphere, before maturing.

Dr. Low covers every aspect of invention, mechanical, physical and chemical. He begins with television, which at the moment is of great interest to general readers; and without going into too much detail explains how the first mechanical television receivers were developed, and how the use of the cathode ray tube and short waves is completely transforming this branch of invention. This is followed by sections devoted to film making and talking pictures, and a short but important chapter on the new musical instruments that electricity and radio have already given us to supplement those that for centuries have been our only means of producing music.



The giant United States airship "Macon" arriving at Sunnyvale, California, her base. (See above.)

Inventions connected with transport are grouped together in the succeeding chapters. As would be expected, these are largely concerned with our entry into the Air Age. The author looks well ahead in the sections describing the autogiro, which appears almost to have solved the problem of rising vertically from the ground; the slotted wing, the greatest of safety inventions; the automatic aeroplane pilot; the provision of seadromes or artificial islands for use on flights across wide expanses of ocean; travel in the stratosphere, and propulsion by rockets. Other important topics similarly dealt with include new sources of power, traffic control systems, counting and calculating machines, and electric clocks, express lifts and many other invaluable devices.

The general reader will be particularly interested in the ideas expressed in the final chapters, which visualise an automatic world, indicate the value of waste or rubbish, which the ingenuity of the inventor has proved on many occasions to be only "matter in the wrong place," and suggest means for encouraging the inventor. The author points out that the only time Britain had a Ministry of Inventions was during the War, and rightly claims that the inventions of peace are as valuable as those directed towards destruction, and that their originators are equally worthy of encouragement and support.

The book includes 12 plates illustrating striking products of recent inventions.

"The Countryman"

Edited by J. W. Robertson Scott

(Vol. XI. No. 1. 2/6)

"*The Countryman*," the well-known quarterly review of country life and industry, celebrates its eighth birthday with this issue. Its value as a record of every phase of rural life has grown continuously during its comparatively brief career and it now contains 183 pages of reading matter, compared with the 74 pages of the average issue of 1928, while the increasing appreciation of its readers is shown by its circulation of 10,000 copies quarterly.

The contents of this birthday number include an article of special interest on life on Bardsey Island, where a small well-housed community supports itself in comfort, chiefly by agriculture. Mr. R. M. Lockley, the author of the article, is himself an island dweller, and his pictures of the days and nights of the islanders and of the wild life of the island have the attractive flavour that only the true nature lover can give.

Another interesting article is by an Austrian naturalist, who explains how he tames herons, ravens and other birds that are captive, and yet free to follow their natural instincts. Other contributions deal with practical points of great importance in connection with farming and fruit growing, and with the more romantic and picturesque side of country life. Exceptionally useful notes on pets, houses, recent books and miscellaneous topics complete an excellent issue.

"The Naturalist on the Prowl"

By Frances Pitt. (Country Life Ltd. 5/- net)

Miss Pitt is now well known as a writer on nature subjects, and her many admirers will welcome this account of the methods she employs in observing and photographing birds and beasts in their native haunts. The book is intended for the novice rather than for the experienced naturalist. Advice is given as to the best wearing apparel and other equipment for the worker in the field, and in regard to the use of the field glass and the telescope. Then follows a detailed description of suitable photographic apparatus and its use in a variety of circumstances, and of the hiding tent that is so indispensable for many classes of work. The remaining chapters are devoted to interesting descriptions of "prowls" at dawn and at dusk. The book on the whole is well written, but the author's obvious efforts to be "bright" involve her at times in very irritating sentences. The author's illustrations are excellent.

New Books

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

Our Own Times (Vol. 1)
by Stephen King-Hall (Ivor Nicholson & Watson, 10/6)

Birds of Great Britain
by W. P. Pycraft (Williams & Norgate, 7/6)

Rainbow Gold

The Romantic Dreams of the Alchemist

By J. Hinton Read

FROM very early times Man has shown an overpowering desire for gold, and centuries ago, before the great deposits of this metal in South Africa and Australia had been discovered, it was even more sought after than at the present day. From a vain longing for gold there sprang up the idea that it might be possible to make it. The early experimenters in this field were called alchemists, and they wasted much time and energy in efforts to produce the Philosopher's Stone, with which to convert other metals into gold. With these efforts went the search for the Elixir of Life, and at a later stage attempts to produce Alcahest, the universal solvent. As an ancient philosopher remarked, the search for this solvent was hopeless, for no vessel could be made to hold such a potent liquid.

To the alchemist the idea of the transmutation of metals seemed reasonable, for he had not the complete knowledge of chemical constitution that modern scientists possess and judged largely by appearance. He knew that glass melts on heating, to become solid again when cooled, and that water vaporises when boiled and leaves a solid residue behind it. He also saw in Nature many apparent transmutations, such as the hatching of a bird in an egg, or the growth of a tree from a seed, and could see no reason why a metal also should not change its form and grow. In his experiments his aim therefore was to hasten the processes of Nature by artificial means. This work could be attempted only by one who understood the secret of Creation, and success could be obtained only by the pure in heart. There was very little hope for charlatans and imposters, who regarded alchemy merely as a means for satisfying avarice, usually by extracting wealth from credulous victims.

Three reputed possessors of the Philosopher's Stone, which turned base metals into gold, are shown in this early 17th century engraving. From left to right they are Thomas Norton of Bristol, John Cremer of Westminster and Basil Valentine of Erfurt, Germany.

The general theory of the alchemist was that "Gold is the most perfect of metals because in it Nature has finished her work," as it was expressed by Roger Bacon, the famous English friar and scientist who is reputed to have discovered gunpowder. It was thought that metals differed only in the proportions of base materials they contained, and that the removal of the dross and impurities from such imperfect metals as lead, tin and copper would yield silver, and finally gold, the purest of all metals. It must be said in favour of the majority of the alchemists that they did not endeavour to make gold in order to gain untold wealth, nor must it be overlooked that they were the working chemists of their day and laid the foundation of chemical science.

The idea of transmutation probably originated with fraudulent efforts by goldsmiths to pass off inferior metals as gold. The beginnings of alchemy have been traced back very far, however, and many legends of its origin were current in mediæval times. According to one of these legends it was a gift from the fallen angels, who made it their business to teach mortals evil. Others ascribed its origin to Hermes, the alleged author of a famous treatise called "*The Emerald Table of Alchemy;*" to Tubal Cain, the earliest worker in metals mentioned in the Bible; or to Vulcan, the lame Greek god who was himself a blacksmith and metal worker. It has even been suggested that the Golden Fleece, which in the well-known Greek legend was carried off by Jason and the Argonauts, was really a treatise on gold making that had been written on a sheepskin.

In the early Middle Ages the most famous alchemists were the Arabians, and those who practised the art in that country were described by a traveller as "a set of stupidest fellows, for they mummified themselves with sulphur and other horrible stinks." The writer further alleged that the aim of these alchemists was to coin false money and that many had been punished for this crime by having one hand lopped off.

The search for the Elixir of Life, the second of the great ideals of the alchemist, was pursued in China before the beginning of the Christian era, and there was a legend that certain islands of the Pacific Ocean were inhabited by people who grew a flower that gave them exemption from the ordinary fate of Man. A Chinese Emperor of the early Christian era was passionately fond of the mysterious and occult, and on one occasion was delighted by the offer of a draught that would bestow everlasting life upon him. As he was about to drink the cup was suddenly seized by one of his ministers, who immediately swallowed its contents. In great fury the Emperor ordered the minister's immediate execution, but with complete self-possession the culprit pointed out that "any attempt on his life would be useless if the draught were effective, and the sentence of death would be unfair if he died." It is said that the Emperor was pacified on being faced with this extraordinary dilemma.

Alchemy reached its climax in the Middle Ages, and the laboratories in which its aims were pursued must have been awe-inspiring to the ordinary people of those times. Distillation seems to have been a favourite operation, and in the alchemical pictures that have come down to us huge stills, earthenware retorts and twisted glass "serpents" litter the floor of the vaulted chambers in which work is being carried on. The glowing furnaces light up weird flasks and crucibles, and in the dim light mysterious objects such as dusty crocodile skins, human skulls and bunches of dried herbs hanging from the rafters can be distinguished.

The longest and most tedious experiments were pursued with the utmost resolution, the alchemist bending over his bellows night and day in order to keep his fire burning brightly, or stirring clear liquids in curiously shaped vessels. The richer alchemists often had assistants to help them and servants busy with the less important work can be seen in the background in many 16th and 17th century prints. Most alchemists were unable to afford this luxury, however, and many lived in the depths of poverty. Some engravings show the alchemist throwing his last gold coin into a crucible in the hope of at last achieving success in the art of multiplying the precious metal, while behind him are his weeping half-starved wife and children.

The alchemists themselves contributed largely to the mystery that surrounded their operations, for they often expressed the results of their researches in the form of mystic symbolic pictures, and described their operations in language that the ordinary man could not understand. One object of this strange practice was to hide alchemical secrets from rivals, or from other people who were not regarded as fit to probe into their activities.

Many strange stories have come down to us that illustrate the general ignorance of the age in which the alchemists lived and the mystery with which those who practised the art were surrounded. One famous alchemist was Raymond Lully, who was born in Majorca in 1235. Lully turned his thoughts to alchemy after a wild youth and is reported to have transformed amazing amounts of base metal into gold. As if this were not enough to arouse wonder, it was believed by many that he had the power of turning himself at will into a red cock.

A painting by Teniers, a famous Dutch artist of the 17th century, showing an alchemist's laboratory. The alchemist himself is brightening up the fire beneath an alembic, or still.

Nicholas Flamelus of Paris was another alchemist who was reputed to have amassed great wealth, and it is related in his will that he had gained possession of the Gilded Book of Abraham, which he was able to interpret and put to good use. Reports of the wealth of Flamelus aroused the curiosity of Charles VI of France, who expressed a desire to see him, but according to one account the alchemist and his wife mysteriously died before a meeting could be arranged. This was not the end of Flamelus, however, for an 18th century physician met a mysterious individual who affirmed that Flamelus was still alive, although he had then reached the advanced age of 400 years! The explanation given was that the alchemist was unwilling to meet the French King and therefore had arranged for two logs to be buried in place of himself and his wife. In spite of his advanced age, Flamelus was said to be still interested in alchemy and to "consort with other addicts in appointed places" at intervals of 20 years.

Another Frenchman who dabbled in alchemy, but fortunately cannot be regarded as a typical alchemist, was Gille de Rais, who lived in the early 15th century. This man was a great soldier and became Marshal of France when only 25 years old. After the burning of Joan of Arc at Rouen he turned to a life of dissipation and eventually resorted to alchemy in the hope of regaining his lost wealth. He is said to have put into practice the belief that human sacrifice was necessary for success in the search for means of producing gold, and to have slaughtered hundreds of children before he was hanged for his crimes in 1440.

One of the mystical symbolic pictures used by Basil Valentine, of Erfurt, to describe chemical processes. The fiery dragon and other creatures represent the chemicals used.

One of the most famous of alchemists was Basil Valentine, a monk who became Abbot of Erfurt. Valentine is said to have hidden his works in a hollow pillar in his Abbey, where they were discovered many years later when a thunderbolt hit the building. He did much really useful chemical work while pursuing his researches, and is perhaps best remembered for his descriptions of antimony and its compounds. His account of this element is to be found in a book with the strange title "The Triumphant Chariot of Antimony," in which he remarks that "he who would write of antimony needs a great consideration and a most ample mind. . . . In a word, no man's life is too short to be perfectly acquainted with all its mysteries."

Another great figure in the story of alchemy was Paracelsus, who was born in 1493, and became the apostle of a new era in chemistry, that of the study of drugs and medicines and of the effect of chemicals on the human body. Some of his theories were ridiculous and disgusting, but he introduced many new medicines, among which were compounds of lead, copper, arsenic and mercury. Although tradition ascribed to him the discovery of both the Philosopher's Stone and the Elixir of Life, he despised alchemy and believed that the main object of chemistry should be to make drugs, and not gold. In his works he gave a vivid description of the physicians of his day, but the praise he accorded them seems queer to our modern ideas of the profession he followed. "They are not given to idleness" he said, "nor go in proud garments, often showing rings upon their fingers, . . . but diligently follow their labours, sweating whole days and nights by their furnaces. . . . They wear leather garments with a pouch and apron, wherewith they wipe their hands. They put their fingers 'mongst coals, into clay and filth, not into gold rings. They are sooty and black, like smiths and colliers, and do not pride themselves on clean and beautiful faces."

Paracelsus was very unruly and so violent in manner and language that he created many enemies and lost his official position as Professor at Basle. After various wanderings he died in poor circumstances at Salzburg in his 48th year.

Although alchemy generally has fallen into disrepute, the search for the Philosopher's Stone has continued to the present day but, like the purse at the foot of a rainbow, the goal of the alchemist has continually receded as he thought he drew nearer to it. Strange to say, he was right in one respect, namely his belief that the transmutation of the elements was possible. The chemical methods he tried would never have produced gold from base materials, however, and this particular transmutation, vainly sought for centuries, still defies all Man's efforts, although he has effected simpler changes of this kind by bombarding atoms with protons and other tiny missiles endowed with almost incredible speeds.

In certain cases the result of bombardments of this kind is to bring about rearrangements of the protons and electrons, the tiny charged particles that we now know to be the bricks of which the elements are built. It is interesting to realise that rearrangements of this kind take place spontaneously in the case of uranium, radium and other radio-active metals. The end of such changes in many cases is lead and in consequence the proportion of lead in the rare minerals containing these elements is slowly but continually increasing. In these cases therefore the alchemist's dream of the growth of metals is realised, but not to the extent that he and the old-time miners believed, for they were so sure that copper and other valuable metals increase in quantity in the earth that exhausted mines often were closed to await the growth of new metal.

Although to us the doings of the alchemist may seem absurd, we must regard him therefore as a figure of romance and mystery and a pioneer on the dim threshold of science.

New Meccano Models

Crane—Bascule Bridge—Automatic Tip—Stone Sawing Machine

THE crane shown in Fig. 1 is of a type fitted to motor lorries for breakdown work. It is provided with a fixed jib that hangs over the rear of the lorry, and the hoisting is operated by hand.

The base should be constructed first, and consists of a 5½″ × 2½″ Flanged Plate, to each end flange of which a Flat Bracket is bolted. Sector Plates are secured to the Flat Brackets and a 12½″ Angle Girder is bolted across the end of each Sector Plate. The Girders are braced by means of 12½″ Strips that are secured between their upper ends and the Flanged Plate. Bracing Strips are added to make the structure quite rigid.

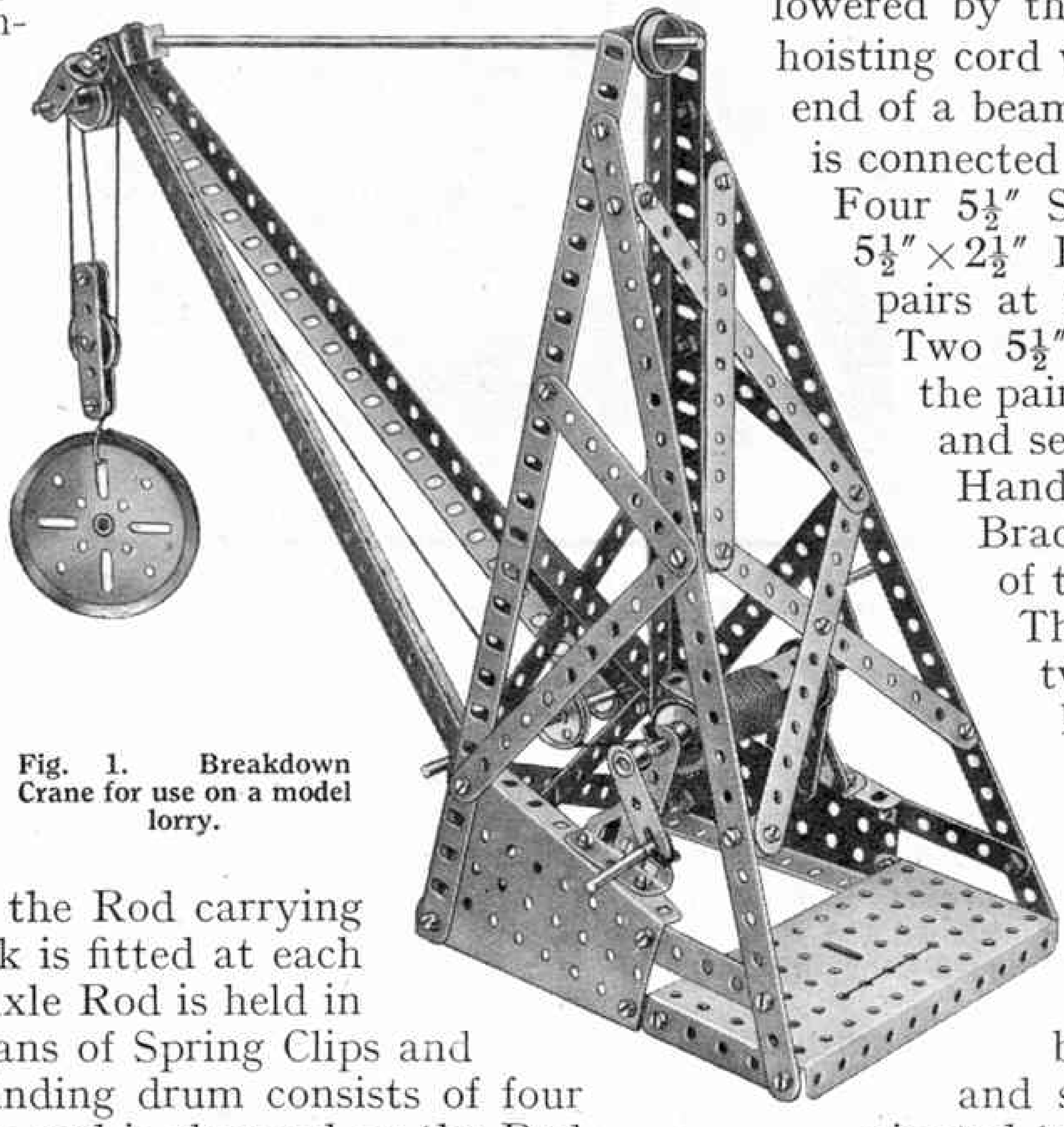


Fig. 1. Breakdown Crane for use on a model lorry.

Trunnions bolted to the Sector Plates carry 2½″ Strips forming journals for the Rod carrying the hoisting drum. A Crank is fitted at each end of the Rod and a 1½″ Axle Rod is held in place in each Crank by means of Spring Clips and serves as a handle. The winding drum consists of four 2½″ × ½″ Double Angle Strips and is clamped on the Rod by means of two 1″ Pulleys.

Two 12½″ Angle Girders are used for the jib and carry at their upper ends two 1″ × 1″ Angle Brackets and also a Cranked Bent Strip. An 11½″ Axle Rod connects the top of the jib to the apex of the vertical Angle Girders. A 2″ Rod is passed through the 1″ × 1″ Angle Brackets and carries two 1″ Pulleys. One of these is free on the Rod and is spaced from the fixed Pulley by Washers.

A single sheave pulley block is made from two 2½″ Strips and a loose Pulley Wheel. A 1″ loose Pulley and a Hook are inserted between the Strips and carried on ⅜″ Bolts as shown. The hoisting cord is attached at the upper end of the Strips and passed round one of the jib-head pulleys and then round the 1″ loose Pulley in the block before being led over the second Pulley at the jib-head. It then passes under a 1″ loose Pulley at the base of the jib and is wound round the hoisting drum.

Parts required for Breakdown Crane: 2 of No. 1; 11 of No. 2; 2 of No. 3; 6 of No. 5; 2 of No. 6a; 4 of No. 8; 2 of No. 10; 10 of No. 12; 2 of No. 12a; 1 of No. 13; 2 of No. 15; 1 of No. 17; 2 of No. 18a; 1 of No. 19b; 1 of No. 20b; 4 of No. 22; 2 of No. 22a; 14 of No. 35; 53 of No. 37; 3 of No. 37a; 2 of No. 38; 1 of No. 40; 4 of No. 48a; 1 of No. 52; 2 of No. 54; 1 of No. 57; 2 of No. 62; 3 of No. 111c; 2 of No. 126.

Bascule Bridge

Another interesting working model is shown in Fig. 2. In this case the lifting span of the bridge is raised and lowered by the operation of a Crank Handle. The hoisting cord wound round the handle is tied to the end of a beam that pivots about its centre and that is connected at its other end to the bridge.

Four 5½″ Strips are bolted at the corners of a 5½″ × 2½″ Flanged Plate and joined together in pairs at their upper ends by Flat Trunnions. Two 5½″ Braced Girders are secured between the pairs of Strips by means of Angle Brackets and serve to brace the structure. The Crank Handle is journalled in ½″ Reversed Angle Brackets that are bolted as shown to two of the 5½″ Strips.

The operating beam is built up from two 12½″ Angle Girders, each of which has two 5½″ Strips bolted to it. The inner ends of the Strips are connected by 2½″ Strips, and the two compound girders so formed are spaced apart at the ends by 2½″ Strips and are made rigid by cross bracing. Three 2½″ Strips are overlapped and bolted across the centres of the girders and secured to Double Brackets that are pivoted to the Flat Trunnions at the top of the vertical tower. Bolts are passed through the Flat Trunnions, each being held in its Flat Bracket by means of two nuts.

The lifting span is made from two 12½″ Angle Girders, the roadway being filled in with 12½″ Braced Girders and having a 12½″ Strip between the two. Two 5½″ Strips connect the roadway to the end of the upper beam, and the other end of the beam has two lengths of cord tied to it and attached to the Crank Handle. As the cord is wound in, the one end of the beam is pulled down and the other end raised, and in this manner the bridge is made to pivot about two Flat Brackets that are secured by Angle Brackets to the Flanged Plate.

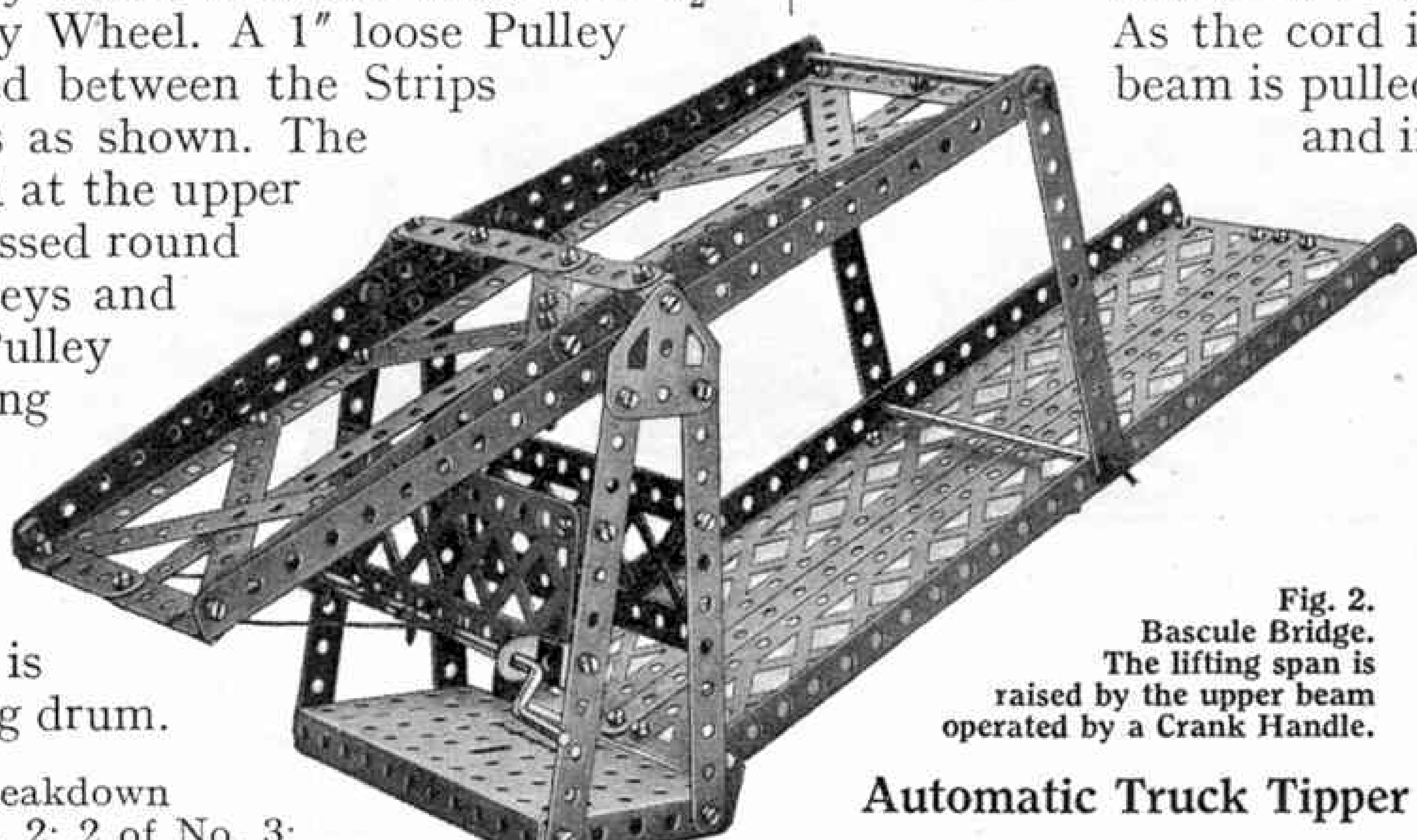


Fig. 2. Bascule Bridge. The lifting span is raised by the upper beam operated by a Crank Handle.

Parts required for Bascule Bridge: 2 of No. 1; 14 of No. 2; 2 of No. 3; 11 of No. 5; 2 of No. 6a; 4 of No. 8; 2 of No. 10; 2 of No. 11; 6 of No. 12; 2 of No. 15; 1 of No. 19; 7 of No. 35; 60 of No. 37; 6 of No. 37a; 2 of No. 38; 1 of No. 40; 1 of No. 52; 2 of No. 99; 2 of No. 100; 6 of No. 111c; 2 of No. 125; 2 of No. 126a.

Automatic Truck Tipper

Very interesting results are obtained from the model shown in Fig. 3. The hopper at the top of the inclined rails should be filled with some fairly fine material such as pea gravel. The truck is brought into position automatically and loaded, and as soon as it is filled it rolls down the incline and tips its contents. It then returns for another load, and the cycle of operations is continued so long as there is any material left in the hopper.

The track is composed of $12\frac{1}{2}''$ Angle Girders that are spaced apart by $2\frac{1}{2}''$ Strips. The lower end of the track is supported on two pairs of $3\frac{1}{2}''$ Strips, that are bolted to a $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip, and the upper ends of one pair of Strips project above the track to prevent the truck running off the end.

At its upper end the track is supported by vertical $12\frac{1}{2}''$ Angle Girders that are braced by $5\frac{1}{2}''$ Strips, and an additional Angle Girder is bolted across their lower ends to provide a rigid base for the model. At the upper ends of the vertical girders a $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate is bolted, and two Sector Plates are bolted between this and a second similar Flanged Plate. These Plates form the hopper, and immediately beneath them is a $3\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate that forms a

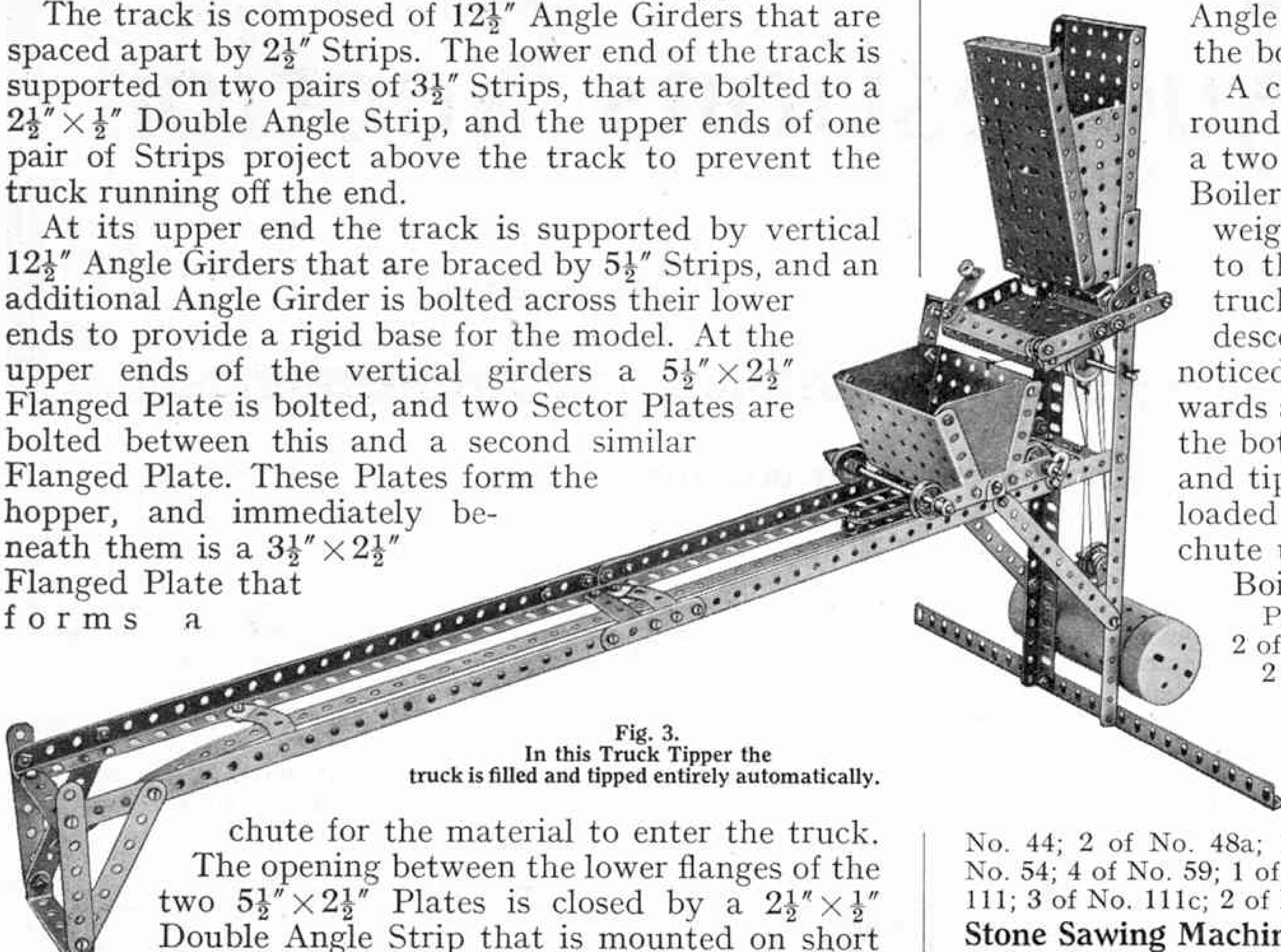


Fig. 3.
In this Truck Tipper the truck is filled and tipped entirely automatically.

chute for the material to enter the truck.

The opening between the lower flanges of the two $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Plates is closed by a $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip that is mounted on short pivoted arms. A Flat Bracket is bolted to a $1\frac{1}{2}''$ Strip forming one of these arms, and a $\frac{3}{4}''$ Bolt is attached to the Flat Bracket by means of two nuts. A $2\frac{1}{2}''$ Strip is pivoted on the $\frac{3}{4}''$ Bolt and is extended by another similar Strip overlapped two holes. The second Strip is pivoted to an Angle Bracket bolted to a $3\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip, which is inserted between the flanges of the $3\frac{1}{2}'' \times 2\frac{1}{2}''$ Plate and pivots about the holding bolts. It carries a Crank serving as a balance weight. When the opening below the hopper is closed, the pivoted arm closes the Double Angle Strip to prevent material sliding off the inclined chute. As the truck reaches the top of the track an Angle Bracket strikes the Crank and allows the material to slide off the chute into the truck, at the same time opening the trap beneath the hopper and allowing more material to fall out.

Two $3\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plates are used for the sides of the truck and are bolted to $3\frac{1}{2}''$ Strips. Cardboard is cut to the required shape for filling in the open sides. The bottom is partially filled in by means of two Flat Brackets at each side. These Flat Brackets are bolted to Angle Brackets, one of which can be seen in the illustration. The centre portion of the truck bottom is filled in with two Flat Trunnions that are bolted to a $2\frac{1}{2}''$ Strip. At the rear the Strip is bolted to a Double Bracket that is pivoted on the Axle of the $\frac{3}{4}''$ Flanged Wheels, and the front end of the Strip is extended by another $2\frac{1}{2}''$ Strip. An Angle Bracket is bolted to the outer end of this Strip and rests on the centre rail of the track. This rail is provided by $12\frac{1}{2}''$ Strips and to prevent projecting bolt heads obstructing the Angle Bracket, the Strips are clamped in place between pairs of transverse Strips. When the Angle Bracket is resting on the centre rail the bottom of the truck is closed.

A cord is tied to the truck and passed round pulleys on the vertical frame and in a two sheave Pulley Block attached to a Boiler End. The Boiler End is suitably weighted so that it pulls the empty truck to the top of the track, but when the truck is loaded gravity causes it to descend again to the bottom. It will be noticed that the centre rail slopes downwards at the lower end of the track so that the bottom of the truck is allowed to open and tip the contents. The truck being unloaded again, it is returned to the top of the chute under the influence of the weighted Boiler End.

Parts required for Automatic Truck Tipper: 2 of No. 1; 2 of No. 2; 6 of No. 3; 12 of No. 5; 2 of No. 6a; 7 of No. 8; 7 of No. 10; 1 of No. 11; 3 of No. 12; 1 of No. 12a; 2 of No. 15a; 1 of No. 16; 2 of No. 18a; 4 of No. 20b; 1 of No. 22; 2 of No. 22a; 1 of No. 23; 8 of No. 35; 84 of No. 37; 16 of No. 37a; 9 of No. 38; 1 of No. 40; 1 of No. 44; 2 of No. 48a; 1 of No. 48b; 2 of No. 52; 3 of No. 53; 2 of No. 54; 4 of No. 59; 1 of No. 62; 1 of No. 90; 4 of No. 90a; 1 of No. 111; 3 of No. 111c; 2 of No. 126a; 1 of No. 162.

Stone Sawing Machine

An Electric Motor is used for supplying the necessary power to drive the stone sawing machine in Fig. 4. Each side of the frame is composed of four $12\frac{1}{2}''$ Angle Girders that make up a square and the two sides are connected by $5\frac{1}{2}''$ Strips and $5\frac{1}{2}''$ Braced Girders. The sawing platform for supporting the work is composed of two $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plates supported on $2\frac{1}{2}''$ Strips. In the actual machine this platform is adjustable for varying the height of the work. The saw frame consists of pairs of Strips that swing on Axle Rods and the lower ends of the Strips are connected by two $5\frac{1}{2}''$ Strips overlapped eight holes. One of the Axle Rods supporting the saw frame carries a Crank that is bolted to the frame, and a second Crank that is connected to a rotating Bush Wheel.

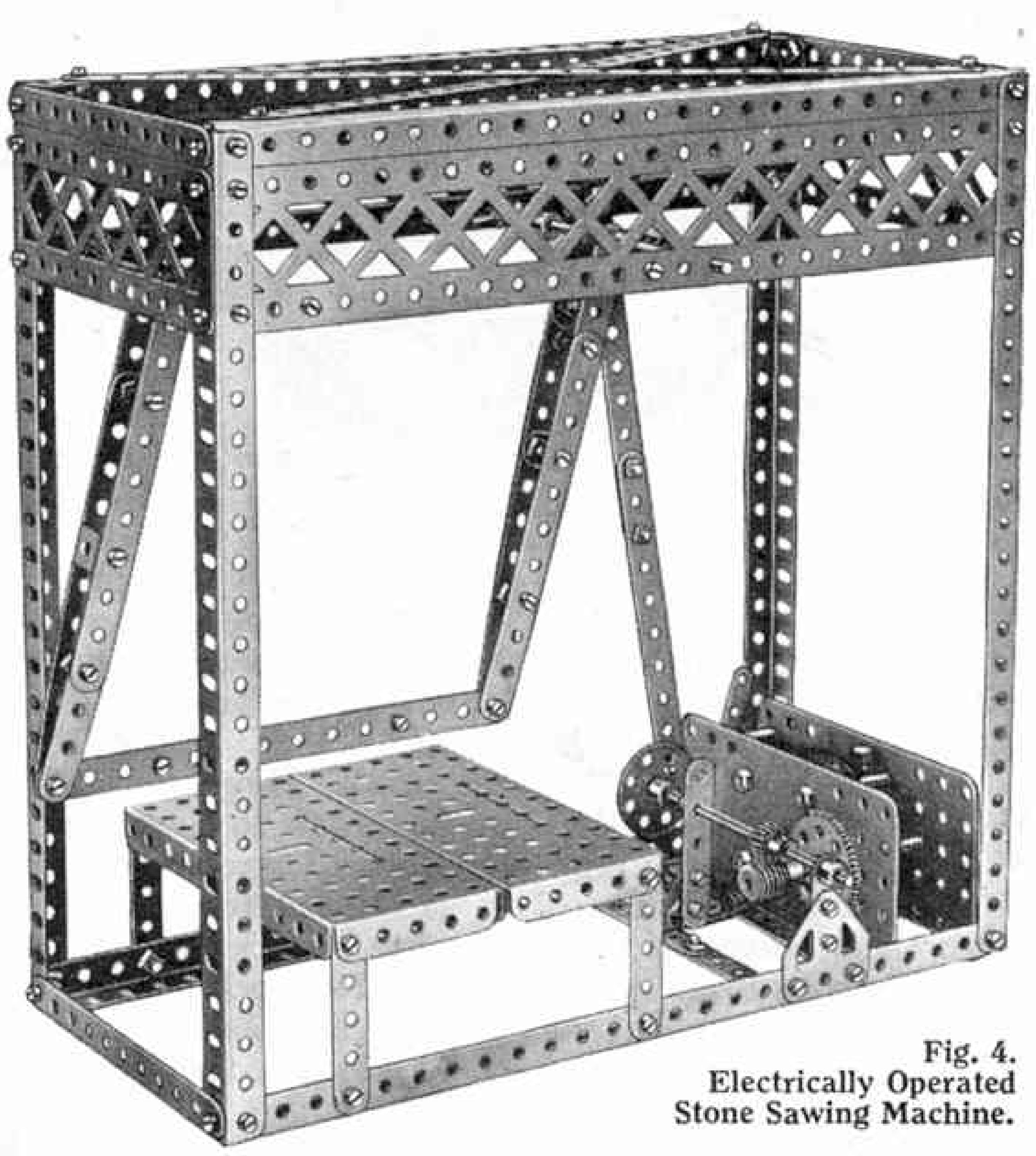
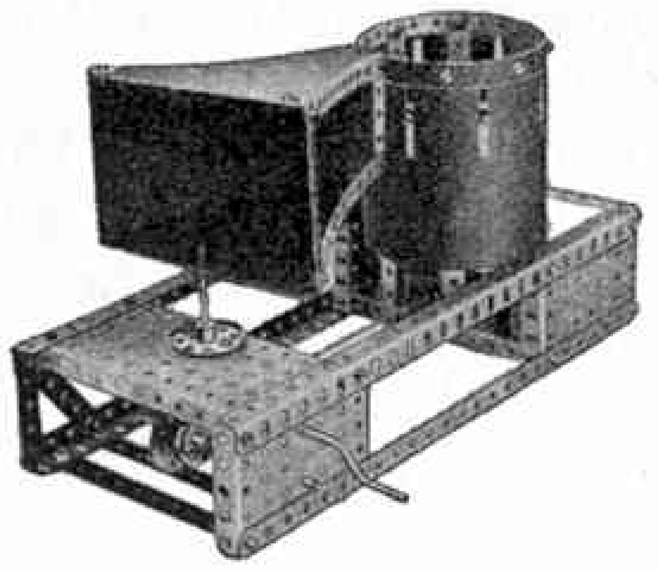


Fig. 4.
Electrically Operated Stone Sawing Machine.

The Bush Wheel is driven from the Motor which carries on its armature shaft a $\frac{1}{2}''$ Pinion driving a 57-teeth Gear. A Worm on the Rod of the Gear drives a $\frac{1}{2}''$ Pinion on the Axle Rod to which the Bush Wheel is secured. As the Bush Wheel rotates it causes the saw frame to swing to and fro.

Parts required for Stone Sawing Machine: 4 of No. 1; 3 of No. 3; 5 of No. 5; 1 of No. 6a; 8 of No. 8; 2 of No. 11; 1 of No. 15; 2 of No. 15a; 1 of No. 18a; 1 of No. 24; 2 of No. 26; 1 of No. 27a; 1 of No. 32; 6 of No. 35; 94 of No. 37; 2 of No. 37a; 4 of No. 38; 2 of No. 45; 2 of No. 52; 4 of No. 59; 2 of No. 62; 1 of No. 63; 2 of No. 99; 2 of No. 100; 1 of No. 126; 1 of No. 126a. No. E6 Electric Motor.

The four models described above will provide hours of interesting fun, and after they have been built as illustrated they can be rebuilt in other forms according to the ideas of the constructors.



Suggestions Section

Edited by "Spanner"

(329)—Four-movement Gear-box for Cranes

Cranes are very popular subjects for Meccano models. This is due partly to the fun that can be derived from the operation of the complete model, partly to the scope offered by a very wide range of prototypes, and partly to the interest that is to be derived from the designing of a model crane that will carry out all the movements of its prototype. Most cranes have four distinct movements—hoisting and lowering of the load; raising and lowering of the jib, or luffing as this movement is generally called; rotating of the superstructure, generally referred to as slewing motion; and travelling movement.

In some modern cranes a separate motor is provided for each movement, so that the various operations can be carried out simultaneously or independently as required. There are many cranes that have only one power unit, however, and a gear-box is provided to transmit the power to the different movements. For obvious reasons it is impracticable to have a separate Motor for each movement in a Meccano model, and a suitable gear-box must be designed.

A gear-box of this type forms a most interesting subject for Meccano construction and allows much scope for ingenuity. It is generally desirable that Meccano gear-boxes should be made as simple as possible, and simplicity is essential when very limited space is available. The possessors of small Outfits will appreciate the necessity for reducing the number of Gears to a minimum; and even constructors with a large range of toothed parts should not use more parts than are absolutely necessary to give the required movements. By minimising the number of Gears in use friction is reduced, and better results are obtained from a model; but sufficient Gears should be used to provide a suitable reduction ratio between the Motor and the driven shaft.

The gear-box illustrated in Fig. 329 has been designed specially for a small model crane or excavator, and provides the four movements necessary for such a model. A special feature of the gear-box is the method of utilising the travelling movement for slewing, this arrangement being suggested by A. Comfort (New Barnet). With this form of drive it is possible to make a more compact gear-box than is usually necessary in order to obtain four movements.

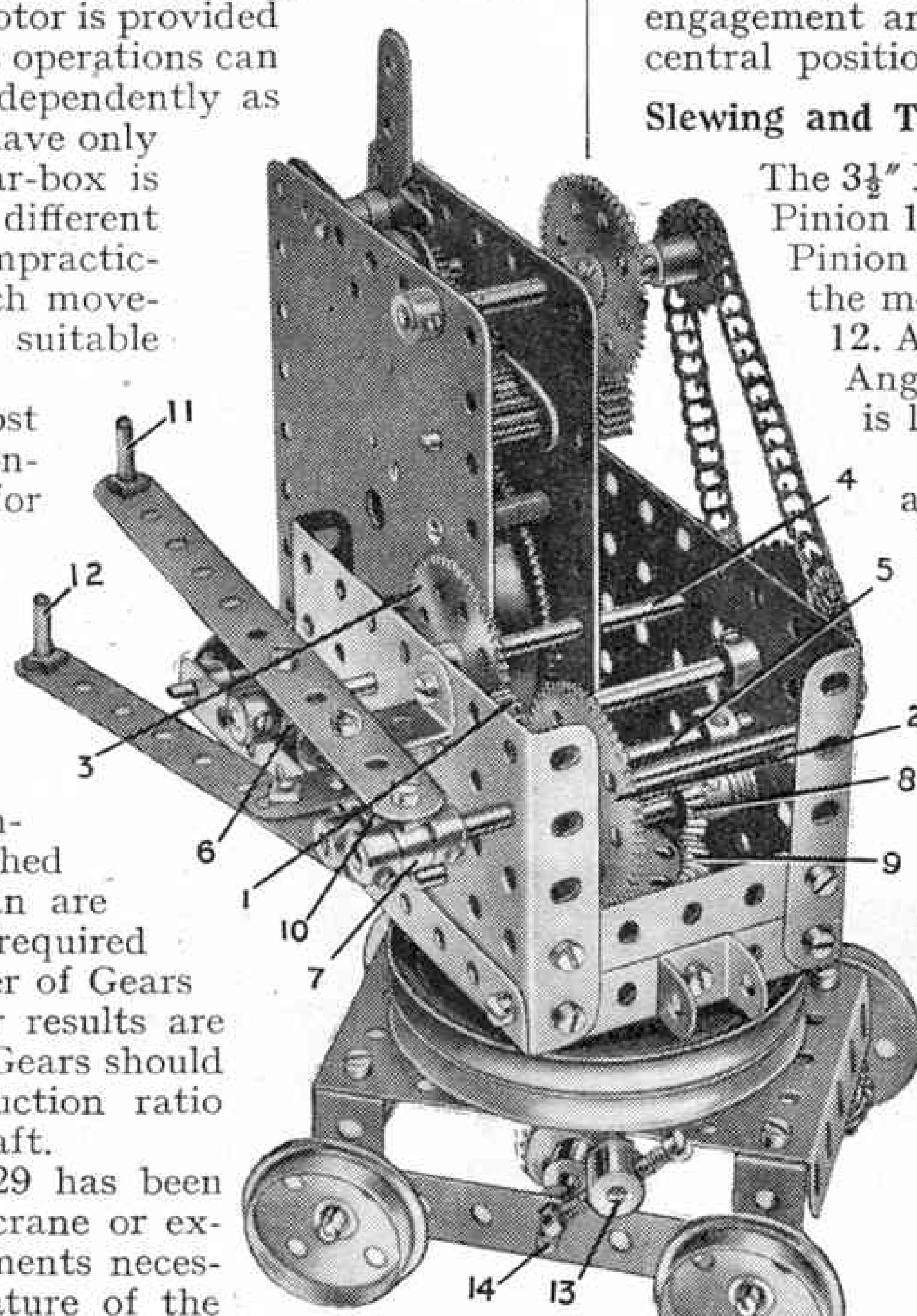


Fig. 329.

Construction of the Gear-box

The superstructure is built up on a $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate that is secured by means of $\frac{1}{2}''$ Bolts to a $3''$ Pulley Wheel, having the boss uppermost. The No. 2 Clockwork Motor is fixed in position by means of two $3''$ Axle Rods passed through the Flanges of the Plate, and through the Motor side plates. Collars on the Rods hold the Motor in position. The sides of the gear-box are formed by $3\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plates.

A $\frac{1}{2}''$ Pinion is carried on the Motor driving shaft, and engages a 57-teeth Gear on a $2\frac{1}{2}''$ Rod that is fitted with a $\frac{3}{4}''$ Sprocket Wheel. A length of Chain round this Sprocket drives a $1\frac{1}{2}''$ Sprocket on the Rod carrying the Pinion 1. It is this Pinion that drives the different layshafts in the gear-box. The hoisting shaft carries the 57-teeth Gear 2, and the luffing shaft carries a similar Gear 3. Cord is wound on to the luffing shaft at 4. It is important that the Motor and side Plates should be carefully lined up to ensure free rotation of the luffing shaft. The Rods of the Gears 2 and 3 are slidable in their bearings and their movement is controlled by the handle 11. The $5\frac{1}{2}''$ Strip to which this is secured is pivoted to a $1'' \times \frac{1}{2}''$ Angle Bracket, and bolts are passed through the Strip and inserted into the bores of the Collars 6 and 7. Nuts on the shanks of the bolts prevent them gripping their respective Rods, and the Collars are free to rotate between two fixed Collars on each Rod. When the handle 11 is moved over to the left of the illustration the Gear 2 is disengaged from the Pinion 1 and the Gear 3 is brought into mesh. In the right-hand position of the handle 11 the Gear 3 is out of engagement and the Gear 2 is engaged. When the lever is in the central position both Gears are out of mesh with the Pinion.

Slewing and Travelling Motions

The $3\frac{1}{2}''$ Rod 5 is journalled immediately below the Rod of the Pinion 1 and is slidable in its bearings. It is provided with a $\frac{1}{2}''$ Pinion that can be engaged or disengaged with the Pinion 1, the movement in this case being controlled by the handle 12. A $4\frac{1}{2}''$ Strip carrying this handle is pivoted to a $1'' \times \frac{1}{2}''$ Angle Bracket, and a bolt passed through the Strip is locked in the Collar 10.

Immediately below the Rod 5 is a $3''$ Rod carrying a $\frac{1}{2}''$ Pinion and the Bevel 8. The Pinion on this Rod is in constant engagement with the Pinion on the Rod 5, and when the latter Pinion is in engagement with the Pinion 1 the $\frac{1}{2}''$ Bevel 8 drives the $1\frac{1}{2}''$ Bevel 9. These Bevels provide both the slewing and travelling movements.

The $3''$ Pulley secured to the superstructure is supported by a second $3''$ Pulley that is fixed, boss downward, by means of $\frac{1}{2}''$ Bolts passed through a $3\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate. The Plate carries two $2\frac{1}{2}'' \times 1''$ Double Angle Strips and the Axles of the travelling wheels pass through these. The Axle Rods support two $3\frac{1}{2}''$ Strips that form bearings for the Rod 14. The $2''$ Axle Rod carrying the Bevel 9 carries two Washers beneath the Bevel and passes through the bosses of the two $3''$ Pulleys. On its lower end it carries a $\frac{7}{8}''$ Bevel that is spaced from the Plate by a Washer. The latter Bevel engages a similar part on the Rod 14, which carries also a $\frac{3}{4}''$ Sprocket Wheel. A length of Chain is passed round the Sprocket and round another $\frac{3}{4}''$ Sprocket on the Rod of one pair of travelling wheels.

When the Pinion on the Rod 5 is in engagement with the Pinion 1, the Bevels 8 and 9 transmit the drive to the Rod 14, which drives the travelling wheels. It will be apparent that if the turning movement of the Bevel 9 is impeded there will be a tendency for the Bevel 8 to run round it, thus slewing the superstructure. In order to lock the Bevel 9 securely to the base, a $2''$ Screwed Rod 13 is screwed into the boss of the lower Pulley. A handle is formed from a Threaded Boss that is locked on the Rod by a nut, and provided with two $\frac{3}{8}''$ Bolts. By turning this handle the Rod of the Bevel 9 can be gripped in the lower Pulley and thus the crane is made to swivel or slew. When the vertical Rod is released the crane travels along the ground.

This movement is quite satisfactory for small models, although there is a tendency for the crane to swivel if it encounters obstacles when travelling. This tendency could be overcome by fitting a brake to the upper $3''$ Pulley Wheel so that it is prevented from rotating while the crane is travelling. The brake could consist of a length of cord that is passed round the upper Pulley and secured to some form of tightening device on the base. A Screwed Rod fitted with a Threaded Boss and journalled in a Double Angle Strip is suitable for this purpose.

(330)—Combination Lock (S. C. Herbert, London, S.E.15)

The model shown in Fig. 330 is an interesting demonstration of the method of operation of a combination lock and can be put to practical use if required. The front of the lock is provided with a rotating dial and with a knob for withdrawing the bolt 8. The dial is mounted on the Rod 1 and consists of a Wheel Flange that is bolted to a Bush Wheel. A knob for rotating the dial is provided by a 1" Gear, and a strip of paper is gummed to the rim of the Wheel Flange and is marked with letters A to Z, and in addition with figures 1 to 10.

The Rod 1 carries a Collar fitted with the $\frac{3}{8}$" Bolt 2, the Collar being gripped securely on the Rod. Two Bush Wheels are free on the Rod and carry $\frac{3}{8}$" Bolts in their bosses, but the Bolts are prevented from gripping the Rod by means of nuts. When the dial is turned the Bolt 2 strikes the shank of the bolt 3 and thus rotates the Bush Wheel. Similarly the $\frac{3}{8}$" Bolt on this Bush Wheel strikes the shank of a bolt on the second Bush Wheel and causes the second Bush Wheel to rotate.

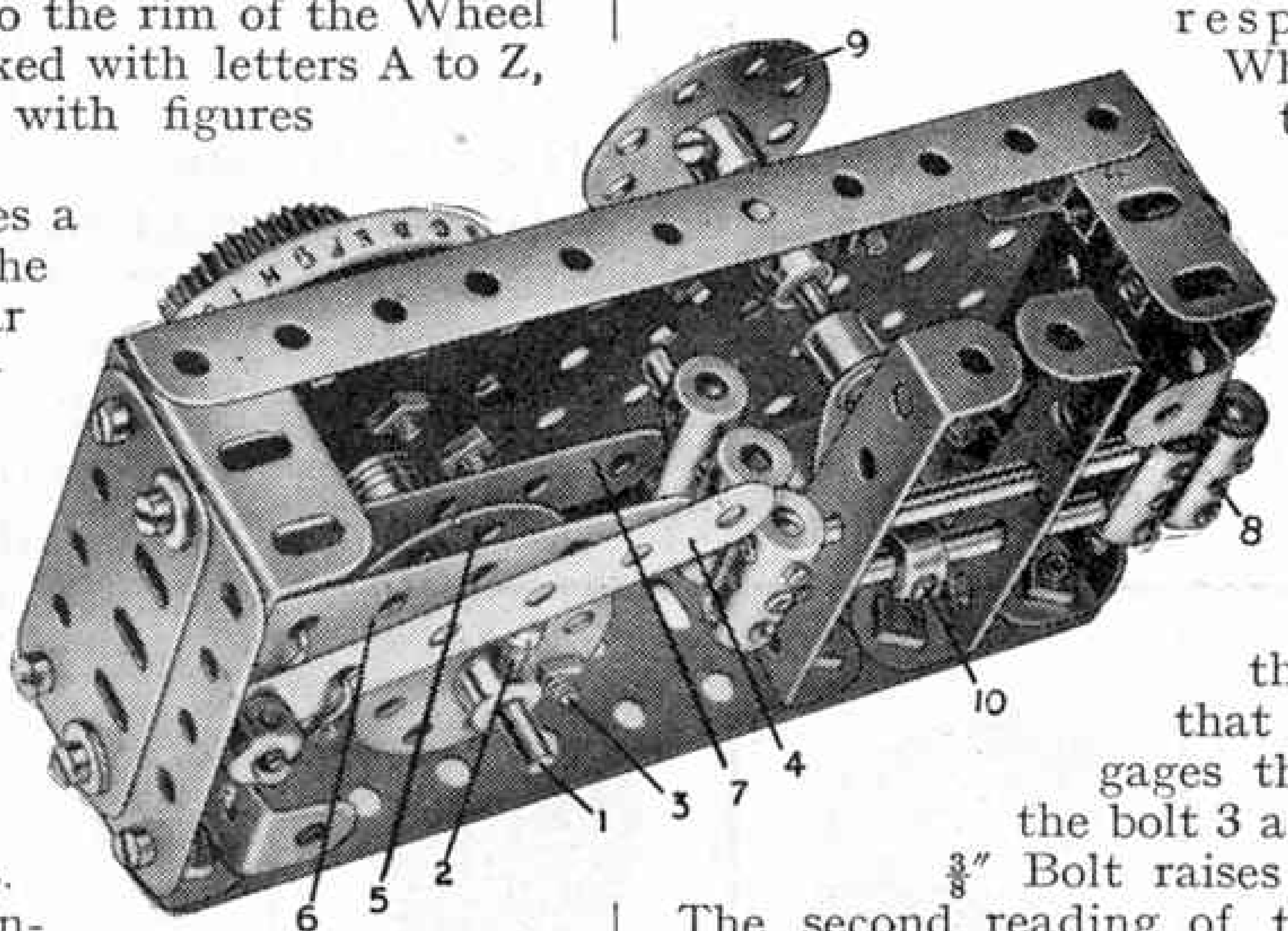


Fig. 330.

The 3" Strip 4 is pivoted on a Rod, and a short length of Spring Cord normally holds the Strip on the Collar of the Bolt 2. There are three of these Strips or tumblers, 4, 6 and 7, each being pivoted on the same Rod and being provided with short lengths of Spring Cord. When the tumblers are in the normal position the bolt 8 cannot be withdrawn. The bolt consists of two Couplings secured on 3" Rods that slide in two $2\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strips. Another Coupling at the inner ends of the Rods carries a $1\frac{1}{2}$" Rod that is provided with two more Couplings. These three Couplings strike the ends of the tumblers to prevent the bolt 8 from being withdrawn. The bolt 3 and the corresponding bolt in the Bush Wheel 5 should be so arranged that when the dial is rotated the three tumblers are not raised simultaneously by the $\frac{3}{8}$" Bolts.

To open the lock it is necessary to make three distinct movements of the dial. It is first turned in a clockwise direction until the $\frac{3}{8}$" Bolts have engaged the bolts in their respective Bush Wheels. It is then turned until the $\frac{3}{8}$" Bolt in the Bush Wheel 5 raises the tumbler 7 and the reading of the dial against a fixed point is noted. The direction of rotation is then reversed so that the bolt 2 engages the other side of the bolt 3 and so the second $\frac{3}{8}$" Bolt raises the tumbler 6. The second reading of the dial is then noted. The dial is again turned in the clockwise direction so that the bolt 2 raises the tumbler 4, and a third reading is taken. With all the three tumblers in the raised position the bolt 8 can be withdrawn by turning the handle 9. The Collar 10 on the lower sliding Rod carries a Threaded Pin that engages the elongated hole of a Crank on the Rod of the Wheel 9.

If the dial is rotated first in an anti-clockwise direction a different set of readings will be obtained. By noting these readings the lock can be opened after the mechanism has been completely enclosed. It is important to ensure that the Collar of the Bolt 2 is securely attached to the Rod 1, and also that the dial is tightly gripped on the Rod. This precaution will prevent any slipping occurring and thus upsetting the combination.

(331)—Intermittent Motion (J. Sumner, Croydon)

An unusual movement is obtained from the device illustrated in Fig. 331. The mechanism is of utility for an automatic intermittent feed motion, and in practice is used in cinematograph apparatus for drawing the film through the camera.

Two 57-teeth Gears are meshed together, and one of them is driven from the power unit. A Pivot Bolt 1 is secured to one of the Gears by two nuts and the moving arm is free to pivot on this Bolt and is spaced from the Gear by a Collar. The arm consists of a 4" Curved Strip extended by means of a $2\frac{1}{2}$" large radius Curved Strip. The end of the 4" Strip slides in the Eye Piece 2 that is pivotally attached to the second 57-teeth Gear. The position of the Eye Piece in relation to the Bolt 1 is very important. It should be arranged almost diametrically opposite, but the operation of the device will be improved if the Eye Piece is slightly in advance of the direct opposite position when its Gear is turning in a clockwise direction.

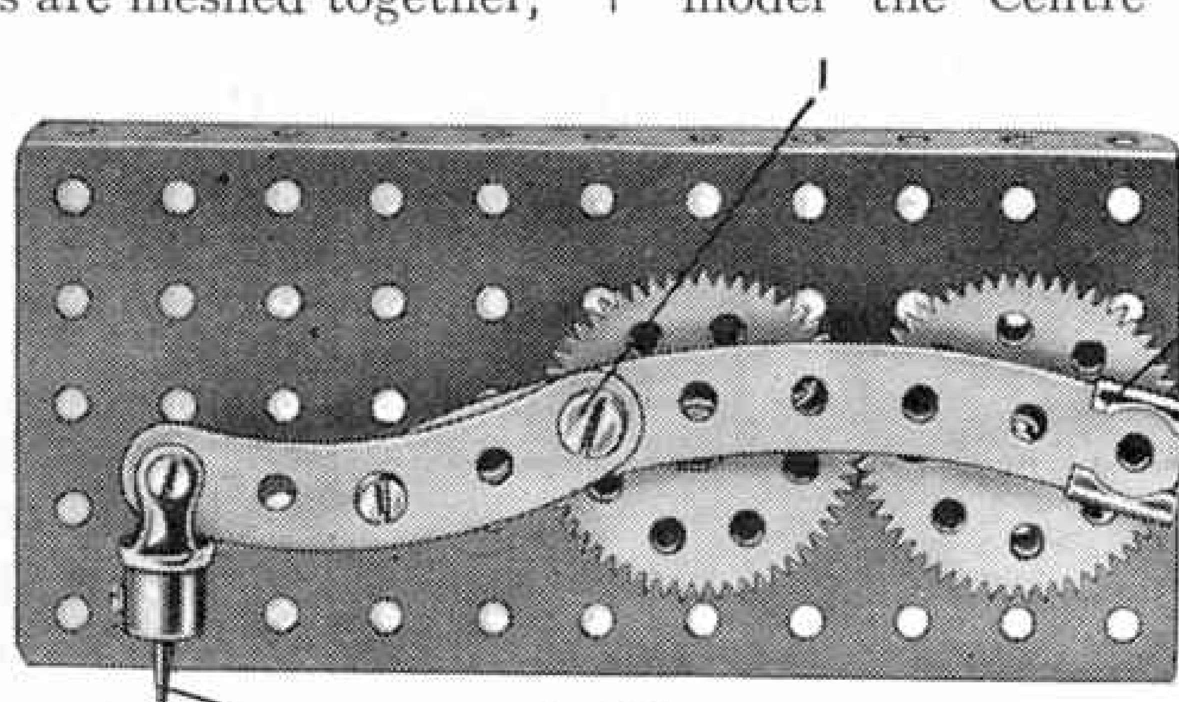


Fig. 331.

The outer end of the $2\frac{1}{2}$" Curved Strip carries an End Bearing in which the Centre Fork 3 is fitted. In the actual device this part is shaped to engage the slots at the sides of the film, and in the model the Centre Fork may engage a Sprocket Chain or belt for providing the necessary feed. When the Gears rotate, movement is imparted to the Centre Fork 3, which follows a straight path for a short distance and then moves upward and backward, describing a semi-circle.

To serve its intended purpose the model should be arranged exactly as shown, but by varying the position of the Bolt 1 in relation to the Eye Piece 2 some very interesting movements are imparted to the Centre Fork 3.

Any suitable part may be fitted in place of the Centre Fork, according to the purpose for which it is intended to use the device.

Miscellaneous Suggestions

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

(M.179.) Rubber Tyred Flanged Wheel.—Recent experiments with rubber tyred wheels for rail cars have prompted a suggestion from G. R. Webb (Wimbledon, S.W.20). The suggestion concerns a rubber tyred wheel that our contributor claims gives very silent running on gauge O track. The wheel is made from a 1" Pulley Wheel fitted with a $\frac{5}{8}$" Rubber Ring and placed face to face with a Bush Wheel that forms the flange. An advantage possessed by this type of wheel is the tendency to prevent wheel slip.

Another suggestion comes from R. Nuttall (Burley-in-Wharfedale, Yorks.), who uses a larger wheel. This is built up from a Face Plate and a $1\frac{1}{2}$" Pulley that is fitted with a Dunlop Tyre.

(M.180.) Remote Control.—An interesting device suggested by R. Tydeman (Stowmarket, Suffolk) enables an Electric Motor to be controlled from a distance to provide two distinct movements. Instead of fitting solenoids or other devices for controlling the gear change mechanism, Tydeman uses a reversing type Electric Motor but removes the reversing switch. The studs behind the switch are connected up to a reversing switch that is mounted wherever required. Alternatively the reversing switch on the Motor can be controlled at a distance by means of cords or Bowden Wire.

The method of obtaining two movements is very ingenious and is achieved by means of two free wheels. They are arranged in such a manner that when the Motor is rotating in one direction one of the free wheels is idle while the other supplies a drive. In the reverse direction of the Motor the first free wheel drives and the second rotates idly, and thus the drive is transferred from one movement to another.

A Pinion on the Motor armature drives a Gear on a long Rod journalled in the Motor plates. A free wheel is mounted at each end of the Rod and the Ratchet Wheels are fixed with the bosses inward so that the teeth are in opposite positions in relation to each other. The Pawls engaging the Ratchets are mounted on the ends of 2" Strips that are attached to 57-teeth Gears but spaced away by Washers. The Gears are free on the Rod, and it will be apparent that when the Rod is rotating one way, one of the Gears is driven and the other is free, and when the Rod drives the other way the drive is changed from one Gear to the other. The Gears may be arranged to drive any required movement.

(M.181.) Front Wheel Springing for Motor Chassis.—Details of a new type of chassis spring have been submitted by H. Upton (St. Albans). The spring is of the semi-elliptic type and the interest centres in the method of mounting it. The front end of the spring is hinged to the front dumb iron and this can be carried out by means of a Meccano Hinge or by means of Double Brackets that are pivoted together. At the rear a $\frac{3}{8}$" Bolt is passed through the end hole of the spring and is secured to the chassis. Thus the rear of the spring is free to slide on the bolt but it is pressed downward by means of a Compression Spring on the shank of the bolt. The Compression Spring helps to smooth out the action of the semi-elliptic leaf spring.

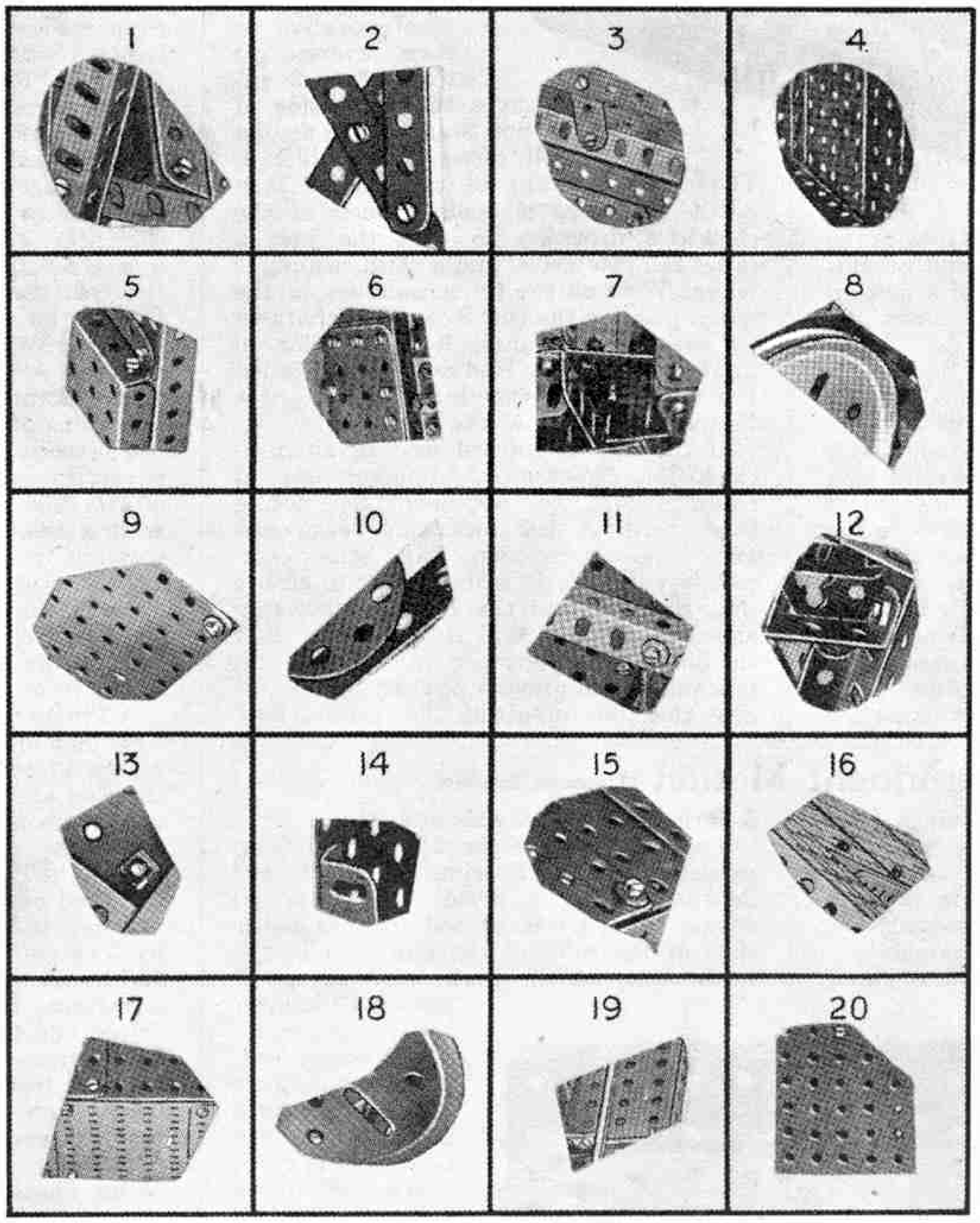
Meccano "Lynx-Eye" Competition

A Test for Keen-Eyed Model-Builders

This month we are arranging another of the popular "Lynx-Eye" competitions. Contests of this kind are particularly suited for the summer months, for in order to participate in them it is not necessary to stay indoors building models, as is the case in ordinary Meccano competitions. Every reader of the "*M.M.*" may take part in the Contest, and it is not necessary to possess a Meccano Outfit. A competitor only requires copies of the 1934 issues of the "*M.M.*," a pencil and a piece of paper.

The task that competitors are set is to find out from which Meccano models illustrated in the "*M.M.*" during 1934 the 20 fragmentary pictures shown on this page have been taken. All the models from which the pictures have been taken appeared in the "*New Meccano Models*," "*Suggestions*" and Contest Results.

Although the task of identifying each of the 20 small pictures may at first sight appear very difficult, careful and leisurely study of the models illustrated in the 1934 issues of the "*M.M.*" will soon enable a competitor to discover from where many of the pictures have been taken. Competitors should note carefully the Meccano parts included in each fragment, as these will in most cases provide valuable clues in solving the puzzle. It should be noted that the fragments shown on this page do not necessarily occupy the same angular positions that they occupy in the original illustrations. That is, in some cases the fragments have been turned upside down.



Competitors should not be discouraged if they cannot identify all the pictures. If no one manages to solve them all, the prizes will be awarded to the competitors whose entries contain the greatest number of correct solutions.

There will be two Sections only: A, for competitors of all ages living in the British Isles; B, for competitors of all ages living Overseas. The following set of prizes will be awarded to the competitors in each Section who succeed in solving the greatest number of pictures. First, Meccano or Hornby Goods value £2-2s.; Second, Meccano or Hornby Goods value £1-1s.; Third, Meccano or Hornby Goods value 10/6. There will also be eight consolation awards of goods value 2/6.

If more than one competitor identifies all the pictures correctly the prizes will be awarded in order of merit to the all-correct entries that are the most neatly prepared.

All entries must be made as follows. Competitors must first write down on their cards the reference number shown at the top of each picture on this page. Then as each picture is solved they should state against each number the issue and page of the "*M.M.*" in which appears the model from which the fragment is taken, the name of the model and the figure number. The entry must bear also the competitor's full name and address, and letter A or B indicating the Section for which the entry is eligible. Entries must be addressed June "Lynx-Eye" Contest, Meccano Ltd., Binns Road, Liverpool 13. The closing dates of the competition are as follows: Entries for Section A must reach Liverpool on or before 29th June, 1935, those for Section B must be posted in time to reach Liverpool not later than 31st August, 1935.

Each competitor is allowed to send only one entry. If more than one solution is submitted the competitor will be disqualified. Before posting their entries competitors should make sure that they have stated their names and addresses and all the details required for identifying the various models.

Competitors should bear in mind that neatness in preparing their entries may be a deciding factor in winning a prize. We are looking forward to a big entry for this Contest and hope that every reader will endeavour to participate.

Model-Building Competition Results

By Frank Hornby

"Christmas" Contest (Home)

The following competitors were successful in winning prizes in the Home Sections of the "Christmas" Model-building Competition.

Section A (competitors over 14).

1st Prize, Meccano or Hornby goods value £3-3s.: P. Kay, Oldham. 2nd Prize: Goods value £2-2s.: E. Hines, Croydon. 3rd Prize, Goods value £1-1s.: A. Armstrong, Leicester. 4th Prize, Goods value 15/–: F. Dodgson, Halifax.

Goods value 10/6: A. Drewell, Greenhithe, Kent; J. Gubbins, Loughborough; J. Hart, Bexleyheath; C. Hudson, Beckingham, Doncaster; J. Matthews, Fillongley, Nr. Coventry.

Goods value 5/–: F. Byron, Liverpool 13; G. Cotton, Niton I.O.W.; G. Haynes, Sutton; K. Robinson, Rugby; J. Walton, Preston.

Section B (competitors under 14).

1st Prize, Meccano or Hornby goods value £3-3s.: A. Blakey, Hartlepool. 2nd Prize, Goods value £2-2s.: P. Bunce, Harpenden. 3rd Prize, Goods value £1-1s.: H. Munson and R. Waldron, Marlow (joint entry). 4th Prize, Goods value 15/–: E. Oyler, N. Mitcham.

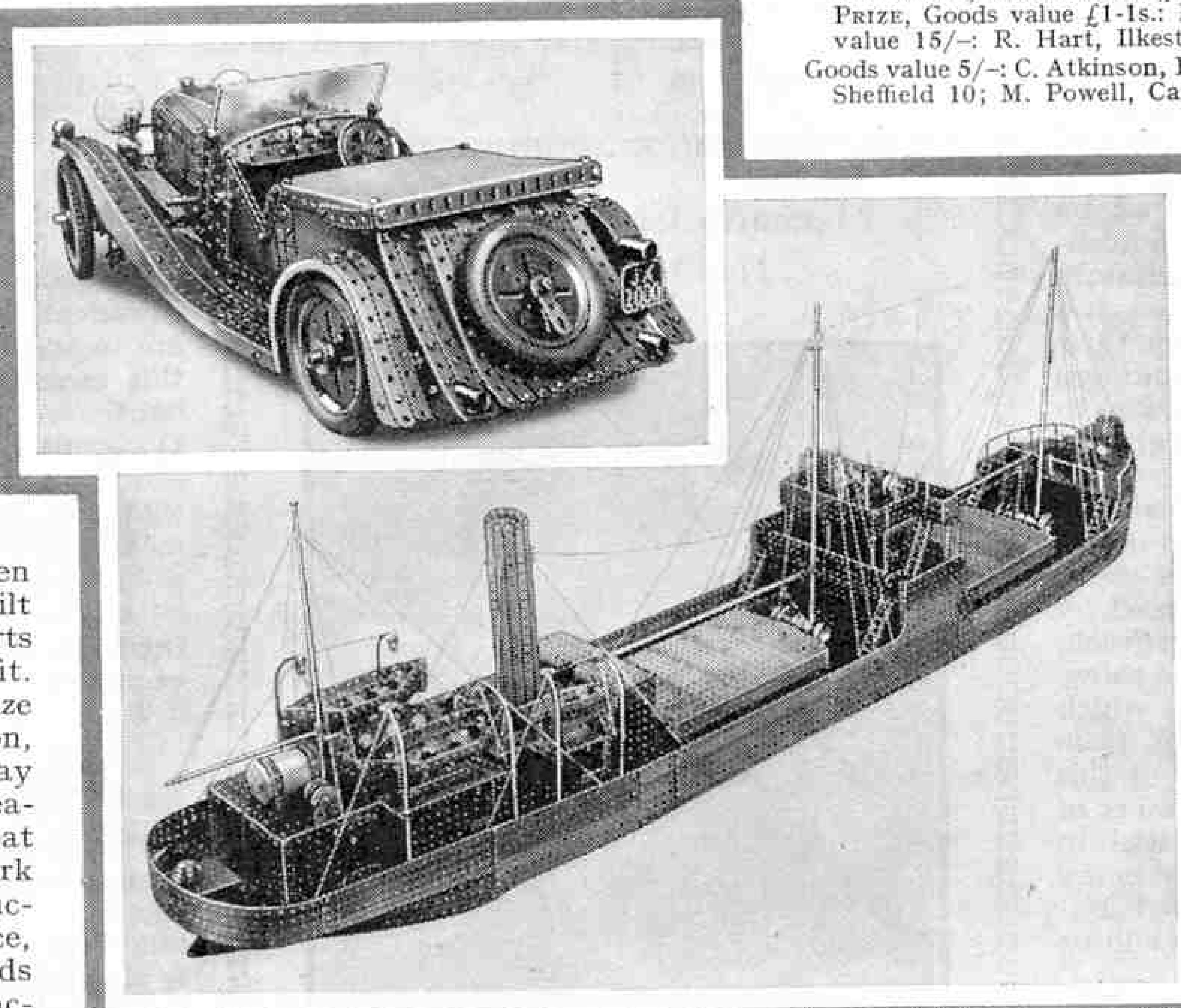
Goods value 10/6: G. Castle, Ilkley; A. Coppin, London, S.W.17; D. Robinson, London, S.W.16; R. Snodgrass, Westcliff-on-Sea; W. Woodend, Barrow-in-Furness.

Goods value 5/–: A. Barkley, Ilford; E. Brett-Harris, Weston-Super-Mare; A. Fear, Exeter; P. Gibbs, Berkhamstead; J. Spark, Haydon Bridge, Northumberland.

This contest was open for models of all kinds built from standard Meccano parts and with any size of Outfit. The model that won First Prize in Section A is a motor wagon, and although it does not display any particularly original features it is obvious that a great amount of very careful work has been done in its construction. Its realistic appearance, which went a long way towards winning the model the distinction it attained, is due principally to skilful discrimination in the use of Meccano parts, and I congratulate its builder, P. Kay, on his good judgment.

I was greatly pleased to find that for once the younger competitors showed the greater initiative in finding original subjects for their entries. A particularly good example of these is a splendid little model of an old-fashioned kitchen range, of the type that is now fast disappearing. There is nothing in the model that calls for a great amount of skill in construction, and it is the solid and generally neat appearance of the model that carried it into favour with the judges. Many competitors seem to think that simple models such as this stand no chance in a Meccano Contest, and consequently they attempt large and intricate structures far beyond the scope of the parts at their disposal. It is a much better plan to choose a small and simple subject and make the best possible out of it, and it is surprising how much pleasure can be obtained in this way, quite apart from the greater possibilities of being successful in a competition. Of course, when one's stock of parts and accessories is large there is no need to confine oneself to simple structures, and the construction of more elaborate models can be attempted.

The model motor car shown on this page is the work of F. Dodgson, Halifax, and it won Fourth Prize in Section A of this Competition. It will be seen that the chief feature of the model is its neat appearance, and it was to this that it owed its success. Unfortunately Dodgson has made use of cardboard and tinplate in finishing off the body and hood; if he had relied entirely on Meccano parts it is probable that he would have won a larger prize.



(Top) Neat construction and well-proportioned detail work are the main features of this model motor car, built by F. Dodgson, Halifax. (Bottom) A fine coasting steamer built by C. Hughes, Doncaster.

"Merchant Ship" Contest (Home)

The awards in the Home Sections of the "Merchant Ship" Competition are as follows:

Section A (competitors over 14).

1st Prize, Meccano or Hornby goods value £3-3s.: C. Hughes, Doncaster. 2nd Prize, Goods value £2-2s.: H. Stephenson, Huyton, Liverpool. 3rd Prize, Goods value £1-1s.: R. Adams, Stoke-on-Trent. 4th Prize, Goods value 15/–: S. Robinson, West Hartlepool.

Goods value 5/–: D. Drinkall, Grimsby; H. Lee, Ardrossan; C. Lynch, Clifton, Yorks.; P. Sims, Bruton, Somerset; L. Wright, Pengam, Glam.

Goods value 2/6: E. Vernon Clayton, Manchester; P. Findlay, Knaresborough; T. Green, Mapperley; J. Mapplebeck, Bradford; S. Wotherspoon, Waterloo, Liverpool.

Section B (competitors under 14).

1st Prize, Meccano or Hornby goods value £3-3s.: C. Seamark, Exeter. 2nd Prize, Goods value £2-2s.: P. Fairfield, Bowdon, Cheshire. 3rd Prize, Goods value £1-1s.: M. Drynan, Wallington. 4th Prize, Goods value 15/–: R. Hart, Ilkeston.

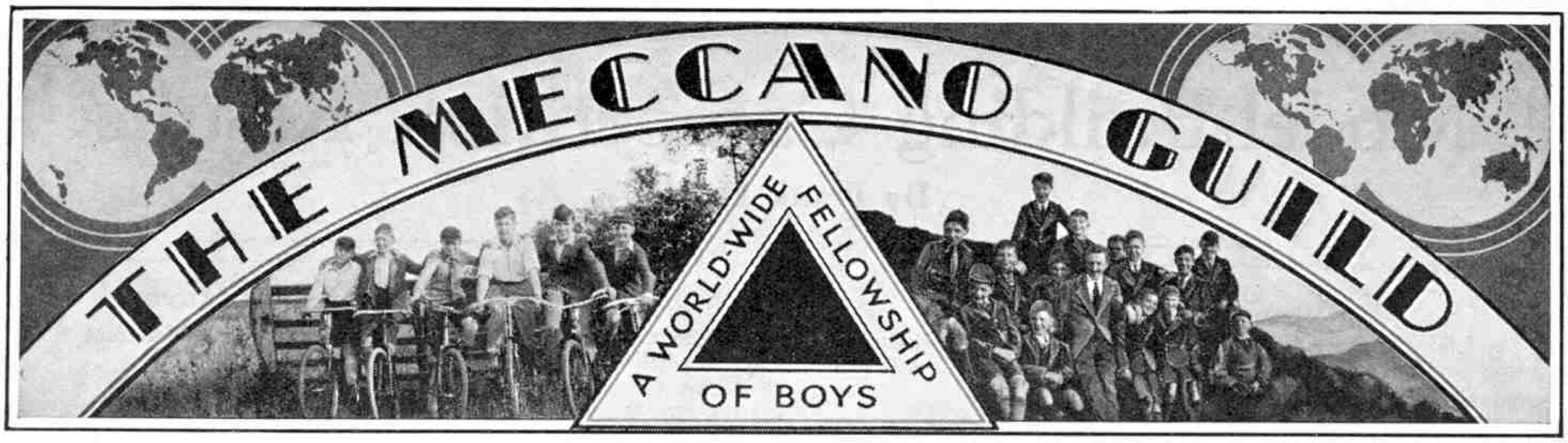
Goods value 5/–: C. Atkinson, Edinburgh; A. Audsley, Cobham; G. Denton, Sheffield 10; M. Powell, Cardiff; R. Webber, Salisbury.

Goods value 2/6: R. Bowen, Liverpool 15; B. Brough, Edinburgh; J. Cameron, Rannoch Station, Perthshire; J. Cooley, Long Sutton; A. Goddard, Worplesdon, Nr. Guildford; A. Milne, Ormskirk; G. Morlin, Cambridge; R. Payne, London, E.12.

Although entries were confined to one type of subject, the great variety of different kinds of merchant ships in existence provided competitors with ample opportunity to exercise their model-building ability and to choose a prototype best suited to the size of their Outfits. Tugs, steam launches, paddle steamers, trawlers, fishing smacks and giant ocean liners are all to be seen in miniature among the entries submitted and it was a really pleasant and interesting task to examine them, although when it came to choosing the models to receive prizes it was not an easy matter to decide.

The First Prize in Section A was won by the fine model of a coasting steamer illustrated on this page. It is the work of C. W. Hughes, and contains a great amount of detail. For instance, in the bows of the model is a winch complete with the appropriate gear-wheels and drums, and the bridge is provided with binnacle, ship's telegraph and bridge screen stanchions, which in the actual vessel are used for supporting tarpaulin screens to protect the ship's officers from spray and wind during rough weather. Ladders made from Strips and 1" Screwed Rods allow access from the well decks to the bridge. The rear portion of the model is occupied by the funnel and superstructure of the engine room, and the ventilator cowls, which are made from Sleeve Pieces with Dredger Buckets secured to them, can be turned round to face the wind as required.

In striking contrast to this modest vessel is a splendid model of the Cunard White Star liner "*Queen Mary*" which won First Prize in Section B for C. Seamark, a member of the Exeter Meccano Club. The model is 4 ft. 7 in. long and is a reasonably close copy of the liner as she will look when completed. The neat manner in which the decks have been shaped and plated is particularly praiseworthy. The foredeck is formed from Triangular Plates, Strips and Flat Plates, with a Hub Disc to represent the forward end of the cabins and passenger quarters, the spaces in the Hub Disc being filled in with 2½" Triangular Plates. Ventilator cowls are formed from Chimney Adaptors, and small lifeboats made from 1½" Strips are carried in davits made from 2½" Curved Strips. The funnels are cardboard tubes painted in the correct colours and are in correct proportion to the general scale of the model.



This Year's Exhibitions

Recently I have been reading over the accounts forwarded to me of Exhibitions held by Meccano clubs at the end of the second winter session. This time always seems to me ideal for an Exhibition, for it provides an opportunity for bringing the activities of the indoor sessions to a climax with an event that can be made a review of the work of several months, since models built during the winter are exhibited and Merit Medallions and prizes earned in competitions are formally presented. I am glad to see that more clubs have now adopted the suggestion I have often made to introduce a little ceremony into affairs of this kind, such as inviting a distinguished visitor to present prizes. It certainly gives successful competitors and keen club workers a greater thrill to receive their awards in this manner, and encourages care and thought in making preparations to ensure a display worthy of the club and of the occasion.

An excellent example of this was furnished by the recent Exhibition of the Old Charlton Meccano Club. This event attracted 300 visitors and was graced by the presence of the Mayor of Greenwich, who kindly presented the prizes and showed keen interest in the display, which included a super model on loan from Headquarters. A striking feature of this and other Exhibitions was the number of youthful visitors who expressed a wish to join in the fun, and there is no doubt in my mind that a competently managed Exhibition is one of the finest means of adding to the strength of a club.

The financial results of practically every Meccano Club Exhibition arranged for this season also have proved satisfactory, although admission charges of course were low. No charge at all was made in some instances. Instead, visitors were invited to place contributions in a box, and it is a great testimony to the skill and enthusiasm shown by officials and members of Meccano clubs, and an eloquent sign of appreciation by visitors, that this method of obtaining revenue was as effective as making a definite charge.

My final judgment of this year's Exhibitions must be that they have been wonderfully successful. As means of giving pleasure to members, and also of advertising a club's existence, they have proved their worth for both large and small clubs, and they must continue to play an increasingly important part in club life.

Turning Visits to Good Account

There is more in a tour of a works or a locomotive shed than mere interest or enjoyment, and members should keep in mind the possibility of turning a pleasant experience of this kind to good use in model-building and other club work. This is done regularly in many clubs. For instance, the members of an Irish club visited a sugar beet factory, and were greatly impressed by the possibility of reproducing in Meccano some of the machines they saw. Eventually they began work on a miniature sugar beet factory, and the model promises to be a huge and interesting structure.

Meccano Club Secretaries

No. 32. D. Legg

D. Legg is secretary of the Exeter M.C. This well-known club was affiliated in 1925. Club affairs are largely controlled by members themselves, who elect officials and a committee to work under the wise guidance of Mr. M. C. Hodder, the Leader, and special care is taken to encourage the introduction of fresh and original schemes for club work.

A Unique Meccano Club Holiday

It is now usual for parties of members of Meccano clubs to spend short holidays under canvas, and the advantages of doing so are fully realised in all quarters. Camping at any time provides an enjoyable open air life, and in company with others of similar tastes, who have been in constant association in club work, provides an ideal form of holiday.

An equally interesting and profitable time will be spent on a holiday that has been arranged for this month by the Mary Swanwick School (Chesterfield) M.C., who are to travel as far afield as Pembrokeshire, in South Wales. There a party of 20 members, accompanied by Mr. Lancaster, Vice-President, and Mr. T. E. John, Leader, are to spend a week at Tenby, and from this centre will make excursions to the lighthouse on Caldy Island, Pembroke Dock, St. David's Cathedral and Pembroke and Manorbier Castles. I believe that this is the first occasion on which members of a Meccano club have arranged a holiday on this ambitious scale and have travelled together so far away from their headquarters, except on a day excursion. Secretaries please correct me if I am wrong!

Correspondents Wanted

During the past few months there has been record activity in connection with the Meccano Guild Correspondence Club, but there is room for many more members in all parts of the world in which the Guild is represented. I should like particularly to receive applications for membership from Canada, South Africa and the United States. I can promise that all applicants from these countries will be put in touch almost immediately with suitable correspondents, for I have a list of members in England waiting for friends from overseas with whom to discuss common interests and hobbies.

Scarcely a week goes by without my receiving news from members of the Correspondence Club in various parts of the world of long-continued friendships begun through the medium of the club. It is always very pleasing to realise how much the Correspondence Club is doing towards encouraging world-wide exchanges of this kind, and I hope that every member of the Guild who has been provided with a pen friend through the medium of the club will write to let me know how his correspondence is proceeding.

Proposed Clubs

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

INDIA—Rajkumar, c/o Ganga Sahai, Esq., Egerton Road, Delhi.
INDIA—Shauket, No. 499/2 Kutchery Road, Karachi.
LONDON—Mr. R. G. Frooms, 82, Greenvale Road, Eltham, S.E.9.
SIDCUP—R. A. Hijlkema, Caerthillian, 38, Station Road.
SNODLAND—J. Tobin, "Little Brome," Birling Road.

Plymouth M.C.—Great ingenuity is displayed in selecting subjects for Model-building Contests. Special competitions are devoted to models of an inventive character, in which members show distinct originality, and other subjects giving them excellent opportunities of showing their skill have included "New Uses for Meccano Parts," "Instruments of Torture," "Household Articles" and "Street Models." Talks have been given by members on "*Broad Gauge Railways*" and "*The History of the Motor Car*," and the G.W.R. Locomotive Sheds at Laira have been visited. An interesting event was a presentation to Master Gorehem, a member of long standing, who recently left the club on his departure for Singapore. Club roll: 70. *Secretary:* P. Frizzell, 85, Beacon Park Road, Swilly, Plymouth.

Bridport Grammar School M.C.—Excellent attendances have been a feature of meetings, and special interest was displayed in a competition for models of locomotives, the prize being given by an interested friend of the club. An excellent series of Lantern Slides, kindly loaned by Imperial Airways Ltd., gave members and other pupils an enjoyable time. Club roll: 25. *Secretary:* H. M. Dommett, Skilling, Bridport, Dorset.

Regis (Corsham) M.C.—Striking models built by members have included a representation of a Canadian wheatland scene and miniature Chair-o-planes, together with a Ticket Punch, a Sailing Ship and a model of the Short "Calcutta." Other meetings have been devoted to games and special competitions, and a gramophone, kindly lent by Mr. N. D. Carter, President, has added interest to the proceedings. Club roll: 18. *Secretary:* R. Bidmead, High Street, Corsham.

Hayes (Kent) M.C.—Excellent progress is being made and a large Bucket Excavator is being built at meetings. Special study has been made of a model Crane loaned by Meccano Ltd. Table Tennis and Draughts have been added to the usual games enjoyed by members and the secretary has given a Lantern Lecture on "*Railway Engineering*." Club roll: 20. *Secretary:* T. A. Steer, 54, Bourne Way, Hayes, Kent.

Mallow M.C.—News of the grant of affiliation was received with cheers by the members. A club model of the local Beet Factory is being built. This factory has been visited by members, who saw all the processes by means of which sugar is extracted from beet, and the decision to build a large model is a sequel to the visit. Club roll: 8. *Secretary:* D. Hickey, 42, Ballydaheen, Mallow, Co. Cork.

Newtownards M.C.—Members are showing keen interest that promises well for the success of the club. Meetings so far have been devoted to the construction of working models, and in addition a Hornby Railway has been laid down. A Rambling Club has been formed and is to be very active during the summer months. Club roll: 8. *Secretary:* J. Getty, Hillcrest, Newtownards, N. Ireland.

Morison Memorial (Clydebank) M.C.—Members have constructed aeroplanes and hangars for an aerodrome scene, and one member has constructed a miniature Wireless Mast and Control Station. Other models are of engineering subjects. Variety was given to the programme by active preparations for the Concert, at which a display of the club's work was given. Club roll: 27. *Secretary:* J. Glassford, 347, Kilbowie Road, Clydebank.

Holy Trinity (Barnsbury) M.C.—Excellent work has been carried out under the new Leadership. Most of the meetings have been devoted to model-building, and to individual work by members on their favourite hobbies. A Social Evening also has been held. The club celebrated the Easter Holiday by an enjoyable visit to Chingford. Club roll: 35. *Secretary:* A. T. G. Dines, 70, Thornhill Road, Barnsbury, London, N.1.

King's Lynn M.C.—Members' interests are widening, and it is a tribute to their skill and enthusiasm that they are in great demand as lantern operators and assistants in organising special displays, especially for charitable objects. Visits have been paid to local Museums and to the Police Station. A large reading room has been opened, and members have access to a Billiard Table which, with Table Tennis, provides them with excellent indoor recreation. Several dances have been arranged and the Leader has been interested to find some of his members blossom forth into full evening dress! Club roll: 22. *Leader:* Mr. I. T. Thatcher, North Hirne, St. Ann's Street, King's Lynn.

A group of members of the St. James (Grimsby) M.C. with Mr. H. V. Hayman, Leader. D. Cartwright, secretary, is on the Leader's right. The club was affiliated in November of last year. Members derive great enjoyment from the building of large club models, and have completed a "Baltic" Tank Locomotive that created great interest when exhibited.

Old Charlton M.C.—The 4th Annual Exhibition was remarkably successful. An impressive display of models and a Hornby Railway were the chief attractions. Cinematograph Shows were given at intervals and the Mayor of Greenwich presented prizes won by members in club work. An interesting feature was a Recruiting Stall, at which information about the Meccano Guild and the Old Charlton M.C. was given to interested visitors. Ordinary meetings have included a talk on "*The L.C.C. Ambulance Service*" by Mr. Howard, an account of the Motor Show by the secretary, a Debate on the relative advantages of Horses and Motors, and visits to a Chemical Works and other factories in addition to model-building in preparation for the Exhibition. Special interest is now being taken in indoor games and charades. Club roll: 21. *Secretary:* W. Jaques, 60, Gurdon Road, London, S.E.7.

Sutton Valence Council School M.C.—A test is made every week of members' powers of observation and their skill in "Meccanocraft," the points awarded being counted in a sessional contest. Simplicity Model-building Competitions and similar contests are held regularly and chemical experiments also have been carried out. The club has been visited by two of His Majesty's Inspectors, and as a result of their interest members are now busily engaged in the construction of models to illustrate the uses of electricity. The models are to be displayed at a Summer School for teachers, to be held at Southampton in July. Members are keen to produce good models in order to bring credit to their club and to the Guild movement. Club roll: 25. *Secretary:* B. Johnes, "The Spinney," Kingwood Ulcombe, Nr. Maidstone.

Hutton Modern School (Eccleshill) M.C.—An interesting programme of Meccano Nights, Hornby Train Evenings and Lectures has been followed. Visits also have been paid to a local Newspaper Printing Works, and to the Locomotive Sheds of the L.M.S.R. and L.N.E.R. A visit to Liverpool, including a tour of the Meccano Factory, is in prospect. Club roll: 10. *Secretary:* W. Holdsworth, 44, Victoria Road, Eccleshill, Bradford.

Chippenham Secondary School M.C.—Good use was made of an enjoyable tour of the works of the Westinghouse Brake and Saxby Signal Co., where members gained many new ideas for model-building. In this club models constructed by members at home are brought to the meetings and judged by vote, and those exhibited have included an Air Liner and an excellent set of Automatic Traffic Signals that were used by D. E. Stevens, their constructor, to illustrate a talk on traffic control. A visit to the Bacon Factory of C. & T. Harris Ltd., was followed by an inspection of the Calne Power Station. Club roll: 16. *Secretary:* J. A. Richards, 30, High Street, Chippenham.

Bexleyheath Boys' Central School M.C.—Recent models have included Bridges, Stations and other railway accessories for use on the club's Hornby Railway, in which special interest is now being taken. Members are being given practice in the duties of all grades of railway workers, and the two hobbies of Meccano and Hornby Trains are admirably combined in the programme. Lectures also are a great attraction, and one of special interest was given by Mr. H. T. Jones, Leader, on "*Submarines*." Club roll: 37. *Secretary:* D. Hicks, 4, St. Audrey Avenue, Long Lane, Bexleyheath, Kent.

HOLLAND

Hilversum M.C.—Good progress is being made, and a special Recruiting Campaign has been organised. Members who bring in most recruits are to be given special awards. Cycle runs are a feature of the programme, and special attention is being given to Model-building Competitions organised by the club and announced in the "*M.M.*" Meetings are held twice weekly. Club roll: 19. *Secretary:* G. Cuypers, Proff Poelsshaat 18, Hilversum, Holland.

NORWAY

Oslo M.C.—Members greatly enjoy meetings, at which all wear their badges. They have built many excellent cranes, motor cars, and locomotives and other models of railway interest. More members are required and the secretary will be pleased to hear from boys who are interested in Meccano model-building. *Secretary:* Mr. T. Raknes, Gimlevn 17, Oslo, Norway.

SOUTH AFRICA

Kilpin Memorial (Rondebosch) M.C.—This club has been formed in succession to the Diocesan College M.C., its name commemorating a keen Meccano enthusiast who died in November 1933. Excellent progress is being made. A trestle table for model-building and other purposes has been kindly presented to the club by Mr. D. C. Alletson, President and Leader, and the Hornby railway layout is being overhauled. A Meccano Part Library has been formed, and several members leave their Outfits at the club room, so that a good stock of model-building material is always available. A talk has been given by Mr. Hillier on "*Photo-electric Cells*," and Mr. Wiener has given a description of a model steam engine that he has built. Club roll: 9. *Secretary:* R. Smuts, School House, Diocesan College, Rondebosch, South Africa.

Explorer Writes for "*M.M.*"—*(Con. from p. 355)*

the thousand tracks of okapis that honeycomb the forest in every direction, found one that he declared to be a female, and which he judged to be a mother, as in the same day the tracks doubled back. And he was right. The footprints, followed by the pygmies with indescribable patience and ability, disappeared into a tangle of vegetation from which every now and then could be heard the slight rustlings as of a big animal moving in its nest.

During all the night the *fundi* and the pygmies remained hidden not far away, quiet and silent as shadows, huddled closely together against the danger of leopards. Then at the first light of dawn a huge tree began to give those slow regular creaking sounds that always presage the fall of one of the mighty of the forest. So, at least, thought the okapi mother who, led by instinct, darted out from the hiding place; and so must have thought the small one, who hesitated and then slowly followed her on his first venture from the dark and well-protected cavern.

But it was the pygmies who, on my instructions, had imitated the noise of the falling tree; and before the baby okapi could recover from the surprise that had stopped him short before those small, black unknown beings who had appeared all around him, the pygmies had enveloped him in a bag. With only a mild display of resistance, a mere matter of principle apparently, he found himself fastened securely in the bag, which was tied to a long pole and hoisted to the shoulders of four pygmies. A few hours of march across the forest, and he reached our base camp, so recompensing us for four months of unceasing work and hardships.

A new task, however, was beginning—that of accustoming the beautiful little animal to have full confidence in man, and of training and preparing him for the long journey of several hours' trip by porters through the forest from the camp to the road, of several days by motor car to Mombasa, and several weeks by boat to England. For Makulu-kulu, on the other hand, the job was done, and I was curious to see how he would fulfill his promises to the spirit who had favoured him so well.

"Mongo, Mongo," I found him murmuring at the little temple, surrounded by all the presents I had just given him. "Listen to me, Mongo, and give me counsel. Of course the salt goes to the wives, and you know what a shouting they would make if I took a little of it. You, who know women, well realise it. Of tobacco I would give you some, but the ants would eat it, and so none would remain for you. The pipe—"he paused and scratched his nose thoughtfully—"if you smoke it, I cannot smoke it; but if I smoke it you will certainly be glad that Makulu-kulu, your faithful son, has in his mouth a pipe as beautiful as the ones of the *Ewanas*. There is the "bi-lan-ketty," beautiful and new and warm; but it is so small for such a big god as you. Listen, Mongo," he concluded, collecting all his goods. "The first time I kill an animal I will give you two huge big bones, one for the animal, one for the okapi you have made me find."

Trusthorpe Mill, Mablethorpe, with a typical drainage channel alongside. Canals of this kind have played a great part in reclaiming land in the Fens and other marshy districts, and the pioneer of work of this kind was Sir Cornelius Vermuyden, a famous engineer of the 17th century.

Arc Welding for Bridge Repairs—*(C. from p. 335)*

the girders.

The average time it took to complete the work in one span was about four weeks, and when the work was nearing completion on the three southernmost spans, the floor was removed from the three adjoining spans, the new floorplates were emplaced, and the remaining three spans were dealt with later in a similar manner.

After the repairs to the first three spans had been completed and the welders were working on the adjoining span, possession of the passenger lines was again obtained on two Sundays and traffic diverted over the adjoining goods lines. The track and the temporary longitudinal timbers for one line were removed each Sunday, and asphalt $\frac{3}{4}$ in. thick was laid in two layers over the floorplates and $1\frac{1}{2}$ in. thick over the girders. A layer of bricks two inches thick, laid in cement, was placed over the asphalt to protect it from injury by platelayers, and then the ballast and track were replaced.

The welding of the floor and ballast plates was undertaken without encountering any difficulties, but in the welding of the existing cross bracings to the girders slight difficulties arose due to the original oil and paint between the various thicknesses of metal oozing out and getting into the weld, owing to the local heat generated. This was eventually overcome by heating the connections locally with blow lamps or oxygen flame; and also by using a caustic soda wash over the part immediately before the weld was made.

Continuous welds, double run, connect the floorplates to the top of the existing girders and bearers. On the underside the floorplates are connected to the edge of the girders and bearers with tack welds, double-run for a length of 3 in. each and spaced at 12 in. centres. The ballast plates provided over the outer girder are connected by single-run welds on the outside and with single-run tack welds of similar size and spacing on the inside.

The total amount of welding, mostly double-run, approximates to 22,000 lineal feet; and the total number of electrodes required amounted to 66,400, all 18 in. long. The welding plant consisted of two machines built to the special requirements of the L.M.S.R.

Each machine consists of a petrol engine, of 33 b.h.p., driving a welding dynamo and an auxiliary dynamo at 1,500 revolutions per minute. The welding dynamo is a compound-wound direct current machine capable of delivering a maximum current of 308 amperes for one hour, or 246 amperes indefinitely, the voltage remaining sensibly constant at the machine terminals at 50 volts. This dynamo is arranged to supply current to three welders simultaneously, and each welder is supplied with a resistance regulator, by means of which he can adjust the current required to suit the particular type and size of electrode being used.

The auxiliary dynamo is capable of delivering 23 amperes continuously at 220 volts, and is used to operate electric chipping hammers, an electric descaling and grinding machine, and an electric drill, and also to provide electric lighting where required. Each large component of the machine is arranged in a cradle, and the machine is designed so that it may be dismantled, moved by hand power, and re-erected in a new position in a very short time.

The satisfactory results obtained by this method of reconditioning the Passenger Lines Viaduct induced the L.M.S.R. to deal in a similar manner with the Goods Lines Viaduct, and this is now complete. This viaduct was constructed between 1878 and 1883 and consists of nine girder spans, the longest being 103 ft. long. Apart from the ordinary freight services, there passes over it the endless procession of 80-wagon trains bringing coal from the Midlands and from Yorkshire to the Metropolis.

Breakdown Cranes—*(Continued from page 352)*

in about three minutes; and when travelling with loads up to 10 tons the speed is 150 ft. per minute.

The structural work of the jib, superstructure frame, carriage, and relieving bogies is all made of rolled steel sections. The whole of the gearing for the various motions is constructed of steel, and has machine cut teeth throughout, with the exception of the slewing rack and pinion, which have moulded teeth.

The rail wheels are 3 ft. in diameter, and the axle journals are 6 in. in diameter and 12 in. in length on the crane carriage, and 5 in. in diameter and 9 in. in length on the relieving bogies.

A turbo-generator is provided on the crane for supplying current to the large jib floodlight, which is required for the night operation of the crane.

Happy Days in Australia

The following extracts are from a letter to the Editor from Mrs. L. Williams, a former member of the staff of the "*M.M.*," who is now settled in Victoria.

"My voyage here was an outstanding thrill. I am sure no matter wherever else I go nothing can impress me so much as my sea journey and my glimpses of our ports of call. I thought the harbour at Malta a magnificent sight, especially when completed by the addition of the Mediterranean Fleet, which was carrying out manœuvres when I was there. Port Said nearly frightened me to death with its scorching heat, for returning Australians told me that it was like Australia for hot weather! I nearly crumpled up and collapsed, thinking I should never endure for long such intensity of heat from the Sun's rays. Fortunately I have found their forebodings to be exaggerated.

"I shall never forget our passage down the Suez Canal, a slow passage all through the night with brilliant moonshine overhead and mountains of sands on each side, stretching away into the deserts beyond. Next came Colombo with its twinkling harbour lights. I should love to spend a month there exploring its very fascinating life, for it carries with it the glamour of the East.

"Ten more days and nights of the deep blue ocean brought us to Fremantle, and I stepped ashore in Australia. I visited Perth, the loveliest city of Australia, and knew then that I was going to like the country. I was disappointed in Adelaide, however. Perhaps I expected too much, and as it was night when we arrived there, I certainly did not give the city a fair trial. I hope to go there some day in daylight.

"Next came Melbourne, and I just fell for its beautiful gardens, its four-squared plan of streets, its dazzling white-topped buildings and its ever-winding stream, the Yarra River, flowing under endless overhanging weeping willows and tall gums. For a year I travelled hither and thither in Victoria, visiting the choice beauty spots and exploring the surroundings of Melbourne. Then I went to Sydney for a holiday and now this city reigns supreme in my choice. I understand why eager enthusiastic Meccano boys send you reams and reams about the Sydney Harbour Bridge. It is stupendous and dominates the whole city, and as I gazed my fill I thought of the "*M.M.*" and wished that all members of the staff could see its mighty span.

"Far more interesting even than the Bridge after a while were the endless pleasure trips and steamer tourist trips to be had, taking one to all Sydney's delightful coves and picnic grounds surrounding this, the most magnificent harbour in the world. One of my most vivid experiences was to sail across Botany Bay by motor launch to Kurnell, the exact spot on which Captain Cook landed in 1770. It does not appear to have changed greatly since his visit, and one can almost sense the ambushed aborigines in the thick ti-tree scrub about 200 yards from the water's edge. Tablets and memorials commemorate his discovery.

"I live at Sandringham, on the coast of Port Philip Bay, and there I can see the great ships as they come in and go out from Port Melbourne. I spend much time swimming and picnicing with friends here in the summer months, and during the winter we "hike" through the countryside, sometimes finding English hawthorn among gums and wattle trees, and wondering how it came there.

"I cannot say enough to describe the glorious sunshine here, the intense blue sky, the clearness and pureness of the air. I love the sunny warm days, and have found life so interesting that I have never had time to long for home."

An Interesting Railway Booklet

The "*L.M.S. Magazine*" devotes a page each month to subjects of practical interest to enginemen, and a booklet containing reprints of the articles that appeared during 1934 has now been published. It contains explanations of the operation of such fittings as the vacuum pump and the automatic steam and vacuum brakes, together with a useful set of diagrams showing the crank positions for various types of engines. New features of the latest standard engines also are described and illustrated, and sectional diagrams showing the positions of the fittings of the latest type of L.M.S.R. smoke-box.

The price of the booklet is 4d., post free, and it can be obtained on application to the "*L.M.S. Magazine*," Euston Station, London, N.W.1.

Branch News

BELFORT (CATFORD).—Lack of a Branch room is causing difficulties, but meetings are held regularly at the home of one of the members, by kind permission of his parents. Excellent track work is carried on, and every effort is being made to secure a new room in order that the activities of the Branch can be extended. The secretary will be very pleased to hear from anyone who can help. Secretary: F. B. Graves, 133, Bromley Road, Catford, London, S.E.6.

WHITGIFT SCHOOL (CROYDON).—Practical meetings for track working have been held regularly and great interest was taken in a Long Word Contest, in which railway terms only were admitted. Visits have been paid to the local Ford Depot, the works of Ever Ready Ltd., and the factory in which Creed Telephones are made. The 6th Annual Exhibition was very successful. The attractions included a large Hornby railway, on which correct timetable running was carried out, and a Lantern Lecture on *"Britain's Largest Railway,"* slides for which were kindly loaned by the L.M.S.R. The Lecture attracted so many visitors that it had to be repeated on the following day. A display of Meccano models and a comprehensive exhibition of stamps arranged by the School Philatelic Society added interest to the Exhibition. The L.M.S.R. Locomotive Sheds at Willesden have been visited, members inspecting many locomotives and displaying special interest in the high speed coaler, which fills a tender with coal in about 70 seconds. Secretary: J. A. Watson, 23, Addiscombe Avenue, Croydon.

A group of members of Warden House (Deal) Branch: Chairman, Mr. E. F. D. Campbell. H. M. Anderson, secretary, is in the middle of the second row. This Branch was affiliated in October, 1934, and members greatly enjoy track meetings, at which each is given duties on the miniature layout that correspond as far as possible to those of a real railway official.

WALLINGTON COUNTY SCHOOL.—Continuous and non-continuous tracks have been laid down at track meetings, and all provided interesting and varied working. A Shunting Competition has been held, and keen interest was taken in a Debate on the relative merits of steam and electricity for train working, the advocates of electricity winning the contest. The Post Office Underground Railway and London Bridge Signal Box have been visited. Secretary: D. Ballardie, 50, Gordon Road, Carshalton, Surrey.

BIRSTALL (LEICESTER).—Although members are hampered by the necessity for dismantling the layout at the end of each meeting, excellent track meetings have been held and interest is fully maintained. The club is now being re-organised, and efforts are being made to find more suitable accommodation and to increase membership. A display is being given at the Birstall Summer Fair, and members are busy planning a suitable layout. Secretary: G. B. Gibson, 49, Front Street, Birstall, Leicestershire.

CHORLTON-CUM-HARDY.—The track has been increased in size and a new terminal station added. Timetable running is practised at each meeting, and on one occasion "Aintree Race Specials" were run, each train being numbered as in real railway working. A lecture on *"Signalling"* by Mr. C. H. Gill, Chairman, and a visit to the Hobbies Exhibition at Manchester have been other attractive features. Secretary: H. Gill, 56, Highfield Road, Chorlton-cum-Hardy.

AUSTRALIA

MELBOURNE.—Track meetings have chiefly been devoted to the operation of the electric railway of Mr. L. Ison, Leader and secretary. Each member in turn took charge of the Main Control Board and efficient co-operation resulted in excellent running. The signalling system of this railway is being extended and electrical interlocking is being introduced in order to enable a fast service of trains to be maintained. A visit has been paid to the railway of Mr. R. Pearson, Richmond, which is regarded as the finest Gauge O layout in Melbourne, and Mr. Pearson ran a service for the benefit of his visitors. A Meccano Aerial Bombing Game built by one of the members provided enjoyment on a Games Evening, at which a Puzzle Solving Competition also was held. Secretary: L. Ison, 8, Hayes Street, Northcote, N.16, Victoria, Australia.

ITALY

MILAN.—Very steady progress is being made with track meetings, and variety is given to the programme by Table Tennis and games. A Lecture on *"A Station in Miniature"* has been given by one of the members. A visit has been paid to the International Fair at Milan, and Rambles, Tennis Tournaments and visits to works are being arranged for the summer. Cinematograph displays held in conjunction with the associated Meccano club also are being given. Secretary: E. Vigo, Corso Genova 19, Milan, Italy.

Branches in Course of Formation

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

DOVERCOURT—Mr. H. J. B. Perry, 7, Beach Road, Dovercourt.

DUNFERMLINE—J. Adams, Dunsloy, Dunfermline, Fife.

Branches Recently Incorporated

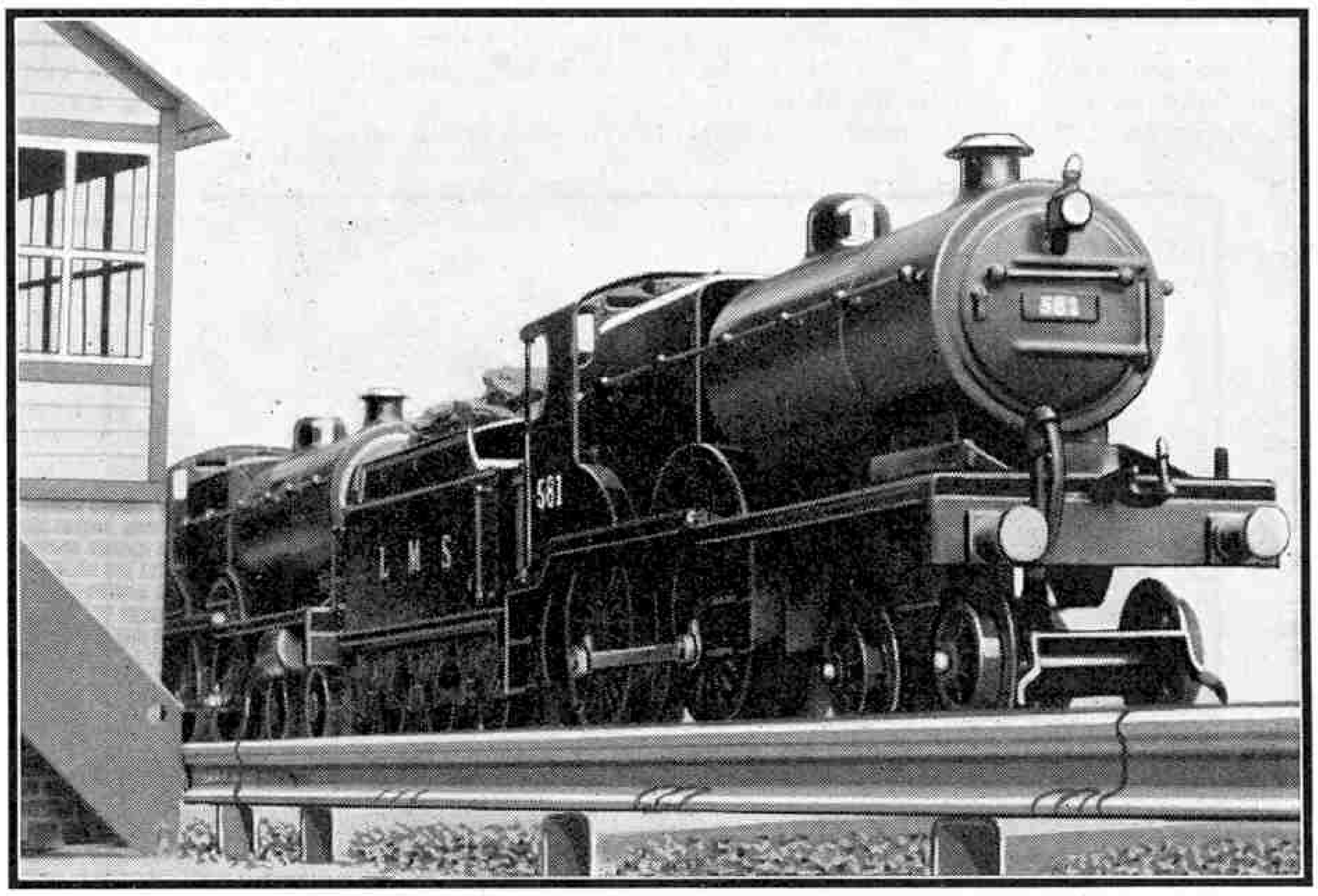
285. KINGS ROAD SCHOOL—H. A. Argent, 15, Park Avenue, Chelmsford.
286. SPRING GROVE CENTRAL SCHOOL—L. R. Harverson, 39, Hartham Road, Isleworth.
287. BOWERHAM (LANCASTER)—G. Fairweather, 44, Palatine Avenue, Lancaster.

Piloting and its Reproduction in Miniature

Why Trains are Double-Headed

THE appearance of two locomotives at the head of a train invariably provokes interest, not only on the part of the railway enthusiast, but of the casual observer also. The use of two engines may be due to a variety of circumstances and causes. The most obvious reason is that the train is too heavy for the locomotive, perhaps as the result of extra traffic; and therefore in order to prevent loss of time and delay to following trains, a pilot or assistant engine is attached. Again, owing to some last-minute defect a large engine booked to work a train may have to give up the turn, and possibly the only substitute available is a much smaller locomotive. In that case also a pilot will be necessary.

Sometimes assistance is taken only between certain points where the gradients are severe. Load limits are usually laid down for various classes of engines, and when train weights exceed these a pilot will be attached, and a special stop may be made to detach it unless a regular halt is booked at some convenient point.



A double-headed express on a Hornby Railway. The pilot engine carries a single "stopping-train" headlamp to indicate that it is assisting only over a portion of the journey, not exceeding 12 miles in length.

Sometimes quite light trains have two engines attached, although the train is well within the power of either engine; and comments are frequently made regarding the apparent waste of effort. In such cases the additional engine is usually being returned to its home station, perhaps after working a special train in the reverse direction. Instead of keeping the engine standing by until a suitable turn of duty, which might involve a considerable period of waiting, the opportunity is often taken of returning it as a pilot.

Piloting has been fairly common on certain lines for many years where load limits for certain classes of engines are strictly enforced. Other systems may be more or less opposed to the practice of double-heading, and its occurrence is then comparatively rare. Quite frequently, however, weight considerations prevent the employment of big engines over particular sections of line, and in that case the regular piloting of heavy trains may be a necessary proceeding.

Hornby Railway owners frequently make use of pilot engines, either for the spectacular effect of a double-headed train, or because some particularly heavy load has to be conveyed. On clockwork systems the attachment of an additional locomotive of suitable type creates no difficulties, but on a Hornby Electric Railway a pilot engine is of no assistance, as it immediately increases the demand on the power supply. Meccano Transformers and Accumulators are designed to operate efficiently one locomotive at once. In any case the power of Hornby Electric Locomotives renders the practice of piloting unnecessary.

Piloting therefore need be considered only as regards clockwork locomotives. Some boys experiment with the practice but do not obtain the results they expect. This may be due to the engines used being "out of condition"; on the other hand, where the locomotives are well maintained and with conditions generally favourable, disappointments or even mishaps are most probably due to the pairing of unsuitable types of engines. A small engine, light in weight with a moderate turn of speed, should not be attached in the front of a heavier and faster one, for it will then be a hindrance rather than a help. The comparative lengths of run of the engines concerned is another important point, for an engine capable of short journeys might be overrun by a bigger one of the long-running type.

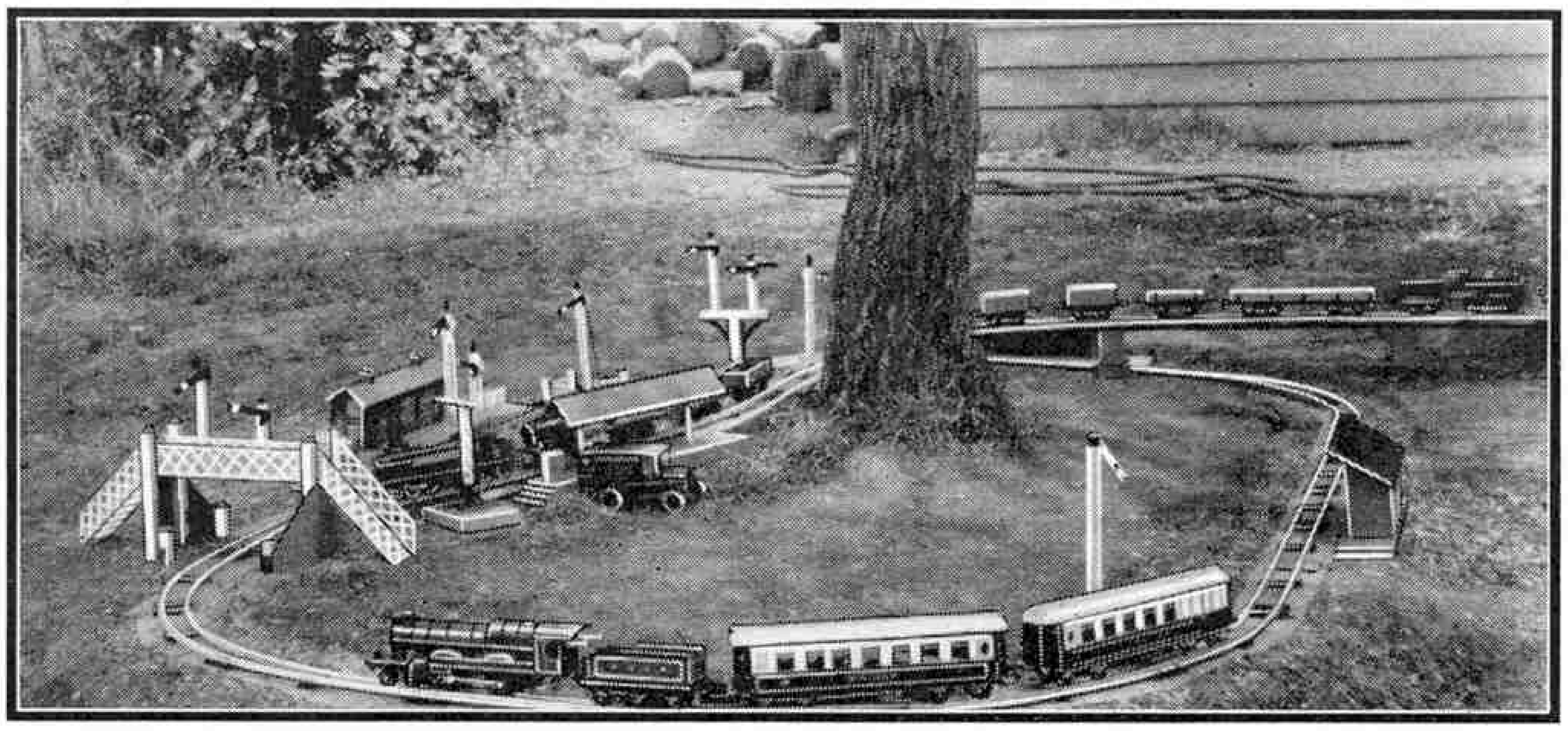
In general the best results are obtained when two engines having similar mechanisms are used together. Thus a No. 1 Tender Locomotive might be assisted by a No. 1 Tank, or two No. 1 Tender Locomotives might be put together at the head of a train. Similarly engines having the No. 1 Special type of mechanism may be paired off, and those having the large and powerful No. 2 Special clockwork, such as the No. 2 Special Tank and Tender Locomotives and the No. 3C engines.

Two Hornby No. 2 Special L.N.E.R. "Shires" make a handsome pair of engines at the head of a heavy train. L.N.E.R. enthusiasts, however, will recall that special regulations ordinarily restrict the running together in Scotland of two of the Class D49 4-4-0 "Shires" or "Hunts" to the main line between Berwick and Edinburgh. This should be borne in mind by those whose layouts are based on the Scottish Area.

Railway Layouts in the Garden

An Interesting Summer Pastime

EACH year during the summer months we receive numerous enquiries from boys who have commenced the fascinating miniature railway pastime during the winter season, as to the possibilities of using Hornby Railway equipment in the garden. Frequently it is asked whether Hornby Rails can be left permanently out-of-doors without any harm coming to them. It must be stated straight away that this must never be done, as Hornby Rails and components are intended essentially for indoor use. If the rails were left outside they would rust rapidly owing to damp, and important components such as Points, with movable working parts, would soon become quite unusable. Similarly none of the Hornby Railway buildings, Stations, Signal Cabins, Engine Sheds, etc., should ever be left outside.



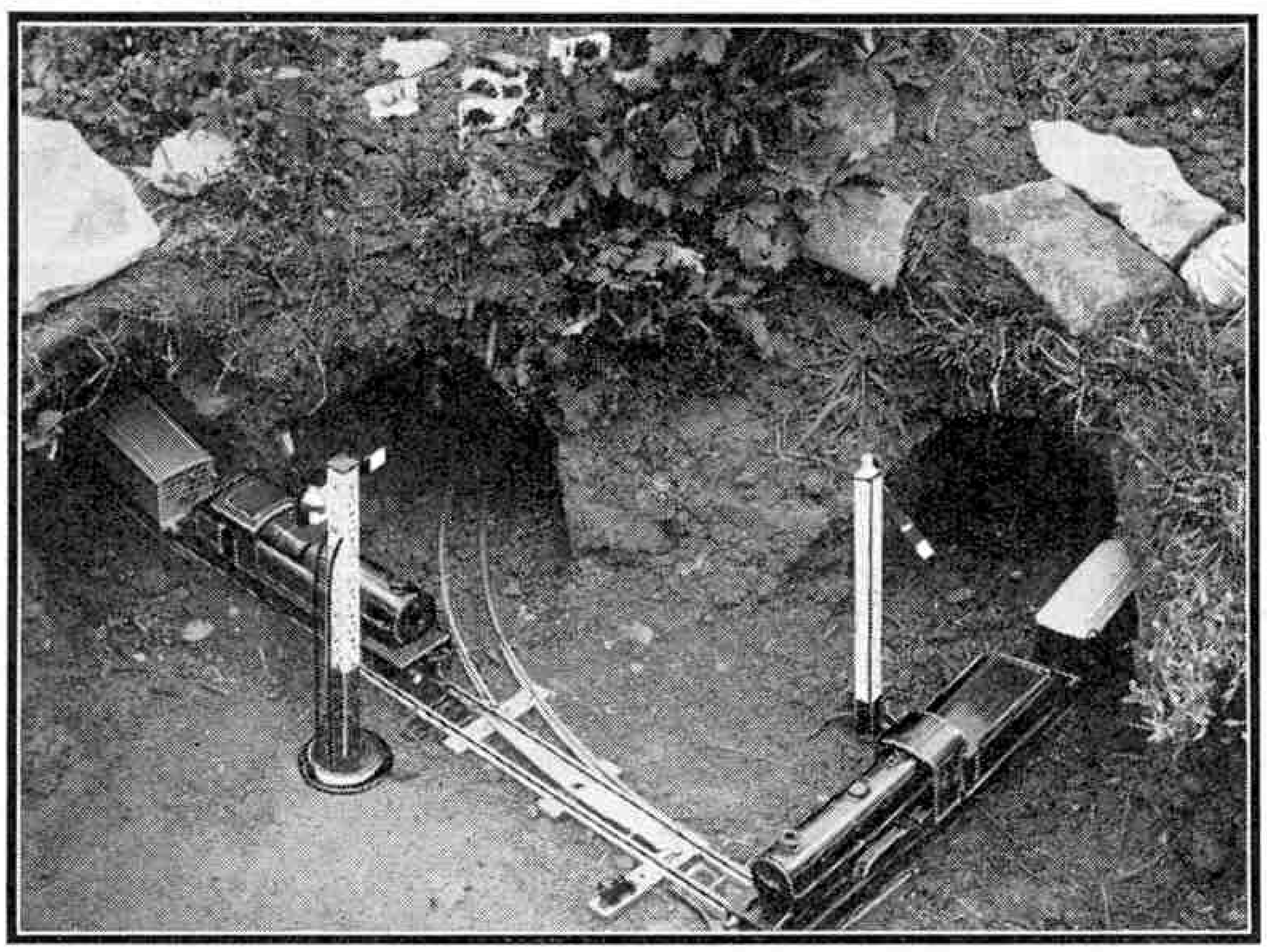
The rails of this layout arranged out-of-doors are supported on bricks sunk in the earth, as suggested in this article. This Hornby Railway is operated by I. Denniss of Armidall, N.S.W.

At first sight this may appear to prevent Hornby Railway owners from enjoying the fun of operating their layouts in the open air. This is not so, however, for, on a fine dry day, there is no reason why they should not arrange their rails and accessories outside, and perform realistic and satisfactory train operations. But it is very necessary to observe certain precautions, which should in no circumstances be neglected.

A miniature railway layout that has been arranged in the garden should never be left there overnight, but should be brought indoors as soon as it is finished with. In order to avoid any possibility of the rusting of the components, they should all be given a careful wipe over with a dry rag after use. This applies particularly to the track, but it will be wise to give the same attention to accessories such as Signals, Level Crossings and buildings generally.

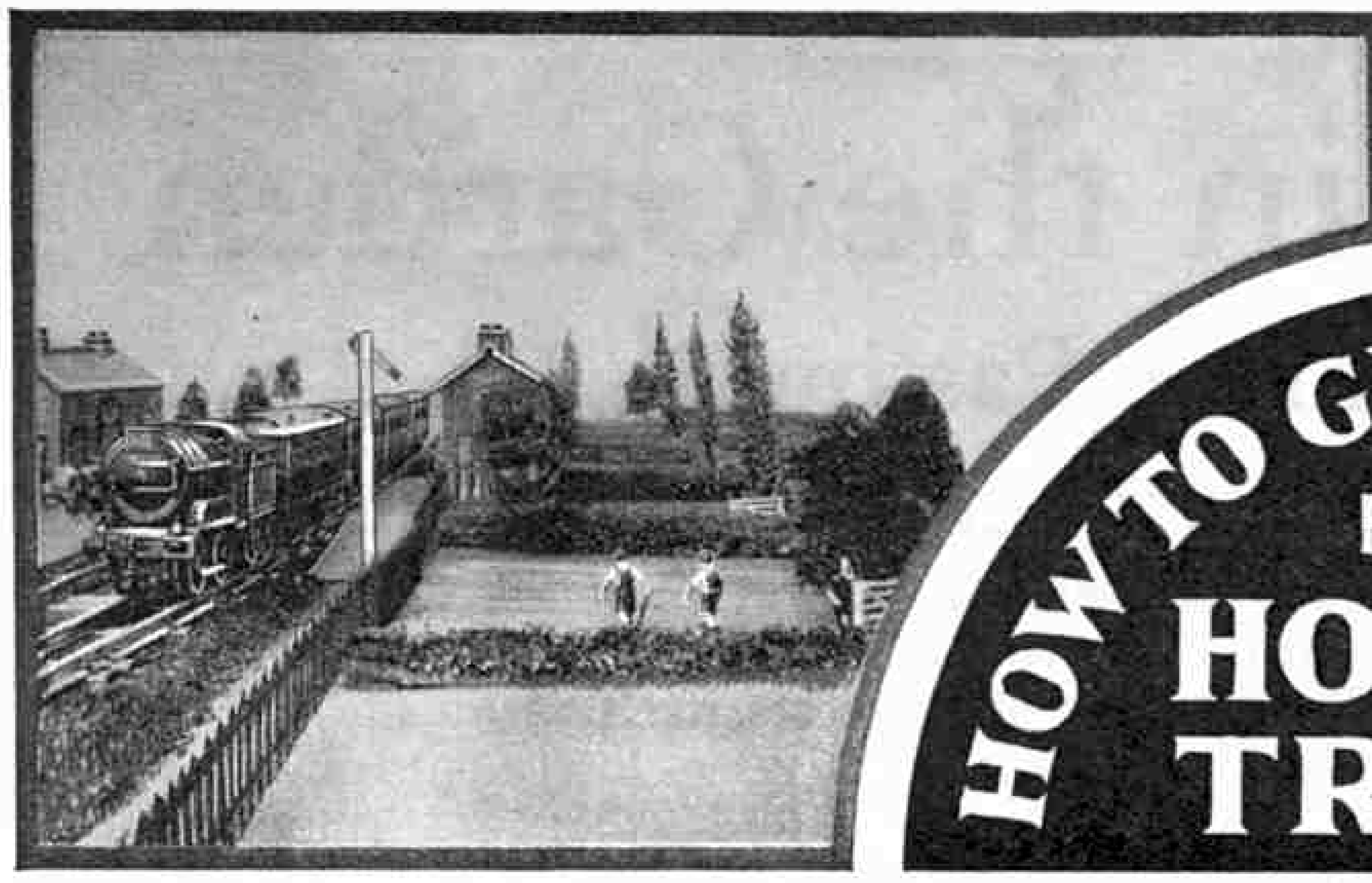
With regard to the laying of the track out-of-doors, the lawn immediately suggests itself as an ideal spot. But unless the grass on it is very closely cut, almost to the smoothness of a bowling green, the rails cannot be laid on it successfully. Difficulty may be experienced in securing a level track and the grass itself will tend to cover the rails and so impede, if it does not quite prevent, the progress of the trains. Some support for the tracks will therefore be necessary in order to raise the rails sufficiently high above the grass, but the level of the line should then be carefully watched.

It may be possible to make use of a patch of ground not normally cultivated. In that case, the track may be laid on lengths of wood placed on the earth formation, which should be well beaten down. Alternatively bricks or tiles and similar articles, make quite a satisfactory support provided that due care is taken in levelling them off. They should be sunk in the soil up to the level of their upper surface.

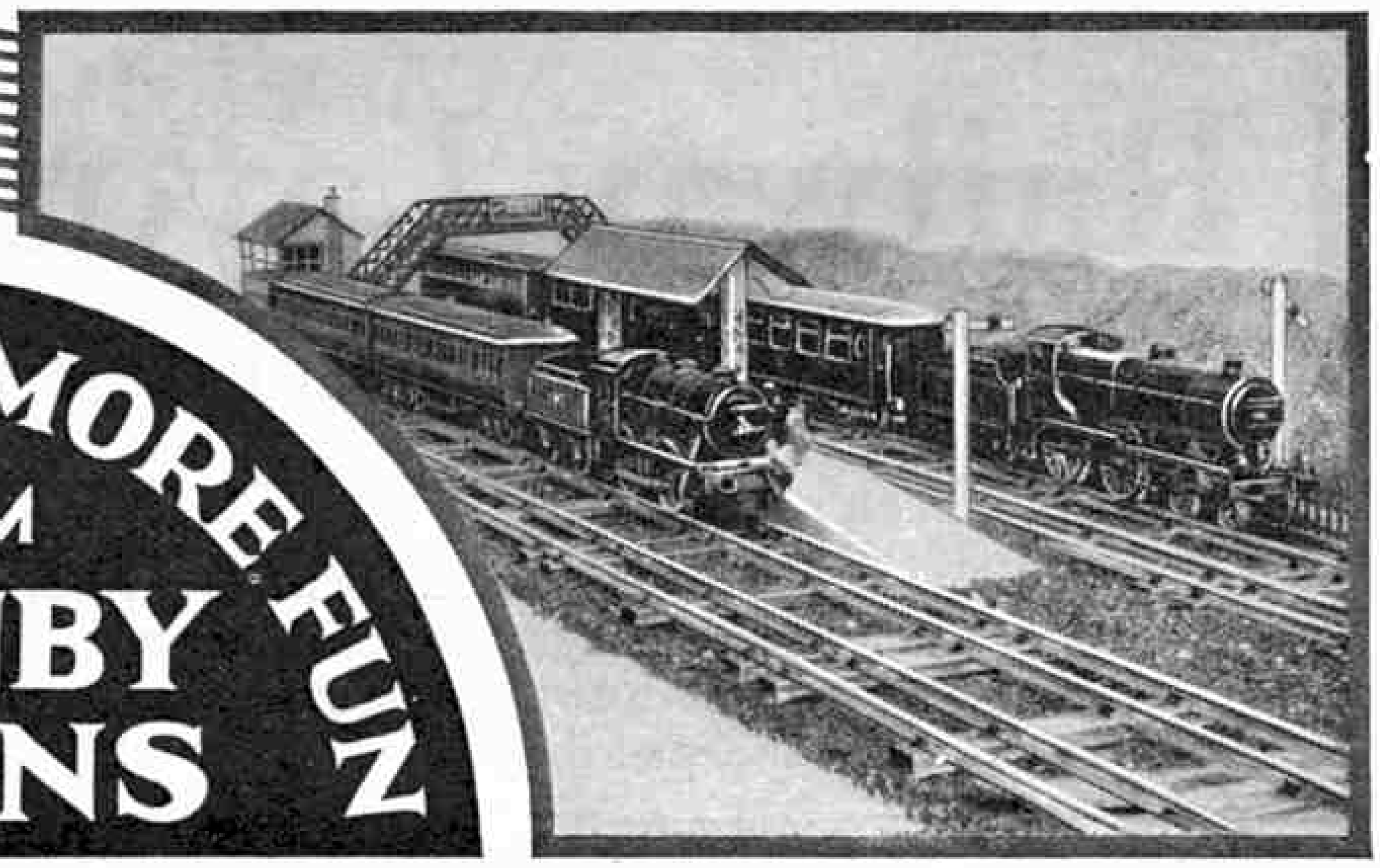


Some interesting tunnelling carried out by R. Lower of Merstham, Surrey. The various tunnels were excavated in clay by means of a long-handled trowel.

An advantage of the use of a plot of ground for the line is that realistic embankments, cuttings and even tunnels may be constructed. Cutting or embankment slopes must not be too steep and particular care will be necessary with tunnels. Although they may be "bored" with the aid of a trowel where the soil is solid, the "cut and cover" method must be used in relatively loose earth, the tunnel being formed by digging a cutting and subsequently covering it in. A suitable "lining" for the miniature tunnel must then be used, such as a rain pipe of suitable size, if available.



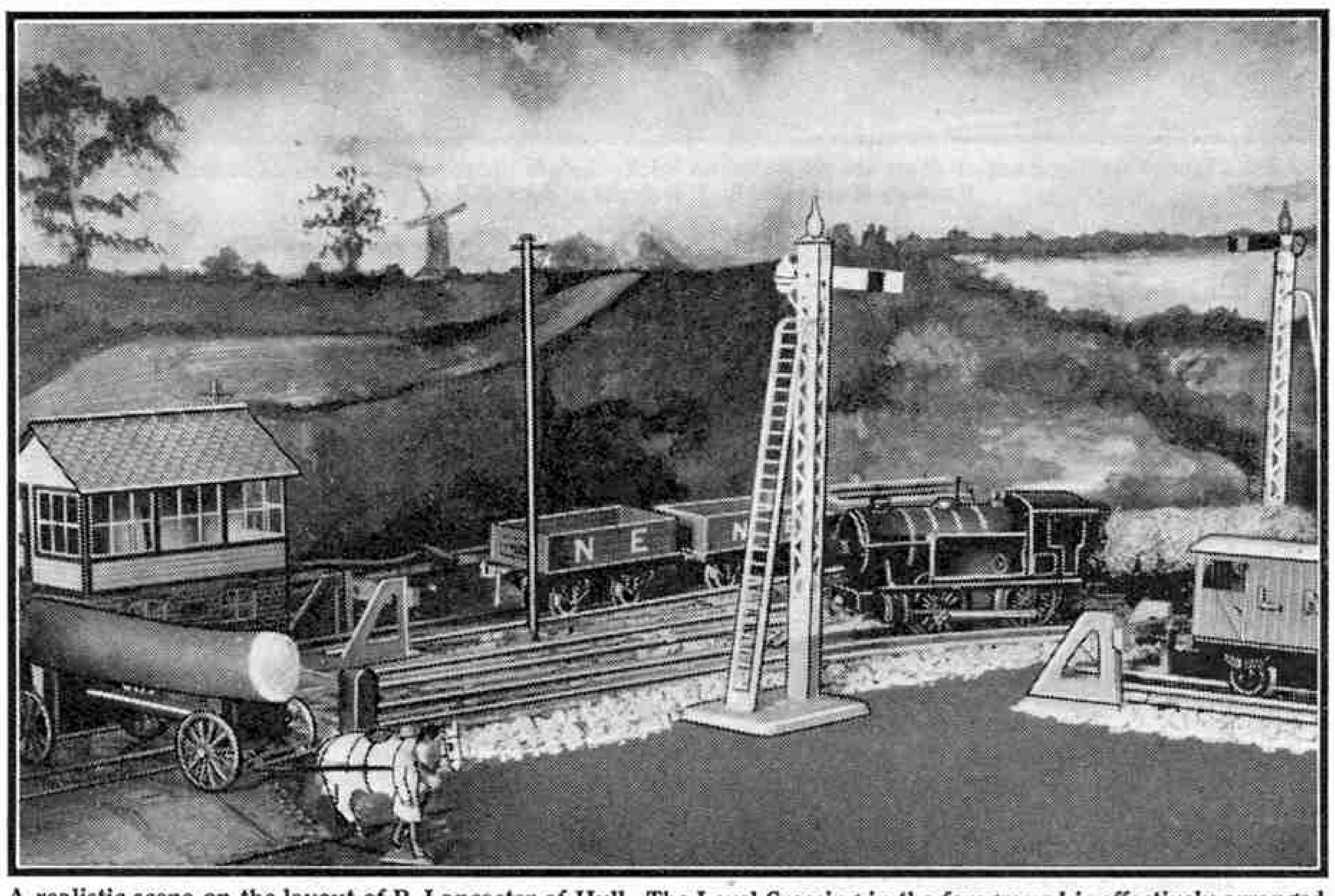
HOW TO GET MORE FUN FROM HORNBY TRAINS



IMPROVING THE APPEARANCE OF A LAYOUT

IN the earliest stages of the miniature railway pastime the efforts of the owner are invariably directed towards the extension of the track in order to render possible more realistic running. The testing of a new locomotive and train, its running-in and general exercising, require only a simple track; but as soon as the engine starts to develop its full power additional rails are invariably obtained in order to give it the advantage of a satisfactory length of run to show its paces. Often, therefore, the track expands rapidly, and in due course becomes more or less complicated. Although quite entertaining working can be obtained on it, however, the general effect of the system may not be very satisfactory, and the owner may wonder why his line has not the finished and realistic appearance that is so desirable.

Accessories play a most important part in the make-up of a miniature railway system. Although many of them do not "work," but are frequently placed at the lineside for various purposes according to their type, they have a great deal of influence on the ultimate effect of the model railway. In addition to accessories that have been considered in detail in these pages on various occasions, there are certain improvements that can be arranged by the railway owner himself in order to improve the looks of things. The extent to which some of these can be adopted depends on the type of layout; whether it is permanently arranged on the floor or baseboard, or whether it is only laid down temporarily and has to be taken up and packed away after use. In the latter case there is rather less scope in certain directions, but a realistic layout can be arranged in spite of this. Since the railway material has to be movable, the lineside effects must also conform to this requirement. In the case of Stations, Signals and Signal Cabins, and other essentially railway accessories, this necessity for removal makes no difference to their characteristics, and Hornby Railway accessories of this kind can be used equally well for permanent or portable layouts.



A realistic scene on the layout of P. Lancaster of Hull. The Level Crossing in the foreground is effectively arranged in conjunction with the road represented in the scenic background, a good instance of careful attention to details.

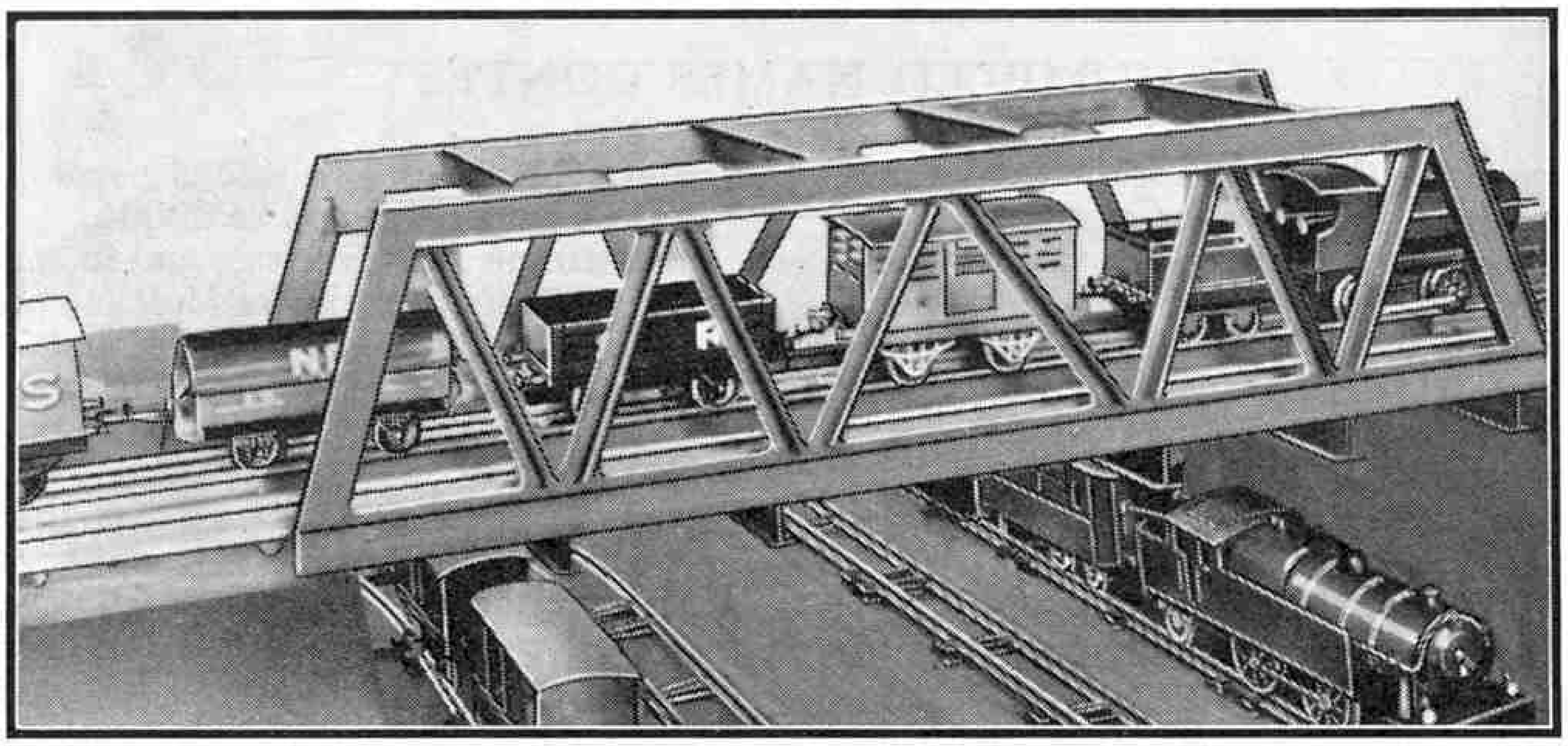
These accessories form what we may term the bare necessities in securing a realistic effect. The provision of scenery is one that sooner or later exercises the mind of the miniature railway owner, and naturally the best effects with this are to be obtained where the layout is permanently arranged. It is possible, however, to attain quite a high standard of realism in scenery, even if the layout is a portable one. Many boys do consider the use of background scenery, but more often than not they shelve the question on account of the difficulties that they anticipate in its production. If a start is once made, however, although some disappointment may be experienced in the earliest stages, they will be surprised at the comparative ease with which a suitable background for a miniature railway can be produced.

Some miniature railway owners make use of prepared scenic friezes, but a disadvantage of these as commercially produced is that the scene repeats itself relatively frequently, and a miniature express on its journey passes a succession of trees, streams, hills or houses that are exactly the same. Where only a short length of background is required this type of frieze may be used, as by careful cutting it may be possible to avoid any repetition.

Where a line is laid out either to represent an actual section of real railway, or to serve an imaginary district having certain characteristics, the use of scenery consistent with the situation is essential. The first necessity is a suitable base or background on which the various features of the countryside are to be depicted. On a permanent layout this may take the form of plain sky blue wallpaper attached to the walls of the room.

For a portable layout this is not possible, so that a substitute for the walls must be found. Most boys are handy at carpentry and will find little difficulty in making up what we may term a series of "stands" of 3-ply or other light wood, to form a continuous "fence" along the outside of the track. To these fences will be attached the wall-paper, cut to the right height and length.

When the background is ready we must decide on the features of the countryside that we wish to incorporate, and mark any of the more important points in with pencil. For instance, the point where a Footbridge crosses the railway will require a footpath to be shown on the scenery, and so on. Then the fields, hedges, trees, houses, distant hills and clouds may be put in by degrees, using either paints or chalks as preferred. As this form of scenery in any case is only background, an excess of detail should not be aimed at. It will in fact spoil the effect, and the aim should be to reproduce only the broad features. After a little practice, and with photographs or picture postcards to copy from, the model railway owner will find that he can turn out quite satisfactory scenery. If he really cannot get the knack of doing so, then no doubt a friend who is more apt in this direction can be persuaded to do the job. Scenic backgrounds of this kind provide an appropriate setting for the miniature system and are well worth the time spent on them.



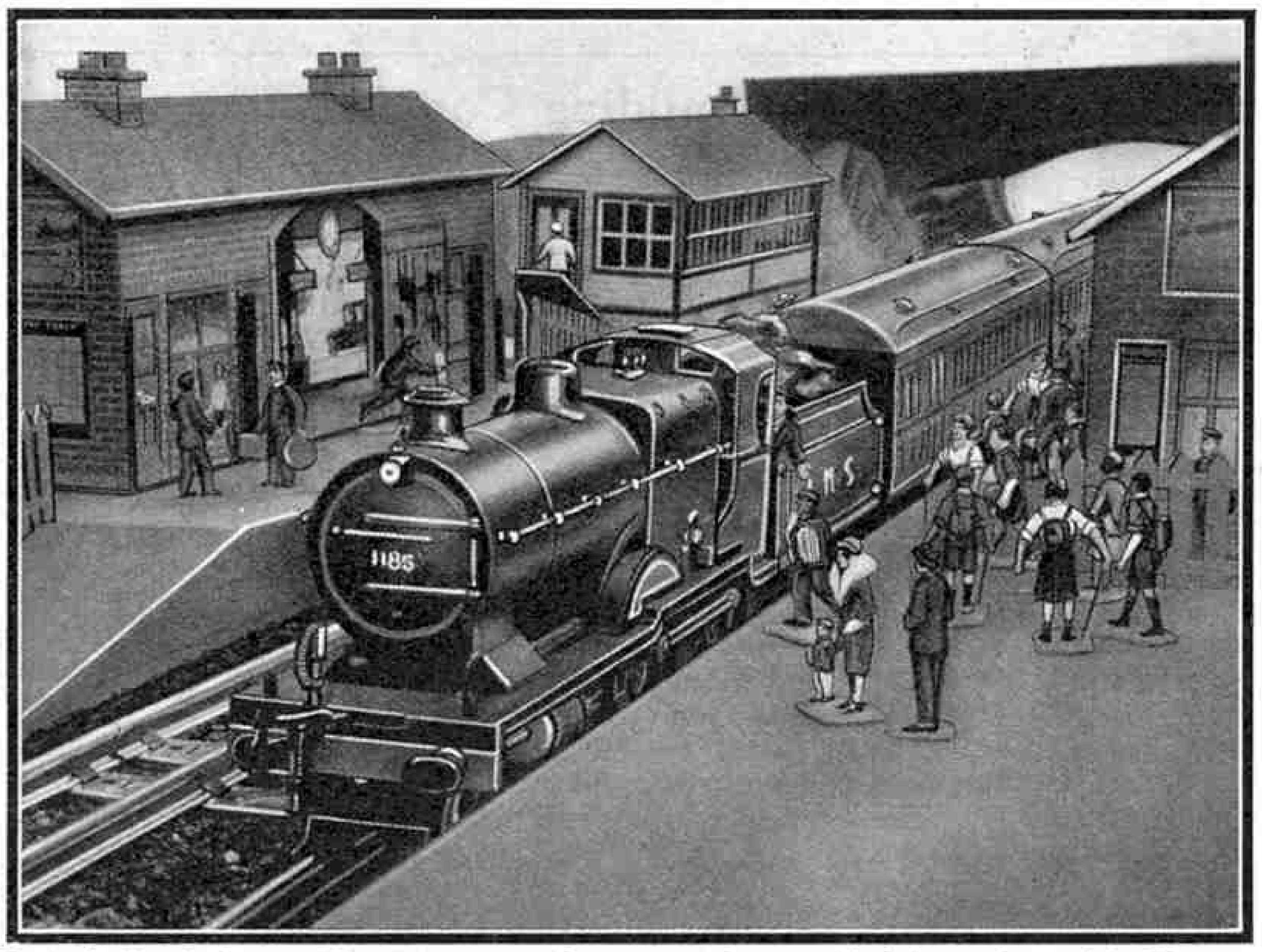
A well-constructed viaduct on the layout of W. G. Young of London, E.6. It carries a double-track main line and is led up to by suitable embankments at each end.

So much for the remote scenery. For the various features that go to make up the lineside surroundings of the line, good use can be made of Hornby Paled Fencing, Trees, lengths of Hedging, and the Cuttings and Tunnels that received particular attention in the April "*M.M.*" Combining the "scenic" and "railway" interests is the Level Crossing that can be used with such good effect if its situation is carefully studied and its approaches are well arranged to fit in with the general character of the lineside surroundings in its neighbourhood.

The various effects and accessories dealt with so far can all be applied either to temporary or to permanent layouts. In one respect those with permanent lines have the advantage, and that is in their ability to make use of ballast for their tracks. Apart from the greatly improved appearance of a line that is neatly ballasted with appropriate material, the use of ballast has the valuable effect of deadening the noise made by the trains. The hard roar that characterises the running on some miniature railways would be toned down considerably if ballast were used.

The best material for ballast is fine granite chippings, which should be well screened and washed before use in order to remove any dust. These chippings give a neat and clean appearance to the track if well laid down and levelled off. A minor difficulty is that the vibration caused by trains makes it practically impossible to keep a neat "edge" on the ballast. This may be overcome by laying thin strips of wood along the edge of the formation, painting these as nearly as possible to tone with the ballast used. Granite chippings can invariably be obtained from a builder's merchant. An alternative material that gives quite good results is what is known as "chicken grit," which can be obtained from a corn chandler.

Even when a layout has been brought to a fair state of completeness in regard to detail, and the locomotive and rolling stock equipment is sufficient to operate a satisfactory service, there is often to be noticed an emptiness or lack of "life." An examination of the causes of this reveals the fact that there are no railwaymen to work the trains, no passengers or merchandise to run them for, no animals in the fields along the line, and no traffic on the roads near it! There is therefore no apparent reason for the line at all!



Part of a Hornby layout. The arrangement of the accessories generally is interesting and the Meccano Dinky Toy figures add considerably to the "life" of the illustration.

The various figures, animals, and motor vehicles of the Meccano Dinky Toys Sets should be used in order to brighten up the situation. First of all there are the railwaymen necessary for running the train service; then the various Passengers on the station platforms and along the miniature roads that encircle the station. There are also the members of the Engineering Staff who are responsible for the general maintenance of the railway and all its stock; and to attend to passengers there are the Train and Hotel Staff, all smart and efficient-looking. These little figures should all find a place on a Hornby Railway.

Join the Hornby Railway Company and become eligible for the competitions announced on this page.

H.R.C. COMPETITION PAGE

Join the Hornby Railway Company and become eligible for the competitions announced on this page.

JUMBLED NAMES CONTEST

During the summer months readers will be concentrating their attention mainly on outdoor matters, and will not be in the mood for competitions that demand brain searching and wrinkling of brows. This month, therefore, we provide a contest which, although it requires something in the nature of mild brain-waves, is not too serious, and can be dealt with anywhere, indoors or out, and at any odd moments.

In the panel in the centre of this page are 16 words, which at first glance appear to belong to some unknown language. It seems almost incredible that such an extraordinary collection of letters can be rearranged to make sense,

VIBJESLRULEIE	**YGHRTELORDONOAA**
THIURHCHWC	**XKOSMEOB**
YESHOUSNRSBE	**NMTMETIOUUBROLDIHE**
DXSRSECAHETYFOPELSTE	**NACAGTNESREELT**
VPTAVLINESO	**GENMATERINN**
IFBGHETAREOHRSUOLRC	**PANCUOHC**
REGADNAPDAR	**YPSOBXETARSER**
CLRIBOEMFA	**LUTTABPEE**

but actually the jumbled names conceal the names of locomotives, railway stations, famous trains and locomotive parts. Competitors are asked to discover these names, or as many of them as possible, and to write them down in the order in which they appear in the panel. Short descriptions of the functions of the locomotive parts mentioned also should be given, and to the remaining names should be added those of the railway companies concerned. One side of paper only should be used.

The Competition will be divided as usual into two Sections, Home and Overseas, and in each Section prizes of Hornby Train material (or Meccano products if preferred) to the value of 21/–, 15/–, 10/6 and 5/– respectively will be awarded. In addition a number of consolation prizes will be given to the competitors whose entries do not quite reach the standard attained by prize-winners, but are nevertheless praiseworthy efforts. In the case of a tie for any prize, preference will be given to the sender of the entry that is presented in the neatest or most novel manner.

Envelopes containing entries must be marked *"H.R.C. June Jumbled Names Contest"* in the top left-hand corner and posted to reach Headquarters at Meccano Ltd., Binns Road, Liverpool 13, on or before 29th June. The latest date on which entries from Overseas competitors can be accepted is 30th September. Every entry must be clearly marked with the name, full address and H.R.C. membership number of the sender.

Railway Photographic Contest

Last month we announced the first contest of the summer series of Photographic Contests, in which competitors were invited to submit photographs of any railway scene. This month we announce the second contest of the series. As in previous contests, there are no restrictions, except that the actual exposure must have been made by the competitor himself; the developing and printing may be the work of a professional. Competitors may send as many different prints as they desire, but no competitor can win more than one prize in one contest. It is important that every print submitted should have on the back the name of the competitor, his full address and his H.R.C. membership number; and the omission of these details will result in disqualification.

The Contest will be divided as usual into two Sections, Home and Overseas, and prizes of Hornby Train material (or Meccano products if preferred) to the value of 21/–, 15/–, 10/6 and 5/– respectively will be awarded to the senders of the four best entries submitted in each Section. In addition a number of consolation prizes will be awarded. In the case of a tie for any prize the prize money will be equally divided. Envelopes containing entries must be marked *"H.R.C. June Railway Photographic Contest"* in the top left-hand corner, and posted to reach Headquarters at Meccano Ltd., Binns Road, Liverpool 13, on or before 29th June. The Overseas closing date in this Contest is 30th September.

Word-Building Contest

In the February issue of the *"M.M."* we announced our first Word-Building Contest, and the number of entries received proved beyond doubt that this type of contest is going to be very popular. We have no hesitation therefore in announcing this month another similar contest. The competition is very simple, and is one in which every member of the H.R.C. will wish to enter. All that competitors are required to do is to make as many different words as they can out of the letters forming the name, *"HORNBY RAILWAY COMPANY."*

Entries should be written on one side of the paper only, and the total number of words found should be stated at the end of the list. Only standard English words may be used; faked and slang words are not eligible. No proper names are allowed.

The Contest will be divided as usual into two Sections, Home and Overseas, and prizes of Hornby Railway material (or Meccano products if preferred) to the value of 21/–, 15/–, 10/6 and 5/– respectively will be awarded to the senders whose entries contain the longest list of legitimate words. In addition a number of consolation prizes will be awarded to the competitors whose efforts are near to prize-winning standard.

Envelopes containing entries must be marked *"H.R.C. June Word-Building Contest"* in the top left-hand corner and posted to reach Headquarters at Meccano Ltd., Binns Road, Liverpool 13, on or before 29th June. The entries from Overseas competitors must be despatched to reach this office not later than 30th September.

COMPETITION RESULTS

HOME

March "Photo Voting Contest."—First: K. Costain (5108), Bolton, Lancs. Second: C. E. Wrayford (6039), Moretonhampstead, Devon. Third: J. C. Button (10335), Crewe, Ches. Fourth: J. Owen (42289), Denby Dale, Huddersfield. Consolation Prizes: D. Morton-Hooper (41462), Sidcup, Kent; C. Brett (5868), Great Coates, Lincs.; E. R. Dudley (37680), Carshalton, Surrey; G. Masterson (28580), Leytonstone, London, E.11.

March "Railway Photographic Contest."—First: S. Garbutt (30122), Altrincham, Ches. Second: J. C. Button (10335), Crewe, Ches. Third: B. Hull (30795), Walton, Liverpool, 4. Fourth: W. B. Hudson (1733), Weymouth, Dorset.

April "Loco Peculiarities Contest."—First: R. H. Mann (18111), Aspley Guise, Bletchley. Second: E. Beven (35158), Birley Carr, Sheffield. Third: J. L. Makin (30933), Penwortham, Preston. Fourth: R. Hebbert (42890), Withington, Manchester.

April "Railway Photographic Contest."—First: D. H. Graham (24449), Bilton, Rugby. Second: R. E. C. Cadman (2324), Llandaff, Cardiff. Third: L. Aldridge (22484), Harestone Hill, Caterham. Fourth: W. B. Hudson (1733), Weymouth, Dorset.

OVERSEAS

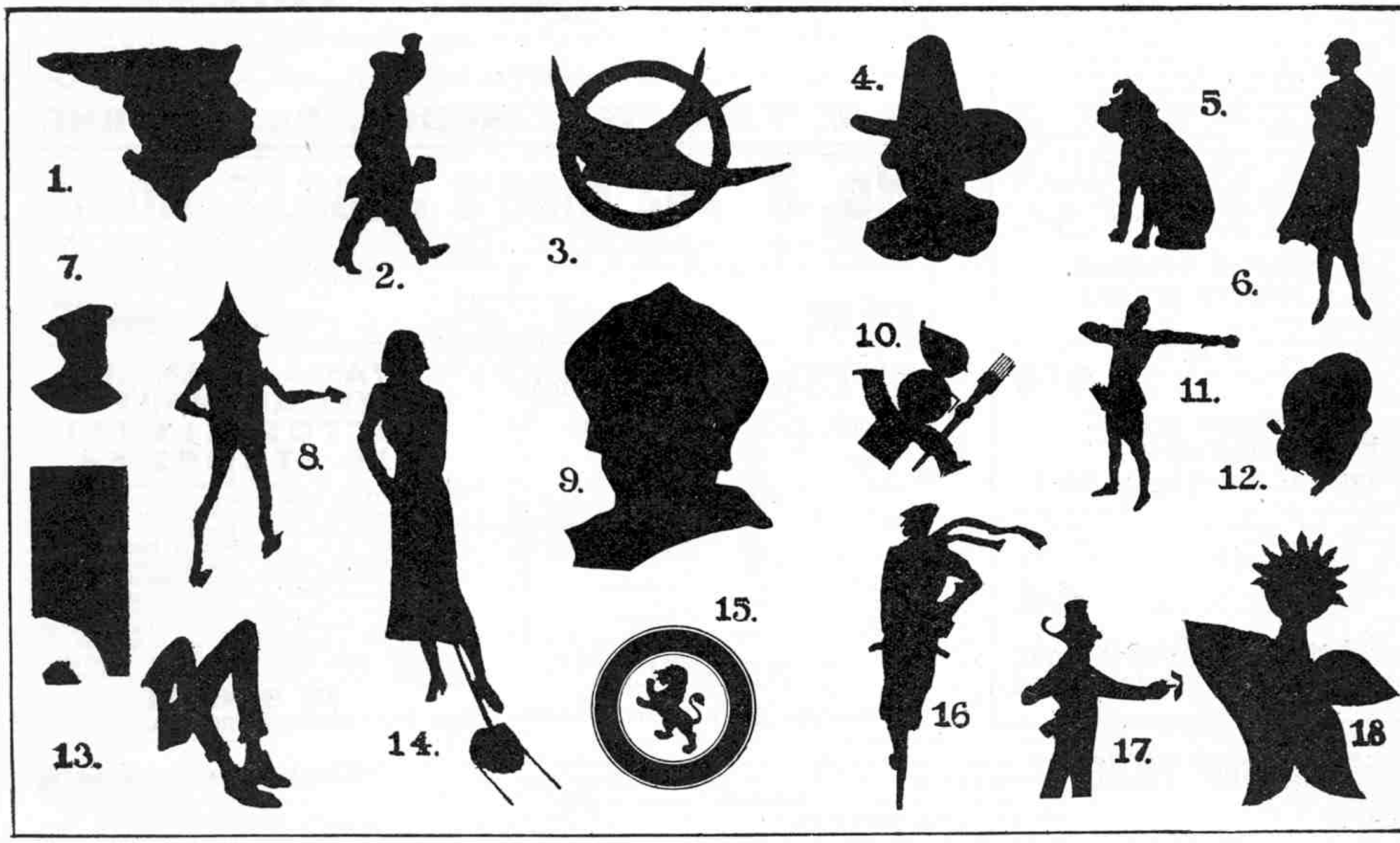
December "Railway Strips Contest."—First: R. A. Wragg (7913), Bandikui, Rajputana, India. Second: F. D. Aria (12362), Tardeo, Bombay, 7, India. Third: D. E. Yockney (39969), Onehunga, Auckland, New Zealand. Fourth: D. Parker (38595), Brussels, Ontario, Canada.

December "Railway Photographic Contest."—First: E. Scott, Calgary, Alberta, Canada. Second: W. Hardgrave (38553), Brisbane, Australia. Third: J. McIntyre (31781), Winnipeg, Canada. Fourth: A. R. Bacon (38242), Deolali, India.

January "Missing Links Contest."—First: D. J. White (9333), Christchurch, New Zealand. Second: I. Brough (9112), Preston, N.18, Victoria, Australia. Third: R. A. Wragg (7913), Bandikui, Rajputana, India. Fourth: E. A. Bunt (24651), Capetown, South Africa.

January "Voting Contest."—First: D. Murison (37642), Buenos Aires, South America. Second: A. J. Cramp (11438), Kogarah, Sydney, Australia. Third: A. G. Fellows (29952), Northcote, Auckland, N.4, New Zealand. Fourth: H. C. Key (24764), Park Circus, Calcutta, India.

Competition Corner



What Advertised Products are Represented Here?

This month we give the third and last of our series of advertisement competitions. On this occasion readers are asked to identify the advertised products represented by the silhouetted figures shown in the illustration above, and to state the names of the firms marketing the products. Each of the figures is a well-known advertising mascot that has been featured prominently in the advertisement pages of newspapers and magazines and, in most cases, on the poster hoardings also.

Prizes of Meccano products, to be chosen by the winners from the current Meccano catalogue, to the value of 21/–, 15/–, 10/6 and 5/– respectively will be awarded to the four competitors who submit the most accurate lists in order of merit. In the event of a tie for any of the prizes, preference will be given to the entry displaying the neatest or most novel presentation.

Readers who do not succeed in identifying all of the products should not be deterred from submitting an entry. Consolation points will be awarded to those competitors who do not succeed in gaining a major prize, and these points will be taken into consideration with those awarded in the April and May contests in allotting 24 special consolation prizes, value 5/– each, that are offered in connection with this series of competitions.

Entries to this month's contest should be addressed "June Advertising Competition, Meccano Magazine, Binns Road, Liverpool 13," and must be forwarded to reach us not later than 29th June. A separate set of prizes has been reserved for competition among Overseas readers, those living outside Great Britain, Ireland and the Channel Isles, whose entries must arrive not later than 30th September.

June Photo Contest

Our Photographic Competitions this summer, as was announced in the April issue, are again open to photographs of any size or subject, made with any make of camera, film or paper. The only restrictions are that each print must bear a title, and that the exposure shall have been made by the competitor himself. All other things being equal, preference will be given to those entries that are the work of the competitor throughout. Competitors who have developed and printed their entries should mark the prints "own work throughout."

Each month until September we shall award prizes to the best photographs submitted, and for the purpose of judging, entries will be divided into two sections, A for those aged 16 and over, B for those under 16. The prizes offered in each section consist of Photographic Materials or Meccano products to the value of 21/– and 10/6 respectively.

Entries to the June Competition should be addressed "June Photo Competition, Meccano Magazine, Binns Road, Liverpool 13," and must arrive not later than 29th June. A duplicate set of prizes is reserved for competition among Overseas readers, whose entries should be similarly addressed and must arrive not later than 30th September.

COMPETITION RESULTS

HOME

April Advertisement Contest.—1. R. J. Biggs (Bristol); 2. D. Patterson (Manchester); 3. E. A. Life (Watford); 4. A. M. H. Lewin (Salisbury).

April Photo Contest.—First Prizes: Section A, A. B. Bishop (Bristol); Section B, P. T. Clarke (London, S.W.14); Second Prizes: Section A, E. H. Coles (Sheffield); Section B, A. D. Townsend (Kingston Hill).

OVERSEAS

Cover Voting Contest.—1. P. Dias (Ceylon); 2. J. M. Tocker (Christchurch, N.Z.); 3. W. Jack (Ballarat East, Australia); 4. R. A. Begg (Hamilton, Ont.). Consolation Prizes: A. Carpinter (Christchurch, N.Z.); E. S. Davies (Montreal); R. Green (New Westminster); C. J. McCain (Sydney, N.S.W.).

January Drawing Contest.—First Prizes: Section A, Myra Morgan (Cremorne, N.S.W.); Section B, R. J. Dickison (Dunedin, N.Z.); Second Prizes: Section A, D. E. Yockney (Auckland, N.Z.); Section B, M. Conly (Dunedin N.Z.).

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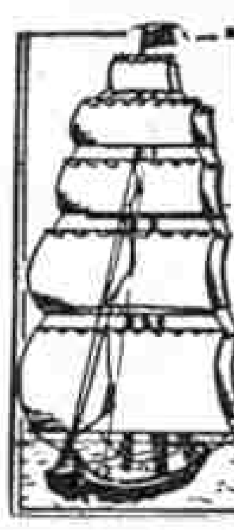
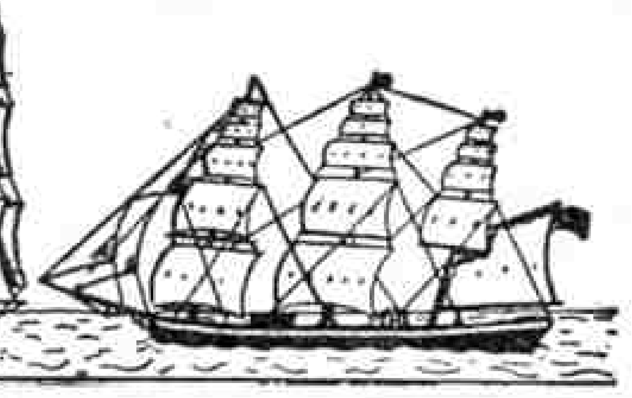


THE 'SHIP' PACKET



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Stamp Gossip
and Notes on New Issues

The Best Designs of 1934

It is probable that the majority of our stamp collecting readers owe their first interest in the hobby to the attraction of striking designs. They will therefore be interested to learn the result of a competition recently organised by our contemporary, *Gibbons' Stamp Monthly*, to discover the 12 best designs of 1934.

That competitors had no easy task may be gauged from the fact that over 1,700 new stamps were issued during the year. Incidentally, it is interesting to observe that no less than nine of the chosen 12 had been previously selected for reproduction in the *"M.M."* during the year, while the other three were higher values from series illustrated in the *"M.M."*

The selected 12 stamps, in their order of popularity, were as follows: 1. Canada 3c. Cartier Commemorative (illustrated in *"M.M."* October, 1934); 2. Grenada Pictorial 2½d.; 3. U.S. Mother's Day Commemorative (*"M.M."* July, 1934); 4. Canada 10c. Empire Loyalist Commemorative (*"M.M."* October, 1934); 5. Basutoland Pictorial ½d. (*"M.M."* March, 1934); 6. Nyasaland Pictorial 1d. (*"M.M."* September, 1934); 7. Grenada Pictorial 1½d.; 8. U.S. Parks 3c. (*"M.M."* December, 1934); 9. U.S. Parks 1c. (*"M.M."* December, 1934); 10. St. Helena Centenary Commemorative ½d. (*"M.M."* August, 1934); 11. Ascension Pictorial 1/–; 12. Australia, Victoria Centenary (*"M.M."* October, 1934).

* * * *

The centenary of the first publication of Hans Anderson's *Fairy Tales* is to be commemorated in Denmark with a special series of stamps. Details of the designs are not available yet but we hope to reproduce specimens in an early issue.

* * * *

The tremendous popularity of Austrian charity and commemorative stamps is revealed in an official announcement that the sales of the Dolfuss commemorative stamp—sold at a premium for charitable purposes—exceeded three millions. A recent winter relief series brought in 100,000 schillings (£4,000) in premiums for the charity.

Jubilee Stamps

In its issue of Jubilee stamps, as in most of its recent stamp issues, Canada has risen to the occasion nobly and presented the philatelic world with a splendid set of six stamps.

Three of the stamps, 3c., 10c. and 13c., are illustrated here by courtesy of the Post Office Department at Ottawa, and the full list of values and designs is as follows: 1c., Portrait of Princess Elizabeth; 2c., portrait of the Duke of York; 3c., composite portraits of the King and Queen; 5c., portrait of the Prince of Wales; 10c., view of Windsor Castle; 13c., the royal yacht *"Britannia."*

Probably the most popular stamp of the series will be the 10c., for the Windsor view is excellently rendered; but the 13c. will run it close, for the inclusion of the picture of the King's famous racing yacht was a wonderfully happy inspiration.

Colonial Pictorials

Quite apart from the Royal Jubilee commemoratives, 1935 will be an interesting year for collectors of British Colonial stamps, for there will be a minor flood of new pictorial issues.

In addition to those issues chronicled recently, several other Colonies and dependent States have pictorial issues in preparation. These are mainly in Malaya, where Negri Sembilan, Pahang, Perak, Selangor and the Straits Settlements are to have new stamps. Each of the series will have one feature in common, the word "Malaya" in the top panel. Johore also is to issue a new 8c. stamp bearing a composite portrait of the Sultan and Sultana.

The series for the combined postal administration for Kenya, Uganda and Tanganyika will contain seven designs covering 14 stamps, while a Cayman Islands set, covering a full range of values, is in preparation and will include five new designs.

The Bahamas also will have a new pictorial design for an 8d. stamp. This stamp will show the customary portrait of the King on the left and a seascape showing a flagstaff and lighthouse in the background on the right. A flock of flamingoes in flight is included in the view.

Ceylon also is changing over to pictorials and certain values of a complete new issue are already in use. The values and designs, all of which include a medallion portrait of the King in one of the upper corners, range from 2c. to 1 Rupee, and provide 11 most interesting industrial and scenic views.

A Prophecy in Fulfilment

In commenting on air mail developments five years ago—in the March, 1930, *"M.M."*—we forecast that the day was not far distant "when all mails will be carried by air over both land and sea." Our prophecy is rapidly being fulfilled. In Britain to-day a great part of the letter mails between the larger cities travel by air without additional cost, and the service is being extended rapidly.

In Holland the transition from surface to aerial transit has progressed much further. Since April all outward Dutch letter mail addressed to other European countries has been carried by air, without extra fee. Only when the sender desires surface transit to be used, *and plainly marks his envelope accordingly*, is the old method employed.

In most countries it is still the general custom to demand a much higher fee for the privilege of using the speedy air mail service. We wonder whether the day will come when the air mail rate will be the normal, and surface transport will be surcharged, as a fine for involving special handling!

* * * *

The story of mail transport as revealed in stamp designs is enriched by the Spanish-Moroccan express letter stamp illustrated here. The design shows a Moorish courier galloping to deliver urgent mails.

* * * *

New Zealand has added three new values to its air mail series, 1d., 3d. and 6d. The design shows a Maori watching an air mail machine landing at the New Plymouth terminal airport.

* * *

Turkey has issued one of the most interesting commemorative series of recent years to celebrate the holding of the International Women's Suffrage Congress at Istanbul in April last. The series contained 15 values ranging from the badge of the Women's Suffrage Union to portraits of women leaders in Art, Literature and Science.

We thank Stanley Gibbons Ltd. for their courtesy in loaning the stamps—other than the Canadian—from which the illustrations for our stamp page have been made.

KING'S ENGLISH

"You don't 'arf look cold, you don't."
"'Oo do?"
"You don't."

* * * *

The soap-box orator was speaking. "It doesn't take me long to make up my mind," he said.
"Of course not," shouted the heckler; "you've such a small stock of material."

* * * *

Diner (tired of waiting): "Waitress, please find out if your colleague from whom I ordered a steak some time ago is still employed here."

* * * *

Plaintiff: "I have two witnesses to prove it."
Defendant: "I have two witnesses to prove that there were no witnesses present."

* * * *

Old Gentleman: "I am 80 and I don't recollect ever having told a lie."
Young Man: "Well, you don't expect your memory to be very reliable at your age, do you?"

* * * *

"But Bill, Jack has got character; you can read it in his eyes."
"Then I have just blackened his character."

* * * *

Goldstein: "Wherever you go in the world you will always find we Jews are the leading people."
McGregor: "Ach, mon, how aboot the North Pole?"
Goldstein: "Vell, Iceberg ain't no Scotch name."

* * * *

MacAllister: "And how did you feel when you learned that your uninsured shop was on fire?"
Isaac: "Feel? I turned as vite as your shirt—no, viter!"

* * * *

"Aren't you afraid the birds will eat your seeds? You ought to put up a scarecrow."
"Oh, it's not worth it. There's always one of us in the garden."

* * * *

"Can anyone tell me," said the Hyde Park stump orator, "who did most in the nineteenth century to cause the working classes to rise?"
"Yes, guv'nor," came the prompt answer; "the fellow who invented alarm clocks."

* * * *

"So your boy is going to be a short story teller, is he?"
"I should imagine so; every time he writes it is to say how short he is."

* * * *

OBVIOUSLY

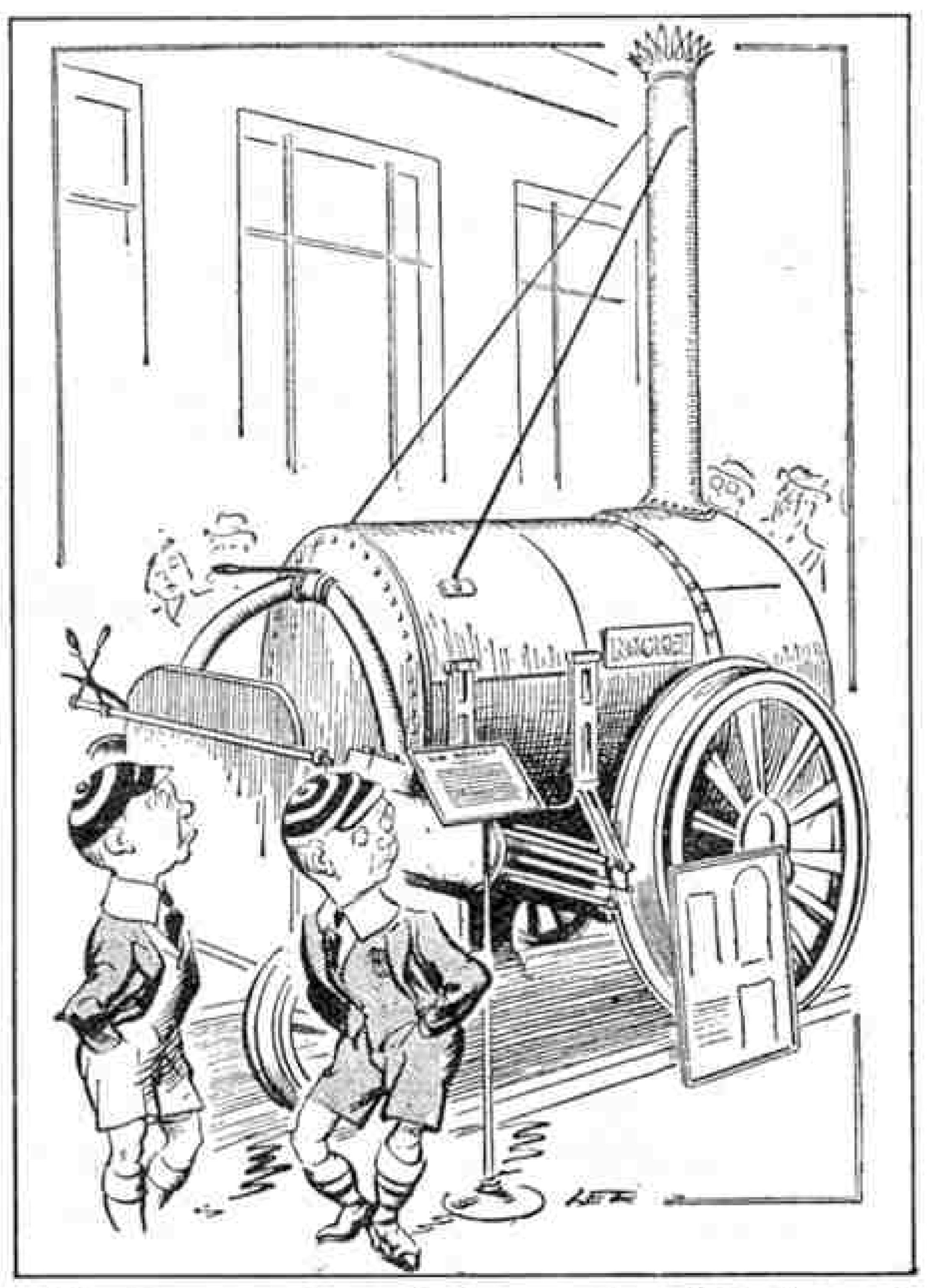
Magistrate: "Can't this case be settled out of court?"
Murphy: "That's just what me and Maloney were trying to do when the police interfered."

BUSINESS METHODS

First Pedlar: "I don't know how you can sell besoms at 1d. I steals the 'afts, I steals the birch, an' I steals the bindin', and even then I 'ave to sell 'em at 2d."
Second Pedlar: "It's easy. I steals 'em ready-made."

* * * *

NOT THEIR IDEA!



Boy to companion reviewing a replica of Stephenson's "*Rocket*" locomotive in the Kensington Science Museum: "I don't know why they make such a fuss about the man. He doesn't seem to have had the faintest idea of how to make an engine."—"*The Evening News*."

* * * *

Workman: "Can I have the afternoon off to see about a job for the missus?"
Foreman: "Will you be back in the morning?"
Workman: "If she doesn't get it."

* * * *

Hobson: "How do you like radio crooners?"
Jobson: "Dead."

* * * *

"How's that new incubator o' yours going?"
"I'm disappointed in it. It hasn't laid a single egg."

* * * *

Old Lady: "Porter, I have something I want you to put on the 2.30 for me."
Porter: "Sorry, mum; we are not allowed to take bets."

* * * *

A man had just visited the zoo for his first time. Upon seeing a camel, he exclaimed, "My, but that horse is warped."

* * * *

Bobby (weeping): "A dog come a'waggin' after me when I was comin' home."
Father: "Why are you crying? Don't you know that when a dog wags his tail, he always wants to play?"
"But this dog, father, took hold of my trousers and wagged his head."

* * * *

Geography Teacher: "Tommy, what are the dual capitals of South Africa?"
Tommy knit his brows in puzzled thought, then suddenly his face brightened as he exclaimed: "Capital S and Capital A."

REALISTIC!

The country paper was reporting the visit of a great tragedian to the local theatre.
"What we like best," the report said, "is his dying scene. He acts the dead man to the very life."

* * * *

"A burglar broke into my flat last night and took a bath."
"Did you catch him?"
"No, he made a clean getaway."

* * * *

Interviewer: "What ten books would you choose if you were cast on a desert isle?"
Author: "It's hard to say; I have written over thirty you know."

* * * *

Sambo: "I came very near to selling my shoes to-day."
Rastus: "How so, brother?"
Sambo: "Well, I had them half soled."

* * * *

A pedestrian, who had been knocked over by a taxi found himself lying in the street directly in the path of an oncoming steam roller. "That reminds me," he cried, "I was to take home some pancake flour!"

* * * *

A rather agitated-looking tramp knocked at the door of a country cottage. "Can you let me 'ave a bar of soap, ma'am?" he asked the householder.
"Do you really mean to tell me that you want soap to wash with?" she asked.
"Not for me, ma'am," replied the tramp, "but my mate's got hiccups and I want to shock him by showing it to him."

* * * *

First Passenger: "Pardon me, does this train stop at Junkstown?"
Second Passenger: "Yes, watch me, and get off two stations before I do."

* * * *

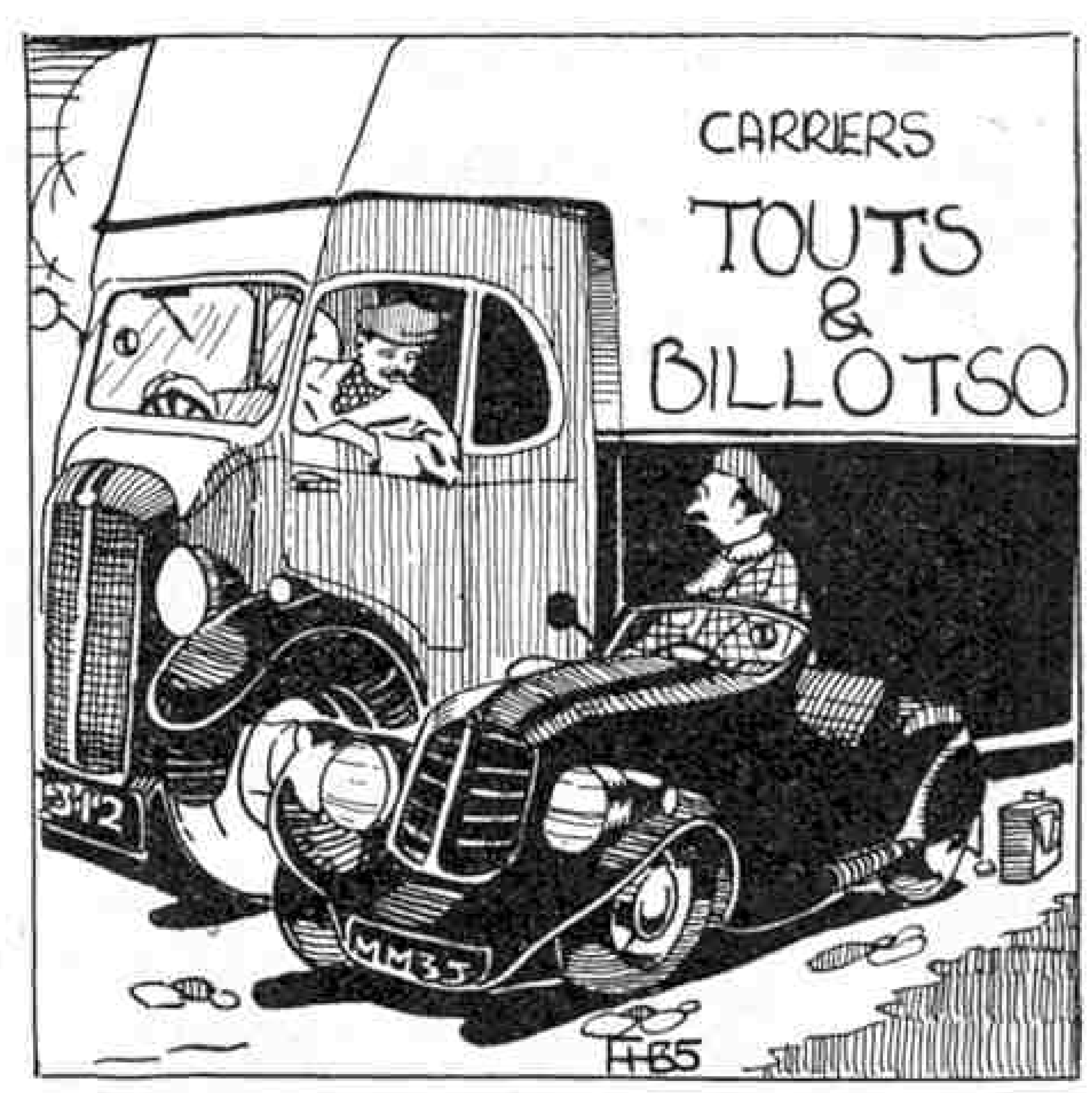
Green: "Why did Napoleon call England a nation of shopkeepers?"
White: "He was afraid of our counter attacks."

* * * *

Little Johnny had been naughty all day and Mother said she would ask Daddy to punish him.
"I don't want Daddy to spank me," protested Johnny.
"Why not?" demanded Mother.
"Daddy doesn't do it properly—he hurts."

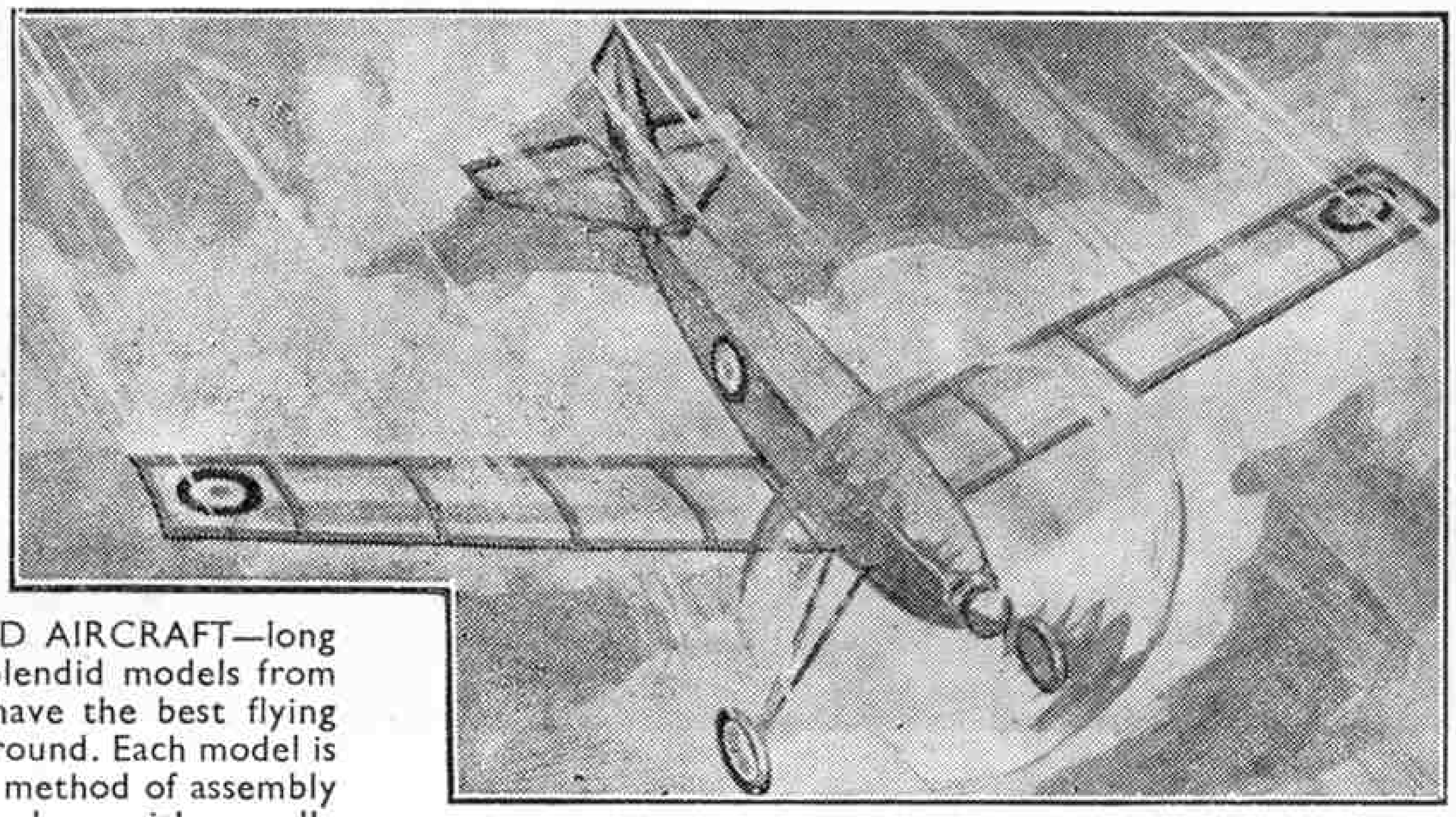
* * * *

WHAT HE NEEDED



Baby Car Motorist: "Can you let me have a little petrol."
Motor Lorry Driver: "Certainly, but I think a new flint is what you really want."

SCUD FLYING MODEL AIRCRAFT



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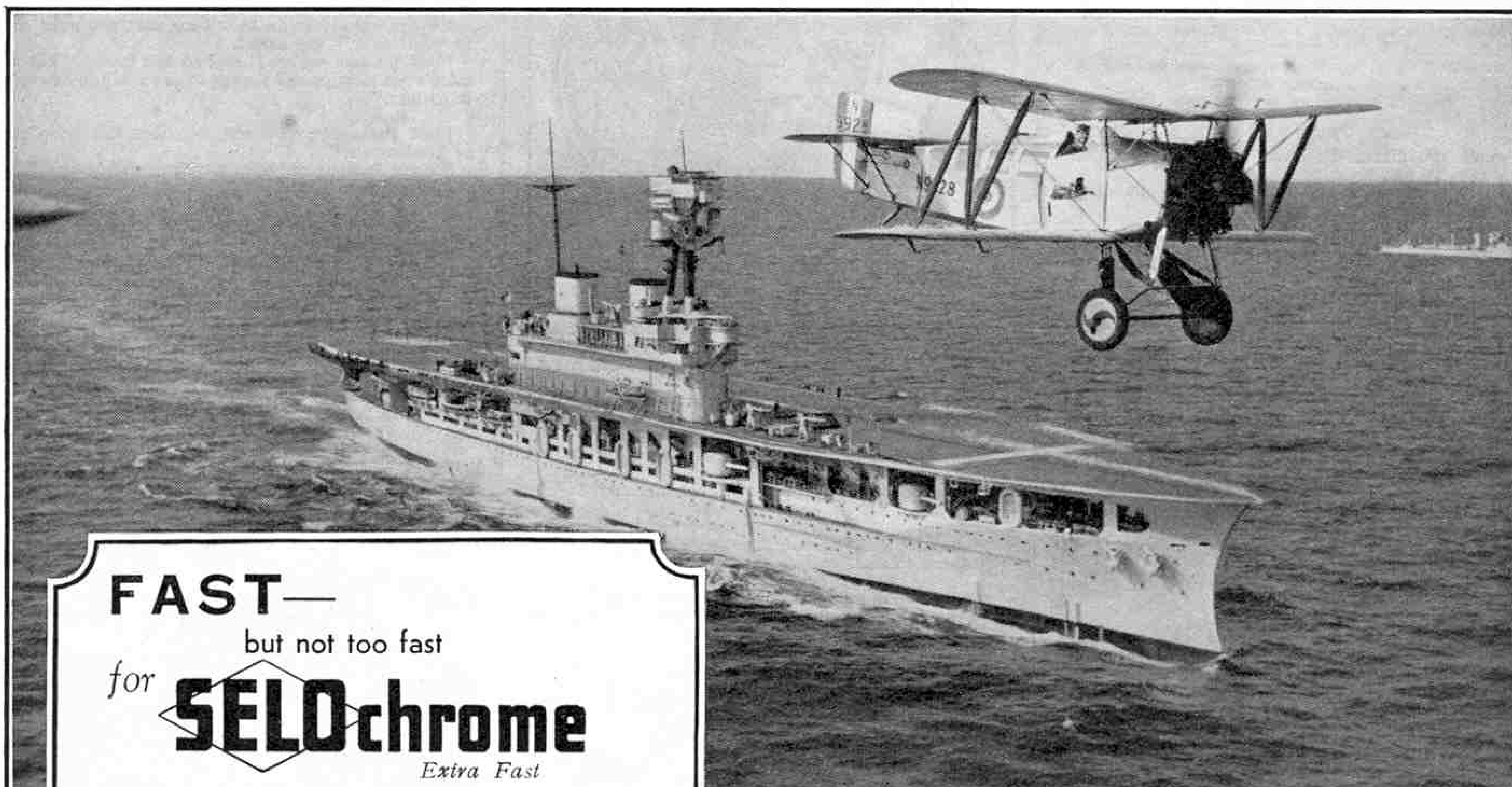

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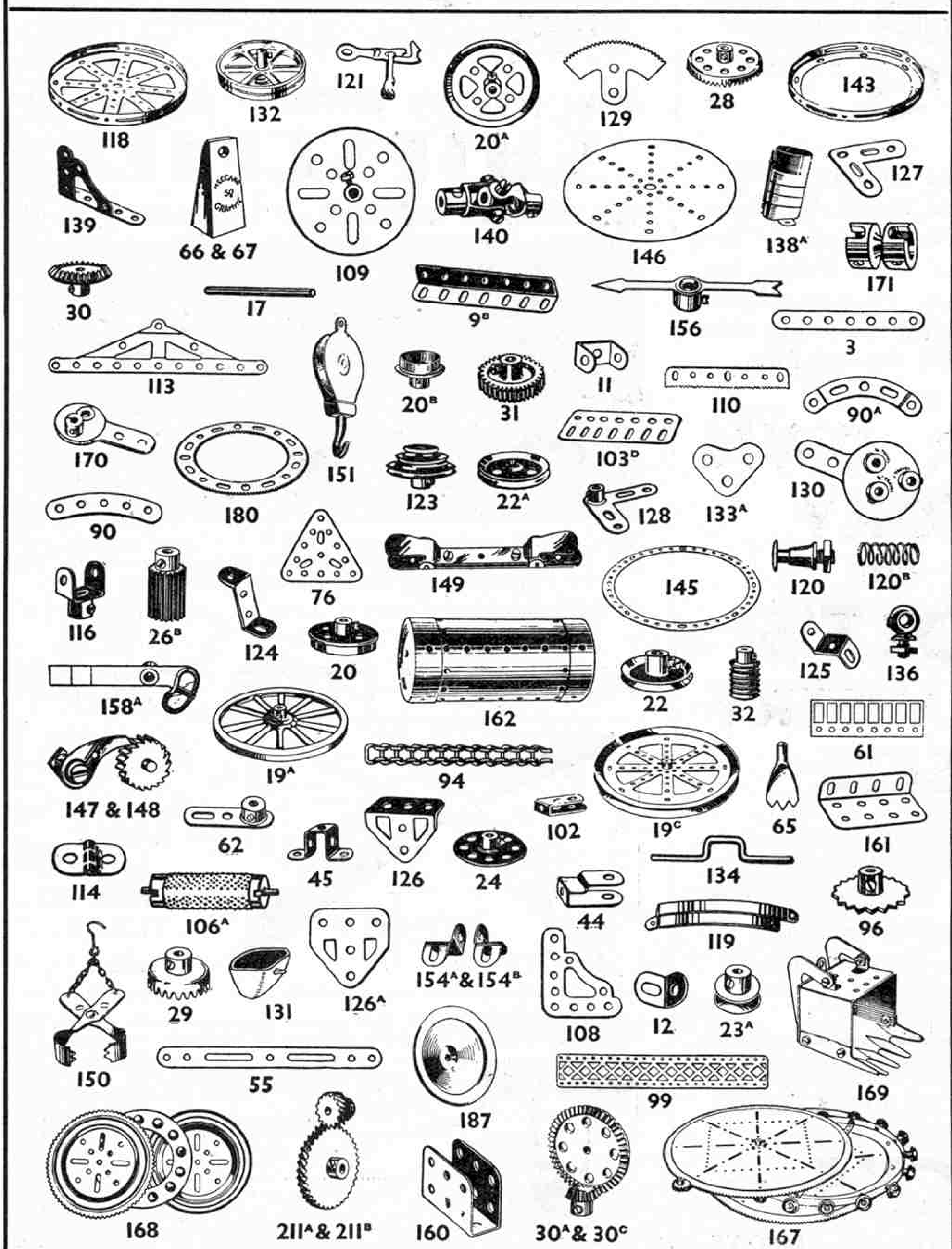

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3	Perforated Strips, 3½" ...	½ doz.	0	4
9b	Angle Girders, 3½" ...	,,	0	8
11	Double Brackets ...	doz.	0	6
12	Angle Brackets, ½" × ½"	,,	0	3
17	Axle Rods, 2"	3 for	0	1
19a	Wheels, 3" diam. ...	each	0	6
20	Flanged Wheels, 1⅛" diam.	,,	0	5
20b	,, ,, ¾" ,,	,,	0	3
	Pulley Wheels			
19c	6" diam., with centre boss and set screw	,,	1	9
20a	2" diam., with centre boss and set screw	,,	0	4
22	1" diam., with centre boss and set screw	,,	0	3
23a	½" diam., with centre boss and grub screw	,,	0	3
22a	1" diam., without centre boss and grub screw	,,	0	2
24	Bush Wheels	,,	0	4
26b	Pinion Wheels, ½" diam., ¾" face	,,	0	6
28	Contrate Wheels, 1½" diam.	,,	0	9
29	,, ,, ¾" ,,	,,	0	6
30	Bevel Gears, ⅞", 26 teeth	,,	0	7
*30a	,, ,, ½", 16 ,,	,,	0	6
*30c	,, ,, 1½", 48 ,,	,,	1	6
31	Gear Wheels, 1", 38 teeth	,,	0	10
32	Worms	,,	0	4
44	Cranked Bent Strips ...	,,	0	1
45	Double ,, ,, ...	,,	0	1
55	Perforated Strips, slotted, 5½" long	doz.	1	6
61	Windmill Sails	4 for	0	6
62	Cranks	each	0	3
65	Centre Forks	,,	0	1
66	Weights, 50 grammes ...	,,	0	9
67	,, 25 ,, ...	,,	0	6
76	Triangular Plates, 2½" ...	,,	0	2
90	2½" Curved Strips, 2⅜" rad.	,,	0	1
90a	2½" Curved Strips, cranked, 1⅜" rad.	,,	0	1
94	Sprocket Chain, per 40" length		0	6
96	,, Wheels, 1" diam.	each	0	3
99	Braced Girders, 12½" long	½ doz.	2	6
102	Single Bent Strips ...	each	0	1
103d	Flat Girders, 3½" long ...	½ doz.	0	7
106a	Sand Rollers	each	1	9
108	Architraves	doz.	1	6
109	Face Plates, 2½" diam. ...	each	0	4
110	Rack Strips, 3½" ...	,,	0	2
113	Girder Frames	,,	0	3
114	Hinges	pair	0	4
116	Fork Pieces, Large ...	each	0	3
118	Hub Discs, 5½"	,,	1	3
119	Channel Segments ...	,,	0	4
120	Buffers	,,	0	2
120b	Compression Springs ...	,,	0	1
121	Train Couplings... ...	,,	0	1
123	Cone Pulley	,,	1	3
124	Reversed Angle Brackets, 1"	½ doz.	0	4
125	Reversed Angle Brackets, ½"	,,	0	3
126	Trunnions	pair	0	3
126a	Flat Trunnions	each	0	1
127	Simple Bell Cranks ...	,,	0	1
128	Boss Bell Cranks ...	,,	0	3
129	Rack Segments, 3" diam.	,,	0	5
130	Eccentrics, Triple throw	,,	1	0
131	Dredger Buckets ...	½ doz.	1	0
132	Flywheels, 2¾" diam. ...	each	2	0
133a	Corner Brackets, 1" ...	,,	0	1
134	Crank Shafts, 1" stroke	,,	0	2
136	Handrail Supports ...	,,	0	3
†138a-z	Ships' Funnels, Raked ...	,,	0	9
139	Flanged Brackets (right)	,,	0	2
140	Universal Couplings ...	,,	0	10
143	Circular Girders, 5½" diam.	,,	1	0
145	Circular Strips, 7½" diam.	,,	0	9
146	Circular Plates, 6" diam.	,,	1	0
147	Pawls	,,	0	3
148	Ratchet Wheels... ...	,,	0	6
149	Collecting Shoes ...	,,	1	3
150	Crane Grabs	,,	0	7
151	Pulley Blocks, Single Sheave	,,	0	8
154a	Corner Angle Brackets, ½" (right hand) ...	½ doz.	0	6
154b	Corner Angle Brackets, ½" (left hand) ...	,,	0	6
156	Pointers, 2½" over all ...	each	0	4
158a	Signal Arms, Home ...	,,	0	5
160	Channel Bearings, 1½" × 1" × ½"	,,	0	2
161	Girder Brackets, 2" × 1" × ½"	2 for	0	3
162	Boiler, Complete ...	each	1	0
167	Geared Roller Bearings	,,	20	0
168	Ball Bearing, 4" diam. ...	,,	3	0
169	Digger Buckets	,,	1	6
170	Eccentrics, ¼" throw ...	,,	0	9
171	Socket Couplings ...	,,	0	9
180	Toothed Gear Rings, 3½" diam. 133 teeth external. 95 teeth internal	,,	2	0
187	Road Wheels	,,	0	6
*211a	Helical Gear, ½" ...	,,	0	9
*211b	,, ,, 1½" ...	,,	2	0

* *Can only be used together.*

†*The series includes 26 different Funnels.*

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M3 Locomotive	4/3
Zulu Locomotive	5/3
No. O Locomotive	5/3
Zulu Tank Locomotive	6/3
No. 1 Tank Locomotive	6/3
No. 1 Locomotive	6/3
LEC 1 Locomotive (Swiss Type)	6/3
No. 1 Locomotive, fitted for Hornby Control	7/6
No. 1 Tank Locomotive, fitted for Hornby Control	7/6
No. 1 Special Locomotive	8/3
No. 1 Special Tank Locomotive	8/3
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No. 2 Tank Locomotive	10/6
No. 2 Special Tank Locomotive	10/6
Metropolitan C Locomotive	10/6
No. 2 Special Locomotive	11/3
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No. 2 Tank Locomotive, fitted or Hornby Control	11/9
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No. 3C Riviera "Blue" Locomotive	12/-
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EO6 or EO20 Locomotive	11/-
E16 or E120 Locomotive	12/-
E16 or E120 Tank Locomotive	12/-
LST 1/20 Tank Locomotive (20-volt)	12/-
LE 1/20 Loco (Swiss Type), 20-volt	12/6
LST 2/20 Tank Locomotive	12/6
E3/20 Locomotive	12/6
E3/20 Riviera Locomotive	12/6
LE120 Locomotive	12/6
EPM16 Special Tank Locomotive	13/9
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E26 Special Tank Locomotive	15/-
E36 Metropolitan Locomotive	15/-
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E120 Special Tank Locomotive (automatic reverse)	15/-
E36 Locomotive	16/3
E36 Riviera "Blue" Locomotive	16/3
E220 Special Tank Locomotive (automatic reverse)	16/3
LE2/20 Locomotive	16/6
LE220 Locomotive (automatic reverse)	16/6
E320 Locomotive (automatic reverse)	17/6
E320 Riviera Locomotive (automatic reverse)	17/6
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Metropolitan H.V. Locomotive	20/-

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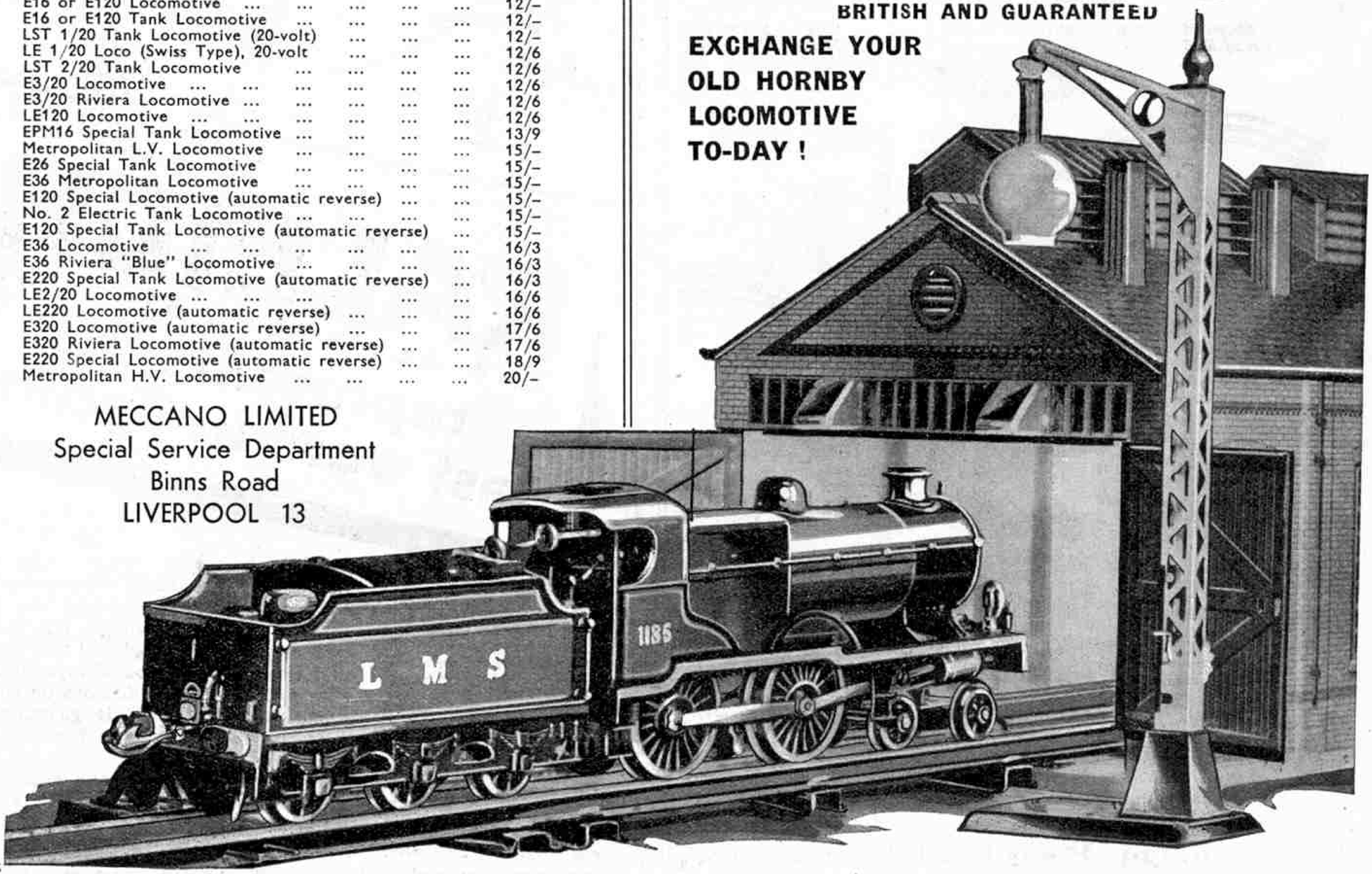

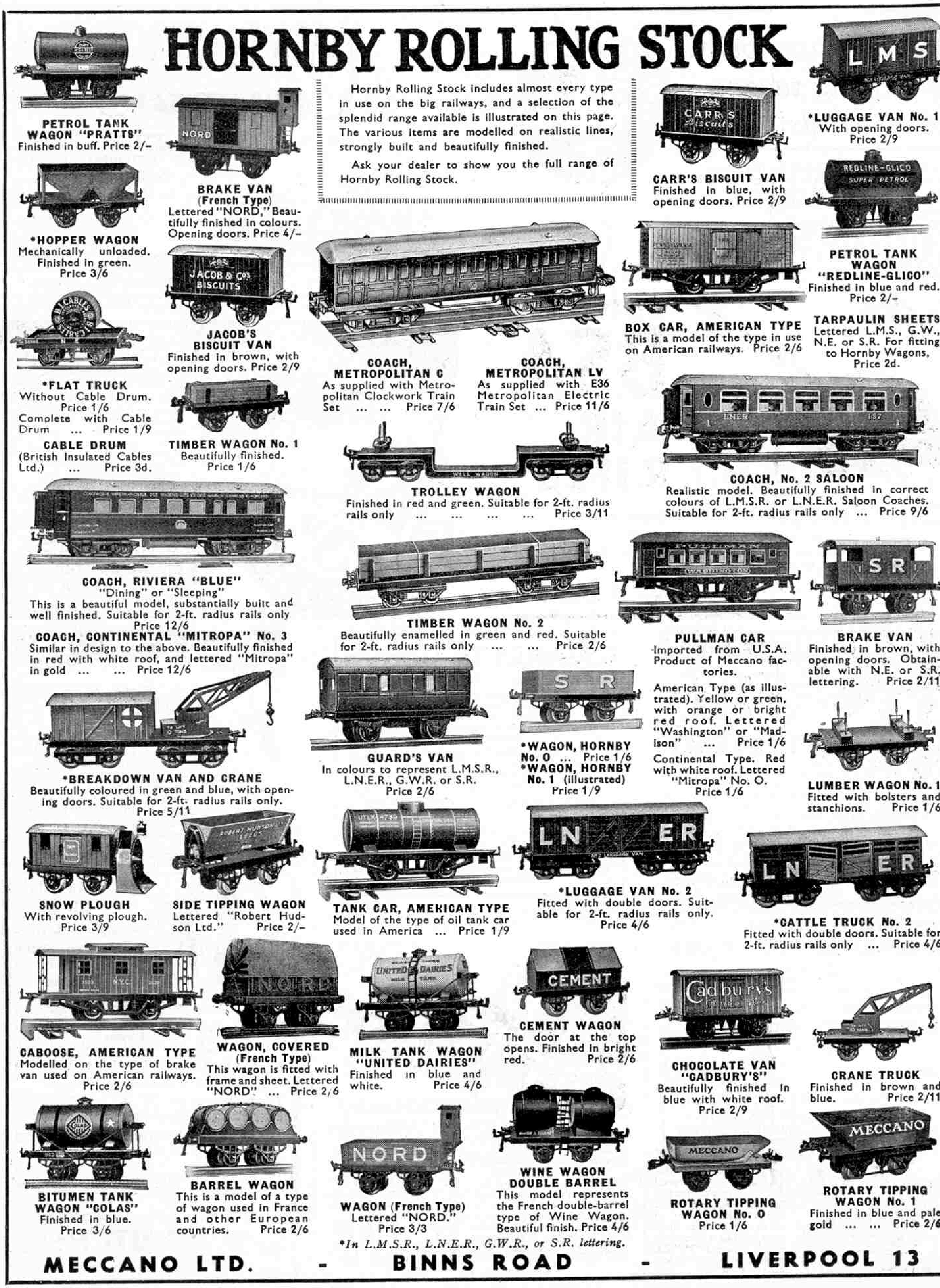
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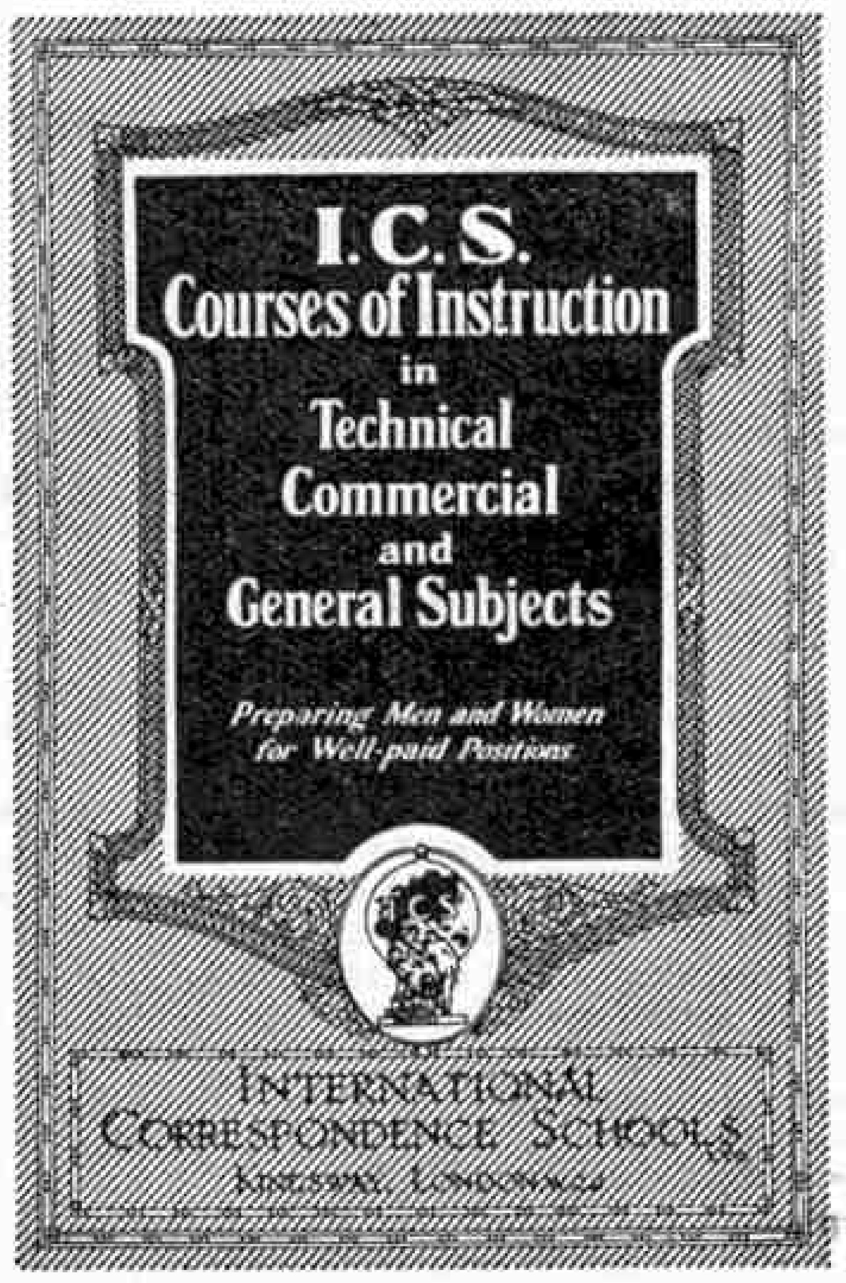

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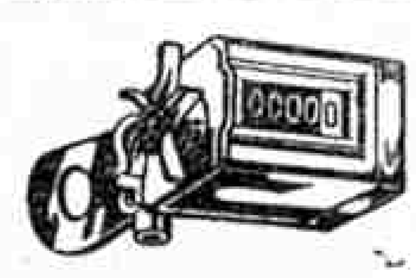

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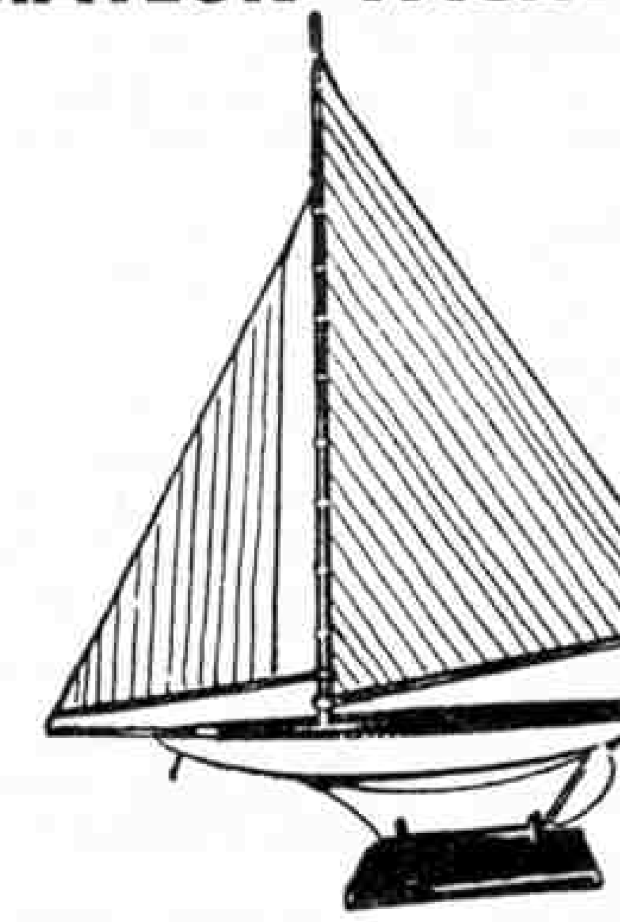

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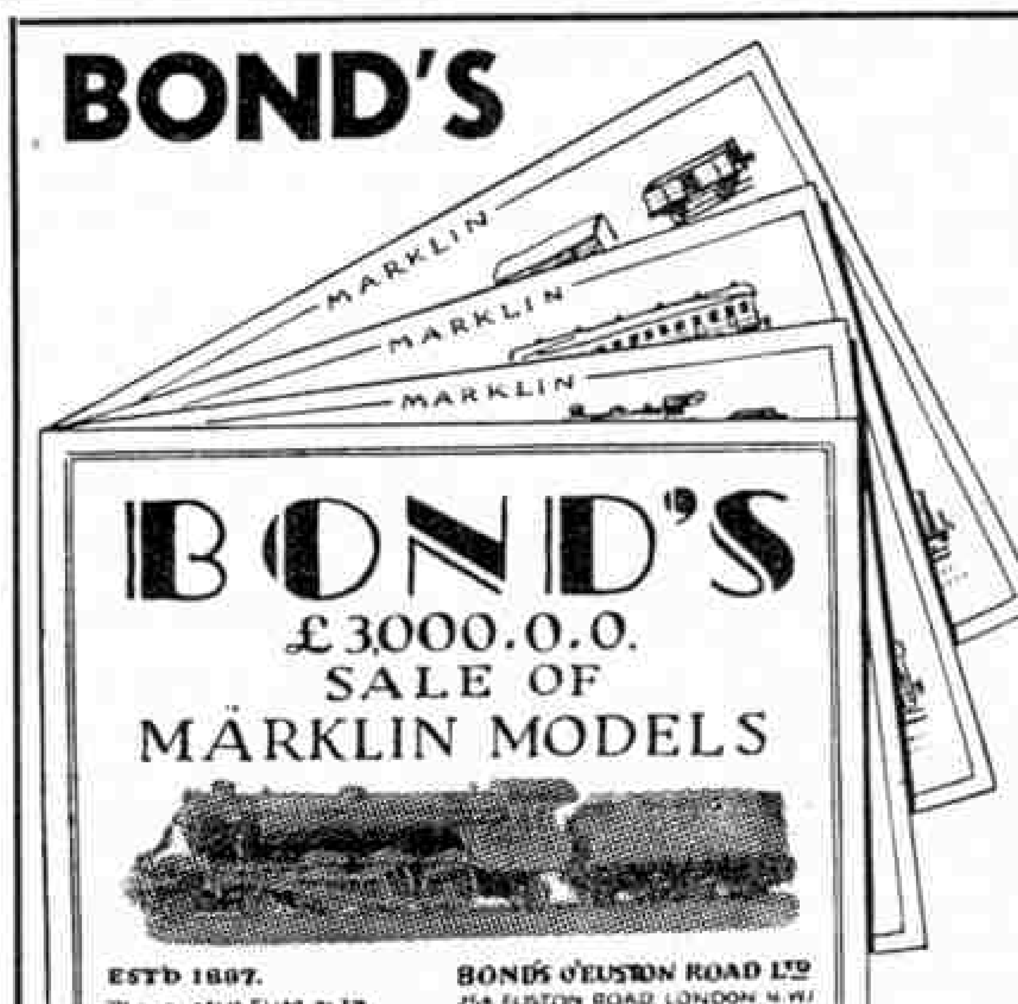

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Sale. "M.M.'s," July 1931–April 1935. Complete. 12/-.—Smethurst, 38, Rowley Bank, Stafford.

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Sale, Chemistry Equipment, worth £4. Sell 35/- or offer.—Allin, School House, Poolsbank, Derbyshire.

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Sale. Good quality Fishing Tackle. Send for free list. —Mudie, 83, The Grove, London, W.6.

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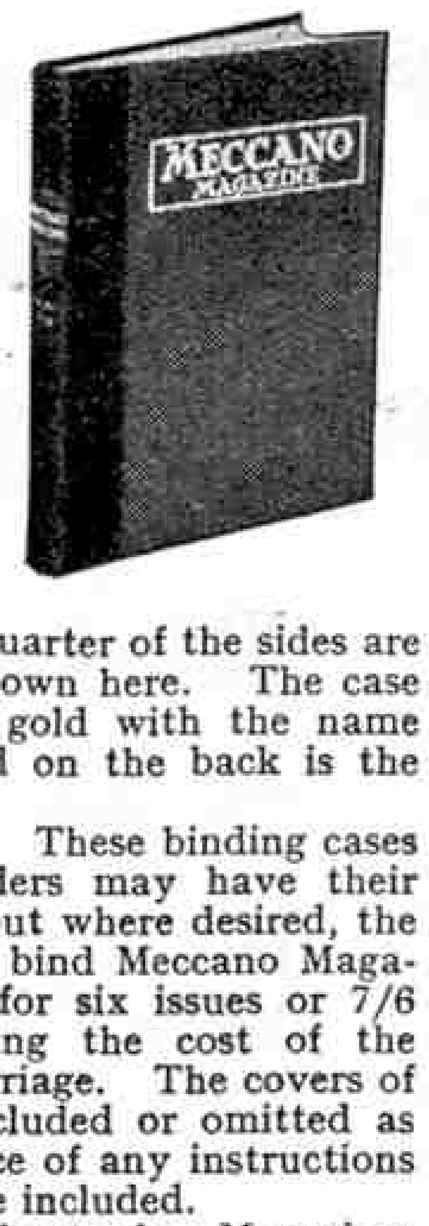
BINDING THE *"M.M."*



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EDITORIAL AND ADVERTISING OFFICE :—
LIVERPOOL 13, 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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Readers Overseas and in foreign countries may order the *"Meccano Magazine"* from regular Meccano dealers or direct from this office. The price and subscription rates are as above, except in the cases of Australia, where the price is 1/2 per copy (postage extra), and the subscription rates 8/- for six months and 16/- for 12 months (post free); Canada, where the price is 10c. per copy, and the subscription rates 65c. for six months, and $1.25 for 12 months (post paid).

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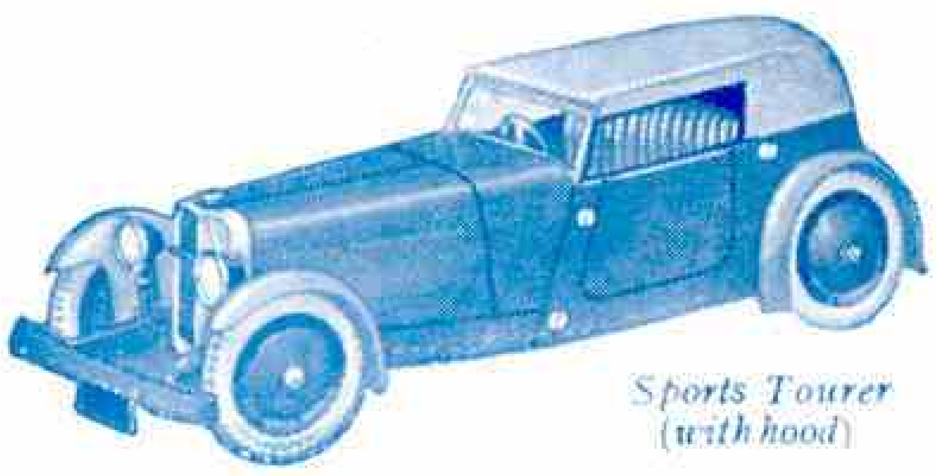
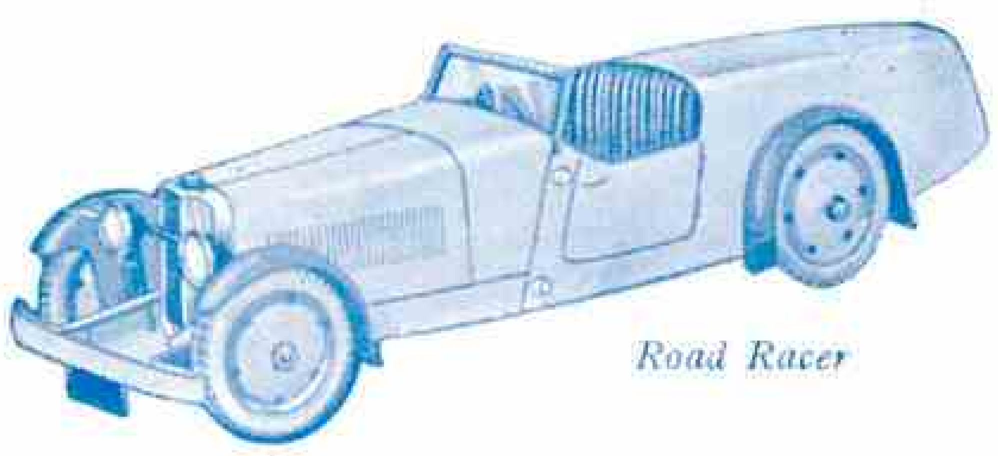


Sports Tourer (with hood)



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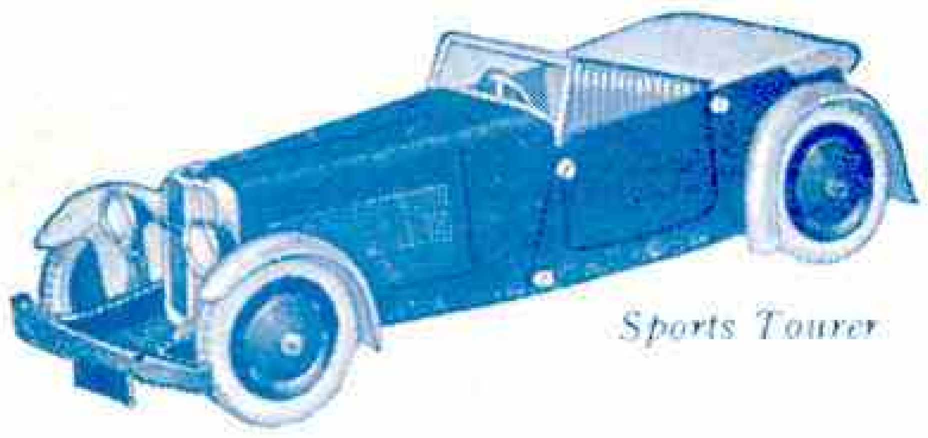

Sports Tourer

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Meccauto 538189

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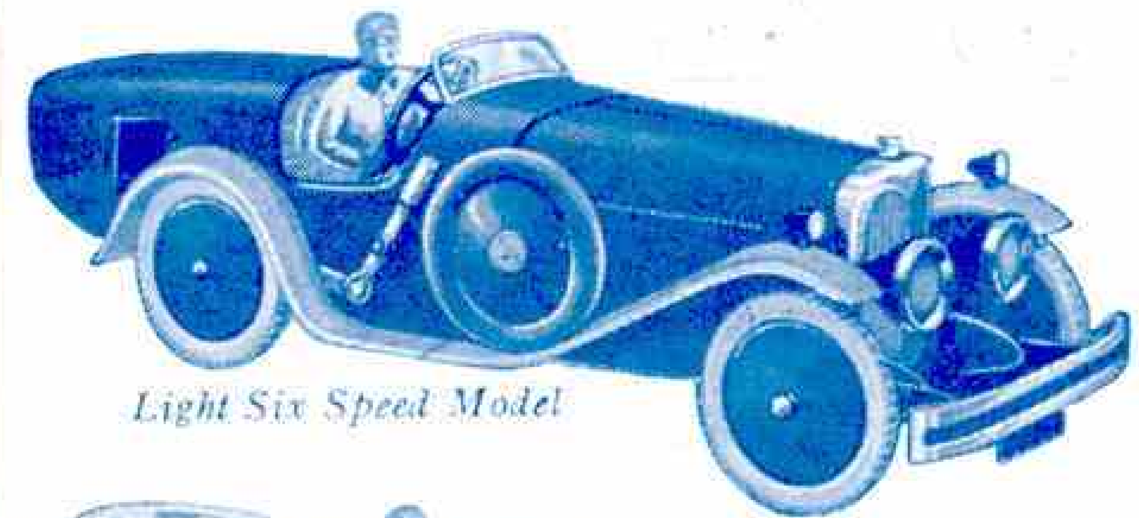
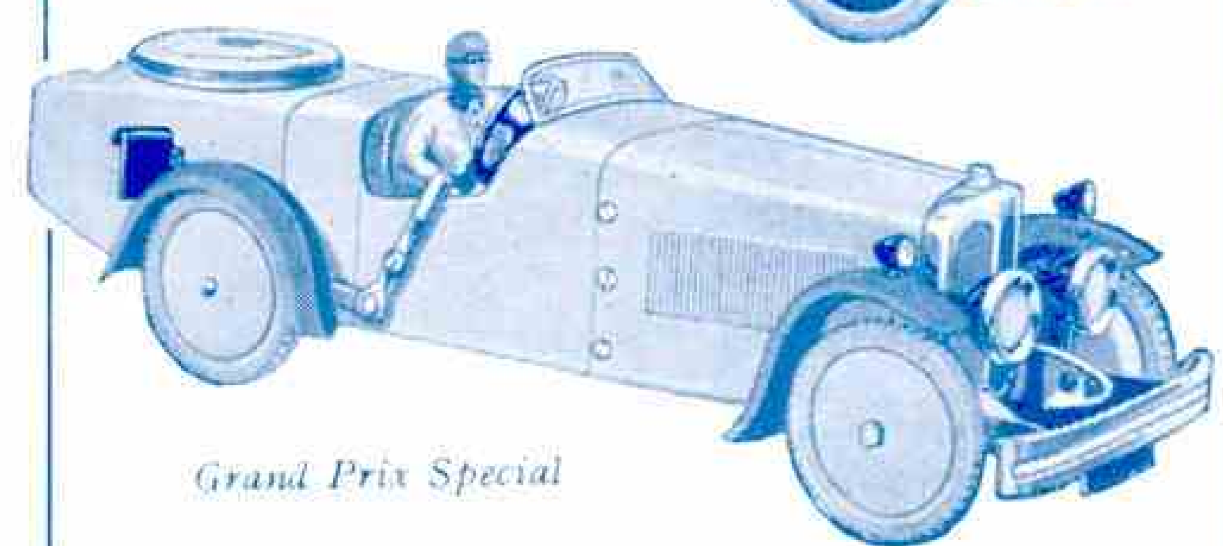
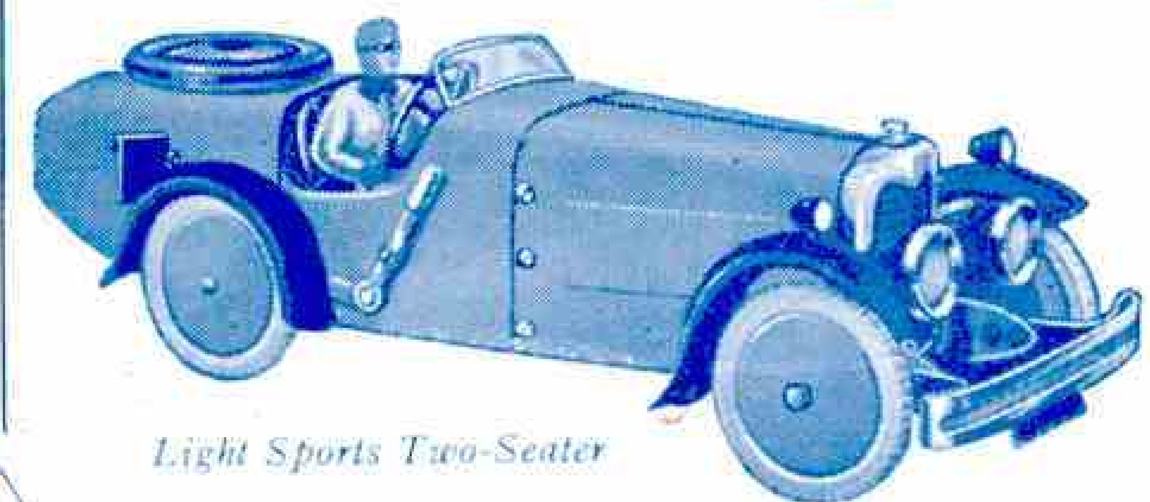


Light Six Speed Model



Grand Prix Special



Light Sports Two-Seater

No. 1 Meccano Motor Car Constructor Outfit

The motor car models that can be built with this Outfit are the finest you ever saw. Look at the examples illustrated above and think of the fun you could have building these and other types equally realistic.

No. 1 Outfit is available in four different colour combinations and is supplied complete with powerful Clockwork Motor. Price **13/6**

No. 2 Meccano Motor Car Constructor Outfit

Larger models of a superior type can be built with No. 2 Outfit. Their handsome and realistic appearance may be judged from the above illustrations.

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If extra parts in any of the standard colours are required they can be purchased from any Meccano dealer. In addition to the four standard colour combinations, the following parts are available in the colours indicated: Body Sections: orange, yellow. Wheels: orange, yellow. Wings: orange, green.

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The Meccano Motor Car Garage provides accommodation for any Meccano model motor car or other cars of suitable size. Inside dimensions: Height 5 in., Length 13 in., Width 7⅞ in. Price **5/6**

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No. 1 Meccano Motor Car Outfit

No. 2 Meccano Motor Car Outfit

MECCANO LTD.
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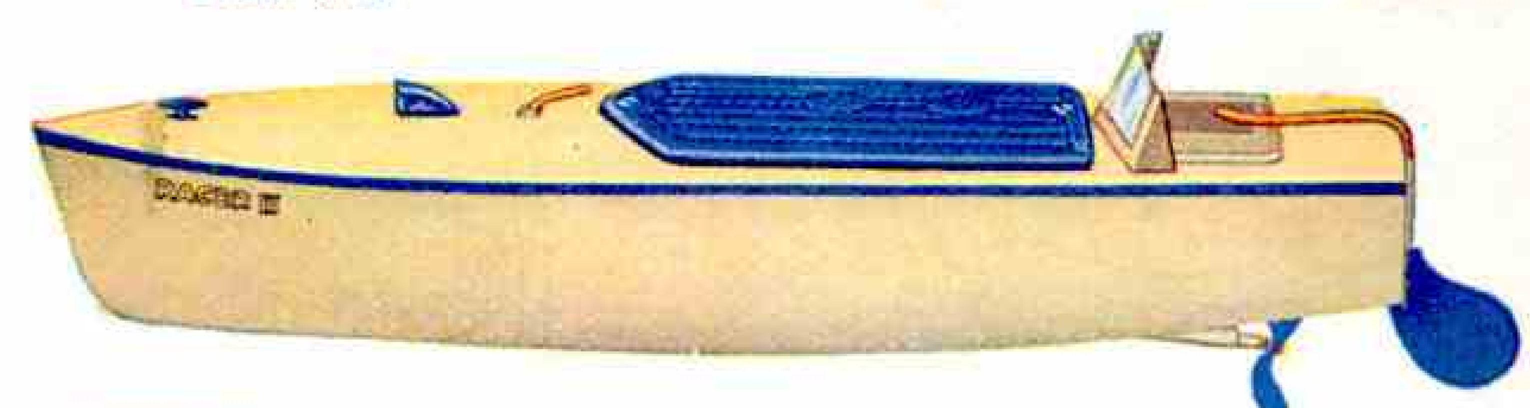
HORNBY SPEED BOAT No. 1. "HAWK." Price **2/11**
Travels over 100 ft. on one winding. Dimensions: Length 9½ in. Beam 3 in.



HORNBY RACING BOAT No. 2. "RACER II." Price **8/6**
Travels over 200 ft. at high speed on one winding. Finished in Blue and Cream. Dimensions: Length 12½ in. Beam 3 in.

HORNBY SPEED BOAT No. 3. "CURLEW." Price **12/6**
Travels over 500 ft. on one winding. Dimensions: Length 16½ in. Beam 3½ in.

HORNBY RACING BOAT No. 3. "RACER III." Price **14/6**
Travels over 300 ft. at high speed on one winding. Finished in Red and Cream. Dimensions: Length 16½ in. Beam 3½ in.

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Travels over 500 ft. on one winding. Dimensions: Length 16½ in. Beam 3½ in.

This is the Hornby Speed Boat Club Badge, which may be purchased from your dealer, price 6d. During Hornby Speed Boat Week it will be supplied free of charge by Meccano dealers to all purchasers of Hornby Speed Boats.

HORNBY SPEED BOAT CLUB

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