VOL. XXI No. 9
SEPTEMBER 1936

MECCANO MAGAZINE

6D.

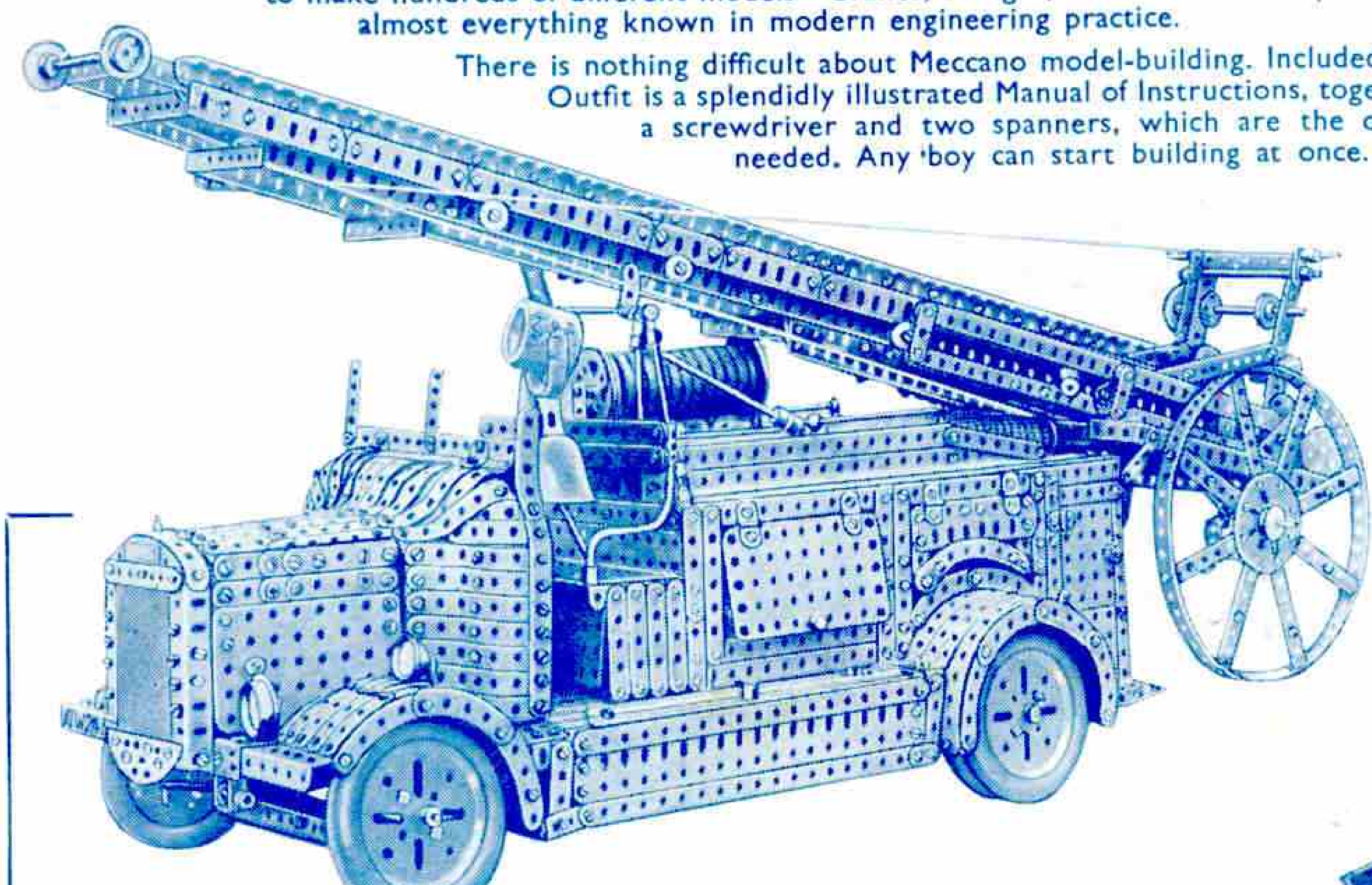
CLEANING A GIANT "PACIFIC" LOCOMOTIVE (See page 507)

MECCANO

Boys! Build Real Engineering Models Like This—with Meccano

There is no other hobby in the world to equal Meccano Model-building; and none that is so full of thrilling interest for boys. Meccano is REAL engineering in miniature. The models are built with REAL engineering parts, accurately made of steel and brass, which can be used over and over again to make hundreds of different models—Cranes, Bridges, Motor Cars, Aeroplanes, in fact almost everything known in modern engineering practice.

There is nothing difficult about Meccano model-building. Included in every Outfit is a splendidly illustrated Manual of Instructions, together with a screwdriver and two spanners, which are the only tools needed. Any boy can start building at once.



This fine Meccano model is a reproduction to scale of the big Scammell Fire Engine illustrated at the foot of this page. The model is remarkably realistic in detail and is fitted with front and rear semi-elliptic springs, modified Ackermann steering gear, and gear-box incorporating three forward speeds and one reverse. The pump control apparatus is worked on exactly similar principles to those followed in the prototype, while the fire escape extends to a length of nearly eight feet. The motive power by which the model is propelled is supplied by a Meccano Electric Motor.

B Meccano Outfit

Prices of Meccano Outfits

COMPLETE OUTFITS

O	Outfit	each	3/6
A	"	"	5/-
B	"	"	7/6
C	"	"	10/-
D	"	"	15/-
E	"	"	20/-
F	"	"	30/-
G	"	"	55/-
H	" (Carton)	"	72/6
Hw	" (Cabinet)	"	97/6
K	" (Carton)	"	132/6
Kw	" (Cabinet)	"	157/6
L	" (")	"	400/-

ACCESSORY OUTFITS

Oa	converts	O Outfit into	A	each	1/6
Aa	"	A " "	B	"	2/6
Ba	"	B " "	C	"	3/-
Ca	"	C " "	D	"	5/6
Da	"	D " "	E	"	5/6
Ea	"	E " "	F	"	11/-
Fa	"	F " "	G	"	26/6
Ga	"	G " "	H	"	17/6
Ha	"	H " "	K	"	60/-
Ka	"	K " "	L	"	225/-

The illustration below shows the "Silver Jubilee" Scammell Fire Engine owned by the Borough of Watford Fire Brigade, of which the above Meccano Model is a faithful reproduction.

D Meccano Outfi

MECCANO LTD. - BINNS ROAD - LIVERPOOL 13

EXTRA SPECIAL EDITION

LINDBERG SQUADRON DISPLAY

Hamleys News

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200-202, REGENT ST., LONDON, W.I. OUR ONLY ADDRESS

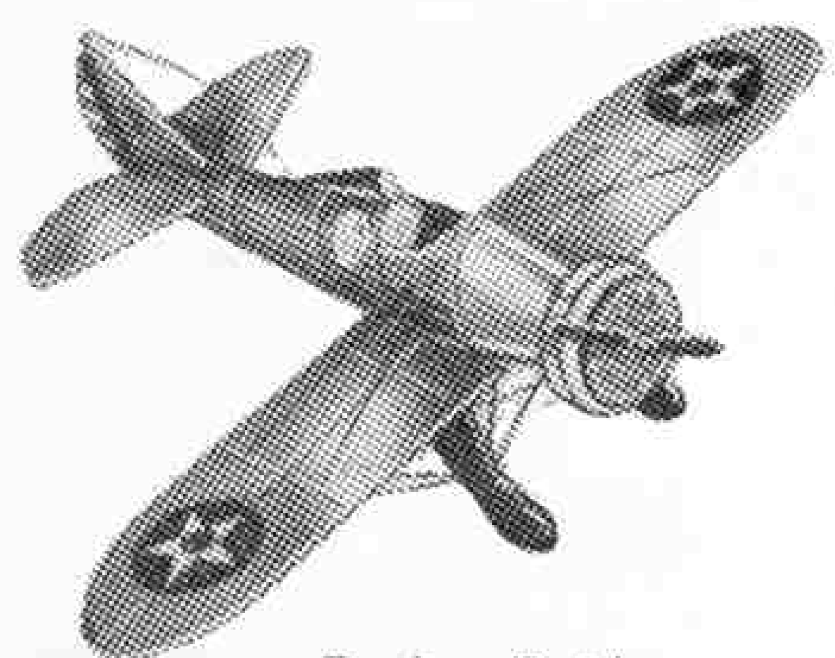
No. 42 *September, 1936*

GREAT AIR PAGEANT

DARING DISPLAY AT HAMLEY AIR PARK

LINDBERG SQUADRON

There's a grand display of the Lindberg Squadron at Hamleys in Regent Street. These fine construction sets enable you to build up your own models of famous aeroplanes. The squadron includes Curtiss Goshawk, S.E.5, Boeing P26A, Sopwith Camel, Chester Racer, U.S. Navy Racer, Macchi Castoldi 72, Super Fury, Boeing F4.B4 (Foreign).



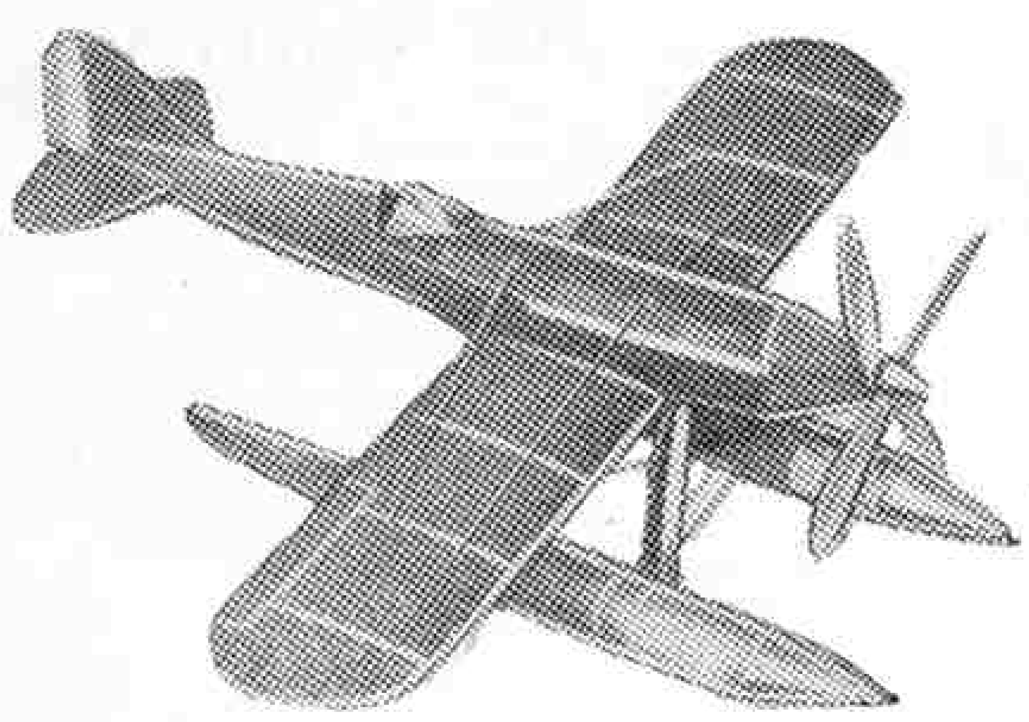
Boeing P26A

ENTER FOR IT NOW

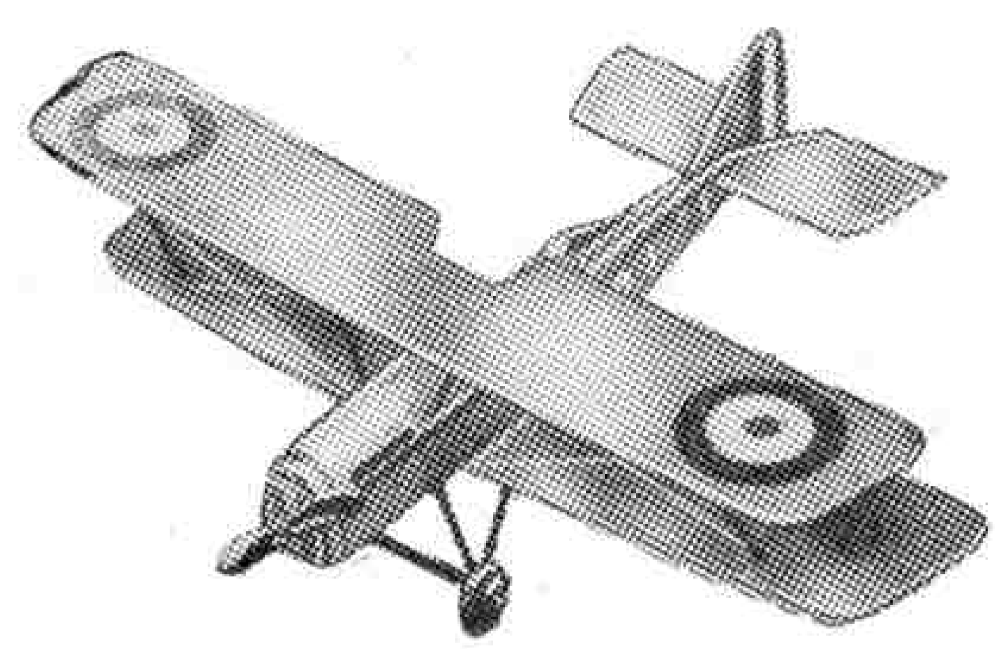
FIRST ANNUAL COMPETITION FOR MODEL AEROPLANE CONSTRUCTION

This competition, which has two sections (Seniors 16 years and over, Juniors under 16), is open until December 31st, 1936. The constructional kits for all planes entered must be purchased from Hamleys.

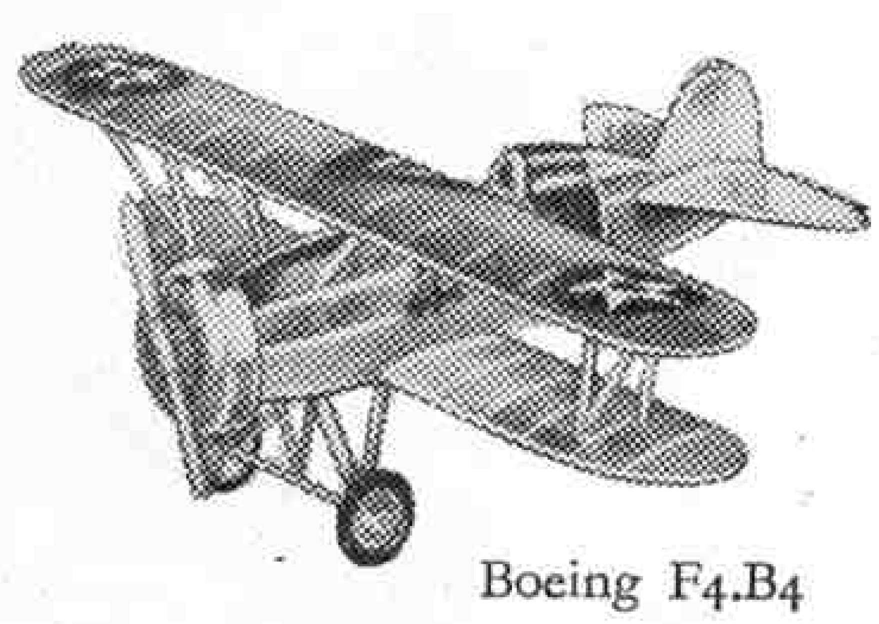
A large range of constructional kits for you to choose from, including the latest control and F.R.O.G. kits are available. Full particulars on request.



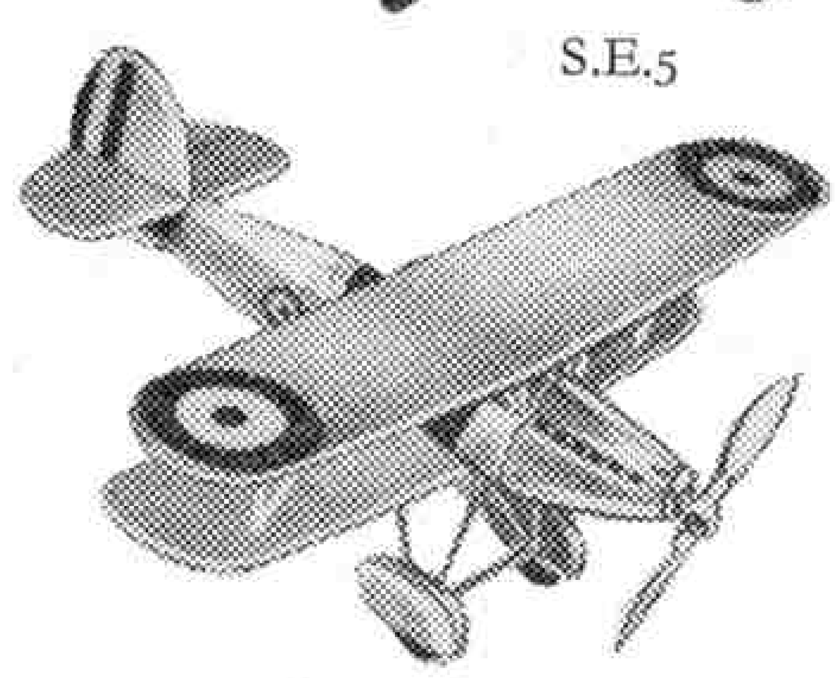
Macchi Castoldi 72



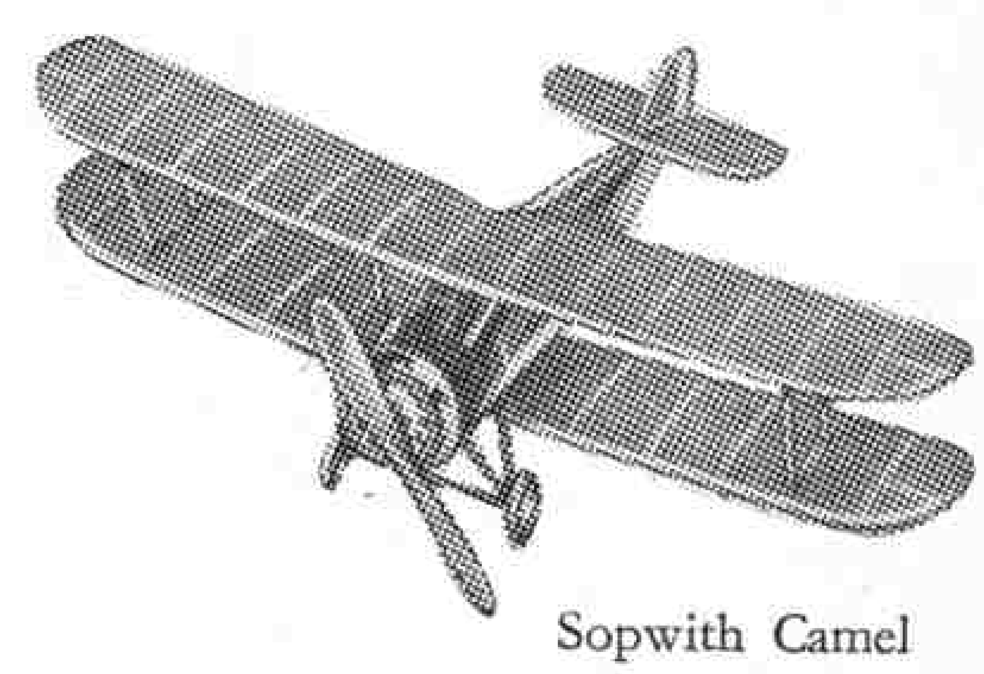
S.E.5



Boeing F4.B4



Super Fury

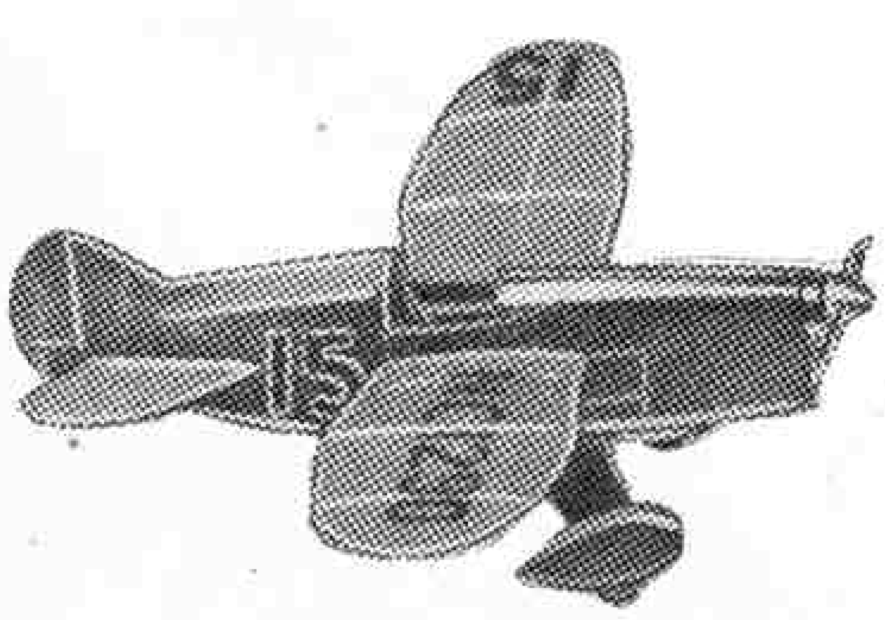


Sopwith Camel

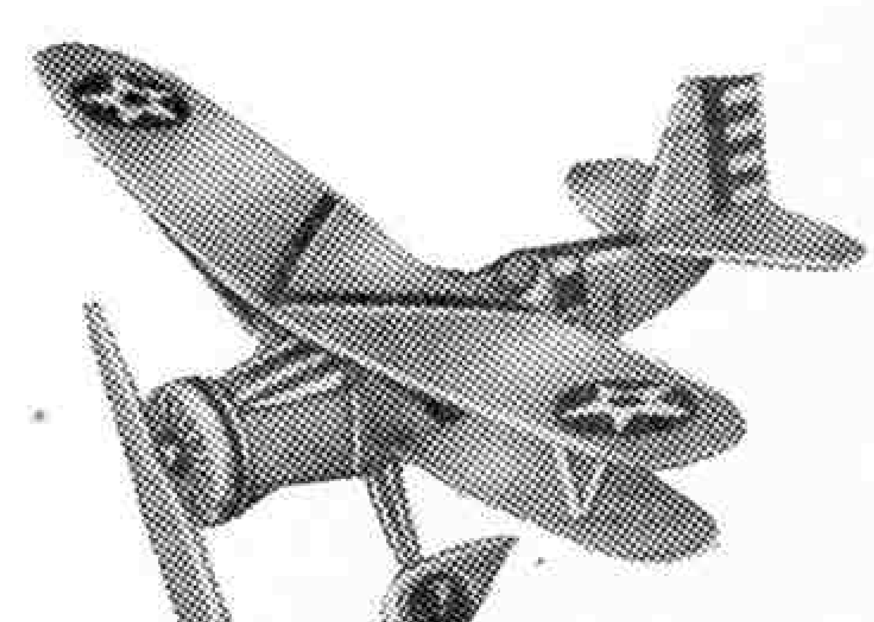
A GRAND IDEA FOR SCHOOL

Lots of boys are now planning to take some of these Lindberg Kits back to school with them to construct during the long, winter evenings. It's a great idea! Why don't you do the same? You can collect the whole Squadron. Special Prices have been arranged for this purpose.

1/6 each; 4 for 5/6; or 8 for 10/6
All post paid
Including Entry Form for Competition



Chester Racer

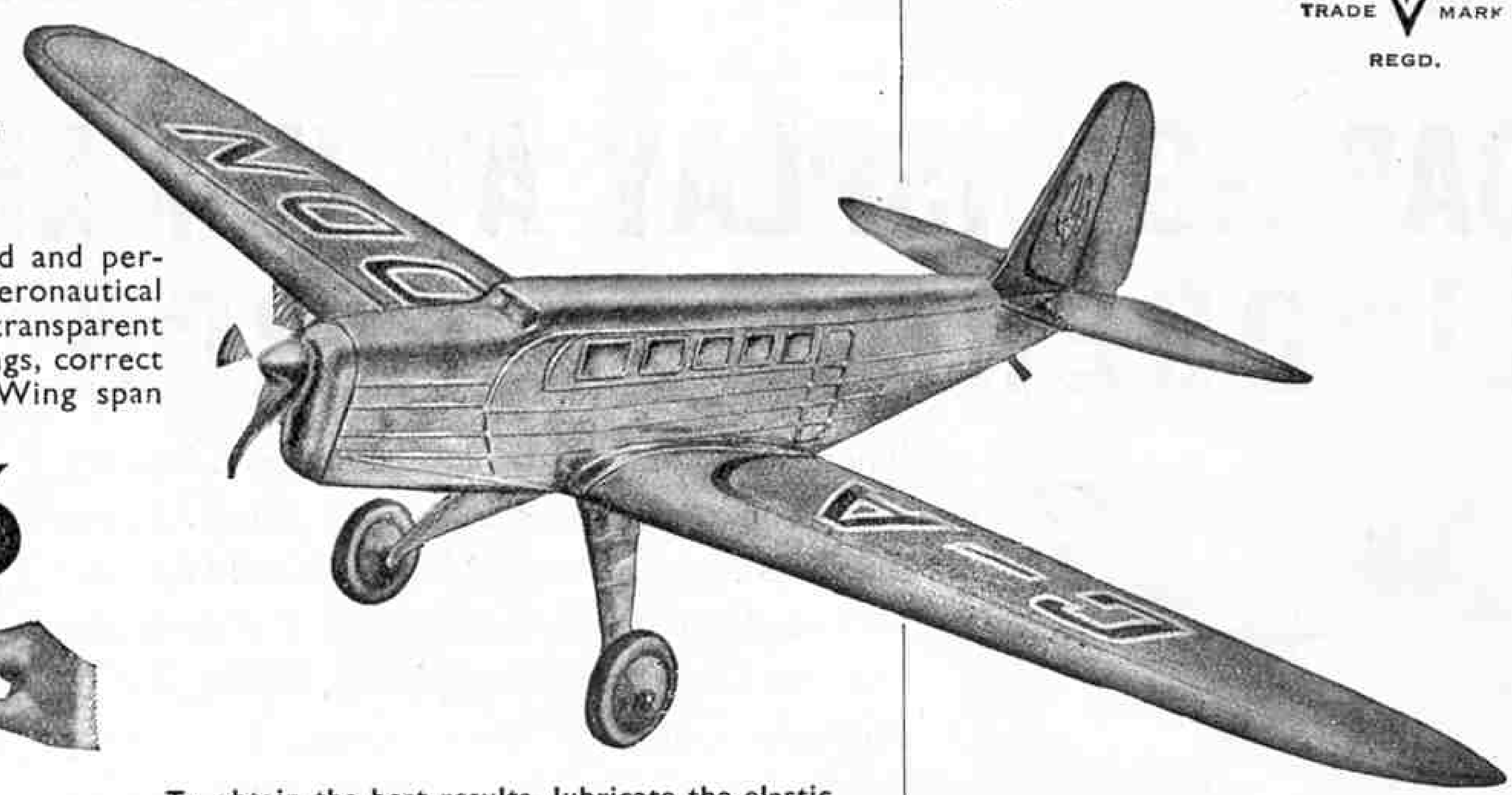


Curtiss Goshawk

FROG MODEL AIRCRAFT

TRADE MARK REGD.

—Start your flying career with a "SILVER ARROW"



A ready to fly model specially designed and perfectly made by the famous "FROG" Aeronautical Engineers. It has an aluminium fuselage, transparent windows, double surface detachable wings, correct pitch air screw, adjustable tail unit. Wing span 16½ in., will fly approximately 120 feet.

PRICE 2/6

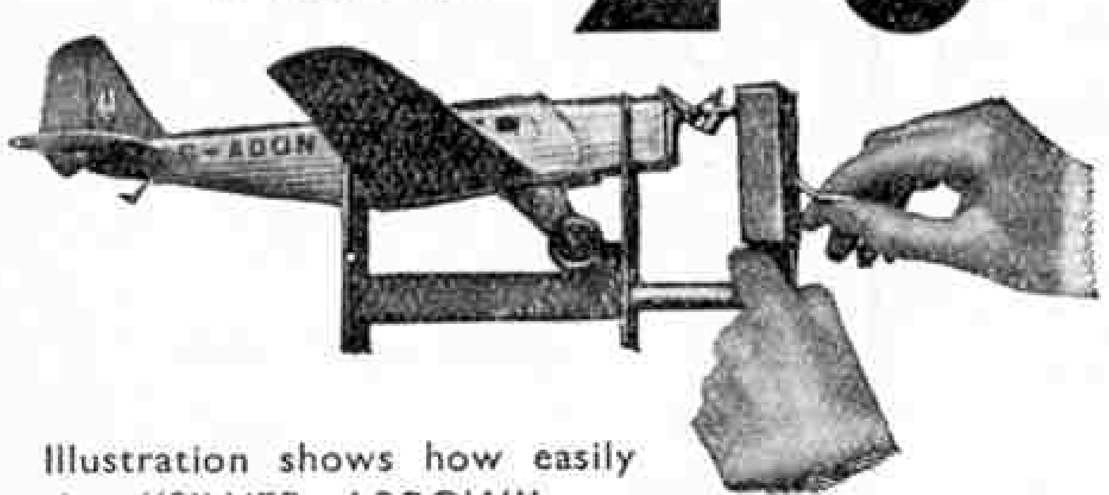
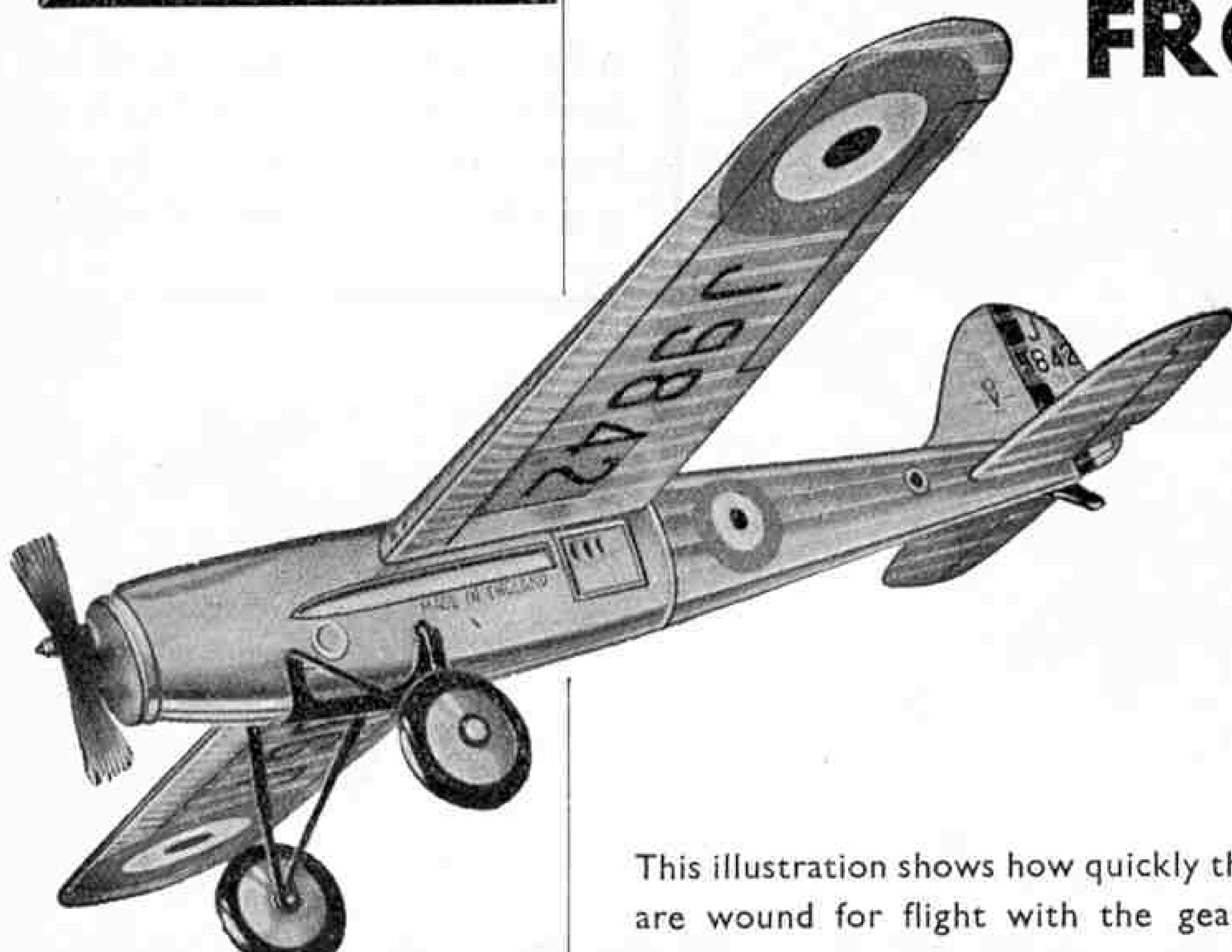


Illustration shows how easily the "SILVER ARROW" can be wound ready for flight with the Patent Geared-up Hand Winder. Price **1/-**

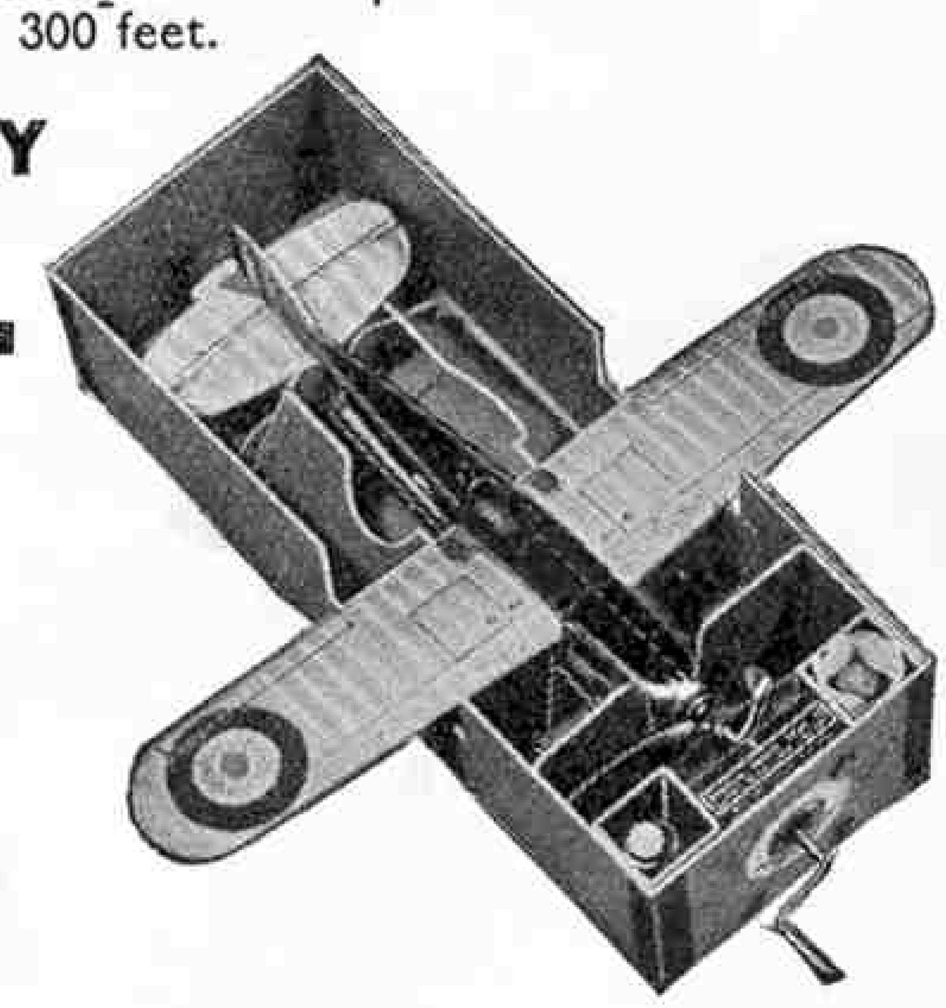
To obtain the best results, lubricate the elastic motor with "FROG" lubricant, price 2d. per bottle.

Qualify for the FROG Flying Club with a FROG MK IV FLYING SCALE MODEL INTERCEPTOR FIGHTER



All metal fuselage of tubular construction, quickly detachable under-carriage and hollow wings. Powerful motor coupled to a precision cut gearbox, accurately carved air-screw. Complete with Patent High Speed Winder Box, motor lubricant, gearbox oil, two spare motors and insertor rod, and fully illustrated flying manual. Wing span 11½ in. With practice it will rise off the ground and fly 300 feet.

NOW ONLY 5/-



This illustration shows how quickly the Frog scale models are wound for flight with the geared-up winder-box.

A PATENT AND EXCLUSIVE "FROG" FEATURE.

FREE FLIGHT INSTRUCTION

Lines Bros. will give free flight instruction by appointment on the Frog Aerodrome at Merton.

Telephone: Liberty 1041.

COUPON To Lines Bros. Ltd. (Dept. 5), Morden Road, London, S.W.19.

Please send me your **new** "Frog" coloured leaflet with particulars of the "Frog" Flying Club and of how to obtain handsome enamelled Air Force pilot Badges.

Name..

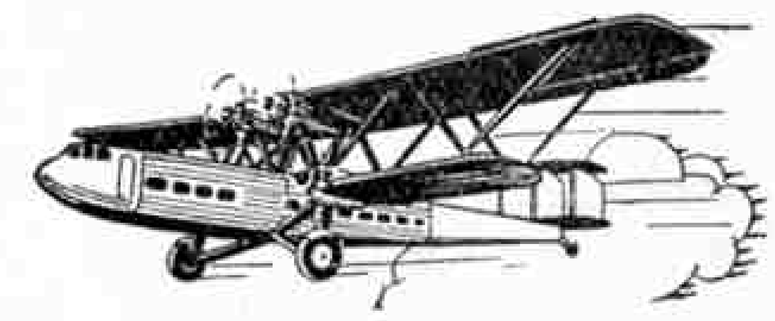
Address..

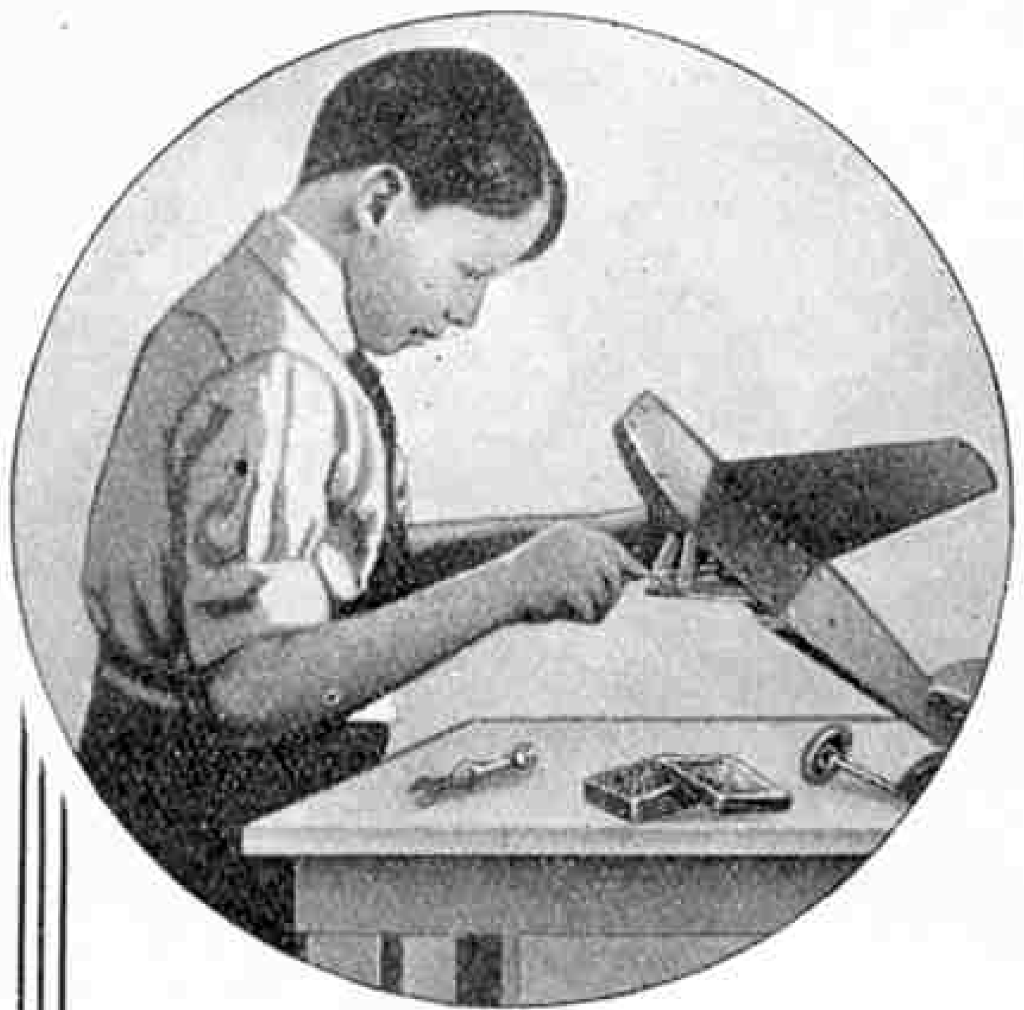
Please write in block letters. 9/36

Designed and made by The International Model Aircraft Ltd. Patented throughout the world. Sole concessionaires:

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

AEROPLANE CONSTRUCTOR OUTFITS





Boys! build your own model aircraft

Every boy should know how aeroplanes are designed and constructed, and should be able to recognise the different types of machines at a glance. These fine Constructor Outfits contain a range of aeroplane parts by means of which boys are able to design and build their own Aeroplanes quite easily.

The illustrated Manual of Instructions included in each Outfit shows how to build wonderful models of high and low wing Monoplanes, Biplanes, Seaplanes and many other interesting types.

Light Biplane (No. 2 Special Aeroplane Outfit)

Racing Seaplane (No. 2 Aeroplane Outfit)

Price List of Aeroplane Outfits

Standard Series.

No. OO Outfit	... **3/3**	No. 1 Outfit	... **7/6**
No. O Outfit	... **4/6**	No. 2 Outfit	... **12/6**

Special Series.

No. 1 Special Outfit **12/6** No. 2 Special Outfit **21/-**

Note. The parts in the No. OO and No. O Outfits are not intended for use with the larger Outfits.

No. 2 Aeroplane Outfit. Price **12/6**

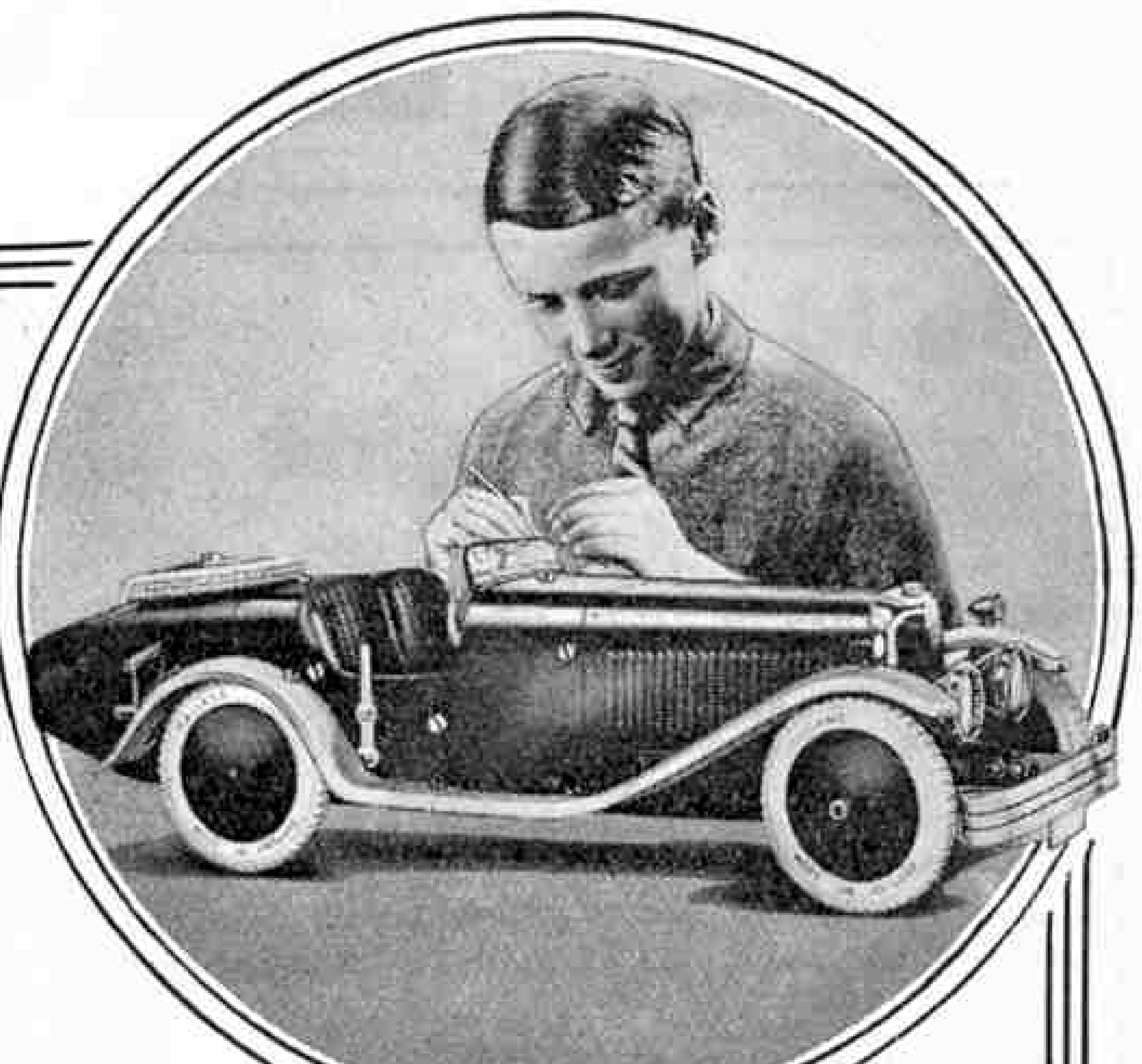
No. 1 AERO CLOCKWORK MOTOR

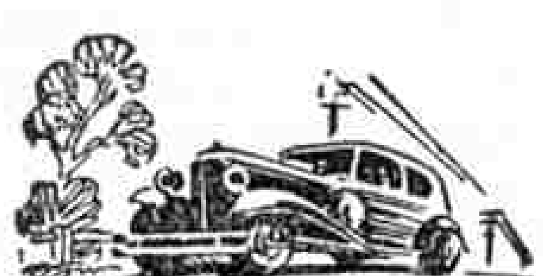
This Motor fits into the fuselage of models made with No. 1, No. 2, No. 1 Special or No. 2 Special Aeroplane Outfits. It will rotate the propeller at high speed, thus adding to the realism of the model. Price **1/9**

No. 2 AERO CLOCKWORK MOTOR

In addition to rotating the propeller, this Motor drives the landing wheels of No. 1, No. 2, No. 1 Special or No. 2 Special Aeroplane Outfit models, making the machines taxi along the floor in a most realistic manner. Price **3/6**

MOTOR CAR CONSTRUCTOR OUTFITS





You will be keen to have one!

No. 1 Motor Car Constructor Outfit. Price **10/-**

No. 1 MOTOR CAR CONSTRUCTOR OUTFIT

The motor car models that can be built with this Outfit are perfect examples of miniature automobile construction. Think of the fine fun you could have building these wonderful models, each one of which faithfully resembles its prototype.

No. 1 Outfit is supplied complete with powerful Clockwork Motor. Price **10/-**

No. 2 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 model illustrated on the right.

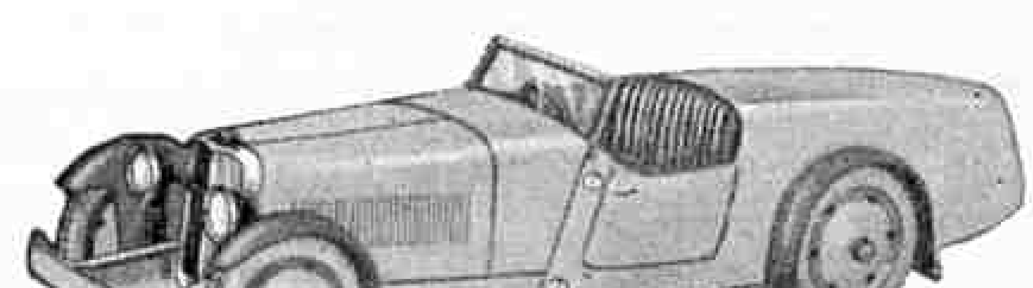
A powerful Clockwork Motor that gives a run of 150 feet on one winding is included in the Outfit. Price **20/-**

MOTOR CAR LIGHTING SET

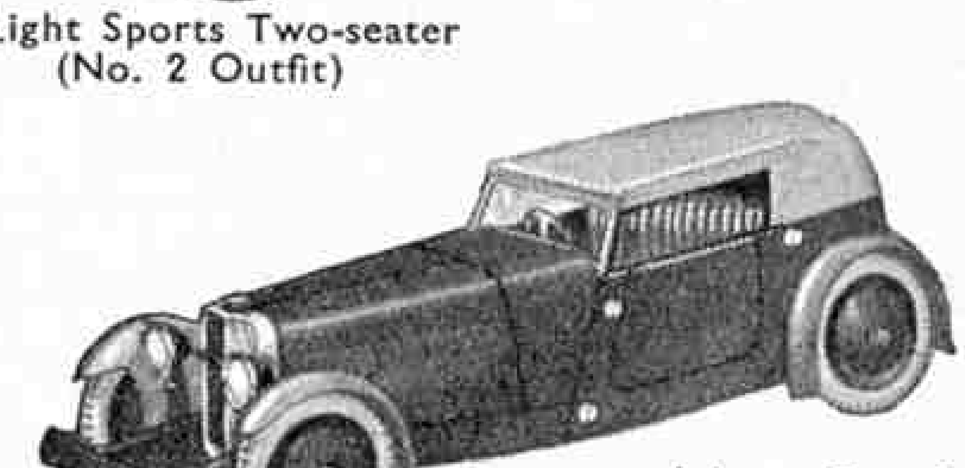
With this Lighting Set the headlamps of Motor Car models built with the No. 2 Motor Car Outfits can be electrically lighted. Price **2/6**

MOTOR CAR GARAGE

This realistic Motor Car Garage provides accommodation for any Meccano model motor car or other cars of suitable size. Inside dimensions: Height 5in. Length 13 in. Width 7½ in. Price **5/6**



Light Sports Two-seater (No. 2 Outfit)



Saloon Coupé (No. 1 Outfit)

PRODUCT OF

MECCANO LTD. - BINNS ROAD - LIVERPOOL 13

Dinky Toys

DOLL'S HOUSE FURNITURE

A WONDERFUL SERIES OF ACTUAL SCALE MODELS

The extension of the range of Dinky Toys to include true-to-scale modern Furniture will be welcomed by all who know the charm of these perfect miniatures. Much care and thought have been given to the design, finish and presentation of every article of this Furniture series. Each piece is based on a typical example of modern design, and **all are actual scale models made to a scale of 7/16th of an inch to one foot.** There is a tone and individuality of style about Dinky Toys Doll's House Furniture which cannot fail to appeal. Among the most attractive features are the opening doors and drawers. This furniture is far superior to anything of its kind that has ever before been produced for the delight and pleasure of young people.

The Dinky Toys Furniture is now ready. See it at your dealer's.

"Dolly Varden" Doll's House

THE LATEST FROM MECCANOLAND

The "Dolly Varden" Doll's House illustrated below has been specially designed for use with Dinky Toys Doll's House Furniture.

The house is collapsible and the exterior is designed to represent a half-timbered dwelling, while the interior decorations, which are printed in nine colours, are in an attractive modern style.

Reinforced leather board is the material of which the house is constructed, and when set up it is as strong as a wood structure. The container, which also is made of reinforced leather board, opens out to show a lovely garden with Tennis Lawn, Carriage Drive, and Rockery, providing an exquisite setting for play with Dinky Toys and Hornby Trees, Hedging, etc. Price 9/6

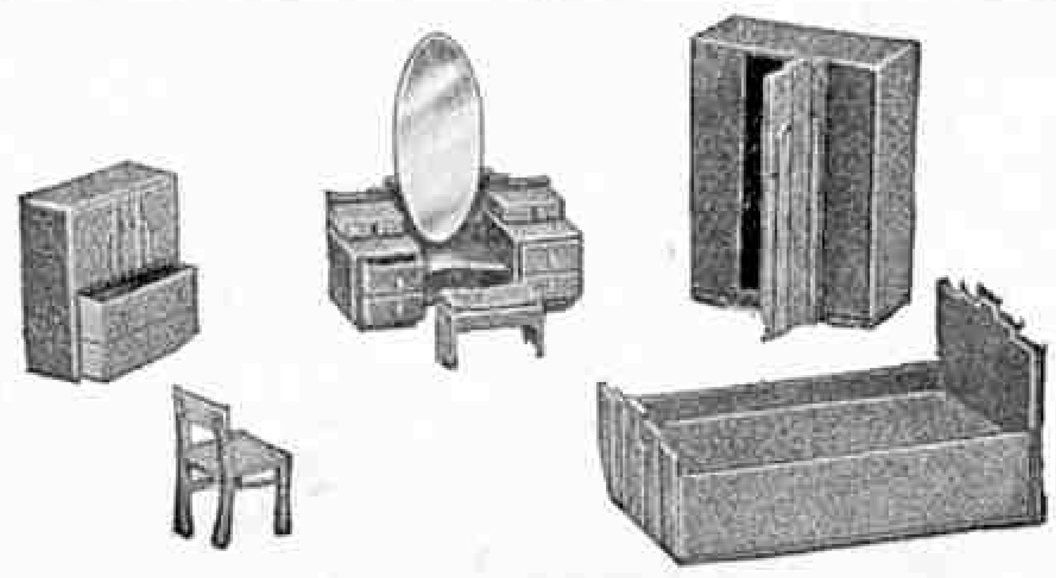
DINING-ROOM FURNITURE

Dinky Toys No. 101

Price of complete set 2/3

No. 101a.	Table...	5d. each
No. 101b.	Sideboard (Opening doors)	9d. „
No. 101c.	Carver Chairs	3d. „
No. 101d.	Chairs	2d. „

Supplied in walnut finish only.



BEDROOM FURNITURE

Dinky Toys No. 102

Price of complete set 2/11

No. 102a.	Bed	6d. each
No. 102b.	Wardrobe (Opening door) ...	9d. „
No. 102c.	Dressing Table (Opening drawers)	10d. „
No. 102d.	Dressing Chest (Opening drawers)	6d. „
No. 102e.	Dressing Table Stool ...	2d. „
No. 102f.	Chair	2d. „

Supplied in colour or walnut brown finish.

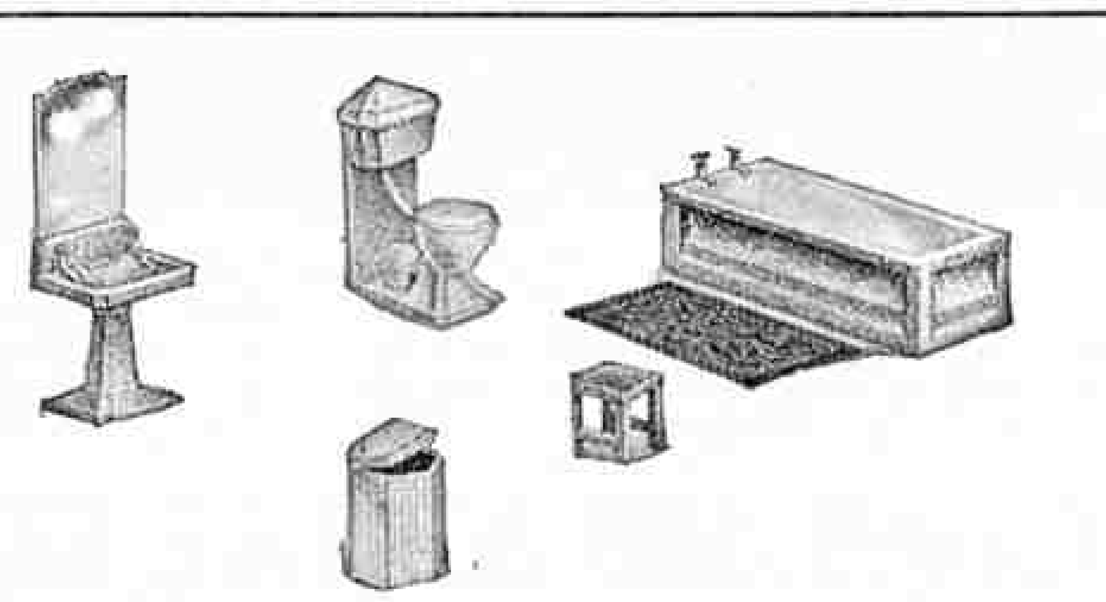
KITCHEN FURNITURE

Dinky Toys No. 103

Price of complete set 2/6

No. 103a.	Refrigerator (Opening Door)	8d. each
No. 103b.	Kitchen Cabinet (Opening doors and drawer) ...	10d. „
No. 103c.	Electric Cooker (Opening door)	6d. „
No. 103d.	Table...	4d. „
No. 103e.	Chair...	2d. „

Supplied in two colour schemes—light blue and white; light green and cream.



BATHROOM FURNITURE

Dinky Toys No. 104

Price of complete set 2/-

No. 104a.	Bath	6d. each
No. 104b.	Bath Mat	1d. „
No. 104c.	Pedestal Hand Basin ...	6d. „
No. 104d.	Stool...	2d. „
No. 104e.	Linen Basket (Opening lid)	4d. „
No. 104f.	Toilet (Lifting lid)	6d. „

Supplied in two colour schemes—pink and white; light green and white.

The Couch Hammock, Tennis Net, Garden Seats, Dinky Toys Garage, Motor Cars and Figures, and the Hornby Trees and Hedging featured in the illustration on the right are not included with the Doll's House and Garden.

DIMENSIONS

The following are the overall dimensions of the "Dolly Varden" Doll's House when built up ready for play. Length, 1 ft. $6\frac{3}{4}$ in. Depth, $10\frac{1}{4}$ in. Height, 1 ft. $6\frac{3}{4}$ in.

The open container on which the house stands measures 3 ft. $3\frac{1}{2}$ in. by 2 ft. $5\frac{1}{2}$ in.

When the house is dismantled and packed in container, the overall dimensions of the complete parcel are $\frac{3}{4}$ in. x 1 ft. $7\frac{1}{2}$ in. x 2 ft. $5\frac{1}{2}$ in.

MECCANO LTD. BINNS ROAD - LIVERPOOL 13

NEXT MONTH: "SPINNING IRON AND CONCRETE PIPES." PUBLISHING DATE: 1st OCTOBER

MECCANO MAGAZINE

Editorial Office:
Binns Road, Liverpool 13
England

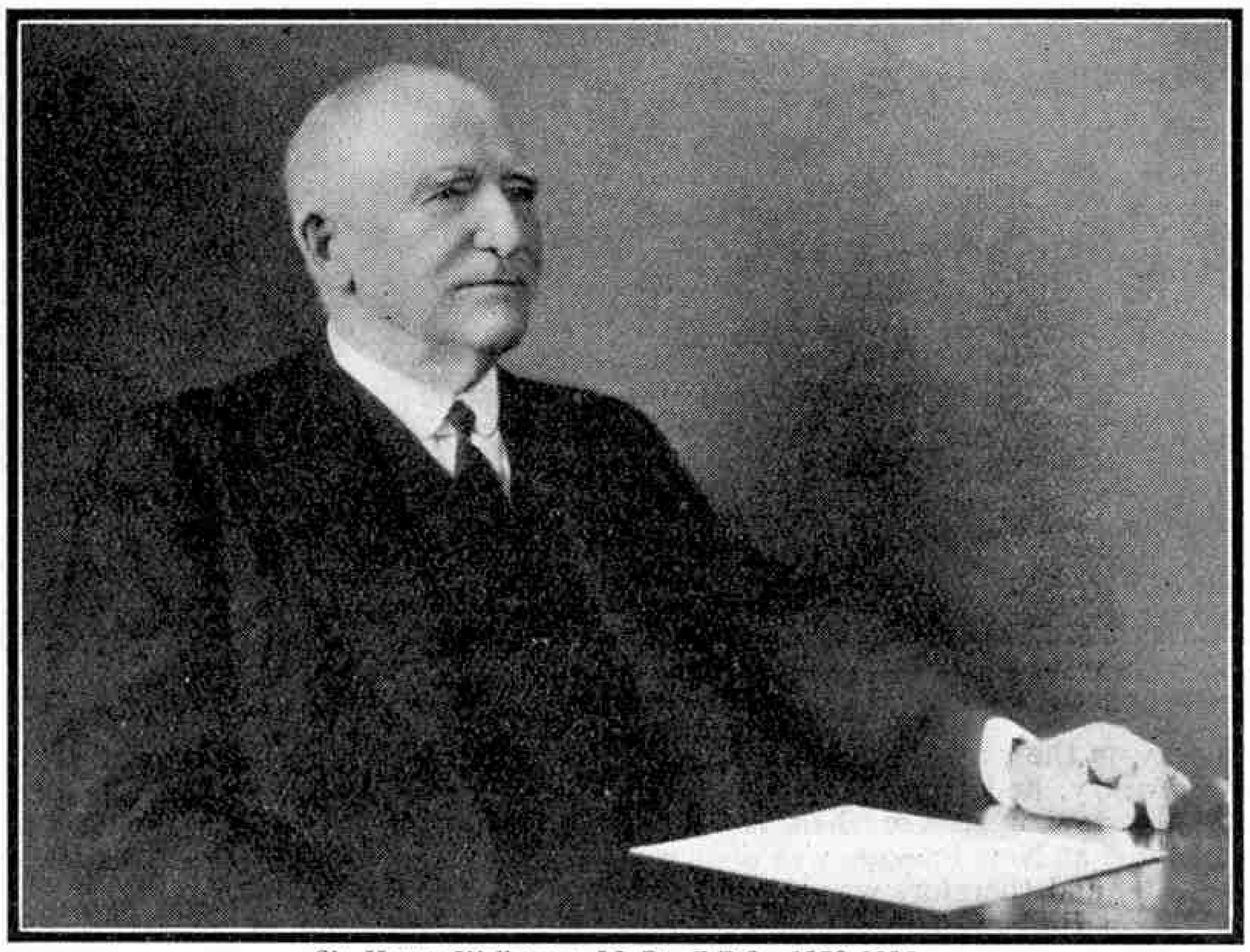
Vol. XXI. No. 9
September, 1936

With the Editor

A Romance of Science and Business

The life story of Sir Henry Wellcome, who died on 25th July last at the age of 82, can fittingly be called a romance of science and business. It begins in the midst of Indian tribes in Dakota, in the United States, where Sir Henry was born. While he was still a youth, Sioux warriors massacred more than 1,000 white settlers near his home, and in the war that followed he was captain of the boys employed in casting rifle bullets.

During this Indian warfare Sir Henry helped his uncle, then a well-known surgeon, in treating the wounded, and afterwards turned his mind to chemistry and pharmacy, in which he achieved a great reputation. He travelled to South America in order to study the forests from which quinine was obtained, and subsequently decided to make his home in England, where with Mr. S. M. Burroughs he founded the firm of Burroughs Wellcome and Co., now world-famous as manufacturers of fine chemicals. The majority of my readers will be familiar with the firm's many photographic products.


Sir Henry Wellcome, LL.D., F.R.S., 1853-1936.

Fighting Tropical Diseases

Business success did not satisfy all Sir Henry's desires by any means, and he was ever on the look out for some means of employing his knowledge and wealth to good advantage. He was particularly interested in Africa, and was friendly with Stanley and others whose explorations in that continent made them famous. Soon after the conquest of the Sudan, he established laboratories in Khartoum to study the diseases that ravaged the continent. He also supported exploring expeditions in practically all parts of the world—many of the great expeditions of modern times were medically equipped by him—and he himself carried out extensive explorations in the upper Nile region of Africa, excavating ancient sites and unearthing relics of Stone Age men in Ethiopia.

Good Things In Store For Readers

I have many interesting articles in store for my readers. Among these is one dealing with a wonderful pipeline, 248 miles long, built to carry water from the Colorado River across great deserts and under mountains to supply Los Angeles and other cities of Southern California. Another attractive contribution will describe a visit to Iceland.

Railway enthusiasts will be glad to know that "A Railway Engineer" has in preparation further footplate articles, which become more popular month by month. Another railway article of outstanding interest will describe the provision at Leeds New Joint Station of colour-light signals, power-operated points, track circuits and a new signal cabin. Readers who enjoyed Mr. O. S. Nock's account in the August issue of his flight from Belfast to Liverpool will find even greater interest in his forthcoming description of an air trip from Amsterdam to Croydon. Other aviation articles will deal with the new "direct-lifting" Autogiro, capable of a big vertical jump, and with recent types of British military aircraft.

Retaining Old Favourites

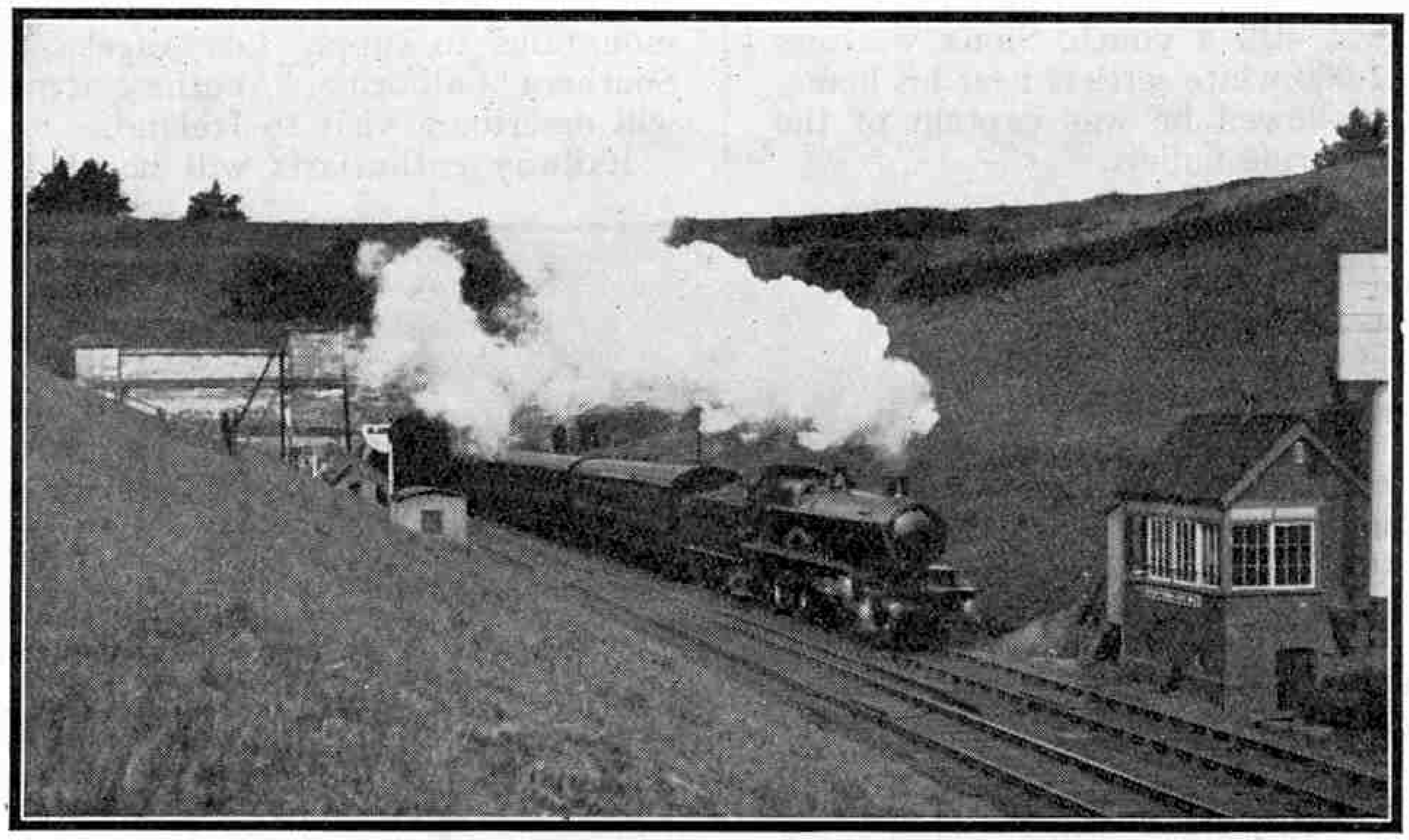
Whenever the "*M.M.*" appears without "*Engineering News*," or some other old favourite, I invariably receive a shoal of complaints and enquiries. This is not surprising, for practically every page of the Magazine is the result of imperative demands from readers. My difficulty is that I am called upon to provide articles and contributions on so many different topics that it is impossible to find room for all of them in every issue. I can assure readers that the absence from any issue of a regular feature does not mean that it is to be discontinued, and they can look forward to its re-appearance the following month.

Boring the Severn Tunnel

How the Engineers Fought Floods

THE day on which this issue of the "*M.M.*" appears can be regarded as the fiftieth birthday of the Severn Tunnel of the G.W.R., for the first goods train ran through it on 1st September 1886. The Severn Tunnel is the longest in Great Britain, apart from the London tubes, and is still the longest under-water tunnel in the world. Its opening greatly improved communication between England and South Wales. Before it was brought into use the quickest rail journey between Bristol and Cardiff took 2 hrs. 14 min. and involved crossing the Severn by ferry, while freight trains had to go round by Gloucester. When train service on the new route was established, the time required for travel between the two cities was reduced to 80 min.

The building of the Severn Tunnel was the most difficult engineering achievement of the whole of the G.W.R. system, and the contractor engaged in the task held that "one such tunnel, with its strangely contorted strata and dangers from floods above and floods below," was enough for a lifetime! Only the dogged perseverence of those in charge, and the courage and resource of the men who worked in the tunnel, enabled it to be completed in the face of a succession of difficulties, disappointments and even disasters.



A G.W.R. up South Wales express emerging from the English mouth of the Severn Tunnel. This tunnel is 4 miles 624 yards long, and is the longest under-water tunnel in the world. Photographs by courtesy of G.W.R.

The story of communications across the Severn estuary is very interesting. The Romans established a ferry on the road from Bath to their military stations at Caerwent and Caerleon. This was closed during the Civil War by Cromwell, because some of his soldiers had been lost there owing to treachery on the part of the ferrymen. It was reopened in the following century, and took the name of the New Passage, a ferry near Chepstow upstream then being known as the Old Passage. The channel at New Passage was open for navigation at any stage of the tide, and therefore was selected by the Bristol and South Wales Union Railway as the site of a steam ferry that commenced to operate in 1863, and continued to work for 25 years. The transfer from train to steamer and vice-versa took place on wooden piers.

The Bristol and South Wales Union Railway later became part of the G.W.R., and eventually powers were obtained to construct a tunnel to replace the cumbersome ferry. Boring under the Severn did not promise to be an easy task, for the range of tides in the Severn estuary is large and on the Monmouthshire side there is a deep-water channel, a quarter of a mile wide and 58 ft. deep at low water, that is known as the "Shoots." It was intended that there should be a depth of 30 ft. between the top of the tunnel and the lowest part of the river bed, and long approaches therefore were necessary in order to avoid a gradient of more than 1 in 100, the maximum proposed. Originally it was planned to sink a shaft in the estuary on a rock that was uncovered at low tide. The rock was covered by 28 ft. of water at high tide, however, and the currents were so strong that this scheme would have been expensive. Because of this, and of the interference to navigation that would have been occasioned by the presence of the shaft, the scheme was abandoned and all the shafts used were on land and outside the influence of tide water.

Work was begun on the Welsh side of the river, the sinking of a brick-lined shaft 15 ft. in diameter and 200 ft. deep being commenced in March 1873 at Sudbrook. The tunnellers soon made their first acquaintance with water, which was to be a constant source of trouble and delay during the work, for they encountered a spring yielding 12,000 gallons per hour, and twice that amount came from a second struck lower down. Two steam pumps were installed, the first to deal with the upper spring, and the second to take away the water of the lower one.

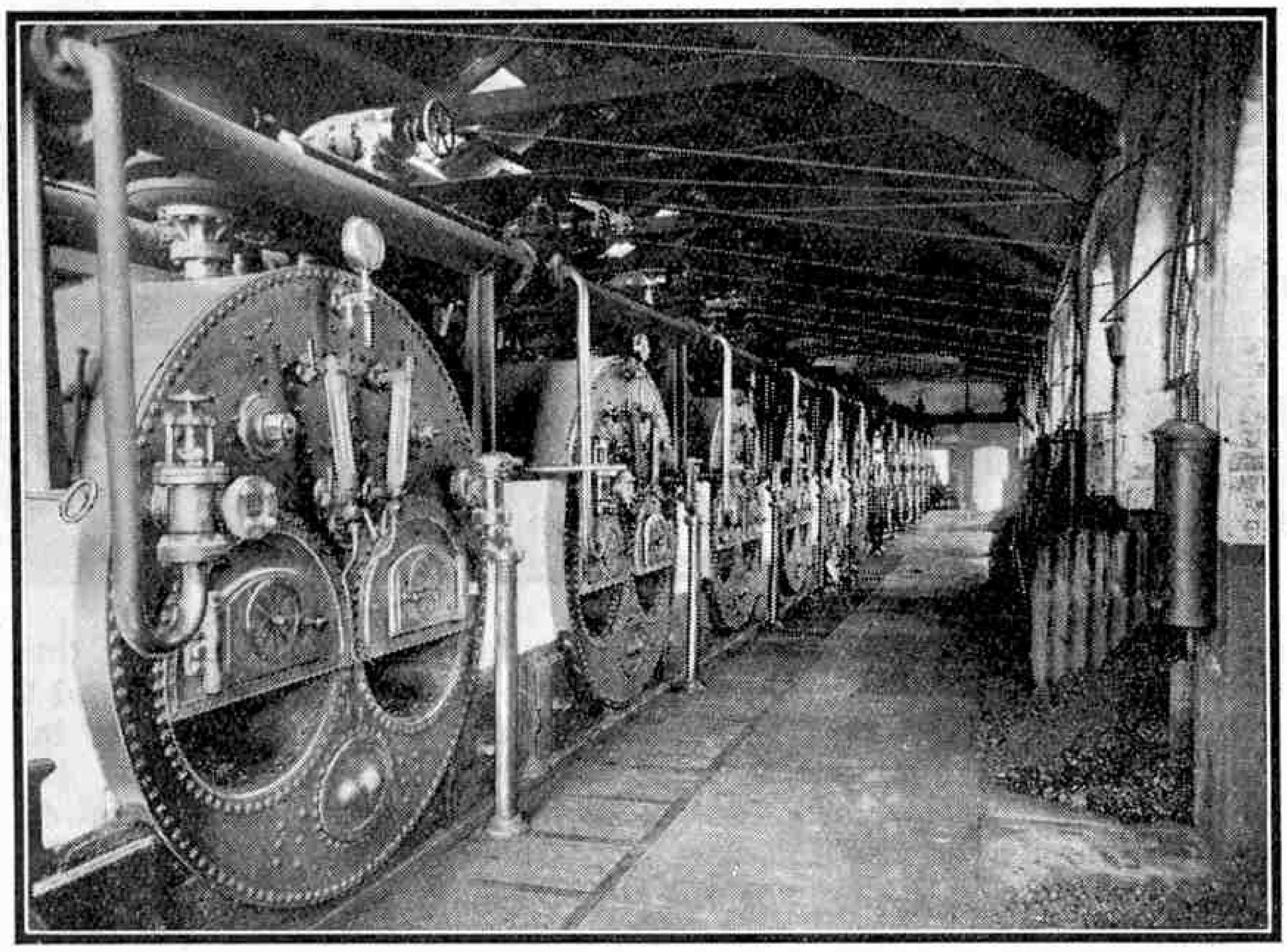
By the end of 1874 the headings of the tunnel itself were begun, and they had been carried nearly a mile under the river bed by August 1877. At first they were driven by means of hand drills and blasting, but later compressed air drills were brought into use. The compressed air required was carried along the headings in a six-inch pipe, and on release from the drills served to keep the air fresh at the working face. Other shafts were sunk on both sides of the Severn, and headings were commenced from them to join up with those from the foot of the Sudbrook shaft, now known as the Old Shaft. By October 1879 there were five shafts altogether, and the original headings from the Old Shaft had been lengthened by two miles, only 130 yds. then separating them from the working face of the headings driven from the Sea Wall Shaft, on the Gloucestershire side.

Then came a disaster. An underground reservoir, afterwards called the Great Spring, burst into the workings, flooding them at the rate of 6,000 gallons a minute. The men had to run for their lives, but fortunately were able to escape through a cross heading into a pumping shaft. Soon the water was 150 ft. deep in the shafts. It was found to be fresh, and at the time when it poured into the tunnel many of the streams in the district dried up. The River Neddern, a tributary of the Severn, actually became dry for a distance of five miles!

After this disaster Sir John Hawkshaw, hitherto Consulting Engineer, was put in charge. The first step was to deal with the water flooding the workings, and heavy oak shields were placed in position by divers at each heading entrance at the bottom of the Old Shaft, while more powerful pumps were installed.

In the efforts to master the incoming water, heroic feats were performed by a diver named Lambert, who is described as "a fair-haired man of few words and great courage." A special flood door had been provided in the heading, the idea being that in case of emergency this would be closed and two valves also screwed down to keep flood water within bounds. These had been left open in the rush to safety when the Great Spring broke in, however, and now had to be closed. In his first attempt Lambert had to make his way into the heading past all the material left behind in the miners' race for life, dragging his air pipe after him. Two other divers assisted him, one being stationed half way along the heading to feed the pipe forward and the other at the bottom of the shaft to turn the frail tube into the heading. Lambert could not approach nearer than 70 ft. from the door, and had to return, bringing his air pipe with him and spending anxious moments when it caught in various obstructions on the way.

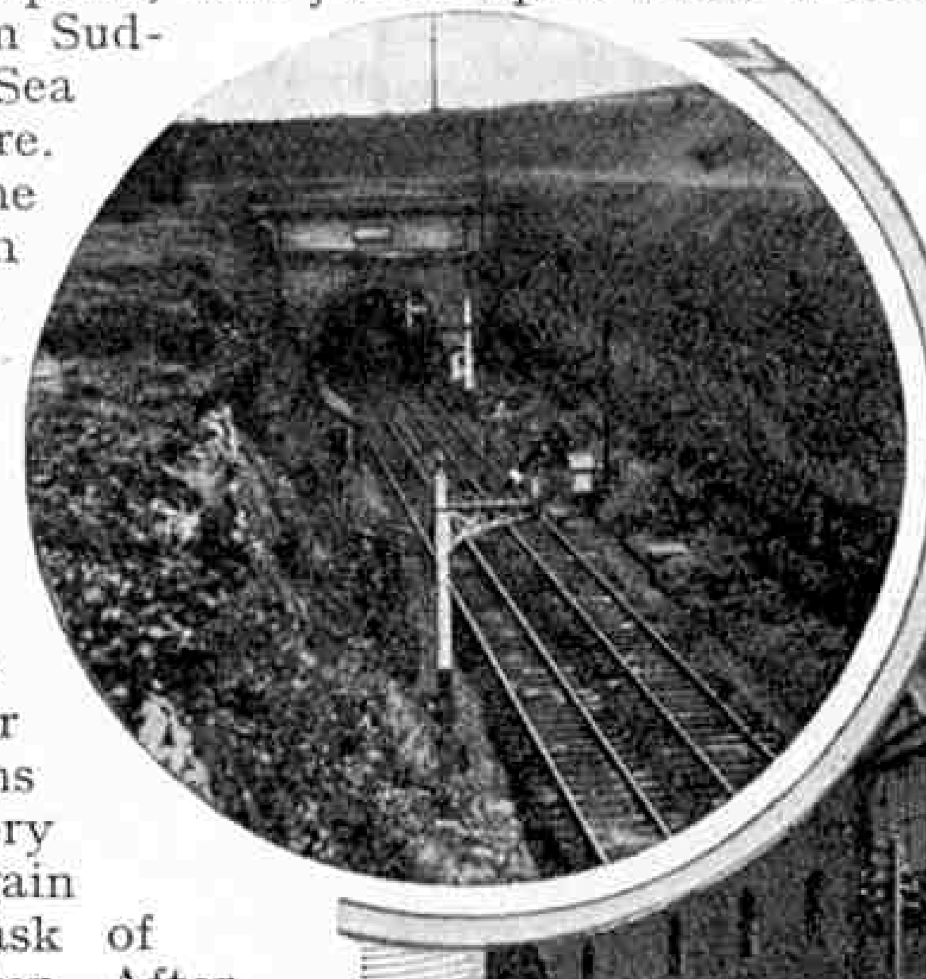
Another attempt was then made by Lambert in company with Fleuss, the inventor of a self-contained diving apparatus. They reached the bottom of the shaft, but owing to inexperience Fleuss could venture no further. Lambert reached the flood doorway, however, and removed one of two tram rails passing through it, but was not able to do more. He went back two days later, removed the second rail and operated the valves. After this, it was a great disappointment to find that the pumps still had considerable difficulty in reducing the amount of water in the workings. When, a month later it became possible to inspect the valves, it was found that one of them had a left-hand thread, and that Lambert had opened it to its fullest extent instead of shutting it down, as he imagined. The works were gradually cleared of water, and the Great Spring was sealed in for the time being by means of head walls of brickwork and cement.

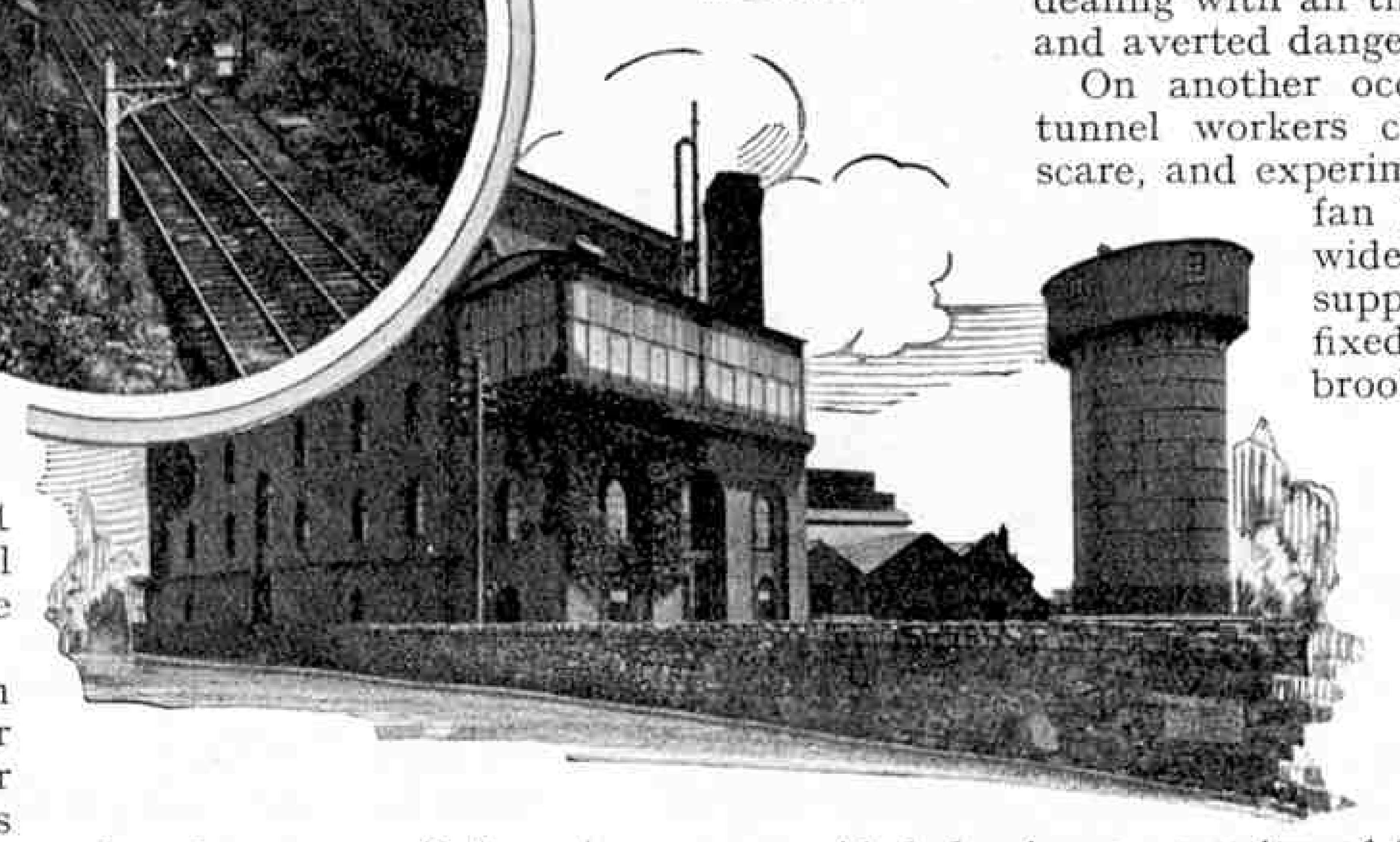


The 12 Lancashire boilers in the No. 1 pumping house at Sudbrook. These boilers supply steam to the pumps that deal with water from the Great Spring.

Hawkshaw decided to place the tunnel 15 ft. deeper under the Shoots, considered to be the critical part of the work. This made it necessary to increase the slope on the Welsh side to 1 in 90, and the lower of the two headings already driven then became the top heading of the tunnel. Work was resumed, but the troubles of the tunnel builders were by no means ended, for in April 1881 the river broke into the workings from a pool known as the "Salmon Pool," where the water is only 3 ft. deep at low tide. A number of men joined hands and waded about the pool at low tide in order to find the hole. One of them discovered it by falling into it, but he was quickly pulled out and the opening was then filled up with clay, loose and in bags.

Later difficulty was caused by a four days' strike and a severe snowstorm in January 1881, during which the coal supplies for the pumping engines gave out, and wood and almost anything else at hand that would burn was thrust into the furnaces in the effort to keep the pumps going. Satisfactory progress was made with actual tunnelling, however, and in September 1881 the two headings, each about 7 ft. square, were joined up to make a clear passage 2¼ miles long from Sudbrook on the Welsh side to Sea Wall Shaft in Gloucestershire. The work of opening out the headings to the full width was then begun, 3,744 yds. of tunnel being completed by the end of 1882.





On the left is a view of the approach to the Severn Tunnel on the Welsh side. Below is the exterior of the No. 1 pumping house at Sudbrook.

The ever-threatening water again put a stop to proceedings in the following October, for the Great Spring once more broke through, this time in greater quantities, 27,000 gallons pouring into the tunnel every minute. Diver Lambert again was prominent in the task of stemming the invading water. After the pumps had gained ground, he went down to close a flood door in the special heading that had been provided in the earlier draining operations.

In the meantime what might have been a more serious disaster took place, for during a storm a tidal wave swept over the Severn banks, putting out the fires of all the pumping engine boilers and pouring down one of the shafts to fill the tunnel to within 8 ft. of the top. Two or three of the men at work climbed the shaft with water flowing down over them; the remainder, 83 in number, were trapped in the tunnel, where they took refuge on raised staging. Next day a small boat was lowered down the shaft end-on, but the rescuers in it could only approach the marooned workmen after some of the submerged staging had been sawn through. Fortunately no further trouble prevented the men from making their way to the surface in safety. The pumps again cleared the workings of water and the Great Spring was restrained by head walls.

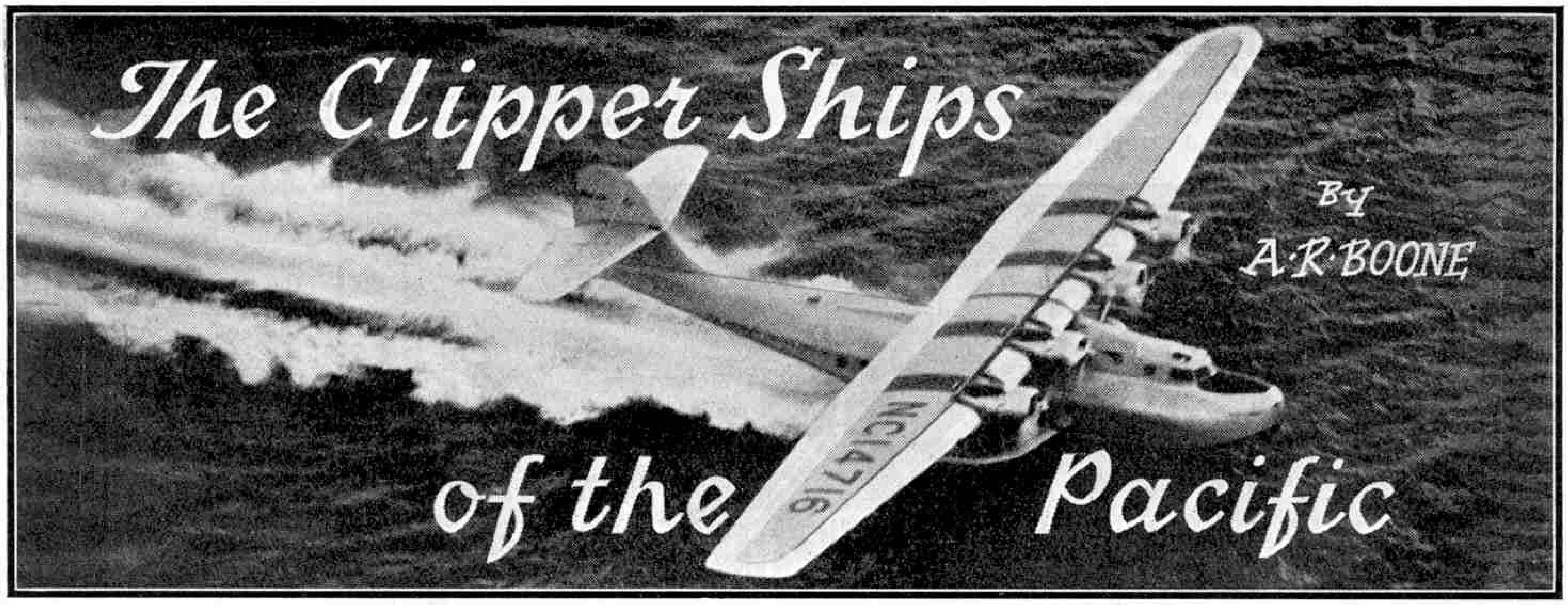
Good progress was then possible both in the tunnel and in the approach cuttings, which required the excavation of more than 800,000 cu. yds. of earth. Steam shovels were used in the latter task. These had never before been employed in Great Britain and their appearance aroused great interest. Eventually the threat of the Great Spring was dealt with by driving a special heading into which the water was allowed to flow through the sluices in the head wall. The pumps then available were masters of the situation, so that it was possible to complete the tunnel without further trouble from this cause. On 18th April 1885 the last length of brickwork was keyed in, and some months later a special train carrying Sir Daniel Gooch, then Chairman of the G.W.R., and other officials, travelled through the tunnel from the Welsh to the English side and back.

An important part of the construction of the tunnel was the lining, which accounted for half of the cost of the complete work. It was made of vitrified bricks laid in cement, and some idea of the immensity of the work carried out in building the tunnel is given by the fact that no fewer than 76,400,000 bricks and 37,000 tons of cement were used. Water pressure on the brickwork caused a considerable amount of trouble. Showers penetrated through the joints in several places, and at one time pieces of the tunnel lining broke off and jets of water shot right across the bore. The water that spurted in all directions sometimes made it impossible to have any lights burning. Work then had to be carried out practically in darkness, but an electric lighting system was installed in the Sea Wall Shaft in 1880, and in the workings at the Welsh end of the tunnel later. This was a remarkable step, for electric lighting was then in its infancy.

In order to avoid mishap from this source it was decided to add to the pumping plant. This meant the sinking of a new shaft 29 ft. in diameter at Sudbrook, and the installation of six large pumps. This provision added to the cost of the tunnel and delayed its opening for traffic by about 12 months, but the plant installed was capable of dealing with all the water of the Great Spring and averted danger of further disaster.

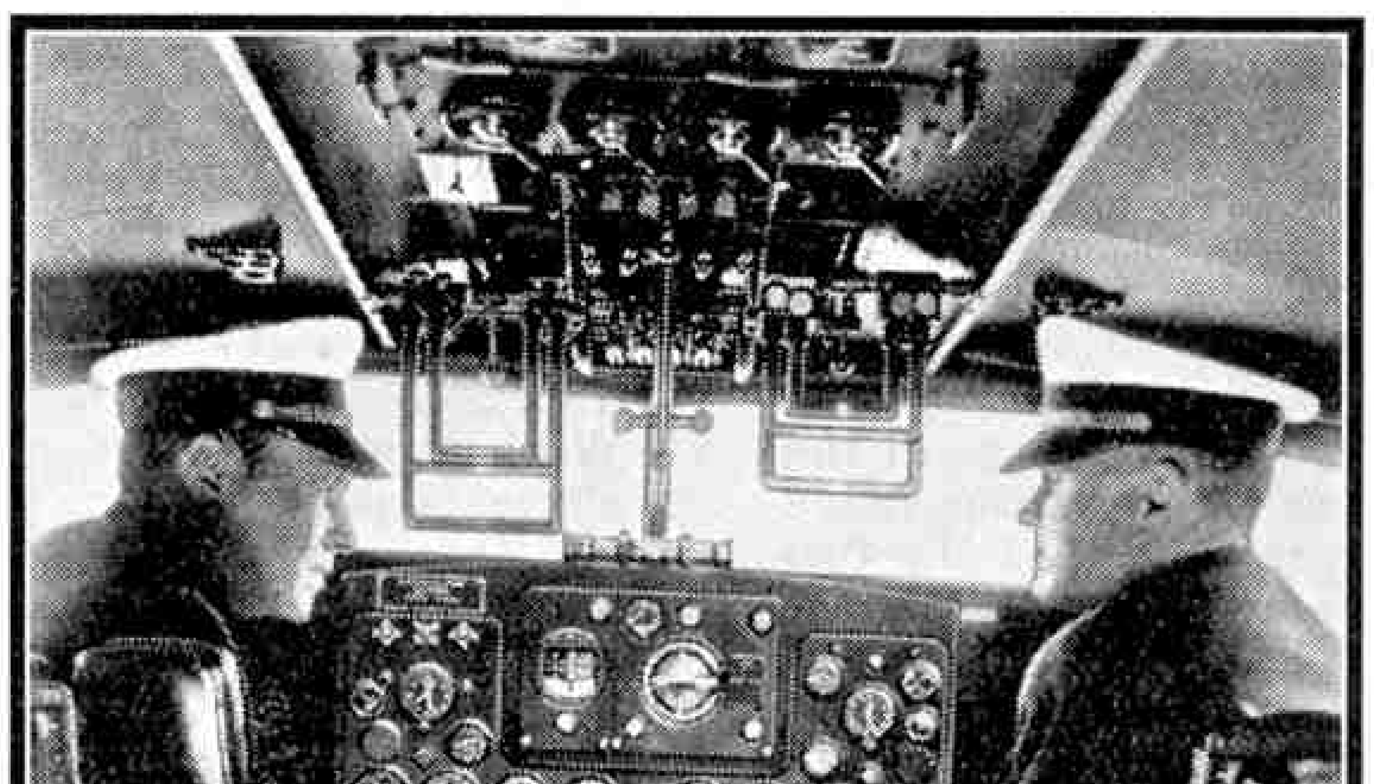
On another occasion the deaths of three tunnel workers caused a "bad ventilation" scare, and experiments were conducted with a fan 12 ft. in diameter and 7 ft. wide in efforts to improve the air supply underground. This was fixed over the New Shaft at Sudbrook and drew air through from the Sea Wall Shaft 2¼ miles away. It continued to work for four years and was of ample capacity, but in 1886 it was replaced by a much larger fan 40 ft. in diameter and 12 ft. wide. This fan was in continuous use until 1924, when the present still more powerful installation was provided, having a capacity of 800,000 cubic feet of air per minute. This is driven by a tandem compound engine supplied with steam from three Lancashire boilers, two being used at once.

Finally, after 13 years of hard work and disappointments, the courage and enterprise of the builders of the tunnel was rewarded by complete success. The full length of the workings is practically 7 miles, with 4 miles 624 yards actually in tunnel, and the total cost was more than £1,800,000. An experimental coal train from Aberdare to Southampton was run through the tunnel early in 1886, but the opening for traffic was delayed until 1st September owing to the necessity of completing the pumping arrangements.



ALTHOUGH public attention of late has been centred on aerial accomplishments on this side of the globe, our airminded American cousins have been hastening the final conquest of the air by their latest achievement in opening up the 8,705-mile route from California to China. This has been done by spanning the vast Pacific Ocean with 25-ton flying boats in which the world traveller is as safe as in a railway carriage on land.

Americans call these monster air liners "clippers," and they are building a large fleet of them in order to cope with future freight and passenger traffic between California and China. Already there have been several trial flights carrying mail and freight, and passenger service will start within a few months. Then one will be able to travel around the globe in 17 days in comfortable, luxurious air liners. Suppose a start is made in New York. From there it will be possible to cross the Atlantic via Montreal, or to reach Marseilles by way of Bermuda, the Azores and Lisbon. The flight will be continued across Europe to Bangkok, by scheduled services already in operation, and thence to Manila over a line soon to be inaugurated. Then will follow the journey by air from Manila across the Pacific to California, and finally a dash across North America back to New York. It is the age-old dream of mariners come true!


In the pilot's cabin of the Pan American Clipper, the flying boat engaged in experimental flights across the Pacific Ocean.

Engineering science has made these Pacific Ocean flights as safe as the proverbial houses, for nothing is left to chance. Here are a few interesting features of the giant air ships employed on the service. They cruise at 157 m.p.h., each crankshaft making 1,800 revolutions in every minute of the flight. This means that the crankshaft of each engine revolves 6,500,000 times during the 60-hour flight from Alameda, in California, to Macao, off the southern coast of China, making a total of 26 million revolutions for the four 12-cylinder engines. Further, there are 900 explosions in each of the 56 cylinders each minute, or a total of 181,441,000 power strokes between California and China. Any three of her engines will keep a "clipper" in the air, no matter how heavily she may be loaded.

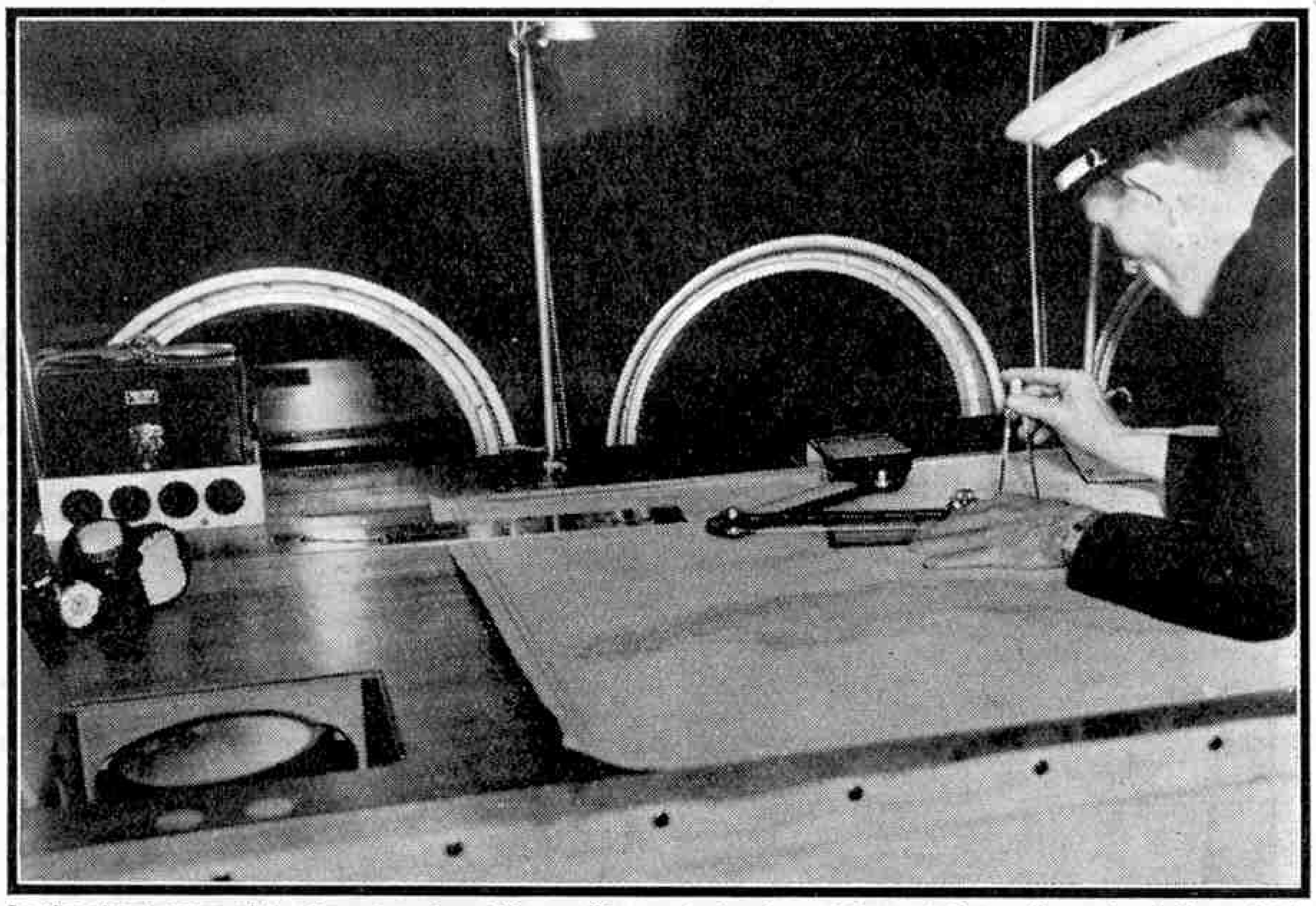
Five specialists will man each air liner when the passenger service is inaugurated, and each will be capable of taking over the job of nearly every other. The captain, for instance, may fly the ship, serve as flight engineer, navigate or work the radio. A "flight engineer" is a comparatively new job on air liners, and on this particular route he takes over many of the former duties of the pilot. He sits in his cabin, above the passengers' compartment and directly beneath the leading edge of the huge wing, and within easy reach has the instruments and controls by means of which he starts the engines, feeds them with petrol, controls them and finally shuts them off at the end of a flight. The removal of all these gadgets from the pilots' cabin has left the men who actually fly the machines only 50 instruments and controls at their fingers' tips.

The flight engineer knows every quirk and rivet in the ship. Not only is he capable of performing any necessary repairs, but each hour during flight he takes 70 recordings, including the rate of petrol consumption, head and base temperatures of two cylinders on each engine, and oil temperature and pressure. His is a busy life, from the time he takes off until he lands.

Once a "clipper" is in the air, vigilance does not relax until the machine is reported safe at her destination. Everyone realises the important part the weather plays in air safety, and perhaps nowhere in the world is such a vast weather forecasting service maintained as that which covers the entire northern Pacific. From Eastern Siberia, Japan, China, the Philippines and the mandated islands south and east of Japan, wireless flashes twice daily reports of local weather and wind conditions.

There are observers at Macao, the terminus, and at Manila, Guam, the tiny island of Wake, Midway and Honolulu, all calling places on the Pacific air route. These men take surface observations four times daily and upper-air soundings, noting wind direction and velocity to great altitudes, twice a day, and they report their observations to Alameda. Then the United States Weather Bureau collects weather information at the same hours from ships at sea, from shore stations in Alaska, and from places all over the United States.

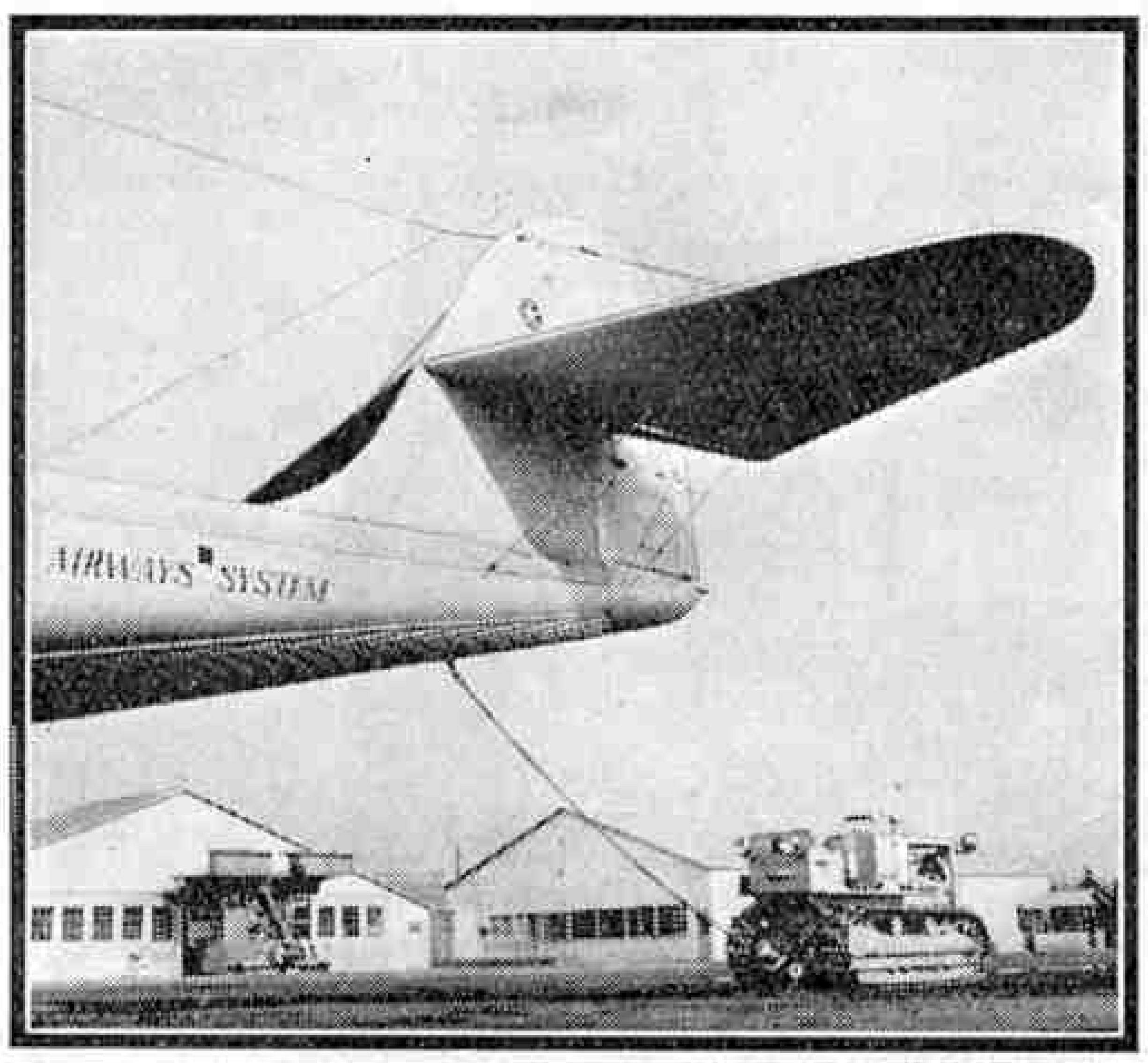
With these reports before him, the meteorologist at the Alameda airport charts the weather as it will develop during the next 12 hrs., and he can then follow the progress of storms as they develop thousands of miles away and direct air liners so that they may shape their courses to avoid these disturbances.



In the chart room of the Pan American Clipper. The navigator is working out his position after taking night sights of the moon and a star.

When a flight actually starts, the weather experts multiply their efforts to provide up-to-the-minute information. Starting three hours before each flight, and continuing throughout, the stations of departure and arrival make observations every hour. More than once they have steered a machine in service from a storm area into calm air, thereby not only saving the crew from distress, but also speeding up the flight. On one occasion a "clipper" was at Midway ready to take off for Wake, when at Alameda indications were discerned of a tropical storm brewing 6,000 miles to the south of its starting point. The disturbance was moving north-westward towards the liner's course at a speed of about 20 m.p.h. News of its approach was despatched by radio to Midway, where a new course 100 miles west of the regular route was quickly planned to enable the machine to avoid it.

When the liner on its new course was half way between Midway and Wake huge storm clouds and heavy rain squalls were seen 100 miles away on the starboard beam. The storm was 200 miles in diameter. It crossed the path of the air liner before the return flight to Midway two days later, and the machine then flew along its eastern boundary, thus missing it completely on both flights as the result of information collected and charted 4,000 miles away.



When on shore the giant clippers are towed by tractors. This illustration gives some idea of the immense size of their tails.

Even if weather changes are sent by radio to the navigators, how do they change courses and yet bring the big air liners into port on time and with unerring accuracy? How important exact navigation is may be realised from the fact that the tiny island of Wake is only 4½ miles long and 2½ miles wide. It is indeed a tiny dot in the vast Pacific Ocean, 1,138 nautical miles west of Midway and 1,309 miles east of Guam. Yet it is reached without hesitation, and similar precision marks every stage of the long flights the "clippers" are called upon to make in maintaining the new service.

In order to achieve this remarkable accuracy, during the day the navigator takes observations every hour of the Sun and Venus, and at night of the Moon and Venus. Intersecting lines indicate within an error of a few miles where the machine was at the precise instant he held his octant toward the sky and got a "fix." These observations serve as a check on radio messages, by means of which the machine's position is determined every 30 minutes. To make sure that all is well, Alameda calls the liner every quarter of an hour.

Although the machine might be on the true course at the moment, cross-winds may be blowing her gradually off her flight path. Whether this is so, and in what direction she is being driven off her path, is determined by an ingenious flask built like an air bomb and containing 1 lb. of aluminium powder. The navigator attaches his drift indicator to a window sill, and casts the flask into the sea. It shatters on impact, the powder quickly forming a tiny, glistening island. Speedily he determines from the scale on the indicator the extent to which the liner is drifting. Still the wind may be coming in ahead from the bow, or astern off the tail, holding the liner back or speeding her along. So the navigator calculates where she would be 15 min. later were there no wind, and after that time has elapsed he determines her position by radio messages and celestial observation. The difference in these positions represents the drift. Air liners can always tune in on some radio station and determine in a few seconds whether they are flying on the charted path or not.

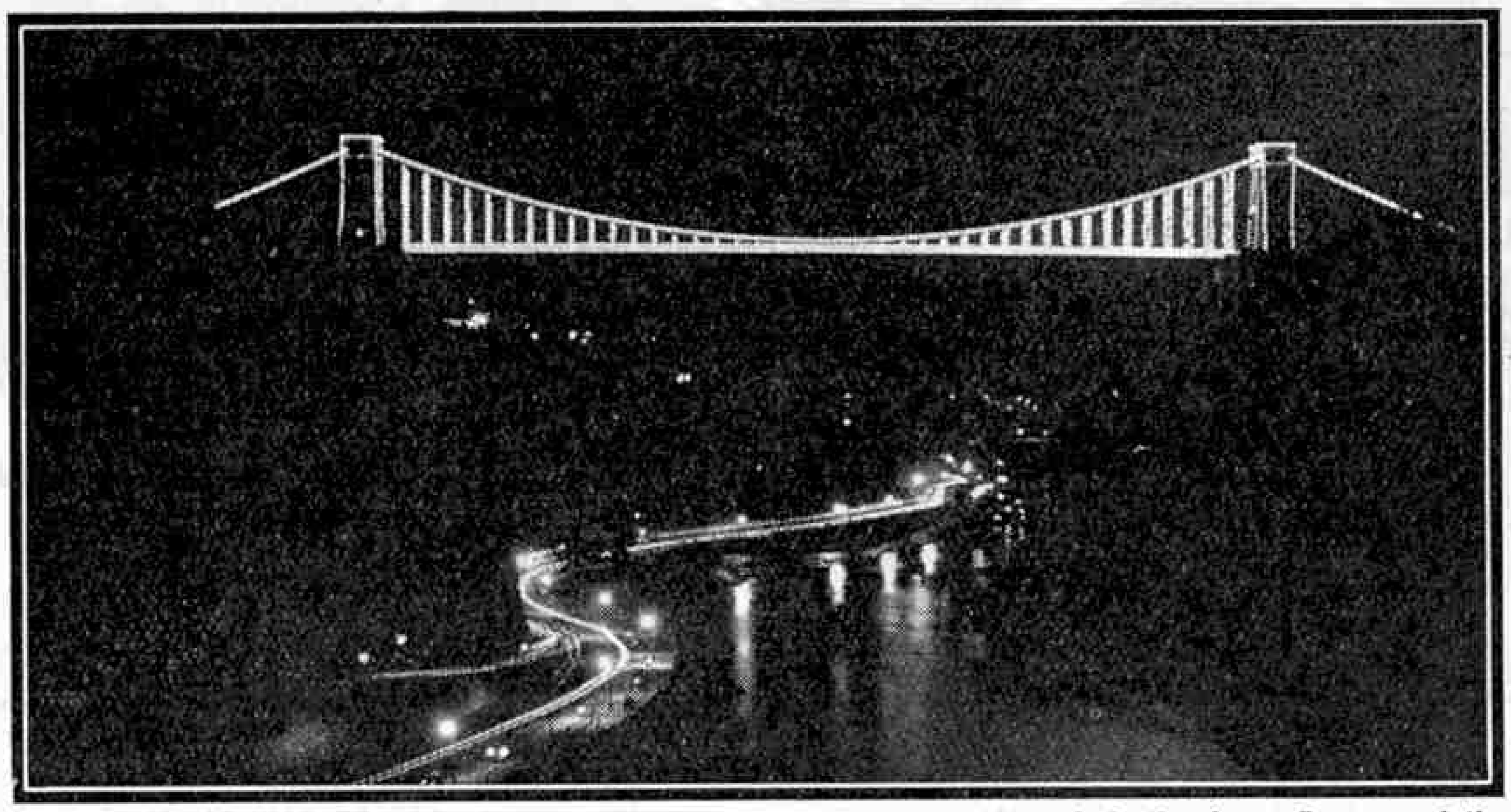
Any of these American "clipper" air liners could circle the globe to-day at the Equator in nine days were it possible to refuel at intervals. Yet to-morrow's round-the-world air liners will be even larger and faster. English and American engineers already are planning huge ships to weigh 150,000 lb., with cruising speeds exceeding 200 m.p.h. They will fly well over the clouds and above storms, at heights of four to five miles, thus permitting passengers to enjoy smooth and comfortable flight.

Centenary of a Famous Bridge

How the Avon Gorge at Bristol was Spanned

By F. R. Winstone

THE foundation stone of the Clifton Suspension Bridge across the Avon Gorge at Bristol was laid 100 years ago on 27th August 1836, in the presence of thousands of people. The annual meeting of the British Association was being held in Bristol that year, and the Marquis of Northampton, the President, was given the honour of laying the first stone of the bridge, which marked the beginning of the construction of the abutment on the Leigh Woods, or Somerset side of the river.



The Clifton Suspension Bridge outlined by illuminations at night. Below it is the Avon Gorge, and the tracks of the headlights of motor cars on the road by the river can be seen.

The story of the Clifton Suspension Bridge began in 1753, when Mr. William Vick, a Bristol spirit merchant, left £1,000 in the keeping of the Society of Merchant Venturers of Bristol to accumulate at compound interest until it reached £10,000, when it was to be devoted to building a stone bridge to span the Avon Gorge. By 1829 the bequest had grown to £8,000, and a committee was then formed to consider how the scheme could be carried out. A stone bridge proved to be out of the question because of the high cost, and as one of the most widely discussed topics of the day was the recently completed Menai Straits suspension bridge, Telford's great triumph, it was decided to build the Clifton venture on similar lines. Accordingly designs for a suspension bridge were invited, and one of those who entered the competition was Brunel, who later created the Great Western Railway and built the "*Great Eastern.*"

At that time Brunel was only 23 years of age. He designed four bridges with single spans varying from 760 ft. to 1,180 ft. in length, and it seemed as if one of his designs would be adopted. Unexpected opposition came from Telford, who when asked to judge the designs argued that a span of more than 600 ft., that of his own Menai Straits bridge, was inadmissible. Telford favoured the erection of two enormous Gothic towers on the banks of the river, to give a central span of 360 ft., but his design did not satisfy the committee and a further competition was held. This time Brunel was successful. The suspended span of his proposed bridge was 600 ft., but in the final plans this was extended to 702 ft.

Taking toll from a motorist about to cross the bridge.

The estimated cost of the bridge was £57,000, or more than seven times the sum to which the Vick legacy had amounted; but more money was raised by means of gifts and loans, and operations began in January 1836, after Brunel had suggested decreasing the width of the bridge and dispensing with some of its ornamental features. Unhappily all the money available was spent by 1840, when the two towers had been completed. Great efforts were made to collect funds, but no more work was done for some 20 years when a new company was formed by prominent members of the Institution of Civil Engineers, who wished to complete the work as a monument to Brunel. The opening of the bridge took place in 1864.

Shortly after the foundation stone ceremony, efforts were made to connect the two sides of the Avon Gorge by means of an iron bar 1,800 ft. in length and 1½ in. in diameter. The purpose of this was to enable workmen to pass from one side of the river to the other in a car suspended from the bar. At the first attempt a hawser broke and one end of the great rod fell into the river. It was raised into position next day, but was then found to be bent in the middle to such an extent that it was practically useless. A new bar was passed over the river in September, however, and the great occasion was marked by Brunel making the journey across the Gorge, along with a youth named Claxton.

As can be imagined, the novelty of the trip was a great attraction, and crowds of people wished to follow the engineer's example. They were allowed to do so at a charge of 5/–, which eventually was reduced to 1/–. There was great eagerness to experience this 19th. century thrill, and in Bristol 100 years ago the first question people asked of their friends and acquaintances on meeting them was; "Have you crossed the Gorge?" It is said that on one occasion a bride and bridegroom essayed the trip on their wedding day. Unfortunately, the hauling ropes refused to work when the couple were half way across, and there they were left for several hours to contemplate the beauties of the Avon Gorge and the hills of Somerset on the horizon. They began to discuss the prospect of staying in their novel and uncomfortable position all night, but fortunately they were rescued in time to avoid this.

The bar stayed in position nearly 20 years, and on one occasion during a general election practical jokers hung an effigy of one of the rival candidates on it over the middle of the river. As this could not be reached by ordinary means it was necessary to engage a rifleman to sever the rope by shooting bullets through it in order to appease the injured dignity of the candidate concerned.

Since its completion the bridge unfortunately has proved a favourite place for suicides. There is a sheer drop of 45 ft., so that there is little likelihood of anyone leaping from the bridge landing safely on the ground. Yet this actually happened on one occasion to a Victorian lady of 60 years ago who determined to take the plunge to death. She was fashionably dressed in the crinoline of the period, and this saved her life, for as she fell it opened out like a parachute and the breeze lifted her clear of the river and landed her unhurt on the bank. The few spectators of this unique event thought it was an advertisement for a circus, and on learning the truth were relieved to find that the would-be suicide had been cured of the desire to end her life.

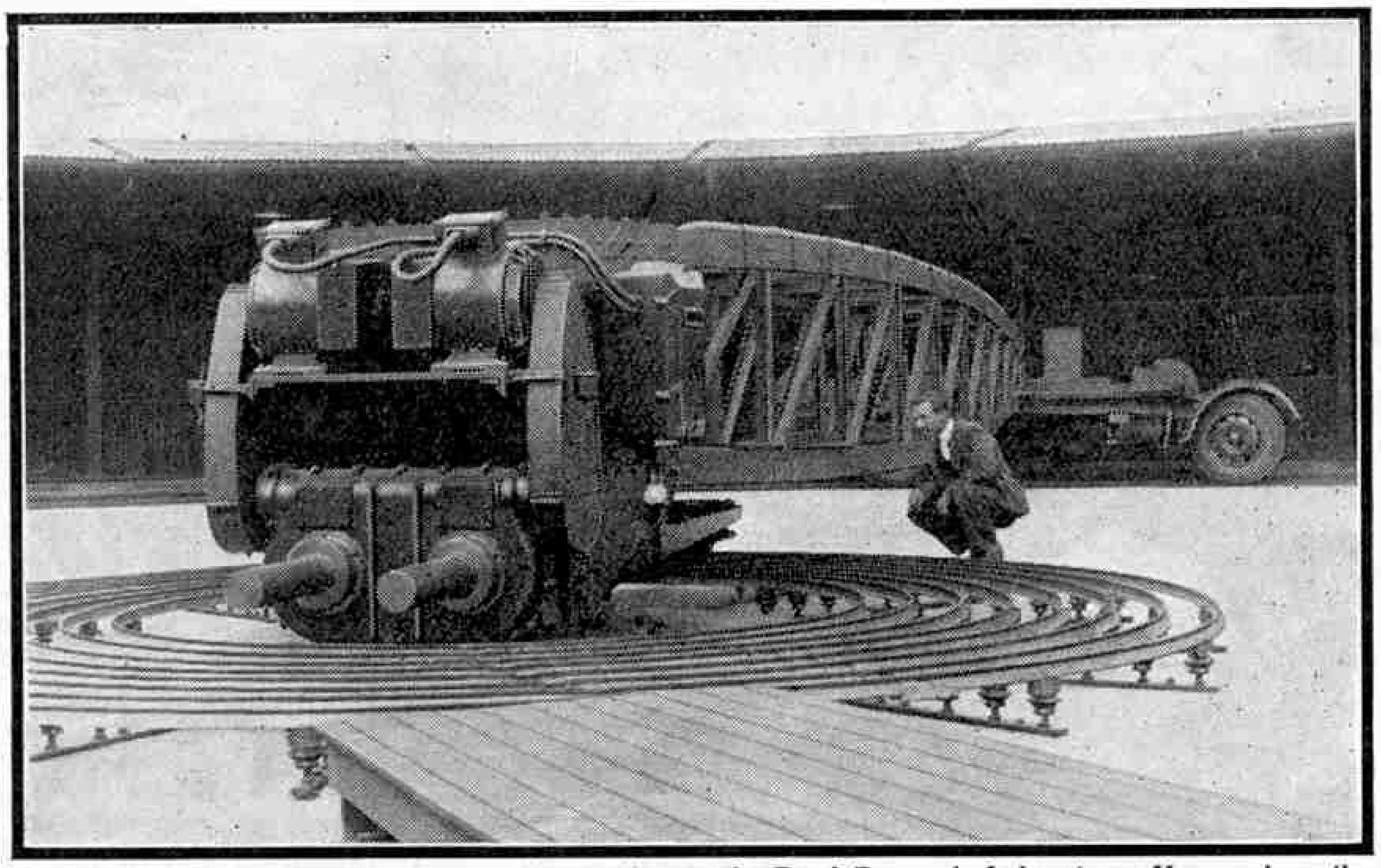
Although Brunel did not complete the Clifton Suspension Bridge, his connection with it gave him the opportunity of making a name in his profession. In subsequent years he used to say that his success was due to his victory in the second competition for designs for this bridge.

A Machine that Tests Roads

Lorry with the Energy of a Six-inch Shell

OUR roads have been restored to importance by the coming of the motor car and the motor lorry, and to-day they are crowded with vehicles of various sizes travelling mostly at high speeds. The resulting wear and tear on their surfaces is so considerable, however, that no less than 50 million pounds are spent annually in Great Britain on road-making and upkeep.

In view of this enormous expenditure it has become necessary to carry out experiments to find the best materials with which to build roads and the most effective ways of making use of them. The chief need is to learn how experimental road surfaces will stand up to the actual strain of traffic passing over it. It is only by tests on full scale roads that we can find whether they are really suitable for the task they are given. In the ordinary way tests of this kind require many years to complete, however, and for this reason machines have been devised that concentrate the wear of years into a comparatively few hours. Three of these machines have been built at the Road Research Laboratory, Harmondsworth. The largest, which is illustrated on this page, employs a full-sized 12-ton lorry running at high speed over an experimental road track. The impression it gives is rather like that of a greyhound racing track in which the electric "hare" has been replaced by a lorry, for this is tethered to a central post by means of a steel arm, and swings round and round on its circular course at a speed of 40 m.p.h. As regards the weight of the vehicle and its speed, the machine is the largest of its kind in the world.



The steel arm of the large road testing machine at the Road Research Laboratory, Harmondsworth. This has to withstand a pull of 25 tons as it whirls a 12-ton lorry round at a speed of 40 m.p.h.

The lorry consists of an A.E.C. chassis in which the engine has been replaced by a 180 h.p. electric motor. It is attached to one end of a steel arm by means of a ball joint, and runs on a track 10 ft. wide in a circle with an average diameter of 110 ft. Each circuit is completed in six seconds.

The steel arm by which the lorry is tethered is an immense girder weighing 5 tons. It has to withstand a pull of 25 tons when the lorry is whirling round at its maximum speed, and if the lorry broke away from its centre post it would shoot from its track, as a stone leaves a sling, with as much energy as is possessed by a shell fired from a 6-inch gun. For this reason special safety devices have been incorporated. The building in which the machine is housed is surrounded by an earth bank, except where the control room adjoins the track, and there a heavily reinforced concrete "crash" wall is provided. The control room itself is of reinforced concrete, with a small safety glass window through which the machine and the road under test can be watched.

As the lorry has to follow a circular course, the steering is locked in the correct position when tests are in operation. A further aid in keeping it on its course is provided by a steel stay attached at one end to the front of the lorry and at the other to a point on the steel arm. This stay usually carries only a light load, and its chief purpose is to act as a safety measure in the event of such an accident as the bursting of one of the tyres.

The centre post around which the lorry swings is bedded in a heavy reinforced concrete pier 6 ft. deep and 8 ft. in diameter. This is connected to concrete foundations under the outer track by eight arms of heavily reinforced concrete, and thus the whole structure rests on a great concrete wheel, 100 ft. in diameter, sunk into the ground.

The wheels of a lorry rotating at the end of a fixed arm would run throughout in the same tracks, and would produce ruts in the road instead of testing a reasonable expanse of surface. This is avoided in the road testing machine at Harmondsworth by moving the end of the connecting arm slowly backward and forward over the central post. The full traverse is made in five minutes, and its effect is to cause the lorry to wear two tracks, each about 2 ft. 6 in. in width.

The electric motor that drives the lorry is supplied with current from pick-up gear surrounding the central post, through cables that run along the steel arm; and the speed can readily be varied from the control room. The opening of the gate leading to the track automatically cuts off the current and brings the machine to rest, and a similar result follows failure of any part of the electrical equipment. Special precautions have to be taken to keep the back axle of the lorry supplied with oil, for this is flung outward by the centrifugal force developed by the immense speed at which the vehicle makes its circuits. As the oil swirls to the outer end of the axle it is fed back again to the inner end by a specially fitted oil pump.

Trials can be carried out in all weathers, for the track is roofed. In fact the engineers in charge may be said to make their own weather, for artificial water sprinklers have been installed to imitate the fall of rain.

Discharging Grain From Ships

New Plant at a London Flour Mill

THE greater part of the wheat that goes to the making of our daily bread is grown in Canada, Australia, South America and other distant parts of the world, and is brought to this country in ships specially fitted for carrying grain. This trade supplies cargoes for the last of the sailing ships that traverse the great ocean routes. Every year several of these vessels bring wheat to this country from Australia. Keen interest is taken in their passages, and an unofficial grain race has been waged annually for many years past.

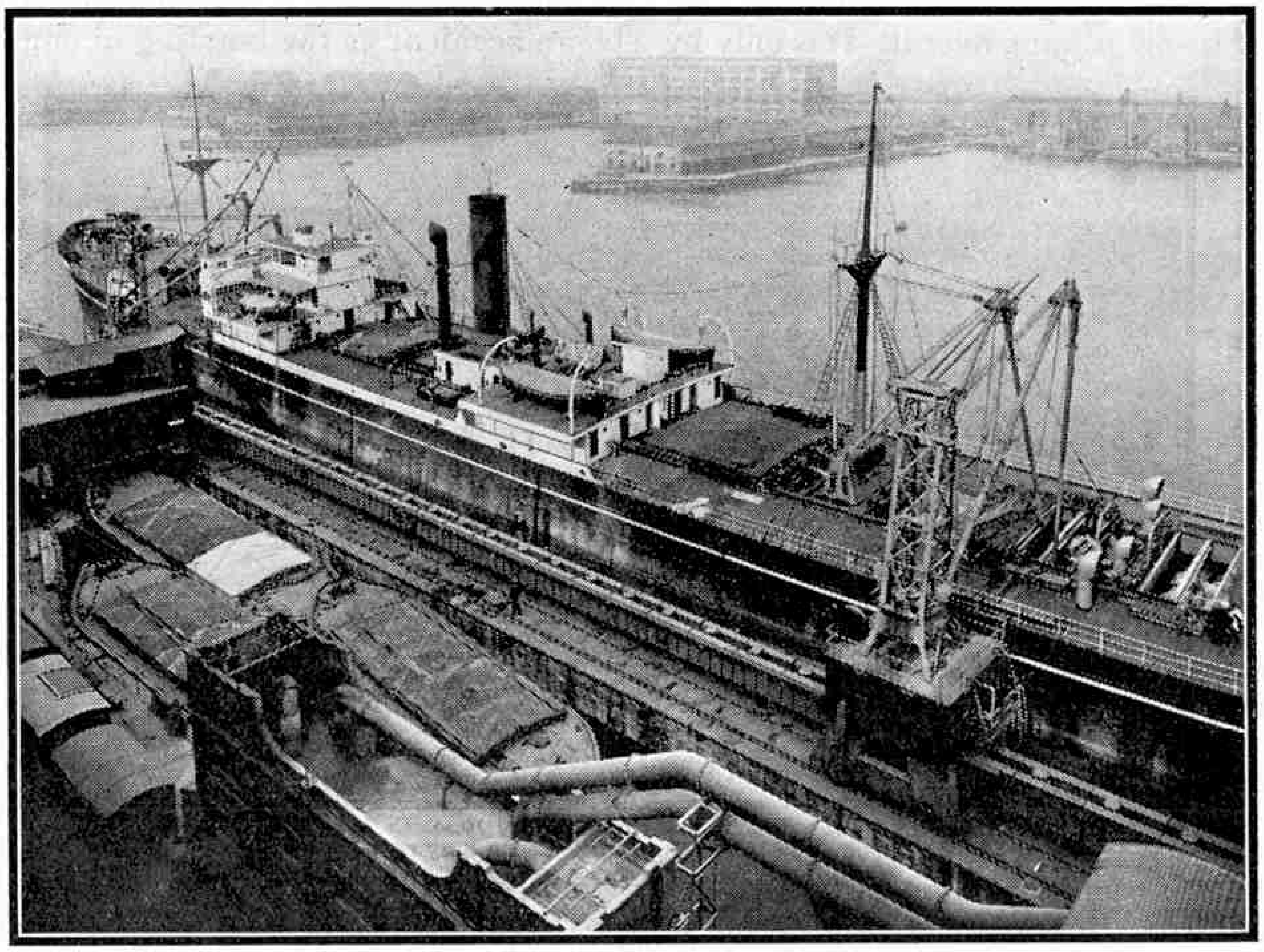
Grain formerly was shipped in sacks, and loading and unloading it were laborious processes. To-day sacks are seldom used. Instead the grain is treated in bulk, and is simply shot into the holds of the ships. Special precautions have to be taken in loading these vessels in order to prevent shifting of the cargo, which might give rise to danger in rough weather.

When the handling of grain in bulk was first introduced, unloading was carried out by means of shovels and scoops, or buckets, which were lifted by cranes on the quayside. Later grabs capable of holding as much as 2 tons of grain were introduced. These also were handled by cranes, and were provided with special gear for closing the grab when it was lowered into the hold, and for opening it again on swinging it over the place where the grain was to be deposited.

The next step was to introduce elevators consisting of continuous vertical belts provided with buckets that scooped up the grain as they were pulled through it at the bottom of their travel. These elevators were suspended from arms projecting from quayside buildings. They delivered the grain to chutes, down which it passed to band conveyors leading into the silos, as the special buildings in which grain is stored are called. One of the disadvantages of this system was that the grain in the hold of a vessel in process of unloading had to be brought to the foot of the elevator.

Wheat is no longer transferred from ship to shore by shovelling into skips lifted by cranes, and even bucket elevators are now seldom employed. Instead the grain is sucked out in the same manner as dust is extracted from carpets by an electric vacuum cleaner. On the wharves or quays where unloading takes place, are towers that run on rails. These carry overhead booms from which are suspended long vertical pipes with nozzles that are dropped into the wheat. Powerful pumps suck air through the pipes, and the wheat is as readily drawn up these as if it were a liquid.

A modern pneumatic grain discharging plant of this kind includes many interesting and novel features, and how these work is illustrated by an improved type of plant that has been installed at the Millennium Flour Mills of Spillers, Ltd. (W. Vernon and Sons' Branch), at Victoria Docks, London. This was built by Henry Simon, Ltd., Cheadle Heath, Stockport. It transfers grain from the holds of ships to the silo at the rate of 240 tons per hour, but when necessary it can be speeded up to deal with 280 tons in the same time.

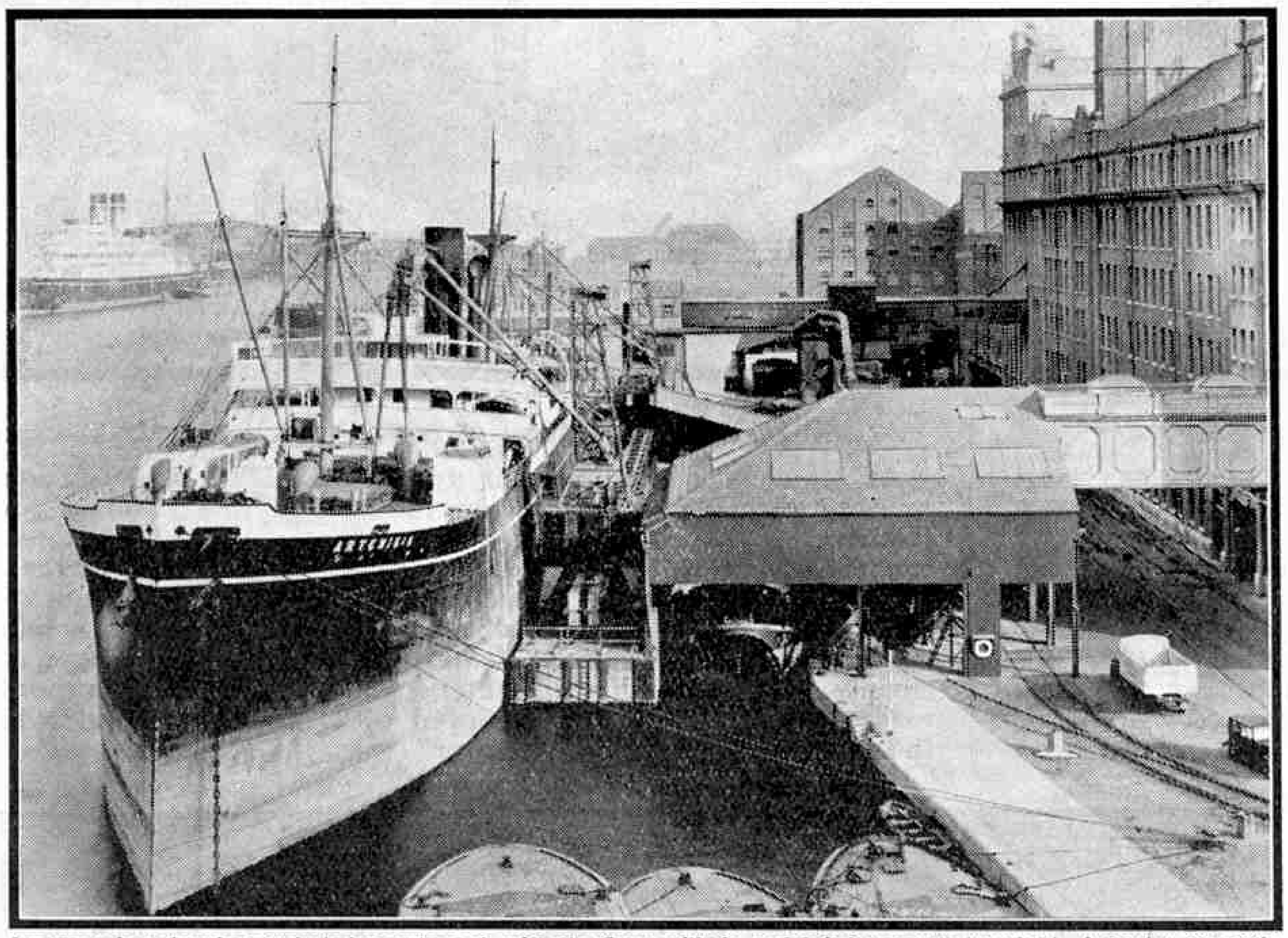


Unloading operations at the Millennium Flour Mills, Victoria Docks, London. The grain is delivered to the two closed conveyors seen on the jetty. We are indebted to Henry Simon, Ltd., for the illustrations to this article.

The concrete jetty alongside which grain ships lie at the Millennium Flour Mills is entirely surrounded by water, a barge dock separating it from a quay in front of the mills, along which run railway tracks. There was already an unloading plant on the jetty, and the new plant was erected while the old one continued to work. The change-over was effected in two stages at week-ends, in order to avoid loss of time.

In designing the new plant it was decided to make use of the two travelling towers already in existence on the jetty. These run on rails alongside the ship to be unloaded, and have been specially strengthened in order to enable them to carry heavier pipe booms to take larger quantities of wheat. They are driven by electric motors and can move along the jetty at a speed of 50 ft. a minute. Each of the structures carries its own motors, together with winches by means of which the booms are hoisted or lowered as required. The necessary electric current reaches their motors through trailing cables, which are mounted on spring drums that allow a certain amount of give and take, in whatever direction the towers are moving.

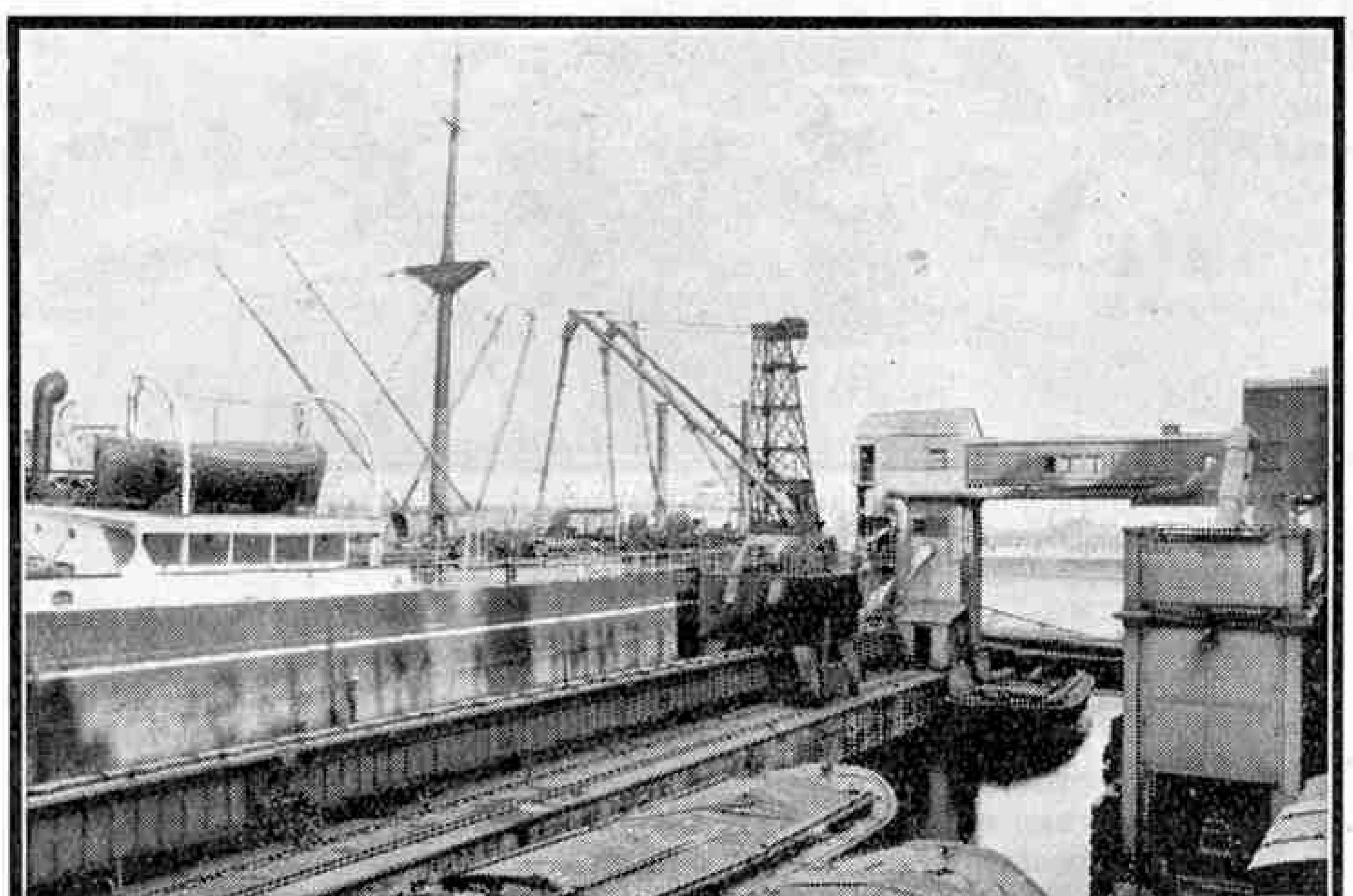
Each of the two booms of the travelling towers ends in a vertical telescopic pipe that is lowered into the holds of ships at the quayside and moved about as required. At the end of each of these pipes is a flexible tube carrying at its end a nozzle that is dipped into the grain when unloading is being carried on. The grain is sucked up into the nozzle and passes through the telescopic pipe into the boom. When it reaches the tower it enters a junction box leading to a pipe by means of which it is delivered on to a conveyor that runs along the whole length of the wharf. The movements of which the booms and the telescopic pipes are capable enable every corner of the holds to be scoured without difficulty, and it is not necessary to push grain towards the nozzles.



Another view showing grain being unloaded, with the flour mills in which it is used on the right. A gantry connects the mills with the jetty.

One of the most interesting features of the plant is the manner in which the unloading is controlled. Formerly this was from a cabin on the pneumatic plant structure. Now the entire operation is in charge of a man stationed on the deck of the ship, immediately above the hold, where he has a full view of the whole of the proceedings. He can easily watch the booms in order to make sure they are in the most convenient positions, and a glance down the hatchway keeps him fully in touch with progress in the hold itself. He makes use of a small master controller, first selecting the motion he requires, and then turning a crank handle to put it into effect.

Several interesting safety devices are fitted, and the control is as nearly foolproof as possible. Electric brakes come into operation automatically when necessary, and a change cannot be made from one winch to another unless the first is stopped. In addition, the connections are so designed that operation is stopped as soon as the man in charge leaves the controller, while the cutting of a cable or its short circuiting to earth has a similar result.



A travelling tower extracting grain from the hold of a ship. From the conveyors beneath the tower the grain passes to an elevator that carries it to the site.

The grain sucked up the pipes and booms of the travelling towers passes through flexible telescopic pipes on to one of two conveyors, which are of special design and act as air pipes under vacuum. Each conveyor is air-tight, and all moving parts are enclosed in a heavy steel box. The two conveyors run along the length of the jetty, between the rails on which the towers are moved, and they are mounted on steel supports. At intervals of 16 ft. there are cast iron inlets that can rapidly be connected by means of quick-coupling flanges to the pipes through which the grain comes, and from each tower the wheat drops through the one of these that is in use on to the conveyor, which carries it along the bottom of its housing to what is called the intake house.

The air sucked in with the grain also passes through the conveyor, and reaches the intake house along with the wheat. An overhead gantry connects the jetty with the mainland at this point, and there the two are separated. The grain is extracted by an electrically-driven tipper provided with special mechanism to avoid stoppages due to any foreign matter that may be mixed with it, and is then delivered to bucket elevators. The elevators in turn deliver to band conveyors, which transfer the grain to the storage bins in the silo. The air passes on into steel cyclones in which it is whirled round to get rid of the dust it contains. After this cleaning it enters welded steel air pipes, which are carried under the gantry, and lead to vacuum pumps in a special house built between the barge dock and the railway tracks on the mainland.

The vacuum pumps are a very important part of the plant, for they produce the suction that unloads the grain and feeds it to the conveyors. There are two sets, each of which is driven by an electric motor with an output of 170 b.h.p., and they work with high efficiency, lowering the pressure on the vacuum side to about a quarter of that of the atmosphere. The motors are equipped with automatic starters, and these can be operated either from the jetty or from the room in the silo in which the grain is automatically weighed. The two conveyors also are electrically driven, each being equipped with a 35 h.p. motor that acts through a train of gearing. These motors are placed in a separate house outside the intake shed.

The plant can be started and stopped from the jetty or from the weighing room in the silo.

Important Aerial Surveys

By the use of aerial methods large tracts of land can be surveyed accurately in very much less time than if the work is carried out by survey parties on foot. In settled countries such as England, air surveys have proved of great value to town planning authorities and in the revision of Ordnance maps, and they have been employed in ascertaining the mineral wealth of undeveloped territories in Africa and elsewhere. At the present time a survey of an area of 3,000 sq. m. in the Belingwe mining district in Southern Rhodesia is being carried out.

In Canada a company has been formed to survey about 25,000 sq. miles of territory in Labrador for signs of minerals. In this case two seaplanes will be employed in the preliminary work of photographing the country from the air, and later in transporting equipment and men from place to place as the survey proceeds, a method that will result in a great saving of time and labour.

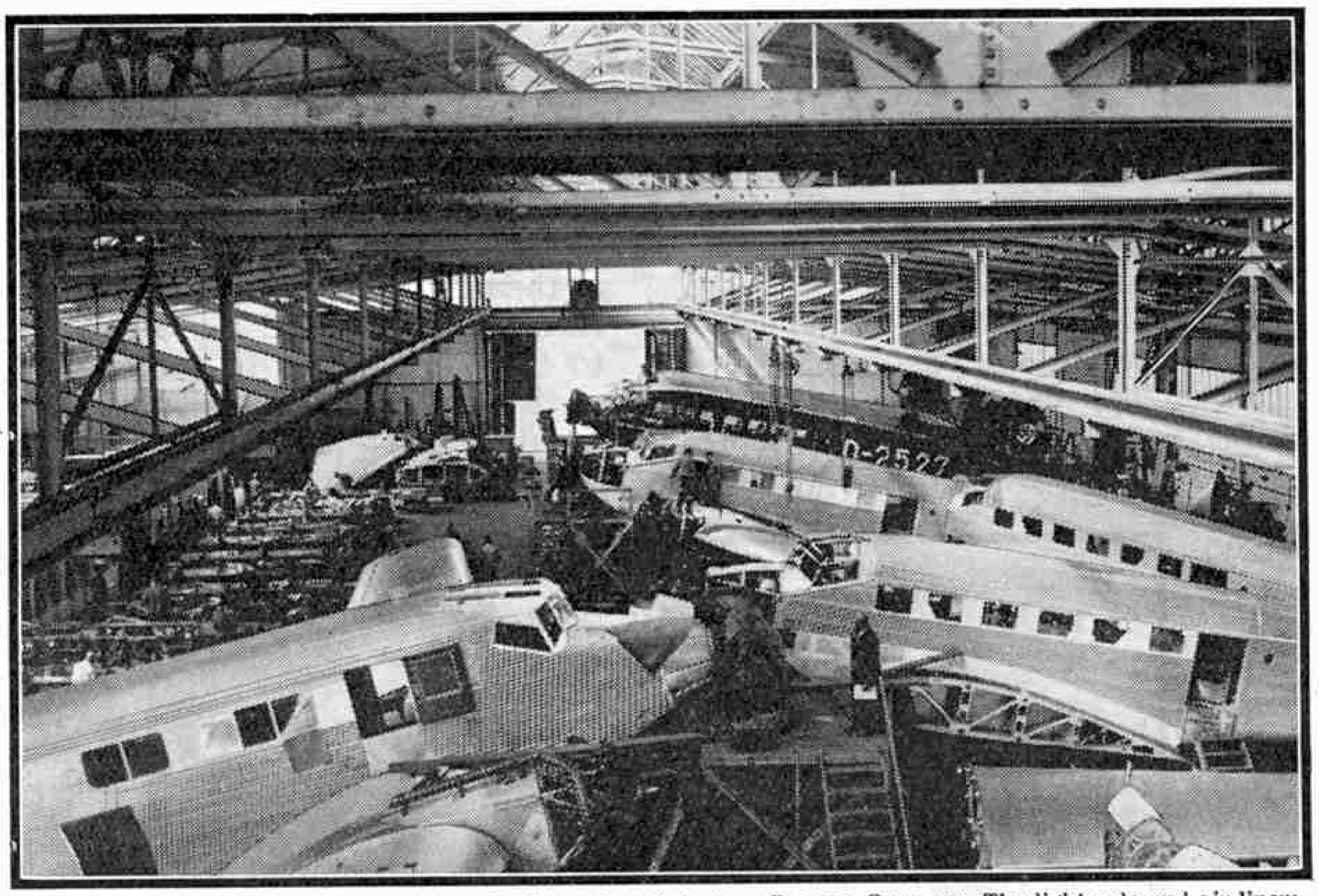
The advantages and value of aerial surveys also are becoming recognised in China, and at Tungchi University a fully equipped Institute for Aerial Survey will shortly be established under the direction of a German expert.

First British Night Air Mail Service

The first British night air mail service began on 27th July last, when a D.H.86 aeroplane of British Airways Ltd., left Gatwick for Cologne and Hanover. The service is being worked in co-operation with A.B. Aerotransport, of Sweden. The machines leave Great Britain at 10 p.m. on Mondays, Wednesdays and Fridays, and set out from Sweden at 1.30 a.m. on Tuesdays, Thursdays and Saturdays. The mails flown from England are handed over to the Swedish company at Hanover, where those for England are collected a few hours later. Eventually a through air mail service to and from Stockholm is to be operated.

"Bristol"-Engined Military Aircraft

At least 14 of the various types of military aircraft now on order by the Air Ministry in connection with the R.A.F. expansion scheme have Bristol engines. Orders recently placed include a large number of Gloster "Gladiator" multi-gun fighters fitted with Bristol "Mercury XI" engines, and several of the Fighter squadrons of the R.A.F. will be equipped with these machines. The "Gladiator" was described and illustrated in the "*M.M.*" of July last. Many Westland "Wallace" general purpose aeroplanes, which have Bristol "Pegasus" engines, also are on order, and one of the new Bomber squadrons will be provided with Vickers "Vildebeest" torpedo bombers, with Bristol "Pegasus III" engines, a type of military aircraft supplied to two of the squadrons stationed at Singapore.



A busy scene in the assembly shop at the Junkers aircraft factory, Dessau, Germany. The light-coloured air liners in the foreground are Junkers Ju.52/3ms, and in the background is a D.L.H. machine. This illustration is reproduced by courtesy of Junkers Flugzeug Und Motorenwerke A.-G.

Large Aerodrome for Rangoon

A new aerodrome is to be built near Rangoon at an estimated cost of about £70,000. The existing aerodrome is at Mingaladon, about 12 miles from Rangoon, and is used by Imperial Airways, Air France and K.L.M. It has become inadequate, and the new aerodrome will be larger, with a runway 1,130 yd. in length, whereas that at Mingaladon is only 800 yd. in length.

Air Transport in New Guinea

It is 10 years since the first prospectors in New Guinea forced their way inland through the jungle and discovered the rich goldfields in the Wau area of the mountainous interior. Their discovery resulted in the opening of important gold mines in that district, but until recently the lack of efficient transport for equipment and food supplies hindered full and efficient working. It took the native bearers 14 days to carry loads up from the coast town of Salamaua to Wau.

The introduction of air transport has changed all this, and the district is now served by air services that fly regularly between Salamaua and the gold mines. Each load has to be flown over jungle-clad mountains, but in spite of this one of the companies operating the services has carried a total of 30,000 tons of freight and considerably more than 30,000 passengers. In addition to ore and mining equipment, the freight aircraft carry a remarkable variety of loads. One batch of cargo recently flown up to Wau included barrels of cement, tins of kerosene, bags of rice and flour, sheets of corrugated iron, cases of tinned food and meat, and metal telegraph poles!

When the loads are landed at the aerodrome at Wau, portions are now transferred to other aeroplanes and flown on to Rama, Watut, Roaring Creek and other subsidiary landing grounds. Surveyors and prospectors are penetrating steadily farther inland, and several thousand Europeans in New Guinea now depend upon air transport for rapid conveyance and for regular receipt of their supplies.

Newcastle Airport Lighting Equipment

The municipal airport at Newcastle-upon-Tyne will shortly be provided with extensive lighting equipment. This will include a complete installation of boundary and obstruction lights, an illuminated wind indicator, three fixed and powerful floodlights, and automatic switch-control gear.

A Famous French Pioneer Airman

The recent death of M. Louis Blériot removed one of the earliest French pioneers of aviation. Many excellent monoplane types of aircraft have been produced to his designs, but it is as the first man to fly across the English Channel that he is best remembered in this country.

Blériot was born in 1873, and when in his twenties began to devote his spare time and money to designing and experimenting with aeroplanes, chiefly of the monoplane type. In spite of many failures and crashes he persevered until he won success. He accomplished his first notable flight in October 1908 when he flew from Toury to Artenay, a distance of nine miles in a Blériot monoplane. The return trip was also made by air. In 1909 he set up an aircraft establishment at Neuilly aerodrome, and the same year created a sensation by making a flight with two passengers. Interest in the man and his machine was heightened by the public exhibition of his No. 11 monoplane at the Paris Salon. This machine was only 28 ft. in span, and was fitted with a 25-h.p. Anzani three-cylinder air-cooled engine.

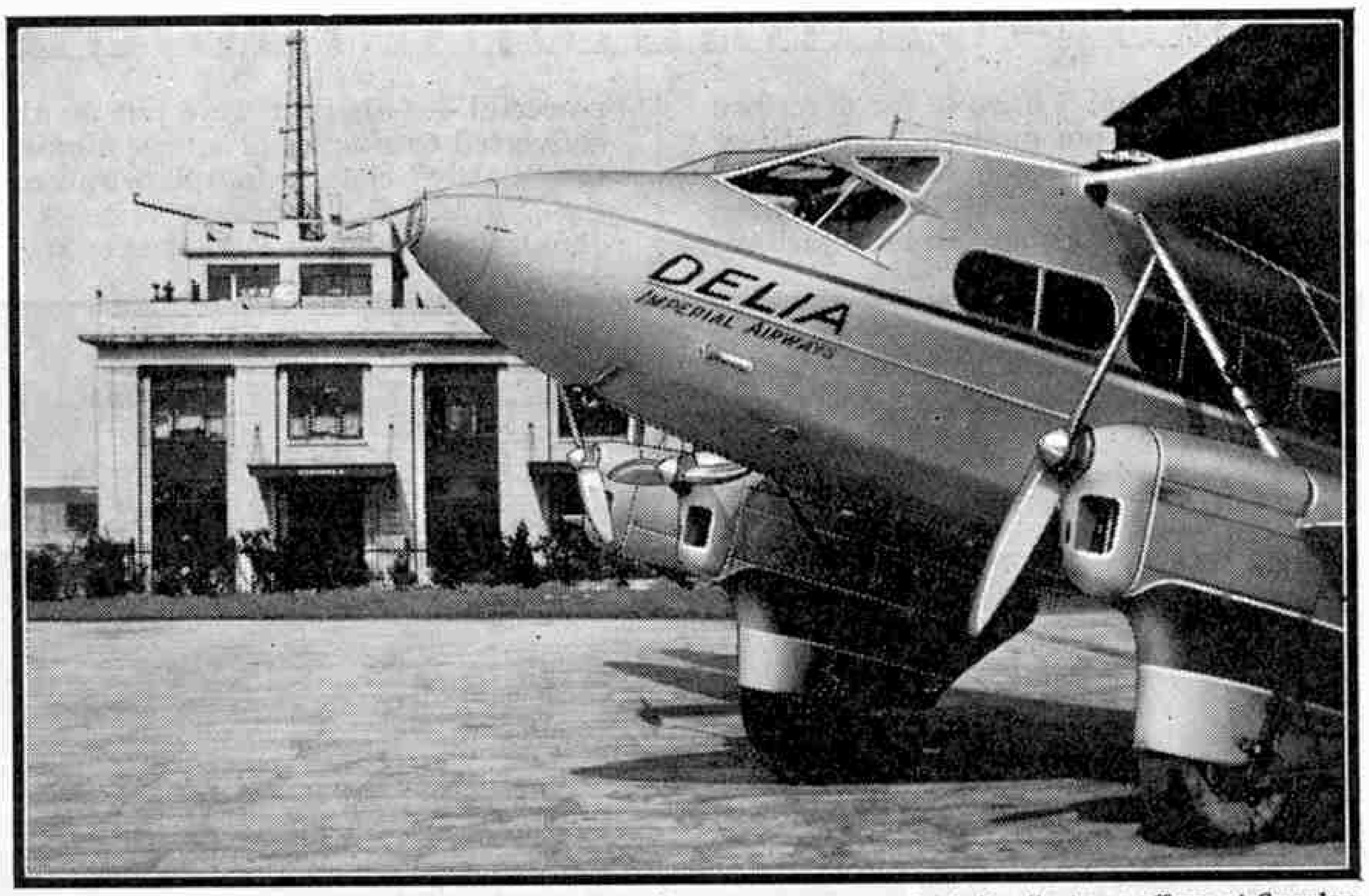
The same year Blériot and Latham, another enthusiast, competed for the *"Daily Mail"* £1,000 prize offered for the first successful cross-Channel flight. Latham tried first, and although he made a good take-off he eventually came down in the sea, but fortunately he was rescued. Blériot made his attempt shortly afterward and used the machine that had been shown in Paris. He took off from Baraques, near Calais, at 4.40 a.m. on 25th July, in the presence of a group of well-wishers who had come to see him start upon his great adventure. The navigating equipment of his machine was very meagre compared with that of a modern aeroplane, and did not even include a compass. He had to rely upon his spectators, therefore, to point out to him the direction of Dover as soon as he was in the air, and the French destroyer *"Escopette"* steamed across the Strait as a guide.

Blériot flew at an altitude of about 250 ft., and his speed averaged 45 m.p.h. Only a few people were about when he flew over the English coast near Dover, and a policeman on night duty was the only person who actually witnessed the airman's descent. He landed in a field at 5.20 a.m., and in doing so broke the airscrew and undercarriage of his machine. These misfortunes were negligible, however, for his success had won him a fortune. A concrete monument on which is a representation of his aeroplane now stands upon the spot where he landed.

During the next few years he made several other excellent flights, but eventually he gave up flying and concerned himself solely with aircraft design and production.

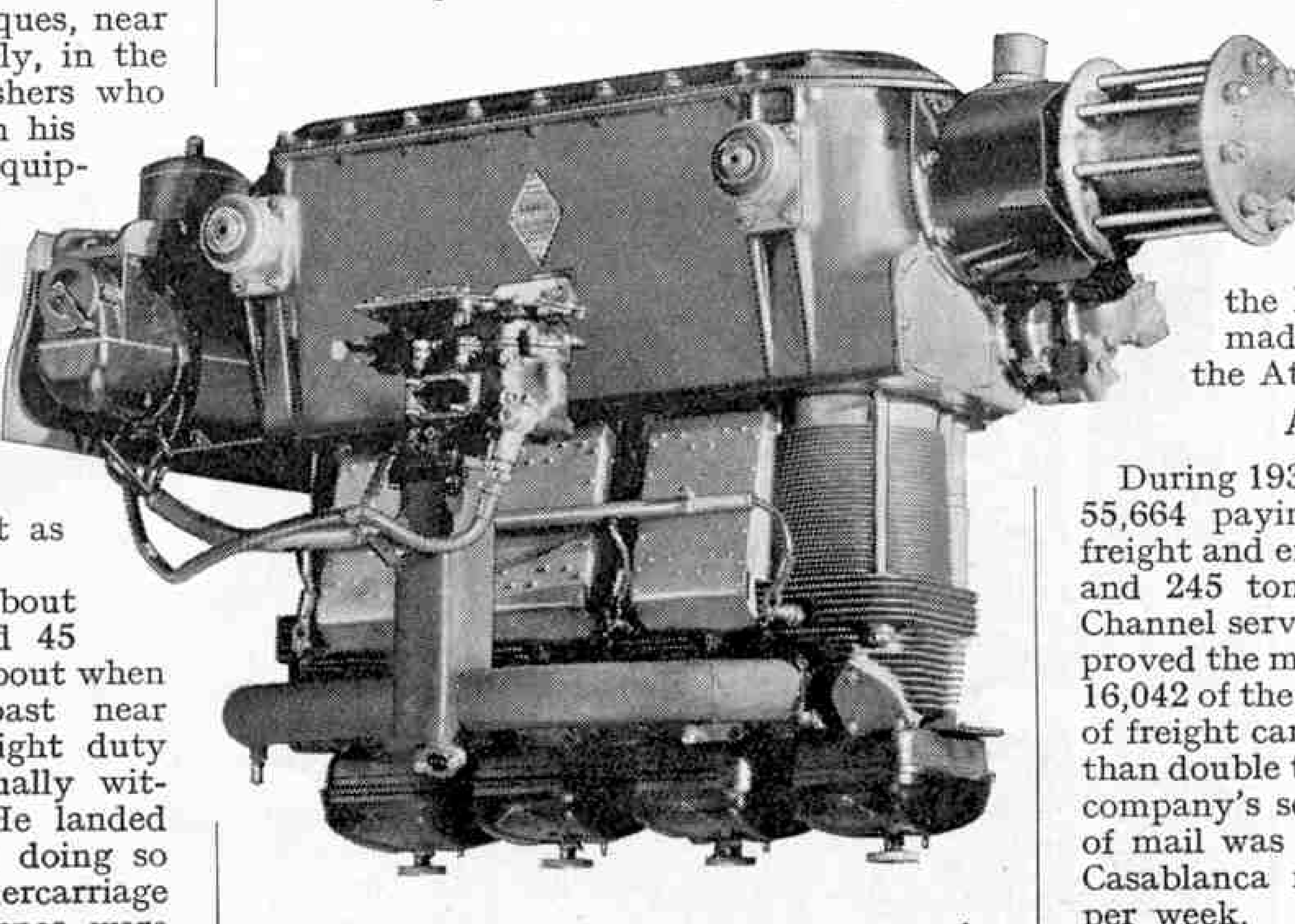
Wind Tunnel Tests of "Flying Flea"

The criticism of the "Flying Flea" ultra-light aeroplane designed by M. Henri Mignet that has followed upon several crashes of small machines of this type gave special interest to the full-scale tests carried out recently in the wind-tunnel at the Chalais-Meudon research station, in France. The tests revealed that the safety factor of the machine can be much increased by equipping the front wing with controls to increase the angle of incidence from 9 to 14 deg. A description of the wind tunnel in which the test was made was given in the *"M.M."* of July 1935.



Imperial Airways liner "Delia," one of the "Diana" class, drawn up outside the Customs offices at Croydon airport. This class of aeroplane is employed on the company's London-Cologne-Zurich route. Photograph by courtesy of Imperial Airways Ltd., and Kodak Ltd.

The latest *"Pou-du-Ciel,"* or "Flying Flea," produced by M. Mignet differs in several respects from the first of the type, as experience has shown some of the improvements necessary to make it an efficient flying machine. In the early machine the upper and lower wings overlapped, but in the latest there is a vertical gap between them. The performance of this new machine is said to be much better than that of its predecessors.



Renault "Bengali Junior" inverted, air-cooled aero engine, the type fitted in the Caudron "Aiglon" monoplane described in the article on page 518. Photograph by courtesy of Societé des Avions Caudron, France.

The Johannesburg Air Race

The Schlesinger air race from England to Johannesburg, South Africa, will not be held on the 15th of this month as originally planned, but at the end of the month. The later date will give competitors the benefit of a full moon on the night-flying stage of their trip.

Many interesting entries have been received, including that of Flt. Lt. T. Rose, who will fly a B.A. "Double Eagle," a new cabin monoplane with two D.H. "Gipsy Six" engines. Percival and Miles aircraft are expected to be well represented. It is probable that Mr. David Llewellyn and Mrs. J. Wyndham will fly a Percival "Vega Gull," and Major Allister Miller, the founder of South African Airways, has entered a "Mew Gull." A Miles "Sparrhowhawk" is to be flown by Victor Smith, the young South African airman who has flown to England to take part in the contest.

Wireless Stations on the East Africa Coast Route

Important technical surveys, carried out in connection with the forthcoming flying-boat route of Imperial Airways down the east coast of Africa, have just been completed by Captain Durrant, Superintendent of Empire Air Routes Wireless, and Mr. R. A. Munday, aviation expert of the Marconi Company. During these surveys arrangements were made for new wireless stations, containing the latest forms of equipment at eight places along the route, including Mombasa, Dar-es-Salaam, Beira and Lourenco Marques.

Capt. Durrant will next concern himself with wireless developments along the Persian Gulf sections of the England-Australia route. It is interesting to note that he was wireless officer in the British airship R.34 when she made her double flight across the Atlantic in July 1919.

Air France Traffic

During 1935 Air France carried a total of 55,664 paying passengers, 1,075 tons of freight and excess luggage, 272 tons of mail and 245 tons of newspapers. The cross-Channel service between London and Paris proved the most popular, and accounted for 16,042 of the passengers, while the quantity of freight carried on it, 413 tons, was more than double the amount on any other of the company's services. The greatest quantity of mail was transported on the Toulouse-Casablanca route, and averaged $1\frac{1}{2}$ tons per week.

French West African Air Service

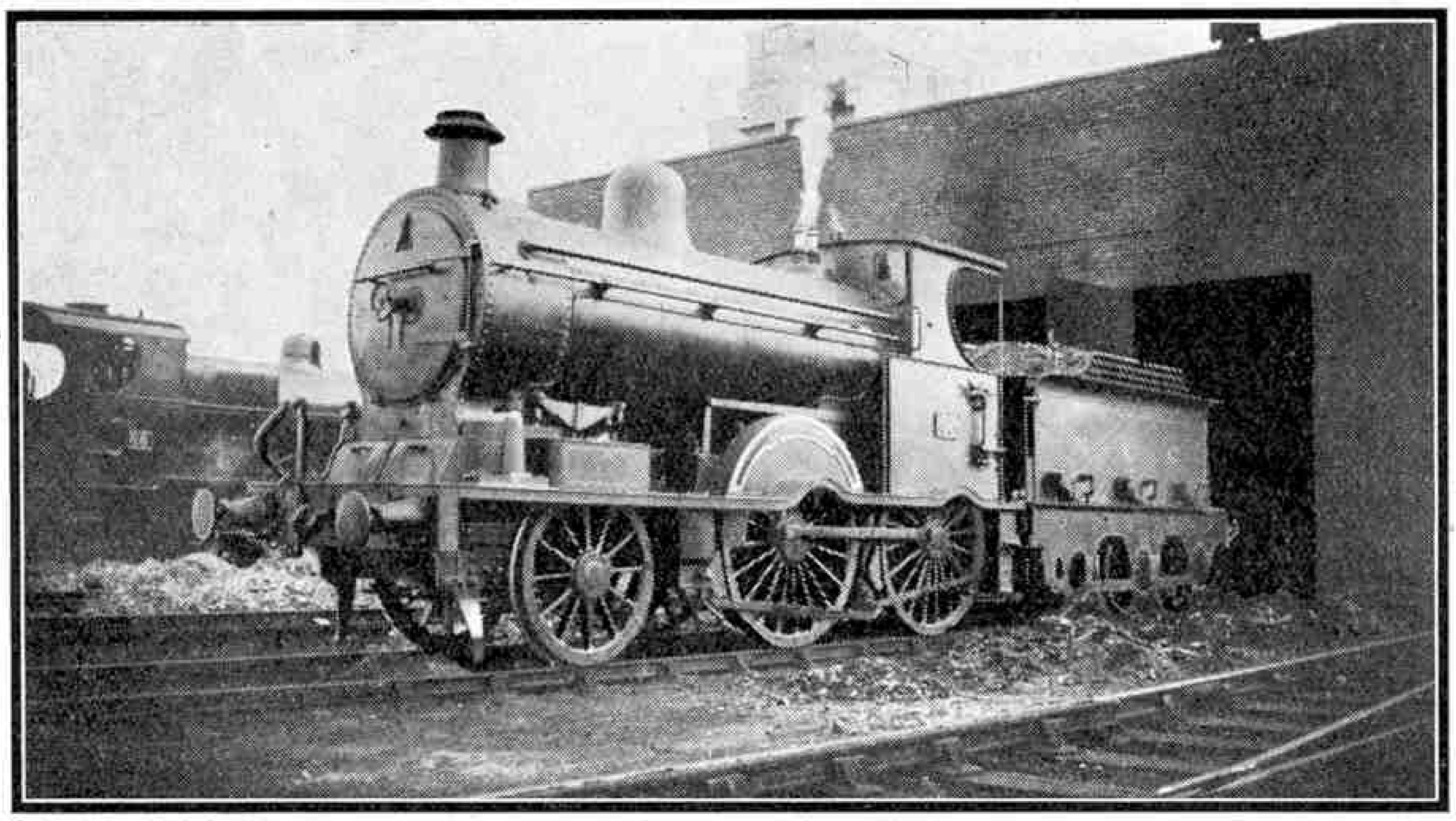
Chargeurs Réunis, a French air transport concern, are planning to establish a regular air service between Dakar and Pointe Noire to link up with the passenger and mail service to South America operated by Air France. They will use three Sikorsky S.43 amphibians which have been ordered specially for the new air line.

Footplate Run on an Irish Compound 2-4-0

Smart Work by 46-year-old engine

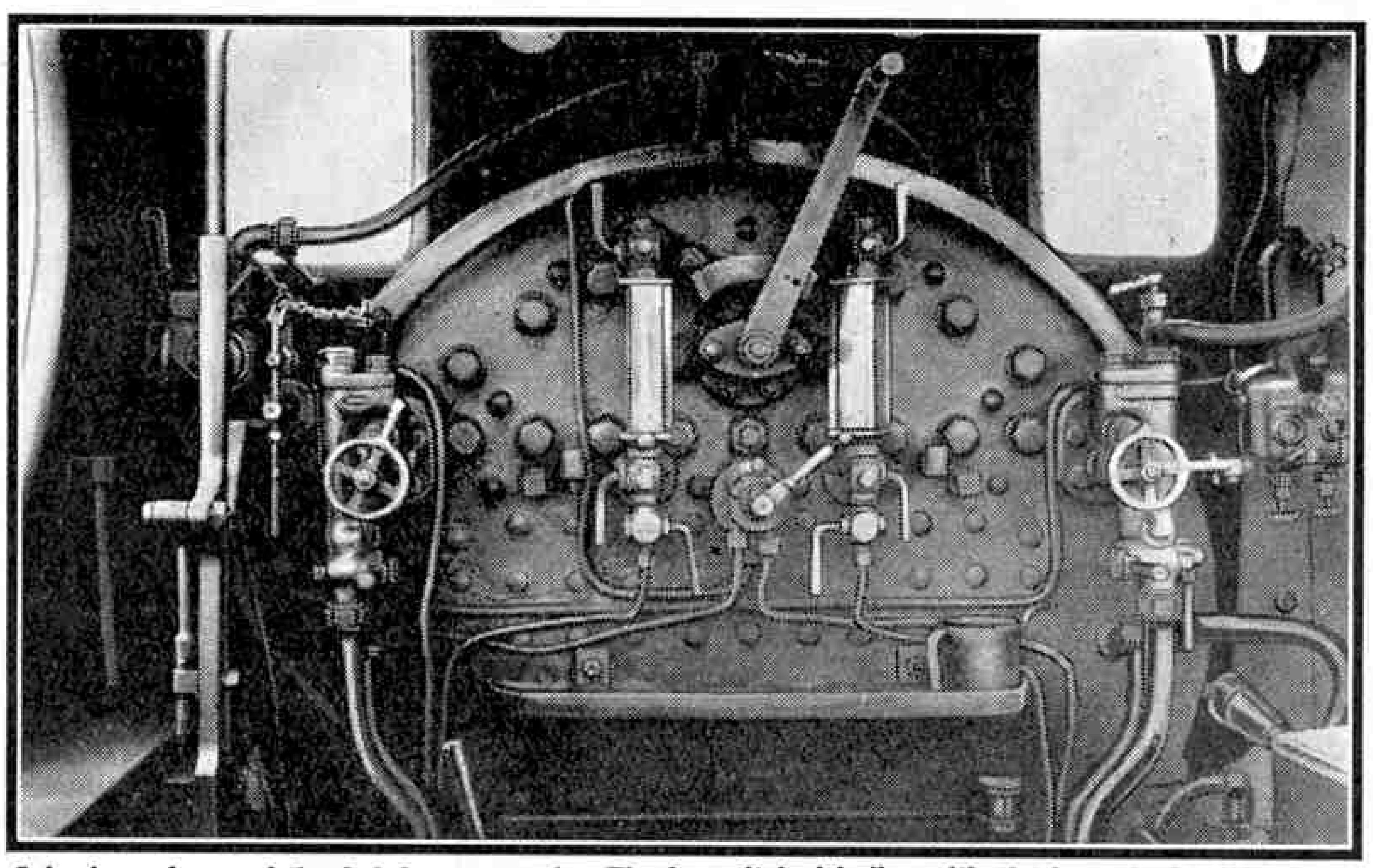
By A Railway Engineer

NEARLY all the footplate journeys that I have so far described in the *"M.M."* have been made on big modern locomotives; the veterans that have featured in the series, such as the Highland "Castles" and the Great Northern "Atlantics," are fair-sized engines even by modern standards. The run about to be described, however, was made on one of the smallest standard gauge (Irish) engines still in service, much less on express duty. But the journey has a greater interest even than this, for the engine in question, No. 57 of the Northern Counties Committee section of the L.M.S.R., is one of the few remaining two-cylinder compounds on the Worsdell-von Borries system.



L.M.S.R. (N.C.C. Section) 2-4-0 compound No. 57 "Galgorm Castle," on which the trip described in this article was made. The engine is shown outside the running sheds at Belfast.

This sturdy little engine, which bears the name *"Galgorm Castle,"* was built as long ago as 1890 by Beyer Peacock and Co. Ltd. At that time Mr. T. W. Worsdell was Locomotive Superintendent of the North Eastern Railway, and his two-cylinder compounds were greatly distinguishing themselves. Mr. Bowman Malcolm, the Locomotive Engineer of the Belfast and Northern Counties Railway, as it was then, decided to try some engines of the same general type; and they proved so successful that no further simple express engines were built for the N.C.C. until 1914. *"Galgorm Castle"* has one high-pressure cylinder 16 in. in diameter and one low pressure 23¼ in. in diameter, each with a stroke of 24 in., and both of course inside the frames. About 10 years ago the engine was fitted with a new boiler a little larger and pitched rather higher than the original, but otherwise she remains substantially as built 46 years ago.



Cab view of one of the 2-4-0 compounds. The low-pitched boiler with the large lookout windows above it is in striking contrast to the cab layout of modern engines.

Only one of the class, No. 56, which is illustrated on the next page, remains entirely unaltered, though the style of painting has been changed twice since the engine was built. Before the Belfast and Northern Counties Railway was taken over by the English Midland Railway, the engines were painted a bright myrtle green picked out with red and yellow lining, and all had polished brass domes. Then came the new livery that was adopted under the Midland regime. It was known officially as "invisible green," but the actual colour was a dark brownish olive. Finally, when the Midland, and with it of course the N.C.C. section, became part of the L.M.S.R. in 1923, the colour was changed to Midland red. Whereas on the parent system only the crack express locomotives are painted red, on the N.C.C. this fine livery is borne by all engines.

It is strange that these little 2-4-0s, which were the first compounds built for the line, should be the last to survive. The more powerful 4-4-0s that were put on the road in 1903 have all been converted to simples of a type almost identical in appearance with the "Castle" class, a footplate run on one of which I described in the *"M.M."* for February last. A point of exceptional interest about these rebuilds is that they use the original valve gear, and this gear was Walschaerts. It was fitted to all Mr. Malcolm's compounds, and must have been one of the earliest applications of the gear in the British Isles.

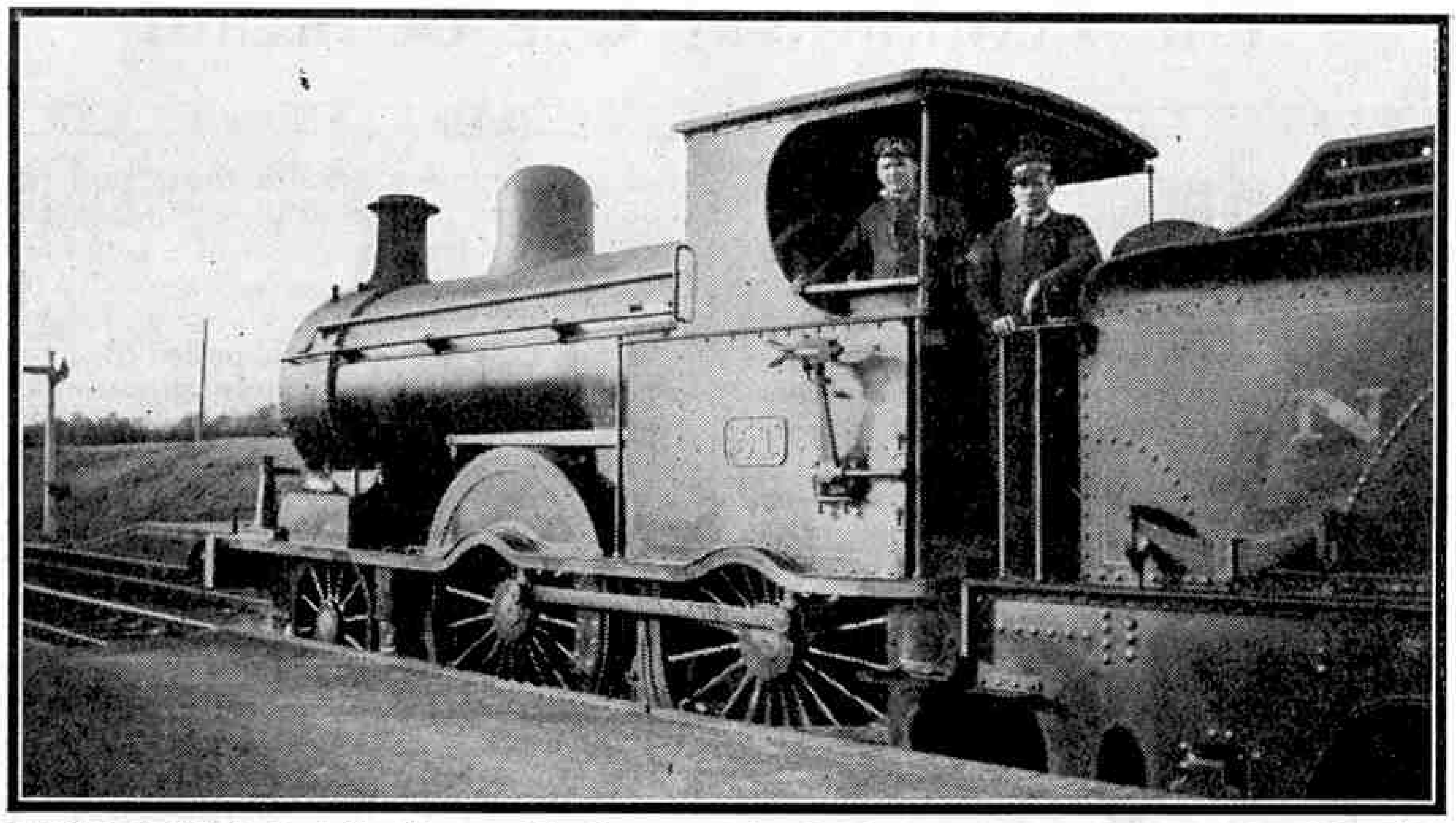
For some time now *"Galgorm Castle,"* with two others of the same class, has been stationed at Cookstown, County Tyrone; that shed has the unique distinction of housing only three engines, and all of them two-cylinder compounds. Their most important turn is the working of the 12.40 p.m. through train to Belfast, and returning with the sharply-timed 4.20 p.m. down; these trains travel on the N.C.C. main line to Londonderry as far as Cookstown Junction. Between Belfast and Dunadry the 4.20 p.m. runs at real express speed to a schedule as fast as that of the *"Portrush Flyer."*

"Galgorm Castle" is in every way a contemporary of the famous engines in York Railway Museum, and riding on her footplate seemed almost like stepping back into the nineteenth century. But at the same time the working of this compound engine was intensely interesting. The regulator is of the single-handle type that the driver pulls over towards him when starting up; it has two ports, like the "Moguls" and other N.C.C. engines, though this feature was introduced when the larger boiler was fitted. The small port or "first regulator" does not give simple working as in the case of the Midland compounds, but is used for light steaming; these N.C.C. engines are all started up full compound. The reversing gear is of the notched lever type, and one operation only is necessary to link up the valves in both high and low-pressure cylinders. The fire-box seemed tiny by modern fashions.

On the occasion of my trip Driver Harkness and Fireman Nelson of Cookstown shed were in charge. The load was of course a very light one by present-day standards—three bogie coaches weighing 85 tons all told—but counting the tender as part of the train the little engine was pulling quite 3½ times its own weight. Working on the same proportion an L.M.S.R. 4-6-2 "Princess Royal" would have 300 tons behind the tender.

We got away from Belfast in true *"Portrush Flyer"* style. Driver Harkness almost immediately opened out to practically full regulator, and for the first hundred yards or so the engine was working in full forward gear, with 79 per cent. cut-off in the high-pressure cylinder and 82 per cent. in the low. With only one low-pressure cylinder there are but two exhausts per revolution of the driving wheels, instead of the usual four in a two-cylinder simple engine. This unfamiliar effect is very curious, and to anyone watching from the lineside it gives a most deceptive idea of the speed at which the train is approaching.

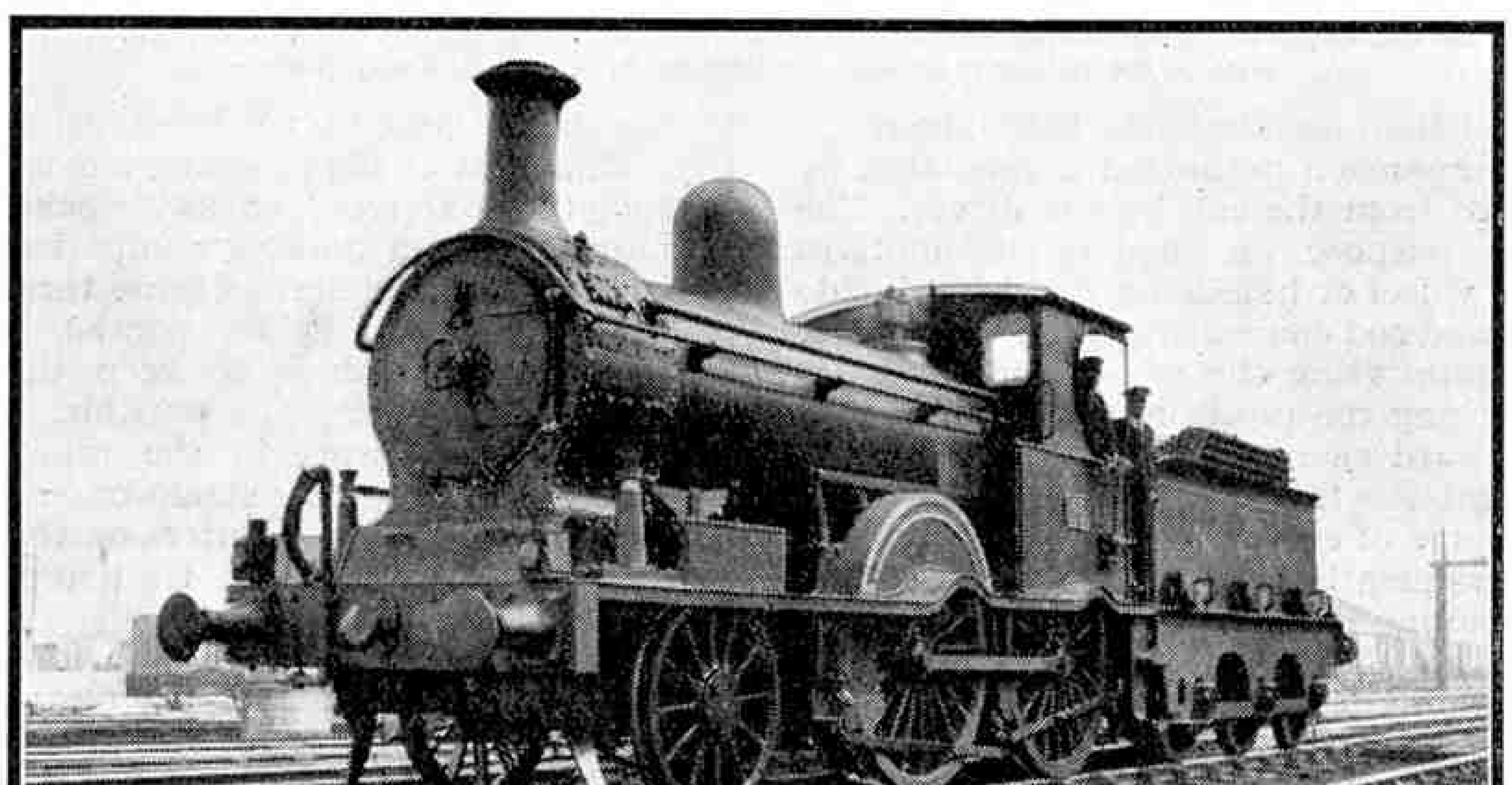
As the speed rose these isolated exhausts developed into a tremendous noise, but about half a mile out the lever was brought three notches back, giving 62 per cent. cut-off in the high-pressure cylinder and 67 in the low; in an ordinary simple this would be equivalent to about 40 per cent. cut-off. We accelerated in fine style along the level beside Belfast Lough, and passed Whitehouse 3.3 miles out in $5\frac{1}{4}$ minutes at 49 m.p.h., but then came the formidable ascent over the Greenisland loop line, where the gradient is 1 in 76 for 3 miles.



L.M.S.R. (N.C.C. Section) No. 51, one of the three remaining 2-4-0 compounds mentioned in this article. This photograph shows very clearly the tablet exchange apparatus on the cab side.

As we passed Whiteabbey the reversing lever was advanced one notch, thereby increasing cut-off to $68\frac{1}{2}$ per cent. in the high pressure cylinder and 73 per cent. in the low. Climbing splendidly over the stately reinforced concrete viaduct at Bleach Green, speed settled down to a steady 32 m.p.h. on the steepest part of the bank. This was really fine work; it compares in a most interesting way with the run on the *"North Atlantic Express"* that I described in the January number of the *"M.M."* On the latter run one of the powerful "Moguls" hauling 190 tons fell to $36\frac{1}{2}$ m.p.h. on this same ascent, even though being worked with full regulator and 40 per cent. cut-off. So *"Galgorm Castle"* passed Ballyclare Junction, which marks the end of the worst climbing, in $13\frac{1}{2}$ minutes from Belfast, 8.2 miles; this was half a minute less than the schedule of the *"Portrush Flyer."*

After passing Ballyclare Junction a very severe permanent way slowing was in force, where speed had to be reduced to 15 m.p.h.; but just beyond this point the long descent to Antrim begins and speed was regained very quickly on the 1 in 180 grade. In barely $1\frac{3}{4}$ miles we accelerated from 15 to 57 m.p.h., and on passing Doagh, Driver Harkness changed over to the first regulator, for the only time on the whole run, and the lever was brought still farther back, giving cut-offs of 48 per cent. in the high-pressure and 54 in the low-pressure cylinder.



This photograph of 2-4-0 No. 56 is of special interest, as it shows the original condition of these compounds, as built in 1890. The small boiler and the generally diminutive characteristics will be noted.

Riding on a 2-4-0 engine at 60 m.p.h. and over can be a tempestuous business, and between Doagh and our first stop, Dunadry, *"Galgorm Castle"* really ran wild. She did not become violently rough like some engines of which I have previously written, but developed a peculiar bouncing action. Near Templepatrick speed rose to 65 m.p.h., and at this pace the slightest curve set up a hearty sideways roll in addition! So we reached Dunadry, 15.9 miles from Belfast, in $22\frac{3}{4}$ minutes—three-quarters of a minute early despite the check. Our net time of $21\frac{1}{2}$ minutes gave an average speed of $44\frac{1}{2}$ m.p.h., a fine figure, including as it did the Greenisland ascent.

Restarting, I was treated to the rare spectacle of a steam locomotive being driven absolutely "all out"; wide open regulator, full forward gear. The engine was a little bit sluggish for the first 50 yards, but after that we got away in tremendous style, and about three-quarters of a mile out the lever was pulled four notches back, giving 48 per cent. cut-off in the high-pressure cylinder and 54 per cent. in the low. We passed Muckamore, 1.4 miles, in the remarkable time of $2\frac{1}{2}$ minutes, and with a top speed of 53 m.p.h. reached Antrim 3.4 miles in $5\frac{1}{4}$ minutes—a smart time over so short a distance. Inclusive of the stop at Dunadry the 19.3 miles from Belfast had taken $28\frac{1}{2}$ minutes.

From Antrim onward we called at all stations, but the run became more interesting than ever. Few railway enthusiasts realise the strenuous and exacting work required on the footplate with a stopping train, especially where, as in this case, the station to station timings are tight. Full regulator and full forward gear was used in getting away from every station, but the reversing lever was usually brought to the third or fourth notch after the first half mile or so; on every section, however, full regulator was used from start to finish.

Such a run demands not only skilful enginemanship, but real physical effort on the part of the driver. A regulator under steam takes some shifting, and a notched lever reversing gear is worse; both controls were being altered every few minutes, and I noticed that *"Galgorm Castle"* had been fitted with a steel plate on the front of the reversing rack, so that by putting one foot against it the driver can get more purchase on the lever. Very sound judgment is needed in stopping at intermediate stations, for the platforms are short, and even with a three-coach train care is needed in drawing up. At the same time whole minutes may be lost by too slow an approach, but on this journey I was astonished at the way in which Driver Harkness maintained full speed until the latest possible moment and then made a perfect stop, every time. Added to all this, in the one and a half minutes we stood at Cookstown Junction the crew actually found time to take water!

How well the strenuous task of working this train was discharged is shown by the very smart runs made on the branch. We had to pick up a four-wheeled van at Antrim, which meant backing right into the sidings of the adjoining Great Northern station; it made us 3 minutes late away, but sure enough we were into Magherafelt on time. The first lap of 3.1 miles to Cookstown Junction took $5\frac{3}{4}$ minutes, speed rising to 49 m.p.h. on the 1 in 213 rise. The branch is single-tracked, but tablets were of course exchanged by hand while standing at the stations.

From Cookstown Junction the branch swings away westward from the main line, and in the first short run of 2 miles, to Randalstown, we attained 48 m.p.h.; this length was completed in $4\frac{1}{4}$ minutes. On the next section the line approaches the shores of Lough Neagh. This great lake is very wide, and being surrounded by low-lying country looks just like the sea; far away to the south could be seen the mountains of County Armagh, and on a serene evening in late spring with scarcely a cloud in the sky it made a very lovely picture. The freshness of the trees and the brilliance of gorse newly in bloom formed a serious counter-attraction to the exploits of *"Galgorm Castle,"* which by now was racing along in gallant style. We ran the $5\frac{1}{2}$ miles from Randalstown to Staffordstown in $8\frac{1}{4}$ minutes with a well-sustained maximum speed of $57\frac{1}{2}$ m.p.h., and some even faster running was made on the next section, where the $3\frac{3}{4}$ miles on to Toome took only $5\frac{3}{4}$ minutes start to stop; in this short distance speed rose to $58\frac{1}{2}$ miles per hour.

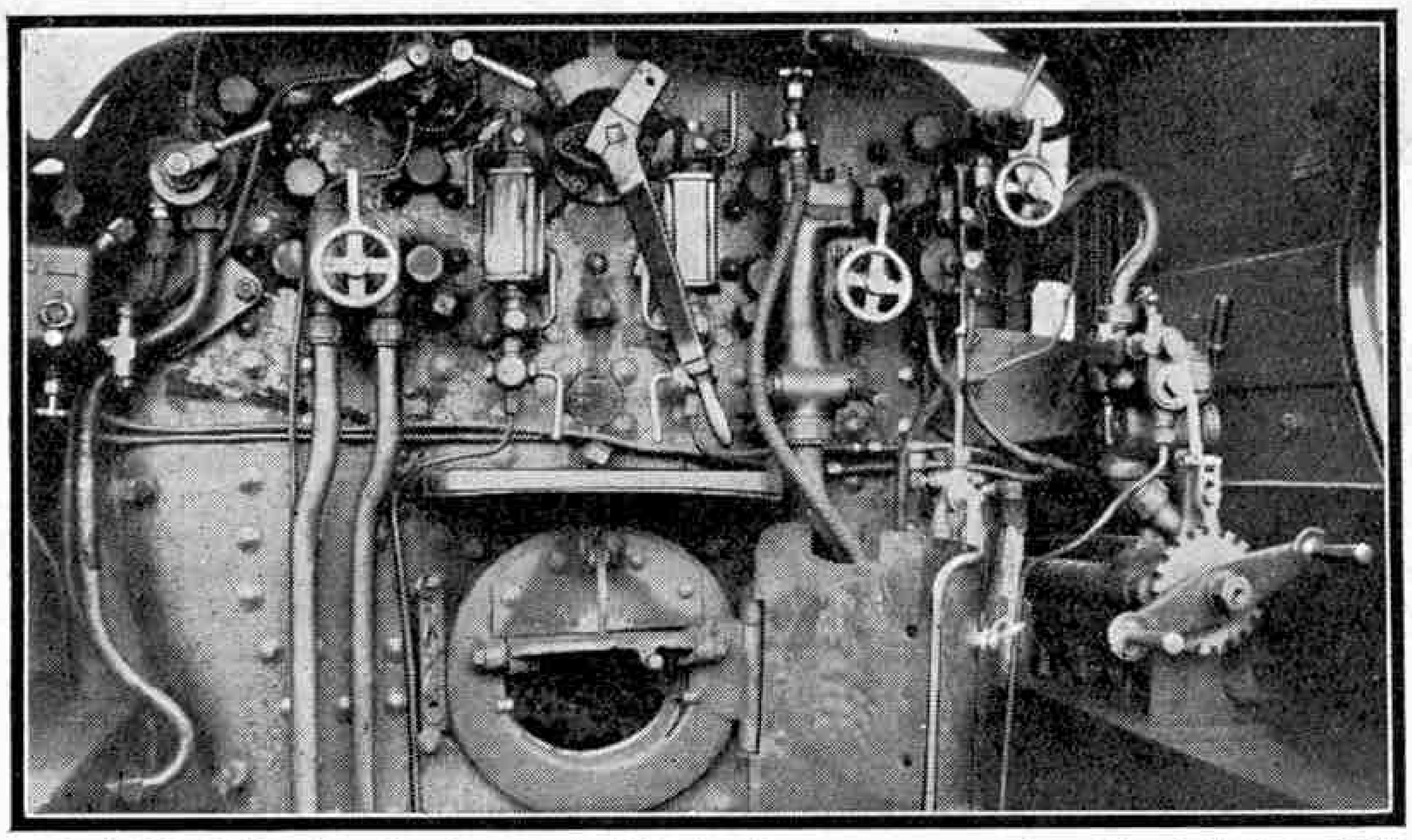
(Continued at foot of next page)

Footplate Terms Explained

The Economical Use of Steam

THE articles by *"A Railway Engineer,"* describing footplate trips, are among the most popular that have ever appeared in the *"M.M."* Large numbers of readers have written to express their keen enjoyment of these articles and to demand more. Among these letters have been some from younger readers asking for explanations of some of the expressions used by the author, and in order to make matters clear to every reader we deal in this article with the points that have most often been raised in correspondence.

A phrase that is often used by *"A Railway Engineer"* refers to running at a "cut-off" of so much per cent. This phrase is connected with the supply of steam to the cylinders. Steam is not admitted to each cylinder throughout the movement of the piston from one end to the other. Instead it is cut off by means of the valves after a certain proportion of the stroke has been completed. The point at which this occurs is always expressed as a percentage of the stroke of the pistons, and is described briefly as the cut-off. Thus a "cut-off of 25 per cent." means that the steam supply ceases when the pistons have each completed 25 per cent., or a quarter, of their stroke. For the remaining three-quarters of the stroke the steam already in the cylinders is xpanded, driving the piston forward or backward until it reaches the end of its travel. The expanded steam is then exhausted as the piston makes its return journey.



A typical footplate view showing the regulator handle, screw reverse gear, driver's brake valve, the firehole door and numerous other important fittings. The water gauges can be seen, one at each side of the regulator handle. Photograph by Mr. O. S. Nock, Bushey.

This expansive use of steam is much more economical than its admission throughout the piston stroke. The degree of expansion permitted is regulated by the valve gear and is controlled from the cab by the driver. The apparatus provided for this purpose on modern locomotives invariably takes the form of a wheel or handle on the driver's side of the cab, operating on a screwed rod connected to the valve gear. On the standard or bracket supporting the wheel and screw, it is now usual to fit a scale marking the position of the valve gear from full forward to full backward gear. As the wheel or handle is revolved, an indicator or pointer is traversed on the screw along the scale, and from this the degree of cut-off can be seen.

The term "notching up" is frequently used to denote the action of shortening the cut-off, or making it occur earlier in the stroke. This term is a reminder of the fact that at one time the valve gear was controlled from the footplate by means of a tall lever mounted on a notched quadrant, a catch handle fitted to the lever allowing a block to engage in any one of the notches from full forward to full backward gear, and thus to hold the lever in the desired position. As the notches have to be spaced relatively far apart, this method of valve gear control does not allow of such a fine degree of adjustment as is possible with a screw gear. The lever arrangement is still found on older locomotive designs, and also is used on shunting engines, where quick reversing is a necessity.

The term "cut-off" in descriptions of footplate trips often is associated with the words "full regulator." The regulator valve of a locomotive admits the steam from the boiler to the main steam pipe, and so to the cylinders; and the driver opens it to the extent required by means of a long handle, known as the regulator handle, that is more or less centrally placed and is one of the most conspicuous fittings in the cab of a locomotive. "Full regulator" means that the handle is pulled over to its limit, opening the steam admission valve as widely as possible. Sometimes the regulator valve is of special construction, with two ports, one small and one large, and one or the other is brought into use according to the setting of the regulator handle. The "first port," or "first regulator," is used for light steaming, and the "second port," or "main regulator," is brought into action for the fast and heavy work necessary on the level or on rising gradients.

The regulator handle may stand up above its spindle, as in the cab of the 2–4–0 compound illustrated on page 504. With large high-pitched boilers the spindle is necessarily high up in the cab, however, and the handle then hangs downwards at a convenient angle for the driver's management, as is seen in the illustration on this page. A short tail-piece is formed at the spindle end of the handle and this usually works over a small quadrant provided with stops at each end. The position of the tail-piece between these stops does not always accurately represent the degree of regulator opening, however, and in such cases adjustments of the regulator position have to be made by the driver more by the "feel" than by the "eye."

The dials of the pressure, steam heating and vacuum gauges are sometimes referred to as "clocks," their circular faces and the moving fingers making comparison with the ordinary time-piece irresistible. The first of these three gauges shows the driver what steam pressure, in lb. per sq. in., he has to work with, and the fireman's job is to keep this pressure up to the working limit, or as near it as possible. The steam heating gauge shows the steam pressure in the pipe leading to the train; before entering this pipe the steam passes through a valve that reduces its pressure. Two pointers on the vacuum gauge show how little pressure there is in the train pipe and in the vacuum chamber respectively. Its record is given in inches, corresponding to the scale of a barometer.

The water gauge is of different form. It consists of a glass tube connected to two cocks mounted on the boiler back or doorplate, so that the height of water in it indicates the level of the water in the boiler. The gauge is commonly referred to as the "glass," and the term "half glass," for instance, means that the water is half-way up the gauge tube and thus stands at about half the normal working level in the boiler.

Another locomotive term connected with the fuelling and watering of the engine is "dip," the word used to denote the water scoop that is lowered from the tender to pick up water from track troughs.

Footplate Run—*(Continued from previous page)*

Immediately after leaving Toome the railway crosses the outlet from Lough Neagh; this is the River Bann, which flows due north to enter the Atlantic beyond Coleraine. A lively run was made on to Castledawson, 4¼ miles in 6½ minutes with a top speed of 54 m.p.h.; on this section the lever was not brought back beyond the third notch. The last section is all uphill; ahead is the splendid height of Slieve Gallion and there are rolling hills stretching far away to the south. The 2¼ miles into Magherafelt took 4¾ minutes, and we arrived almost on the stroke of 5.33 p.m.

From here it is only 10 miles on to Cookstown, but I was bound for Coleraine, via the Derry Central line. Thus finished an excellent trip. It illustrates the strenuous work needed to operate a stopping train, but is chiefly of note as showing what these historic little compounds can do. Their days are numbered, however, for in addition to the three 2–4–0s, only one other standard gauge compound express engine remains, the 7 ft. 4–4–0 *"Parkmount."*

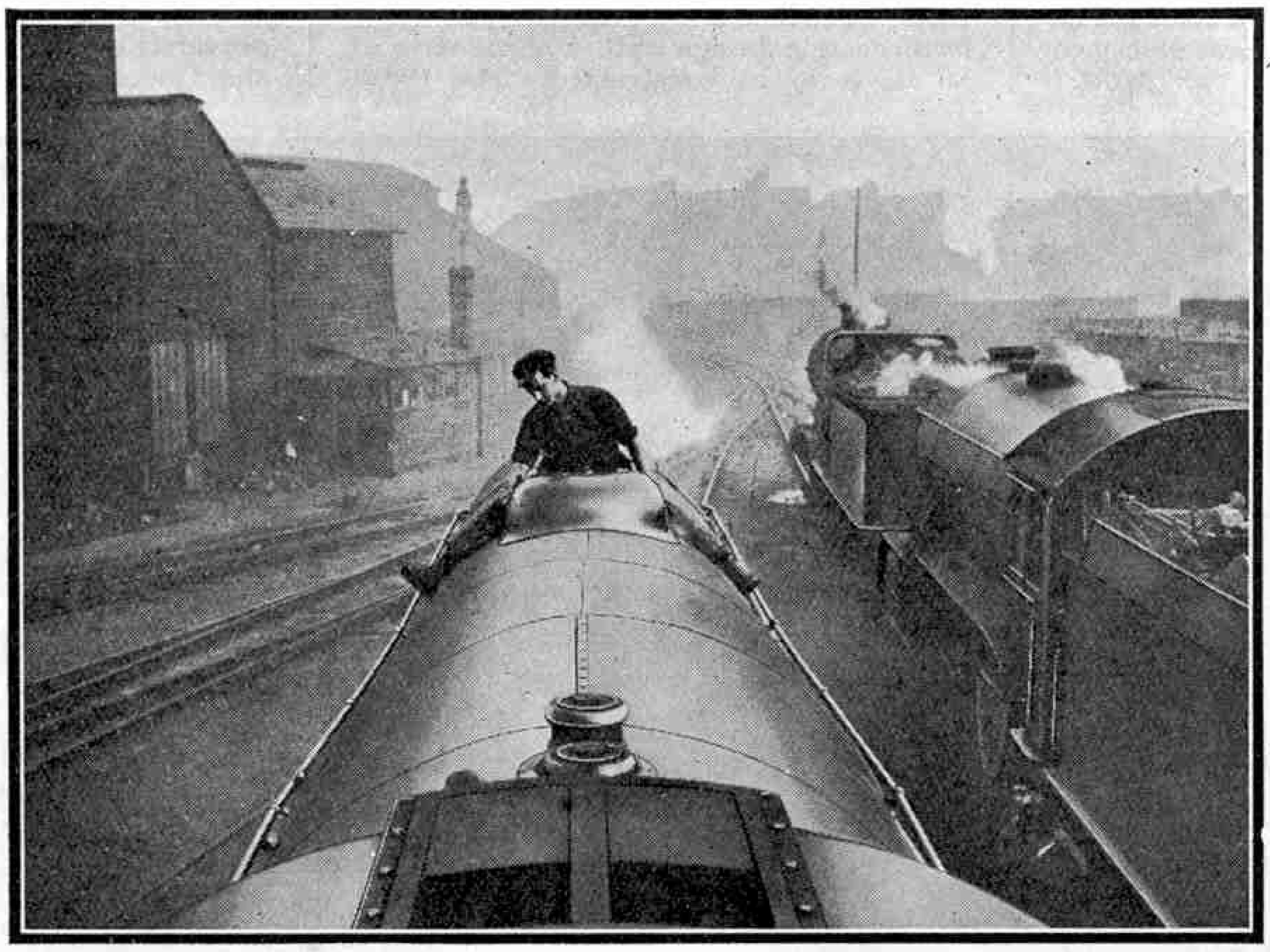
How Locomotives are Cleaned

Spraying with Hot Water at High Pressure

THERE are few finer sights than a magnificent modern locomotive that has been polished up in readiness for a long and speedy run at the head of a famous train. A well-groomed engine is a source of delight to the railway enthusiast, and gives even the most casual observer or traveller an impression of smartness and efficiency on the part of the company owning it.

Most drivers and firemen commence their careers as engine cleaners, working in gangs under the general supervision of a chargeman cleaner. The materials used are simple when cleaning is carried out by hand, as it is almost exclusively in this country. Cleaning oil is drawn from storage tanks at the sheds, and is applied by means of the familiar hand cloths that appear to be part and parcel of the equipment of every locomotive man! The oil used includes paraffin for removing dirt, and the degree of finish imparted to the wiped surface depends a great deal on the condition of the paint, and also on the skill exercised by the cleaners.

Of what we may term the spectacular parts of the locomotive, as opposed to the working parts, perhaps the easiest portions to deal with are the cab and tank sides, splashers and similar details. The boiler is the most prominent part of the modern locomotive, and if its jacket is in good condition and well cleaned the whole of the engine has a good appearance. Unfortunately the upper surface of the boiler is liable to suffer from the effects of smoke and soot from the chimney, and therefore tends to blacken on an engine that is finished in colour. The surface underneath the boiler barrel is protected from smoke from the chimney, but is liable to be blackened in patches from making acquaintance with the small flares used by enginemen and shed staff as aids to inspection. Dirt tends to accumulate also at any joint or raised surface, such as the bands encircling the boiler casing, especially if wiping is carried out across them.



A cleaner at work on the boiler of an L.N.E.R. "Pacific." The upper part of the boiler requires vigorous treatment, as it becomes blackened by the soot and smoke from the chimney.

The tender sides present a broad flat unbroken surface that at first sight would appear to be ideal for good cleaning effects. It is difficult to maintain a permanently good effect on the sides, however, for several reasons. Dust thrown up by the engine in course of travelling settles on the tender sides, which also are subject to splashes when water is picked up. Coal dust from the footplate is blown back when on the run, and the tender is so near the footplate that it collects ash when fire cleaning or fire dropping is carried out. A point of interest is that oil is frequently flung off the rapidly moving rods of modern locomotives having outside valve gear, when travelling at high speed. This is blown back in streaks on to the tender, and sometimes on to the train, where dirt sticks to it.

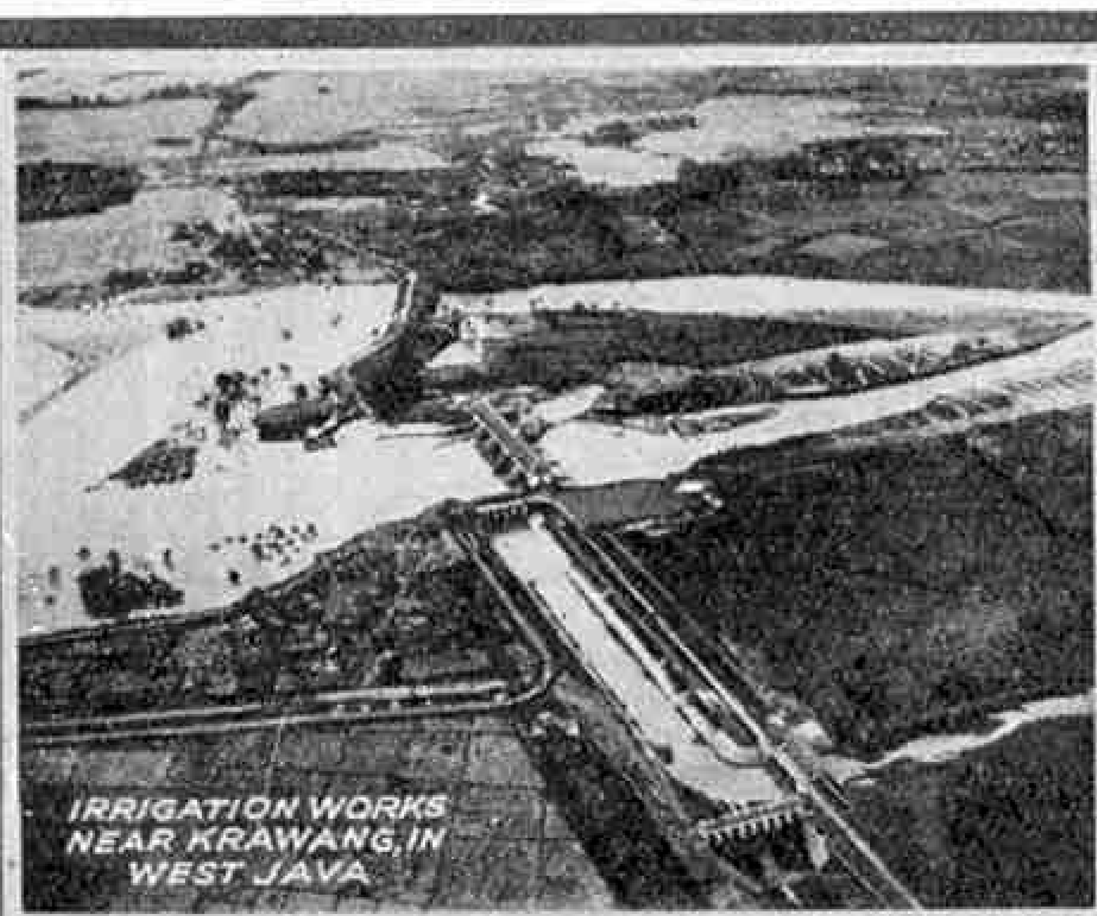
An interesting practice is now followed on the L.M.S.R. with a view to preserving the finish of a cleaned engine. This consists in applying a special preparation developed after a considerable amount of work on the part of the technical research authorities at Derby. The preparation is viscous, and smells strongly of ammonia, and it deposits a coating of wax on the cleaned surfaces. A splendid finish is given to engines treated with it, and it helps to preserve their paintwork as well as making them easier to clean subsequently. Two kinds of this "wax" are in use. One is for black engines, and the other is employed on the more select classes of engines that are finished in red, such as the "Princesses," "Royal Scots" and "Jubilees."

Cleaning a large express engine thoroughly involves much time and labour. To make a big tender engine presentable means a day's work for perhaps three or four cleaners, and they will use anything up to 48 hand cloths on the job! It is not surprising therefore to find that efforts have been made to speed up the work, especially in America and Canada, by the introduction of spray cleaning. Steam and hot water under pressure are projected on to the dirty surfaces by means of a special portable spraying gun, and its forcible application removes the accumulated dirt in a fraction of the time required for hand wiping. Similar equipment has been experimented with on the L.N.E.R., and with it two men can completely clean an engine in a short time. As time goes on it will be interesting to see whether the mechanisation of running shed equipment is extended to include the installation of such apparatus as a regular feature.

Perhaps the most interesting application of this form of cleaning comes from Canada, where a special engine cleaning plant has been installed at the Turcot Engine Shed of the Canadian National Railways in Montreal. In this the engine is driven past the installation while a number of jets spray a cleaning fluid on to all parts. The fluid is applied at high pressure. It is a mixture of hot water and a special compound that dissolves oil and grease, which is washed away, and a light film of wax is left on the clean surface.

The operation of the plant is simple and automatic. After closing the cab windows and ventilator, the man responsible for the cleaning takes the engine slowly over the length of track past the apparatus. When the engine reaches a certain spot the jets come into play, and these only cease operation when the last wheel of the tender has passed off the apparatus, and the whole length of the engine has been subjected to a thorough cleaning. If certain parts of the engine are particularly dirty, and require more attention than the rest, the engine is moved more slowly than usual for these to be dealt with. This in no way affects the working of the apparatus, the jets remaining in action all the time. Passenger locomotives are wiped down by hand after passing through the plant, but this is not considered necessary with shunting engines.

Modern locomotives are far less "showy" than the engines of former days, which carried many copper and brass fittings to be polished up. Copper-capped chimneys and brass domes, safety valve casings and splasher beadings were favourite forms of decoration, but they added very largely to the labour of cleaning. In order to reduce the amount of attention necessary, it became the custom to paint over such details, although the G.W.R. still retain polished copper and brass fittings on their principal express locomotives. In recent years there also has been a tendency to abandon the use of colour for all except the most important locomotive classes.



ENGINEERING NEWS

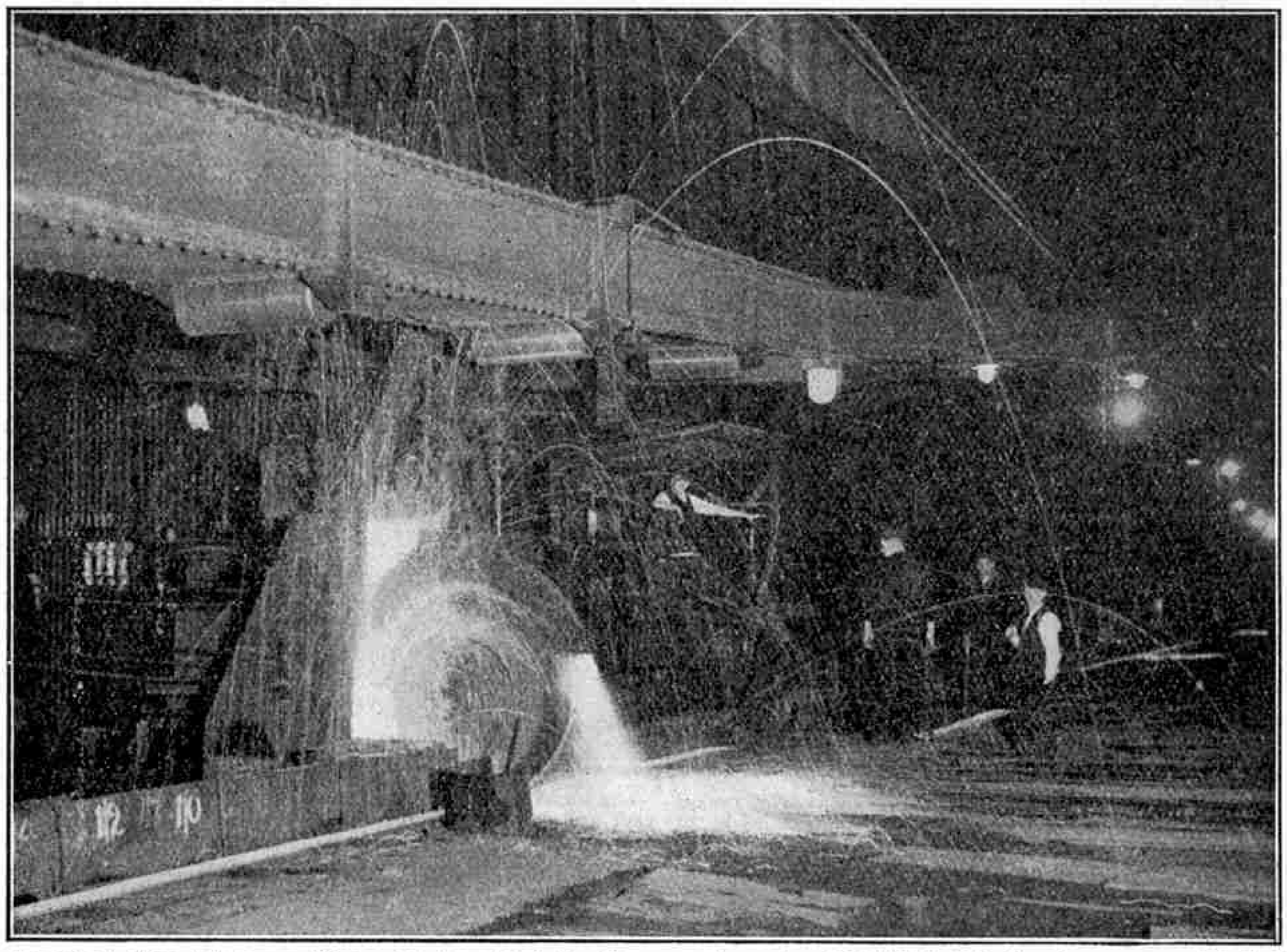
Transporting a 20-Ton Glass Disc by Rail

A 20-ton glass disc 200 in. in diameter and 26 in. thick was recently conveyed by railway from the Corning Glass Works, Corning, New York, to Pasadena, California, where it will be prepared for installation in a 200-in. reflecting telescope, by far the largest ever constructed. The casting of the giant glass disc was described and illustrated on page 512 of the "*M.M.*" for September, 1935.

The transportation of this valuable scientific freight across the United States was undertaken only after more than a year of planning by packing and transporting specialists. The disc was packed in a steel crate that weighed 10 tons, and was constructed of ½ in. plate steel reinforced by heavy angle and channel section girders. During the journey across the continent great care had to be exercised in operating the special train, owing to the fact that the bottom edge of the crate was only 6 in. above the rails, while the top had only a 3-in. clearance in some of the tunnels and bridges along the route. The train was a New York Central three car special.

Dialling Ships at Sea

A new system of telephony for use in calling ships at sea has been developed in America. Under the new system each ship has a three-figure number assigned to it, and only the particular ship it is desired to call receives the message. When an operator wishes to speak to a ship he simply dials its number, as if using an automatic telephone, and this action sends out a series of tone pulses that are received by all the ships within range. The ship called is the only one that receives an audible signal, however, and in it a bell warns the operator, who picks his handset off the hook and replies in the usual manner. When the telephone conversation is finished the handset is returned to its hook, and the call signal receiving apparatus is automatically reset.



An Edgar Allen hot saw cutting red hot metal at the Glengarnock works of Colville's Ltd., to whom we are indebted for the illustration.

A Telford Bridge to be Preserved

A stone arch bridge built by Thomas Telford to carry the Glasgow-Carlisle road over the River Clyde, is to be closed to traffic and preserved as a permanent example of his work. It is only 18 ft. 6 in. wide and is unsuitable for present day traffic. The road is to be diverted and a new ferroconcrete bridge with a single span of 96 ft. is to be constructed. The width between parapets of the modern bridge will be 60 ft. The whole scheme will cost £58,000.

World's Longest Aerial Railway

The first portion of a new aerial railway that when completed will be the longest and highest of its kind in the world is now in operation in the north of Italy. It commences at Cervinia, and goes up the mountain ridge that forms the Swiss-Italian frontier towards the Matterhorn. The section now completed ends at the ski-ing runs on the Maison Plain, but eventually the cableway will extend to the Theodule Pass, 11,000 ft. above sea level, from which the stiffest part of the climb to the summit of the Matterhorn 4,000 ft. above it begins.

10 Tunnels Under New York River

Work will commence soon at New York on the construction of a new tunnel that is to be driven under the East River between Manhattan Island and Queensborough, on Long Island. There are already nine tunnels underneath the East River, and five bridges across it, and another bridge is now being built. The existing tunnels carry only railway traffic, however. The new one will be the first under this river to accommodate motor vehicles, and will provide a direct route between New Jersey and Queensborough. It is expected that the new tunnel will be completed in time to serve as a means of transport to the great World Fair that is to be held on Flushing Meadows, Long Island, in 1939.

Colours for Submarines

In future British submarines are to be painted to suit the particular light reflecting properties of the water in which they are intended to operate. Until now they have all been painted grey-green, but experience has shown that the vessels show up clearly in some seas when painted this colour, although in others they are not easily visible. Under the new system submarines for service in the Atlantic will be painted green-grey, and those to be stationed in the Mediterranean royal blue. Black appears to be the most suitable colour for submarines operating mainly in the Red Sea.

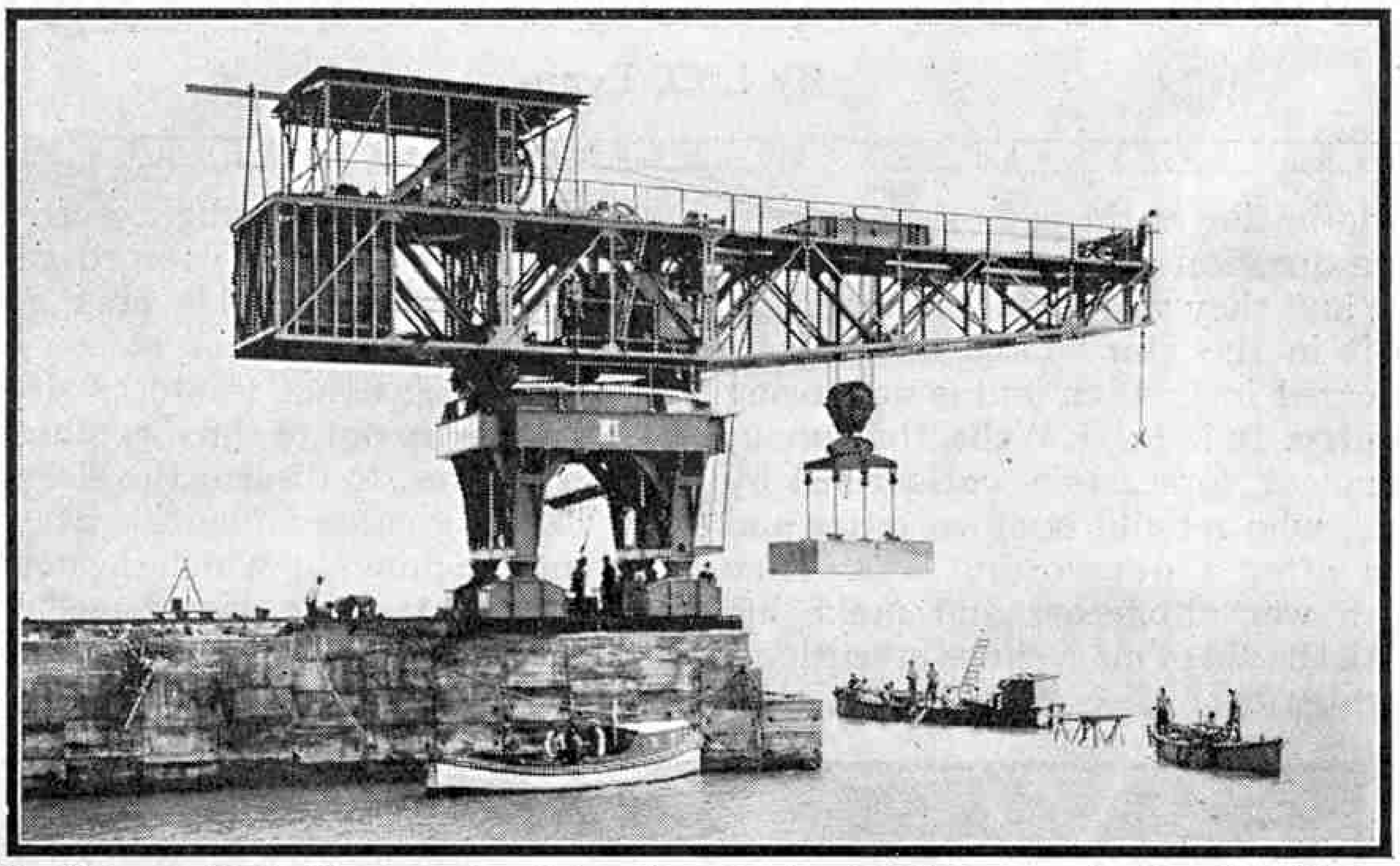
Giant South African Dynamite Factory

Modderfontein, near Johannesburg, will shortly possess the largest dynamite factory in the world. An enormous plant already exists there and it is now to be extended by new works on which £1,000,000 is to be spent. These will include at least one new factory and additions to the ammonia plant, which is now inadequate to meet demands.

With the exception of the great steel works at Pretoria, the dynamite factory employs more workpeople than any factory in South Africa, and at present is turning out 800,000 cases of dynamite each year. When the proposed extensions are completed the output will reach 1,600,000 cases annually.

A Titan Crane for Harbour Work

The upper illustration on this page shows a 90-ton Titan Crane that has been specially built by Werf Gusto Ltd., Schiedam, Holland, for service in the harbour of Las Palmas, in the Canary Islands. It is intended for placing concrete blocks required in the construction of quay walls and piers, and is of the travelling type with portal legs that can be turned through an angle of 90 degrees. The load is suspended from a travelling trolley that is moved along the jib by means of winding mechanism. The blocks can be deposited in any required position, and can be lowered to a depth of about 63 ft. below the water level.



The 90-ton electrically driven crane described on this page, at work on harbour construction at Las Palmas, in the Canary Islands. Photograph by courtesy of Werf Gusto Ltd., Schiedam, Holland.

A New Use for Stainless Steel

Stainless steel has been applied to a great variety of purposes, ranging from the making of cutlery to the lining of the interiors of giant milk tanks and high-pressure steam pipes. One of its most recent applications is in facing two Venturi-flume meters that have been constructed by the Derwent Valley Water Board at Yorkshire Bridge in connection with a new reservoir at Ashopton, Derbyshire. The meters are used for measuring the flow of water in the river, and the lower illustration on this page shows the two flumes, one of which is in the background and is partly submerged, while the other is in the foreground and is seen dry. It is important in meters of this kind that the measuring throat should maintain its original contour, and stainless steel is being used in order to prevent changes due to erosion and accumulations of moss, algae and other fresh-water growths.

The steel facing is bedded on concrete, and is constructed of Firth-Vickers "Staybrite" steel plates, covering a total area of approximately 320 sq. ft. The length overall measured along the bottom is 26 ft. 4 in. The plates were all very carefully shaped before despatch from the makers' works, and numbered to facilitate erection.

Two Venturi-flume meters on the River Derwent that have been lined with stainless steel. That seen in the foreground of our illustration is dry, and the other is partly submerged. Photograph by courtesy of Industrial Units Ltd., Sheffield.

Four 82,500 kVA Generators for Boulder Dam

Although construction of the great Boulder Dam in the United States of America is now completed, engineers are still at work installing the mighty generating plant. This includes four huge hydro-electric generators, each of 82,500 kVA capacity, all of which are expected to be in operation before the end of this year. These machines are twice as large as any of their kind previously constructed, and they will supply electricity to many towns and cities over a wide area, including Los Angeles.

Giant Omnibuses for Moscow

In the near future two new systems of transport are to be introduced in Moscow. In one of these, giant buses 34 ft. 6 in. in length and capable of carrying 100 passengers will be used. The bodies of these vehicles will be made of steel sections welded together and faced with aluminium. The windows will be of unbreakable glass, and the doors will be wide enough to allow three persons to enter at the same time.

In addition to these vehicles, a number of semi-trolley electric goods trucks are to be introduced. These will be able to operate either on power taken from overhead conductor wires, or from batteries carried in the trucks themselves. When using the overhead trolley wires they will be able to travel at speeds up to 30 m.p.h., with a full load, but the maximum speed, when operating on their own storage batteries, will be 10 m.p.h.

* * * *

The Government have granted to the Anglo-American Oil Company, Ltd., marketers of Esso products, licences to search for petroleum covering nearly 500 square miles in the south of England.

World's Highest Multiple Arch Dam

A fine multiple arch dam that when completed will be the highest of its kind in the world, is to be built in the United States of America. It will form part of an important reclamation scheme that is being carried out in connection with Salt River, and will be built across the Verde River in Arizona. It will have a height of 270 ft., and a crest length of 750 ft., and will consist of 10 reinforced concrete arches supported by nine hollow reinforced concrete buttresses spaced 60 ft. apart. The new structure will be known as the Bartlett Dam and will cost £450,000.

A New Canadian Industry

The manufacture of a peculiar substance known as rock wool, which is one of the most effective insulation materials yet discovered, is now being carried on in two separate plants in Ontario. At one of these plants electric furnaces are used in conjunction with a special mechanical spraying device for converting molten rock into fibres, from which is produced a long-fibred wool that weighs from three to four pounds per cubic foot. The product made at the other plant is a heavier short-fibred material. The greater part of the material from the two plants is being used for building insulation and soundproofing, and for the acoustical treatment of offices, theatres and broadcasting studios.

Lighting and Cooking by Bottled Gas

Many of the crofters of the Western Highlands of Scotland are now cooking, heating and lighting their homes by means of bottled butane gas, referred to on page 463 of the August Magazine. The gas is distributed in liquid form in steel containers, which when full, weigh under 50 lb. and contain enough gas to last a family of three for six to 10 weeks, and will keep an ordinary gas mantle alight for 450 hours.

Upon installation the consumer is supplied with two containers of gas and one regulator. The regulator is attached to one of the containers and this is then ready for service, the other container being held in reserve until the first is exhausted. When the first container is empty, the regulator is disconnected and attached to the full container. Before the second container has become exhausted a further full container is delivered to the consumer, and the empty is taken away for refilling.

There is actually nothing new about this gas, for it has been used for many years in remote districts of America and on the Continent.

"Things to Come"

A World Ruled by Scientists and Engineers

By I. O. Evans

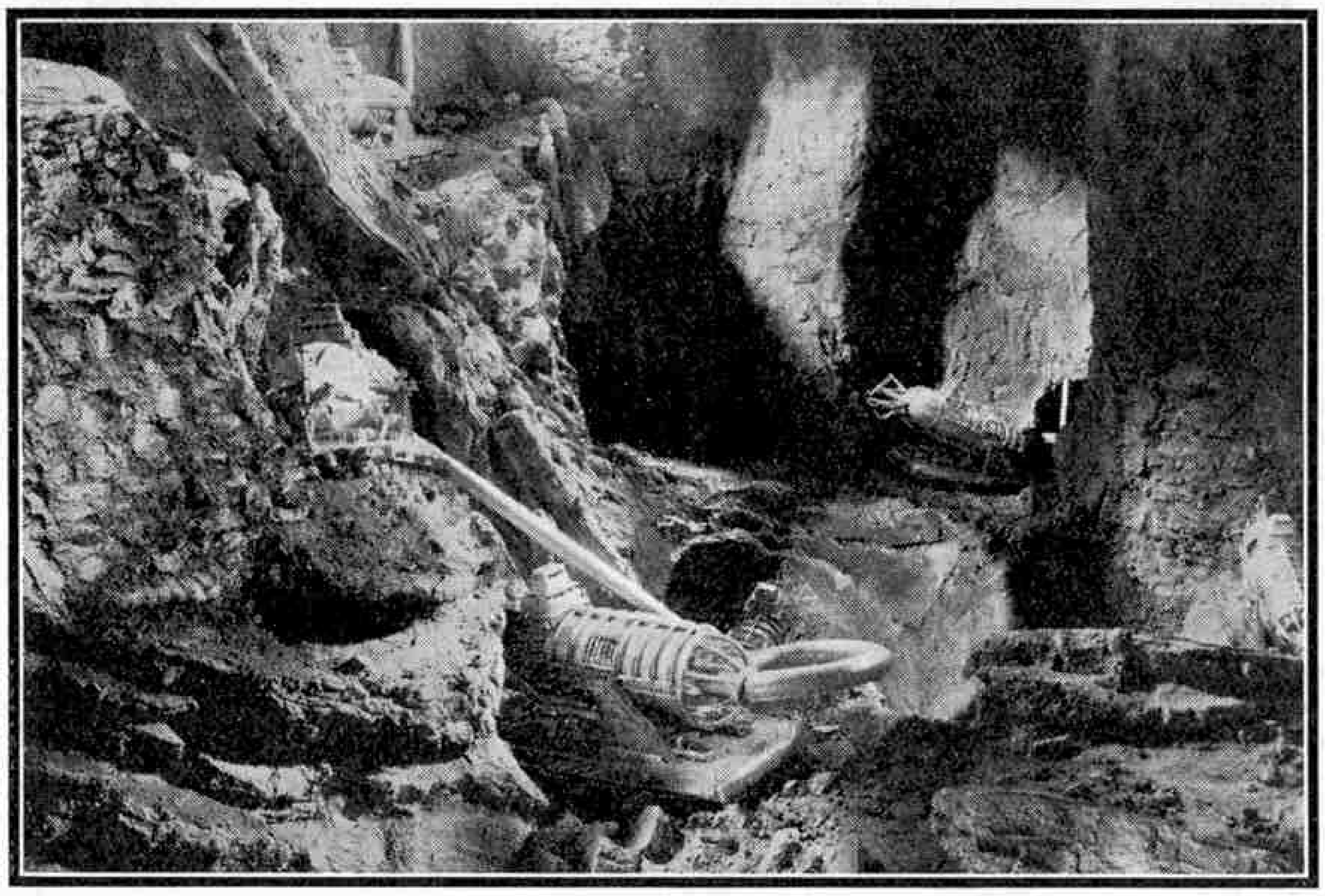
WHAT will the world be like at the end of the present century? That is a question all Meccano boys must have asked themselves, and they will find a fascinatingly interesting answer to it in the film *"Things to Come,"* which has already appeared in London and is now being shown all over the country. In it H. G. Wells, the famous writer of scientific romances, forecasts a world ruled by engineers and scientists, who rebuild bombed cities and reconstruct civilisation after a devastating war. They banish poverty, abolish war altogether and make life complete and happy with the aid of marvellous inventions. Not content with mastery over their own Earth, they turn to other worlds, and their crowning achievement is a great space gun to fire a shell to pass round the Moon.

One of the aeroplanes used by the engineers' government is shown descending near "Everytown," the city in which most of the scenes in the film take place. It is the first of the inventions we see in the picture, a "small new 1970 type" with its wings curved back like a swallow's. It is jet black and glossy, built of some new alloy, and its method of flight is new. The whole thing is "different" and strange, and the uniform worn by its pilot is equally remarkable, for he is clothed in black gas-proof material with great gauntlets, and his chest and head are enclosed in a huge circular shield that makes him look over seven feet high. This shield is a 1970 gas mask, and when he swings the visor down to talk, it looks like a black halo behind him.

The airmen have their headquarters at a great airport at Basra, where they are seen loading their machines and crowding up the huge gangways into them in readiness for conflict with a war lord in "Everytown," who is preparing to resist the new government of scientists and engineers. In the picture we go back there and from a drift of cloud across the sky we hear the distinctive throb of some new type of engine. Then, sweeping out of the cloud, huge and black and terrible, comes a great bomber. It flies very steadily and with an air of being irresistible; it looks less like an aeroplane than an air battleship. Behind it come others, with their many roaring propellers and their far-spreading wings.

The old-style aeroplanes of "Everytown's" war lord cannot resist these mighty creations of the engineer and fall in flames, or are forced to earth. The pilots of the government fleet pull levers that release bombs containing neither explosives nor poison nor disease germs, but a harmless gas that produces sleep, and then hundreds of airmen leap out of the machines and descend by means of parachutes, to disarm the sleeping people.

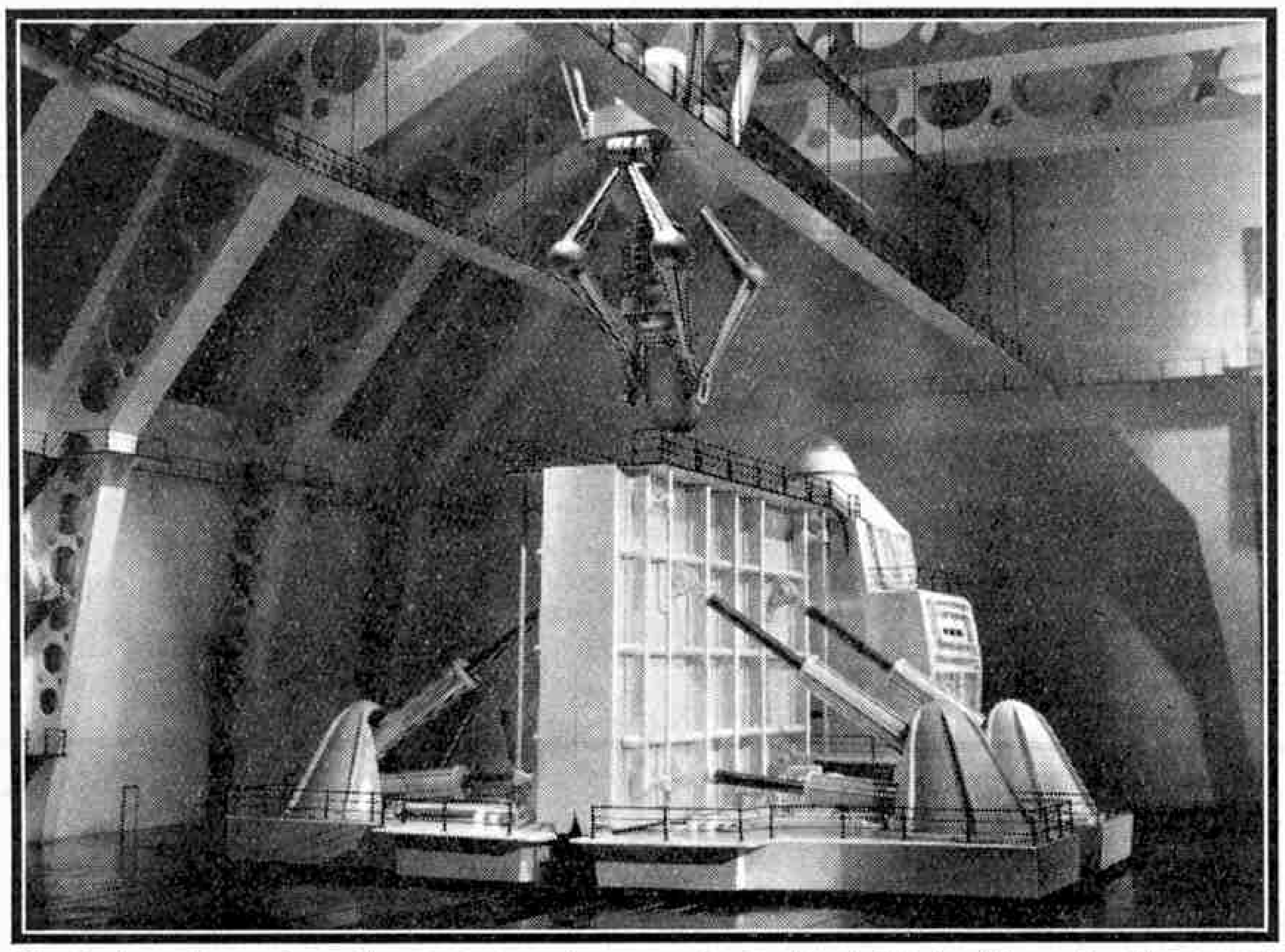
These great aeroplanes are fascinating to watch, but the giant machines by which the new "Everytown" is built are no less attractive. Great mechanical excavators burrow into the hills, blasting and hurling rocks aside. As the illustration on this page shows, they are like nothing we use to-day. They consist of immense cylinders, moving on huge tractor-carriers and supplied with explosives and power by great flexible steel-ribbed tubes. Below them are the control rooms that house their crew, and these seem small and unimportant in comparison with the machines themselves. Nozzles like the muzzles of great guns project jets of explosive liquid against the surface rock. Then spider-like metal arms move great rods of carbon close against it. There is the flash of an electric spark and an explosion, and masses of rock crumble, break away, and crash heavily down as the huge machine recoils upon its springs.



Giant excavating machines at work on the mountain side, preparing the site for the new underground city of "Everytown," the chief scene of events in the film "Things to Come."

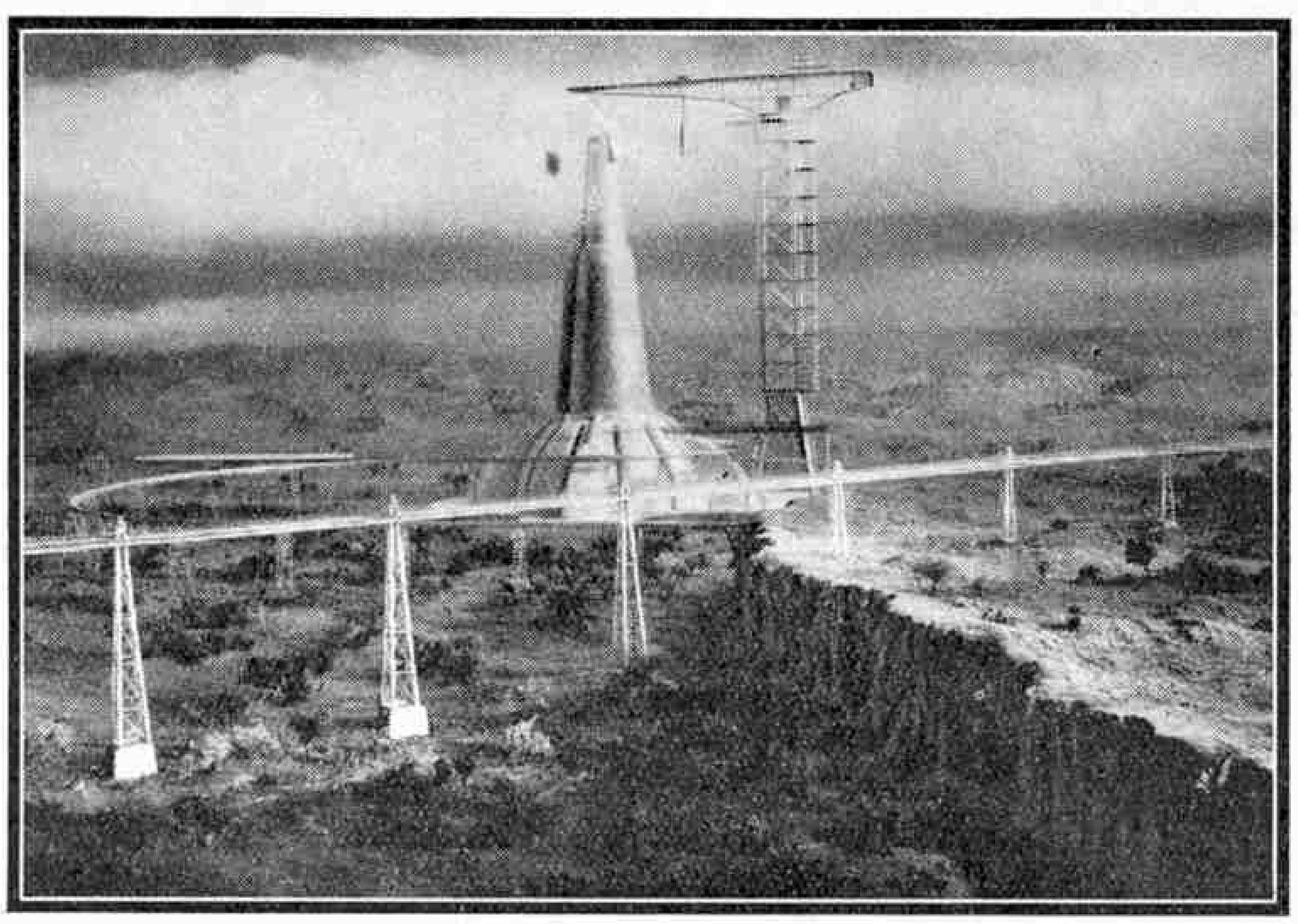
The houses of the new city are built of huge sheets of metal made by pouring the molten material into a great container, carried on a wheeled trolley. The sides of the mould are supported by pistons moving in narrow cylinders, and as they separate they reveal a thin sheet of glowing metal, newly-cast and fit for use as soon as it has cooled. This slides along on a carrier, while the walls of the mould return to their place ready for a new sheet to be cast. The work of erection is carried out by a machine that seems to be a combination of a tank and a crane. From the front of its body projects a long arm, tipped with a suction pad that is pressed against one of the great metal sheets, to grip it and lift it high into the air before placing it against a metal framework.

Thus the homes of the city are built, the wall of a whole apartment being placed in position in one operation. The people dwell in flats each provided with a balcony overlooking the streets. The new "Everytown" is not a city of skyscrapers or of concrete blocks of dwelling-houses and offices, however, for it is built, not up into the air, but underground, leaving the surface of the earth unspoilt for cultivation, games and sports. In its streets are moving ways, a series of platforms like those at the top and bottom of a modern tube escalator, by which its people can travel about conveniently. Overhead are railplanes, swift torpedo-shaped cars running on rails suspended from girders of latticed steel, and the flats and the different levels of the town are reached by lifts travelling in transparent shafts. All work in silence, for it has been recognised that noise in a machine is a sign of waste.



The giant mould used for casting the huge metal sheets of which the buildings of "Everytown" are made.

The new "Everytown" is a place where most of us would like to live. But some of its citizens think it "unnatural" and long for the "good old days." They are distressed because new things are always being done and new inventions made. A great gun has been cast to fire shots round the Moon, and a young man and a girl are to make the first adventurous journey into space. Thousands of volunteers have clamoured for this privilege, but an artist who hates "all this progress" uses the city's system of broadcast-television to rouse the people to smash the great space-gun, and so put an end to the rule of the scientists and engineers. Stepping into a dark studio, he waves his hand to the electrician to show that he is ready. As the studio light flashes on, his voice is heard in receiving sets all over the world and his image appears on their screens.



The great space gun designed to shoot a shell carrying human beings on a voyage round the moon. The shell is lowered into the gun by means of the hammerhead crane on the right.

The people are impressed by his arguments and rush off to destroy the great gun. Word is taken to the leading engineers; and the young people who have volunteered for the expedition are anxious to be fired into space at once before the mob can do any damage. They set off for the gun in a helicopter, looking something like an Autogiro with a closed-in torpedo-shaped body. Really its principle is very different; for during flight the horizontal screw above it is driven, not by air-pressure, but directly by an engine. As the pilot moves a switch the screw revolves, and the helicopter rises vertically and hovers in the air, noiseless except for the whirring of its screw. The tail-screw now propels it forward through the clouds until it reaches the space-gun, and as it sinks to the ground the great girders and cables and machinery around seem to be rising past it.

The gun itself is a triumph of engineering. Supported by immense shock-absorbers and pointing vertically upward, it towers high into the air, and beside it stands a complicated mass of lattice-girders, with a swinging arm to load it. The whole thing looks as though giants had been experimenting with a super-Meccano set. The engineer and the adventurers travel upward in one of the transparent lifts to the loading platform. The great shell is lowered to their level and with a purring of motors its great steel door swings open. The two young people who are to travel in it are strapped inside to supports, which they are to clutch with all their muscles tensed to break the shock of the discharge. The door is shut, and the shell is lifted slowly into the air.

Now it is a race against time; the mob who wish to destroy the complicated machinery that actuates the gun are scrambling down the cliffs and rushing towards its base. The moving arm of the loading tower swings the shell round until it is exactly above the muzzle. The great pistons of the shock-absorbers slide out ready to take the recoil, the shell vanishes into the mouth of the gun, and the grip that held it returns empty and the moving arm swings clear to one side. In a concussion chamber, safe from the shock of the discharge, the engineer has his hand on the firing-switch, but there is a clock before him and he dare not throw the switch until the proper moment, lest the shell, instead of circling the Moon and returning to Earth, be lost forever in outer space. Its two young passengers clutch their supports, tense with expectation, not knowing whether the next moment will find them dragged ignominously out to face the scorn of the crowd, smashed lifeless to the floor by the concussion as the gun is fired, or drifting weightless but unhurt about the shell as it moves swiftly through space. Meanwhile the mob have entered the control tower—but it would spoil the story to say more.

This exciting scene is the climax of a film suggesting many mechanical marvels of the future that will give Meccano engineers new ideas for model-building.

Liverpool to Dublin by *"Lady Leinster"*

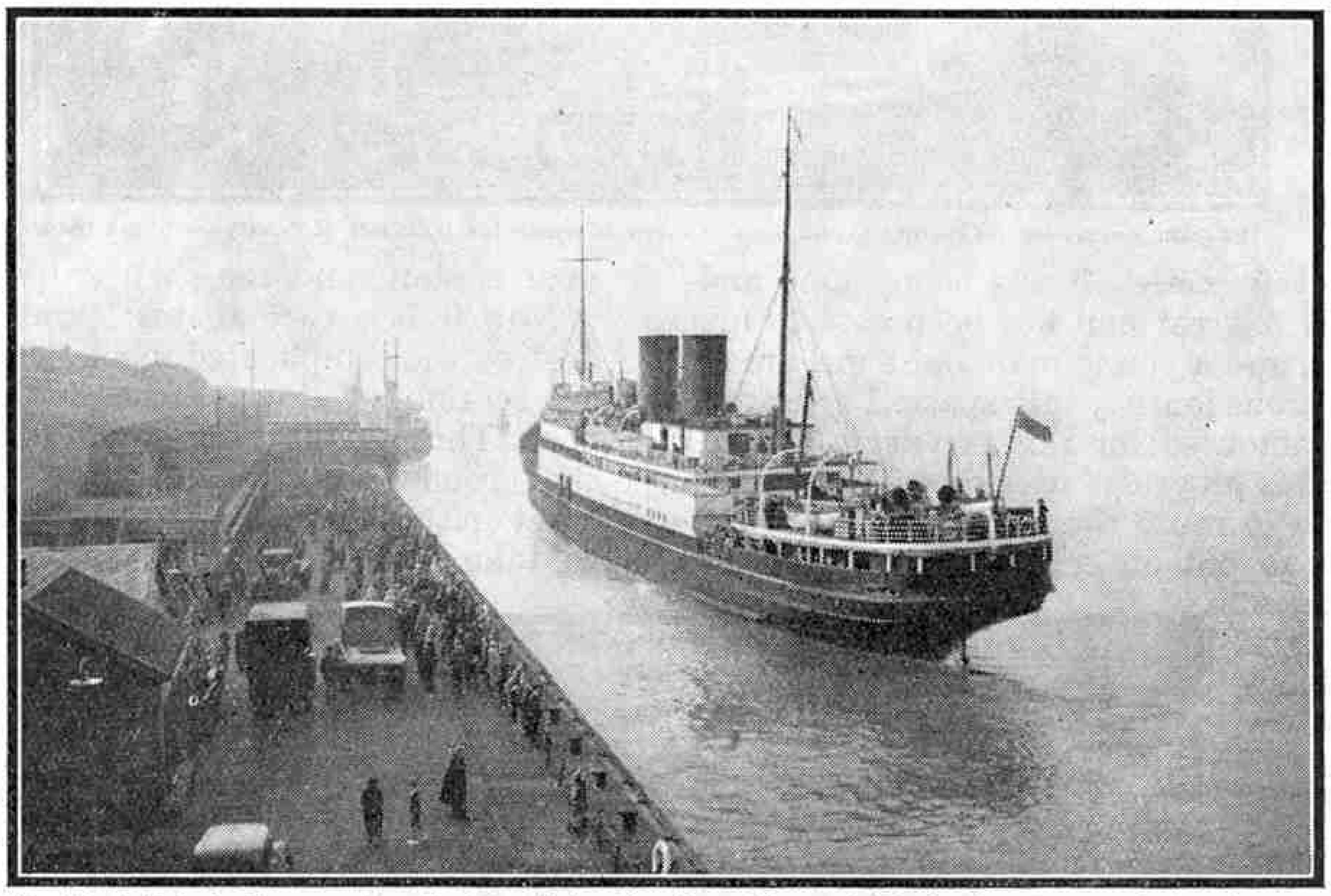
Fine Work by Veteran Steamer

By O. S. Nock, B.Sc., D.I.C.

A CHAIN of unusual circumstances combined to make this cross-channel trip of the most exceptional interest. In the ordinary way the night Irish steamers sail from Liverpool landing stage, and the simultaneous departure, at 10.15 p.m., of the Belfast and Dublin boats provides the fascinating spectacle that I described when writing of the *"Ulster Queen"* in the *"M.M."* for October 1935. On this occasion, however, the Cunard White Star liner *"Samaria"* was sailing from the landing stage at about 10 p.m., and so the Dublin steamer left from Gladstone Dock, three miles down the river and right opposite New Brighton.

I was interested to find that our ship was the *"Lady Leinster,"* whose departure from Liverpool I had previously watched from the bridge of the *"Ulster Queen."* She was berthed in the most southerly branch of the dock, and although it was after 10 p.m. there was still sufficient light to distinguish the colour of her funnels, that brilliant grass green that gives the British and Irish Steam Packet Company's ships such a distinctive appearance. The Gladstone Dock is used principally by the Canadian Pacific and Cunard White Star lines, and berthed just ahead of the *"Lady Leinster"* was a 16,000-ton C.P.R. liner, the *"Montcalm."*

It was just before the Whitsun holidays, and traffic for Ireland was extremely heavy. Most of the connecting trains were running in duplicate, and it was well after our advertised departure time when the last of the vans bringing passengers' luggage raced up alongside the berth. When I met Captain Hawkins on the bridge a few minutes later he sounded a note of tremendous enthusiasm. "She's the finest vessel on the British coast" were almost his first words to me, and the *"Lady Leinster"* went a long way towards justifying such a claim by making a magnificent crossing.



The "Lady Leinster" approaching the Prince's Landing Stage, Liverpool. The landing stage is afloat, and vessels can berth alongside at all states of the tide.

She is not large as cross-channel ships go, for her gross tonnage is only 2,284, but she draws a good deal more water than most vessels of her class and consequently travels more steadily in rough weather. She was built no less than 24 years ago, for the Belfast Steamship Company, and bore the name *"Patriotic."* For the bulk of her career she has worked on the Liverpool and Belfast service, and it was only a few years ago, when the new motorships *"Ulster Monarch," "Ulster Queen"* and *"Ulster Prince"* were commissioned, that the older steamers were transferred to the Dublin route.

It was 10.53 p.m. when the gangways were let down. We were berthed very close to the *"Montcalm,"* and our bow had to be worked away from the quay very carefully; but an even more tricky piece of navigation awaited us at the dock entrance. The lock leads out into the river in a direction almost due south, and coming out of No. 1 branch of the dock there is very little space in which to swing the ship round. The big liners are of course always assisted by tugs, but Captain Hawkins had to rely entirely on manœuvring with the engines. We slipped quietly past the *"Montcalm"*—although not a big ship by modern standards she towered above us—and a moment later were heading straight for a jutting-out corner of the dock wall near the lock gate. For a few thrilling seconds it seemed as though we must collide, but then both engines were put full astern, the ship was pulled up within a few feet of the wall, and the starboard engine put full ahead. The *"Lady Leinster"* swung beautifully in the confined space, and a few minutes later we were safely in the lock.

"It's the only way, with a north wind," the Captain explained. "You've got to let her go right up to the wall, then"—with most expressive gestures—"pull her up sharp and swing her round!" The lock is big enough to take the largest liners that come to Liverpool, and it was no less than twenty minutes before we were lowered to river level. During this time our progress was in the care of a dock pilot who was shouting orders from the quayside through a megaphone. At last the gates ahead of us were opening; the pilot gave the orders necessary to get us under way again, and then finally . . . "Half-ahead port." A pause, then "Half on both. Good night, Sir!"

"Good night!"

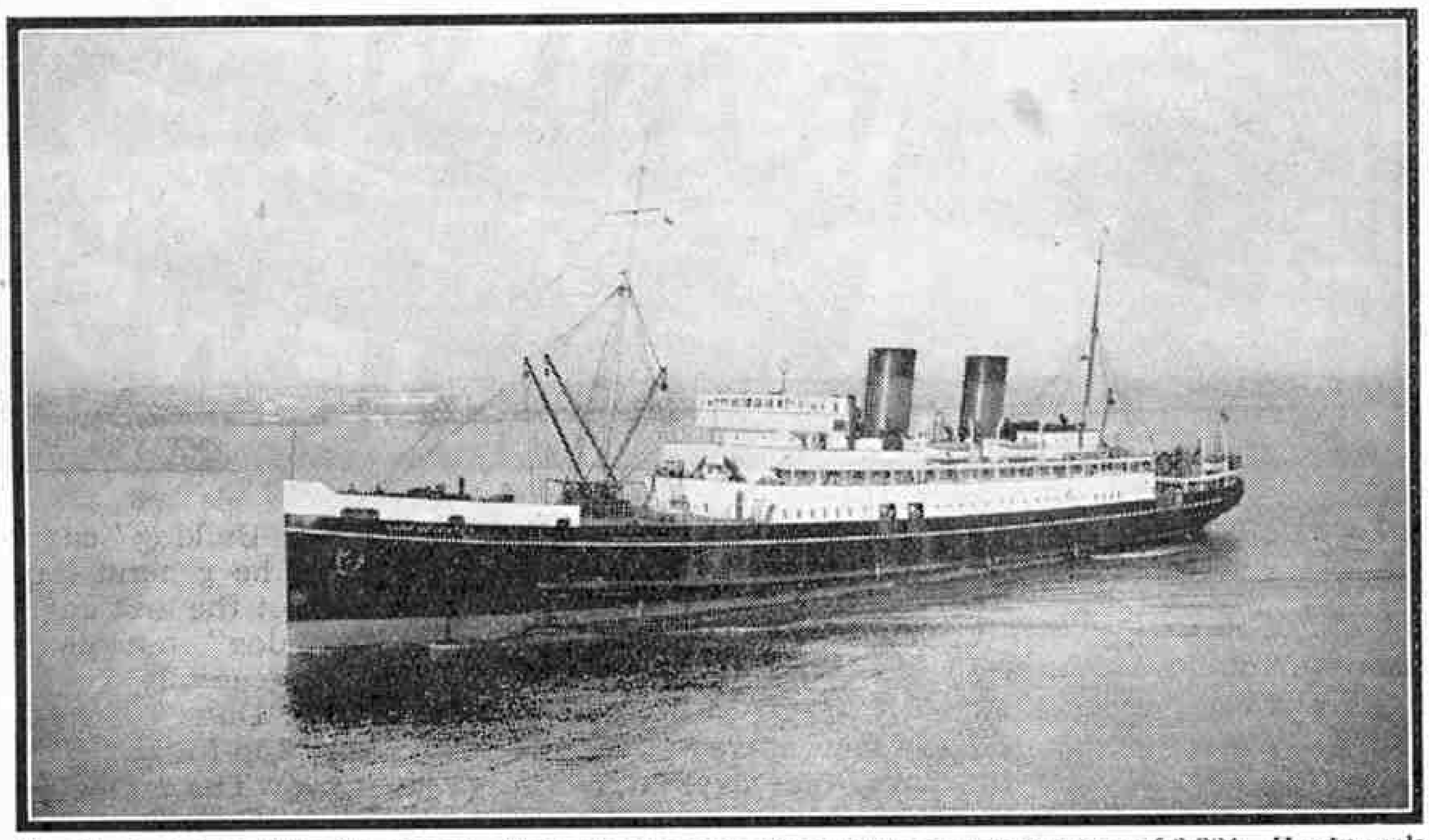
So we steamed out into the Mersey. It was 11.22 p.m. when we left the lock, and by the time we had described a complete semi-circle and were heading north past New Brighton it was fully an hour later than if we had left the landing stage on time at 10.15 p.m. Timekeeping is of no little importance on this service because the boat connects at Dublin with two important expresses of the Great Southern Railways, the 7.0 a.m. English Mail to Cork, which also serves Killarney and the south-west, and the 7.20 a.m. "Limited Mail" to Galway. So every effort was made to regain lost time, and the *"Lady Leinster"* was soon doing a good 19 knots.

As we threaded our way down the ever-fascinating channel that leads out of the Mersey, between the long line of flashing buoys, Captain Hawkins talked of his experiences and of the healthy rivalry between the Dublin and Belfast boats. He told how one night the two ships left at exactly the same moment, and after manœuvring from the quayside came abreast of each other in the river. Then—"I rang down to the Chief: 'The *Ulster Queen's* just level with us. Let her have it.'" I can quite imagine how the challenge was taken up in the rival ship, and Captain Hawkins went on to tell how they raced neck and neck almost to the Crosby lightship. But there the *"Lady Leinster"* put on a tremendous extra spurt, was first at the turn, and afterwards led the way to the Bar Light, where their courses diverged.

* * * *

I went down to the engine-room shortly after we passed the Formby Lightship. The *"Lady Leinster,"* in contrast with most cross-channel ships, is driven by a four cylinder compound triple expansion steam engine. There is one high-pressure cylinder, one medium-pressure, and two low. One screw is driven by the two low-pressure cylinders, while the other is driven by the high and medium. The cylinders are placed vertically above the crankshaft, just as in the latest marine oil engines; but with only four cylinders to drive the ship they are necessarily very big. I was interested to see that the valves were operated by the Stephenson link motion, which at one time was almost universally used on British locomotives; in the case of the *"Lady Leinster,"* however, the valve gear is so tremendously heavy that a small subsidiary engine is necessary to reverse the main engines.

The working of this triple expansion compound engine makes a most interesting comparison with that of a railway locomotive. All four cylinders have a stroke of 36 in., the high-pressure cylinder is 21½ in. diameter, the medium pressure 35 in., and each of the low-pressure no less than 41 in. diameter. Such dimensions put in the shade even the greatest of American locomotives. Speed is controlled entirely by the regulator, which is operated by the usual form of horizontal wheel. There is no need in a ship for adjustment of the point in the piston stroke at which steam is cut off; on a railway, with rising and falling gradients, the output of power required from the engine is constantly varying, but at sea it is quite steady. In the *"Lady Leinster,"* steam is cut off after the piston has travelled 65 per cent. of its stroke in the high-pressure cylinder, 70 per cent. in the medium, and 55 per cent. in each of the low-pressure cylinders; this is equivalent to about 20 per cent. in a simple engine, so that the steam is very thoroughly expanded. Piston valves are used on the high and medium-pressure cylinders, but the low-pressure are fitted with double port slide valves.



The "Lady Leinster" in the Mersey. This cross-channel steamer has a gross tonnage of 2,284. Her funnels are green with black tops.

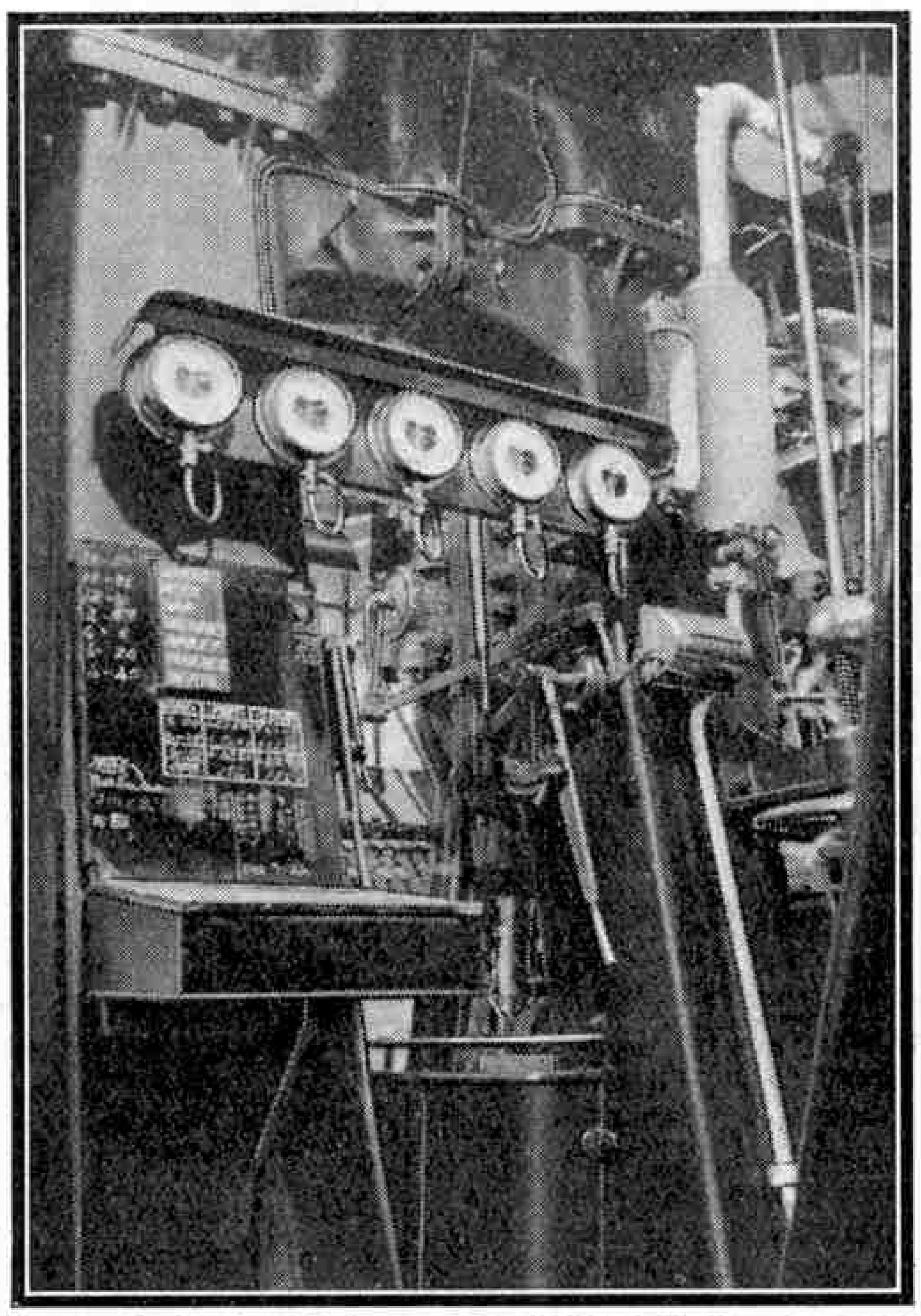
A reciprocating steam engine at full speed is a thrilling sight. Even when riding on the footplate of an express train you never get an opportunity of standing close to the pistons and connecting rods, but on the control platform of the *"Lady Leinster"* you are right between the two pairs of cylinders. At 19 knots the crankshafts are making 160 revolutions per minute, and the huge rods are flying up and down, a mass of shining steel almost too rapid for the eye to follow. There is surprisingly little noise—the bulk of what there is comes from the pumps—but the atmosphere is thick with the all-pervading smell of hot oil.

Just ahead of the main engine room are the boilers. The furnaces are oil fired, and about 24 tons of fuel are used in making the crossing. They use a very thick black treacly oil that is the residue after petrol and higher grades have been distilled off, but with the efficient type of burner fitted it is a first-rate steam raiser.

The *"Lady Leinster's"* engines develop about 6,500 horse power. Comparing this with the 16,000 horse power of the L.M.S.R. ships on the Holyhead-Dun Laoghaire mail service, the disparity seems incredible, but it is a remarkable example of the price you have to pay for speed at sea. The L.M.S.R. boats of course have a tonnage of 3,500, but the difference in speed, 23 knots as against 18 to 19, does not seem much at first sight. But even in a ship of the *"Lady Leinster's"* size to increase speed by one knot means developing an extra 1,000 horse power! An even more striking fact was emphasised at the time of the *"Queen Mary's"* maiden voyage; with a modern giant liner, to increase speed from 30 to 35 knots would mean putting in engines of exactly double the power!

* * * *

When I came up on deck again we were just off the north coast of Anglesey. After passing the Bar Lightship our course is almost due west right across the Irish Sea, and although the strong north wind was catching us heavily, the *"Lady Leinster"* rode as steadily as though she were steaming in quite sheltered waters. Vivid stabs of light to the south showed the whereabouts of the Skerries lighthouse, just to the north of Holyhead; we passed abeam at about 3.0 a.m. and a rough calculation showed that we were picking up lost time well and should, with reasonable luck, make our connections in Dublin safely.



A view in the engine room, showing the medium pressure cylinder. The small lever like a locomotive regulator is for operating the reverse engine. The log of the trip is chalked on the cylinder wall.

After passing the Skerries I turned in for a while, but was on the bridge again shortly after 5 a.m. It was a grey stormy morning. A great bank of leaden clouds hung in the west, effectively veiling the Irish coast; small detached rain clouds were racing across the sky and the sea was a heaving mass of greyish-green and white. Far away to the south-west was the L.M.S.R. mail steamer heading for Dun Laoghaire and leaving a trail of black smoke that in the damp air hung, so it seemed, fo rmiles behind. Watching her through the glasses I was soon able to pick up the Kish lightship, by which she passed very close as usual.

We were steaming towards the Howth peninsula, though it was some little time before any land showed up at all. Then gradually the rocky headland called the Nose of Howth took shape out of the shroud of rain, and at the same time a clearing in the sky revealed the Wicklow Mountains away to the south. Soon the whole coastline of Dublin Bay was visible; we watched the mail steamer turn into Dun Laoghaire harbour, and a long rift of clear sky away in the west silhouetted the towers and spires of the city itself.

We had passed abeam of the Kish at 5.42 a.m., and although the *"Lady Leinster"* had come at a great pace it was still touch and go as to whether our connections would be made. We passed within half a mile of the coast at Howth Head, getting a fine view of the lighthouse that is built right out on the extreme nose of the rocks. This lighthouse is called the Bailey. The hills on the south side of the bay were now looking very fine; a shaft of early morning sunshine was glinting on the water just off Dalkey, and with the glasses I could pick out every detail of Dun Laoghaire harbour. In the meantime the heavy rain clouds were slowly rolling up the slopes of the Dublin Mountains, and the westernmost summits stood out sharply against the sky.

The channel leading into the river Liffey is bounded by two very long breakwaters. As we reached the entrance speed was reduced to one half, but our race was practically won, for it was barely 6.20 a.m. The sky was rapidly clearing, and although isolated squalls of rain were still sweeping across from the north-west, the reft clouds in all directions showed patches of brilliant blue. As you draw nearer the city the prospect develops into a curious mixture of elegance and gaunt industrialism. Near at hand are the electricity works and, just upstream, what is surely the world's most colossal gasometer; farther ahead is the magnificent classical pile of the Custom House, and beyond that the famous tower of the Four Courts.

We were now approaching the quay at North Wall. In the ordinary way the steamer is swung round in the river, but to save time Captain Hawkins decided to berth at once with the bow pointing upstream. So we rode straight up to the quayside, and at 6.43 a.m. the gangways were run across. Fully 47 minutes of lost time had been made up, and our passengers were able to catch their various trains with time to spare!

As soon as all these early passengers were ashore, the gangways were let down again and the ship swung round. I went down to the engine room to watch this operation. Telegraph signals from the bridge came very rapidly; the Chief and the Second Engineer with deft turns of the regulator wheels adjusted the steam pressure to give the speeds required on the port and starboard engines. Changes in direction were frequent, and I was astonished to see how quickly the valve gear was shifted and how silently the main engines restarted; but when one engine was going ahead and the other astern the effect when seen from a short distance away was odd in the extreme!

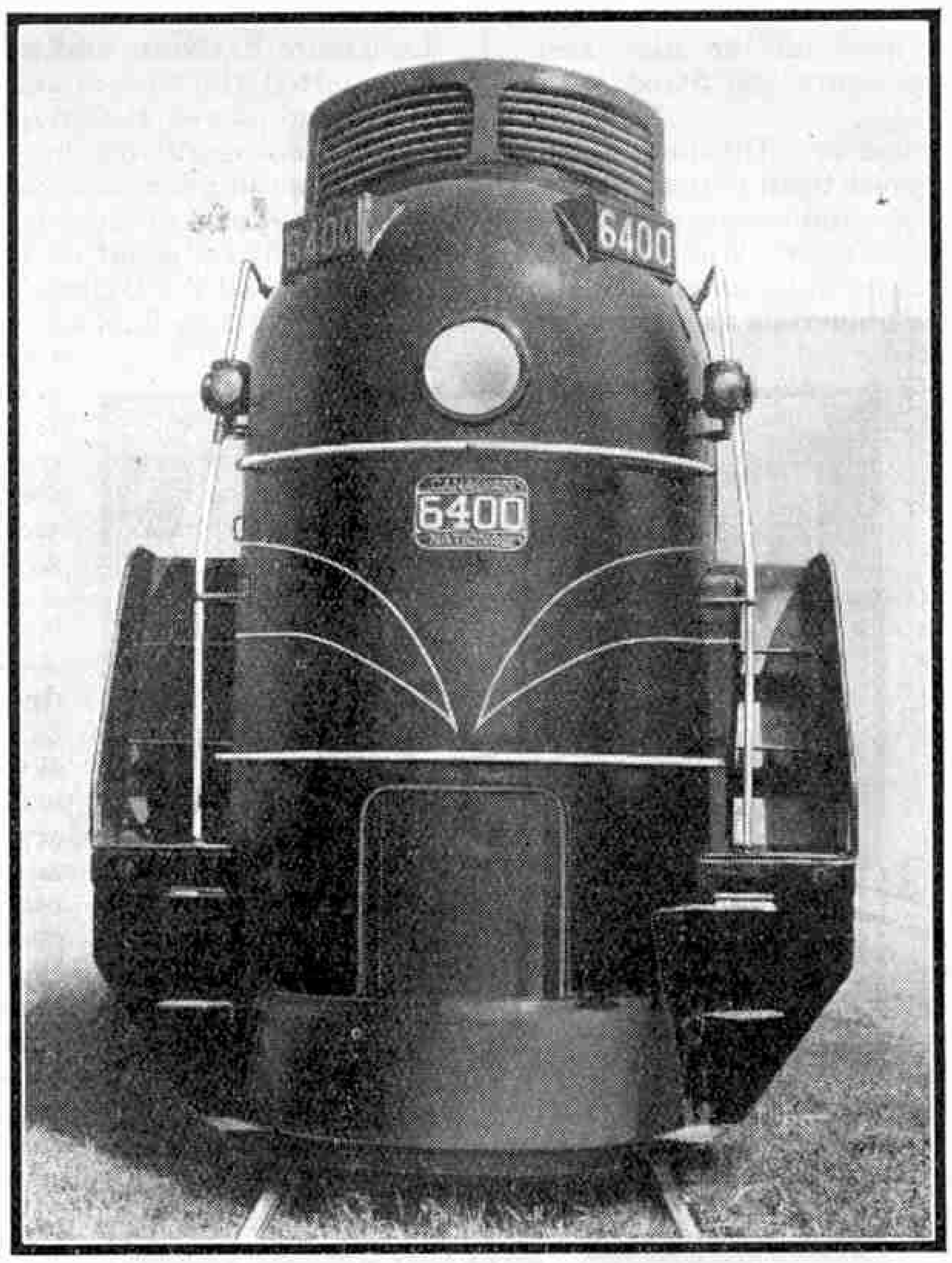
Canadian National Streamlined Locomotives

Locomotive streamlining has been introduced in Canada with the building of five new 4–8–4 engines for the Canadian National Railways by the Montreal Locomotive Works. These are the largest streamlined locomotives in the world. The outward form adopted was developed by the National Research Council at Ottawa in collaboration with officers of the C.N.R. Motive Power Department after a series of wind-tunnel tests, and the photograph reproduced on this page shows in a striking manner how all the familiar front-end features have been concealed beneath the streamlined casing. The pilot or "cow-catcher" is absent, for the rounded front extends to within a few inches of the rails, and the automatic coupler fitted to the front of the engine disappears behind a door when not in use. All pipes formerly exposed are covered by a casing that extends from the smoke-box to the cab of the engine at the usual running board level above the driving wheels, but the wheels and the running gear are left exposed for easy inspection.

The chimney, bell and other boiler-top equipment except the whistle are concealed in another casing running along the boiler from the smoke-box front to the cab. This casing has a louvred front end with the object of inducing a draught when the engine is running to throw the smoke and steam from the chimney well upward and clear of the cab and train. The front window on the right-hand side of the cab is of a special type consisting of a disc of high-grade glass, which revolves at a very high speed and gives clear vision to the driver.

The new engines, Nos. 6400-6404, have been given a striking appearance by the adoption of a new colour scheme. The front and smoke-box of the engine and the wheel centres are black. The cab, the running board apron and the tender are the same shade of green as C.N.R. passenger stock, with gold lining. The wheel rims are aluminium in colour, and the boiler and casing above it are of unpainted planished steel that has merely to be wiped with oil to retain its natural blue-grey colour. The number of the locomotive appears in bronze on a red background on the running board apron, and the familiar tilted "label" bearing the words "Canadian National" appears on the tender sides, gold lettering being used on a red background.

These giants are intended for use between Montreal, Toronto and Sarnia on the route of *"The International Limited."*



The striking front end of the first Canadian streamlined locomotive. Photograph by courtesy of the Canadian National Railways.

The "Earl" Class on the G.W.R.

Ten 4–4–0 engines named after various West Country Earls have been added to the series of G.W.R. locomotives that bear distinguished titles. Although the four-coupled locomotive was pronounced obsolete for main line express work on the G.W.R. some years ago, and such famous 4–4–0s as the "Cities" and "Counties" have all been withdrawn, there is still much work for which the "mixed traffic" type of 4–4–0 of moderate weight and with wheels of medium diameter is suitable. This is especially so on the hilly routes in Central Wales and on the Cambrian Coast, where weight restrictions apply.

On the G.W.R. this 4–4–0 type of locomotive originated with the "Duke" or "Devon" class in 1895, and was developed in the "Bulldog" series. Now that it has become necessary to replace many of these engines, the opportunity has been taken to evolve the "Earls." These engines conform to the traditional type of G.W.R. 4–4–0 with outside frames, for they incorporate certain usable parts from "Duke" and "Bulldog" engines now broken up. Briefly the general impression of the appearance of the first engine completed is that "Bulldog" outside frames and running gear generally have had mounted on them a "Duke" domed boiler, but without the top-feed apparatus.

The cylinder and boiler dimensions of the "Earls" correspond to those of the "Dukes," and as the working pressures and driving wheel diameters are the same the tractive efforts are identical. The total weight of an "Earl" is 49 tons in working order, or nearly 2 tons more than that of a "Duke." The tenders provided are of the 3,500-gallon type and accommodate 6 tons of coal.

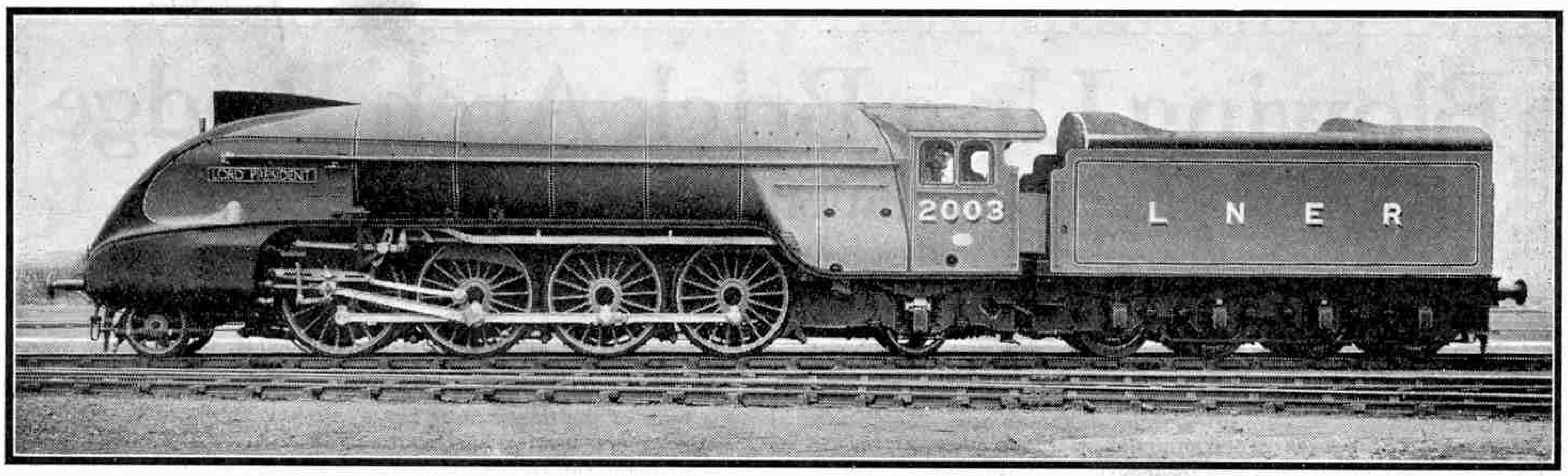
As might be expected, the engines have a somewhat Victorian appearance as compared with modern designs, and the building of small 4–4–0s will no doubt come as a surprise to many G.W.R. enthusiasts. The "Earls" have however been produced to meet the special requirements of the routes over which they are to run and represent an interesting instance of the economical use of material.

The first 10 engines thus dealt with are Nos. 3200-09, and they bear the following names:—*"Earl of Mount Edgcumbe," "Earl of Dunraven," "Earl of Dudley," "Earl Cawdor," "Earl of Dartmouth," "Earl of Devon," "Earl of Plymouth," "Earl of St. Germans," "Earl Bathurst," "Earl of Radnor."*

Diesel Railcars for L.P.T.B.

The London Passenger Transport Board has placed an order for two A.E.C. Diesel-engined railcars generally similar to those of the same make that are in use on the G.W.R. They are to be employed between Chesham and Chalfont, where one of the G.W.R. vehicles was given a trial last March, as it was completed a little before it was actually required by the G.W.R. The introduction of these cars will enable additional connections to be made at Chalfont with main line trains to London, without interfering with existing through services from Chesham to Baker Street and Marylebone.

Each car, driven by two 130 h.p. 6-cylinder oil engines, will seat 70 passengers and will incorporate such safety devices as dead man's handle control, automatic brake trip cock gear and air-operated doors. An interesting variation from the standard equipment of the G.W.R. cars will be the fitting of standard L.P.T.B. automatic couplers. These cars will be the first Diesel railcars to be put into service by the L.P.T.B.



Speeding by a "Sandringham"

The latest "Sandringham" class engines that have recently taken over the hardest duties at Leicester (G.C.) shed are putting up some remarkable work. On the 6.20 p.m. from Marylebone No. 2849, *"Sheffield United,"* in the able hands of Driver Newall and Fireman Lees, recently made some brilliant running with a 9-coach train weighing 310 tons tare and 325 tons loaded. Northolt Junction was passed on time in 17 minutes from the start, and then No. 2849 went up the 1 in 175 of Gerrards Cross bank at 56 m.p.h. After slacking to 35 m.p.h. through High Wycombe and taking the ascent to Saunderton at a steady 50 m.p.h., Driver Newall completely eclipsed his previous fast running with Atlantic No. 5363, described in the June *"M.M.,"* by averaging 76.7 m.p.h. over the 15.3 miles from Princess Risborough to Grendon, with a top speed of 85 m.p.h. So Finmere, 59.0 miles, was reached in 63½ minutes.

On the next stage, to Woodford, the maximum was 74 m.p.h. at Culworth Junction, and then came a thrilling finish. Speed rose to 85 m.p.h. at Braunston, 77 was reached beyond Rugby, and going up Lutterworth bank the minimum speed was 58½. The culminating effort of a superb run was a top speed of 88 m.p.h. on the final descent into Leicester. The 34 miles from Woodford were run start to stop in 32 min. 55 sec., and for 27 miles of this distance speed averaged 73 m.p.h.

This run was recorded by Mr. O. S. Nock.

L.N.E.R. Developments

The L.N.E.R. have placed an order for a new turntable to be installed at Norwich. This turntable will be of the latest design with a diameter of 70 ft. and therefore will be capable of turning the largest engines in service on the line.

A contract also has been placed for the electrification of the new coaling plant to be installed at Nottingham, where the Colwick Locomotive Depot is in course of modernisation. The new plant will have a capacity of 500 tons.

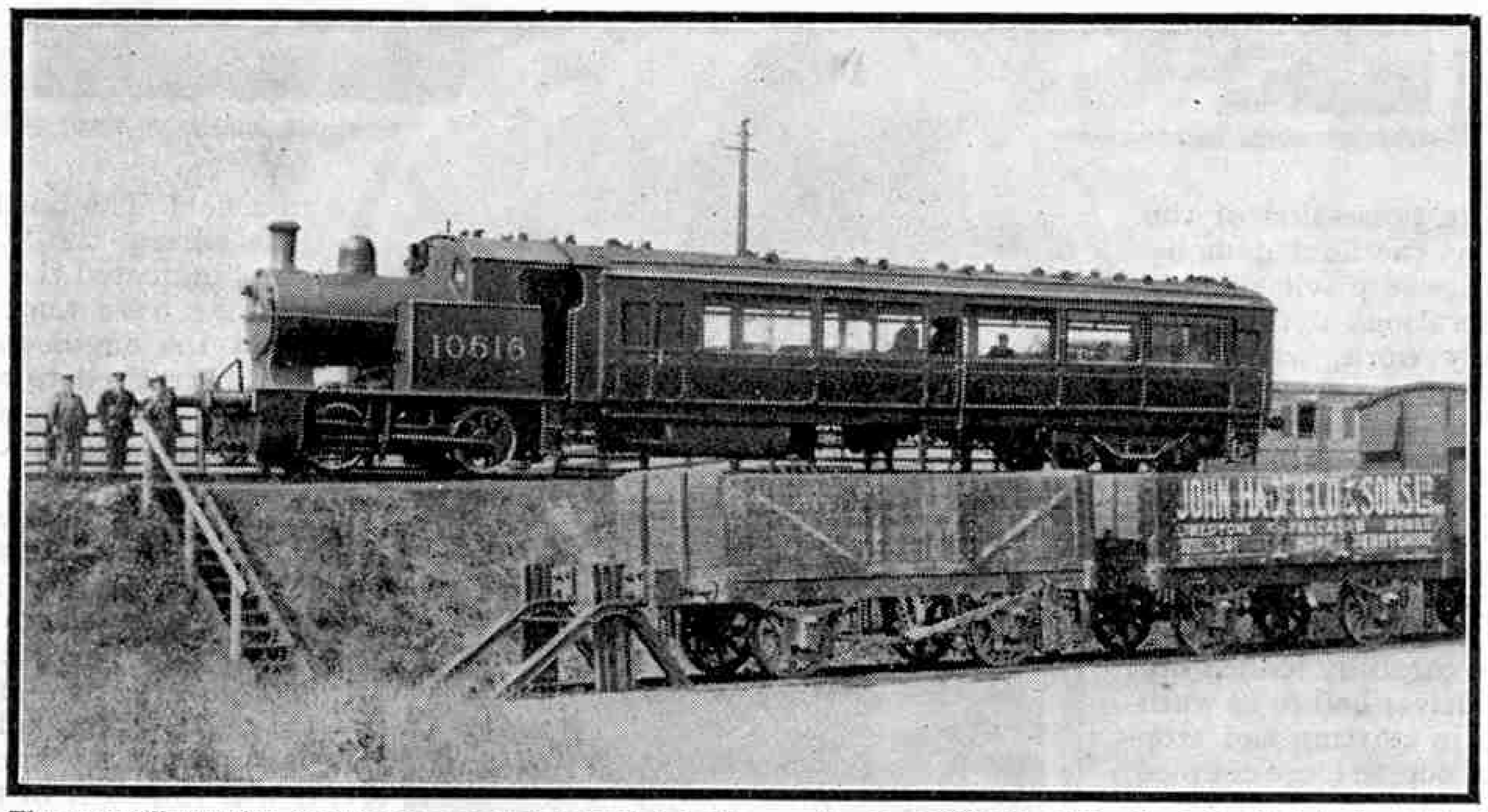
In view of the actual and prospective activity in the coal, iron and steel trades the L.N.E.R. recently placed special contracts for the building of 1,800 open goods wagons of 12-tons capacity, 1,400 12-ton hopper coal wagons, and 100 20-ton hopper coal wagons.

An extensive programme of wagon building during the forthcoming year has been approved after a special survey of the existing and prospective conditions in each of the many branches of industry served by the L.N.E.R. This survey has taken into account the withdrawal of a number of existing wagons not of the most modern design, and provides for the construction of 7,550 open goods wagons, 300 of which will be specially suitable for the conveyance of road-rail containers. It includes 430 covered goods wagons all of which will be fitted with the continuous brake, and 150 special wagons for the conveyance of the increasing fish traffic. There also will be 1,265 bolster wagons for the conveyance of iron, steel and timber traffic, of which 15 will be of a special design for the conveyance of exceptionally long girders and steelwork up to 90 ft. in length. In addition 700 new cattle wagons, 1,600 coal wagons and 14 special trolley trestle wagons for the conveyance of exceptional loads are to be constructed, and other items include 250 goods brake vans, 59 horse boxes of modern design, and 300 large covered containers.

L.M.S.R. "Bedrooms on Wheels"

Composite sleeping cars of the most up-to-date design have recently been put into service from Derby Works. The underframes and six-wheeled bogies are built up of rolled steel sections and electric arc welding is used instead of riveting. The body structure forms an integral part of the underframe and welded steel members enter very largely into its construction. The outside panels are of steel sheets. Special measures have been taken to eliminate noise, the vehicles running on wooden-centre wheels of Mansell type. The heating, lighting and ventilation have been the subject of special attention.

The number of new cars is 13. Each accommodates six first class and 14 third class passengers, and there is also an attendants' compartment. A distinctive external feature is that the hot air and cold air distributing ducts of the ventilating system are carried outside the roof of the vehicle.



The upper illustration on this page shows L.N.E.R. 2-8-2 locomotive No. 2003 "Lord President," which is streamlined in a similar manner to the "Silver Link" series of "Pacifics." Photograph by courtesy of the L.N.E.R. The lower photograph, by H. C. Casserley, shows one of the few remaining rail-motor vehicles of the combined engine and coach type. This L.M.S.R. unit was built by the former Lancashire and Yorkshire Railway.

Unusual Loads

A chain measuring over a mile (1,895 yards) was recently moved by rail from Cradley Heath to Millbrook. It was loaded on to four close-coupled open goods wagons, enough slack being allowed between the wagons to permit of tension on the drawbars during conveyance. The chain links were 6 in. long, 3¾ in. wide and 1⅛ in. in diameter.

A Georgian red brick house, Brooks Hall, Ipswich, and the furniture and effects in it have been moved from Suffolk to Somerset by rail, seventeen wagonloads of bricks and masonry, fruit trees, bins and outhouses, and four container loads of furniture travelling from Ipswich Station to South Cheriton. The Hall has now been re-erected, and this is believed to be the first occasion on which a complete house and its contents have been transported by rail.

The *"Green Arrow"* Freight Service

The *"Green Arrow"* system for freight was introduced by the railway companies for the purpose of speeding up traffic. Delivery is in accordance with a pre-arranged schedule. It is generally effected next day, but this is not guaranteed, as was inadvertently stated on page 452 of the *"M.M."* last month.

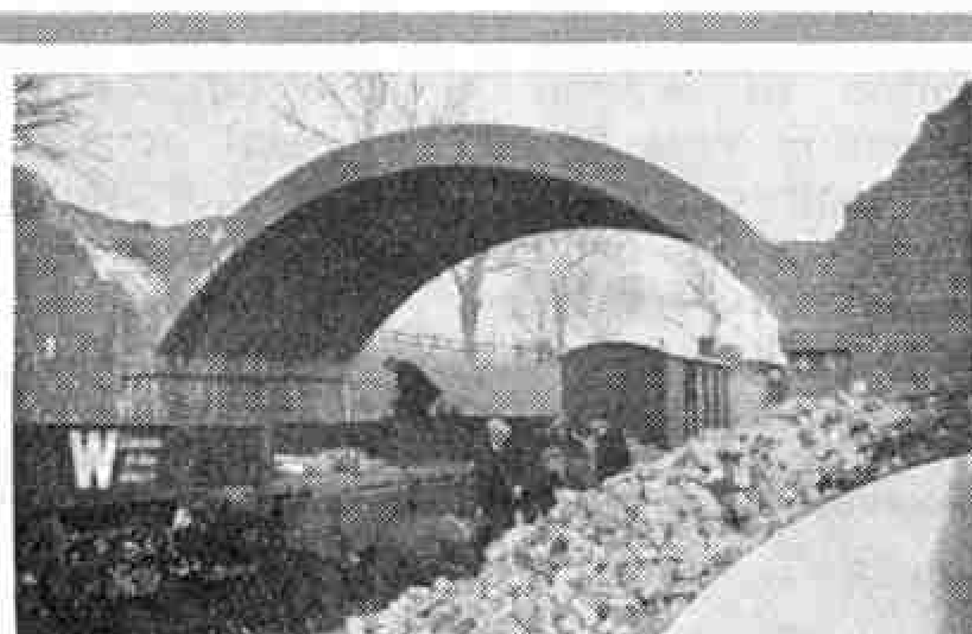
Blowing Up a Brick Arch Bridge

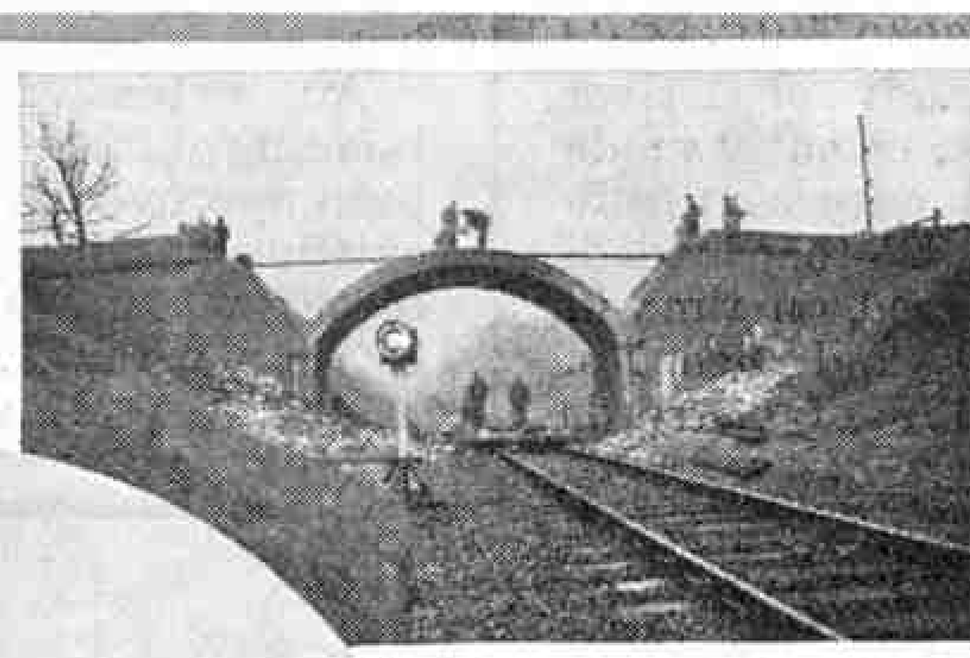
Novel Operation on the G.W.R.

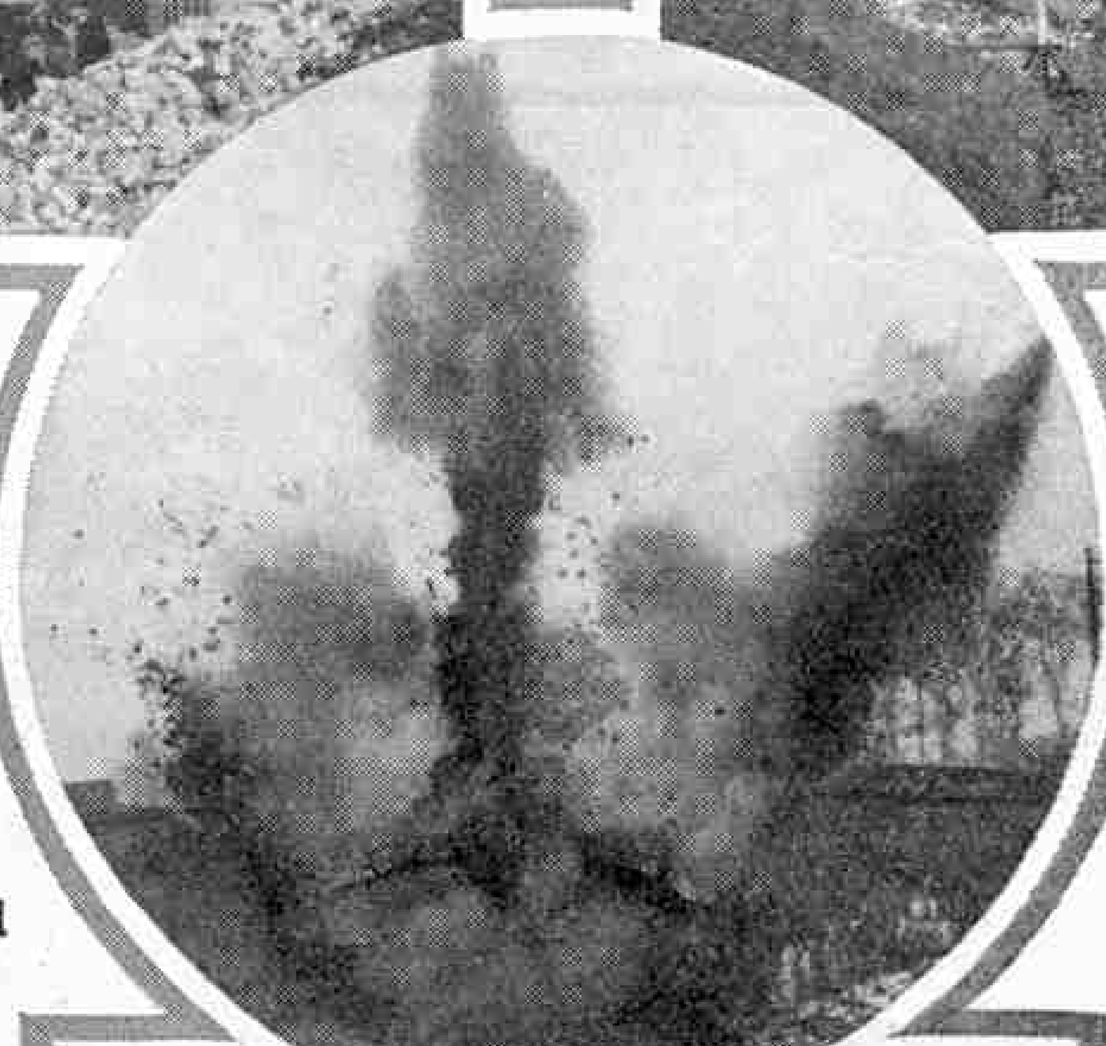
By a Railway Engineer

AN engineering job of a most unusual kind was carried out recently on the Great Western Railway near Overton-on-Dee, Flintshire. In a shallow cutting on the single line between Ellesmere and Wrexham a single span brick arch bridge was becoming unsafe. It was what is known as an accommodation bridge, provided for the use of a farmer whose land had been severed by the construction of the railway. In recent years the land on one side had been sold and so the bridge was no longer required, and in view of its condition the novel course was taken of blowing it up.

Naturally it was necessary to reduce the amount of brickwork to be demolished by explosion to an absolute minimum, and so the parapets and earth filling were removed before the day fixed for the final operation. This left only the actual arch, but even this contained about 9,500 bricks. The preliminary work had been carried out without any interruption of train service, beyond the necessity of putting on a speed restriction. On a Sunday in April, the engineers obtained absolute possession of the line in order to carry out the final demolition, and on that day I was privileged to witness not only the operations at the site, but also the preliminary work, which in itself was very interesting.







The upper illustrations show the preliminary dismantling and the packing of the explosive charges. The explosion is seen taking place in the central photograph, reproduced by courtesy of the G.W.R., and the result is shown below.

The headquarters of the Divisional Engineer responsible for the job are at Oswestry, and here at 6.15 a.m. the special train was ready. It consisted of a ballast brake van at each end and about a dozen low-sided wagons, with drop-down doors; it was hauled by an old 0–6–0 goods engine. The explosives, 10 lb. of ammonal, were carefully loaded into the rear brake van. The driver had to be warned not to be too violent in starting and stopping, for the train was of course loose coupled; even with the greatest care the rear brake van got plenty of shaking up.

We got away just after 6.30 a.m. A trip in a permanent way brake van can be quite an entertaining experience: only a dim light, from four narrow windows, a small cheery party gathered round the enclosed fire, and all the time the van riding almost as hard as a locomotive. We stopped at Ellesmere to pick up a permanent way gang, and here the engine was run round the train in order that we might proceed in the opposite direction up the Wrexham branch; this joins the line from Oswestry in a trailing junction. At about 7.20 a.m. the site was reached.

Stripped right to the arch, what was left of the bridge had a most singular appearance. The first job to be done on arrival was the packing of the charges. A row of 10 holes 1½ in. in diameter had previously been drilled along each of the lines where the arch joins the abutments; this line is called the springing of the arch. Another double row of 16 holes had been drilled along the crown. These holes were about 12 in. deep, and into each was packed a small charge of ammonal that occupied about half the depth of the hole; the space remaining above the charge was plugged up with clay after the detonating fuse wire had been attached to the charge. While the packing was in progress it was quite a novel experience to clamber up to the crown of the arch, and from rail level those working on the top seemed to be in a precarious position. Two detonators were used, and 18 of the charges were wired up in series to each of these by fuse wire along which the speed of detonation is no less than 40,000 ft. per second.

In the meantime the permanent way gang were making a temporary platform of old sleepers underneath the arch to catch the bulk of the debris from the explosion, and protect the track. The train was now divided, half on either side of the bridge. At the actual point the railway is on a rising gradient in the direction of Ellesmere, and half the wagons, together with the rear brake van, were left on the rising side, with the nearest wagon 150 yds. from the bridge; on the opposite side, the engine drew the remaining trucks away to an equal distance. After the explosion the line would be completely blocked, and the train was divided in this way so that a truck could be brought up on each side of the debris, and the work of clearing up made much quicker.

It took nearly two hours to pack the charges, and then the detonators were wired up by long flexible leads to a small 50-volt portable hand generator that was placed about 100 yds. to the side of the line, in a field. The finishing touches were put to the wiring, the "C" and "T" signs which had indicated the speed restriction past the bridge were removed out of harm's way, and the engineers, platelayers, and spectators retired to a distance of 150 yds. on either side; only the intrepid press photographers and movie camera men ventured nearer than this.

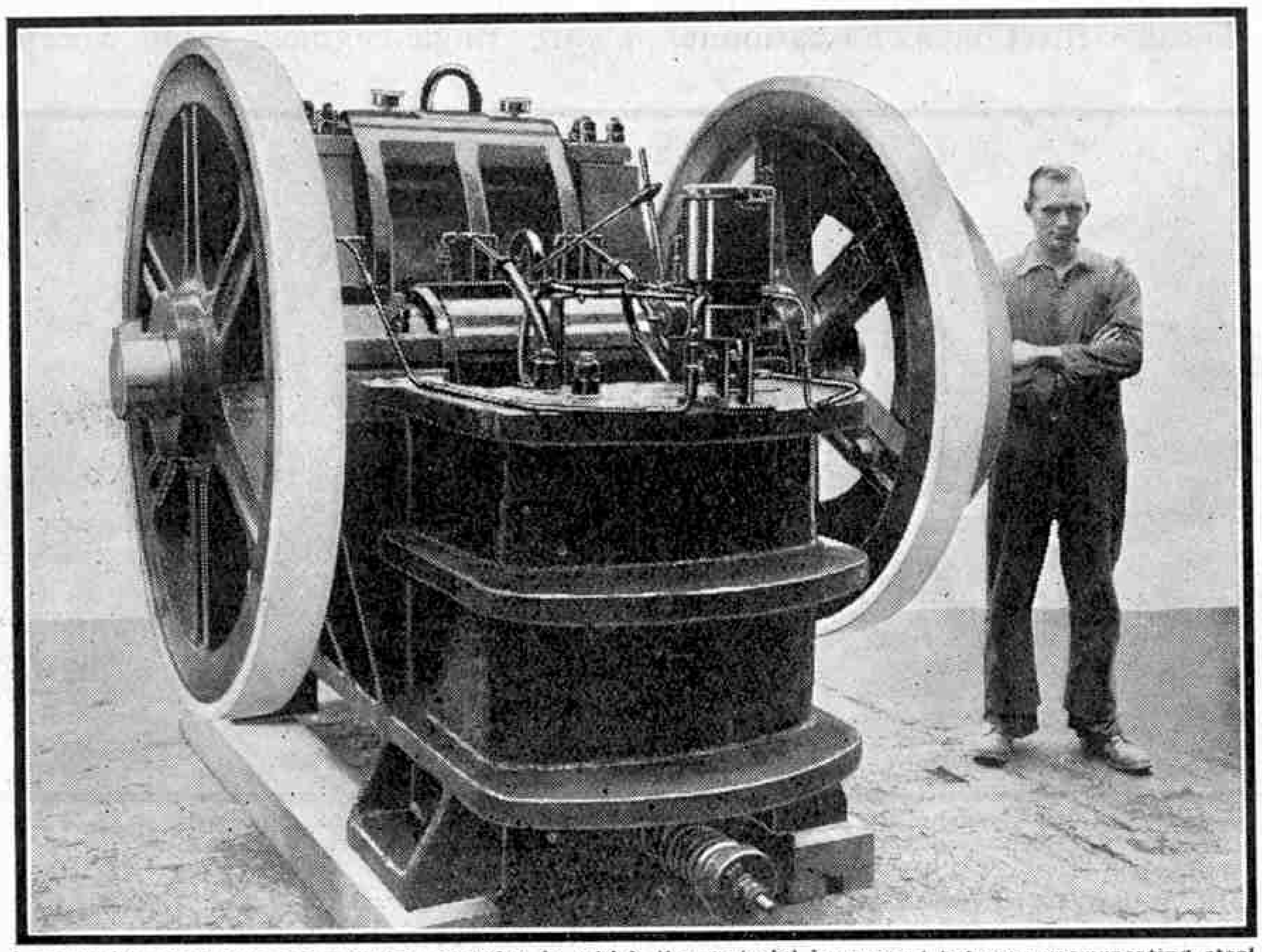
In a few minutes the whole scene was hushed; men talked in whispers. Then—a sharp whistle. For a second the atmosphere was electric, and suddenly came an explosion that shook the ground beneath us, a cloud of dust, and an eruption of bricks like a miniature volcano. It was all over in a few seconds, but one of my most vivid recollections of it was the sight of the photographers calmly filming the event amid a perfect hail of bricks; The explosion was too well done to be really spectacular, however. The bulk of the arch was severed cleanly at the springings and fell solid across the temporary platform, and it was only a very small proportion of the bricks that provided the principal thrill for the spectators. One or two individual bricks were thrown a tremendous distance; one fell right beyond the engine, fully 250 yds. away, and another hurtled down the track in the opposite direction nearly to the far brake van, causing workers to take cover between the trucks.

The speed with which the line was cleared was not the least notable feature of this interesting job. The engine pushed its half of the train up the rising gradient towards the bridge, while a number of wagons were detached from the other half and allowed to run downhill by gravity, though of course a man walked by the side of each one periodically applying the hand brake to keep the speed dead slow. In this way wagons were quickly brought on either side of what was left of the bridge, and it was then a comparatively easy matter to shovel up the bricks from the wooden platform. The explosion took place shortly after 9.30 a.m. and by 11 o'clock the line was clear enough for the train to pass through; if necessary an ordinary train service could have run, for only the final tidying up remained. Every little detail of the operation was of interest, however, as showing the careful organisation that attends the carrying out of an engineering job on a railway.

Powerful Crushing Machinery

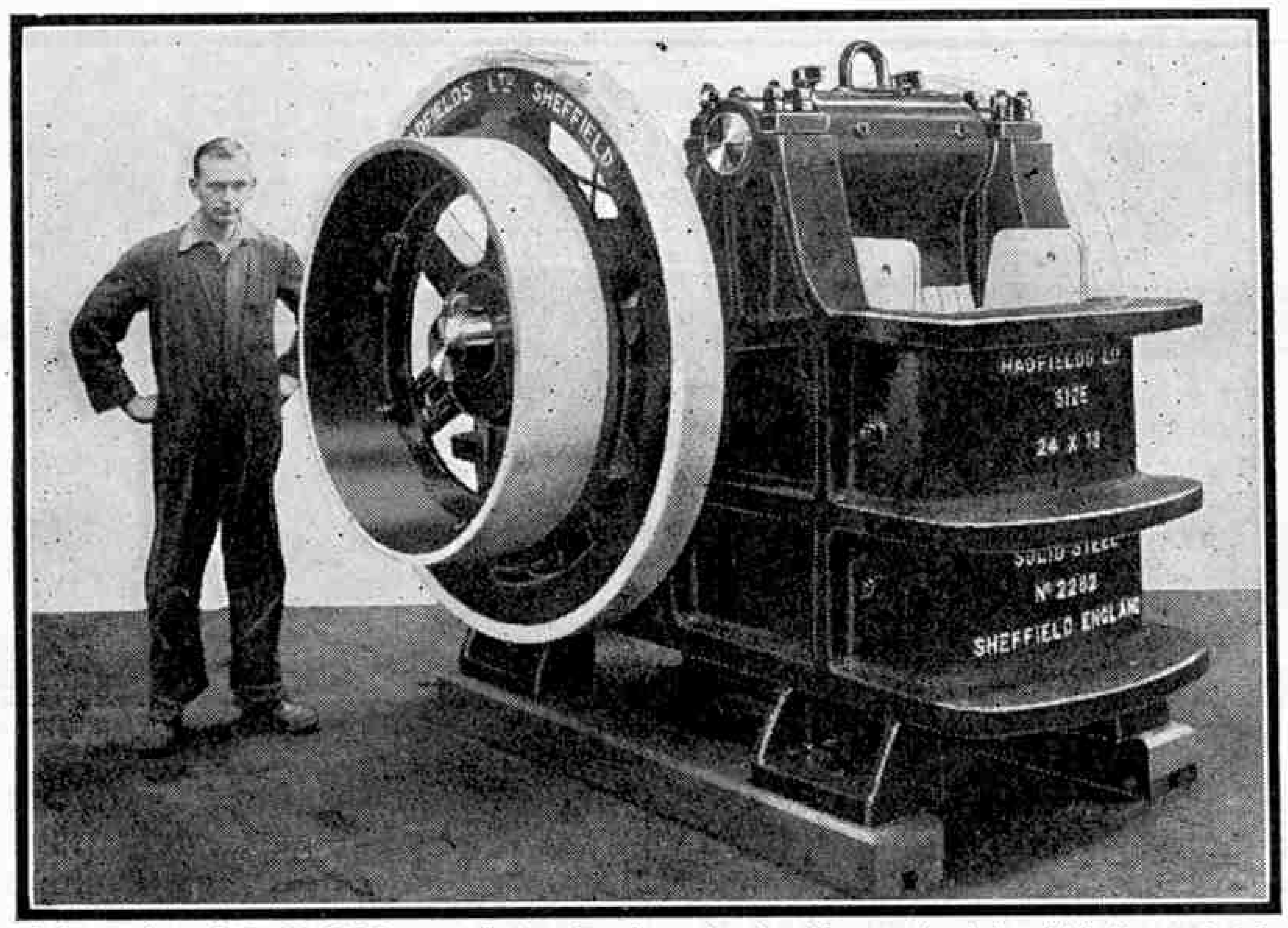
Breaking Up Rock, Stone and Ore

THE equipment used at mines and quarries generally includes powerful machines for crushing rock, stone or ore into pieces of the required size. Various types of machines are available for this work, some of which incorporate a rapidly revolving rotor fitted with swinging hammers, while others have reciprocating steel jaws, between which the stone or ore to be broken up is fed. A machine of the latter type is illustrated on this page. It is made by Hadfields Ltd., of Sheffield, who are probably the largest manufacturers of this class of breaker in this country, and is available in various sizes, the largest of which is capable of dealing with 300 tons of material an hour. The machine shown in the illustration is a 24″ × 13″ machine, the dimensions denoting the size of the opening through which the stone is fed, and it has an output capacity of from 20 to 25 tons of hard stone an hour, when set for 2½″ ring product.



A powerful stone and ore breaking machine in which the material is crushed between reciprocating steel jaws. For our illustrations we are indebted to Hadfields Ltd., Sheffield.

The stone or other material is crushed between a pair of toothed jaws, one of which is fixed rigidly inside the body of the machine, and the other in a swinging holder, or stock, that has a reciprocating motion imparted to it when the machine is in operation. The swing stock is suspended from a strong steel shaft that is rigidly secured at each end to the top sides of the frame and acts as a pivot upon which the swinging jaw rocks when the machine is working. The necessary movement is produced by the action of an eccentric shaft in a pitman, which imparts motion to two toggles situated between the back end of the breaker frame and the bottom of the swing stock. The eccentric shaft is fitted with two fly wheels and is driven by a belt pulley attached to one of these wheels.



A front view of the Hadfield ore and stone Breaker, showing the opening into which the material to be crushed is fed.

Solid steel construction is used throughout and except in the case of very large machines, the frame is made in one solid piece in toughened cast steel. This use of steel makes the machine extremely strong and light in weight for its capacity, features that render these Breakers ideal for portable plants for use in road making and in situations difficult of access, such as are frequently met with in mines.

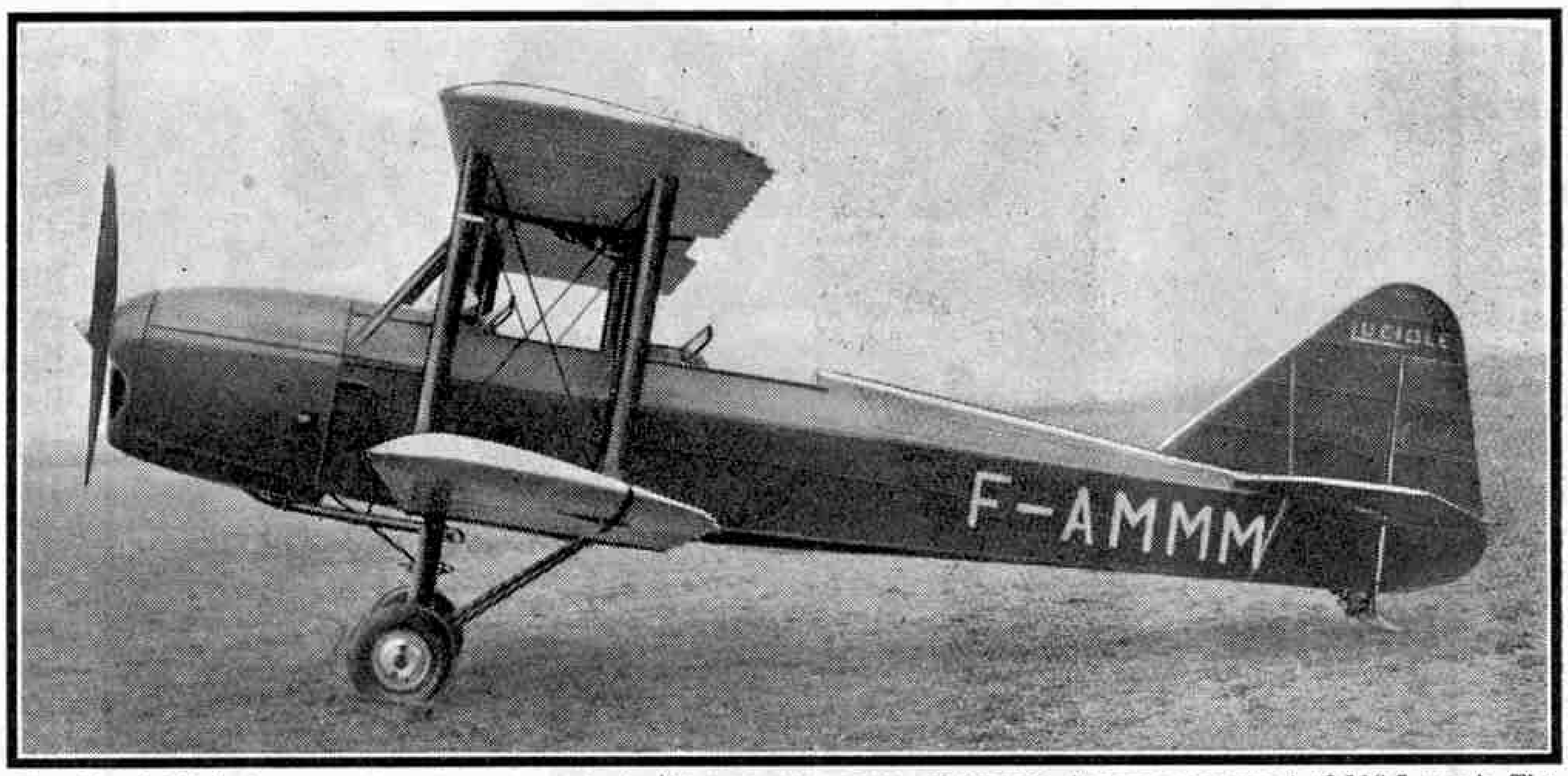
Stone and ores are very abrasive substances and in order to give the crushing jaws and certain other parts of the machine a high resistance to the wearing action of these materials, they are made of special manganese steel. Lubrication of the eccentric shaft bearings is accomplished by a high pressure central feed lubricator, fitted at the back of the machine.

Other types of jaw breakers made by the firm include a double-action machine, in which both the crushing jaws oscillate. This machine is known as the "Shearar" double-action jaw crusher. In it the jaws are driven from separate eccentric shafts, which run at different speeds, with the result that one jaw makes approximately twice the number of crushing strokes as the other in a given period. One of the swing stocks is driven at the top end and the other at the bottom, and the motion of each is controlled by toggles. Adjustments are provided that enable the size of product to be varied at will, and the machine therefore can be used for both fine and coarse crushing.

French Light Aeroplanes

Types of Caudron Machines

THE aeroplanes with which we deal this month are made by the well-known Caudron Company, of France. This company was one of the pioneers of French aircraft and dates back to the earliest days of aviation in that country. Caudron military aeroplanes played an important part during the Great War, but although the firm have produced some interesting military types since then, they have paid more attention to light aeroplanes designed for the use of civilian flying schools, clubs and private owners. These machines range from two-seaters to six-seaters, and although certain structural details patented by the company are common to most of the types, the latter are sufficiently varied to be easily identified.



The "Luciole" is the only biplane produced by the Caudron Company, of France. It has a top speed of 110.5 m.p.h. The illustrations to this article are by courtesy of Societé des Avions Caudron.

The engines fitted in all Caudron aircraft are produced by the Renault Company, who were among the earliest builders of aero-engines in France, and even before the War had become noted for their important part in the development of the air-cooled Vee type aero engine. The Renault engines of Caudron aeroplanes, however, are of the "in-line" inverted air-cooled type, with four or six cylinders.

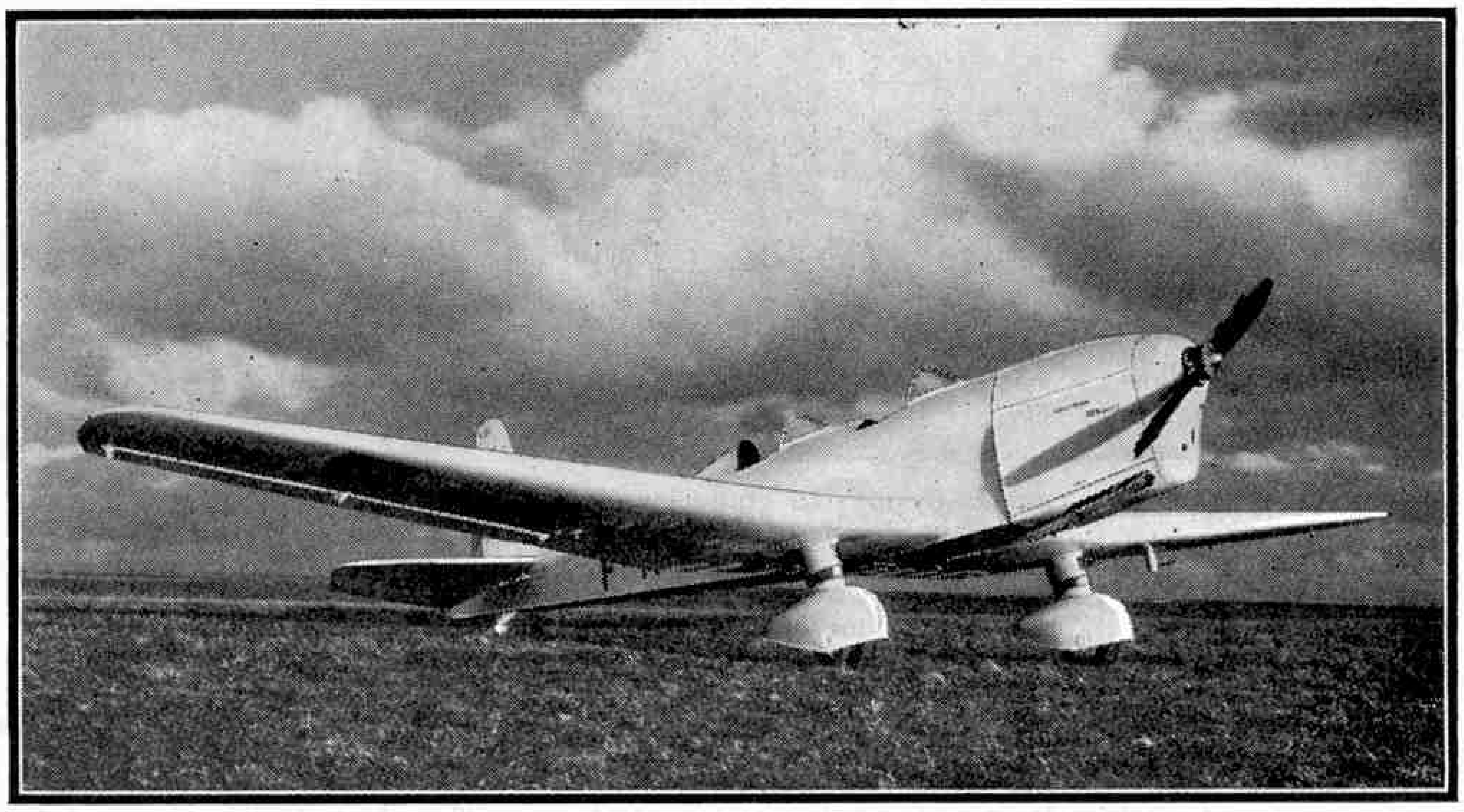
For several years monoplanes have been much more popular than biplanes in France, and the Caudron Company are now engaged almost entirely in producing them. Probably one reason for this preference is that a monoplane gives a much better view than is obtainable from a biplane, which is a great advantage. The absence of the struts and rigging necessary in a biplane, accounts partly for this, and it also lessens the weight of the aeroplane, and the cost of production.

Most of the monoplanes produced by the company are of the low wing type, the only high wing ones being the "Phalène," and two others, the "Fregate" and the "Pelican," that have been developed from it. These three are single-engined cabin aeroplanes. The "Fregate," shown in the lower illustration on this page, is not the usual cantilever monoplane, as the wings are not only attached to the top of the fuselage, but also are supported by four inclined struts fixed at their upper ends to the undersides of the wings and at their lower ends to the bottom of the fuselage. The wings are made of spruce, with a covering of fabric, and can be folded back. Their trailing edges are hinged along the full length, but only the outer portions are used as ailerons, the centre portion being hinged merely to facilitate folding back.

One of the few types of high wing monoplanes made by the company is the "Fregate," shown above. It is a cabin machine with seating for three passengers.

The length of the "Fregate" is 26 ft. 11 in., and its height 6 ft. $11\frac{1}{2}$ in. The fuselage is a spruce structure, with the usual covering of fabric treated to make it weatherproof. The cabin seats three passengers, one near the pilot and the other two on a wide seat that extends across the back of the cabin, as in certain British light aeroplanes. A large door on each side of the cabin gives easy access to the interior. The engine, which is mounted in the nose of the aeroplane, is a Renault "Bengali," with four cylinders in line, developing 140-150 h.p. With this engine the aeroplane has a top speed of 130.4 m.p.h., and cruises at 115 m.p.h. There are two fuel tanks, one inside each wing, and sufficient fuel is carried for a flight of 528 miles. The greatest height to which the aeroplane can climb is 14,760 ft., or almost three miles.

The two other Caudron monoplanes illustrated here are of the low wing type. The "Aiglon" is particularly attractive in appearance, and is an ideal machine for a private owner who does not demand the comfort and protection provided by an enclosed cabin, but nevertheless requires a machine in which he can take a friend for a flight. The two open cockpits, one for the pilot and the other for his passenger, are arranged in tandem, and there are two luggage compartments forward of the front cockpit. The span of the "Aiglon" is 37 ft. 4 in. and the wing is built in three sections, the centre section having the same chord and thickness throughout, while the two outer ones taper in both chord and thickness towards their tips. The spars and ribs of the wing are of spruce and plywood, and those of the centre section fit into special recesses in the underside of the fuselage. Wing flaps are attached to the trailing edge of this section, and ailerons are fitted to the remainder of the wing. The short, rather stumpy legs of the undercarriage are enclosed in streamlined fairings and have balloon-tyred wheels and powerful brakes.



A fine photograph of the "Aiglon," in which the deep fuselage and the thick wing are well brought out.

The engine is a Renault "Bengali-Junior" of 100-112 h.p., and gives the aeroplane a top speed of 133.5 m.p.h. and a cruising speed of 111.7 m.p.h. The service ceiling is 13,120 ft. The fuel tanks are fitted in the centre section of the wing, one on each side of the fuselage, and carry enough fuel for a non-stop flight of 435 miles.

The "Simoun" Caudron low wing monoplane. The curved roof of the cabin gives the machine a humped appearance.

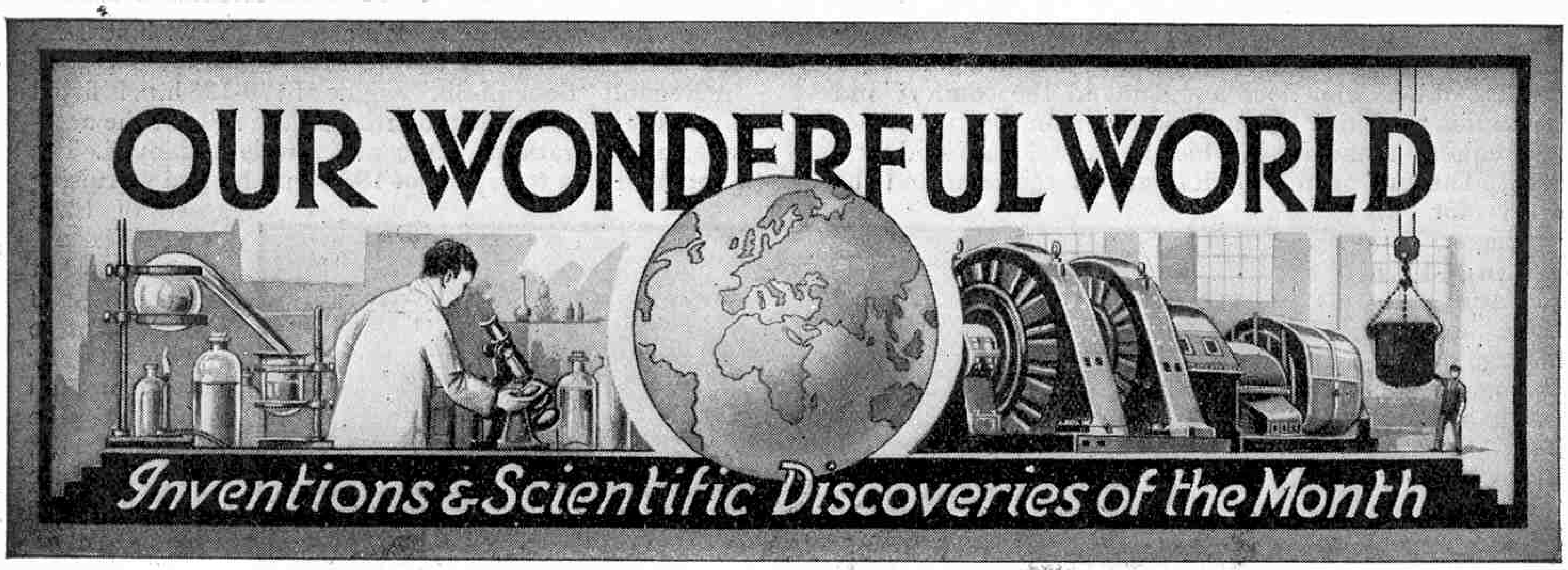
The other low wing monoplane is the "Simoun," a slightly larger machine than the "Aiglon." It is designed to carry four passengers, and therefore is excellent for use on internal air lines and for air taxi work. The structure of the wing follows the general Caudron practice, being of wood and in three sections, with the centre one attached to the underside of the fuselage. A light metal alloy is used extensively in the construction of the fuselage framework, and the roof and bottom are of magnesium sheeting; the whole is covered with fabric. The enclosed cabin has large windows that give a wide outlook, and the seats for the passengers are arranged in pairs. There is the usual luggage compartment, which in this instance is behind the cabin. The undercarriage is of the divided type, and the legs and the upper halves of the wheels are covered with streamlined fairings.

A Renault "Bengali-Six" engine of 170-195 h.p. is fitted on a special detachable mounting in the nose of the aeroplane, and a variable pitch airscrew is employed. The "Simoun" has a top speed of 186.3 m.p.h., and a cruising speed of 167.6 m.p.h. The all-up weight, that is the weight of the aeroplane when fully loaded and ready to take off, is 2,706 lb., and the service ceiling is 19,860 ft.

The current types of Caudron aircraft include only one biplane. This is the "Luciole," shown in the upper illustration on the previous page. It is a two-seater light biplane of the kind that has long been favoured for training purposes. The two open cockpits are situated one behind the other, and dual control is provided. Another point about the machine that is important to those in charge of flying schools and clubs, and also to private owners, is that it occupies only a small amount of hangar space. The wings can be folded back easily and quickly, and the width of the machine is then reduced from 32 ft. 5½ in. to only 9 ft. 6 in. It is an equal-span biplane, and the upper wing is flat. The wings, the fuselage and the elevator of the tail unit are made of spruce, but the rudder, another part of the tail unit, is of welded tubular steel; fabric is used as the covering for the machine.

The "Luciole" is 32 ft. 5½ in. in length and 9 ft. in height, and employs the same type of Renault engine as the "Fregate" monoplane. The petrol tanks are in the centre section of the lower wing and hold enough fuel for a flight of 410 miles. The aeroplane has a top speed of 110.5 m.p.h., and cruises at 96 m.p.h.

In addition to the types described in this article, the company have produced many other commercial aeroplanes, and since the winning in 1933 of the Coupe Deutsch de la Meurthe, an annual European air contest for light aircraft, by a Caudron aeroplane, they have become actively interested in the production of light racing monoplanes. Up to the present only one type has been designed for racing purposes. This is the Caudron C.460, a low wing monoplane with a top speed of 314.2 m.p.h.



A Lake in a Volcanic Crater

The illustration on this page and the upper one on the opposite page show two views of Crater Lake, high up in the Cascade Mountains in Oregon, in the United States. How it got its name is explained in a report issued by the Carnegie Institution of Washington, which describes it as a lake "cupped in the heart of what once was a great cone-shaped mountain, built up by successive outflows of volcanic lava and ashes, which met with disaster, it is believed, through the blowing off of its top in a mighty explosion. It is probable that a lake formed in the crater directly thereafter, but it was a lake, not of water, but of red hot, seething lava which gradually cooled, solidified, and in part receded into the depths whence it came.

"As unmistakable evidence of a volcanism that must have continued throughout countless centuries geologists point to crater walls, 2,000 ft. high, which are composed of layers of lava, of pumice, and of volcanic breccia, indicative of recurrent eruptions; to instances such as the Devil's Backbone where the molten lava has broken through fissures in the mountain side, leaving fillings which are harder than the surrounding rock and which remain after the softer materials have washed or weathered away; and to cinder cones, such as Wizard Island, approaching or rising above the surface from the lake floor, 2,000 ft. beneath.

"The lake has no known intake or outlet. Rain and melting snow are the sole sources of supply; seepage and evaporation are the sole agencies of depletion. Apparently also these conditions are in remarkable balance, for the water level of the lake changes little from year to year.

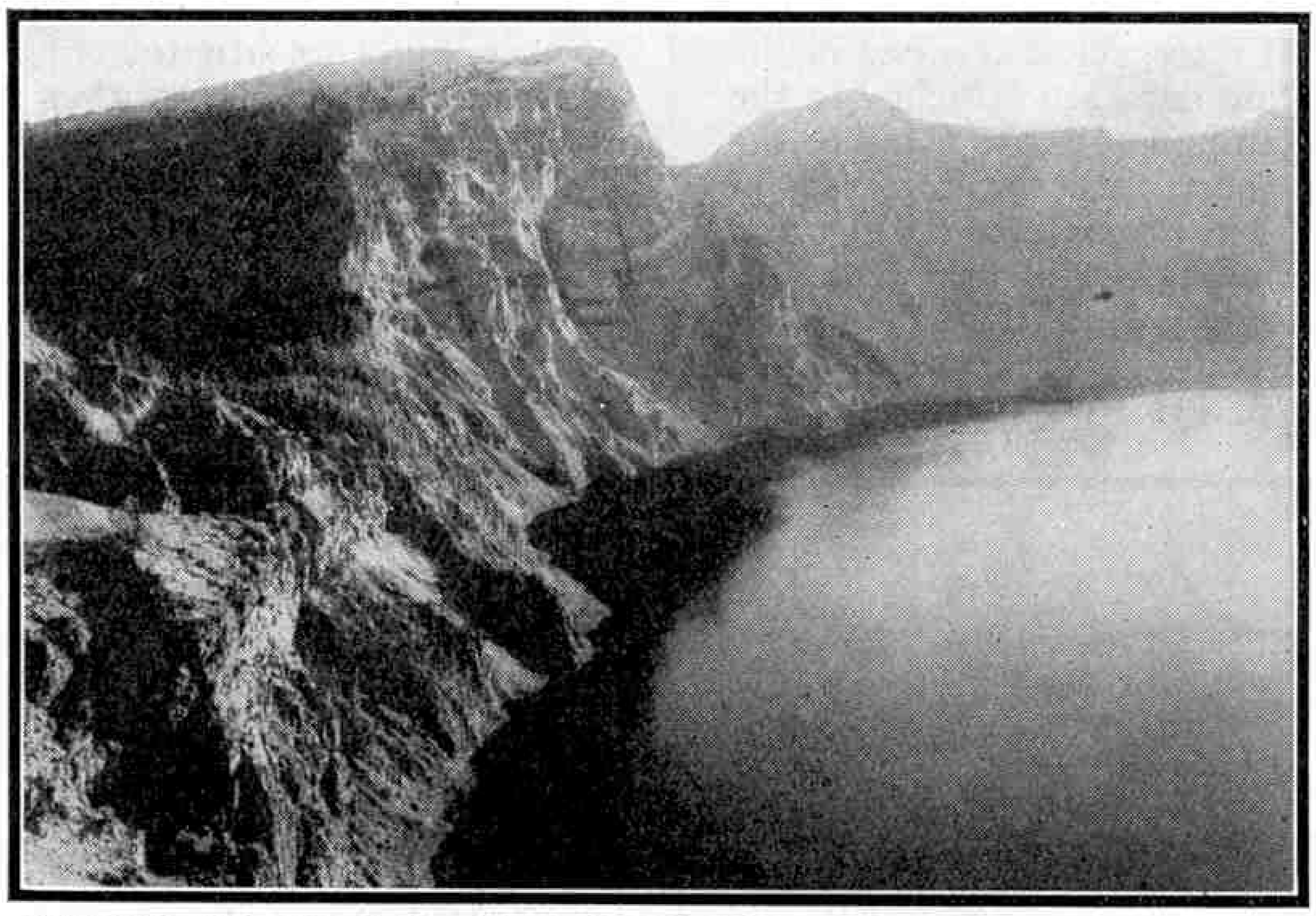
"No one fails to express astonishment at the incredible blueness of its water. Indeed, the intensity of the colour so deeply impressed the first white men who saw the lake, a party of prospectors seeking gold who chanced upon it in 1853, that they named it the Deep Blue Lake. As seen from the rim above, the water, a lovely turquoise blue along the shallow borders, shades by myriad gradations into darkest Prussian blue in the deeper parts. Upon descending the crater wall to the lake and viewing the water from a boat, one notes that the colour deepens to dark indigo."

Why is Crater Lake so Blue?

The Carnegie Institution decided to find why the water appeared to be so blue, and asked Dr. Edison Pettit, a famous American astronomer, to look into the problem. The explanation he gave showed that its colour and that of the sky are due to the same cause. In the words of the report already referred to: "The blue of Crater Lake and the blue of the sky are due to the selective scattering of rays of light which have been diverted from a straight course by molecules of water, in the one case, and, in the other, by molecules of air.

"If light should strike particles that are comparable in size with the wave-length of light—one fifty-thousandth of an inch or smaller—then an interesting change occurs. The direction of travel of the long waves of the light beam, the waves that produce the sensation of red when they fall upon the eye, will be shifted slightly, but only very slightly, by the particles as the waves pass on; whereas the direction of travel of the short waves of the light beam, the waves that produce the sensation of blue, will be profoundly changed by the particles. It is these short waves that, reaching the eye of the observer, account for the blue colour.

"It is just this selective scattering of light, the scattering caused by extremely fine particles of dust and of water vapour in the air and even by the molecules of the air itself, that gives us the various colours of the sky, its fundamental blue, and the red and gold of sunrises and sunsets."



Crater Lake, in the Cascade Mountains in the United States. This photograph and the upper one on the opposite page are reproduced by courtesy of the Carnegie Institution, Washington.

Our Drifting Continents

If Columbus had waited until the present day to set sail for the unknown West, he would have had to make a longer voyage before finding America, for in the interval that continent has drifted farther away from Europe. The difference in distance would not have troubled him greatly, however. The westward motion of the New World is slight, and during the 70,000 years since it is believed to have begun the North Atlantic Ocean has become only a foot wider every year. Other lands are wandering at higher speeds. For instance, it is believed that the distance between Africa and the great island of Madagascar is increasing by as much as 30 ft. a year; and Greenland appears to be moving away from Scotland at the rate of 60 ft. a year.

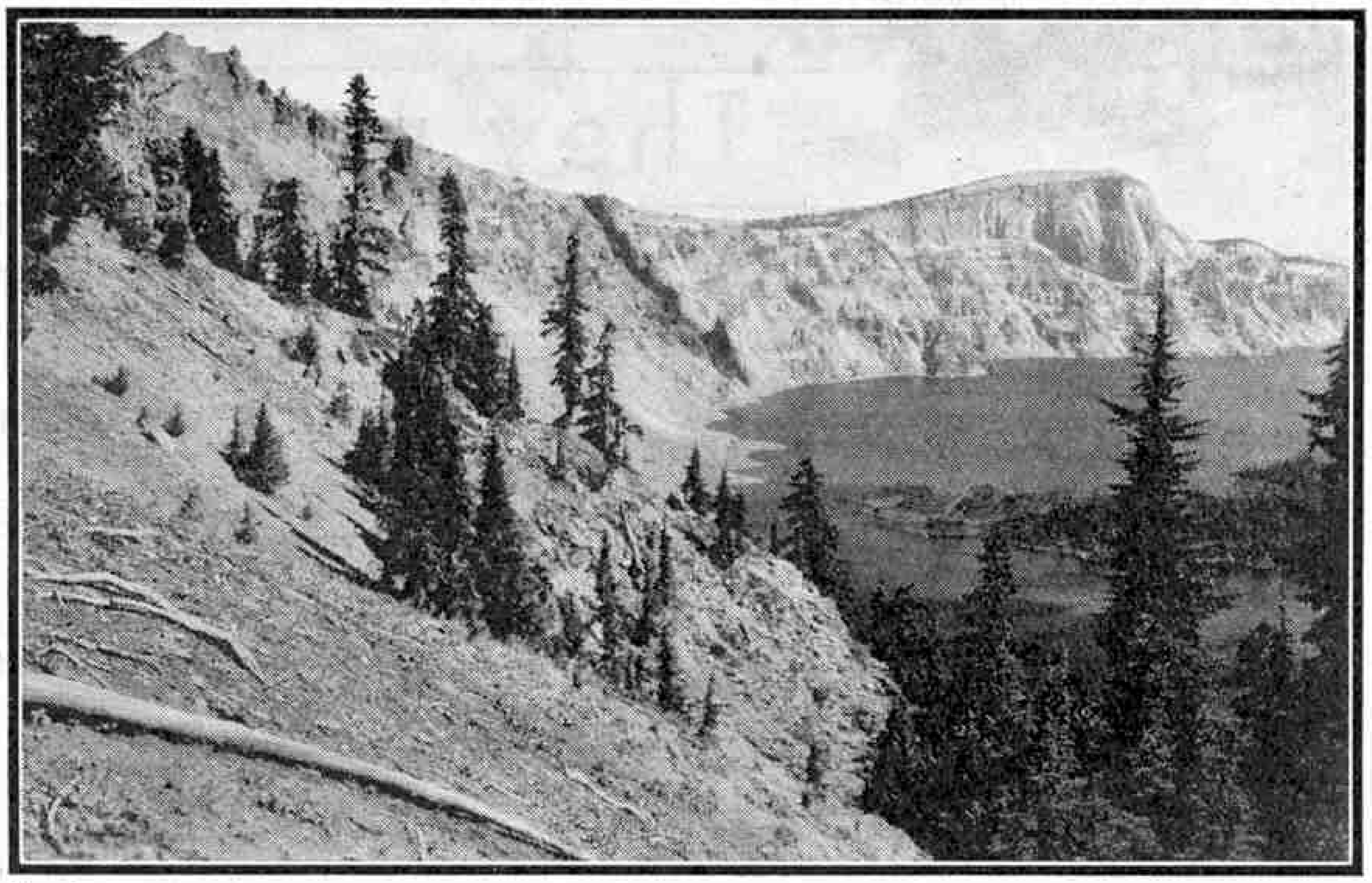
This drifting of great land masses provides evidence for the belief that at one time the continents formed a single great mass, which eventually broke up into fragments that gradually receded from each other. A glance at a map shows that in places they have surprisingly similar coast lines that can be fitted into each other. The east coast of South America and the west coast of Africa are good examples of parallel coast lines of this kind, and no doubt my readers can find others. Peculiarities in the plant and animal life of the two continents mentioned also suggest that in some past ages they formed part of a single land mass, and it has been calculated that South America actually began to separate from Africa about 30 million years ago, and has receded at a speed of about 9 in. a year.

World's Largest Insect

What is believed to be the world's largest insect is 15 in. long from the tips of its feelers to the end of its hind legs. It is a kind of stick insect, with a long thin body, and its home is the island of New Guinea. It would be difficult to give the measurement of the smallest insect for comparison with this giant, for many species are microscopic in size.

A Roaming Minor Planet

I wonder how many of my readers know that in February of this year a projectile weighing more than 100 million tons rushed past the Earth, not more than 1,500,000 miles away, at the rate of 20 miles a second. Even the astronomers who keep track of the movements of heavenly bodies did not know this until the projectile was rushing away from us again. Then they realised that a very small change in its course might have caused a disastrous collision. It is startling to realise that such a huge mass should have come so close without our realising it, but it is perhaps a comforting thought that if any similar wanderer in the skies ever does crash into the Earth at high speed, we shall have no warning of the impending disaster.



The inner slopes of Crater Lake. The black ridge in the centre is the "Devil's Backbone," and was formed by molten lava breaking through a fissure. The lake occupies the crater of an extinct volcano.

The visitor who nearly called upon us is a minor planet that almost seems to have gone astray. It does not keep to the general track of such bodies, between the paths of the Earth and of Mars, but at times is very near the Sun and at others runs away to a distance from the centre of our system that is considerably more than twice that of the Earth. The chances against an actual collision of course are very large. Fortunately for us the track of the minor planet is inclined to that of the Earth, but a shift of only $1\frac{1}{2}$ deg. would bring the two into the same plane. Even then the risk of trouble would be remote, and it has been calculated that there is only one chance in 50,000 of a collision.

Bubbles of Lava 30 ft. in Width

The lower illustration on this page shows a bubbling pool of lava in the crater of Vesuvius. Some of the bubbles shown are 30 ft. wide. There is little difficulty in reaching the crater to see pools of lava of this kind, for a wire-rope railway leads to within 150 yds. of its summit. The crater itself is a walled plain a mile or more in circumference. It is visited by many tourists, and outbursts of steam from small cones forming in it, with an all-pervading sulphureous smell make a visit to it one to be remembered.

Bubbles of boiling lava in the crater of Vesuvius. Some of the bubbles are 30 ft. in diameter. Photograph by H. Elwell, Liverpool.

Can Fish Hear?

Whether a fish can hear or not is a question on which there has been much argument. No fish with ears, or with any organs that seem to correspond to them, has yet been discovered, but careful fishermen do not make unnecessary noises, believing that these may scare the fish away.

The problem aroused the curiosity of a Russian experimenter, who set out to find out whether there was any foundation for the fisherman's precaution. He tethered a fish in an aquarium by means of a flexible lead that was long enough to allow it to swim about freely. A telephone diaphragm submerged in the water was made to emit sound waves by touching a key that at the same time sent a very mild electric current through the fish. Every time the key was closed the fish jumped. This of course might have been due to the electric shock, but after many trials of the double apparatus, the electric shock was omitted and only the sound produced. Still the fish jumped. It must therefore have detected the sound in some manner, and learned to associate it with an electric shock, so that finally the sound alone was sufficient to cause it to jump.

Similar tests with an electric bell suspended above the tank in which the fish lived also made it leap, so that it seems as if we must credit it with ability to hear.

When the Strait of Dover was Dry Land

The British Isles seem to have been separated from Europe almost by chance less than 8,000 years ago. Where the Strait of Dover are now was then a stretch of hilly country, and the only part of the present channel in existence at that time formed a deep bay of the Atlantic Ocean between Cornwall and Devon on the one hand, and Normandy and Brittany on the other. There was a valley along the line of the present strait, and this was invaded by the sea when the land began to sink, with the formation of a narrow waterway. The tides in the North Sea and in the western ocean ebbed and flowed at different times, and the four tidal currents that swept through the channel daily scoured it out to greater width, cutting it back to the cliffs of Dover on the north and those of the present French coast on the south.

The disappearance of the land bridge between Great Britain and Europe stopped the advance of many creatures then making their way westward towards the moist and comparatively warm lands on the shore of the Atlantic Ocean. Among these were many insects, such as that well-known butterfly, the Camberwell Beauty. The climate of Great Britain is suitable for this butterfly, but it arrived too late to make its home there. The specimens captured in the country reach it by long flights across the North Sea from Scandinavia, chiefly in the autumn.

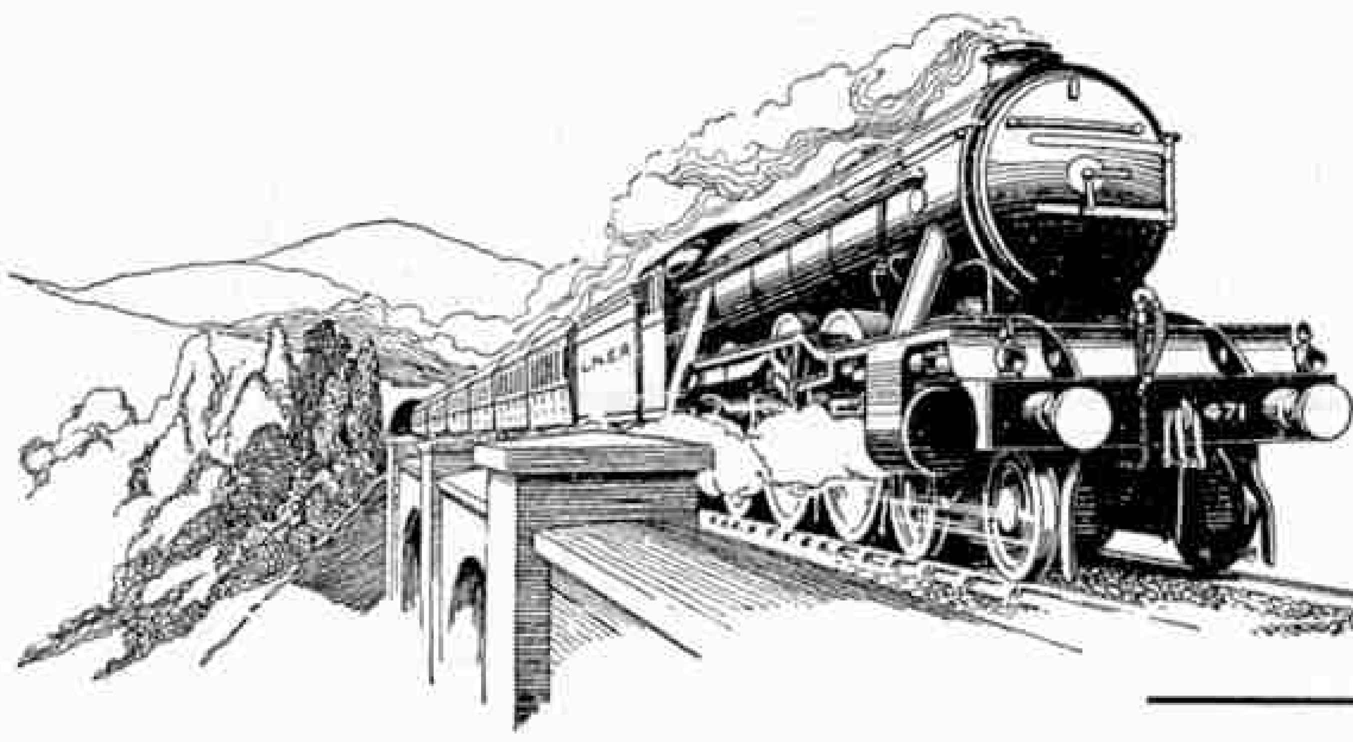
Ireland also was cut off from Great Britain about the same time, with similar results. Less than two-thirds of British plants are found in Ireland, for they spread westward too late to reach that country. An even more interesting case is that of the common hare. This is not found in Ireland, and the Irish hare is a different variety that seems to be a survivor from the days of the Ice Age, when the climate of the British Isles was arctic.

A Perpetual Block of Ice

In the warm climate of New Mexico, in the south west United States, there is a cave that contains a bed of ice that never melts. To add to the mystery of its occurrence there, the ice is embedded in lava, which of course was molten when it was formed.

The explanation usually given for this curiosity is that lava on cooling becomes porous owing to the expulsion of gases from it, and tunnels and large openings are formed in it. During a cold spell at some time in the past, a great space formed in this manner in the New Mexico lava bed. This was filled with water that froze and was then protected from surface heat by the lava itself, which is an excellent insulator. The mass of ice therefore probably is a relic of the most severe winter ever experienced in the region in which it is found. It is blue in colour and streaked with dark lines believed to consist of layers of dust and ashes.

Masses of so-called "fossil ice," which probably are much older than that in the cave in New Mexico, are found deeply buried in certain districts in Central Asia.



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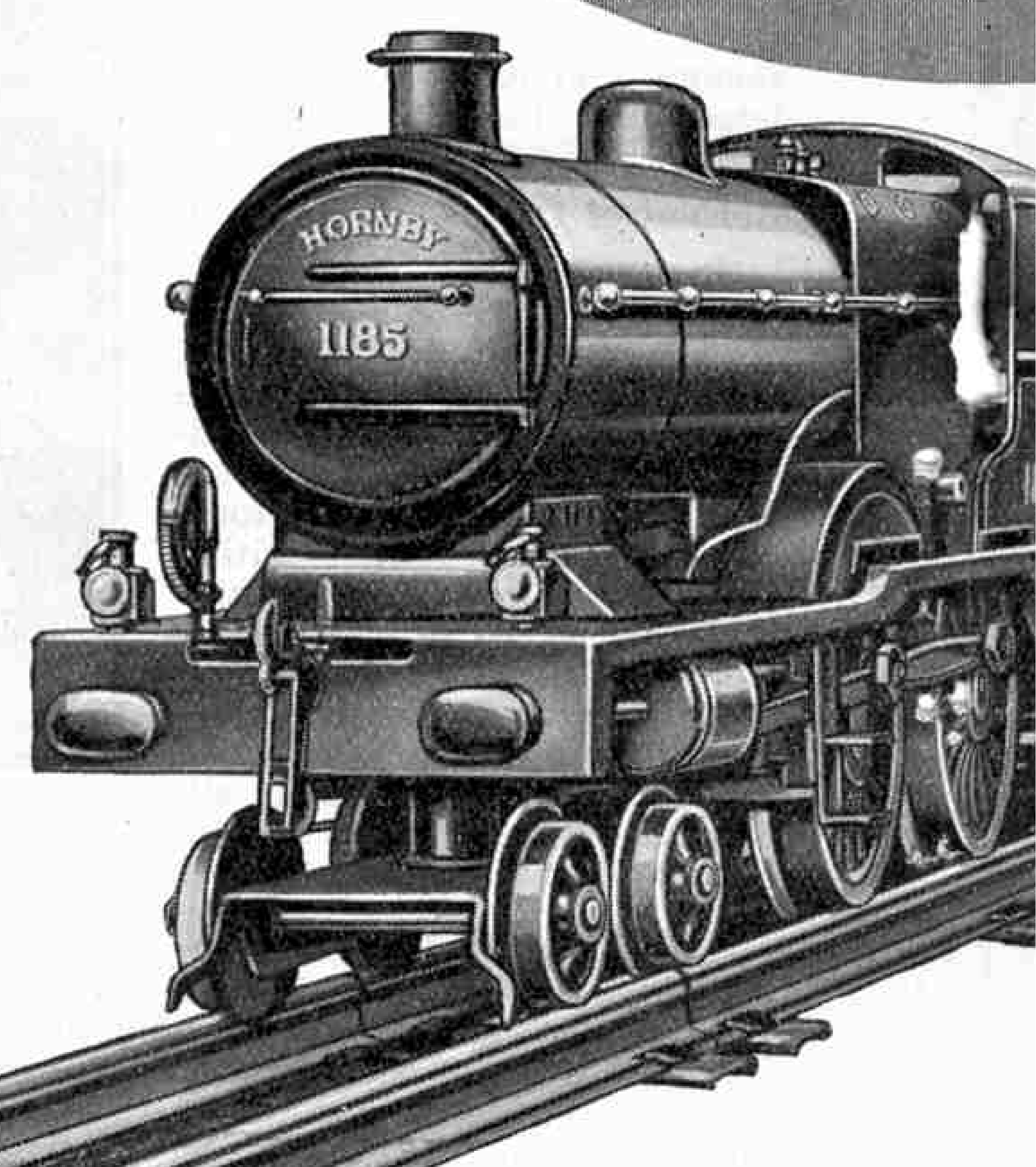

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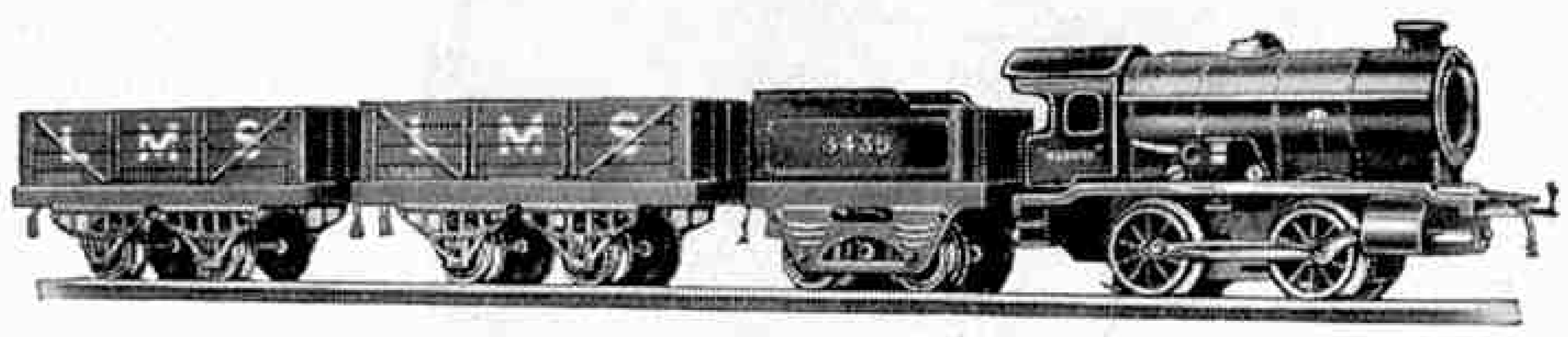

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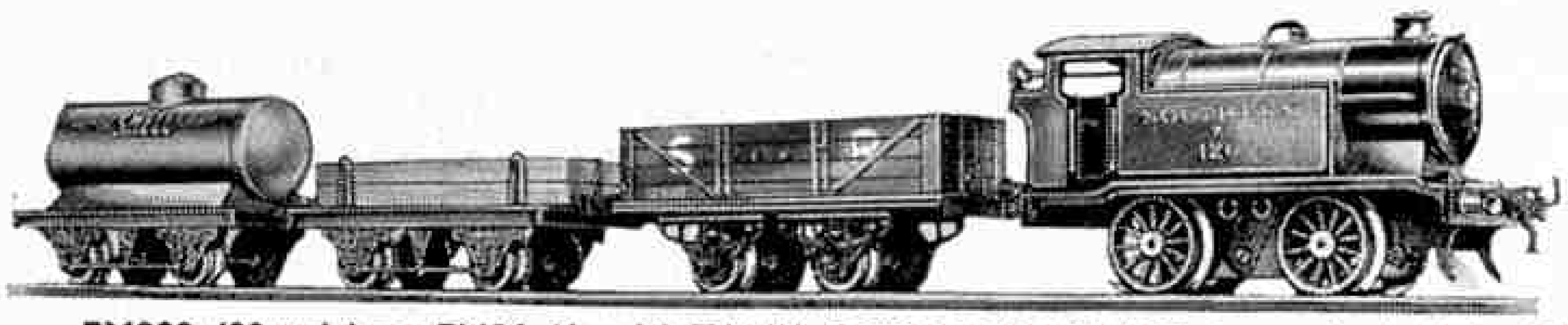

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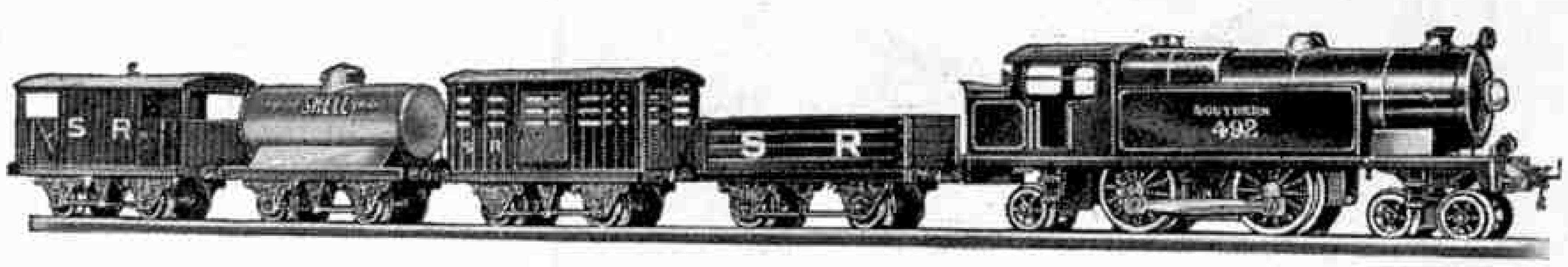

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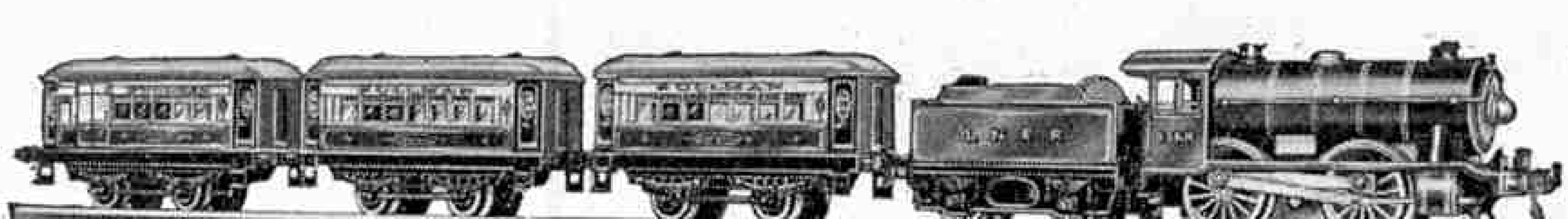

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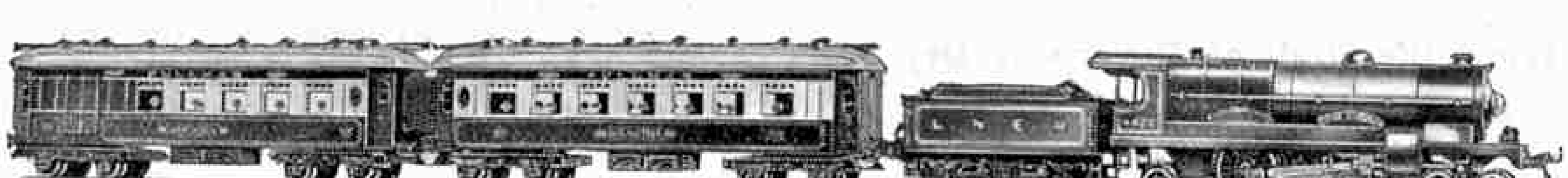

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Books to Read

Here we review books of interest and of use to readers of the "M.M." We can supply copies of these books to readers who cannot obtain them through the usual channels. Order from Book Dept., Meccano Limited, Binns Road, Liverpool 13, adding 1/- for postage to the price. Postage on different books varies, but any balance remaining will be refunded.

"Famous British Trains"

By R. Barnard Way

(Ivor Nicholson and Watson. 5/- net)

Famous trains are an endless source of attraction, and their interest is not restricted to railway enthusiasts, for ordinary travellers also are eager to read about their journeys and the engines that haul them. Mr. Way's book is well calculated to satisfy these needs. It is described as a chronicle of the daily work of named British expresses, and deals with the history and routes of all the named trains of the four railway groups. There are no fewer than 56 of these, ranging from old-established favourites such as "*The Flying Scotsman*" and the "*Cornish Riviera Express*," to such innovations as the cruising "*Northern Belle*" of the L.N.E.R., and the same company's latest introduction, "*The Silver Jubilee*," a train that has made railway history by its speed achievements. The electric "*Brighton Belle*" also is included, and readers are taken across the Irish Sea for journeys in Northern Ireland on named trains of the N.C.C. section of the L.M.S.R.

The book is one that will be valuable to all who are specially interested in trains. No technical knowledge is demanded from its readers, and every traveller would find it a fascinating companion on any railway journey dealt with in it. It is well illustrated, as all railway books should be. A coloured reproduction of "*The Silver Jubilee*" emerging from a tunnel forms the frontispiece, and in addition there are 60 reproductions of photographs and a sketch map to illustrate the routes described.

L.N.E.R. 2-8-2 locomotive No. 2002, "Earl Marischal," emerging from a tunnel. This and the upper illustration on the next page are from "Famous British Trains," reviewed on this page.

"Gradients of the British Main Line Railways"

(The Railway Publishing Co. Ltd. 5/- net)

This publication consists of the reproduction in book form of the series of gradient profiles that appeared in the issues of "*The Railway Magazine*" during 1929 and 1930, covering nearly 9,000 route miles of track in Great Britain and Ireland. All the main line systems are included, together with the chief branch and other lines on which fast trains run. An interesting feature is that a uniform scale of inclination has been adopted, so that the difficulties of different routes can readily be compared. In addition to the gradients and the distances appearing on each profile, such details are given as the permanent speed restrictions, areas where reduced speed may be necessary owing to colliery workings, and single line sections.

As an aid to ready reference, the profiles of each group, joint lines and the Irish railways are printed on paper of different colours. Information as to the location of the mile posts on each route is included, and there is a complete index to the various profiles. The book forms a useful work of reference and is invaluable to those who make a habit of recording the locomotive work during a journey.

"Camp Devotions"

By K. C. Sparrow, B.Sc.

(Brown, Son and Ferguson Ltd. 1/- net)

Mr. Sparrow is an experienced Scoutmaster, and for many years was a keen and successful Meccano club Leader, so that his knowledge of boys and their requirements is thorough and extensive. He has already written an excellent book dealing with instructional play and games for Scouts, and he has now followed this by one dealing with the religious side of life in camp. His aim is to include everyone in camp in the devotions he suggests, and he gives schemes for suitable services in which the Scout Law plays a prominent part. He expresses the hope that his booklet "may help Scoutmasters to make camp devotions an inspiring and natural part of the day," and his sincerity and thoroughness should lead to the fulfilment of his wish.

"Woodcarving and Design"

By Lynn Miller. (Pitman. 7/6 net)

Woodcarving is an attractive craft that provides training in the use of tools, and at the same time encourages the development of artistic ability and the capacity to appreciate sound design. Mr. Miller's book is well calculated to satisfy these requirements, and a budding craftsman who follows its instructions should acquire skill in all branches of this handicraft.

After a preliminary chapter on design, the author deals more particularly with the woodcarving craft, describing the tools employed and their preparation, and giving details of actual work on the bench. Then follow exercises designed to give the learner command over his chisels and gouges, and these lead to actual examples of the production of models of various kinds, such as tables and frames. The book is admirably illustrated by means of 31 plates, chiefly of magnificent examples of woodcarving, and 89 drawings of designs and the tools with which they are executed.

"Parasites of Ponte Bello"

By Ernest W. Prangley. (Stockwell. 3/6 net)

This is a story of a desperate struggle with robbers and cut-throats who terrorised Ponte Bello, a valley in the wild foot-hills of the Drakensburg range in South Africa. Saunders Hope, the hero, almost single-handed frees the valley of brigands in spite of their attempts to drive him out, and even to murder him, and unmasks the rascally manager of a banana plantation who has been their chief ally. The finish is wildly exciting. There is a desperate gun fight in which the brigand leader is shot, and an invading horde of fierce natives is swept away by a torrent of water set in motion by the opening of the gates of a gigantic reservoir.

The story is full of thrills, and the unusual scene in which it is laid adds greatly to its interest.

"Exploring the Stratosphere"

By Gerald Heard. (Nelson. 3/6 net)

The stratosphere is a region of the atmosphere, beginning at a height of from seven to ten miles, in which the temperature is nearly constant at about 50 deg. to 60 deg. C. below freezing point. Its existence was revealed by temperature measurements made by means of small sounding balloons carrying safety-recording instruments, and the story of its discovery and of daring balloon ascents made into it is told by Mr. Heard in his latest book. One of the balloons reached the great height of 14 miles, or nearly three times that of Mount Everest. Aeroplanes also have reached the stratosphere, and the whole story of ascents into this strange region is one of fascinating adventures in the cause of science that can be compared with the great voyages of Columbus and Magellan.

The "Cornish Riviera Express" hauled by "King" class locomotive No. 6012, "King Edward VI." The train is travelling on the remarkable stretch of railway laid on the sea wall near Teignmouth.

From stratosphere voyages the author turns to the uses that we can make of the knowledge gained by them. There is reason to believe that our weather depends very largely on what happens in the stratosphere, which also is the approach to the mysterious ionised layers, such as the Heaviside layer, that reflect wireless waves of various lengths back to earth and make communication round the world possible. A complete knowledge of the conditions prevailing at any time in this region of the atmosphere therefore will be of the utmost service to us.

The stratosphere also may become a great highway of the air, for in it there will be less resistance to the passage of an aeroplane than at lower levels. The air at great heights is too thin to support life, so that these machines will have sealed cabins supplied with oxygen, and airmen who ascend into it will wear special suits, such as that shown in the lower illustration on this page, reproduced from Mr. Heard's book. Looking still further ahead, the stratosphere, in the author's own words, can be looked upon as the "training ground for rocket flight." It is not a ceiling, to be reached by persistent endeavour, but a floor or platform whence to launch ourselves into empty space. It also supplies the answers to many scientific questions, each of which is dealt with fully in the book. One of special interest concerns the mysterious cosmic rays, which are much more in evidence in the stratosphere than at the Earth's surface.

The task of giving a popular account of the stratosphere could not have been better done than by Mr. Heard, whose fascinating story will show his readers that the adventures into the skies that he describes have literally opened up new worlds. There are 10 excellent photographic illustrations, chiefly of high altitude balloons, and a diagram of ascents into the stratosphere.

"Every Boy's Book of Aeroplanes"

(Sampson Low. 3/6 net)

This book is a pictorial survey of the principal new aeroplanes of all the chief countries in the world. It contains 135 half-tone illustrations, and each is accompanied by a caption giving the dimensions and constructional details of the aeroplane illustrated. In addition to being an excellent book for the young air enthusiast, it is ideal for the model-maker, who will find it invaluable in building realistic models of the various types of aeroplanes shown.

"Walking Tours and Hostels in England"

By Sydney Moorhouse. (Country Life Ltd. 3/6 net)

There is no way in which the beauty of English country can be seen to better advantage than by walking through its lanes and over its ancient tracks, and those who enjoy this increasingly popular recreation will find Mr. Moorhouse's little book very useful. The fourteen tours described cover selected areas ranging from the English Lakes, the Peak district and the mountains of North Wales to the Chilterns, Devon and Cornwall, and the Downs. Each is planned to last a week. In each case the route is marked on a specially drawn map, and the walk for each day is carefully arranged to take in as many places of real interest as possible.

The practical value of the book as a guide is increased by the association of each tour with a group of youth hostels where accommodation for the walker can be found. The book indeed has been compiled with the help of the Youth Hostels Association, by whom it is officially recognised, but suitable hotels, farmhouses and other places in which to stay also are indicated in it.

"Pictorial Britain and Ireland"

(H. K. McCann and Co. Ltd. 8/6)

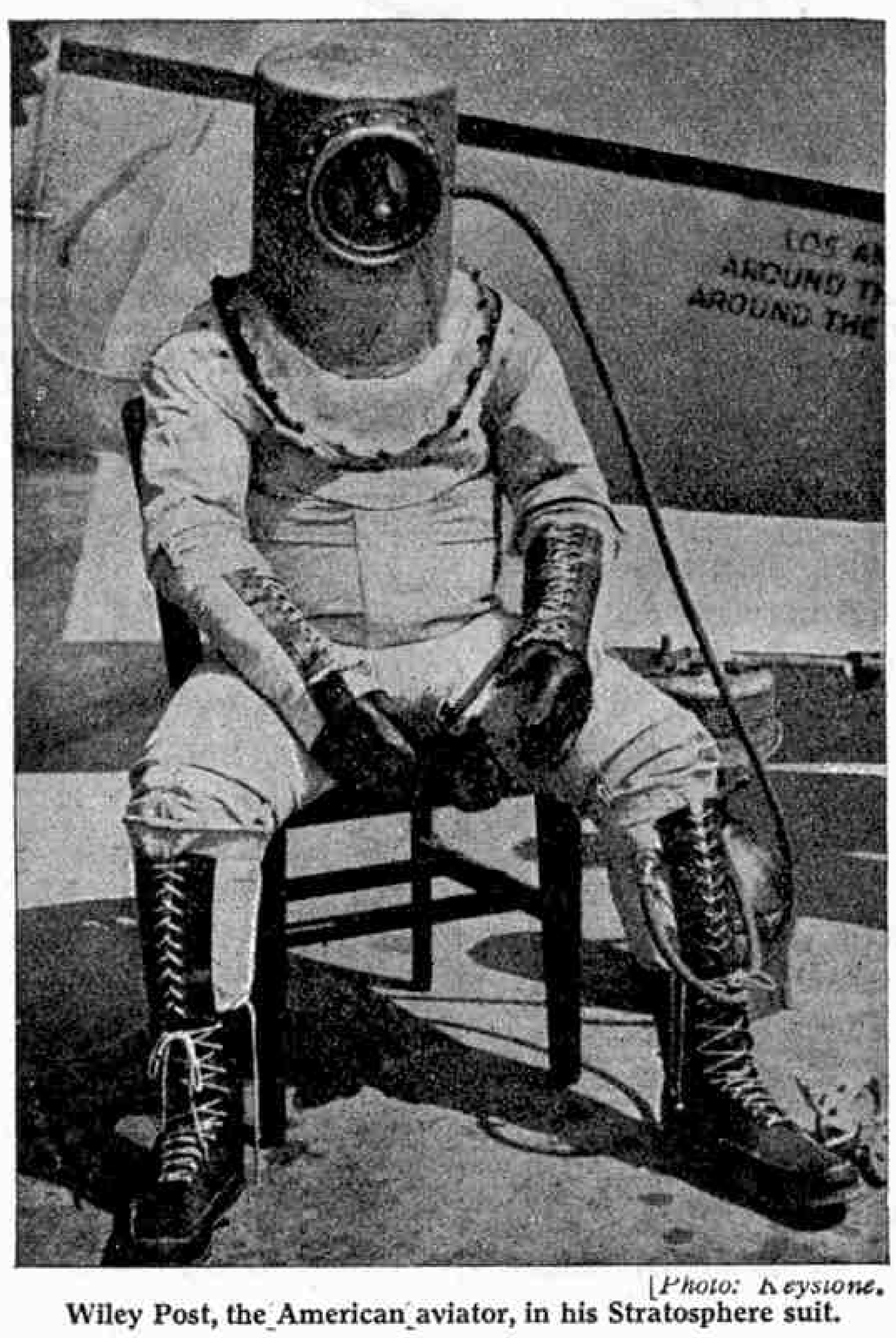
This attractive pictorial record of the roads of Great Britain and Ireland has been issued on behalf of the Anglo-American Oil Co. Ltd., and has for its outstanding feature a series of eight double page plates in colour, each 18¼ in. by 12⅛ in., reproducing road maps by Mr. Alfred Taylor. These maps are a delightful blend of artistry and wording, for along the motor roads shown on them are quaint designs and pictures illustrating points of special local interest, together with appropriate quotations and rhymes. In addition Mr. S. P. B. Mais supplies interesting notes on the chief towns and villages marked, and these form brilliant word pictures telling in brief the story of the British and Irish countryside. The combination of author and artist has produced a guide that is more attractive than the ordinary technical book, and at the same time is full of value to the motorist planning or making a comprehensive tour.

"The Electrical Handicraftsman and Experimenter's Manual"

By H. R. Langman and J. H. Moore (Technical Press. 7/6 net)

This book explains how to make fascinating working models from comparatively simple materials, and is remarkable both for the ingenuity displayed in constructional details and the wide range covered. Every type of electrical component is dealt with, from switches and joints to cells and condensers, and the making of electro-magnets and many different kinds of motors and dynamos is fully described. A special chapter is devoted to a simple universal electrical outfit that will enable experimenters to obtain a thorough grasp of the scientific principles behind these models.

Constructional work is explained with the aid of carefully-planned diagrams that show how each model is made and works.



[Photo: Keystone.

Wiley Post, the American aviator, in his Stratosphere suit.

Calling the Fire Brigade

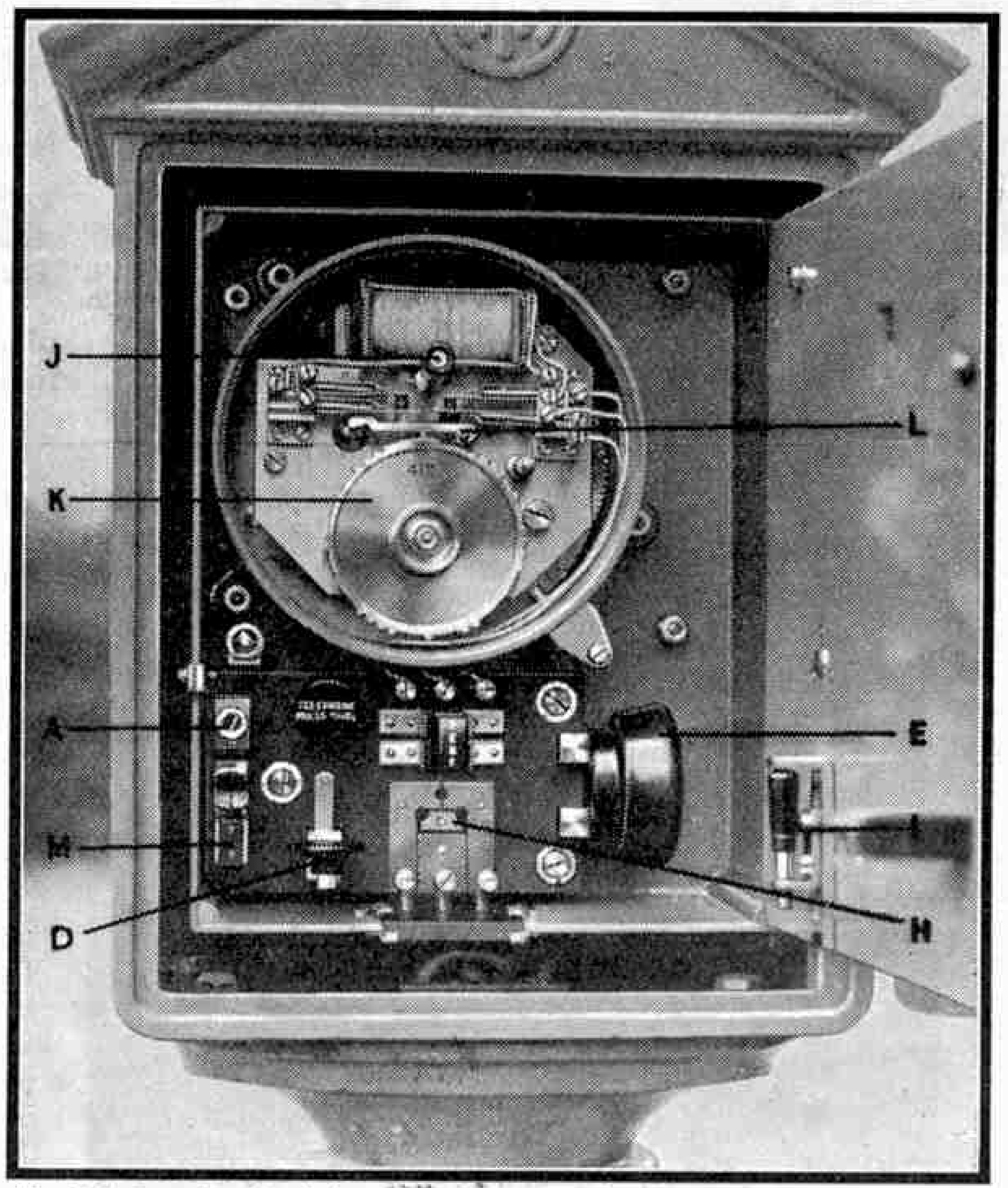
How Modern Street Alarms Work

By Louis E. Calvo, M.I.Fire E., M.J.Inst.E.

"BREAK Glass—Pull Handle—Wait Here." These are the instructions on a modern street fire alarm. When they are followed in the event of a fire, news of the outbreak is flashed at lightning speed to the fire station and in an incredibly short time motor fire engines heralded by their clanging bells arrive, and are directed to the fire they have come to fight. How do the drivers of these familiar and speedy motor vehicles know which fire alarm to go to for this information?

Modern fire alarm signalling has evolved from the use of the hammer and gong used by the look-outs on watch-towers. Prior to 1850, watch-towers were erected in large cities, and these commanded a clear view of the district. It was the duty of each watchman to look out for fires, and when he discovered one to tap his tower bell with a hammer. The number of taps was the number of his district, and they were repeated by the other watchmen, thus spreading the alarm over the whole city. This is important, as it was the origin of the numerical signal system.

The transmission of alarms by electric telegraph was first introduced in Berlin in 1849, and indicators in the fire stations then showed the number of the alarm box from which the call was sent. This system has been steadily developed, and to-day in the area covered by a fire brigade there are many alarms at convenient points, from which news of a fire in the district is swiftly and automatically despatched to the central station by the mere pulling of a handle. The message sent over the wires in this manner does more than transmit the news of the outbreak; in addition it tells the station officials and firemen from which box the alarm came, and the engines and escapes race there to learn the exact position of the blaze.



The interior of a street fire alarm box, showing the clockwork mechanism by which the alarm is transmitted to the fire station. The illustrations to this article are reproduced by courtesy of the Automatic Electric Co. Ltd.

Let us look at a typical street fire alarm box. There are several different types, but an examination of one like that seen in the lower illustration on the opposite page will show the general principle. When the glass is broken, a small projecting door falls clear of the handle, which can then be pulled without fear of the hand being cut by fragments of broken glass. As we want to see how the alarm works, but do not wish to call out the fire brigade, we must refrain from pulling the handle at this juncture.

When the outer door of the box is opened by means of a key another box is revealed, and the door of this has to be opened to enable the mechanism to be seen. This is shown in detail in the illustration on this page. The main instrument is enclosed in a case with a glass front, and the triple metallic cases, insulated from each other, provide protection for it against extreme weather conditions. These cases are practically dust-tight. The air partitions between them shelter the signal movement from the effect of changes in temperature and prevent the deposition of moisture on it.

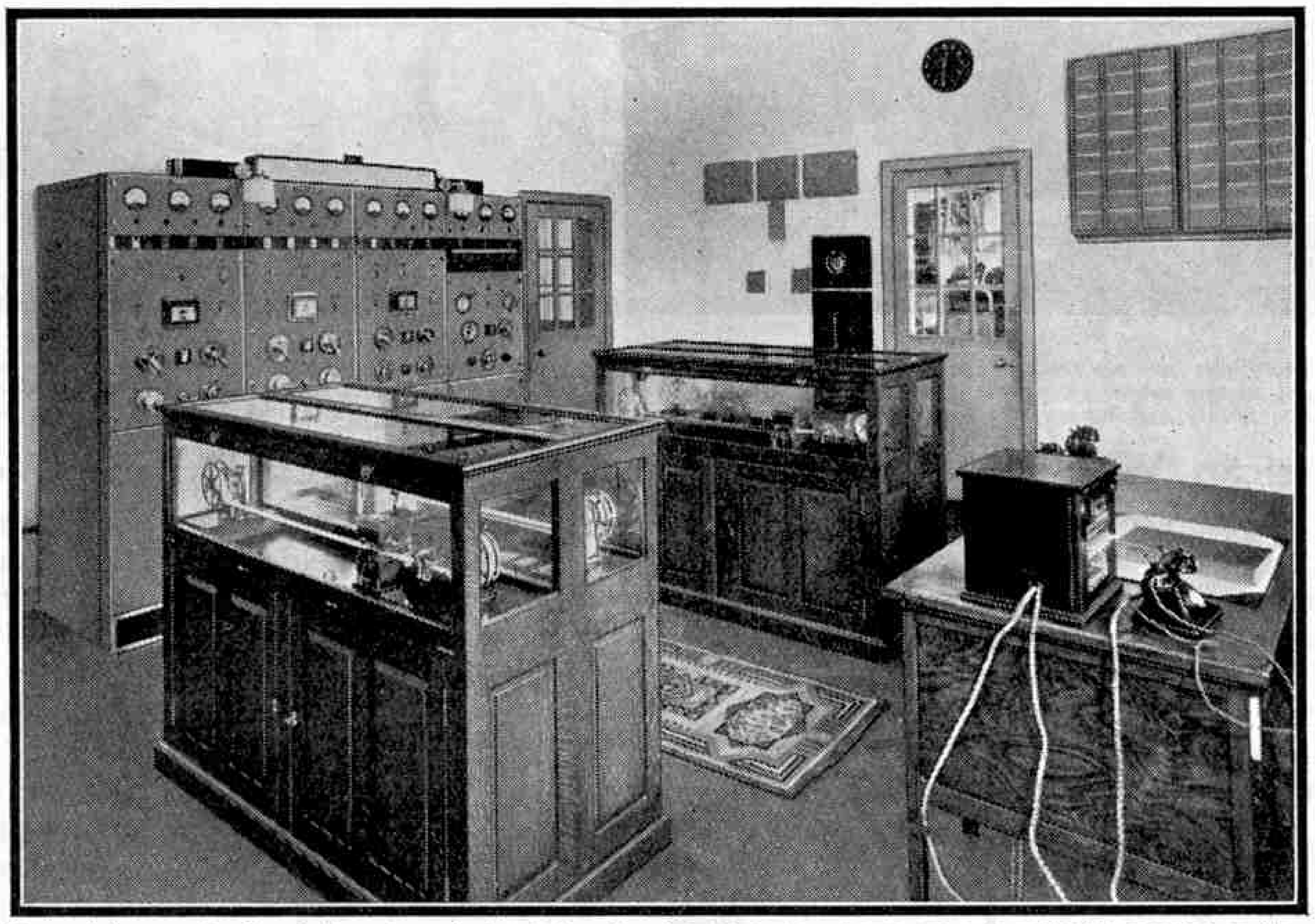
On the insulated panel at the bottom of the box is a telephone jack A. An official who wishes to call the fire station inserts the terminals of a portable hand telephone in the jack, and presses the button marked "Telephone—Press Once." The part marked "Test" is known as the silent test plug, and when this is pulled outward, the box is disconnected from the receiving apparatus at the fire station. A tapper key for signalling purposes, using a pre-arranged code, is provided at D, and at E there is a sounder that enables anyone at the box to hear if another call is being transmitted on the circuit. In that case nothing is done that would prevent its receipt at the station.

The incoming and outgoing cables of the box are fixed to the two outer terminals at the foot of the panel and an earth plate connection is made at the terminal between them. A plug switch is shown at H, and the plug for use with it is mounted at I. The incoming or outgoing cable can be earthed, or the box short-circuited, by inserting the plug in the appropriate hole in the switch. If the corresponding terminals in adjoining boxes are earthed, the section of cable between the two can be subjected to the operations of linesmen without risk of interference with the alarms.

The corresponding terminals at the top of the panel form the connections to the signal mechanism proper above them. This is known as a succession non-interference movement, for it is possible to start simultaneously several boxes on the one circuit, and to receive the signals correctly in succession without interference.

When the handle is pulled, a trip on the inside of the outer door depresses the lever J. This brings the clockwork drive into action, and it rotates the code wheel K in a clockwise direction. Round the rim of the code wheel are teeth that work the signal lever L and are spaced to give the number of the box in code. This lever is pivoted and actuates the break signal contacts through the medium of insulating pieces. The code is transmitted three times per call in one revolution of the code wheel spindle, the speed being four impulses per second. If re-operated, the box will make 16 calls before the clockwork mechanism is run down.

The design of the alarm provides several important safeguards which ensure that a box cannot be introduced into the circuit until the apparatus is entirely normal. For instance, when the plug I is removed from its holder, a catch falls and prevents the inner door being closed, and the box therefore cannot be left with the plug in one of the holes of the plug switch H. Again the silent test key is pressed into position by the closing of the door. The outer door cannot be closed until the spring is rewound; it then presses on the inner door and a shorting plug is pushed between the springs M, immediately below the telephone jack A, thereby removing the resistance of the mechanism from the line circuit.



The watchroom of a fire station. Incoming code impulses from fire alarm boxes are automatically recorded on the tape of the registering mechanism in the foreground.

Having replaced the glass and closed the box, let us proceed to the watchroom of the fire station and observe what happens there. This room is shown in the upper illustration on this page. The lines of the circuits terminate on the switchboard, a slate or marble polished panel. This carries switches and instruments for testing the conditions of the circuit and localising faults, together with means for regulating the charging and discharging of the batteries; and the associated apparatus of the switchboard actually informs the watchroom attendant of any particular circumstance as it arises, by means of visual indicators and supervisory lamps.

When the handle of an alarm box is pulled, its code wheel rotates and a train of code impulses is automatically recorded at the station on the paper tape of a punch register, the time and date also being added. Simultaneously, the code number is sounded on a gong, and visually indicated to the Brigade. This can not only be done in one station, but can be repeated automatically to several stations.

The punch register mechanism is driven by clockwork. It is in circuit with the alarm boxes and an electro-magnet is released at each impulse, punching a hole in a paper tape. The impulses are arranged to punch up to five per second.

The paper tape passes through a stamp that automatically records the minute, hour, day, month and year, and then on to a clockwork apparatus that collects it as it is fed out of the register, to form a permanent record of the calls received. The code number is received in 6 seconds and double checked in 20 seconds.

The gong that sounds the alarm by giving the code number is electro-mechanical in action. It also is connected in the circuit and operates once for each impulse. The visual indicator that also comes into play when an alarm is given is a frame containing the code numbers or the addresses of the boxes, or both, and the particular indicator concerned is illuminated on the operation of the call-box. This does not exhaust the work that can be carried out from a box, for in addition its electrical impulses can be made to operate alarm bells, door opening gear, engine starters, automatic station lighting, and traffic signals to give the "all red" sign to clear the roads for the engines. Ambulance calls are also included on many circuits. In these cases the boxes contain a compartment at the rear in which there is a telephone, and access to this is obtained by breaking a small pane of glass.

Power for the circuits and watchroom equipment is supplied by accumulators in open glass boxes. These are installed on substantial stands, and all cables are protected by bead type alarm fuses, which cause an alarm bell to ring immediately a fuse operates. All batteries are trickle-charged by copper oxide metal rectifiers, which are silent in operation and require no attention when once set. The capacity of the charger is sufficient to carry the load in the event of battery failure, or during the period of changing a battery. If on the other hand the charger or the mains supply fails, the batteries will continue to provide the power for several days, or until the defects have been remedied.

A modern street fire alarm.

There is no doubt that the installation of a modern fire alarm system is an essential part of fire fighting equipment, and it forms the quickest, safest and most reliable means of calling the fire brigade. It will be noted that the main object is to provide the public with means of giving a perfect fire call. The safety devices incorporated in the alarm ensure that normal conditions are certain when the door is closed, and all fire calls will be received in spite of disconnection or earthing at one point. Even if both these faults occur at one and the same point, the fire alarm service continues in working order, as it does also when an alarm box is short-circuited. The system described has been in experimental use at the Headquarters of the London Fire Brigade since 1931, and during that time not one false call due to any fault of the apparatus has been received.

And now, I wonder how many readers can say where is the nearest fire alarm to their homes.

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.

South African Witch-Doctors

"Muti," or medicine, is responsible for many strange purchases from South Africa curio dealers. The witch-doctors who make them prefer to send deputies to obtain what they want, for they shun publicity. That is the reason why some of their more unusual methods continue to remain mysteries. Lions' fat smeared on the body is said to conquer pimples, but what special virtues there are in the bits of tortoises and ostrich eggs that these men use is a problem Europeans cannot solve. The tails of certain animals, especially the giraffe and the wildebeeste, are in great demand, and the horns of certain small buck are hollowed out to serve as containers for "muti."

Certain mineral stones rejected from gold mines are prized by witch-doctors, who also buy the teeth of crocodiles and lions and use them for "throwing the bones," the method they follow in looking into the future. For the fashionable witch-doctor the hind legs of ant-bears and baboons also are necessary, for they add much to his prestige.

Assortments of roots and herbs are used by witch-doctors and also by native herbalists. By far the most common native complaint is the humble but troublesome stomach ache. The remedies for this are bewildering in their number and variety, ranging from barks and herbs to portions of frogs. Madness is sometimes treated by burning a bat and making the patient inhale the smoke. Many of the remedies used are poisonous, if incorrectly taken. Mistakes seldom occur, however, and when they do a charge of murder may follow.

Like all other professions, that of the native witch-doctor has its quacks and crooks, but most of those who practise it are genuine in their beliefs and methods. It is slowly dying out, however, for the traditional belief of the natives in the witch-doctor's powers is being vanquished by the spread of European ideas among them.

D. C. KIRKLAND (Durban).

A South African witch-doctor in full regalia. Photograph by Lynn Acutt, Durban.

Bird Life in the Welsh Hills

My friends and myself derive much pleasure from tramping over fields, along lanes and through the many little woods around our homes in the Welsh Hills. We take special delight in looking for birds' nests. We never rob these of their eggs, however, and are careful to disturb the birds themselves as little as possible, contenting ourselves with examining the nests and on occasions photographing them.

There are few birds among those to be met with in the neighbourhood whose nests we have not found and inspected. The peewit, or the lapwing plover, eluded our most diligent searches for a long time. The first of the names by which this bird is known is derived from its peculiar call. Its usual haunts are marshy or ploughed fields, but it builds its home so cunningly, and the eggs blend in colour with the ground so well, that it is possible to stand within a few paces of a nest without seeing it. The birds are extremely wary, and feign injury and limp about in order to attract intruders and lead them away from their nests. When we did find a peewit's nest on the edge of a cornfield, it was more by good fortune than skill in searching. In it were four eggs, greyish in colour and marked with black blotches. They were pear-shaped and their pointed ends were together in the centre of the nest. While we looked at the eggs, the owners circled around, uttering their high-pitched cry.

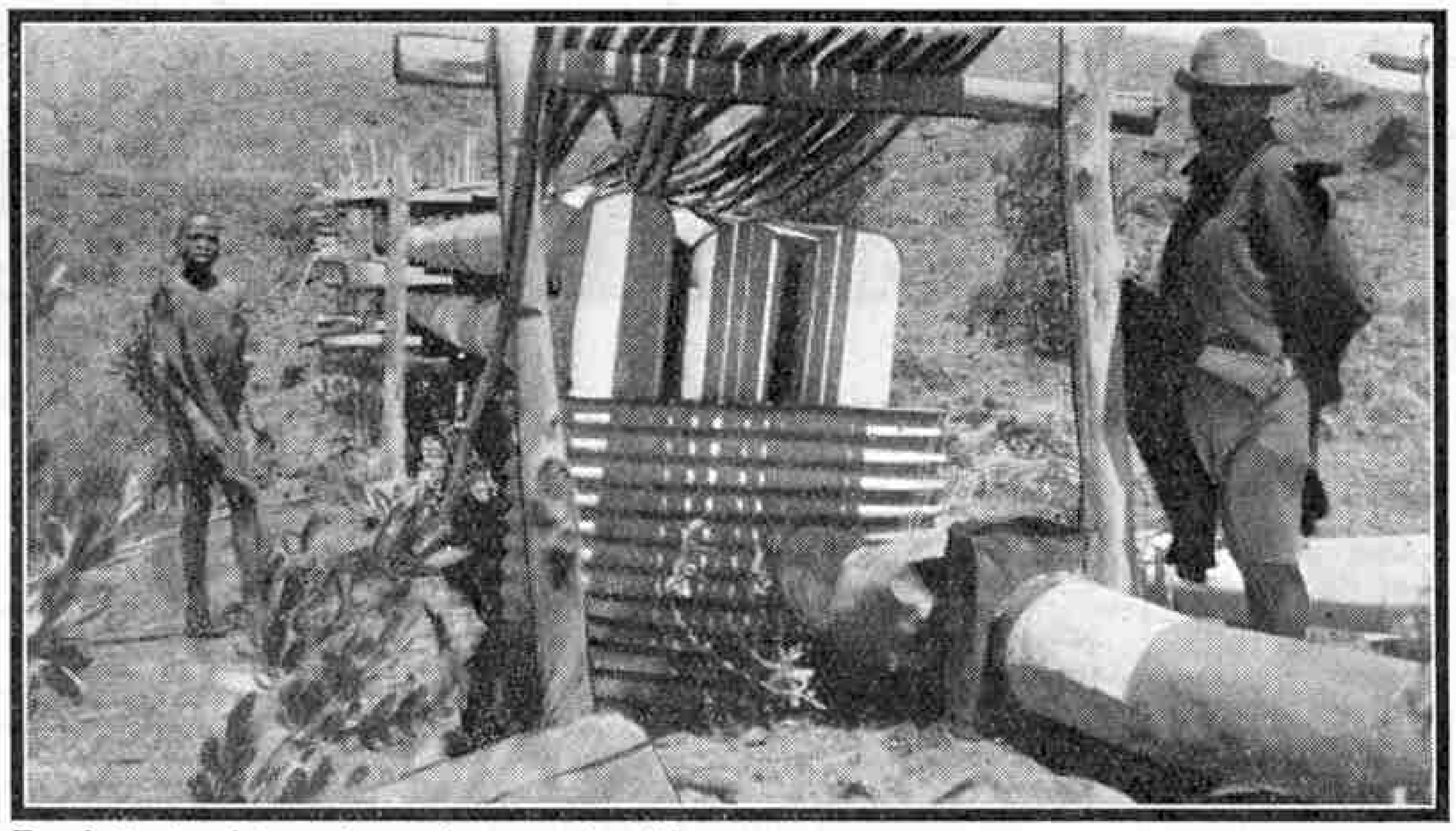
Other nests we have seen have included those of the curlew, the tawny owl, and the sparrow-hawk, as well as those of more common birds. It is curious to find that the nests of the smaller birds are more elaborate than those of the larger ones. For instance, the common wren, one of the smallest of British birds, weaves scores of feathers into the lining of its home, but a few blades of grass are sufficient for the curlew. I have found it very interesting indeed to make comparisons of this kind between the nests of the various birds I have been able to watch.

G. E. FANTHORPE (Newtown).

A Unique Water Supply System

The farmers in the Eburru district of Kenya rely almost entirely on the condensation of natural steam jets for drinking purposes, for bathing, and for giving to their cattle. An adequate supply of fresh water is essential to farming, and there must be few farms that have no normal water supply, and make use of a source so curious as this.

The mountain slopes above the farms are full of jets of natural low pressure steam, and these have been harnessed to supply a constant flow of water that has enabled thousands of acres of land to be occupied. Previously the district was thought to be completely useless, but now it supports a large population engaged in agriculture.



Tapping natural steam to supply pure water. The photographs on this page are by S. Hemsted, Kenya.

The apparatus for making use of the steam is remarkably simple. A jet is capped by a large tank, which is placed upside-down over it and has a hole cut in its side, to which are soldered lengths of corrugated iron piping of large diameter. In some cases several jets close together are capped in this manner by a single tank. The steam passes along the pipe, and the longer this is the better, for the steam then is given more opportunity to condense. A trickle of water forms in each pipe, and this is collected and led where it is required.

The rate of condensation varies from day to day. It is more rapid when a strong wind blows across the pipes, and is less complete on hotter days, when the water supply is correspondingly diminished.

S. HEMSTED
(Gilgil, Kenya).

The natural steam collected in the manner illustrated above is passed through long pipes in order to condense it. The water of this unique supply is always warm.

A French Seaside Holiday

Last August I was privileged to spend a short time at the seaside holiday home of a friend in France. I travelled first to Paris by way of Boulogne, and in the Nord station there boarded a train for Quend Plage, my destination. Most of the locomotives I noticed in the station carried smoke deflectors. I travelled third class and found the metal seats of my compartment very uncomfortable in comparison with those of third class trains in Great Britain. At the end of a journey lasting 45 minutes the train drew up in a wayside station resembling those to be seen in the English countryside, except that the plants were shrivelled up and the high platform was replaced by a raised gravel structure only six inches above the track.

My friend met me at the station, and I found that it was necessary to travel two miles by bus to complete the journey. The country there is very flat and sandy, and it is for this reason that the railway remains so far inland. The sand is held together in dunes by means of a special grass, sown by the peasants. One interesting result of the flatness of the land is that at night six lighthouses can be seen, ranging from Cape Gris Nez in the north to Dieppe in the south west.

The journey of two miles occupied 15 minutes, but at last on rounding a curve the village came into view. It has been built during the last eight years as a holiday resort, and is small, its population being about 72 in winter and 1,500 in summer. The main road runs straight through to the sea. It is macadamised in the centre, but is bordered by wide gravel paths. The houses of the village interested me greatly. They are scattered about, and are of all sizes, shapes and colours. The medley seems to be typically French, and in some ways is more picturesque than the more symmetrical layout of houses resembling each other that make up similar places in many parts of Great Britain. I thoroughly enjoyed my stay there with my French hosts. H. DRABBLE (Mosborough).

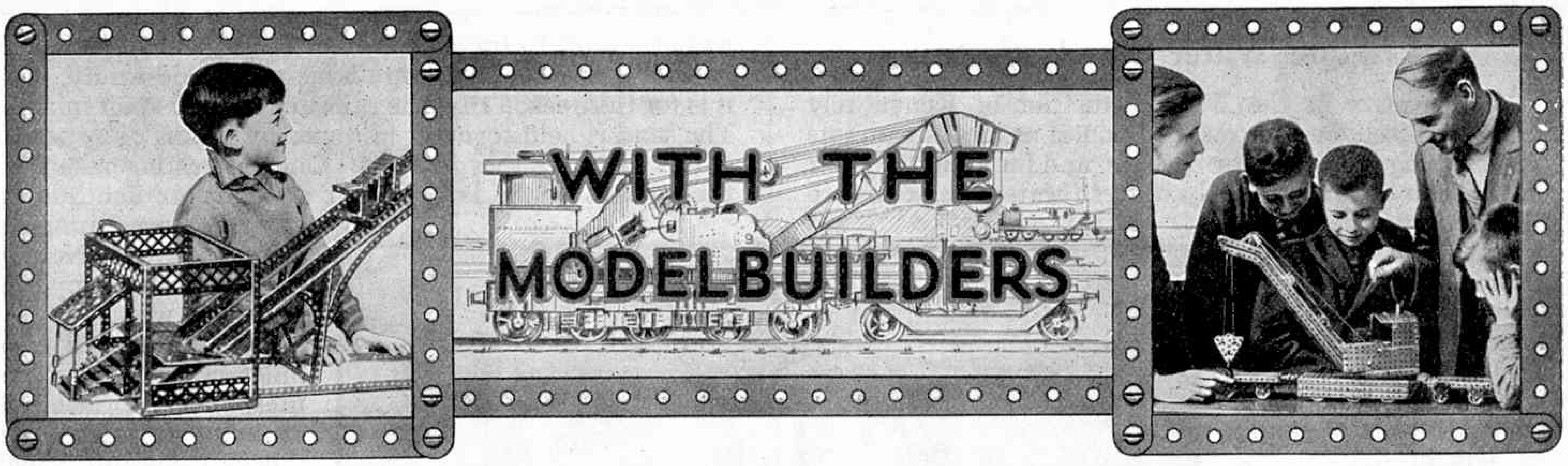
A Swiss Salt Mine

There are salt mines at Le Bouillet, south of the Lake of Geneva, and I was greatly interested in their working when I visited them recently. They consist of underground passages, or galleries, in which the rock is known to contain salt, and this is extracted by flooding them with water and leading off through pipes the brine that is formed.

The entrance to the mine is a narrow tunnel driven straight into the side of the mountains, and from it the various underground passages branch off. Some of the galleries are fitted with electric light, and acetylene lamps are carried to light the way along the others. The pipes are made of hollowed-out tree trunks, one end of each section being pointed, like a pencil, to enable it to be fitted into the blunt end of the next portion. Some of the pipes are 100 years old. Experiments recently have been made with cement and cast iron pipes, however.

During my passage through the mine I saw a large drill in use to obtain samples of rock for examination. Black diamonds are used at the boring end of this drill.

The visit was very enjoyable, but I was glad when I emerged into the bright sunshine after my stay underground. M. S. BONFORD (Harpenden).



OLD TIME STEAMSHIPS

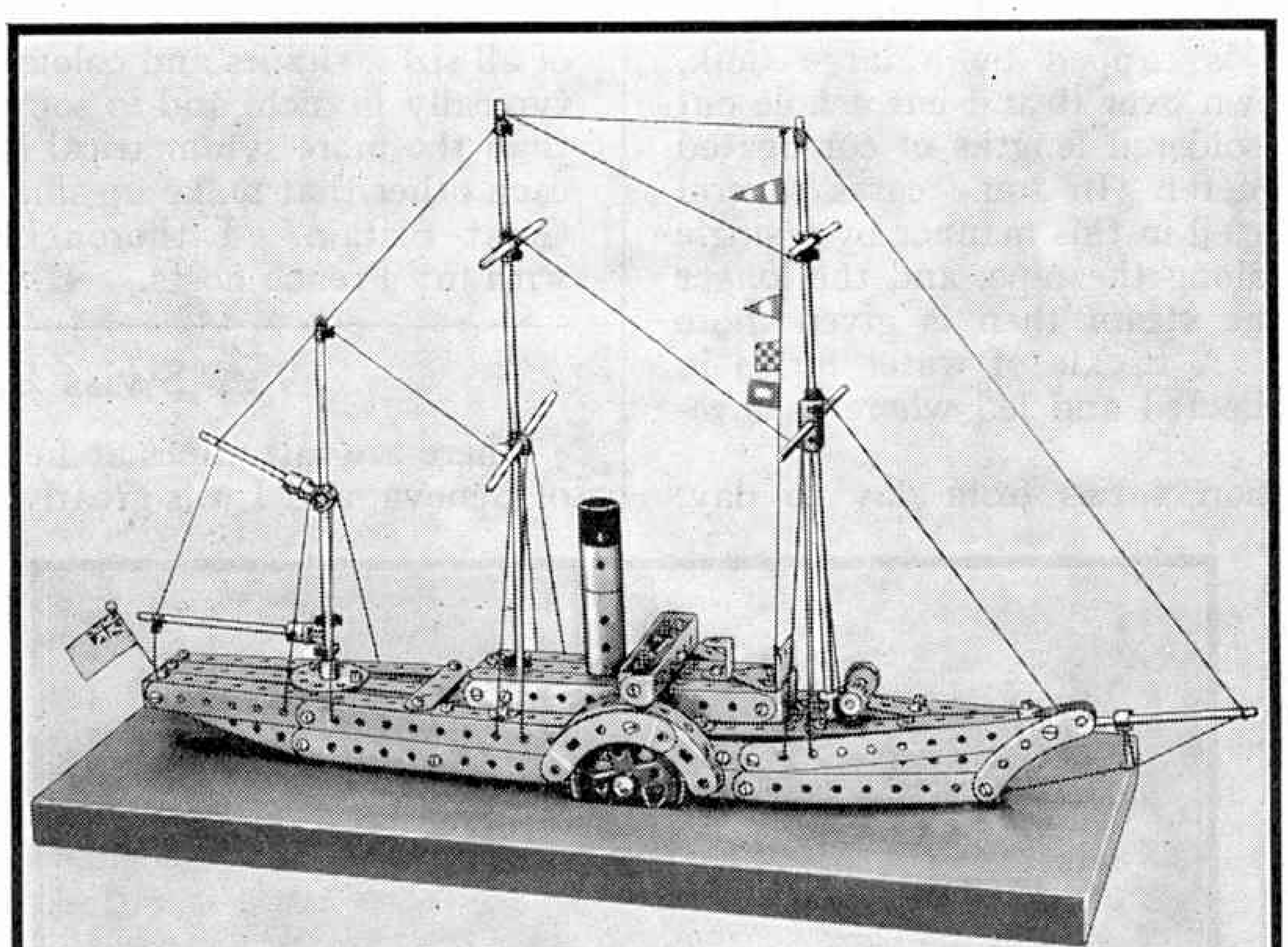
The illustration on this page shows a simple but effective Meccano model of the first Cunard steamer, "*Britannia*," which began her service in 1840. This model was intended to be displayed with the well-known Meccano demonstration model of the Cunard White Star liner "*Queen Mary*," illustrated on page 230 of the "*M.M.*" for April last, and therefore was built to the same scale. Apart from this comparison, the "*Britannia*" forms a very interesting subject for reproduction, and the model will introduce the model-builder who is looking for new subjects to a field that has been little explored.

The construction of these old-time ships need only be simple to give excellent results. The judicious use of a few Strips and Strip Plates produces an excellent hull, paddle boxes are well represented by Curved Strips of suitable size, and Pulleys can be used to form paddles. If desired, the shaft carrying the paddles can be connected through a high ratio reduction gear to one of the small Meccano Electric or Clockwork Motors. This greatly increases the interest of the model.

Early steamships were fitted with masts and sails, and these can readily be reproduced in Meccano with Rods and Couplings. The rigging can be secured to the masts and yards by means of Anchoring Springs, and small accessories such as masthead lamps, sidelights, and crows-nests can be built up from Collars and Couplings. Funnels, part No. 138, are suitable for most models of this type.

The appearance of these model ships can be greatly improved by fitting sails cut from good quality white paper and fitted to the yards by means of gum or cotton.

An interesting model of this type recently submitted was that of a Mississippi side-wheeler. These vessels are well known to Meccano boys. They were of shallow draught and had enormous superstructures that make them particularly suitable for reproduction in Meccano. The model submitted was a very fine effort, and the typical moving beam of the engine, protruding from the top of the superstructure, was cleverly represented by a number of Meccano Strips. The beam was driven by an Electric Motor and was connected to the crankshaft by a long coupling rod. The paddles carried at the ends of the shaft operated in exactly the same manner as those fitted to the prototype.


A Meccano model of the "Britannia," the first vessel of the Cunard line.

DISPLAY MECHANISMS

A working Meccano model is always a great attraction, whether it is an imposing super model, or a smaller one incorporating an ingenious or humorous movement. It is therefore not surprising to find that Meccano models of all kinds are largely used for display purposes. In addition, the adaptability of Meccano enables novel movements to be devised that can be incorporated in special displays. Many examples of these have come to our notice, and the details of the two models now described may suggest similar schemes to other model-builders.

A model Grandfather Clock, built with the aid of Super Model Instruction Leaflet No. 14a, was recently loaned by a Meccano enthusiast, P. W. Mills, Lowestoft, for the purpose of advertising a brand of self-rising flour. The clock was displayed in a shop window, and there attracted considerable attention, much to the satisfaction of the shop owner. An interesting feature of the model was the face. This was cut from blue cardboard, on which were mounted gold Roman numerals, and the result was very effective.

An example of the use of Meccano mechanisms for operating non-Meccano displays that has been brought to our notice by E. A. Tooke, Peckham, was exhibited recently in the window of a London chemist. It took the form of a working model leg that moved in a similar manner to that of a human leg in the act of walking. The leg was arranged in front of a screen in which was cut a slot, and the cranked end of a Meccano Crank Handle projected through the slot. This end had a covering of thin rubber, and as it rotated it pressed against the underside of the leg while it was sweeping out at an angle of 90°.

The inner end of the Crank Handle was connected at right-angles to a long Rod by means of a Coupling. One end of this Rod was fitted with a counterpoise, and the other end was connected by a pivotally mounted Strip to a rotating Face Plate that formed a crank, and was driven at slow speed by an Electric Motor.

MECCANO GRUBS AND INSECTS

Snails, flies, mosquitoes and other small forms of life are seldom looked upon by Meccano enthusiasts as potential subjects for new Meccano models, but they have been chosen by Victor Nabb of Market Drayton as prototypes for a series of very interesting models. Nabb is interested in the study of insect life, and occasionally gives illustrated talks on the subject. For this purpose he has constructed a number of large size models of certain insects from Meccano parts, and it will readily be understood that these have made his talks very much more attractive to his hearers. A similar plan could of course be followed with many other subjects, and no doubt model enthusiasts with a second hobby will find the idea of interest.

Considerable ingenuity has been exercised in the construction of the Meccano insects, and good use has been made of Strip Plates, Spring Cord, and such small parts as Centre Forks and Handrail Couplings. One model, representing a locust, is of particular interest, as it has been built with extreme care and the finished model is correct in every detail. The body is relatively long and is formed in the centre from a Meccano Boiler, without ends. The head, which is built up from two $2\frac{1}{2}''$ Triangular Plates and two $2\frac{1}{2}'' \times 1\frac{1}{2}''$ Flexible Plates, is secured to one end of the Boiler by means of Flat Brackets, and to the other end of the Boiler is attached a representation of the long tapering rear portion of the body, formed from a number of $12\frac{1}{2}''$ Strips secured to circles of $5\frac{1}{2}''$ and $3\frac{1}{2}''$ Strips.

The legs presented some difficulty at first, but finally were made to look very much like those of an actual locust by making use of a number of Reed Hooks and two Special Screwdrivers. The handle of each Screwdriver was extended slightly by a Sleeve Piece opened out at one end. The blades were then bent slightly to the required shape, and "hairs" represented by short lengths of Copper Wire were fitted where required.

Each of the four wings, when completed, represented many hours' delicate work. A frame was first built up from Rods, and these were also used to form the main structural members of the wings. Lacings of thin copper wire was next woven inside the wing frames, and after one or two failures, four really beautiful wings were ready for fitting to the body. Each wing was secured in place by means of two Handrail Supports. Pieces of Spring Cord were used in building up the wings and also formed the smaller legs and antennae. In order to preserve the shape of these, pieces of Spring Cord, twin lengths of 22 S.W.G. Copper Wire were passed down their centres.

In building models of moths and butterflies, Nabb introduces somewhat different methods from those already described. For instance, the fat and comparatively stumpy body of a large model Emperor Moth he has made recently has been reproduced by constructing a suitably shaped framework and covering it with a series of narrow frills of the required colours. These frills are cut from any light material and stained with ordinary coloured writing ink. The wings are simple frameworks built up in sections and covered with artificial silk that is cut into narrow strips as required. Later the colouring is added, and Spring Cord is used in forming the legs and antennae.

WIRELESS CABINET DESIGNS

For the wireless enthusiasts who wish to design their own cabinets the following ideas, from B. Bennett, Belfast, are of particular interest. The usual method of building up a cabinet of this sort is to construct a strong wooden box and fit this at the back with a removable panel. A second panel, to be screwed in position, is cut for the front of the cabinet and this usually consists of a sheet of three-ply wood, the centre of which has been cut away to form a design or fret.

These designs are liable to break, and to guard against this Bennett has constructed frets from Meccano parts to replace the wooden ones of his own cabinet and those of some of his friends. Curved Strips and short straight Strips were used largely in making these, and a few special parts such as Ring Frames and small Corner Brackets were incorporated in one or two examples. One of the most attractive cabinet fronts takes the form of a set of organ pipes built up from Strips covered with thin gauze.

LINK MOTIONS (J. CARROTHERS, BELFAST)

In the past many excellent demonstration models of valve gears and link motions have appeared in the "*M.M.*" and these have always created much interest. Mr. J. Carrothers, Belfast, is a keen model-builder who has taken full advantage of the possibilities offered by these motions, and one of his recent efforts is a reproduction of the link motion fitted to Atkinson's Differential Gas Engine, which enables a four-cycle stroke to be obtained for every revolution of the crankshaft.

The construction of this gear is simple. A crank 2″ long is built up from a $1\frac{1}{2}''$ Strip and a Crank. This is mounted on the driving shaft of the engine, and is pivotally secured to a 3″ Strip that carries a Simple Bell Crank at its lower end. The Strip and Crank overlap two holes, and one end of a second 3″ Strip is pivoted in the centre hole of the Crank. The free end of this Strip is secured by a bolt and lock-nuts to the frame of the model. The lower end of the Bell Crank points away from the cylinder, and is linked up with the piston by a $4\frac{1}{2}''$ Strip. The vertical distance between the centres of the Simple Bell Crank and crankshaft must be $3\frac{1}{2}''$, the former being 1″ forward of the latter.

A Meccano Wall Clock

A Simple Weight Driven Time-keeper

As a result of many requests for an accurate but simple clock, we describe in this article a Meccano Wall Clock that will interest specially model-builders who have a limited supply of Meccano parts at their disposal.

The frame is formed from two $12\frac{1}{2}''$ Angle Girders 1, fitted with two $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plates, one of which is shown at 2. The near side Plate has been removed in order to expose the gear-train. A $5\frac{1}{2}''$ Angle Girder 3 is bolted across the upper flanges of the Flanged Plates 2, and two further Girders of similar size are bolted to the inside edge of each Plate. One of these Girders is shown at 4, and they both form supports for two $4\frac{1}{2}'' \times 2\frac{1}{2}''$ Flat Plates. One $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flat Plate and two $5\frac{1}{2}''$ Strips are bolted between the two rear flanges of the Plates 2, Fig. 2. Two $4\frac{1}{2}''$ Strips 5 are fitted as shown.

Two $12\frac{1}{2}'' \times 2\frac{1}{2}''$ Strip Plates are secured to the Girders 1, and bridged at the bottom by a $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Strip Plate. At the top two $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Strip Plates are fitted as shown in Fig. 1, and they are connected together at their upper corners by a $2\frac{1}{2}''$ small radius Curved Strip. Fancy work is added to the bottom of the clock and this is formed from five $2\frac{1}{2}''$ small radius Curved Strips and two 4″ Curved Strips.

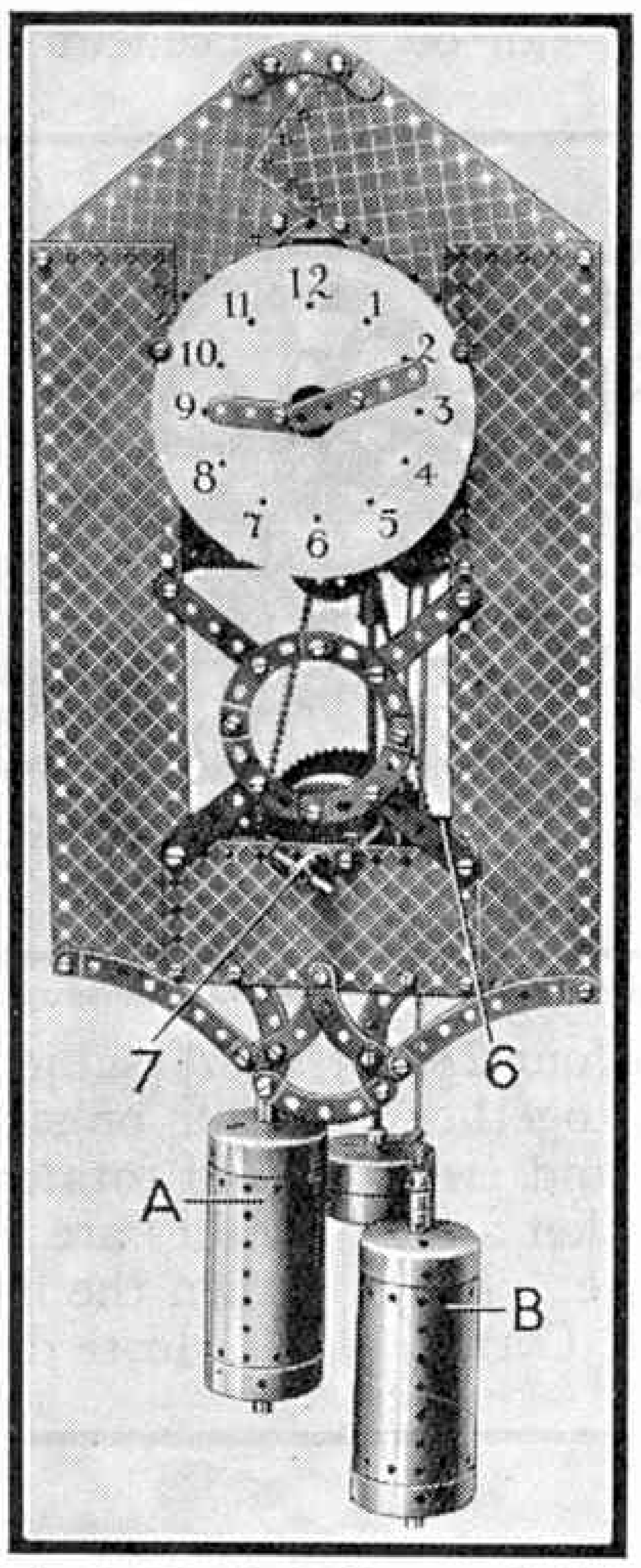


Fig. 1. This simple Meccano Clock is fully described on this page.

The lower end of the Girders 1 each carries a $2\frac{1}{2}'' \times 2\frac{1}{2}''$ Flat Plate, the outer edges of which are fitted with $2\frac{1}{2}''$ Angle Girders. The Flanges of these Angle Girders point inward, and at their upper ends they are bridged by a duplicated $5\frac{1}{2}''$ Strip, a portion of which is shown at 6, Fig. 1. Two Double Arm Cranks are now fitted to form reinforced bearings, and one of these is secured to the centre of the $5\frac{1}{2}''$ Strips 6. The other is bolted to the lower $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Strip Plate as shown.

The winding barrel consists of two Wheel Flanges and two Face Plates, bolted together by two $\frac{3}{4}''$ Bolts, to form a large diameter drum. The boss of one of the Face Plates is turned inward so that it is accommodated inside one of the Wheel Flanges, and the complete winding barrel is mounted on a $3\frac{1}{2}''$ Rod that carries also a Ratchet Wheel and a 3″ Sprocket. The Ratchet Wheel is locked on the $3\frac{1}{2}''$ Rod with its boss pointing to the back of the model; and the Sprocket Wheel, free to turn on the Rod, is mounted in a similar manner, but is spaced away from the Ratchet Wheel by a Washer. In one of its outer holes a Pivot Bolt is secured and on this is carried a spring-loaded Pawl. The front end of the $3\frac{1}{2}''$ Rod carries a Coupling 7, fitted with a $1\frac{1}{2}''$ Rod, forming the winding handle.

The 3″ Sprocket drives, through a length of Chain, a $\frac{3}{4}''$ Sprocket Wheel mounted on the same Rod as a $1\frac{1}{2}''$ Sprocket 8. A second length of Chain connects the Wheel 8 with the Sprocket Wheel 9, and this is mounted on a 3″ Rod, together with a 57-teeth Gear that is in mesh with a $\frac{1}{2}''$ Pinion locked on the same Rod as a second 57-teeth Gear. This last Gear is carried on the front end of its Rod immediately behind the face, and is in engagement with a $\frac{1}{2}''$ Pinion mounted on the same Rod as the Gear 10. The Rod is carried at one end in a bearing formed from a Double Bent Strip. A $\frac{1}{2}''$ Pinion on the escapement rod is in constant mesh with the Gear 10.

The Gears that transmit the movement from the minute hand to the hour hand are now fitted. The Rod carrying the Sprocket 9 is fitted with a $\frac{1}{2}''$ Pinion that meshes with a 57-teeth Gear 11 on the Rod 12. This Rod is $3\frac{1}{2}''$ in length and carries the minute hand at its outer end. At its centre is a $\frac{3}{4}''$ Pinion, meshing with a 50-teeth Gear on the Rod 13, and also a 1″ Gear that engages with a similar part on the Rod 14 carrying a second $\frac{3}{4}''$ Pinion. This Pinion drives a 50-teeth Gear on the Rod 15, which carries on its front end a $\frac{1}{2}''$ Pinion. A 57-teeth Gear, that is free to turn on the Rod 12, meshes with this latter Pinion, and is fitted with a $\frac{1}{2}''$ Reversed Angle Bracket. This part is bolted to the 57-teeth Gear and it protrudes through a hole in the centre of the face. A $1\frac{1}{2}''$ Strip represents the hour hand.

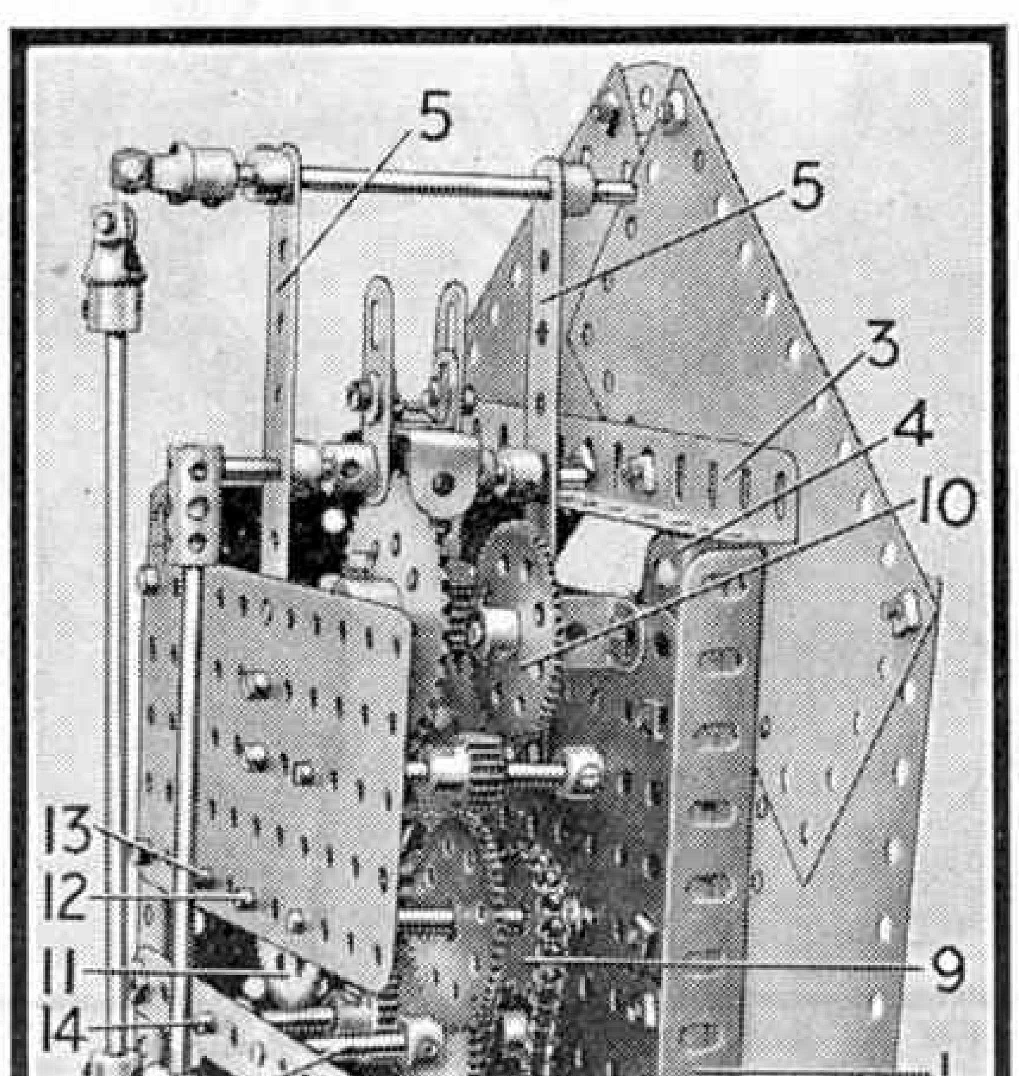


Fig. 2. The gearing of the Wall Clock.

The escapement wheel and pallet are fully described in the Suggestions Section on page 473 of last month's "*M.M.*" The mounting of the pendulum will be apparent from the illustration. The flexible connection at the top of the pendulum consists of two short lengths of flexible steel wire. The pendulum itself is built up from one 8″, one $11\frac{1}{2}''$ and one $3\frac{1}{2}''$ Rod joined together by Couplings. The "bob" is built up from two Boiler Ends in which is placed a small quantity of lead scrap.

The driving weights, shown in Fig. 1, are formed from Boilers filled with lead scrap and are attached to the driving cords by End Bearings. The cord from the weight A is taken to the drum, round which it is wound in an anti-clockwise direction. The cord from B passes over the Pulley 16 and is wound anti-clockwise on the drum.

In Search of New Models

Countryside Figures and Scenes

LAST month we described a number of models of typical people seen at the seaside; this month we turn to the country. The same general idea is followed, the models representing figures and machinery that can be seen during a holiday in the countryside, where there is no lack of interesting subjects for reproduction with Meccano.

A hay-field is the source of the first models to be dealt with. The old way of cutting grass was by means of a scythe, and this method is illustrated in miniature in Fig. 2, which shows a simple but clever reproduction of an old-time farmer plying his scythe. No difficulty should be experienced in building this and similar models. The body of the farmer is formed from four 2½" large radius Curved Strips. These are secured together at the top by means of two Double Brackets and two Flat Brackets, and at the bottom a Double Bracket and two 1½" Strips are used for a similar purpose. The shoulders are cleverly reproduced by means of 1" Corner Brackets, secured to the body by Angle Brackets. The scythe is built of a 4½" Rod and a 4" Curved Strip, joined by means of a Collar fitted with a bolt. An amusing feature is the spring-mounted head, which moves almost continuously and lends an atmosphere of quaintness to the figure. A Flexible Coupling Unit is secured at each end in the longitudinal hole of a Coupling, the lower one of which is bolted to the inside of the body by a ½" Bolt and nut. The upper Coupling is attached by means of a 1" Rod to a Bush Wheel forming the hat.

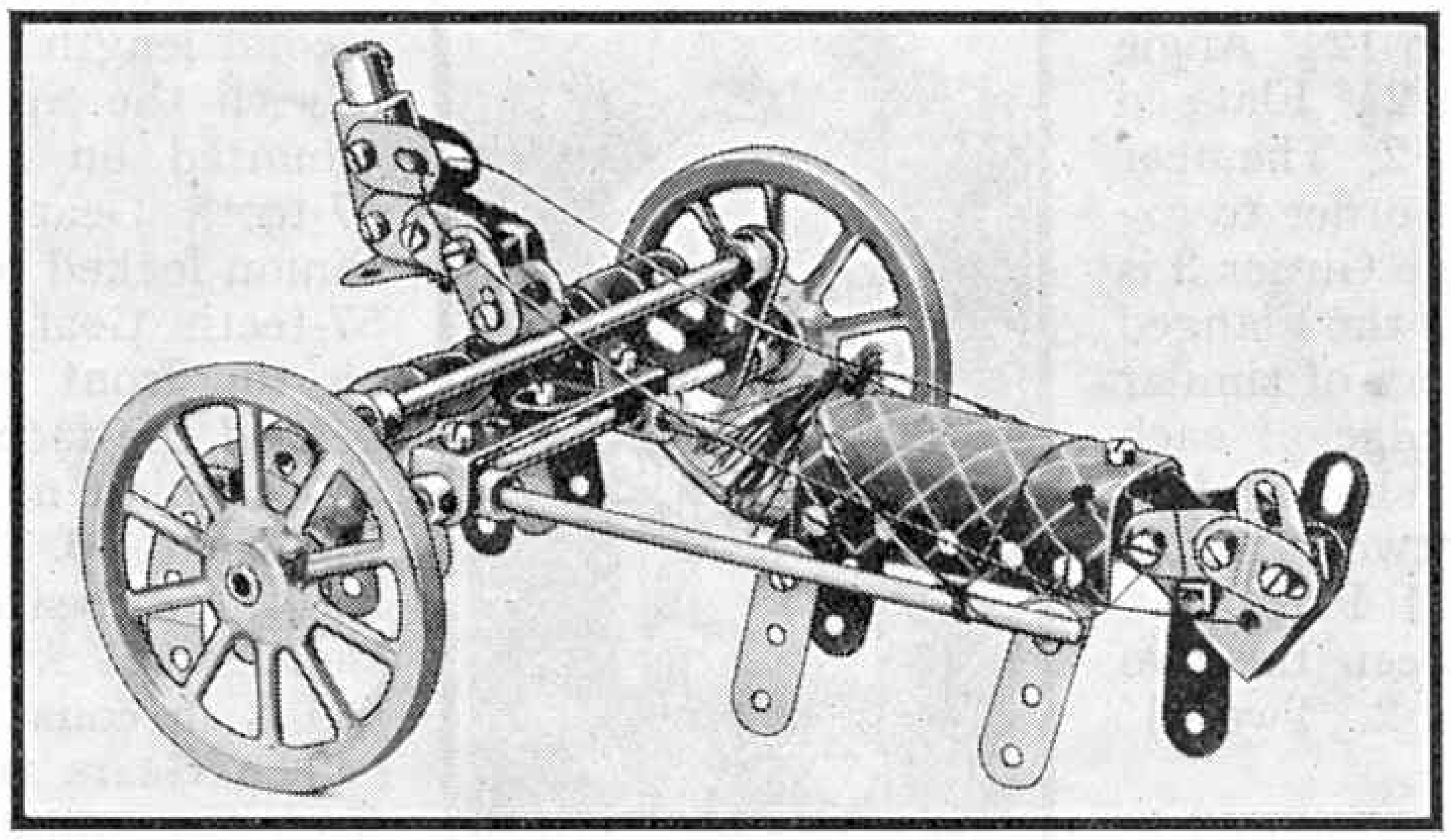


Fig. 1. A simple but realistic model of a horse rake at work.

Other figures suggesting different farming occupations can readily be constructed on similar lines. Such simple actions as digging, hoeing and cutting with the aid of a sickle form excellent subjects for reproduction, and the builder will find ample scope for ingenuity when arranging the arms, legs and heads of his figures. Models of this kind do not rely for their successful appearance on the inclusion of a great number of parts, but rather upon the builder's imagination and ability to put a few parts to good use.

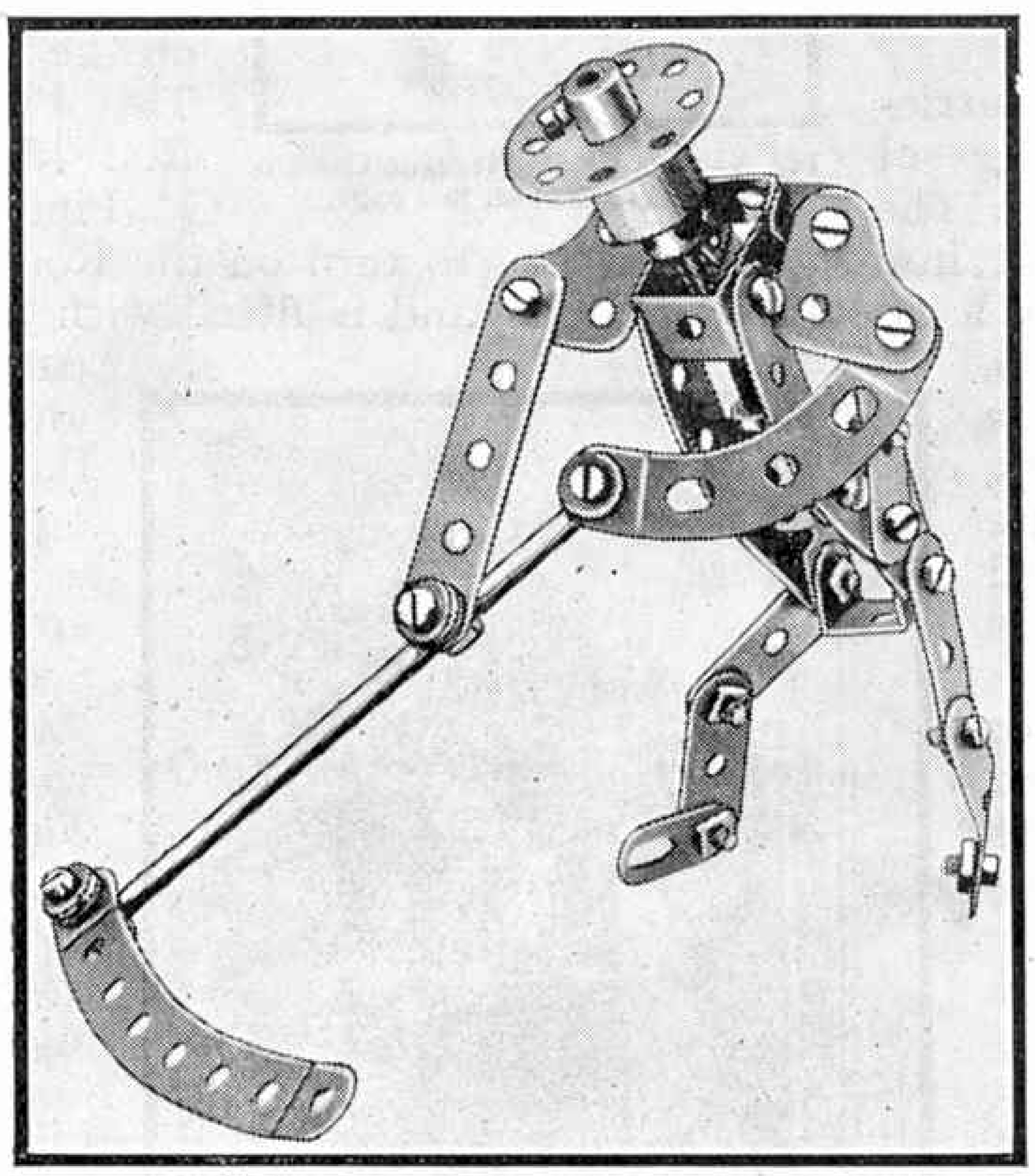


Fig. 2. A Meccano farmer wielding a scythe.

Modern methods of grass cutting on a large scale offer splendid opportunities for the agricultural model-builder, for many large and interesting machines have been devised for this purpose. The small horizontal cutting machine or mower in general use in this country forms an excellent subject for the small Outfit owners. A large wheel mounted to one side of the machine operates a cutter fitted at right-angles to the wheel, acting through a series of bevel gears. A right-angle drive formed from cord can be used in a simple model.

Before the hay is gathered in and stacked it must be dried by turning it, and is made up into swathes and haycocks. The specially designed machines, drawn by horses or tractors, that are used to carry out the necessary operations form excellent subjects for Meccano models. A hay tedder has four or six large rakes, mounted to form a long drum and rotated through spur gearing from the wheels. The rakes are fitted with a parallel link motion so that they turn the hay without throwing it into the air.

Horse drawn rakes are used for making the swathes or long ridges of hay, and a clever reproduction of a machine of this kind is shown in Fig. 1. This is a simple model and, with the addition of a few Curved Strips and 3" Wheels, is quite suitable for the small Outfit owner. The forks, or tines, are represented by 2½" small radius Curved Strips mounted on a Screwed Rod, and this is attached at each end to a Simple Bell Crank pivoted at its centre on the main axle. The driver is formed from a series of Flat Brackets and Double Brackets and a Rod Socket represents his head. The construction of the horse is very simple. A "U" Section Curved Plate forms the body, and each leg is built up from a Flat Bracket and a 1½" Strip. The tail, reins and harness are represented by short lengths of Meccano Cord.

Fig. 3 at the top of the next page shows a Meccano model in which the atmosphere of a favourite country scene has been successfully captured. Carting hay from the field to the stackyard is so typical of country life that no article of this nature would be complete without some mention of it. The design of hay carts has remained unchanged for generations, and their simplicity and solidity make them eminently suitable for reproducing in Meccano.

The sides of the model cart are built up on a $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate, and the carrying frames are secured to the upper edges of these by Obtuse Angle Brackets. The front and rear carriers are represented by $2\frac{1}{2}''$ Flat Girders and those at the side by means of $5\frac{1}{2}''$ Strips. Hay of course must be added to give a final realistic touch. This can readily be represented by six bundles of Hornby Fibre, and real straw or grass also can be used.

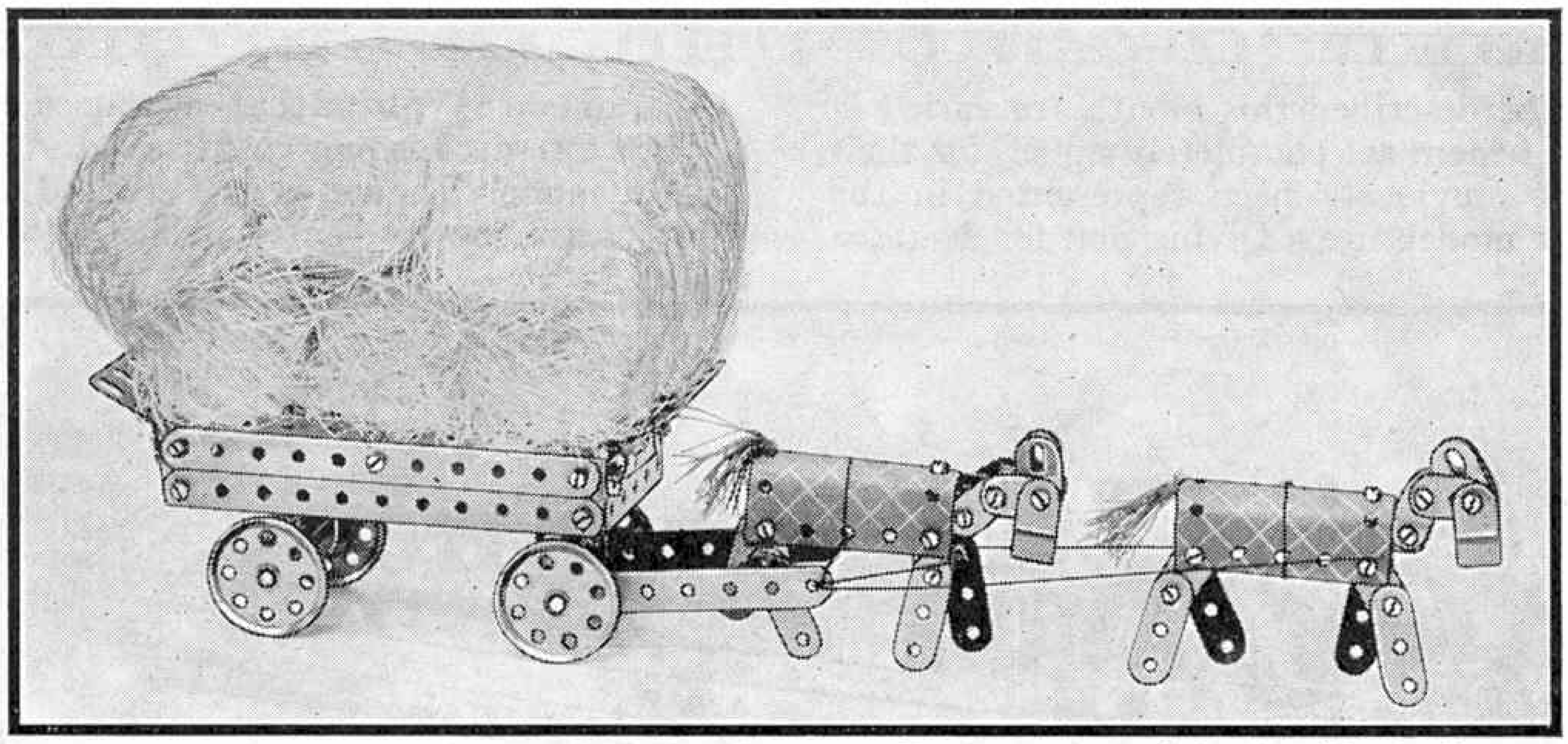


Fig. 3. A familiar countryside feature well reproduced in Meccano. The hay consists of six bundles of Hornby Fibre.

The familiar reapers and binders used in harvesting wheat and other grain are ideal model-building subjects, for they are picturesque in appearance and incorporate interesting mechanisms. The cutter is similar to that of the grass mower, and is driven through a crank and gearing connected to the large wheel of the machine. Rotating arms press the grain against the cutter and lay it flat on the conveyors. These arms form what is called the reel and are driven by a secondary set of bevels, but in small models, cord can be used for this purpose. The conveyors carry the grain up to the sloping platforms on the offside of the machine on which it is bound into sheaves. Many interesting models of this kind have been described in the *"M.M.,"* an excellent example that won a prize in a Model-building Contest being illustrated on page 293 of the May, 1936 issue, and any keen model-builder who has spent a holiday in the country and has seen the machines they represent at work will find great pleasure in trying to build one for himself.

When they were first introduced these machines were drawn by horses, but to-day tractors are freely used, and a combination of a tractor and a reaper and binder would make a very attractive model. More recently, machines that actually thresh the corn as it is gathered and deliver it into sacks have been introduced, and the reproduction of one of these in miniature would be an interesting piece of work.

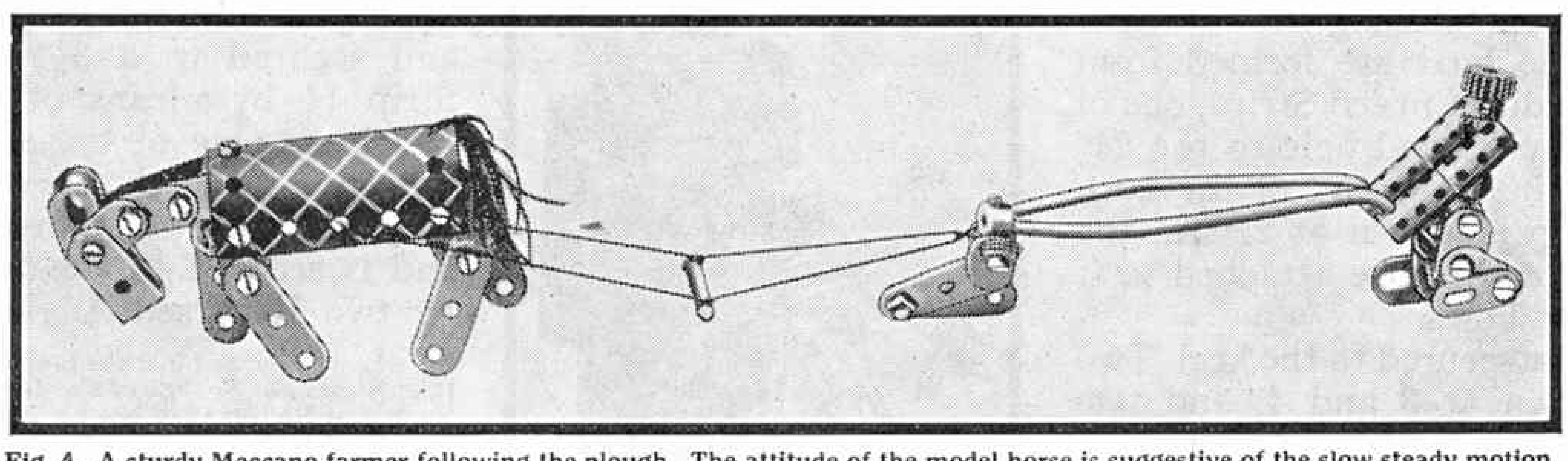


Fig. 4. A sturdy Meccano farmer following the plough. The attitude of the model horse is suggestive of the slow steady motion characteristic of ploughing, and the figure typifies strength.

A farming scene entirely different from those already described is reproduced in Fig. 4, which shows a very simple model plough together with a horse and ploughman. Little difficulty should be experienced in constructing an attractive model of this kind.

The plough blade is formed from two $1\frac{1}{2}''$ Strips, bolted together as shown, and secured by means of two $\frac{1}{2}'' \times \frac{1}{2}''$ Angle Brackets to two Collars. The Collars carry the shafts, which consist of two 5″ Rods bent to the required shape. The outer ends of these Rods pass into the end plain holes of two Couplings that form part of the ploughman's arms and are attached by two bolts to the upper ends of a Small Fork Piece. A Rod passing through the longitudinal hole of this Fork Piece carries at its upper end a $\frac{1}{2}''$ Pinion, representing the ploughman's head, and at its lower end a Coupling to which are secured the legs formed from Flat Brackets. The horse is built in the same manner as that hauling the rake and the traces can readily be fitted in the manner shown in the illustration.

A large number of machines are used in conjunction with the plough, and illustrations of these are to be found in the advertising sections of many farming and engineering periodicals. They include spring tine harrows, potato diggers, cultivators and drilling machines, all suitable prototypes for new models, and those who are searching for new ideas for entries in model-building contests will be well advised to consider one or more of these.

The construction of a miniature spring tine harrow is not difficult, and only very few parts are required. The large horizontal frame is best built up from a series of Strips set on edge, and connected together by two Angle Brackets. The finished frame forms three sides of a square and carries three long Rods disposed laterally. These Rods, which are mounted in the upper holes of Flat Trunnions bolted to the frame, are prevented from sliding by means of Collars.

The tines are now added, and these can be fitted to the three Rods already mentioned in a similar manner to those in the model horse rake. They are curved to a greater extent, however, and therefore are best represented by Strips bent to the required shape. Three Cranks are now fitted, in line, to the three Rods, and all are coupled together by a long Strip. This Strip is lock-nutted to the Cranks and it is linked up to a lever at its rear end. By moving the lever the tines can be adjusted to work at any depth. In large harrows two levers are often provided, each of these controlling half of the tines.

The addition of one or two horses and a farmer will add considerably to the appearance of the model and these can be built on exactly similar lines to those shown in Fig. 4. The reins and traces may be represented by short lengths of cord.

Attractive New Models

Motor Ice Yacht and Deep Sea Diving Suit

THE models to be described this month are varied in type and two of them are completely novel, for their subjects have not previously been represented in the Magazine. The new models are a Diving Suit for deep sea work, and a Motor Ice Yacht, and are illustrated in Figs. 2 and 4. The other two models dealt with are a Motor Launch and an Arch Bridge.

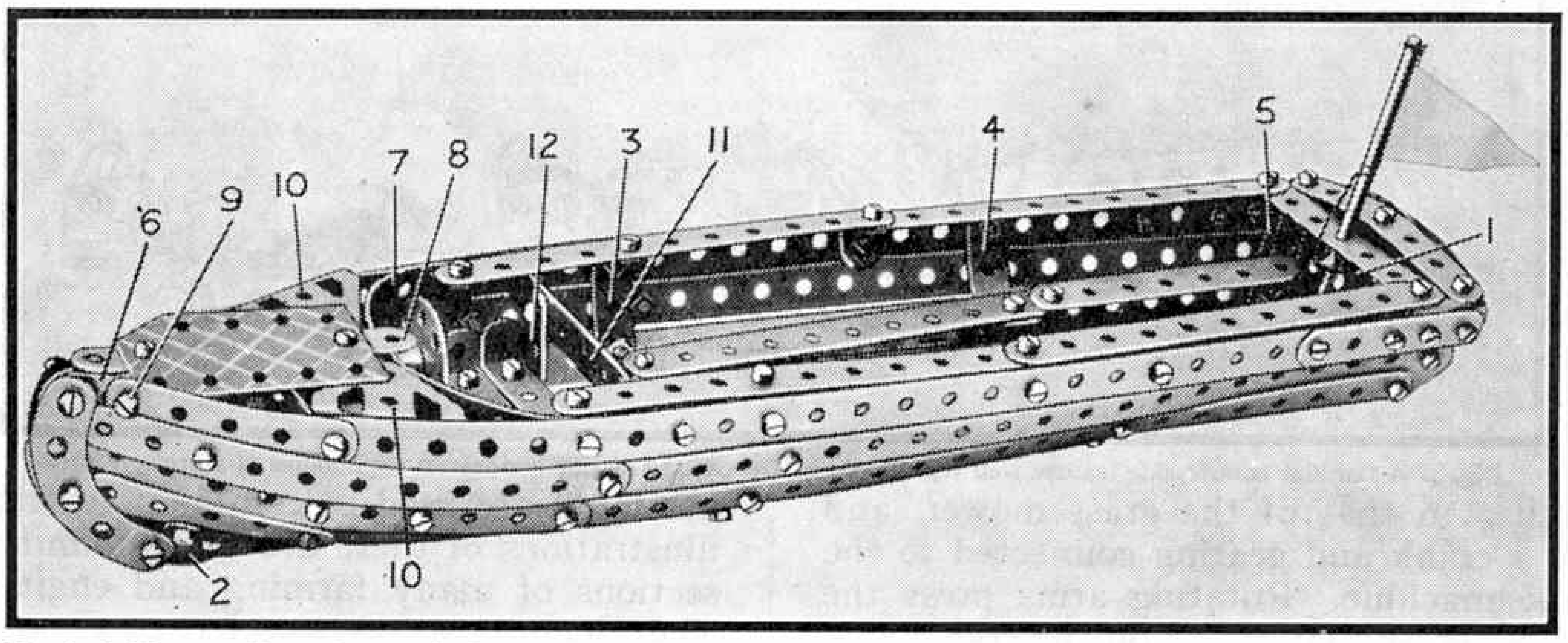


Fig. 1. A Meccano Motor Launch built on excellent lines. Its construction is described in detail in the accompanying article.

The Motor Launch, shown in Fig. 1, is a particularly neat model built with Outfit F. Its building is commenced by constructing the keel, which is formed from two $12\frac{1}{2}''$ Angle Girders bolted together, at their round holes, to form a "T" section Girder. Between the two Girders at the forward end, a $2\frac{1}{2}''$ Strip is inserted for a distance of three holes and is held in place by means of two nuts and bolts. At the rear is a Flat Bracket to which the rudder, a Flat Trunnion, is afterwards attached. This end of the keel is fitted with two Angle Brackets bent outward slightly, and secured in place by bolts passing through the end slotted holes. The two Brackets form supports for a $2\frac{1}{2}''\times1\frac{1}{2}''$ Flanged Plate 1 representing the transom.

The bows of the boat are formed from three $2\frac{1}{2}''$ small radius Curved Strips, one of which is bolted by its end hole to the $2\frac{1}{2}''$ Strip carried at the front end of the keel. This Curved Strip is shown at 2, and the two other similar Strips are attached to it and overlap four holes.

The ribs are now secured to the keel. Two of these are shown at 3 and 4, and two others are fitted to each side, one represented by a $2\frac{1}{2}''$ Strip at the bow and the other, a $1\frac{1}{2}''$ Strip 5, at the stern. The lower end of the $1\frac{1}{2}''$ Strip at the stern is secured to the flange of the Plate 1.

When the ribs are in position the "planks" can be fitted, and the lengths of these are shown in the illustration. The top-most plank is fitted first. It is built up from one $12\frac{1}{2}''$ Strip and two $2\frac{1}{2}''$ Strips, and is extended at one end by means of a Flat Bracket 6. The second plank from the top consists of one $12\frac{1}{2}''$ and one $5\frac{1}{2}''$ Strip overlapping each other five holes. The third or centre plank is formed in a similar manner, but is secured in position slightly nearer the bows. Of the two remaining planks, one consists of a $12\frac{1}{2}''$ Strip and $2\frac{1}{2}''$ Strip, and the other of two $5\frac{1}{2}''$ Strips that overlap each other three holes.

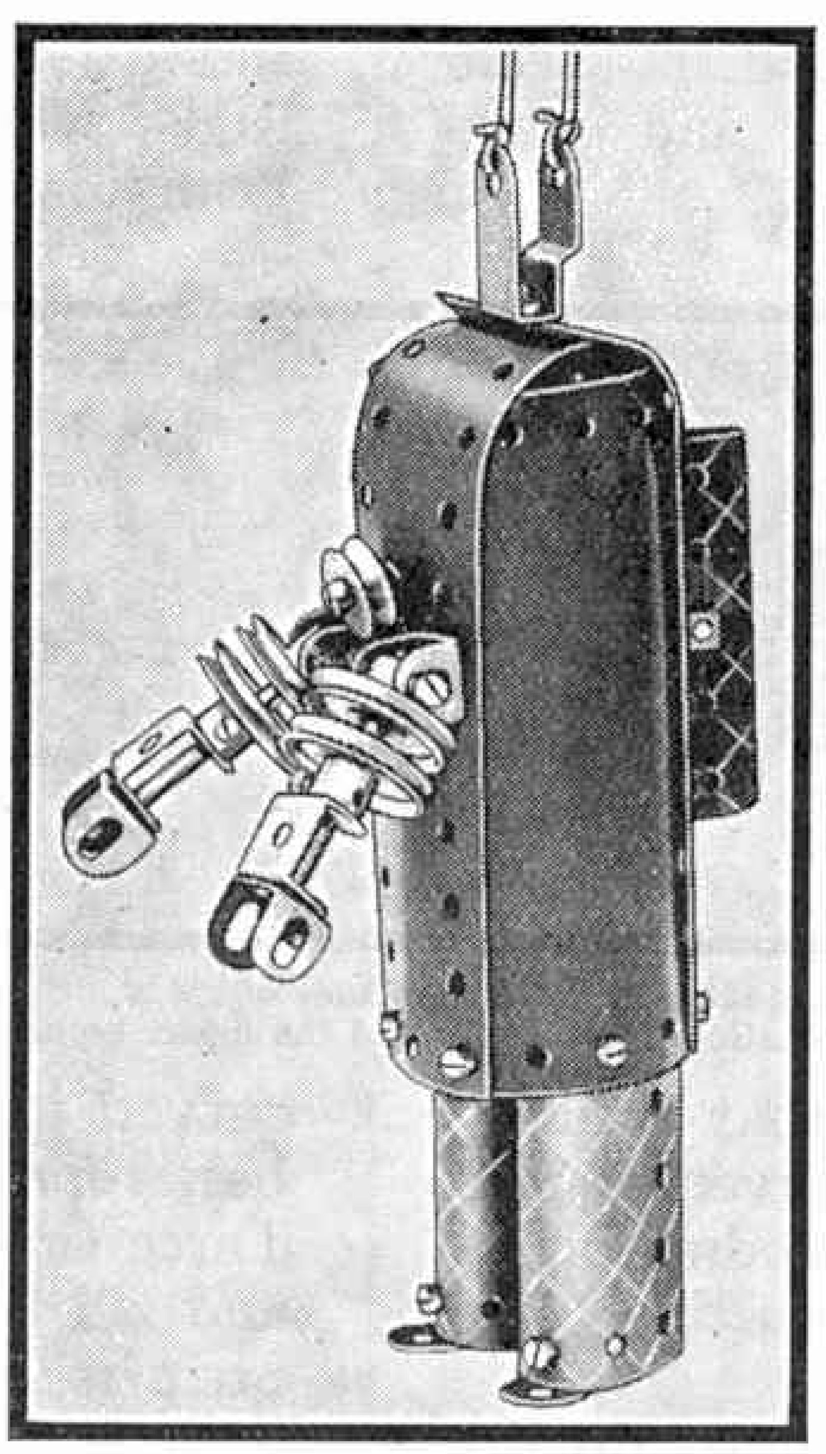


Fig. 2. An unusual model subject, a deep-sea diver.

The fore-deck is now constructed. A $5\frac{1}{2}''$ Strip 7, curved in the manner shown, is first secured across the hull and this carries at its centre hole a $\frac{1}{2}''\times\frac{1}{2}''$ Angle Bracket locked in place by means of a Threaded Pin carrying a Bush Wheel, which represents the steering wheel. The Angle Bracket forms a support for one end of the $3\frac{1}{2}''$ Strip 8, the opposite end of which is bolted to a further $\frac{1}{2}''\times\frac{1}{2}''$ Angle Bracket held in position by the Bolt 9. The $3\frac{1}{2}''$ Strip 8 carries a $2\frac{1}{2}''\times1\frac{1}{2}''$ Flexible Plate, the corners of which are bent slightly in order to preserve the shape of this part of the model. The fore-deck is completed by the addition of the two Trunnions shown at 10 in the photograph.

Seats and flag-staff are all that are now required to complete the model. The flag-staff is represented by a 4" Rod that is held in position in the boat by means of two Collars, and a flag cut from a piece of coloured paper is fitted by means of a short length of Meccano Cord. The seat for the helmsman is formed from two $2\frac{1}{2}''\times\frac{1}{2}''$ Double Angle Strips held together and secured to a $3\frac{1}{2}''\times\frac{1}{2}''$ Double Angle Strip 11 by means of two $1''\times1''$ Angle Brackets. One of these Angle Brackets is shown at 12. Each side seat is built up from a $5\frac{1}{2}''$ and a $3\frac{1}{2}''$ Strip, overlapping one hole, and is secured to the bottom of the boat by two Reversed Angle Brackets.

Parts required to build the model Motor Launch: 8 of No. 1; 15 of No. 2; 4 of No. 3; 2 of No. 4; 11 of No. 5; 2 of No. 6a; 2 of No. 8; 5 of No. 10; 12 of No. 12; 2 of No. 12a; 3 of No. 12c; 1 of No. 15b; 1 of No. 24; 97 of No. 37; 2 of No. 37a; 5 of No. 38; 2 of No. 48a; 2 of No. 48b; 1 of No. 51; 1 of No. 59; 2 of No. 90; 3 of No. 90a; 1 of No. 111; 2 of No. 111c; 1 of No. 115; 4 of No. 125; 2 of No. 126; 1 of No. 126a; 1 of No. 188.

The strange-looking model shown in Fig. 2 is based on a form of diving dress of the type invented by German engineers, and used by the Italian divers of the "*Artiglio*" in their search for the gold of the ill-fated "*Egypt.*" The dress is designed for salvage work in very deep water, and the man who descends in it is suspended in a position from which he can direct the use of explosives or of the grab employed to dig out treasure from a sunken vessel. Great strength is necessary at the enormous depths at which work is carried on with the aid of this dress.

The model can be constructed with Outfit B. The body is built up from two $4\frac{1}{2}'' \times 2\frac{1}{2}''$ and two $5\frac{1}{2}'' \times 1\frac{1}{2}''$ Flexible Plates bolted together, and the upper edges of the $5\frac{1}{2}'' \times 1\frac{1}{2}''$ Plates are joined by means of a nut and bolt that also holds in position a Cranked Bent Strip to which are secured the Cords representing the hoisting ropes. Each arm consists of a $1\frac{1}{2}''$ Rod fitted with two Pulleys, a Double Bracket and two $\frac{1}{2}'' \times \frac{1}{2}''$ Angle Brackets. One of the Pulleys is fitted with two bolts and the shanks of these pass through the slotted holes of two $\frac{1}{2}'' \times \frac{1}{2}''$ Angle Brackets that are attached to the body by a nut and bolt. The two $\frac{1}{2}'' \times \frac{1}{2}''$ Angle Brackets on the outer end of the $1\frac{1}{2}''$ Rod are retained in position by means of a Spring Clip. A compressed oxygen cylinder is represented by a $2\frac{1}{2}'' \times 1\frac{1}{2}''$ Flexible Plate bent into the shape of a U and secured to the model by two Cords.

The legs are fitted last. Each of these is represented by a U section Curved Plate, part No. 199, and the feet are reproduced by Reversed Angle Brackets.

Parts required to build the model Diver: 1 of No. 10; 2 of No. 11; 8 of No. 12; 2 of No. 17; 4 of No. 22; 1 of No. 23; 2 of No. 35; 20 of No. 37; 6 of No. 38; 1 of No. 44; 2 of No. 111c; 2 of No. 125; 1 of No. 188; 2 of No. 189; 2 of No. 190; 2 of No. 191; 2 of No. 199.

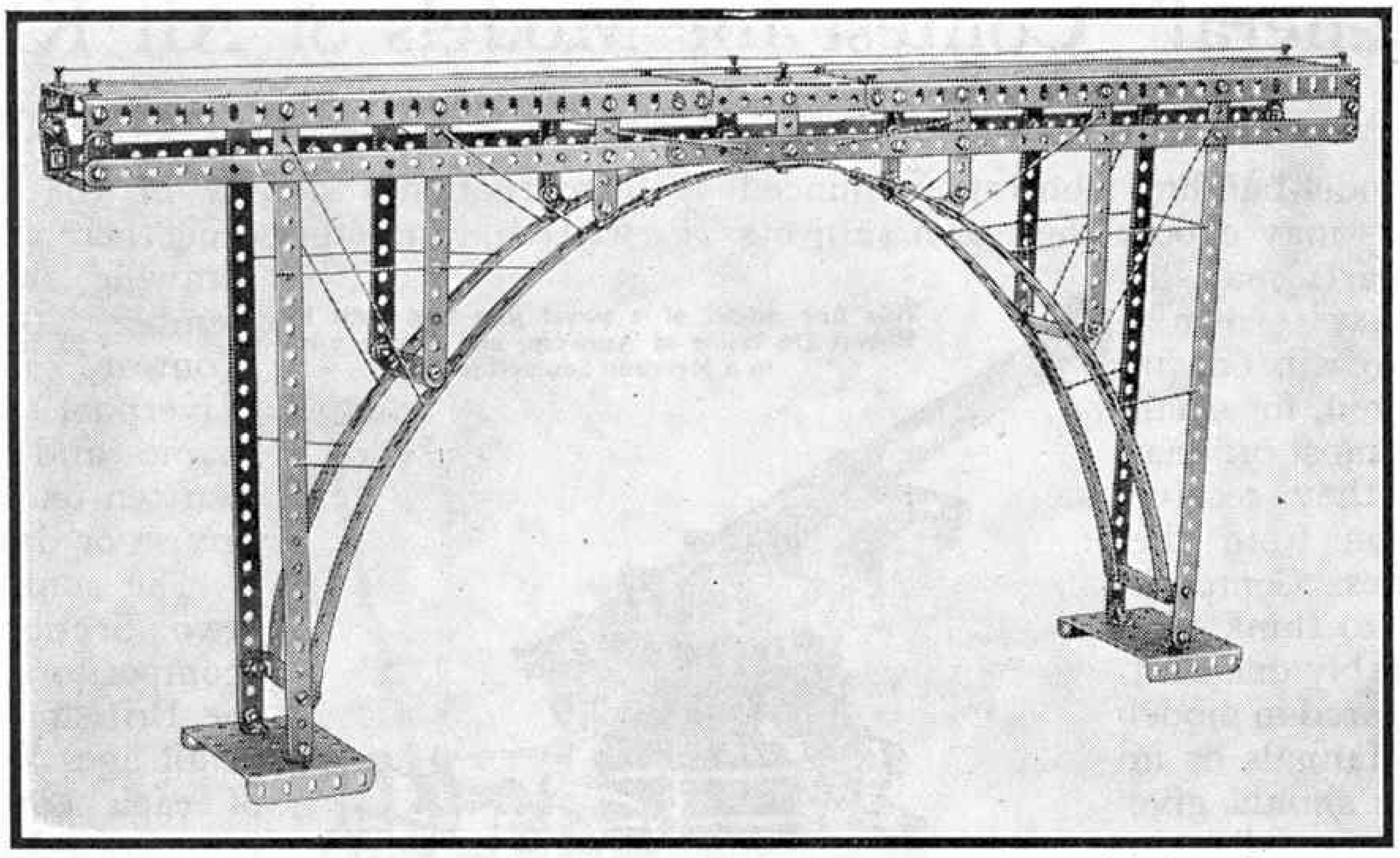


Fig. 3. An interesting arch bridge that can be built with the parts included in Outfit D.

A fine model Arch Bridge built with Outfit D is shown in Fig. 3. This is suitable for incorporation in a Hornby Railway if only a single line is to be used in the section in which it is included.

Each main side member of the model is formed from two $12\frac{1}{2}''$ Angle Girders joined together by a $5\frac{1}{2}''$ Strip that overlaps each Girder two holes. Two $12\frac{1}{2}'' \times 2\frac{1}{2}''$ and one $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Strip Plates are used to connect them, and six $\frac{3}{8}''$ Bolts protruding upward, and fitted with Cord as shown, represent handrails. Each end support of the roadway is formed from two $12\frac{1}{2}''$ Strips that are secured in position at their upper ends. The lower ends of the Strips carry $\frac{1}{2}'' \times \frac{1}{2}''$ Angle Brackets and a $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip also is fitted. The Angle Brackets form the connection between the vertical $12\frac{1}{2}''$ Strips and a $3\frac{1}{2}'' \times 2\frac{1}{2}''$ Strip forming the base.

The arch may now be fitted. This is built up from four $12\frac{1}{2}''$ and two $5\frac{1}{2}''$ Strips, and is attached by bracing strips of varying lengths to the underside of the roadway. Additional bracing is added, and this takes the form of lengths of Meccano Cord.

Parts required to build the model Arch Bridge: 10 of No. 1; 13 of No. 2; 4 of No. 3; 4 of No. 5; 2 of No. 6a; 4 of No. 8; 8 of No. 10; 8 of No. 12; 92 of No. 37; 6 of No. 37a, 1 of No. 40; 7 of No. 48a; 2 of No. 53; 6 of No. 111c; 1 of No. 195; 2 of No. 197.

A neat model Motor Ice Yacht, built with Outfit B, is illustrated in Fig. 4. This model is characteristic of the ice yachts that in winter frequent the frozen lakes and rivers of Canada. Ice yachting is great sport, for high speeds are attained and remarkable feats of balancing by their crews are called for.

The base of the model is a Flanged Sector Plate fitted underneath, at its widest part, with two Angle Brackets and two Flat Brackets 1, which support a $2\frac{1}{2}''$ Strip 2 representing the rear runner. At its narrow end the Sector Plate is fitted with two Trunnions 3 that carry the $5\frac{1}{2}''$ Strips forming the outriggers. The outer end of each Strip has bolted to it a $\frac{1}{2}'' \times \frac{1}{2}''$ Angle Bracket and a Flat Bracket, and to the Flat Bracket is secured a $2\frac{1}{2}''$ Strip.

A Magic Motor 4 is bolted to the wide portion of the Sector Plate by Angle Brackets, and to the upper end of this Motor two Flat Trunnions are secured by means of Reversed Angle Brackets. These Reversed Angle Brackets are bolted to the two upper lugs of the Motor by their round holes, and their slotted ends are so arranged that they are $\frac{1}{2}''$ apart. The Flat Trunnions, bolted to the slotted ends of the Reversed Angle Brackets, carry two Double Brackets, and these form bearings for a $3\frac{1}{2}''$ Rod representing the propeller shaft. A $\frac{1}{2}''$ fast Pulley gripped on this shaft is connected by means of a Driving Band to the pulley on the driving spindle of the Motor. The propeller consists of a Bush Wheel, secured on the propeller shaft and fitted with four $2\frac{1}{2}''$ Strips representing the blades. If desired, these Strips can be twisted slightly to improve the effect.

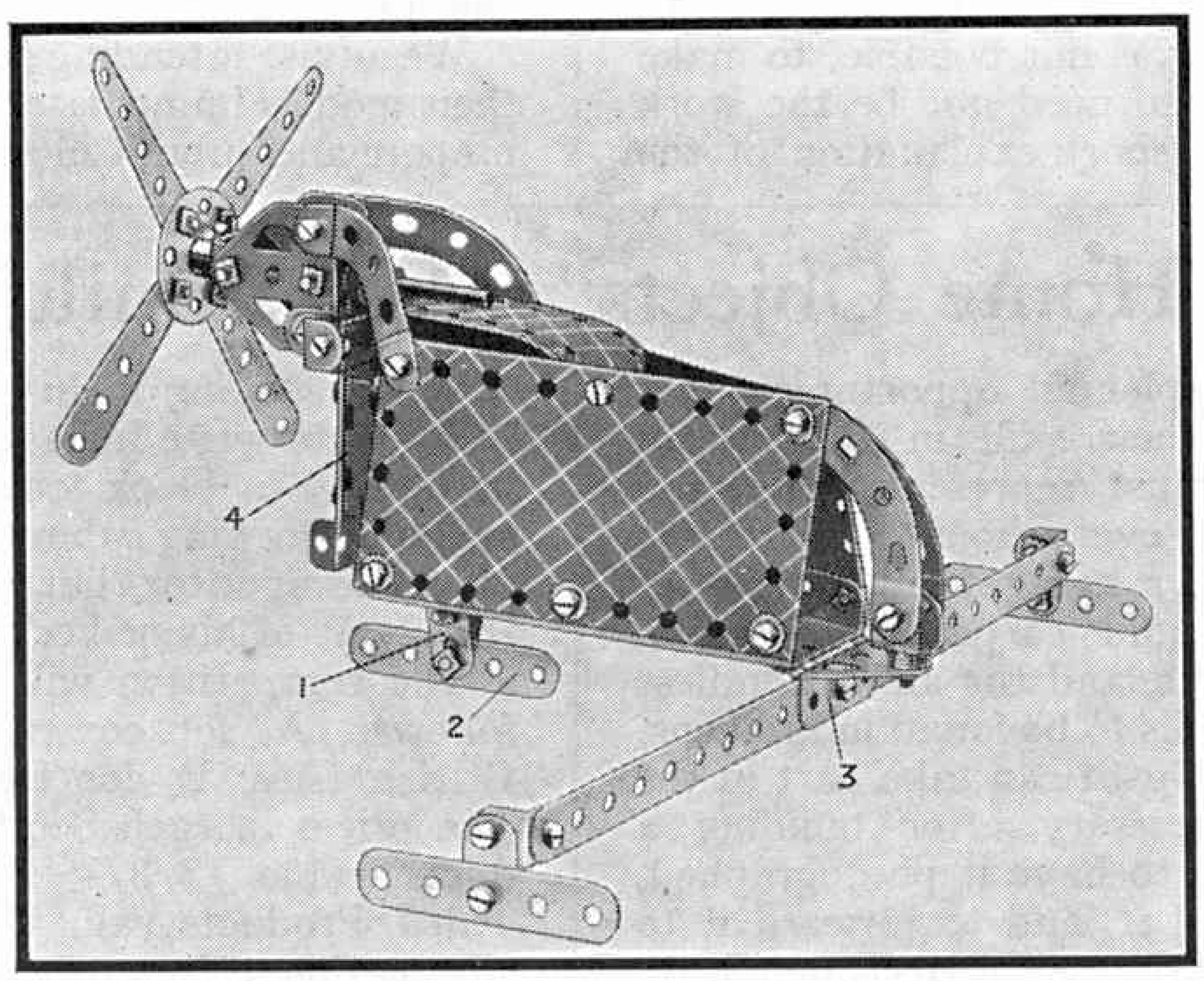


Fig. 4. The prototype of this power ice-yacht is to be seen in winter on the frozen lakes of North America.

The cabin is built up from two $4\frac{1}{2}'' \times 2\frac{1}{2}''$ Flexible Plates bolted to the side flanges of the Flanged Sector Plate that forms the base of the model. Each of the top centre holes of the Flexible Plates is fitted with a bolt carrying a $\frac{1}{2}'' \times \frac{1}{2}''$ Angle Bracket, and these form supports for a $2\frac{1}{2}'' \times 1\frac{1}{2}''$ Flexible Plate as shown. The rear portion of this Plate is held in position beneath the protruding end of the propeller shaft. The top of the Flat Trunnions, carrying the propeller shaft, is braced by two Curved Strips.

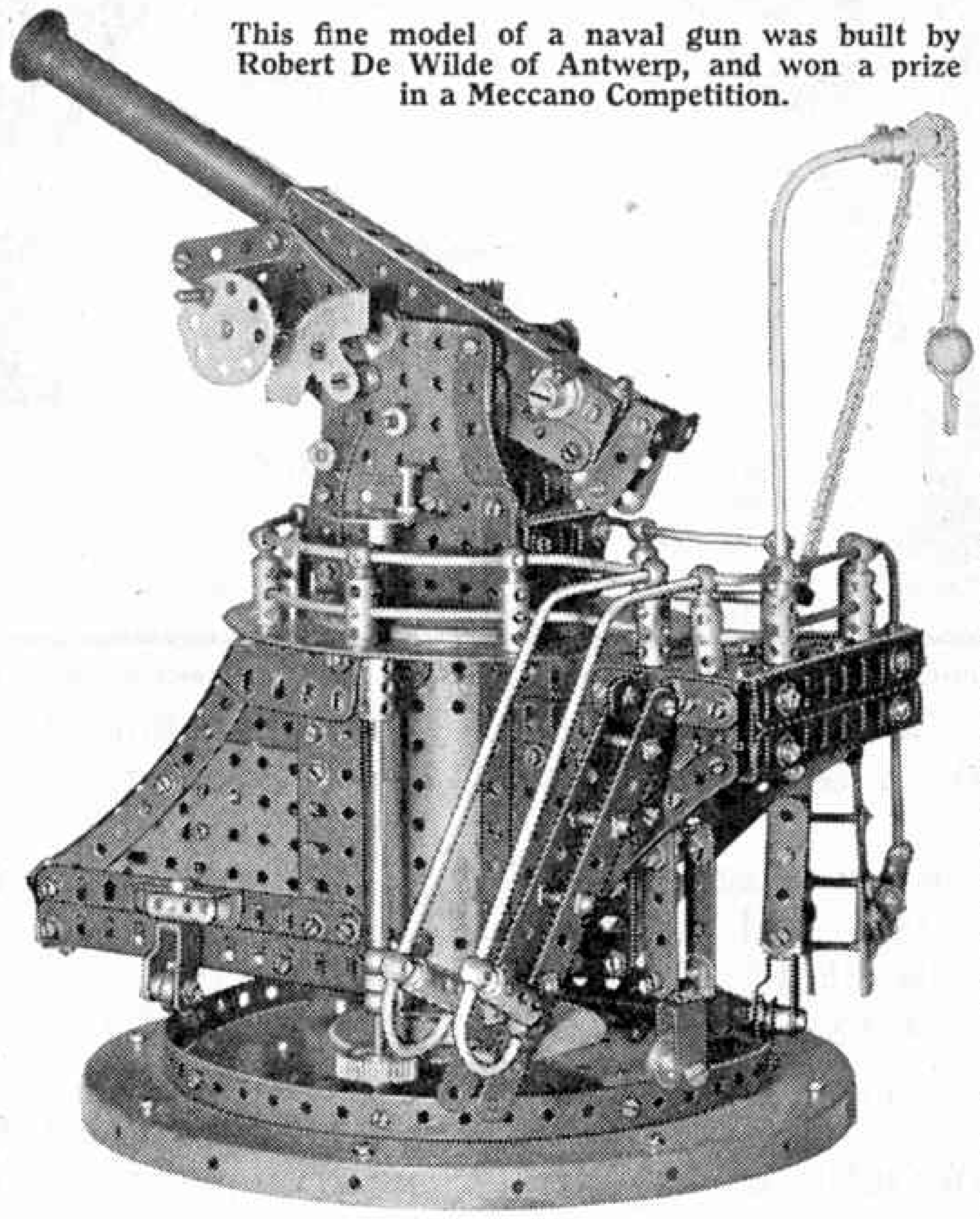
Parts required to build the Ice Yacht: 2 of No. 2; 9 of No. 5; 4 of No. 10; 2 of No. 11; 8 of No. 12; 1 of No. 16; 1 of No. 23a; 1 of No. 24; 42 of No. 37; 1 of No. 37a; 12 of No. 38; 1 of No. 54a; 4 of No. 90a; 1 of No. 111c; 2 of No. 125; 2 of No. 126; 2 of No. 126a; 1 of No. 186; 1 of No. 188; 2 of No. 191; 1 Magic Motor.

Meccano Model-Building Competitions

"General" Contest for Models of All Kinds

In the "General" Model-building Contest announced this month, competitors may choose their own subjects and any number of parts may be used. It is not necessary to own a large Outfit in order to win one of the splendid prizes offered, for small models often prove the most original and interesting, and they receive just as much attention from the judges as the larger ones. Competitors should simply try to think of a suitable subject, preferably one that has not previously appeared in model form in the Meccano Manuals or in the "*M.M.*," and then should give their imaginative powers full rein and put forward their best creative efforts.

As is the case with all model-building competitions announced on this page, this Contest is open to "*M.M.*" readers of all ages living in any part of the world. The only condition is that models submitted must be the unaided work of competitors, both in regard to design and construction.



This fine model of a naval gun was built by Robert De Wilde of Antwerp, and won a prize in a Meccano Competition.

When an entry is completed, it is only necessary to have it photographed or, if this is not possible, to make a good drawing of it, and these need not be the work of the competitor himself. A short explanation of the constructional details of the model should then be written, and this, together with the photograph or drawing, should be posted to "September General Model-building Contest," Meccano Ltd., Old Swan, Liverpool 13. The competitor's age, name and full address must be written on the back of each photograph or drawing sent in.

The contest will be divided into two Sections as follows:—A, for competitors of all ages living in the British Isles; B, for competitors of all ages living Overseas. The age of each competitor will be taken into consideration in judging the entries. The prizes to be awarded in each Section will be: First, Meccano Products value £3/3/–; Second, Products value £2/2/–; Third, Products value £1/1/–. There also will be a number of consolation prizes in each Section.

Entries for Section A must be posted in time to reach Liverpool on or before 31st October, 1936. The closing date for Section B is 31st December, 1936.

We advise intending competitors to commence work on their models immediately so as to have plenty of time to prepare and submit illustrations before the closing dates.

"Familiar Home Objects" Model-Building Contest

This Contest will provide splendid opportunities for all model-builders to show their skill in the use of Meccano parts, for entries must represent something that is to be found in almost every home. There is a very wide choice of subjects, ranging from articles of furniture, vacuum cleaners, and carpet sweepers to electric heaters and gas cookers, and the almost endless variety of appliances and utensils to be found in kitchens.

Every owner of a Meccano Outfit can take part in the competition. All that is necessary after building a model of the chosen object, is to have it photographed, or to make a good drawing of it, and to forward it to "Familiar Home Objects Contest," Meccano Ltd., Binns Road, Liverpool 13. There are no restrictions in regard to the size of the Outfits that may be used in building the models, and competitors may submit more than one model if they wish. Small and simple models will have just as good a chance to win prizes as more complicated and elaborate structures, for the deciding factors will be the degree of accuracy and realism with which the original is reproduced, and of the skill with which Meccano parts are employed. A model that contains a large number of parts that do not serve any useful purpose has little chance of success.

When sending in his entry each competitor must remember to write his age, name and full address clearly, preferably in block letters, on the back of each photograph or drawing submitted. These need not be the work of the competitor, but the model itself must be entirely the result of his or her own unaided efforts.

The competition will be divided into two sections as follows: A, for competitors of all ages living in the British Isles; B, for those of all ages living Overseas. The prizes in each Section will be, First, Meccano Products value £3/3/–; Second, Products value £2/2/–; Third, Products value £1/1/–. In addition there will be consolation prizes in each section.

In section A the last day on which entries can be received is 31st October, 1936. The closing date for Section B is 31st December, 1936.

Prize-winners will be notified by post as soon after the closing dates as possible, and lists of awards, together with illustrations and descriptions of principal prize-winning models, will be published in due course in the "*M.M.*" Prize-winners will have the opportunity of choosing any items they like from the current price lists. Models that appear in any of the Meccano publications are not eligible for this contest.

Model-Building Competition Results

By Frank Hornby

May "Simplicity" and "Small Outfits" Contests (Home Sections)

May "Simplicity" Contest (Home Section)

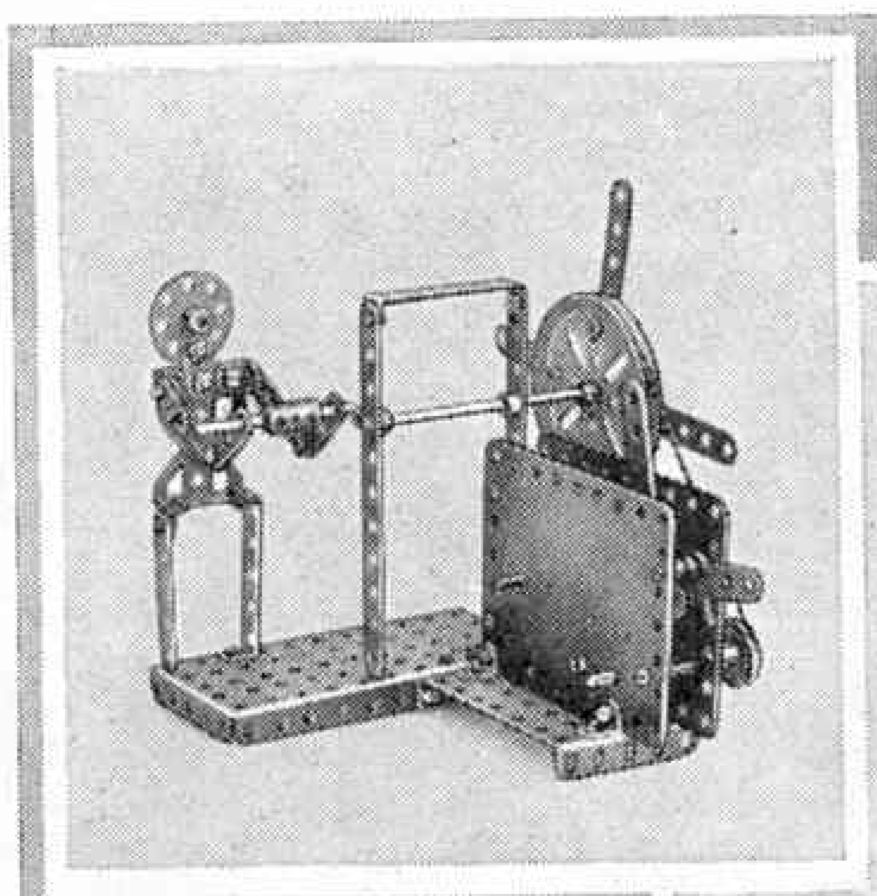
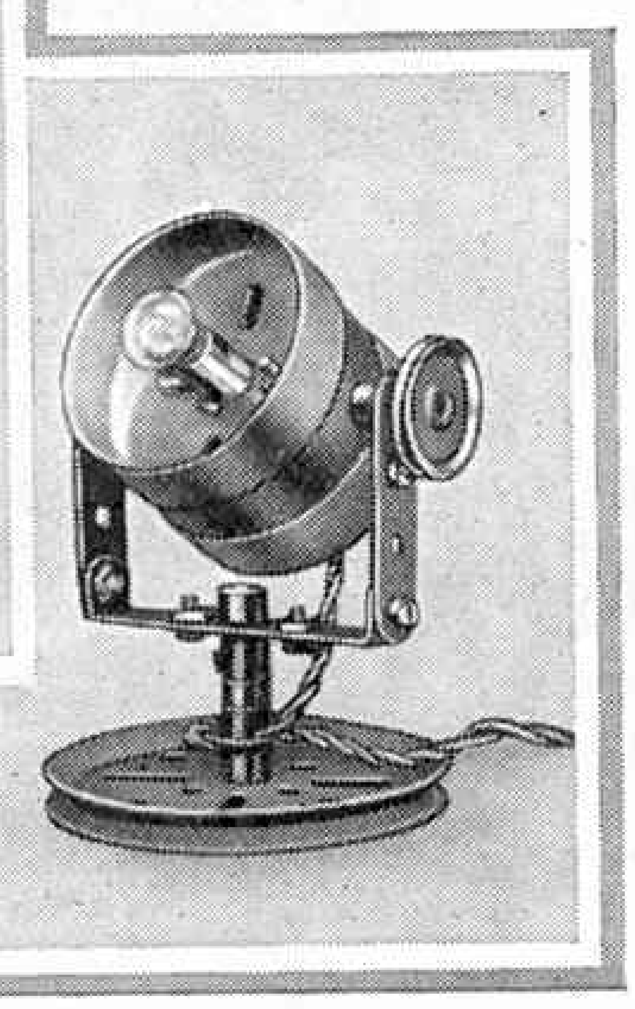
The results in the Home Section of the "Simplicity" Model-Building Competition, details of which were announced in the May 1936 issue of the "*M.M.*," are as follows:

1st Prize, Meccano or Hornby Products value £3/3/–: A. Spring, Cainscross, Nr. Stroud. 2nd, Products value £2/2/–: A. Audsley, Cobham. 3rd, Products value £1/1/–: R. Cathmore, Dundee.

Products value 10/6: W. Houghton, Daventry; J. Maguire, Belfast; A. Aldridge, Hook, Nr. Basingstoke; R. Rish, Wallasey; A. Tipper, Exeter.

Products value 5/–: E. Helby, Jersey; A. Kennett, Richmond, Surrey; P. Wickham, Countesthorpe, Leicester; R. Dent, Cambridge; R. Morley, Dorchester.

I was greatly pleased to find a large collection of ingenious models submitted for this competition, and the variety of subjects represented made it a pleasure to examine them. First Prize was awarded to A. Spring, who submitted a group of three models, two of which are intended to show the contrast between modern wireless sets and those that were considered the "latest thing" only a few years ago. The older type of receiver is represented by a box having 5½″ × 1½″ Flexible Plates for the top and ends and 2½″ Angle Girders and Strips for the back and front. The control dials are bolts fitted with washers and ½″ loose Pulleys, and the loud speaker, which is of the cone type, is made from a Road Wheel mounted on the end of a short Rod held in the boss of a 1½″ Bevel Gear. The cabinet of the modern wireless set has 2½″ × 1½″ Flexible Plates for its top and ends, and 2½″ × 2½″ Strip Plates for the back and front. The front Strip Plate is decorated with a border of Angle Girders, and a 1½″ Flat Girder fitted with a 1″ Triangular Plate and three bolts, on each of which are two washers, forms the control panel and tuning controls.

The quaint model of a man "turning the mangle" shown above was sent by G. B. Thompson of Sheffield. The realistic searchlight on the right is the work of R. Cathmore, Dundee.

The third model submitted by this competitor is a miniature vacuum cleaner, the body of which is made from two Sleeve Pieces connected end to end by means of a Chimney Adaptor. Chimney Adaptors also form the ends, and the handle and supports are made from stout wire. A short length of Spring Cord wrapped with a binding of thin twine represents the flexible suction pipe, and is provided at one end with an End Bearing and a 1″ Triangular Plate to form the nozzle. The electric lead is a piece of cord and a Collar is used to represent the point plug.

"*Crikey, another record by Shell!*" is the title given by A. Audsley to the amusing model with which he won Second Prize. This model is based on the humorous advertisement design for Shell petrol that was popular a short time ago. The actual advertisement shows a man watching a motor car moving at a terrific speed. An impression of the speed at which the car is moving is given by the fact that the man is shown with two heads, facing in opposite directions, as though he has swung his head very rapidly from left to right to follow the movement of the car. The model consists of a Flat Trunnion with 1″ × ½″ Angle Brackets bolted to its lower corners and two 1½″ Corner Brackets attached to its apex. The two 1½″ Corner Brackets are connected by a 1″ Triangular Plate, and to this are bolted two 1½″ Strips, each of which is fitted with a 1″ loose Pulley. The 1″ Pulleys form the two heads.

The Third Prize model built by R. Cathmore is a small searchlight. It is provided with a flashlamp bulb, which is fitted inside a lantern made from three Boiler Ends placed one on top of the other, the centre one being provided with two Threaded Pins in diametrically opposite holes to form a pivot. The pins engage in a "U" shaped frame of Strips that is mounted on a swivelling base.

Outstanding models among the entries that received prizes of 10/6 are a simple chiming clock, which was sent by W. Houghton, and a biplane by R. Rish. A. Tipper won a prize with a fine model of a 4–6–2 locomotive.

"Small Outfits" Contest (Home Section)

The list of prizewinners in the "Small Outfits" Contest (Home Section) is as follows:

1st Prize, Meccano or Hornby Products value £2/2/–: R. Walford, Newton Abbot. 2nd, Products value £1/1/–: K. Fielding, Retford. 3rd, Products value 10/6: W. Raybould, Bloxwich.

Products value 5/–: P. Dowell, Atherstone; P. Frost, W. Bridgford; P. Wickham, Countesthorpe, Leicester; R. Clarke, Nottingham; B. Thompson, Sheffield; A. Turner, Derby; L. Summers, Birmingham; G. Yates, Kingswinford; C. Halstead, London, E.10; J. Maguire, Belfast.

A model dragline built with Outfit F and submitted by R. P. Walford secured First Prize, and although the subject is not original, splendid work has been done in its construction. The model is very small, and is driven by a number of miniature hand winches, which actuate the various motions.

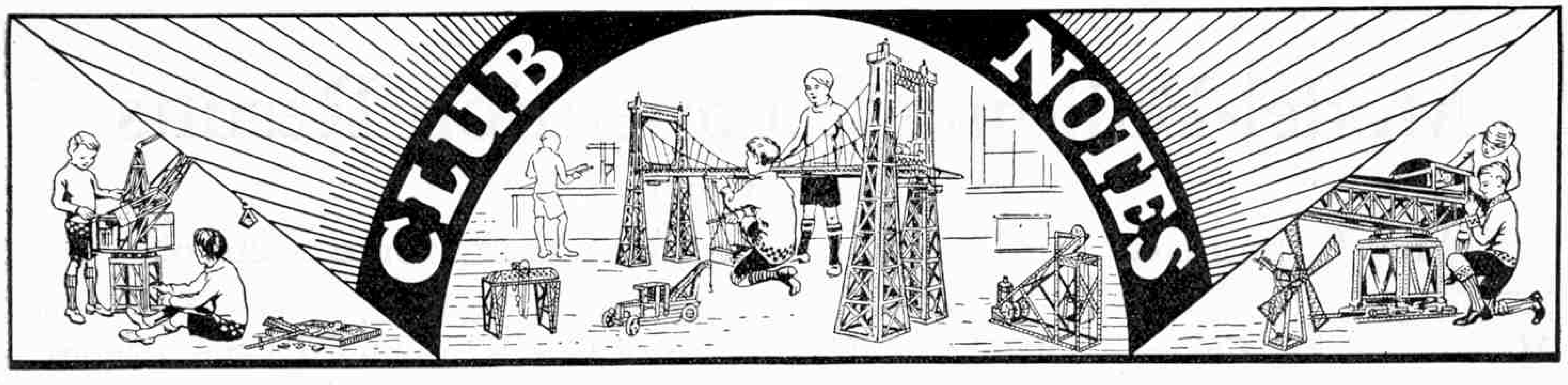
K. Fielding was awarded Second Prize for a model of a sack lifting machine of the type used in warehouses for lifting sacks of flour and bales of various materials and placing them in neat stacks. The model is rather like a porter's truck running on two wheels, and in addition to the usual tongue is provided with a second tongue which is movable. In use the tongues are pushed underneath the sack to be moved, and the sack is then wheeled to its destination. If it is necessary to unload the sack at a height above floor level a handle mounted on the truck shaft is rotated and this operates a length of chain running on Sprockets, which movement raises the upper tongue and its load to the required height. The model is neatly constructed and works in exactly the same manner as the actual truck on which it is based.

A floating crane forms the subject of one of four models submitted by W. Raybould. It incorporates a simple pontoon constructed from 3½″ × 2½″ Flanged Plates bolted between two 12½″ Angle Girders. The jib and the bearings for the winches are made from Strips, and the method of construction ensures that these are quite rigid. The model is driven by means of a Meccano Magic Motor, and as the jib is fitted with special multi-sheave pulley blocks the crane is able to lift considerable loads. The other models sent by Raybould are a steam roller, heavy oil engine, and a folding foot pump. The cylinder of the pump is a Sleeve Piece fitted with two ½″ Flanged Wheels through the boss of one of which slides a Rod. This is pivotally connected to the base frame and has a Collar at its cylinder end to represent the piston. The cylinder is attached to the foot lever, and this is held in the raised position by Spring Cord. A clip made from 1½″ Strips serves to hold the pump closed.

Among the winners of prizes of 5/– is a model of a deck hoisting gear similar to that found on small vessels. It was built by J. Maguire, and includes a small steam operated winch and a mast that supports a boom or jib. The model was built from parts in an Outfit F, and as the builder lacked sufficient small Pulleys for the sheaves he overcame the difficulty in a very clever manner, by means of specially designed pulleys. These were made by pushing pieces of stout wire through Collars and then binding the wires on to the Rod that forms the boom. The hoisting cord passes round the Collars, and as the cord is wound in the Collars revolve freely on the wire.

The winding drum consists of a Sleeve Piece, through the centre of which is a Rod that is held concentric by means of bolts passed through the holes in the Sleeve Piece and screwed into Collars on the Rod. The Rod carries a 57-teeth Gear Wheel and a ¾″ Flanged Wheel that forms the belt pulley.

As this contest proved so popular it is intended to organise further competitions of a similar nature, and I hope that all those who submitted entries for the present contest will watch for announcements concerning these in future issues of the "*M.M.*"

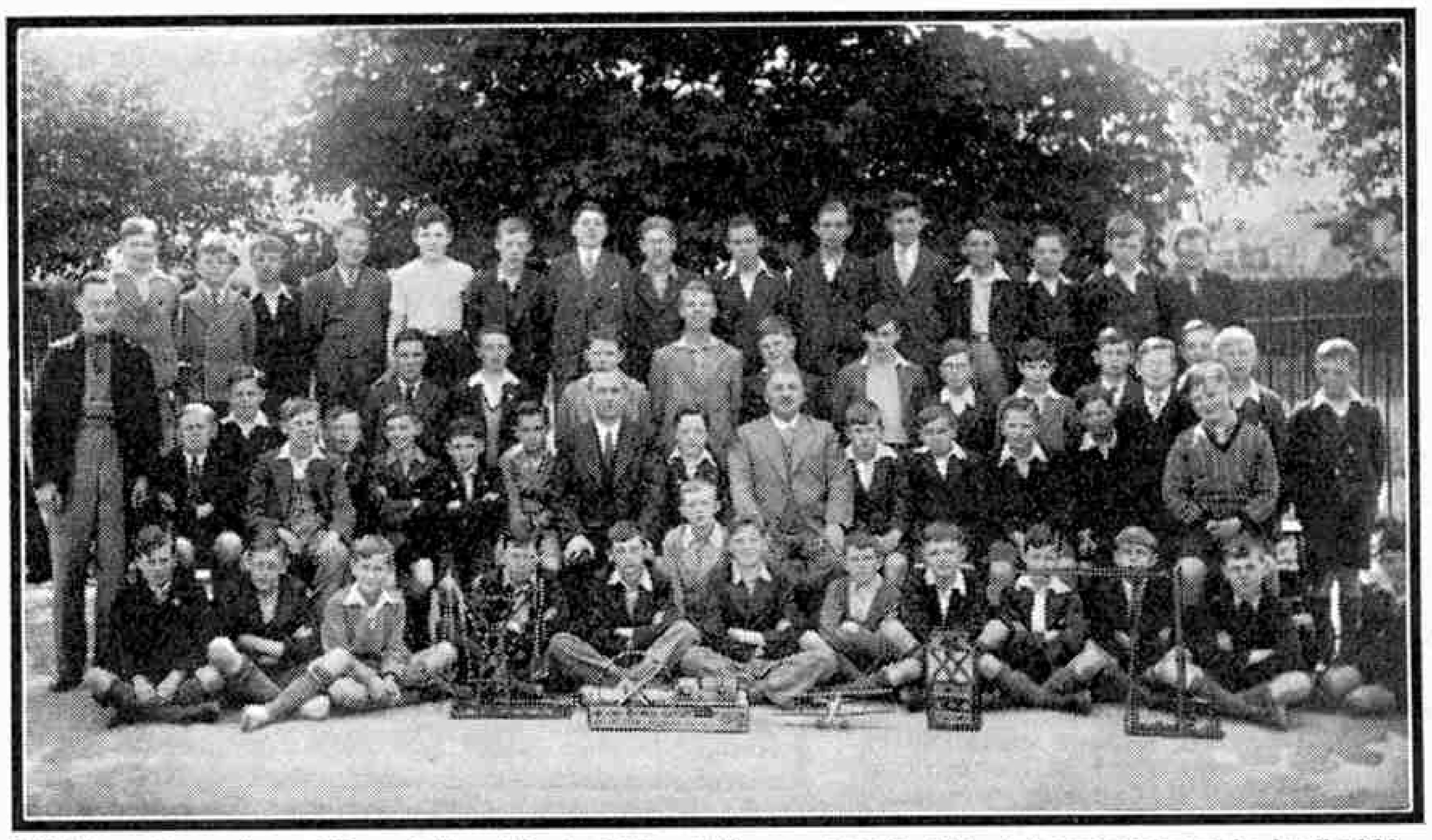


Wednesbury M.C.—Most meetings have been held out-of-doors, and some enjoyable cricket matches have been played. On Empire Air Day a party visited Castle Bromwich aerodrome, where a tour of the hangars, machine shops, armoury and photography departments was followed by a display of aerobatics and a fly-past of aircraft. The programme also has included a cycle run to Brewood, and Model-building and Fretwork. Club roll: 20. *Secretary:* A. L. Morgan, 17, Cobden Street, Fallings Heath, Wednesbury.

Sid Vale M.C.—Some excellent models were produced during a recent "Meccano Robot" Contest, and the largest one was about 3 ft. in height. A Fire Engine Contest held during another meeting also produced some fine models, and the first prize was won by a streamline fire engine. Club roll: 20. *Secretary:* S. R. J. Gliddon, Sheffield House, Sidmouth.

St. Stephens (Saltash) M.C.—The Meccano, Hornby and Woodwork sections have combined during recent outdoor meetings, when cricket and baseball have been played. A cycle run was made to Plymouth Airport to see the demonstration flights of Clem Sohn, the "bird man." The club has been invited by Mr. Ellis, the Leader of Plymouth M.C., to combine with that club in regard to visits to local works and other places of interest. Club roll: 11. *Secretary:* B. Braund, 9, Homer Park, Saltash.

Old Charlton M.C.—Recently-completed models have included a mechanical advertisement and a crane. A very enjoyable indoor Entertainment Evening has been held, during which a "thriller" game was played. The "criminal" had to drop one clue for the two boys chosen to be the detectives, and their subsequent investigations resulted in an arrest being made and a Mock Trial held that lasted two weeks! The dropped clue was a small piece of paper on which were written the answers to some general knowledge questions. At the trial the charge against the accused was so well contested that finally he was acquitted. Members greatly enjoyed a Lecture by Mr. Fish, a local gentleman, on his model railway, built by himself and worked by 14 model locomotives, including both steam and clockwork types, of his own construction. Mr. Fish has kindly consented to display and operate his layout at the next club Exhibition. Club roll: 22. *Secretary:* W. Jaques, 60, Gurdon Road, London, S.E.7.



Officials and members of Regent Street Central School (Heywood) M.C. This club was affiliated in April 1930, and now is one of the largest in the Meccano Guild, the number of members totalling 150. Model-building and Lantern Lectures are the most popular features of the programmes.

Claremont Avenue School (Kenton) M.C.—Cricket has been played at most outdoor meetings, and at indoor ones the study of a large Meccano model has been the chief interest of members. Materials are being collected for building the model Belisha crossing illustrated in the "*M.M.*" of March last. Club roll: 14. *Secretary:* G. Turton, 5, Brookfield Crescent, Kenton.

St. James' (Grimsby) M.C.—Indoor meetings have been devoted chiefly to constructing a chassis of a large steam lorry. Ackermann steering gear was fitted, but it was worked by a crank instead of the worm and 57-teeth gear wheels. The Leader built an excellent model of a pair of scales, an interesting feature of which was that the scales remained parallel irrespective of the extent to which the beam was tipped. Other models completed included a windmill with sails that revolved slowly, in a very realistic manner, and two racing cars. Club roll: 5. *Secretary:* A. N. Dixon, 65, Yarborough Road, Grimsby.

Plymouth M.C.—The club quarterly magazine "*Gearbox*" is rapidly increasing in popularity, and many excellent contributions for it have been received from members. The Birthday celebrations this year will include a club Party and an Open Evening. The Meccano section have decided to build a "set piece" for the occasion, and this will be a dockside scene. The decision has been made known to all members in order to give them ample time in which to find out the advantages and disadvantages of the different types of models it is proposed to include in the scene. Club roll: 25. *Secretary:* R. G. Symons, 47, Lisson Grove, Plymouth.

Kidderminster M.C.—A debate on "*Talking versus Silent Pictures*" led to a lively discussion that ended in favour of the "talkies." A Lecture by the secretary on "*Trevithick*" and the engines and machinery he supplied to the Peru silver mines was much enjoyed. On another occasion one member brought a microscope, and with it the others viewed some of the minute creatures that exist in pond water. A Visit to the Parish Church has been arranged, and the party will be conducted by Mr. Hodgkins, a local antiquarian, who will tell them many interesting historical facts about the building. Club roll: 12. *Secretary:* E. J. Watkins, "Elmar," Wolverhampton Road, Kidderminster.

Fraserburgh M.C.—Meetings continue to be well attended. Plans for the Exhibition are going ahead, and several good models have been completed and painted. They include a large vertical drill, a crane and a beam engine. Others being built include a steam shovel, a new motor chassis and an aeroplane. Additional crossovers and left-hand points have been bought for the club layout, and a signal gantry has been made. Interesting timetable operations have been carried out. Club roll: 28. *Secretary:* W. J. Dawson, Phingask, Fraserburgh.

Bexleyheath Boys' Central School M.C.—The fine display staged on the School Open Day included a clockwork spiral railway; a model workshop driven by a small mains motor; three model steam engines and a Dinky Toys layout. The display was a great success and attracted many visitors. Club roll: 30. *Secretary:* D. Hicks, 4, St. Audrey Avenue, Long Lane, Bexleyheath, Kent.

St. Oswald's (Norbury) M.C.—A Cycling Section has been formed, and has proved helpful to the Cricket Section, as most of the club cyclists are cricketers. The Cricket Section have played four matches, all of which they have won. Games Evenings have been introduced. A Visit has been paid to the local Telephone Exchange, and a photograph of the members was taken, by permission, while they were on the roof of the building. Other excursions to local places of interest have been arranged. Club roll: 21. *Secretary:* R. A. Smart, 14, Kensington Avenue, Thornton Heath, Surrey.

Islington M.C.—Interesting talks have been given, one by the Leader on "*The Making and use of Charcoal*" and another by a member who described his holiday in Russia. Model-building has been continued, though to a lesser extent than during the winter. At one meeting model aeroplanes with Meccano parts attached were made to run along a length of cord. Club roll: 10. *Secretary:* S. H. Gardiner, 3, Tiverton House, Pleasant Place, Canonbury, London, N.1.

Sutton Valence Council School M.C.—The club has been occupied chiefly with a Sports and Games Contest against the remainder of the School. It included six-a-side football, running, jumping, and cricket-ball throwing, and ended in a victory for the club by 166.5 points to 131.5. A silver medal offered by the club for the best individual performance was won by a member of the School team who scored 26 points. A Safety First Exhibition is being arranged, one of the chief features of which will be a miniature town with Dinky Toys traffic signs, etc. The School playground is also to be marked out for traffic, to be represented by boys on toy motor cars or cycles. It is hoped to have a small cinema in one of the classrooms, and the screen holder and many of the necessary fittings will be made of Meccano parts. Club roll: 24. *Secretary:* J. Chandler, "Herriard," Chart Sutton, Maidstone.

Exeter M.C.—In spite of the light summer evenings, model-building activities have been continued as energetically as ever, and during a recent month 19 models were completed. They included a clever reproduction of the German airship "*Hindenburg*," a Belgian cargo vessel and a tennis umpire's chair. A small party, including the Leader and secretary, recently visited Liverpool for a tour of the factory and a talk with the Guild Secretary. Club roll: 30. *Secretary:* K. Milton, 18, Baker Street, Exeter.

AUSTRALIA

Melbourne M.C.—At one meeting a member brought along a model bucket excavator and demonstrated its efficiency in scooping up coal, which was represented by sunflower seeds. Meetings have been devoted chiefly to operating the Leader's Hornby layout. Each member in turn has acted as a train despatcher and has been responsible for arranging a programme of operations. Later he has taken a turn as signalman, and as usually there are three trains running at the same time this official has been kept very busy! There are now four stations on the layout. Club roll: 10. *Secretary:* L. Ison, 8, Hayes Street, Northcote, N.16, Victoria, Australia.

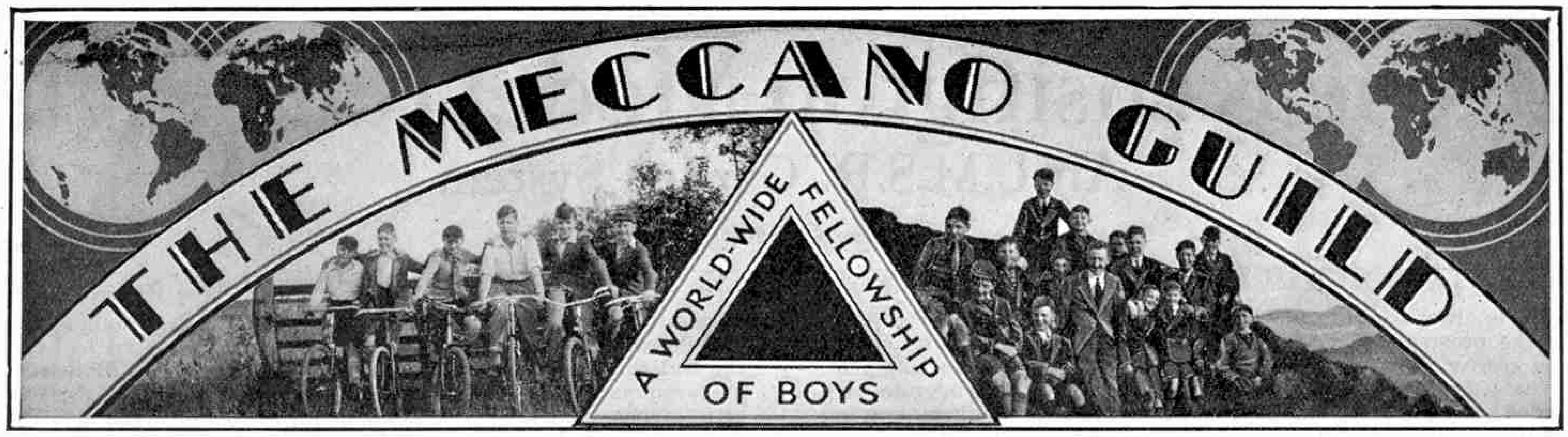
Nhill Xlcr M.C.—When a local display was organised to advertise the Anzac Sports and Cycling Carnival, the club assisted by exhibiting models of a big wheel with advertisements on each car, a cycle track with two cyclists travelling at different speeds, and working models of vertical nad horizontal steam engines. The models were driven by a $\frac{1}{2}$-h.p. electric motor, and ran continuously for $7\frac{1}{2}$ hrs. The exhibits were very favourably commented upon by the local press. Arrangements have been made for Visits to a power house, a flour mill, and to the printing works of the "Nhill Free Press." A series of interesting Lectures on different subjects, including the "*Uses of Meccano parts and mechanisms*," is in progress. Club roll: 16. *Secretary:* F. Haustorfer, Leahy Street, Nhill, Victoria, Australia.

SOUTH AFRICA

Continental (Capetown) M.C.—A talk has been given by the secretary on "*How the 'Empress of Britain' was launched.*" Open Nights and meetings spent in playing Games have been very popular, but Model-building has not been neglected, and some excellent cranes and windmills have been completed. Preparations for the club's first Exhibition are well advanced. A Library is being organised. Club roll: 6. *Leader:* Mr. R. H. Woodley, 10, Stirling Street, Capetown, Cape Province, South Africa.

NEW ZEALAND

Christchurch M.C.—Another visit to the invalid boy friend of the club has been paid by four members, who took several new models with which to entertain him. A very enjoyable outing was held on Easter Monday, when a party went to Godley Head Lighthouse and to Lyttleton, where some of the boys visited an English ship in port there. Model-building and Hornby Train contests have been included in the programme, and a fine display of models has been arranged for the club's seventh Birthday Party. Club roll: 20. *Secretary:* L. W. Best, 28, Circuit Street, Strowan, Christchurch, N.W.1, New Zealand.



Preparing for the Winter Sessions

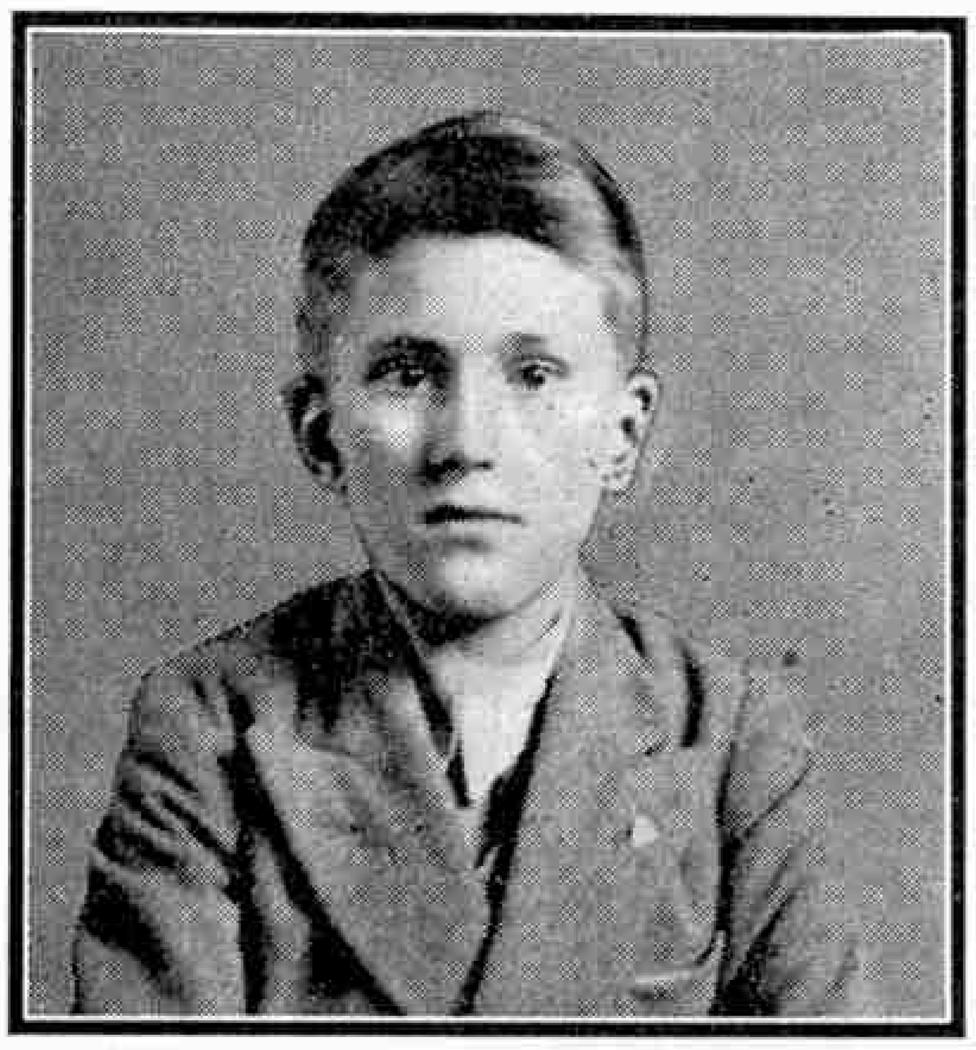
In the Meccano Guild, as in most youth organisations, September is a period of transition. At the beginning of the month members are still enjoying summer activities, but at its close they are eagerly anticipating, and in some instances have already begun, the varied indoor activities that make the club winter meetings so very enjoyable. I always think of September as the "conference" month, when Leaders, officials and members get together to discuss club policy and the programme to be followed during the forthcoming winter sessions.

A good scheme that can be adopted as a preliminary to such a conference is for the secretary to send a postcard to each member informing him of the date and time of the meeting, and asking him to send to the Leader before that date one or more written suggestions for new schemes, or for the improvement of old ones. The Leader should then sort out these suggestions into groups, each dealing more or less with one subject, so that at the conference he is able to put the various subjects before the members quickly and without overlapping or repetition. The proposals should be made out and discussed, and then voted upon. The sudden popularity of some particular hobby may have produced many requests for its inclusion in the club programme, and a unanimous or majority vote will secure its adoption. Some of the members may be so keen on it that they would drop other equally interesting pursuits on one side in its favour, but the Leader and officials must exercise tact, and allot the new hobby only a fair share of the time available during the sessions.

Opinions will be divided with regard to other proposals, and in such cases also a good deal must be left to the discretion of the Leader. It is unwise to "swamp" the club programme with some new scheme that is extremely popular at the moment; on the other hand, it is foolish to turn down too hastily any scheme on which the members are not unanimous, for that particular scheme may, on trial, prove to be a great success. Members should agree at the beginning of the conference that any plan which receives a certain number of votes, this number depending upon the number of members present, should be given a fair trial, and finally rejected or adopted permanently strictly on its merits.

Meccano Club Secretaries

No. 37. J. G. Slater



J. G. Slater is Secretary of the Pennthorpe School (Chislehurst) M.C. Model-building is the chief activity of this young and very enthusiastic club. Lantern Lectures also are greatly enjoyed.

Value of the Personal Visit

It is all to the good if the Leader is able to find time to visit the parents of as many of the members as possible before the opening of the first of the winter sessions. He is able to give parents a much better knowledge of the club and its officials than they are likely to have formed from the accounts given by their enthusiastic sons. By his personal account of the club's activities, and his testimony as to their constructive nature, the Leader is able to arouse the interest of the parents and to give them the satisfaction of knowing exactly what their sons will be doing on club nights. Time spent in such visiting is never wasted, for parents who are kept in touch with the progress of a club in this manner invariably become its keen supporters.

Another point is that at such visits the Leader is very likely to come in contact with gentlemen who are not only qualified, but also willing, to give lectures to the club from time to time. Many interesting talks on their daily work and experiences by engineers, mechanics, sailors and others have been secured in this way, while permission to visit factories also has been obtained from owners or managers who have similarly become interested in club work.

Gaining Friends and Recruits

This matter of making known the splendid aims and the good work of the clubs has been carried further by some enterprising clubs. In their endeavours to gain the support of local residents who take a practical interest in the hobbies and amusements of boys, they prepare a circular letter giving a short account of the club's history and activities, and outlining its plans for the coming session. This letter is printed if possible, or duplicated in some way, and a copy is sent to local residents, inviting them to visit the club and see the members actually at work. In some instances a definite "Visitor's Night" is arranged early in the session, and the letter contains an invitation to attend on that particular night. This method involves some small expense, but in most cases it brings the club excellent results, financially and otherwise.

The beginning of the winter session is also an excellent time for a general recruiting campaign. The entire membership of the club should take part in this, and as every member is in the happy position of being able to speak from personal experience, his efforts to persuade his friends of the advantages of association with the Meccano Guild should be very successful. Just one bit of advice to the recruiting member: always remember to have an application form handy so that when you do find a recruit you will be able to make sure of him on the spot! For my part, I shall be very pleased to send secretaries supplies of the leaflet that explains the aims and organisation of the Guild, to pass on to club members. The application form that must be filled in and signed by a recruit is on the back of this leaflet.

Merit Medallions

By the end of this month Leaders will be able to let me have their nominations for Merit Medallions for the summer sessions. I would mention, for the benefit of new Leaders, that in every affiliated club, at home and overseas, two Medallions are available each session for any kind of good service to the club or the Guild movement generally. The recommendation of the Leader is sufficient, and the names of the members concerned are inscribed on their Medallions, and are made known to all the Guild in the special list published annually on this page. I should like to receive the nominations immediately after the close of the present session.

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:

AUSTRALIA—R. McLean, Marion St., Charters Towers, Queensland.
INDIA—N. S. Narang, Shish Mahal Road, Lahore.
NEW ZEALAND—L. Gilmore, Arney Street, Greymouth.

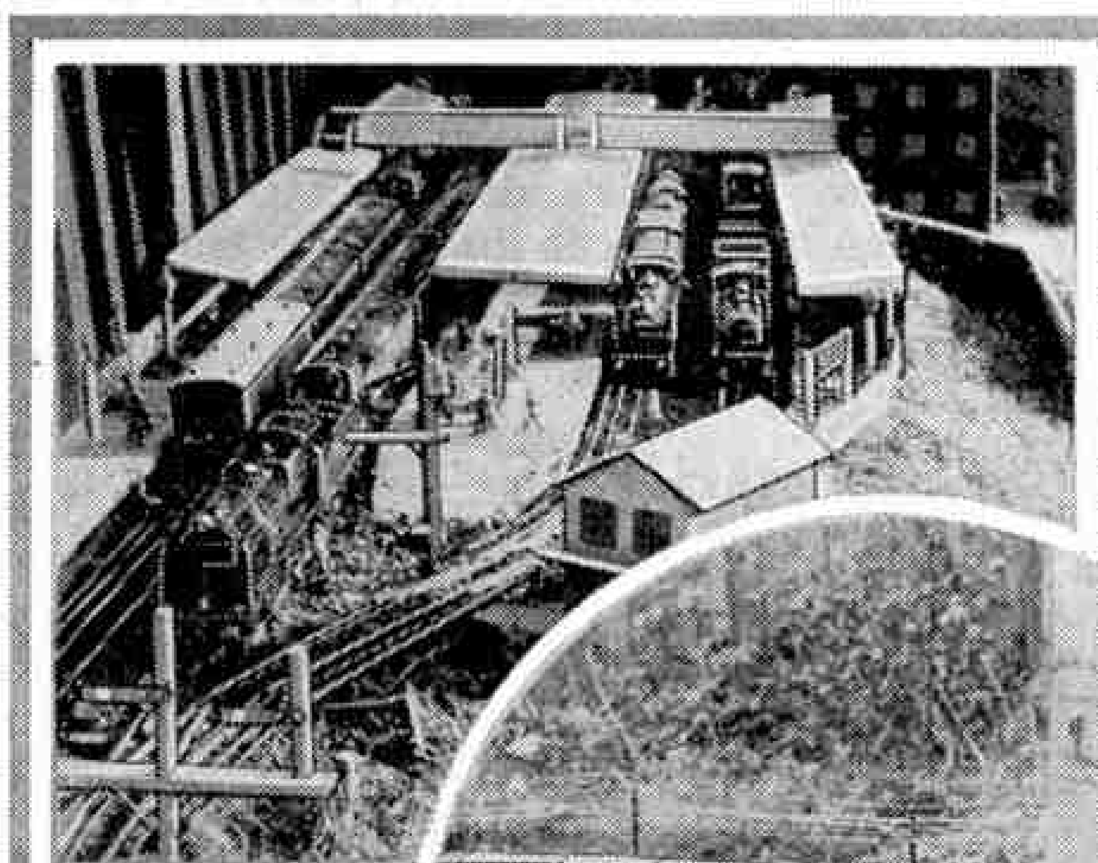
The Kensington Model Railway

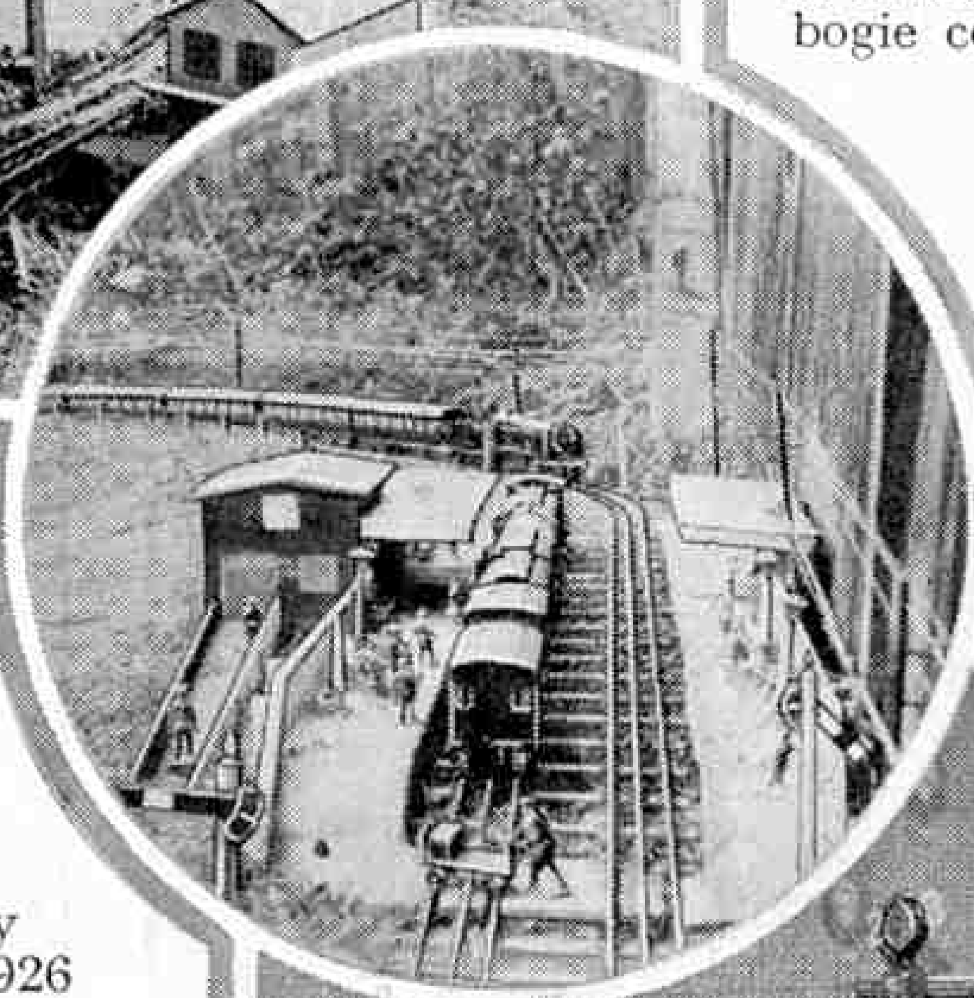
An L.M.S.R. Garden System

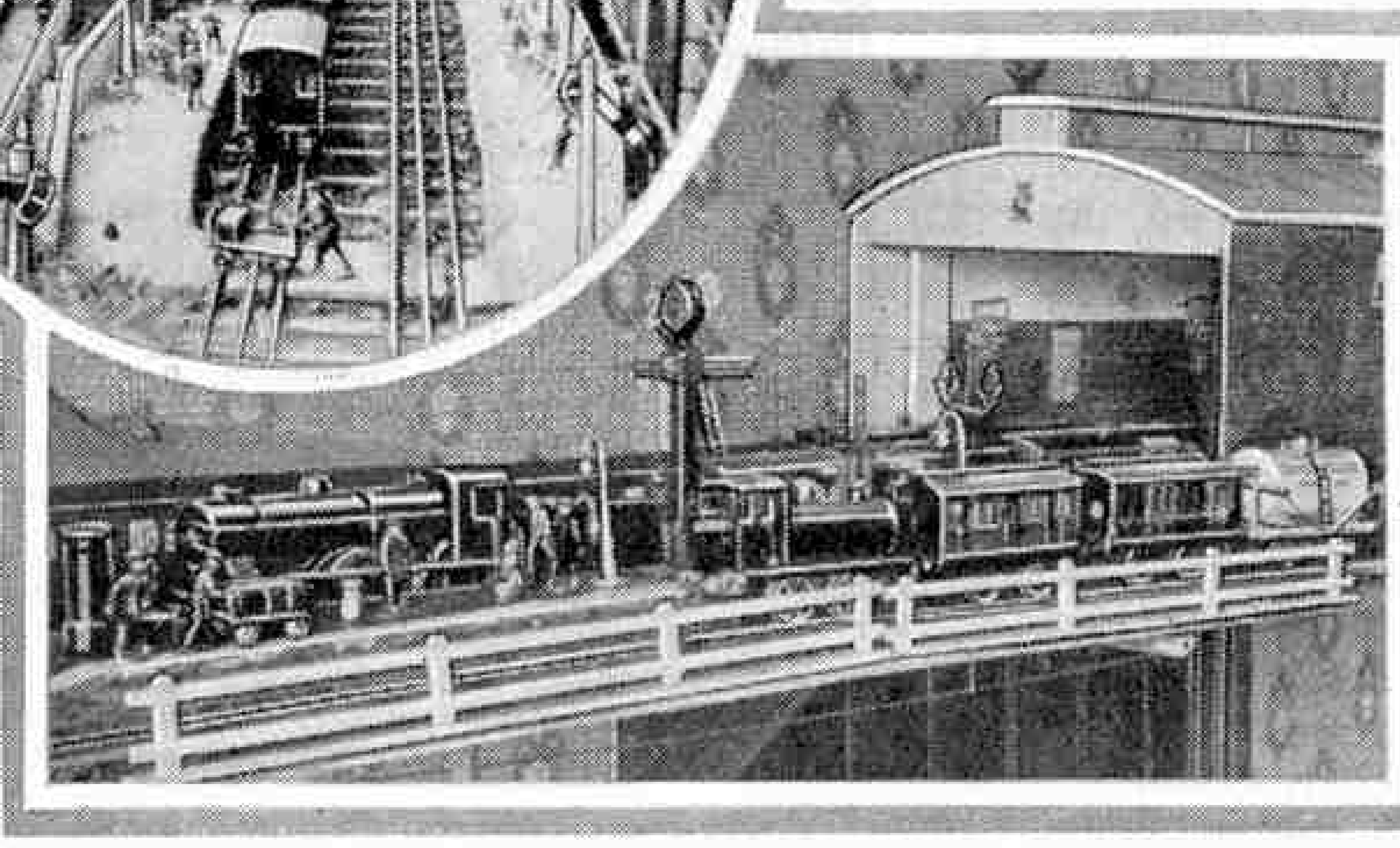
By C. Dodds

IT is always interesting to a miniature railway owner to trace the progress of his line from its beginnings and to record the successive steps leading up to the latest state of development. The Kensington Model Railway, which I own and operate, is a good example of the manner in which miniature railway systems grow. In its earlier days it was an indoor track, and it graduated from a table railway through the intermediate stage of a portable line laid on the floor to a permanent system in a room of its own. Now it has been transformed into an outdoor railway that is still being extended.

The line began as a simple oval, and was operated by a small tender engine and coach. During the course of the first three years additional rails were obtained from time to time, until it became possible to stage an interesting layout on the dining room table. In 1921 a Hornby "Zulu" Tank Locomotive and a few trucks were added, and by 1924 it had assumed too great a size for the table, and was laid more or less permanently on my bedroom floor. The general form of the layout was then a fairly large oval with one or two sidings.







Scenes on the Kensington Model Railway, operated by C. Dodds, Harborne, Birmingham. The illustrations at the top and on the left show "Stafford" and "Sandbach" stations respectively. Part of the indoor line from which the outdoor railway was developed is seen below.

Later, after a house removal, my one ambition became that of having a system laid in the attic that was now available. During the course of the next few years this materialised, and a single track was laid down round three sides of the room, with a terminus at each end. At this time the original small-radius curves were abandoned for larger ones, so that a Hornby 4–4–4 No. 2 Tank Locomotive bought in 1926 could be used. There were then about nine trucks, but still no passenger stock. I now wanted to run passenger trains, so the track was doubled, and with the two engines it was possible to run an interesting service by timetable between the two termini.

Soon I had enough rails to go right round the attic, so in 1929, at the expense of a few sidings, the railway was made a continuous double track circuit about 22 ft. by 18 ft. Two stations were built of wood and cardboard, and at each there were appropriate sidings. The railway became gradually more realistic, and I had a lot of fun out of it. Two signal boxes were installed, one having 14 levers, and the other 8, and there was communication by means of Morse Code tapping keys between them. The rails were ballasted with granite chips; this deadened the noise a lot and greatly improved the appearance.

In 1930 I decided that the line should represent L.M.S.R. practice, and in that year was fortunate to get a Hornby No. 2 Special Standard Compound. Curiously enough the number of the engine that used to haul my train to school every morning was 1185, the same as that of my Hornby model! This engine pulled with ease five wooden bogie coaches twice round the layout, and was used exclusively for express passenger trains. The 4–4–4 Tank was used on goods trains, and the "Zulu" Tank still did excellent work as a shunter.

I then became interested in electric engines, so my father built for me an electric locomotive of the 4–4–4 wheel arrangement. The motor was a Meccano one, geared to the driving wheels. Overhead wires were put up over the down line, and the engine was fitted with a pantograph collector. In consequence of another move, this time to a house without an attic, the railway was dismantled for a time and its parts lay disused in a number of packing cases. But in 1934 I decided to make a layout as near the real thing as possible in the garden, and set about the whole job systematically, making full use of my experience with the attic layout. A site was selected giving a run of about 200 ft. that was dead straight, except for a right-angled turn mid-way. I began to level the route with the aid of a spirit level, but found it necessary to incorporate a gradient of 1 in 90 for 70 ft.

The railway is to represent in its final form the stretch of main line between Stafford and Manchester. So far there are three stations, "Stafford," the principal terminus, "Sandbach," a small passing station, and "Wilmslow," the temporary terminus until the line is completed to "Manchester." South of "Stafford," the lines converge into a single track and pass underneath a small path into a wooden hut, on the floor of which extensive sidings are laid in Hornby Rails for the storage of goods and passenger rolling stock, and locomotives.

"Stafford" station has four platforms, covered by wooden awnings, and at the entrance to the station there is a concrete road, with a three-storey office building surmounted by a tower. The platforms are of concrete, and their average length is seven feet, so that each easily accommodates a train of six bogie coaches. The points are operated mechanically from a signal box at the north end of the station.

From "Stafford" there is a double track main line all the way to "Wilmslow," and this line is electrified by means of a brass centre rail. The electric control panel at Stafford is mounted on the garden fence at a convenient height above the signal box. The panel incorporates one controller for the down line and one for the up, an automatic cut-out in case of a short circuit, an ammeter, and seven section switches. These section switches are used to connect either controller with any platform line in the station, also various sections of the line leading to the hut. This means that at any given moment, three trains can be held in "Stafford" on 'dead' sections of the line while another train is being moved.

From "Stafford" to "Sandbach" there is a straight run of 54 ft. up an incline of 1 in 90. This section of the line is on an embankment on which grass has been cultivated to prevent washing out by rain. "Sandbach" is a small two-platform station, 4 ft. long, and is used only by local stopping trains. From "Sandbach" the line curves to the left through a right-angled turn with a radius of 10 ft., and the line is "banked" or super-elevated. At this point there is a cutting, followed by a tunnel 10 ft. long, and the line then is level all the way to "Wilmslow." From "Sandbach" to "Wilmslow" is about 45 ft. "Wilmslow" has two main platforms and one bay.

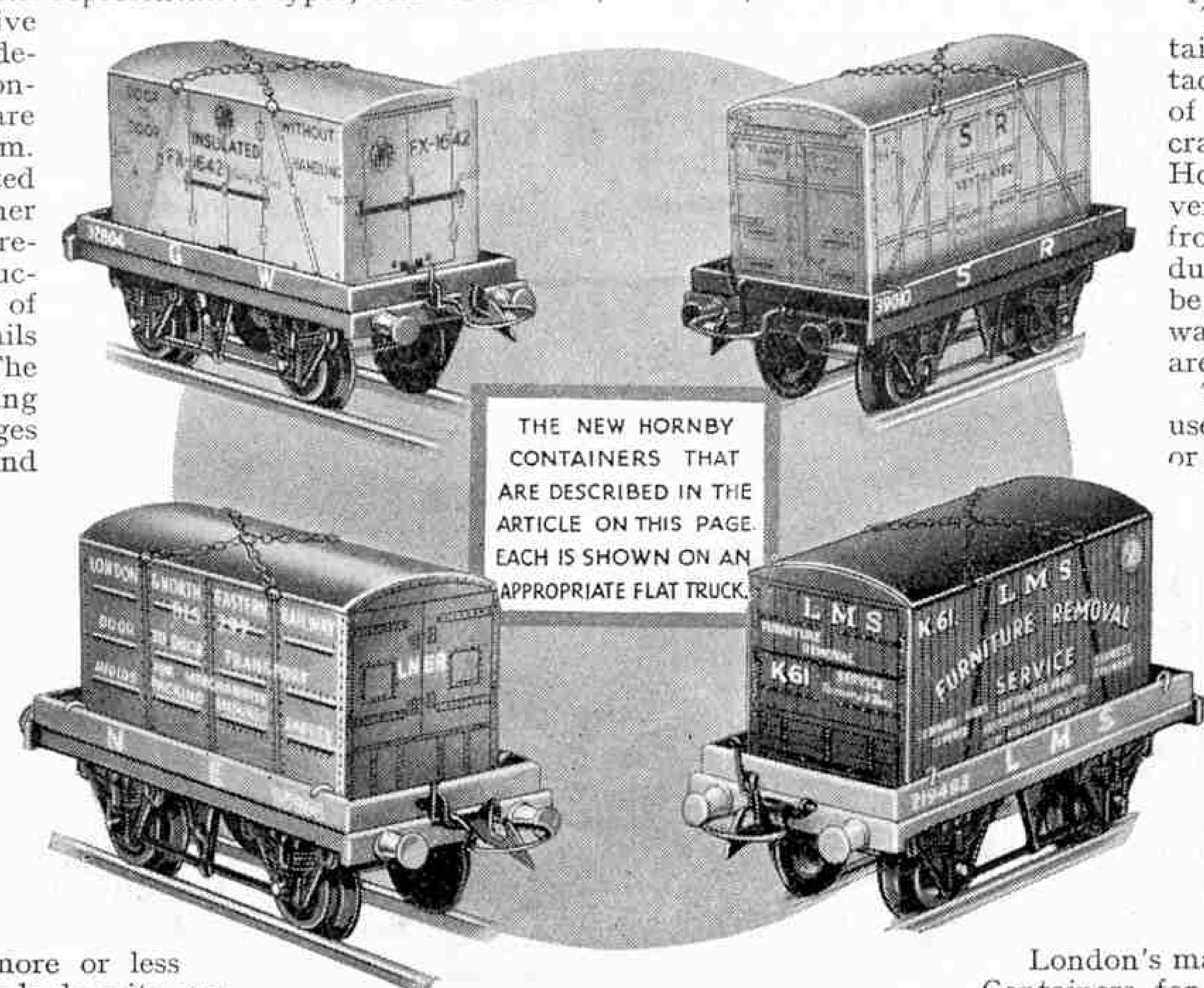
North of this station the lines consist temporarily of well-painted Hornby rails to provide extra siding accommodation and sufficient room to turn large trains until the line is completed to "Manchester." At "Wilmslow" the controllers are similar to those at "Stafford," and they are housed in a small watchman's hut. Power for the line is obtained from a dynamo supplying 16 volts and this is brought from the generating hut to "Wilmslow" by means of telegraph wires, which give the line a very realistic appearance. There is electric bell communication between "Stafford" and "Wilmslow" and this is used for signalling train movements.

Containers for Hornby Railways

By "Tommy Dodd"

THE new Hornby Containers are an important introduction to the Hornby Series that I am sure will be welcomed by all Hornby railway owners. A railway container is similar to the body of a railway van or wagon, and can be carried on a suitable rail vehicle, or on a road lorry, as required. Its handiness has earned for it the appropriate title of "*the suitcase of commerce.*" Cranes lift it from lorry to rail, or back again as required, and thus goods packed in it are carried right through to their destination, without being disturbed on the way. They are in fact "*despatched in bulk and delivered in detail,*" as we are told by a railway poster advertising this road-rail container service.

With the miniature Containers now available, this "door-to-door" service can be provided on Hornby Railways. Hornby Containers are of four different representative types, one for each group, and the distinctive colours, lettering and other details adopted for their containers by the four groups are accurately reproduced on them.



THE NEW HORNBY CONTAINERS THAT ARE DESCRIBED IN THE ARTICLE ON THIS PAGE. EACH IS SHOWN ON AN APPROPRIATE FLAT TRUCK.

The L.M.S.R. is represented by a Furniture Container "K61." The finish of this reproduces the timber contruction with vertical boarding of the real thing. All the details of the original are shown. The ironwork, such as the strapping on the sides and the door hinges on the rear end, is in black, and all lettering is in yellow, giving a very smart effect on a background of the familiar Midland red.

The possibilities of the publicity afforded by the carriage of real containers through the streets have not been neglected by the railways. Almost all containers now are decorated with concise wording, calling attention to the special advantages of this form of transport, and in comparison with most of the earlier more or less experimental containers they look quite gay affairs. Thus on the Hornby L.M.S.R. Container the words "Furniture Removal Service," and other phrases amplifying them, are prominent in addition to the initials of the owning company. This Container is distinguished also by carrying the L.M.S.R. Coat-of-Arms on each side.

Steel container construction is represented by the Hornby L.N.E.R. Goods Container "BLS297." The corrugations pressed out in the sides and front end of the original are well reproduced, as are the courses of rivets and the ventilating bonnets at each end. The design of the rear end shows two upper doors and the usual drop-down loading flap, with the necessary hinges and fastenings. This Container is finished in the familiar L.N.E.R. "red oxide" shade used for brake-fitted and "piped" wagons. The lettering is in yellow, and on the sides appears the full title of the company. Words emphasising the door-to-door nature of L.N.E.R. container transport and its advantages also are shown.

The G.W.R. representative is an Insulated Container "FX1642," as used for the transport of frozen meat imported from overseas, and has doors at the sides as well as at one end. It has a neat and clean appearance, for it is finished in white with black lettering and, like nearly all G.W.R. equipment, it bears the neat and up-to-date monogram of the company. It is very complete in detail, for its design includes the locking bars and other fittings for securing the doors, even to the minute hooks that hold these back when they are open for loading or unloading. The word "Insulated" appears on the side doors, and the other wording emphasises the special importance of container service for perishable traffic.

The finish of the Hornby S.R. Ventilated Container, "M644," like that of the L.N.E.R. one, represents steel construction. This container is of the type used for the carriage of fresh meat and other similar traffic that requires to be kept cool. Two rows of ventilating slits therefore are represented along the sides and on the ends. Both side and rear-end doors are provided, with the hinge and locking arrangements characteristic of S.R. containers carefully reproduced. The finish is striking, giving a smart exterior and the impression of a cool well-ventilated interior, for it is carried out in aluminium all over, the lettering being in S.R. dark green. The initials of the company appear at the front end and on the side doors. On the latter also appears the word "Ventilated," together with an invitation to "Enquire at any S.R. station for details," and the initials of the Company.

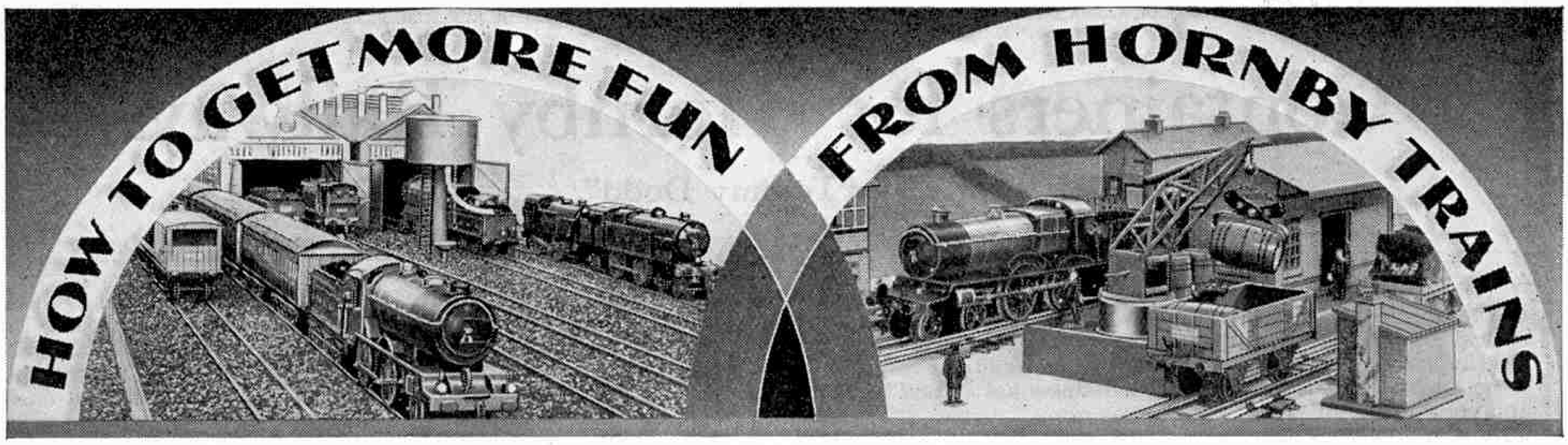
The Hornby Miniature Containers are fitted with lifting tackle on the roof in the form of chains and a ring for the crane hook. When loaded on Hornby Flat Trucks they look very effective, as can be seen from the photographs reproduced on this page. They can be obtained mounted in this way on Flat Trucks, and also are available separately.

The complete units can be used singly as parts of freight or passenger trains as required; and they can be used also to make up complete trains, particularly of Insulated and Ventilated Containers for perishable traffic. Trains with containers of this type will form excellent miniature reproductions of those "freight flyers" that run from Plymouth and Southampton Docks with frozen meat, and from the West and South-West with freshly-killed meat and perishable produce to keep London's markets supplied.

Containers for general goods also can be used to form complete trains if required. A complete train of Furniture Containers is not perhaps a common sight on real railways. There is no reason why such a train should not appear on a Hornby railway, however, for it can be supposed to consist of returning "empties," or to be engaged in a special "removal in bulk" such as might be involved in moving complete the effects of a large mansion, or a school, or some similar institution. Examples of extensive removals on these lines have been undertaken by all groups, and the speed and convenience of the operations have demonstrated the efficiency of the container system.

The addition of Hornby Containers adds considerably to the fun and realism of freight working in miniature. A feature of modern practice has been the development of special flat wagons for container traffic only. These are fully fitted with automatic brake gear for running in passenger or fast goods train formations. The Hornby Flat Truck represents very well this type of vehicle, but in addition is a wagon of more general utility. It would be an interesting plan to reserve one or two Flat Trucks specially for container service, and these should be classified as "brake-fitted" on the lines of the suggestion that appeared in the article "*Special Freight Working In Miniature*" on page 238 in the "*M.M.*" of last April. In a fast freight train composed partly of wagons supposed to be brake-fitted, such wagons should always be placed next to the engine.

Occasionally containers are to be seen loaded on ordinary open wagons. This practice can be followed in miniature if desired; Hornby No. O or No. 1 Wagon can be pressed into use in this way if a Flat Truck does not happen to be available at the particular time.



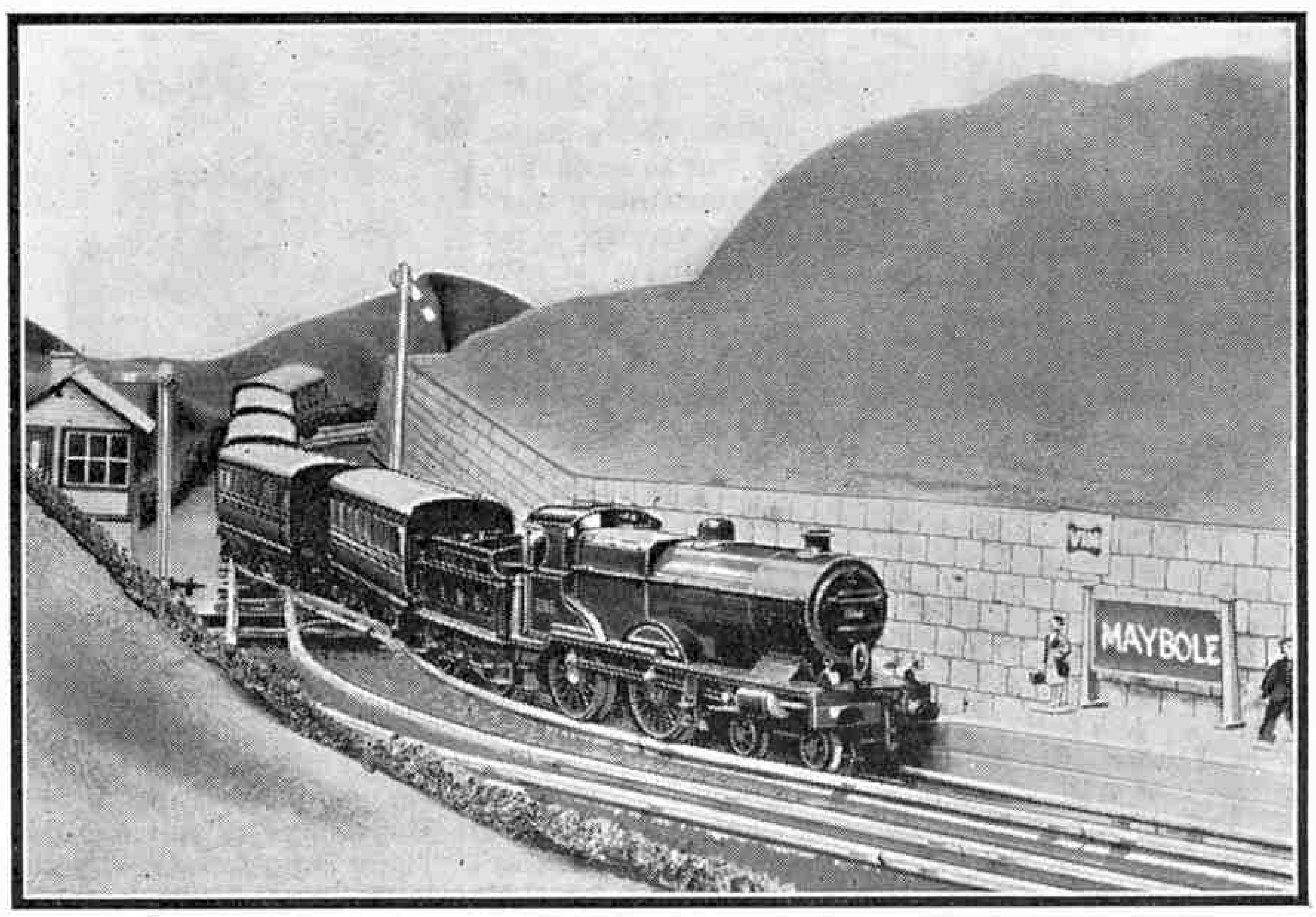
L.M.S.R. (G.S.W.R. SECTION) SERVICES

THIS month we return to a type of article that from our correspondence appears to be very popular with Hornby Railway owners. From time to time we refer to special features of a real railway group, or a section of a group, and show how these can be reproduced in miniature with Hornby components. In this article we deal in this manner with the part of the L.M.S.R. that was formerly the Glasgow and South Western Railway, still familiarly referred to as the "Sou' Western." This is an interesting section that is particularly suitable as the prototype of a Hornby railway, for practically all L.M.S.R. locomotive types up to and including "Royal Scots" are to be found on G.S.W.R. metals, and the standard Hornby L.M.S.R. Locomotives therefore can be used on its miniature representative.

On the main line of this section between Glasgow (St. Enoch) and Carlisle, pride of place always has been held by trains run in association with the Midland services to and from St. Pancras. The present-day *"Thames-Clyde Express"* is worked over this route, and therefore should not be missed from the timetables of a miniature G.S.W.R. line. A miniature *"Thames-Clyde Express"* composed of Hornby No. 2 Saloon Coaches in L.M.S.R. colours has a very smart appearance, especially if the vehicles are fitted with train name boards. Making suitable boards is not a difficult task, and the lettering can be carried out in Indian ink on plain white card.

For motive power the first choice should be a Hornby *"Royal Scot"* No. E320 or No. 3C Locomotive, according to whether the layout is operated electrically or by clockwork. This type of engine is fitted with smoke deflectors and has quite an impressive appearance at the head of a train, as the upper illustration on the opposite page shows. Additional interest is given by the use of a miniature route indicator of the semaphore type on the front of the engine, as shown in the illustration. These interesting fittings formerly were peculiar to the Caledonian Railway, now also part of the L.M.S.R., but since grouping they have been adopted for the G.S.W.R. Section. The indicator consists of a central stem, with two small semaphore arms pivoted to it that can be made to take up various positions in a similar manner to the hands of a clock. The central stem serves as a means of attachment to a lamp bracket of the locomotive.

In miniature the central stem of the route indicator can be omitted. The two semaphore arms are best cut out of white card or stiff paper, with one end rounded and with the projecting semaphore portions slightly wider at their outer ends. The arms should be $\frac{1}{2}$ in. long and should be $\frac{1}{8}$ in. wide at their outer ends. When cut out, one should be placed on top of the other and a hole pierced through both at the rounded end with a stout pin. They should be fitted together by means of a very small paper fastener, the two projecting legs of which are bent flat after passing through the semaphore arms, and then doubled back so as to fit on the lamp bracket of a Hornby Locomotive.



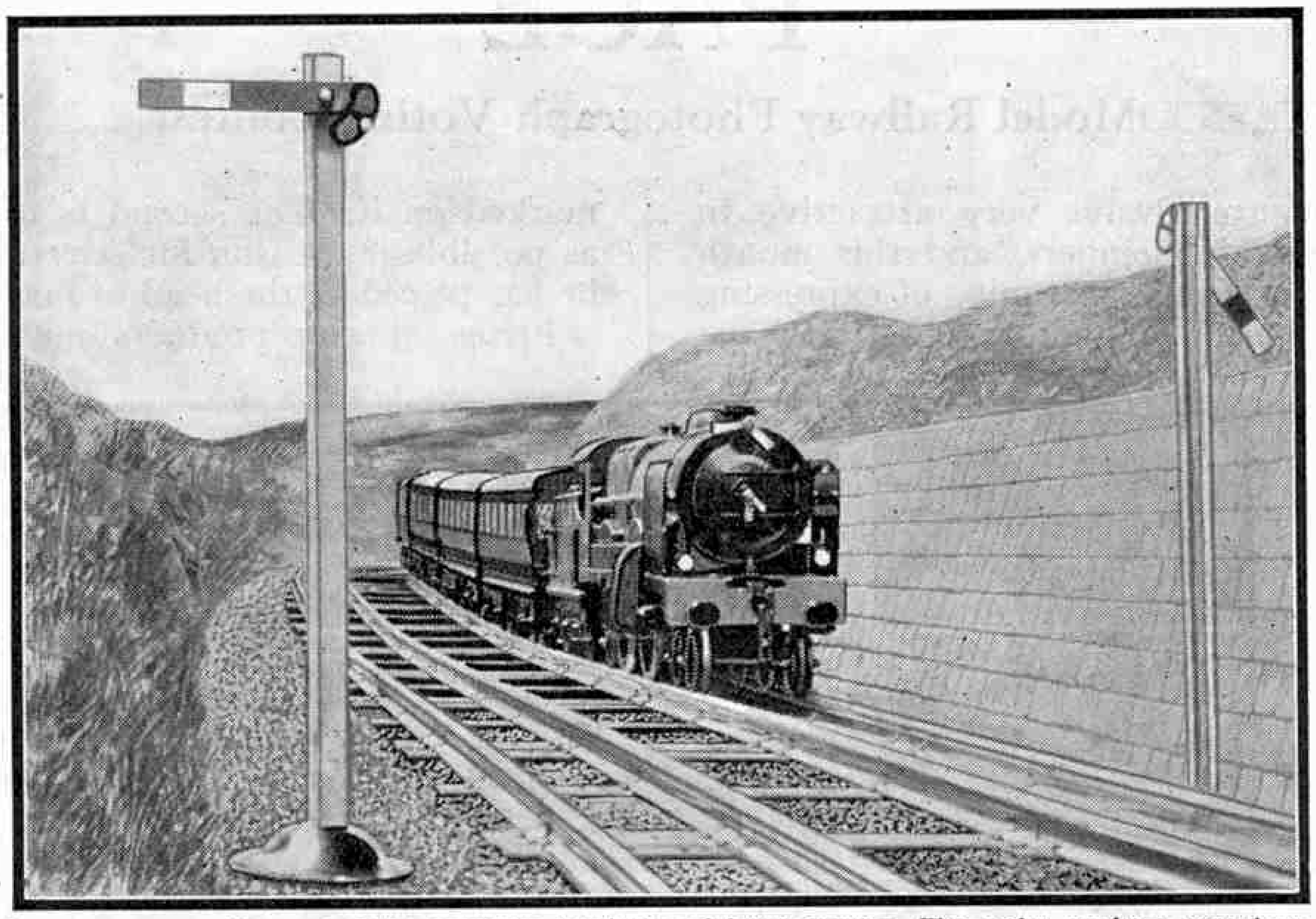
An express entering a station on a Hornby layout representing the G.S.W.R. Section of the L.M.S.R. The main line is single, but becomes double track at the station in order to provide a passing loop.

When the head of the fastener has been touched up with white paint the indicator is ready for use. The arms can readily be set as required for the route to be indicated. Trains between Carlisle and St. Enoch have the arms in the "quarter-to-four" position as seen from the front of the locomotive, and this setting is shown in the photograph previously referred to.

If a "Royal Scot" is not available the chief passenger trains can be handled by a Hornby L.M.S.R. E220 Special Locomotive or the corresponding No. 2 Special Clockwork engine. This type of locomotive is a splendid representation in miniature of the well-known L.M.S.R. Standard Compounds that now perform a great deal of the main line work on the G.S.W.R. section. Readers no doubt will remember the sound performance of Compound No. 914 between Stranraer and Glasgow that was described in the article *"Belfast to Glasgow by L.M.S.R."* on page 72 of the *"M.M."*

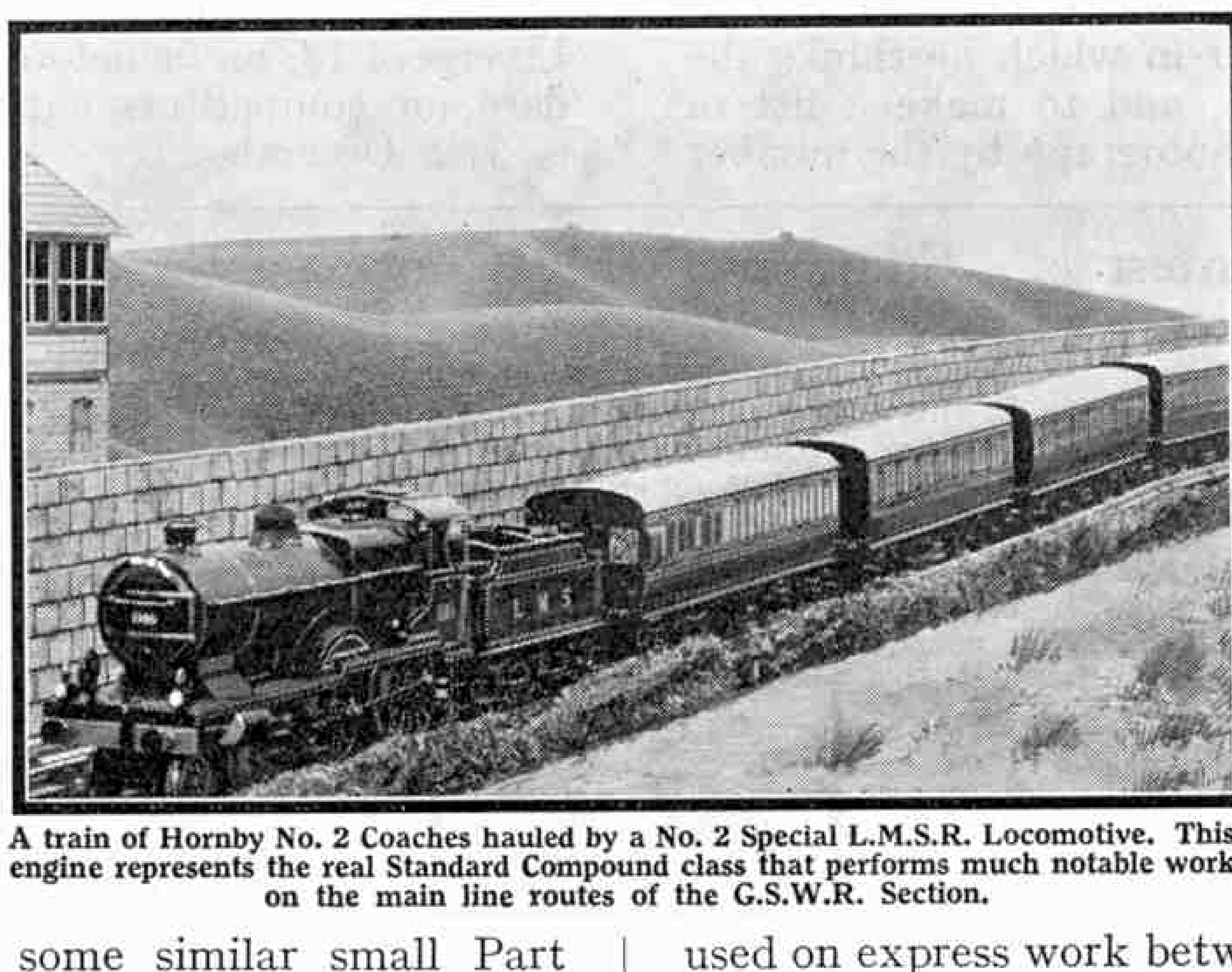
for last February. This difficult route has always been distinguished by the splendid work of the locomotives running over it, and the traditions set up by the feats of one-time G.S.W.R. engines are ably carried on by the present-day Compound and Class "2P" 4-4-0 engines.

The association of the Stranraer line with the "Short Sea Route" to Ireland via Larne renders it of special importance, and the train services run in connection with the steamer sailings are of distinct interest. The principal services between Glasgow and Stranraer are included among the L.M.S.R. named trains, *"The Fast Belfast"* and *"The Irishman"* supplying the afternoon and evening services respectively. The Irish services generally were long known by the expressive nickname of the "Paddies," a title that needs no explanation. L.M.S.R. No. 2 Saloon Coaches can be used to make up these trains in miniature, and No. 2 compartment-type Coaches also are suitable. The route indicator is set at the "ten past two" position.



A Hornby No. 3C "Royal Scot" Locomotive hauling a miniature express. The engine carries a semaphore route indicator, constructed in the manner described in this article and mounted on the top lamp bracket.

A feature of this route is that much of it is single track, with passing loops situated at certain stations. This state of affairs is found on many miniature railway systems, so that the realistic representation of this line is not difficult. The working of the up and down trains must be so arranged that no undue delays occur at crossing places, and passing loops must have sufficient capacity for the longest trains operated, or some awkward operating problems may crop up. Single line working on the staff or tablet system could be instituted on the miniature line if desired, and will be found very fascinating. The exchanges on this route are carried out by hand. Stops therefore will have to be made at the "tablet stations" on a Hornby railway while a suitable "tablet" for one section—represented by a Meccano Collar perhaps, or some similar small Part carried in the tender—is exchanged for that belonging to the succeeding section.



A train of Hornby No. 2 Coaches hauled by a No. 2 Special L.M.S.R. Locomotive. This engine represents the real Standard Compound class that performs much notable work on the main line routes of the G.S.W.R. Section.

Another important route cuts across from Dumfries, on the Glasgow and Carlisle main line, to Challoch Junction on the Stranraer line. Single line working again applies here, but through traffic between England and Ireland via Stranraer passes this way. For miniature purposes the rolling stock and motive power of the Glasgow and Stranraer route can be used with good effect.

Between Ayr and Glasgow there is a remarkably heavy service of business and residential trains, with restaurant cars at suitable times of the day, in addition to the through expresses and other trains for Stranraer that also travel via Ayr. This traffic should be represented on a miniature G.S.W.R. system, and No. 2 Coaches are specially suitable for the composition of the trains. Restaurant facilities on this route formerly were provided by the Pullman Car Company Ltd. The L.M.S.R. have taken over their interests on this and on the Caledonian Section, but the Pullman cars themselves are still in use as L.M.S.R. vehicles. Hornby No. 2 or No. 2 Special Pullmans therefore can be employed in miniature. Most if not all the Pullmans thus taken over have been painted in L.M.S.R. colours, but there is no reason why vehicles in the standard Pullman finish should not be used on a Hornby layout.

The E220 Special L.M.S.R. Standard Compound is the first choice in the matter of locomotive power. Those readers who have in use locomotives of the old Hornby No. 2 type can employ them for the slower and more local trains, on which they will represent such G.S.W.R. 4-4-0s as still remain in service. The route indication for the Ayr trains requires the semaphore arms to assume the "ten past two" position, when seen from the front of the engine.

In spite of the short-distance character of much of the G.S.W.R. running, few tank engines are employed on this section. This was so in pre-grouping days, and conditions have not altered much in this respect. But if tank engine designs are few, this is made up for by the presence of some of the biggest engines of this type in service in this country. These are the large G.S.W.R. "Baltic" tanks, which are used on express work between Glasgow and Ayr. Hornby E220 Special Tank Locomotives can take the place of these giants on a miniature system. An inevitable result of the scarcity of tank engines is that a great deal of local and even of branch work is carried out by tender locomotives, which frequently have to perform much "tender first" running. This is a convenient practice from the operating point of view on a miniature system, and it saves the constant turning of tender engines.

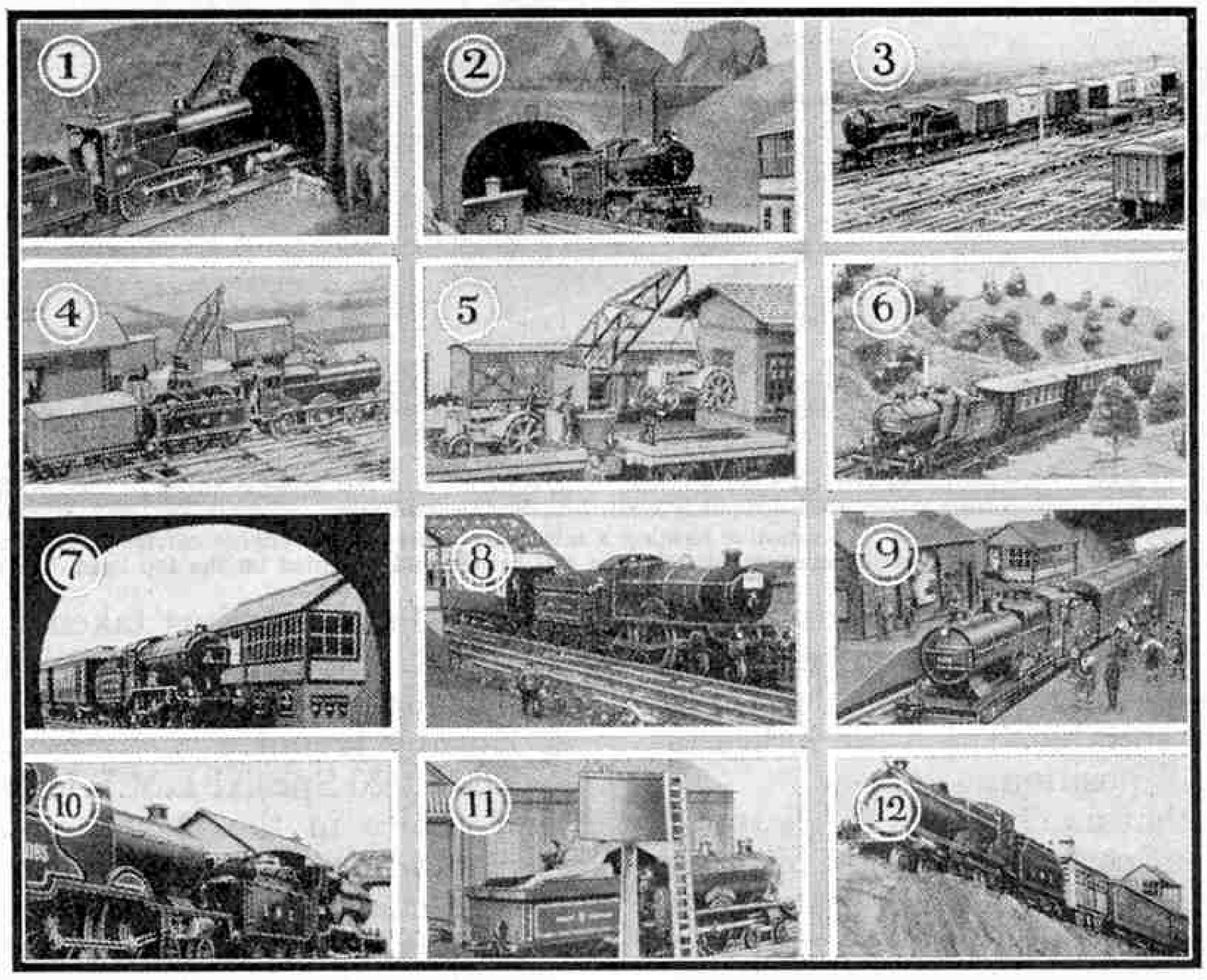
Join the Hornby Railway Company and become eligible for the competitions announced on this page.

H.R.C. COMPETITION PAGE

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

Model Railway Photograph Voting Contest

Voting competitions are always very attractive to Hornby Railway Company members, and this month we are giving them a further opportunity of expressing their opinions upon a series of photographs that have been used to illustrate the variety of railway topics dealt with in the *"M.M."* The 12 photographs reproduced on this page show interesting scenes on Hornby railways. Some of them concentrate attention on the locomotive or on the train, their principal features being interesting formation or working. In others the lineside structures and the surrounding scenery are of greater importance, and these combine with the trains to form realistic railway scenes. We are asking members to examine these photographs and to place them in order of attractiveness according to their own views on building up realistic layouts.



Each competitor is only asked to do two things. The first is to decide the order in which he thinks the photographs should be placed, and to make a list in this order, representing each photograph by the number marked on it. The second is to state in as few words as possible his reason for selecting the photograph that he has placed at the head of his list.

Prizes of any products manufactured by Meccano Ltd., to the value of 21/-, 15/- and 10/6 respectively, will be awarded to the three entrants whose lists are nearest to the one decided upon by taking into account the votes of all the competitors. In the event of a tie for any prize, the award will be made to the competitor whose entry is presented in the neatest or most novel manner. This is a point worth remembering, as it sometimes happens that an entry good in other respects is handicapped by untidy presentation.

Envelopes containing entries must be marked *"H.R.C. September Voting Contest"* in the top left-hand corner and posted to reach Headquarters at Meccano Ltd., Binns Road, Liverpool 13, on or before 30th September. The closing date for competitors entering in the Overseas Section is 31st December.

Railway Photographic Contest

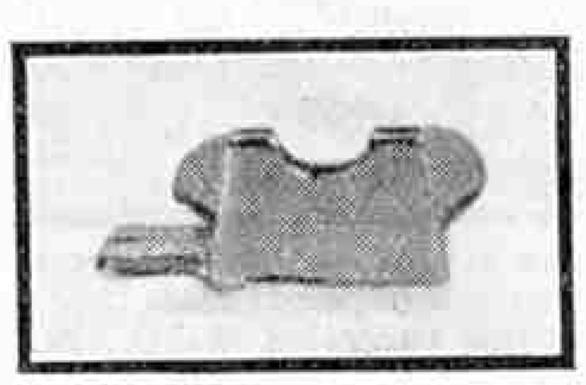
The coming of September may be said to herald the approach of the end of the outdoor photographic season, for the days now are shorter and the light generally is not too good. This month's Photographic Contest therefore is the last of the present series. In it we offer prizes for the best photographs of *"Any Railway Subject."* Entrants may submit as many prints as they desire, but no competitor can receive more than one prize. As usual, the actual exposure must be the work of the competitor himself, but it is not necessary that he should have done his own developing or printing.

The Contest will be divided as usual into two sections—Home and Overseas—and prizes of any products of Meccano Ltd. to the value of 21/-, 15/- and 10/6 respectively will be awarded in each section. Every print submitted should have on the back the name of the competitor, his full address and his H.R.C. membership number.

Envelopes containing entries should be addressed *"H.R.C. September Photo Contest,"* Meccano Ltd., Binns Road, Liverpool 13. The closing date in the Home Section is 30th September. Overseas, 31st December.

Summer Puzzle Contest

The accompanying illustration of a well-known Hornby product is the third and last in this series of mystery photographs, the first and second of which were published in the July and August issues respectively. Competitors are now invited to forward to Headquarters on a postcard their solutions to the three puzzles.



The Contest is divided into two Sections, Home and Overseas, and a cash prize of £1 1s. 0d. will be awarded to the competitor in each section who gives the best solution to the three puzzles of the series. The closing dates are 30th September in the Home Section, and 31st December in the Overseas Section, and all entries should be addressed *"H.R.C. Summer Puzzle Contest,"* Meccano Ltd., Binns Road, Liverpool 13.

Competition Solution

MAY "LOCOMOTIVE SHADOWS CONTEST"

(1) 4-6-2 "Silver Link," L.N.E.R. (2) 4-6-2 "Turbomotive," L.M.S.R. (3) 4-6-2, L.N.E.R. (4) 4-6-0 Victoria Government Railways. (5) 4-4-2, L.N.E.R. (N.B.). (6) 4-6-2T. S.R. (7) 4-6-0, "Royal Scot," L.M.S.R. (8) 4-6-0, Palestine Railways. (9) 4-4-2, L.N.E.R. (G.N.). (10) 4-6-0, "Lord Baltimore," B. and O. Railway. (11) 4-4-0, M.R. Smith Compound. (12) 0-8-0T., S.R. (13) 4-4-2, L.N.E.R. (G.N.). (14) 4-6-2, German State Railways. (15) 2-6-0, L.N.E.R. (16) 2-6-0, L.M.S.R. (N.C.C.). (17) 4-6-2, Nord. (18) 2-8-2, "Cock o' the North," L.N.E.R. (19) 4-6-0, Streamlined "King," G.W.R. (20) 4-8-4, Class K, N.Z.R. (21) 4-6-4 German State Railways. (22) 4-6-2, L.N.E.R. (23) 4-6-2, Indian State Railways. (24) 4-4-0, L.M.S.R. (M.R.). (25) 4-6-0, "King," G.W.R.

COMPETITION RESULTS

HOME

July "Locomotive Knowledge Contest."—First: K. Costain (5108), Bolton, Lancs. Second: J. N. Leedam (43458), Burnley. Third: J. T. Fraser (2267), Exeter. Consolation Prizes: H. A. S. Cowles (47636), Goudhurst, Kent; S. Holloway (79), Plymouth; B. S. Jones (18593), Duffield, Derbyshire; J. C. Button (10335), Crewe, Ches.

July "Railway Photo Contest."—First: C. Spencer (44179), Sheffield 6. Second: V. L. Breeze (2134), Lewes, Sussex. Third: D. Fear (18477), Taunton, Somerset. Consolation Prizes: P. Andrew (22670), New Barnet, Herts.; S. H. Gardener (47996), Canonbury, London, N.1; J. W. Hague (1258), Ripon, Yorkshire.

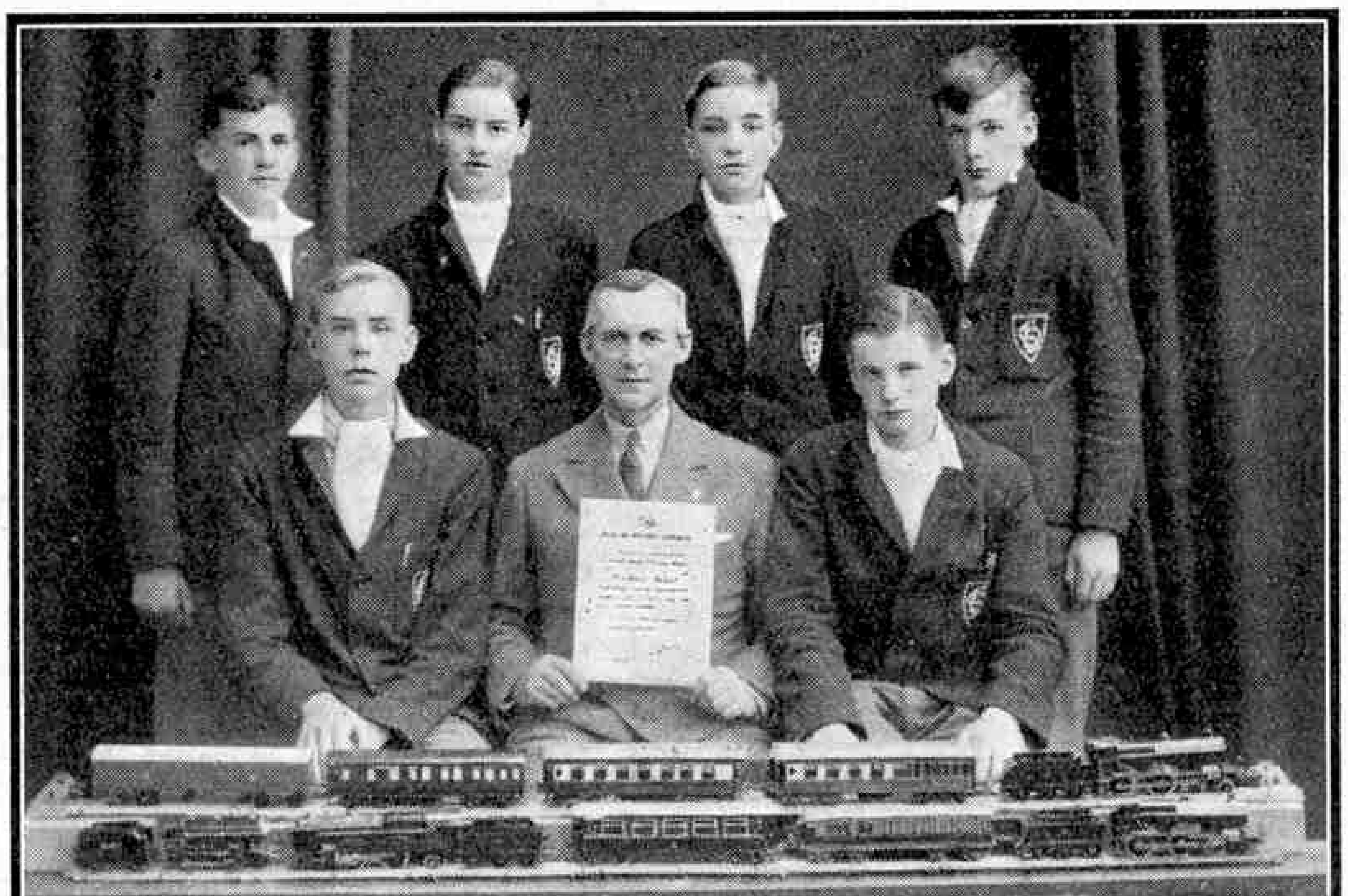
Branch News

Bedford School.—The Branch layout represents the main line of the Midland Section of the L.M.S.R. from St. Pancras to Leicester, and a branch line representing the Tilbury section has recently been laid down. It is hoped to complete the doubling of the main line in the Autumn, and to instal goods yards at "Leicester" and "Cricklewood." Further locomotives are to be obtained and the whole layout will ultimately be electrified. At the School Exhibition a complete terminal station with five platforms, constructed by the "Chief Engineer" of the line, was highly commended and secured the highest obtainable prize. This station is now installed as "St. Pancras" on the Branch layout. Secretary: J. E. D. Rothwell, 6, Kimbolton Avenue, Bedford.

Folkestone.—Excellent progress is being made with the harbour works at "Folkestone" on the Branch layout, and the harbour is to be served by two lines of rails. "Boat Train" services are already in operation and are run to a special timetable. Night mail trains are regularly operated and the principal one is now named the "*Midnight Mail Express*." Goods and local services are run in addition. Improvements to the signalling of the line have been under consideration, and it has been decided to instal several new signal cabins. The Autumn Session commences this month and an attractive programme of track meetings, visits and other functions is being arranged. Secretary: F. E. Saunders, 79, Dover Road, Folkestone.

Elmside (Exeter).—A model road system complete with traffic signals and controlled crossings has been built, and Dinky Toys motor vehicles keep up a constant service on it. Road working is on an organised basis in co-operation with the rail services. During a recent spell of intensive traffic, 30 trains were run in a period of two hours and scheduled times were observed throughout. It was decided that the Branch track, which has been in its present position for three years, should be taken up and rearranged, and this was done after a general clean-up during the holiday period. Secretary: T. W. A. Smith, 98, Ladysmith Road, Exeter.

Islington.—After several meetings in which particular attention was given to track laying, some very satisfactory train running has been experienced. The arrangement of various accessories, including stations, goods depots, and locomotive sheds, has added considerably to the realism of operations. At one track meeting trains of all kinds were run and the locomotives and rolling stock of all groups were represented. A popular feature recently was a trip to Southend. This was greatly enjoyed, and is to be repeated in the Autumn. An interesting Lantern Lecture dealt with "*Britain's Greatest Railway*." The slides were kindly loaned by the L.M.S.R. Future arrangements include a Concert and an Exhibition, and preparations for both are well in hand. Attendance continues to be excellent, but there is room in the Branch for more keen members. Boys in the neighbourhood who are interested should communicate with the Secretary. A trial has been given to the assignment of particular duties to each member in turn, so that all will gain a knowledge of all aspects of operation. Secretary: F. H. Gardener, 3, Tiverton House, Pleasant Place, Canonbury, London, N.


Members of Bedford School H.R.C. Branch No. 310 with their Chairman, Pay-Captain W. H. Coomber; Secretary, J. E. D. Rothwell. This Branch has recently been incorporated, and is developing a realistic layout based on the Midland main line of the L.M.S.R. Some of the Branch stock used is shown.

Glengorse (Battle).—At a recent meeting a complicated track was arranged with the aid of additional Hornby material that has been obtained. On this occasion a new Hornby No. 3 "*Lord Nelson*" was given its first run, its finish and the realistic appearance of the smoke deflectors fitted being greatly admired. Subsequent track meetings have been held out-of-doors; the most successful arrangement incorporated a large continuous main line with two terminal stations, and many interesting train operations were carried out. Secretary: P. B. Bollard, Glengorse, Battle, Sussex.

Rutherglen (Glasgow).—A great variety of trains has been operated at recent meetings, the chief express passenger service being maintained by a special four-coach set train formation. The working of goods trains has not been neglected and shunting also has proved popular with many members. The most interesting outing yet enjoyed by the Branch was a visit to the Polmadie Motive Power Depot of the L.M.S.R. The locomotive sheds and repair shops, the coaling plant and the turntable also were inspected, and members were allowed to go on the footplates of engines of three different classes. One of these was a "Royal Scot" No. 6121 "*H.L.I.*"; another was a 2–6–0 standard "Mogul," and the remaining one an 0–6–0 goods engine. At the final meeting of the Summer Session games were indulged in, and the results of prize competitions announced. Secretary: R. G. Langmuir, 11, Afton Street, Shawlands, Glasgow, S.1.

Whitgift School.—Interesting meetings with good timetable running have been held. Competitions devised by the members themselves have been greatly enjoyed. There was great excitement at a recent track meeting when comparative tests between various locomotives were carried out. It is hoped that members will be able to inspect the electric signal box at London Bridge. Secretary: J. C. Watson, 23, Addiscombe Avenue, Croydon, Surrey.

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.

Chingford—G. Flowers, 1, Hortus Road, Chingford, London, E.4.

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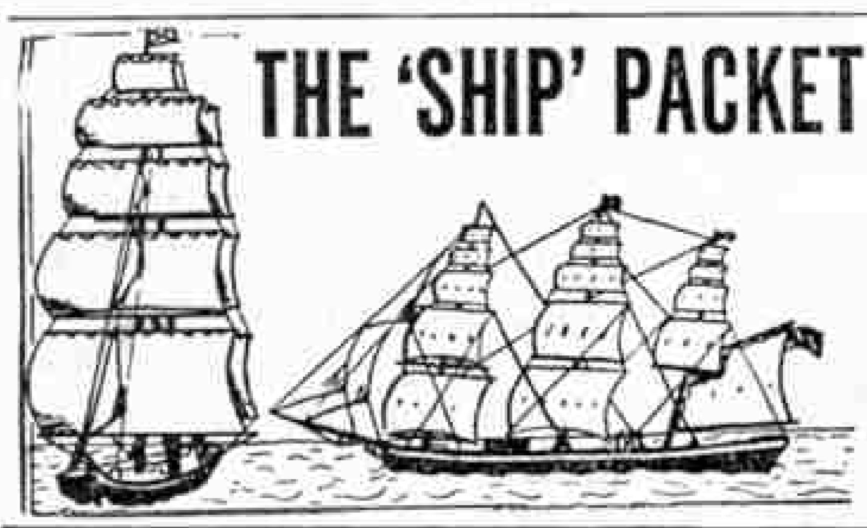

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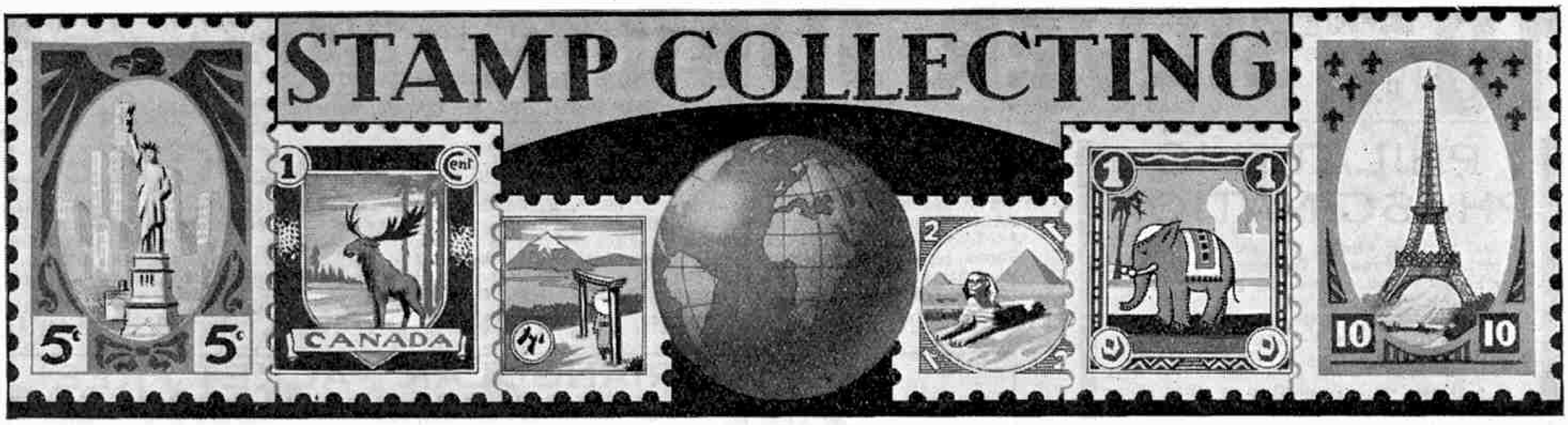
This magnificent FREE collection contains fine K. GEORGE SILVER JUBILEE issues, including a set of CANADA (Royal Family); AUSTRALIA (K. George on his horse Anzac) as well as the WINDSOR CASTLE issue. Also, this pkt. contains EGYPT (late K. Fuad); GREECE (Hermes); SIAM (Ex-King Prajadhipok); CHINA; JUGO-SLAVIA (Croatia); RUSSIA (Thunderbolts); JAPAN; BULGARIA; KENYA & UGANDA (obsolete K. George) etc., etc. Absolutely **FREE** to all genuine applicants for one of our famous 'Grey' booklets of stamps on approval who enclose 2d. stamps, or without approvals, P.O. 2/6. SPECIAL OFFERS, 25 Newfoundland 1/-, 50—5/-; 50 Japan 1/3, 100 5/-; 10 Japanese China 1/-; 50 Luxembourg 1/6, 100 5/-; 10 Vatican 1/-; 50 Spain 1/-, 100 3/6.

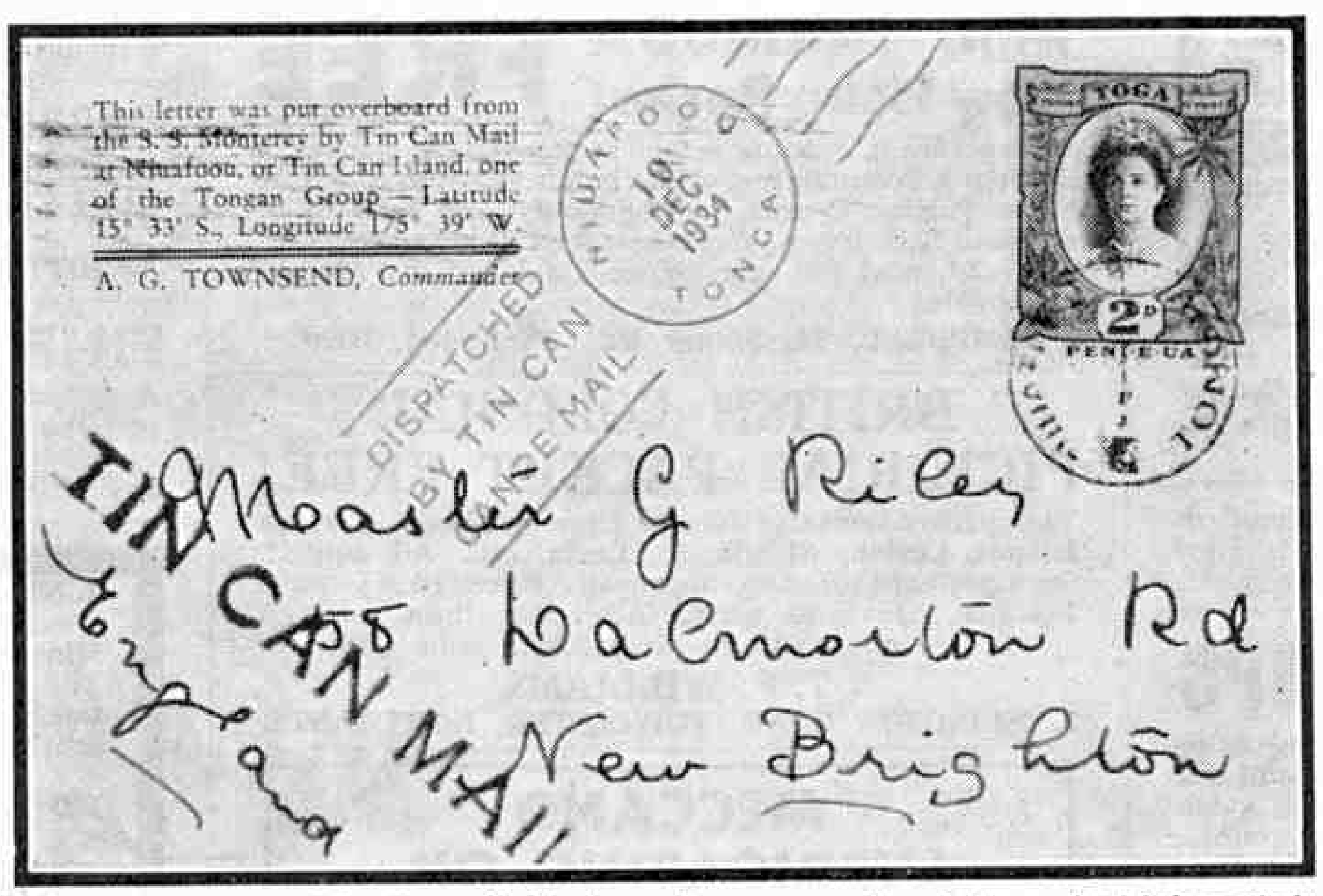
WINDSOR STAMP CO.
(M.M. Dept.), 59, Lee Road, Blackheath, S.E.3.



ORGANISED STAMP COLLECTING

WITHIN the next few weeks the popular stamp collecting season will be in full swing once again. No doubt many of our readers who have collected stamps in a haphazard way in past years have made up their minds to start on proper lines this season, and our article this month is directed to help such readers particularly. A well-kept collection provides its owner with an unlimited amount of pleasure.

An album and some stamp mounts form the only essential equipment for a commencement in stamp collecting, and it is advisable to buy the best that can be afforded. Unnecessary economy in this direction is a mistake. A loose-leaf album is better than one that has a fixed number of leaves and definite spaces devoted to various countries, for it permits expansion of the space devoted to any particular country, and the pages and stamps may be re-arranged as the growing collection demands.



This illustration, and that immediately beneath, are examples of stamps best left on their covers, the upper one because the cover is a souvenir of a most unusual type of mail service, and the other because the postmark indicates the stamp was used on the first day of issue.

The only satisfactory stamp mounts are those that can be peeled cleanly away from the stamp or the album page when it is necessary to make a change for any reason. Such mounts can be purchased at 8d. per 1,000, only a copper or two more than the cheap, dangerous bits of gummed paper that are frequently sold as stamp mounts. Cheap mounts will not peel off cleanly; either they tear a piece of the surface from the album page or they cannot be removed from the back of the stamp without risk of damage to the stamp itself. Any apparent saving achieved by the use of cheap stamp mounts is quickly lost when one or two stamps are ruined.

One word of warning must be given in connection with the use of stamp mounts, however. Even a good mount will not peel cleanly away from an album page or stamp unless it is perfectly dry. In no circumstances should an attempt be made to remove a mount while the gum is still damp.

There is a host of other accessories that a keen stamp collector can find useful, but only two of these are really required by the beginner—a catalogue and a pair of tweezers. The catalogue is a guide that simplifies the identification and arrangement of the stamps in their proper order, as well as listing details of perforation and watermarks that often are the sole means of distinguishing between various issues of the same country. It is just as helpful to the stamp collector as a compass is to a mariner. Young collectors are well catered for in the Gibbons "Simplified" catalogue and the Whitfield King "Standard" catalogue, both of which are priced at 5/-.

A splendid example of a used stamp. Note how perfectly the design is centred on the stamp and that the postmark is so light as not to obscure even the slightest feature of the design.

A pair of tweezers is often the last piece of equipment that the younger collector considers a necessity, and yet, in our view, it ranks almost next to the album itself. Stamps can so very easily be soiled, and their value is so quickly depreciated by dirtiness, that the use of tweezers is really important as a guard against fingermarks that would quickly deprive a stamp of its "mint" condition. At first the tweezers may seem a very clumsy tool, but after a little practice they are quite easy to use and in time their use becomes semi-automatic. Other items of equipment that the collector will find necessary as he progresses are a perforation gauge, watermark detector, a magnifying glass and a colour guide. Every one of these is really an essential to the serious collector, but the young collector can manage without them quite well for a considerable time. In a later article we hope to deal in greater detail with their employment in identifying stamps.

Having got together the essential equipment, the next stage in organising the collection is the mounting of the stamps that have been accumulated already. If it is intended to include both used and unused (mint) stamps in the collection, the two types should not be mixed together, but kept in separate rows on the page or, better still, on separate pages. A hard and fast rule should be made that dirty, heavily postmarked, or torn stamps shall not be included. The aim of the collector must be to make his collection neat and clean looking, and nothing detracts more from this object than heavily obliterated specimens. We do not agree with those who contend that only the most lightly postmarked stamps should be included, but somewhere between the lightly postmarked specimen and the dirty one there is a point that the young collector can adopt as the standard below which his used stamps may not fall.

If it is desired to retain stamps that fall below the standard set for the collection proper, there is no reason at all why the other specimens should not be put into a reserve collection that is retained for reference only. Here also may go the fiscal stamps, the meter frank specimens, and the odd curious charity stickers that every young collector seems to cherish. After all, those things have their interest, and there is no reason why anyone who desires to enjoy their possession should not do so, provided he does not consider them a legitimate inclusion in his stamp collection.

In the ordinary way every scrap of paper must be removed from a stamp before it is mounted in the collection, but there are certain exceptions to this rule, such as interesting postmarks, advertising cancellations, stamps on flown covers, etc., and in an early article we propose to deal with the handling of items such as these, and with the arrangement of the collection in the album.

In this article we have indicated certain general lines of action that every young collector should take to put his stamp collecting on to a proper basis. Inevitably, however, other points will arise in the experience of individual readers and in all matters of doubt on such points readers should not hesitate to write to the Editor of the "*M.M.*" for assistance.

10 DIFF. (NO G.B.) SILVER JUBILEE FOR 3½d. (Postage 1½d. Extra) TO ALL APPLICANTS FOR OUR BARGAIN APPROVALS CONTAINING OTHER JUBILEES, etc.

Don't delay, write at once for this wonderful packet, to: **THE PUKKA STAMP CO., 27, Normandy Ave., BARNET.**

PHILATELIC PHASCINATION

200,000 Stamps, what a pity we have no time to sort them through! We have purchased a huge accumulation, formed, for goodness knows what purpose, by an elderly collector. The collection dates back to the early days of Stamp Collecting. Even in the very brief glance we have allowed ourselves, we have noticed many high catalogue, some rarely seen nowadays. This is at a glance, we have no time at all to gauge the perforation, colour and other varieties which must abound. There is nothing to equal the pleasure of sorting a large accumulation such as this, so, as we are denied the pleasure ourselves, we are making it over to our customers. We have weighed the mixture into bags and offer it just as it stands, at 6d. (there's a chance for you boys and girls). 1/3, 2/9, 5/3, 10/3, and 25/– a bag. There is both the chance of some pleasant finds (we ourselves have seen three stamps catalogued over £4, while turning the mixture over, also some penny blacks and early Colonial Imperfs.) and the certainty of some real philatelic enjoyment. We especially urge our own customers to take as big a bag as possible, as we should not like them to miss it and there will be insufficient stock for repeat orders.

LIQUIFACTORS
43, Rectory Road, London, S.W.6 (England)

100 Different Stamps Free to Approval applicants. Liberal discount.—Cuthbert, Newsham Lane, Broughton, Preston.

Entirely free. 30 British Colonials including modern pictorials. Request approvals.—G. Kingsmill, New Barnet, Herts.

FREE SETS of STAMPS

6 Cuba or 6 Imperial China or 6 Straits Settlements or 6 old French, etc. Just send stamps value 2d. and ask for my Approval Sheets containing some high value stamps at low prices and with progressive discounts. State which set of stamps desired to be sent free.

P. ILLINGWORTH,
TRANMERE PARK, GUISELEY, near LEEDS.

New Greek Air Mail FREE

along with 25 other different stamps. Say whether British Colonial or Foreign preferred—to applicants sending 2d. in stamps and requesting our Booklets of Stamps. Special discounts allowed.

The BRAMLEY STAMP CO.,
TOWN END, BRAMLEY, LEEDS.

SENT BY AIR MAIL

Celebrated "Richemont" 6d. and 1/– packets, sets and singles, sent on approval by Swiss Air Mail. 50 Swiss, 1/–; 50 U.S.A., 1/–; 40 Canada, 1/–. Complete pictorial Swiss set of 7, 4d.

A. M. PHILLIPS,
Richemont, St. Légier, sur Vevey, Switzerland.

PICTORIAL STAMPS—FREE!

Make sure that you obtain this delightful series of pictorial stamps.
Two **ALGERIA** (Street in the Kasbah); Two **ANDORRA** (Notre Dame de Meritxell); One **ANDORRA** (Recouvrements); Two **GUADELOUPE** (Sugar-refinery); One **REUNION** (Waterfalls); Two **TCHAD** (Panther in ambush); Two **SENEGAL** (Bridge over river).
ALL OF THESE SENT **FREE** to applicants for our approvals who enclose 2d.
THE STANDARD AND UNIVERSAL STAMP CO. (SM9), 16, Gloucester Place, Greenwich, S.E.10.

CHEAP APPROVALS

My beautiful Approval Selections are ideal for filling those vacant spaces. Pictorials, Colonials, and hard to get items. Selections from 4 a 1d. Free Gift Bi-coloured Persia all applicants.

A. V. TAPP,
108, CHESTERFIELD RD., BRISTOL

ANOTHER OUTSTANDING OFFER!

We always celebrate the opening of the Philatelic Season with a real **Bumper Gift** and this year we offer the **OCEANIA PACKET,** brimful of magnificent **Pictorials** from the Southern Seas. Here are some specimens included—Australia, **1/- Lyre Bird** and a **1936 Commemorative** of the Submarine Telephone to Tasmania; **Toga,** Coat of Arms mint; **Papua,** pictorial depicting Motuan Girl; **New Zealand,** Pied Fantail and Kiwi bird stamps; **Nauru,** view of island; **West Samoa,** showing Samoan girl with Kava Bowl; Australian comm. Centenary of Victoria, 2d. This packet would cost **1/6** from some approvals but is **FREE AND POST FREE.** Just send a P.C. requesting approvals to

THE UNIVERSITY STAMP CO., 13, WALTON WELL ROAD, OXFORD

TRIANGULAR PACKET FREE!

As a special opening offer for the new Season, we are presenting this wonderful collection **absolutely FREE.** The contents include—**Mozambique Triangular** as illustrated; Reunion (Waterfall); Middle Congo (**Train steaming over Viaduct**); Straits (Tiger); Belgium (**Rare Railway commemorative**); China (Sailing Boat); **2 Mint Air Mails,** and many other wonderful stamps. To obtain this fine gift, simply request approvals, and include 2d. postage. (No approvals sent abroad.) Price of packet alone 9d.

MICHAEL HERBERT (M.M.),
8, Woodstock Road, Walthamstow, London.

Mint BERMUDA New Issue Packet FREE

Magnificent opening season's offer: **Grand Packet** of **28 British Colonials** inc. above handsome stamp, a **Rare Silver Jubilee, Cyprus** (1934 Salamis) and soon to be obsolete K.G. issues. Write now for this grand free gift. Send 2d. post (6d. abroad) and ask for my **Modern** approvals.

CAMPBELL, 71, Manor Rd., Tankerton, Kent.

BRITISH COLONIAL PICTORIAL PACKET FREE!

This packet contains stamps from **Bermuda, Cayman Islands, Ceylon, Nigeria, St. Lucia,** etc. All unused. Send postcard for cheap approvals. Prices ½d. upwards. Postage paid both ways. All applications received before noon will be despatched same day.

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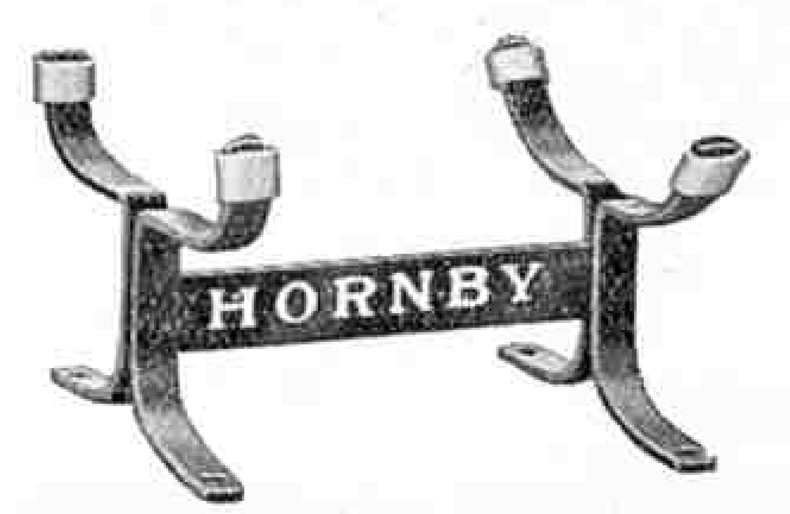
MECCANO LUBRICATING OIL

Before commencing to operate a Meccano model, or to run a Hornby Train, all gears and bearings should be oiled thoroughly with Meccano Lubricating Oil. This oil is specially prepared and is of the right consistency for the purpose. Price per bottle 6d.

Meccano Ltd., Binns Road, Liverpool 13.

Stands for HORNBY SPEED AND RACING BOATS



Every owner of a Hornby Speed or Racing Boat who prides himself on taking care of his model should obtain a Hornby Boat Stand on which to place his boat when it is not in use. The Stands are available in the following sizes: No. 1 for No. 1 Speed Boats; No. 1R for No. 1 Racer; No. 2 for No. 2 Speed Boat and No. 2 Racer; No. 3 for Nos. 3, 4 and 5 Speed Boats and No. 3 Racer. They can be obtained from any Meccano dealer price 9d. each (any size).

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100 diff. Stamps Free to approval applicants, good discount.—Gosling, 21, Powling Road, Ipswich.

"ABBEY" on a packet spells VALUE!

Unused Pictorials (Colonial, Air, and Foreign), 15 for 6d., 35 for 1/–. Special Mixture Used and Unused, 15 for 6d. Postage extra.

ABBOTT BROS., 16, Sedgemoor Road, Liverpool, 11.

FINE BRITISH COLONIALS

A collection of 700 different for 25/–, or pick where you like at ½d. each stamp—willingly sent on approval on request. Address:

S. F. BICKERS, 201, HILL LANE, SOUTHAMPTON.

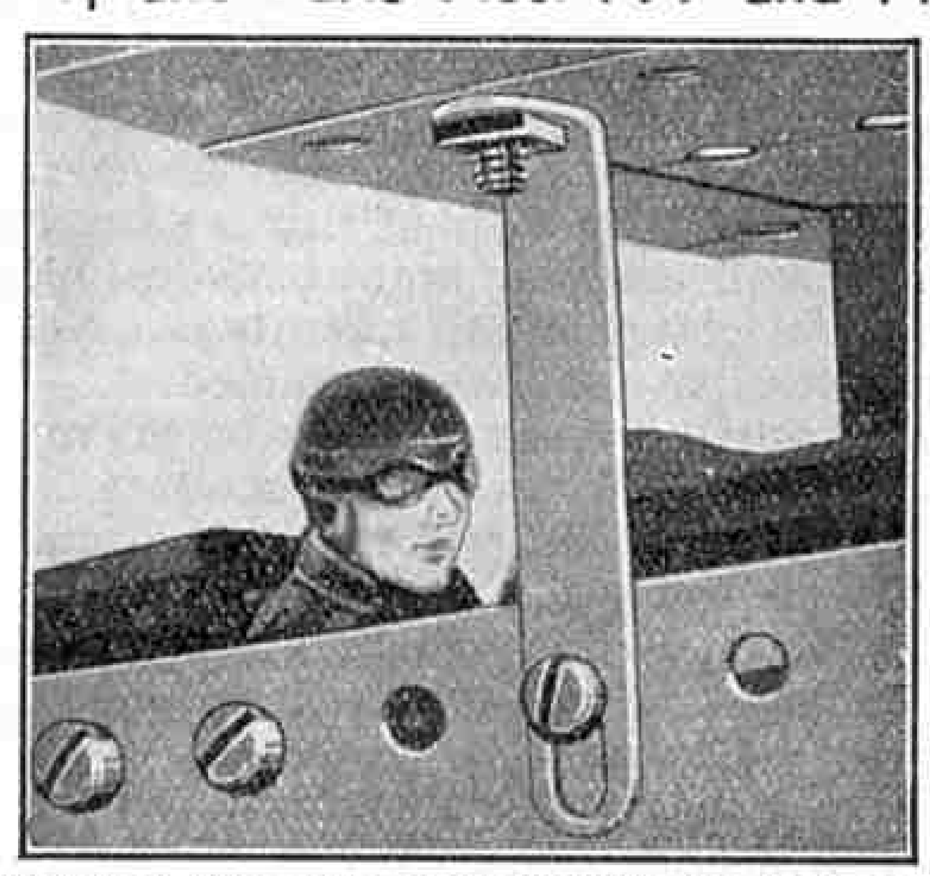
BARGAIN OFFERS

Jubilees.—15 Colonial, all different, Used ... 1/6
Used **Sets Complete. Canada** or **Hong Kong** 2/–
Mint Sets. Bechuanaland, Swaziland, each 2/6
The **'Different'** packet of **British Colonials** containing 60 different fine used **Jubilees, Commemoratives** and **Recent Pictorials** 3/3
100 Iran (Persia), 2/9; 50 for 1/6
100 French Colonials (all bright pictorials) 1/6
Cash with order. Postage extra.

T. R. HUGHES
'Ibis Cottage,' Long Park, Amersham

MINIATURE AEROPLANE PILOTS

Aeroplane Parts Nos. P99 and P100



Miniature Pilots are now available for fitting to all open cockpit machines built with the Nos. 00, 0, 1, 2, 1 Special and 2 Special Aeroplane Constructor Outfits. These attractive little figures, which add a wonderful touch of realism, are supplied with green coat and orange cap, blue coat and red cap, or red coat and green cap. Aero Part No. P99, which is suitable for fitting to the Nos. OO and O Outfit models, is fixed to a special bracket that takes the place of the Propeller Shaft Bracket in the Outfit. The special bracket is secured by passing bolts through the sides of the fuselage into the threaded holes in the bracket. The Propeller Shaft rests in the bearing socket formed in the Pilot's body.

Part No. P100 (illustrated above) is used in Nos. 1, 2, 1 Special and 2 Special Outfit models. The Pilot is fixed to a double angle bracket ready for bolting to the sides of the fuselage.

Prices:

P99 Aeroplane Pilot ... ... each 4d.
P100 „ „ ... ... „ 4d.

Meccano Ltd., Binns Road, Liverpool 13

Stamp Gossip

and Notes on New Issues

New French Issues

Among recent French issues are several of exceptional interest. Pride of place in British collectors' eyes must be taken by the 75c. and 1 fr. 50c. values commemorating the unveiling of the Canadian War Memorial at Vimy Ridge, but unfortunately at the time of going to press specimens were not available for illustration here. Both stamps bear the same design, a simple front view of the complete memorial. The framework of the stamp is rather heavy and has the effect of dwarfing the noble dimensions of the memorial, but our Canadian readers particularly will join with us in appreciation of this very graceful French tribute.

Next in interest come two stamps commemorating the centenary of the death of Claude Joseph Rouget de L'Isle, composer of the French national anthem *"La Marseillaise."* There are two values, 20c. and 40c.

The 20c., illustrated here, shows a portrait of de L'Isle, who was a Captain of Engineers stationed at Strasbourg when he wrote the song in 1792. In company with his brother officers, he dined one evening with the mayor of the city, who expressed regret that no special marching song had been composed for the Army of the Rhine. On his return to his quarters de L'Isle sat down at his desk and in a moment of inspiration composed his famous revolutionary song. The full beauty of the stirring words and music were revealed when the song was sung by a battalion of 600 men from Marseilles who marched to Paris, to strengthen the revolutionary cause, and the song has ever since been known as the *"Marseillaise."*

The 40c. value depicts Francois Rude's famous sculpture *"La Marseillaise,"* from the Arc de Triomphe.

A third new French issue a 75c. stamp, illustrated here, commemorates Jean Francois Pilatre de Rozier, one of the world's pioneer aeronauts. De Rozier's special claim to fame is that he achieved the first successful ascent in a balloon. This was in Paris in November, 1783, when he made an ascent in a hot air balloon along with the Marquis d'Arlandes, remaining in the air 20 to 25 minutes.

King Edward VIII Stamps

We understand that definite preparations are in hand in Australia for the production of the new King Edward VIII stamps, and it is probable that these will appear for the first time on the Coronation Day next year.

The design will show a head and neck profile of King Edward facing left, bordered by a wreath of intertwined oak and wattle with other symbolic emblems. The stamps will be produced by the line engraved process with the usual inscription "Australian Postage" at the top and the value tablets at the foot. The values will range from ½d. to £2.

Shortly the Commonwealth stamps will appear on a paper bearing a new watermark depicting the correct Imperial Crown. The present Australian watermark shows an incorrect type. New paper has already been ordered.

Colonial First Day Covers

So great has become the demand for lightly cancelled used colonial stamps that the work of the postmasters in many colonies has been in danger of becoming disorganised by requests from collectors and dealers in other countries to have letters stamped and returned through the post. As a result, the Colonial Secretary has issued an instruction that in future such requests shall not be complied with.

In the ordinary way this instruction would have had the effect of making used stamps from the colonies, particularly those used on the first day of issue, scarcer and dearer, and to overcome this difficulty our advertiser, Mr. A. F. McQuarrie, of Wallasey, has devised a scheme whereby First Day Covers of the new stamps of King Edward VIII will be available to collectors at cheaper rates than ever before.

This has been made possible by the taking of orders in advance on a large scale, and the collaboration of some of the largest business firms abroad who will post letters all over the Empire on the correct date. The network of the scheme provides for the despatch of letters from any part of the Empire to any other part, and already orders have been received for despatches from Newfoundland to Nauru, from Papua to Pimlico, and from Aden to the Virgin Islands, in addition to other exchanges.

Mr. McQuarrie will be glad to send full details of this scheme, and of similar arrangements for the despatch of air mail covers, to any *"M.M."* reader who is interested.

Dutch Triangulars

Holland has marked the tercentenary of Utrecht University by issuing two very striking triangular stamp designs, 6c. and 12½c. values.

As our illustration shows, the 6c. bears an effigy of Pallas Athene the Goddess of Wisdom. The 12½c. stamp bears a similar design, but in this case the portrait is of Gisbert Voetius, an eminent Dutch theologian who played a large part in the foundation of the University.

* * * *

On 22nd June last, in connection with the race for the "Brown Ribbon of Germany," the German Post Office issued a special Charity stamp for sale at the Munich-Riem race course and a number of specially selected Post Offices.

The design, as our illustration shows, depicts a horse race in progress. The nominal value of the stamp was 42 rpf. plus a charity premium of 42 rpf., but actually the stamp was sold at 1 rm. 50.

U.S. Centennials

The latest issue in the long series of U.S. stamps marking the centennials of the various States of the Union is the 3c. Arkansas commemorative, illustrated here. The central plaque shows the Old State House at Little Rock, the capital. On the left is seen a representation of the old Arkansas Post, the first white settlement in the State, while in the right-hand panel appears a view of the recently erected new State Capitol.

Air Mails Growth

The Post Office returns for the quarter ending 30th June show a great increase in the weight of air mail flown from Great Britain to the Continent. The weight of letters flown was nearly 99,000 lb., an increase of 170 per cent. on that for the corresponding quarter in 1935. The increase is due very largely to the fact that first class mail to Scandinavia can now be sent by air without surcharge.

* * * *

Australia is to celebrate the 150th anniversary of the founding of New South Wales by a special stamp issue in January.

We thank Stanley Gibbons Ltd. for their courtesy in loaning the stamps from which the illustrations on this page have been made.

SOMETHING TO THINK ABOUT

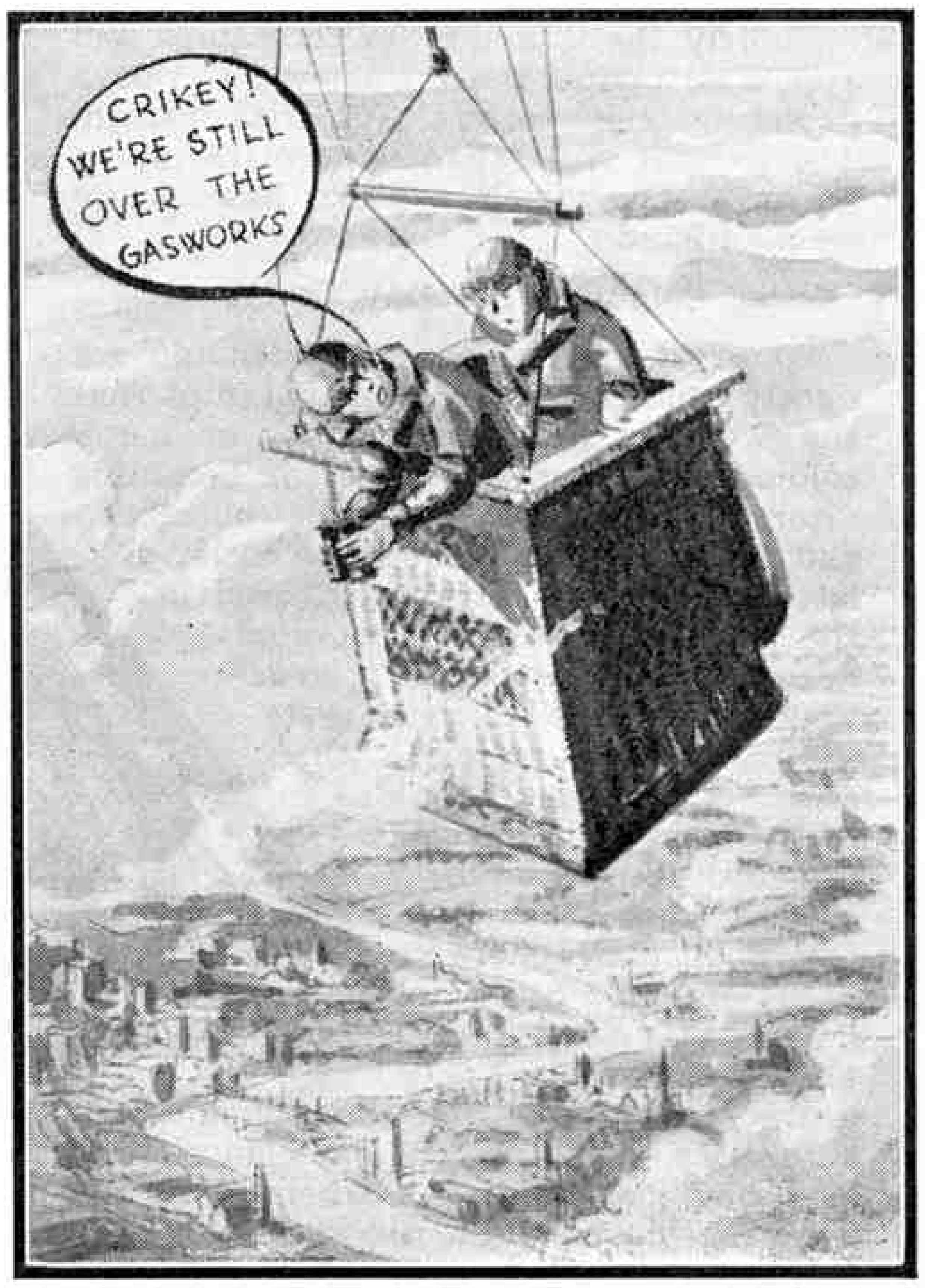
III. Is it possible to go up in a balloon on a perfectly still day, and to remain immovable for a time while the Earth beneath rolls round, descending when some desired spot comes directly below?

THERE is something attractive in the idea that a cheap and easy means of travelling would be simply to step off the Earth and wait until the destination in view comes directly underneath. Anyone wishing to reach New York, say from Lisbon, would not actually go there, but would simply wait until New York came to him.

Travel of this kind would be very speedy—if it were possible. Let us suppose for a moment that it is, and see what happens. The Earth turns round once in every 24 hours, and every place on the Equator therefore travels at the rate of about 1,050 m.p.h. Lisbon travels more slowly, for it is on a smaller circle of latitude than the Equator, but nevertheless its speed is the high one of a little more than 800 m.p.h. A balloon released above that city therefore would be over New York, which is practically due west of it, in four hours, although the distance between these two places is about 3,000 miles.

Balloon travel by waiting at a great height would have the drawback that it would only be possible to go due west. Our imaginary traveller need not worry about that, however, for he could easily return to Lisbon by ascending in New York and letting the rest of the Earth go by under him! Although in effect he would travel nearly round the Earth, this would only take the remaining part of a day, that is about 20 hours. The fastest ships take a much longer time to complete the journey, even when travelling by the direct route eastward across the Atlantic Ocean.

Another interesting point is that New York could not be reached from London in this manner, for the balloon traveller going directly westward from the latter city would soon find himself over Labrador. If he went farther he would reach the prairie region of Canada, and he would have to complete his journey by train, car or aeroplane. Balloon voyages also would be completely out of the question for travelling north or south, say from London to Aberdeen or to South Africa, but within limits they would be very valuable.



A terrible disappointment. After ascending to a great height in the hope of reaching Canada by letting the Earth turn round beneath them, the balloonists find that they have not moved from their starting point. The reason for this is explained in the accompanying article.

Unfortunately the prospect of crossing the Atlantic Ocean in a balloon high up above the Earth in a few hours is only a dream. If an enthusiastic reader decided to give the plan an experimental test, he would be doomed to suffer a disappointment similar to that of the balloonists shown in our illustration, who are astonished to see below them the familiar features of the place they thought they had left far behind them.

The truth is that it is impossible to step off the Earth by any simple means of this kind. Although we cannot see anything but clouds above the solid ground on which we live, the Earth really extends for many miles above its apparent surface; the invisible blanket of air that surrounds it is as much a part of it as the solid rock mass of Mount Everest, and rotates with it. Every particle is subject to the gravitational attraction of the Earth, and we could only escape by allowing ourselves to be shot off at a rate of no less than seven miles a second. Such a speed is unattainable, for space guns and rockets packed with the tremendous amount of energy required have not yet been invented. They are the dream of those who look forward to the time when we shall be able to travel to the Moon, or to other destinations in space, and are found only in sensational stories of the future.

The balloon itself also must be regarded as part of the Earth. When it is tethered to the ground, in readiness for its ascent, it is travelling with the Earth at the same speed as everything else in the neighbourhood. It is not left behind as soon as it is released, but continues to move eastward, just as every solid object in its neighbourhood does, and with undiminished speed.

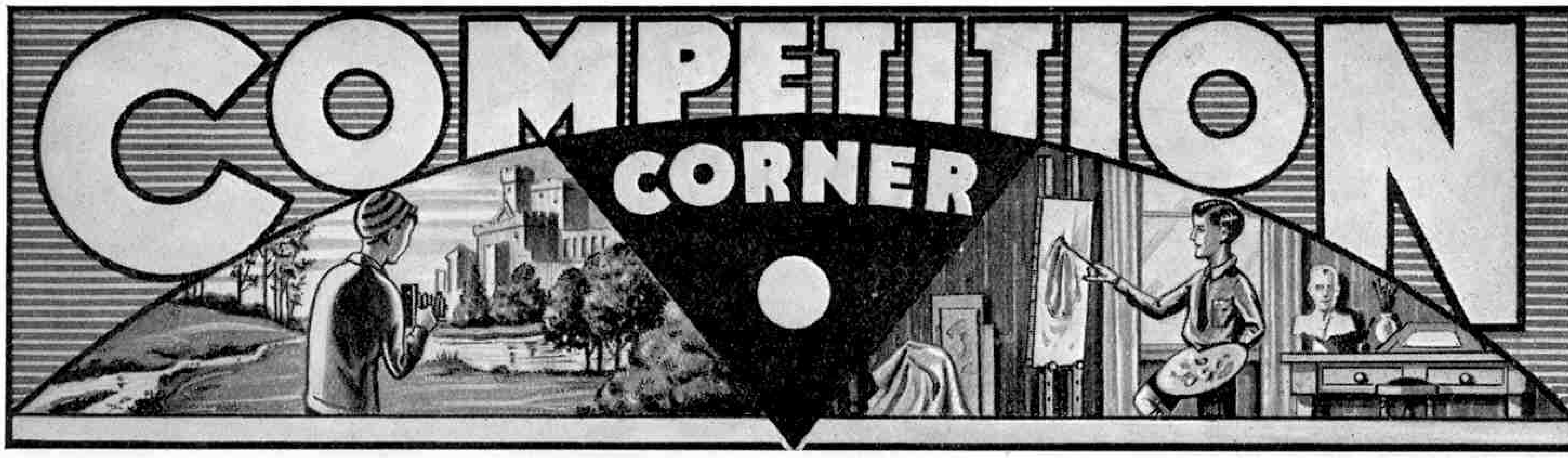
This may not be easy to realise, but here is an experiment that any reader can try for himself without expense or danger. Suppose a boy stands in front of a wall facing east, and leaps as high into the air as possible. If the time during which he loses actual contact with the Earth is only one tenth of a second, the wall will sweep on eastward to a distance of 88 ft. while he is in the air. If the jumper really were free of the Earth, in the manner suggested for a balloon, he would therefore be struck violently by the wall and his face would suffer severely! Nothing of the kind happens in reality, for the simple reason that the jumper continues to maintain his own eastward velocity while he is in the air.

Like the boy jumping into the air, a balloon when released is carried round in the air surrounding the Earth. Of this there is no doubt. Balloons that have been set free in Great Britain have stayed in the air for several hours, but have always descended in that country, or very near it. If they had not retained their Earth speed while in the air, they would have been swept away westward, or rather left behind, and would have come down in the Atlantic Ocean, if not in America.

The objection may be made that these balloons have not gone high enough. The answer to this is that no balloon, whatever its height, has ever shown the slightest trace of being left behind by the Earth. One indication of this would be a tremendous gale as the air rushed at high speed past the stationary balloon. Even at heights of 13 or 14 miles nothing but calm has been experienced, apart of course from normal winds of the kind familiar to everybody. These do not blow at 1,050 m.p.h., but they offer the only known means of causing balloons to move through the air, and only then in an aimless drift.

The only way in which one could remain still above the Earth would be by travelling at high speed. This sounds an absurdly contradictory statement, but it is worth considering. Suppose that an aeroplane ascends above some point on the Equator. The surface of the Earth then would whiz past the pilot of the machine at the rate of about 1,050 m.p.h. if he were really still, and as his machine would start with this eastward velocity, it would be necessary for him to fly westward at equal speed to neutralise the effect. The pilot then would be able to argue that he remained still, and that the Earth below him was travelling eastward at 1,050 m.p.h. On the other hand those on Earth watching him would think they were still, for its rotation gives no sense of movement, and that the airman was travelling round the Earth at a speed of about 1,050 m.p.h.

H. A. ROBINSON.



ANOTHER "POINT WORDS" CONTEST

Several readers have written to ask for another competition of the "Point Words" type that we introduced some three years ago. They found it more puzzling than the average word competition, and readers who have not yet tried their skill in a contest of this kind will find it a distinctly teasing novelty.

In this competition readers are required to take from this issue of the "*M.M.*" any phrase or sentence containing exactly 25 letters, and to rearrange the letters to form a square in which as many complete words as possible are formed in the vertical and horizontal lines. For each word of five letters in one line 10 points are awarded; for a word of four letters, five points; for a word of three letters, two points; and for a word of two letters, one point. A line containing two words of three and two letters respectively thus scores three points. The maximum possible score is 100, but a score of 60 points from an average phrase may be considered quite satisfactory.

	10	10	2	1	—
10	C	R	A	B	S
10	R	A	T	E	D
5	U	P	O	N	F
5	S	I	N	E	H
5	E	D	R	A	M

Total: 58

Letters may appear in the square only as many times as they occur in the original sentence, and short words forming part of a longer word in the same line do not count in reckoning up the score. Only genuine English words in current use may be used; proper nouns and coined or slang words are ineligible.

Competitors are at liberty to select any suitable sentence or phrase in this issue of the "*M.M.*," but in submitting their entries they must indicate the page and line from which the words are taken.

In order to make clear what competitors are asked to do, we have taken the phrase "in a car suspended from the bar," from the third line in the second column on page 498 of this issue, and in the centre of this page we have given a specimen "Point Words" working from this phrase. Our example is framed so that the full system of scoring is revealed. We have deliberately chosen this phrase to give what we consider to be an average result, and it will be seen that the total score is 58. The Magazine contains other phrases that will give much larger scores, and readers will find it useful to choose one with a fair sprinkling of letters such as T, R, S and E.

There are two Sections in this Contest, for Home and Overseas readers respectively, and in each cash prizes of 21/–, 15/–, 10/6 and 5/– will be awarded to the four best entries in order of merit. In the event of a tie, preference will be given to the entries displaying the neatest or most novel presentation.

Entries should be addressed to "Point Words, Meccano Magazine, Binns Road, Liverpool 13." Those from competitors at Home, that is in Great Britain, Northern Ireland, the Irish Free State and the Channel Islands, must be posted to reach this office not later than 30th September. Entries for the Overseas Section must arrive not later than 31st December. The awards in the Home Section will be announced in the November "*M.M.*"

September Photo Contest

This month's competition is the last of the 1936 series of Photo Contests, and we hope that all of our readers who have not yet submitted an entry will make a point of sending along one of their holiday snapshots this month.

The conditions of our photo contests are so very simple that every camera-owning reader should take part. Any subject is eligible, and any make of camera, plate, film or paper may be employed. The only restriction is that the exposure must have been made by the competitor himself. Developing and printing may have been done professionally, but readers who do this part of the work themselves should mark the back of the print "own work throughout." Any number of prints may be submitted but the competitor's name, age and address must appear on the back of each print. It is not sufficient to indicate the age group only. The actual age must be given.

The entries will be divided into two sections: A, for competitors aged 16 and over; and B, for those under 16. Cash prizes of 21/– and 10/6 respectively, will be awarded in each section.

Entries should be addressed "September Photo Contest, Meccano Magazine, Binns Road, Liverpool 13," and must be sent to reach this office not later than 30th September. A separate set of prizes will be reserved for competition among Overseas readers, whose entries must arrive not later than 31st December.

COMPETITION RESULTS

HOME

July Sketchogram Contest.—First Prizes: Section A, T. R. Hayes (Nottingham); Section B, C. Buttery (Grantham). Second Prizes: Section A, J. Browne (Luton); Section B, A. M. Adam (London, N.6).

July Photo Contest.—First Prizes: Section A, D. H. Warner (Richmond, Surrey); Section B, B. P. Furley (London, W.1). Second Prizes: Section A, R. P. Tonkin (London, E.18); Section B, G. Arnold (Burgess Hill). Consolation Prizes: E. C. Haywood (Carlton, Notts.); C. P. Silver (Exeter).

OVERSEAS

Vocation Voting Contest.—1. J. C. Oleaga (Buenos Aires). 2. W. A. Carpinter (Christchurch, N.Z.). 3. A. Rutherford (Christchurch, N.Z.). 4. W. L. Jarvis (Capetown). Consolation Prize: A. G. Fellows (Auckland, N.Z.).

April Photo Contest.—First Prizes: Section A, G. C. Taylor (Sydney); Section B, C. Galdes (Valletta, Malta). Second Prizes: Section A, A. Hagg (Falun, Switzerland); Section B, M. Nicholls (Natal, S.A.). Consolation Prizes: G. S. Davies (Dunedin, N.Z.); B. B. Silan (Ipoh, F.M.S.); M. Abdul Wahid (Mysore, S. India); L. B. de Lancastre (Lisbon, Portugal).

A SOFT SPOT

The farmer had given an old Irishman permission to sleep in his barn, and at night found him lying on a heap of straw with a drainpipe for a pillow.

"Don't you find that pipe hard?" asked the farmer.

"No, yer honor," said Pat. "I've filled it with straw."

* * * *

Schoolmaster (suspiciously): "Is this essay all your own work, Jones?"

Jones: "No, sir, Dad wrote it, and I corrected it."

* * * *

Waiter: "How do you like your coffee, sir?"

Guest: "Without cream."

Waiter: "Sorry, sir, we've no cream; would it do if I gave it you without milk?"

* * * *

Master: "Now, boys, this is a very difficult problem. Watch the blackboard carefully while I go through it."

* * * *

Judge: "It seems to me that I have seen you before."

Prisoner: "You have, your honour; I gave your daughter singing lessons."

Judge: "Thirty years."

* * * *

"Do you know where little boys go to who fish on Sundays?"

"Yus, but I ain't lettin' you in on a good thing. You'll 'ave to find out for yerself, same as I did."

* * * *

Mark Twain had the best recipe for insomnia. He said: "If you cannot sleep, try lying on the very edge of the bed; you might drop off."

* * * *

Applicant: "And if I take the job am I to get a rise in salary every year?"

Employer: "Yes. Provided of course that your work is satisfactory."

Applicant: "Ah, I thought there was a catch in it somewhere."

* * * *

There had been a car smash; one driver had been pitched on to the road, the other into the hedge.

Voice from hedge: "Roadhog!"

Voice from road: "Hedgehog!"

* * * *

Two doctors lived together, one a doctor of medicine, the other a doctor of divinity.

A caller from the village, asking the man-servant if he might speak to the doctor, was asked: "Do you mean the doctor who preaches or the doctor who practises?"

* * * *

Jimmy: "That problem you helped me with last night was all wrong, Dad."

Dad: "All wrong? Well, I'm sorry, son."

Jimmy: "You needn't exactly worry about it, because none of the other fathers got it right either."

* * * *

SOUNDLESS

Customer: "I've brought back this music stool you sold me."

Shopkeeper: "Why?"

Customer: "Well, I've twisted and turned it in all directions, but I can't get a single note out of it."

SOME SHOT

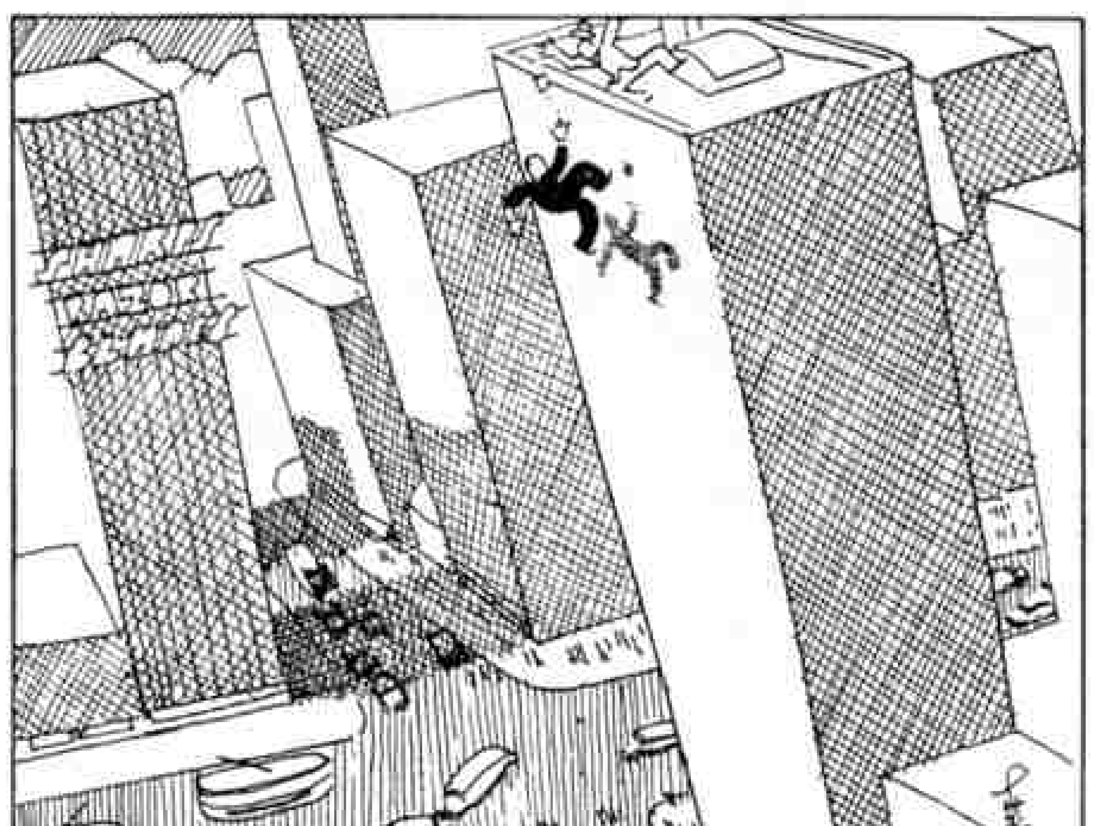
Mike was before the bench on a charge of poaching.

"Do you admit that you killed the bird?" asked the judge.

"Indade Oi don't, sor," said Mike. "The only bird I shot with me gun was a rabbit, and that Oi killed with me stick."

* * * *

AN AWFUL PROSPECT



Man falling from skyscraper: "Catch this mirror, Tom! If I break it I'll have seven years' bad luck."

* * * *

New Recruit (to chief gunner): "Tell me, sir, is it true that the harder you pull the trigger the farther the bullet travels?"

* * * *

Auntie: "Which one of you children ate those grapes I had in the cupboard? No use denying it, I saw the seeds and skins on the floor."

Willie: "It wasn't me, Auntie, 'cause I ate the seeds, skins and all."

* * * *

"A moth leads a curious life."

"How come?"

"He spends the summer in a fur coat and the winter in a bathing suit."

* * * *

"Jimmy, dear," whispered the burglar's bride, as he started on his evening's work, "try to be a little quieter when you come in to-night."

"Certainly," replied the husband. "Did I wake you up last night?"

"No, but you wakened Mother, and I don't want her running up to prison and complaining to father that I married an amateur."

* * * *

"I hear you have a garden; I suppose things are growing very rapidly."

"Yes, the neighbour's hens; every time they get into it they grow fatter."

* * * *

Teacher (trying to teach boy manners): "Where do you keep your hat, Willie?"

Willie: "On my head."

Teacher: "Where should it be?"

Willie: "On father's."

* * * *

A wireless expertlet from Bristol
In error once swallowed a crystal;
This caused oscillation,
So in desperation
He "earthed" himself, using a pistol.

* * * *

"I can tell the age of a chicken by the teeth."

"But they haven't any teeth."

"No, but I have."

* * * *

Talkative Lady: "A big man like you might be better occupied than in cruelly catching little fish."

Angler: "Perhaps you're right. But if this fish had kept its mouth shut it wouldn't be here now."

* * * *

"Now, Willie, give me that sweet you are eating."

"I c-can't, teacher. It belongs to Harry Williams!"

GONE

He had gone into the manager's office to inquire if he could have the Saturday morning off for the purpose of digging his garden.

"But my dear man," said the manager, "Smith told me only a day or two ago that you hadn't a garden."

"Well then," was the reply, "someone must have taken it off the window sill."

* * * *

Jim: "All the prizes at the swimming gala were carried off by one man."

Jack: "What did he get?"

Jim: "Six months."

* * * *

"My boots were guaranteed for four months," said Sandy to the boot-maker, "and they need easin'."

"But they seem to fit."

"Ay, they're fine on me, but tight for my brither on night shift."

* * * *

Employer: "What do you mean by telling me that you had seven years' experience at a bank when actually you have never had a job before?"

Applicant: "Well, sir, you advertised for a man with imagination."

* * * *

Voice on Telephone: "My son will be unable to attend school this morning; he is not well."

Master: "I'm sorry. Who's speaking?"

Voice: "My father, sir."

* * * *

Peter: "May I have twopence for a man who is crying out in the street?"

Mother: "Certainly, sonny. What is he crying about?"

Peter: "Cream ices, twopence each!"

* * * *

Uncle: "So you finished bottom of the class at spelling to-day?"

Nephew: "Yes, I put too many Z's in 'scissors'."

* * * *

Mother: "Aunt Mary wants to know if you will carry her train at her wedding."

Small Son: "I will if it's a Hornby!"

* * * *

Customer: "Waiter, it's almost half an hour since I ordered that turtle soup."

Waiter: "Sorry sir, but you know how slow turtles are."

* * * *

"I'm buying this fountain-pen for my wife," he explained.

"A surprise, eh?" beamed the shop assistant.

"Rather! She's expecting a new car."

* * * *

Constable (to speeding foreigner): "Ere, you mustn't go rushing abaht like that. What's yer name?"

Speeding Foreigner: "Je ne comprends pas."

Constable: "Ow d'yer spell it?"

* * * *

NOT LIKELY

Q.M.S.: "Where are you going?"

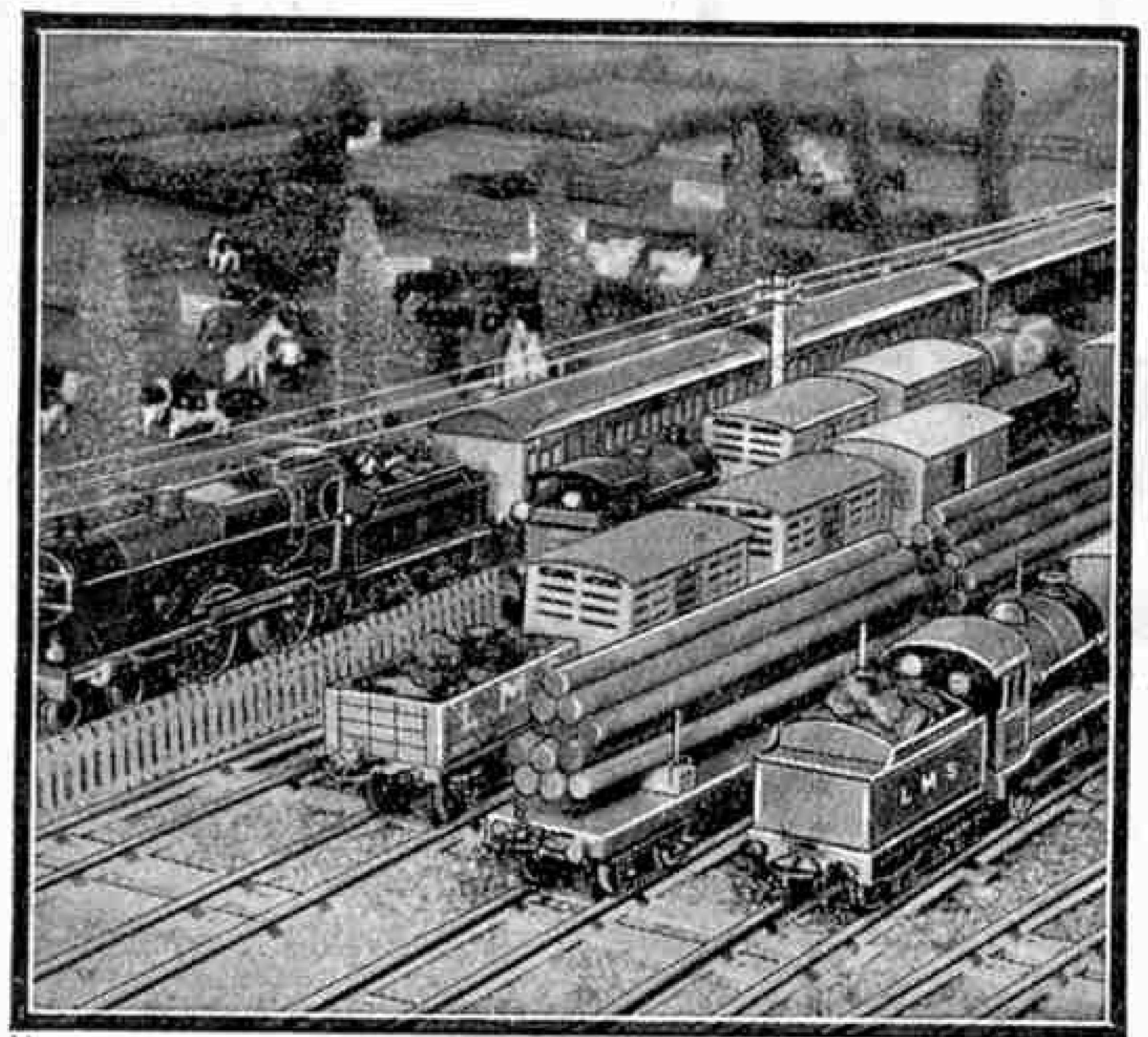
Private: "To fetch water."

Q.M.S.: "In those disreputable trousers?"

Private: "No fear, in this 'ere pail."

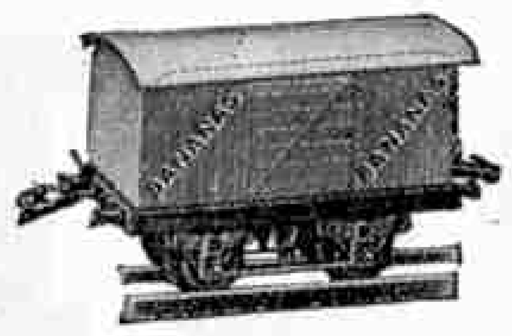
HORNBY ROLLING STOCK

GAUGE O

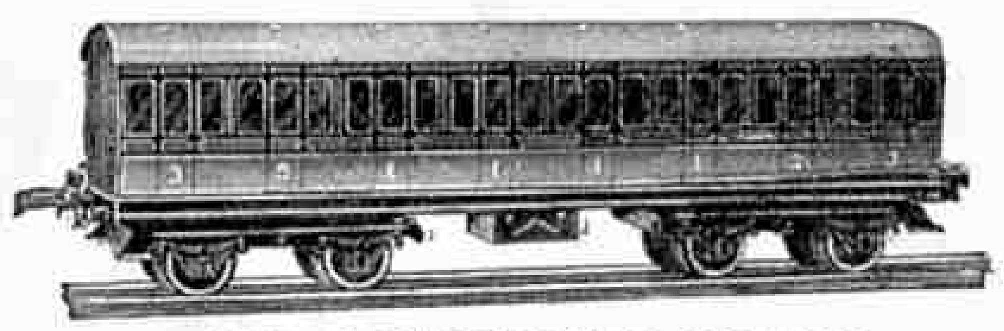


The Hornby Series includes a splendid range of realistic Rolling Stock. Each item is fitted with patented and exclusive automatic couplings, a special feature that places it in a class entirely of its own. There are Pullman Cars, Passenger Coaches, Guards' Vans, Tipping Wagons, Lumber Wagons, and many other types, all beautifully finished.

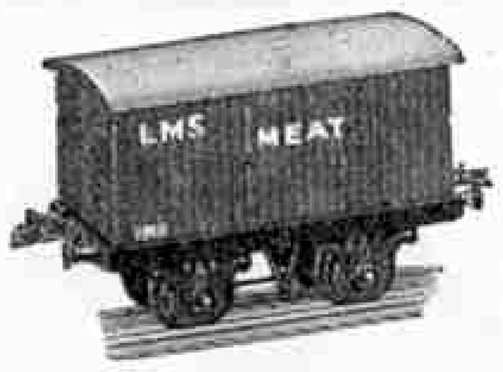
An attractive selection of Hornby Rolling Stock is illustrated and described on this page. Ask your dealer for a complete price list.



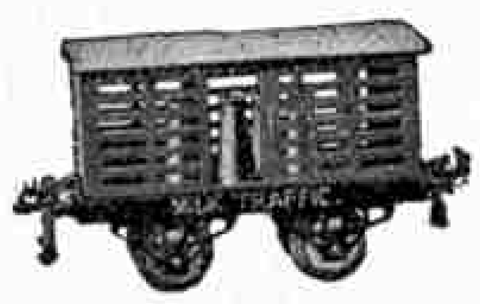
No. 1 BANANA VAN
An attractive model, finished in yellow and red. Price **2/9**



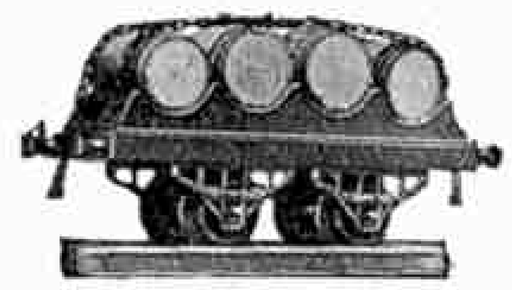
***No. 2 PASSENGER COACH**
Suitable for 2-ft. radius rails only. First-third or Brake-third. Price **7/6**



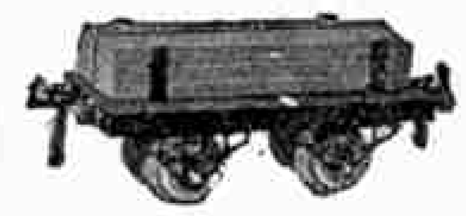
MEAT VAN
This is a very realistic model. Available lettered L.M.S. only. Price **1/9**



No. 1 MILK TRAFFIC VAN
Fitted with sliding doors. Complete with milk cans. Price **2/11**

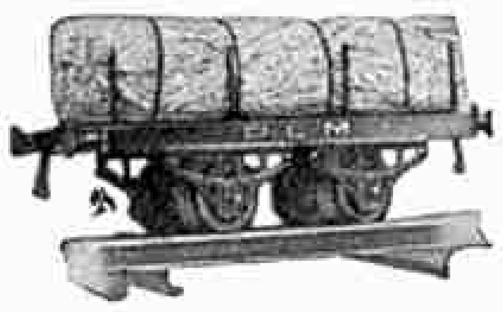


BARREL WAGON
This is another interesting model of a type of wagon used in France and other European countries. Price **2/6**

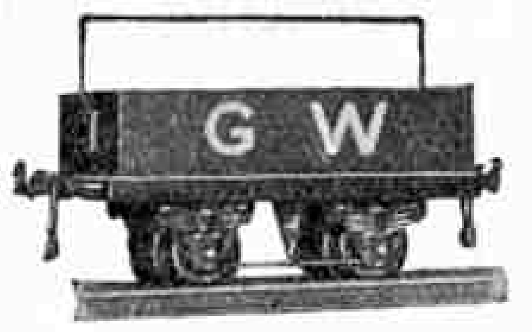


No. 1 TIMBER WAGON
Beautifully enamelled in yellow and red. Price **1/6**

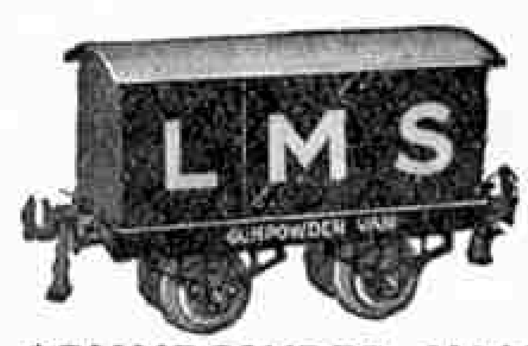
No. 1 SIDE TIPPING WAGON
Excellent design and finish. Lettered "Robert Hudson Ltd." Price **2/-**



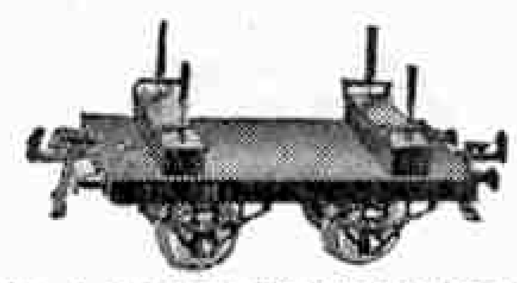
FIBRE WAGON
This is an interesting model of a type of wagon used in France and other European countries. Price **1/3**



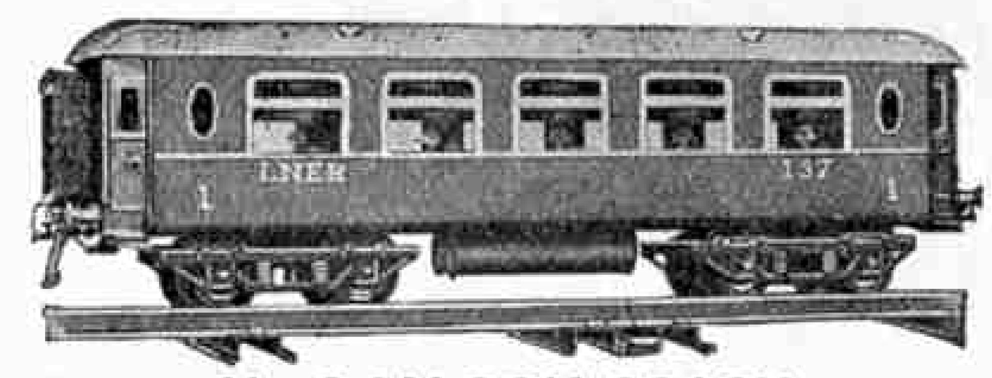
***OPEN WAGON "B"**
Similar to Hornby Wagon No. 1 but fitted with centre tarpaulin supporting rail. Price **2/-**



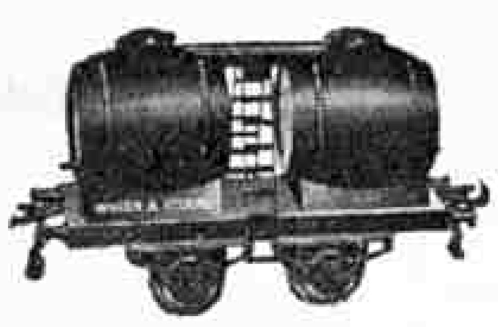
***GUNPOWDER VAN**
Finished in red. With opening doors. Price **2/9**



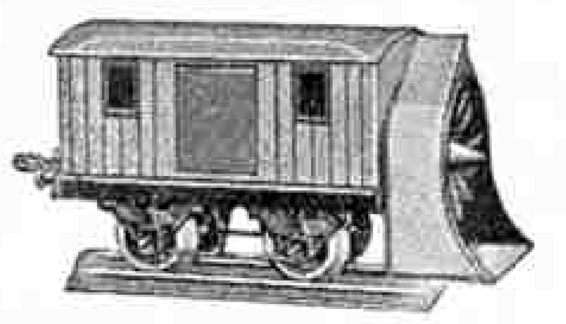
No. 1 LUMBER WAGON
Fitted with bolsters and stanchions for log transport. Price **1/6**



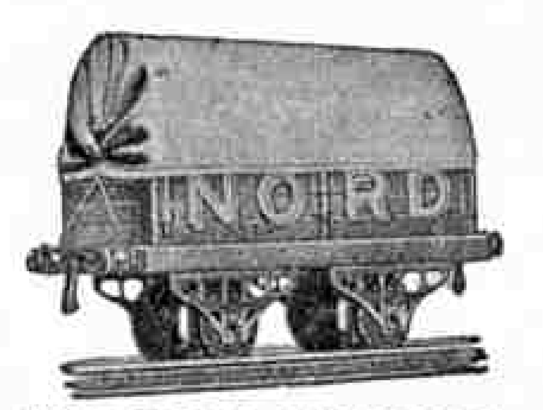
No. 2 SALOON COACH
Realistic in design and beautifully finished. Two types are available: L.N.E.R. (as illustrated) enamelled brown, and L.M.S. enamelled maroon. Suitable for 2-ft. radius rails only. Price **9/6**



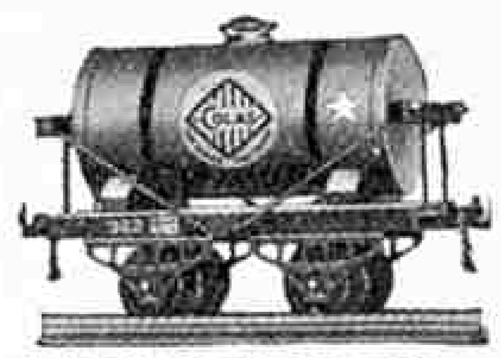
WINE WAGON DOUBLE BARREL
An attractive model artistically enamelled in red and green. Price **4/6**



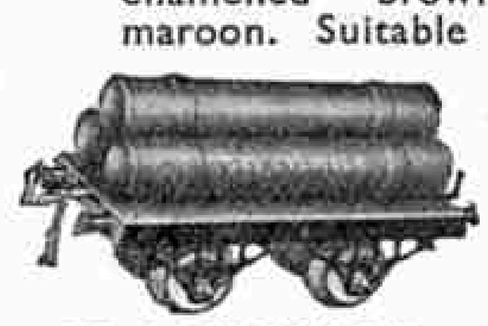
SNOW PLOUGH
With revolving plough. Price **3/9**



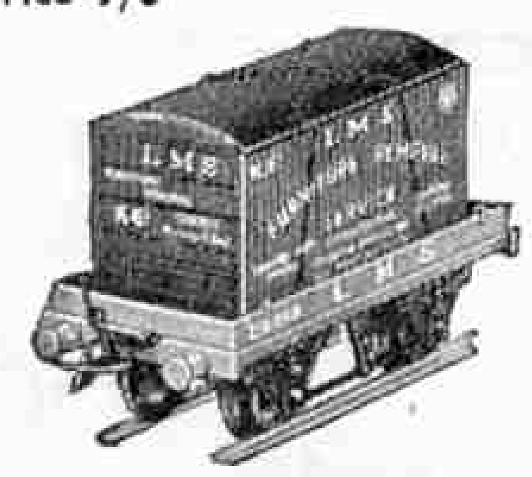
COVERED WAGON (French Type)
This wagon is fitted with frame and sheet. Lettered "Nord" Price **2/6**



BITUMEN TANK WAGON "COLAS"
Finished in blue. Price **3/6**



GAS CYLINDER WAGON Price **1/11**



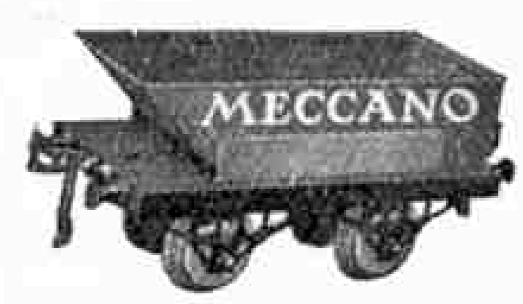
***FLAT TRUCK**
Complete with Container. Price **2/-**

CONTAINERS
L.M.S.R. (Furniture), L.N.E.R. (Goods), G.W.R. (Insulated), S.R. (Ventilated). Price **6d.** each

No. 1 PETROL TANK WAGON "B.P."
Finished in yellow. Price **2/-**

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

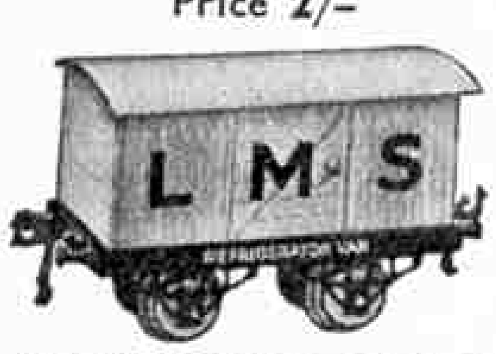
COAL WAGON
Similar to Hornby Wagon No. 1. Fitted with an embossed representation of coal. Price **2/3**



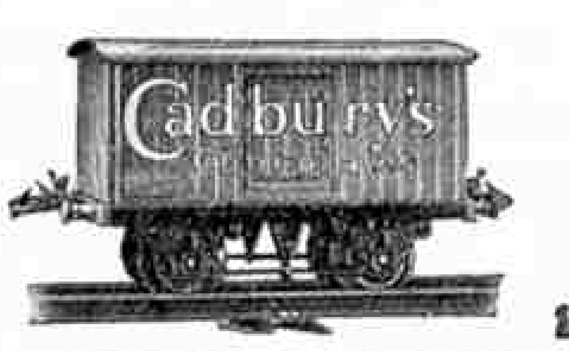
No. 1 ROTARY TIPPING WAGON
Finished in orange. Price **2/6**

***FLAT TRUCK**
Without Cable Drum. Price **1/6**
Complete with Cable Drum. Price **1/9**

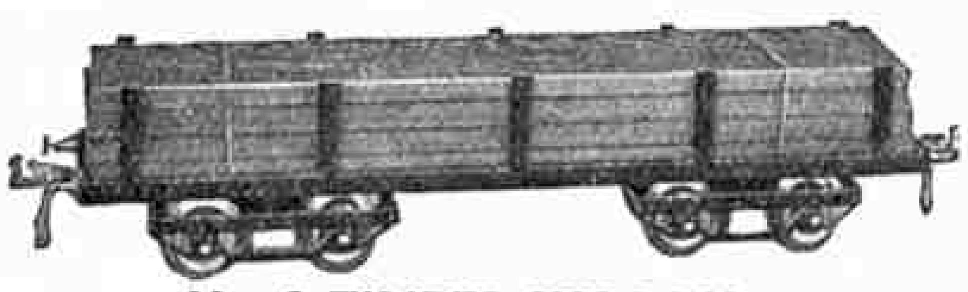
CABLE DRUM
(British Insulated Cables Ltd.). Price **3d.**



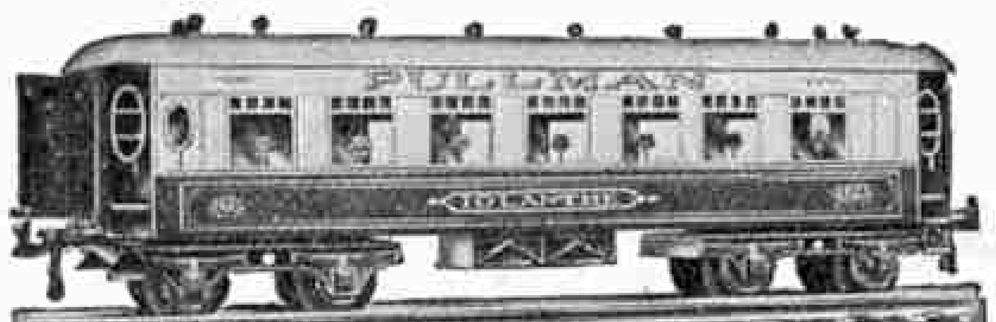
***REFRIGERATOR VAN**
Beautifully enamelled. Fitted with opening doors. Price **2/9**



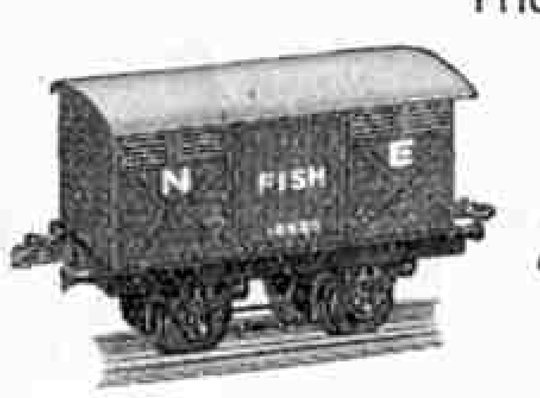
CHOCOLATE VAN "CADBURY'S"
This van is beautifully enamelled in blue with white roof. Price **2/9**



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



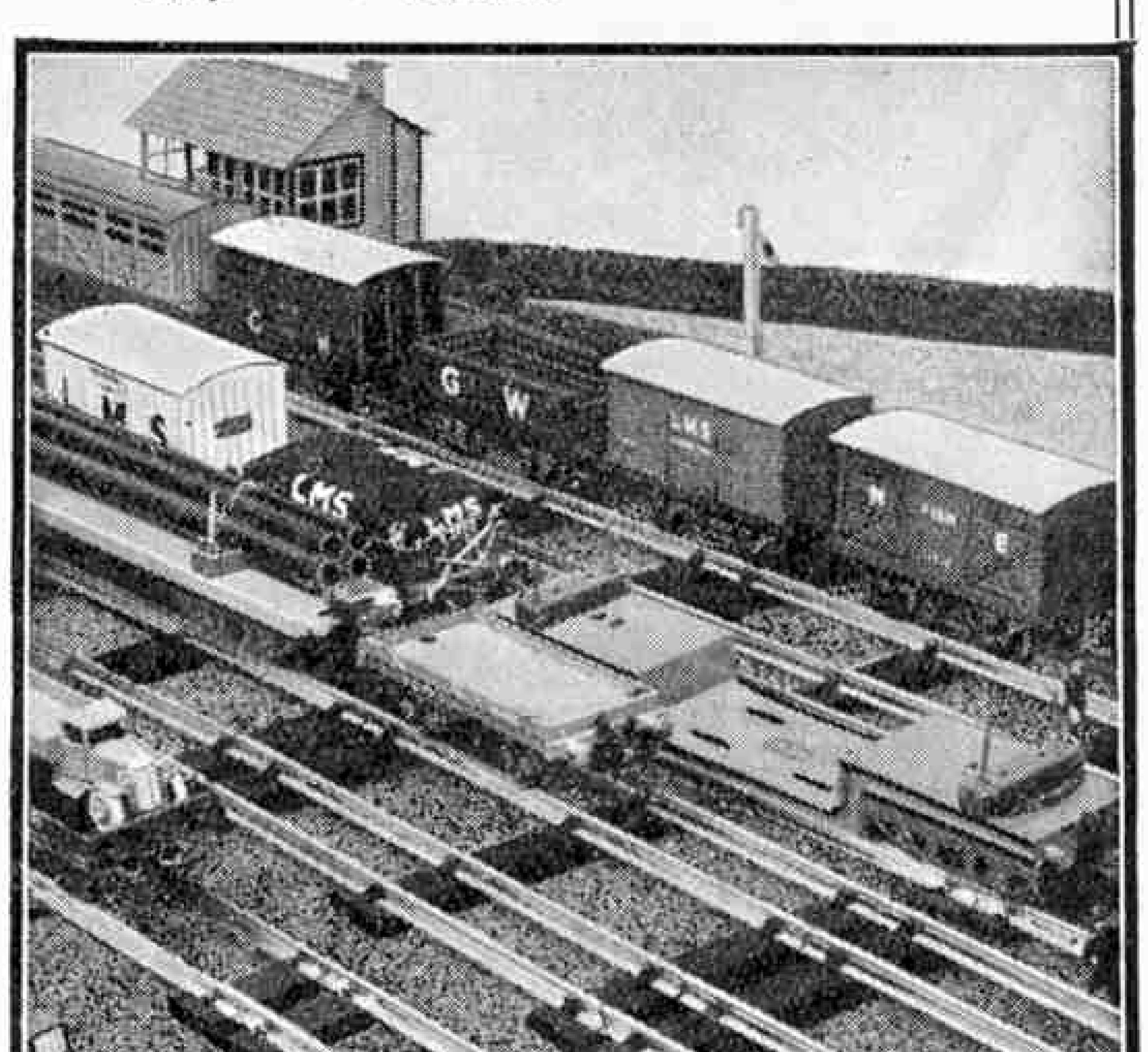
No. 2 SPECIAL PULLMAN COACH
As supplied with No. 2 Special and No. 3 Pullman Train Sets. This splendid coach is perfect in detail and finish. Suitable for 2-ft. radius rails only. Price **13/-**



FISH VAN
This is a distinctive model. Available lettered N.E. only. Price **1/9**

No. 0 MILK TRAFFIC VAN
An attractive model. Available lettered G.W. only. Price **1/9**

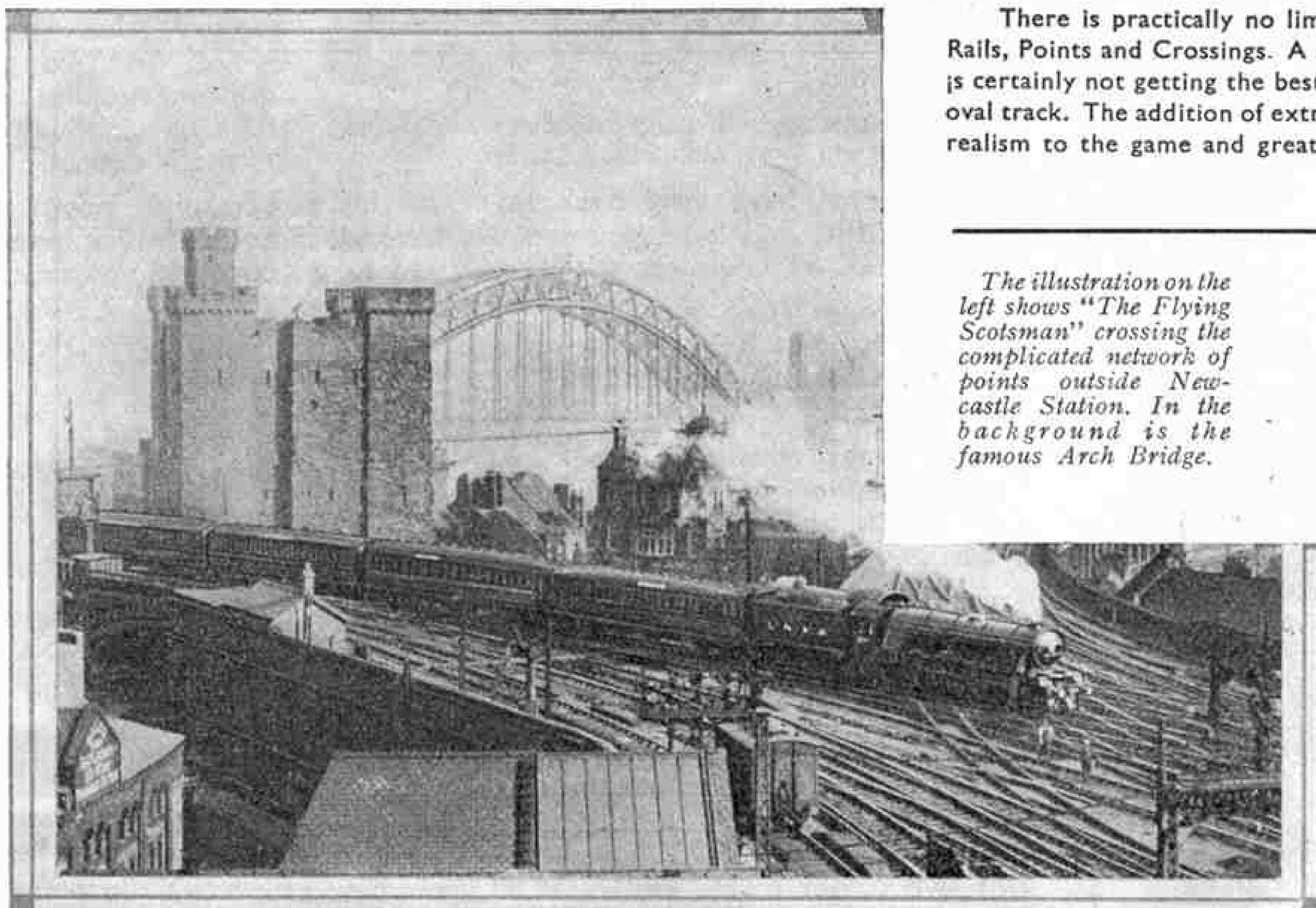
**In L.M.S., L.N.E.R., G.W. or S.R. lettering.*



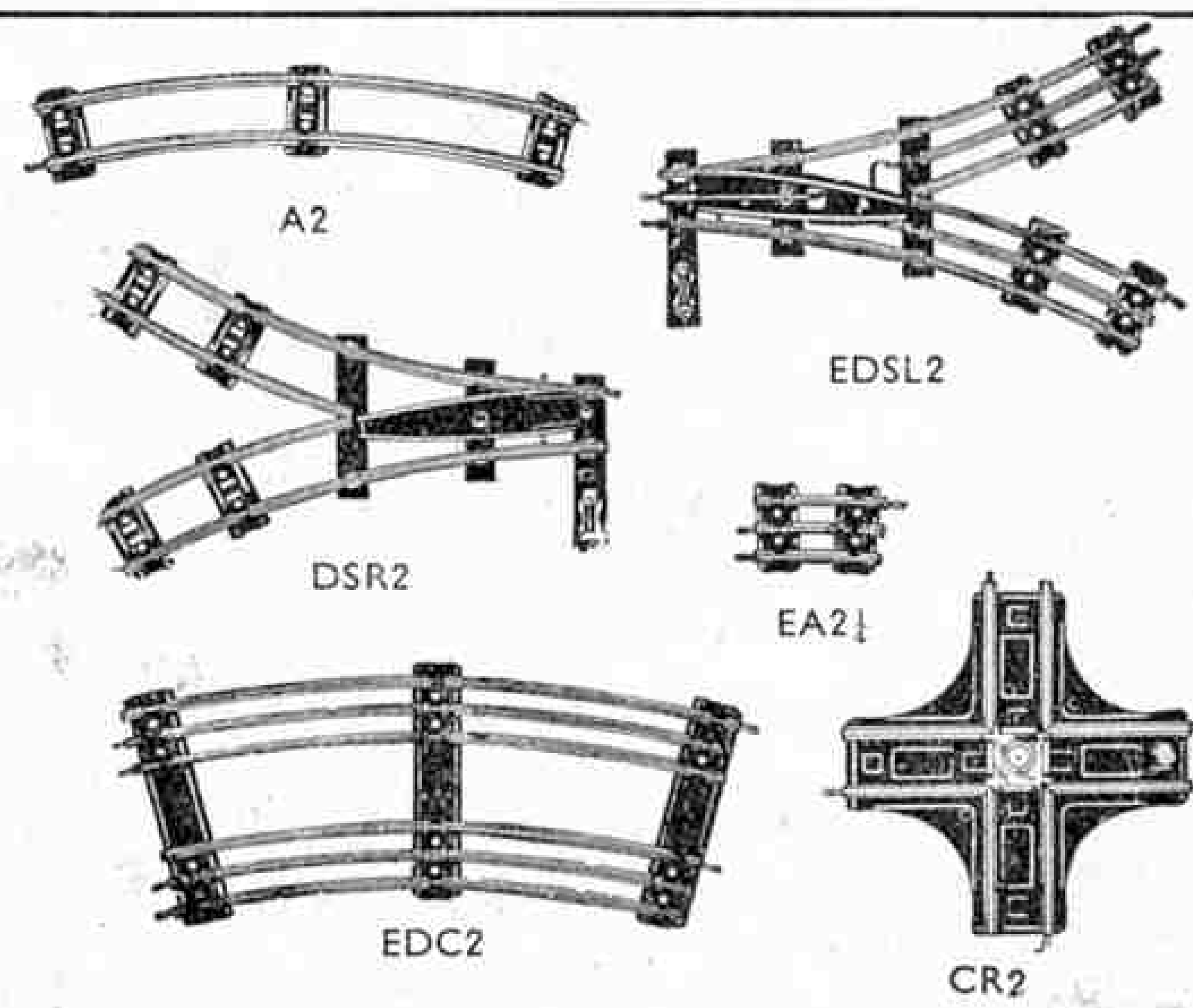
Manufactured by MECCANO LTD., BINNS ROAD, LIVERPOOL 13

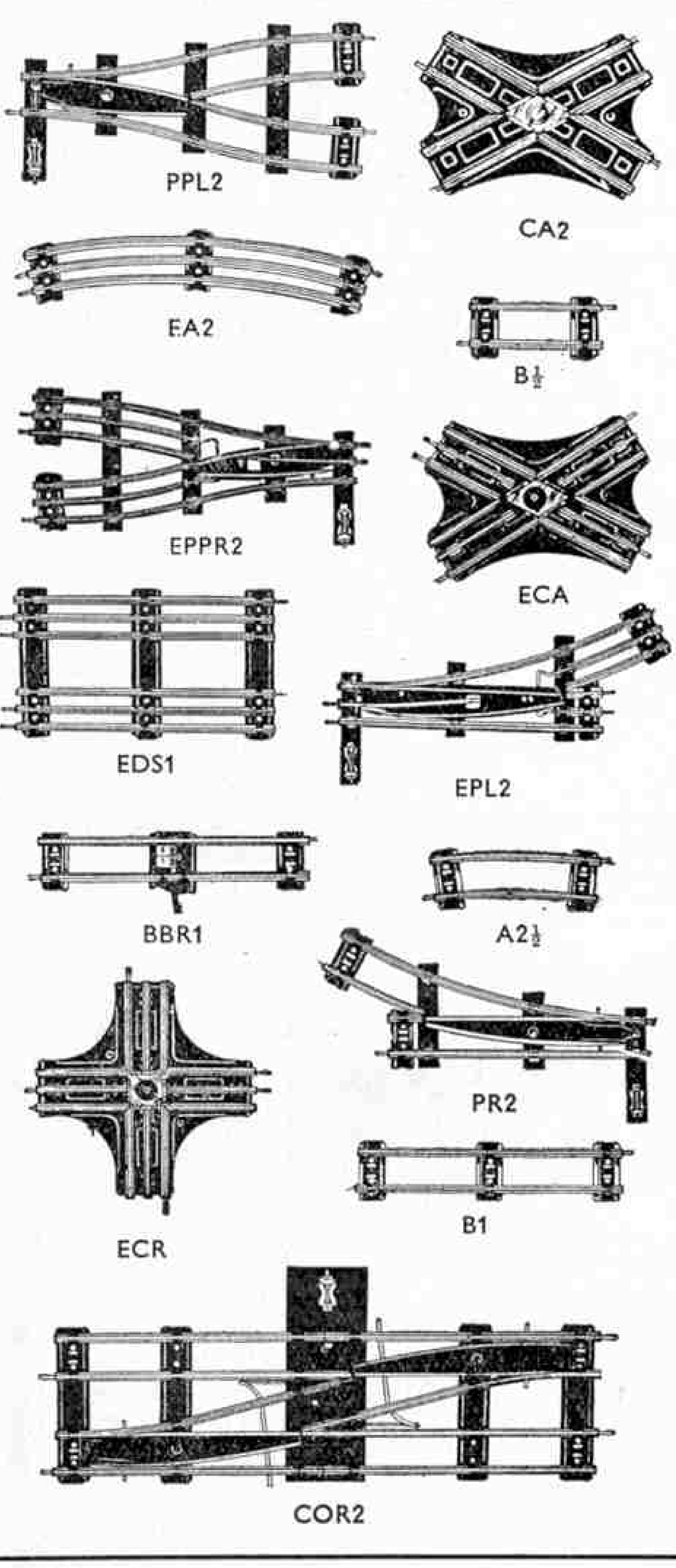
Hornby Rails, Points and Crossings

There is practically no limit to the number of rail formations that can be built with Hornby Rails, Points and Crossings. A supply of Rails is included in every Hornby Train Set, but the owner is certainly not getting the best out of his set if he is satisfied with merely running it round a simple oval track. The addition of extra Rails and of Points and Crossings to his equipment lends a delightful realism to the game and greatly enhances the fun.



The illustration on the left shows "The Flying Scotsman" crossing the complicated network of points outside Newcastle Station. In the background is the famous Arch Bridge.





Rails for Electric Trains, Gauge O, 1¼"

CURVED RAILS

1-ft. Radius

EA1	Curved rails ... ... per doz.	5/–
EA1½	Curved half rails ... ... „	4/6
EA1¼	Curved quarter rails ... ... „	4/–

2-ft. Radius

EA2	Curved rails ... ... per doz.	5/–
EA2½	Curved half rails ... ... „	4/6
EA2¼	Curved quarter rails ... ... „	4/–
EDC2	Curved rails, double track ... ½ doz.	9/–

STRAIGHT RAILS

EB1	Straight rails ... ... per doz.	5/–
EB½	Straight half rails ... ... „	4/6
EB¼	Straight quarter rails ... ... „	4/–
EDS1	Straight rails, double track ... ½ doz.	8/6

POINTS

For 1-ft. Radius Curves

EPR1	Right-hand points	per pair 5/9
EPL1	Left-hand points	

For 2-ft. Radius Curves

ESPSR2	Right-hand points	per pair 7/6
ESPSL2	Left-hand points	

CROSSINGS

ECA	Acute-angle crossings ... ... each	2/9
ECR	Right-angle crossings ... ... „	2/9

DOUBLE SYMMETRICAL POINTS

For 1-ft. Radius Curves

EDSR1	Double symmetrical points, right-hand,	
EDSL1	Double symmetrical points, left-hand,	per pair 6/–

For 2-ft. Radius Curves

EDSR2	Double symmetrical points, right-hand,	
EDSL2	Double symmetrical points, left-hand,	per pair 7/–

PARALLEL POINTS

EPPR2	Parallel points, right-hand	per pair 7/–
EPPL2	Parallel points, left-hand	

CROSSOVER POINTS

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

EMC20	Switch rail (20-volt) ... ... each	1/3
EMC6	Switch rail (6-volt) ... ... „	1/3
TCP20	Terminal connecting plates (20-volt) „	1/3
TCP6	Terminal connecting plates (6-volt) „	1/3

Rails for Clockwork and Steam Trains, Gauge O, 1¼"

CURVED RAILS

M9	Curved rails (9-in. Radius)... per doz.	2/6
MB9	Curved brake rails ... ... each	3d.
A1	Curved rails (1-ft. Radius)... per doz.	3/6
A1½	Curved half rails „ ... „	3/–
A1¼	Curved quarter rails „ ... „	2/6
AB1	Curved brake rails „ ... each	4d.
A2	Curved rails (2-ft. Radius)... per doz.	3/6
A2½	Curved half rails ... „ ... „	3/–
A2¼	Curved quarter rails „ ... „	2/6
AB2	Curved brake rails „ ... each	5d.
DC2	Curved rails, double track „ ... ½ doz.	6/–

STRAIGHT RAILS

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

CROSSINGS

CA1	Acute-angle crossings (for 1-ft. radius track) ... ... each	1/9
CA2	Acute-angle crossings (for 2-ft. radius track) ... ... „	1/6
CR1	Right-angle crossings (for 1-ft. radius track) ... ... „	1/9
CR2	Right-angle crossings (for 2-ft. radius track) ... ... „	1/6

POINTS 9-in. Radius (for MO Trains)

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

For 1-ft. Radius Curves

PR1	Right-hand points... ...	per pair 3/–
PL1	Left-hand points	

For 2-ft. Radius Curves

PR2	Right-hand points... ...	per pair 3/–
PL2	Left-hand points	
PSR2	Points on solid base, right-hand	per pair 8/6
PSL2	Points on solid base, left-hand	
SPSR2	Points on solid base, right-hand	per pair 5/–
SPSL2	Points on solid base, left-hand	

These points are similar to Points PSR2 and PSL2 but they are not fitted with ground disc or for Hornby Control.

PARALLEL POINTS

PPR2	Parallel points, right-hand	per pair 3/6
PPL2	Parallel points, left-hand ...	

DOUBLE SYMMETRICAL POINTS

For 1-ft. Radius Curves

DSR1	Double sym. points, right-hand	per pair 3/6
DSL1	Double sym. points, left-hand	

For 2-ft. Radius Curves

DSR2	Double sym. points, right-hand	per pair 3/6
DSL2	Double sym. points, left-hand	

CROSSOVER POINTS

COR2	Crossover points, right-hand	per pair 12/–
COL2	Crossover points, left-hand	
RCP	Rail connecting plates	½ doz. 2d.

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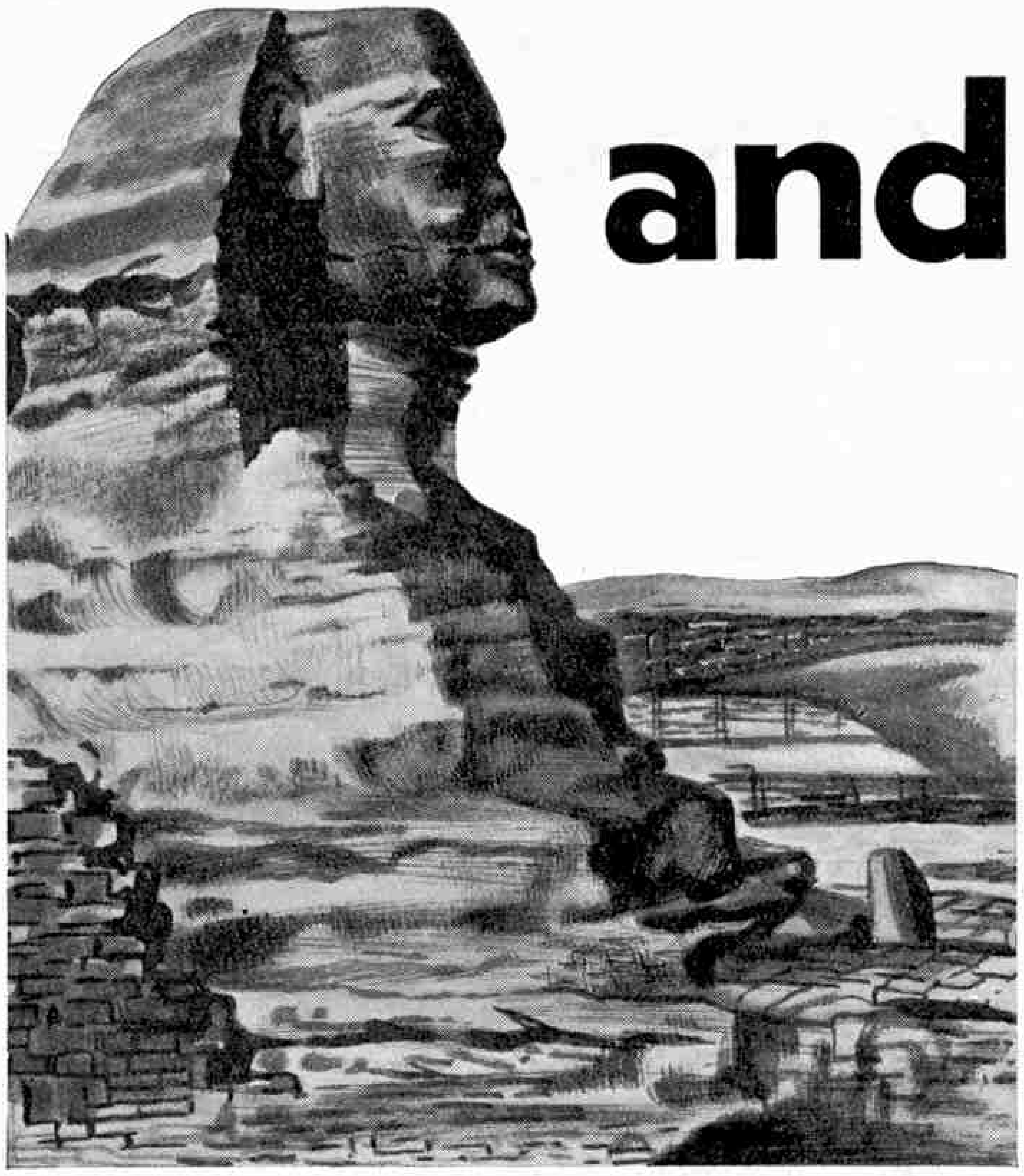

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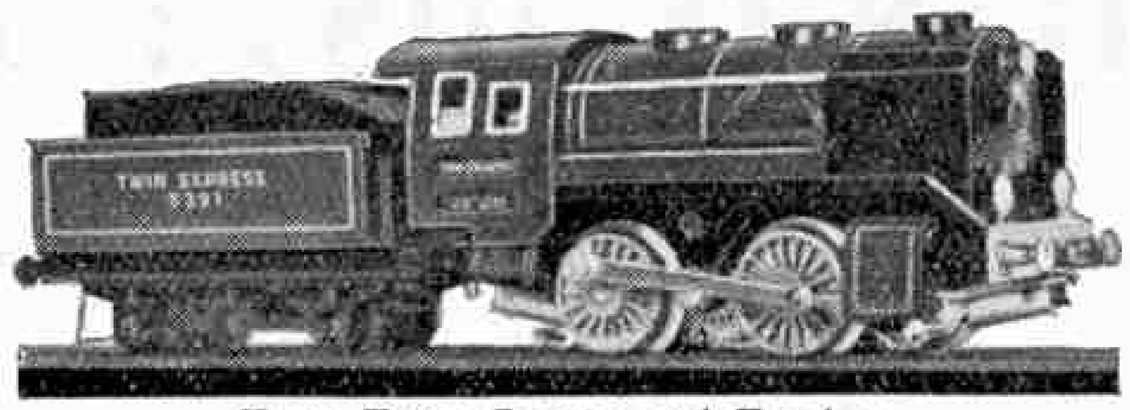

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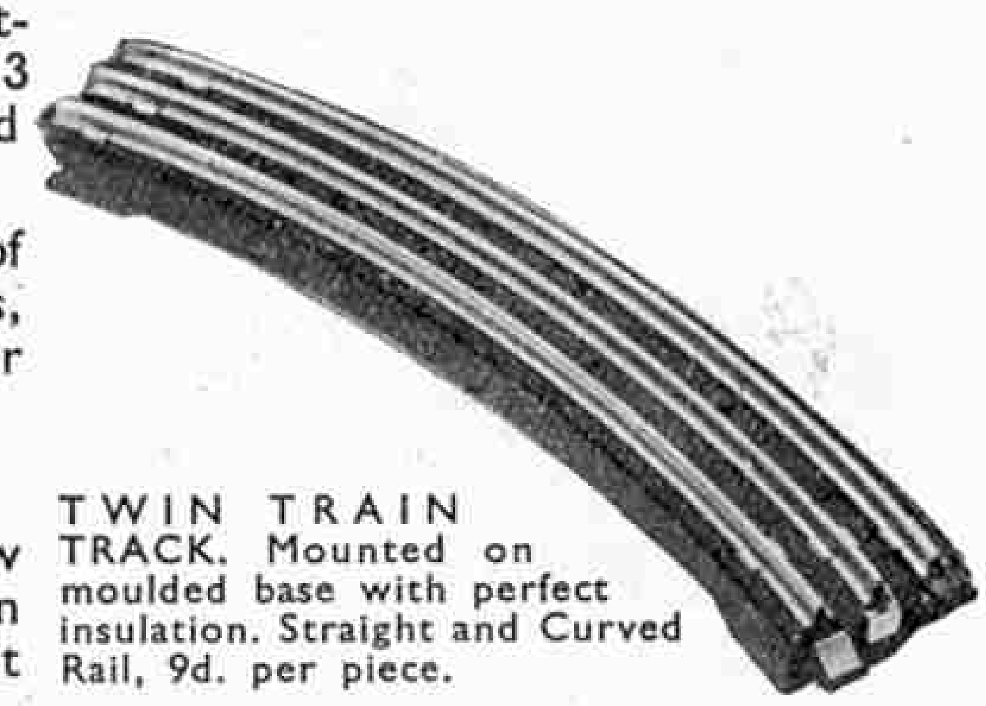

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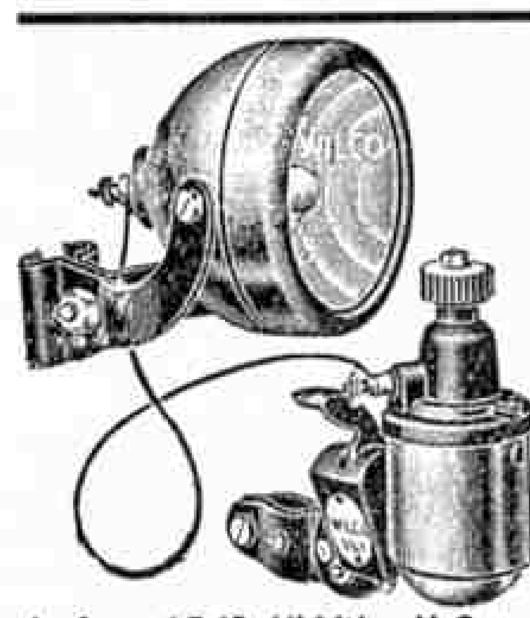

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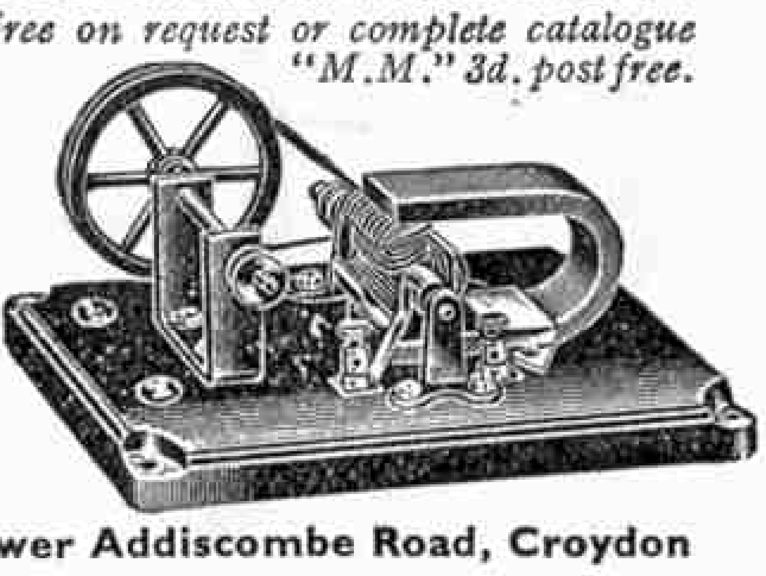

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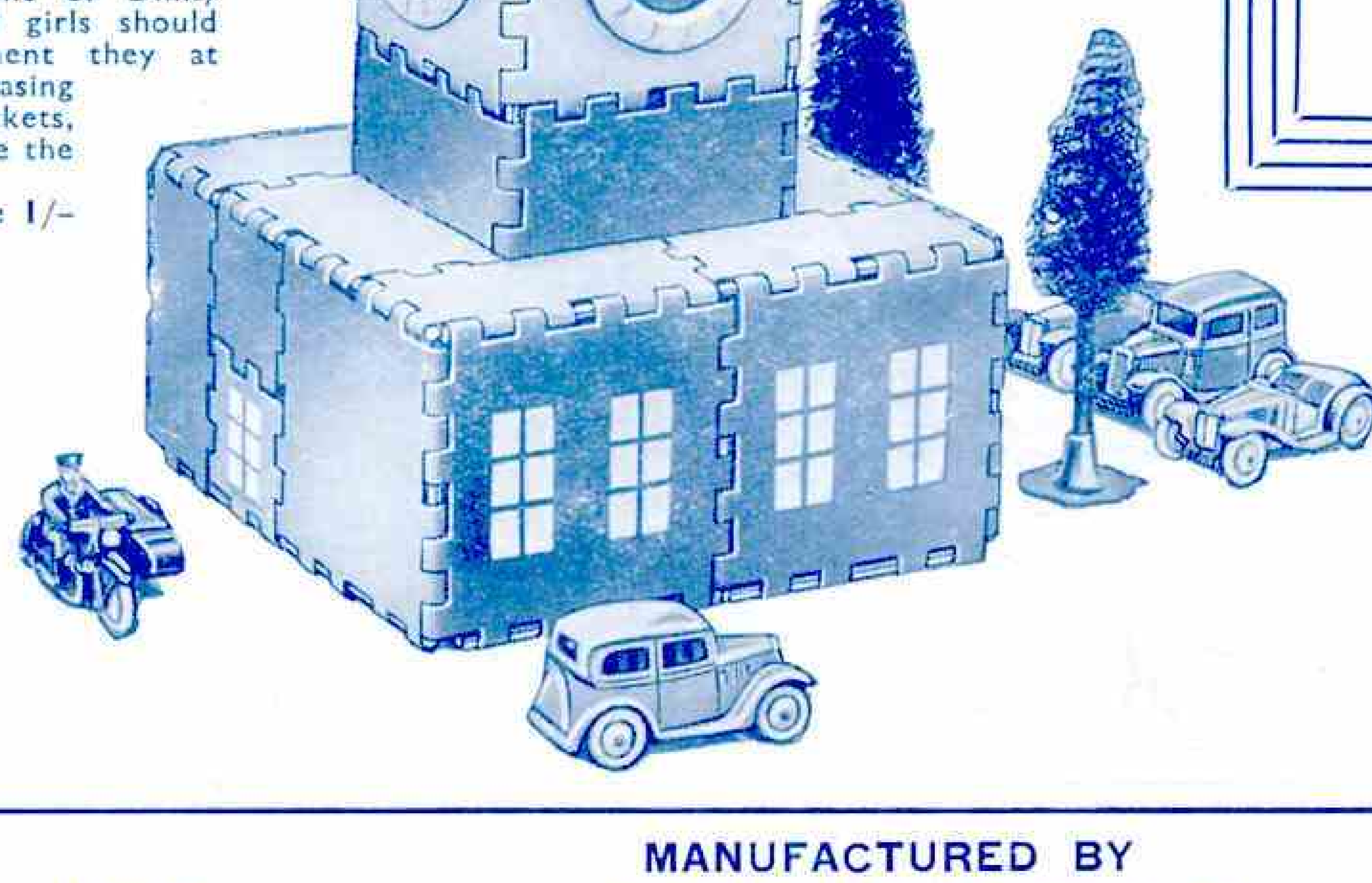

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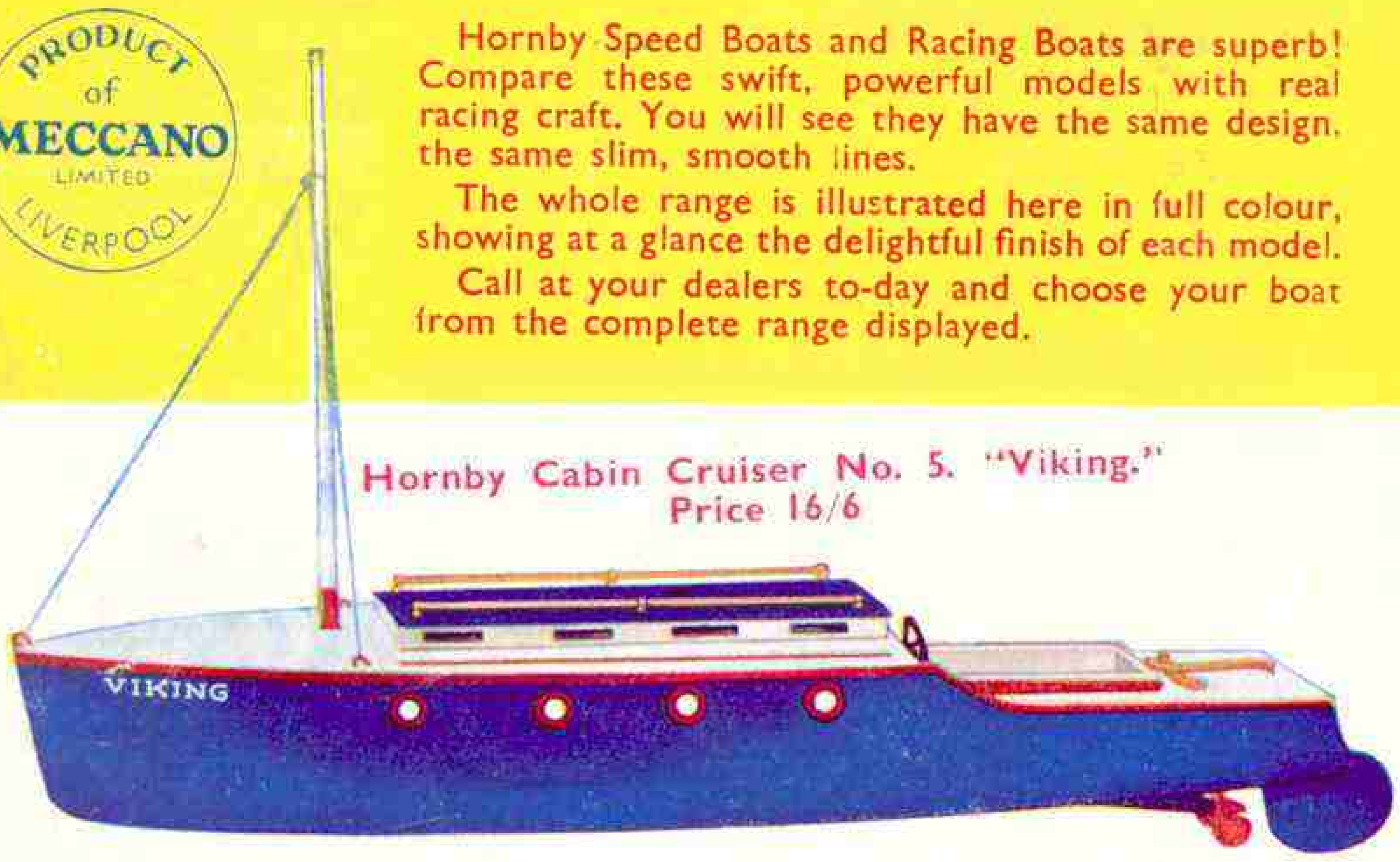

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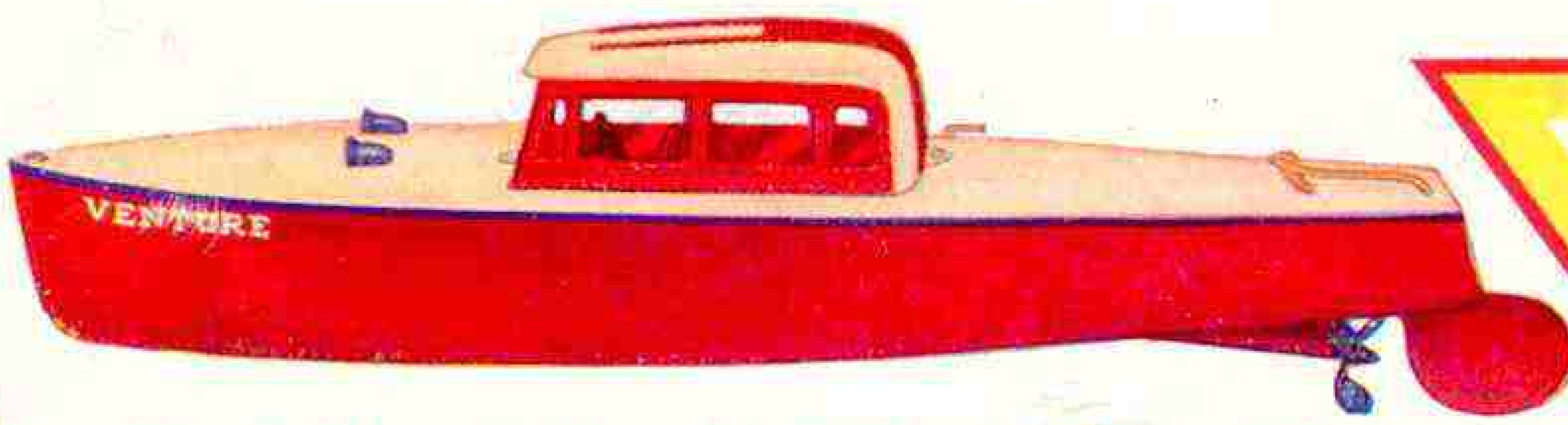

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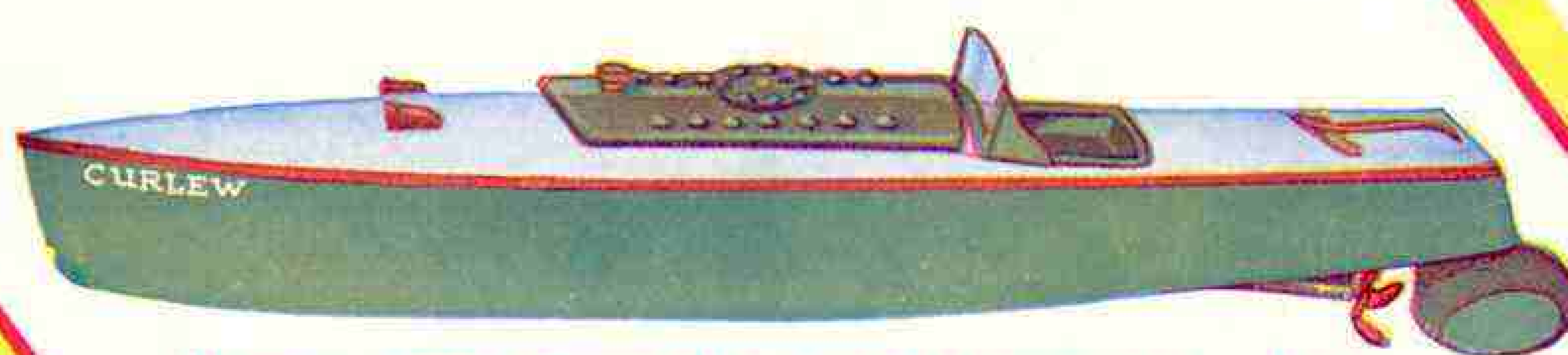

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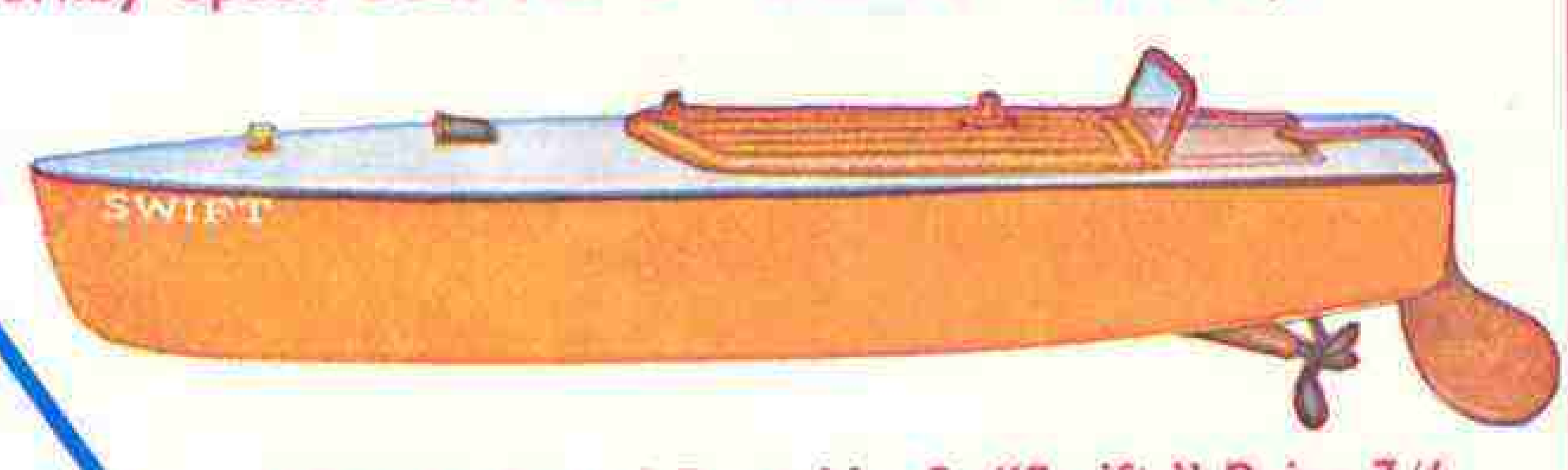

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