VOL. XXII. Nº 6. JUNE 1937

MECCANO MAGAZINE

THROUGH THE HEART OF THE CASCADE MOUNTAINS

6D.

★ IMPORTANT TO ALL READERS

"Princess Elizabeth"

A MAGNIFICENT HORNBY SCALE MODEL OF THIS WORLD RECORD-BREAKING LOCOMOTIVE

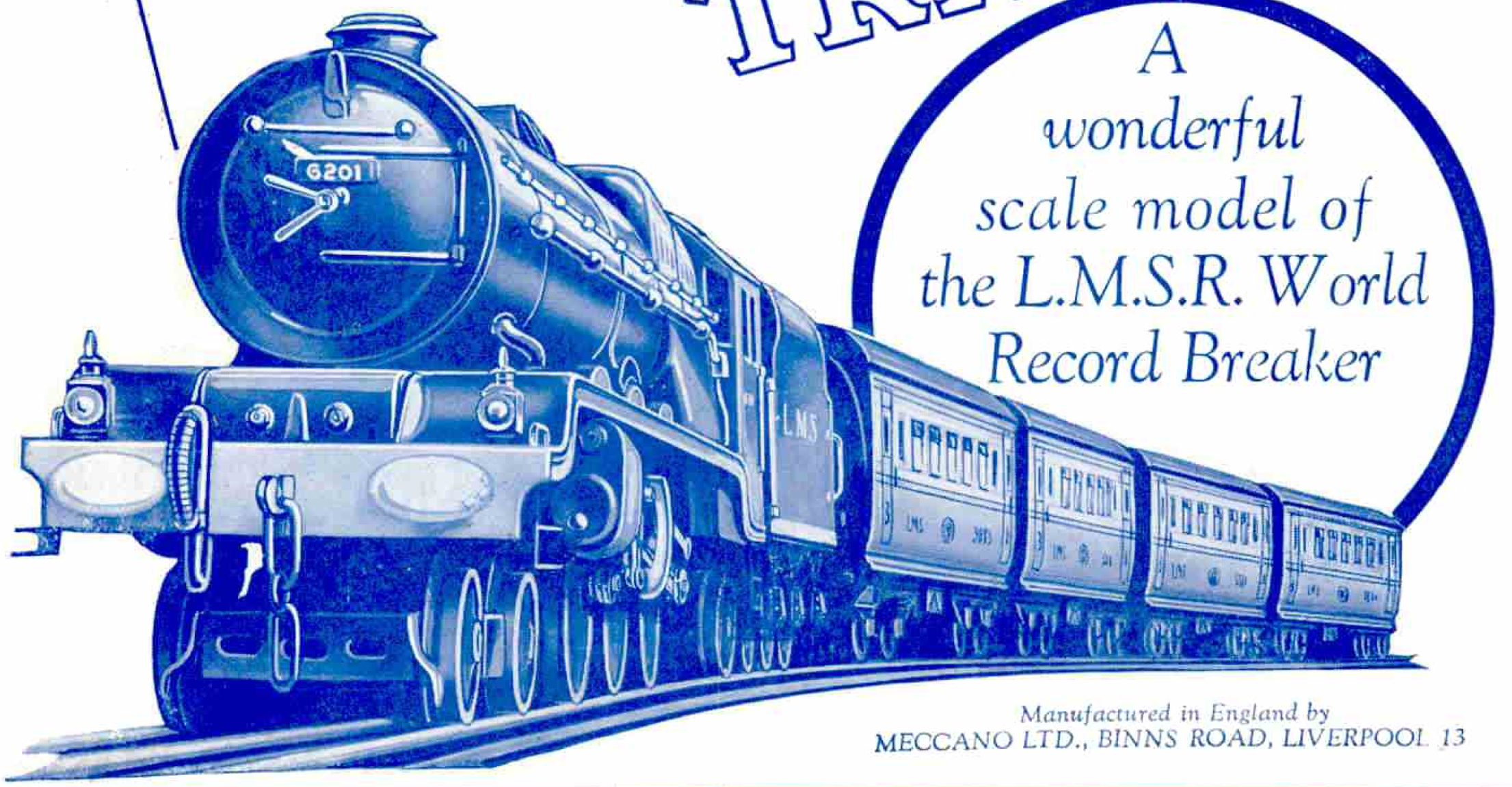
Four hundred miles non-stop at an average of 70 m.p.h.; maximum speeds of 95 m.p.h.; Beattock bank and Shap incline surmounted at 66 m.p.h. with a 260-ton load! These remarkable feats were performed by L.M.S.R. 4-6-2 "*Princess Elizabeth*" in November 1936.

Think of the thrill of owning a model of such an engine; not merely a perfect reproduction, but one having the same qualities of power, speed and efficiency! This is now made possible by the latest product of Meccano Ltd.—the magnificent Hornby scale model locomotive "*Princess Elizabeth*"—20-volt automatic reversing.

Price, complete with tender, in special presentation box, £5 5s. 0d.

The model may be purchased also through the new Hornby Deferred Payments Scheme. Ask your dealer for details. (Not applicable to the Irish Free State.)

HORNBY TRAINS



A *wonderful scale model of the L.M.S.R. World Record Breaker*

Manufactured in England by
MECCANO LTD., BINNS ROAD, LIVERPOOL 13

MERCEDES WITH AN ENGINE THAT DRONES

Hamley's News

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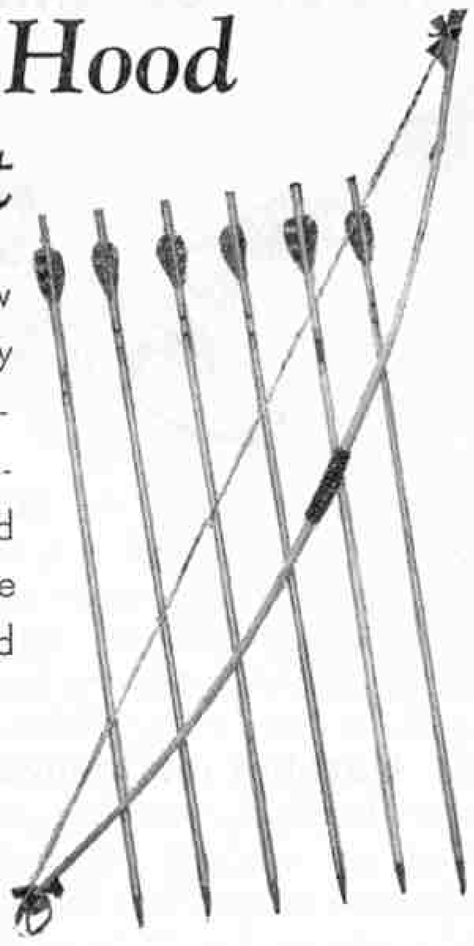
No. 21 June, 1937

BEACH BALLS FOR THE SUMMER

WONDERFUL OUTFIT FOR THE COMPLETE YOUNG ARCHER

The Robin Hood Archery Set

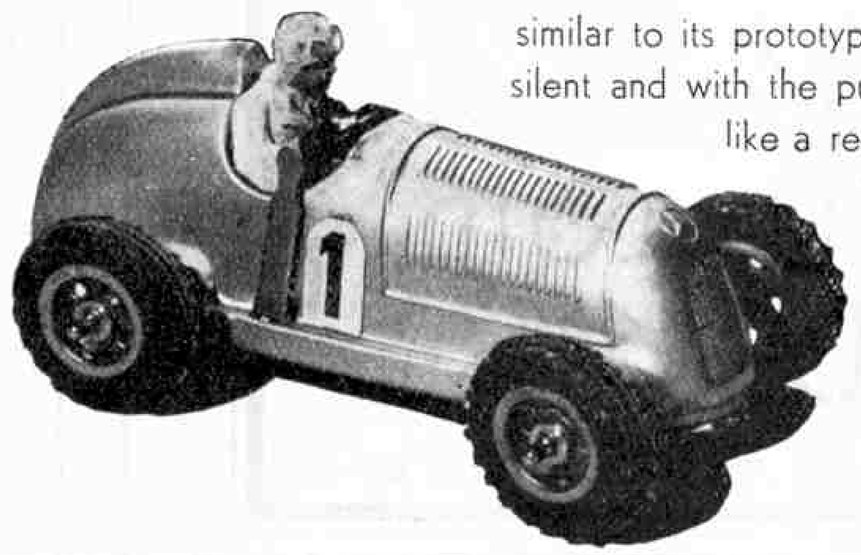
is more than a toy. The bow is 3 ft. 3 in. long, beautifully sprung and properly constructed in best quality lancewood, guaranteed to stand hard wear. The set is complete with six strong, metal pointed feathered arrows



PRICE **11'6**

Post 6d.

MERCEDES RACING CAR



This wonderful little model is in every way similar to its prototype. When wound up it is silent and with the pushing of a lever drones like a real car; on a second lever being pushed it moves forward making a louder noise as of a car accelerating.

PRICE **3'-**

Post 4d.

FOR SUMMER HOLIDAYS

Ideal to keep the children amused at the seaside, this double lined red rubber raft. Easily inflated by mouth, and with handles to facilitate carrying.



PRICE **3'11**

Post 4d.

BEACH BALLS

Beautifully coloured, made in one piece with no inside bladder. Every youngster should have one of these for this coming summer.

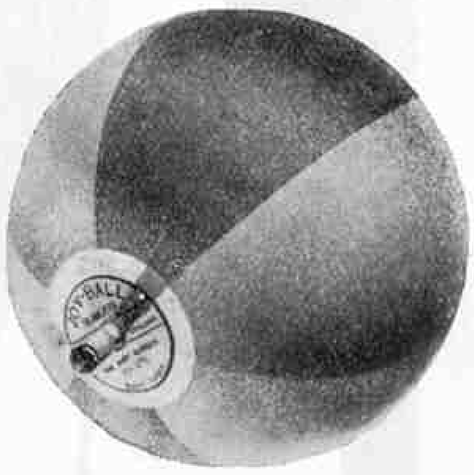
PRICES

3'6

4'6

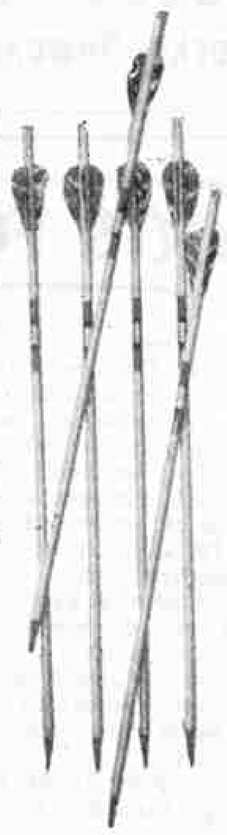
5'6

Post 3d.



Six Feathered Arrows

For the more ambitious young archer a set of arrows, extra to those supplied with the Robin Hood archery set. Metal pointed, gaily coloured ends, beautifully finished.



PRICE

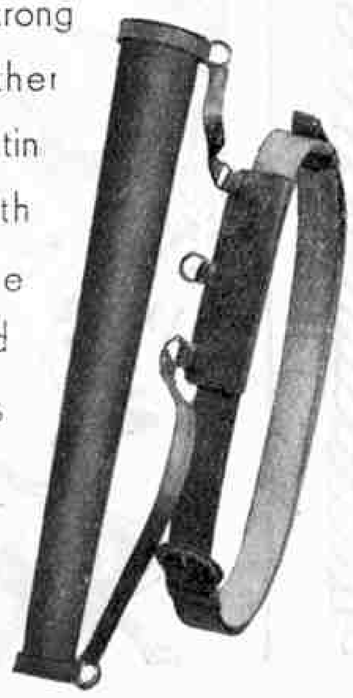
5'3

THE SET OF SIX

Post 6d.

QUIVER FOR SIX ARROWS

To be worn at the side; made of strong polished leather and lined with tin. Complete with comfortable leather belt and metal fastenings



PRICE

7'6

Post 4d.

FINE ARCHERY TARGET



For great fun and plenty of practice. Diameter 1 ft. 11 in. Thick matted straw with canvas face, painted in four colours.

PRICE **13'6**

Post 4d.

better for YOUR cycle



BLACK CELLULOID INFLATORS

"Noweight," 15" x ⅞" ... **2/6**
"Sterling," 15" x ⅞" ... **2/3**
"Featherweight," 15" x " **2/-**
"Pumpeese," 15" x ¾" ... **1/9**
"Reliable," 15" x 11/16" ... **1/6**
Also in white and a range of standard colours, **3d.** extra. "Reliable," **2d.** extra.

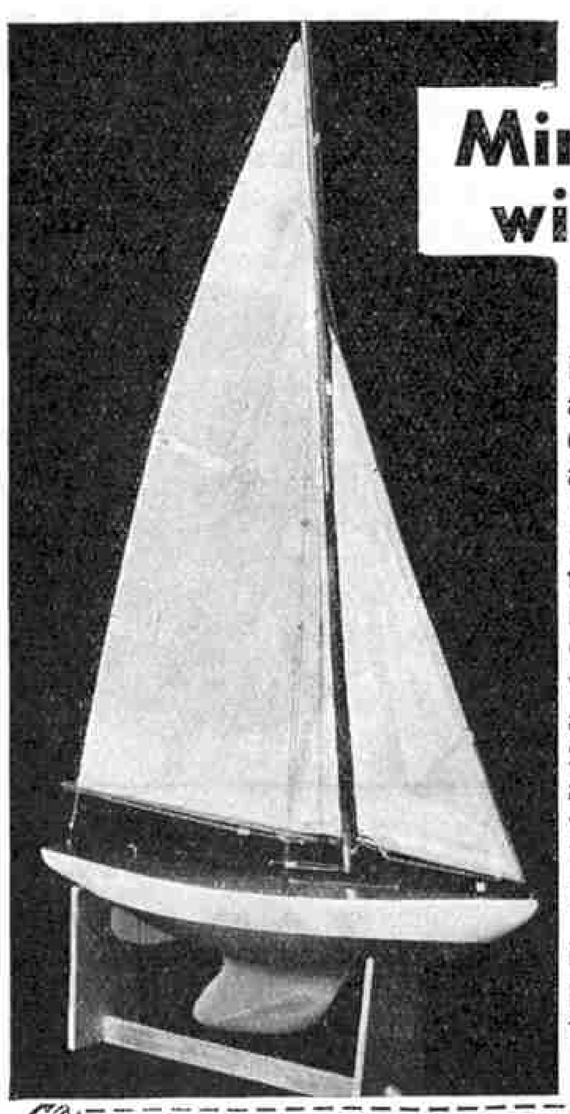
OTHER INFLATORS

"ACME" (celluloid, metal lined)
15" x ⅞" **2/3**
Metal Inflator, 15" x ⅞",
Black **1/3.** Plated **1/6**

Send for Bluemel's Pocket Catalogue containing interesting cycling data.

Bluemel's
CELLULOID
PUMPS.

BLUEMEL BROS. LTD., Dept. 27, WOLSTON, Nr. Coventry



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Miniature Yacht will win Races:
it's Clyde-built!

Built to a standard of accuracy and finished to a degree of perfection never before achieved.
● The Queen visited our B.I.F. Stand and admired these yachts, of which she has bought several.
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Address.....
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Your tools last longer and work better if they are kept well lubricated and free from rust—so use "3-in-One" Oil. Excellent for all mechanical appliances, etc.

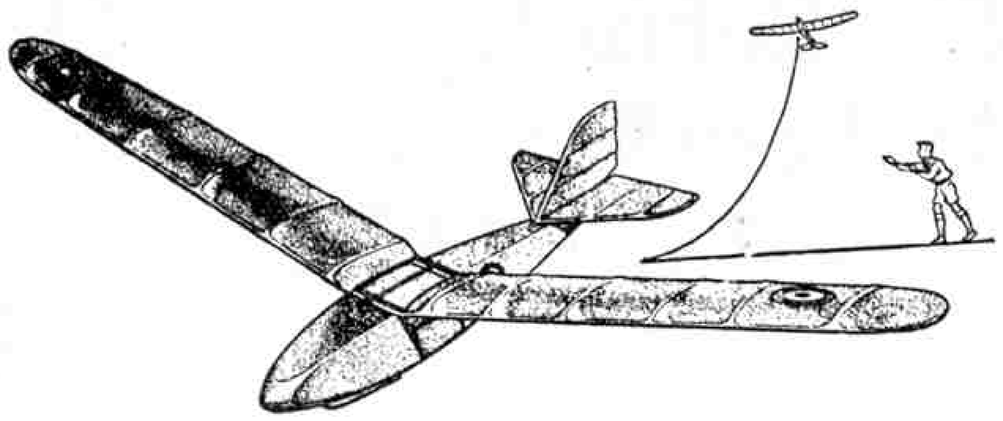
From Ironmongers and Stores

Oilright Can 8d. Handy Can 1/3. Also in bottles, 7d., 1/3 and 2/6 (8 ozs.)

CLEANS—LUBRICATES PREVENTS RUST

· "3-IN-ONE" OIL ·

HIGH PERFORMANCE SAILPLANE



This splendid model from the **SCUD** range performs exactly like a full-scale Sailplane. It is the only British-made machine of its type made, and when correctly trimmed and under suitable weather conditions has soaring flight of up to ten minutes. This is definitely the machine for the enthusiast and will provide hours of instructive flying. **No propeller to wind. Nothing mechanical to go wrong.** Totally enclosed fuselage, mainplane and tail unit double surfaced, covered jap silk and doped silver. Skid under-carriage. Includes new catapult launching gear. Gliding angle in calm air, 1 in 15. Span 38". Price **17s. 6d.**

SEND NOW FOR ILLUSTRATED CATALOGUE DESCRIBING OUR 1937 RANGE

Stocked by leading dealers throughout the kingdom

SCUD MODELS LTD.
Lovaine Crescent Model Works, Newcastle-upon-Tyne



NEW MECCANO PARTS FOR OLD!

Good News for Meccano Boys

Every Meccano boy should know o. the wonderful Meccano Part Exchange Scheme, in order to take the fullest advantage of it.

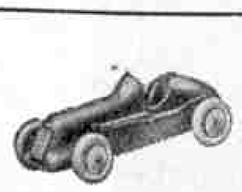
We undertake to exchange any damaged Meccano parts for similar new parts at half the current list price, no matter how old or how much damaged the parts are. Just send them to us, addressed to the Service Department, Meccano Limited, Binns Road, Liverpoo 13, together with a remittance covering half the cost of the new parts. The remittance should include postage on the new parts and will be exactly the same as that you pay on the parcel of old parts you send us.

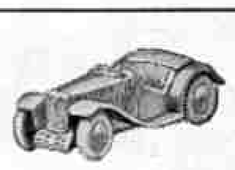
It is very important that you enclose your own name and address written in plain characters.

If you prefer to do so, you can effect the exchange through your dealer.

FINISHED IN RICH COLOURS

DINKY TOYS





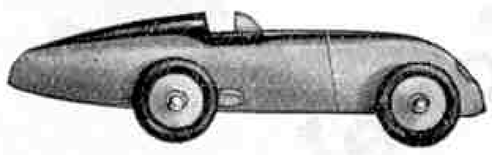
SMALL CARS
Dinky Toys No. 35
Fitted with rubber tyres

No. 35a	Saloon Car	each	3d.
No. 35b	Racer...	,,	3d.
No. 35c	"M.G." Sports Car	,,	3d.

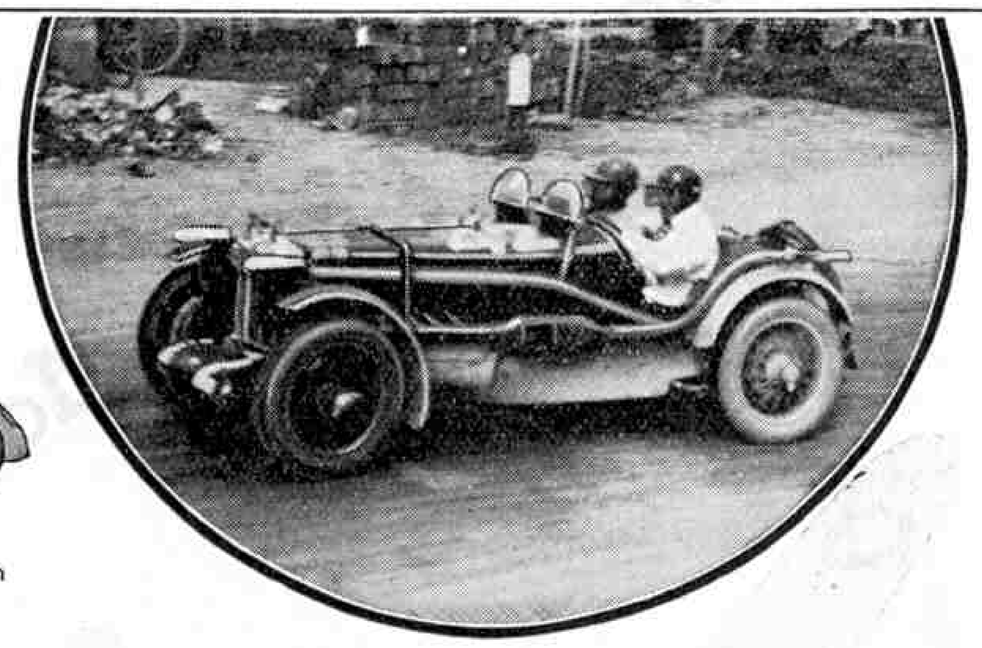
Price of complete set **9d.**

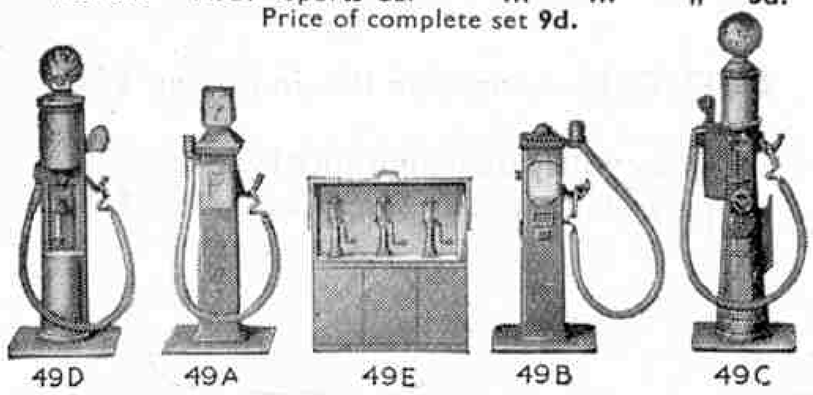


HOTCHKISS RACING CAR
Dinky Toys No. 23b
Assorted colours. Fitted with detachable rubber tyres.
Price **4d.** each



RACING CAR
Dinky Toys No. 23a
Assorted colours. Fitted with detachable rubber tyres.
Price **4d.** each



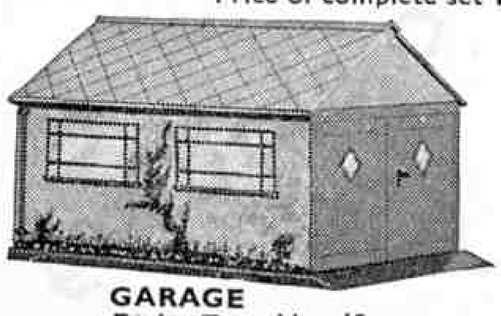


49D 49A 49E 49B 49C

PETROL PUMPS Dinky Toys No. 49
Scale models fitted with rubber hose pipes. Realistically coloured.

No. 49a	Bowser Pump	each	3d.
No. 49b	Wayne Pump	,,	3d.
No. 49c	Theo Pump each **3d.** No. 49d Shell Pump	,,	3d.
No. 49e	Oil Bin (Pratts)	,,	3d.

Price of complete set **1/3**



GARAGE
Dinky Toys No. 45
Fitted with opening double doors. Will accommodate any two Dinky Toy Motor Cars.
Price **1/3** each



PILLAR LETTER BOX G.P.O.
Dinky Toys No. 12a
Price **3d.** each



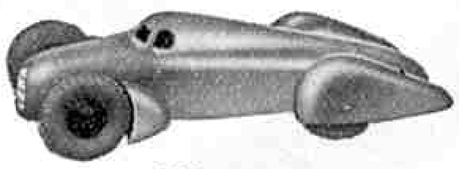
STREAMLINE SALOON
Dinky Toys No. 22h
Assorted colours. Fitted with rubber tyres.
Price **4d.** each



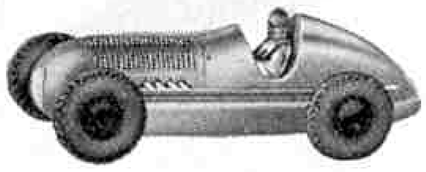
STREAMLINE TOURER
Dinky Toys No. 22g
Assorted colours. Fitted with detachable rubber tyres.
Price **4d.** each



23e



23d



23c

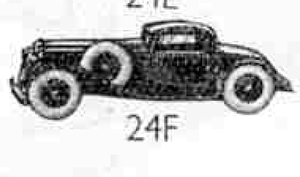
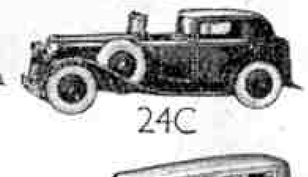
RACING CARS
Dinky Toys No. 23
Fitted with driver and detachable racing tyres. Assorted colours.

No. 23c	Mercedes-Benz Racing Car	each	8d.
No. 23d	Auto-Union Racing Car	,,	8d.
No. 23e	"Speed of the Wind" Racing Car	,,	8d.

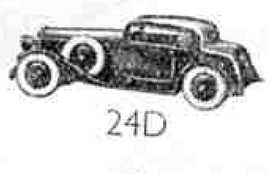
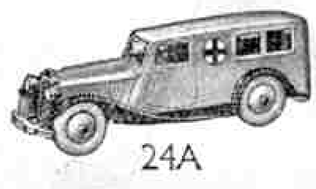
Price of complete set **1/11**



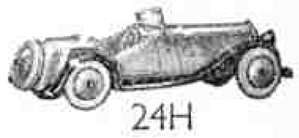

24E 24G

24F 24C

24D 24A

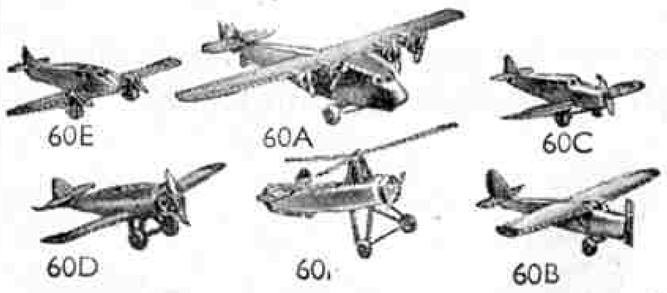



24H 24B

MOTOR CARS
Dinky Toys No. 24
Fitted with detachable rubber tyres and silver-plated radiators

No. 24a	Ambulance	each	6d.
No. 24b	Limousine	,,	6d.
No. 24c	Town Sedan ...	,,	6d.
No. 24d	Vogue Saloon ...	,,	6d.
No. 24e	Super Streamline Saloon	,,	6d.
No. 24f	Sportsman's Coupé	,,	6d.
No. 24g	Sports Tourer (4 seater)	,,	6d.
No. 24h	Sports Tourer (2 seater)	,,	6d.

Price of complete set **3/11**



60E 60A 60C 60D 60 60B

AEROPLANES Dinky Toys No. 60

No. 60a	Imperial Airways Liner	each	9d.
No. 60b	D.H. "Leopard Moth"	,,	6d.
No. 60c	Percival "Gull" ...	,,	6d.
No. 60d	Low Wing Monoplane	,,	6d
No. 60e	General "Monospar"	,,	6d.
No. 60f	Cierva "Autogiro" ...	,,	6d.

Price of complete set **3/-**



ROYAL AIR MAIL SERVICE CAR
Dinky Toys No. 34
In correct colours. Fitted with detachable rubber tyres.
Price **6d.** each



MOTOR TRUCK
Dinky Toys No. 22c
Assorted colours. Fitted with detachable rubber tyres. Price **6d.** each



33A 33C 33F



33E 33B

MECHANICAL HORSE AND FOUR ASSORTED TRAILERS
Dinky Toys No. 33
Fitted with detachable rubber tyres

No. 33a	Mechanical Horse ...	each	6d.
No. 33b	Flat Truck	,,	6d.
No. 33c	Open Wagon ...	,,	6d.
No. 33e	Dust Wagon ...	,,	8d.
No. 33f	Petrol Tank	,,	8d.

Price of complete set **2/9**

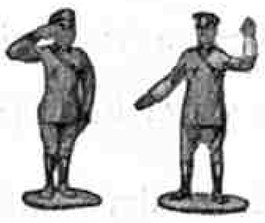


BEACON
Dinky Toys
No. 47d
Realistic model of a Belisha Safety Beacon.
Price **1d.** each



PETROL STATION
Dinky Toys No. 48
Accurate reproduction of a filling station. Printed in appropriate colours.
Price **1/3** each

STREAMLINE BUS
Dinky Toys No. 29b
Fitted with rubber tyres.
Price **6d.** each





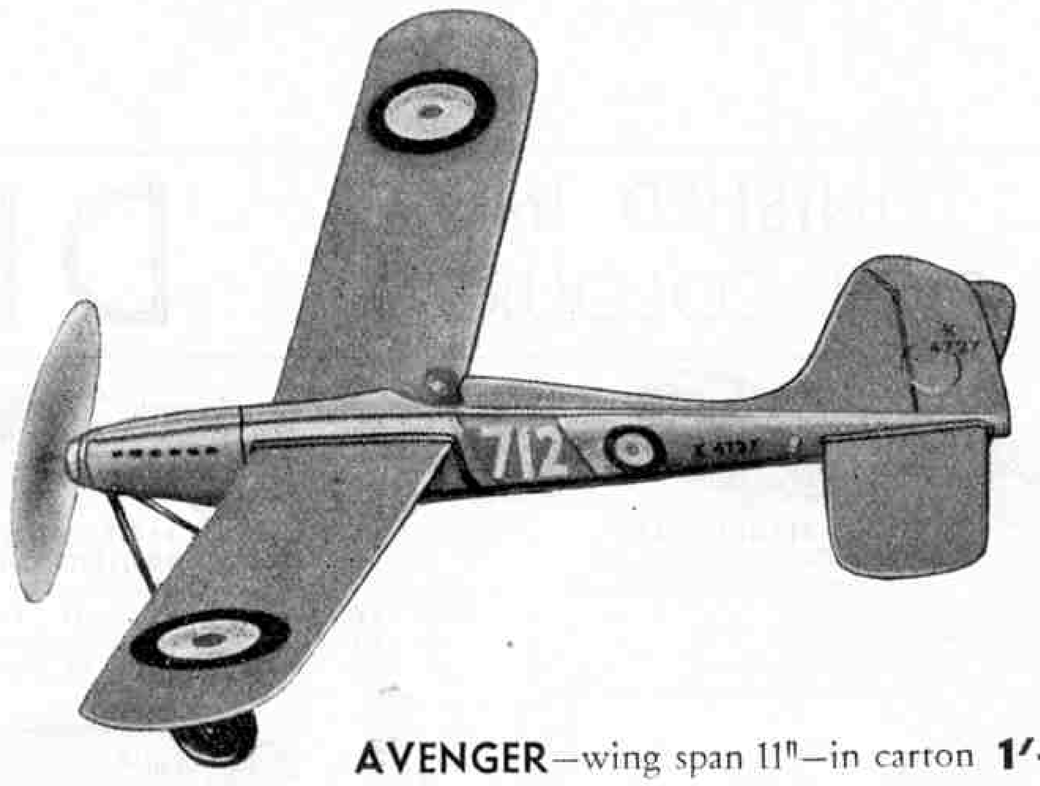
A.A. BOX, MOTOR CYCLE PATROL AND GUIDES
Dinky Toys No. 44
Collectors of Dinky Toys will find this realistic road set of particular interest. Each item is finished in correct colours

No. 44a	A.A. Box	each	8d.
No. 44b	A.A. Motor Cycle Patrol	,,	9d.
No. 44c	A.A. Guide directing traffic	,,	3d.
No. 44d	A.A. Guide at the salute	,,	3d.

Price of complete set **1/11**

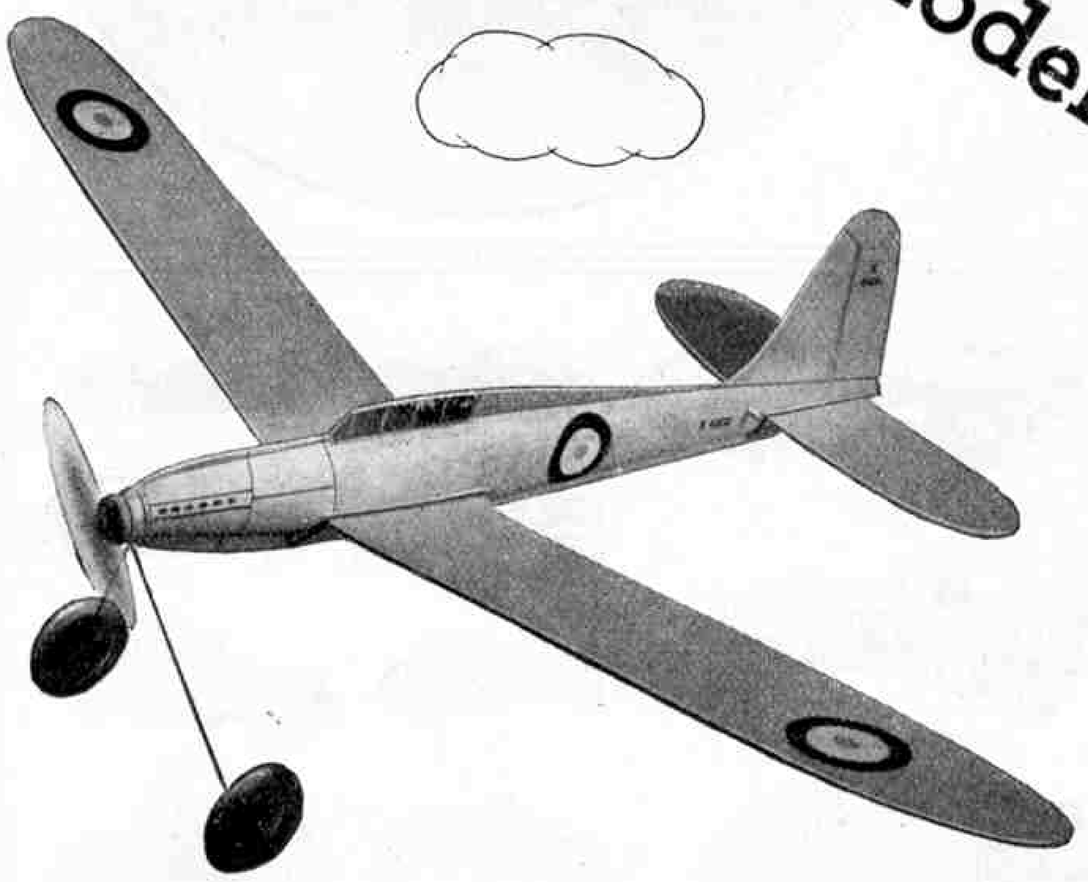
MECCANO LTD. — BINNS ROAD — LIVERPOOL 13

And now a FROG Model aeroplane for a shilling



AVENGER—wing span 11"—in carton **1'-**

Complete with patent high-speed winder and packed in specially constructed box **1'11**



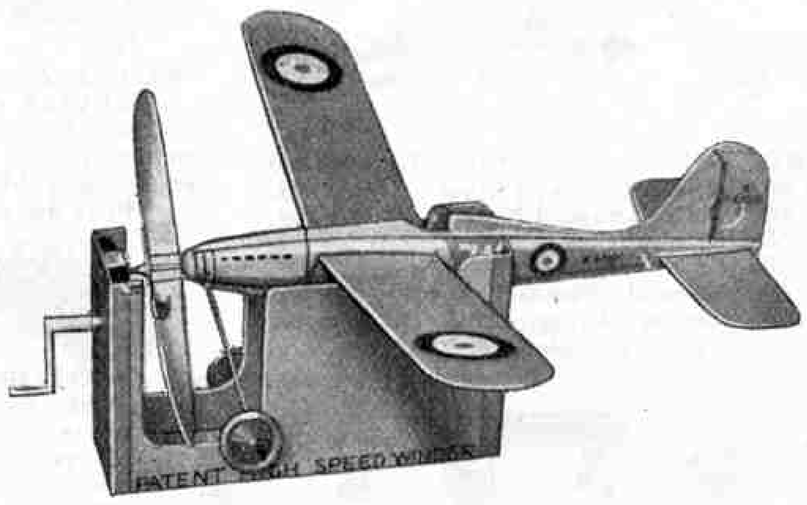
RAIDER—wing span 13¼"—in carton **1'11**

Complete with patent high-speed winder and packed in specially constructed box **2'11**

These wonderful new FROG Aeroplanes bring Model Flying within the reach of every boy. They are built with the same care as the famous FROG MK. IV, and an entirely new method of manufacture is used. The RAIDER and AVENGER follow R.A.F. practice and are modelled on the lines of high speed dive bombers, and single seater fighters.

Both models are almost unbreakable and have a tubular fuselage, sprung undercarriage, balsa wood wings, and are finished in the R.A.F. colours. They have an exceptionally good flying performance, and may be flown both in and out of doors.

This illustration shows how easily these models can be wound for flight with the patent high speed winder.



OBTAINABLE AT ALL GOOD TOYSHOPS AND STORES

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

Please send me your "Frog" coloured leaflet with particulars of the "Frog" Flying Club and how to obtain handsome enamelled FROG Pilot Badges.

Name.....

Address.....

.....

Please write in block letters.

6-37

FROG MODEL AIRCRAFT

Trade Mark Regd.

All FROG model aircraft are covered by world Patents granted and pending.

Made in England by International Model Aircraft Ltd.

Sole Concessionaires:

LINES BROS. LIMITED, TRI-ANG WORKS MORDEN ROAD, MERTON, LONDON, S.W.19



In winter Morris approve Patent Castro. AA. C.C. WAKEFIELD & CO. LTD., Wakefield House, Cheapside, London, E.C.2

HORNBY ELECTRIC & CLOCKWORK TRAINS

The Most Fascinating Pastime in the World!

You have spent many happy hours watching real trains at work. Now start a railway of your own and enjoy the thrill of operating Engines, Coaches, Wagons, Signals and Points on actual railway principles. It's the most fascinating pastime in the world!

From the day of their introduction Hornby Trains have always represented the latest model railway practice. Designs are continually being improved and new items added so that the system is complete in practically every detail. There are Locomotives for all duties, driven by electric motors or by clockwork. There is Rolling Stock of all kinds including Pullman Cars, ordinary Coaches and Guard's Vans for passenger services, and numerous Wagons and Vans for freight working.

The Accessories are now better than ever before, while with the Rails, Points and Crossings an endless variety of layouts can be constructed, both for Electrical and Clockwork Trains.

Hornby Train Sets are available at prices ranging from **15/-** to **75/-** for Electric models and **4/11** to **65/-** for Clockwork models.

A selection from the range of
HORNBY LOCOMOTIVES

ELECTRIC MODELS

EM120 (20-volt) or EM16 (6-volt) Locomotive (non-reversing) Price **8/6.**

EO20 (20-volt) Locomotive (reversing) Price **22/-.**

E120 (20-volt) Tank Locomotive (reversing) Price **24/-.**

E120 (20-volt) Special Tank Locomotive (automatic reversing) Price **30/-.**

E220 (20-volt) Special Tank Locomotive (automatic reversing) Price **32/6.**

E220 (20-volt) Special Locomotive (automatic reversing) Price **37/6.**

CLOCKWORK MODELS

M1/2 Locomotive (reversing) Price **4/6.**

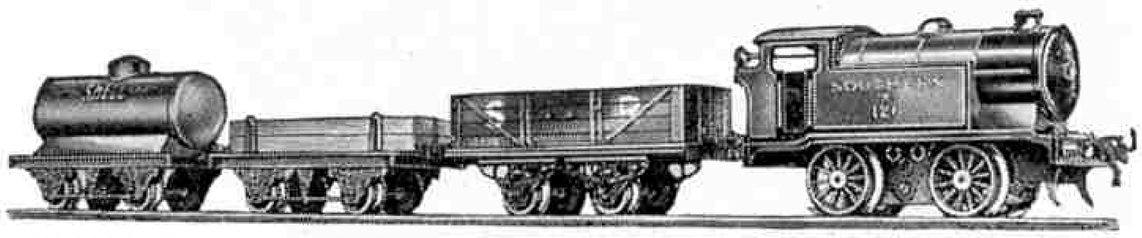
M3 Tank Locomotive (reversing) Price **7/6.**

No. O Locomotive (reversing) Price **10/6.**

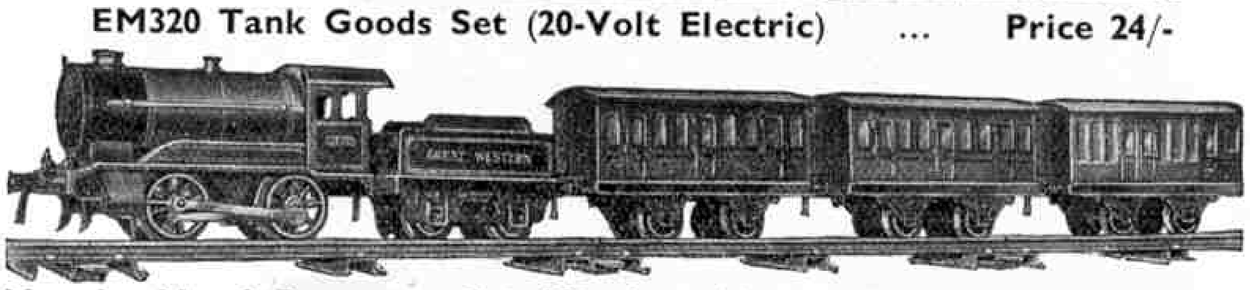
No. 2 Special Locomotive (reversing) Price **27/6.**

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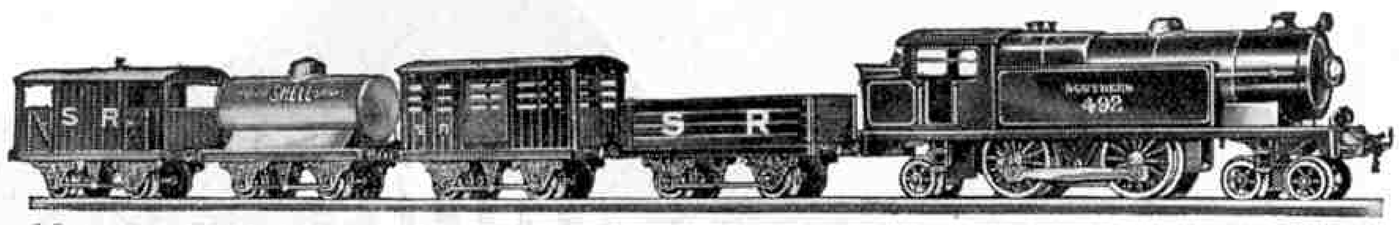
A SELECTION FROM THE RANGE OF HORNBY TRAINS



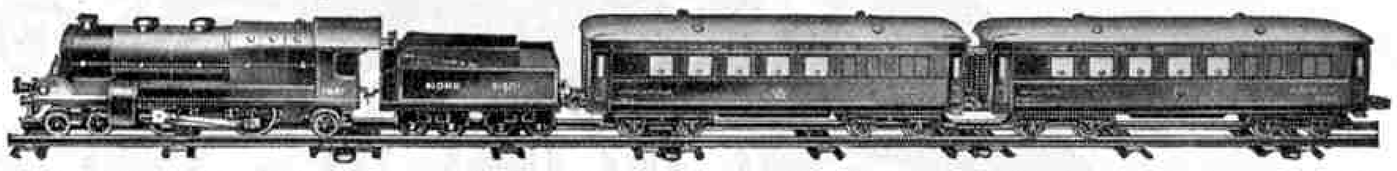
EM320 Tank Goods Set (20-Volt Electric) ... Price 24/-



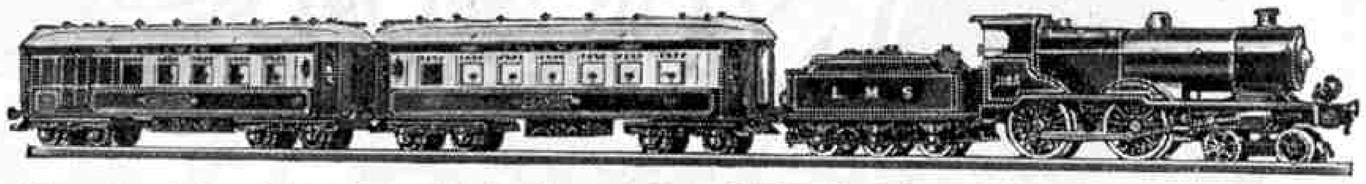
Hornby No. 1 Passenger Set (Clockwork) ... ... Price 25/-



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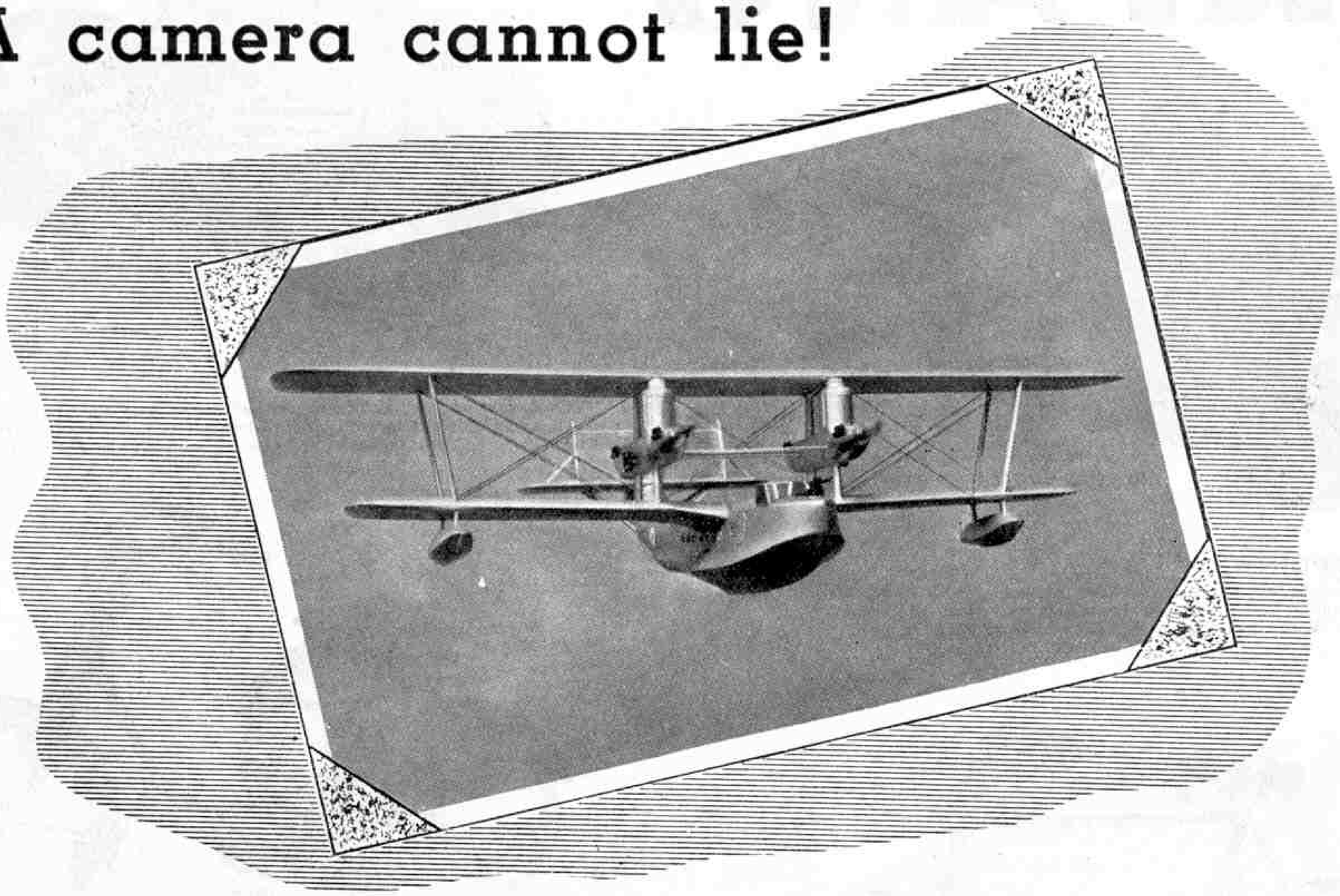
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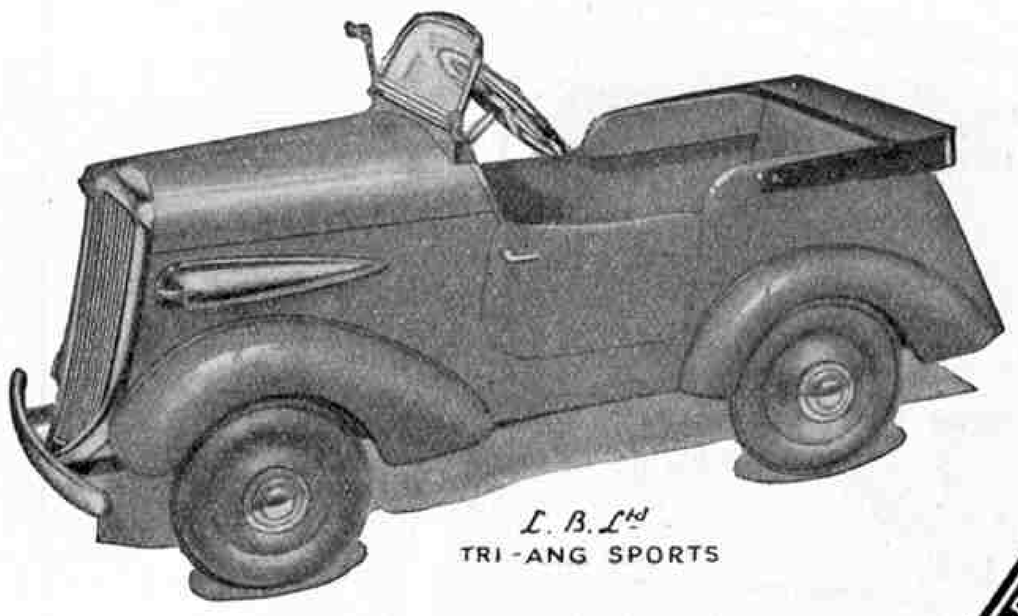
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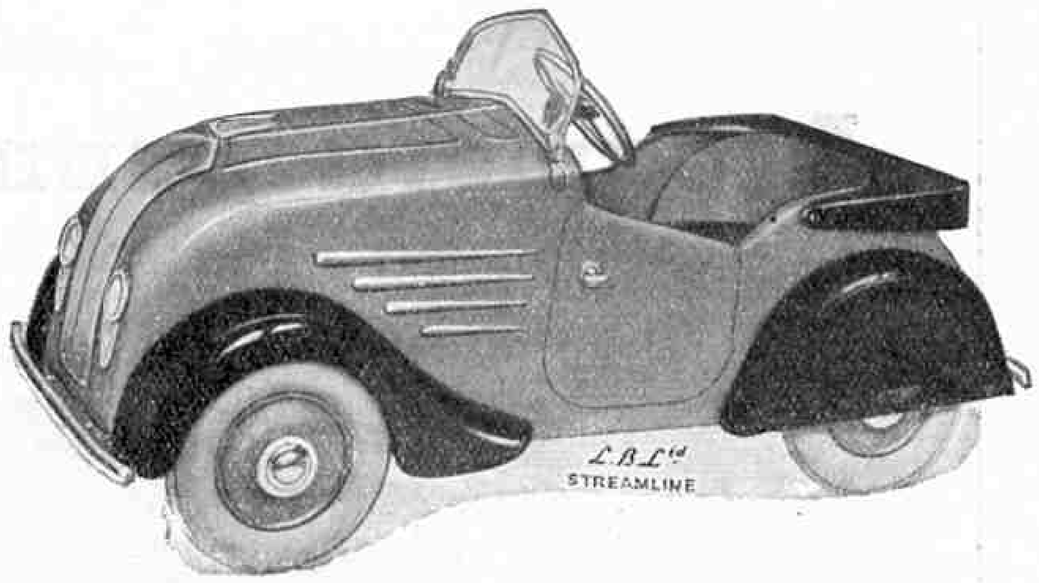


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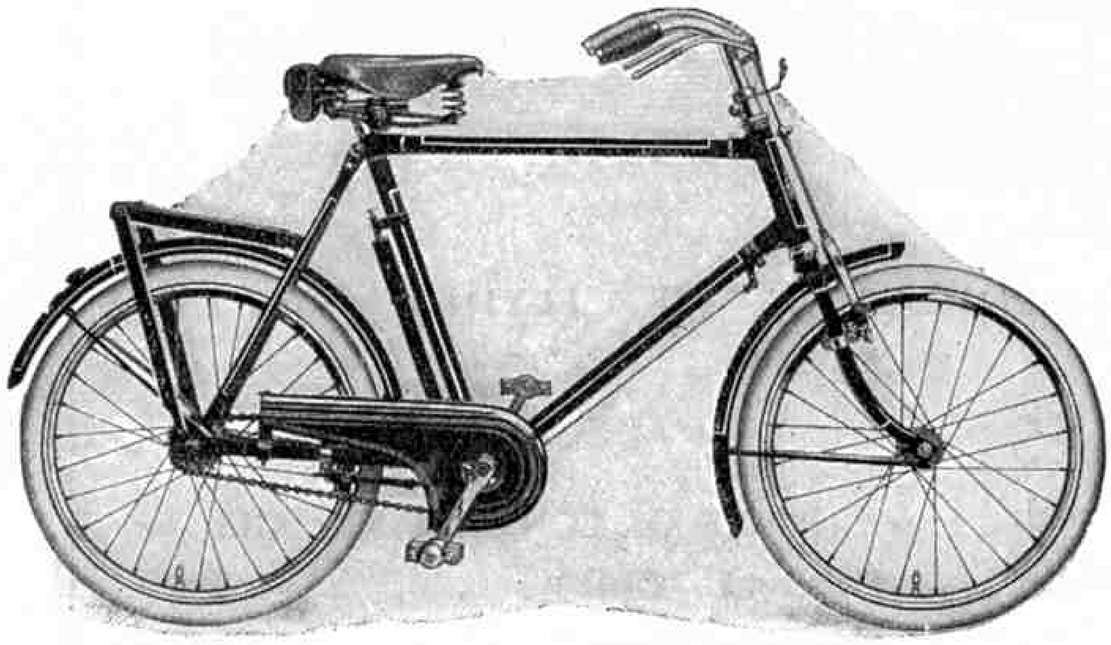
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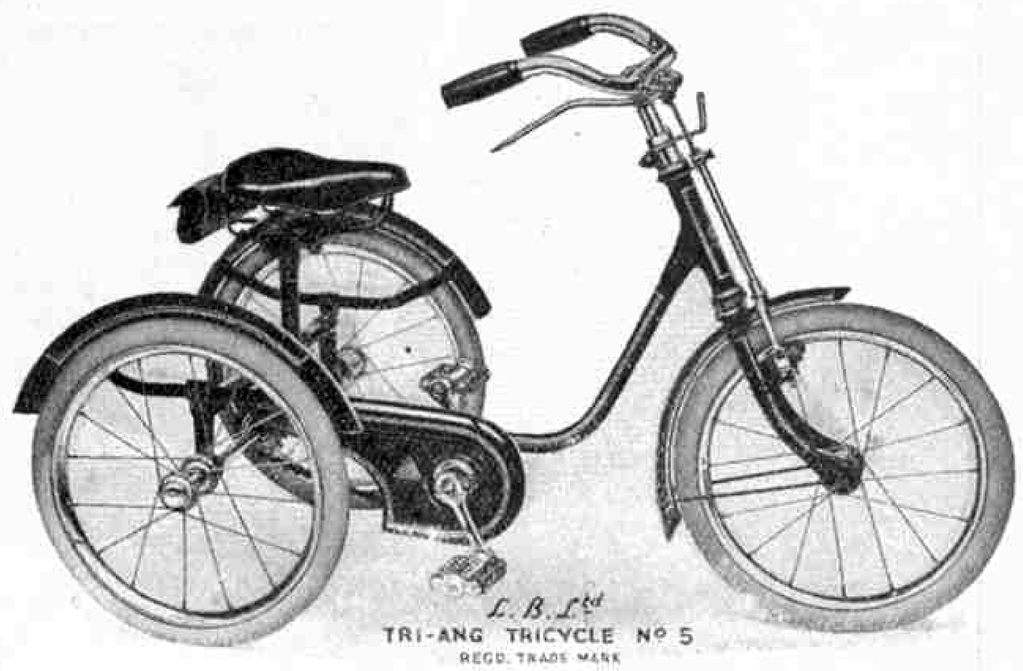
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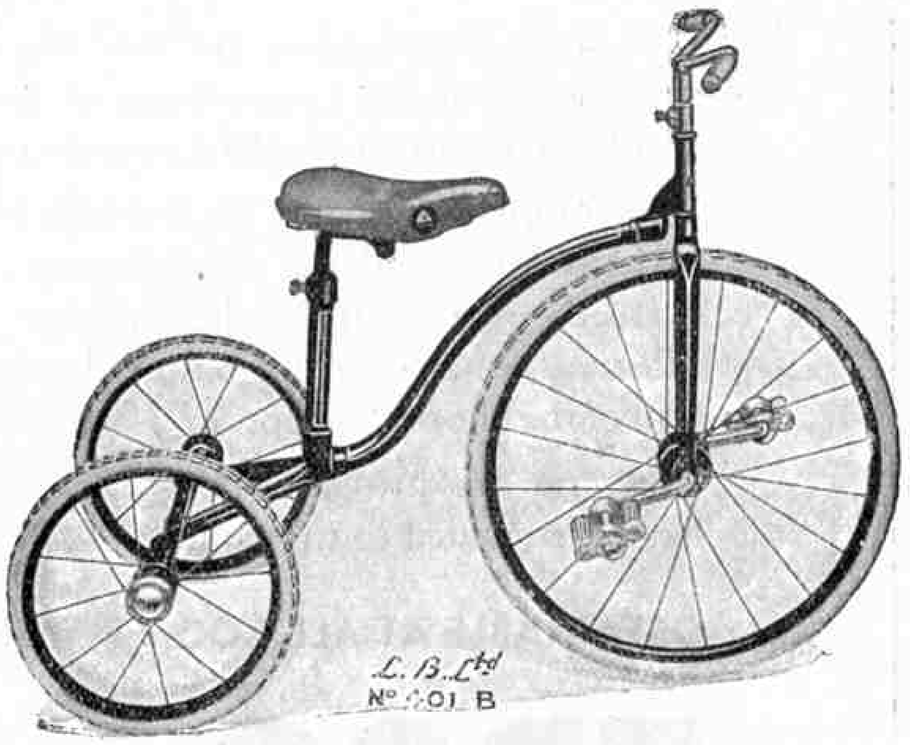
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NEXT MONTH: "A HOLIDAY IN FINLAND." PUBLISHING DATE: 1st JULY

MECCANO MAGAZINE

Editorial Office:
Binns Road, Liverpool 13
England

Vol. XXII. No. 6
June, 1937

With the Editor

Engineering Triumphs at the Coronation

The Coronation of their Majesties King George VI and Queen Elizabeth will long be remembered for the many amazing scenes that it brought with it. Last month I pointed out that, for the first time in history, the marvels of radio would enable all of us to be in a sense within Westminster Abbey throughout the Coronation ceremony, and it is interesting now to look back on the events connected with that wonderful day and to see how great a part the engineer and the scientist played in them.

The greatest marvel of the Coronation was the broadcast from the Abbey and various points along the route of the procession. This was certainly a complete triumph for the B.B.C. The Abbey ceremony was a really splendid achievement, and I was thrilled as I listened to it in the quiet of my own room. The gorgeous music, particularly the stirring trumpet fanfares, and the wonderful voice of the Archbishop of Canterbury combined to produce an effect that at times was overwhelming. The Coronation provided also the first big test for television, which seems to have come through with complete success, even at places more than 60 miles from London.

The transport achievements of Coronation day were also magnificent. There must have been millions of people packed along the processional route, and the task of taking them there, and returning them later in the day, was a stupendous one. Only a few years ago this task would have been impossible, yet now it was carried out almost without a hitch. The Underground railways have reason to be proud of the fact that, in spite of the enormous number of trains they ran, the schedule was maintained throughout the day.

America to England and Back Within a Week

Another interesting connection between the Coronation and engineering was provided by the astonishing double trans-Atlantic flight made by Mr. Dick Merrill and Mr. Jack Lambie. The purpose of the flight was to carry Coronation photographs to America as soon as possible. It had been hoped also to take films of Coronation scenes, but unfortunately these were not ready in time.

The two airmen achieved the distinction of being the first to make the journey from the United States to Great Britain and back within a week. They left New York on 9th May, and landed at Croydon 21½ hrs. later; on the return flight they took off from Southport on 13th May, and arrived at New York in 24 hr. 22 min. later. The round flight was remarkable for the ease and simplicity with which it was carried out. There were head winds on the return trip, but otherwise there was no trouble, the machine simply taking off and flying steadily throughout each of its long ocean trips. One of the features of this flight that impressed me was the absence of fuss and newspaper "boosting." It was a serious business trip, carried out quietly and efficiently.

The *"Hindenburg"* Disaster

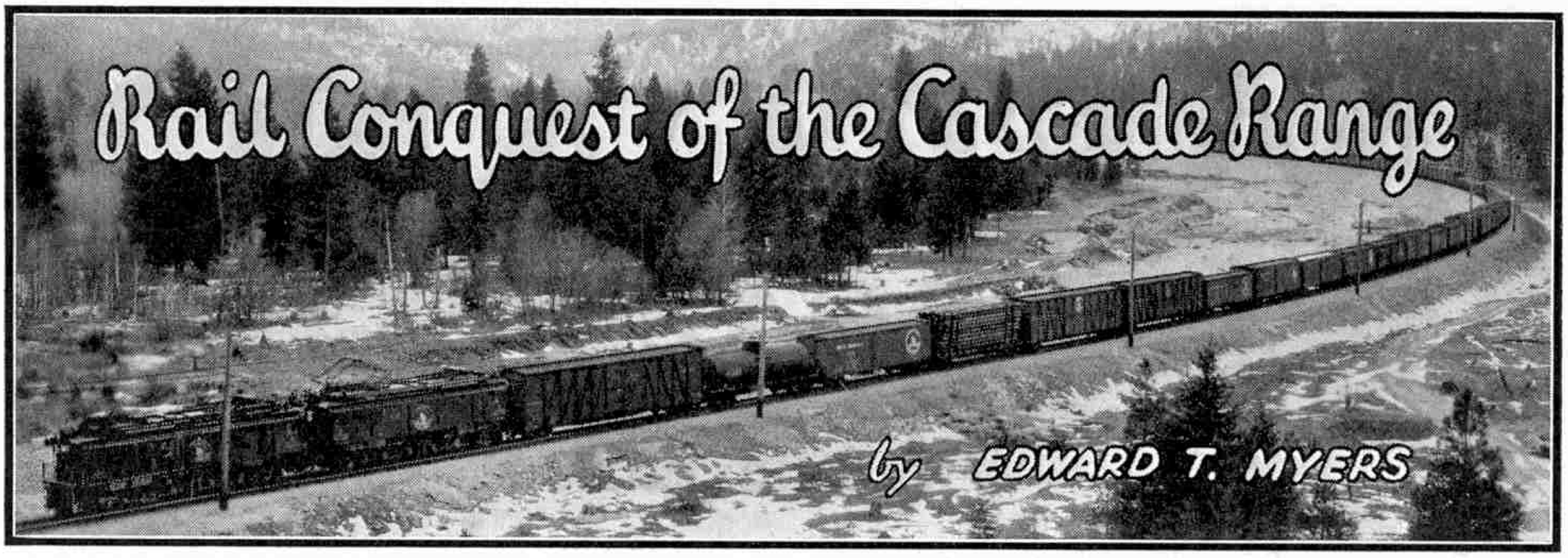
The story of airships is not an encouraging one, but even the recent *"Hindenburg"* disaster does not prove that the airship is unsafe. It is probably better than existing flying boats or land planes for very long flights, particularly across the great oceans, for if its engines stop it does not crash, but drifts in the air until they are put right. The real trouble at present is that the gas bags are filled with the inflammable hydrogen. If the non-inflammable gas helium could be produced more cheaply, and used always, there would be no more fire disasters such as that of the *"Hindenburg."* Whatever may have been the cause of the wreck of this fine airship—and it seems certain that this will never be known—there is not the slightest doubt that the deaths were due directly to the hydrogen catching fire.

L.M.S.R. Driver Honoured

My readers will join with me in congratulations to Driver T. J. Clarke of Crewe on his inclusion in the Coronation Honours List, his award being the Medal (Civil Division) British Empire. Driver Clarke is familiar to all Hornby Train enthusiasts as the man in charge of the famous L.M.S.R. locomotive *"Princess Elizabeth"* in November of last year when a world's record in long-distance steam travel was set up by covering the 401.4 miles from Glasgow to London non-stop at an average speed of 70 m.p.h. He is keenly interested in the splendid Hornby scale model of the *"Princess Elizabeth"*; readers will recall the photographs of him that appeared in the announcement of this model in last month's *"M.M."*

Important To All Readers

Readers will be interested to know that, in response to widespread requests, arrangements have been made to supply certain Meccano products on deferred payment terms. For example, the splendid new scale model of the L.M.S.R. *"Princess Elizabeth,"* and the larger Meccano Outfits, can be obtained in this manner. The scheme of payments is simple and straightforward, and any Meccano dealer will explain it with pleasure. Alternatively full particulars may be had from Meccano Limited, Binns Road, Liverpool 13.



ONE of the largest and most efficient railway systems in the United States is the Great Northern Railway, which connects Chicago with the Pacific coast. It pierces first the Rocky Mountains and then the Cascade range on its way to Seattle, Tacoma, Portland and other towns and cities on the west coast. Its lines also stretch into Canada, serving Winnipeg on the one hand and Vancouver on the other, and altogether it operates 9,288 miles of main line track, including the Chicago, Burlington and Quincy system, in which it has a controlling interest.

The story of the Great Northern Railway is intimately associated with the success of James J. Hill, its Canadian-born founder, and with the development of the fertile plains of the North West. Through Hill's vision and guidance, the Great Northern grew from the first standard-gauge steam railroad in the North West to its present position as a great transcontinental line extending from the Mississippi River to the Pacific Ocean. Hill built his line on a firm financial basis without Government help, a thing considered impossible at the time.

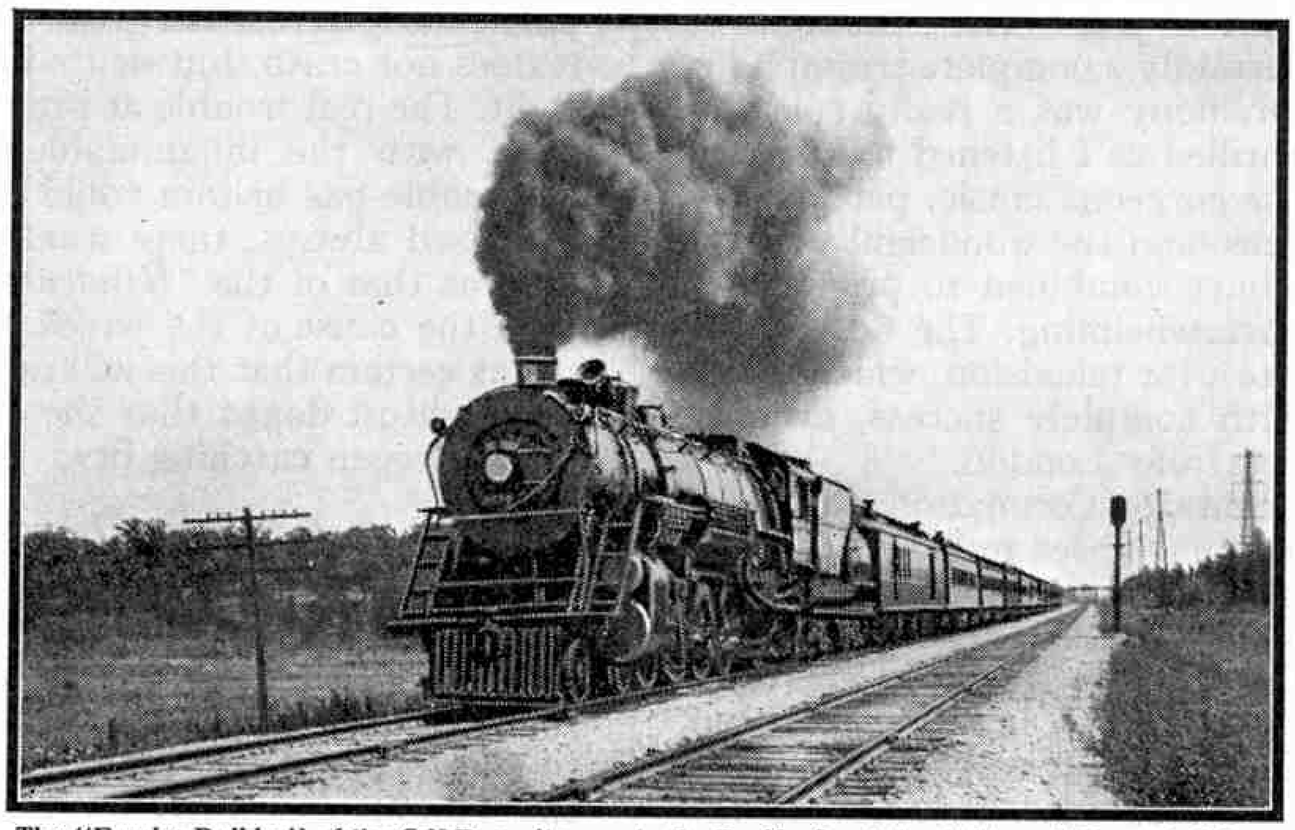
For many years the great region west of the Mississippi had no rail connection with the east or the west coast. One railroad from the east reached the Mississippi, and during the summer a line of steamboats plied on the river between St. Paul and this rail connection, while a few boats steamed farther south to the lower Mississippi. The only other means of transport was by wagon overland, and there was great need for better facilities if the country was to become settled. Steps therefore were taken to charter a railway to run from St. Paul to the point where the Red River crosses the Canadian boundary, with the result that in 1862, the St. Paul and Pacific Railway Company completed 10 miles of railroad.

James J. Hill had begun by working as a shipping clerk for steamboat companies, and gaining experience and knowledge of the productive possibilities of the region to be traversed by the proposed railway. By 1871 he had established a regular through service to Winnipeg and other points on the Red River by rail, road and steamboat, and by the time he was 40 years old had accumulated a fortune of 500,000 dollars and was just ready to begin the career that made him famous. He realised that the difficulties with the railroads already built or planned was that they started nowhere and ended nowhere, and in 1879 he reorganised the defunct railroad as "The St. Paul, Minneapolis and Manitoba Railway Company." Extensions had been constructed to the Canadian boundary, where connection was made with a Canadian line to Winnipeg, and thus Hill now had a railroad with 560 miles of completed line.

Mr. Hill and his associates had risked their fortunes in this project because of their faith in the fertile wheat country to which the line gave access. It has been said that "Hill was more than a builder of railroads. Other sections of the West were settled from the ox cart. Mr. Hill's country was settled from the box car." He built his railroad, attracted settlers from the East and also from Europe by advertising, and then showed them the best methods of farming and even furnished breeding stock free.

Hill was not without keen competition, for the Northern Pacific Railroad reached the Pacific coast in 1883, when the St. Paul, Minneapolis and Manitoba was only reaching out into the prairie region and acquiring lines to the head of Lake Superior.

By 1889, the railroad had become too large for its charter and the Great Northern Company was formed by Mr. Hill to take over the lines. Plans were now made to build the Pacific extension, and surveying parties were sent out to find a way through the Rocky and Cascade Mountains.



The "Empire Builder" of the G.N.R. on its way to the Pacific Coast, hauled by a "Mountain" locomotive. Photograph by our reader A. Hobart, Minneapolis.

Hill desired a line with low gradients and little curvature, and he wanted the mountains crossed at a low level. Indians had often told stories of a good pass, but Lewis and Clark, the pioneer explorers of the North West, and subsequent government and railway engineers had failed to find it, and the Northern Pacific Railroad therefore had been built through a less desirable pass to the south. John F. Stevens, locating engineer for Mr. Hill, found the pass in 1889, however. This was one of the outstanding achievements of the history of railroad engineering.

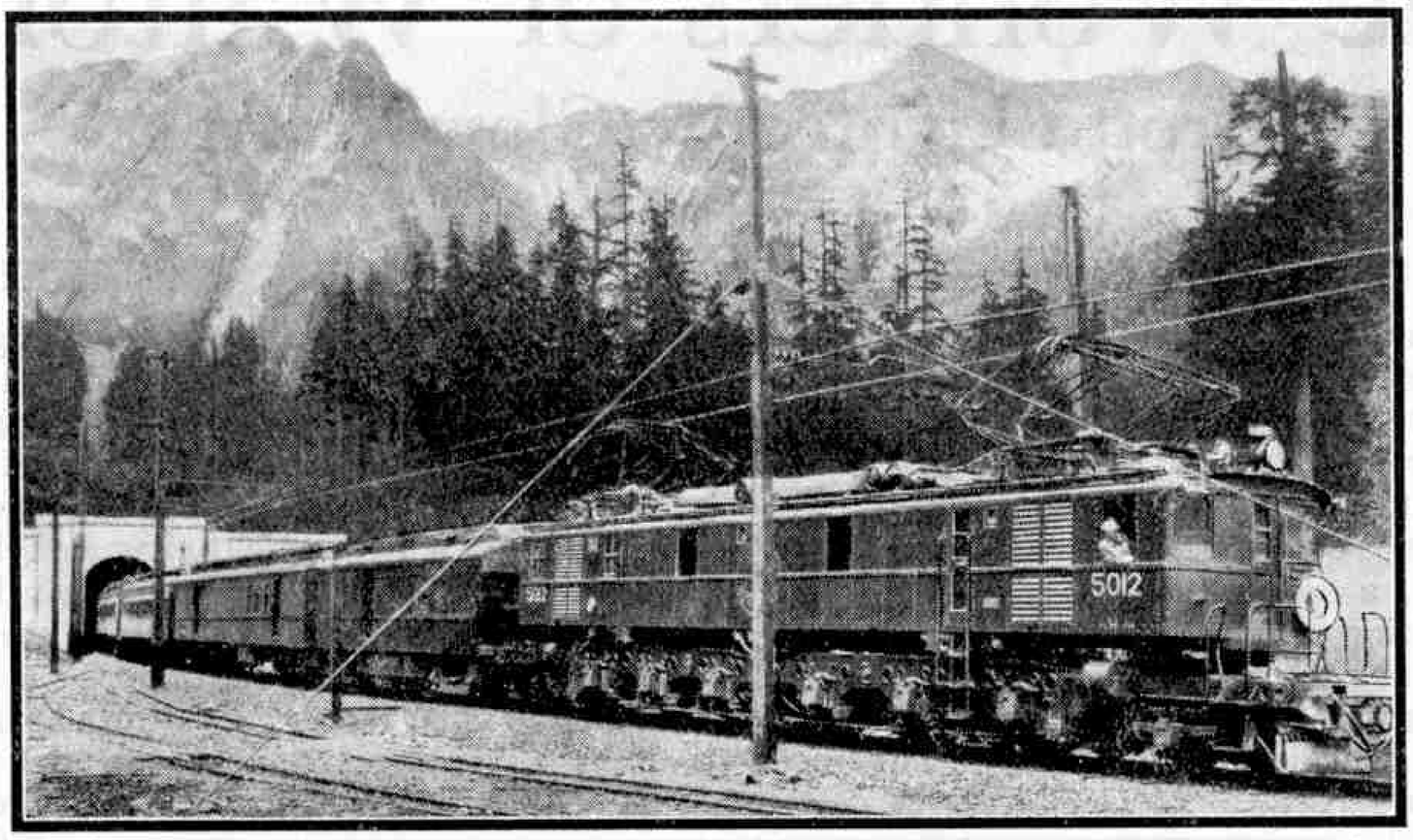
The long-sought way through the mountains was discovered in midwinter. Mr. Stevens' only companion in the quest was a halfbreed, who was left in camp, because he said he was ill, while the engineer looked for the way through the mountains. Actually the halfbreed was afraid of evil spirits believed to protect the legendary pass. After trailing through two false passes that only brought him once more on the east of the divide, Stevens finally reached the real summit in December 1889. After continuing through the low wide valley, which had but little resemblance to a mountain pass, Stevens at last found himself looking westward over an expanse of lower mountain ranges, and knew he had found the elusive pass! With the thermometer falling to 40 deg. F. below zero, he spent the night tramping backward and forward through a runway in the snow in order that he might not freeze to death. A statue of the great engineer stands at the spot to-day, where it is visible to passengers in the great steel trains roaring past.

The crossing of the Cascade Mountains by rail also was not easy to plan, and required the construction of a tunnel 13,000 ft. in length. In order not to delay construction, temporary switch-backs with 1 in 25 grades were constructed so that trains could climb to the summit. Switch-backs are troublesome as well as dangerous, however, and the tunnel was started as soon as possible.

The Great Northern has always continued to improve its methods of operation. When atmospheric conditions in the tunnel through the Cascades ultimately became intolerable, and even dangerous,

owing to the working of coal-burning locomotives up the heavy gradients, plans were made in 1909 to electrify the tunnel section. A hydro-electric plant was built in one of the canyons, and four three-phase locomotives were purchased. Transmission of three-phase alternating current is easy and convenient, but two trolley wires in addition to the rail return are needed, and three-phase locomotives operate at a constant speed, in this case 15 m.p.h.

This plan worked well and it was decided to extend the electrification down the steep gradient, of rather more than 1 in 50, in order to use electric rather than steam helpers. The electric pushers would assist the steam locomotive up the gradient and then they would pull the train with steam off up through the less severe gradient through the tunnel. Sufficient power for this plan was not available at the hydro-electric plant, however, and variable-speed locomotives were needed to work with the steam power. For these reasons it was decided to try a completely new system, in which alternating current at a pressure of 11,000 volts is supplied through a single trolley. The locomotives are of the motor-generator type, the 11,000-volt supply running a synchronous motor which in turn operates a 600-volt direct current generator supplying the traction motors. The use of direct current permits more flexible control of motors and so of speed, and to-day powerful electric locomotives haul over the tracks giant trains of more than 100 wagons, similar to that seen in the heading to this article.

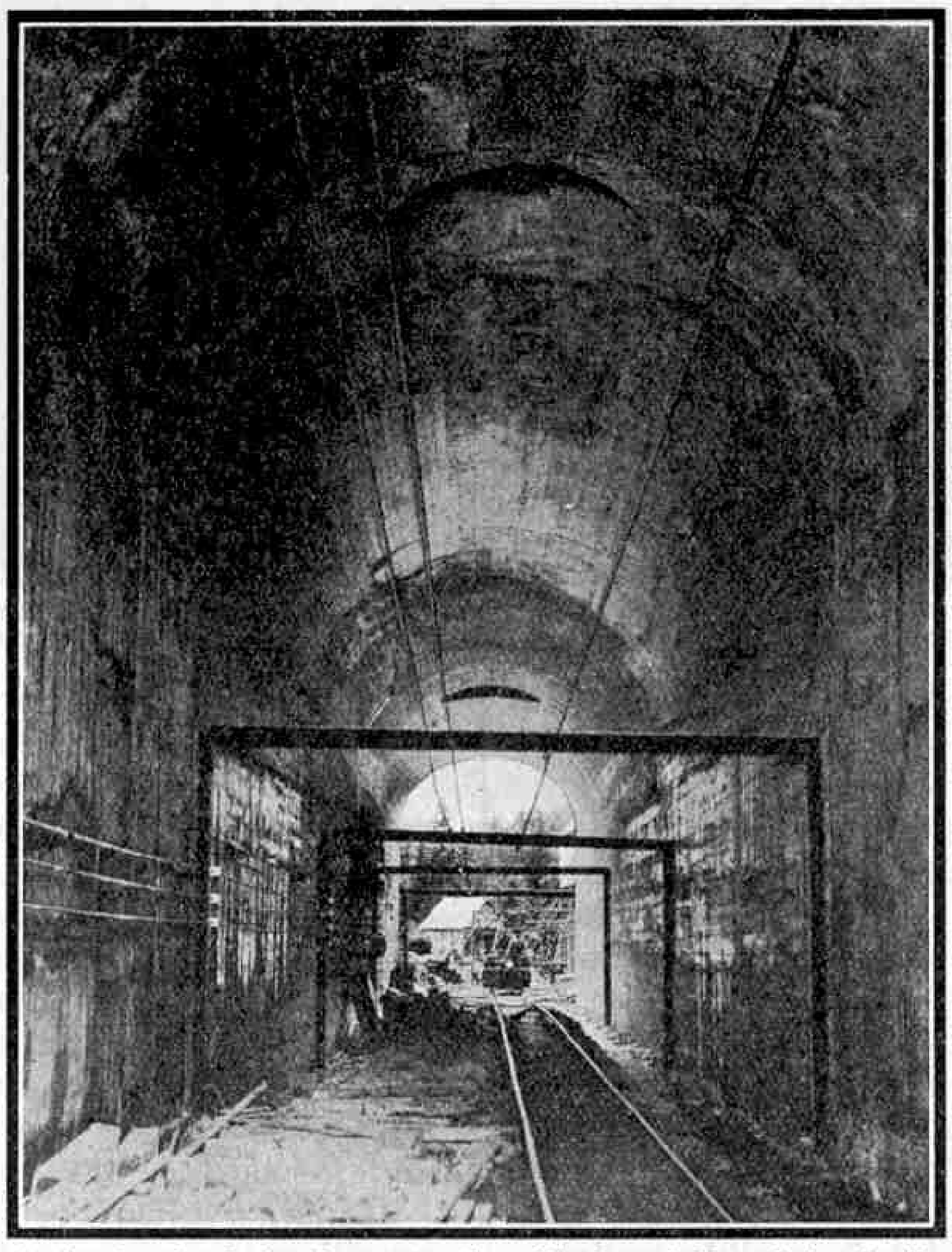


The "Empire Builder" hauled by an electric locomotive emerging from the Cascade Tunnel. For the illustrations on this page, and that reproduced at the head of the article, we are indebted to the Great Northern Railway.

Even so the Cascade crossing was very bad, having high curvature, and heavy gradients, and being subject to snowslides in winter, although there was little or no evidence of possible snowslide trouble when the route was selected. Forest fires cleared the mountain sides of protecting trees, however, and masses of snow could then slide down. Sheds were erected over the tracks and solved the problem for a time. Then more and more sheds became necessary, until in 1917, the only solution seemed to be the construction of a long tunnel. The Great War interrupted this plan, and when the War was over, the effect of it and of the new Panama Canal, which was taking away considerable traffic, made this plan unreasonably expensive.

Meanwhile, the snow sheds began to require replacement at a cost of 210 dollars, or roughly £42 a foot, and their total length was 40,000 ft. So Frederick Mears and, later, Mr. Stevens were sent out to discover a route through the mountains that would eliminate the dangerous snow slides, and would reduce the ruling gradient. After an exhaustive study of the territory, in the summer of 1925, Mr. Stevens reported that a 8-mile tunnel line was the only project that could be justified. Unfortunately this did not avoid the 1 in 50 ruling gradient, of which there were five miles against westbound traffic and 11 miles against that bound east, but with electrification many of the objections to such a gradient would be eliminated.

The plan had the advantage of replacing 43 miles of winding line by 34 miles of easy high-speed electrified railroad, and was approved at the close of 1925. The new line was opened for service in January 1929. Its most spectacular feature was the Cascade Tunnel, the construction of which was described in the *"M.M."* in October 1931. Later in the year a new de-luxe train, named the *"Empire Builder"* in honour of James J. Hill, was placed in service, reducing the running time from Chicago to Seattle by five hours. The present timing of the *"Empire Builder"* between Chicago and Seattle, a distance of 2,196 miles, is 58¾ hours westbound and 56½ hours eastbound. These times are made possible by the use of powerful "Mountain" and "Empire Builder" types of locomotives.



An interior view during the construction of the Cascade Tunnel, showing the concrete lining and temporary narrow-gauge track. This tunnel is eight miles in length, and is the longest in America.

The *"Empire Builder"* leaves Chicago at the foot of Lake Michigan on its run to the coast. On the first morning out, St. Paul, the capital of Minnesota, is reached. The Mississippi River is then crossed on a fine old stone arch bridge, and the other "Twin City," Minneapolis, is reached. This is a city of great flour mills, and its site was determined by the presence of falls in the river that supplied water power.

For a time the line follows the Mississippi River. Then it breaks away westward, and the names of several of the towns passed through have interesting associations. There is Melrose, so named because the position reminded its founder of Melrose Abbey in his native Scotland. Another town is named in honour of La Verendrye the explorer who in 1783 was there looking for a river leading to the Pacific. Near Verendrye, to the right of the track as the train approaches the high bridge crossing the Mouse River, can be seen a granite globe dedicated in 1925 by the Upper Missouri Historical Expedition to the honour of David Thompson, an English geographer.

In order to get a rough idea of the climbing done by the train, it must be remembered that Chicago is left at an altitude of 588 ft. on the first night. During the second night an altitude of 2,486 ft. is reached, and at Summit, Montana, the train is 5,213 ft. above sea level. This is high enough for railway travel, but is the lowest Rocky Mountain crossing north of New Mexico.

On approaching the mountains, a stone obelisk is noted near Meriwether which marks the farthest north point reached by Lewis and Clark on their pioneer exploring expedition at the beginning of last century. This is the beginning of the "real west," and huge mountains tower over the line from all sides. The "triple divide" in the main range of the Rockies is passed, and west of Spotted Robe, the tracks cross the highest bridge on the main line, 210 ft. above "Two Medicine River."

In the 170 miles after leaving Summit, the train drops 3,321 ft. Idaho is passed and the train enters Washington, a great fruit state near the centre of which the Cascade Range is crossed. The highest point of this crossing is in the great Cascade Tunnel and is 2,881 ft. above sea level. The terminus of the line is Seattle, and lines extend also to Tacoma, into Oregon and northward to Vancouver.

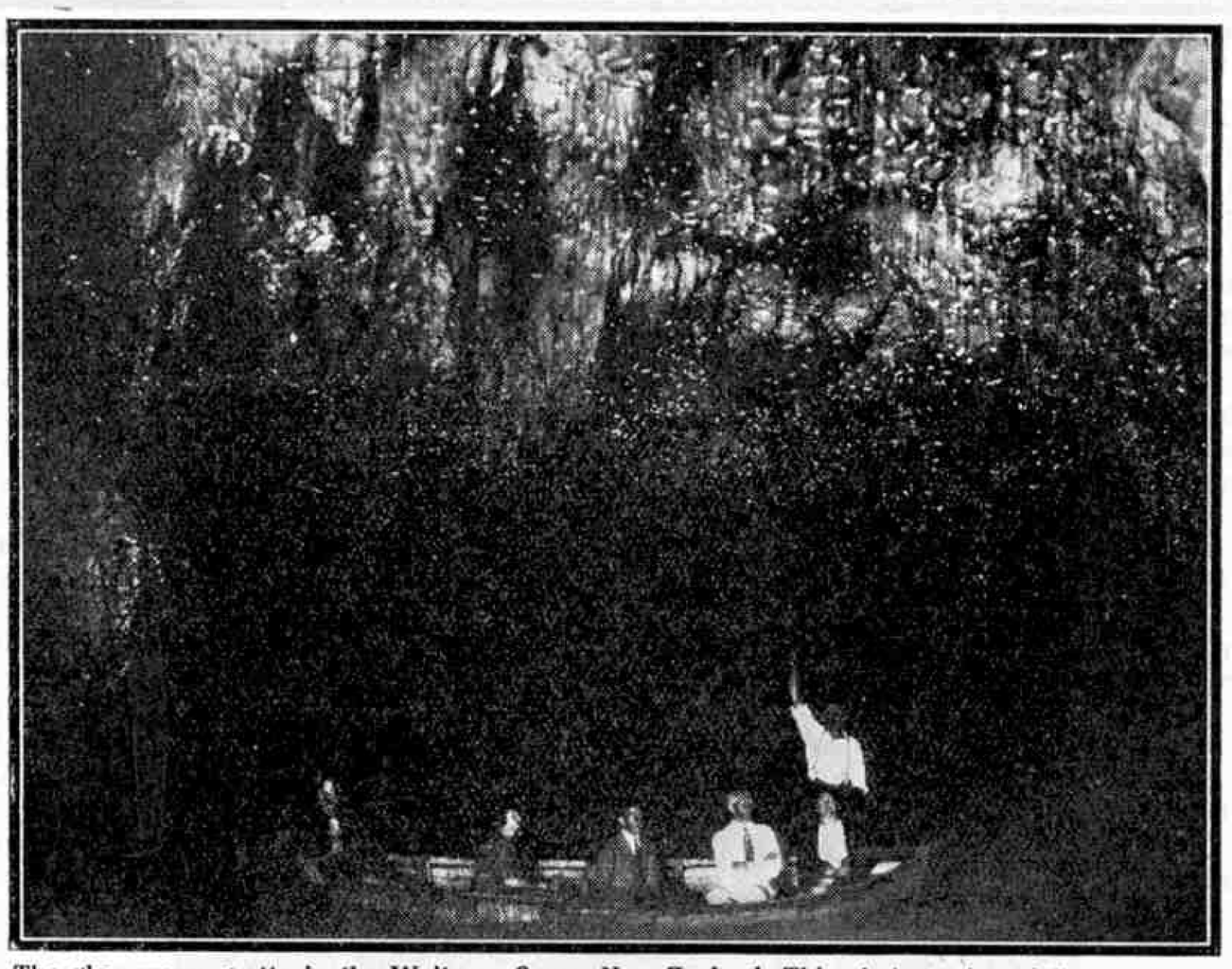
The Wonders of Waitomo

Grotto Lighted by Glow-Worms

By "Traveller"

THERE are many wonderful caves in various parts of the world, each with its beautiful limestone formations, both stalactite and stalagmite, but only at Waitomo, in the North Island of New Zealand, can a grotto be found that is lighted by glow-worms. The world-famous Waitomo Caves were discovered in 1879 by a Mr. Fred Mace, a surveyor with a great deal of courage and an inquiring mind. On paddling up a quiet stream in a beautiful valley bounded by high hills covered with thick scrub, he found that it suddenly disappeared into the hillside through a large entrance, looked on by the Maoris as "tapu," or sacred. He boldly passed through the opening and paddled on until he came to a great open shaft, reaching out far into the darkness above him.

Mace returned to the opening and induced the natives to bring wood, with which he constructed rude ladders. Assisted by these, and with candles as his only means of light, he managed to climb up 40 ft. to the caves above. Later the entrance which is now used was discovered. It is reached by a path that runs through thick and beautiful native bush.



The glow-worm grotto in the Waitomo Caves, New Zealand. This photograph and the upper one on the opposite page are reproduced by courtesy of the New Zealand Tourist Bureau.

The Waitomo Caves are situated in the centre of the North Island. The stream flowing down the valley is large, and is flanked by tall and stately totaras, and if it were not for the large and luxurious Government Hostel perched on the side of one of the hills bounding the valley, there would be nothing to suggest that here is a great tourist resort that every year is visited by thousands of people.

Just inside the entrance can be seen the shaft up which Mace climbed, and lights suspended in this show its almost perpendicular sides and give some idea of the relentless action of the water that has eaten away the rock to form it.

The caves are very damp and slightly muddy underfoot. The sides are of solid limestone, mostly in a greyish brown shade, and the visitor is surprised by the presence on the rocks of a small green moss or lichen. What keeps this green is not known; the only source of light is the electric lamps now installed, and switched on for about two hours daily.

From the entrance the guide led the party of visitors of which I was a member down through a very narrow and very low tunnel, descending into the bowels of the hill until a series of caves are reached. In one of these, bounded by glistening wet stalagmites of many fantastic shapes and reminding one of the ruined pillars and columns of some ancient city, a flight of steps runs down to the river. We were warned that there must be absolute silence, and then descended the steps to a small landing stage, beside which was moored a boat large enough to hold about 20 people, and dimly lit by a shaded lamp. The light was extinguished and the boat was gently moved off, propelled by the guide pulling on wires which are fixed around the cave.

Suddenly it seemed as though we had entered fairyland. The pitch darkness of the ceiling above was broken by myriads of pinpoints of light forming all sorts of fantastic shapes like the branches of trees, or the rows of street lights of a large city. The wonder and splendour of it all was almost indescribable. Silently the boat moved on until the glow suddenly ceased, and we found we had come to the very opening through which Mace entered the cave. Turning about, we again made our way slowly through the glow-worm grotto to the landing stage, where we reluctantly disembarked.

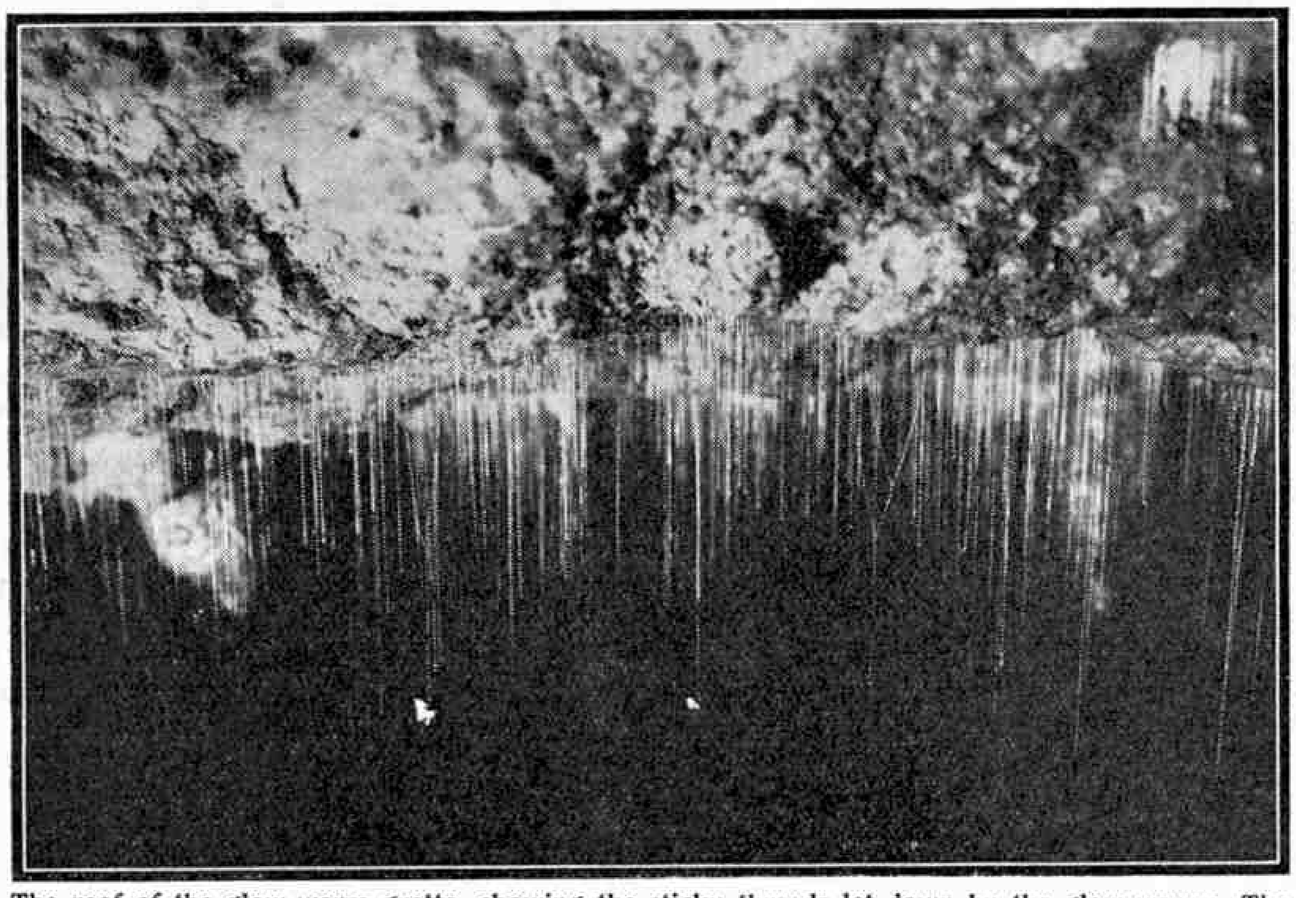
There are four stages in the life of the glow-worm responsible for this wonderful illumination. These are the egg, the larva, the chrysalis and the fly, the total period covered being about five months. The glow-worm larva, that is the grub or caterpillar, is slimy, fragile and dirty grey in colour, and has a skin so transparent that it is possible to see its internal organs. It makes a silk sheath, placed horizontally and saturated with a slimy liquid, and inside this contraption it glides backwards and forwards.

Hanging down vertically from the horizontal sheath are silken threads spun by the larva, and these are covered with little globules of mucus so that they resemble silver-headed necklaces. These threads vary in number and size. Specimens have been seen up to two feet in length and it has been estimated that some of the larva have had as many as 15 to 20 threads depending from the sheaf.

Now it is because of these threads that the glow-worm derives its distinctive scientific name, and indeed the

threads are its life centre, and are seldom destroyed except when an insect is caught in them.

The glow-worm larva is carnivorous and uses its light to attract insects to the vertical threads. The organ that emits the light is in the ultimate segment at the posterior-extremity of the larva, and is a gelatinous and semi-transparent structure, capable of great diversity of form. Scientists have long tried to solve the very intricate problem of the production of the light. All that can be said of it is that it is green in colour and does not give off heat rays. Whether its origin is chemical or otherwise, and how it is controlled are delicate questions that some day might be answered, when a new era in lighting even more wonderful than that of electricity, may begin.



The roof of the glow-worm grotto, showing the sticky threads let down by the glow-worms. The threads are used to catch the midges and other insects on which the glow-worms feed.

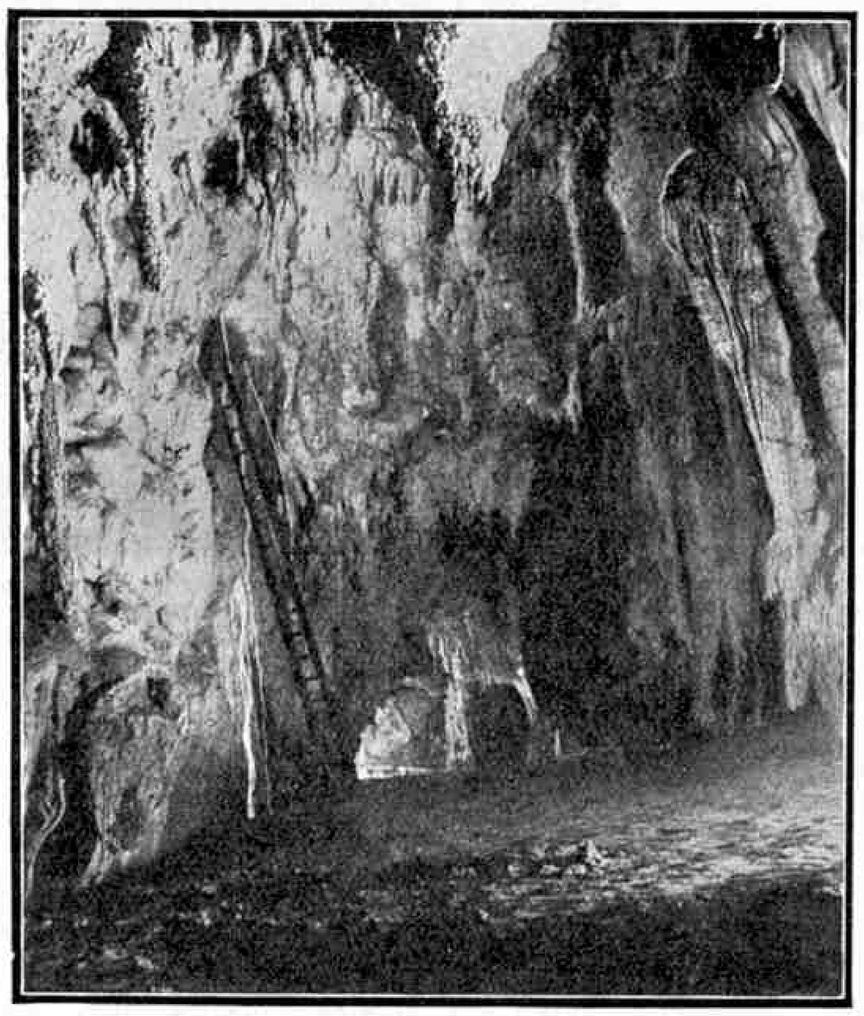
Tiny insects such as midges are attracted by the glow-worm's light, just as they are to a candle flame or other light in a dark place, and when one of them touches the threads it is lost beyond all hope, for there it sticks, struggle as it may. The vibrations caused by its efforts to break loose attract the attention of the glow-worm, which quickly winds up the hanging thread, as an angler winds up his line, and then eats and absorbs the catch.

The hanging threads serve the glow-worm in another way. They are so sensitive that vibrations caused by the slightest sound are registered. The glow-worm is thus warned of danger and then either dims or completely cuts off its light, over which it exercises remarkably effective control.

The glow-worm will be found only where there is an abundance of midges and the like. No place is more favourable as a breeding ground for these than the Waitomo Caves, for the banks of the subterranean stream are simply infested with grubs that live on the organic matter in which the mud is rich. These grubs are soon transformed into tiny midges, which emerge from the water and are attracted by the light of the worms, only to be snared in the silken trap. The hundreds of thousands of glow-worms in the caves are limited to that number for no reason other than the restricted roof space. If the cavern were larger it would still be draped with lights, and the reason for it all is the abundant food supply in the river mud.

When the glow-worm larva has reached its full size it re-absorbs all the hanging threads. For the first time it leaves the silken sheaf, hangs down from it, and then goes through one of the most mysterious and amazing experiences in Nature's wide realm, the change from a grub to a chrysalis. In that stage it retains its luminosity, but takes no food. In a few days there emerges from the chrysalis a perfect insect, a dainty dark-winged fly about twice as large as a mosquito, and not unlike a small daddy-long-legs. It shuns daylight and is seldom seen.

From the glow-worm grotto we passed on to inspect some of the limestone formations in the caves. In one small cavern vast stalactites and stalagmites have met to form a replica of a great pipe organ with light greenish limestone pipes. Behind this is a very large stalactite, with its corresponding stalagmite grown up to within a bare eighth of an inch of it. As far as can be measured the tips of these are no closer to each other than they were 60 years ago, when Mace discovered them, yet building is going on all the time. It is estimated that a cubic inch of limestone stalactite takes 300 years to form.

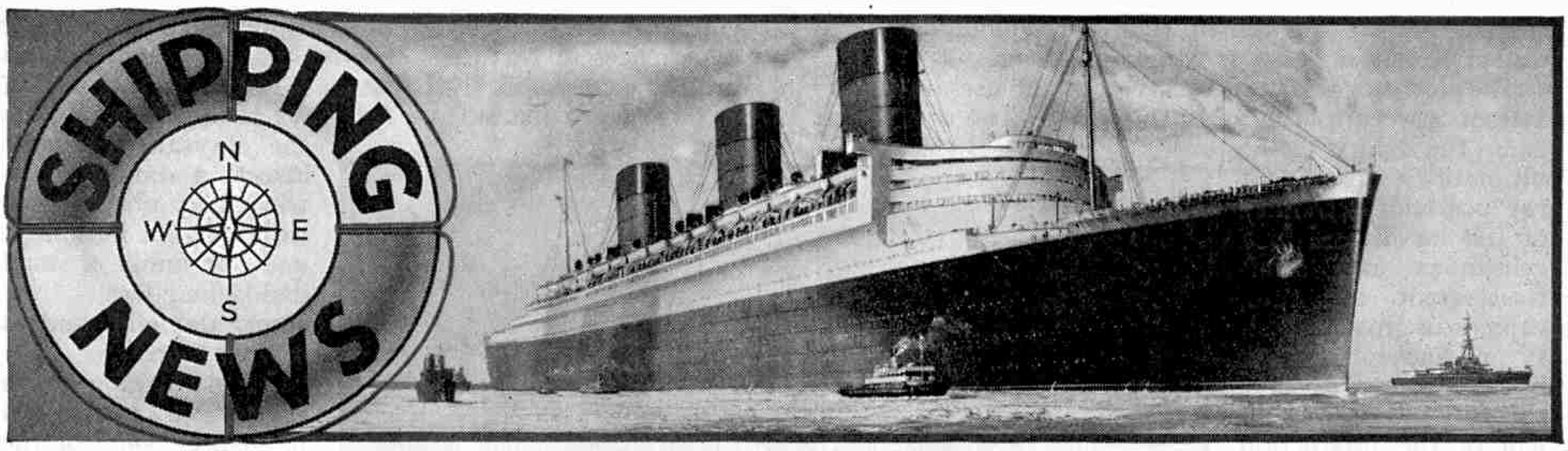


Waitomo Cathedral, a gigantic cavern with a domed roof. This cavern is one of the wonders of the Waitomo Caves.

Another marvel of Waitomo is the Cathedral, a vast and lofty cavern in which is faithfully portrayed the five orders of architecture. Its vast walls and ceilings look magnificent as the guide swings the large searchlight around in order to bring out their beautiful cream and pink tints. The acoustics are perfect, not a semblance of an echo being apparent, and it is possible to look from here along the roof of the cavern above the river and to see the thick mass of threads let down by the glow-worms. The light was switched off and we stood quietly while one after another the lamps of the glow-worms were lighted. The guide spoke, and all perceptibly dimmed.

The Cathedral is only one of the many wonders of Waitomo. The Blanket Chamber is no less remarkable. It derives its name from limestone formations that in texture and appearance imitate folded blankets so closely that the deception is only realised when the guide taps a fold gently with his stick. The rock then responds with a deep resonant note. Many of the stalactites throughout the caves produce a musical sound when tapped, some of them giving rich bell-like notes.

We passed through another series of narrow passages, formed by the waters rushing down to lower levels, and came out into the daylight again an hour and a half after entering the caverns.



Admiral's Barge for Royal Journey

On 27th April their Majesties the King and Queen, accompanied by Princess Elizabeth, proceeded in State down the Thames from Westminster Bridge to Greenwich, where they opened the National Maritime Museum. This is the first occasion for over 100 years on which a King and Queen of England have travelled on the Thames, and a new Admiral's Barge specially designed by Mr. Hubert Scott-Paine was used for their journey. This barge is of a design that is to be standardised for Naval Commanders-in-Chief of Home ports and Mediterranean stations, with a view to producing a boat suitable for all ceremonial occasions. The barge was escorted by a flotilla of the new 60-ft. motor torpedo boats, representing the newest arm of the Navy. The six craft of which this flotilla consisted are capable of travelling at nearly 40 knots.

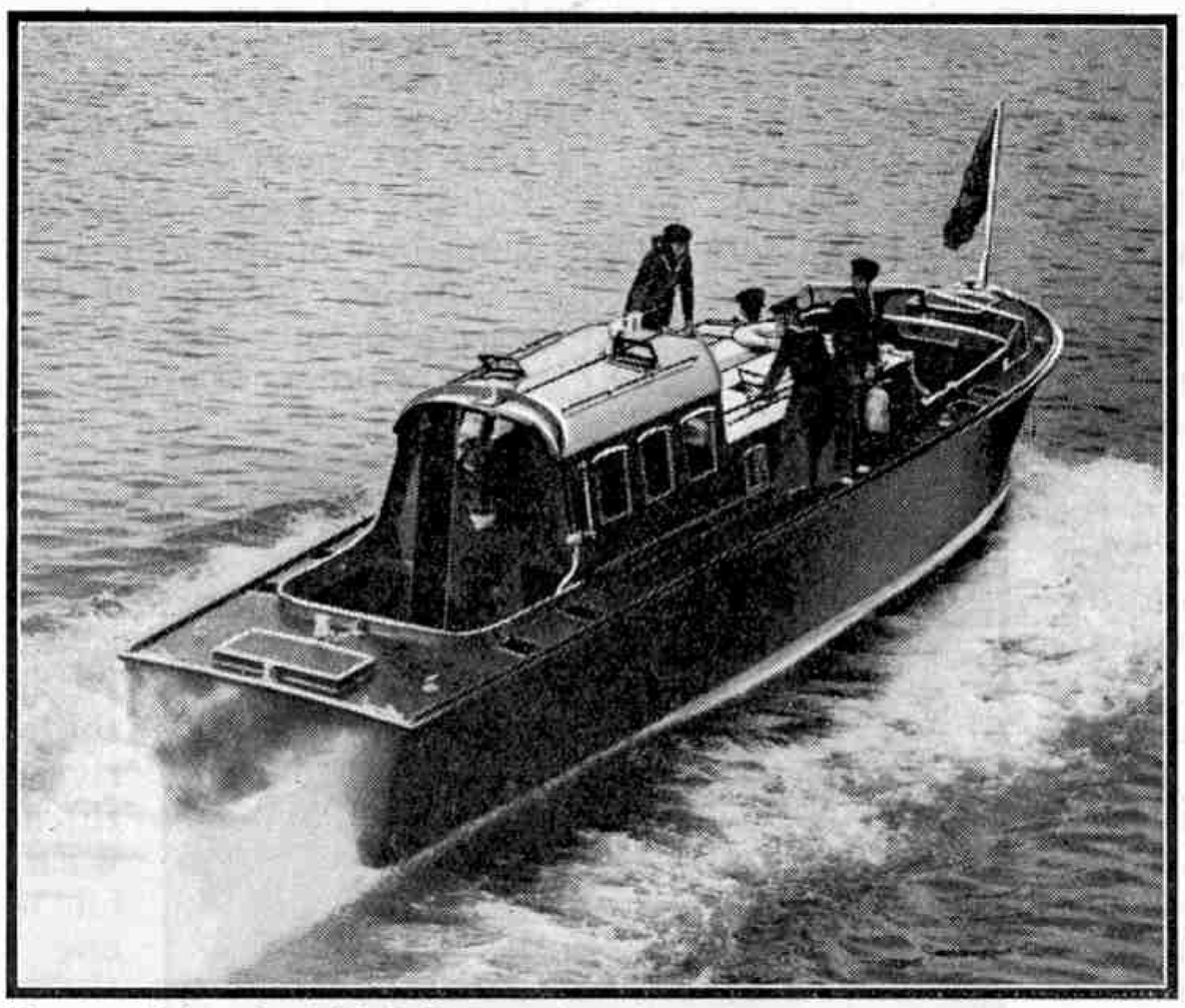
The new barge was built by the British Power Boat Company for the Commander-in-Chief of the Nore, Admiral Sir Edward R. G. R. Evans. It has a length of 45 ft., a beam of 9 ft. 6 in., and a draught when normally loaded of 2 ft. 9 in. The displacement is 6¾ tons. Three standard "Power Meadows" engines are fitted, each of which develops 100 h.p. They are controlled by means of "Power Bendix" gear, in which only one small lever about 6 in. long is used.

Passengers are accommodated in a large cockpit or well-deck forward, and a saloon. Immediately aft of the latter is the wheelhouse and engine room, beneath the floors of which are concealed the engines. There is another well-deck abaft the wheelhouse, and the stern compartment of the boat contains the petrol tanks and rudder heads. The boat is luxuriously fitted out, in keeping with the dignity of the Service. Her hull is green with a gold line, and has a varnished rubbing strake.

On trials, the barge ran from Southampton to Chatham in 10 hrs. in spite of adverse conditions, and a speed of 26.8 knots was attained.

* * * * *

On 18th April the Italian pilot Cavmagnani set up a world mile record of 112.6 k.p.h. or 69.92 m.p.h., for motor-boats of 400-kilos. The previous record made by the same pilot stood at 69.27 m.p.h. The trials took place on Lake Maggiore near Arona.



The new triple-engined Admiral's Barge in which their Majesties The King and Queen, accompanied by Princess Elizabeth, proceeded down the Thames in April. Photograph by courtesy of the British Power Boat Co., the builders of the barge.

The Eastbourne Life-Boat Museum

The only life-boat museum in the British Isles was opened at Eastbourne on 22nd March by Sir Godfrey Baring, Bt., the Chairman of the Royal National Life-boat Institution.

The contents of the museum illustrate the developments in life-saving from shipwreck during the last 148 years. A series of 13 models shows the change in life-boat construction during this period. The first in this series is a model of *"The Original,"* the first life-boat, built by Henry Greathead at South Shields in 1789. This pioneer vessel was an open rowing boat made buoyant with cork. Other models are of the pulling and sailing life-boat of the 19th century, and of a steam life-boat propelled by jets of water. There are also models of six different types of modern motor life-boat, and five of these have been specially made by motor mechanics of the Institution, who are expert model-makers.

Air-cases, relieving scuppers, a propeller and capsizing switch and other parts of the life-boat are displayed in the new museum, and other exhibits show the contrast between the early cork life-belt and the modern kapok belt, and the old and new methods of calling out the crew and of getting a line to a wreck.

Building the New Cunard White Star Liner

Important changes as compared with the *"Queen Mary"* are being made in the design of "No. 552," the Cunard White Star liner under construction at Clydebank. These will make the new vessel more buoyant than her predecessor, and she is expected to ride the seas more easily and to develop a greater speed.

The side oil bunkers and water tanks that were a prominent feature of the *"Queen Mary"* are at a much lower level in the "552," and her centre of gravity accordingly will be lower, giving greater stability. An improved arrangement of the water compartments will enable these to act as anti-rolling tanks, and steadiness is further assured by the fitting of broad bilge keels.

The bow of the vessel will be similar to that of the *"Queen Mary,"* but the midship section and stern will be different. The shape of the stern has been designed to assist the four special propellers in giving maximum thrust with minimum vibration. The deck plan also incorporates departures. Experience with the *"Queen Mary"* has shown that when a ship fitted with a top-gallant forecastle, or short upper deck forward, is driven at high speed into a head sea, she takes a considerable amount of water and spray over her bows. The new vessel will have a flush foredeck, crossed by a massive steel V-shaped breakwater. These variations in methods of construction and the modification of the layout of hull and machinery are expected to achieve a great saving in weight without any loss of strength.

The displacement tonnage, or total water-borne weight, of the vessel, will be less than that of the *"Queen Mary."* Her gross tonnage has been unofficially estimated as 86,000 tons, which is considerably greater than that of the *"Queen Mary"* or the *"Normandie."*

Giant American Floating Dock

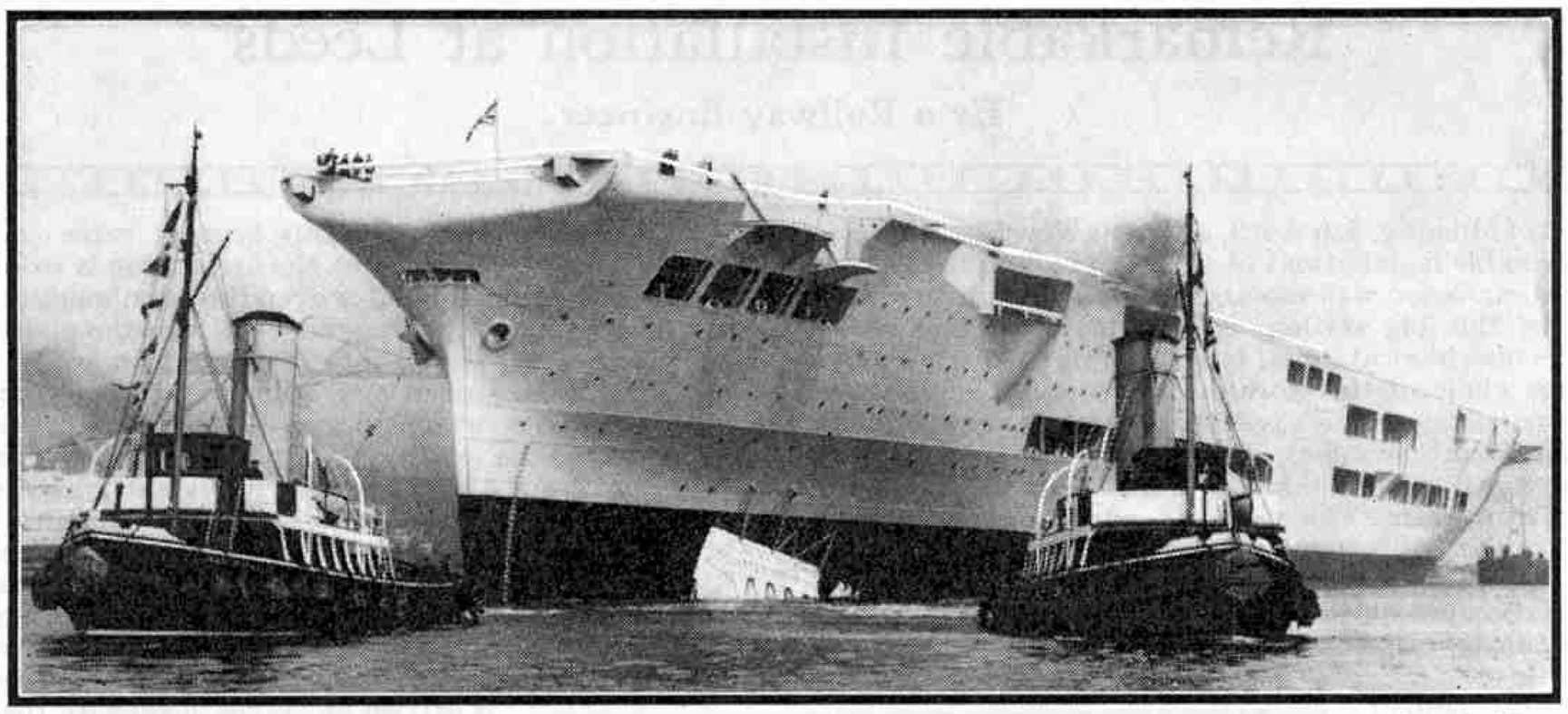
The United States Navy Department has ordered a new floating dry dock for Pearl Harbour, Honolulu. The dock, which will require some 30,000 tons of steel to build, will be 1,016 ft. long and 155 ft. broad, and will have a height of 75 ft. from the keel to the top deck. The displacement is estimated at 45,000 tons, and the dock is to be so designed that it will be possible to tow it at speeds up to 10 knots.

World's Most Modern Aircraft Carrier

The launch took place on 13th April at Cammell Laird's yards at Birkenhead, on the Mersey, of the aircraft carrier H.M.S. *"Ark Royal,"* the first British vessel to be designed specially for the large-scale operation of aircraft. The ceremony was performed by Lady Maude Hoare.

Few details of the vessel have yet been released, but it is known that she will have a displacement of 22,000 tons, a length of 685 ft., a beam of 94 ft., and a draft of 23 ft. Her armament will consist of 4.5 in. guns. It has been stated unofficially that she has stowage accommodation for about 70 aircraft, and that she will be driven by Parsons geared turbines, giving a maximum speed of about 30 knots. It is expected that she will have high-pressure water-tube boilers of the three-drum type.

The *"Ark Royal"* should be completed and delivered next year. She will be the first of three new aircraft carriers, the others, the *"Illustrious"* and the *"Victorious,"* being scheduled for completion in 1939. There are at present five British carriers in service, having a total capacity of 165 aircraft. These are the *"Courageous"* and *"Glorious"* (22,500 tons), *"Eagle"* (22,800 tons), *"Furious"* (22,450 tons), and *"Hermes"* (10,850 tons). In addition to these five is the *"Argus,"* which is mainly used as a floating base for "Queen Bee" radio-controlled aircraft.



The aircraft carrier H.M.S. "Ark Royal" in the Mersey after her launch. She is being towed to the fitting out yards of her builders, Cammell Laird and Co. Ltd. The photographs on this page are by B. and A. Fielden, Blundellsands, Liverpool 23.

Pilot Cutter for Mersey Service

A new steam pilot cutter named *"William M. Clarke"* was recently completed by Smith's Dock Co. Ltd., of Southbank-on-Tees, for the Mersey Docks and Harbour Board. The vessel has a length between perpendiculars of 155 ft., a beam of 30 ft., and a moulded depth of 14 ft. 6 in. She has been specially constructed with additional stiffening, and has a raked stem and a cruiser stern. Her triple expansion engines are supplied with steam by a single boiler with a working pressure of 200 lb. per sq. in. Telemotor steering gear is installed, and other equipment includes a direction finder and fathometer, or depth gauge. The capstan, boat hoist and other auxiliaries are all operated by steam.

The usual accommodation is provided for the officers and crew, and there are cabins for 36 pilots, with a dining saloon, lounge and large chartroom. Quarters are provided aft for 10 apprentice pilots.

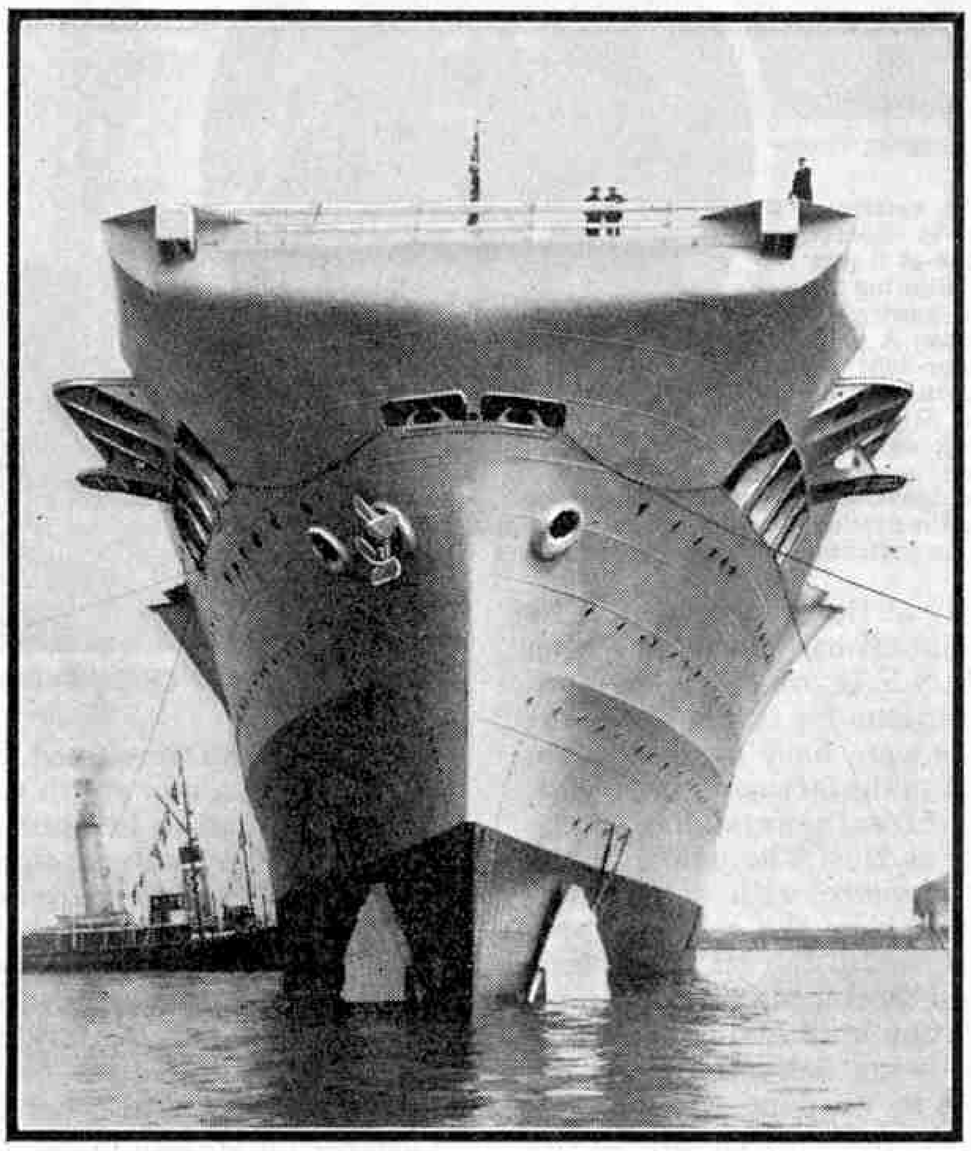
On her trial trip in service conditions over the Mersey measured mile, the *"William M. Clarke"* achieved an average speed of more than 12 knots.

Launch of S.R. Paddle Steamer

The new paddle steamer *"Ryde"* under construction by Wm. Denny and Bros. Ltd., at their Leven (Dumbarton) Shipyard for the Southern Railway was launched in April. This vessel is to join the present vessels in the company's service between Portsmouth and the Isle of Wight, the addition being made in view of the electrification of the S.R. London to Portsmouth line in July.

The *"Ryde"* has a cruiser stern, a promenade deck extending her full length, a single pole mast, and bow and stern rudders. Her length overall will be 233 ft., her breadth moulded 29 ft., and her deadweight tonnage, at 7 ft. 2 in. maximum draft, 130 tons. She will be propelled by paddle wheels operated by triple-expansion reciprocating steam engines that will give her a speed of about 14½ knots.

The number of passengers and crew carried will be about 1,080, and spacious accommodation is provided for the former.



A striking bow view of the "Ark Royal" showing her fine hull lines.

Heroic Rescues at Sea

The Royal National Life-boat Institution recently awarded two silver and two bronze medals to members of its crews. The first silver medal went to Thomas Sinclair, coxswain of the Aberdeen life-boat, and the bronze medals to the motor mechanic, Alexander Weir, and to John Mason, a member of the crew. Thanks on vellum were awarded to the five other members of this crew. These awards were made in recognition of gallantry in rescuing the crew of the steamer *"Fairy"* of King's Lynn, which was disabled in a gale. When the life-boat went alongside she was lifted by a sea right on the steamer's rail and then slipped backwards into the sea. She was taken alongside again, however, and rescued the *"Fairy's"* seven men in a few minutes.

This was one of five services by the Aberdeen life-boats in a period of 10 days, during which the worst gales within living memory at Aberdeen were experienced, and the south breakwater was washed away. During those 10 days the Aberdeen life-boats were on duty nearly 60 hours. For these five services the Institution has given the crews money awards amounting to over £100, in addition to the medals and vellums. Coxswain Sinclair, who has now been awarded the silver medal, won the bronze medal for gallant service on Christmas Day, 1935.

The other silver medal was won by George Leng, of Flamborough, Yorkshire, and thanks on vellum went to each of the eight members of his crew for their gallantry in rescuing 15 men from the Grimsby trawler *"Lord Ernle."* The coxswain, crew and the 46 launchers have also received money awards.

The call came at 11 o'clock at night when the tide was low and the life-boat had to be launched by hand over the sand and rocks, many of the launchers going into the sea up to their chests. The life-boat found the trawler close inshore, her bows touching the cliffs, north of Flamborough Head. Her stern was under water and she was being continually swept by heavy seas. The life-boat anchored and a line was fired over the wreck, but it took three hours to haul the 15 men from the wreck to the life-boat. This work was carried out first by the light of a bonfire of fishboxes and paraffin, lighted on the trawler's forecastle and when this burnt out, by the light of the coastguard's searchlight from the top of the cliffs 400 ft. up. Twice the line broke, and once the life-boat was flung by a heavy sea on to the trawler, and half of her rudder was torn away, but every man was rescued and the life-boat got back safely at 4.30 next morning.

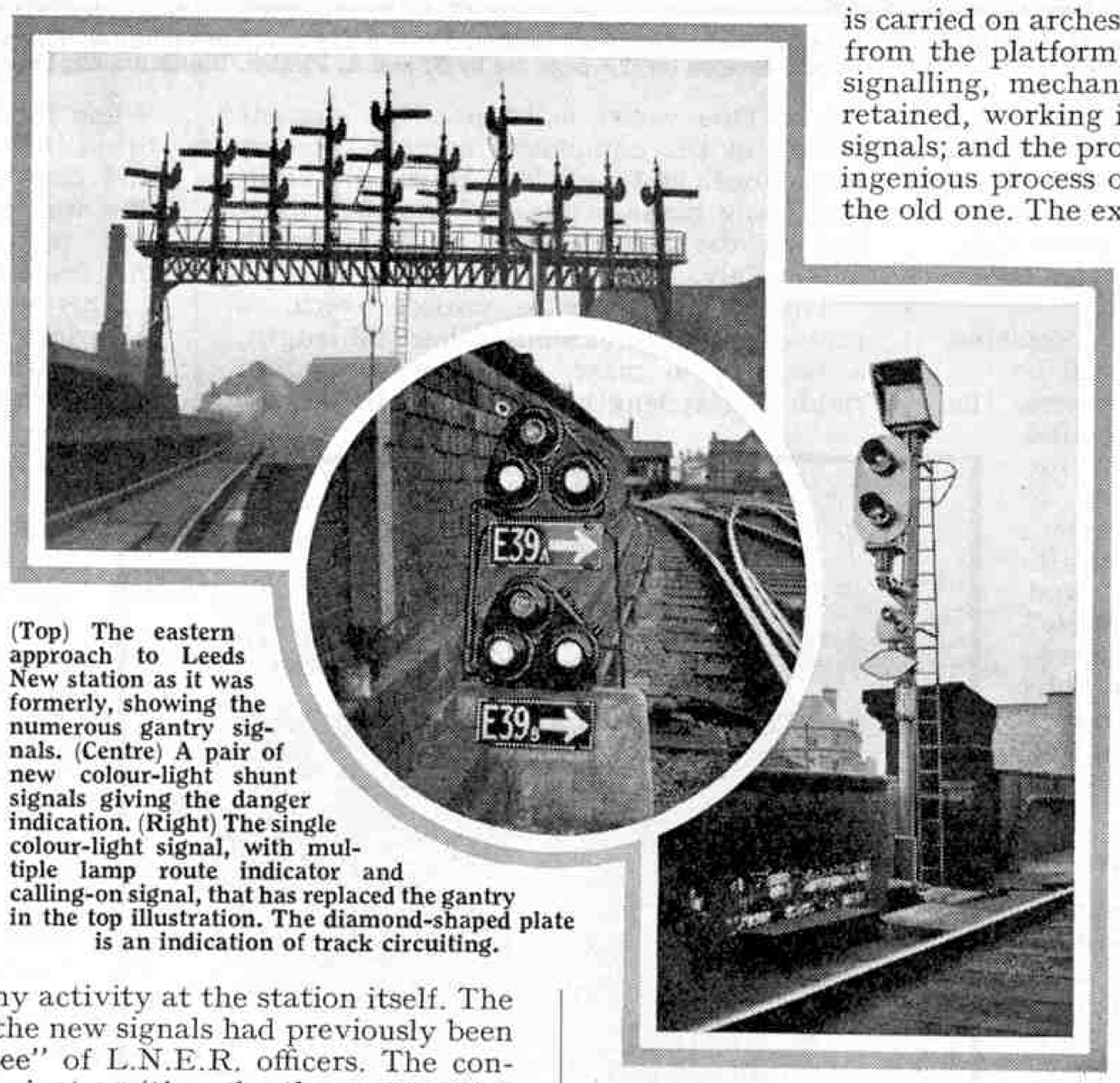
Signalling from a Control Panel

Remarkable Installation at Leeds

By a Railway Engineer

IN the early hours of Monday, 5th April, at Leeds New Station, one of the most remarkable installations of power signalling that have yet been put into commission was successfully brought into service. At the west end of this big station, which previously had been operated from three mechanical signal boxes having over 200 levers between them, the whole of the working was brought under the control of a single panel from which points and signals are operated by means of small thumb switches. The station handles a heavy traffic and the presence of a double-line bottle-neck at each end makes it difficult to operate. The manifold advantages resulting from bringing a complicated layout to a single control point will be apparent at once. I have written "single"; for although the east and west ends of the station are quite distinct from each other, and are operated from separate cabins, the master control in all cases lies with the West box.

No alterations were made in the track layout, and the actual signalling involved nothing more than the replacement of the existing semaphores by day colour light signals of the single lens, or "Searchlight" type, though very full use has been made of route indicators, in order to reduce the number of lights displayed. The whole station has been track-circuited, however, which, among other advantages, allows the progress of each train to be watched on one or other of the control panels. Also, by the provision of numerous ground lights, every conceivable shunting movement can now be controlled by signal indication, a big point in this particular layout. The contract for the work was awarded to Westinghouse Brake and Signal Co. Ltd., and we will now follow the whole job through, step by step.



(Top) The eastern approach to Leeds New station as it was formerly, showing the numerous gantry signals. (Centre) A pair of new colour-light shunt signals giving the danger indication. (Right) The single colour-light signal, with multiple lamp route indicator and calling-on signal, that has replaced the gantry in the top illustration. The diamond-shaped plate is an indication of track circuiting.

Work began just over two years ago, although at that time there was no evidence of any activity at the station itself. The exact location and height of all the new signals had previously been settled by a "sighting committee" of L.N.E.R. officers. The contractors selected the most convenient positions for the power point mechanisms, and soon the London offices were busy preparing the necessary designs. But the completion of manufacturing drawings, and the satisfactory settlement of all technical points, is only the beginning of a modernising scheme such as this. The whole of the work has to be done without any interference with traffic, and many other phases of railway activity such as the relaying programme, must be taken into account in organising its execution.

By the late summer of 1935 things were beginning to happen on the site; an advance guard of the installation staff had arrived and the first consignments of material were being delivered from the contractors' works. One of the first jobs to be done was the rail bonding; prior to the resignalling there were no track circuits in the station, and the whole of the permanent way therefore had to be prepared. The fishplates alone do not provide a good enough connection from one rail to another for the small electric currents used in track circuiting, and the ends of the rails are joined by galvanised iron bonding wires, except of course where one track circuit ends and the next begins, the rails there being insulated from each other by means of fibre plates. Other important preliminary work was the making of the concrete foundations for the new signal posts.

In the meantime the cable runs were being prepared. For all the external wiring paper-insulated lead-sheathed cable was used, all of which is armoured throughout its length with steel tape. With such excellent protection this type of cable can quite safely be buried under the ballast, as the armouring is stout enough to withstand a blow from a pick, or even the derailment of a wagon; but it is only buried when crossing the track. For the main longitudinal runs it is carried on steel slings supported on walls, the underside of platform facings, or at any other convenient place. At the various junction points, where branch cable runs are taken off across the track from the main length, circular disconnection boxes are used that from a distance look like giant mushrooms.

The first section of the job to be brought into service was that at the east end of the station, where the eleven tracks in the station itself converge to a double-line "bottle neck" that extends for nearly a mile past Marsh Lane, the first station out. From the constructional point of view the main difficulty was that no space whatever existed to build the new signal cabin, as the railway is carried on arches, level with the house-tops, right from the platform end. In this section of the resignalling, mechanical operation of the points is retained, working in conjunction with colour-light signals; and the problem of space was solved by the ingenious process of building the new cabin inside the old one. The existing mechanical locking frame was entirely re-arranged as a temporary measure, all the signal levers being grouped at the end nearest the station, and the points levers at the opposite end. The next step involved the replacement of that section of the original frame containing the points levers by a reconditioned frame of a similar type, and above this latter was mounted the new control panel carrying the thumb switches for operating the colour-light signals.

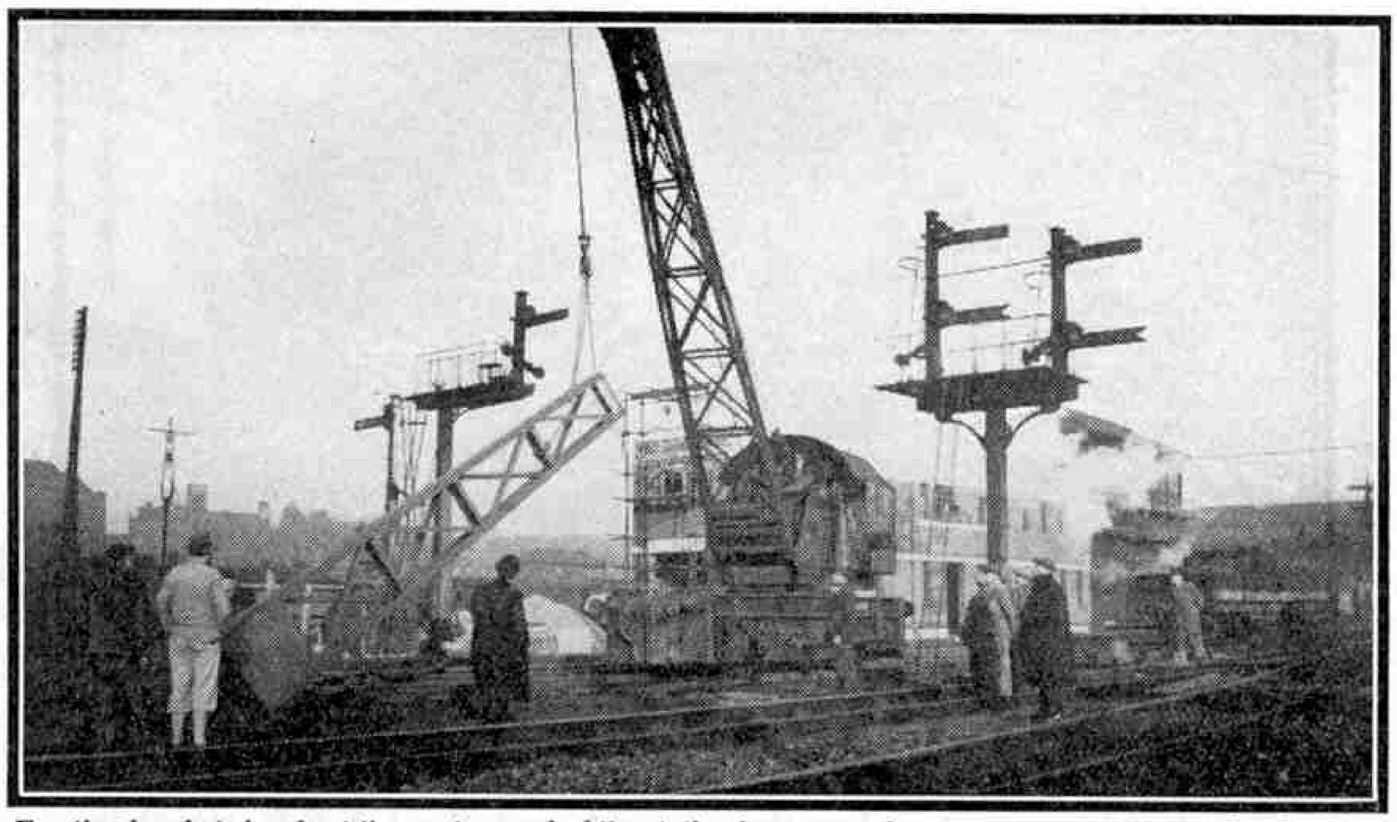
Preparations were then made for building the new west wall of the cabin, reducing the overall length of the building by rather over one half; this of course could not be done until the panel had been brought into service and the old mechanical signal levers disconnected. On the ground floor the wall was built up, and all the racks for carrying the control and interlocking relays were fixed in position. The north and east walls were rebuilt and a new south wall was constructed alongside the old. All this work had to be done without interfering with the operation of what is always a busy signal box, and indeed some of the constructional feats had to be carried out with the delicacy and precision of a surgical operation.

By the end of November 1935 a large number of the new signal posts had been erected. In the case of signals mounted adjacent to the track to which they refer, tubular steel masts are used. These present no difficulties in erection, for they are light and can be manhandled readily, but the large-overhang bracket posts that are needed for certain locations are an altogether different proposition. By the judicious use of sheer legs it is possible to erect them without the aid of power, but on this particular job a steam crane was employed.

On a Sunday in late November partial occupation of certain tracks was obtained and all these large structures were fixed. Each had been delivered from the contractors' works in two pieces, a latticed steel tower, and the overhanging brackets. In every case the tower was hoisted up so that it hung vertically from the crane, and then it was lowered very gradually on to the concrete foundation, where the fixing bolts were projecting upward ready to fit through the appropriate holes, in the base of the tower. Then one of the

erectors climbed up to the top, a plumb line was suspended, and careful measurement was made to see that the tower was dead vertical before the bolts were finally tightened up and the bracket hoisted into position.

It is now time to say something of the points operating gear, a good deal of which was in position by the end of the year. At the east end of the station, although the switches remained mechanically operated, it was necessary to fit electrical detectors. These are for the purpose of proving that the points are lying in the correct position, lighting the appropriate indication lamps on the control panel; and also to ensure that no signal can be switched to "all clear" unless the route is correctly set. These electric detectors are fixed in the four-foot way, and unless the points are fully home to within one-eighth of an inch no circuit is made and a signal reading over them cannot be pulled "off." In passing, it seems queer to refer to pulling-off in the case of a colour-light signal, but the old terms still linger, and one often hears the signals themselves called "sticks," just as though they were semaphores.



Erecting bracket signals at the western end of the station by means of a steam crane. The new signal cabin, partially complete, can be seen in the background.

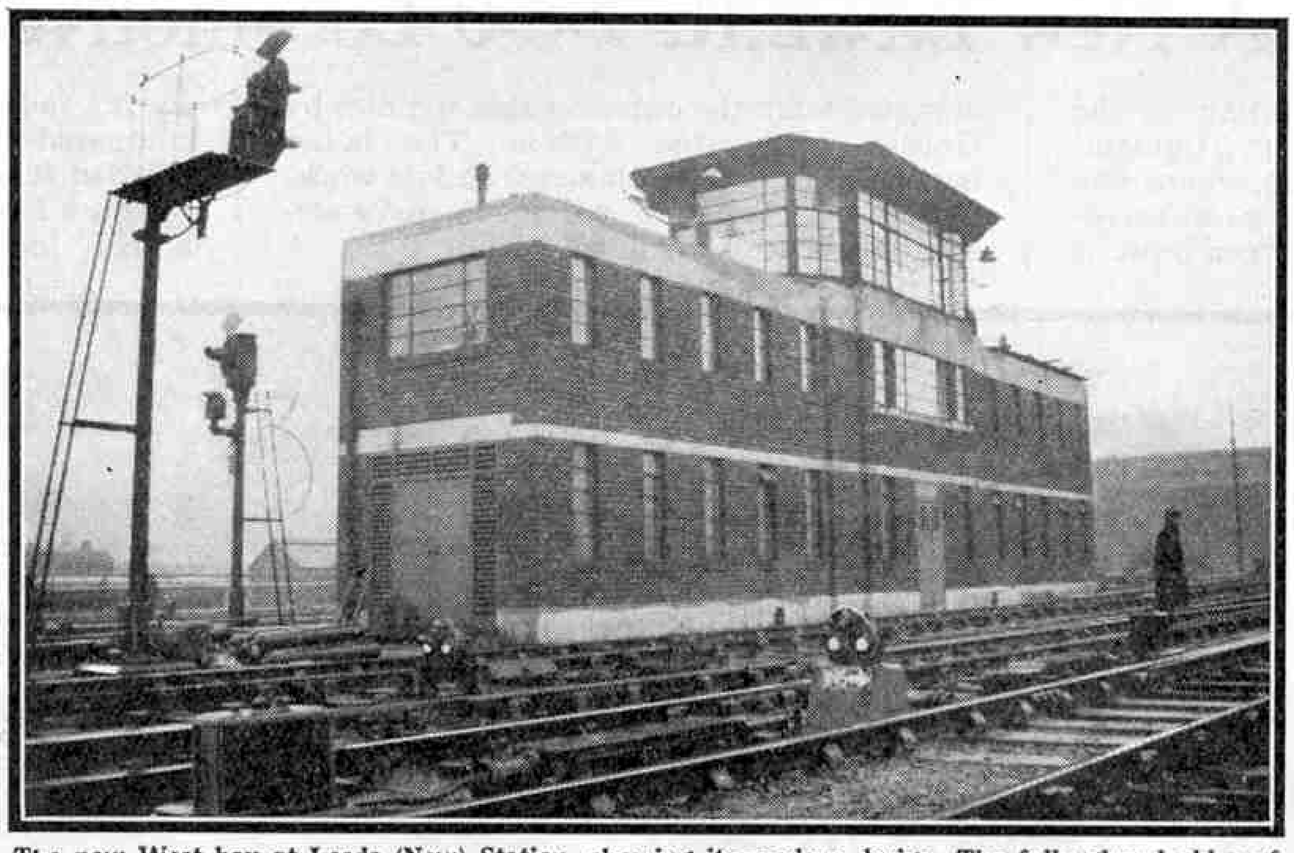
At the west end of the station all the points are worked electro-pneumatically. Powerful air cylinders working at a pressure of 70 lb. per sq. in. drive the switches by means of an escapement gear that ensures the points being unlocked, shifted, and then re-locked in the correct sequence. To the switch blades are coupled the electric detectors, just as at the east end. There are altogether 64 pairs of air-operated points all of which are fed from a compressor plant housed on the ground floor of the West signal box. Some of the most complicated changeover work occurred in connection with the fitting of the points, because the new rods had to be got into position and then temporary mechanical connections restored so that the station could be worked normally until the time came for the final changeover. The most awkward cases were those points fitted with a facing-points lock and electric detector in the four-foot. After the new gear had been put in, and mechanical fittings such as wire detectors, wheels, and lock plungers restored temporarily in the most convenient positions available, there was virtually a double set of equipment between the rails, and no little ingenuity had to be shown in the arrangement of the rodding.

In the original layout there were some tremendous runs of point rodding; it would have been a formidable business to alter, or slew these, and several pieces of new apparatus, the final position of which was fouled on this account, had to be fixed temporarily as near as possible to their final locations. They were moved to their final positions on the first Sunday after the new signalling was brought into service, by which time the old rodding had been cleared away. Some of the electro-pneumatic points valves had to be dealt with in this way. These valves, which control the supply of air to the points-operating cylinders, are of an ingenious design that cuts off the air supply the very instant the points are completely thrown, the actual admission of air being controlled by pin valves operated by electro-magnets.

The West cabin is a remarkable example of modern railway architecture. The control room, which forms the topmost storey, is quite small for the amount of traffic that is handled at the station, but this compactness is the outstanding feature of the whole re-signalling scheme. The control panel from which the west end of the station is operated is built in three vertical planes, of which the largest is only 7 ft. long by 4 ft. high. On this panel is displayed an illuminated diagram of the complete layout, and all the points and signals are worked from small thumb switches fixed at their correct geographical positions on the "map." The interlocking, which prevents a signalman from setting up any conflicting route, is done entirely by means of electric relays. Thus, if it is desired to shift any particular points, the necessary current cannot reach the points valve magnets before passing by way of a number of relays, the contacts of which prove that no opposing movements are signalled.

The panel itself is an instrument of striking appearance. The tracks are painted white on a background of matt olive green; two white lights indicate whether each track circuit is occupied or not; the light every signal is showing is repeated on the panel, and other lights show the position of each pair of points. But above all it is the size of the panel that leaves the most lasting impression; even with an all-electric locking frame the control room would require to be four or five times its present length. The panel includes also the block instruments for linking up with the adjacent signal boxes west of the station. These instruments are built into the main panel, and with their coloured dials and highly polished needle indicators they look extremely smart.

All four walls of the control room are glazed practically from floor to ceiling, and so provide an excellent bird's-eye view over the station yard. On the first floor, just below the control room, is a long gallery containing the interlocking relays, and in a similar room on the ground floor are housed the track relays and those used for points indication. The interior of the cabin is finished throughout in a very pleasing colour scheme of green and cream, while outwardly, smart and carefully executed pointing gives the building an appearance in every way worthy of the remarkable equipment contained within.



The new West box at Leeds (New) Station, showing its modern design. The fully-glazed sides of the upper portion give the signalmen splendid views of the tracks.

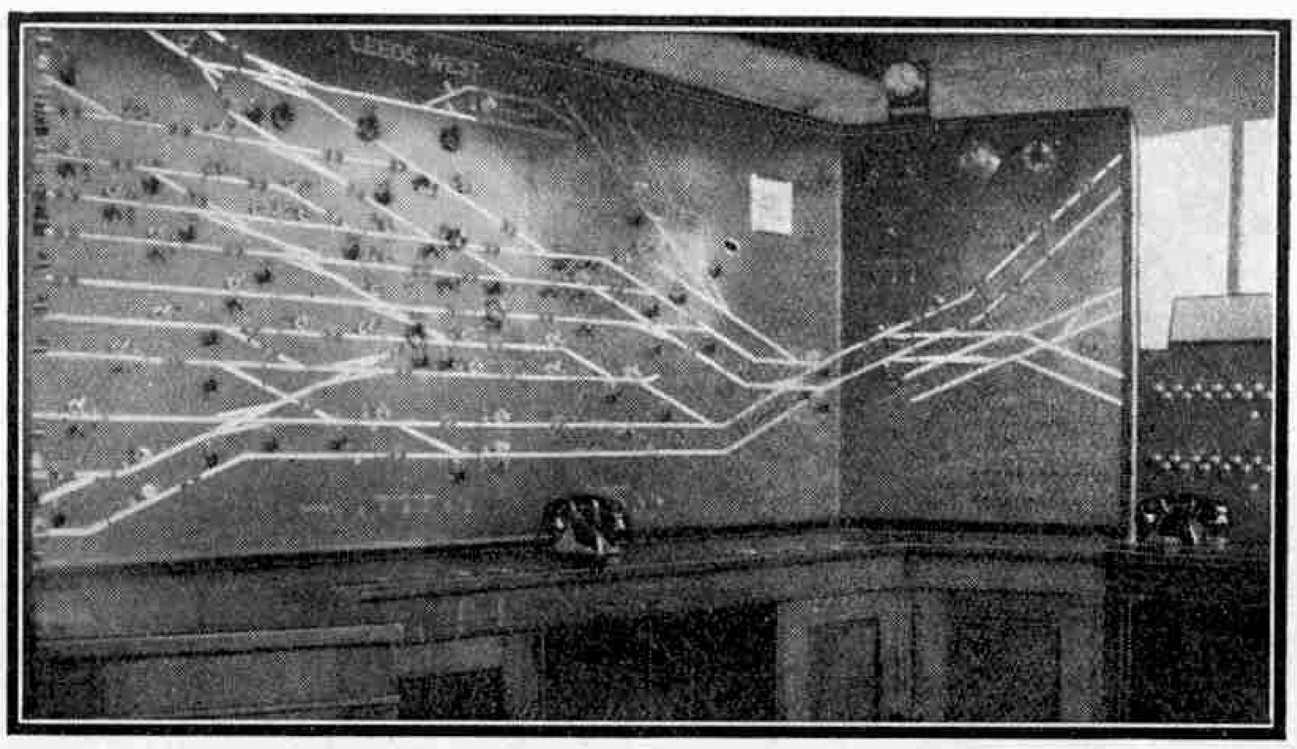
Needless to say, the bringing into service of such a job was an operation of the first magnitude. The new East box, and the signalling controlled from it, has been in commission since June 1936, but the changeover at that end of the station was on an altogether smaller scale to the task carried out on 4th April, 1937. The difficulty of the conversion was increased four-fold by the amount of demolition work to be done. The old West box, standing cheek by jowl with the new cabin, had to be completely dismantled, and this heavy work meant the presence of ballast trains, a steam crane, and the comings and goings of locomotives.

By 10 p.m. on Saturday, 3rd April, all was ready. The track circuits had previously been tried out, and their indication lights were showing up on the panel; the signals were all connected, but of course their lights were not yet switched in, and all control circuits had been thoroughly tested out. All the old mechanical signal arms had to be taken off, but by far the biggest job was the changing over of the points. Old mechanical fittings had to be disconnected, cranks, rollers, wheels taken up, and vast lengths of rodding cut and

cleared out of the way. Shortly after 11 o'clock little gangs of men were ready at their appointed switches, flares were blazing all over the station yard, and with the passing out of the last train work began in earnest. Loud speakers had been installed so that the men at the control panel could broadcast to any part of the yard, and as each pair of points was coupled up to the new electro-pneumatic machines, the points detectors were set, the switches thrown to and fro for the first time by power, and the indication lights on the panel checked with the actual position of the points.

This all sounds very simple, but actually it meant hour upon hour of patient tiring work. All the time the dismantling of the old signal cabin was in progress, many of the points could not be moved owing to the presence of ballast trains, and to add to the difficulties a drenching rain began about three in the morning and continued without a pause for over twelve hours! But in spite of this fully half the points were coupled up by daybreak on the Sunday morning. At each pair of points, when the fitters had completed their work and indication lights were showing on the panel, it was then necessary for each switch blade to be tested to see that it was electrically detected between the right limits. A pair of men engaged on this testing work signalled by much arm waving how they wanted the points thrown; normal, then reverse, and each time the men on the panel reported by loudspeaker what indication lights were showing. Then a wooden pole with a carefully shaped end one-eighth of an inch thick was placed against the stock rail, and the points were thrown again. The switch was nearly home, but still not quite; "no indication" now came from the voice on the loudspeaker. The electric detection was correctly adjusted.

By mid-day the old West box was razed to the ground, and the demolition gangs turned their attention to some of the signal gantries, which if left in position might have interfered with the sighting of the new colour lights. Oxy-acetylene cutters made short work of the latticed brackets, and incidentally provided some brilliant firework displays. About this time too the proceedings were brightened up by the arrival of a new "announcer" at the cabin microphone, when the engineer who had been testing out at the panel all night was relieved by a colleague; the latter coming on the scene as fresh as a daisy was soon broadcasting his own most infectious good humour. During the next hour the station yard echoed with monologues such as this: "One-three-six points next Jim. You can't have 'em just yet, we're track-loaded, but I'll tell you a funny story while you're waiting . . . . ."



Part of the control panel in the new West box. Thumb switches placed by the points and signals shown diagrammatically control the whole of their operation from the panel.

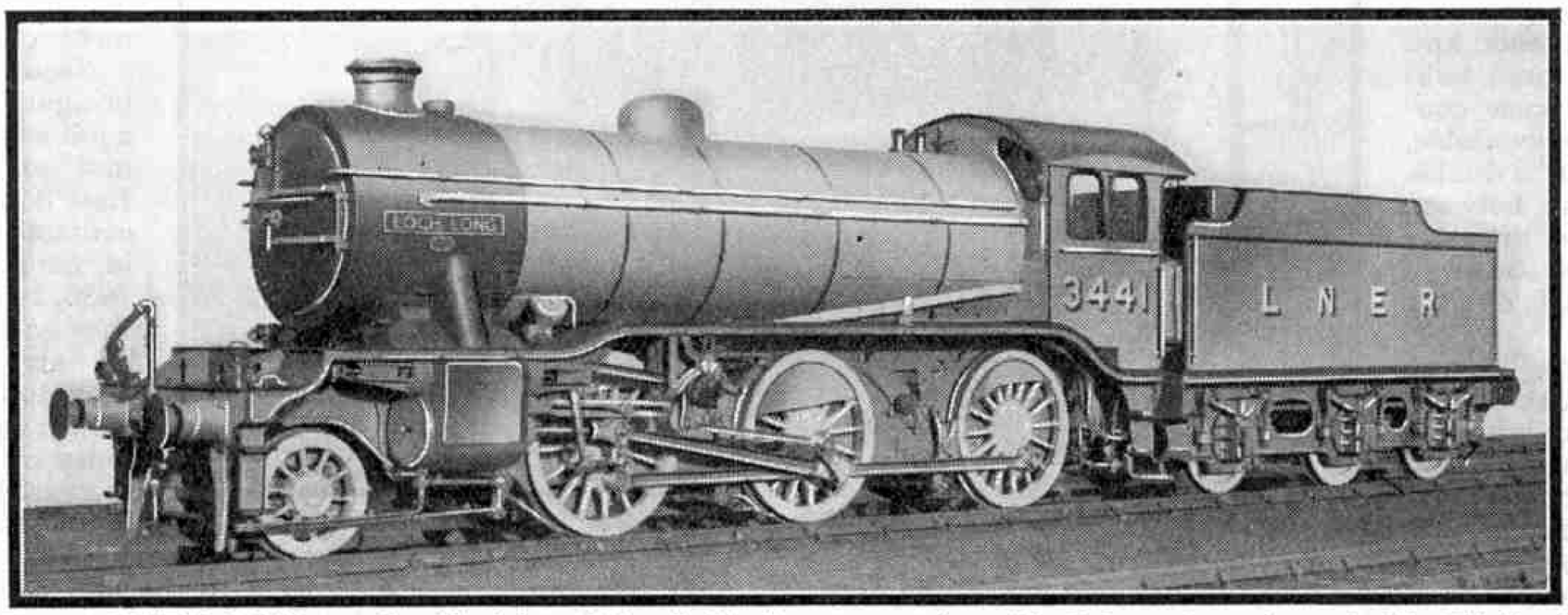
I should mention that practically all trains had been diverted on this Sunday, those of the L.M.S.R. going into Wellington Station and those of the L.N.E.R. into Central. By late afternoon all the points were coupled up and tested out, and the L.N.E.R. signal inspectors commenced a series of exhaustive tests. Every conceivable route was set up, the interlocking examined to see that protection was afforded and that no conflicting route could be set up. This part of the job was a lengthy business and lasted well into the night, but at 3 a.m. on the Monday morning, exactly to programme, the new signalling was handed over to the traffic department as satisfactory.

Since then the signalmen have quickly taken the measure of their new charge, and are using with skill and efficiency what is to them an entirely new method of operating. I have little doubt that in a very short time their verdict on panel working and colour-light signals will be much the same as that expressed to me by one of the signalmen at the East box, when I asked him what he thought of the new system. His reply, in the broad Yorkshire dialect, rang with conviction that was good to hear: "Ee, but it's champion!"

A New L.N.E.R. 2-6-0 Locomotive

IN order to avoid double heading on the heavily-graded L.N.E.R. West Highland line to Fort William and Mallaig, where axle loads are strictly limited, a new three-cylinder 2–6–0 locomotive has been built at Darlington Works to the design of Sir Nigel Gresley. The new engine is now at work, and bears the number 3441 and the appropriate name *"Loch Long."* It is classified as "K.4" in the L.N.E.R. locomotive list, and forms practically a smaller version of the very successful "K.3" 2–6–0 design originally developed on the G.N.R. and since adopted, with modifications, as a standard for L.N.E.R. construction.

"Loch Long" has three cylinders 18½ in. in diameter, with a piston stroke of 26 in., driving the second pair of coupled wheels. The piston valves are 8 in. in diameter, the outside valves being operated by Walschaerts valve gear. The inside valve is actuated from the outside valve spindles by Gresley conjugated motion. The boiler barrel is 5 ft. 6 in. in diameter and its working pressure is 180 lb. per sq. in. A 24-element superheater is fitted.



The new L.N.E.R. 2-6-0 locomotive "Loch Long," described in the accompanying article. It is now in service on the West Highland line for which it has been specially designed. Photograph by courtesy of the L.N.E.R.

A comparison between the "K.3" engines and the new "K.4" locomotive is of interest. The cylinders have the same dimensions, and the boiler pressure is identical in the two classes. The driving wheels in the new design are smaller, however, being 5 ft. 2 in. in diameter against the 5 ft. 8 in. of the "K.3" engines. The heating surface of the boiler of the new engine amounts to 1,732 sq. ft. and the grate area is 27.5 sq. ft., compared with the corresponding figures of 2,308 sq. ft. and 28 sq. ft. of the larger engines.

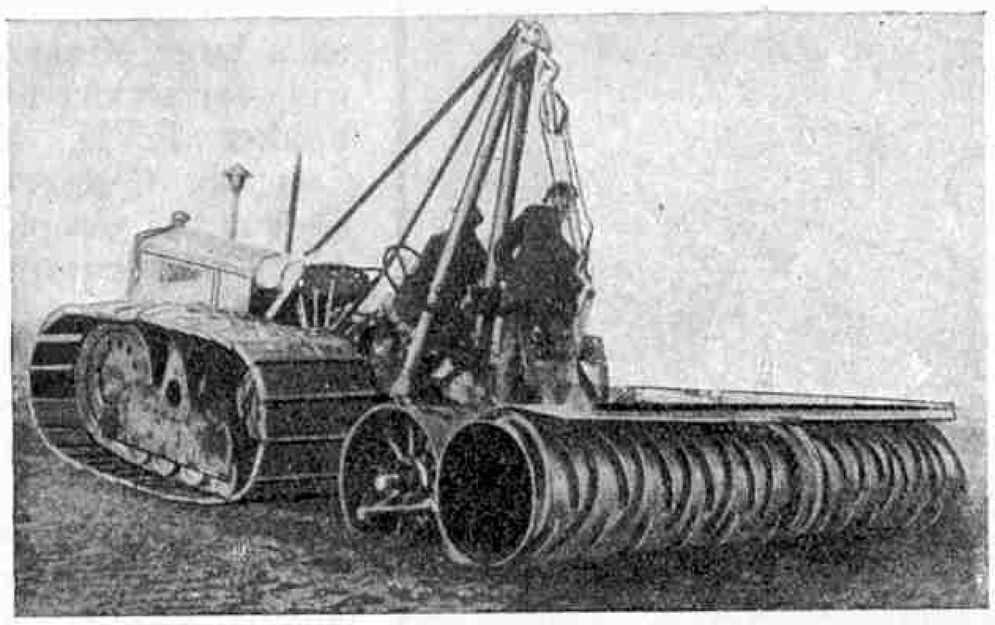
"Loch Long" is 4 tons 2 cwt. lighter than a "K.3" locomotive, weighing 68 tons 8 cwt. in working order. The smaller size of the driving wheels of the new design has an effect on the tractive effort figure; as the cylinder dimensions and boiler pressure are the same for each class, the difference due to the reduction of the driving wheel diameter is directly apparent. At 85 per cent. of the working pressure the tractive effort of *"Loch Long"* is 32,939 lb.; that of a "K.3" class engine is 30,031 lb.

The tender is of standard six-wheeled design and has a capacity of 3,500 gallons of water. It weighs 44 tons 4 cwt. full, and thus the total weight of the engine and tender ready for the road is 96 tons 4 cwt.

Machinery for Harvesting Peat

Drying and Pulverising Fuel from Bogs

SEVERAL interesting machines have been developed by Peco Ltd. for the harvesting of peat. This material is found in bogs, and has to go through several processes before it becomes a marketable product for use as a fuel or otherwise. In its natural state it contains 90 to 95 per cent. of water, and it is the elimination of this water content to the required extent that presents the difficulty of



producing peat fuel. From time immemorial the peasant, remote from other sources of fuel supply, has cut with a spade lumps of peat from the bog, stacking these in piles so that eventually the water drains and evaporates away and the peat becomes sufficiently dry to burn. Such a process on any considerable scale would involve prohibitive expense in hand labour and the product would be unsaleable in competition with coal or other fuels even where these alternatives are high in price due to distance from a source of supply.

If, after the draining of the bog, the peat with its then moisture content of 88 to 90 per cent. is cut by machinery and taken to a central factory for drying, the expense becomes prohibitive. It has been ascertained that to reduce the proportion of moisture in the peat by artificial drying to the required figure of, say 10 per cent., needs the consumption of more than the whole of the heat units contained in the peat. If it can be reduced by any means to approximately 50 to 55 per cent., however, then subsequent treatment in a factory becomes a practical proposition.

The machinery that has been devised by Peco Ltd. for the harvesting of peat has all been based on the reduction of moisture content of the peat to the lowest possible figure before the peat is actually sent to the factory. It has been found for instance that if the bog is first drained and the surface is then disturbed sufficiently to ensure the operation of the drying effect of wind and sun, then successive layers of the peat can be removed and despatched to the factory with only 50 to 55 per cent. of water in them. For the subsequent drying and treatment of the peat Peco Ltd. have designed novel apparatus and methods. Some of the special machines used have been built up from tracks, sprockets, idlers, weight-carrying rollers and other parts of Fordson Roadless tractors with very wide swamp shoes for operation over the bog, and supplied by Roadless Traction Ltd.

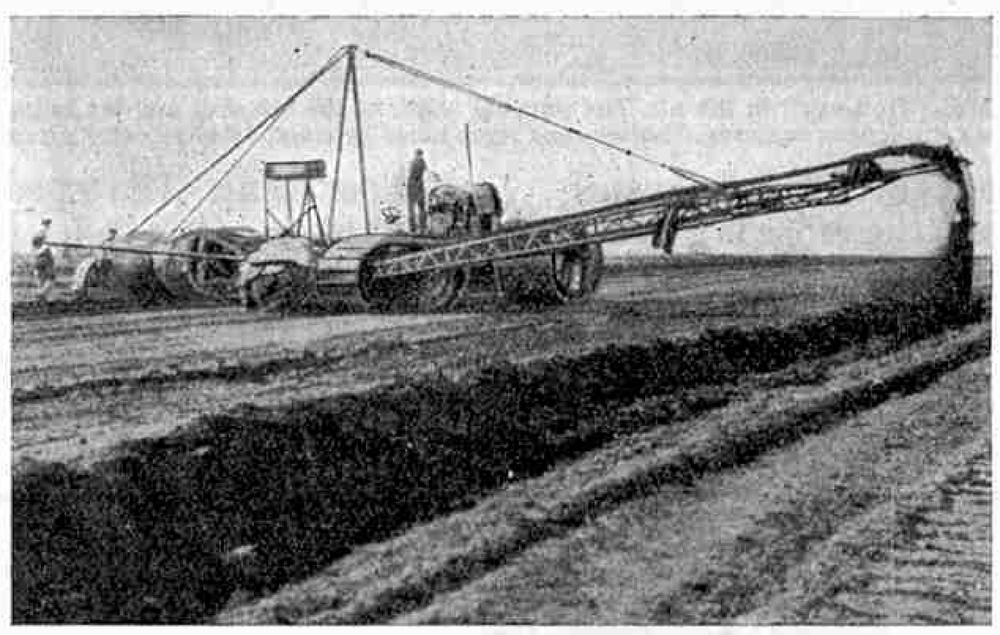
The first operation on the bogs is to provide drainage. Many experiments have been carried out with mole drains and ditching machines of various descriptions, tractor hauled. In the result the best method of all has been found to be the creation of open drains by means of a disc ditcher. The disc of this machine is 10 ft. in diameter and makes a ditch approximately 4 ft. deep and 4 ft. in width at the top. The ditches are cut at the rate of 100 to 250 yds. per hour. A feature of the disc is that on the concave side of it radial angle ribs break up the peat and distribute this over the surface behind the ditcher.

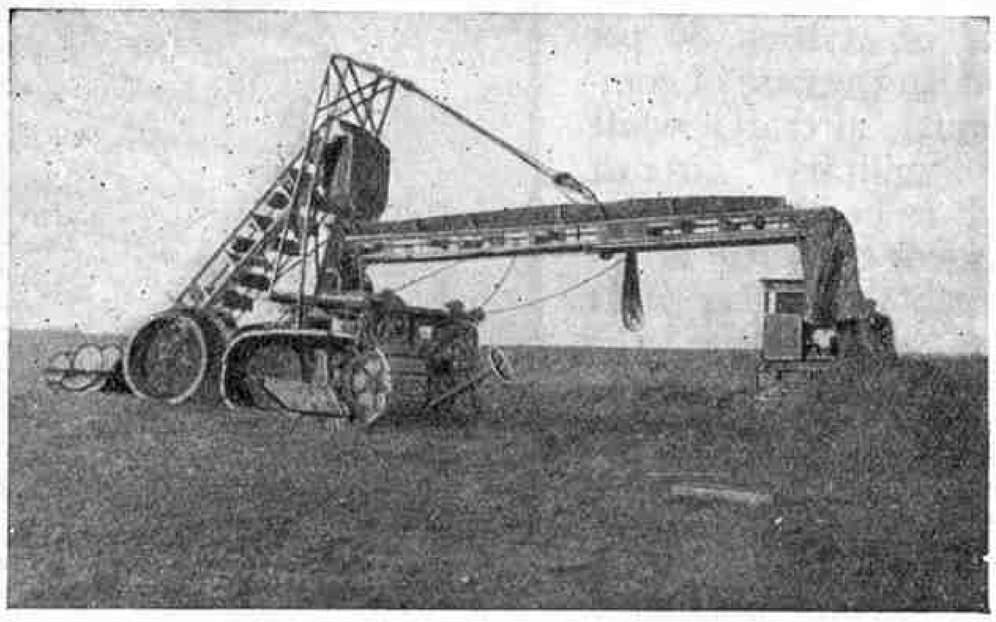
The ditches having been provided over the bog at regular intervals, the surface gradually becomes firmer and more easily operated over, and the next process is to disintegrate it to permit of further drying out of the peat by means of sun and wind. This can be done in many ways, such as by harrows of various types. One of the most effective ways is by means of the machine shown in the upper illustration on this page. This is a rotary miller hauled behind a powerful tractor. The way in which this miller would break up the surface of the peat is obvious from the photograph. As in the cases of the other machines devised for dealing with peat, the tractor hauling the miller is built up of various parts manufactured by Roadless Traction Ltd., such as rubber jointed track, sprockets, idlers and rollers, and is engined by a 75 h.p. Crossley Diesel.

When a surface layer of disintegrated peat has been created and dried out to the required extent, the next requirement is to collect this layer, to load it into trucks and transfer it to the factory. For this purpose a ridger has been devised. This is pushed over the bog by a tractor, the effect of the implement being to transfer thin surface layers of dried peat into a series of ridges. This is the first step in the transference of the dried peat in the direction of the railway line built at the side of the bog and connecting with the factory.

The next operation is to transfer the ridges of peat into one large ridge of material alongside the railway. For this purpose the harvester shewn in the central illustration is employed. This transfers the ridges of dried peat from the remote parts of the area progressively towards the loading point adjacent to the line. The method of operation of the harvester is to load the ridged peat by means of two Archimedean screws on to a conveyor belt projecting laterally from the harvester to a distance of 50 ft. nearer the railway line. In other words the ridge of dried peat is transferred bodily by the harvester 50 ft. nearer its destination. The capacity of the harvesting machine is 1,000 cu. m., or about 1,300 cu. yds. per hour.

In this manner the material for transmission to the factory is collected into one big ridge adjacent to the railway line, and the final operation is to pick up this material with the loader shown in our lower illustration, which transfers it to the railway trucks. As will be seen from the illustration, the tractor in this case carries in front of it two opposed Archimedean screws, which collect the material and deposit it in the buckets of an elevator. From this elevator it pours on to an endless belt, delivering it to a railway truck.





(Top) A rotary miller, which disintegrates and loosens the peat. (Centre) Harvester collecting dried peat into a single ridge. (Right) Loading railway trucks with peat.

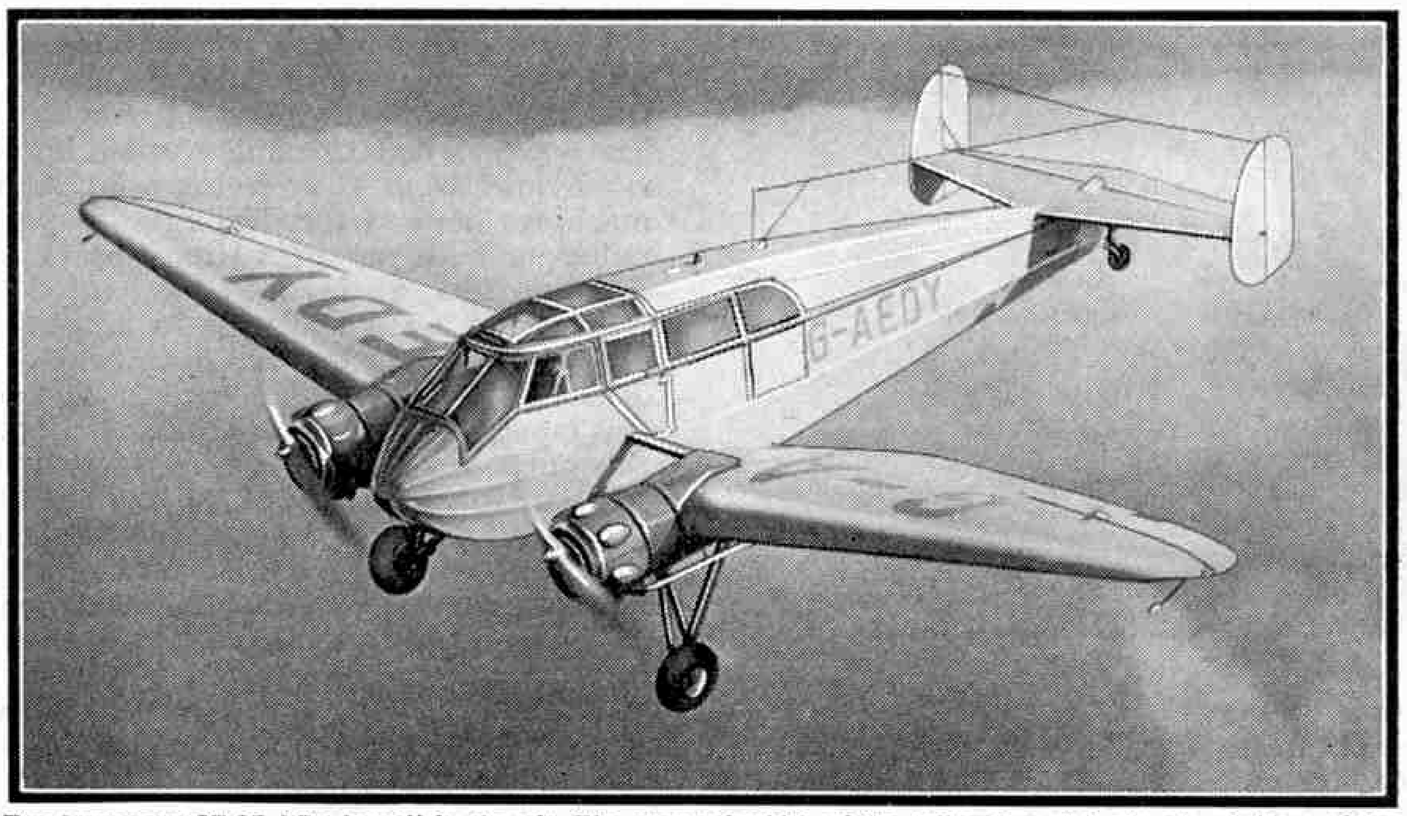
We are indebted to Roadless Traction Ltd. for permission to reproduce this article and illustrations from *"The Roadless News."*

Monospar Aircraft

Monoplanes with a Patent Wing Structure

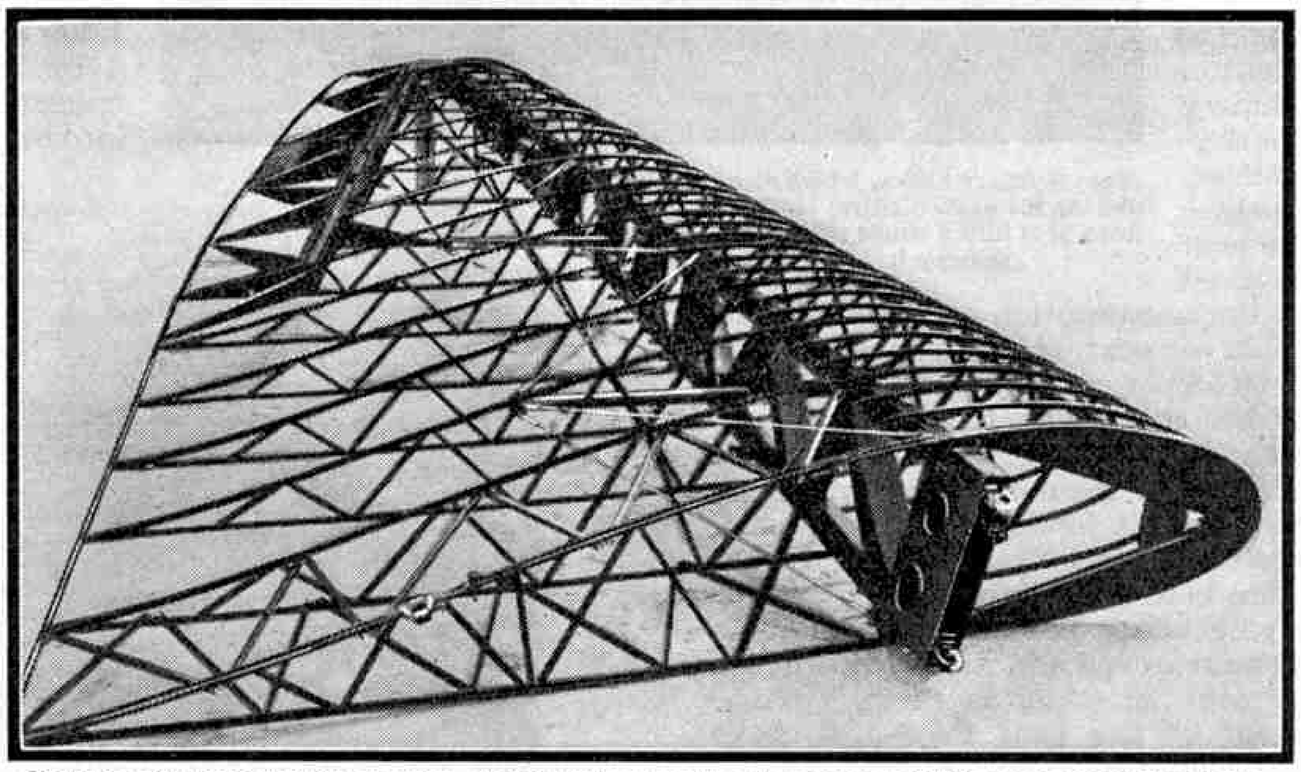
THE majority of monoplanes have cantilever wings, which are unbraced and are supported only at their junction with the fuselage. This form of structure has become popular with designers chiefly because it possesses great strength and can be made fairly light, and also because the absence of external bracing struts reduces the drag, or wind resistance, of the aeroplane.

An interesting development of this wing structure was made a few years ago by Mr. H. J. Stieger, a British aircraft designer who was chief designer to the Monospar Company and the General Aircraft Co. Ltd., now merged in General Aircraft Ltd. In the design Mr. Stieger introduced, only one spar is used in a full cantilever wing, and the name "Monospar" therefore is given to the system he worked out. This gives a substantial reduction of weight in the wing structure, and a greater payload, or additional military equipment in the case of Service aircraft, can be carried. A further saving in weight is obtained if the system is extended to the construction of the fuselage.



The Monospar ST.25 "De Luxe" in the air. The unusual width of the tail unit and the large windows of the cabin are conspicuous features. Photographs reproduced by courtesy of General Aircraft Ltd.

Actually the Monospar wing makes possible an increase in payload of at least 30 per cent. in the case of commercial aircraft, while for military aircraft such as bombers the increased capacity is invaluable, whether it is used to increase the weight of the armament or bombs carried, or to reduce the size of the fleet, or of the machines, previously required to meet certain demands.



Skeleton view of a Monospar wing, showing the general arrangement of this patent wing structure.

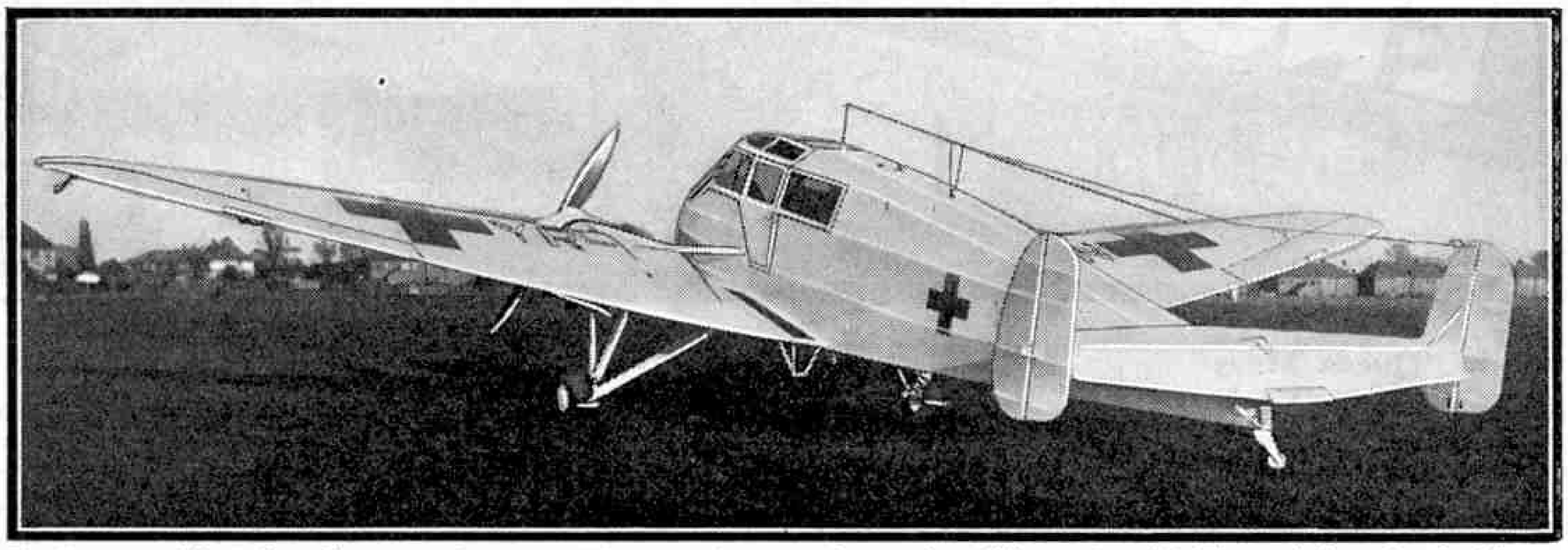
In a Monospar wing a single transverse spar carries a number of main ribs spaced apart. The spar is braced to resist torsion, or twisting effect, by means of rigid struts or wires arranged in pyramid fashion. "Former" ribs are provided between the main ribs in order to strengthen the fabric when the wing is covered. The use of fabric covering makes it easy and economical to maintain the wing in good condition, and provides quick access to the framework for overhaul and repairs to be carried out. The lower photograph on this page shows the structure of this patent type of aeroplane wing.

Soon after the introduction of the Monospar principle the Air Ministry became interested and ordered a large Monospar wing for service on a Fokker F.VII 3m. Carefully observed tests of the aeroplane when thus equipped confirmed the calculations of the designers in every way, particularly in relation to strength, stiffness and weight. The saving in wing weight effected was 39.2 per cent. and this was equivalent to an increase in payload of 37.7 per cent., or an extension of range of 43 per cent. The speed of the aeroplane was also increased by 10 m.p.h.

The Monospar system of wing construction was demonstrated by the company in an experimental aeroplane known as the ST.3, which was built for research purposes. It was a three-seater low wing monoplane of the enclosed cabin type, and had two 40/45 h.p. Salmson engines. The ST.3 was submitted to more than 1,000 hrs. of flying in the most rigorous conditions, and during that time officially observed terminal dives were made at speeds of more than 178 m.p.h., while aerobatics of all kinds were carried out. The machine also was taken-off, flown, and made to perform all normal manœuvres without difficulty with one engine shut off. In order to subject the structure to the most thorough test the ST.3 actually was flown with various component parts of the wing spar torsional bracing removed, and also with wing coverings slackened intentionally beyond the "unairworthy" standard. It came through the prolonged ordeal satisfactorily, and the data obtained during the tests has proved invaluable in designing subsequent Monospar aircraft.

Subsequently other improved Monospar aeroplanes were

produced, including the ST.10, in which Mr. H. M. Schofield, a director and general manager of General Aircraft Ltd., won the King's Cup Race in 1934. The ST.25 twin-engined 5-seater monoplane was added to the range of Monospar aircraft in the following year, and at first was appropriately called the "Jubilee." After the death of King George V it was re-named the "Standard." It had two 90 h.p. Pobjoy "Niagara II" engines, which gave it a cruising speed of 123 m.p.h., and was of all-metal construction with the exception of the fabric covering. It was followed last year by the ST.25 "De Luxe," "Ambulance," "Freighter" and "Transport" machines, all based upon the "Standard."

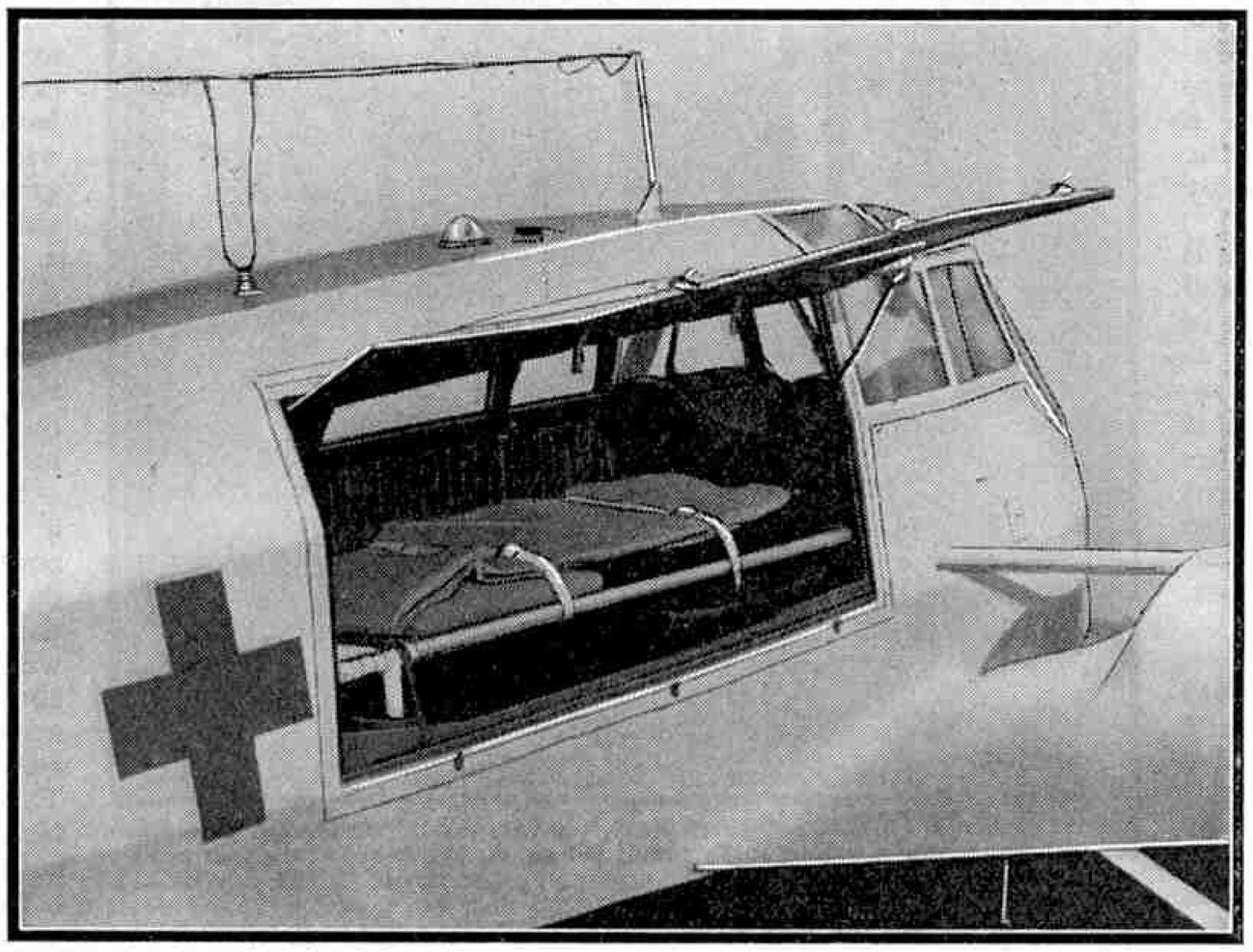


The Monospar "Ambulance" accommodates a stretcher case, doctor, and nurse, in addition to the pilot. The specially equipped cabin can be used as a dressing station when the aeroplane is not in flight.

The ST.25 "De Luxe" and the "Ambulance" are illustrated on these pages. The first of these machines is a luxury edition of the ST.25 and is ideal for the private owner who demands the fullest and best cabin equipment. Another reason for the suitability of the ST.25 in this respect is the small amount of hangar space it requires. The length of the aeroplane is 26 ft. 4 in. and the height 7 ft. 10 in., and when the wings are folded back the span is reduced from 40 ft. 2 in. to only 14 ft. 10 in. The wings and fuselage are built on the Monospar system, and the former taper both in chord and thickness from the engine nacelles to the tips. The wing centre section is built into the fuselage and forms a part of its underside.

The framework of the wings, fuselage, and tail unit are of metal, and all are covered with specially-treated fabric. The "chassis" of the fuselage consists of a shallow main girder, braced so that it has a high degree of torsional rigidity, and a tubular framework that forms the "cabin tray." The secondary structure is of light but rigid metal stringers. It is this construction that has made it possible for the ST.25 to be adapted to a number of purposes without entailing any modifications to the main structure. The tail unit has twin fins and rudders, an arrangement that is not usual on British aircraft. The entire structure is corrosion-proof and is capable of withstanding any atmospheric conditions to which it may be subjected, including operation over the sea. The undercarriage is of the fixed type. Pobjoy "Niagara III" engines are fitted, and enable the aeroplane to attain a maximum speed of 125 m.p.h.

The enclosed cabin is light and as roomy as possible in an aeroplane of this size, and the arrangement of the seating also makes for comfort. There are two seats in front, for either two pilots or one pilot and a passenger, and behind them is a double seat, with a fifth seat centrally situated at the back of the cabin. The Monospar "Freighter" is, as the title suggests, a non-passenger machine. In this version of the "Standard," the rear seats of the cabin have made way for a large compartment specially protected at the sides and provided with extra stiffening in the floor. The "Transport" model is specially furnished to meet the needs of the air taxi or small air line operator, and includes Sperry gyroscopic navigating equipment, and special remote control of the rudder and tail-plane.



The large horizontally-hinged door in the starboard side of the fuselage raised to show the stretcher in position in the cabin.

The Monospar "Ambulance" is the first British aeroplane to be specially constructed as an ambulance. Nobody could mistake the purpose for which this aeroplane has been designed, as it is finished entirely in white and bears a large Geneva Red Cross on each wing and on each side of the fuselage. Structurally the "Ambulance" is so similar to the ST.25 that it is unnecessary to describe it in detail. The cabin arrangements and equipment are of special interest, however, as they were designed under the auspices of the British Red Cross Society. The aeroplane is perfectly fitted for its special duties, and in its silent and roomy cabin a patient can receive attention in conditions of stability and comfort. There is comfortable seating for a doctor and a nurse in addition to accommodation for the pilot and patient, and the machine is so completely equipped that it is suitable for use as a dressing station when not in flight. Special cupboards and racks are stocked with medical stores and instruments, and a curtain hung behind the pilot ensures privacy for the patient.

Any type of ambulance must be easy to load. The Monospar "Ambulance" is excellent in this respect, for there is a large horizontally-hinged door in the starboard side of the cabin, and special loading arrangements are provided, so that a stretcher can be lifted through this aperture without tilting.

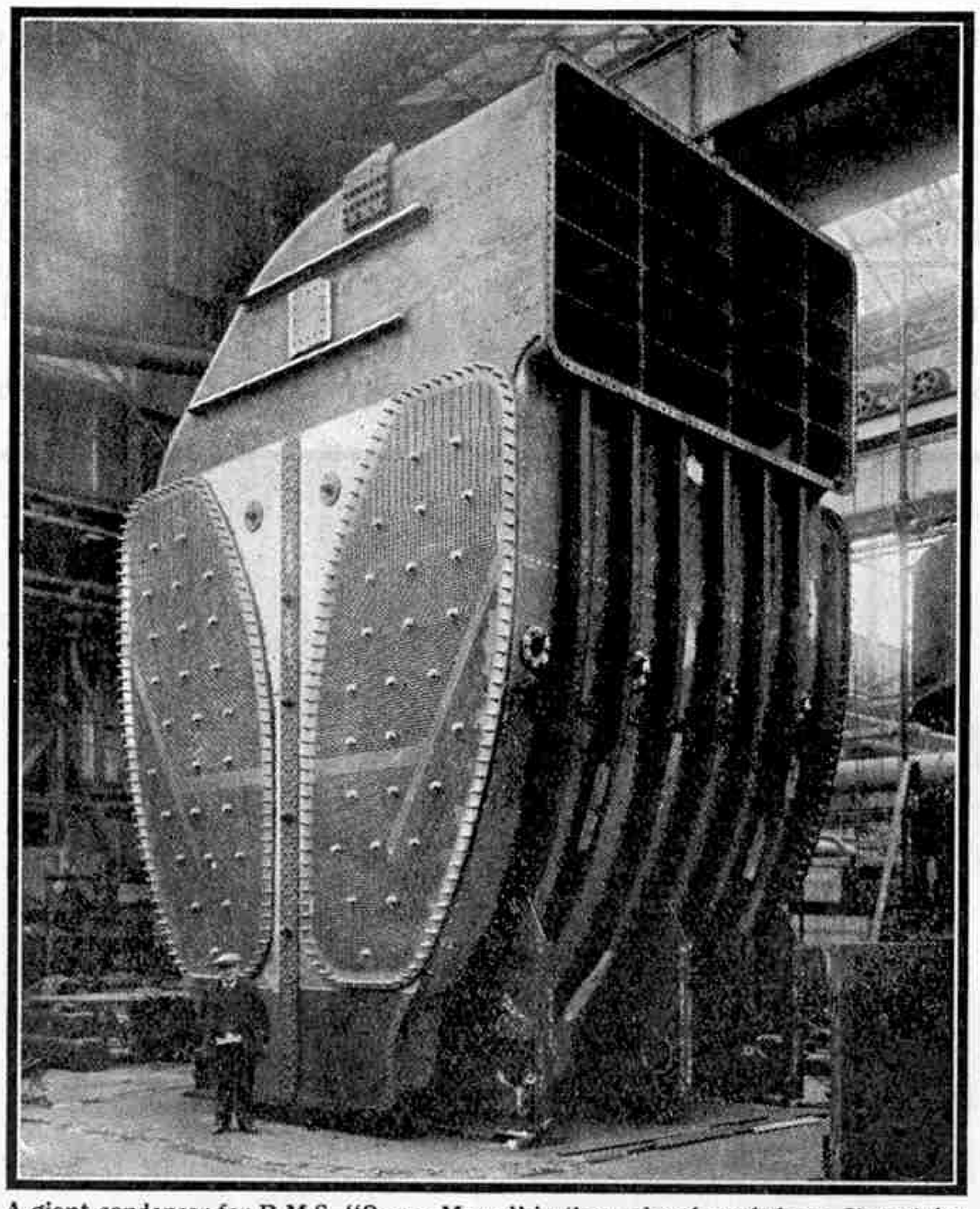


Giant Condensers in "*Queen Mary*"

The illustration on this page shows one of four similar regenerative condenser units that form part of the engine room equipment of the Cunard White Star liner "*Queen Mary*." They were built by G. and J. Weir Ltd., Glasgow, and are used for condensing the exhaust steam from the main turbines. The condensate, or condensed steam, is returned to the boilers for re-evaporation.

Each condenser contains 13,780 solid drawn tubes of cupro-nickel, each ¾" in diameter, which have a total cooling surface of 41,000 sq. ft. These are fitted between end plates inside an outer steel casing. Cold sea water is pumped constantly through the tubes by large electrically-driven centrifugal pumps, and the exhaust steam passes round the outside of the tubes, where it is cooled and condensed. As the condensate drips from the tubes it falls into a reservoir formed in the base of the casing, and is then withdrawn by centrifugal extraction pumps.

A feature of these condensers is that the condensate is extracted at a temperature equal to that of the incoming exhaust steam, so that little heat is required to re-evaporate it in the boilers. This is achieved by arranging the tubes with a wide steam passage right to the bottom of the condenser, so that the steam reheats the condensate as it drips from the tubes.



A giant condenser for R.M.S. "Queen Mary," in the makers' workshops. It contains 13,780 tubes, giving a cooling surface of 41,000 sq. ft., and is one of the four similar units installed in the engine-room. Photograph by courtesy of G. and J. Weir Ltd.

The New Waterloo Bridge

The new Waterloo Bridge over the Thames, which is to be built on the site of the old structure that has now been demolished, will consist of five spans, each of about 238 ft. Each span will consist of twin re-inforced concrete arches, side by side, with a flat section 33 ft. wide between them. This method of construction will produce a lighter and more pleasing effect than could be obtained by a single arch of great width, which would give a heavy tunnel-like appearance.

The piers will be faced with granite up to a level slightly above high-water mark, and their upper portions and the main outer surfaces of the bridge will be faced with Portland stone. The parapet will be surmounted by white bronze balustrading, with lamp standards of the same material.

At each end of the bridge two stairways will be provided. Those on the north side of the river will lead to the Victoria Embankment, and will be connected by a pedestrian subway beneath Wellington Street. The subways at the south end will lead to the foreshore, and will be designed to serve a possible future embankment on that side of the river. The present projecting masonry on the Embankment near the old bridge will be removed.

The Search for Oil in England

The Anglo-American Oil Company Ltd. have selected a site one mile north-east of Hellingly, Sussex, for their first test bore in the search for oil in England. The bore is to be drilled on Grove Hill, the geological formation of which has been found suitable for the accumulation of oil or natural gas. Whether these products are present or not will only be known when the deeper layers have been penetrated by the drill.

The well probably will be sunk to a depth of 4,000 ft. About 30 men will be employed on this work, and drilling will continue for about six months.

Great Harbour Scheme for Capetown

Further details are now available of the great harbour construction and land reclamation scheme to be carried out in Table Bay Harbour, Capetown, which was referred to in the "*Engineering News*" pages of the March 1937 "*M.M.*" When the scheme is completed Capetown will possess one of the finest artificial harbours in the world, which will be capable of accommodating the largest ocean liners afloat.

The work to be carried out will cost £2,250,000, and will include the construction of a new mole nearly 1½ miles long across Table Bay. This will be primarily a harbour wall, but in addition it will provide one of the finest marine promenades in the world.

Three deep water berths also are to be built, and over 363 acres of land will be reclaimed from the sea. Part of this land will provide a site for a giant graving dock. The existing Mole will be removed and in its place a great temporary embankment will be built. At a future date the scheme will be completed with additional quay walls along the embankment, across the harbour, and following the new mole to the harbour entrance.

Since the beginning of 1937 a rock breaking vessel has been continuously at work night and day preparing the sea bed for the great new berths. Dredgers will start reclaiming land when the foundation of the new quays appear above water. They will gather sand from the sea bed in Table Bay and from parts of the New Basin where greater depth is required, and dump it in the area to be reclaimed.

The work is to be pushed forward with the utmost speed and it is expected that all three berths and the immediate reclamation work will be completed within the next four years.

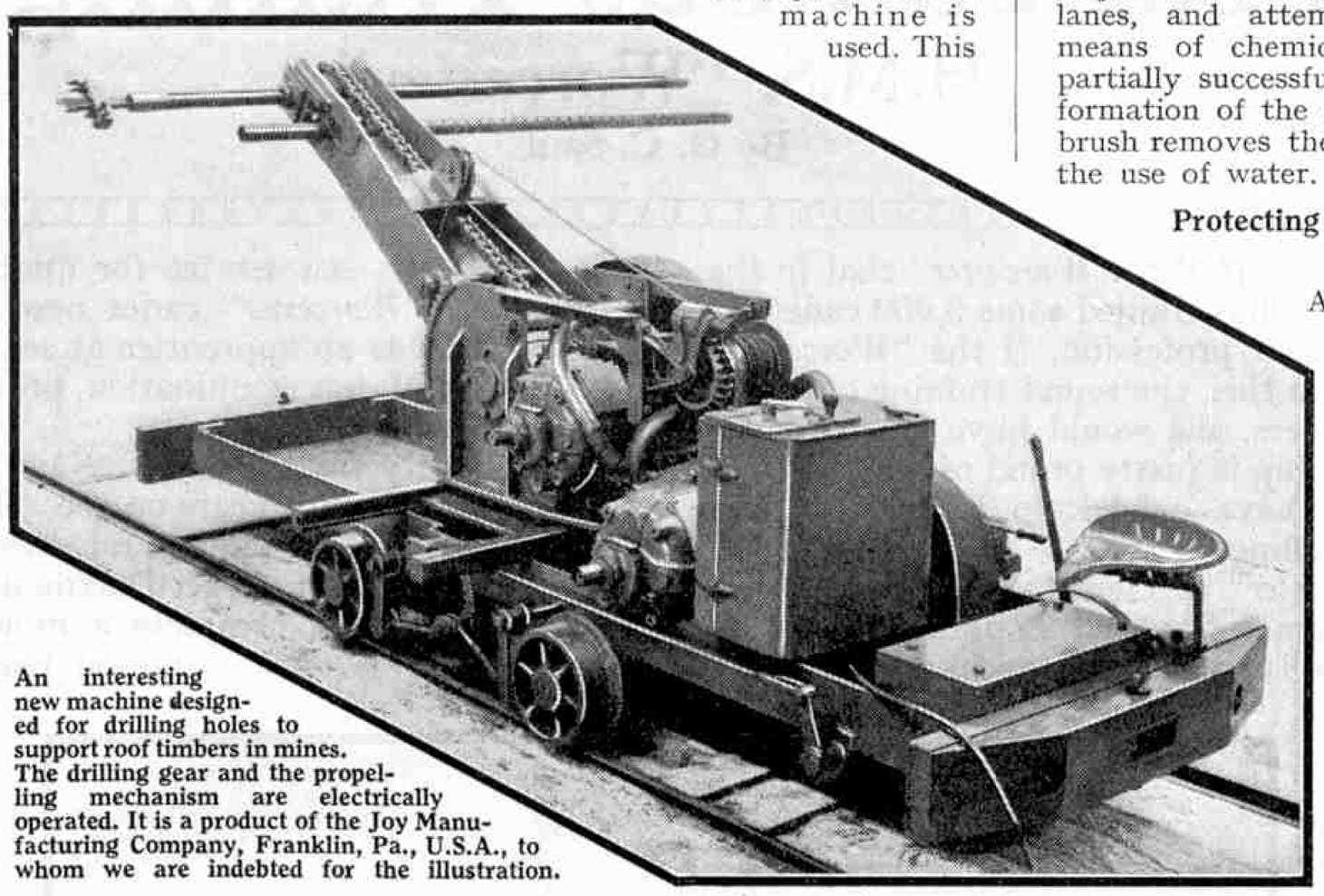
Steel Houses Floated Across a River

A number of five-roomed houses, built entirely of steel, are being constructed by a large company in the United States of America for their employees. The houses are completely assembled in the factory and then the plumbing and electric installations are made. The houses are built in blocks of six and as each block is completed it is launched on a river and floated to the company's colony site.

Rock-Drill for Use in Mines

The machine shown in the upper illustration on this page is a hitch drill manufactured by Messrs. Joy Manufacturing Company, Franklin, Pennsylvania, U.S.A. The term "hitch" refers to a method of supporting the roofs of mine workings that is in extensive use in the United States. In this method the roof timbers are not held up by vertical posts, but by supports inserted into holes cut in the walls of the gallery, just below the roof level.

The hitch drill illustrated is a machine for cutting the holes to receive the supports. It is mounted upon a four-wheeled chassis that is driven by an electric motor, and runs upon rails laid along the floor of the mine. The drill is carried at the end of a jib, which can be raised or lowered to the required height, its elevation being controlled by a small worm-driven winch operated by hand. A spring-loaded pawl meshing with a toothed quadrant locks the jib in the desired position during drilling. The jib is mounted on a turntable so that it can be swung through a right angle on each side of the centre line, and other adjustments are provided to enable the operator to place the cutter in the required position.



An interesting new machine designed for drilling holes to support roof timbers in mines. The drilling gear and the propelling mechanism are electrically operated. It is a product of the Joy Manufacturing Company, Franklin, Pa., U.S.A., to whom we are indebted for the illustration.

The drill spindle, which is carried in a pair of heavy bronze nuts mounted at the end of the jib, is threaded externally and has a keyway cut along its entire length. A chain-driven sprocket is carried on the spindle between the jib side plates, and this has a projection that engages in the keyway. As the spindle is rotated it screws itself through the nuts, and so provides the necessary feed to the cutter.

The drilling spindle is fitted with a cutter at each end, so that holes can be drilled on the left or right of the machine at will.

Traffic Control on Kincardine-on-Forth Bridge

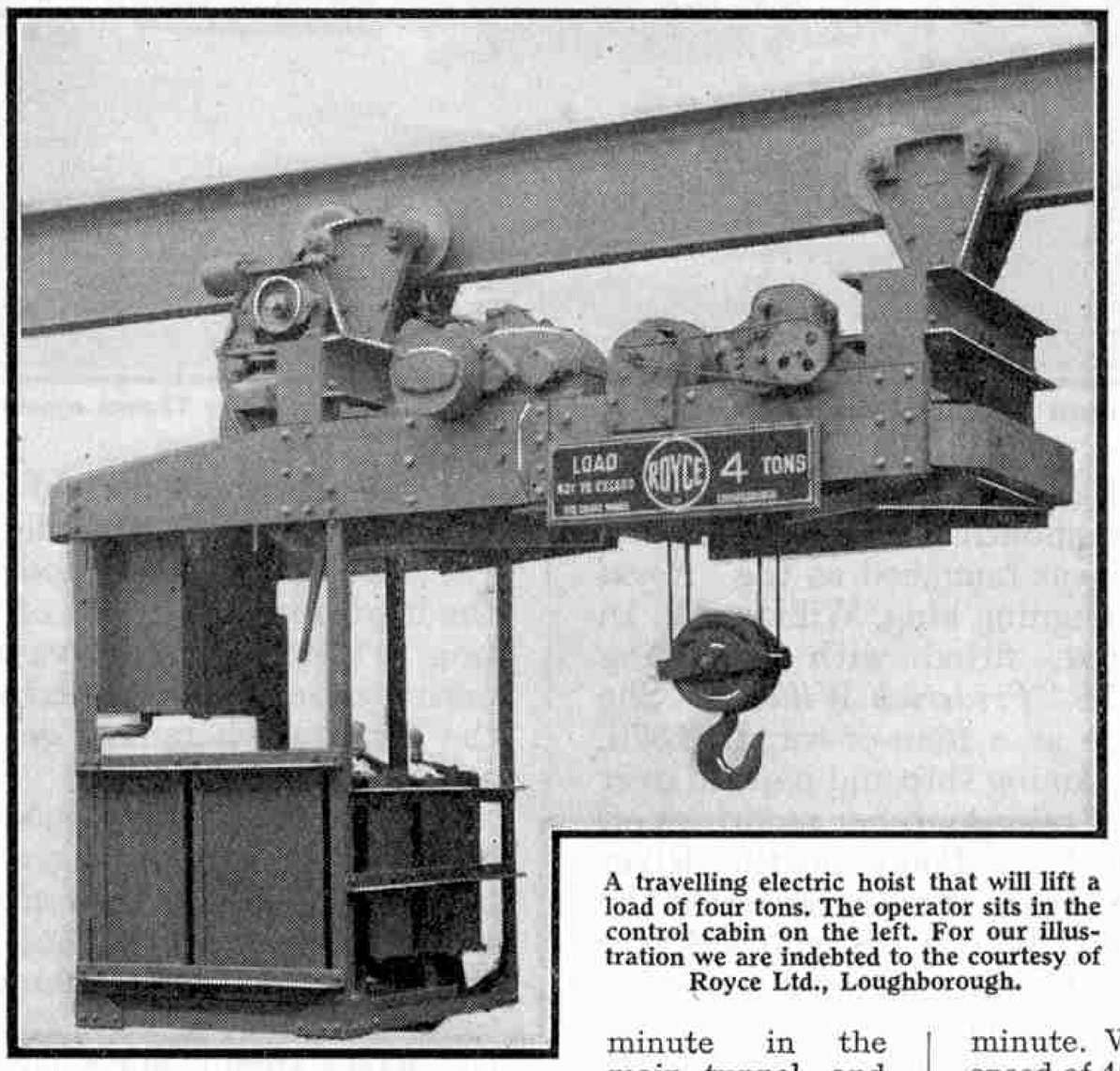
Traffic passing over the new Kincardine Bridge, which was described in the "*M.M.*" for February last, is to be controlled by an official making use of speech amplifying apparatus and loud speakers. The necessary equipment is now being installed on the bridge, and it is hoped that by this means delays caused by congestion will be greatly reduced.

The apparatus is being supplied by the General Electric Co. Ltd., and consists of a 50-watt amplifier system and two mains-energised speakers, one of which will be placed at the north end of the bridge and the other at the south.

Cleaning the Mersey Tunnel

For cleaning the walls and ceiling of Queensway, the great road tunnel under the Mersey, a curious machine is used. This machine, which was specially designed for the work, is in use practically every night. It is shaped to fit the varying contours of the tunnel roof, and is mounted on a turntable on a rigid six-wheeled chassis. It carries 256 flails of cloth, which come in contact with the walls or roof with a wiping movement, and at the same time water under pressure is sprayed on. The machine travels at the rate of 5.8 ft. per minute in the main tunnel, and 8.4 ft. per minute in the branch tunnels.

Another novel machine employed in the tunnel is a mechanical brush with wire bristles. This is driven by a 9 h.p. electric motor and is used to clean the roadway. With the exception of one short section of rubber surface, the roadway is constructed of cast iron setts with diamond-patterned studs. Approximately 8,000 vehicles pass through the tunnel daily in the winter, and between 10,000 and 11,000 in summer. Oil from these vehicles drips on to the centres of the four traffic lanes, and attempts to remove it by means of chemical solvents were only partially successful owing to the studded formation of the surface. The mechanical brush removes the oil easily, even without the use of water.



A travelling electric hoist that will lift a load of four tons. The operator sits in the control cabin on the left. For our illustration we are indebted to the courtesy of Royce Ltd., Loughborough.

Protecting an American Building from Floods

A large department store in Pittsburg that is in a district subject to heavy floods has been equipped with aluminium sheets or bulkheads to hold back flood waters. The bulkheads are normally concealed behind decorative panels on the walls of the ground floor. They are suspended from the ceiling by means of a trolley, and in the event of a flood are pushed up to the windows of the store. Other bulkheads are provided for blocking the doorways, and when all are in position and locked together they provide complete protection from flood water up to 12 ft. in depth.

Opening of the Moscow-Volga Canal

The Moscow-Volga Canal, referred to in the "*Engineering News*" pages of the "*M.M.*" for March last, is to be opened to traffic this summer. Among its many outstanding features is a complete semaphore signalling system, similar to that used on railways, which is being installed throughout the whole length of the canal for the purpose of controlling and regulating the traffic. A special fleet of 183 vessels, 41 of which are already completed, is being built for service on the new waterway, and it is estimated that this year alone over a million tons of freight and two million passengers will be carried over the canal.

Through this great waterway building materials, timber, and granite will reach the capital from the north, oil from the south, fruit from the sub-tropical regions, and miscellaneous cargo from other parts of the country.

The construction of the canal has involved an enormous amount of excavation.

A Travelling Hoist

The lower illustration on this page shows an electric transporter that will lift four tons at the rate of 50 ft. a minute. With its full load it travels at a speed of 450 ft. per minute. Both lifting and travelling motions are fitted with automatic electric brakes, which are applied automatically when the operating current is switched off for any reason. The bogie construction allows the transporter to negotiate curves having a radius as small as 16 ft. This interesting hoist is manufactured by Royce Ltd., Loughborough.

A World-Famous Training Ship

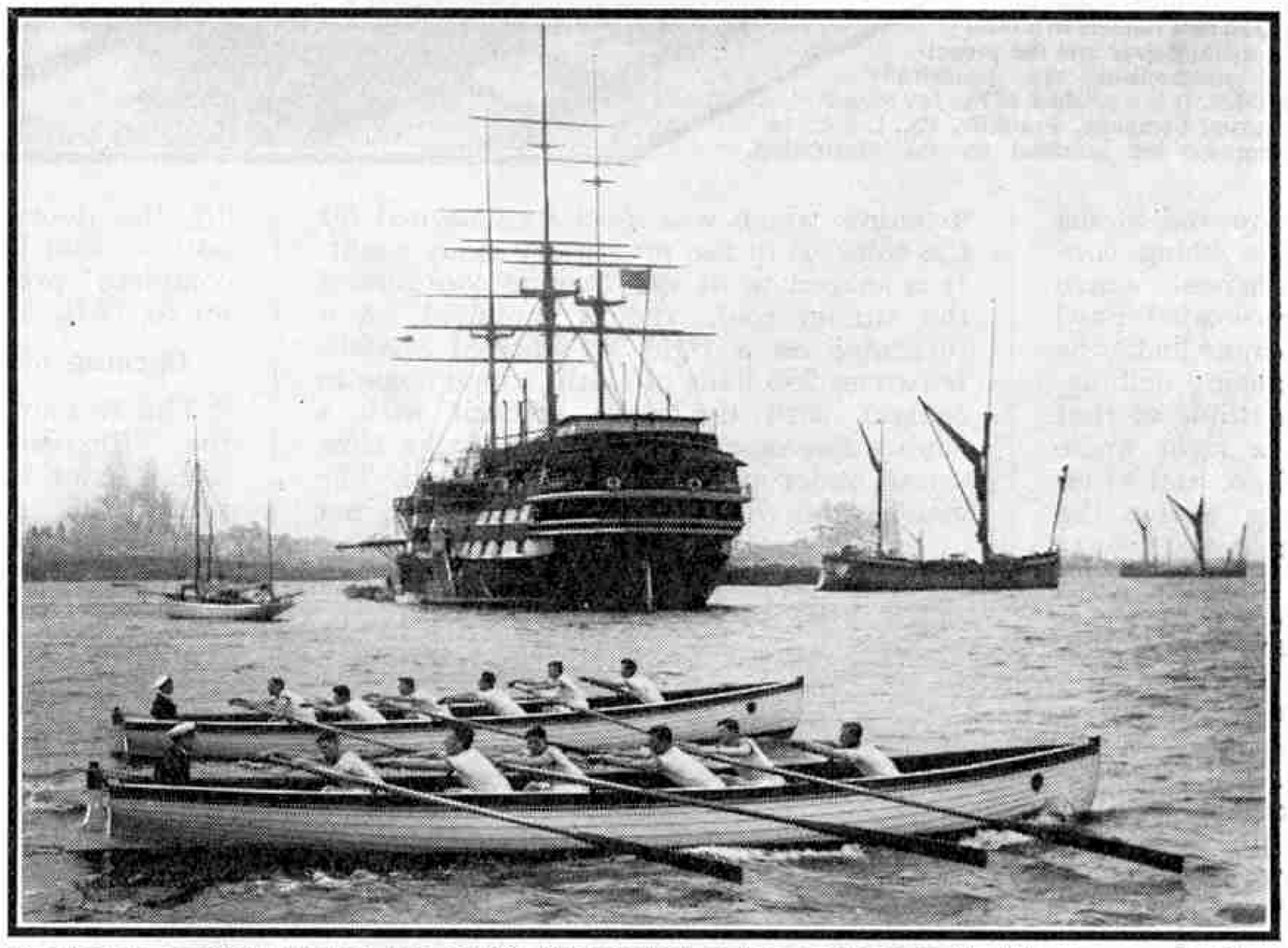
H.M.S. *"Worcester"*

By G. C. Saul

IT is the proud boast of H.M.S. *"Worcester"* that in the course of 74 years she has trained some 6,000 cadets in all that pertains to their profession. If the *"Worcester"* had done no more than this, the sound training of a vast number of ship's officers, she would have achieved her purpose, but the old ship is justly proud of the fact that many of her cadets have gained no little fame and distinction in their calling.

The present *"Worcester"* was lent to the Committee of the Incorporated Thames Nautical Training College by the Admiralty in 1876. It superseded the 50-gun frigate of 1,500 tons previously used as the training ship, which had become too small to accommodate the growing numbers.

Formerly named the *"Frederick William,"* the present vessel is a fine roomy ship of 4,725 tons displacement, 214 ft. long with a beam of 60 ft. She has four decks which, with her large beam, make her exceptionally suitable for a training ship and provide excellent living and school accommodation. With her trim rigging, polished brass-work and white painted ports it is difficult to realise that she was first commissioned more than a century ago. Originally laid down at Portsmouth in 1833 as a sailing ship mounting 74 guns, she was launched as the *"Royal Sovereign"* in honour of the reigning king, William IV. In 1860 she was reconstructed, fitted with propelling machinery, and re-named the *"Frederick William."* She completed her active service as a man-of-war in 1876, when she was fitted up as a training ship and handed over to the Worcester Committee, taking up her moorings off Greenhithe opposite Stone Ness Point in the River Thames. Here for the last 60 years she has remained the floating home of generations of Worcesters who will ever look back upon their years of training within her wooden walls as the happiest period of their lives.



The famous nautical training ship H.M.S. "Worcester" at her moorings in the Thames opposite Stone Ness Point, with boat race crews in training.

Cadets are admitted between the ages of 12 and 16 years by entrance examination. The system of education is based upon the principle of giving each boy a sound general education followed by the opportunity of specialising for a specific career such as the Merchant Navy, Royal Navy or Aviation. The Board of Trade allows two years spent on board the *"Worcester"* to count as one year's sea service for qualified Merchant Navy cadets. A *"Worcester"* cadet need therefore serve only three years as an apprentice at sea before qualifying for his Second Mate's examination, providing he has attained the age of 20 years.

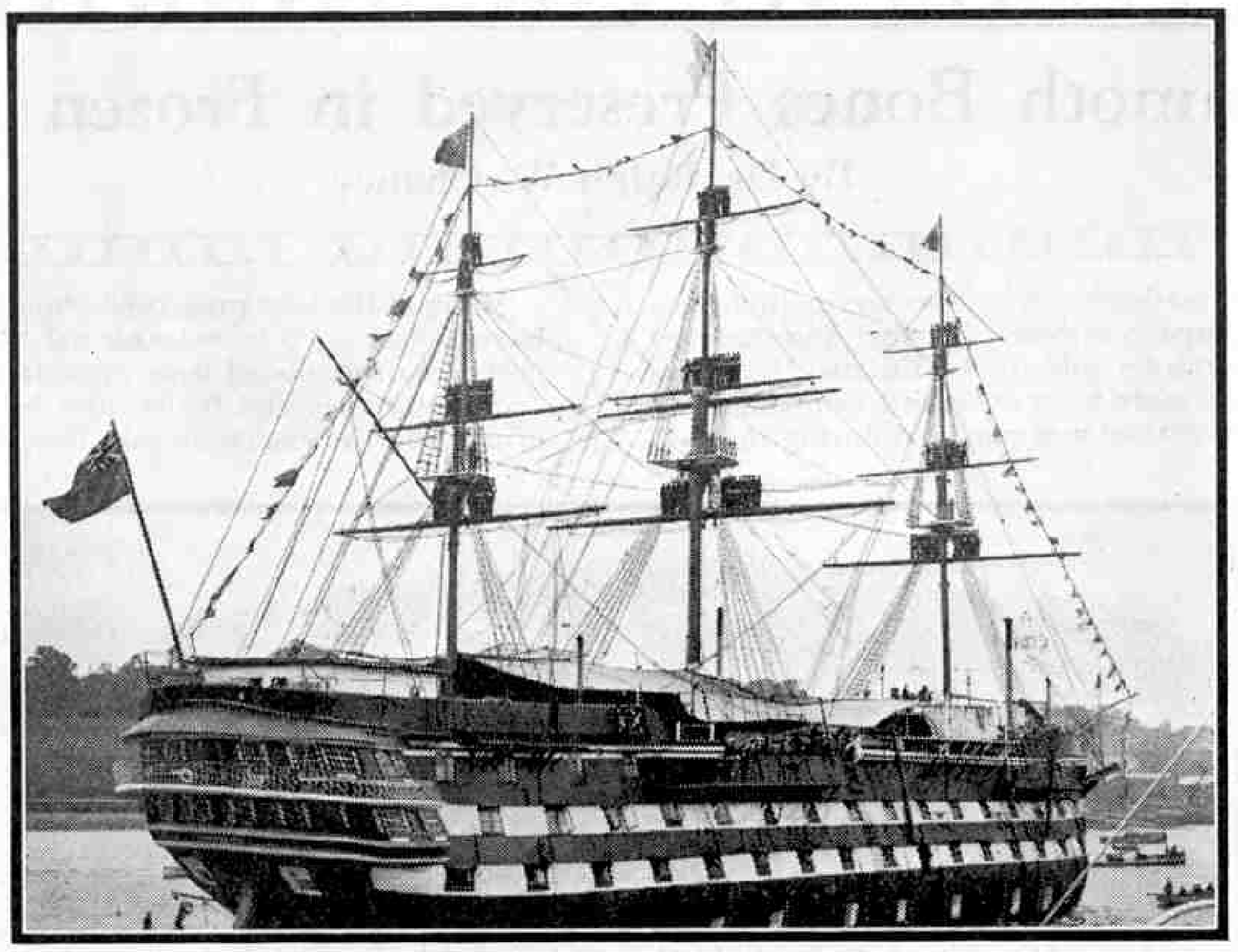
Candidates for the Royal Navy undergo a course of approximately two years on the *"Worcester,"* when they become eligible to compete for entry to the sixth form at the Royal Naval College, Dartmouth. Cadets wishing to take up aviation complete a minimum course of two years in *"Worcester,"* and on reaching the age of 18 qualify for Worcester Air Certificates, the necessary flying experience being obtained subsequently at a flying school. For those cadets who wish to take up other professions in later life provision for the continuance of general studies in the upper school is made. Instruction in seamanship is carried out concurrently with school work, and the cadets are called upon to perform many practical seamanship duties in the ordinary course of ship's life.

The *"Worcester"* is virtually a sailing ship at anchor and affords facilities for practical seamanship which are rarely to be obtained elsewhere. The ship possesses 18 pulling, sailing and motor boats of various classes, while a modern ship's life-boat is stowed on the boat deck for Board of Trade life-boat drill. In addition, a 12-ton auxiliary yawl serves as a small tender for taking cadets for short trips down to the sea reaches of the Thames, where they get actual experience in pilotage and navigation.

In these days of fast modern steam and motor vessels, opportunities of learning at sea the arts of seamanship that were part of the working day in sailing ship times are rare. These accomplishments are taught as part of the *"Worcester"* curriculum. Under the direction of the Chief Officer the cadets have assisted in re-stepping the masts, rigging sheer-legs, sending up and rigging new masts and yards, bending sails, rerigging, rattling down, spreading awnings and reeving new boats' falls, besides undertaking every day the minor duties of the sailor. Cadets run the routine boats, which are so arranged that every cadet gets a turn at pulling and steering during the term. Power driven boats are avoided, for the reason that

boat-pulling, under utility conditions, produces fine physical development. Generally, all branches of practical seamanship are taught, and instruction given in executive and navigating officers' duties.

Cadets sleep in hammocks on the lower deck, which has a plentiful supply of fresh air through large gunports throughout its length. The hammocks are stowed away when not in use and the deck is kept clear throughout the day. The fore part of the main deck is used exclusively as a dining room and is equipped with all modern conveniences for the service of meals. General school is held on the main deck amidships where the classes are partitioned from each other. Permanent class rooms are also available for special purposes. In addition there is a physics laboratory, wireless telegraphy room, model room, library and museum, billiard room, sick bay and gymnasium. The latter is a large, lofty space, formerly the propelling machinery space of the ship, where boxing, concerts, dances and lectures are also held. A talking film apparatus has recently been installed in the gymnasium, and selected films are shown to the cadets at regular intervals. The chart room, modelled on that of a modern liner, contains the latest navigational instruments, steering teacher, chronometers, sextants, charts, rangefinders, echo sounding gear, and a complete Sperry gyro-compass installation.



Cadets of the "Worcester" preparing to man the yards on Prize Day of last year.

Ashore the College possesses in the Ingress Abbey Estate some 37 acres of parkland extending from the main London Road to the foreshore immediately opposite the ship. Here are provided playing fields for rugby and hockey, six tennis courts, cricket pitches, and a splendid enclosed swimming bath where swimming, life-saving instruction and water-polo can be carried on throughout the year.



Chairing the 1936 winner of the King's Gold Medal, which is awarded to the most popular "Worcester" cadet of the year.

The fine old building, Ingress Abbey, centrally situated in the grounds, houses the college offices and chapel, while the wings are set aside for a sanatorium and electric laundry. This building, which dates back over a century, takes its name from the original "Chapel to the Virgin," erected and founded by Edward Lucas in the reign of Edward III.

The Captain Superintendent and Chief Officer, assisted by the Second and Third Officers and six Naval Petty Officers termed instructors, look after the seamanship side of the instruction, while the general education is controlled by the Headmaster and six Assistant Masters. The whole of the staff is under the supervision of the Captain Superintendent.

The present Captain Superintendent, Commander Gordon Charles Steele, V.C., R.N., himself an old Worcester, left the "*Worcester*" in 1908 on completion of his training, joined the P. & O. Company as a cadet, and served in several of their ships prior to the outbreak of the Great War. He then served as an officer in the Royal Naval Reserve until 1915, when he was transferred to the Royal Navy as a reward for distinguished service in action. He saw considerable service in submarines and "Mystery" ships, was in the Battle of Jutland, and was later awarded the Victoria Cross for exceptional bravery in action during the attack on Kronstadt Harbour.

In the opening paragraph reference was made to the fact that many "*Worcester*" cadets had met with no little fame and distinction in their calling, and it is fitting, perhaps, to recall a few of these. Without displaying any preference, one might mention first Admiral Count Togo, the "Nelson of Japan." It was in 1873 that Togo entered the "*Worcester*" as a cadet, and throughout his life he was always ready to pay tribute to the training he received in his early days. It was a matter of great pleasure to him when he revisited this country in 1911, to reboard the "*Worcester*" and address a few words to the cadets who were then in training.

Another famous "*Worcester*" cadet is Admiral Sir Edward R. G. R. Evans, better known as "Evans of the '*Broke*'," from the vessel in which he led a British destroyer flotilla in a stirring victory in the North Sea during the Great War. He had previously won fame as second in command of the expedition of 1912, during which Captain Scott reached the South Pole. Lieut. H. R. Bowers, one of the ill-fated party who perished with Captain Scott, also was a "*Worcester*" cadet.

We are indebted to the courtesy of the Editor of the "*Sperryscope*" for permission to reproduce this article.

Fossils in the Making

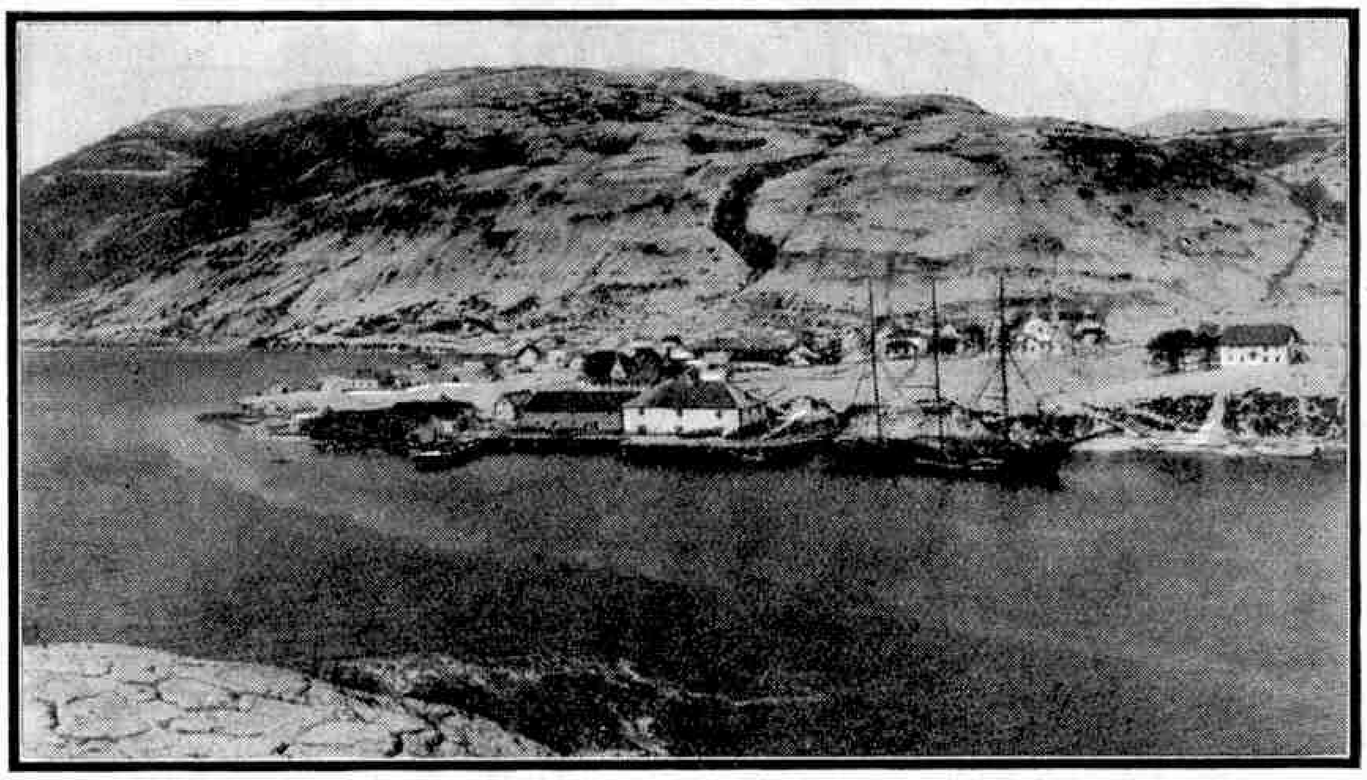
Mammoth Bones Preserved in Frozen Earth

By Dr. Ralph W. Chaney

NEAR Fairbanks, less than two degrees from the Arctic Circle, the Fairbanks Exploration Company is removing vast quantities of frozen soil and gravel in its search for gold. It is estimated that from a single one of its gravel mines more than one-third as much earth will be moved in the next few years as was removed during the construction of the Panama Canal. With the co-operation of Mr. Roy B. Earling, general manager of the Company, opportunities were afforded me of examining the workings.

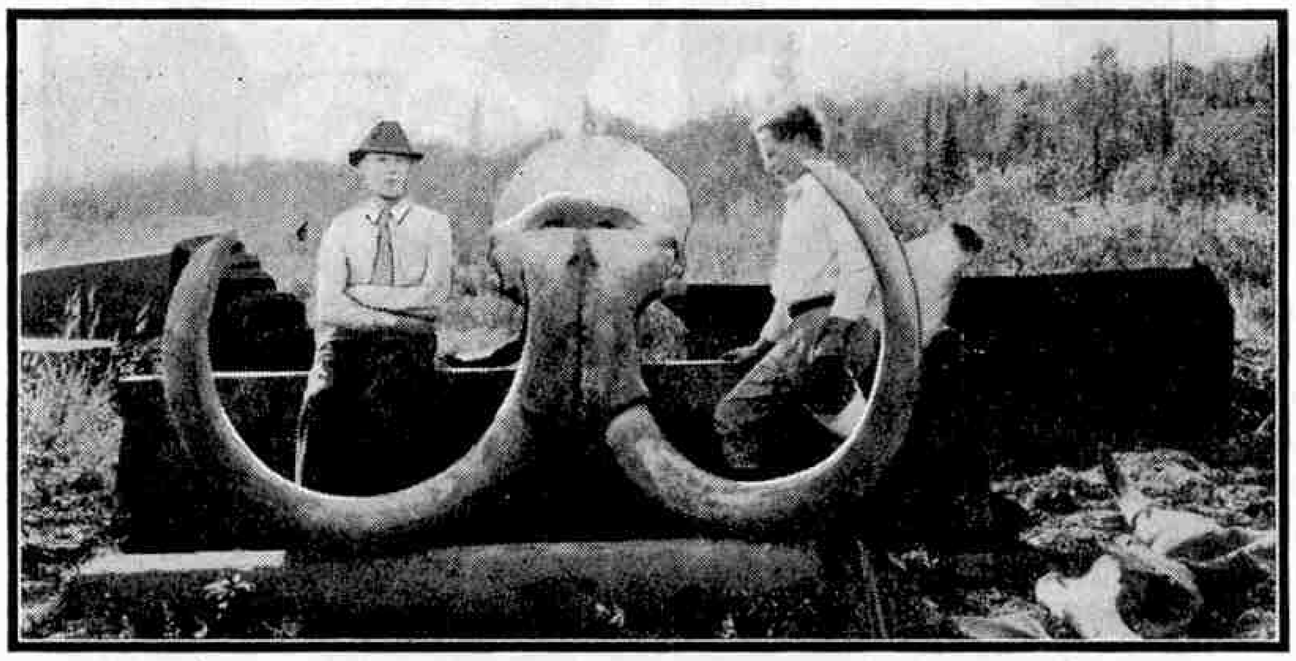
Before the gravels can be mined, the frozen overburden must be removed. This represents the fine sediments that have been washed and blown from adjacent hills, and contains large amounts of moss that has been buried as it accumulated. The first step in stripping operations is to remove the moss. Thereafter, about four inches of overburden are thawed daily by the sun, which in midsummer shines many hours a day longer than in middle latitudes. Every day this melted material is washed away by huge streams of water, exposing the frozen sediment below. As many as two summers may be required to reach the gold-bearing gravels, and during the following summer, these are thawed by pumping into them through iron pipes large amounts of water that has a temperature of about 50°F.

In some places quantities of bones have been preserved in the overburden and gravel. Great bisons are most common, but the remains include also bones of mammoths, horses, caribou, musk oxen and occasional lions. Of the animals named, only the caribou is still found in Alaska.



Kodiak, Alaska, in 1912, covered with ash from the eruption of Mt. Katmai, a volcano 100 miles away. The illustrations to this article are by courtesy of the Carnegie Institution of Washington.

At one point the skulls of two mammoths were being uncovered at the time of my visit. One of these was 4 ft. in length, with tusks 5½ ft. long and 7 in. in diameter at the base. Many antlers of caribou had been washed out at this point. But most numerous were the remains of bisons; in addition to leg bones and long-spined vertebrae, there were more than 30 skulls scattered about where they had been washed clear by the "giants," which is the term applied to the great streams of water used for hydraulic mining. One of the skulls has horns with a spread of over 3½ ft.; the horns of the modern bison are rarely over 2½ ft. in spread. On some specimens muscles, hide and hair are preserved.



Tusks of a mammoth discovered in frozen soil in Alaska. The bones also have been found of bison, musk oxen, horses and lions, which do not now live in Alaska.

Locally the tunnels and nests of ground squirrels are abundant in the frozen overburden. Their contents, cached for winter use, include many seeds of plants that still live in this region. Beaver dams, made up of thousands of tree stems, are washed out of the frozen overburden by the great jets of water.

Spruce, willow and birch are also represented by wood, preserved in its original condition. Leaves of willow, birch and alder, and twigs and cones of spruce also are found. These have not been chemically altered, and decay has been prevented by natural refrigeration.

Many of the best preserved plant fossils in western North America have been buried in volcanic ash. Accumulating rapidly, these fine particles of exploded lava provide a favourable cover under which decay of leaves and fruits may be delayed until their form is imprinted on the enclosing ash. Deep burial below other sediments or lava flows compacts the ash into solid rock, in which prints of these leaves and fruits may show all of the surface details of living structures.

Such fossils were formed, of course, long before the day of man upon the earth. The actual mode of preservation may therefore only be surmised. The most reliable basis for such theories is a study of modern burial of plants in the accumulations of active volcanoes. The exciting events on Kodiak Island in June 1912 provide an example, although the inhabitants then had no thought of scientific discovery. A heavy mantle of volcanic ash, blown from Katmai Volcano, 100 miles distant on the mainland, filled the air with sharp dust, blanketed fields and villages, crushed roofs and changed a green island to a gray brown desert overnight.

A year later I spent a few hours on Kodiak Island, and surveying this desolate land, realisation came that here might be buried, sealed away from decay, preserved for future study, a record of the forests of 1912. So I resolved to return some day to see how such entombed plants were faring.

Nearly a quarter of a century passed before this hope could be realised. Once upon the island, I lost no time enquiring the whereabouts of small lakes, for it was in lakes along ancient stream courses that many of the fossil-bearing ash deposits of the past were accumulated in the western United States. There were evidences on hand to show the effects of the ash fall upon vegetation. But only decayed structures were to be seen on the surface. What might be preserved under the layers of ash deposited in lakes and valleys?

Silver Lake, dammed by beavers, is a body of water scarcely half a mile across. Along the shallow shore, light-coloured ash lies upon the gravel. Digging with pick and scooping by hand, excavations were made at various points near the shore. At convenient depths as much as a foot and a half of ash covered the rocky lake bottom, and always there were great numbers of spruce needles embedded in it. Spruce cones and leaves and stems of alder also were present, but as in the volcanic deposits of Oregon, where vast numbers of redwood needles dominate the fossil record, the relatively indestructible remains of conifers are most numerous. Broad leaves like those of the alder are more likely to be broken, so that they make up only an unrecognisable carbonaceous mass.

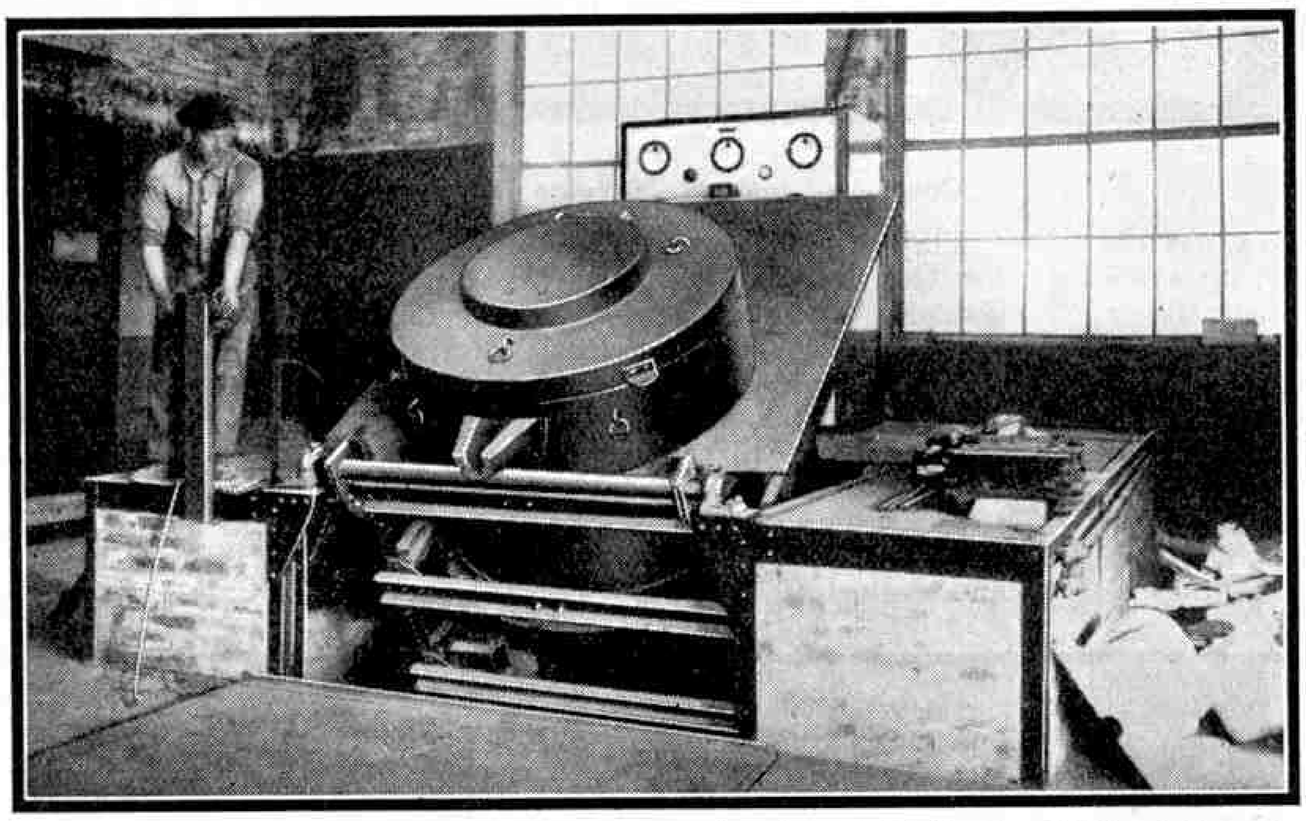
We are indebted to the Carnegie Institution of Washington for the information contained in this article.

Modern Electric Furnaces

Melting Alloys at High Temperatures

MUCH of the progress that has been made in engineering during recent years has been made possible by the introduction of remarkable new metals and alloys, each possessing special features that make it suitable for a definite industrial application. The characteristic qualities of these metals depend largely on the treatment to which they are subjected during their manufacture. The temperatures required are often very high, and in all cases must be capable of control within very fine limits. The most suitable source of heat for the purpose is the electric furnace. This is available in many different types, and is capable of producing temperatures of from 1,300 to 1,800 deg. C.

Electric furnaces develop intense heat in a small space, just where it is required for operation, and can be readily controlled to give the exact temperatures required. They are all enclosed while working. The metal therefore is not burned or oxidised, as it might be when heated in a furnace fired with coke or carbon, and the product is pure.



An induction furnace for smelting metals. It has a capacity of over 1,000 lb. of metal. The photographs on this page are reproduced by courtesy of Metalectric Furnaces Ltd., Birmingham.

Modern electric furnaces are of three main types. In the first, and perhaps the most widely used, the metal is heated either by means of a resistance, consisting of such material as pulverised carbon or nickel chrome alloy, which is made hot by the passage of an electric current through it. In some instances the metal itself forms part of an electric circuit, and the resistance it offers to the passage of the current raises the temperature to the required degree.

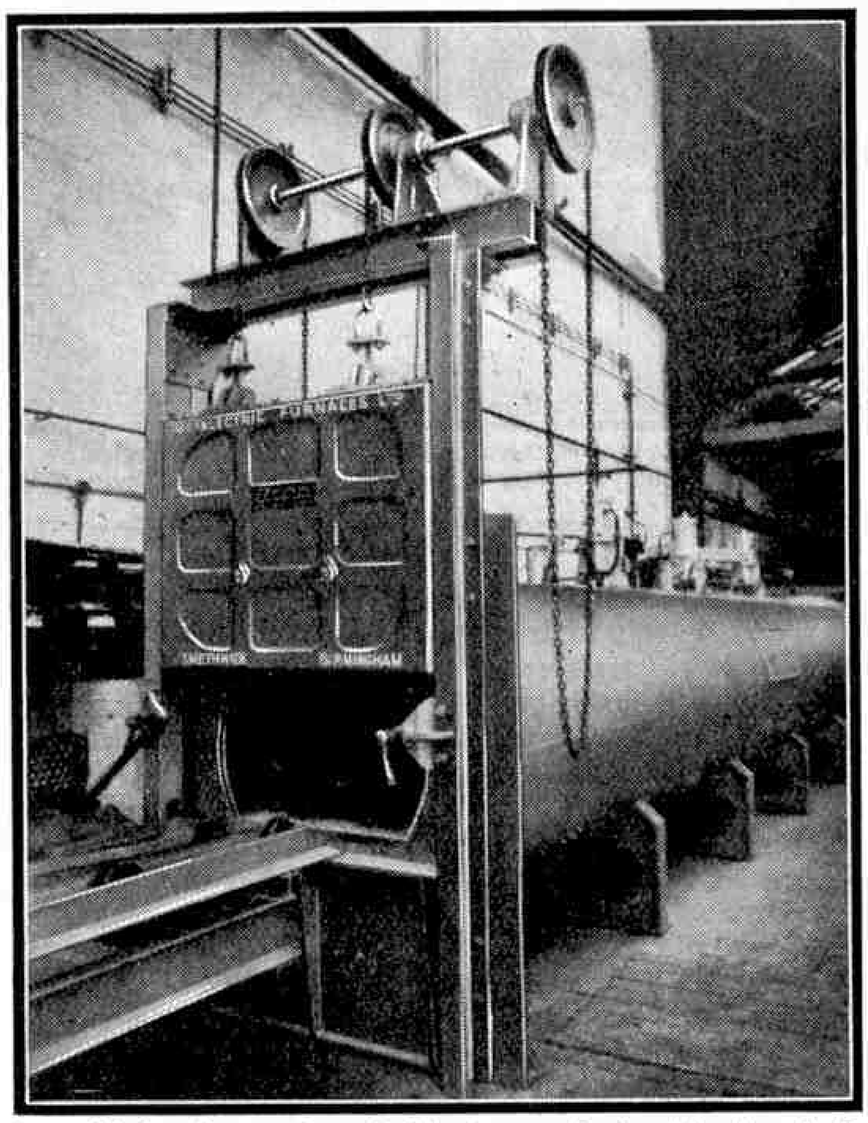
In the second type of furnace an electric arc produces the heat required. Furnaces of this kind are used when steel and alloy castings are required.

The third type of electric furnace is known as the induction furnace. In this a coil of wire surrounds the furnace chamber and is connected to a supply of alternating electric current at high frequency. The charge of metal to be treated is placed inside the chamber, and when current is passed through the coil a secondary current of low voltage but extremely high amperage is induced in the charge. This has the effect of raising the temperature of the metal.

Until recent years the induction furnace was used chiefly for the melting of copper alloys. Great progress has recently been made in the design of these furnaces, and they are now used also for super-heating and refining cast iron and high grade steels, as well as for dealing with many other metals and their alloys.

Typical modern electric furnaces are shown in the illustrations on this page. They are products of Metalectric Furnaces Ltd., Birmingham. The one seen in the upper illustration is a Metalectric-Russ Induction Furnace installed in a large works in England, where it is in operation continuously day and night. It will accommodate 10 cwt. of metal at one charge, and will produce a temperature of 1,550 deg. C. The varied uses to which it is put include the refining of high grade steel and iron alloys of every description.

The successful treatment of aluminium alloys is a process that requires particularly even heating and very exact control of furnace temperatures, those required varying from about 300 to 500 deg. C. These conditions make the use of a high temperature electric furnace of the type already described impossible, and for this reason Metalectric Furnaces Ltd. have produced a special heating unit for the purpose. It is known as a low-temperature re-circulated atmosphere furnace, and is shown in the lower illustration on this page. The heating elements in it are arranged in rows inside a cylindrical chamber. There they are in the path of a current of air produced by a motor-driven fan. The air passes at high speed through the cylinder, thus maintaining uniform temperature at all parts of the furnace. The metal is therefore heated actually by air circulation, and uneven heating is impossible.



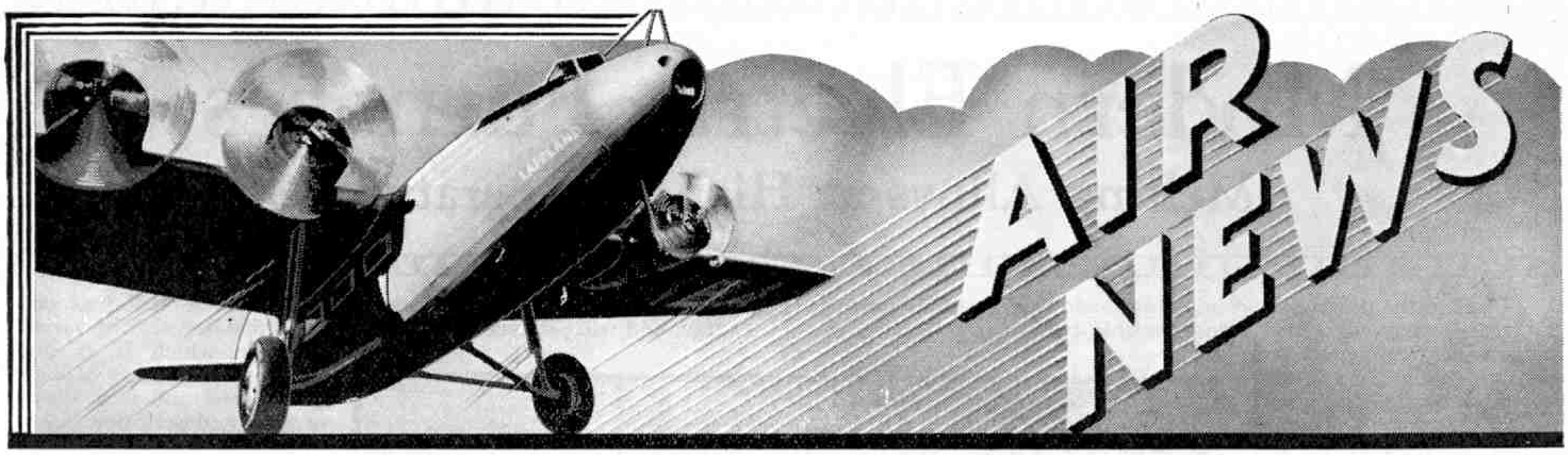
A special low temperature electric furnace for heat treatment of various alloys. In this furnace the metal is heated by hot air circulated through the chamber by motor-driven fans.

The temperature developed in this furnace is 400 deg. C., and exact control is given by means of a thermocouple placed in the air stream passing into the furnace chamber. The furnace illustrated is 25 ft. in length and 3 ft. 6 in. in diameter. When working at its maximum temperature it consumes 120 kW.

Metalectric Furnaces Ltd. also manufacture other types of electric furnace, each designed for special kinds of work. One of these is used for annealing welded joints, such as those of a pipeline, and is portable, so that it can be carried to the work. The furnace chamber proper consists of two semi-circular sections fitted with a suitable clamp arrangement. The pipe to be treated is placed between the sections, which are then brought together and clamped round the joint. Special split rings are provided in the furnace to enable pipes of different diameters to be accommodated.

The heating elements consist of heavy nickel chrome strips, and the temperature produced is about 650 deg. C. In order to permit control of the temperature in the furnace within the required limits, holes are provided through which thermocouples can be inserted in the chamber. These couples are connected to suitable control and recording instruments, the latter giving a continuous indication of the temperature of the pipe throughout the whole period it is in the furnace.

In addition to their use in metallurgical work, electric furnaces are used in the manufacture of products such as aluminium and calcium carbide, and artificial nitrates for use in agriculture and in the manufacture of certain explosives.



More Record Flights

Mr. H. F. Broadbent, the 26-years old Australian airman, last month set up a new record for a solo flight from Australia to England by accomplishing the journey in 6 days 8 hr. 25 min. This was 1 day 11 hr. 25 min. less than the time taken by the previous record holder, Mr. H. L. Brook, of Harrogate, when he flew from Port Darwin to Lympne in 1935. The Australian pilot stated on arrival that the flight had been uneventful, the only really anxious period being when he was near Rangoon and passed through the storms that precede the monsoon.

This was not the fastest flight ever made from Australia to England, for in 1934 O. Cathcart Jones and Kenneth Waller on their return trip in a de Havilland "Comet" after competing in the Melbourne Air Race completed the journey in 5 days 15 hr. 55 min.

It is interesting that Broadbent should have wrested this record from Brook, as only two days later the latter completed a record flight from Capetown to Croydon, covering the distance of 7,500 miles in 4 days 18 min. This was 15 hr. 55 min. less than the time set up by Amy Mollison in May last year. The Brook flight was a return one, and by accomplishing both the outward and homeward journeys in 9 days 9½ hr. he also gained the unofficial record for the double journey. He flew by way of Johannesburg, Kisumu, Khartoum, Cairo and Rome, and had much better luck than on some of his previous long-distance flights. His only misfortune on this occasion was to break one of the landing flaps of his aeroplane when alighting at the Littorio Aerodrome, Rome. The damage was quickly repaired, and caused a delay of only a few hours.

"Caledonia" Visits London

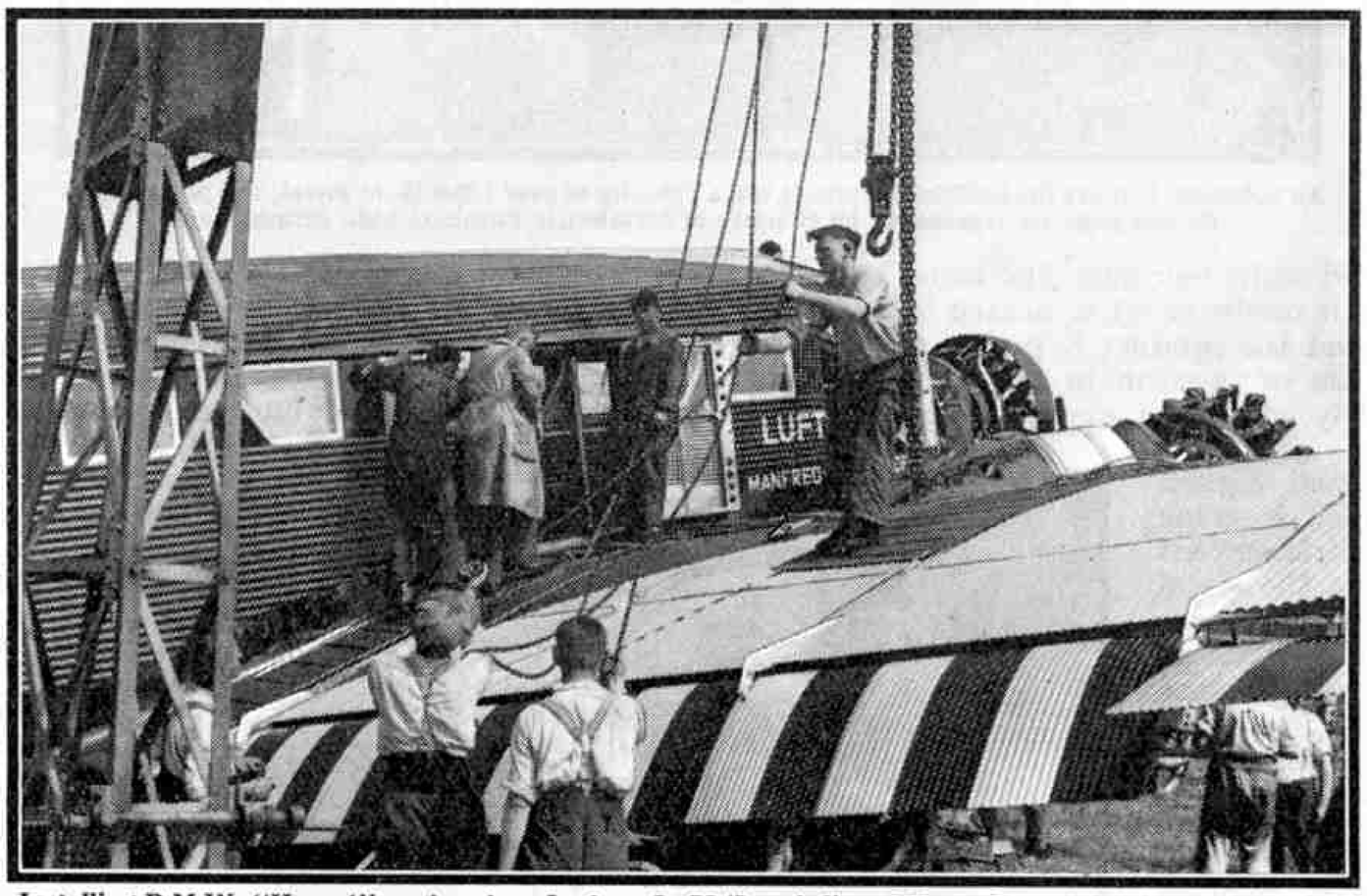
The *"Caledonia,"* one of the two Imperial Airways long-range flying boats, recently made several flights over the London area. The flights were made to enable wireless tests to be carried out between the machine and the station installed at Aerial House, the new headquarters of the Civil Aviation Department of the Air Ministry.

Coast-to-Coast Air Service in Canada

Elaborate preparations are being made for the completion of the airway across Canada. This coast-to-coast service is to be organised by Canadian National Railways through a private company to be formed for the purpose. The company will fly only the main line of traffic between east and west, together with such feeder services as the Canadian Government consider to be of national importance, and they will be given an exclusive contract to carry mails, passengers and express freight over those routes.

The full benefit of this great service will not be felt in this country until the North Atlantic air service is in operation. It will then be possible for loads from Africa, India, or Australia to be carried right across both Canada and the Atlantic to England.

One of the many problems in connection with the organisation of the trans-Canada airway has been the preparation of landing grounds in Northern Ontario. There, in almost uninhabited regions of lake and bush, gangs of men have been toiling through the intense cold of winter and the heat of summer, when they were troubled by plagues of flies. The work has gone forward steadily in spite of difficulties, and nearly 50 landing grounds have been provided between Quebec and Manitoba. The work has involved the felling of immense numbers of trees, the stumps of which have been removed by dynamite, and the clearing of great stretches of bush.



Installing B.M.W. "Hornet" engines in a Junkers Ju.52/3m air liner. The engine on the right has just been lowered into position. Photograph by courtesy of Junkers Flugzeug-und -Motorenwerke A.G., Dessau.

Fighting the Ice Danger

The dangers of ice formation on the wings of aircraft during flight have caused much concern recently. The problem has been discussed in the House of Commons, and Sir Phillip Sassoon, Under Secretary of State for Air, revealed that only eight of Britain's 150 civil aircraft are fitted with apparatus to combat ice formation.

Four of the five Lockheed "Electra" monoplanes bought by British Airways Ltd., are fitted with de-icing equipment consisting of a rubber tubular coating over the leading edges of the wings. Pulsating air is blown through the tubing, causing it to expand and thus to crack the ice as it forms, leaving it free to be blown off by the slipstream.

Imperial Airways have for several years been carrying out experimental work to devise a really effective apparatus for combating ice formation, and improved de-icing equipment has been fitted to one of the company's D.H.86 air liners. This equipment is applied to the struts as well as to the wings, and forces over the surfaces a chemical fluid that prevents the formation of ice. Tests of the equipment carried out at the Martlesham Heath Station of the Air Ministry have proved that it does not in any way impair the normal aerodynamic qualities of the machine. Further tests are to be made, however, so as to gain experience with the apparatus under actual ice-forming conditions.

Imperial Airways are also experimenting with another method in which ice formation is prevented by chemical means. In this method a paste known as "Kill-frost" is employed. The paste has been evolved as a result of considerable laboratory research, and is applied to all the surface of the aeroplane.

Russian Arctic Flights

Commercial flights to the Arctic regions are being carried out by Golovin and Farikh, two Russian airmen. Golovin recently completed a long air tour northward from Moscow, and Farikh is engaged in survey flights across Siberia in a large specially equipped monoplane that is said to be of the twin-engined type.

British Airways Summer Services

The summer timetable of British Airways Ltd., shows that "*The Viking Royal Mail Express*" service to Stockholm by way of Amsterdam, Hamburg, Copenhagen and Malmö has been speeded up, and Denmark and Sweden are reached an hour earlier than under the winter schedule. This acceleration has been made possible by the acquisition of a fleet of Lockheed "Electra" air liners. The journey is now completed in 7 hr. 20 min. flying time, and passengers can breakfast in England, have lunch in Germany, tea in Denmark, and dinner in Sweden.

In 1936 the aircraft of British Airways covered 347,130 miles on this route and carried 188,739 lb. of mails, or approximately 5,000,000 letters. During the summer holiday season the traffic to Scandinavia was four times as heavy as at the beginning of the year, and present indications are that this volume will be even greater this summer.

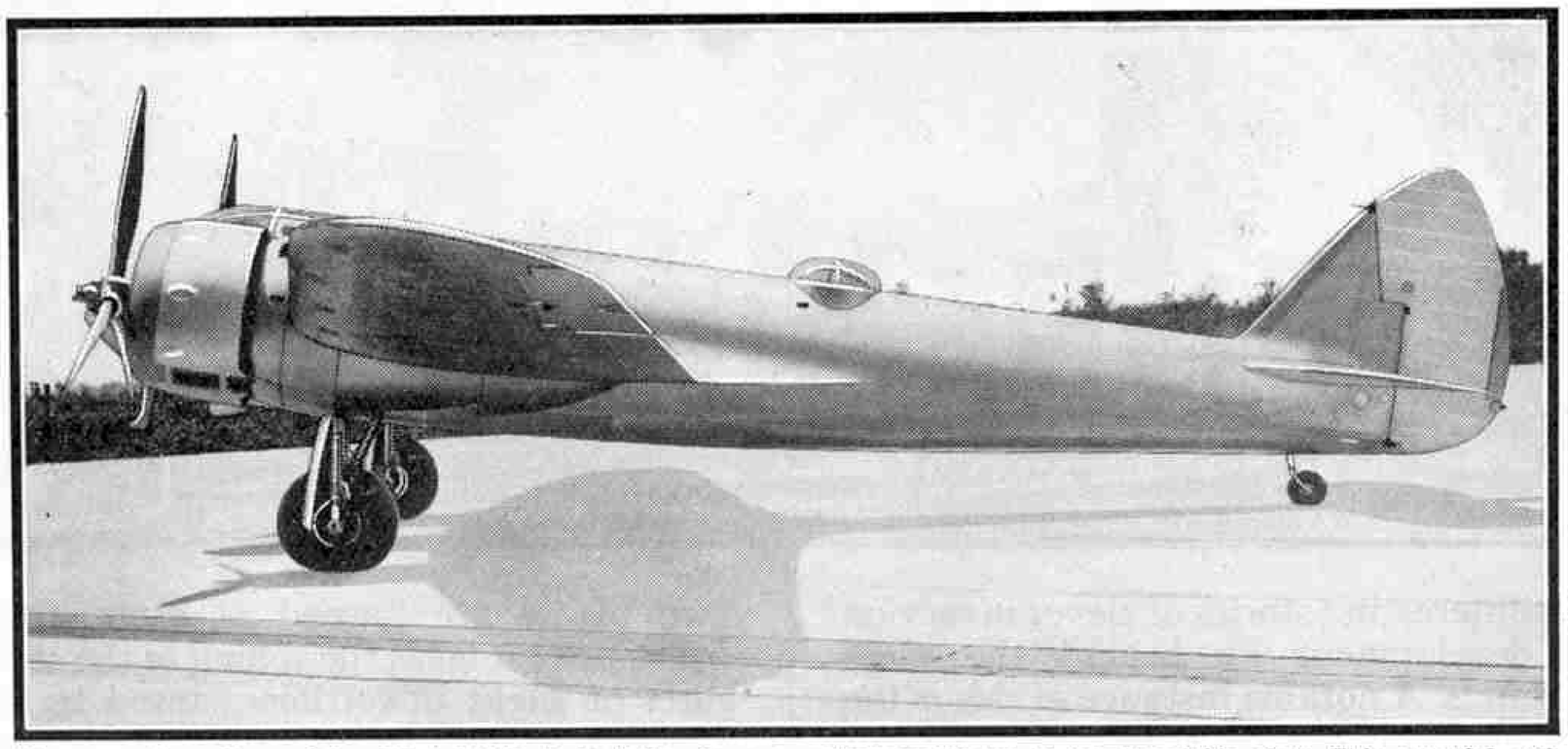
The company are now operating three services daily to Paris, and four services will be run daily during the peak period of the Paris Exhibition, from June to September. Some of the Lockheed "Electras" are operating on this route, and have brought the French capital within 1½-hr. flying time of London. On this busy route, the company carried three times the volume of traffic during last Summer as compared with the earlier part of the year, and the number of passengers carried is increasing month by month.

"*The Viking Night Mail and Freight Express*" service to Hanover is being continued throughout the summer. This service is restricted to the carriage of freight and mails, and at Hanover connects with the services of the national air transport companies of Sweden and Denmark to Scandinavia. It gives British Airways the distinction of being the only British company to operate a night mail route to the Continent.

New Bristol "Mercury" Engine

The latest addition to the extensive range of Bristol engines is the "Mercury XII," a medium supercharged version of the well-known "Mercury IX," which is fully supercharged. The "Mercury XII" has completed a 100-hrs. running test with outstanding success, and is now under production for the R.A.F.

The new engine will be the standard engine of the first production series of the new Westland "Lysander" Army co-operation monoplanes. It is exceptionally suitable for such duty, as it is of relatively small diameter, so that there is no difficulty in providing a wide field of vision for the pilot, and its low weight and moderate fuel consumption are important advantages from the standpoint of long range. The engine also has an exceptionally good power output for take-off, which is a very valuable asset in a military aeroplane that may have to operate from very restricted areas.



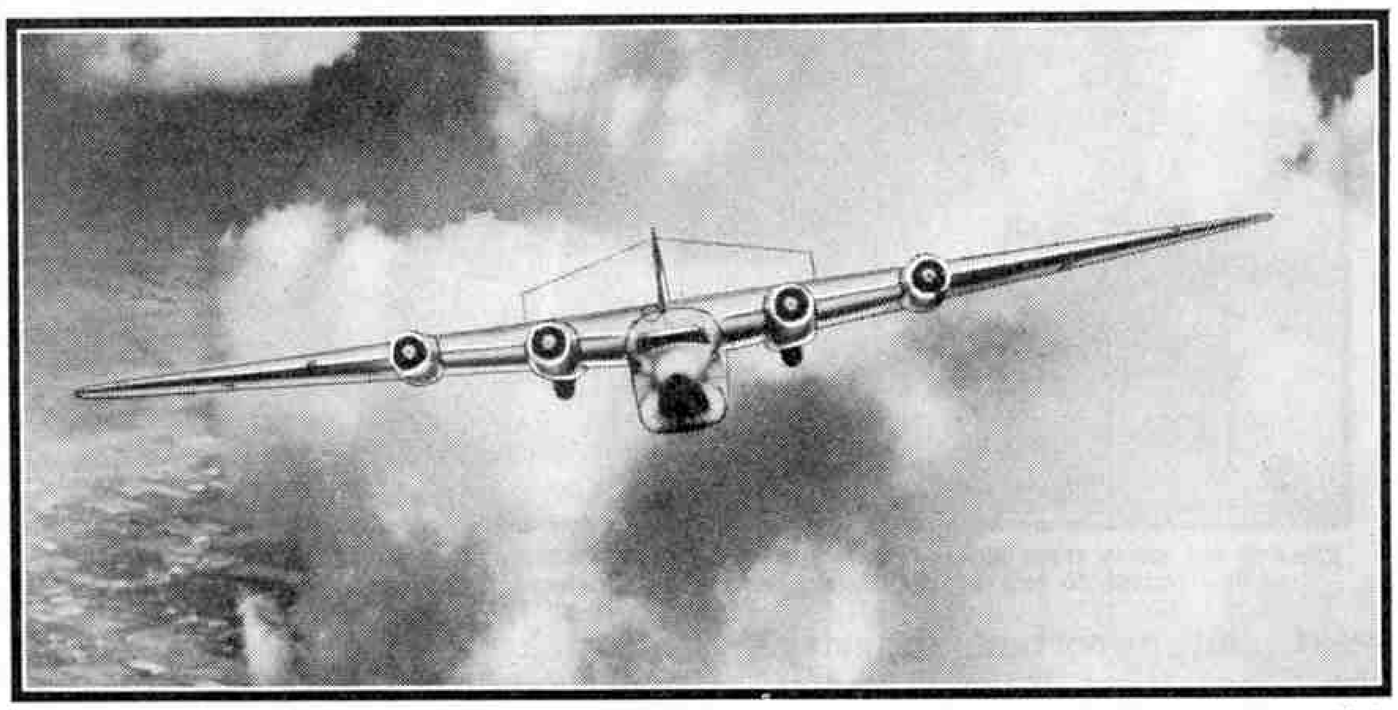
The very clean lines of the Bristol "Blenheim" Bomber are well brought out in this broadside view. This graceful, yet formidable machine is of the mid-wing type, and has two Bristol "Mercury VIII" engines. It is being supplied to several R.A.F. squadrons. Photograph by courtesy of the Bristol Aircraft Co. Ltd.

American Air Liners with Speed of 250 m.p.h.

The Boeing Aircraft Company of Seattle, U.S.A., have received an order from Trans-continental and Western Air, Inc., for six air liners each capable of seating 32 passengers by day and having sleeping accommodation for 18 passengers at night. In design the new aircraft are based on the Boeing "299" middle-wing bomber. Each machine will have four Wright "Cyclone" engines and be able to attain a speed of about 250 m.p.h. on only 75 per cent. of full engine power. Delivery of the aeroplanes is to be completed within a year, and they will be put into service on T.W.A. long-distance air routes.

Pan-American Airways also have ordered two aeroplanes of the same type, and as the range of these machines is about 4,000 miles, it is expected that the company will use them for experimental flights across the Atlantic.

The Boeing Company are busy also on an order placed last autumn by Pan-American Airways for six huge monoplane flying boats, which will be the largest ever built in the United States. They will be two-decker machines, will carry 60 passengers by day and 40 by night, and will have a cruising speed of approximately 200 m.p.h.



An artist's impression of "Ensign," the first of the 12 new air liners for Imperial Airways. These high wing cantilever monoplanes are being built by Sir W. G. Armstrong Whitworth Aircraft Ltd.

Round the World by Air

Recently Imperial Airways were called upon to arrange a round-the-world air trip for a client. In accordance with the plan they prepared, the traveller flew from London to Germany, where he boarded the airship "*Graf Zeppelin*" for the ocean crossing to South America. Then followed an overland flight by stages to San Francisco, where he embarked on a Pacific flying boat that conveyed him to Manila. There came the first and only break in this great aerial trip, as it was necessary to change from air liner to ship for the journey to Hong Kong. From Hong Kong the traveller flew by Imperial Airways' service to Penang, and along the main Empire route to Australia, afterwards returning to England by way of India and Egypt.

Since this tour was carried out a regular air service between Manila and Hong Kong has been started by Pan-American Airways, and it is now possible to travel entirely round the world by air.

Inspection Flights by Empire Flying Boats

Inspection flights are being carried out along the England-South Africa Empire air route by Imperial Airways to test the ground organisations and other arrangements provided for the Empire flying boats. Recently the Short flying boat "*Satyrus*" flew in stages from Alexandria to Kisumu, and from there to Mombasa, Dar-es-Salaam and Lindi, and back to Alexandria. During this trip the tests carried out proved the suitability of the new airport equipment, and valuable experience was gained in connection with wireless and weather services and in regard to general meteorological conditions. The flight aroused great interest at the various halting points. For instance, at Dar-es-Salaam the entire town turned out to watch the arrival of the flying boat, the size of which caused the natives to refer to it as "the Carnera aeroplane."

"*Cambria,*" one of the long-range Empire flying boats, is carrying out an inspection flight over sections of the proposed marine air route between Alexandria and Kisumu. This flight is enabling the staffs at the various stations to acquaint themselves with the details of the giant craft.



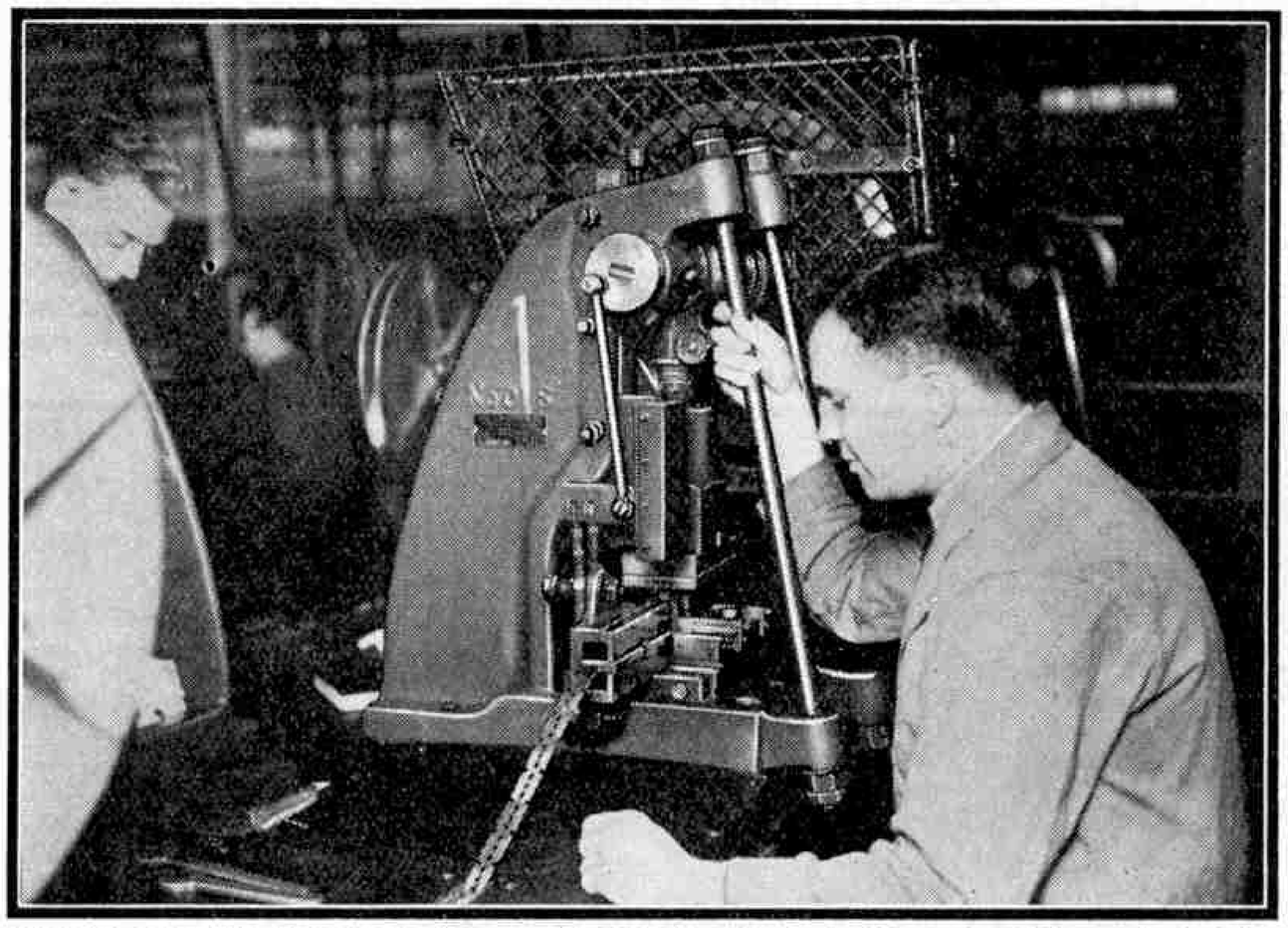
SOME of the most interesting stories of clever invention and industrial development lie behind the most familiar everyday things. A notable instance of this is the safety razor. Its invention is comparatively modern, for although men have shaved for many centuries, it was only in 1895 that Mr. King Gillette, an American cork salesman, tired of the danger and discomfort of the older way of shaving, set himself to find a safer way. He thought of a guarded razor-holder with a thin renewable blade, which could be cheaply made and replaced when necessary.

Mr. Gillette knew little about razors, and less about steel and its manufacture, and he had a hard fight to establish his invention, for, like many inventors, he had to meet discouragement, and even scornful amusement. He believed in his invention, however, and at last started to manufacture his new razor in 1901. In a short time he had changed the method of shaving for thousands of people, and from his tiny beginning there has grown up a great and important industry.

The new factory on the Great West Road, London, where Gillette razors and blades are made must be one of the finest industrial buildings in the country, and the processes carried on in it are fascinating to watch. The blades are not made singly; instead they are produced end-to-end in one long ribbon of steel. This simplifies handling, and makes it easy to obtain accurate control of the operations, for in effect the long strip of blades becomes its own conveyor, and is easily coiled for transport.

Coils of blank strip steel are received at the works stores, and after checking and examination, are passed to presses that work at high speed, pressing out the blades and the central perforation at the rate of 320 blades a minute. Each coil of strip weighs about 30 to 35 lb., and each pound of steel represents approximately 400 blades. Two blades are formed at each stroke of the press.

The next stage is the rolling of the strip to take out any burrs or slight distortions caused by the presses. Then follows the highly exacting process of hardening. Gas-fired hardening furnaces are used, and the strip of blades passes steadily through a chamber in which the temperature is accurately controlled, then through a quenching plant and finally is polished before it is passed on to the electric tempering plant. The tempering follows the hardening, the strip being finally coiled on a drum.



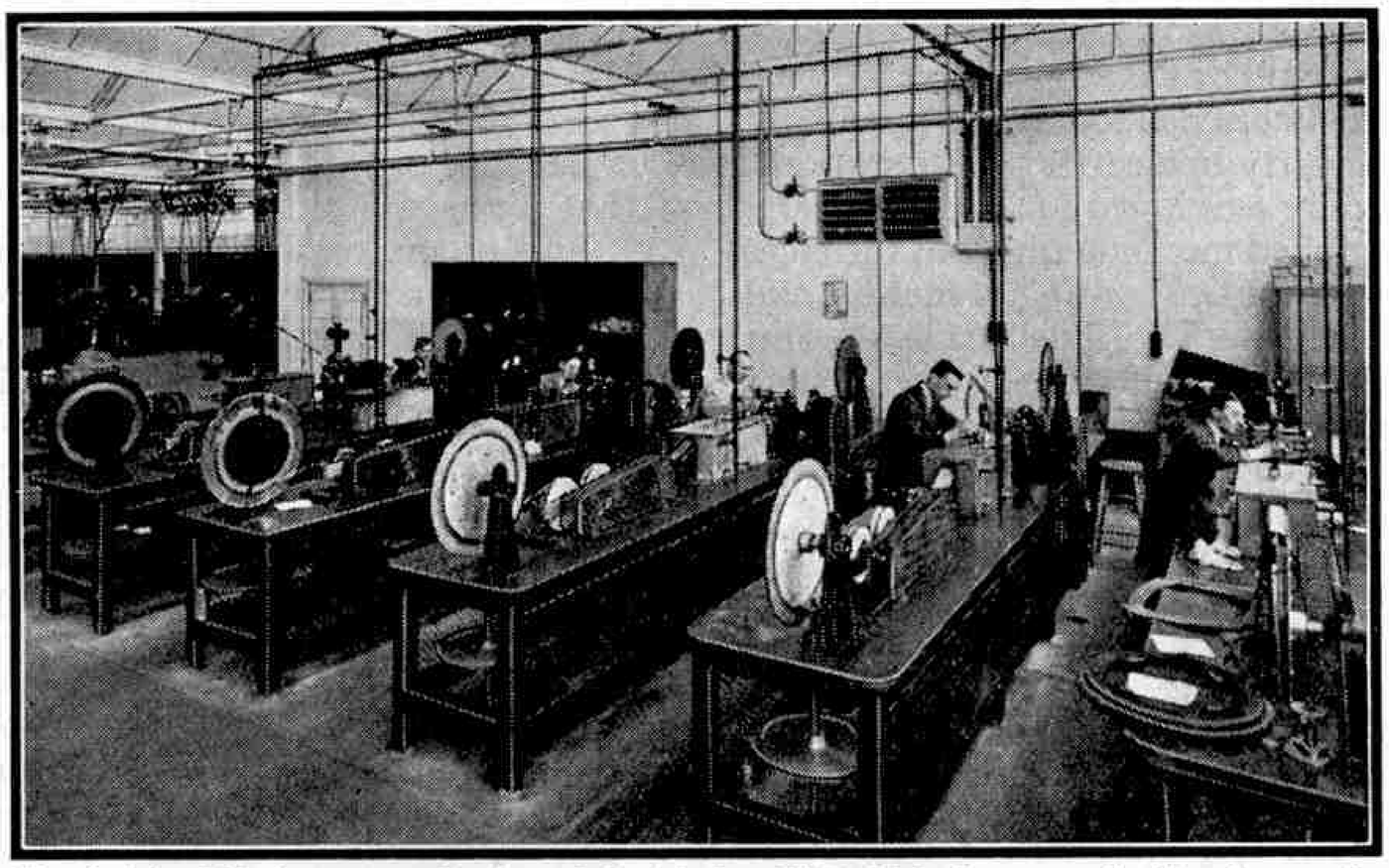
Pressing out safety razor blades from a coil of blank strip steel at the rate of 320 a minute. The illustrations to this article are reproduced by courtesy of Gillette Industries Ltd.

An interesting detail of the tempering is that while the edges of the blades are tempered to the hardness most suitable for shaving, the centres are of a somewhat different temper, the object being to give a flexibility that enables the blade to take the correct curve and fit its holder perfectly. To devise means of giving different tempers to two portions of such a small article as a razor blade, and of doing this consistently with millions of such blades, was very difficult, but it has been done successfully. The temperatures at which hardening and tempering are carried out are closely controlled and periodical tests are made on blades taken from the batches going through.

The next process is the marking of the blades with the trademark and other lettering. This is done by acid etching, the strip passing through the machine to a point where rubber stamps print the inscription in acid. The "inking" of the stamps with the acid solution is an interesting process, for endless cellulose bands dip into an acid bath, and bring up a supply to two pairs of fabric pads that are level with the blade strip. The rubber stamps move sideways, first resting on the acid-damped pads and then moving over to print on the blades. Both sides of the blades are printed at once, and the strip then passes on

through a bath of soda solution, which neutralises the acid. The strip is then dried and polished.

Grinding, honing and stropping are the next processes, but before the blade strip reaches this point, several coils of standard size are spot welded to form one large coil in order to avoid continual re-loading and re-setting of the machines. The grinding, honing and stropping is handled by a battery of specially designed machines, working in stages, which gradually give to the blades the perfect edge essential for their purpose. These machines put a perfect edge on the razors in less than half a minute.



The plant in which the name and trade mark is etched on Gillette blades by means of rubber stamps with acid on them. The acid is then neutralised by passing the blades through a soda bath.

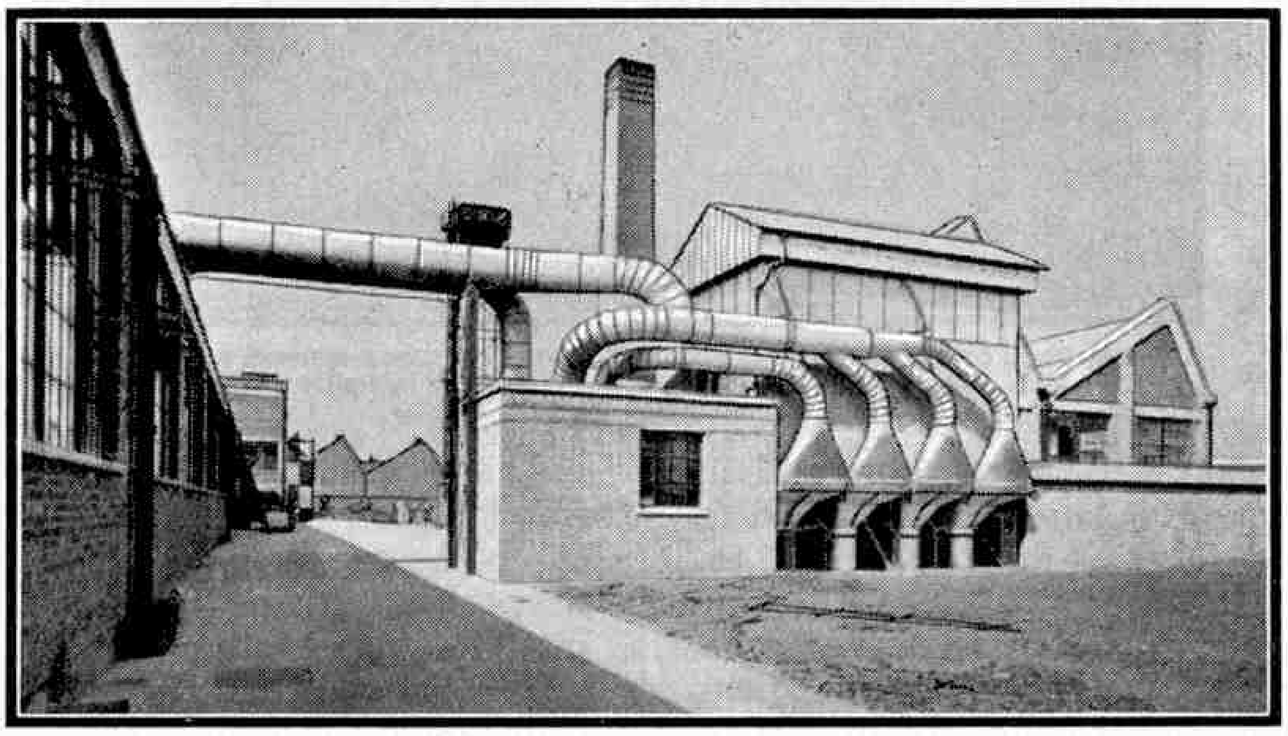
As the blades emerge from the final honing machine, they pass to a point where they are rapidly cut off, and for the first time become separate blades. They are then pushed out of the machine, and fed on to a holder, known as a charger, which holds 1,000 when full. The blades are literally blown on to the chargers, for, as each comes level with the charger end, a compressed air blower impels it down the bars of the charger.

The loaded chargers are next inspected, and any defective blades are removed. It may not seem easy to find incorrectly finished blades amongst the large batches in the chargers, but the inspectors do their work easily. Blades that are not up to standard reflect light differently, and can be detected when the charger is held at a certain angle. Very few faulty blades are found.

Each razor has a waxed paper wrapping and an outer printed wrap, and these are put round them on a flat rotating table. First the printed wrapper is fed from a magazine-stack, and placed in a pocket on the table. Then, as the table turns, the waxed paper is cut from a roll and a shaped knife leaves the paper ready to fold around the blade. As the table turns still further, the blade is slipped off the charger and placed in position on the two wrappers, and finally metal fingers working in pairs close the wrappers round the blade and the work is done. The last stage of all is reached by the next movement of the table, the little package being pushed by a plunger into a vertical tube, from which batches of blades are removed as they accumulate.

The insertion of the blades into cartons of five or ten also is carried out by machinery. Batches of blades are placed in a number of parallel channels, and from these they are fed in batches of five or ten to pockets in an endless chain that moves on along the machine. The cartons, which are loaded into a vertical feeding tube or channel, are fed into pockets in a second endless chain, and at the same time are opened and prepared for the blades. At one point the two chains run parallel with their pockets opposite, and a simple traversing movement by a finger moves the blades across and into the cartons. The carton ends are then gummed and sealed by further mechanical fingers, and the packets are fed to a table for checking before they are finally wrapped in a cellophane outer wrapper that excludes damp.

In addition to the blades, the holders in which they are used also are made in the factory. The handles are turned from rod and tube, and all the turning, threading and knurling operations are carried out on the automatic lathes. Certain pressed parts call for several successive processes, and when these and the turning operations are completed, the parts are plated in various ways. The plating shop can deal with gold, silver, nickel and chromium plating, and there is a large department in which parts are polished before and after plating.



The dust removal plant at the Gillette razor factory. This sucks out the dust from the polishing shop, in which the air is changed every two minutes.

In this polishing shop is an ingenious machine that deals with the upper surface of the razor cap. The caps are placed on an endless chain, and pass under a series of polishers, emerging at the other end with a brilliant surface. As they pass under the buffs, the caps are given a slight oscillating movement that prevents the polish from being in lines across the surface, and ensures a smooth level finish.

Polishing is dusty work, and a special exhausting plant removes all injurious matter by strong suction. The whole of the air in the room is changed every two minutes, and the dust is collected in a special building.

The factory is notable for its fine layout and architectural features, all of which are designed towards making work as easy and efficient as possible. The employees number over 900, and at full capacity 1,500,000 blades and 25,000 razors are turned out each day. Truly, this is a remarkable development from one man's simple thought.

Making Pulverised Fuel

Vacuum System for Drying and Grinding Coal

IN recent years pulverised coal has found increasing use for firing boilers, particularly in electric power stations. Fuel in this form is not only employed for raising steam, however, for it is being applied more and more in furnaces of all kinds, including those for the melting of metals, and in kilns for producing cement. The illustration on this page shows a pulverised fuel installation on the British Rema Patented Vacuum System, the application of which is not restricted to coal, for minerals and other friable or even hard materials also can be ground by similar means.

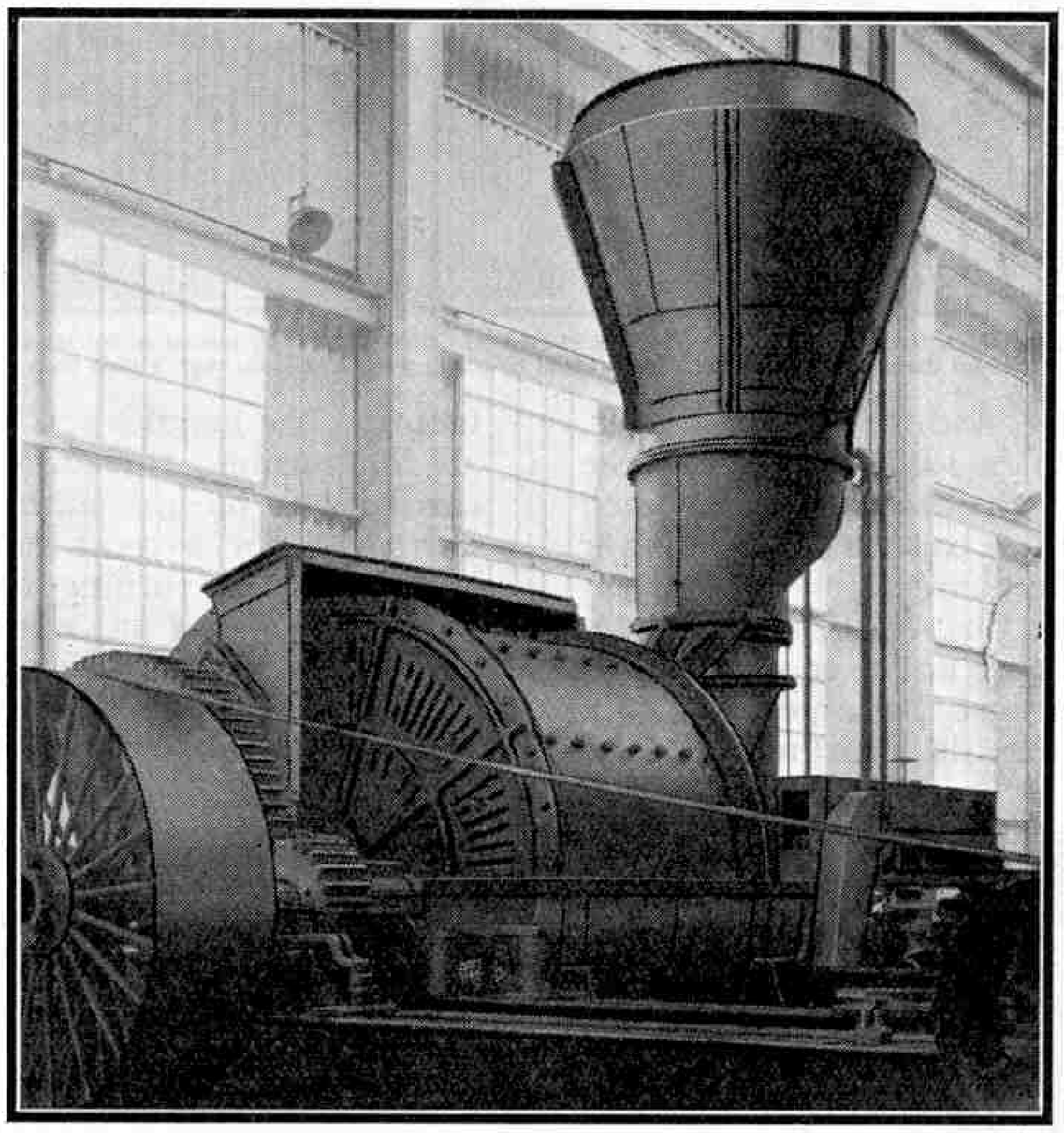
In the plant illustrated the coal is fed into an inlet pipe by means of a special device, and is then carried up the vertical pipe by a powerful stream of air produced by a fan. The air is hot and the current gives a spinning motion to every particle of coal, so that if this is wet it is thoroughly dried and brought into the best condition for the subsequent crushing. The drying action is so rapid that 10 per cent. of moisture is extracted during passage through a pipe 6 ft. in length when the air is heated to a temperature of 350 deg. F. A greater proportion of moisture is removed when the air is made even hotter.

The dry coal is swept by the stream of air into a separator, where fine particles are carried right through to an inner cone. The larger pieces fall down chutes to the crushing mill, in which they are reduced to powder, and this is carried to the separator through the vertical pipe already referred to.

The purpose of the separator is to divide the fine material from that requiring crushing. In it the finer particles pass to the inner cone, where a series of adjustable vanes give a circular motion to the stream carried along by the air current. The result is a centrifugal action, the larger and heavier particles falling and being returned through discharging flaps to the crushing mill, while the finely ground coal is extracted by means of a powerful fan and fed to the burners in the furnaces.

In practice the plant delivers finely powdered fuel at the same rate as coal is supplied to it, for the material circulates so rapidly that the "fines," or particles sufficiently small for use in the furnaces, are extracted immediately they are produced. No ground fines are allowed to stay in the mill. This is the secret of the high grinding efficiency of the plant, since the whole of the power driving the mill is exercised on material requiring crushing, and is not absorbed in dealing with coal that already is fine enough.

Fuel of any required degree of fineness can be obtained by setting a handle, which adjusts the positions of the vanes at the entrance to the inner cone of the separator, and thus controls the centrifugal separating action. No further attention is necessary when this handle has been set. Pieces of coal that are too heavy to be lifted by the air current fall to the lower end of the pipe, and are easily removed on opening a trap. When dirty coal containing iron pyrites and other impurities are being ground, the machine can be arranged to reject a large percentage of this unwanted material, thus saving power and wear and tear of both mill and furnace linings.



A British Rema ball mill pulverising plant with part of the casing removed to show the discharge grids and gearing. This photograph is reproduced by courtesy of The British Rema Manufacturing Co. Ltd., Halifax.

Several different types of pulverising mill are available in the Rema system, and each of these is particularly suited for handling certain kinds of material. The mill in the plant illustrated on this page is a ball mill, in which the coal is ground by impact with steel balls in a revolving drum. The drum is made of heavy mild steel and is provided with machined and spigoted angle rings at each end, to which are secured the inlet and discharge end plates respectively. It is surrounded by a dust-tight sectional mild steel casing of welded construction, with heavy angle iron flanges where the sections are joined together. A lining of heavy stepped plates of chrome steel is secured in position by countersunk bolts, and the balls are made of high carbon steel.

The coal or other material to be ground in this ball mill is delivered to the inlet end by the air separator, entering the drum through the inlet end plate. There it mixes with the steel balls, and their cascading movement grinds it to a fine powder as the drum revolves. The cascading of the balls is intensified by the stepped formation of the lining plates. The material passes through the drum quickly and is discharged through slots in the outer end plate to the casing. There it is caught up in the air current and carried to the ascension pipe and thence to the air separator, where the fines are drawn off and the coarse particles are rejected. The latter are then returned to the revolving drum for further treatment in the manner already described.

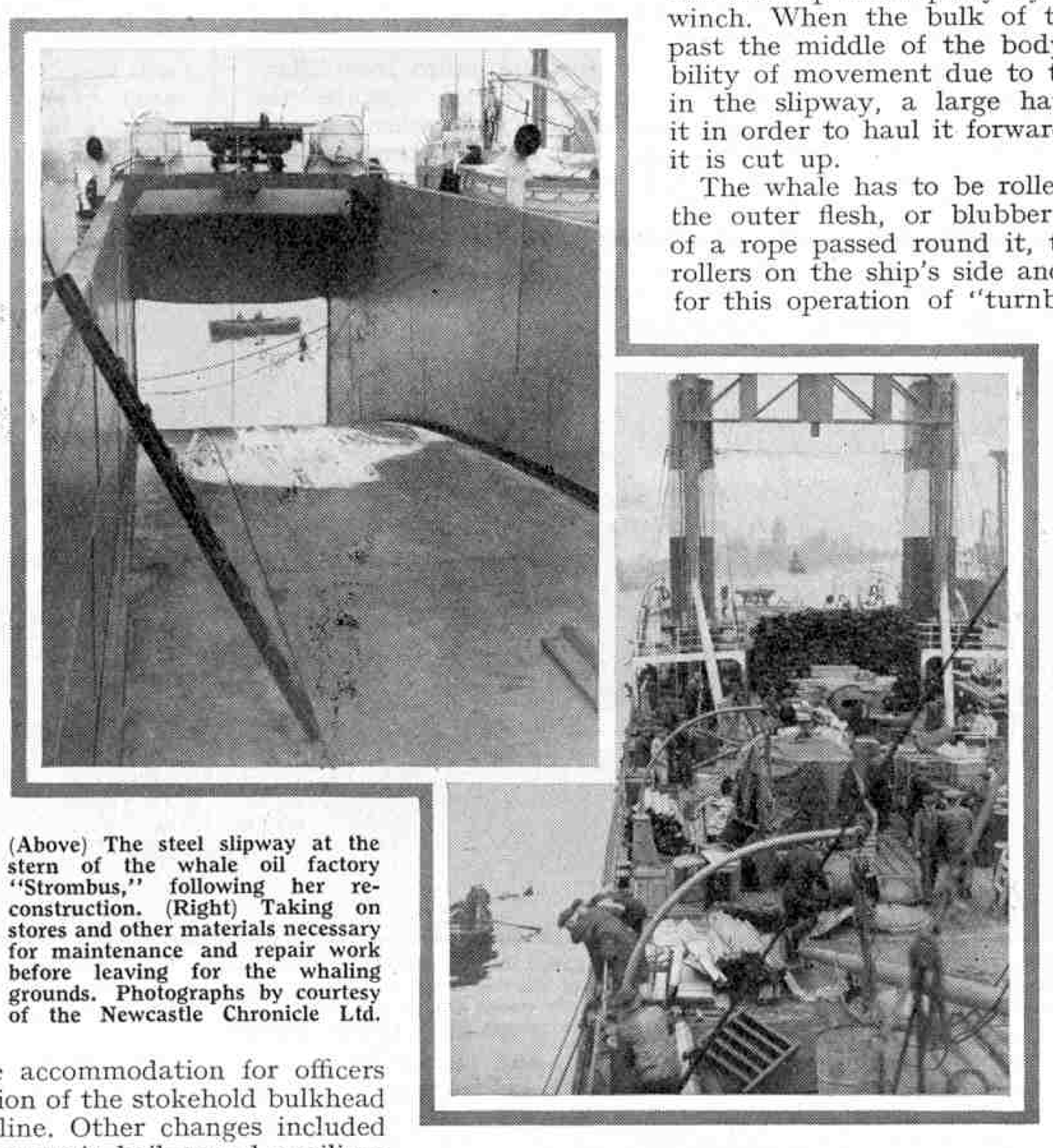
The "*Strombus*"

A Modern Floating Whale Oil Factory

THE whaling industry has made greater progress in the last 25 to 30 years than almost any other modern enterprise. It has advanced from the adventurous and extremely hazardous method of hunting, "playing" and securing the catch at close quarters from small open boats, to the use of catchers equipped with explosive harpoon guns and factory vessels in which the blubber is converted into oil with great efficiency. The equipment now employed has converted whaling almost into an exact science.

One of the most modern of the vessels engaged in this important industry is the "*Strombus*," which was originally built as an oil tanker, but was converted into a whale oil carrier several years ago. She has now been entirely remodelled and equipped in order to bring her in line with the requirements of a modern floating whale oil factory, able to deal quickly and efficiently with the combined catch of the fleet of specially equipped high speed whale catchers. The work of reconstruction was done by the Palmers Hebburn Co. Ltd., at their Hebburn yard, to the order and under the superintendance of Messrs. Salvesen of Leith, the owners of the large whaling fleet with which she will work.

The vessel now has a length of 410 ft., a moulded breadth of 51 ft. 9½ in., and a deadweight tonnage of 7,720, and is capable of dealing with about 12 large whales per day in the course of a season's fishing, extending from December to March. A blue whale provides an average of 16 to 17 tons of oil.



(Above) The steel slipway at the stern of the whale oil factory "Strombus," following her reconstruction. (Right) Taking on stores and other materials necessary for maintenance and repair work before leaving for the whaling grounds. Photographs by courtesy of the Newcastle Chronicle Ltd.

The chief alterations effected to the vessel involved the removal of the large donkey boiler, housed centrally in the machinery casings, and of the funnel, masts and main boiler uptakes. The galley and the accommodation for officers were transferred from the region of the stokehold bulkhead right aft down to the waterline. Other changes included the re-arrangement of the three main boilers and auxiliary machinery to accommodate a fourth boiler, additional evaporators, and electrical generating sets to supply the needs of the factory equipment.

A specially strengthened steel slipway was constructed from the level of the waterline aft to the flensing deck amidships. Up this slipway are hauled the whale carcases, often measuring over 90 ft. in length and sometimes weighing more than 120 tons.

The "*Strombus*" sailed for the whaling grounds last November, after taking on board provisions, including live stock, and a variety of spare parts and materials necessary for the repair work to the vessel herself and the attendant whale catchers. The vessel is thus independent, and whaling operations can be conducted without interruption during the short season.

The output of a floating whale oil factory depends primarily upon the efficiency of the attendent whale catchers, and in particular on the skill of the gunners. The five catchers attached to the "*Strombus*" are specially strengthened for navigation in ice. Each is from 100 to 125 ft. in length and carries a crew of about 12 officers and men. The most modern of these vessels attain a speed of 15 knots and are very quick in manœuvring. They receive their stores, fresh water, and oil fuel from the parent ship, which also carries the materials for repair work.

When proceeding on a whale-catching expedition a sharp look-out is kept, and as soon as the whale is sighted the catcher approaches as close as possible, and manœuvres into position for firing the harpoon gun in the bows of the vessel. Almost invariably the shot is successful, and the whale is securely "hooked." The catch is brought alongside and a spear with a compressed air connection is driven into it. Air is then pumped in to keep it afloat, and it is buoyed and cast loose while the hunt is continued.

When the day's work is ended the catcher returns to the parent ship, towing her catch alongside, and the whales are then drawn tail first up the slipway by means of a special "fishing" winch. When the bulk of the whale, from the head to past the middle of the body, is stranded without possibility of movement due to the rise and fall of sea water in the slipway, a large hauling winch is connected to it in order to haul it forward to the flensing deck, where it is cut up.

The whale has to be rolled over in order to deal with the outer flesh, or blubber. This is effected by means of a rope passed round it, the free end being led round rollers on the ship's side and attached to winches, which for this operation of "turnbuckling" are run in opposite directions.

The blubber or "spekk" is passed forward and fed into boilers by means of a special elevator, which cuts it up and distributes it in equal proportions to the boilers. Steam at a low pressure is then introduced to render down the blubber. As the oil accumulates on the surface of the mixture it is drained off into tanks below, or if necessary into small separators fur further refining, and finally is passed into the main bulk storage tanks.

Press boilers, in the forward factory, deal with the bones. These are cut into pieces by steam-driven saws and fed in convenient sizes into the boilers through openings in the flensing deck. Salt water is then added, and the temperature of the mixture is raised to boiling point by the introduction of steam at a pressure of about 56 lb. per sq. in. Oil collects on the surface, and this is drained off into receiving tanks. Sight glasses on the oil lines enable the operator to judge when the best oil has been drawn off, and the remaining mixture is then diverted to apparatus forward where the last traces of oil are extracted, filtered and transferred to the several collecting tanks, or if necessary passed through the small separators for further refinement.

The flesh from the carcases is fed through openings in the flensing deck into boilers consisting of an external fixed drum and an internal rotating perforated drum, and containing preheated salt water and steam. The resulting mixture is digested under the action of heat and the perforated rotating inner cylinder until the mixture has been suitably reduced, when it is blown into the separators, there being one separator for each of the seven boilers installed. Water is added and the separated oil is drawn off at the top. This is then run into the clear tanks, as the main storage tanks are called, or if necessary further refined in small centrifugal separators and then passed into the tanks, the residue from the separators being ejected by pressure through a shell connection below the water line.



Midland Dynamometer Car Runs

Experimental dynamometer car trials were carried out recently over certain Midland Division routes of the L.M.S.R., three return trips being made on different routes. The first run was from St. Pancras to Leeds and back, with a stop at Leicester in each direction, and the second was again to Leeds and back, this time with stops at Nottingham and Sheffield in each direction. For these runs a train of nine vehicles, weighing 302 tons including the dynamometer car, was worked by 4-6-0 locomotive No. 5614, *"Leeward Islands."* The third run was from St. Pancras to Manchester and back.

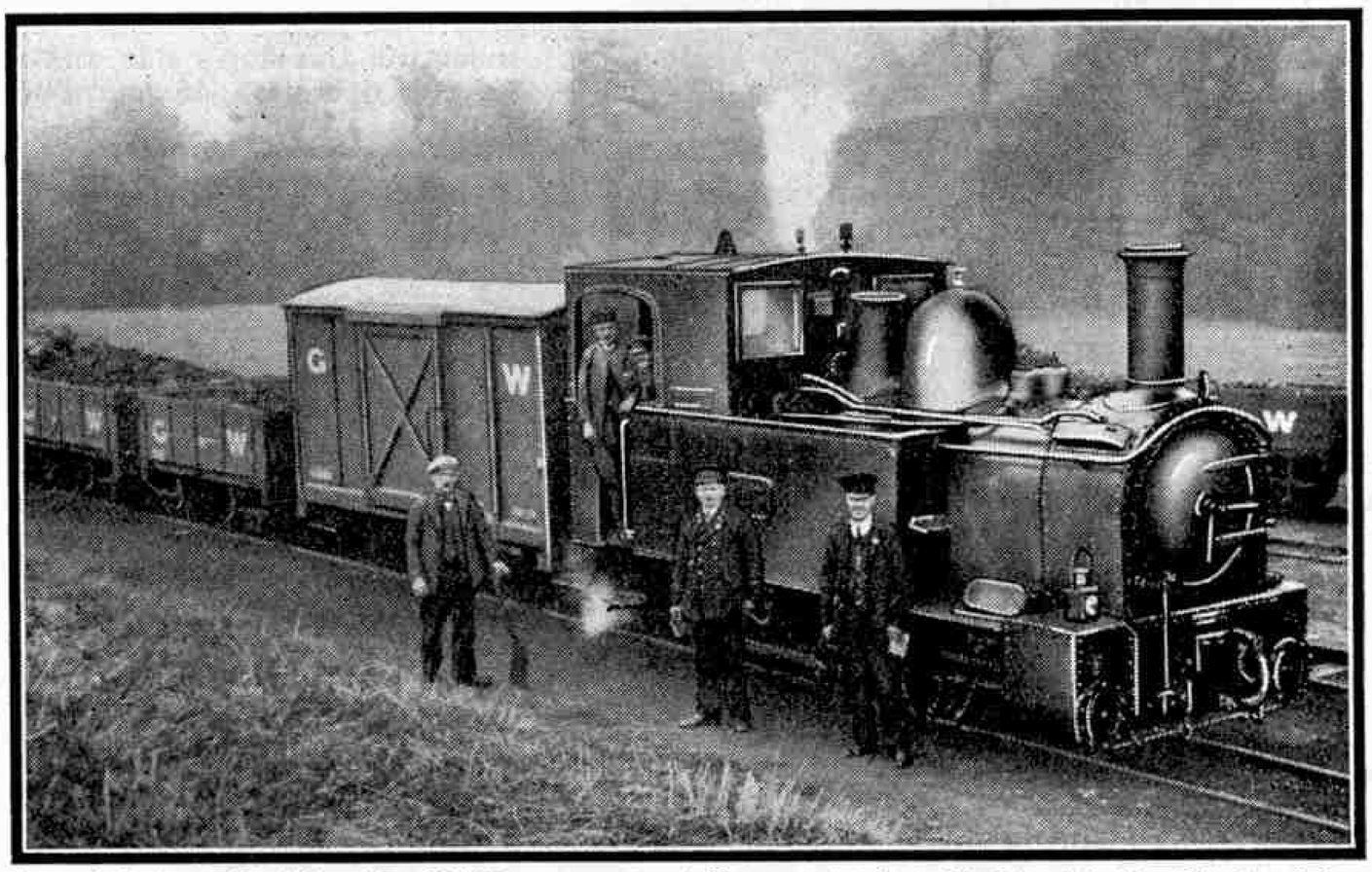
On the first run the 99 miles to Leicester were completed at an average of 62.1 m.p.h. in 95 min. 40 sec. start to stop, instead of the 96 min. experimentally scheduled, although speed restrictions for permanent way operations and mining subsidences in colliery areas were against high average speeds. On the return journey, the 99 miles up from Leicester were covered at an average of 64.1 m.p.h., and the gain on the experimental schedule amounted to 3½ min.

On the second day the 123½ miles between St. Pancras and Nottingham were covered at an average of 63.1 m.p.h.; and in the up direction at an average of 64.6 m.p.h. in spite of 11 restrictions of speed on each journey. On the return journey an exceptional performance was achieved on restarting from Sheffield, when a speed of 44 m.p.h. was attained in four miles from the start up the continuous 1 in 100.

On both Leeds tests the enginemen on the down runs were Driver F. G. Howard and Fireman J. Hall of Kentish Town, and on the up runs Driver W. North and Fireman H. George, of Leeds.

On the down Manchester run No. 5278 of Class 5P5F, with Driver W. Smith and Fireman A. Crooks of Trafford Park on the footplate, and a load of 258 tons, covered the 61½ miles from Derby over the steeply-graded Peak Forest section to Manchester in an overall time of 68 min. 10 sec., compared with the experimental schedule of 72 min. The overall journey of 190 miles from St. Pancras to Manchester (Central) was completed in 3 hr. 22 min., a gain of 33 min. on the fastest time in this direction.

In the southward direction No. 5264, of the same class as the engine concerned in the down run, in charge of Driver G. H. Beebe and Fireman R. Fowlkes of Trafford Park, maintained the experimental schedule of 73 min. for the 61½ miles from Manchester to Derby. Then, despite the comparatively small driving wheels of this class of engine, some high maximum speeds were reached, including one of 91 m.p.h., two of 86.6 m.p.h., and one of 85 m.p.h. The 99 miles between Leicester and London were covered in 92½ minutes start to stop, at an average speed of 64.1 m.p.h. and including stops at both Derby and Leicester, the journey of 190 miles from Manchester to St. Pancras was completed in an actual running time of 3 hr. 15½ min.



A goods train on the interesting G.W.R. narrow-gauge line running from Welshpool to Llanfair-Caereinion. The train is hauled by No. 823, "Countess," one of the two 0-6-0 tank engines used on the line, which was formerly operated by the Cambrian Railways. Only goods trains are run, and the other engine used is No. 822, "The Earl." Photograph by G. Charles, Brymbo.

Locomotives for New Scottish Trains

The names selected for the five L.M.S.R. streamlined 4–6–2s Nos. 6220-24, which were mentioned in the April *"M.M.,"* are as follows: *"Coronation," "Queen Elizabeth," "Queen Mary," "Princess Alice"* and *"Princess Alexandra."* These engines are for *"The Coronation Scot,"* a new train that will commence a 6½ hour service between Euston and Glasgow next month.

The names, *"Dominion of Canada," "Commonwealth of Australia," "Dominion of New Zealand," "Union of South Africa"* and *"Empire of India,"* have been chosen for the L.N.E.R. engines to be used on the new *"Coronation"* express.

New 4-6-0 Locomotives for the G.S.R.

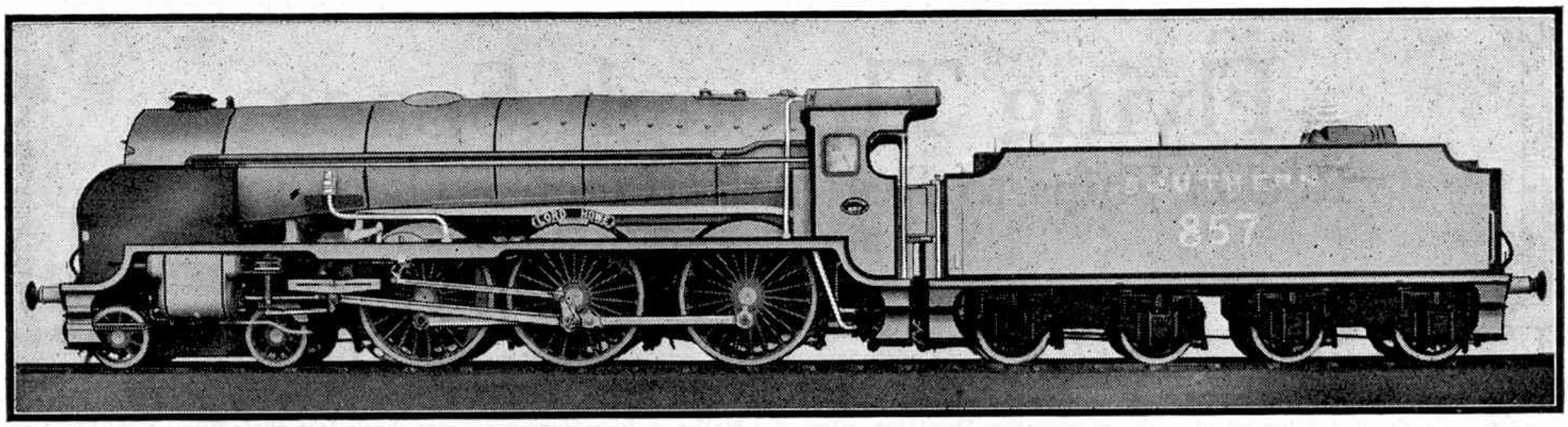
Some new 4-6-0 express locomotives are being constructed at Inchicore Works by the Great Southern Railways of Ireland. They are intended for use on the heavy mail trains between Dublin and Cork, but will not be available for traffic until early next year. They will incorporate three-cylinder simple propulsion and will be the first engines of this kind in Ireland. The cylinders are to have a diameter of 18½ in., and a piston stroke of 28 in. Long-travel piston valves 9 in. in diameter will control the admission of steam, each with its own independent set of Walschaerts valve gear. The driving wheels will be 6 ft. 7 in. in diameter, and the boiler, which will have an internal diameter of 5 ft. 10¾ in., will have a total heating surface of 2,371 sq. ft. and a working pressure of 225 lb. per sq. in.

Six-wheeled tenders with roller-bearing axleboxes will be employed, having a capacity of 5,000 gallons of water. It is hoped to describe the new engines more fully and to illustrate them in the *"M.M"* at a later date.

Locomotive Christenings

Recently G.W.R. four-cylinder 4-6-0 No. 4037, formerly *"Queen Philippa,"* was renamed *"The South Wales Borderers."* The naming ceremony was performed by Major General L. I. G. Morgan-Owen, C.B., C.M.G., C.B.E., D.S.O., Colonel of the South Wales Borderers, at Paddington Station, in the presence of officials of the G.W.R. and officers of the regiment. This engine is one of several of the original "Star" Class that have been rebuilt as "Castles," and is the second locomotive so rebuilt that has been renamed specially, the other being No. 100A1 *"Lloyd's."*

L.M.S.R. locomotive naming ceremonies have been carried out at Euston and at Lime Street, Liverpool. At Euston No. 5501, formerly *"Sir Frank Ree,"* has been named *"St. Dunstans"* by Captain Sir Ian Fraser; and No. 5595, *"Southern Rhodesia,"* by Dr. Huggins, Prime Minister of Southern Rhodesia. At Lime Street the Lord Mayor of Liverpool, Alderman W. Denton, named 4-6-0 locomotive No. 6132, *"The King's Regiment (Liverpool)."*



S.R. No. 857, "Lord Howe," one of the "Lord Nelson" class locomotives. This engine has been fitted with an enlarged tapered boiler with a round-topped fire-box, as described on this page. Photograph by courtesy of the Southern Railway.

Fine Running on an Unusual Route

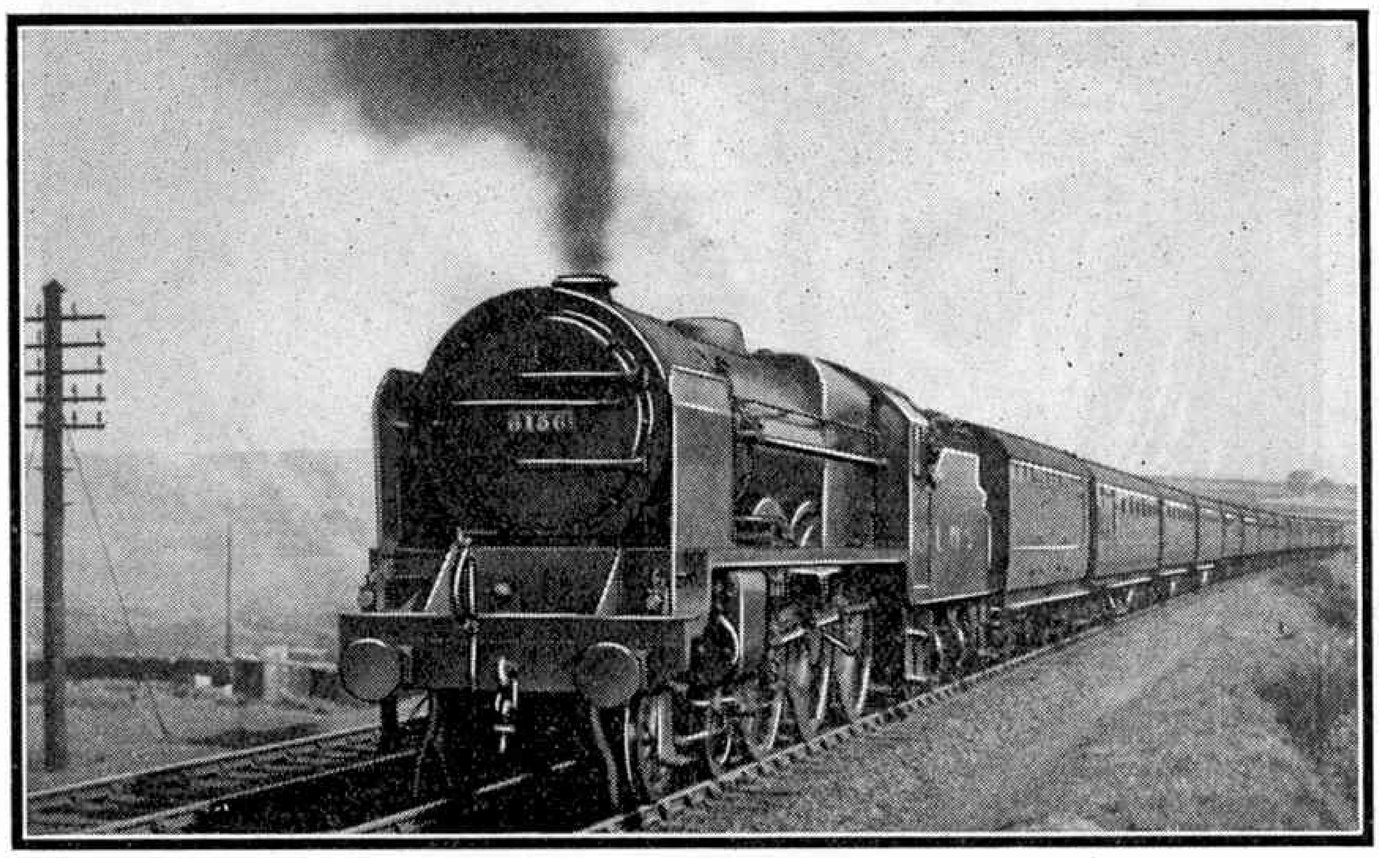
An interesting example of the special routing arrangements that are put into force sometimes when the regular main routes are temporarily blocked was noted recently by Mr. O. S. Nock. On account of engineering work near Lichfield, several L.M.S.R. main line expresses to the north were diverted via the Birmingham district. Trains from the north took the direct line from Stafford towards Wolverhampton as far as Bushbury Junction; then to avoid the crowded main line through Dudley and Birmingham they were diverted via Bescot and Aston, rejoining the Birmingham main line at Stechford, 3½ miles on the London side of New St. Station.

On this occasion the up *"Ulster Express"* made a very fine run, in spite of extra delays apart from the diversion. The load was heavy, 397 tons tare and 425 tons with passengers and luggage, and was hauled by a "Royal Scot," No. 6138, *"London Irish Rifleman."* A good start was made from Crewe and speed was sustained at 45 m.p.h. up the 1 in 177 of Madeley bank, while the long but very gradual descent to Stafford was covered at a steady 72 to 75 m.p.h. A careful easing followed through the station, but once on to the Birmingham line No. 6138 went splendidly up the long 1 in 320 bank past Penkridge and Four Ashes at a sustained 56-57 m.p.h. A special stop was then necessary at Bushbury Junction to take water.

The 33.6 miles from Crewe to Four Ashes had taken 40¼ min., but after getting away from Bushbury some very cautious running followed over the connecting line, so that the 44½ miles from Crewe to Bescot took 61¾ min. Passing this latter point dead slow, No. 6138 then picked up splendidly to 55½ at Great Barr, only 3½ miles further on, but very severe slowings had to be made over the junctions at Aston, and again on rejoining the main line, so that the train took 79½ min. to cover the 54.3 miles from Crewe to Stechford. Then No. 6138 went away like the wind. Hampton-in-Arden was passed at 67 m.p.h., and the four-mile rise at 1 in 330 to Beechwood tunnel mounted without speed going below 65½ m.p.h. But then unfortunately came a whole succession of signal checks so that the remaining 17 miles into Rugby took as long as 32 min.

On the next stage the express took the regular main line and Driver Haynes made the most of it. The train is allowed 50 min., start to stop, for the 35.9 miles to Bletchley, a leisurely schedule that allows for a possible diversion via Northampton, but on this trip the distance was reeled off in 38¾ min., inclusive of a bad signal check at the finish. The 26.8 miles from Welton to milepost 48½ were covered at an average of 68.8 m.p.h., with top speeds of 75 m.p.h. at Weedon and 78 m.p.h. at Castlethorpe.

On the final stage into Euston the train used the slow line on account of engineering operations on the fast line. However, No. 6138 continued to do well, passing Berkhamsted, 18.7 miles from Bletchley start in 22 min. After two further checks there came a very lively finish, for the slow line, with a sustained maximum of 75 m.p.h. at North Wembley. Further checks were inevitable with only one approach line into Euston available, and the train eventually arrived in one minute over four hours from Crewe; but the net time was only 196 min.



A down Scottish express climbing Shap, hauled by locomotive No. 6156, "The South Wales Borderer," as formerly running with a 3,500 gallon tender. Photograph by Rev. E. Treacy, Edge Hill, Liverpool.

L.M.S.R. Locomotive News

The following new engines are at work: 2–8–0s Nos. 8024/5, 2–6–4Ts Nos. 2487–90 and 4–6–0s Nos. 5334–52.

Class 5X 4–6–0s Nos. 5906, *"Ralph Brocklebank,"* 5910, *"J. A. Bright"* and 5948, *"Baltic,"* and class 4 4–6–0s Nos. 25624, *"Thomas Campbell"* and 25699, *"Vulcan"* have been condemned.

S.R. "Nelson" Class Locomotive Reboilered

A new and larger boiler has been fitted to S.R. 4-6-0 No. 857, *"Lord Howe,"* of the "Lord Nelson" class, and the engine as now running is shown in the illustration at the top of this page. The new boiler gives the locomotive a most imposing appearance, and apart from its size it incorporates several differences from that originally fitted. It has a tapered barrel and a round-topped fire-box in place of the Belpaire pattern boiler ordinarily fitted to the "Nelsons." The inside fire-box now extends into the boiler barrel, forming a combustion chamber and reducing the length of the tubes. The fire-box heating surface and the superheater surface are increased, but the tube heating surface is reduced. A single snifting valve now appears behind the chimney. Boiler pressure remains as before at 220 lb. per sq. in.

It is of special interest to notice that the reboilering has been effected without increasing the empty weight of the engine by more than 3 cwt., as the result of the use of nickel steel plates in the construction of the new boiler. The weight of the engine alone is now 77 tons 5 cwt. empty, and 85 tons 12 cwt. in working order. The engines of the "Lord Nelson" class employ alloy steel for their motion parts, so that the use of nickel steel for the new boiler further improve the power-weight ratio.

Although they are not a numerous class, the "Lord Nelson" engines show variations, of which the large boiler now carried by No. 857 is the latest example. No. 859, *"Lord Hood,"* has smaller driving wheels than the rest of the class; No. 860, *"Lord Hawke,"* has a longer boiler barrel; No. 862, *"Lord Collingwood,"* has a double chimney; and No. 865, *"Sir John Hawkins,"* has its cranks spaced so that there are four exhaust beats to each revolution of the driving wheels instead of the eight characteristic of the other engines.

New L.N.E.R. Train

On the third of last month the L.N.E.R. inaugurated a night express service between Marylebone and the North East Coast. This is the first regular service to operate between these points.

Flying Through Space

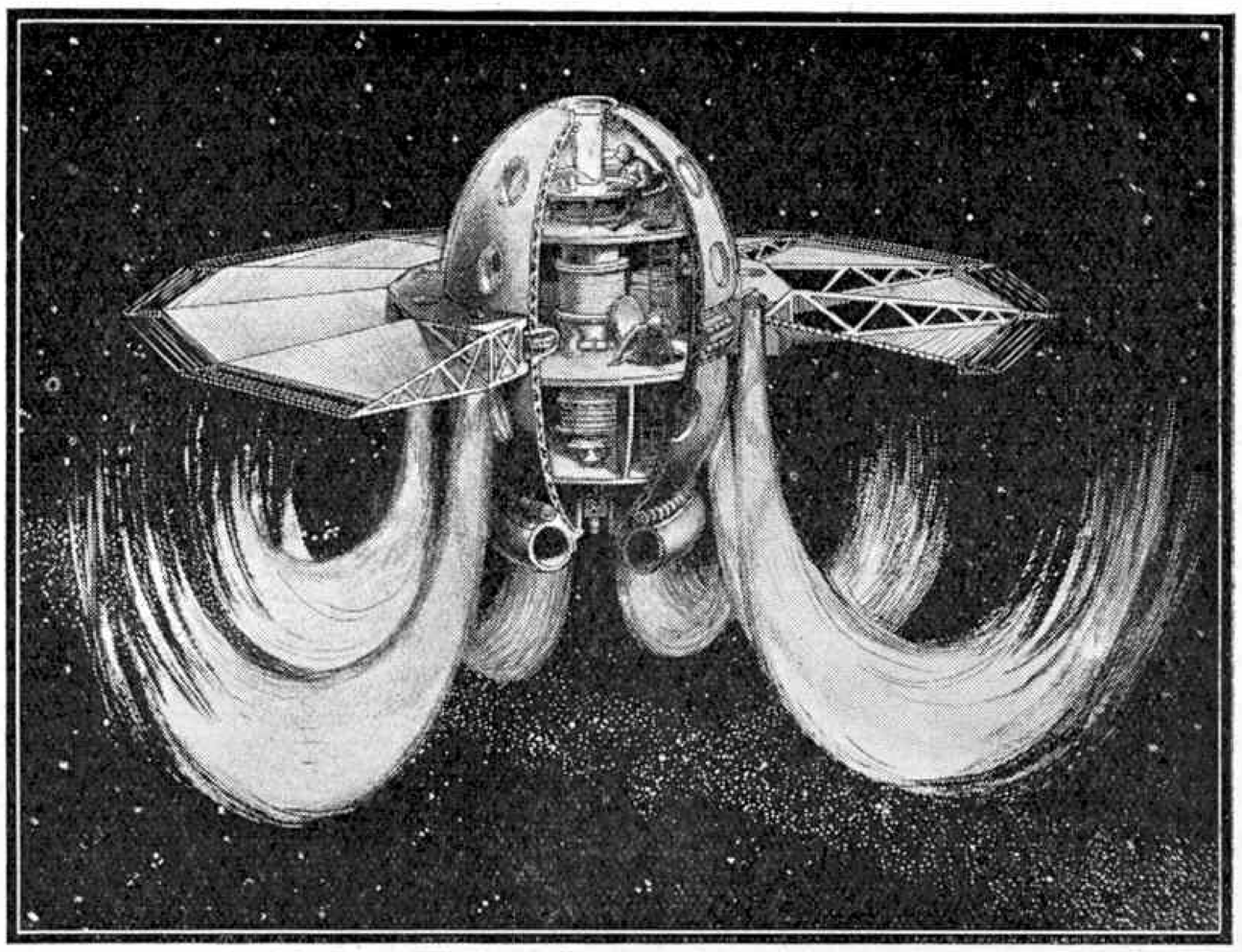
Rocket Ships to Reach the Moon and Planets

By I. O. Evans

LONG before flying became possible there were people who believed in it, or told stories about it, or with crude apparatus tried experiments that led them nowhere or ended in a crash. From very early days come stories of flying carpets and flying horses, and the Greeks had a legend of a clever inventor, Daedalus, who made waxen wings with which he flew across the sea. His son Icarus is said to have flown too near the Sun, so that his wings melted in its fierce heat. For a long time these stories were thought to be mere romances, but now we may well wonder if Daedalus really made a workable parachute of some kind, with which Icarus crashed, all sorts of queer details being added later as the story passed from mouth to mouth.

There also have been ideas for flying still further, leaving this Earth and reaching the Moon, the planets or even the distant stars. As long ago as the days of the Roman empire a writer named Lucian wrote an amusing wonder-yarn about a trip to the Moon and a battle between its people and those of the Sun. In the eighteenth century Bishop Wilkins, a scientific thinker, discussed plans for flying to the Moon, and the invention of balloons made such ideas seem less impossible than before.

Balloons are useless for really great heights, however, for the air is too thin to buoy them up. Aeroplanes and helicopters are equally useless there, for their wings and revolving screws cannot "bite" on the rarefied air, and in order to get into the upper regions of the atmosphere and beyond it, to say nothing of travelling to the moon or the planets, some method of flying is necessary that is entirely new and does not depend on the atmosphere and its support.



A space-ship designed by F. von Ulinski, an Austrian engineer, who calls it the cathode rocket ship. It carries no fuel, but obtains power from the absorption of the Sun's rays by the wing surface.

The most obvious suggestion is to make a great gun to fire a shell to the Moon. Last century Jules Verne used this idea in two of his exciting stories, and a great space gun that is a feature of H. G. Wells's film *"Things to Come"* was illustrated in the *"M.M."* of September 1926. Unfortunately this idea has many disadvantages, apart from the fact that we could not at present make a gun anything like powerful enough. The shell would have to leave the gun with a speed of seven miles a second in order to overcome the Earth's attraction. As the shell rushed through the air at this headlong speed, the heat due to friction might melt it or set it on fire, and it seems quite certain that, no matter how carefully they were padded and protected, the crew would be killed by the terrible shock of discharge.

It might be arranged that the gun should fire a smaller gun, and this another, and so on, in order that the shell may attain the necessary speed in steps instead of in one terrific jerk. This would be difficult to manage, however, and the shock of each discharge would still be very great.

But suppose the process is reversed, and a series of shells is made to fire the gun instead of the gun firing the shell. By continuous firing the speed could then be built up more gradually. At first glance this seems an impossible idea. We use it already, however, in something familiar to everybody, for a rocket is exactly like a gun, except that it fires itself into the air, instead of having its recoil taken by springs and a heavy gun-carriage. It does not fire a shell, but the gases it discharges backwards have just the same effect.

Rockets have already been used for propelling cars and cycles and sledges, and for driving aeroplanes ahead at a greater speed. With them speeds are worked up surprisingly quickly, and in a rocket car one experimenter, Fritz von Opal, reached a speed of over 60 m.p.h. in two seconds. Work with such high explosives of course is dangerous, and more than one "rocketeer," among them Max Valier, a very daring pioneer, have lost their lives, but this does not prevent others from following in their steps.

A rocket would be perfectly suited for flight into space if it could be made large and powerful enough. It does not need air to burn in, for the oxygen it uses is part of the fuel; nor does it require air to "kick" against, and indeed works best in a vacuum. Groups of workers are experimenting with the first rocket-aeroplanes, and at any time we may hear that some very good results have been obtained. The earliest of these rocket-aeroplanes are not likely to be aimed at the Moon. They will probably be small experimental affairs, carrying recording instruments high into the air, higher perhaps than even the smallest and lightest balloon can go. Then larger machines may follow, until one is made of man-carrying size, and passenger flights high into the stratosphere may eventually be as common as a Channel crossing is to-day.

Such high-altitude aeroplanes would never be content with the slow speeds of aeroplanes driven by airscrews. New problems would arise with the coming of the rocket planes. They would have to be made air-tight, for they would be passing through regions where the air is far too thin to breathe, and would have to carry their own stores of oxygen like a modern submarine. They would need special controls and recording instruments, and would be directed by means of a new science of "space navigation," keeping their route by the stars. Crews of special training and skill would be required to handle and pilot them.

As soon as such flights are successfully made, and perhaps even before, daring rocketeers will seek to reach outer space beyond the atmosphere. Such attempts will be made partly with the idea of "breaking records," but partly also with the finer ideal of winning new knowledge. There the stars are no longer obscured by even the clearest air, and could be studied to much greater advantage; even the corona, the belt of light which surrounds the Sun and normally can be seen during eclipses, could be inspected at leisure from a rocket-aeroplane.

The higher the rocket-planes travel the greater the problems they will have to face. We have no idea whether the heat of the Sun or the strange "cosmic rays," which have only recently been discovered and of which little is known, will prove injurious to human life or not, once the protection the atmosphere gives has been passed. The rocket-planes no doubt will have to be carefully shielded to ward off their ill effects, as well as to protect their occupants from the bitter cold. Another danger may come from meteors. The air protects the Earth from these flying masses of metal and stone, burning up most of them.

As the journeys grow longer and more daring, they will demand more elaborate equipment. The rocket ships will have to carry sufficient compressed air for a long space voyage besides water, food, scientific instruments, books and other matters for the use of the crew, and large quantities of fuel will be required in addition. At first, no doubt, gallant groups of adventurers would be willing just

to reach a planet with no hopes of returning, content to signal back to earth that they had arrived safely, but if space travel were to continue, plainly the space-ships would have to take enough fuel and other stores for the return journey.

One of the greatest difficulties would be caused by the changes in the weight of every thing and person in the rocket when in outer space. Whenever the space-ship moved upwards with increasing speed, all its occupants would feel themselves pressed downwards against the floor, and similarly everything in it would increase in weight. For this reason the acceleration would have to be regulated in order to protect the travellers from being crushed by their own weight. As soon as sufficient speed had been gained, and the rockets were throttled down to keep it constant, then, so long as the ship was near to the earth, normal weights would be resumed.



An experimental rocket air mail in action. Mr. G. Zucker, its originator, watching his rocket being fired at Lymington in an attempt to reach the Isle of Wight. The rocket failed to reach the island.

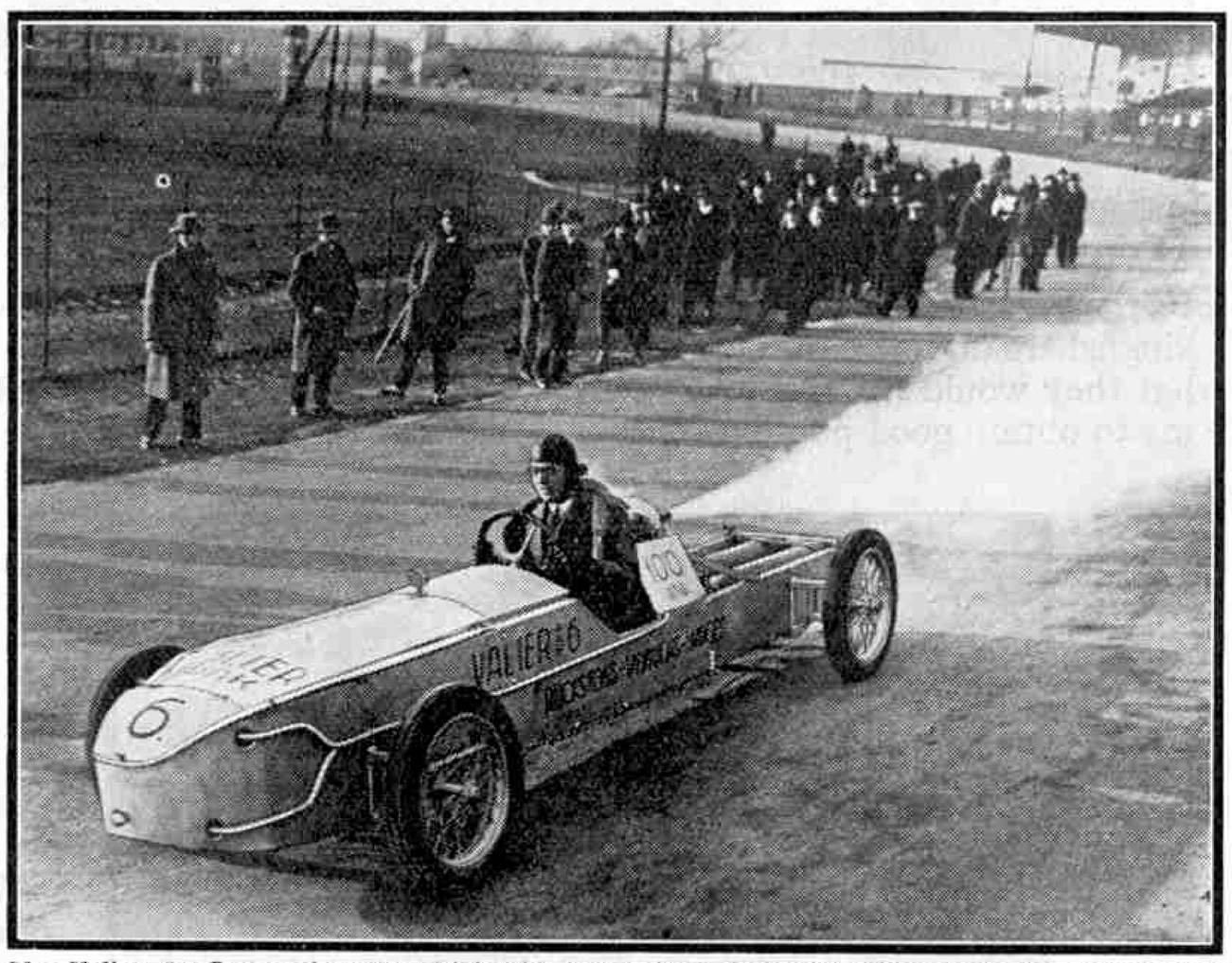
Now supposing the rockets were switched completely off, either by some accident or because enough speed has been gained to carry the space-ship through to its journey's end. In that case the ship would lose speed, just as a stone thrown upwards or a shell fired upwards lose speed before they begin to fall. But at the same time everything in it would lose speed at the same rate. The result would be that the occupants would have no weight whatever. The slightest touch or movement would send them moving about the rocket-ship, and an incautious step would send them soaring from the floor, to strike the ceiling with a painful thud and then to rebound and strike the floor. Until they could grasp something, or until the rockets were again switched on, they would bump up and down, or maybe from side to side.

This would be very inconvenient and dangerous to the rocketeers. To guard them from injury, the inside of their space-ship would have to be well padded and provided with handholds, by means of which they could crawl safely about. Engineer and pilot would probably be strapped down in their seats near the controls. Moreover, the loss of weight would affect the body, we do not know how seriously; it might cause some grave injury or be no worse than an attack of seasickness or might not even be noticeable. Again any loose objects would be liable, if jerked, to bang about the space-ship, striking the crew painfully or crashing into the delicate machinery; everything would have to be fastened down. An even greater nuisance would be water and other liquids, drifting through the air like a mist or collecting in spherical "bubbles" and floating about the place.

To avoid this, the flight probably would have to be mapped out so as to arrange for the rockets to be kept on almost continuously. The further they got from the Earth the greater their driving power would be, so that after a time they would make the speed of the space-ship too great and it would have to slow down. Reverse rockets at its prow could accomplish this, but then everything in the rocket would fall upward! Probably the simplest plan would be to slew the space-ship round, by means of auxiliary rockets fired sideways, until it travelled with its base foremost, and then the main rockets could be used to slow it and to give its occupants weight at the same time.

Such manœuvres would need careful calculation and skilled piloting. The course of the ship would have to be worked out so that it travelled, not toward the position of the goal at the moment of starting, but to the point where it would be at the moment of arrival. For all the planets and moons are themselves moving very rapidly, and their movements would have to be taken into account. Then the pilot would have to use the greatest skill in making a landing, taking the utmost care not to dash his frail craft against the surface.

All these ideas of space travel are very fascinating, but is there anything in them? Can we hope that the great interplanetary rocket-ships will be constructed, or is it only a dream? No one can tell, for there are so many things that we cannot foresee. One of the greatest difficulties would be the provision of suitable fuel, and at present we have nothing powerful enough and light enough to use. Special alloys of which to construct the craft, and means of storing oxygen, or of re-purifying used air to make it breathable again, also would be required, and new inventions along these lines might make space travel much more possible. Attempts are being made to free the energy we believe to be stored in the atom; and if these succeed we might then have at hand a store of available energy suitable for use in the rocket-planes. Similarly, the cosmic rays and the radiation of the Sun may prove to be not a danger, but a source of help. Once beyond the Earth's atmosphere, the space-ship might extend vast wings to entrap these rays in some manner and to transform them into useful energy, not only for driving the rocket ship, but also for heating, lighting, and other purposes.



Max Valier, the German inventor, driving his rocket car on the Avus track, Berlin. The rockets used were charged with carbon dioxide instead of powder.

What would the pioneers of space flight find at the end of their venture? On the Moon there would no doubt be minerals, but it seems scarcely likely that there would be anything alive. The planets might be uninhabitable, or they might contain living things that would destroy the space-crews as they arrived. That would be one of the things that the space-ships would be sent to discover. Some of them might be suitable for human occupation, and might form new colonies where men and women could live.

The building of a rocket space-ship would be very costly. It has been calculated that it would be necessary to spend £20,000,000 to construct one capable of taking four people into space and of bringing them back again. Space-ships to reach the Moon or the planets would cost far more, but if this and other difficulties can be overcome there will be no lack of volunteers willing to risk their lives in voyages beyond the Earth's atmosphere.

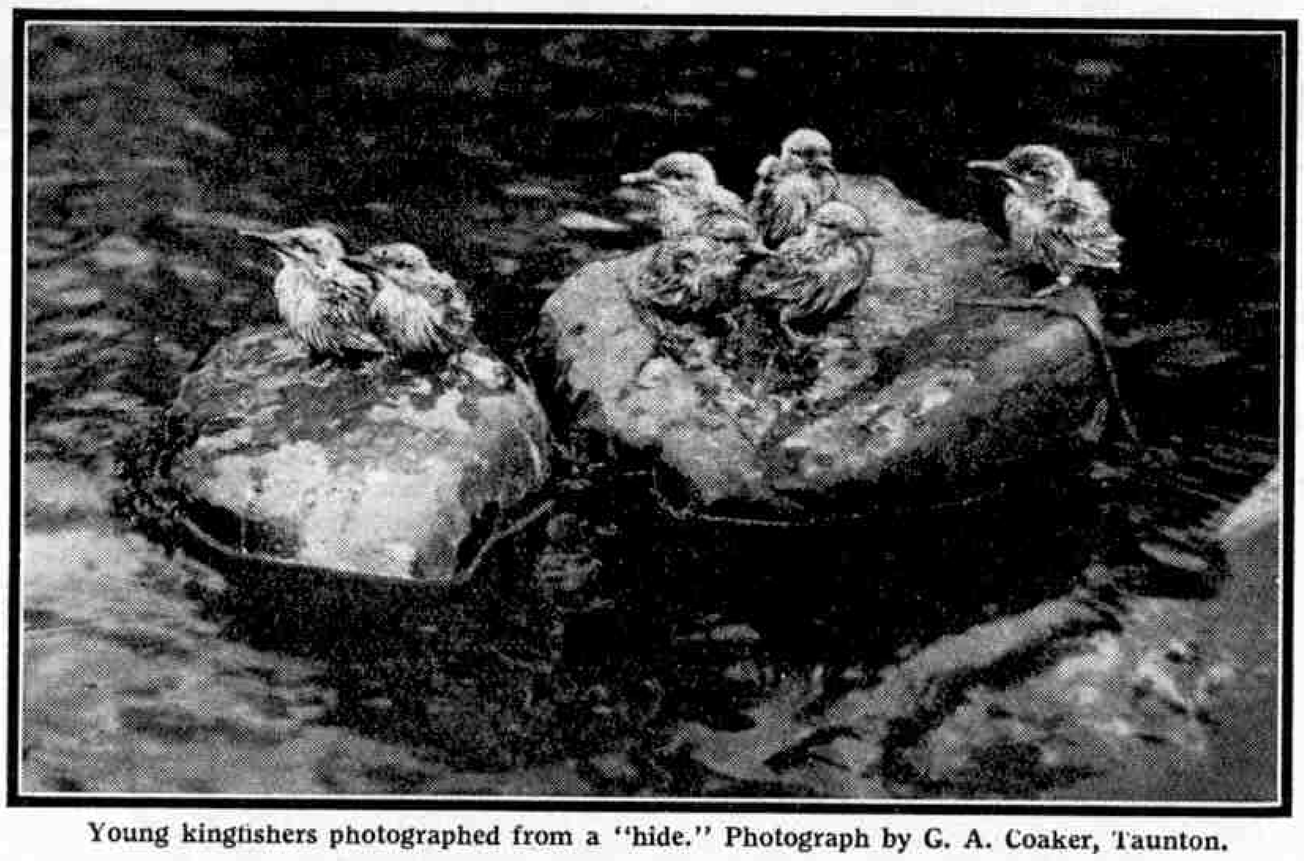


These pages are reserved for articles from our readers. Contributions not exceeding 500 words in length are invited on any subject of which the writer has special knowledge or experience. These should be written neatly on one side of the paper only, and should be accompanied if possible by original photographs for use as illustrations. Articles published will be paid for. Statements in articles submitted are accepted as being sent in good faith, but the Editor takes no responsibility for their accuracy.

Photographing Baby Kingfishers

The summer before last I was walking along the bank of the River Exe when a kingfisher suddenly flew out from a clump of alders on the bank. I looked for the nesting hole and soon found it, with seven fully-fledged young in it. I was not able to visit the nest until a week later, by which time the whole brood had left.

On visiting the place again last summer I was delighted to find the kingfishers had selected the same nesting hole. The nest at that time contained three eggs, and so I collected a few branches, and built a "hide" in the alders about five feet from the nest. I also placed a dead branch in the mud in the river. I had found from previous experience that kingfishers do not pause on the nesting hole, and hoped that they would use this branch as a perch, and so enable me to obtain good photographs of them.



Young kingfishers photographed from a "hide." Photograph by G. A. Coaker, Taunton.

One day, when the young were about half fledged, I went to my hide to try my luck. I placed my camera on a tripod in the river about three feet from the bough, after arranging a distance release. Shortly after I had settled in my place, the male kingfisher flew on to a branch just above my head, and so near that I could clearly see the minnow he had brought. After a slight pause he flew into the hole, where he was loudly welcomed, but soon flew up river again, to collect more provender for the ever-hungry young. Both the male and the female birds came and went frequently, often perching on the branch in the river, and I succeeded in photographing them there. I also snapped the young when they left the nest. G. COAKER (Taunton).

Staffa and Iona

Recently I made the trip from Oban round Mull to Staffa and Iona on the "*Lochfyne.*" Iona is reached after sailing for almost three hours along the rocky coast of Mull, and passengers are landed in small motor boats, as there is no pier on the island. On landing we were conducted by the purser of the ship along the main street to the Cathedral, which dates back to the 13th century, but has been restored several times since then. Many early Scottish kings are buried there.

After a short stay we returned to the "*Lochfyne*" and left for Staffa. The crossing takes only 35 minutes, and on arrival we found that there was a heavy swell on the sea, as the island is exposed to the full force of the Atlantic. Landing indeed is not always possible, for passengers have to be taken off by small motor boats, but we had no difficulty in this respect, and soon were making our way over octagonal columns of lava to Fingal's Cave. This Cave is an awe-inspiring sight. It is high and vaulted like the nave of a cathedral, and the water at its foot is very deep and looks almost black.



The Cathedral on the island of Iona. Photograph by F. Burnet, Haddington.

We continued our voyage round Mull and eventually reached Tobermory. There we stayed only a few minutes, while passengers and mails were landed, but we had time to hear of the wreck of a Spanish galleon, one of the vessels of the Great Armada, which is supposed to have been carrying a large quantity of gold when she came to grief in Tobermory Bay. From Tobermory to Oban, our starting point, took a further two hours. F. BURNET (Haddington).

Sacred Indian Birds

While on a tour of the Madras Presidency, I witnessed an interesting custom at Chingolpet, a small town in the south. On the outskirts of the town there is a small rock, and every day at noon two birds come there to be fed. These birds are sacred to the Hindu inhabitants, who regard them as the god Siva and the goddess Parvati respectively.



The priest about to feed one of two sacred birds in an Indian town. Photograph by P. N. Roy, Calcutta.

At mid-day I and many others assembled on the rock to see the two strange birds. About 12 o'clock they alighted on the rock a short distance from us. In size they resembled eagles, but their colouring was different. They flew hither and thither on the rock while a priest cleaned a portion of the rock with a silk cloth. Two pots, one containing water and the other a mixture of rice, banana and milk, were then brought, and the priest sat on the cleaned spot and called the birds with mysterious sounds. The birds came slowly towards him, and eventually began to eat and drink. When they had finished their meal they flew away, and the priest then distributed the remains among the onlookers, who ate the food immediately with great reverence.

P. N. Roy (Calcutta).

Cutting and Polishing Diamonds

During a visit to Kimberley a few years ago, I was able to see how rough diamonds are treated in readiness for marketing. There are five diamond mines near Kimberley, and one of them, the Old Kimberley Mine, often known as the "Big Hole," has the distinction of being the largest man-made hole in the world. In shape it resembles a funnel, and it is 2,000 ft. deep, but contains water to a depth of nearly 1,000 ft. Its surface area is 38 acres.

From the mines the diamonds are taken into Kimberley to a sorting office, the door of which is kept locked and is only opened to those producing a special permit. There the diamonds are passed to sorters, who examine them and arrange them in heaps according to size and shade of colour. Occasionally stones of different colours are found, and I have seen diamonds coloured brown, green and mauve.

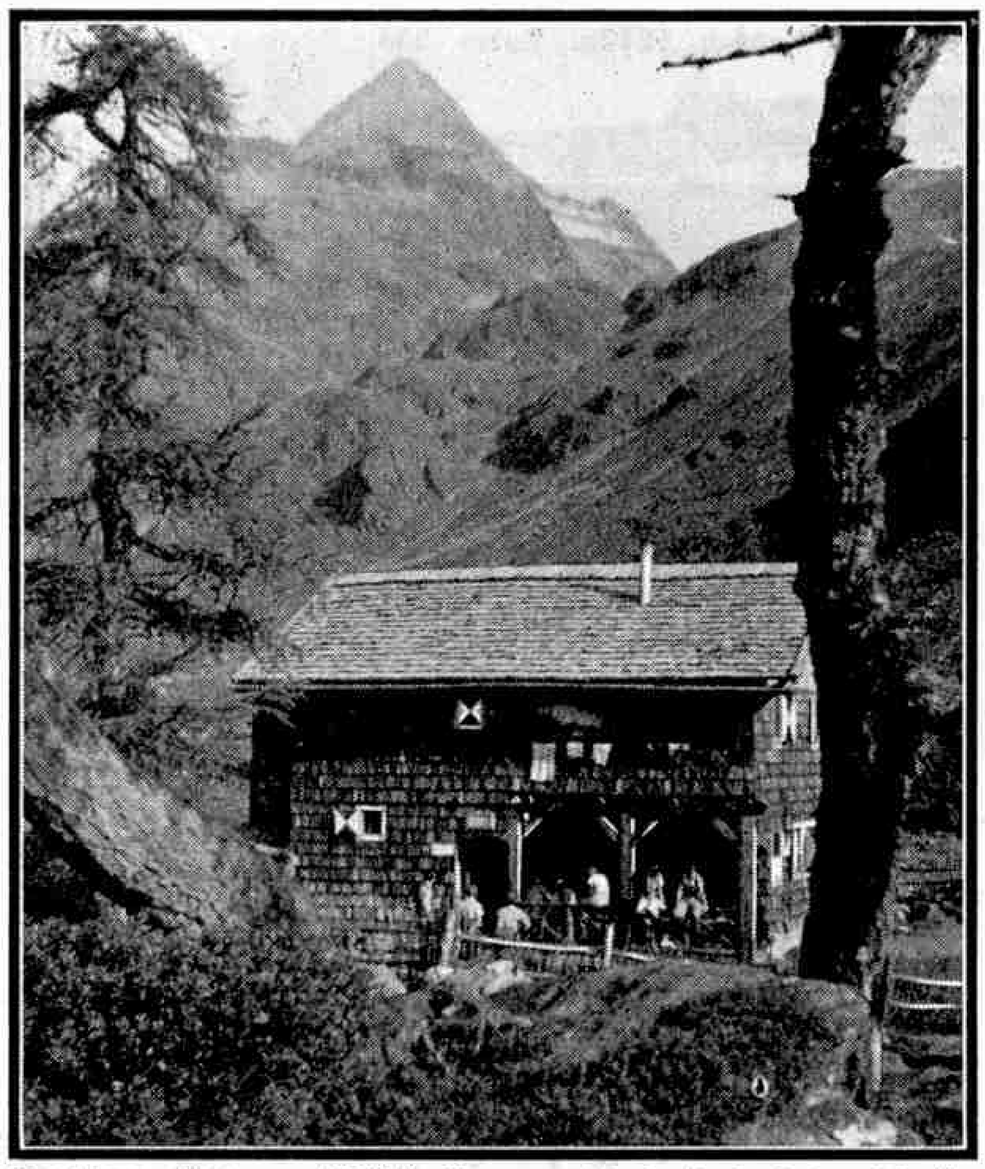
From the sorting office the diamonds are sent for cutting either to Amsterdam, or to works just outside Kimberley, where the cutting is done by means of circular, toothless copper saws smeared with a mixture of diamond dust and oil. In operation, these are set vertically above the diamonds, which are fixed in a hard heat-resisting cement. The saws make 4,500 r.p.m., and usually take from two to five days to cut a stone, but in certain cases as many as 16 days are required.

After cutting, the stones are removed to the polishing room. There they are held against the edge of revolving metal discs, also covered with a mixture of dust and oil. The process is similar to that of sandpapering wood. This work has to be done very carefully, and powerful magnifying glasses are employed to ensure accuracy. The diamonds are then ready for putting on the market.

T. J. W. Foy (Bedford).

The Mountain Huts of Austria

Recently I spent a mountaineering holiday in Austria, climbing during the day and sleeping at nights in huts that are specially provided for climbers. These huts are run by the German and Austrian Alpine Club and are to be found in the strangest of places. One I stayed at is in such an exposed position that it has to be anchored down to the rock by means of 1 in. wrought iron bars. It is at an altitude of about 9,000 ft., or roughly twice the height of the highest mountain in the British Isles.



The Lienzer Hut, over 6,000 ft. The mountain in the background is the Talleiten Spitze, of 10,000 ft. Photograph by E. H. Coles, London, W.11.

Most of these huts are built of wood, the outside being covered with wooden tiles that from a distance look like stone. In the summer they are looked after by a man and his wife, but in winter conditions are so severe that the caretakers have to retire to some sheltered village. All supplies have to be carried up, either by porters or on the backs of mules, and the huts are often a day's walk from the nearest village or road.

The charges for staying at these huts are very low, especially for members of the Alpine Club. Some climbers bring their own food and cook it themselves, and no exception is taken to this practice. The Austrians are a musical race, and in nearly all huts is a guitar or some other musical instrument that anyone may borrow to pass away the evening. Everybody goes to bed fairly early, for a start is often made at six o'clock next morning. The beds usually are only bunks with straw mattresses, but I have never needed much encouragement to fall asleep after climbing into my sleeping bag and covering myself with a couple of blankets.

E. H. Coles (London).

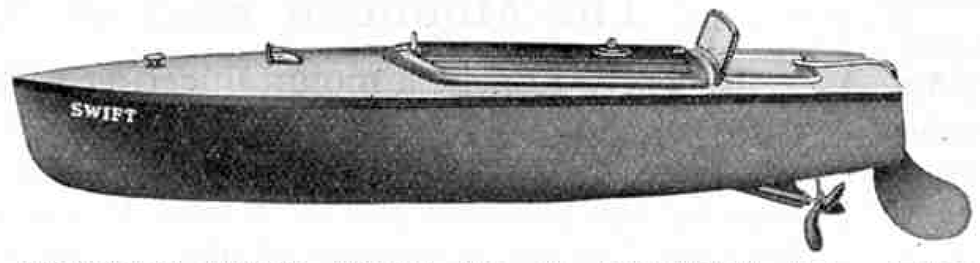
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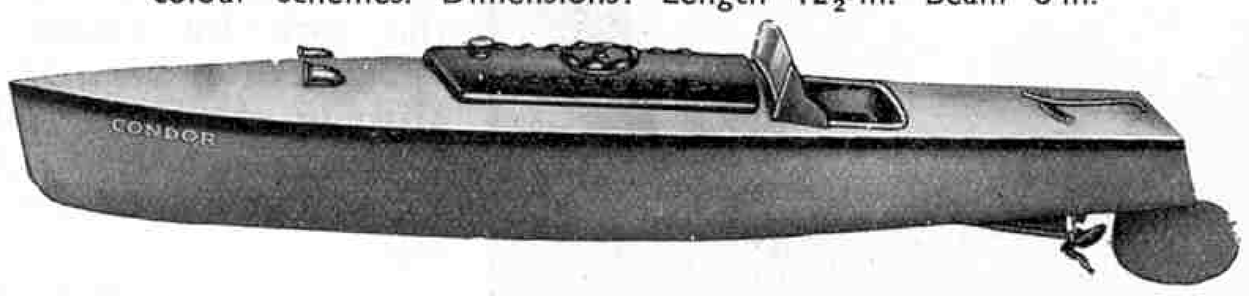
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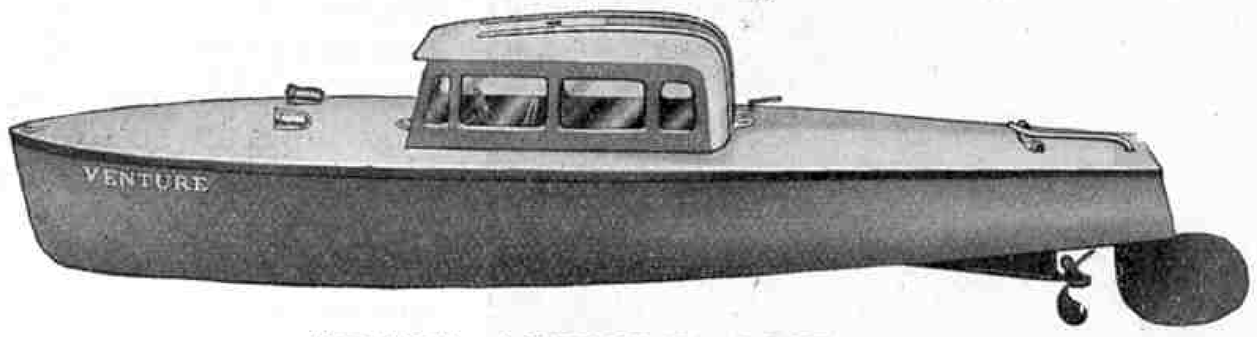
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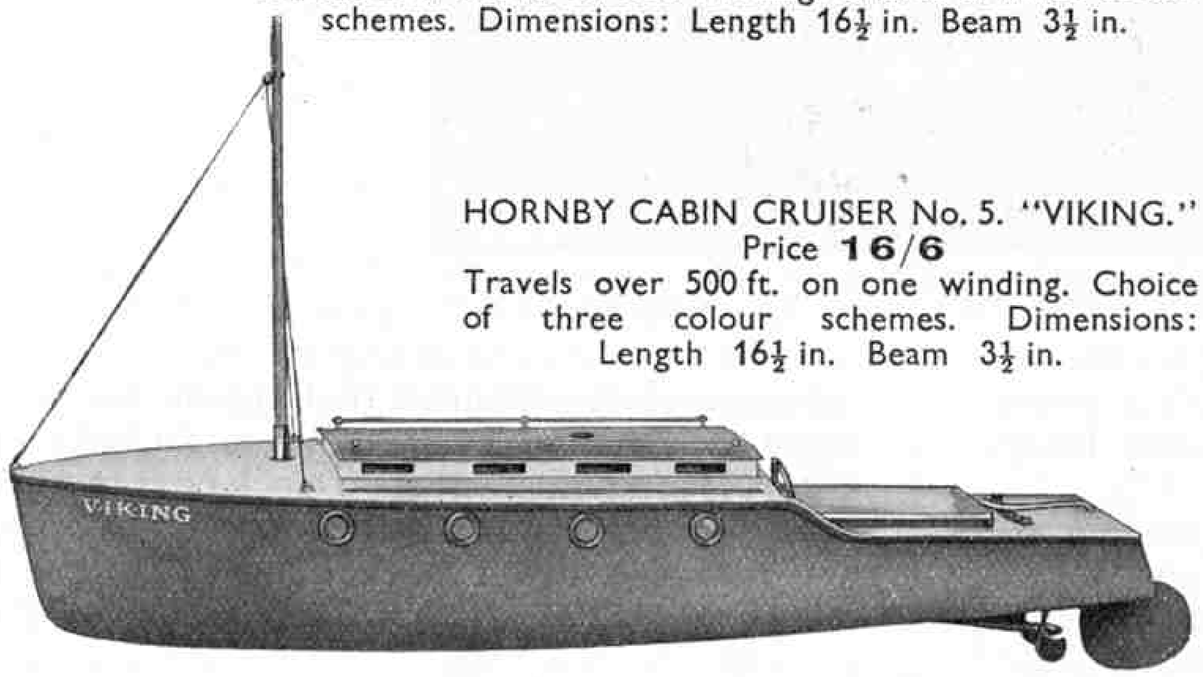
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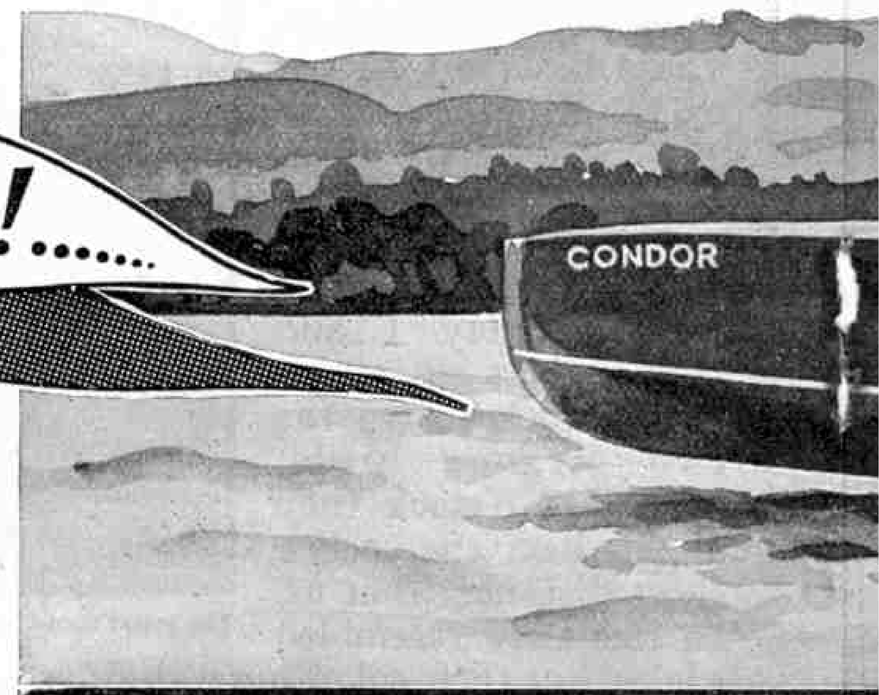
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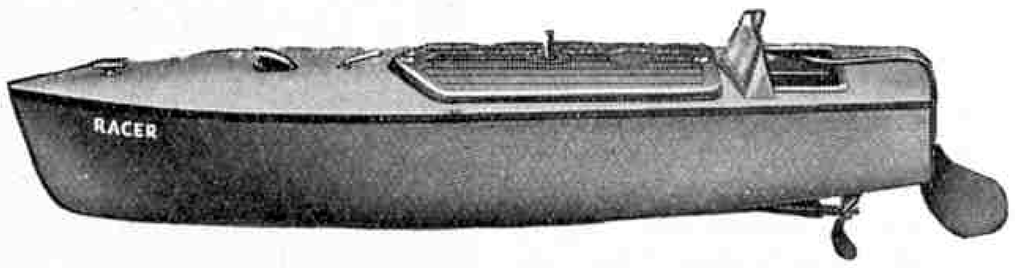
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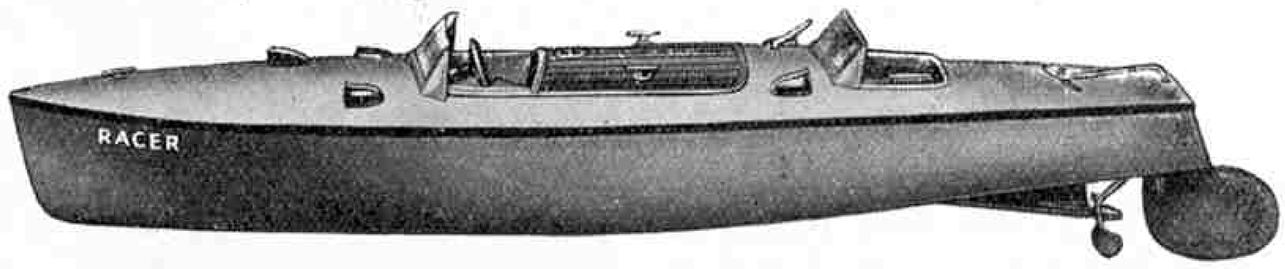
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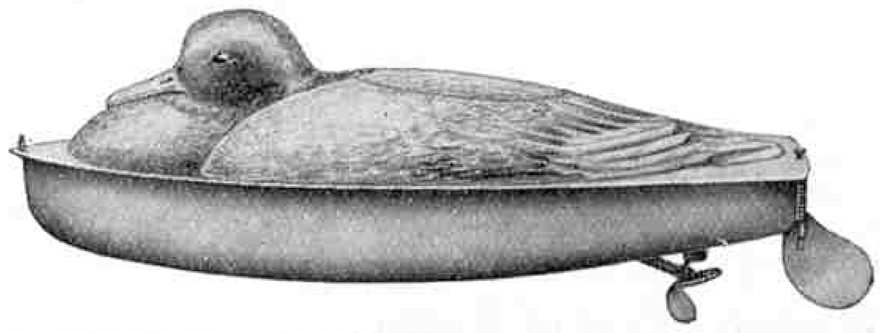
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A Record Pike

I am sure that my readers will share the pleasure shown by Mr. Tom Stevenson, and recorded in the illustration on this page, in the giant pike that he has caught when they learn that he is as interested in Meccano as they are. Mr. Stevenson is a Meccano dealer, and also an enthusiastic fisherman. His pike is the largest caught in the British Isles during the 1936-7 season, and the largest that has come from Norfolk waters during the last 45 to 50 years. It was caught in Heigham Sounds on 14th February last. Mr. Stevenson was fishing with a 9 ft. two joint split cane rod, 50 yds. of undressed silk line with a breaking strain of 18 lb., a fine trace and fairly small hooks, and as a bait used a live roach of about 5 oz. Before it was gaffed the pike put up a splendid fight that lasted about 15 min.

The weight of the fish was 31 lb. It measured 45½ in. from its head to the fork of its tail, and its girth was 24½ in. Its scales were carefully examined by an expert, who found that it was 15 to 16 years old and had grown with admirable regularity throughout its life in the pure water of Heigham Sounds, where there was plenty of food for it.



Mr. Tom Stevenson, Norwich, with a 31-lb. pike from Heigham Sounds, the largest caught in Norfolk for 45 to 50 years.

What Brings a Pigeon Home?

A homing pigeon seems to require only 20 sec. or so to find the direction in which it must travel to its loft, and then makes for home at express speed. It cannot rely on landmarks seen while on its outward journey, for it usually travels by train and is cooped up in a basket, and in any case it is not even necessary that it should have a bird's eye view of the country over which it flies, for there is at least one instance in which a bird actually walked part of the way home. This bird had been caught while on the return flight and its wings had been clipped to guard against its straying away, but even this did not prevent it from finding the way home.

There seems no limit to the distance over which a pigeon will fly to reach home. An American bird once flew from Maine, the easternmost part of the United States, to Texas, 2,100 miles away, and another found its way back from Venezuela to its loft in New York City, 2,200 miles away. Even these amazing flights are insignificant in comparison with one of no less than 7,200 miles made in 1931 by a bird released at Arras, in north-eastern France, that flew to Indo-China in 24 days. The bird was specially brought to France in order to attempt this great flight, which must be a record, and it is difficult to account for its ability to find its way half round the world. From Indo-China it travelled in a wicker basket in the hold of a ship, and certainly had no opportunity whatever of studying its homeward route.

Strange Effect of Radio

Pigeons exercise common sense when homing. They follow the easiest route, flying round storms and fog, instead of making a bee line for their destinations. They do not fly in darkness, but seem to be baffled by radio, for instances are known in which experienced birds have been misled, or even compelled to stop flying, when their paths led them to a broadcasting station. Birds tossed into the air from the roof of a station that is not broadcasting act normally, spiralling upwards and then starting for home, but they become confused and settle on the ground as soon as broadcasting begins.

Nothing is yet known as to the means by which a homing pigeon finds its way. This is a mystery throughout the ages, for homing pigeons certainly were known in Solomon's day. The suggestion has been made recently that their ears form living earth inductor compasses. This compass is used in aeroplanes, and contains a coil of wire in which an electric current is generated as it is carried through the Earth's magnetic field. Any deviation from the line laid down for the machine in which it is used is revealed at once by a change in the amount of current generated. The suggestion that the ears of the homing pigeon correspond to the sensitive coil of the earth inductor compass would explain why broadcasting seems to upset pigeons, but many experiments and observations would have to be made in order to confirm the theory.

Great Britain's Largest Tree

The tallest tree in England and Wales is a Douglas fir to be seen at Powis Castle, Welshpool. This is nearly 178 ft. in height, and its girth about 4 ft. from the ground is a little more than 11 ft. At Kilbride, in Argyllshire, there is a silver fir that is of practically the same height. This Scottish tree measures 20 ft. 7 in. round its trunk at breast height, however, and therefore can be looked upon as Great Britain's largest tree.

There are many other magnificent trees in this country. Powis Castle, where the Douglas fir already referred to is growing, is also the home of the Champion Oak, which is 105 ft. high and has a girth of 23 ft. 6 in. Other old oaks are to be found in many parts of the country, many of them being the subjects of traditions and romantic stories. Some are of enormous girth and because of this have been supposed to be of very great age. This is not necessarily true, for in certain cases two or three trees have grown together so that they appear to form a single tree. A good example of this is provided by the chestnut, at Tortworth, Gloucestershire, which has been claimed as the oldest and largest tree in England. Its girth is more than 50 ft., but this measurement probably takes in two and perhaps three trees instead of one.

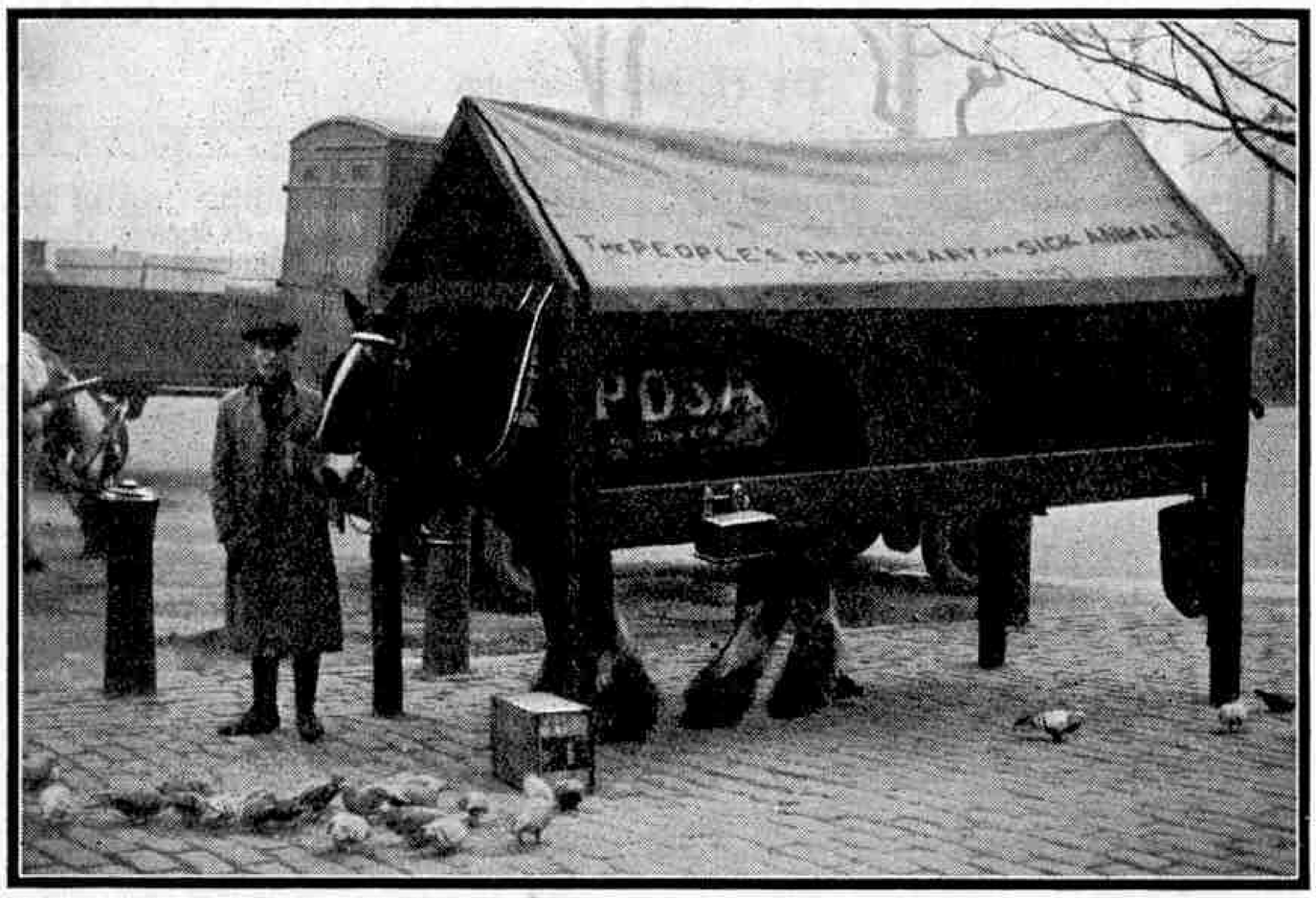
The largest British tree is insignificant when compared with the giant eucalyptus trees of Australia. One of these, a giant eucalypt growing in the Cumberland Valley, Victoria, is believed to be the tallest tree in the British Empire. Its height has just been checked by forestry officials, and is now placed at 301 ft. 6 in. Its girth a little more than 4 ft. from the ground is 20 ft. 6 in., and it contains about 100 ft. of timber, which is worth £400 to £500. This giant is surrounded by others from 260 ft. to 285 ft. in height. All of them are eucalypts, which retain their leaves throughout the year.

A Useful Service

The illustrations on this page show a horse that is stationed at the foot of Tower Hill for the purpose of assisting with heavy loads. In bad weather the horse remains in a shelter, seen in the upper illustration, until a call for its services comes along.

The horse is maintained by the People's Dispensary for Sick Animals of the Poor, and has been at work at the foot of Tower Hill for more than a year. Its services are free, as are those of other trace horses maintained in various parts of London by the Dispensary. Good use is made of all of them, and it is said that horses passing up Tower Hill regularly refuse to go on until their friend has joined up to help them. Then they step out gaily and energetically behind their leader.

The Dispensary has a large hospital in Egypt, where a novel service has just been introduced for the purpose of collecting animals that are sick or injured. These are now brought into the hospital in a boat that travels up and down the Nile in order to collect them.



A trace horse that helps to pull heavily-laden carts up Tower Hill, London. It is maintained by the People's Dispensary for Sick Animals.

Ambergris Defies the Chemist

Ambergris is one of the few natural materials that so far has defied the efforts of the chemist to probe into its secrets and to reproduce it. This strange material is a product of the sperm whale, and is sometimes found in large black lumps in the bodies of dead whales, and occasionally as a grey mass washed up on beaches in the tropical and semi-tropical seas this creature inhabits. It is probable that the lumps are due to irritation set up in the whale's stomach, for often the beaks of cuttle-fish swallowed by the whale are found embedded in them.

Ambergris smells disagreeably when it is first taken from a whale, but soon acquires a fragrance that becomes continually sweeter. It is eagerly sought after because it is an invaluable base for choice scents, for it seems to have the strange property of acquiring scents or perfumes from materials around it, and its own scent blends with these to produce an agreeable and lasting effect. In the past it has been literally worth its weight in gold, and even to-day the discovery of a large lump of ambergris would yield a small fortune. The largest piece recorded appears to have weighed about 750 lb., but others weighing 400 lb. and 336 lb. also have been found, while many reach a weight of more than 100 lb.

The scent of ambergris is remarkably lasting. The material dissolves readily in alcohol, and a few drops of the resulting tincture placed on absorbent paper retain their scent for months. It is said that the perfume of ambergris is still to be detected lingering in a room at Hampton Court Palace after a lapse of 100 years, and the scent has been reported to persist for as long as 300 years.



The friendly trace horse of Tower Hill at work.

Swimming Electric Batteries

Recent experiments carried out in the New York Aquarium seem to suggest that electric eels from South America are capable of talking to each other electrically. Normally the eels use the currents they produce to defend themselves or to stun small fish on which they live, but it was found that the discharge of its current by an eel at one end of a tank caused eels at the opposite end swimming over to join it, as if some sort of message had been broadcast through the water. The members of an expedition about to start for Brazil to study these eels in their homes therefore are taking with them an "eel caller," or a device that produces electric currents imitating those of the eels. With this they hope to lure the eels into nets.

The currents produced by the eel have actually been tested and measured, and have been found to be of two kinds, of high and low voltage respectively. A full grown eel gives a current at 300 volts that is capable of stunning a horse, and even a baby eel can administer a really nasty and uncomfortable shock. A neon lamp has been lit by connecting its terminals to wires dipping into a tank containing an eel six feet in length, and crackles were heard in headphones substituted for the lamp. Listening posts therefore are to be set up by the members of the Brazilian expedition in order to detect the presence of eels.

How the electric eel produces its current is not known accurately, and the manner in which it switches the current on or off also is still a mystery. The source is a sort of battery consisting of thousands of plates of muscular tissue occupying the greater part of the length of the eel's body, and it is strange that the eels do not shock themselves or each other.

A Library on a Film

The quantity of books and other printed matter that has to be stored in libraries is now so enormous that the greatest difficulty is often encountered, not only in providing the necessary storage space, but also in handling the books themselves. All trouble of this kind may disappear when the practice of photographing books on micro-films becomes more general. There is no doubt that there is a great future for this practice, the coming of which will effect a revolution in the handling of written words that will be the most important change in this respect since Gutenberg invented the modern art of printing.

A page of a book or a newspaper can be photographed on a film on which the reproduction occupies only one two-thousandth of the area of its original, and the contents of a large library, now requiring a huge building and a large staff, can be preserved in the space at present occupied by a card catalogue. Special magnifying mechanism is available for reading micro-film books, so that the films serve every purpose for which a library is intended.

Micro-films may solve other problems besides that of storage space in libraries. It has been suggested that such books as telephone directories should be printed in this manner, especially those for large and populous areas, such as London or New York, the directories for which tend to become unwieldy in size and to be produced in uncomfortably small print. Encyclopædias also can be produced on micro-films, and will then be easier to handle than the ponderous tomes now published, while they will be less subject to deterioration and to injury in use. In business records may be kept for filing purposes, and the exchange of information on matters of all kinds will be easily effected by the distribution of micro-film records.

Bee-Keeping

A Fascinating and Profitable Hobby

By H. M. Pearson

BEE-KEEPING is one of the most fascinating of outdoor pursuits, and provides many happy hours for those who take it up. In addition it brings with it adventure of no mean order, to say nothing of a profitable harvest in honey at the end of each season. It is the emergencies that suddenly arise, and demand quick thinking and swift action, that provide the joys of bee-keeping, however, for the unexpected often happens and sometimes catches even the most experienced bee-keepers unawares.

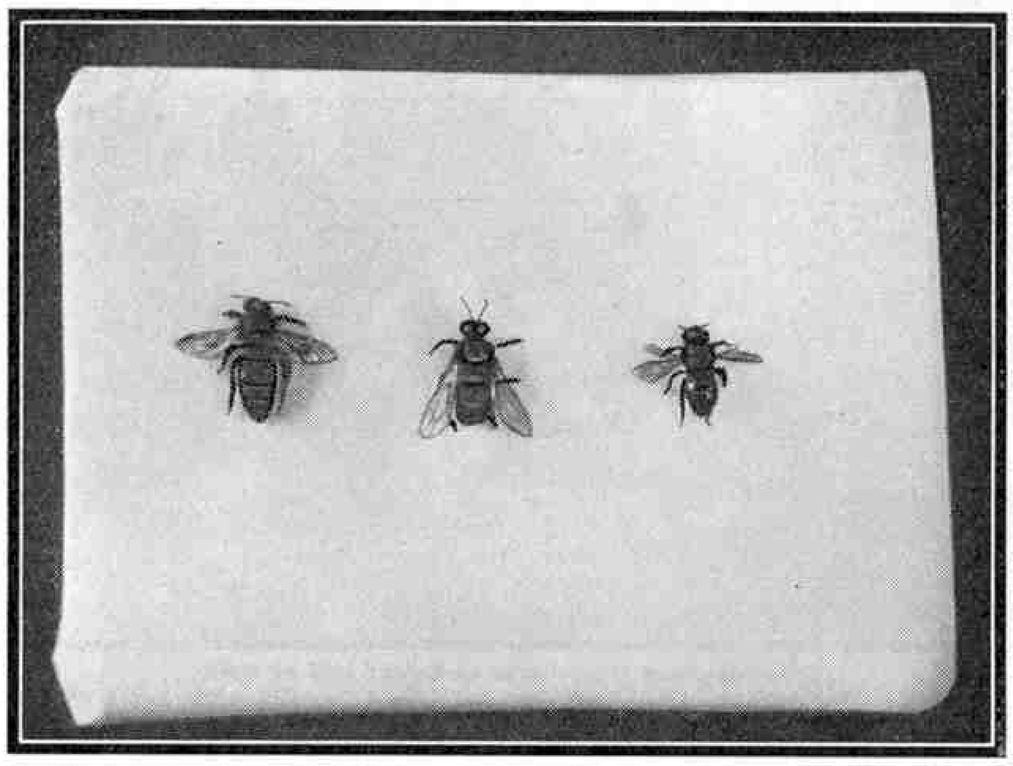
Anyone can keep bees, and there are no great difficulties in starting, nor does one need an expensive plant. Although the winter can profitably be spent in reading about bees and bee-keeping, it is direct experience that counts most, and the easiest way to get this is to join a local Bee-keepers Association, or to give a helping hand to an experienced bee-keeper.



Old-fashioned skep bee hives. For this illustration, and the upper one on the opposite page, we are indebted to the courtesy of the British Bee-keepers Association.

The days of straw skeps for bees have long since passed away. The modern apiarist keeps his bees in up-to-date wooden hives with movable parts, which give him a measure of control, and enable him to secure a greater harvest of honey from a single colony of bees than his forebears took from a whole apiary. Hives can be purchased complete, painted and fitted up ready for the bees, for about 45s. to 50s., or in the flat, ready to be put together, for about 38s., though there are both cheaper and more expensive types available for those who wish.

It is a good plan to buy a hive in parts, and to put it together, for this is an ideal way of getting to know the different sections so that further hives can be made without difficulty. It is important that all measurements should be correct, and that bee spaces and passages should be exact in size. A badly fitting hive is very unsatisfactory, for bees cannot work in a draughty home and tight narrow places or openings that are too big have to be sealed up by the bees with wax and propolis. Another reason for taking care to start with a hive that is well made is that any hives that are added later should be of the same type, so as to have standard parts all interchangeable. My advice to anyone starting is "Don't buy, make it yourself if you can."



Members of the bee family. From left to right they are the Queen, the drone and the worker.

To be successful with bees one must follow Nature, and the more closely her ways are adhered to, the more will the bees be assisted and the better will be the results achieved. Nearly everyone seems to imagine that all bees gather honey and sting. In this they are wrong, however. It is perhaps the dread of meeting the "hot end" of the bee that deters many an otherwise quite venturesome person from approaching too closely when bees are about. Their fears usually are groundless, but nervousness irritates a bee more than anything and if one handles bees carefully and deliberately without any hasty nervous movements there is little fear of being stung at all.

The bee's sting was never designed by Nature to penetrate human flesh and she will not attack unless infuriated. However angry the bee may become, she does not attempt to sting until she has first let down two sensitive feelers, bearing at their extremities delicate sense hairs that indicate the nature of the surface, for as the sting is in her tail she cannot see what she is endeavouring to attack. This momentary pause enables quick-eyed people to knock off the vicious insect before the attack is begun. The queen never uses her sting except against her rivals, and as the drones are males, they are stingless and quite defenceless.

It is important to obtain a good, docile, hardworking strain of bee from a reliable breeder. Good bees are just as easy to obtain as other varieties, and I would strongly recommend the British-bred Italian bee. People who are misled into buying fancy strains of bees regret it before long. Another thing to avoid is buying a cheap strain of bee that has a name for being bad tempered, as most black or half-bred ones usually are. In any case it is advisable to wear a veil to protect the face, and at the start thin gloves may be worn until confidence is acquired, when they will soon be discarded as being awkward.

A normal working colony of bees will possess one queen, which is a perfect female insect and the mother of the hive, and about 40,000 to 50,000 worker bees, together with a few hundred drones. The term queen is indeed misleading for she is in fact the servant of the colony, and must obey every whim and wish of the worker bees, at whose mercy she alone lives. They tend her very carefully and protect her, clustering round in calamity, due to cold or starvation, so that she is the last to die.

During the summer months the rate of egg laying by the queen is prodigious. A good queen at the peak of her life will lay about 3,000 eggs per day for weeks at a time. The egg is a small white object, nearly 1/16 in. long, from which a tiny grub hatches out three days after laying. This is fed copiously by the nurse bees and absorbs as much food through its skin as it does with its mouth. The pearly white larvae can be discerned at a glance on the comb, as they lie curled around in their cells, and during this stage of their life they double their weight in a few hours. The cell is finally sealed over while an interesting metamorphosis goes on underneath, and three weeks after birth the young bee, covered with silvery hairs, gnaws its way through the coverings to face life. Its first act is to enjoy a hearty meal of honey from a nearby cell, and during the next fortnight it does little except indulge in eating and play

flights outside the hive, leaving the work to the older bees.

The worker bee is not a true female. Her head and thorax are similar to those of the queen, but she has not the elongated abdomen that makes the latter so conspicuous when seen on the comb, even when smothered with bees. The life of the bee varies from six weeks to as much as six months. Bees born during the spring and summer months lead an active life of hard work and unceasing toil, and are literally worn to death in a few weeks. Those born during the autumn months have naturally little to do except to keep up the warmth of the cluster, which survives through the long winter, and are then ready to start the next season's work before handing over to the young bees born in the early months of the year.



On the left a natural swarm of bees is seen hanging in a cluster from a small branch. On the right the swarm is being thrown down from a skep before it is placed in an empty hive.

The drones are heavier and bulkier. They are born during the early part of the Spring and lead an idle lazy life, with no work to do. They are even fed by the worker bees and on fine days disport themselves in the sunshine or drop into a comfortable flower blossom for a quiet sleep. In August, when supplies begin to fail, food is withheld from the drones, who crowd unhappily together in odd corners and along the bottom of the hive, but ere long they are forcibly evicted by the merciless spinsters and left to die. In many cases they are savagely attacked and severely mutilated. This slaughter of the drones is a sure sign that the honey season is over.

Bees do not gather honey. As they flit from flower to flower they dip their tongues into the nectaries of the blossoms and, by means of the hairs with which this organ is liberally covered, they lap up the sweet nectar provided and pass it down into the honey sac, which lies at the end of a long gullet. Beyond this and opening into it is the true stomach. On returning to the hive the bee brings up the nectar, already chemically inverted by mixing with saliva, and stores it in the cells. There the surplus moisture is gradually evaporated by the heat of the hive and by constant stirring from the bees' tongues, and not until this operation is completed and the cell sealed over are the contents known as honey.

The most important result of nectar gathering by the foraging bees is the fertilisation of the various flowers visited, for many plants, particularly fruit trees and bushes, are wholly dependent on insect fertilisation. Our little friend the honey bee therefore is an important asset to the farmer. The fruit blossoms appear early and the honey bee, owing to its colonisation through the winter, is then the only insect about in sufficient numbers to ensure full and complete pollinisation. For example, in apple blossom there are five stigmas, each of which requires to be fertilised for the perfect fruit to be formed. If four only are reached by the bee the apple will develop, but will look lumpy and will rarely hang long enough to ripen, for the first wind will send it to the ground. Perfectly formed fruit seldom falls with the wind, and if those on the ground are examined it will be found that in almost every case imperfect fertilisation has been the cause of their downfall. In the same way gooseberries, raspberries and many other fruits are wholly dependent on insect fertilisation, in which the honey bee is the chief agent.

The lower portion of the hive forms the brood nest and consists of a timber-sided box holding 10 standard-sized combs, each 14 in. long and 8½ in. deep. Around this is an outer casing with 2 in. dead space between the two walls. Single-walled hives also are obtainable, but are not recommended. Over the top of the brood chamber is laid a thin zinc sheet containing rows of perforated slots, known as the queen excluder. These holes are sufficiently large to allow the ordinary bee to pass through, but prohibit the passage of the queen with her larger body and thus confine her activities to the brood chamber.

Above the queen excluder are placed "supers," each of which holds eight shallow combs in which the bees store their honey, for it is the natural instinct of the bee to store above the breeding cells. The successful bee-keeper aims at managing his colonies in such a way that the quantity of honey stored is far in excess of what is required by the bees as winter food. The surplus he then removes at the end of the season, leaving sufficient food in the brood chamber to last the bees through the winter months. On an average a good bee-keeper should be able to lift 70 lb. of honey per colony in each season, but not every colony is at the same strength and the amounts stored vary enormously. A good strong colony stores about 112 lb. quite easily in a good season and cases occur in which twice, or even three times as much, is taken off a single working colony.

The hives tend to become overcrowded during the course of the summer and that, together with the effect of the sun's heat beating down on the roof and the hive front, makes the conditions inside almost unbearable. This the bees seek to relieve by swarming. Once they make up their minds to do this it is almost impossible to stop them. One fine day, usually a Sunday, when the bee-keeper is away somewhere, a swarm will leave the hive. Preparations have been going on for some time and from 6 to 15 queen cells may be found on the combs, from which young queens will shortly emerge so that the colony is not left queenless. The queen and the old bees then emerge with a joyful hum and fill the air with a swiftly circling cloud of bees, which gradually drifts away to some convenient spot, where they presently gather and soon form a dense cluster.

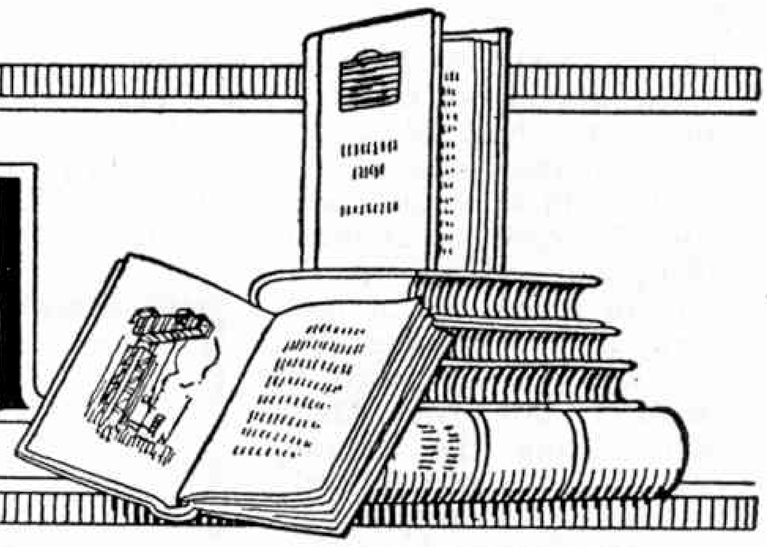


The author of this article in a corner of his apiary, with a smoker in his hand for subduing the bees.

Meanwhile a kindly neighbour, hearing a loud hum has probably seen the erring bees and a message is quickly sent, "Mr. Snook, your bees have swarmed!" The anxious bee-keeper leaves everything, seizes a straw skep and hotly pursues his wandering bees. The chase may take him over hedges and across fields and ditches, and often leads him a pretty dance before the cluster settles, the bees being legally his only so long as he keeps them in sight to claim them. Holding the skep underneath the cluster he gives the branch or post on which the bees are hanging a smart shake and adroitly catches them as they fall. He then quickly inverts the skep on a cloth, ties them up and carries them off in triumph back to his apiary. There they are used to form a new colony in an empty hive or to strengthen a weak stock. If left the bees will start to build comb and so form a new colony on their own, for in this way is the natural increase of bee life obtained.

Bee-keeping is a hobby that can well be taken up by boys, who will find intense interest in studying their bees. Two of the most successful bee-keepers I have yet encountered are lads of 8 and 10 years of age respectively, who have built their own hives and actually have taken their first Certificate for proficiency.

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.

"Bird Behaviour"

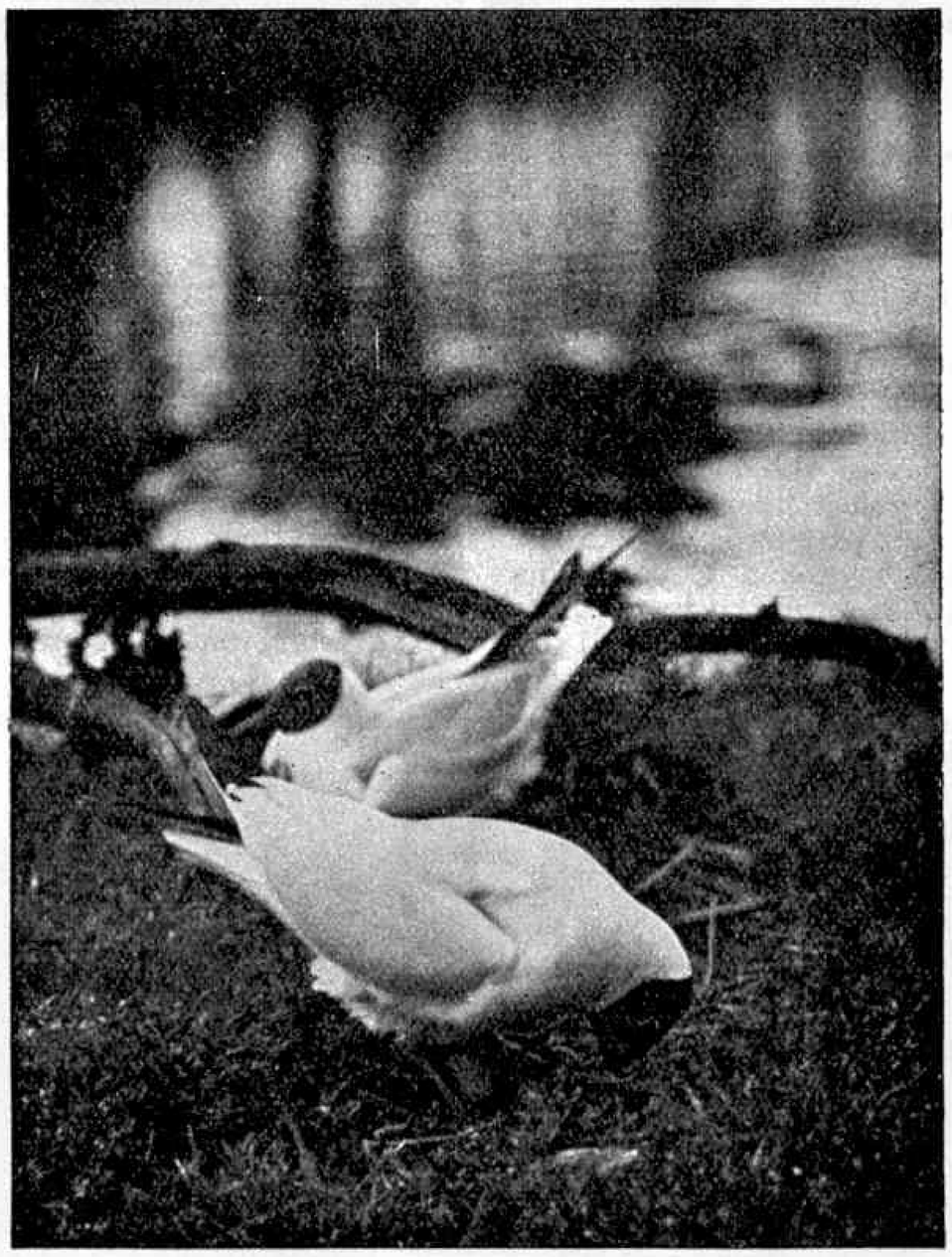
By F. B. KIRKMAN. (Nelson. 7/6 net)

Interest in bird life never flags, and indeed is intensified as we learn more of birds and their ways. The appearance of this book will be welcome to all bird lovers, more particularly as it gives the results of keen observation and experiments carried out by the author over a period of 30 years. It does not attempt to cover the whole of the bird kingdom; instead of aiming at this the author selected the black-headed gull for special study. This bird is familiar to Londoners as a winter visitor to their parks and the riverside, and is well known all round the shores of Great Britain, and patient field work in conditions of all kinds has enabled the author to give a full and fascinating account of its daily life and of the manner in which it responds to changing conditions around it.

Mr. Kirkman carried out many tests in order to discover how the gull behaves in unusual circumstances, or in emergency, and the great mass of interesting information that he has collected will be a wonderful help in understanding birds in general. In later chapters he classifies the forms of behaviour that the gulls have shown while he has been studying their actions, explaining how they show fear, anger and other emotions.

Nobody who is interested in birds could fail to find immense pleasure in Mr. Kirkman's fascinating story, and particularly in his descriptions of the behaviour of the gulls when he substituted various objects for their nests and eggs. He replaced the eggs by golf balls, cricket balls, a small piece of coal, stones, and even an onion and a vaseline tin; and discovered that a substitute of almost any colour, shape or material was accepted if it did not give rise to discomfort, or was not too large to sit upon or so small that it sank into the nest. These and many other equally interesting experiments on individual behaviour and social life among the gulls are told in a pleasantly attractive style.

The story is illustrated by means of 30 plates containing photographs taken by the author, all excellent and many of them unique.



Black-headed gulls settling on their eggs. This illustration, and the upper one on the opposite page, are from "Bird Behaviour," reviewed on this page.

"Comets"

By MARY PROCTOR and A. C. D. CROMMELIN (Technical Press Ltd. 8/6 net)

Comets have always been objects of intense interest. In the earliest days, they were looked upon with awe, and their appearance was thought to foretell plague, pestilence and famine. The awe still remains, although we now know much more about these visitors from space, and we are all eager to know whence they come, how they travel and what they are made of. The answers to these questions, as far as they can be given, are to be found in this interesting book. It tells fascinating stories of famous comets, and gives graphic accounts of the work of pioneer comet hunters and of the many interested astronomers, chiefly amateurs, who to-day sweep the skies regularly with their telescopes in the hope of obtaining the earliest glimpses of new comets.

Halley's comet is dealt with in one of the most attractive chapters in the book. This is the most famous of all comets, because it was the first to be recognised as a periodic visitor to our night skies. When it was realised that it returned at definite intervals, its previous appearances were traced, and found to coincide with many remarkable historical events.

The problem of the origin of comets also is considered. It now seems to be agreed that they originate within the solar system, and are not captures from space, as was once thought. Most of them appear to be directly connected with one or other of the giant planets, from the intensely hot interiors of which they may have been expelled.

The book is packed with authoritative information, but would have been more attractive if it had contained more reproductions of photographs of famous comets. The only one of this kind included shows Halley's comet at its most recent return in 1910, and the remaining illustrations are drawings and diagrams, together with a photograph of the observatory of a famous comet hunter of South Africa.

"The Airman and the Air"

By A. B. FIELDING. (Pitman. 5/- net)

This book has an unusual beginning, for instead of the customary outline of the history of flying, the author starts with a detailed study of wind, cloud, rain and fog, and explains how they affect aeroplanes and why pilots must know something about them. This is of great interest, and enables readers to appreciate the problems that confronted the pioneers of flying and now have to be taken into account by designers and operators of aircraft. Chapters on bird and insect flight lead to a survey of the early efforts of Man to fly by imitating the birds, and the author then passes on to deal with the first practical attempts to fly and the development of mechanical flight.

The later part of the book deals with the design of modern aeroplanes and engines, more in regard to principles than to materials and construction. Other aspects of aviation that are considered are airships and parachuting. The book concludes with a very useful dictionary of aeronautical terms and a list of notable flights made during the past three years. Numerous line drawings illustrate important points in the text and add greatly to the interest of the book.

"Raymond's Inheritance"

By G. M. ROGERS. (Harrap. 3/6 net)

This is the tale of Raymond Holmes, a boy who with a friend leaves South Africa to live in an English manor house that he has inherited. Then he finds that there is a mystery about his new home, for the previous heirs had been murdered in order to make way for the villain of the story to inherit their wealth. Raymond alone now stands in the way. He immediately becomes the target of the miscreants who support his rival, and has many exciting and dangerous adventures, narrowly escaping death from snake bite, poison and violent attack. Complications follow, but eventually the assailants are captured or dispersed, and the boy is able to enjoy his inheritance in peace. The story comes to a thrilling climax, in which a faithful Chinese takes a prominent part. There is a coloured frontispiece in addition to four full page line illustrations.

"Behind the Letter Box"

By STUART CHESMORE. (Nelson. 2/6 net)

The many activities of the Post Office bring most of us into contact with it almost daily in one way or another, and behind the services which it renders is a marvellous organisation. The glimpses of its working afforded by this excellent little book are of necessity brief, but they give a good idea of the technical skill involved, and also of the human interest that runs throughout this great public undertaking.

Every section of the work of the Post Office in turn is dealt with, among them the wonders of the automatic telephone, the long-distance trunk lines and the International service, the telegraph and air mails. In addition the less spectacular but nevertheless exacting services such as the parcel post, savings bank, postage stamp printing and distribution, and the deciphering of incorrect spelling and freak addresses are all included. Interesting stories are told of the unusual things that Post Office officials occasionally have to do in order to assist the public in cases of emergency or accident, and these will be a revelation to those who always seem to grumble at everything the Post Office does for them.

The book is well illustrated by means of 13 plates, most of them reproducing official photographs. These are as interesting as the author's own story, with which they make up a most attractive little work that provides pleasurable reading. T. R. ROBINSON.

"Life in the Animal World"

By F. H. SHOOSMITH, Ph.D. (Harrap. 5/- net)

This is not a mere text book of biology, but an account of life and animals that is accurate and full of interest. The reader is made to feel at home in the animal world immediately, for the author begins with a chapter that helps him to realise what is meant by calling one animal a reptile, another a bird, and a third a fish and so on. Then we learn how important oxygen is to life, lowly creatures such as the sponges and worms needing only small quantities taken in through the skin, while higher animals have elaborate breathing apparatus that is involuntary in action.

Sections follow on what animals eat, how they move and their general habits, and with these we enter what can only be described as a wonder world that will be a revelation to the reader. It is interesting to find that insects can never grow much larger because they are unable to take in sufficient quantity of oxygen, while the largest of creatures also suffer disadvantages, for they find it difficult to move unless they take to the water, as the whales have done. A giant 60 ft. high would be totally unable to walk or move at all, for his legs would break under the weight of his own body.

A particularly absorbing chapter deals with animal partnership and parasites. The oldest example of partnership is that of the crocodile and the plover lapwing, birds that clear the crocodile's gaping jaws of the leeches that infest them. Similar partnerships are found in every sphere of animal life, and many of these are described and explained in detail.

How Nature has provided animals with means of both offence and defence is the next topic. Bony shells and armour, spikes and other forms of protection are dealt with, and we read about stranger means of defence, such as the ability of the cuttlefish to make a smoke screen, and the trick of the skunk, which protects itself by means of an unpleasant scent. Some animals can even mutilate themselves to escape death, sacrificing portions of their bodies to save the rest, and in some cases the members cast off are regrown.

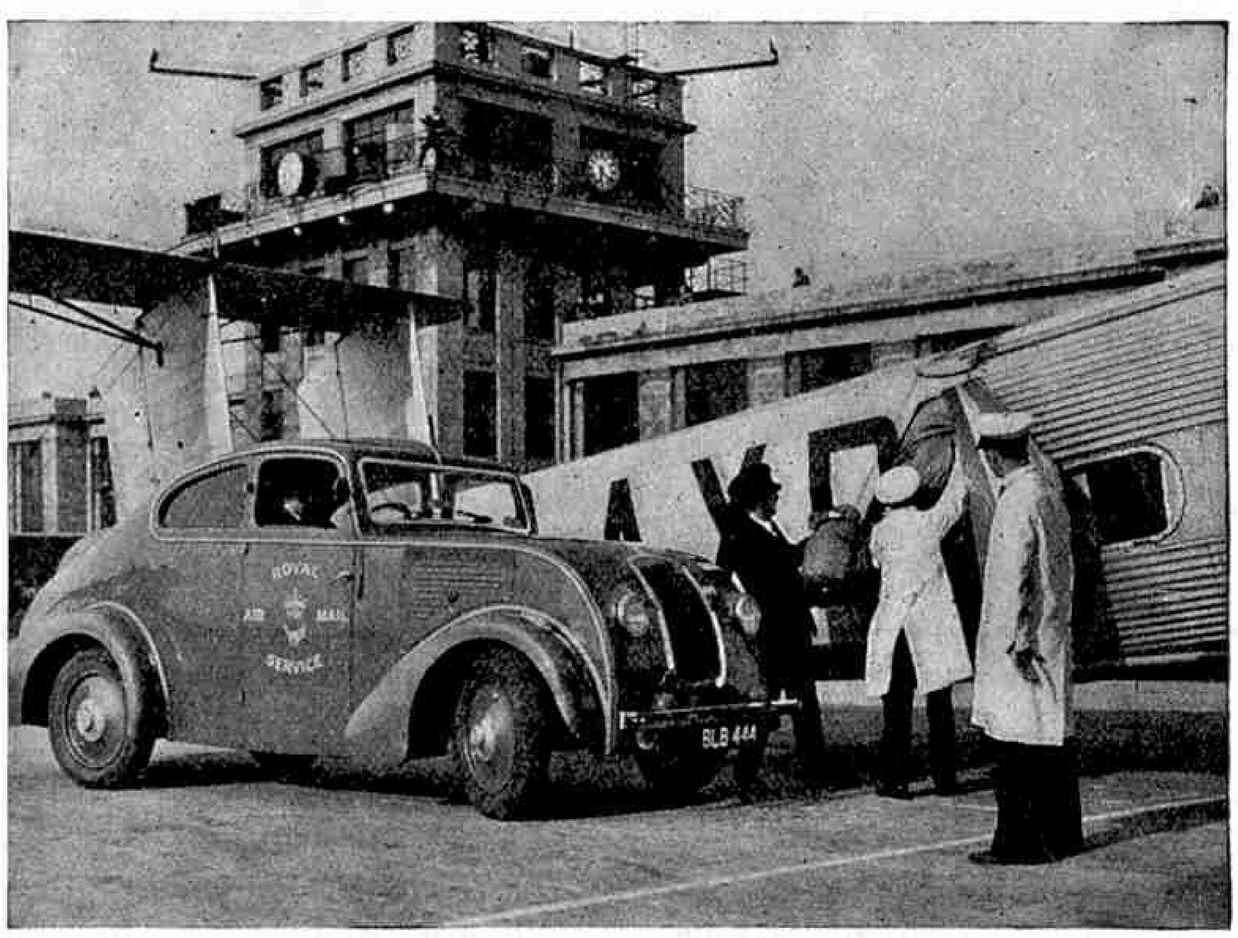
Colour plays a great part in the preservation of animals, and the best efforts of mankind have never approached the wonderful camouflage effects of Nature. The praying mantis can imitate to the life orchids and other flowers and plants. Other insects resemble twigs and leaves, and scores of other fascinating examples of these strange powers are given.

The senses of animals is another subject that is dealt with. This is a topic about which comparatively little can be known, for it is not easy to realise how any animal sees its world. Other chapters deal with the manner in which animals care for their young, how they behave in the course of their daily lives, and the manner in which they meet crises. One of the most remarkable of these is the capacity to feign death that many wood-lice, spiders, beetles and other creatures have. Some birds also possess this faculty, notably the landrail; and other interesting tricks are those of the night-jar, which pretends to be maimed while luring intruders or enemies away from its nest. Finally comes a survey of animal history, showing how primitive forms of life developed into fish, reptiles and other higher beings.

The book is lavishly illustrated with half-tone plates and original diagrams, and is a mine of information that will fascinate all who have the slightest interest in the animal world.



A black-headed gull chick begging for food. The chick pipes and pecks, and sometimes springs up an inch or two in the air when hungry.



Transferring mails from a Post Office van to an aeroplane at Croydon Airport. From "Behind the Letter Box," reviewed on this page.

"Scouts in the Shan Jungle"

By SERCOMBE GRIFFIN. (Harrap. 3/6 net)

The scene of this exciting story is the Shan States, which lie between Burma and China. The author has himself lived in the country he describes and his knowledge of its inhabitants is put to good use in his thrilling yarn. His heroes are three Boy Scouts, one of them a Bengali, who rescue an Armenian millionaire from Indian robbers. Then the story takes us in the jungle with the troop to which they belong, one member of which is a quiet serious youth named Moung Khan, who seems to interest many strange people who make enquiries about him from his comrades. In the jungle there are many exciting adventures, in which the Scouts have narrow escapes from cobras and crocodiles, take part in the trapping of a man-eating tiger, and witness the capture of fierce wild elephants.

The most thrilling adventures follow the kidnapping of Moung Khan, however, for this leads the members of the troop into conflict with an unscrupulous Shan Chief who terrorises the subjects of a native state, and is only overcome after many strange and hazardous experiences. The Scouts play a great part in this. They find and rescue their comrade Moung Khan, who turns out to be a Shan Prince and eventually takes the place of the baffled villain. A thrilling story, illustrated by an excellent coloured frontispiece and four full page drawings.

In Search of New Models

Fun with Summer Games Subjects

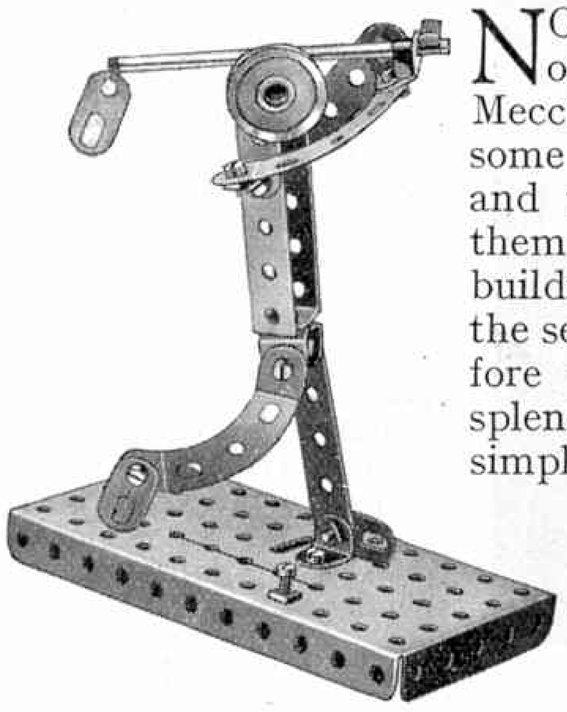


Fig. 1. A Meccano golfer misses his drive. The "ball" is a $\frac{3}{8}$" Bolt.

NOW that the sunny months of summer are with us, all Meccano boys are taking part in some of the many outdoor sports and pastimes that are open to them. It is only right that model-building also should be fitted in the season, and this month therefore we draw attention to the splendid fun that the making of simple humorous models of sports subjects brings with it. All the models illustrated on these pages represent people engaged in popular summer sports, and they require only a few simple parts for their construction. Models of this kind can be assembled very quickly, but in building them there is wonderful scope for ingenuity in the design and construction of the simple mechanisms that make the figures "work" and thus bring them to life.

The realistic caricatures of cricket players and umpire shown in Figs. 2, 3 and 4 are particularly good examples of this light model-building. The attitudes of these figures, particularly that of the wicket-keeper, are remarkably successful, and the models generally are full of life and vigour, features that are obtained by the skilful arranging of the few simple pieces used in their construction.

In making models of this type, everything depends upon the positions of the Strips and other parts relative to each other. For example, a slight alteration in the placing of the feet of the batsman in Fig. 2 would produce an effect totally different from that given at present. His legs, which are represented by $1\frac{1}{2}$" Strips, look extremely shaky, and the construction of his face gives him an apprehensive look that suggests fear of the demon bowler about to swing over a fast one from the opposite page. A few dexterous twists and turns of his limbs might give him more confidence in his ability to withstand the bowler's onslaught.

The wicket-keeper seems to be very alert. His crouching attitude is good, and the position of his head and arms suggest skill and determination that may have something to do with the batsman's uneasiness. The bowler, in Fig. 3, has his arms well spread out and his neck craned forward. The position of his head, a $\frac{1}{2}$" fixed Pulley fastened to the Threaded Pin, gives him a rather aggressive attitude, and there is no doubt that he is to be feared!

All three of these figures are similar in constructional details, the variety of effects being obtained by careful positioning of the Strips that form their bodies, arms and legs. A different method of construction is employed for the umpire. He is a rather fat, pompous-looking gentleman, and evidently is keeping a stern eye on the game! His body is composed of $2\frac{1}{2}$" Curved Strips of different radii, covered in by a $5\frac{1}{2}" \times 2\frac{1}{2}$" Flexible Plate. The legs of his trousers are formed by $2\frac{1}{2}" \times 1\frac{1}{2}$" Flexible Plates bent round a pencil to form tubes, and they are pushed on to the ends of Strips fastened inside the "body."

Figures of this kind can easily be made to work by mounting them on a baseboard, and connecting their arms and legs to Eccentrics or Cranks by means of wire. In this manner the bowler can be made to deliver the ball, the batsman to raise his bat and play a stroke, and the umpire to signal "Out."

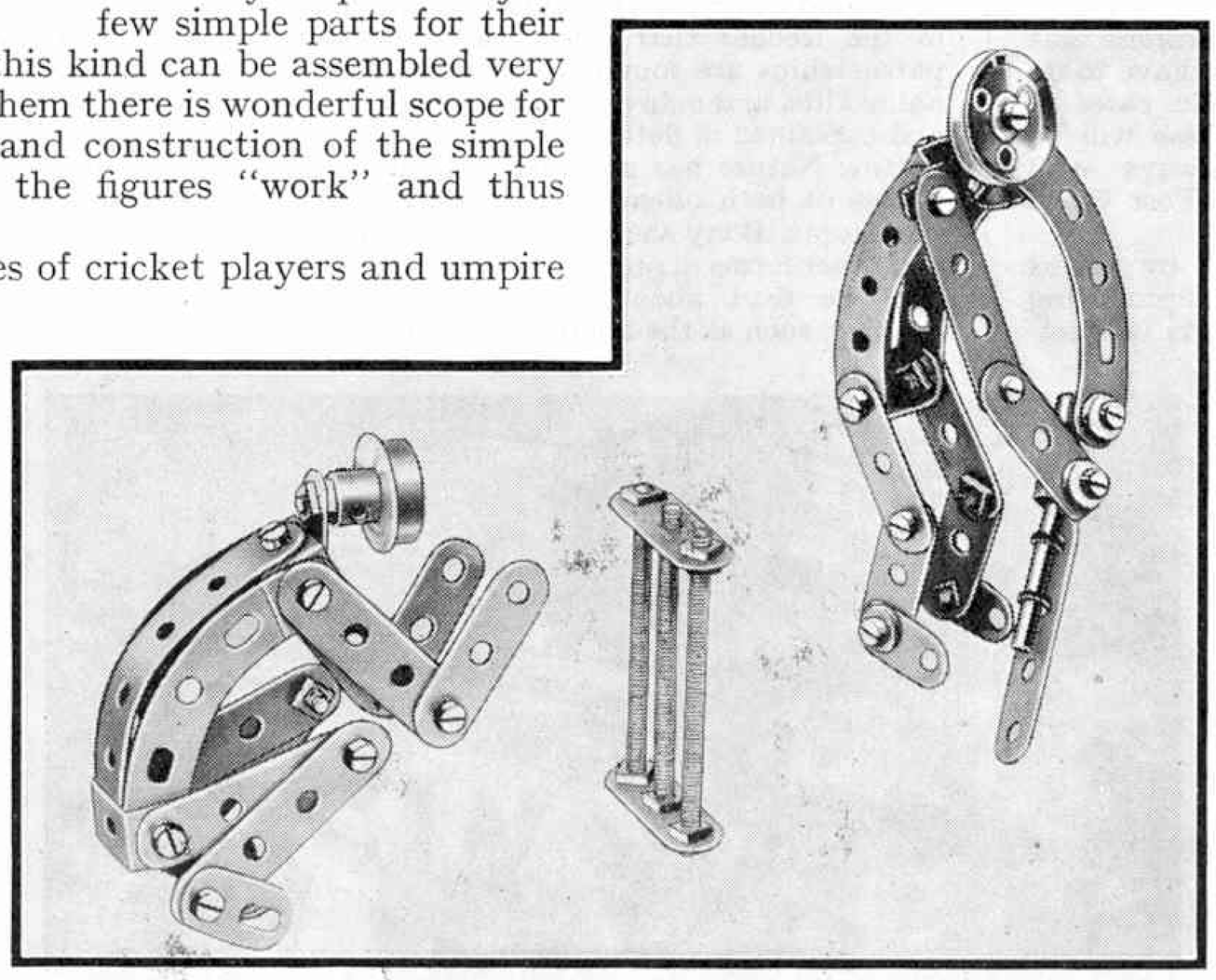


Fig. 2. Meccano cricketers at play. The batsman seems uneasy, but the wicket-keeper looks ready for anything that comes his way!

Most model-builders have opportunities of participating in the annual school sports, where they should notice many incidents that will provide good subjects for humorous Meccano models. For instance, it is not an unusual occurrence for an unfortunate competitor to miss his footing at the water jump! His ungraceful plunge into the ditch always raises loud laughter, much to the disgust of the discomforted victim. Other incidents, such as hurdlers in action, the start of a sprint, and an obstacle race, all provide ample opportunities for the watchful model-builder, and the skill with which the correct "action" is reproduced will greatly increase the effect of the model.

The model of a tug-of-war shown in Fig. 5 is an interesting example of a simple working "sports" model. The constructional details of such a model can, of course, be modified to suit the parts one has available. In the model illustrated all the figures are mounted on a single base, and in each the legs and arms are pivoted by lock-nutted Bolts to the Curved Strips that form the body. Each of the figures is placed in a different attitude, and variations in construction, chiefly in body details, add to the interest of the model.

The team on the right-hand side is composed of

Meccanitians of robust proportions, but the "anchor" man of this team excels all in rotundity of figure! The knotted "muscles" of his arms are Collars and Hexagonal Couplings, and his neck is a Cranked Bent Strip!

A length of Spring Cord is used for the rope, and is reinforced by threading a piece of Wire Line through its centre. The Cord passes through a Collar fixed in each of the figure's hands, and Bolts hold it firmly in place. The backs of the two "anchor" men are extended downward with Strips, and both are hinged to a compound strip carried below the base. The compound strip consists of two $12\frac{1}{2}$" Strips, which are overlapped two holes by $5\frac{1}{2}$" Strips placed one on top of each other to make a strong joint.

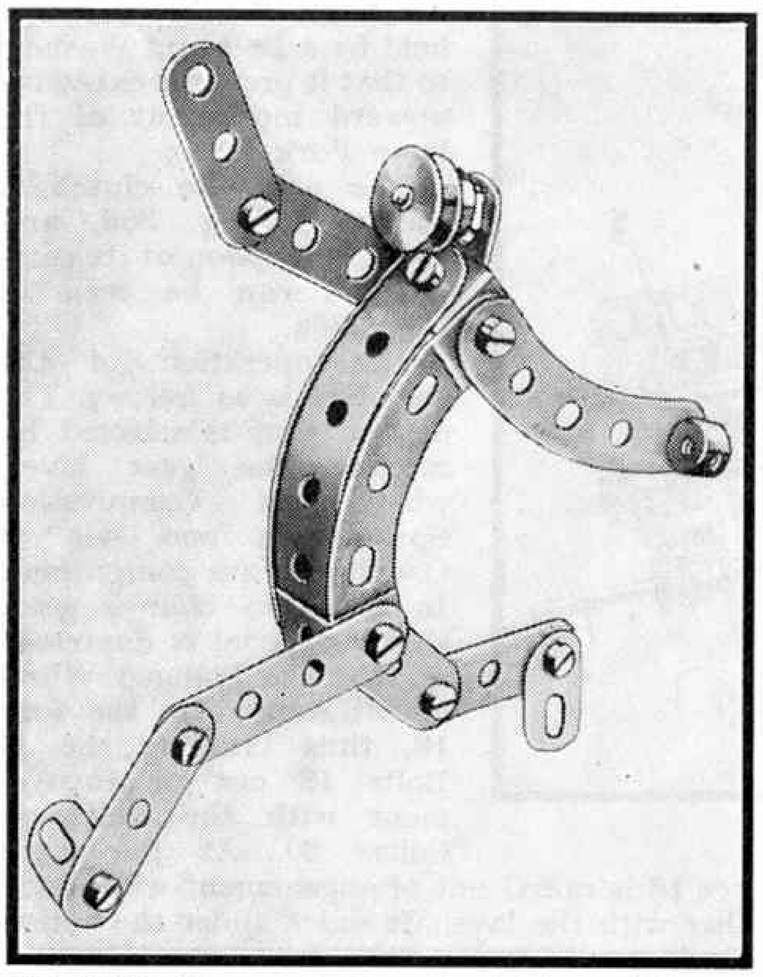


Fig. 3. The Meccano bowler preparing to send down a "hot" delivery to the timid batsman shown in Fig. 2.

The $5\frac{1}{2}$" Strip protruding from the base is a lever pivoted on an Angle Bracket fastened under the base, and on a lock-nutted Bolt on the compound strip. A very amusing effect is obtained by moving this lever from side to side, the teams swaying slowly backward and forward and thus giving the impression that a really well-balanced contest is in progress. An extra touch of realism is lent by the umpire, whose excitement and eager attitude suggest the cheer-leader of one side rather than the impartial judge.

Boating also has its humorous incidents, and owners of small Outfits particularly will find this a new and interesting field for their attention when searching for simple models to build during the summer months. The smaller craft, such as the rowing boat or punt, are the best types to make a start with, and such models can be made additionally interesting by the inclusion of a rowing crew arranged in realistic attitudes.

Most readers will have seen illustrations of the punter whose pole has stuck in the mud, leaving him hanging on to it in mid-stream, while the other occupants of the punt are unaware of his predicament! A great deal of fun can be obtained in building up humorous scenes of this kind, and so few parts are required that owners of even the smallest Outfits can build really attractive models.

Owners of large Outfits will find plenty of fun in fitting their boats with workable figures. For example, the model oarsman built with Outfit C, which is illustrated in the "New Outfit Models" article on page 356, can be made to row his boat by means of a pivoted Strip. The Strip is pivoted to the back of the oarsman and also to a Bush Wheel that is mounted on a Rod driven either by a *Magic* Motor or through Pulleys in contact with the ground, so that the oars operate when the model is pushed along.

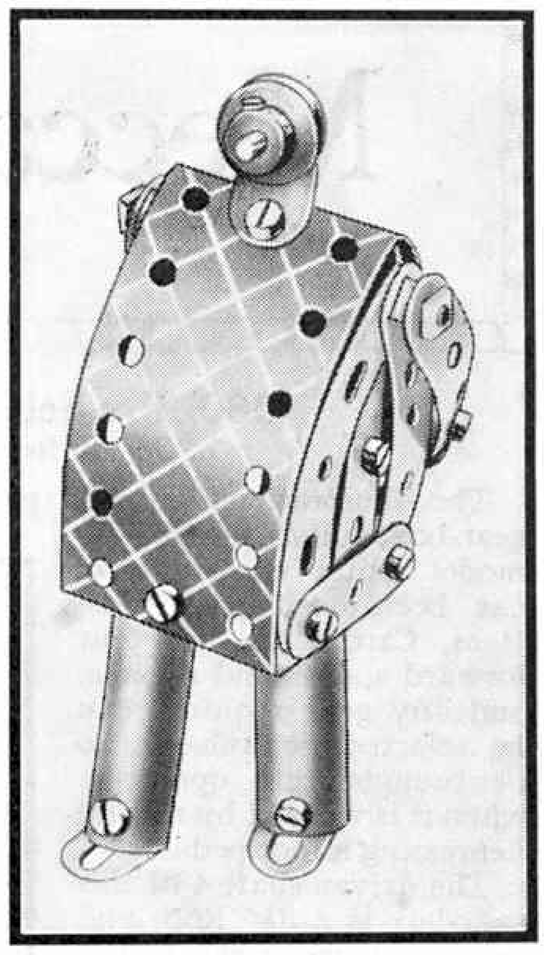


Fig. 4. The umpire keeps a stern eye on the game.

Although golf is not confined to the summer months it is at its peak at this time of the year. A golfer, who is evidently not very skilful with the club, for he has just missed his drive, is shown in Fig. 1. In this realistic little model one can almost detect an expression of annoyance on the golfer's "face"! The figure is built up from Double Angle Strips, Curved Strips and Strips, and his club is a $3\frac{1}{2}$" Rod, on one end of which is a Flat Bracket that forms its head. The ball is a $\frac{3}{8}$" Bolt lock-nutted to the Flanged Plate that provides a base for the model. The scene could be made additionally effective and humorous by the inclusion of a bored caddy leaning on a bag of clubs.

In making figures of sportsmen in action it is a good plan to mount their heads on short lengths of Spring Cord, or on Springs fastened inside their bodies, so that their heads bob about when tapped. Their arms also can be joined in a similar manner, but Spring Clips should be used in place of Spring Cord so that they vibrate in one direction only. By applying this idea to the golfer a very quaint and amusing effect can be obtained, which will cause much fun when the model is exhibited to one's friends.

Tennis is another sport that is full of "action pictures," and it is interesting to try to reproduce the various attitudes that the players assume when attempting awkward strokes. A suitable net can be made from Cord, and it can be supported on posts formed with Strips mounted on bases.

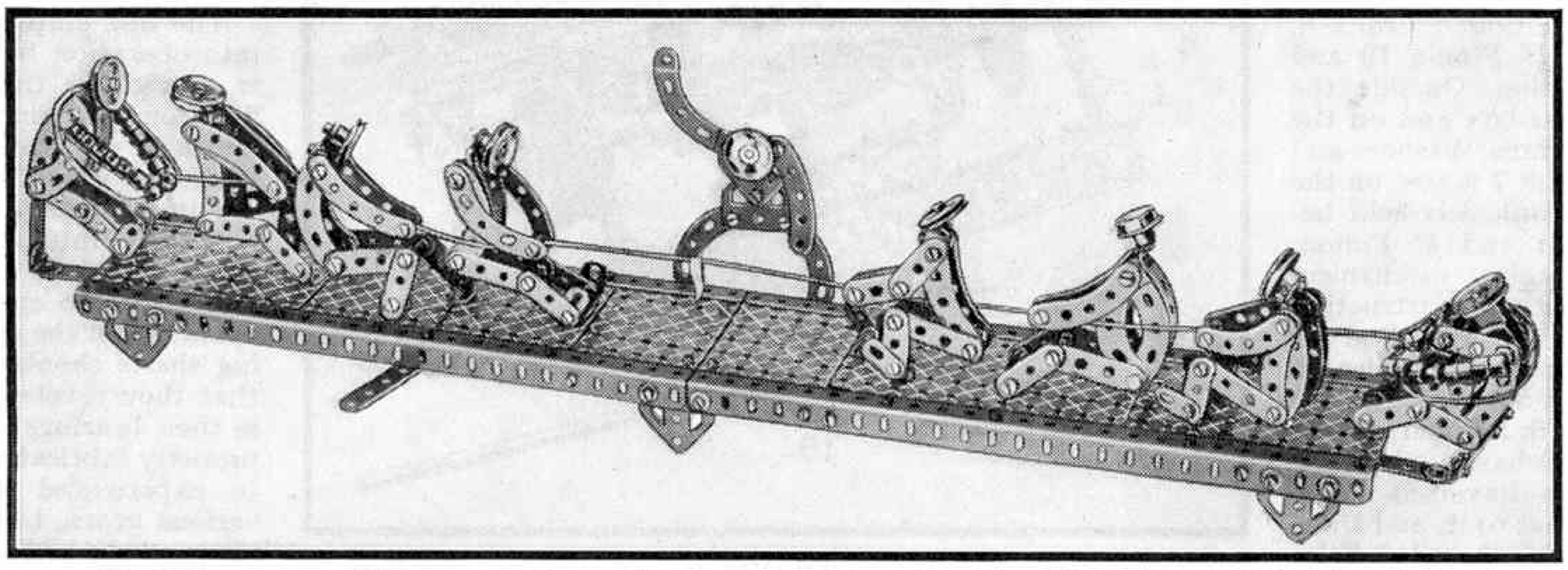


Fig. 5. A strenuous pull. Two teams of Meccanitians engaged in a tug-of-war. The judge is all set to declare the victors!

Motor cycling and ordinary cycling also provide good subjects for simple models, especially if treated from the humorous standpoint. An amusing example is a tandem cycle, with a stout rider behind "taking it easy," while his thin companion in front pedals with gusto!

Meccano Suggestions Section

By "Spanner"

(380) Pre-Selector Gear-Box

(B. Rees, Cardiff)

The illustrations on this page show a compact pre-selector gear-box, suitable for use in model motor chassis, that has been designed by B. Rees, Cardiff. It has four forward speeds and reverse, and any gear required can be selected beforehand, to be brought into operation when it is wanted by merely depressing a foot pedal.

The driven shaft 4 of this gear-box is a 3½″ Rod, and carries at its inner end a Coupling 5. A 57-teeth Gear and a 50-teeth Gear are placed on the Rod between the 1″×1″ Angle Bracket and the Double Angle Strip, and the ½″ Pinion that forms part of the reverse gear also is fastened on the Rod, but outside the frame of the gear-box. A second ½″ Pinion is secured to a Pivot Bolt passed through the centre hole of the right-hand 3½″×½″ Double Angle Strip 1, and is in constant mesh with the adjacent ½″ Pinion.

The driving shaft carries between the Angle Bracket and the Double Angle Strip, a Collar, a ¾″ Pinion and a ½″×½″ Pinion. Between the two 1″×1″ Angle Brackets the Rod passes through the elongated hole of the Crank 7, and a built-up dog clutch is fitted to the end of the Rod. The clutch consists of a Collar 6 fixed to the Rod by two Bolts, which also pass through the elongated holes of two Flat Brackets. A second Collar is spaced from Collar 7 by half a Compression Spring, and the Flat Brackets are secured to it by two Set Screws. The layshaft is a compound rod formed by joining together a 2″ Rod and a 5″ Rod by a Coupling. The 2″ member of the Rod carries a 50-teeth Gear, and the 5″ member carries a 57-teeth Gear, Crank 7, a Collar, Crank 8, six Washers, a ½″ Pinion 10 and finally a ¾″ Pinion. Outside the frame of the gear-box and on the same Rod, are three Washers and a ½″ Pinion. Crank 7 is free on the layshaft, and Crank 8 is held between the Collar and ½″ Pinion.

The gear-changing mechanism is very simple both in construction and operation. A 6½″ Rod is journalled in the upper holes of the 1½″ Corner Brackets 3, and it carries Coupling 9, a Collar, Crank 8 and a second Collar. A 3½″ Rack Strip 12 has two Reversed Angle Brackets 11 bolted to it, and these are secured in the threaded holes of the Collars by bolts, the securing nuts being tightened up against the Brackets to hold them in place. A Flat Bracket 13 acts as a support for the Rack Strip.

Reference to Fig. 380 will make clear the construction of the selector. A 4½″ Rod 14 carries a Boss Bell Crank 15, which forms the operating pedal. A 3″ Strip is fastened to the horizontal arm of the Crank 15, and at its free end it carries a 1″×½″ Angle Bracket arranged so that the shorter arm of the Bracket acts as a stop by making contact with the side member of the gear-box.

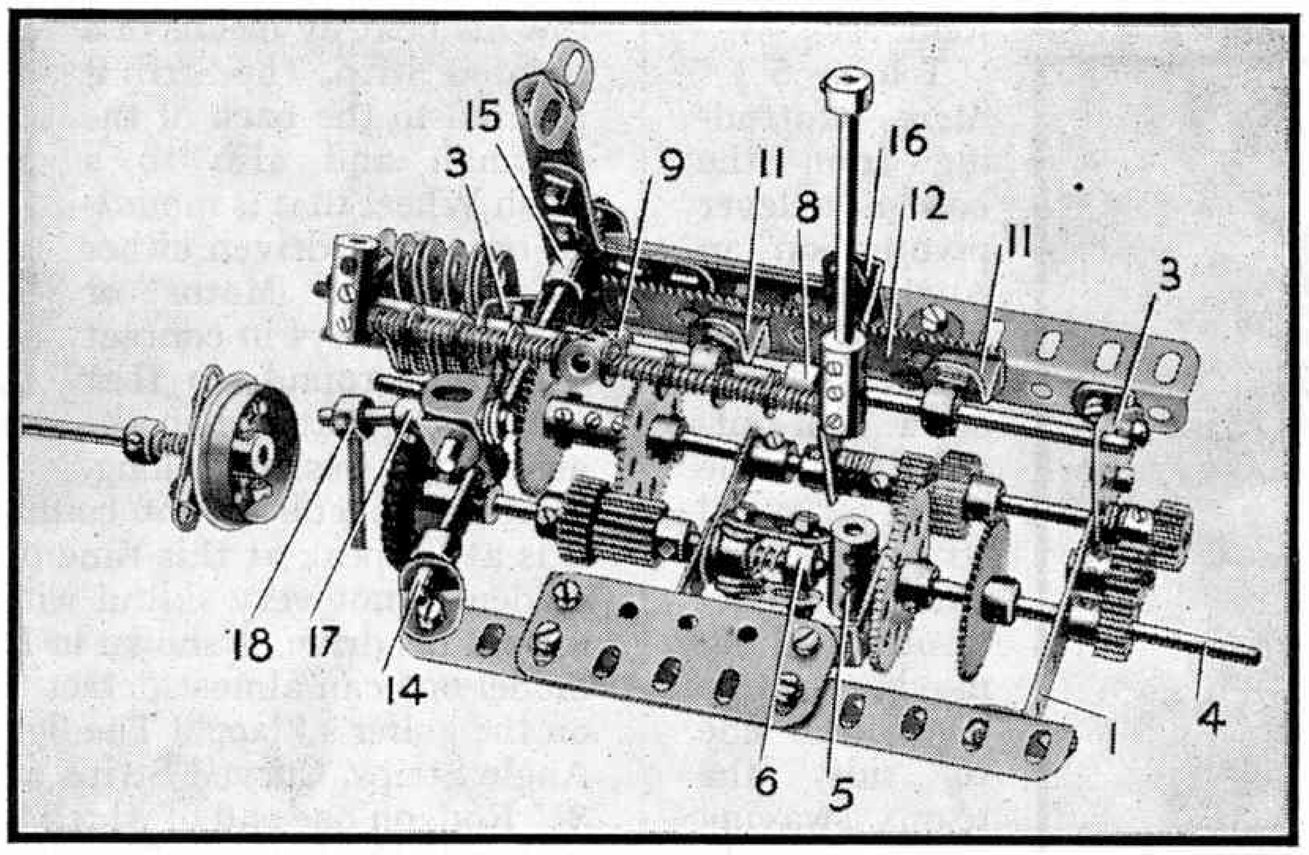


Fig. 380

The gate is built up on two 2″ Screwed Rods fastened one above the other to the left-hand Corner Bracket 3, and 1½″ Strips are placed on the Rods and spaced by Washers so that their positions coincide with those of the gears. The large Fork Piece 17 is pivoted on a 1″ Rod held in the top hole of a Coupling fixed on Rod 14. An Angle Bracket is firmly held by a Bolt and Washers so that it prevents excessive upward movement of the large Fork Piece.

The complete clutch is shown in Fig. 380, and the construction of its components can be seen in Fig. 380a.

The operation of the gear-box is as follows. The desired gear is selected by moving the gear lever, when the Compression Springs on one side of Coupling 9 are compressed. In order to change gear, the foot pedal is depressed so that the Flanged Wheel is withdrawn by the fork 18, thus bringing the ½″ Bolts 19 out of engagement with the Bolts on Collar 20. At the same time the Angle Bracket 16 is raised out of engagement with Rack Strip 12, which together with the layshaft slides under the action of the Compression Springs.

Reverse gear is taken through the ½″×½″ Pinion and 57-teeth Gear and the three ½″ Pinions outside the frame of the gear-box. Bottom gear is provided by the ½″×½″ Pinion, 57-teeth Gear, ½″ Pinion 10 and the other 57-teeth gear on Rod 4. Second gear is given by meshing the ½″×½″ Pinion with the 57-teeth Gear on the layshaft, and the ¾″ Pinion on the layshaft with the 50-teeth Gear on Rod 4. Two sets of ¾″ Pinions and 50-teeth Gears are brought into operation for third gear, and top gear is a direct drive through the dog clutch unit.

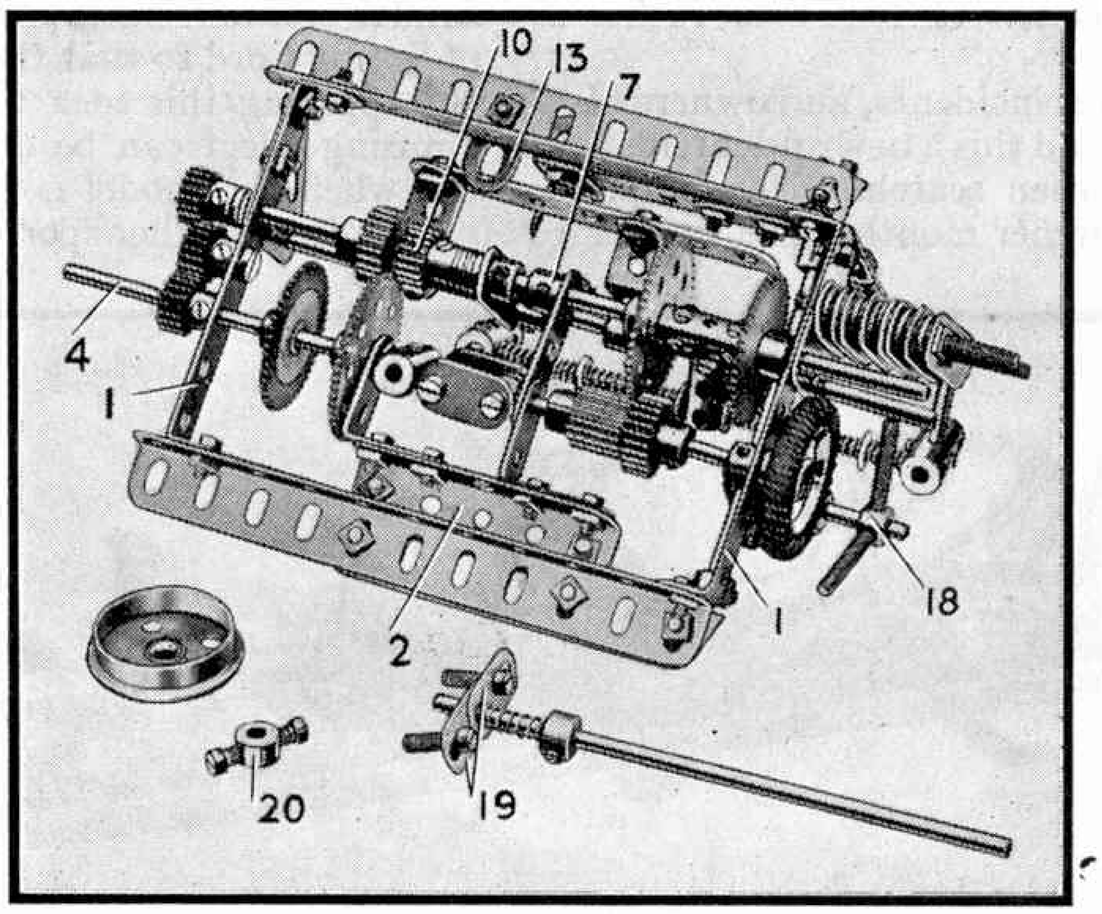


Fig. 380a

The dog clutch unit is brought into operation by Crank 7, which is moved by the 57-teeth Gear fixed on the same shaft when the layshaft is placed in top gear position. When the other gears are in operation the Crank does not come into contact with the 57-teeth Gear.

In order to ensure the efficient operation of the gear-box, all moving shafts should be well oiled so that they revolve and slide freely in their bearings. If the layshaft is properly lubricated no trouble will be experienced in operating the various gears, but if the Crank 7 binds on the layshaft the following simple device may be incorporated to overcome the difficulty. An Angle Bracket is fastened to the upper side-member of the gear-box in the fifth hole from the right (Fig. 380a). A 2″ Strip is pivoted to the Angle Bracket by means of a lock-nutted Bolt in its second hole. The longer arm of this Strip is also attached by a set screw to the boss of Crank 7, and a nut is screwed up against the boss so that the set screw is prevented from locking the Crank to the layshaft. An elastic band is attached to the shorter arm of the Strip and to the bolt holding Flat Bracket 13.

(381) Stroboscope (A. Carr, Wolverhampton)

The stroboscope is an ingenious instrument that to-day is largely used by engineers for observing mechanisms working at high speed. A revolving wheel or moving parts of machines appear to be stationary when looked at through the instrument if this is properly adjusted. This effect is obtained by viewing the mechanism through a slit, in front of a rapidly revolving shutter, the speed of which can be varied at will. If the shutter is made to rotate at the same speed as the wheel or other moving object it is desired to examine, the eye receives a succession of glimpses of the mechanism at the same point in its rotation. Owing to the persistence of the image formed in the eye, this series of glimpses blends into a continuous steady image. If the speed of the shutter exceeds that of the moving object the image seen by the eye appears in reverse slow motion, but if the shutter speed is reduced to a point slightly below the speed of the object under observation it is seen revolving slowly in the direction in which it actually is moving.

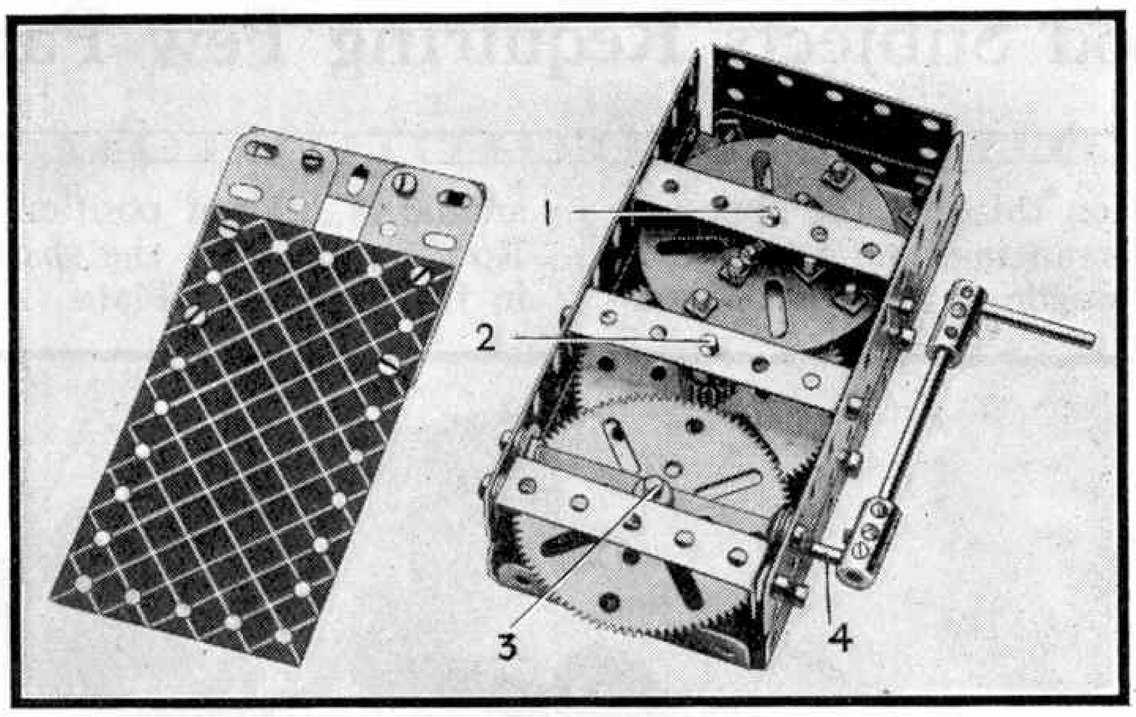


Fig 381

A simple hand-driven model of this mechanism was submitted by A. Carr, of Wolverhampton, and is shown with the back of the casing removed in Fig. 381. In this model, however, the shutter has four slots in it instead of one, so that as the shutter gives four glimpses of the subject under study each revolution, to obtain a still image, it is necessary to rotate the shutter only at one quarter the speed of the subject.

The mechanism is contained in a box, the front of which is built up from $5\frac{1}{2}$" Angle Girders connected together at each end by $2\frac{1}{2}$" Angle Girders. Two $2\frac{1}{2}" \times 1\frac{1}{2}"$ Double Angle Strips and two $2\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strips are bolted in the position shown, to form bearings for Rods 1 and 2. The $2\frac{1}{2}" \times 1\frac{1}{2}"$ Double Angle Strip forming the bearings for Rod 2 is opened out slightly to allow sufficient clearance for the $2\frac{1}{2}$" Gear Wheel. Bearings for Rod 3 are provided by two $2\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strips, the lower one being spaced from the $5\frac{1}{2}$" Angle Girders by two Washers on each side. The upper one is similarly spaced from the two $5\frac{1}{2}$" Flat Girders.

The shutter is a Face Plate carried on Rod 1, and its round holes are covered by fastening bolts in them or by pasting them over with paper. Behind the Face Plate and on the same Rod, is a $\frac{1}{2}$" Pinion, and a Collar is fastened on Rod 1 outside the Double Angle Strip that forms the lower bearing.

A $2\frac{1}{2}$" Gear on Rod 2, which carries also a $\frac{1}{2}$" Pinion, meshes with the $\frac{1}{2}$" Pinion on Rod 1, and a second $2\frac{1}{2}$" Gear fastened on Rod 3 meshes with the $\frac{1}{2}$" Pinion on Rod 2. Rod 3 carries a $\frac{1}{2}$" Helical Gear that meshes with a second $\frac{1}{2}$" Helical Gear on the $3\frac{1}{2}$" Rod 4. Two $4\frac{1}{2}" \times 2\frac{1}{2}"$ Strip Plates are used to enclose the front and back of the casing.

The stroboscope can either be held in the hand or mounted on a rigid base. An interesting point to note is that if a mark on a revolving disc is viewed through the stroboscope, only one image appears when the shutter is rotating at a quarter of the speed of the disc. When the shutter speed is increased to half that of the disc, two images diametrically opposite to each other are seen. The reason for this is that the shutter gives a glimpse of the mark on the disc at each half revolution. When the speed of the shutter equals that of the disc, four glimpses are seen each revolution, and four separate still images appear, spaced equally round the rim of the disc.

Many interesting experiments can be carried out with the completed instrument. For example, a word written on a piece of paper pasted to a rapidly revolving disc of cardboard can be read quite easily when viewed through the stroboscope, provided that the speed of the shutter is matched exactly to that of the disc.

(382) Single Suspension Grab (B. Adair, Maryport)

Most model-builders will be familiar with the single suspension grab used on the Meccano Level-Luffing Automatic Grabbing Crane, and although this mechanism functions excellently when once adjusted, a little difficulty is sometimes experienced in making the correct size knot in the hoisting cord. Model-builders who have had this trouble will be interested in a single suspension grab by B. Adair, Maryport. In addition to entirely eliminating the trouble referred to, the modified grab has the advantage that it is readily detachable from the hoist cord.

The operating mechanism is contained between two 3" Flat Girders spaced by $1\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strips. At the centres of the Flat Girders are 1" Triangular Plates. To the upper pair of these are fastened $1\frac{1}{2}$" Strips, across which further $1\frac{1}{2}$" Strips are bolted at right angles. The hooks are bolted to Cranks that in turn are fastened to 2" Rods journalled in the second holes from the ends of the 3" Flat Girders. The Rods carry also the 57-teeth Gears 1 and 3. Between the 57-teeth Gear 1 and the Crank and on the same Rod is a Handrail Support, to which a Coupling is fixed by its grub screws. It carries Rod 2 in its centre plain hole and forms a catch. A length of Spring Cord 5 is held in a Collar at one end of the 3" Flat Girder, and the other end of the Cord is passed into the centre bore of a Coupling secured on the 2" Rod. This is the controlling spring for the catch.

The $5\frac{1}{2}$" Strips that form the arms of the grab are pivoted to $\frac{3}{4}$" Bolts. The place of the hoist cord used in the Super Model Automatic Grabbing Crane is taken by an 8" Rod, which passes through Double Angle Strip 6 and through the $1\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strips spacing the vertical $1\frac{1}{2}$" Strips. The upper end of the Rod carries an End Bearing, and a Collar is fastened to the lower end. The $\frac{1}{2}$" fixed Pulley seen in Fig. 382 takes the place of the knot in the hoist cord. The weight of the Rod and Pulley ensures its proper operation.

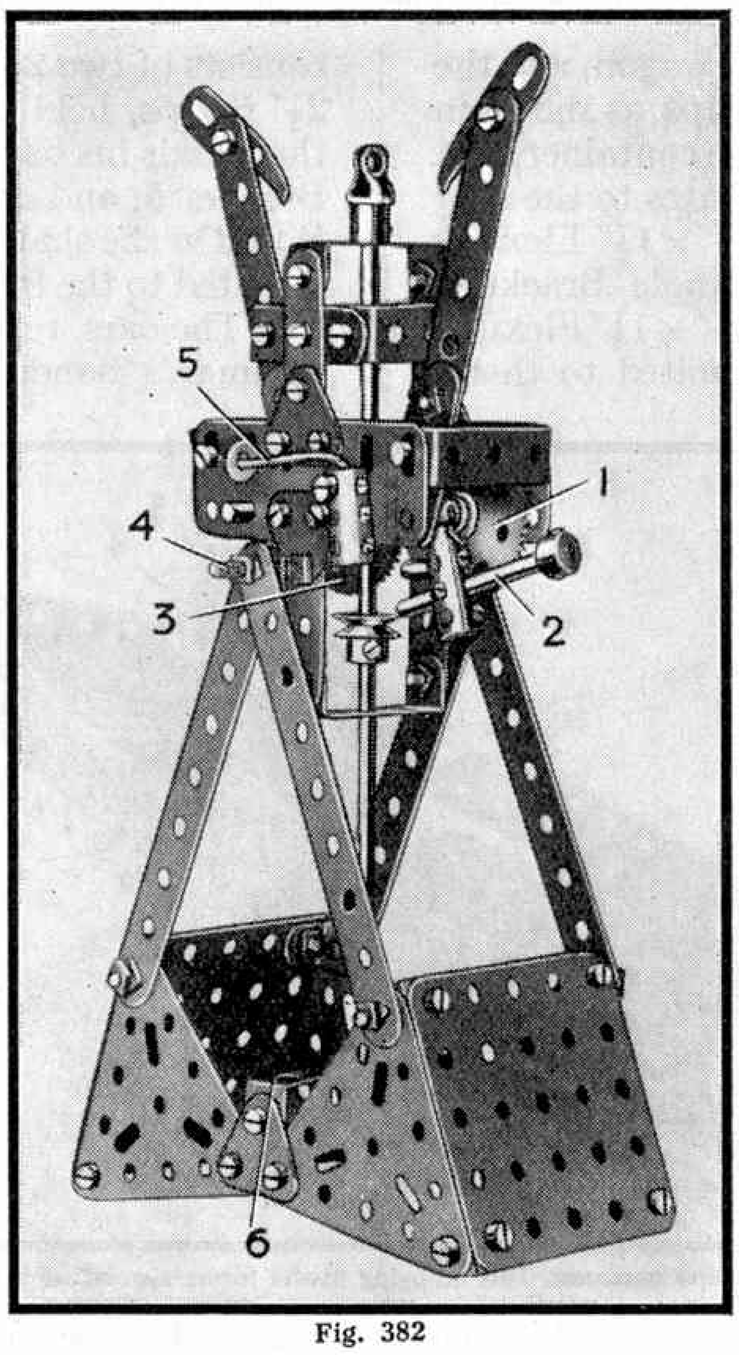


Fig. 382

Miscellaneous Suggestions

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

M.195. L. Cookson, Warwick, submitted recently a suggestion for transmitting the drive from one Rod to another without the use of Couplings. Bush Wheels are secured to the ends of the driving and driven shafts, and a Swivel Bearing is bolted through its boss to a Strip or Plate midway between the shafts. The Collar of the Swivel Bearing is, therefore, pivoted between its forks, and is in line with the bosses of the Bush Wheels. A Rod is passed through the collar so that its ends just engage in diametrically opposite holes in each of the Bush Wheels. When the driving shaft is rotated the Bush Wheel secured on it transmits its motion through the swivel bearing device to the other Bush Wheel. We have tested this arrangement and find that it is satisfactory with Rods 4" or more in length. Shorter Rods than this bind in the holes of the Bush Wheels.

M.196. Many model-builders find difficulty in placing nuts on bolts in remote parts of intricate models. J. Stevens of Lowestoft points out that the job is made easy by placing the nut in the arms of a Small Fork Piece, the arms being squeezed together slightly to hold it. The small Fork Piece can then be mounted on a Rod of suitable length to reach the shank of the Bolt. In an alternative arrangement the nut can be gripped in the Fork Piece by means of a nut and bolt passed through the holes in the forks.

New Outfit Models

Good Subjects Requiring Few Parts

THE four models illustrated on this and the opposite page can be built with Outfits ranging from A to C, and include a horse-drawn tipping wagon, a gantry crane, a low-wing monoplane and an amusing representation of a Meccano oarsman. Although they are intended mainly for readers who possess small Outfits, they are all sufficiently interesting to warrant the attention of owners of a more extensive Outfit or collection of parts.

The model horse-drawn tipping wagon illustrated in Fig. 1 is a fine subject for Outfit A. Its construction is commenced by joining two $5\frac{1}{2}''$ Strips 1 with $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips, one at each end. This forms the frame of the wagon, and the axles are passed through holes in the $5\frac{1}{2}''$ Strips, as shown in the illustration. The next step is to build the container, and this is done by bolting $5\frac{1}{2}'' \times 1\frac{1}{2}''$ Flexible Plates to the long sides of a $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Flanged Plate, and a $2\frac{1}{2}'' \times 1\frac{1}{2}''$ Flexible Plate to one of the shorter sides. Two Angle Brackets, indicated at 2, are then lock-nutted to the $5\frac{1}{2}'' \times 1\frac{1}{2}''$ Flexible Plates, and a $2\frac{1}{2}'' \times 1\frac{1}{2}''$ Flexible Plate is bolted to them. This allows the end of the cart to swing open. Two Trunnions are bolted to the bottom of the $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Plate, and the Rod serving as the back axle passes through their bottom holes, supporting the container yet leaving it free to swivel.

A Reversed Angle Bracket is bolted to the forward Double Angle Strip and adjusted so that the container normally is balanced in a horizontal position. The bolt that fastens the Reversed Angle Bracket in position also holds a $\frac{1}{2}'' \times \frac{1}{2}''$ Angle Bracket. A $\frac{3}{8}''$ Bolt passes through the free hole in the Bracket and is then locked in the boss of Bush Wheel 3, so that the Bush Wheel is free to turn on its pivot. Two $5\frac{1}{2}''$ Strips forming the shafts are then fastened by $\frac{1}{2}'' \times \frac{1}{2}''$ Angle Brackets to the Bush Wheel.

The body of the horse is made from a U Section Plate, and $2\frac{1}{2}''$ Strips are used for its legs. Its neck is constructed of two $2\frac{1}{2}''$ Curved Strips, and two Flat Brackets bolted to the free ends of the Curved Strips represent its head. The animal is held in position between the shafts by a 2" Rod journalled in the shafts and passing through holes in the U Section Plate.

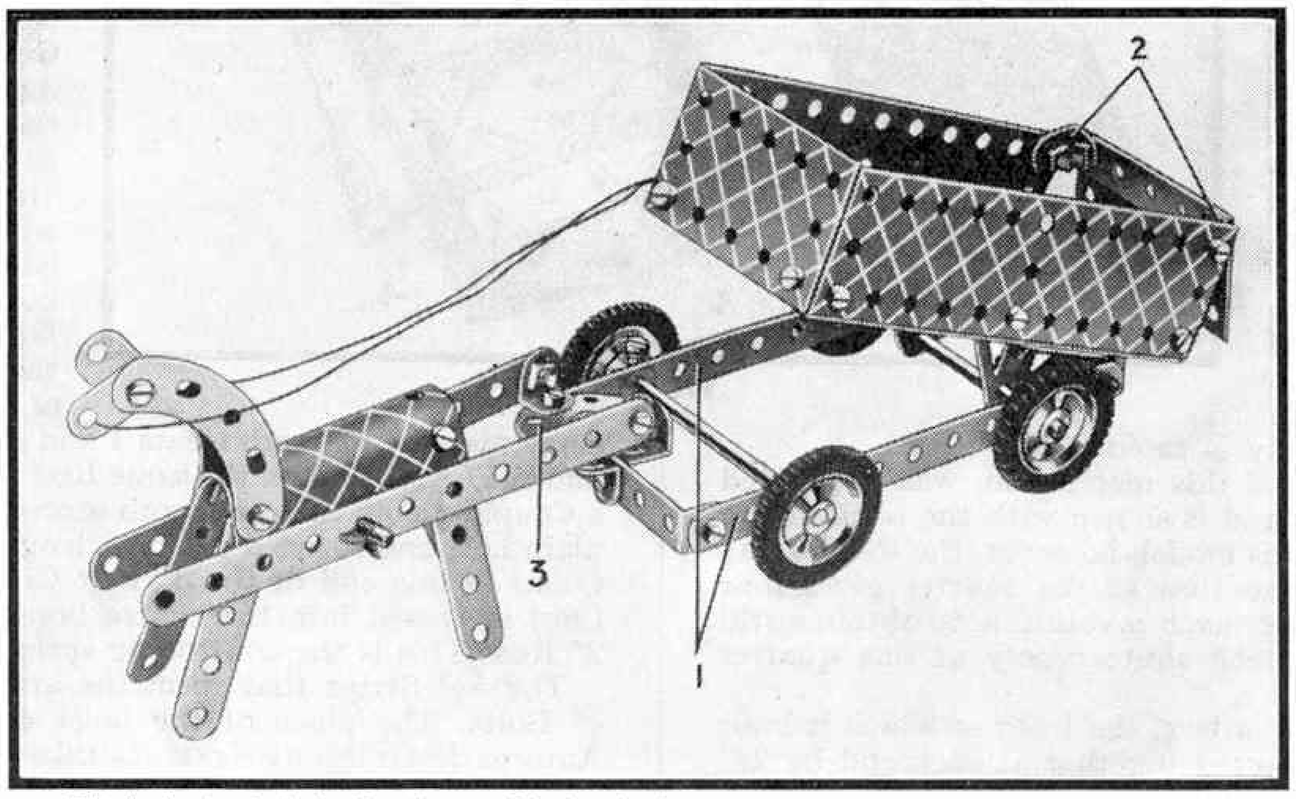


Fig. 1. A simple but attractive model of a tipping wagon, which can be built with Outfit A.

Parts required to build the model horse-drawn tipping wagon: 4 of No 2; 5 of No. 5; 2 of No. 10; 5 of No. 12; 2 of No. 16; 1 of No. 17; 4 of No. 22; 1 of No. 24; 4 of No. 35; 27 of No. 37; 4 of No. 37a; 1 of No. 38; 2 of No. 48a; 1 of No. 52; 2 of No. 90a; 3 of No. 111c; 1 of No. 125; 2 of No. 126; 2 of No. 188; 2 of No. 189; 1 of No. 199; (4-1" Tyres not included in Outfit).

The model illustrated in Fig. 2 shows a Meccano oarsman who has obviously rowed himself out and is resting on his oars after a hard pull! This amusing model can be built from the contents of Outfit C.

The construction of the boat will be obvious from the illustration. The body of the oarsman consists of two $2\frac{1}{2}''$ Curved Strips and his legs and arms are $2\frac{1}{2}''$ Strips, held by Bolts 3 and 4 respectively. The Bolt that holds his back in position holds also a Reversed Angle Bracket 5, and an Angle Bracket is bolted to this by a $\frac{3}{8}''$ Bolt. On the shank of the Bolt is a 1" Pulley. A Bush Wheel is bolted to the free hole of the Angle Bracket to represent a hat. The oars, represented by $5\frac{1}{2}''$ Strips, are secured in the oarsman's hands by means of Cord, and they pivot on rowlocks consisting of 2" Axle Rods supported by Spring Clips in double brackets, each of which is built up from two Angle Brackets.

A $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip is used for the seat, and is attached pivotally to the sides of the boat with two $\frac{3}{8}''$ Bolts. The oarsman is fastened to the seat by means of an Angle Bracket, which is bolted to the Double Bracket forming the lower part of the body.

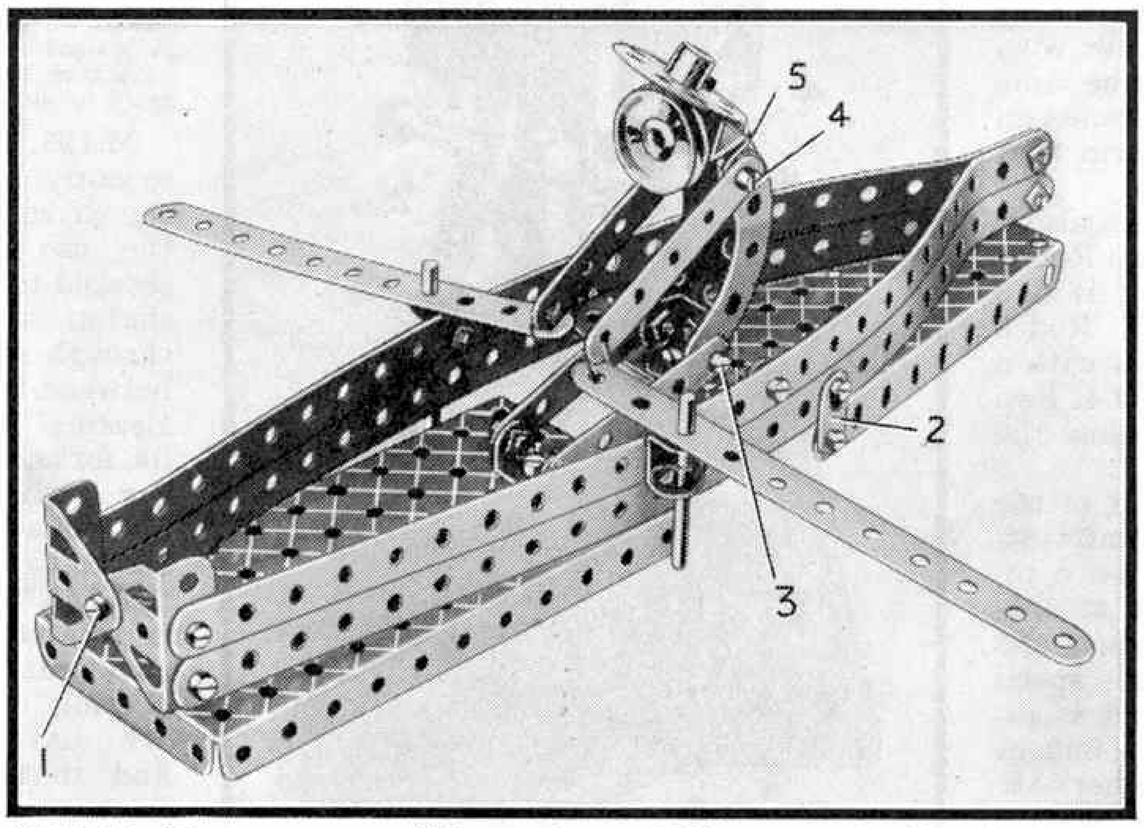


Fig. 2. The Meccano oarsman. This amusing model forms a good subject for Outfit C.

Parts required to build the Meccano oarsman: 4 of No. 1; 2 of No. 2; 5 of No. 5; 3 of No. 10; 2 of No. 11; 8 of No. 12; 2 of No. 17; 1 of No. 22; 1 of No. 24; 2 of No. 35; 26 of No. 37; 7 of No. 37a; 1 of No. 48a; 1 of No. 52; 1 of No. 54a; 2 of No. 90a; 3 of No. 111c; 2 of No. 125; 2 of No. 126.

Fig. 3 shows a fine model of a travelling gantry crane that can be built with Outfit B. The gantry support at one end is made by bolting the two upright $5\frac{1}{2}''$ Strips 1 to a $5\frac{1}{2}'' \times 2\frac{1}{2}''$ Plate and bracing them with two more $5\frac{1}{2}''$ Strips 2. The support at the other end consists of two more upright $5\frac{1}{2}''$ Strips bolted to the wider end of a $4\frac{1}{2}''$ Sector Plate. The two units thus built up are then joined by $12\frac{1}{2}''$

Strips, along which the hoisting trolley runs. The bolts 3 hold in position a $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip, connecting the $12\frac{1}{2}''$ Strips, and the compound bracing strips 4 are built up from three $2\frac{1}{2}''$ Strips.

The sides of the control cabin consist of $4\frac{1}{2}'' \times 2\frac{1}{2}''$ Flexible Plates, and two $2\frac{1}{2}'' \times 2\frac{1}{2}''$ Flexible Plates are used for the top. The crankhandle 5 and Rod 6 are journalled in the holes of the Flexible Plates that form the sides of the cabin. In order that Rod 6 may be turned easily, a Bush Wheel with a $\frac{3}{8}''$ Bolt through one of its holes, is fastened to it. The hoisting trolley consists of two Trunnions joined together by a Flat Bracket, and the Axle Rods holding the 1″ Pulleys, four in number, on which it runs, are passed through the end holes of the Trunnions.

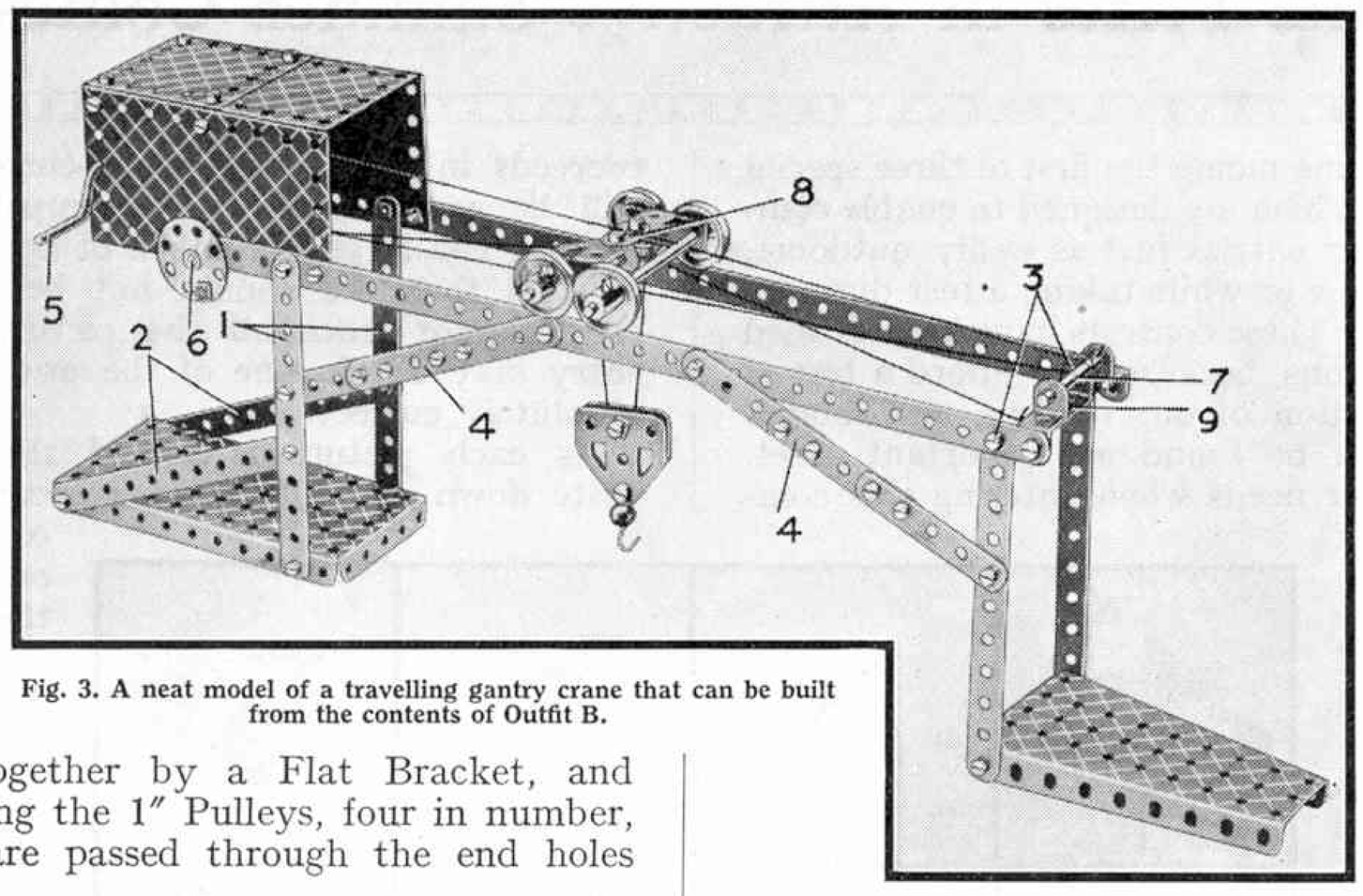


Fig. 3. A neat model of a travelling gantry crane that can be built from the contents of Outfit B.

The pulley block consists of two Flat Trunnions held together by means of a $\frac{3}{8}''$ Bolt 6. On the shank of this Bolt, between the Flat Trunnions, there are three Washers to allow the cord to slide easily. The Hook is held by a $\frac{3}{8}''$ bolt that passes through the bottom holes of the Flat Trunnion.

The Cord for moving the trolley is first attached to Flat Bracket 8, then led over Rod 7 to Crank 5, round the shaft of which it is wound several times. The free end of the Cord is then tied to Flat Bracket 8. The pulley Cord is tied first to the centre hole of Double Angle Strip 9, and is then led over the first axle of the trolley, through the pulley block, over the second axle of the trolley and lastly is fastened to a Cord Anchoring Spring on Rod 6.

Parts required to build the gantry crane: 2 of No. 1; 6 of No. 2; 8 of No. 5; 1 of No. 10; 4 of No. 12; 1 of No. 15b; 2 of No. 16; 1 of No. 17; 1 of No. 19s; 4 of No. 22; 1 of No. 24; 4 of No. 35; 40 of No. 37; 2 of No. 37a; 3 of No. 38; 2 of No. 48a; 1 of No. 52; 1 of No. 54a; 1 of No. 57c; 1 of No. 111c; 2 of No. 125; 2 of No. 126; 2 of No. 126a; 1 of No. 176; 2 of No. 190; 2 of No. 191.

The monoplane illustrated in Fig. 4 can be built with Outfit C, and is based on the Monospar ST/25 five-seater cabin machine, which is equipped with twin engines of 90 h.p. each. The fuselage of the model should be built first. Four $12\frac{1}{2}''$ Angle Girders are joined together at one end by Flat Brackets, and are spaced apart by $2\frac{1}{2}''$ Strips at the other end. The $2\frac{1}{2}''$ Strips 1 that form the nose of the machine are fastened to the fuselage by means of Obtuse Angle Brackets, which are bolted in the elongated holes of the Angle Girders. The free ends of the $2\frac{1}{2}''$ Strips are then bolted to the Angle Bracket 2.

The leading edges of the wings consist of two $12\frac{1}{2}''$ Strips overlapping five holes, and the trailing edges of two $12\frac{1}{2}''$ Strips overlapping seven holes. The Strips are joined together at their ends by $2\frac{1}{2}''$ Curved Strips, and the wings are then bolted to the two $12\frac{1}{2}''$ Angle Girders that form the bottom of the fuselage. The spaces between the Strips are filled in with $5\frac{1}{2}'' \times 2\frac{1}{2}''$ and $4\frac{1}{2}'' \times 2\frac{1}{2}''$ Flexible Plates. The engine nacelles are formed by U Section Plates, and are fastened to the wings by means of Angle Brackets. Bearings for the propeller shafts, which are represented by $3\frac{1}{2}''$ Rods, are formed by $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips held by the Bolts 3.

The tail plane is composed of $5\frac{1}{2}'' \times 1\frac{1}{2}''$ Flexible Plates, and the $2\frac{1}{2}'' \times 1\frac{1}{2}''$ Flexible Plates forming the rudders are bolted to it by means of $\frac{1}{2}'' \times \frac{1}{2}''$ Angle Brackets. The entire tail assemblage is fastened to the fuselage by means of Bolt 4. The tail wheel is represented by a $\frac{1}{2}''$ loose Pulley, and the bearings for the $1\frac{1}{2}''$ Rod on which it is carried are two Flat Brackets, bolted to the lower part of the fuselage.

The landing wheels are 1″ fast Pulleys, which are secured on a $3\frac{1}{2}''$ Rod supported in the end holes of two $2\frac{1}{2}''$ Cranked Curved Strips forming the undercarriage. The upper ends of the Curved Strips are fastened by $\frac{1}{2}'' \times \frac{1}{2}''$ Angle Brackets to the fuselage, just in front of the wings.

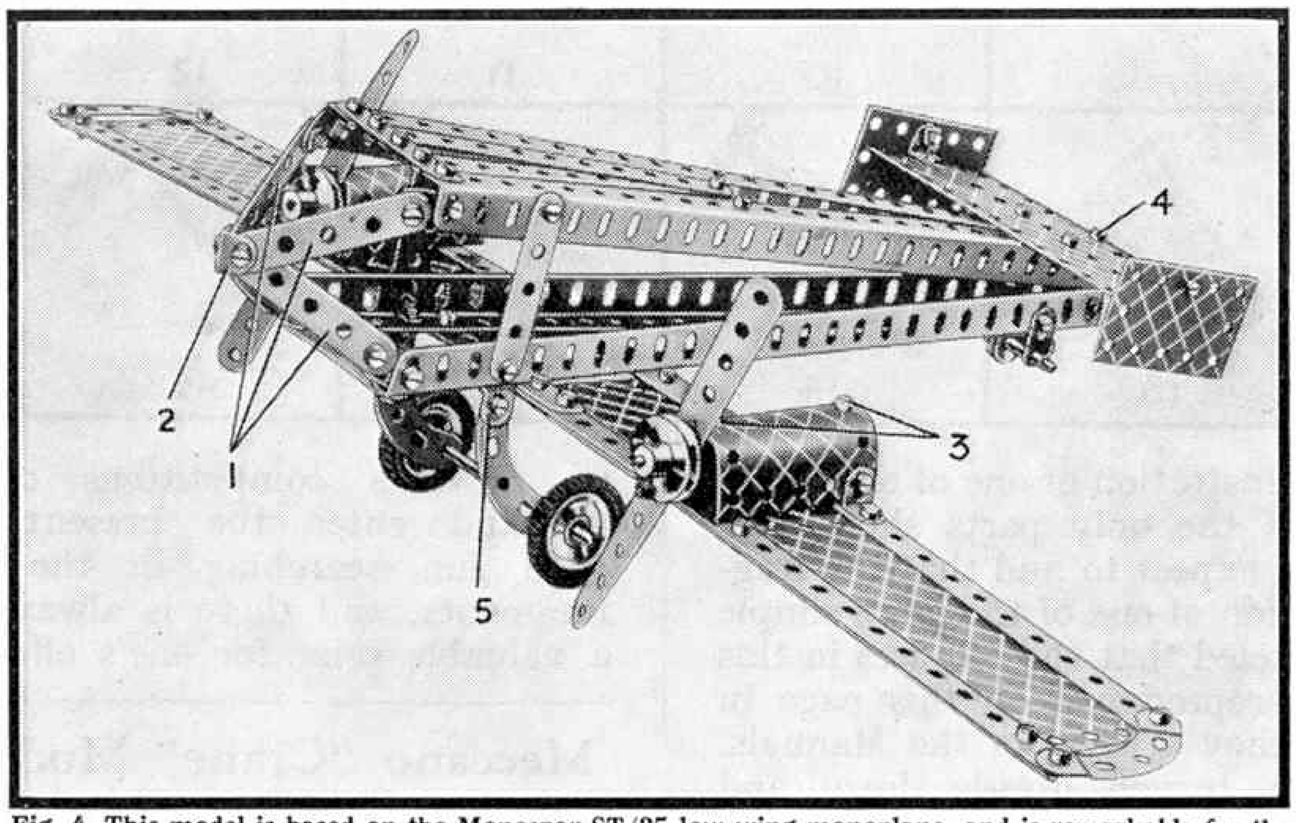


Fig. 4. This model is based on the Monospar ST/25 low-wing monoplane, and is remarkable for the good effect obtained by the use of only a few simple parts. It can be built with Outfit C.

If a '*Magic*' Motor is available it is a good plan to incorporate it in the model for the purpose of driving the landing wheels. The best position for the Motor, of course, is inside the cabin almost directly above the axle of the wheels. It may be fixed in place by bolts passed through its flanges and into the lower $12\frac{1}{2}''$ Angle Girders forming the fuselage. The drive should be taken from the small pulley of the Motor shaft to a $\frac{1}{2}''$ fast Pulley fixed on the axle of the landing wheels, the driving band being twisted to drive the wheels in the correct direction.

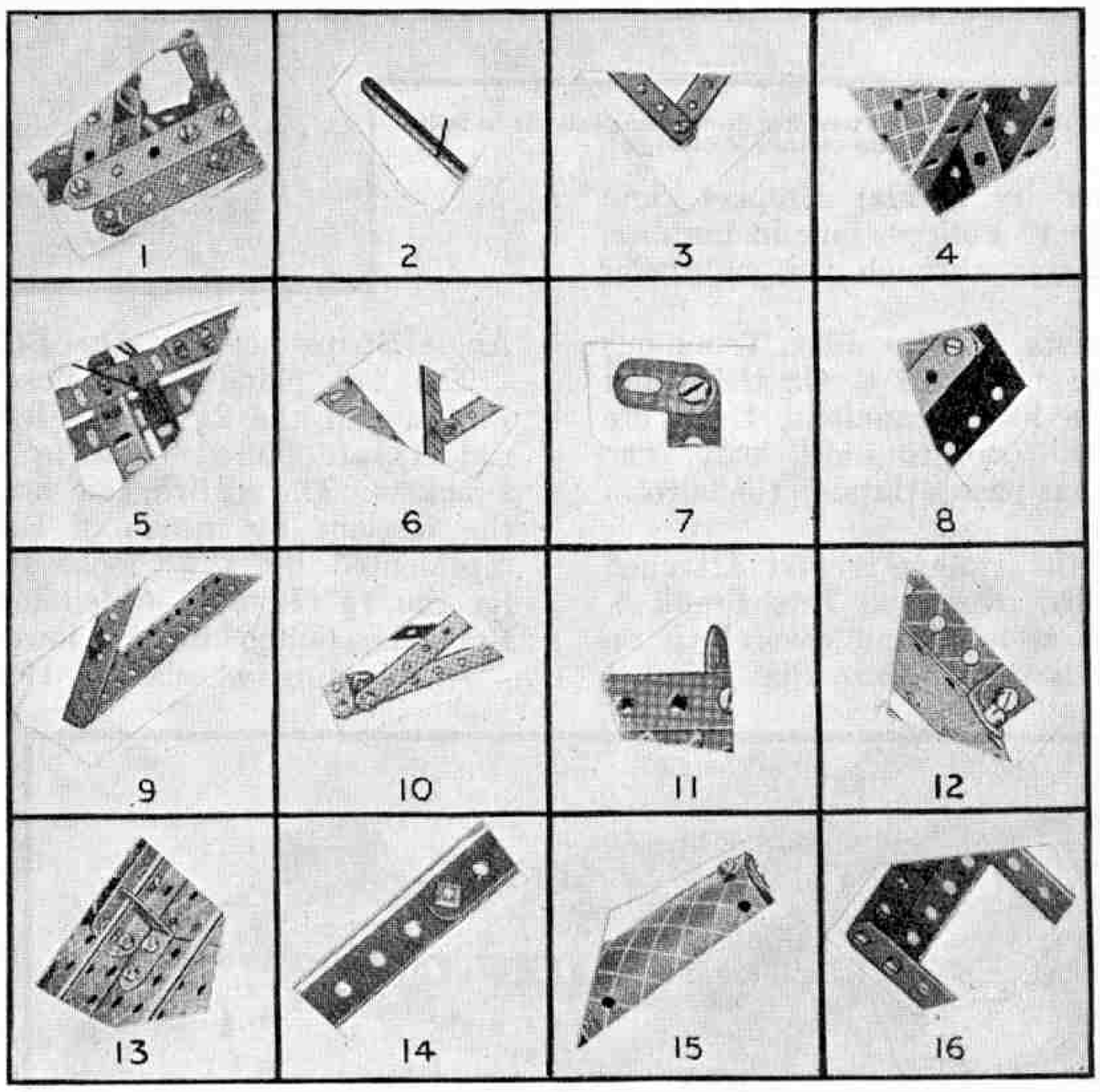
Parts required to build the model Monospar ST/25: 4 of No. 1; 5 of No. 2; 8 of No. 5; 4 of No. 8; 5 of No. 10; 7 of No. 12; 4 of No. 12c; 3 of No. 16; 1 of No. 18a; 4 of No. 22; 1 of No. 23; 6 of No. 35; 61 of No. 37; 1 of No. 37a; 4 of No. 38; 4 of No. 48a; 2 of No. 90a; 1 of No. 111c; 2 of No. 188; 2 of No. 189; 2 of No. 191; 2 of No. 192; 2 of No. 199; (2-1″ Tyres not included in Outfit).

A New "Lynx Eye" Competition

Fine Prizes in Attractive Summer Contest

This month we are announcing the first of three special summer competitions, which are designed to enable competitors to prepare their entries just as easily outdoors, during a pause in a game or while taking a rest during a ramble, as in the house. These contests have been termed "Lynx Eye" Competitions, because they afford a test of the powers of observation of our readers, and model-building skill also will be found an important asset.

All that a competitor needs when entering this competition are copies of the O/E and F/L Manuals, a pencil, paper and a pair of sharp eyes! He is asked to find out from which model illustrations in the Manuals the 16 fragmentary pictures in the centre of this page have been taken. This will be found an interesting piece of detective work. Inspection of the Manual illustrations will enable competitors to "spot" quickly the sources of many of the fragments, and with closer scrutiny they will then soon track down the rest.



The particular Meccano parts shown in the fragments will provide valuable clues in solving the puzzles. For instance, if one of the pictures contains a portion of a Coupling or a Gear Wheel, it can only have been taken from the illustration of one of the larger Outfit models; similarly, if the only parts shown are Pulleys and Strips one may expect to find that the fragment is part of the illustration of one of the more simple models. It should be mentioned that the pictures in this puzzle are not necessarily reproduced on this page in similar positions to those they occupy in the Manuals. Some of them have been turned upside down and others sideways.

The competition will be divided into two sections: A, for readers living in the British Isles, and B, for readers living Overseas. The prizes that will be awarded in each section are as follows: First, Meccano products value £2/2/–; Second, Meccano products value £1/1/–; Third, Meccano products value 10/6. A number of consolation prizes also will be awarded in each section.

In the event of more than one competitor solving all 16 puzzles correctly, the prizes will be awarded to the first correct entries examined. If no competitor succeeds in submitting an all-correct result the prizes will be awarded to those competitors whose entries contain the largest number of correct solutions. Competitors therefore should not be discouraged because they cannot trace all the picture fragments, for an entry may obtain one of the prizes although it is not absolutely correct.

As each picture is solved the competitor should write down carefully on a postcard, first the number of the picture as given on this page, and then the Manual number of the model from which it is taken. The postcard must in addition contain the competitor's name, age, and full address, together with letter A or B to indicate the section for which the entry is submitted. Postcards must be addressed "Lynx-Eye" Contest No. 1, Meccano Ltd., Old Swan, Liverpool 13.

Entries for Section A must reach this office not later than 31st July, 1937, and for Section B, not later than 31st August, 1937.

Solving these puzzle pictures will be found a remarkably fascinating pastime and we strongly advise all readers who have not participated in previous competitions of this kind to hurry up and enter the present Contest. It is really good fun searching in the Manuals for the tiny fragments, and there is always the chance of winning a valuable prize for one's efforts.

Meccano "Crane" Model-Building Contest

We take this opportunity of reminding readers that the "Crane" Competition, full details of which appeared in last month's *"M.M.,"* is still open for entries. In this competition prizes are offered for the best Meccano models of any kinds of cranes, and there are no restrictions, the contest being open to readers of all ages, living in any part of the world. Intending competitors living in the British Isles should forward their entries in time to reach Liverpool before 30th June, 1937. The Overseas section, for competitors living outside the British Isles, will remain open until 31st August, 1937.

Model-Building Competition Results

By "Spanner"

The "Ewbank Carpet Sweeper" Contest

This month I am able to announce the names of prize-winners in the "Ewbank Carpet Sweeper" Model-Building Competition. In this Contest, full details of which were announced in the November 1936 issue of the "*M.M.*," cash prizes were offered for the best models of the well-known Ewbank Carpet Sweeper, manufactured by Entwisle and Kenyon Ltd., Accrington.

Entries were received from competitors living in all parts of the world, and were judged jointly by Entwisle and Kenyon Ltd. and Meccano Ltd. Careful consideration was given to each model, and it was decided to make awards to the competitors named in the following lists. The cash prizes in the Home Section were presented by Entwisle and Kenyon Ltd.

Home Section.

1st Prize, Cheque for £3/3/–: L. Brown, London, W.6. 2nd, Cheque for £2/2/–: R. Hough, Wallington, Surrey. 3rd, Cheque for £1/1/–: P. Lawson Fairfield, Bowden, Ches.

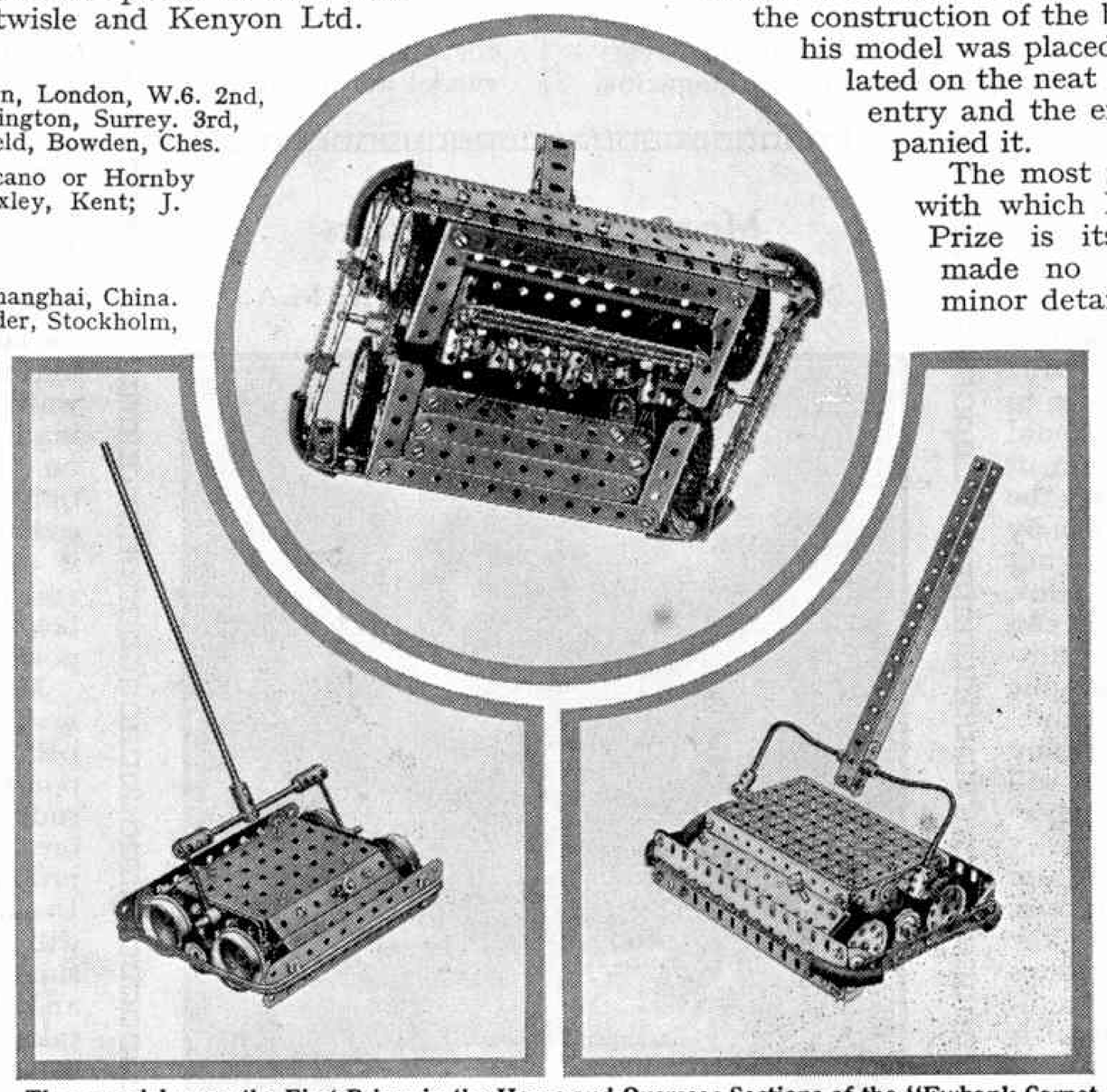
Consolation awards consisting of Meccano or Hornby products value 5/–: G. Webb, Bexley, Kent; J. Dean, Claygate, Esher, Surrey.

Overseas Section.

1st Prize, Cheque for £3/3/–: J. Nie, Shanghai, China. 2nd Prize, Cheque for £2/2/–: L. Linder, Stockholm, Sweden. 3rd Prize, Cheque for £1/1/–: A. Butcher, Kaiapoi, Canterbury, New Zealand.

Consolation awards consisting of Meccano or Hornby products value 5/–: H. Clark, Hokianga, N. Zealand, D. McLeod, Richmond, Natal, S. Africa.

The splendid quality of the models submitted in this Contest may be judged from the two prize-winning entries shown on this page. I was greatly pleased with the accuracy with which many competitors succeeded in reproducing not only the general form of the Ewbank Sweeper, but also its many special features, some of which are very difficult to represent in Meccano. Skill and neatness in construction characterised the models for which prizes were awarded, and many others that were but little behind them in merit.



These models won the First Prizes in the Home and Overseas Sections of the "Ewbank Carpet Sweeper" Competition. The model on the left was built by J. Nie, Shanghai, and that on the right by L. H. Brown, London, W.6. In the circle is a view of Brown's model from underneath, showing the novel construction of the brush.

It was not expected that model-builders would be able to reproduce exactly the mechanical features of the Ewbank Sweeper, or that they would be able to make their models actually sweep. Many strikingly realistic entries were submitted, however. Several competitors, particularly in the Home Section, even devised ingenious brushes for their models, and were highly commended by Entwisle and Kenyon Ltd. for their enterprise, and the skill with which they put their novel ideas into practical form.

L. H. Brown, the winner of First Prize in the Home Section, submitted a very cleverly-built model that bore a striking resemblance to the real sweeper. The model is illustrated here, and it owes its success to the attention paid to reproducing accurately all the major points of the actual sweeper.

Entwisle and Kenyon Ltd. were very pleased with the reproduction in this winning model of the device for holding the dust pans open while the dust is discharged. The arrangement consists of a $2\frac{1}{2}''$ Strip pivoted at its centre hole to a $1'' \times \frac{1}{2}''$ Angle Bracket that is bolted to the brush casing. A $1''$ Rod is fixed to one end of this Strip by means of a Collar. The Rod passes to the outside of the casing and is there fitted with a second Collar. The other end of the $2\frac{1}{2}''$ Strip is pivotally attached to a short piece of strong wire, which is joined to the hinged dust pans by means of Hinges. A short piece of Spring Cord is connected to the $2\frac{1}{2}''$ Strip and to the casing of the sweeper in order to return the dust pans to the closed position when the lever is released. A slot is cut in the $1''$ Rod and to lock the dust pans open it is only necessary to push the Rod down and slide it forward a little so that the slot catches on the edge of the hole in the $5\frac{1}{2}''$ Flat Girder.

The construction of the brush in Brown's model also is ingenious. A spindle is provided with 10 Couplings, into the ends of which are fixed bristles cut from an old broom. The Couplings are staggered around the spindle, and thus the brush has the twisted form of that used in the actual machine.

The Second Prize in this Section was awarded for a model built by R. Hough, Wallington, which displays real ability and excellent construction and is little behind that of the First Prize-winner in merit. Brown made better use of Meccano in the construction of the brush, and chiefly for this reason his model was placed first. Hough is to be congratulated on the neat manner in which he prepared his entry and the excellent description that accompanied it.

The most impressive feature of the model with which P. Lawson Fairfield won Third Prize is its simplicity. This competitor made no attempt to reproduce all the minor details of the Ewbank Sweeper, and although his model lacks much of the interest provided by the detail work of the other prize-winning models, it is an excellent example of neat construction. Fairfield is only 13 years of age and therefore has good reason to be proud of his success in open competition with model-builders of greater age and experience in the use of Meccano.

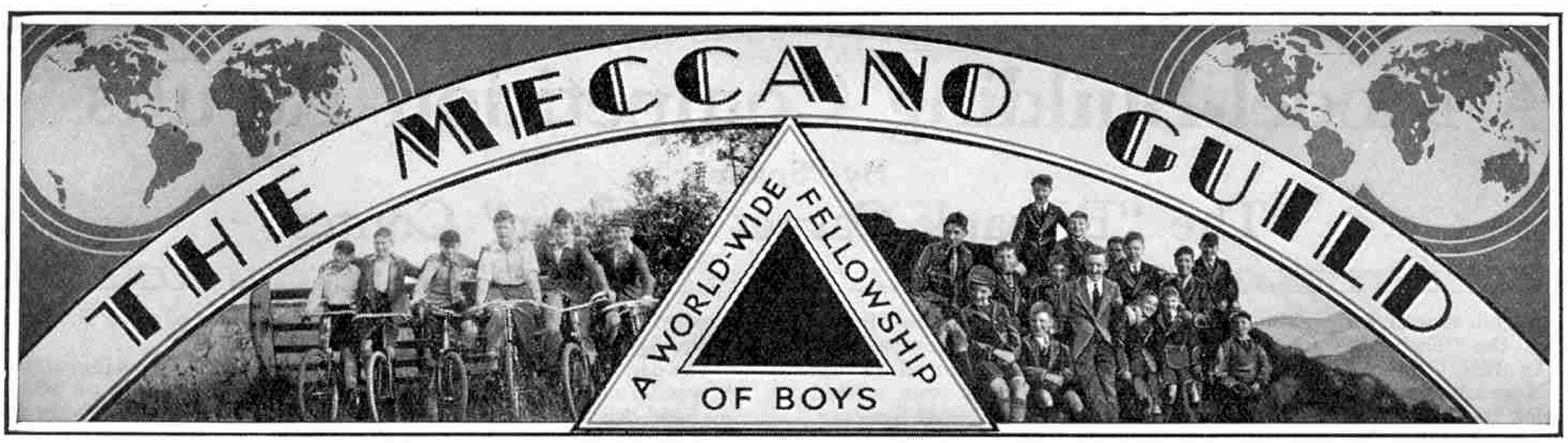
In the Overseas Section, Joseph Nie of Shanghai won First Prize with a model, built entirely from Meccano parts, in which constructive ability and skill in choosing the most suitable parts have produced a very pleasing and realistic result. In this model the brush consists of lengths of Spring Cord, which are stretched between bolts fixed in spiders formed by Universal Couplings mounted on a Rod.

Among the many interesting methods for making brushes used by entrants in this Contest, one of the most novel was that adopted by Lars Linder, the winner of Second Prize in the Overseas Section. This competitor solved the rather difficult problem by the use of pipe cleaners assembled in a most ingenious manner.

A few competitors built their models full size. One of the best of these was submitted by A. V. Butcher, Canterbury, New Zealand, and his model won high praise from Entwisle and Kenyon Ltd., who were much impressed by the evident care that had been taken to copy even the smallest detail of the prototype. Butcher used large Rubber Rings (Part No. 142) for representing the corner buffers that form a conspicuous and valuable feature of the actual sweeper. The wheels of the model are Artillery Wheels (Part No. 19a) and they transmit motion to the brush by making frictional contact with a $1''$ fast Pulley fastened on a Rod between them.

Flexible Plates play an important part in the construction of the casing of the sweeper, and $12\frac{1}{2}''$ Strip Plates are used for the front. Unfortunately, owing to the method of construction it was necessary to cut a slot in one of the Flexible Plates in order to accommodate the lever for discharging the dust pans.

At first Butcher used a brush from an actual Ewbank Sweeper in his model, but this was afterwards replaced by an home-made brush consisting of a piece cut from an old motor car wheel cleaner. The model works quite realistically and bits of paper and crumbs can be swept up with ease.



A Splendid Record

The portraits and group photographs that have appeared in the Guild Pages of the "*M.M.*" form wonderful records of club life, of which I am very proud. I have always been as pleased to include photographs from small clubs as to publish those from famous and more powerful organisations, and I shall not be satisfied until every Meccano club has been represented in this manner in the Magazine. For this reason I should like to receive good photographs from Leaders of all clubs that have not yet figured in my photographic gallery.

It is not difficult to have a suitable photograph taken, and when one is reproduced the members of the club concerned are delighted with the distinction, and other Meccano boys living near their headquarters are made to realise that they are missing splendid opportunities of joining in the fun of club life. The photographs that give the best results of course are those taken by a professional photographer. It is not essential that these should be sent, however, for many keen amateurs can take group photographs that are suitable. There usually is at least one photographer in every Meccano club, and the fine light evenings and sunny week-ends of the Summer Session will provide him with excellent opportunities of showing his skill.

Sharply-focussed photographs are essential for reproduction purposes, and care should be taken that the background is plain. Outdoor groups photographed in picturesque surroundings are very attractive, but detail is bound to be lost if the background is confused and so elaborate that attention is distracted from the main feature of such a group photograph—the officials and members themselves.

Forming a Photographic Section

If possible a Photographic Section should be formed in every club, with a senior who has had some photographic experience as its Leader. Younger members who join will appreciate the help given to them in their efforts to learn how to take good pictures, and will enjoy the excursions that are undertaken to give them practice. They should be encouraged by the offer of small prizes for the best collection of photographs taken on club excursions, rambles and cycle runs, and the results of their efforts will form an attractive pictorial record of club life in summer.

The prizes I have suggested could be awarded on the displays made by members at an Exhibition at the close of the Summer Session, or early in the first Winter Session. I should like to see as many prints as possible of photographs taken by members on all occasions, for there is nothing I enjoy more than the evidence that such photographs give me that Meccano club members thoroughly enjoy themselves. If any of these are suitable for reproduction, I shall certainly make use of them. Each issue of the Magazine is prepared well in advance of the date of publication, and for this reason all prints should be sent to me at the earliest possible moment.

Meccano Club Leaders

No. 89. Rev. R. I. Mitchell, M.A.



The Rev. R. I. Mitchell, M.A., is the Leader of the Fraserburgh M.C., which was affiliated in October 1935. The club has both Senior and Junior Sections, and these hold separate meetings. Keen interest is taken in Meccano model-building and in the construction of model aeroplanes.

Speed Boat Racing

The other day the Leader of a club wrote to tell me that he appreciates the value of cricket matches, rambles and cycling runs in summer, as I have suggested, but that for various reasons none of these features could be introduced in his club programme. He asked for alternatives, and I suggested Hornby Speed Boat racing and model aeroplane flying, hobbies that greatly interest all boys and give them opportunities of taking part in exciting races and competitions.

There must be few clubs in which a sufficient number of Hornby Speed Boat owners to ensure enjoyable contests cannot be found. A suitable stretch of water can easily be found, for lakes and ponds are fairly common, and most public parks have a sheet of water of some kind where model boating is permitted. If there is any doubt on the latter point preliminary enquiries should be made. In any case it is essential to choose a sheet of water that is shallow enough to permit wading, and it should be of such a size that boats can cross comfortably with power in reserve.

Members will enjoy cruising their boats up and down, comparing their behaviour, starting them from different points, trying various settings of rudder and noting the effect of any breeze that may be blowing. Racing provides the greatest fun, however. Usually some system of handicapping will be necessary. The slower and smaller boats can be given a start, and it is very thrilling for a member taking part to hold his boat as he listens to the counting of the starter, waiting for the moment when he can release it. Then he dashes round to the opposite bank, to share in the excitement as the boats forge their way along to the finishing point and the onlookers try to pick out the winner.

* * * *

I should like to remind Leaders that Merit Medallions can be awarded for good work done on behalf of the club during the summer sessions, and I shall look forward to receiving nominations in respect of the present session early next month.

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:

BERMUDA—A. C. H. Hallett, Juniperhill, Pembroke, Bermuda.
EXETER—W. F. Chapman, 79, St. Leonard's Road, Exeter.
EXETER—A. Walland, 7, Newcourt Road, Topsham.
GOLCAR—D. Livesey, 30, Heathfield Road, Scar Lane, Golcar, Yorks.
KIRKCUDBRIGHT—G. Warnock, Bank of Scotland House, Kirkcudbright, Scotland.
ROCKENHAM—N. Fitzpatrick, 17, St. Mary's Cottages, Rockenham, Passage West, Co. Cork, I.F.S.



Colchester M.C.—During a recent Contract Night two model airship mooring masts were built by rival companies. An exciting Table Tennis Tournament has been held. There have been some excellent talks, one of the most interesting being a description of the "*Quetta Earthquake*" by Capt. Harwood. Rev. A. B. Grosvenor, President, gave a talk on "*Paper-making*," and at another meeting an interesting description was given of "*Match-making*," and of the factory of Bryant and May Ltd., at Bow, London. Preparations for an Exhibition include the planning of a railway timetable. Club roll: 25. *Secretary:* E. J. Tracey, 199, Harwich Road, Colchester.

Stretford Public Libraries M.C.—This recently affiliated club is holding fortnightly meetings. Model-building is being enthusiastically carried out, and many models of different types of aircraft were built for an Aviation display. Outstanding successes were a bomber, searchlight, and an illuminated aircraft control tower. Club roll: 31. *Secretary:* Miss F. Scattergood, Public Library, Technical Institute, Stretford Road, Old Trafford, Manchester, 16.

St. Oswald's (Norbury) M.C.—Meetings are now held in a class-room off the Church Hall, and the more spacious accommodation has made possible a larger membership and an increased number of sections. All members have been showing great keenness and enthusiasm. Very good progress has been made with model-building, and this has been followed by Lantern Lectures, Games and Debates on such topics as "*Should Cyclists Be Taxed?*" and "*Should Tinned Goods Be Used?*" A particularly enjoyable Lantern Lecture described "*Modern New York.*" A small party of members visited the recent Old Charlton M.C. Exhibition, and were much impressed by the large amount of work that had been done to ensure the success of the display. It has been decided to arrange a Social Evening between the two clubs. Work has already started on designs for models and posters for an Exhibition which it is planned to hold next autumn. Club roll: 31. *Secretary:* R. H. Smart, 14, Kensington Avenue, Thornton Heath, Surrey.

Cold Harbour M.C.—Recent activities have been devoted chiefly to model-building, and a variety of scientific models, such as microscopes and projectors, have been built. Club roll: 12. *Secretary:* R. S. Hill, Anstie Farm, Holmwood, Surrey.

Great Baddow (Chelmsford) M.C.—A Model-Building Contest has been held, at which three prizes were given by a local Meccano dealer. The subject was "Workshop Models," and the three winning models were of a Rope-making Machine, Grinder, and Vertical Drill respectively. The donor expressed his pleasure at the excellence of the models. The Party held during last Session was a great success, and it is hoped to make it an annual event. After tea the members took part in games and community singing, and when the Juniors had gone home the hall was cleared and a dance was held. Club roll: 38. *Secretary:* K. J. Avis, 5, Crescent Road, Great Baddow.

Whitgift Grammar School M.C.—Preparations for an Exhibition have been completed. Several Croydon dealers are kindly lending models to augment the club display, which will be notable for its great variety. At one meeting a competition was held in which the members had to fill in gaps in a story with the names of Meccano Parts. A visit to the famous Croydon Bell Foundry of Gillett and Johnston Ltd. was greatly enjoyed. Club roll: 56. *Secretary:* A. F. Jordan, 16, Old Farleigh Road, Selsdon.

Morrison Memorial (Glasgow) M.C.—The subject of a recent Model-Building Contest was "Swing Bridges," and some very good entries were submitted. The Aeroplane Section is making good progress. The Woodwork Section have completed a station and a footbridge, and are now constructing a model town. During an outing to Edinburgh a visit was paid to St. Giles' Cathedral M.C., and was much enjoyed. The Leader recently gave a very interesting Lantern Lecture on "*Switzerland.*" Club roll: 75. *Secretary:* D. Elder, 119, Dumbarton Road, Clydebank, Scotland.

Islington M.C.—Attendance at meetings continues to be very good, but new members are always welcome. Recent meetings have been devoted very largely to model-building, a large model being constructed at each. The club recently co-operated with the Islington H.R.C. Branch in organising an Exhibition. Club roll: 17. *Secretary:* A. D. Straker, 48, Onslow Gardens, Muswell Hill, N.10.

Barnard Castle School M.C.—An excellent Anniversary Display included a model of a windmill pump, elevated crane and a stamping machine. A model workshop was loaned by Headquarters. There was also a special screwed-down track, on which realistic Hornby Train operations were carried out. Club roll: 10. *Secretary:* S. W. Telfer, York House, The School, Barnard Castle, Co. Durham.

Old Charlton M.C.—The club Exhibition was very successful. An interesting visit has been paid to the United Glass Bottle Works. The party were shown the actual machines making the bottles, and also a furnace which was being heated. At one meeting a talk on "*Naval Guns*" was given by a member, and was followed by a short discussion on the subject. A parent of one of the members has kindly consented to carry out the club printing, and to revive the Magazine, which was discontinued because of difficulty in getting the club press to work. Club roll: 20. *Secretary:* W. Bailey, 63, Rectory Grove, Woolwich, S.E.18.

Bristol Grammar School M.C.—Excellent models have been constructed on Model-Building Nights. Two Lectures that were much enjoyed described "*A Visit to London*" and "*The Cunard White Star Liner 'Queen Mary'.*" Club roll: 18. *Secretary:* L. C. Stear, "Highbank," Trelawney Road, Cotham, Bristol, 6.



A cheery group of officials of the Malvern (Johannesburg) M.C., with Mr. E. Sykes, the Leader, fifth from the left in the back row. A special feature of this club is a very successful Girls' Section, and the secretary of this, Miss Jessie Russell, is seen next to the Leader. The secretary of the Boys' Section is Mr. B. Saunders, second from the left in the same row. This flourishing South African club was formed nearly 18 years ago, and now has a membership of 85.

AUSTRALIA

Maylands M.C.—The club is divided into two groups called the Red and Green Faction and the Blue and Gold Faction respectively. A friendly spirit of rivalry exists between the two groups and results in keen competition for superiority in Model-building and other Competitions. At one meeting each Faction was allowed an hour in which to present a programme, and points were awarded for individual and co-operative work. A Models Exhibition produced some excellent models, the most outstanding being a group representing "The Story of Shipping." The Leader has given Lectures on "*The Classification of Locomotives*" and "*The Story of Rubber.*" A determined effort is being made to stimulate public interest in the good work of the club, and a Visitors' Month has been arranged, during which five of the meetings will be open to visitors. The meetings will be varied, so as to give visitors as good an idea as possible of the club's activities. Club roll: 30. *Secretary:* M. Thomson, 13, Kennedy Street, Maylands, W.A.

EGYPT

Zagazig M.C.—Model-building is carried on in both Meccano and wood, and many interesting models are constructed. At one meeting the club was visited by Mr. Helmi, an engineer at the Zagazig Government Trade School, with which the club joined in a recent two-days' tour that included a visit to the Egyptian State Railway Workshops at Cairo. One of the most enjoyable recent outings was to the Port Said State Lighthouse, and the party also visited the Port Said Salt Station, and a Liverpool liner in the port at the time. Excellent photographs were taken by the Photographic Section of the club. Club roll: 22. *Secretary:* Miss B. Mangourie, 39b, Gannabiet Sikka Hadid Avenue, Zagazig.

HOLLAND

Maastricht M.C.—Recent meetings have been held on Saturday evenings. A good deal of model-building has been accomplished, and outstanding models have been a switchback railway and a crane, both electrically operated. One member built an electrically-operated "Zeppelin train," the revolving propellers of which gave it a most realistic appearance when in motion. Club roll: 36. *Secretary:* L. Mulders, Houthemerweg 20, Meerssen bij Maastricht.

NEW ZEALAND

Christchurch M.C.—The splendid spirit of goodfellowship that permeates the meetings, and the enthusiastic interest taken in the programmes arranged, ensures the continued success of this club, the membership of which almost doubled last year. A club Magazine has been started, and is appropriately called "*The Coupling*," as it gives news of both the Meccano and Hornby Train Sections of the club. An unannounced visit to the Ashburton M.C., 50 miles away, by the Leader and two former secretaries, resulted in the three members becoming the central figures at a mock trial, that caused great amusement and ended in their acquittal. A cycling picnic to a secret destination that turned out to be Waimairi Beach proved so enjoyable that it is probable other "mystery" outings will be held. Club roll: 26. *Secretary:* L. P. Chapman, c/o 28, Circuit Street, Strowan, Christchurch, N.W.1.

SOUTH AFRICA

Continental (Capetown) M.C.—Excellent models constructed have included Roundabouts, Airships and Excavators. The models have been shown to the parents of the members and have been highly praised. Club roll: 10. *Secretary:* J. Bruyns, 57, Constitution Street, Capetown.

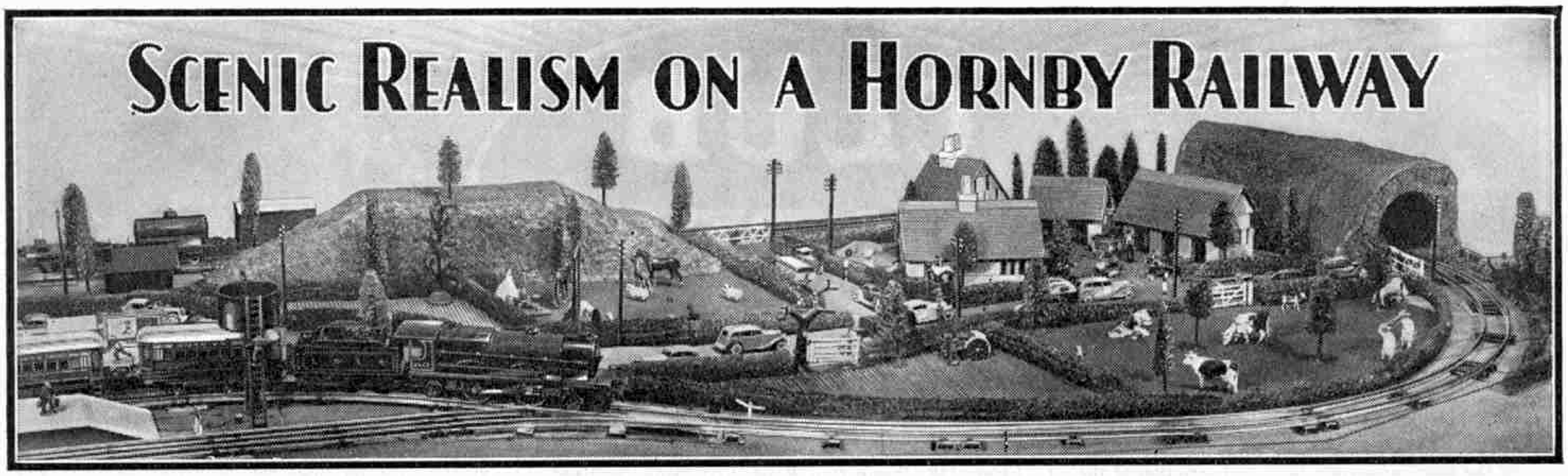
Clubs Not Yet Affiliated

CANADA

Forest Hill Village M.C.—Meetings are being held regularly in a room at the village school, by the kind consent of the Principal. An excellent programme has been planned, and many fine models are being built. *President:* Mr. D. Anglin.

Broadview (Toronto) Y.M.C.A. M.C.—This club is fortunate in having a special room available for meetings. An attractive programme has been drawn up, and all the members are most enthusiastic. Club roll: 30. *Secretary:* B. Marriott.

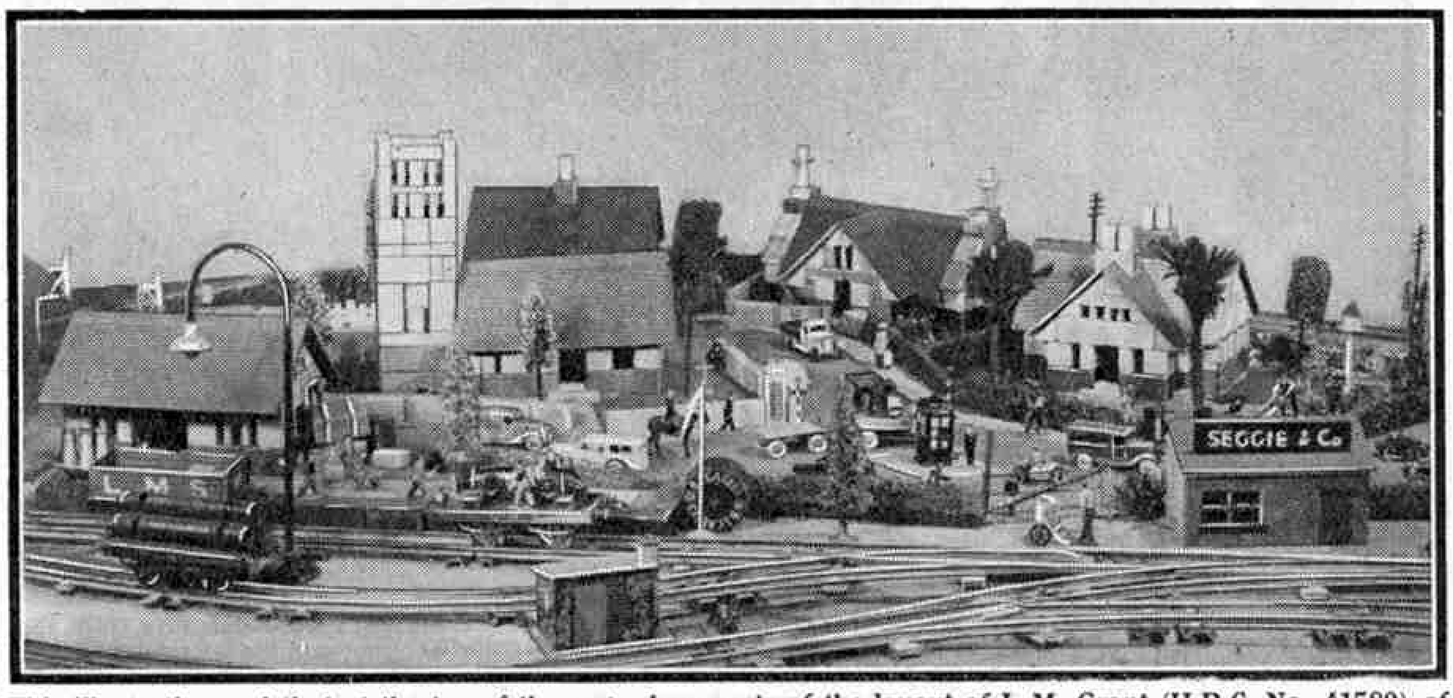
SCENIC REALISM ON A HORNBY RAILWAY



ON most Hornby layouts greater attention is given to the actual railway features than to their setting. This may sometimes have the result of spoiling the realistic effect of the line. There are of course exceptions, and one of these is the layout shown in the illustrations on this page, in which special attention has been given to the scenic surroundings, and imagination has been exercised in planning the arrangement as a whole.

This layout has been developed by I. M. Grant, H.R.C. No. 41580, of Dundee. The railway track itself is an oval with a loop line at one side serving a wayside station. A goods yard and sidings extend from the loop, and farther on are the engine sheds.

From the very start the owner of the system was anxious to obtain a life-like effect on his railway. He seized the opportunity that came with the advent of Dinky Toys, and immediately started what has since grown to be a splendid collection, giving an excellent reproduction in miniature of a village and its neighbourhood, its traffic and its inhabitants, together with the railway serving them. Hornby Hedging and Trees have all contributed to the general realism, with the addition of further articles made at home from simple raw materials.



This illustration and that at the top of the page show parts of the layout of I. M. Grant (H.R.C. No. 41580) of Dundee. The effect is remarkably realistic owing to the care that has been taken in the planning and arrangement of the surroundings of the line.

A particularly interesting feature is the model village, which can be seen in the lower illustration. The construction of the church, and church hall, an "Ideal Home" and the public garage has been effected with Lott's Bricks. The church is complete with a miniature graveyard, and an everyday scene showing a dog barking at a cat that is seated on the wall outside the churchyard! The "Ideal Home" has a lawn, which a miniature gardener is cutting. A sun-dial, dove-cot and rockery have also been included. The public garage is complete with Dinky Toys Petrol Pumps and Dinky Toys attendants, who give an air of efficiency to the establishment. These men have been provided with uniforms of orange and green, and the breakdown lorry belonging to the garage is painted in the same colours. Another touch of realism is afforded by the sight of a motor cycle combination with two policemen in it at the tail of a van which has just entered the "restricted area" denoted by the appropriate Road Signs.

The village is served by a passenger station made up of a main platform on which are erected station offices and waiting hall, and also an island platform witl shelter. Dinky Toy Railway Staff and Passengers give a remarkable impression of the activity and bustle usually associated with a station. In the goods yard there is a realistic petrol storage tank, which was made from a cocoa tin mounted on pillars and provided with a top gallery and ladders made of wire. A local coal merchant's office, which can be seen in the lower illustration, is situated close to the siding. This office is made of three-ply wood and cardboard, coated with glue and sawdust to give the necessary "roughcast" effect.

From the village we turn to the country; green felt has been used to represent grass and this is bordered by Hornby Hedging and Trees which give an excellent effect. Cows, horses, and sheep are to be seen in the various fields, while a "ploughed field" of corrugated paper adds the necessary finishing touches.

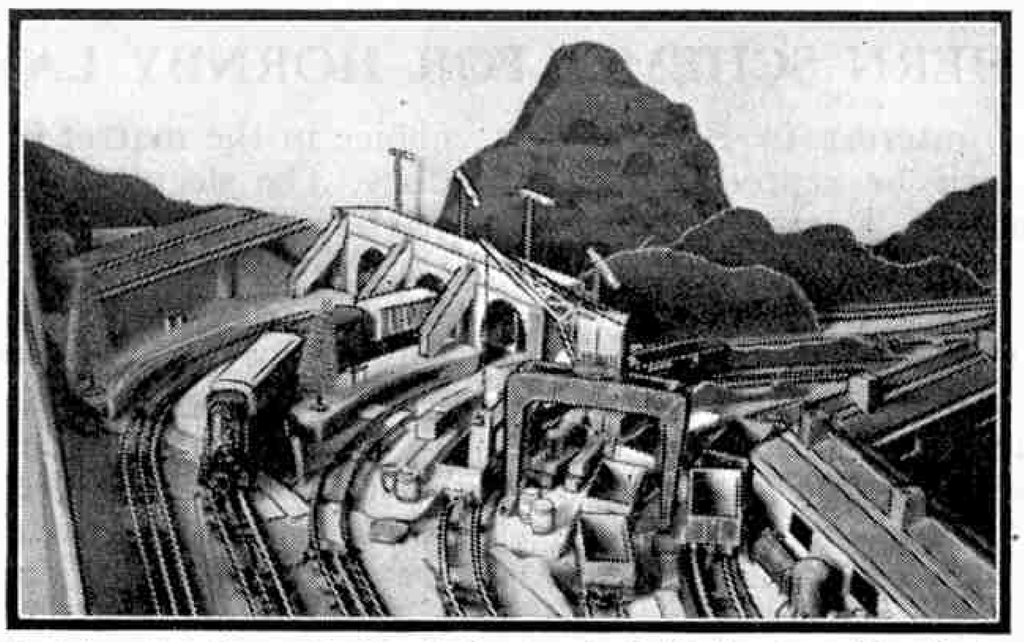
The most outstanding feature of the country area is a farmyard. This is complete with stables, barns, and several other buildings, surrounding a courtyard covered with granulated cork. Hens and various farmyard animals are to be seen wandering round.

The whole layout is traversed by several yards of roadway, about 5 in. in width. For making this, cardboard of uniform thickness is used, and a "tar macadam" effect was arrived at by sprinkling fine sand on a thin coating of glue. The effect is considerably enhanced by the inclusion of appropriate Belisha beacons, traffic signals and telegraph poles alongside the main roads. Altogether there are something like 70 Dinky Toys confined to the roads alone, including all sorts of vehicles and pedestrians, policemen and A.A. men. The layout is completed by the inclusion of electric lighting in all the buildings and in the goods yard; the church is floodlit by means of a Meccano Lighting Set. The locomotives in use are a Hornby No. 3C "*Flying Scotsman*" for passenger work, and a No. 1 Special Tank for mixed traffic. The locomotive stud and the amount of rolling stock are to be increased shortly.

A Brazilian Reader's Layout

Interesting Plan with Four Main Lines

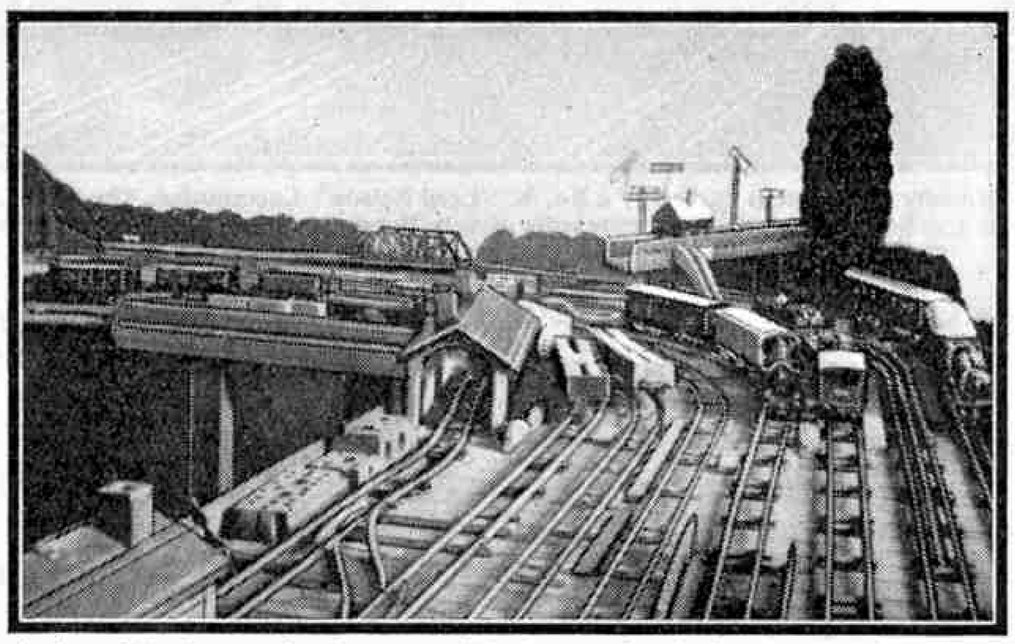
FROM time to time descriptions of model railways operated by readers have been published in the "*M.M.*," and this month we deal with the layout of Peter W. Brooker of Sao Paulo, Brazil, whose railway has many interesting features. The system originally was laid on the floor of an outhouse, but some time ago the owner read an article in the "*M.M.*" dealing with the construction of raised baseboards for miniature railways, and at once decided to adopt this method for his own layout. This he has done with success, and his track is now laid on tongued and grooved floor boards, supported on legs made of lengths of 2 in. square wood. The "ground level" of the system is 2 ft. 4 in. from the ground, and the whole covers a space 9 ft. by 12 ft. 8 in., with an opening measuring 3 ft. 7 in. by 6 ft. 6 in. in the centre for the operator.



An interesting view on the layout of our reader P. W. Brooker, of Sao Paulo, Brazil, which is described on this page.

Experiments were made with various layouts, and that now in use consists of four main lines, each forming a complete oval. There are in addition various loop lines, sidings and track connections that allow very interesting working. Crossover points between the individual tracks are so arranged that a train can start on the innermost line, and make one or more circuits over each track in succession until it arrives on the outermost oval. The reverse process also can be carried out, a train starting on the outside track and working its way round to the inside. Although the layout is a clockwork one, the whole of one of the circuits and part of another are made up of electric rails, which are used when a friend of the owner exercises "running powers" over the system for his electric train.

Stations, engine sheds, a turntable and other equipment have been included. The engine sheds have been constructed to take up a minimum of space. Their roofs are as low as possible, and half of each is hinged at the peak, thus giving access to the whole length of the shed inside. This is an advantage when dealing with clockwork locomotives, the controls of which are manipulated by hand.



A view of the layout showing one of the locomotive sheds, the general arrangement of the tracks and several trains.

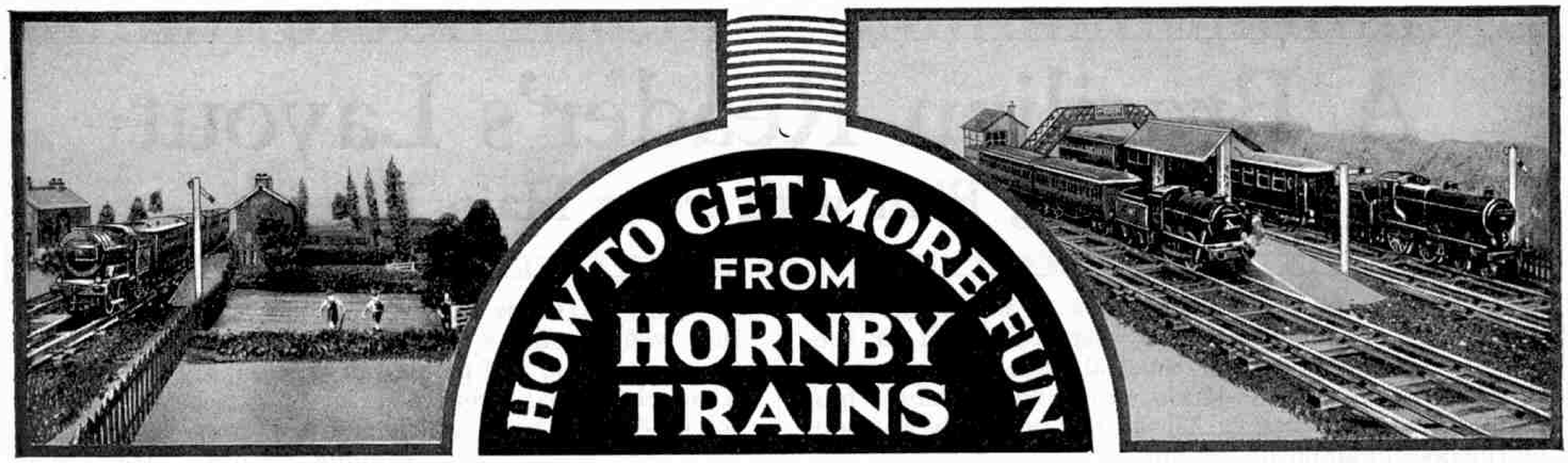
Signals are installed, and most of them have been placed on the outside of the layout in order that they should not get in the way when the winding up of engines and other operations have to be attended to.

As will be seen from the illustrations, care has been taken to obtain a realistic effect by the incorporation of scenery. This is home-made, and consists chiefly of thin wooden sheets cut to represent hills, hedges and trees in outline, and painted in different shades of green. A novel use has been made of broken bathroom tiles coloured light blue, which are laid down to represent running water. The main stream passes under the viaduct seen in the lower illustration.

Locomotive power is supplied exclusively by engines from the Hornby range. There is one Riviera "Blue" Locomotive and Tender, used chiefly for express passenger and fast freight work, and one No. 2 Tank Engine and two No. 1 Tanks to deal with shorter-distance traffic. Passengers are accommodated in Hornby Riviera "Blue" Coaches, which are very effective, for the construction with end doors and relatively small windows is typical of much of the passenger stock in use abroad.

On the freight side, operations are carried out by means of a variety of wagons, mostly from the Hornby range. Bogie stock is particularly favoured. Mineral traffic is handled by two of the No. 2 High Capacity Wagons recently introduced, and there is also a Rotary Tipping Wagon that is useful for constructional and engineering work, as well as for loads that can conveniently be tipped. For exceptional loads there is a Trolley Wagon. A No. 2 Cattle Truck is useful for the movement of livestock, and there is a No. 2 Luggage Van that is employed in general traffic and represents the familiar bogie box car of overseas practice. Banana, Milk and other vans also are available for the conveyance of produce and perishable traffic, and there are in addition various wagons for miscellaneous duties. Goods yard equipment includes the gantry travelling crane, shown in the upper illustration on this page, that is very useful for the loading and unloading of wagons. It can also be used for transferring items of miniature merchandise across the track from one platform to another if necessary, a useful facility when traffic is heavy.

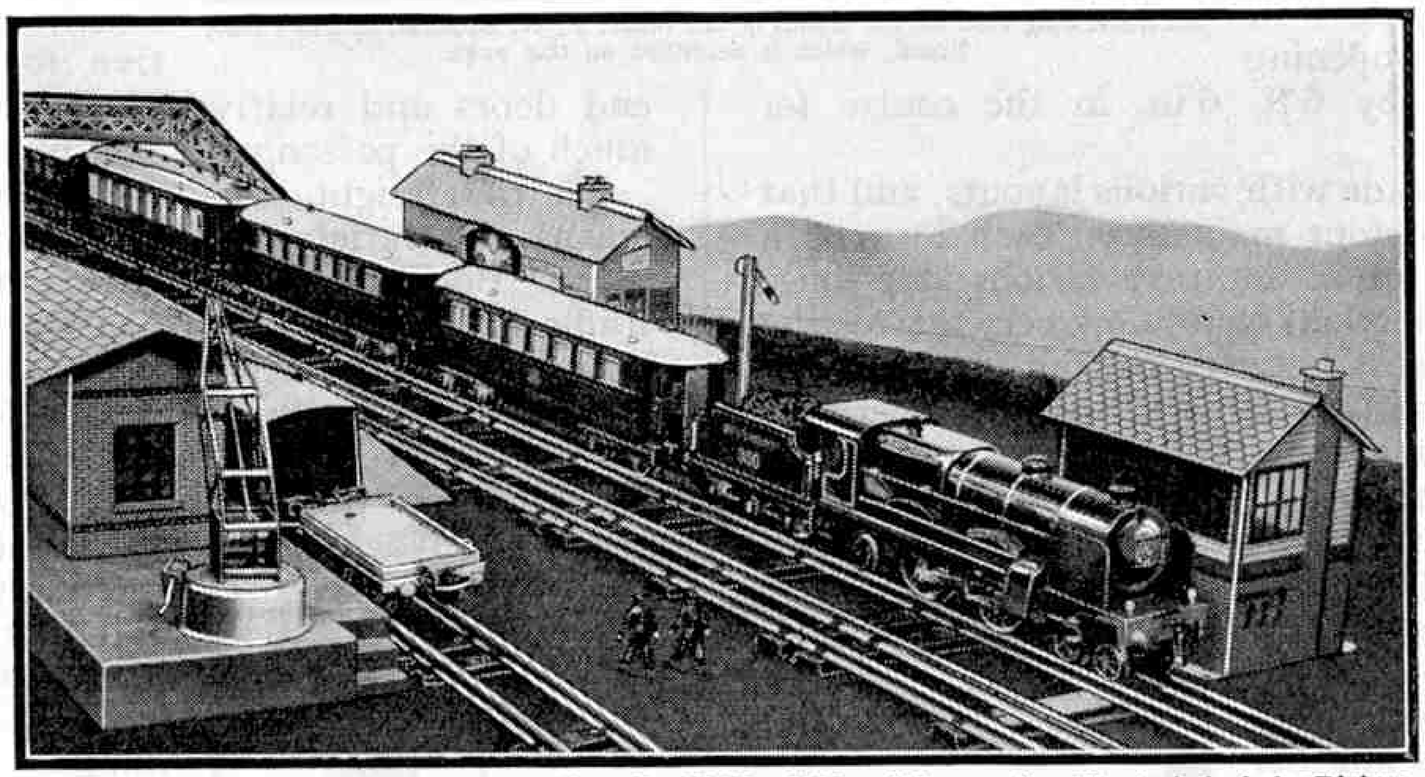
Miniature goods and other offices have been constructed and are placed in suitable positions on the layout. By careful attention to details of this kind it is possible to arrange some really good effects from quite simple material. Readers will no doubt agree that a very satisfactory result has been obtained on this layout.



SOUTHERN SCHEMES FOR HORNBY LAYOUTS

THERE are many points of interest in Southern Railway practice that can well be reproduced on Hornby layouts representing that line. Recent introductions both in the Hornby Series and in real practice, suggest attractive possibilities of working that will appeal to "*M.M.*" readers, and especially to those who are keen Southern model railway owners.

Perhaps the best known of all S.R. main line services are the Continental Boat Expresses between Victoria and Dover, or "the Boats," as the railwaymen call them. These trains are run in miniature on almost every Southern layout. A "*Golden Arrow*" Train Set is included in the Hornby Series, and Hornby components make it possible to assemble a miniature "*Golden Arrow*" in a realistic manner. The luxurious Pullmans of real practice are exactly reproduced by the Hornby No. 2 Special Pullman vehicles, and the Hornby E320 and No. 3C Locomotive in S.R. colours is named "*Lord Nelson*," and represents the famous engines of the class invariably used for these trains.



An express on a Hornby S.R. system hauled by a No. 3C "Lord Nelson" Locomotive. The train includes Riviera "Blue," Pullman and Southern stock, and represents closely the make-up of the through train ferry sleeping car trains that run between London and Paris in actual practice.

Recent events have added a very interesting member to the series of Continental services—the "Ferry Boat Train." As its name implies, this runs in connection with the train ferry vessels between Dover and Dunkerque, as described by "*Railway Engineer*" in his articles in the issues of the "*M.M.*" of March and April last. The "Ferry Boat Train" is truly international, providing primarily a sleeping car service between the capitals of Great Britain and France. Its character is reflected in its composition and appearance, for it includes sleeping cars operated by the well-known International Sleeping Car Company, familiar British Pullmans and S.R. stock. It is operated of course by S.R. engines between London and Dover.

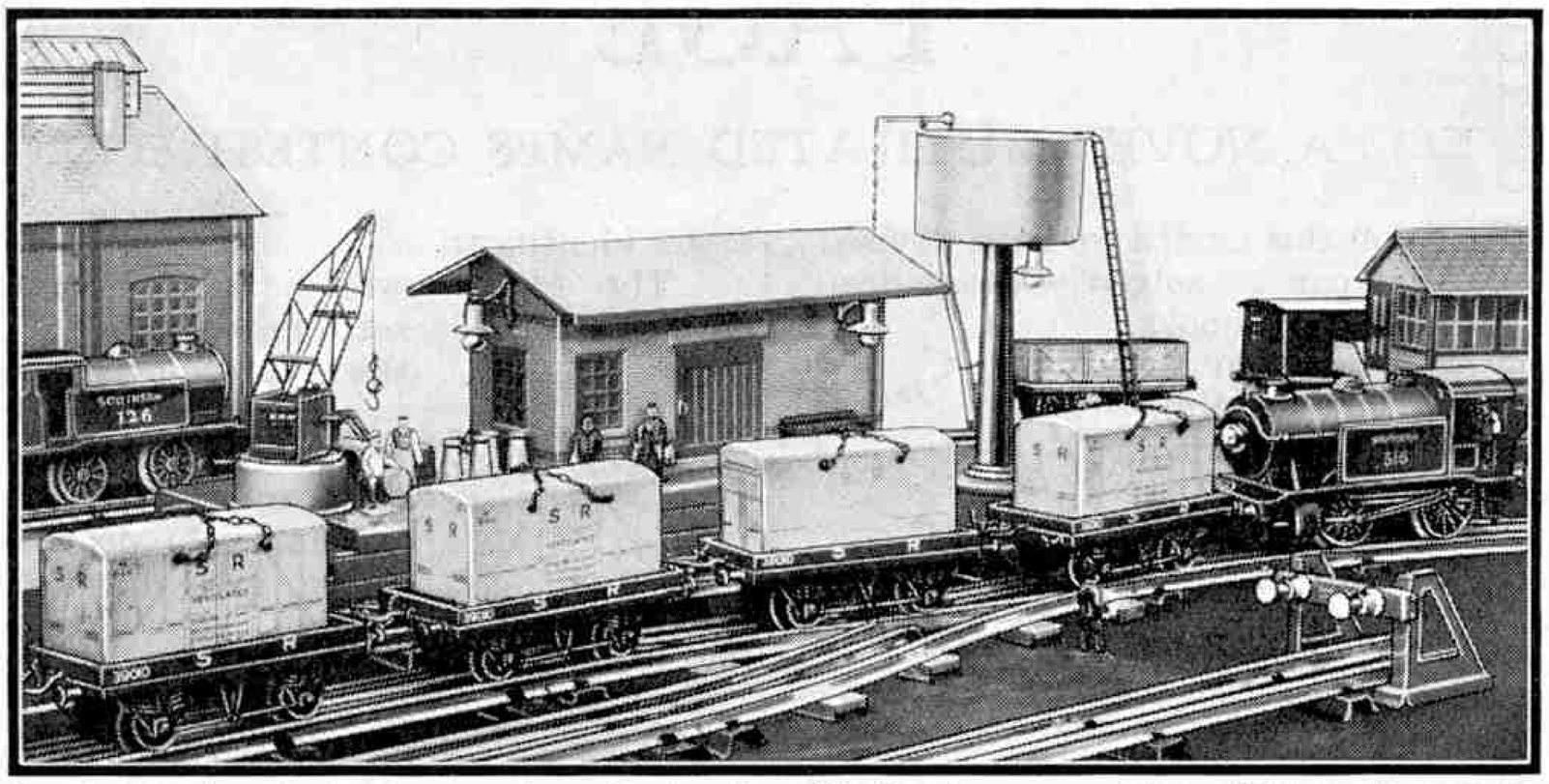
Such a train in miniature would make an interesting sight on a Hornby layout, and fortunately all the necessary components are available in the Series. An E320 and No. 3C "*Lord Nelson*" Locomotive would be the first choice in the matter of motive power for such a turn of duty. The sleeping car vehicle included in the Hornby Riviera "Blue" Train Set is exactly what is required for the ferry boat part of the train that goes right through to Paris. The real vehicles that have been specially built for this service are of the standard International Sleeping Car Company type, which is represented by the Hornby Riviera "Blue" Coach. Their dark blue livery makes a vivid contrast with the dark green of the engine and S.R. stock on the one hand, and the handsome umber and cream of the Pullman part of the train on the other. The use of Hornby Pullmans either of the No. 2 Special or No. 2 type is an obvious suggestion, and for the remainder of the train the Hornby No. 2 Coaches, either first-thirds or brake-thirds, can represent the S.R. stock used.

A point to be remembered in connection with this "Paris sleeper" is that on the down journey to Dover the sleeping cars are at the rear of the train, as on arrival at Dover Marine they have to be reversed off the end of the train by a shunting locomotive and then propelled on to the train ferry. The opposite process is carried out in the up direction, the sleeping cars thus being placed at the head of the train for the run to Victoria.

The marine arrangements necessary for the realistic running of a train of this kind of course will vary according to the space that is available, and the ideas of the individual model railway owner. Sometimes it is possible to include an actual quayside with a model steamer, and the realism of miniature "Boat Train" operations is then greatly increased. More frequently the ships themselves have to be represented on part of the painted background scenery.

A useful scheme for such a close connection between railway and marine operations as this, where the trains actually pass into the ferry steamer, would be to show the steamer on a false background and to allow the coaches to pass through suitable openings into the space "behind the

scenes," where they could remain until required for the "return journey." Readers will remember that an important part of the loading arrangements on this ferry boat service is played by an articulated bridge connecting the ship with the quayside. Those who are keen Meccano model-builders as well as Hornby Train owners will not have much difficulty in making a suitable connection with their outfits. Meccano Parts of course can be used effectively for many other quayside and port features, such as cranes.



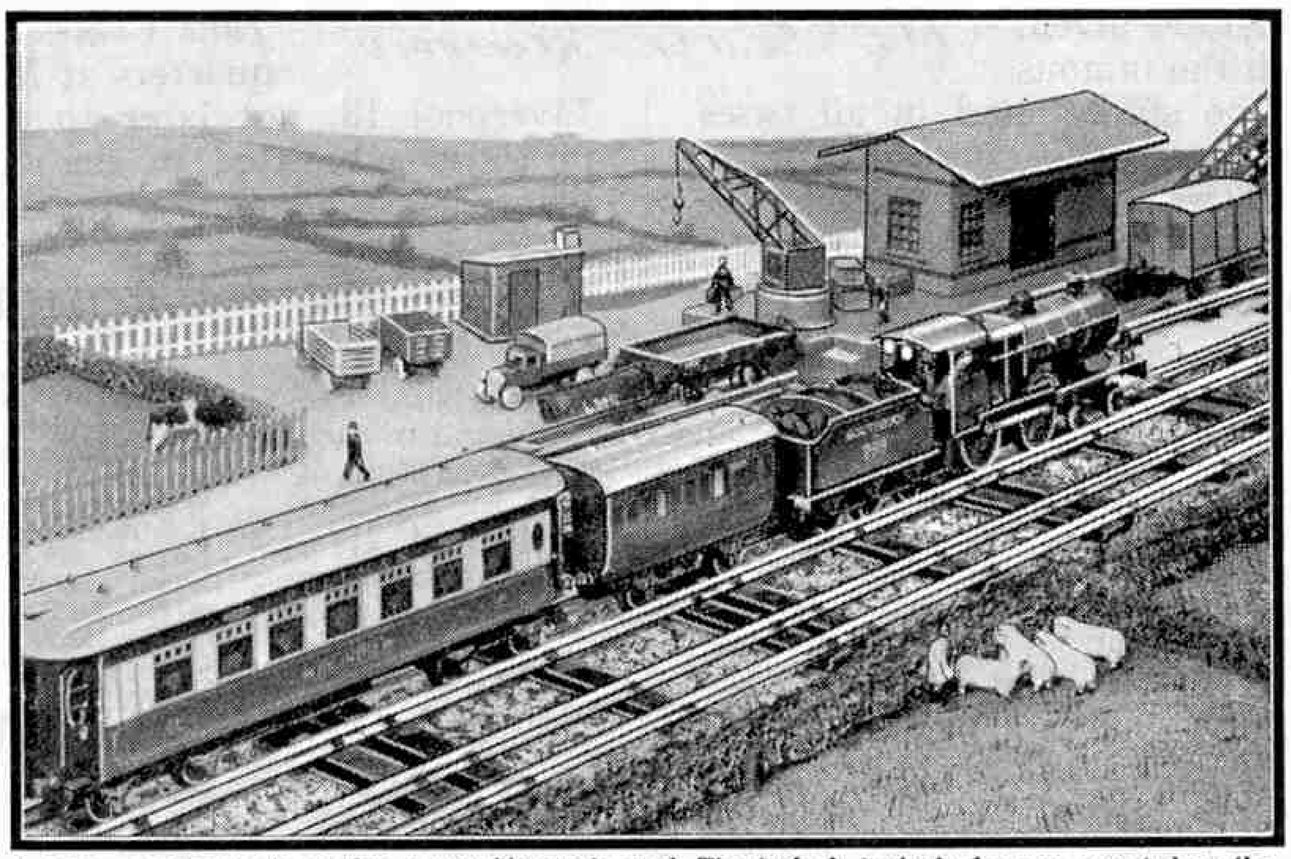
Shunting Containers at a busy goods depot on a Hornby railway. The Containers represent the ventilated type in use on the Southern Railway for various classes of perishable traffic, and they are carried appropriately on standard Flat Trucks.

Some boys may desire to complete the operation of the Ferry Boat Train on French territory. Those who have one of the popular Hornby Riviera "Blue" Locomotives can do so easily, for this engine represents typical practice of the Nord system over the lines of which the train makes the remainder of its journey to Paris. In imagination the layout will then be transformed into the French system for the time being. Older readers may recall an Anglo-French arrangement of this kind that was described in these pages in June 1932. Instead of the train ferry, however, this presumed the existence of the long-proposed Channel Tunnel.

Freight traffic also is handled by the Dover-Dunkerque ferry service, and this suggests the use in miniature of the various Continental-type wagons of the Hornby Series. They will add considerably to the variety and interest of the usual freight trains on model Southern systems.

In previous articles dealing with S.R. working we have described the operation of various regular services from the Pullman "Boats" to express freight "Market" trains. The Southern Railway by reason of its situation is much concerned with train working of an irregular character, from Royal Specials to Kent Coast excursions. At times of Royal events there are of course frequent demands for special trains for the conveyance of Royal parties and for important visitors from overseas. For instance, there were many calls of this kind in connection with the Coronation, and such trains therefore are of topical interest. Their composition depends on the stock possessed by any miniature S.R. "Company." Pullman or saloon type vehicles are suitable, the number employed depending on the size of the supposed party, and the lower illustration on this page shows a typical "Special" of this kind, made up urgently for a small party. A single No. 2 Special Pullman is used and two No. 1 Guard's Vans in S.R. colours, one at each end, are attached for baggage.

In the operation of Royal Trains on the S.R. a departure is made from the usual practice of indicating the route of a train by means of the familiar white discs. The discs are used, but they occupy the usual "Royal Train" position adopted for the headlamps on other systems. Four white discs therefore are employed, one on each of the three brackets above the buffer beam and the remaining one below the chimney. In former years the engine was elaborately decorated, and most readers will have seen illustrations of Royal engines of days gone by carrying Coats-of-Arms, Crowns and other trappings. This practice is not now followed, but there is no reason why those who wish to distinguish their miniature Royal Specials in this manner should not do so. Crowns, Coats-of-Arms and other devices are to be found in colours in many advertisements and on many articles at the present time, so that it is not difficult to arrange quite a brave display on a Hornby Locomotive detailed for Royal duty.



A Pullman "Special" passing a wayside goods yard. The train is typical of many operated on the Southern Railway in actual practice.

Turning to special freight running, apart from the regular perishable traffic, there are seasonal rushes that may occur suddenly about this time of year, according to the weather and the market demand. It is essential that the utmost speed should be observed in dealing with highly perishable freight such as fruit, and that its transport should be under the best possible conditions. This accounts for the wide use made of containers in actual practice, for freight is not disturbed from the time it is packed until it reaches the market, after transport by road and rail. Miniature Containers are now available in the Hornby Series and are of various kinds; as it happens the S.R. representative is of the ventilated type and therefore is very suitable for perishable traffic. Miniature fruit or other specials, according to the season, can therefore be run in a realistic manner on a Hornby railway.

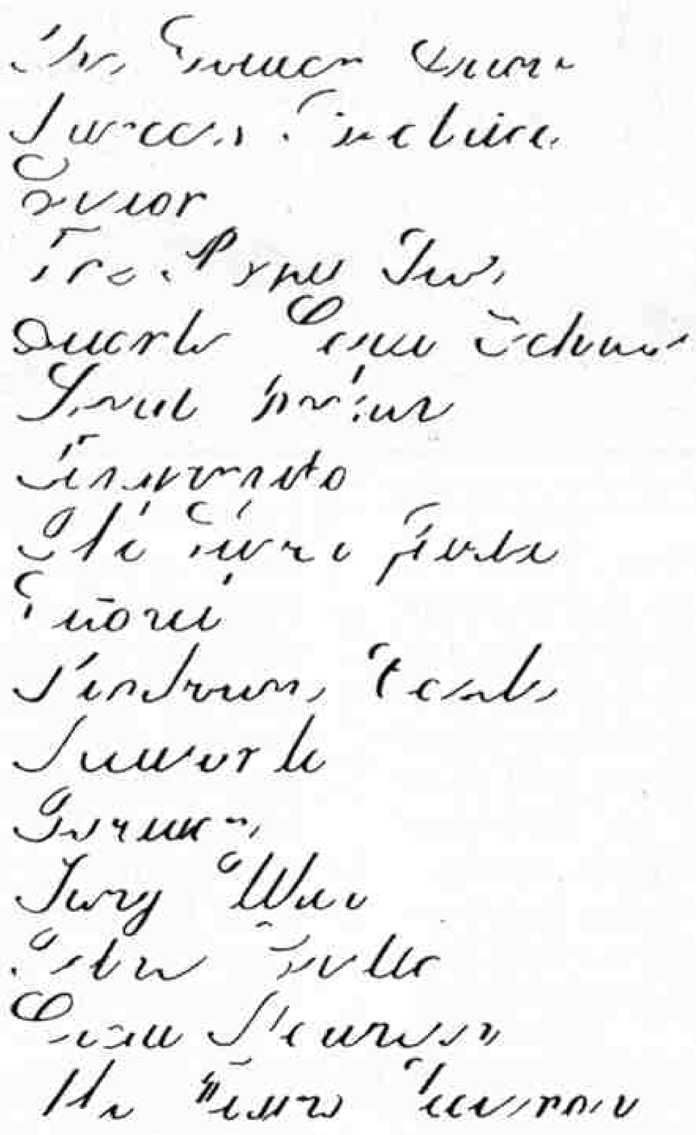
Join the Hornby Railway Company and become eligible for the competitions announced on this page.

H.R.C. COMPETITION PAGE

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

A NOVEL MUTILATED NAMES CONTEST

For our chief competition this month we have devised an interesting puzzle that can be solved without deep study and delving into reference books. The 16 names shown in part in the panel on this page were first carefully written out in full, and then a portion of each letter was removed, so that none of them can now be read at a glance. The names include those of famous locomotives and trains and well-known stations, and competitors are asked to complete them.



Only part of each letter has been deleted, so that there is a complete set of clues to each name. A little ingenuity, combined with knowledge of the engines, trains and stations represented, will enable competitors to solve the puzzle. All the names should be familiar to H.R.C. members, and entrants will find useful additional clues in the number of words in each, and their lengths.

In their solutions members are asked to give the numbers and wheel arrangement of the locomotives, and the names of the towns in which the stations are situated also must be given. The stations between which the famous trains included run must be stated, and in all cases the railway company or companies concerned must be written alongside the answers in order to complete the identification of each mutilated name.

The contest will be divided into the usual two sections, Home and Overseas, and the prize-winners in each will be awarded goods manufactured by Meccano Ltd. to the respective values of 21/–, 15/– and 10/6. Any competitor who is unable to decipher all the names, or to give the additional data requested, should not hesitate to send his entry along, although it may not be complete. If he is unable to fill out a particularly puzzling name, other competitors may have similar difficulty, and it must be borne in mind that there will be several consolation prizes in addition to the main awards. In the case of a tie for any prize, the judges will make the award to the sender of the entry that is neatest or most original in presentation.

A competitor can send his solution on a postcard if he wishes, but he must be certain to add his name, H.R.C. membership number, and full address. Entries must be marked *"H.R.C. June Contest,"* and must reach Headquarters at Meccano Ltd., Binns Road, Liverpool 13, not later than 30th June, in the case of those submitted in the Home Section, and on or before 30th September in the Overseas Section.

Railway Photographic Contest No. 3

Our April and May Railway Photograph Contests attracted large entries, and many photographs of considerable merit were submitted by competitors. This month we announce the third contest in this series. During June the days are long and bright, and conditions for photography usually are favourable. Every amateur photographer among H.R.C. members therefore should make a great effort to secure good photographs of locomotives, trains or some other subject of railway interest and enter them in this competition. There are no restrictions of any kind, except that the photograph should be one of a railway scene and that the actual exposure must have been made by the competitor himself. The developing and printing may be the work of a professional. Only prints are to be sent, and details of each must be entered on the back, together with the competitor's name, H.R.C. membership number and full postal address.

Unsuccessful entries will be returned if a stamped addressed envelope of suitable size accompanies the entry. Prize-winning prints become the property of Meccano Ltd., and are filed for possible use in future issues of the *"M.M."* Several prize-winning photographs have already appeared on the *"Railway News"* pages.

The Contest will be divided into two sections, Home and Overseas, and in each will be awarded three prizes consisting of any products manufactured by Meccano Ltd., to the respective values of 21/–, 15/– and 10/6. Several consolation prizes also will be awarded. Envelopes containing entries must be marked *"H.R.C. Photo Contest No. 3,"* and posted to reach Headquarters at Meccano Ltd., Binns Road, Liverpool 13, on or before 30th June. Overseas closing date, 30th September.

Competitors should make a careful note of these closing dates because any entry that arrives at Headquarters later than the published date cannot be considered.

COMPETITION SOLUTION

"February Missing Words Contest"

The missing words in the order in which they should be inserted in the short account of a modern fireless locomotive are as follows: Factories, sidings, sidings, curves, wheelbase, factory, fire, sparks, factories, superheated, water, superheated, pressure, boilers, reducing, cylinders, recharging, shunting, haul.

COMPETITION RESULTS

HOME

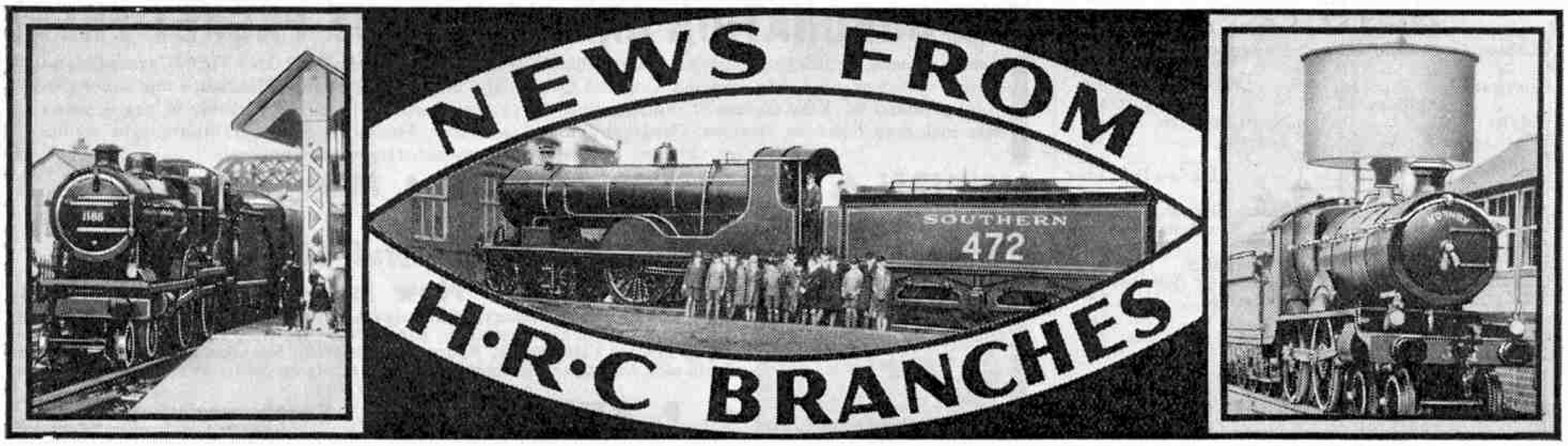
April "Mystery Picture Contest." The clever concealment of the various objects illustrated in this contest set competitors a difficult task to perform, but most competitors succeeded in identifying the majority of the pictures. The prizes were allocated as follows: First: C. E. WRAYFORD (6039), Moretonhampstead, Devon. Second: J. C. BUTTON (10335), Crewe. Third: H. DENT (43908), Newton Abbot, Devon. Consolation Prizes: J. L. MAKIN (30933), Penwortham, Preston; R. BURROWS (6144), Sudbury, Wembley; W. G. PRICE (24659), Combe Martin, N. Devon; J. H. SOWEBRY, Marple, Ches.; D. EARLE (41617), Wembley Park, Middx.; P. CRANE (53193), Lewisham, London, S.E.13.

April "Photographic Contest No. 1."—The photographs submitted in this contest were particularly good, and it is hoped that a few of the prize-winning entries will be published in a future issue of the "M.M." After careful consideration the prizes were awarded as follows: First: B. R. HAMILTON (22892), Willesden, London, N.W.2. Second: C. SPENCER (44179), Sheffield 6. Third: D. F. FORBES (14092), Leith, Edinburgh 6. Consolation Prizes: H. S. G. DARKE (4461), London, N.W.11; R. O'SULLIVAN (26085), Belfast; D. FEAR (18477), Taunton.

OVERSEAS

December "Joke Contest."—First: A. MCINTYRE (30925), Winnipeg, Canada. Second: R. MYBURGH (37538), Capetown, S. Africa. Third: W. A. CARPINTER (42509), Christchurch, New Zealand. Consolation Prizes: G. HEALY (43145), Sask., Canada; J. A. RODRIGUEZ (3647), Montreal, P.Q., Canada; A. M. MANGOURIE (38666), Zagazig, Egypt.

January "Voting Contest."—First: A. G. FELLOWS (29952), Northcote, Auckland, N.4, New Zealand. Second: P. SEVESTRE (43525), Fecamp-Sue. Inf., France. Third: D. MURISON (37642), Buenos Aires, S. America. Consolation Prize: W. CARPINTER (42509), Christchurch, New Zealand.



Branch News

PLYMOUTH.—An increase in membership has resulted in record attendances. Regular track meetings have been held, at which interesting trains have been run. After drawing up a list of stock and track suitable for further use, it was decided to purchase more rails. Each of the various sections of the club is to arrange for Lantern Lectures representing its activities. On behalf of the Printing Section, the Leader gave a Lecture on *"How You Get Your News,"* in which the production of an issue of a local newspaper was traced. A Lecture dealing with *"Famous British Locomotives"* was given by the Assistant Leader. Secretary: R. G. Symons, 47, Lisson Grove, Mutley, Plymouth.

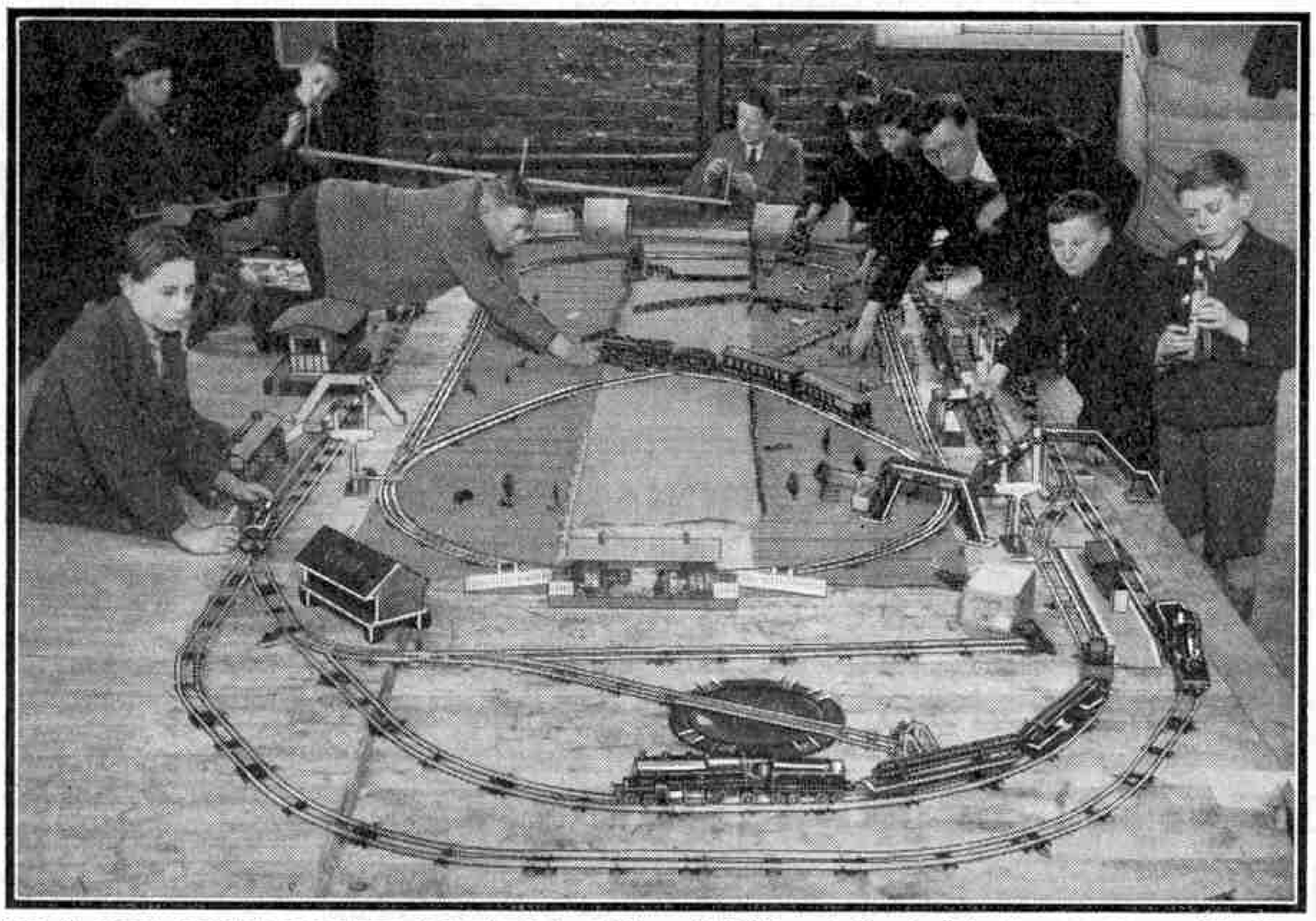
DOVER.—Track operations to timetable have been the main feature of meetings, each member being given a time sheet and a clock or watch. Trains are run strictly to time, and no talking is allowed except when essential to working. A new Hornby M1 Locomotive has been purchased, bringing the locomotive stud to seven. An enjoyable afternoon has been spent at Dover Marine Station, where members saw *"Sir John Hawkins,"* of the "Lord Nelson" class, and *"Sir Gareth,"* of the "King Arthur" class, among other interesting locomotives. Secretary: D. F. E. Moore, 48, Folkestone Road, Dover.

ELMSIDE (EXETER).—Increased enthusiasm has resulted from the operating of trains by teams of members, points being awarded for correct running. New members found this an excellent method of acquiring efficiency in the handling of trains. At a recent "Directors' Meeting" it was decided to re-lay the track to a new design, and work has now commenced on this. The track is to be fenced. Following discussions in regard to team competition, contests are to be held in connection with track operations, and a Trophy is to be competed for monthly. Members had great fun with an interesting "Coronation" programme of trains. Operations with Dinky Toys have provided an interesting diversion from railway working. Secretary: J. Fenwick, 28, St. John's Road, Exeter.

HORNSEA.—The Branch track has been extended to double track, and three new stations have been added to the layout. Electric signalling is to be installed shortly. A reading on *"The Story of the Railway,"* illustrated by a number of lantern slides, was much enjoyed by members. Secretary: P. Richardson, "Summerleigh," Esplanade North, Hornsea.

ST. STEPHENS (SALTASH).—Shunting operations have been the chief feature of track meetings. Competitions have been held, in which points were awarded for the general efficiency and railway-like manner in which trucks were marshalled. Lectures on *"Submarines"* and *"Composing Type at a Printing Works"* have been given. *"Road v. Rail"* was debated keenly by members, the majority favouring railways. Table Tennis has been played at several meetings. Secretary: B. Braund, 9, Homer Road, Saltash.

GREENOCK.—Following a month of extensive preparations, the Branch Exhibition took place recently. It proved a great success, although it was the first arranged by the Branch, and there was a small profit. Regular meetings have been suspended until the commencement of the Winter Session in October. Secretary: G. Bruce, 8, Margaret Street, Greenock.



Mr. J. Beard, Leader of the Mount Senior School (Newark) M.C. and Mr. A. Priestley, secretary, with other members operating the layout of the Hornby Railway Section of the club at a recent Exhibition. This part of the club's display aroused great interest among visitors. Photograph by courtesy of "The Nottingham Journal."

ITALY

MILAN.—Members visited the 18th Campionaria Fair of Milan, and were greatly interested in the numerous exhibits. Special attention was paid to several new electric streamlined trains, designed for high-speed services, and various technical details of the trains were explained to members. Open-air activities have commenced, and members greatly enjoy games of tennis, football and basket-ball, in addition to rambles in the country. Secretary: E. Vigo, Corso Genova 19, Milan.

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.

ABERGAVENNY.—J. C. Baker, "The White House," Llanfoist, Mon.

BARROW-IN-FURNESS.—L. Thomas, 29, Dane Avenue.

BIRMINGHAM—J. A. Bailey, 48, Yew Croft Avenue, Harborne.

BOURNEMOUTH—B. Mayner, 75, Northcote Road.

BURNLEY—N. Leedam, 9, Red Lion Street.

CHARD—R. A. Batstone, 7, Holyrood Street.

GLASGOW—W. Clifford, 9, Silvergrove Street. S.E.

LONDON, N.W.10—D. F. B. Keven, 32, Sellons Avenue, Harlesdon.

LONDON, S.E.17—G. Gilbert, 272, Merrow Street, Walworth.

WALTON-ON-THAMES—J. Gittens, 8, Oakfields.

Branches Recently Incorporated

323. ABBEYFEALE—B. Hynes, Provincial Bank House, Abbeyfeale, Co. Limerick.

324. NEWCASTLE-ON-TYNE—J. Porter, "Meadow View," Morpeth.

SETS (Postage Extra)

4	Labuan	6d.	5	Newfoundland ...	2d.
8	,, ...	1/2	10	,, ,, ...	5d.
4	Leeward Is. ...	3d.	15	,, ,, ...	8d.
1	,, ,, Jubilee	4d.	1	,, ,, Jub.	4d.
5	Malta	2d.	4	Negri Sembian ...	3d.
10	,, ...	5d.	5	Nigeria	3d.
15	,, ...	8d.	10	,, ...	6d.
1	,, Jubilee ...	2d.	1	,, Jubilee 1½d.	3d.
5	Fed. Malay States	2d.	1	,, ,, 2d.	4d.
10	,, ,, ,,	5d.	5	North Borneo ...	4d.
15	,, ,, ,,	8d.	3	Nth. Rhodesia ...	3d.
4	Mauritius	2d.	1	,, ,, Jub.	3d.
1	,, 12c. Jub.	9d.	4	Nyassaland ...	3d.
5	Morocco Agencies	3d.	1	,, Jubilee	4d.
2	,, Jubilee	6d.	5	Palestine	2d.
11	,, King Ed.	1/6	10	,, ...	5d.
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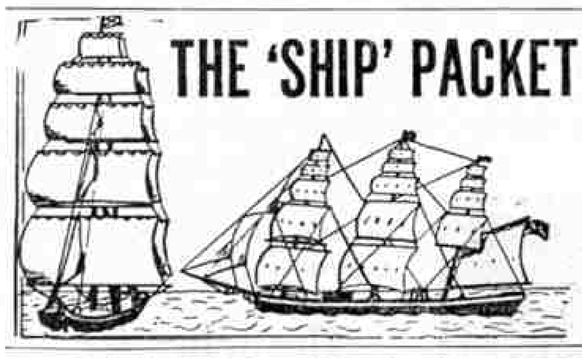
G. P. KEEF, Willingdon, Eastbourne, England.

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Representative set of 45 (one stamp from each of the 45 Colonies)	**4s. 6d.**

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Cash with order—Postage extra.
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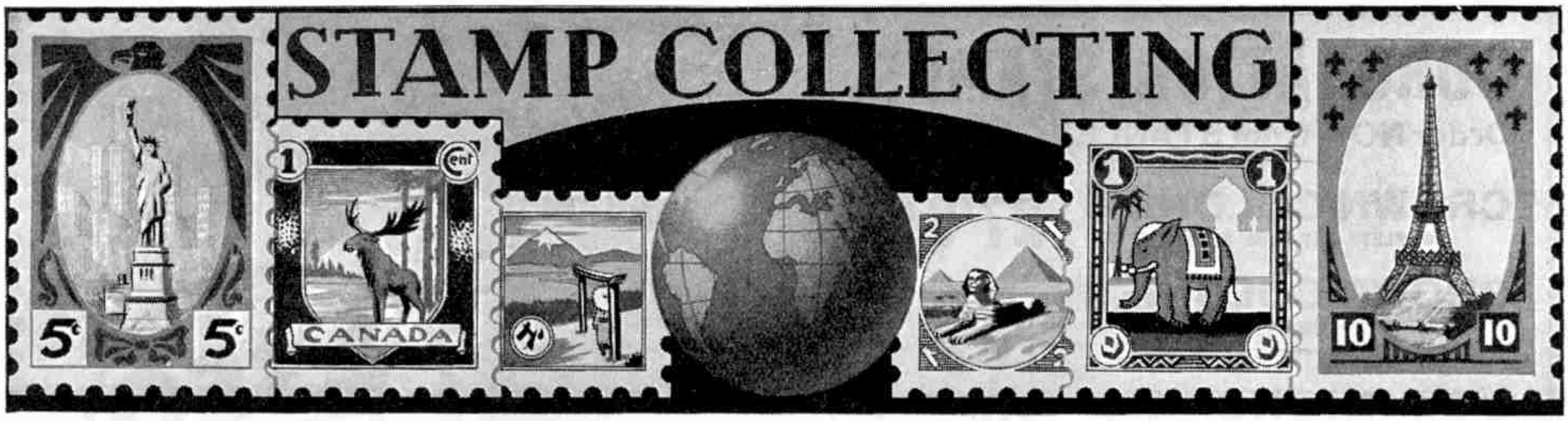
One Variety from each of the 45 Colonies (45) Stamps	**5/-**
135 Different (3 from each of the 45 Colonies)	**£1/7/6**

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CORONATION STAMPS

INTEREST during Coronation Week naturally centred on the appearance of the Coronation commemorative stamps and the new permanent King George VI series, specimens of which are illustrated here.



The design of the Commemorative stamp is specially notable for the fact that this is the first time a British stamp has borne portraits of both the King and Queen. The design is the work of Mr. Edmund Dulac, a well-known artist, who made special portraits of their Majesties for the stamp.

The portraits are displayed on a dark background and enclosed within a decorative border. Between the heads of their Majesties is a crown with their initials interlaced underneath. In the side border are, on the left, the Orb and, on the right, the Ampulla, the vessel holding the holy oil used during the Coronation ceremony; and in the bottom border is the date of the Coronation. The words "Postage" and "Revenue" appear across the top of the stamp and the denomination figures are in the two bottom corners, the lettering and figures being in harmony with the general character of the design.



The design is intended to convey a feeling of rejoicing, the intertwined white lines on the sides suggesting garlands and the device in the shape of Maltese crosses in the top corners Union Jacks. The artist has laid particular emphasis on the crown.

The stamp of which at least 500 millions are being printed, was placed on sale at all Post Offices on Thursday, 13th May, and will remain on sale for about two months.

The first permanent stamps of the new reign were placed on sale on Monday, 10th May. The denominations are ½d., 1d. and 2½d., and they are all of the same general design, which is the work of another well-known artist, Mr. Eric Gill, who has just been elected an Associate of the Royal Academy of Arts. The stamps are simple in appearance, and much less ornate than the designs of the King George V series, although not so plain as those of King Edward VIII. Some ornamentation has been introduced by the inclusion in the corners of the Rose, Thistle, Daffodil and Shamrock, the emblems of the four countries constituting the United Kingdom. These are drawn in the simplest possible manner as heraldic emblems rather than realistic representations. Reliance is placed upon the lettering, "Postage" and "Revenue," at the sides to bind the whole design together. The crown also is drawn as an heraldic emblem and is made large and clear as representing the authority of the State. The denomination in figures is enclosed in a circle placed centrally at the foot of the stamps.





The head of His Majesty is reproduced from a drawing by Mr. Edmund Dulac and represents a modelling in relief. The backgrounds of the stamps are in rich colourings of approximately the same shades as the current stamps. The designs for these stamps and for those of the Coronation issue were considered by the Royal Fine Art Commission, who made valuable suggestions for their improvement. The stamps are printed on paper watermarked with the new royal cipher, i.e., G.VI.R. and Crown.

The Southern Rhodesia issue consists of four stamps of 1d., 2d., 3d. and 6d. values respectively, and in size and colouring these are similar to those issued for the Silver Jubilee of King George V. The design includes portraits of their Majesties King George VI and Queen Elizabeth, and a picture of the Victoria Falls showing the famous road-rail arch bridge and a locomotive in the foreground. The stamps were placed on sale on Coronation Day and will be available until 31st August. Unfortunately specimens were not available for illustration at the time of writing.



The Canadian Coronation issue consists of one value only, the very striking 3c. stamp illustrated on this page. As our readers will observe, this stamp is not unlike the King George V Jubilee issue, but the new stamp scores in the cleanliness of its design and the elimination of many of the involved decorative features that elaborated the Jubilee issue.

This stamp was issued on 10th May and, simultaneously, the three remaining stamps of Canada's new King George VI issue appeared. These values are 4c., bistre, 5c., blue and 8c., orange, each using the design illustrated in the May *"M.M."*

The longest set of Coronation Commemoratives comes from Newfoundland, Britain's oldest colony, which has been notable throughout stamp history for its lavish celebration of important Royal events. The shortness of the time available made it impossible to prepare a full series of new designs, and most of the new stamps therefore are clever adaptations of pictorial designs previously in use in the Dominion. Four of them are illustrated in our stamp pages this month. The remaining designs are as follows, each of the stamps including an inset portrait of the King surmounted by the Crown and the Coronation Date: 1c. Codfish; 8c. Corner Brook Paper Mills; 14c. Newfoundland Dog; 15c. Northern Seal; 20c. Transatlantic Beacon; 25c. Sealing Fleet; 48c. Fishing Fleet.



Newfoundland has issued a 2c. stamp also, and this bears the design used throughout the Crown Colonies for their Coronation Commemorative issue. It shows portraits of the King and Queen with crossed Sceptres between them surmounting the Orb and supporting the Imperial Crown. The Coronation date is set out at the top of the stamp with the name of the Colony across the foot. The value tablets are in the lower corners, and the side borders show the Sceptre and the Sword of State.



Australia did not issue a commemorative stamp but instead replaced the old 2d. and 1d. permanent values on 10th May by two stamps portraying respectively the King and the Queen. We hope to reproduce the Australian and Colonial stamps in our next issue.

CORONATION STAMPS

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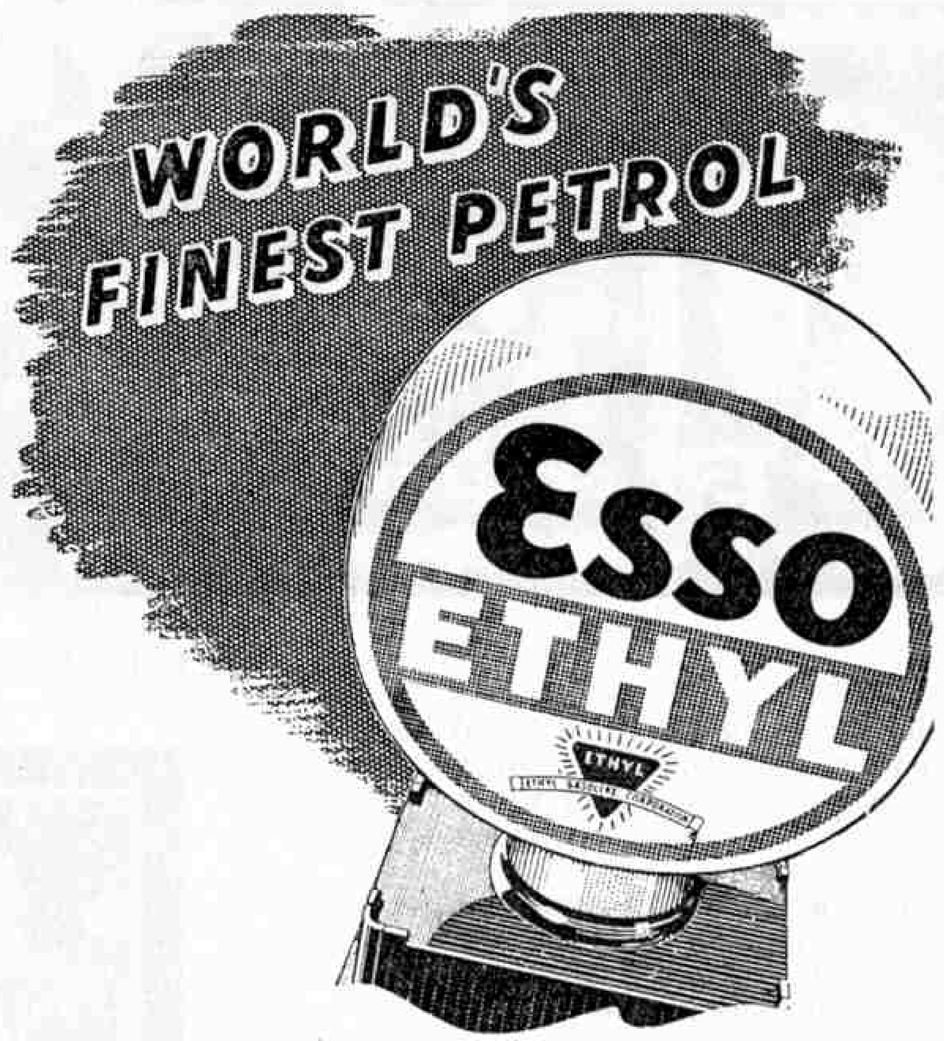
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Please note:

1. All orders must be pre-paid.
2. Orders are being dealt with in strict rotation.
3. Orders for the DOMINIONS Set will not be despatched until we can supply it complete, as offered. This will not be until the middle or end of July at the earliest, when supplies arrive from the most distant countries.
4. The above prices are subject to alteration without notice.
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This unique packet contains stamps bearing the heads of **Murdered persons only. RUSSIA** (Czar), murdered in a cellar. **ITALY,** Romulus and Remus (one killed the other); Cæsar (stabbed). **JUGO-SLAVIA,** special mourning stamp for King Alexander (who was shot). **4 CHINA,** Martyrs issue—Teng-Keng and his three compatriots (all were assassinated). **GREECE,** Rigas Feros (poet, killed by the Turks). **U.S.A.,** President Lincoln (shot in a theatre). Absolutely **FREE.** All you have to do is to send 1½d. postage and ask for approvals. Senders of collectors' addresses receive 6 Persia or 6 Venezuela free. 100 British Cols., 1/–; 20 Airpost, 6d.; 6 Triangular, 6d.; 20 Brazil, 8d.; 1,000 different, 3/11, 10 newly issued Pictorials, 6d. **H. C. WATKINS (M. Dept.), GRANVILLE ROAD, BARNET.**

20 Splendid Unused free to applicants ½d. approvals. Lines, 318, Ripple Road, Barking.

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

25 DIFFERENT FRENCH COLONIES FREE. Request approvals. Winter, 89, Cobham Road, Seven Kings.

100 Different Stamps Free to applicants for ½d. approvals. Cox, 14, Broadmead Av., Worcester Park.

Send Coronation and Colonial pictorials, will return like value in U.S. Commems. Use pict. postage. M. W. Hare, Reedley, Cal. U.S.A.

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How to obtain the "M.M."

The *"M.M."* may be ordered from all Meccano dealers, or from any newsagent or bookstall. Price 6d. per copy. Direct subscriptions to this office will be at the rate of 4/– for six, or 8/– for twelve issues. As a rule, back numbers cannot be supplied, because we print only sufficient copies to fill our standing orders. To prevent disappointment, therefore, place a regular order either with your dealer, newsagent, or direct with this office.

Meccano Magazine, Binns Road, Liverpool 13.

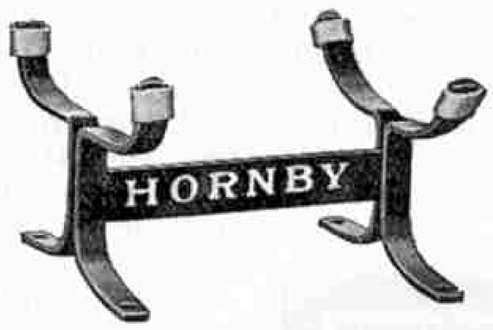
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2. **See that the full amount of the price and any postage is included. It is unfair to expect advertisers to fulfil their undertakings promptly if short remittances are sent.**
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A fine set of 4 charity stamps issued in April this year, showing Queen Astrid holding the Infant Prince Baudouin. 9d.
50 Belgium various, 8d.

CYPRUS

Three of the lovely 1934 pictorials, which will shortly be obsolete, and 20 other fine British Colonials, sent free to all applicants for approvals enclosing 2d. postage.

KENYA

1st May 1935 pictorial set of 7 Kenya-Uganda-Tanganyika, showing Mount Kilimanjaro, Jinja Bridge, Arab Dhow, Lion, etc. All with portrait of King George V and so shortly obsolete. 9d.

R. D. HARRISON - ROYDON - WARE



Stamp Gossip

and Notes on New Issues



Dutch Scout Stamps

The World Scout Jamboree, to be held this summer in Holland, has been marked by the issue of the three striking stamps illustrated on this page. The 1½c. value shows the Fleur-de-Lis scout badge mounted on a grey shield superimposed on a background of green. The 6c. value gives an impressive display of international flags, with a drum rolling out a rallying call.



The 12½c. stamp, the value most commonly used for foreign correspondence, shows a likeness of the Greek God Hermes, whose principal duties were to guide the gods on their journeys to strange and unknown places. This design therefore is symbolic of the greatest of all scout ambitions, to be a "pathfinder."

The stamps were designed by the well-known Dutch artist, Pijke Koch of Utrecht, and were placed on sale on 13th April. They will remain on sale until the end of August when the Jamboree ends.

Coronation Postmark

In addition to issuing the special Coronation commemorative stamp illustrated on the previous page, the Canadian post office marked the Coronation by the use of a number of special Coronation cancelling dies bearing the design of the British flag and an appropriate inscription, with bilingual equivalent for post offices in the French Canadian territory.

These special dies were brought into use on 10th May and continued throughout the week.

Safety First Postmarks

On this page we illustrate another of the interesting "Safety First" postmarks that have recently been used in Germany. The slogan in this postmark is directed to cyclists, and exhorts them always to keep their rear lights in working order. The design almost makes the message obvious.



Ten slogans are included in the series. The most interesting of those not illustrated here are two calling for care at cross-roads and level crossings respectively. Each of these bears a simple design illustrating the message. A third pictorial slogan reads "Cyclists! Motorists! Don't cut corners," the last three words being bent around a representation of a right-angled bending road, complete with traffic arrows. The complete series makes a most effective piece of propaganda.

Postmaster-General Broadcasts

Following his statement to the Press Conference held at the General Post Office on the afternoon of 5th May, in which he announced details of the Coronation stamps and the new permanent King George VI issues, the Postmaster General, Major The Rt. Hon. S. C. Tryon, gave a short broadcast talk on the new stamps in the London Regional News Bulletin the same evening.

The greater part of the talk was devoted to a description of the new stamps, full details of which appear in our article on the previous page, but Major Tryon also gave some interesting additional facts concerning post office stamp issues in order to show how great a task it had been to get the four new stamps ready for issue in Coronation Week.

In 1840 the total issue of the famous 1d. red and 2d. blue stamps, the only stamps then in use, was about 96 millions, and the printers were proud of the fact that each of their presses would produce 41,000 stamps a day. Now the Post Office sells no less than 7,500 million stamps a year, including 800 million in books and 800 million in rolls, and each of the modern printing presses can produce as many as 15 million stamps a day.

The work of designing, printing and distributing the new stamps, Major Tryon explained, had been completed in record time. Never before had the stamps of a reign been issued in this country so soon after the King's accession.



When the issue of the special Coronation stamp ceases, in about two months' time, its place will be taken by a 1½d. stamp of the same design as the new ½d., 1d. and 2½d. stamps. Stamp books will be issued shortly afterwards, in which ½d., 1d. and 1½d. stamps of the new permanent issue will be included, but rolls of these stamps for the stamp vending machines will not be available until later in the year, when it is hoped to issue also some of the higher values in King George VI series. Designs for these are already in hand.

* * *

Fruit and flowers have frequently been used as stamp designs but vegetables have rarely been chosen by designers.

Late this month, however, a short series of seven stamps is to appear in Bulgaria to avertise Bulgarian fruit and vegetables. The designs have been chosen in competition, and it is anticipated that a most attractive series will be produced.

* * *

Will Mr. T. R. Copeland please send his address to the Editor.

Stanphil Stamp Books

The two latest additions to the series of Stanphil Stamp Books, published by Stanley Gibbons Ltd., are No. 6, *"Postage Stamps and the Empire's Story,"* by A. O. Crane, and No. 7, *"Literature and Stamps,"* by A. E. Gould.



The first of these books relates the story of the growth of the British Empire from the stirring times of Queen Elizabeth to the present day, as told by stamp designs. The book is profusely illustrated with reproductions of Colonial pictorial stamps, and although gaps in the stamp story still exist, the growth of the Empire is set out with amazing coherence.

"Literature and Stamps" deals with the interesting story of the world's literature from Egyptian times down to modern days, and presents a very full account of the work of most of the famous writers, together with their portraits. The author has shown great ingenuity in locating stamp illustrations. For example, his reference to Shakespeare's *"Merry Wives of Windsor"* is aptly illustrated by one of the famous British Colonial King George V Jubilee stamps.

All of the Stanphil stamp books can be obtained from stamp dealers and booksellers throughout the country, price 1/– each, or direct from Stanley Gibbons Ltd., 1/2 post free.

Philatelic Congress Souvenirs

The 24th Philatelic Congress in Great Britain is being held this year at Folkestone from 8th to 11th June, the organising society being the Cinque Ports Philatelic Society.

In addition to the usual series of lectures and discussions on philatelic topics there has been arranged a varied social programme that will ensure a week of full activity for all the delegates.

In order to commemorate the Congress an attractive set of souvenir labels is being sold at the price of 1/– per sheet. Each sheet contains 12 "stickers" with designs as follows: A Martello tower; The Grand Hotel, Folkestone, at which the Congress will have its headquarters; Folkestone Harbour; Shepway Cross, near Lympne; Canterbury Cathedral; Folkestone Railway Viaduct; the Arms of the Cinque Ports; Folkestone War Memorial; Dover Castle; Leas Cliff Hall, the Seal of Folkestone; and the William Harvey Memorial.

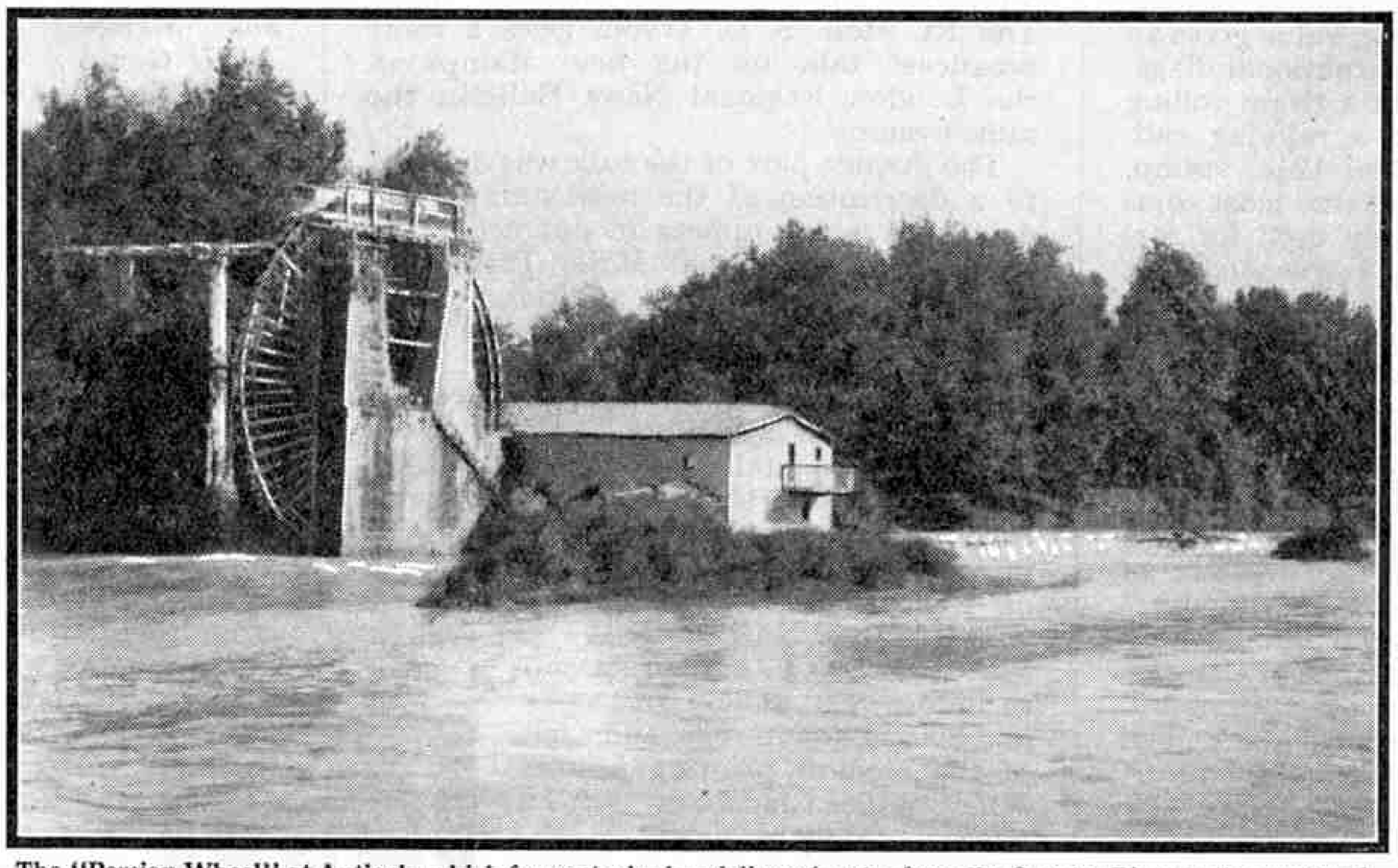
We thank Stanley Gibbons Ltd. for their courtesy in loaning the stamps from which the illustrations for our stamp pages have been made.

The Great Wheels of Antioch

By W. H. Payn

Antioch is an ancient city that once was the greatest in the Near East and the capital of the kingdom of Syria. It was a centre of trade and learning, famous for its wealth and the magnificence of its buildings, and indeed its power and glory seemed destined to survive for ever. It has passed through so many disasters, including sieges, plagues, famines and earthquakes, however, that it has shrunk into a small town of only a few thousand inhabitants.

Of the past glories of Antioch little remains but the name, for vineyards and fruit gardens cover the site of the old city and most of its historical ruins have been destroyed to furnish building material. One interesting relic of ancient days survives, however. This is the famous "Persian Wheel." Since earliest times, the irrigation of the fields and gardens along the banks of the wide Orontes River, which flows through Antioch, has been carried out by means of great water wheels, and though these have mostly been displaced by motor pumps, two or three are still in use, one in the very centre of Antioch. These wheels are supported by stone pillars and worked by the swift flow of the river. They are more than 30 ft. in diameter and are remarkable for their structure and design, since they are made to lift water by the flow of the river itself. They have not altered in the smallest detail since Xenophon described them in his histories written nearly 400 years before the birth of Christ, and every part, including hubs, spokes, buckets and troughs, is made entirely of wood.



The "Persian Wheel" at Antioch, which for centuries has delivered water from the Orontes River to the surrounding fields and gardens for irrigation purposes. Photograph by W. H. Payn, Bury St. Edmunds.

All day long the melancholy creaking of the Great Wheel of Antioch sounds over the town and the silent fields beyond. Round and round it goes, driven by the force of the river, and as it turns the water pours from its wide spokes and from the small buckets situated just where each spoke joins the rim of the wheel. Much of the water is lost as the wheel rises, and more escapes as each bucket tips over to empty its contents into the troughs at the tops. In spite of this a steady stream leaves the cistern to travel along the miles of narrow wooden troughing which carries the precious water to the fields along an aqueduct 30 ft. wide. This is on a level with the tops of the surrounding trees. It is known to this day as Hadrian's Aqueduct, and was certainly built in Roman times.

Syria is famous for its ancient water wheels, and there are others at Hama, between Damascus and Aleppo. This city lies in a narrow valley through which the Orontes flows, and there are four huge water wheels on the banks of the river. The largest of these has a diameter of about 75 ft. and is almost certainly the largest water-raising wheel in existence. All four wheels are built of wood, with iron axles, and they run ceaselessly day and night.

A Trip on the "*Talisman*"

By R. G. Robertson

I shall never forget my first trip on the "*Talisman.*" I was going for a cruise from Dunoon to Tighnabruaich and the Kyles of Bute. When it was time for departure I naturally expected to hear the bells that usually precede the departure of a steamer, but no bells sounded, and the "*Talisman*" glided away without fuss, and gaining speed rapidly. I learned later that the captain directly controls all the machinery and there is no telegraph.

Shortly after leaving Dunoon we passed another Clyde pleasure steamer, the "*Duchess of Montrose,*" crowded with holiday makers on their way to Loch Long and the upper reaches of the Clyde. When I went below I saw at a glance that engines occupied an unusually small space. The vessel is driven by an electric motor of 1,300 s.h.p. that is supplied with current by a generator driven by oil engines. The machinery runs so smoothly that there is no vibration and none of the usual motions of a paddle steamer.

On coming up on deck again, I was surprised to see that we had already passed Innellan and were speeding round Toward Point at a good 16 knots, heading for Rothesay and its lovely bay, lively with launches and white sails. There were other pleasure steamers at the pier at Rothesay, but the "*Talisman*" was manœuvred into position as easily as a car is placed in a garage.

After leaving Rothesay and putting in at Port Bannatyne for a few moments the "*Talisman*" headed for Tighnabruaich and scenes of beauty and charm unmatched anywhere—the Kyles of Bute. The channel dividing Bute from Argyllshire narrowed between heather and bracken hills until it seemed as if the "*Talisman*" might be landlocked; but just as she was passing through the narrows another prospect was opened and scene after scene was unfolded in infinite loveliness and charm.

This wonderful trip was all the more delightful to me because it was made on the "*Talisman.*" Although this vessel is equipped with the latest oil-electric machinery, she is a paddle steamer, this form of propulsion being selected because in service she has to move in restricted places and to negotiate shallow waters.

Filling Motor Car Tyres with Water

It seems absurd to suggest filling motor car tyres with water, but this course is recommended by the engineers of a famous tyre company in the United States. Needless to say, it is not proposed that the tyres of ordinary motor cars or lorries should be filled with anything but air. The tyres for which water is better are those fitted to farm tractors with which there is a tendency for the wheels to bounce when pulling heavy equipment over ground that is rough or uneven.

Formerly attempts were made to keep the wheels of such tractors in contact with the ground by weighting them, but this was troublesome and it has been found that the use of water in the tyres gives better results.

A special hose pipe adaptor is used for filling purposes and the ordinary water main pressure is suitable. When the tyres have been filled with water they are pumped up with air as usual, the water taking up about three-quarters of the space within the rubber tube.

"Tabloid" Guide to Photography

This is the title of a booklet recently issued by our advertiser, Burroughs Wellcome & Co., Snow Hill Buildings, London, E.C.1. Readers of the "*M.M.*" who are photographers will find this booklet exceptionally interesting. It explains, step by step, the production of a photograph from the development of the exposed film to the finishing of prints and enlargements. It is intended for the beginner, but also would be valuable to advanced workers.

The price of the booklet is 2d., but readers can obtain copies free of charge by writing to Burroughs Wellcome & Co., mentioning the "*M.M.*"

Flying Model Aeroplanes

The increasing popularity of flying as a hobby has created an enormous demand for model aeroplanes of all types, and the leading stores are meeting this demand with models that fly and in every other way reflect the spirit of the age. Perhaps the most popular of all flying models is the FROG MK.IV. This is a scale model of a modern fighting aircraft that has an extremely good performance.

For those who find as much interest in building a machine as in flying it, there is a large range of FROG scale model construction kits, and aeroplanes built up from the parts included in these give excellent performances. The construction kits form a new departure, because every important part is blanked out and ready-shaped. No tools therefore are required.

FROG machines are made by Lines Brothers Ltd., Morden Road, London, S.W.19, who will be glad to send full details to any reader who is interested.

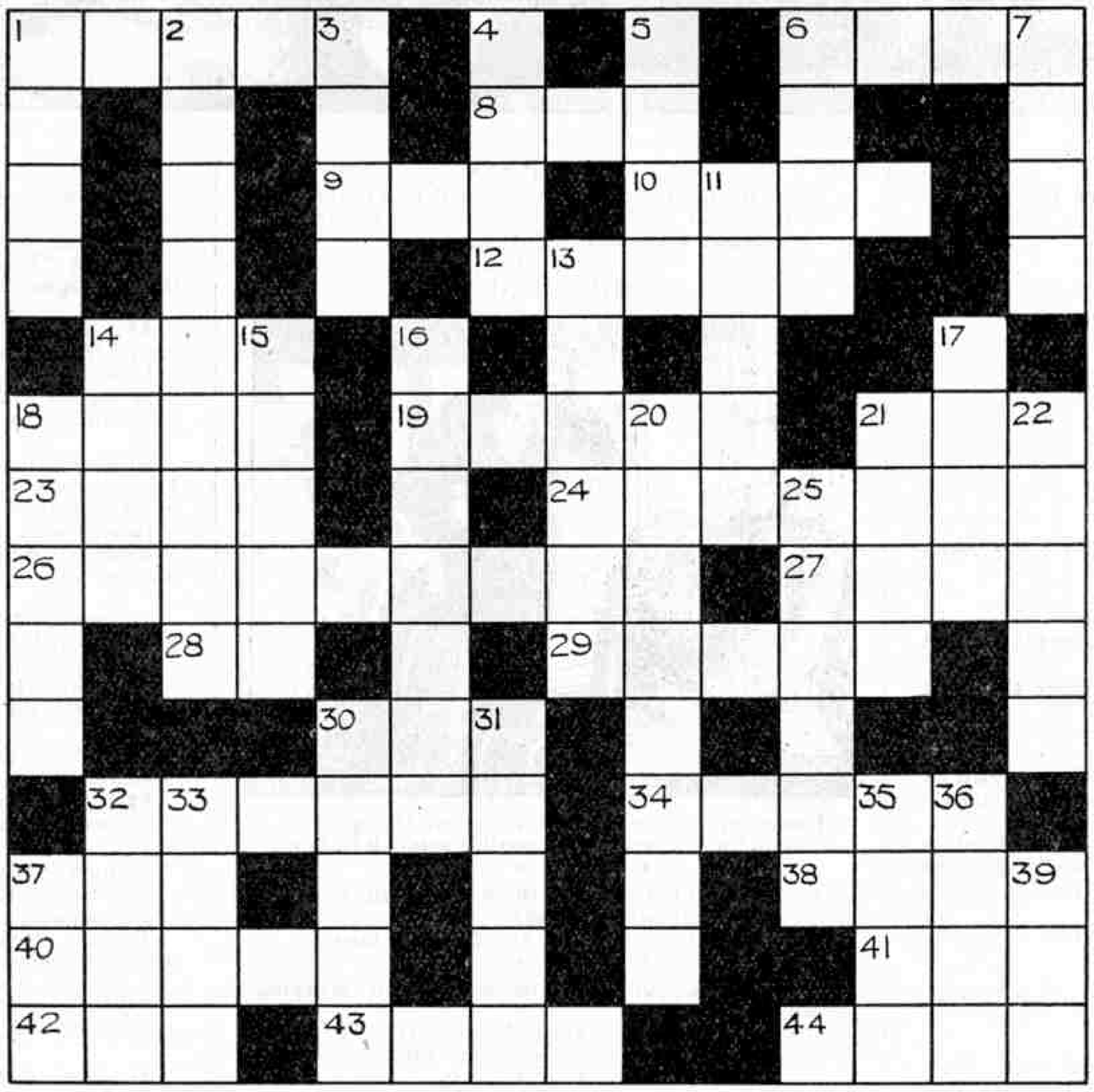
Speed Achievements of 1936

C. C. Wakefield and Co. Ltd., have issued an attractive booklet, "1936 Achievements," that tells the story of another year of triumph in the world of speed. It gives full accounts of great achievements by aeroplane, motor car and motor cycle, beginning with Flight Lieut. Rose's great journey from England to Capetown by air, and his record-breaking return flight. Other achievements in the air dealt with include Mrs. Mollison's new records over the same course later in the year, and Miss Batten's great flight to New Zealand. How Captain Eyston shattered world speed records with his famous car "*Speed of the Wind*" and motor cycling triumphs of the year also are recorded.

The booklet is splendidly illustrated, and any reader of the "*M.M.*" who would like a copy can obtain one free on writing to C. C. Wakefield and Co. Ltd., Wakefield House, 30 and 32, Cheapside, London, E.C.2, and mentioning the "*M.M.*"

Competition Corner

JUNE CROSSWORD PUZZLE



CLUES ACROSS

1. Proclamation
6. Robust
8. Before
9. Thick fluid
10. Measure of land
12. Giant
14. Insect
18. Weird
19. Desire
21. Short legged horse
23. Fruit
24. To catch in a trap
26. Most severe
27. Cricket term
28. Pronoun
29. Hackneyed
30. Beverage
32. Radio parts
34. Elemental commotion
37. Number
38. Recess
40. Boredom
41. Small member of the body
42. Girl's name
43. Lyrics
44. Mountain lake

CLUES DOWN

1. Repetition
2. Travellers' guide book
3. Kind
4. Joke
5. Fuel
6. Wind
7. Perceive
11. Inclines
13. Lay siege to
14. Sugar producing plant
15. Bird's nest
16. Hurry along taking short steps
17. Wound
18. Race-course
20. Gives in trust
21. Hollow in the earth
22. Popular head-dress
25. Idea
30. To be of benefit
31. Attempt
32. Sell
33. Indian coin
35. School roll
36. Heath
37. Dried leaves
39. Know

The "*M.M.*" crossword puzzles in the past have been exceptionally popular, principally, no doubt, because they are set for amusement rather than strenuous competitive effort. This month's puzzle will be found to follow the lines of those set in previous issues in that it is fair and interesting. The clues are all perfectly straightforward, and every word used can be found in Chambers' or any other standard dictionary.

Prizes of Meccano Products value 21/–, 15/–, 10/6 and 5/– respectively will be awarded in order of merit to the senders of the four correct solutions that are neatest or most novel in presentation. The prizes will be duplicated for the Overseas section, which is open to all readers living outside Great Britain, Ireland and the Channel Islands.

Entries should be addressed "June Crossword Puzzle, Meccano Magazine, Binns Road, Liverpool 13," and must be sent to reach this office not later than 30th June. A separate set of prizes will be reserved for Overseas readers whose entries must arrive not later than 30th September.

June Photo Contest

Each month this summer we are offering prizes for the best photographs submitted. There are no restrictions as to subject, size, make of camera, film or paper, but each print must bear a title and the exposure must have been made by the competitor.

Entries for each month's competition will be divided into two sections, A for readers aged 16 and over, B for those under 16; and prizes of Meccano products or Photographic Materials, as chosen by the winners, to the value of 21/– and 10/6 will be awarded in each section.

In addition to its title, each print must bear on its back the competitor's name, age and address. Unsuccessful entries will be returned if a stamped addressed cover is sent for the purpose.

Entries sent this month must be addressed "June Photo Contest, Meccano Magazine, Binns Road, Liverpool 13," and must arrive not later than 30th June. Overseas closing date 30th September.

Competition Closing Dates

HOME		
June Photo Contest	...	30th June
June Crossword Puzzle	...	30th June
OVERSEAS		
Car "Faces" Voting Contest	...	30th June
March Drawing Contest	...	30th June
April Crossword Puzzle	...	31st July
April Photo Contest	...	31st July
Coronation Eye Teaser	...	31st August
May Photo Contest	...	31st August
June Photo Contest	...	30th September
June Crossword Puzzle	...	30th September

Watch the Closing Dates:

Competitors, both Home and Overseas, are particularly requested to make a careful note of the closing dates of the competitions.

In sending entries to competitions that are divided into age groups, competitors should take particular care to mark their ages clearly on the back of the entry. It is not sufficient merely to indicate the age group, as age allowances are given to ensure equality of opportunity for the younger competitors.

COMPETITION RESULTS

HOME

April Crossword Puzzle.—1. K. Costain (Bolton). 2. W. Hewson (Troon). 3. T. D. Tasker (Barnsley). 4. L. W. Chitty (West Wimbledon, S.W.20). Consolation Prizes: J. K. Robinson (Rugby); A. S. McDonald (Giffnock); C. R. Brown (Hatton); F. Pratt (Long Eaton); R. F. Hester (High Wycombe); W. W. Pollard (Slough); D. Goodman (Hertford).

April Photo Contest.—First Prizes: Section A, K. Dyson (Tadcaster); Section B, D. H. Parry (Friston). Second Prizes: Section A, J. R. Tottle (Taunton); Section B, P. F. Chapman (St. Leonards-on-Sea). Consolation Prizes: J. H. Sowerby (Marple); C. M. Sinclair (Glasgow, S.W.2).

OVERSEAS

Broken Resolutions Contest.—1. N. R. Gray (Paris). 2. R. Cross (Sydney). 3. F. J. Collinson (Capetown). 4. F. H. Brown (Toronto).

"Animalesques" Contest.—1. D. Attree (Queen's Bay, B.C.). 2. R. H. Denniston (Wanganui, N.Z.). 3. R. Stuart (Ohakune, N.Z.). 4. Miss T. Dimech (Sliema, Malta). Consolation Prizes: O. F. Haylock (Christchurch, N.Z.); L. A. S. Johnson (Cheltenham, N.S.W.); J. Lyons (Penang, S.S.).

NOTICE TO INTENDING COMPETITORS: Entrants to drawing and similar competitions are asked to note that unsuccessful entries can only be returned if a stamped addressed cover is sent with the entry.



STRAIGHT HINT

Villager (paying arrears of rent): "Now I'm square."
Landlord: "Yes, but I hope you'll be round next week."

* * * *

Mother (hearing crash from dining room): "Doris, whatever are you doing?"
Doris: "Nothing; it's done!"

* * * *

First Salesman: "What do you sell?"
Second Salesman: "Salt."
First: "Why, I'm a seller, too!"
Second: "Shake!"

* * * *

Tommy: "That is a very long pie."
Mother: "It was very long rhubarb."

* * * *

Teacher: "If I said: 'I'm handsome,' what tense would it be?"
Pupil: "Pretence."

* * * *

Boss: "Late again! Can't we do something about this?"
Office Boy: "Possibly, sir; we could move the office nearer my home!"

* * * *

Gentleman: "Are you very poor?"
Tramp: "Sir, if canvas were twopence a yard, I couldn't buy enough to make a canary a pair of spats."

* * * *

A huge American car stopped in a Warwickshire road, opposite an old countryman. "Say," said the driver, "kin you tell me if I am right for W. Shakespeare's house?"
"Yessir," replied the yokel, "but there bain't no need to hurry—he's dead!"

* * * *

Policeman: "Why the speed? Are you late for an accident or in a hurry to see the judge."

* * * *

Little Johnny (watching his father put up a windmill): "Dad, what do you want to put up a windmill for? We already have enough wind."

* * * *

Diner (fishing out fly from his soup): "Waiter, what is this?"
Waiter: "That, sir, is a vitamin bee."

* * * *

Farmer: "What d'ye mean by shying stones at my dog?"
Boy: "He bit me!"
Farmer: "How many times?"
Boy: "Once, and once bitten, twice shy!"

* * * *

Gent.: "Are the sandwiches fresh?"
Waiter: "Don't know, sir, I've only been here a fortnight."

* * * *

Bill: "Bill Jones' body has been recovered."
Jack: "Why, I didn't know he'd been drowned."
Bill: "He hasn't. He merely put on a new suit of clothes."

* * * *

PROUD OF IT!



The Judge (severely): "The evidence shows that you threw stones at this man."
Prisoner: "And the look of him shows I hit him!"

TOO BAD

"Why do dentists call their offices 'dental parlours'?"
"I suppose it would make their patients feel too bad if they called them drawing-rooms."

* * * *

OBVIOUSLY



Passenger: "Does this tram stop at the quay?"
Conductor: "There'd be a terrible splash if it didn't!"

* * * *

Teacher: "What do you think Cromwell would be doing if he were alive to-day?"
Pupil: "Drawing the Old Age Pension, miss."

* * * *

"Why were you kept in school this morning, Tommy?"
"Because I laughed when the teacher said, 'Never use a preposition to end a sentence with'."

* * * *

"Where you been?"
"'Avin me 'air cut."
"You know you can't 'ave yer 'air cut in company's time?"
"Well, it grew in company's time, didn't it?"
"Not all of it."
"Well, I ain't had it all cut off."

* * * *

Mike was going to London for the first time, and his friend Pat was giving him a few hints on what to do and where to go.
"Be careful about the Zoo, Mike," advised Pat. "You'll see foine animals if you follow the words 'To the Lions' or 'To the Elephants,' but take no notice of the sign which says 'To the Exit.' It's a fraud, and it was outside I found myself when I went to look at it."

* * * *

The village fire brigade stood by while the top floor of a three-storey farmhouse blazed merrily.
"Why don't you try to put the fire out?" asked a bystander.
"Our hoses ain't any too powerful, mister," replied the fireman. "We'll 'ave a better chance when the fire gits to the ground floor."

* * * *

The captain of a ship took on two new hands, Bill, who was without a written character, and Tom who had excellent references.
After a few days at sea rough weather set in, and while crossing the deck with a bucket in his hand, Bill was swept overboard. Tom saw what had happened and sought out the captain.
"D'yer remember the man wot came aboard without a character, sir?" he asked.
"Yes," said the captain, "what of it?"
"Well captain, he's away with yer bucket," was the reply.

* * * *

Jones: "You have quite a variety of plants in your garden, but why are they all labelled 'May flower'?"
Brown: "You see, old man, they may flower, and they may not."

* * * *

Sambo: "If I could have a wish now, I would wish for a great big wagon load of watermelons."
Tambo: "Would you give me one?"
Sambo: "No, anybody too lazy to wish for himself isn't going to get watermelons from me."

BARGAIN PRICE

Salesman (having fitted a farmer with an overcoat): "Fits you beautifully, sir, and I'll let you have it for just half the catalogue price."
Farmer: "Thanks, that'll do. What is the price of the catalogue?"

* * * *

At a meeting of a Rural Council Bob Thomas suggested the purchase of a chandelier for the Parish Hall.
Dick Jenkins, an old farm hand, was disgusted. Said he, "A chandelier! and who is going to play it, I should like to know?"

* * * *

Business Man: "Yes, when I first came to London I had only one shilling in my pocket with which to make a start."
Interviewer: "How did you invest that shilling?"
Business Man: "Used it to wire home for more money."

* * * *

Tommy: "If I were invited out to dinner, should I eat pie with a fork?"
Granny: "Of course you would, Tommy."
Tommy: "Have you got a pie in the house I could practise on, granny?"

* * * *

Owner: "I am going to call my new racing car 'Bad News'."
Friend: "Why?"
Owner: "Because it travels fast."

* * * *

Tommy: "What time does the tide come in?"
Old Salt: "Five fifty-five; I've told you a dozen times already."
Tommy: "I know; but I like to see your whiskers waggle when you say it."

* * * *

"What struck you most at school to-day, William?"
"The teacher, father."

* * * *

Teacher: "I challenge you to give me the name of a useless article."
Pupil: "What about a glass eye at a keyhole?"

* * * *

"I say," said the English tourist, "you have a great many hills in this country of yours, Pat."
"Shure, of course," returned Pat, "there was so much land that we had to put it in heaps."

* * * *

Lunatic: "We like you better than the last superintendent."
Superintendent: "Why?"
Lunatic: "Well, you seem more like one of ourselves."

* * * *

"Nothing the matter with you at all," said the doctor. "You are in perfect health. Why, your pulse is as steady as clockwork."
"But, doctor," cried the patient, "you've got your finger on my wrist-watch."

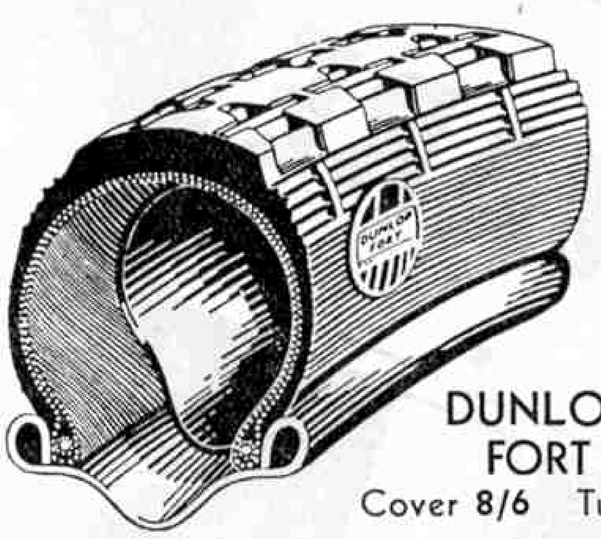
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BIG CHANGES



Prospect: "What's the difference between this new model and last year's car?"
Salesman: "Well, the cigarette lighter is about an inch nearer the steering wheel."

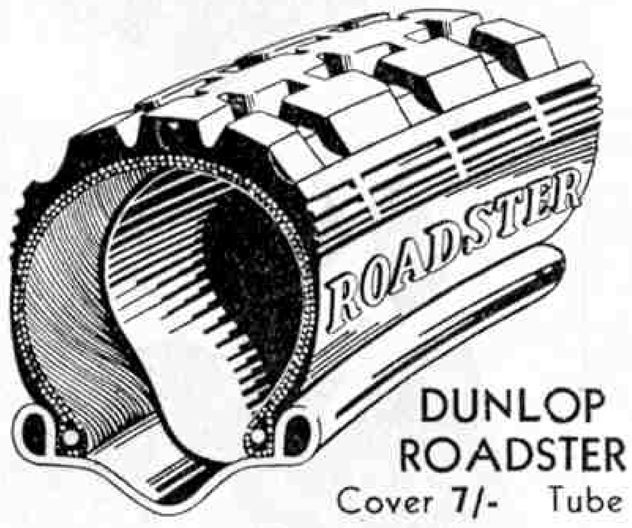
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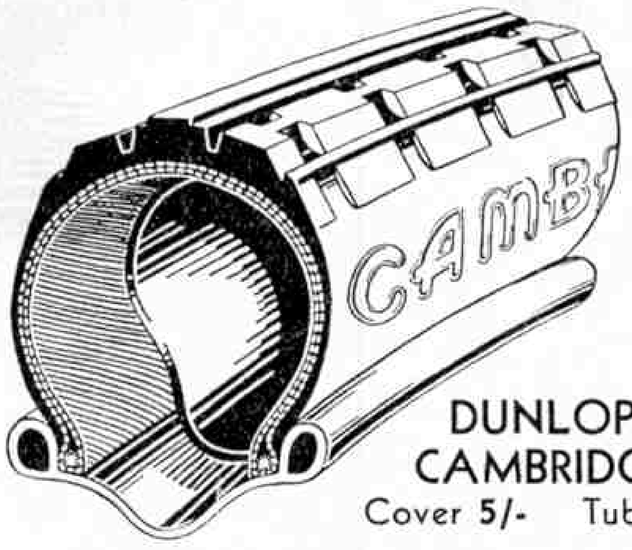
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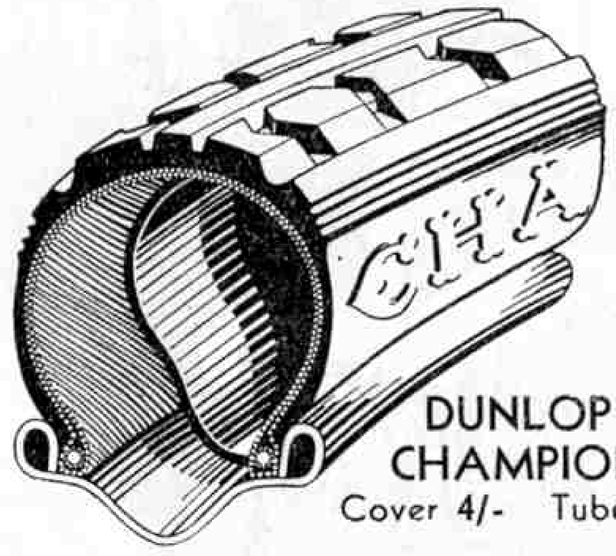
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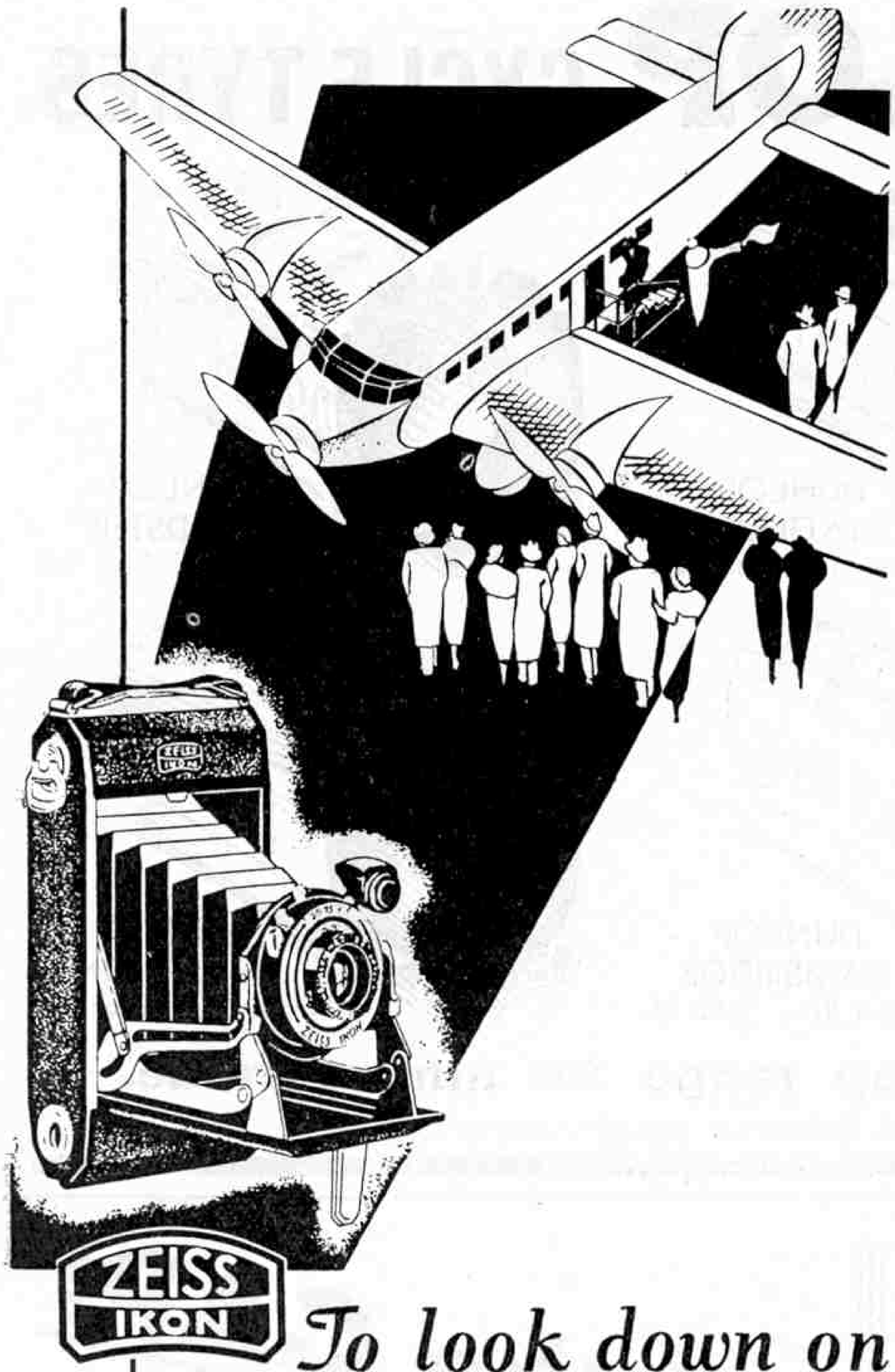
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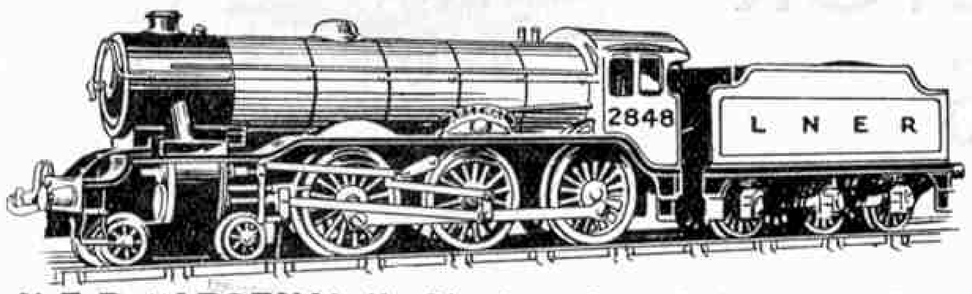
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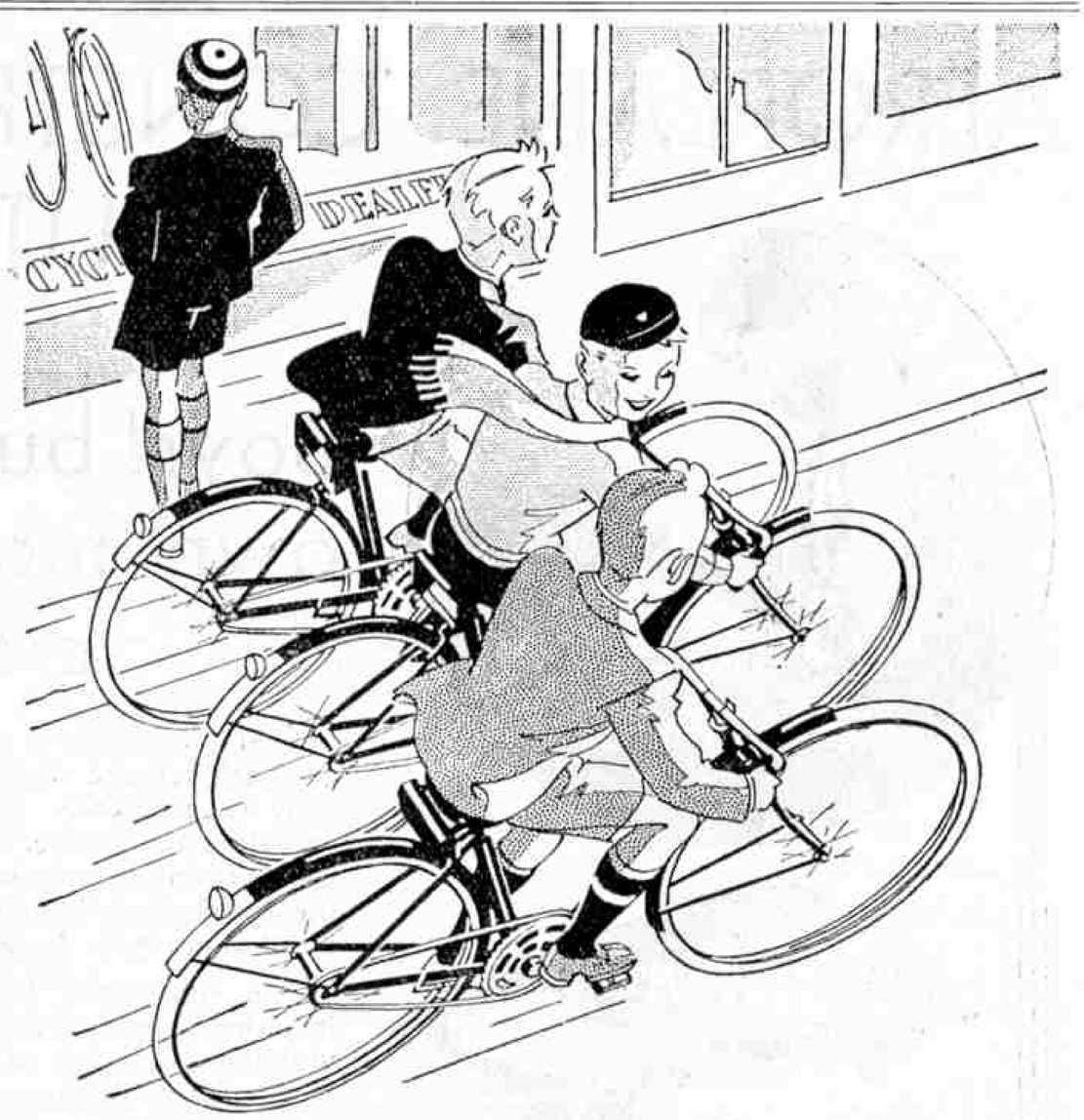


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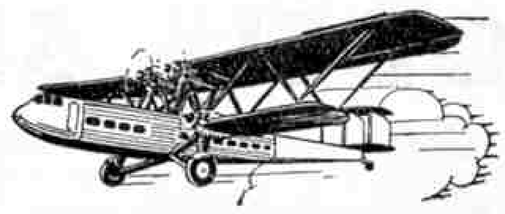
MODELS FROM £4. 12s. CASH
(Sturmey-Archer 3-speed gear 21/- extra, cash)
Deferred Terms.
5/- *down and 12 equal monthly payments from 8/9. Sturmey-Archer 3-speed gear 2/1 extra monthly. Dunlop tyres and the best of everything. Raleigh "Dynolamp" patent lighting unit 16/9 extra. Send for free copy of "The Jubilee Book of the Raleigh" and address of nearest dealer.*

THE RALEIGH CYCLE CO. LTD.
NOTTINGHAM (Depots and Agents Everywhere).

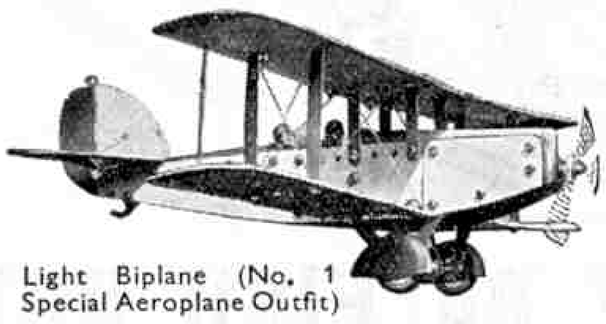
RALEIGH
THE ALL-STEEL BICYCLE
INDIVIDUALLY PRODUCED

Fit the Sturmey-Archer 3-speed gear—the gear that "makes cycling easy"

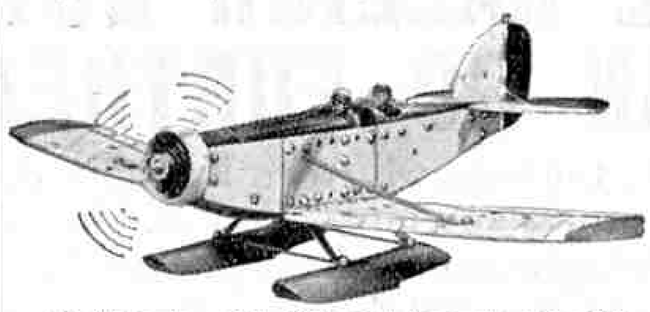
AEROPLANE CONSTRUCTOR OUTFITS







Light Biplane (No. 1 Special Aeroplane Outfit)



Civil Seaplane (No. 2 Special Aeroplane Outfit)

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.

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.



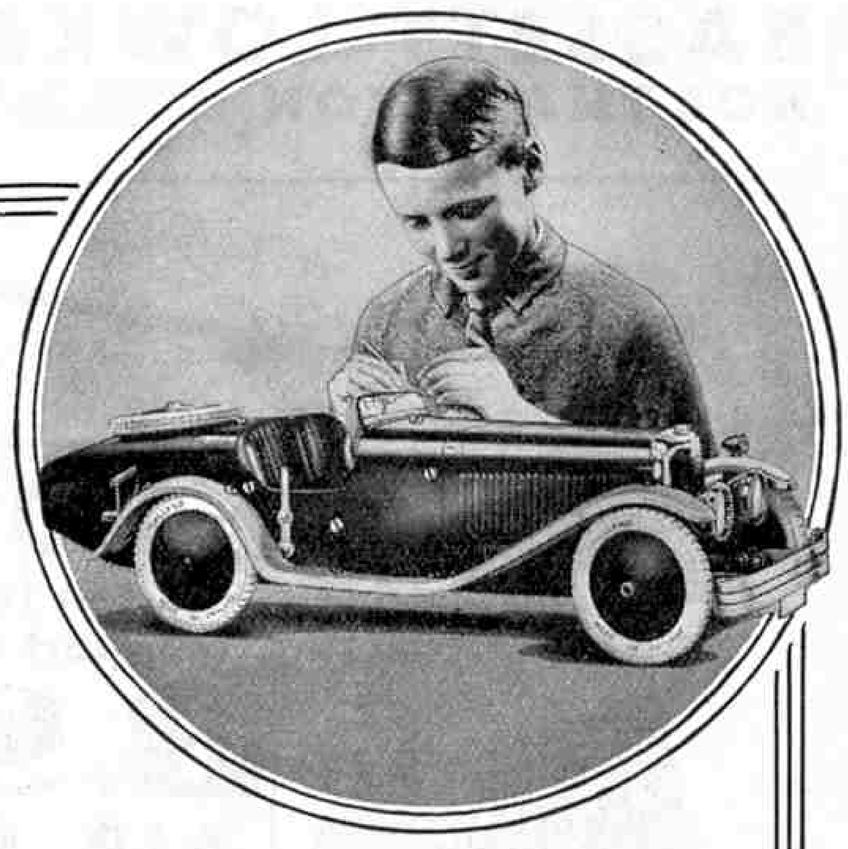
No. 2 Special Aeroplane Outfit. Price **21/–**

No. 1 AERO CLOCKWORK MOTOR

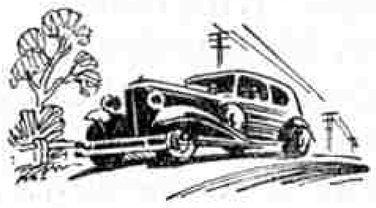
This Motor fits into the fuselage of models made with No. 1, No. 2, No. 1 Special or No. 2 Special Aeroplane Outfits. It will rotate the propeller at high speed, thus adding to the realism of the model. Price **1/9**

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.

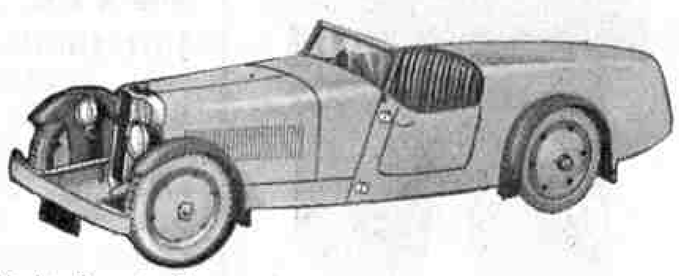
A powerful Clockwork Motor that gives a run of 150 feet on one winding is included in the Outfit. Price **20/–**

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 5 in. Length 13 in. Width 7⅞ in. Price **5/6**



Light Sports Two-seater (No. 1 Outfit)



Saloon Coupé (No. 1 Outfit)

A CORONATION NAVAL REVIEW

with

SHIPSERIES Water-line Models, scale 100′=1″.

Can YOU tell one ship from another? If you are a **SHIPSERIES** modeller you will know the different types.

SHIPSERIES latest, complete cast models:

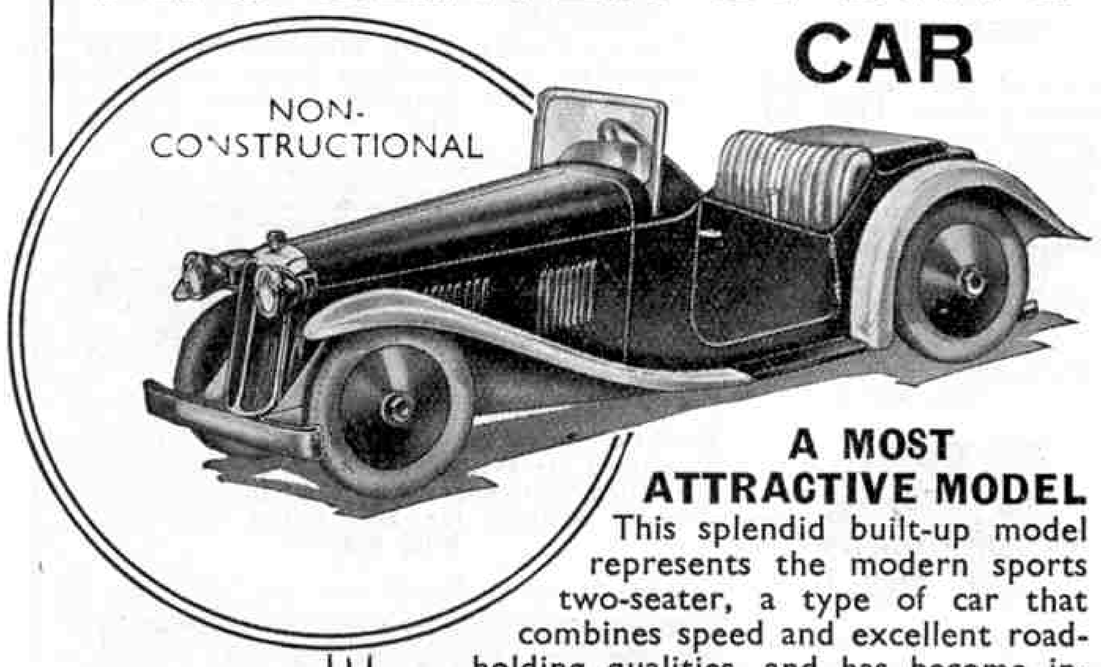
The Leander class, Cruiser - - - -	price **1′-**
Paddle Pleasure Steamer - - - -	,, **6d.**
Display Set, Ships of the Royal Navy - -	,, **2′6**
,, ,, ,, Merchant Navy -	,, **2′6**

Every Week is NAVY WEEK with these realistic models

For list and address of nearest agent, write:

A. J. HOLLADAY & CO. LTD. (Desk B)
3, Aldermanbury Avenue, London, E.C.2

A REALISTIC
TWO-SEATER SPORTS CAR



A MOST ATTRACTIVE MODEL

This splendid built-up model represents the modern sports two-seater, a type of car that combines speed and excellent road-holding qualities, and has become increasingly popular during recent years. Speed is suggested by the sweeping lines of the bodywork and mudguards, together with the sloping radiator and wind-screen.

The model faithfully resembles its prototype in all important respects. It is complete in itself, no constructional or assembly work being required. It steers from the wheel, and is fitted with a strong clockwork motor that gives a long and steady run.

Overall dimensions: Length, 8½ in.; Width, 3¼ in.; Depth, 2⅞ in.

Price **6′6**

The model is beautifully made and finished, and is richly enamelled in Blue and Cream

Manufactured by
Meccano Ltd., Binns Rd., Liverpool 13

Build your own engine

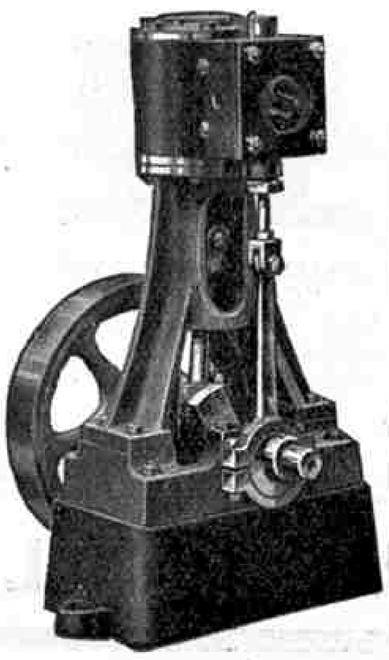
Only a few hand tools required.

Stuart No. 10.
Completely machined set with full Instructions:
from **18/6** post free.

All our sets from **5/-** upwards, illustrated and described in our No. 2 catalogue, 6d. post free.

72 pages fully illustrated.

STUART TURNER LTD.
Henley-on-Thames



Can you make Invisible Ink?

EXPERIMENT 38. Dissolve a few small crystals of Copper Sulphate in a little water, and use this solution as an ink to write on paper. When the message you have written becomes dry it will not be visible (unless you have made your solution too strong). You can now "develop" this "invisible ink" in two ways.

1. Warm the paper carefully in front of a fire, and the message will show up in dark letters.

2. Expose it to ammonia vapour, produced in Experiment 28, and the letters will become deep blue.



★Try out the above, it is only one of the many interesting and instructive experiments which can be carried out with Lott's Chemistry Sets.

LOTT'S CHEMISTRY BOX No. 1 ... ... 3′6

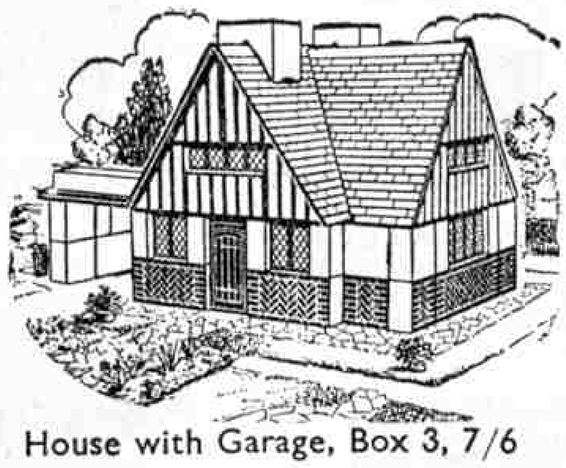
★PRICES

Box 0.	24	Experiments	2/-
,, 1.	42	,,	3/6
,, 2.	80	,,	6/-
,, 3.	131	,,	10/6
,, 4.	181	,,	15/6
,, 5.	228	,,	21/-

Also at 31/6, 42/-, 73/6 and 105/-.

Have you seen the New Tudor Blocks?

★All Boxes Now Contain bricks coloured to represent windows, doors and herring-bone bond brickwork, with which many beautiful buildings in the old English half-timbered style can be made.



House with Garage, Box 3, 7/6

★PRICES

Box 1.	18	Models ...	2/6
,, 2.	36	,, ...	5/-
,, 3.	54	,, ...	7/6
,, 4.	72	,, ...	10/-
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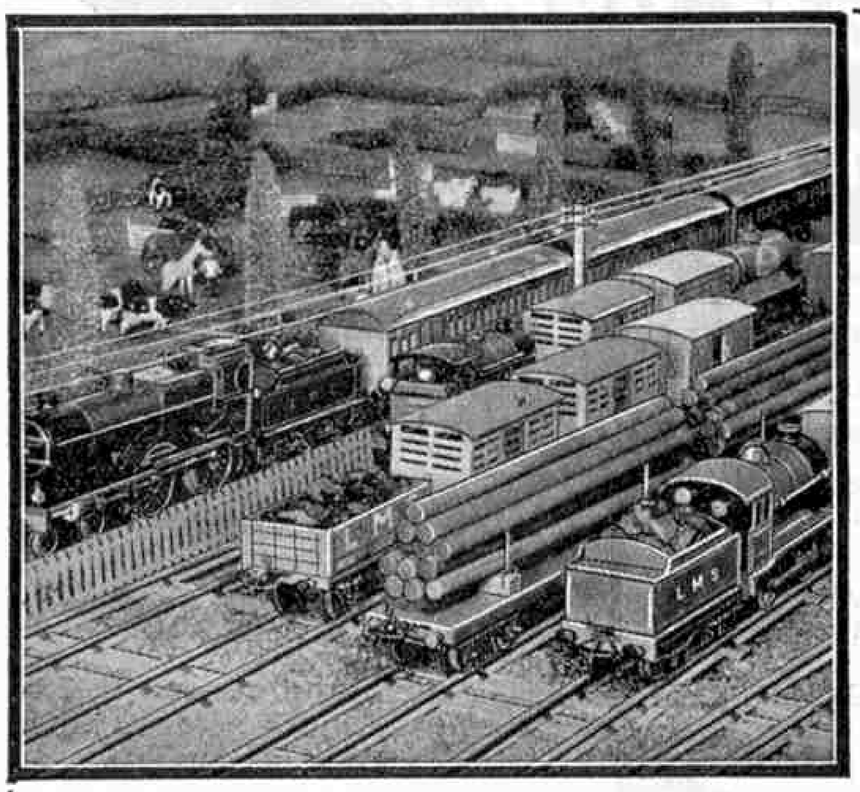
Ask your dealer for full particulars or write to the Manufacturers for illustrated lists of all products including Chemistry Spares and extracts from the Experiment Books.

Dept. M.M.

LOTT'S BRICKS LTD., WATFORD HERTS.

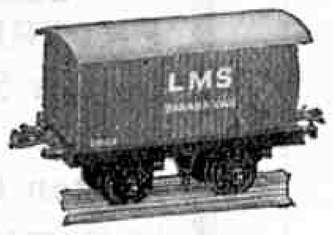
HORNBY ROLLING STOCK



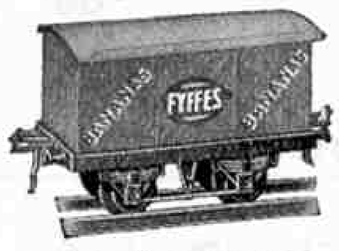


The Hornby Series includes a splendid range of realistic Rolling Stock. Each item is fitted with patented and exclusive automatic couplings, a special feature that places it in a class entirely of its own. There are Pullman Cars, Passenger Coaches, Guards' Vans, Tipping Wagons, Lumber Wagons, and many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

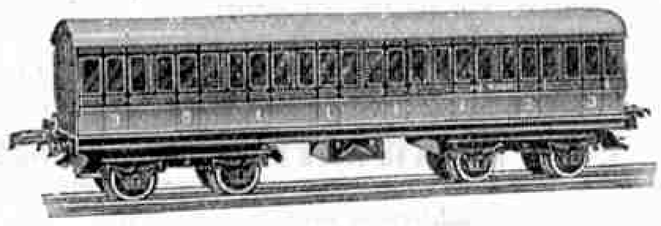
An attractive selection of Hornby Rolling Stock is illustrated and described on this page. Ask your dealer for a complete price list.



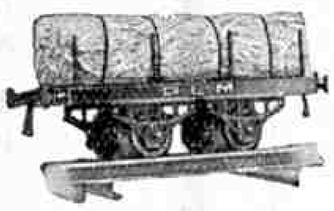
No. O BANANA VAN
Lettered L.M.S. only.
Price **1/9**



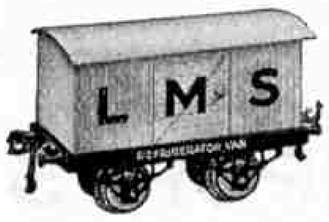
No. 1 BANANA VAN "FYFFES"
Sliding doors.
Price **2/9**



No. 2 PASSENGER COACH
Suitable for 2-ft. radius rails only. First-third, or Brake-third. Available in the colours of the L.M.S., L.N.E., G.W. or S. Railway groups.
Price **7/6**



FIBRE WAGON
This is an interesting model of a type of wagon used in France and other European countries.
Price **1/3**



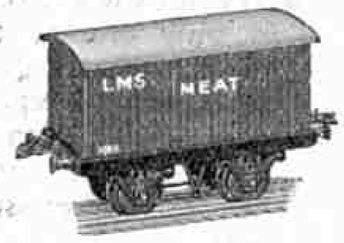
***REFRIGERATOR VAN**
Finished in red. With opening doors. Price **2/9**



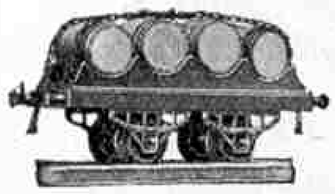
No. 1 TIMBER WAGON
Beautifully enamelled in yellow and red.
Price **1/6**



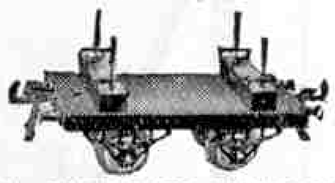
No. 1 SIDE TIPPING WAGON
Excellent design and finish. Lettered "Robert Hudson Ltd."
Price **2/–**



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



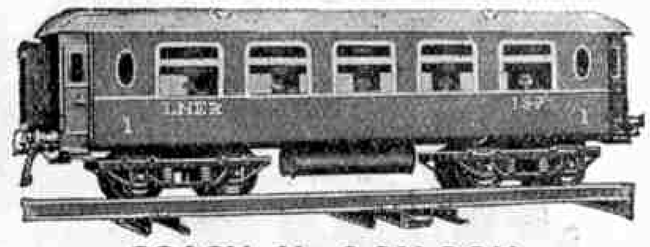
BARREL WAGON
This is another interesting model of a type of wagon used in France and other European countries.
Price **2/6**



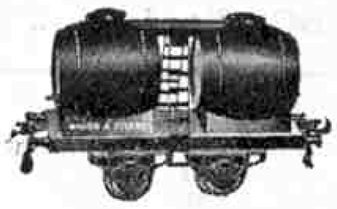
No. 1 LUMBER WAGON
Fitted with bolsters and stanchions for log transport.
Price **1/6**



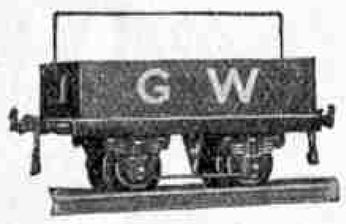
SNOW PLOUGH
With revolving plough.
Price **3/9**



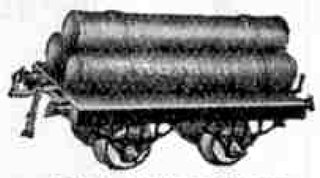
COACH, No. 2 SALOON
Realistic in design and beautifully finished. Two types are available: L.N.E.R. (as illustrated) enamelled brown, and L.M.S. enamelled maroon. Suitable for 2-ft. radius rails only.
Price **9/6**



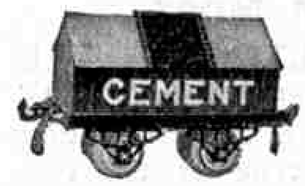
WINE WAGON DOUBLE BARREL
An attractive model artistically enamelled in red and green.
Price **4/6**



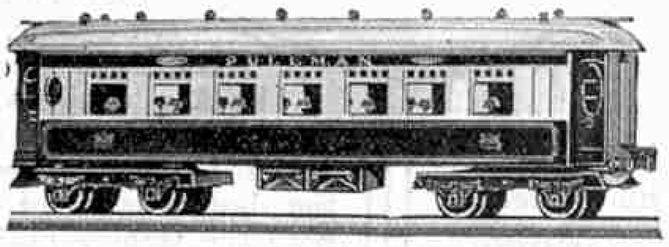
***OPEN WAGON "B"**
Similar to Hornby Wagon No. O but fitted with centre tarpaulin supporting rail.
Price **2/–**



GAS CYLINDER WAGON
Finished in red, lettered gold.
Price **1/11**

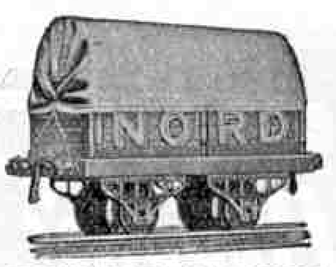


CEMENT WAGON
The door at the top opens. Finished in bright red.
Price **2/6**

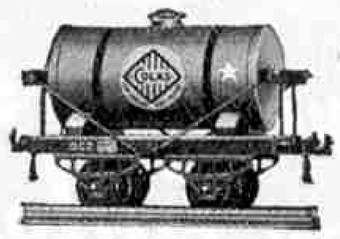


COACH, No. 2 SPECIAL PULLMAN
For 2-ft. radius rails only.
Price **13/–**

COACH, No. 2 SPECIAL PULLMAN COMPOSITE
For 2-ft. radius rails only.
Price **14/–**



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**



TROLLEY WAGON
Finished in brown and blue. Suitable for 2-ft. radius rails only.
Price **3/9**

TROLLEY WAGON
Fitted with two Cable Drums.
Price **4/3**



No. 2 HIGH CAPACITY WAGON
Finished in correct colours of G.W.R. and L.M.S.R. "Loco Coal" Wagons, or L.N.E.R. "Brick" Wagon.
For 2-ft. radius rails only.
Price **3/9**



***No. O WAGON**
Price **1/6**

***No. 1 WAGON**
(Illustrated).
Price **1/9**



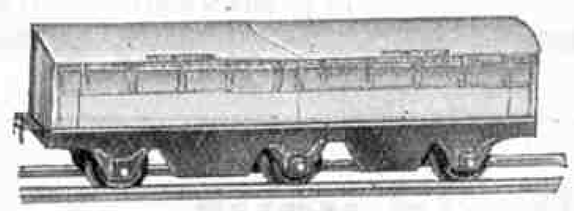
COAL WAGON
Similar to Hornby Wagon No. O. Fitted with an embossed representation of coal.
Price **2/3**



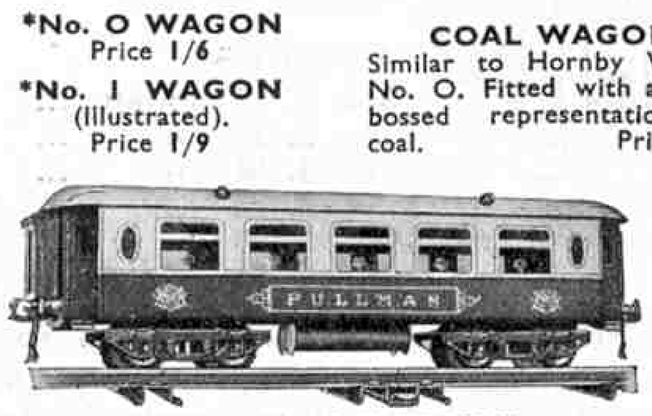
OIL TANK WAGON "MOBILOIL"
Finished in battleship grey.
Price **2/–**



No. 1 PETROL TANK WAGON, "SHELL-B.P."
Price **2/–**



COACH
No. O "SILVER JUBILEE"
Articulated. Finished in silver and grey.
Price **1/9**



COACH, No. 2 PULLMAN
For 2-ft. radius track only.
Price **9/6**



No. O MILK TRAFFIC VAN
An attractive model. Available lettered G.W. only.
Price **1/9**



CHOCOLATE VAN "CADBURY'S"
This van is beautifully enamelled in blue with white roof.
Price **2/9**

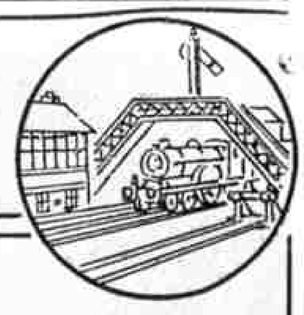


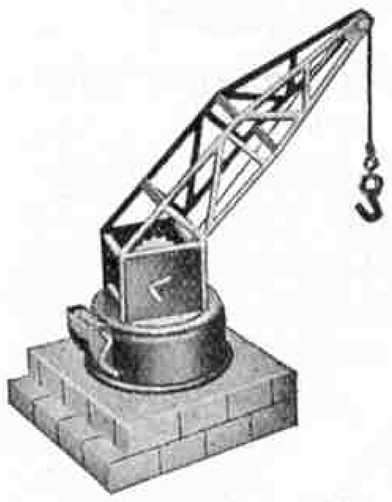
No. 2 TIMBER WAGON
For 2-ft. radius rails only.
Price **2/6**

Lettered L.M.S., N.E., G.W. or S.R.

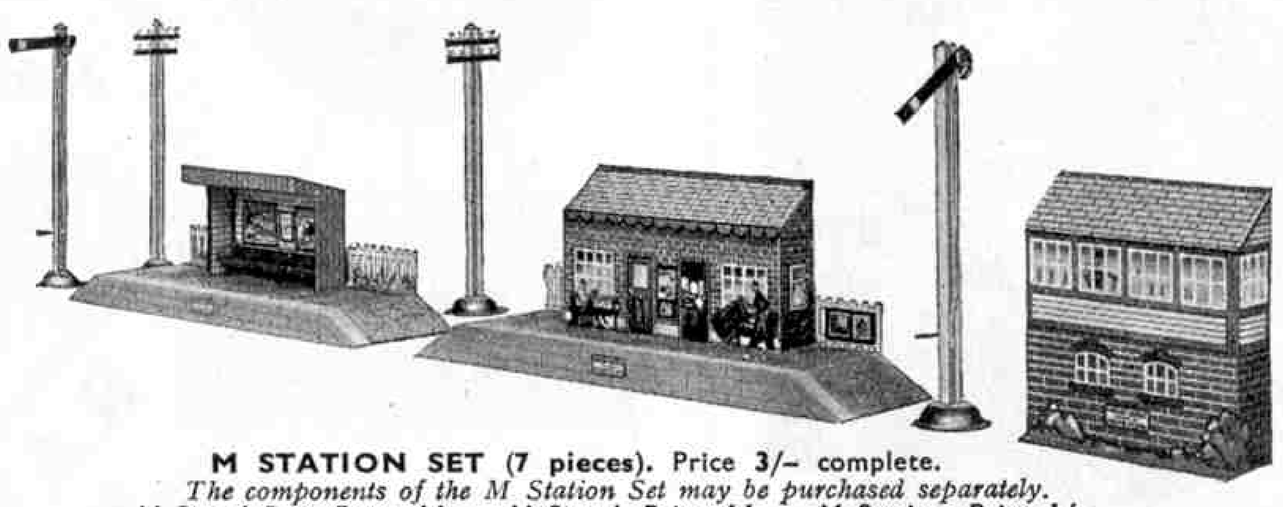
MECCANO LTD., BINNS ROAD, LIVERPOOL 13

HORNBY ACCESSORIES





PLATFORM CRANE
Fitted with a crank handle and ratchet mechanism.
Price **3/11**

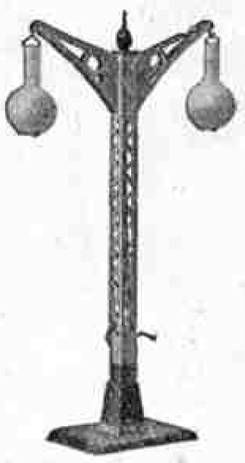


M STATION SET (7 pieces). Price **3/–** complete.
The components of the M Station Set may be purchased separately.
M Signal Box. Price **4d.** M Signal. Price **4d.** M Station. Price **1/–.**
M Telegraph Pole No. 1. Price **3d.** Wayside Station. Price **9d.**



No. 1E LAMP STANDARD ELECTRICAL
(Single, as illustrated.)
Price **2/11**

No. 2E LAMP STANDARD ELECTRICAL
(Double.)
Price **3/3**

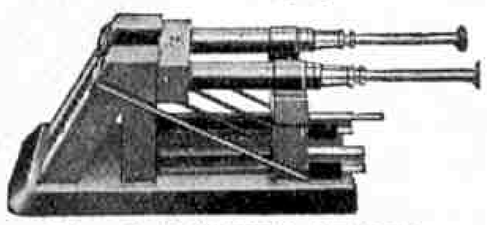


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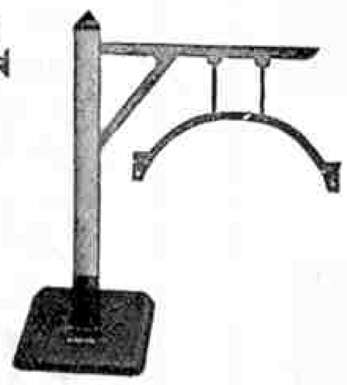
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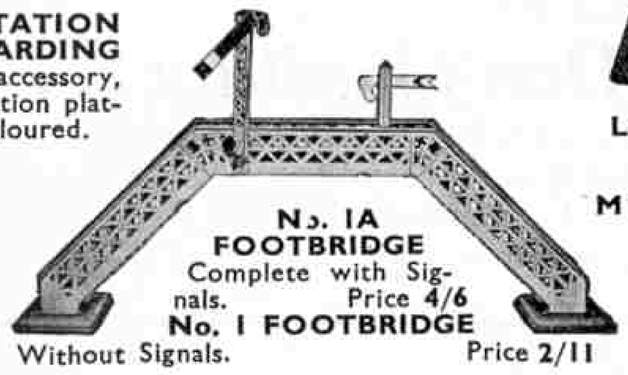


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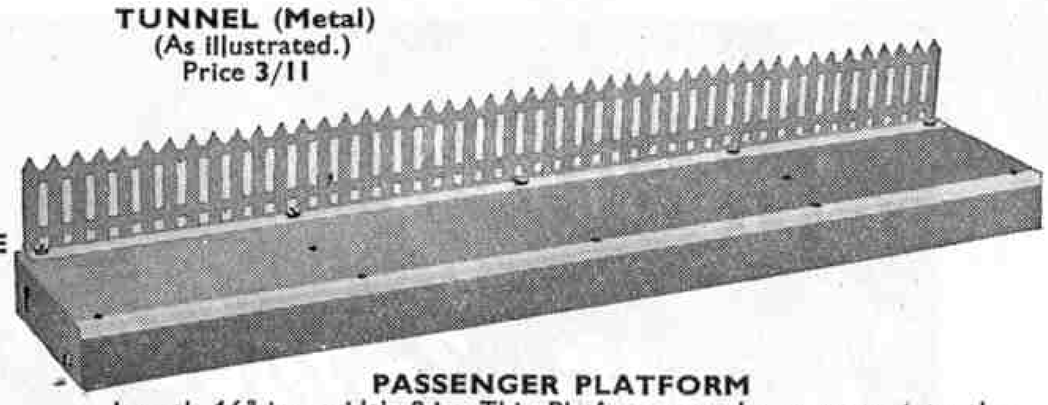


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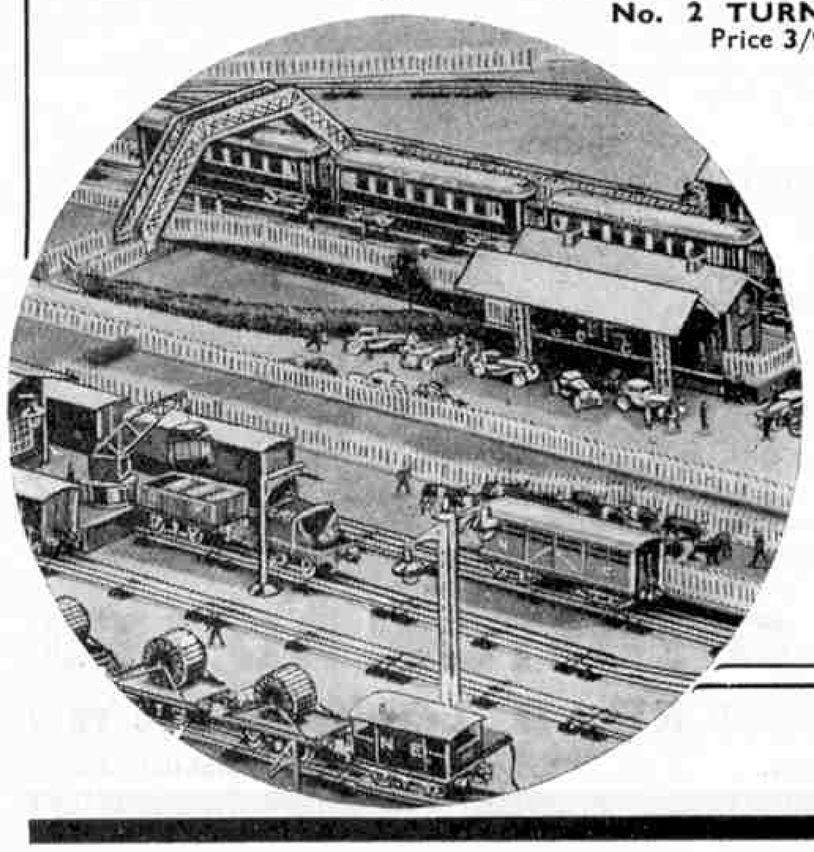
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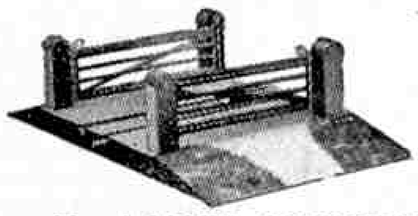


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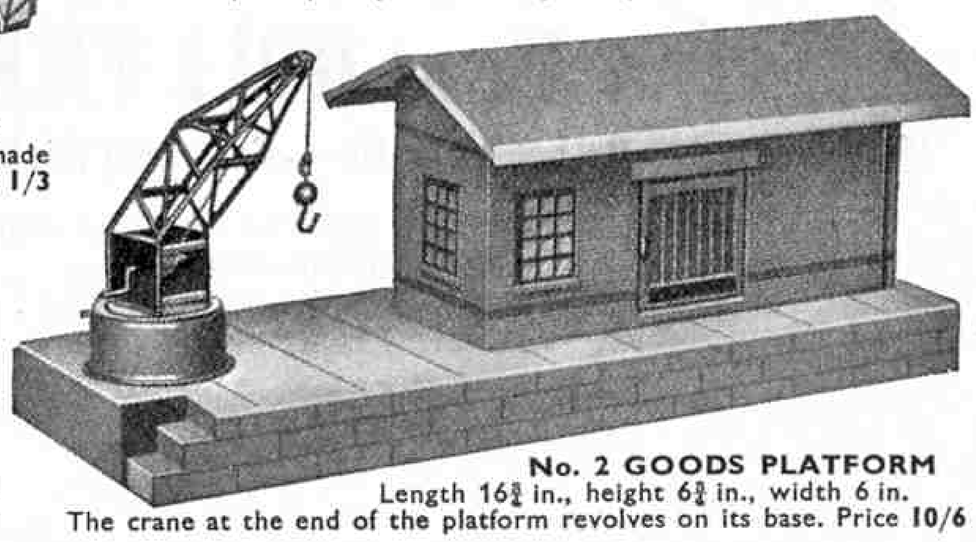


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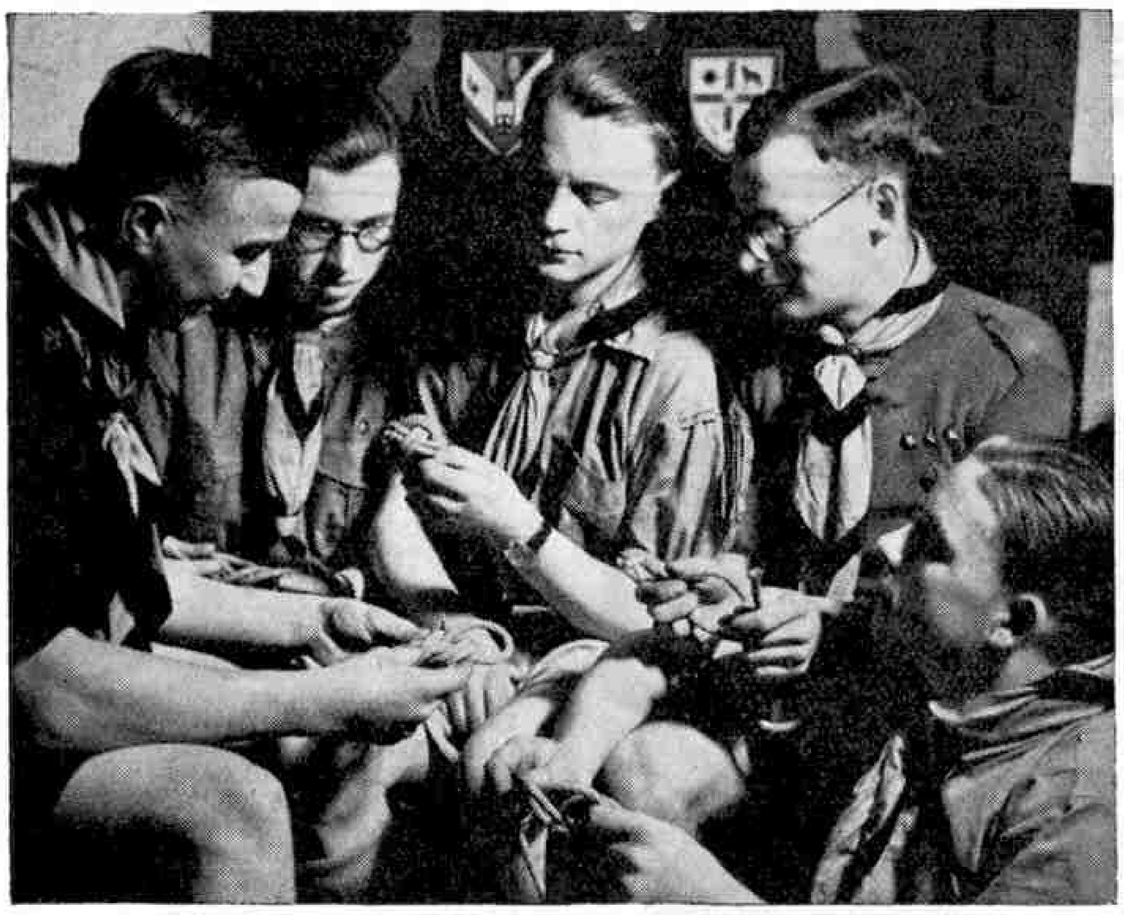


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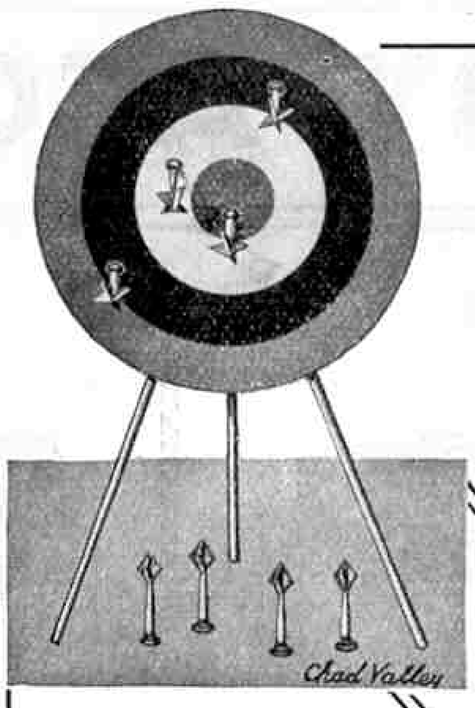
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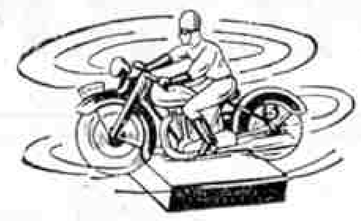
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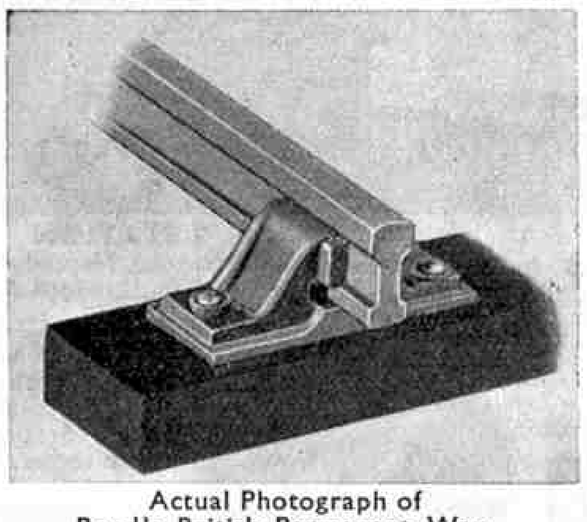
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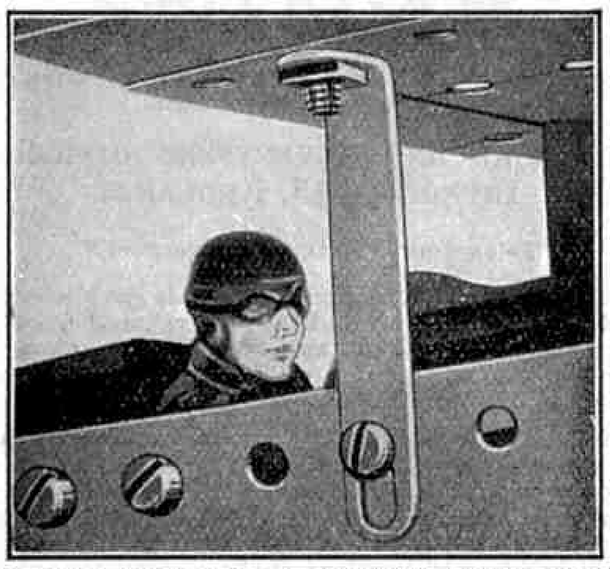
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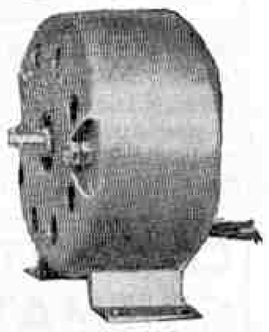
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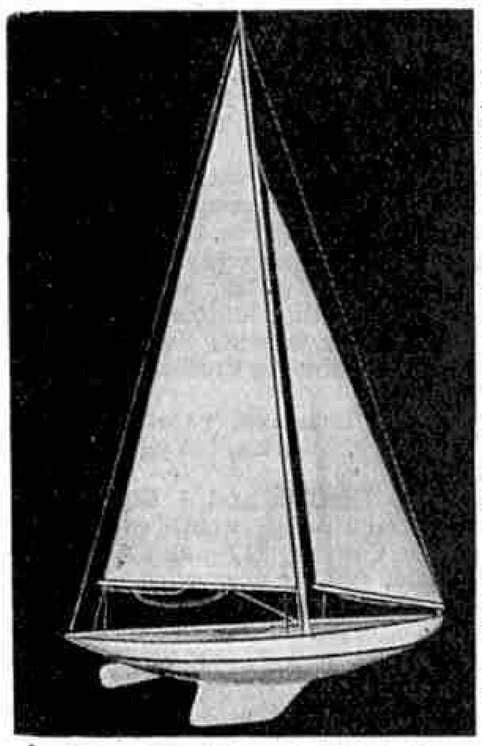
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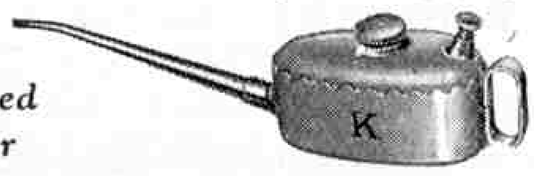
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MECCANO MAGAZINE

Registered at G.P.O., London, for transmission by Canadian Magazine Post.

EDITORIAL AND ADVERTISING OFFICE:—
LIVERPOOL 13, ENGLAND.

Telegrams: "Meccano, Liverpool."

Publication Date. The "*M.M.*" is published on the 1st of each month and may be ordered from any Meccano dealer, or from any bookstall or newsagent, price 6d. per copy. It will be mailed direct from this office, 4/– for six issues and 8/– for twelve issues.

To Contributors. The Editor will consider articles and photographs of general interest and payment will be made for those published. Whilst every care will be taken of articles, etc., submitted, the Editor cannot accept responsibility for any loss or damage. A stamped addressed envelope of the requisite size should be sent where the contribution is to be returned if unacceptable.

Readers' Sales and Wants. Private advertisements (i.e., not trade) are charged 1d. per word, minimum 1/–. Cash with order. Editorial and Advertising matters should not be dealt with on the same sheet of paper.

Small Advertisements. 1/6 per line (average seven words to the line), or 16/– per inch (average 12 lines to the inch). Cash with order.

Display. Quotations for space bookings, and latest net sale figures, will be sent on request.

Press Day, etc. Copy should be sent as early in the month as possible for insertion in following issue. We usually close for press on or before 6th of each month for following issue. Half-tone blocks up to 100 screen.

Proofs of advertisements will be sent when possible for space bookings of not less than half-an-inch.

Voucher copies. Sent free to advertisers booking one inch or over. Other advertisers desiring vouchers should add 8d. to their remittance and should order voucher copy at same time.

Remittances. Postal Orders and Cheques should be made payable to Meccano Ltd.

Ordering the "M.M." Overseas

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

The U.S.A. price is 15c. per copy, and the subscription rates $1 and $2 for 6 and 12 months respectively (post free).

Overseas readers are reminded that the prices shown throughout the "*M.M.*" are those relating to the United Kingdom and Northern Ireland. Current Overseas Price Lists of Meccano Products will be mailed free on request to any of the undermentioned agencies. Prices of other goods advertised may be obtained direct from the firms concerned.

CANADA: Meccano Ltd., 187-189, Church St., Toronto.

UNITED STATES: Meccano Co. of America Inc., New Haven, Conn., Meccano Co. of America Inc., 200, Fifth Av., New York.

AUSTRALIA: Messrs. E. G. Page & Co., 52, Clarence Street, Sydney, N.S.W.

NEW ZEALAND: Models Limited, Third Floor, Paykel's Buildings, 9, Anzac Avenue (P.O. Box 129), Auckland, C.1.

SOUTH AFRICA: Mr. A. E. Harris (P.O. Box 1199), 142, Market Street, Johannesburg.

INDIA: Karachi: Daryanamal and Bros., Elphinstone Street, Bombay; Bombay Sports Depot, Dhobi Talao. Calcutta: Bombay Sports Depot, 2, Lindsay Street. Madras: Bombay Sports Depot, 162, Mount Road.

The Editor wishes to make known the fact that it is not necessary for any reader to pay more than the published price. Anyone who is being overcharged should lodge a complaint with the Meccano agent in his country or write direct to the Editor.

WEBLEY AIR PISTOLS



Marvellously accurate for target practice.
No license required to purchase.
Senior 45/-, Mark 1 30/-, Junior 20/-, Webley Air Rifle 84/-
Write for List. WEBLEY & SCOTT LTD., 87, WEAMAN STREET, BIRMINGHAM, ENG.

MECCANO

ENGINEERING FOR BOYS

The Best Hobby in the World for Boys

Every boy is happiest when he is inventing, creating and building. That is the reason for the everlasting popularity of Meccano. It is the most wonderful and the most fascinating hobby in the world, because it enables full scope to be given to all the inclinations and desires that are the natural heritage of boys.

There is no limit to the number of models that can be built with Meccano—Cranes, Clocks, Motor Cars, Ship-Coalers, Machine Tools, Locomotives—in fact everything that interests boys. The most wonderful thing about Meccano is that it is REAL ENGINEERING; yet it is so simple that any boy can join in the delightful fun and excitement of model-building without having to learn anything. A beautifully illustrated Book of Instructions and a screwdriver and a spanner—the only tools required—are included with every Outfit.

Make friends with your dealer—he can help you.

Prices of Meccano Outfits

COMPLETE OUTFITS

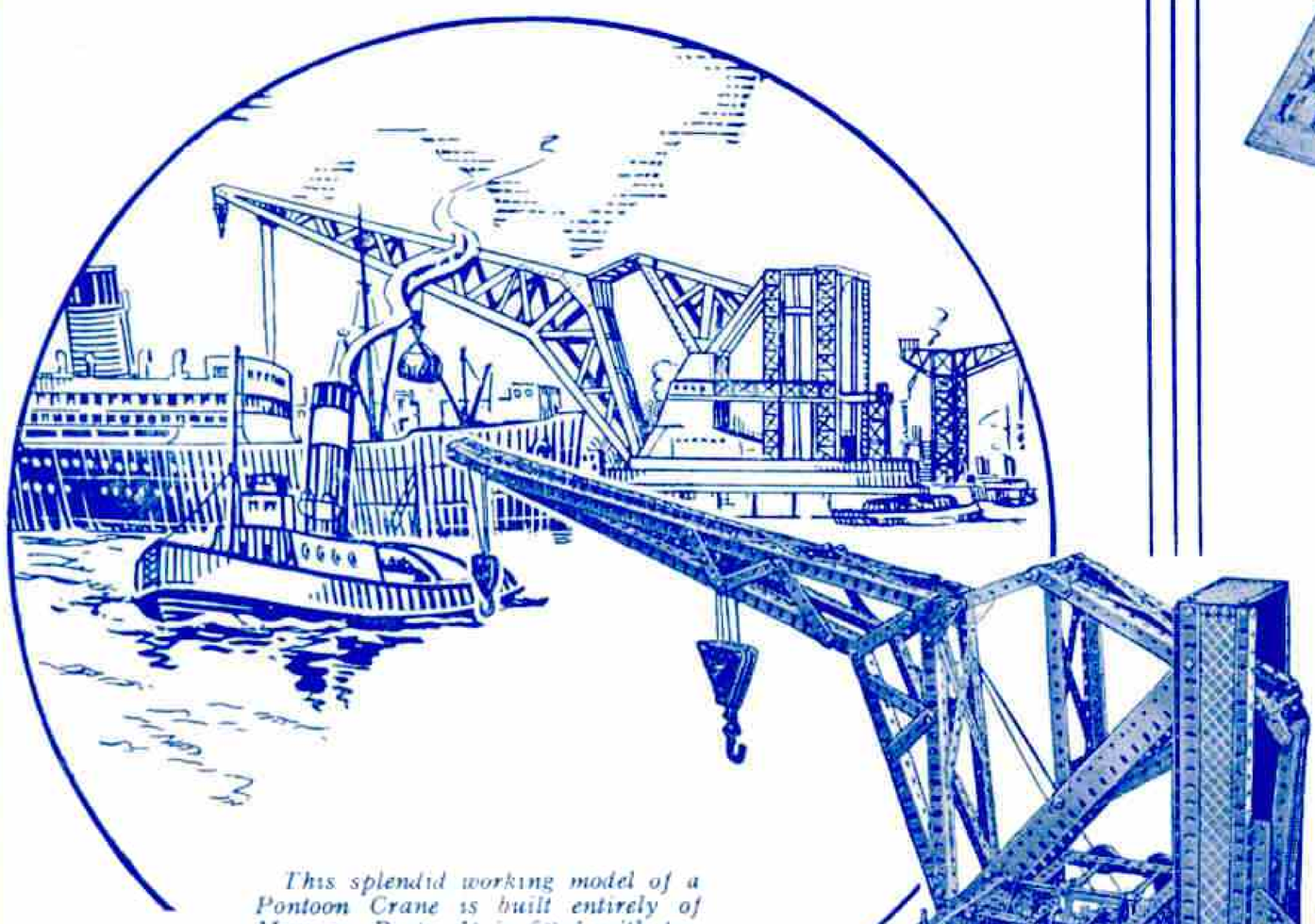
A	Outfit	each	5/-
B	,, ...	,,	7/6
C	,, ...	,,	10/-
D	,, ...	,,	15/-
E	,, ...	,,	20/-
F	,, ...	,,	30/-
G	,, ...	,,	55/-
H	,, (Carton)	,,	72/6
Hw	,, (Cabinet)	,,	97/6
K	,, (Carton)	,,	132/6
Kw	,, (Cabinet)	,,	157/6
L	,, (,,)	,,	400/-

ACCESSORY OUTFITS

Aa	converts A Outfit into	B	each	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/-

* Carton † Cabinet

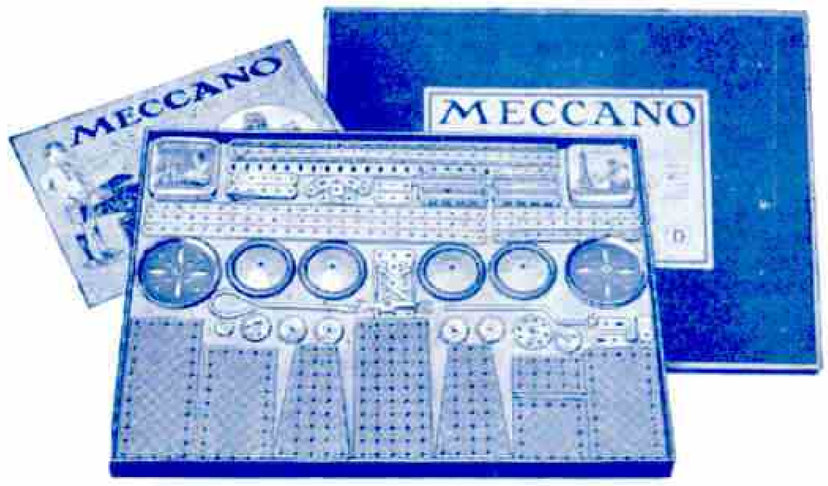
Meccano Limited, Binns Road, Liverpool 13



This splendid working model of a Pontoon Crane is built entirely of Meccano Parts. It is fitted with two Electric Motors, one of which controls the swivelling and luffing movements, while the other controls the two pulley blocks. A beautifully illustrated 4-page folder, giving full instructions for building the model can be obtained from any Meccano dealer, price 2d., or direct from Meccano Ltd., Binns Road, Liverpool 13, price 3d., post free. Ask for Leaflet No. 28.



A Meccano Outfit. Price 5/-



D Meccano Outfit. Price 15/-



H Meccano Outfit. Price 72/6



HORNBY SPEED BOATS

The best of all outdoor pastimes

Sailing a model speed boat is one of the most thrilling hobbies you could have, brimful of excitement from start to finish. But the amount of fun you get depends on the kind of boat that flies your colours. That's why you'll be proud to own a Hornby–every inch a champion, sleek, smart and swift.

Remember, Hornby Boats are the best that you can buy–best in appearance, and best in performance and reliability.

There are five splendid models from which to choose, beautifully finished in attractive colours. Each one follows closely the design and general characteristics of a famous speed boat prototype.

Each model is built with the same precision and craftsmanship as the famous Hornby Trains. Ask your dealer to show you the full range and see for yourself how perfect they are!

Manufactured by MECCANO LTD., Binns Road, Liverpool 13.

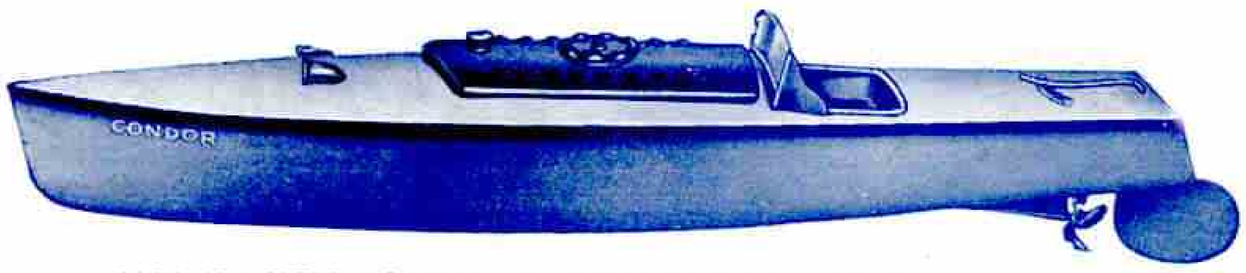




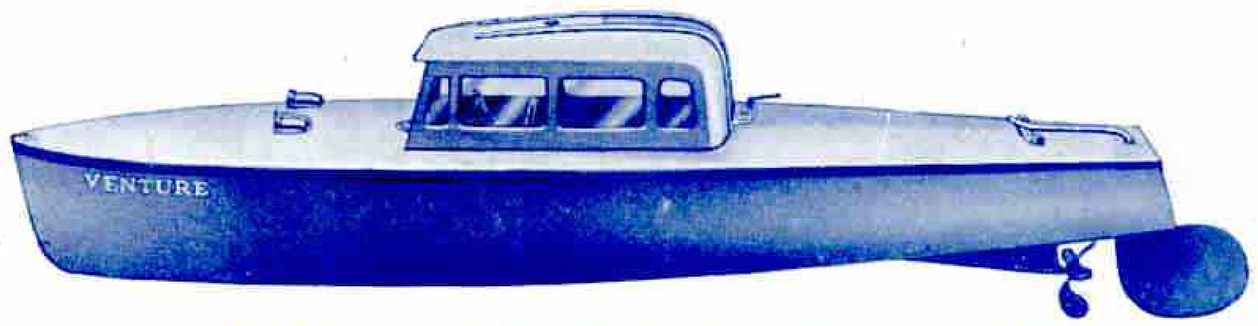
HORNBY SPEED BOAT No. 1 "CORONATION." Price **2'11**
Travels over 100 ft. on one winding. Dimensions: Length 9¼ in. Beam 3 in.



HORNBY SPEED BOAT No. 2 "SWIFT." Price **7'6**
Travels over 300 ft. on one winding. Dimensions: Length 12½ in. Beam 3 in.



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



HORNBY LIMOUSINE BOAT No. 4 "VENTURE." Price **15'6**
Travels over 500 ft. on one winding. Dimensions: Length 16½ in. Beam 3½ in.

HORNBY CABIN CRUISER No. 5 "VIKING." Price **16'6**
Travels over 500 ft. on one winding. Dimensions: Length 16½ in. Beam 3½ in.

Join the Hornby Speed Boat Club

If you own a Hornby Boat you should join the Hornby Speed Boat Club. You can do this by purchasing a special badge (illustrated above) from any Meccano dealer, or direct from Meccano Ltd., price **6d.**



Pennants

Pennants for Hornby Speed Boats Nos. 3 and 4 may be purchased separately. They add the final touch of realism to these boats. Price **2d.** each

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