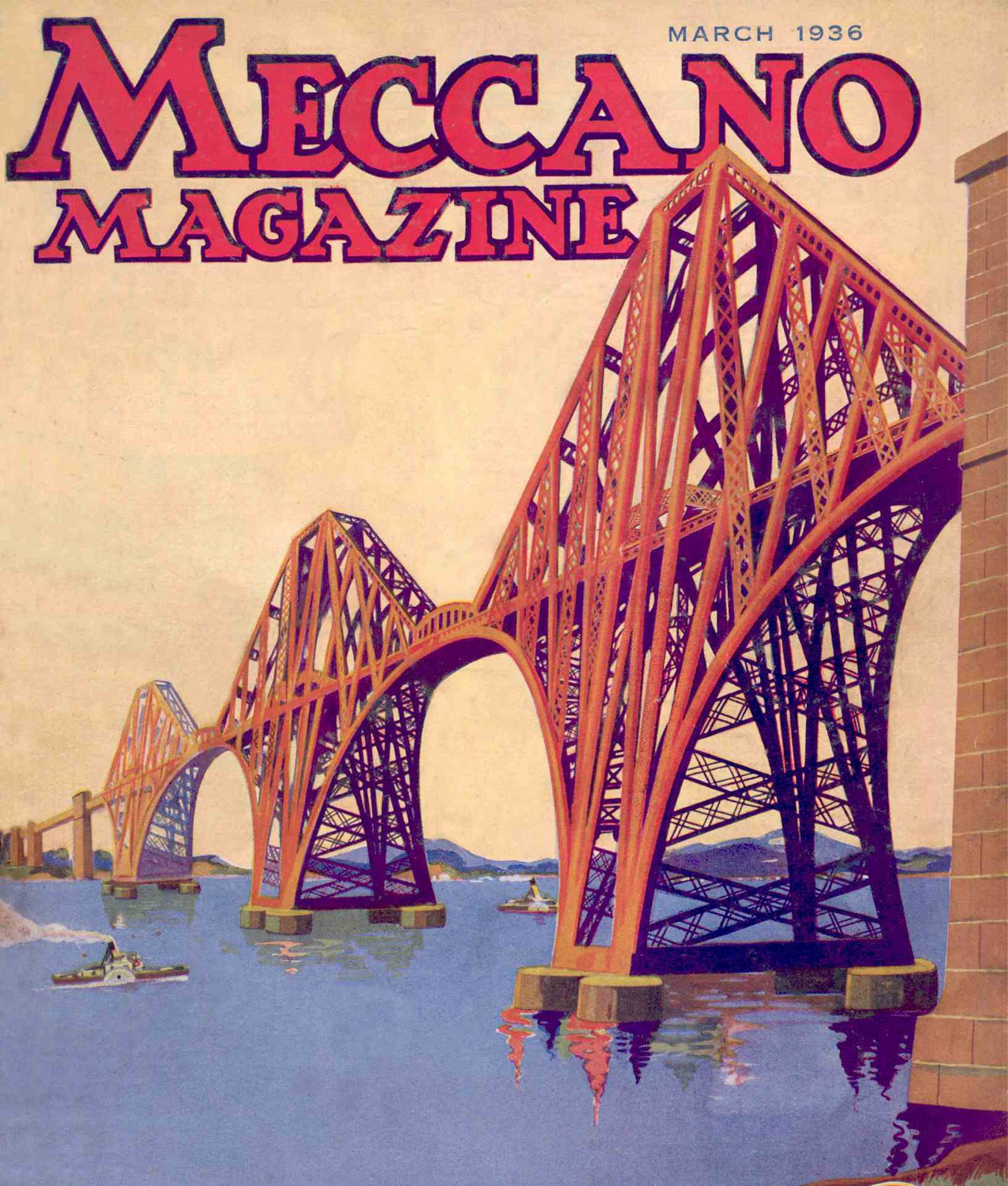
MARCH 1936

MECCANO MAGAZINE



Famous Bridges.

(See page 130)

No.3
VOL.XXI

PRICE
6d

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

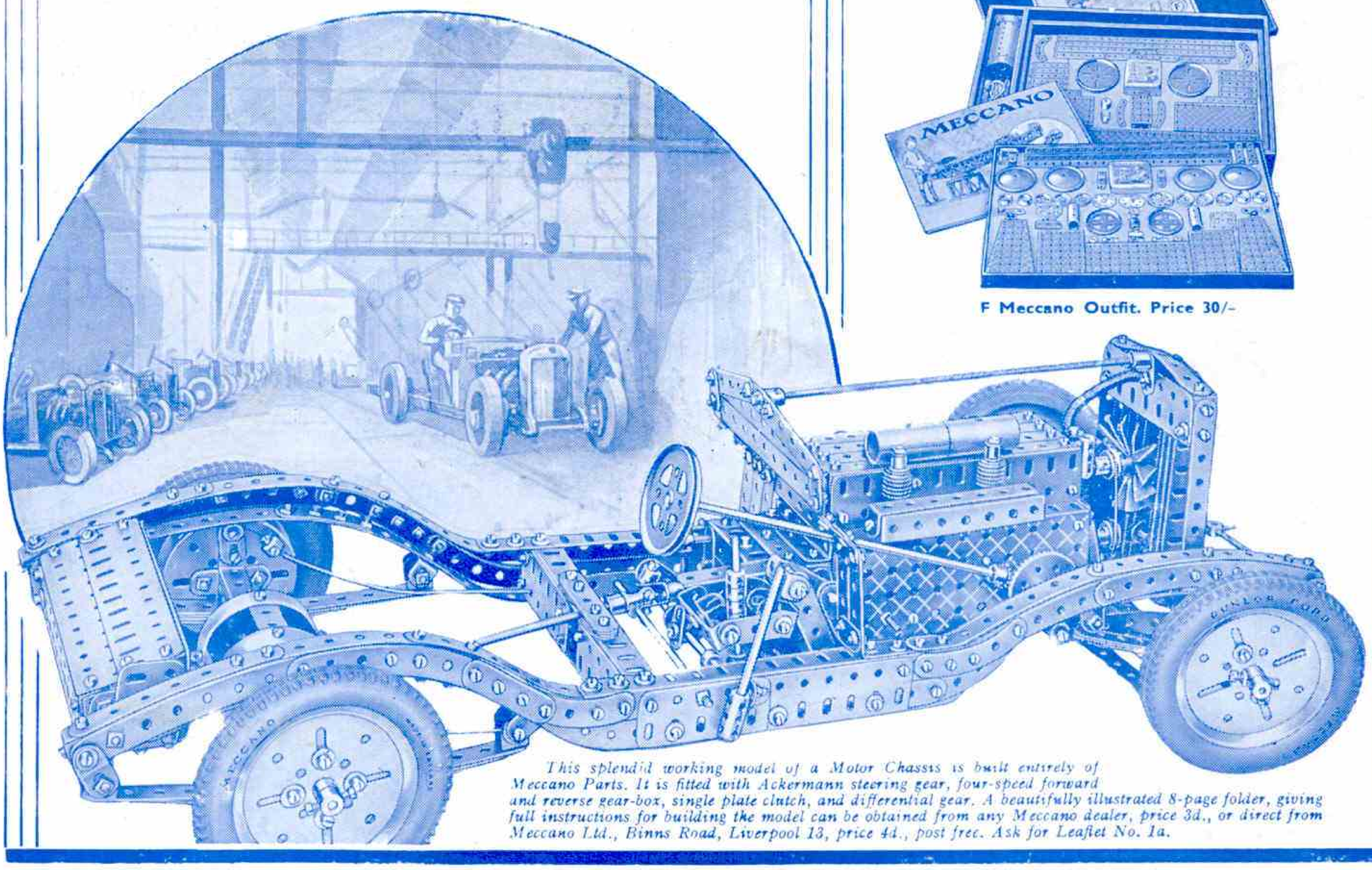
Aa	converts A Outfit into B	each	2/6
Ba	B	C	..	3/-
Ca	C	D	..	5/6
Da	D	E	..	5/6
Ea	E	F	..	11/-
Fa	F	G	..	26/6
Ga	G	H	..	17/6
Ha	H	K	..	60/-
Ka	K	L	..	225/-

Meccano Limited, Binns Road, Liverpool 13

A Meccano Outfit. Price 5/-

D Meccano Outfit. Price 15/-

F Meccano Outfit. Price 30/-



This splendid working model of a Motor Chassis is built entirely of Meccano Parts. It is fitted with Ackermann steering gear, four-speed forward and reverse gear-box, single plate clutch, and differential gear. A beautifully illustrated 8-page folder, giving full instructions for building the model can be obtained from any Meccano dealer, price 3d., or direct from Meccano Ltd., Binns Road, Liverpool 13, price 4d., post free. Ask for Leaflet No. 1a.

EXTRA SPECIAL EDITION

SEE THE JUBILEE TRAIN WITH THE 'SILVER LINK' LOCOMOTIVE

Hamley's News

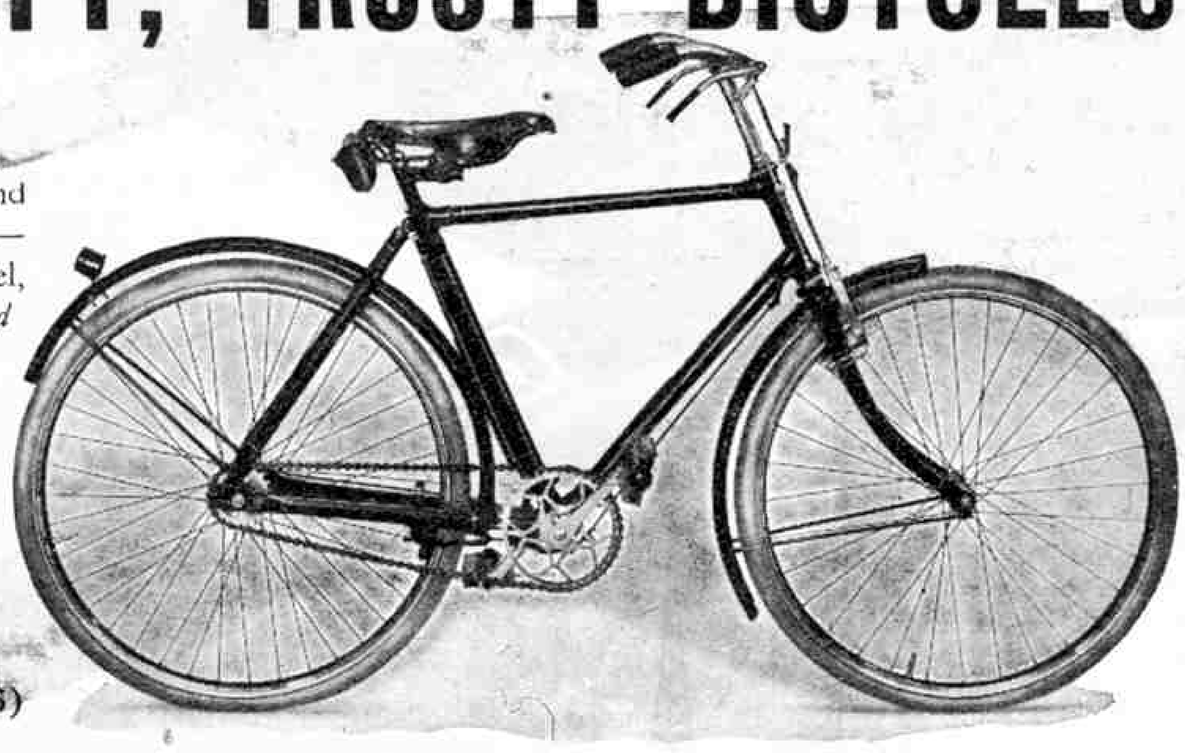
· HAMLEY · BROTHERS · LTD · ESTABLISHED · 1760 ·

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

No. 35 *Friday, March 29th*

BOOK YOUR COPY OF THE EASTER LIST **NOW.** FULL OF NEW IDEAS

NEW, SWIFT, TRUSTY BICYCLES



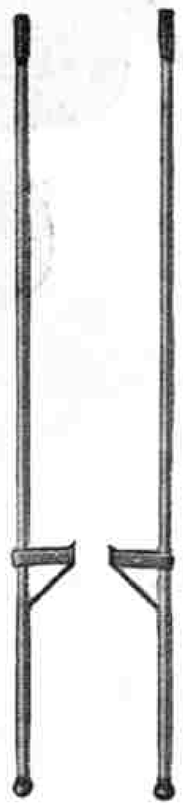
Here's the 'Unity' Cycle, a grand cycle with swift modern lines—chromium plating, black enamel, smartly picked out in green. *And* they're absolutely dependable—materials, workmanship are all of the best. They're fitted with the famous Dunlop Tyres. Unitys are grand cycles for boys and girls from 5-15. Price

£3 15 0 (BOYS)

£3 19 6 (GIRLS)

Three speed £1 0 0 extra

STILTING *is grand sport*



You can tower above everyone's head, look in at high windows, reach the branches of trees, walk along with giant strides, if you have a good pair of stilts. You can alter the height of this pair, and they've got rubber handles and pads—they're the best stilts you can get anywhere.

Price **7/6**

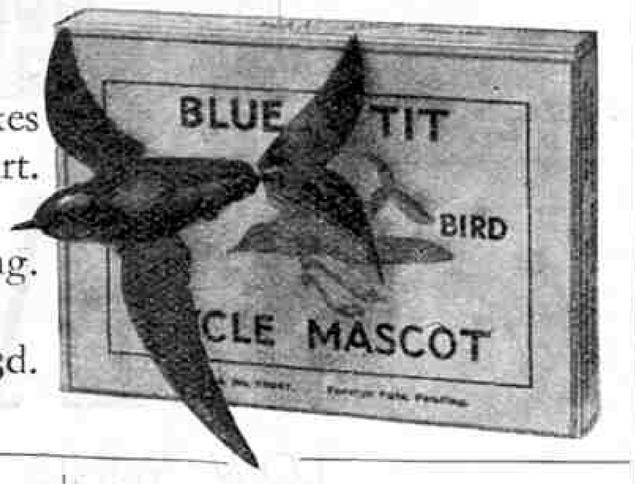
Carriage 1/-

CYCLING'S MORE FUN *with a Speedometer*

When you swoop down hill with the wind behind you and you feel the thrill of speed, it's grand to know just what pace you're going. Those long journeys, too—it's good to know exactly how far you've been—and how far you've cycled altogether—and how many miles your faithful bicycle has taken you. You get all this with one of these Speedometers—they're dead accurate and very easy to fit.

Price **19/6** Post 6d.

A FLYING MASCOT FOR YOUR HANDLEBARS



The Blue Tit Mascot makes your bicycle extra smart. Its wings flap and its tail revolves as you ride along.

Price **1/3** Post 3d.

Split Second Timing

A stop watch brings new interest to your games. Time your performance and your friends'—running, cycling, swimming to accurate fractions of a second—see whether you're improving. There are a thousand things to time with a stop watch. It's strong and absolutely reliable.

Price **15/-** Post 4d.

The Editor says:

This page has room to show only a few of the toys, models, the immense range of equipment for all sports and pastimes to be seen at Hamley's. Drop in and see us at 200–202, Regent Street. You will enjoy an hour or two looking round.

Correspondence is invited on all matters connected with model aeroplanes, speed boats, trains, motor cars, games, conjuring and other pastimes. If our limited space prevents our answering them in this page they will be answered personally.

Write to the Editor, Hamley's News, 200–202, Regent Street, W.1.

POWERFUL *LONG-RANGE* CATAPULT

If you want a really businesslike catapult, accurate, with an enormous range, here it is. It's got immensely powerful elastic, a stout leather sling, and very strong wooden handles.

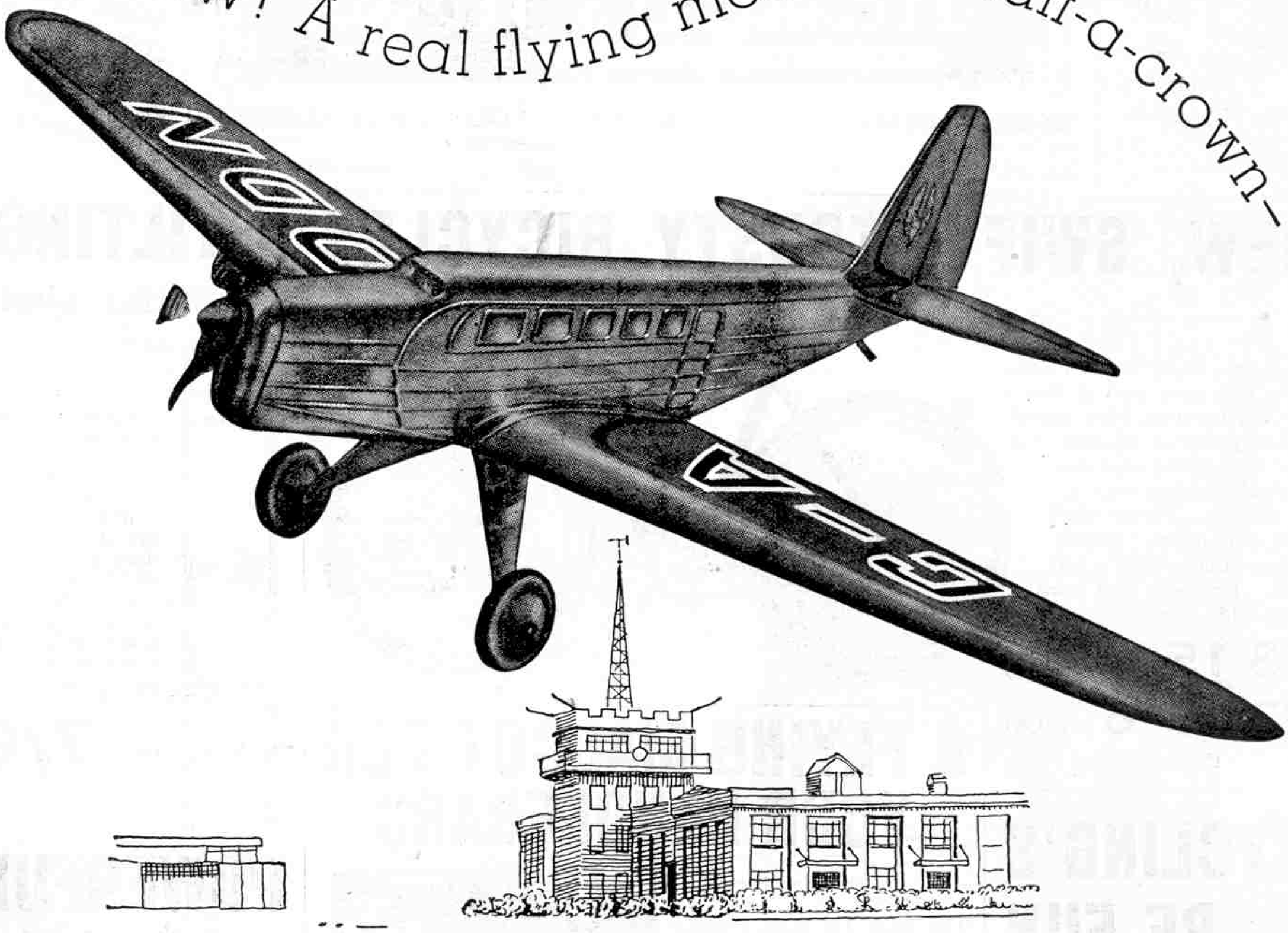
Price **1/9**

Post 3d.

STOP PRESS

First time ever seen in England. New constructional plane. Comes from Australia. Revolutionary method of construction—very easy to build—strong—flies fast and far. Details now available at Hamley's.

NEW! A real flying model for half-a-crown—



SILVER ARROW

LOW WING MONOPLANE SINGLE ENGINE AIR LINER

PRICE 2/6 EACH

For the first time, air-minded men can buy a real flying model for half-a-crown: true to type, with a good performance, the Silver Arrow reproduces latest developments in Air Liners. Its price has deliberately been fixed at half-a-crown to enable a small fleet to be acquired, and to encourage the study of the theory and practice of flight.

SPECIFICATION

Aluminium Fuselage: Propeller and Nose Piece detach in a crash: Accurate pitched Propeller: Adjustable Controls: Transparent Windows: Wing Span 16½ ins.: Spare Motor and Insertor Rod: Double surface detachable Wings.

Designed and made by International Mode Aircraft Ltd. Patented throughout the world. Sole concessionaires:—
Lines Bros. Ltd., Morden Road, London, S.W.19.

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 of how to obtain handsome enamelled Air Force pilot badges.

NAME.....

ADDRESS.....

Please write in block letters. 3/36

FREE

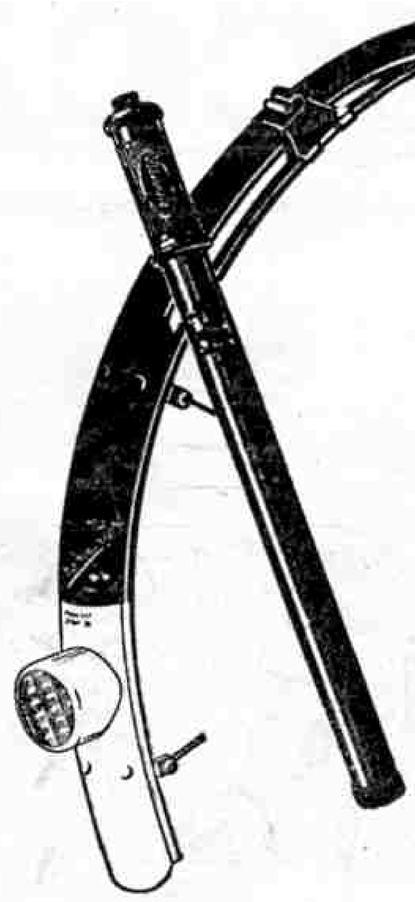
Send for your copy now!

- Autographed Story by "OPPY"
- Full-length Portrait of "OPPY"
- Pictures of Milliken and Stuart
- Details of B.S.A.-TERRY 1935 Records

The *inside* story of the greatest successful onslaught ever made on British Road Racing Records! Tells you how "Oppy," Milliken and Stuart astonished the cycling world in 1935. It's a book every clubman should possess. It's history—and it's an inspiration to everyone! What's more—it's FREE. Write for a copy to-day. Please mention this advertisement in your application.

Herbert Terry & Sons Ltd.

REDDITCH, WORCS.



HERE IS THE *new* MUDGUARD with *built-in* WHITE PATCH

Prov. Pat. No. 27917–35

Available in "Noweight," 7/3 per pair; "Featherweight," 5/2; and "Lightweight," 6/10. Without white patch, 6d. less. Fork clips extra if required.

15 in. "Featherweight" pump, 2/–. Others from 1/6.

No. 10 "Prismatic" reflector; white body, 1/4; black body, 1/3.

Bluemel's

FAMOUS for QUALITY

SEND FOR CATALOGUE

BLUEMEL BROS. LTD., WOLSTON, near COVENTRY

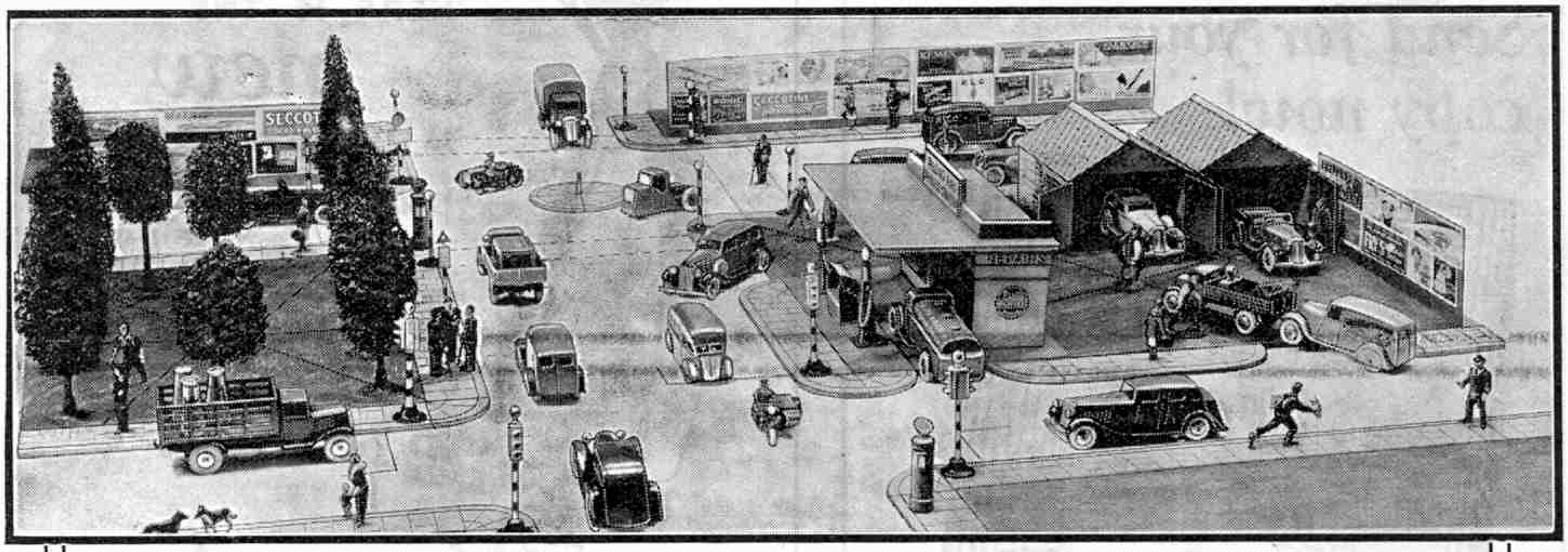
It's easy to see why 'Hair Conscious' men get 'first choice'! Their well-groomed appearance gives them a winning confidence. Dress your hair with Anzora in the morning and see how immaculately tidy it stays all day! But insist on Anzora—original and best fixative. **ANZORA Viola for dry scalps, ANZORA Cream for greasy scalps. In bottles 9d., 1/3 and 2/3. ANZORA Brilliantine, for a glossy dressing, in 1/– bottles.**

THE GOLD MEDAL HAIR CREAM

ANZORA MASTERS THE HAIR

ANZORA PERFUMERY COMPANY, LTD., LONDON, N.W. 6

TOYS OF QUALITY MADE BY MECCANO LTD.

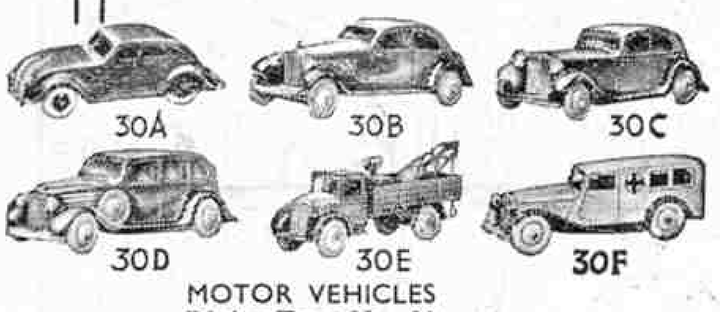


A Charming Collecting Hobby — DINKY TOYS (200 VARIETIES) — The Best that you can buy

The above illustration shows in a striking manner the realistic effects that may be obtained with Dinky Toys. The components used are listed below, excepting the pavements and hoardings which are quite easily made of cardboard or plywood.

Pillar Letter Box. G.P.O. ...	Dinky Toys	No. 12a	...	Price each	3d.	Sportsman's Coupé	Dinky Toys	No. 24f	... Price each 9d.
Pillar Letter Box. Air Mail ...	" "	No. 12b	...	" "	3d.	Sports Tourer (four seater) ...	" "	No. 24g	... " " 9d.
Robot Traffic Signals. Two-way (4)	" "	No. 47c	...	" "	3d.	Vogue Saloon	" "	No. 24d	... " " 9d.
Belisha Beacons (8)	" "	No. 47d	...	" "	1d.	Vauxhall Car	" "	No. 30d	... " " 9d.
Road Signs "Roundabout" (4)	" "	No. 47r	...	" "	1½d.	Petrol Tank Wagon "Texaco"	" "	No. 25d	... " " 9d.
Road Sign "No Entry"... ...	" "	No. 47q	...	" "	1½d.	Wagon	" "	No. 25a	... " " 9d.
Petrol Station	" "	No. 48	...	" "	1/6	Daimler Car	" "	No. 30c	... " " 9d.
"Theo" Petrol Pump	" "	No. 49c	...	" "	4d.	Atco Lawn Mowers Van	" "	No. 28n	... " " 6d.
"Shell" Petrol Pump	" "	No. 49d	...	" "	4d.	Newsboy	" "	No. 3e	... " " 3d.
Oil Bin (Pratts)	" "	No. 49e	...	" "	3d.	Woman and Child	" "	No. 3a	... " " 3d.
Garages (2)	" "	No. 45	...	" "	1/6	Storekeeper	" "	No. 4c	... " " 3d.
Market Gardener's Van	" "	No. 25f	...	" "	9d.	Business Men (7)	" "	No. 3b	... " " 3d.
Covered Van	" "	No. 25b	...	" "	9d.	Women (3)	" "	No. 3f	... " " 3d.
Mechanical Horse	" "	No. 33a	...	" "	6d.	Electricians (2)...	" "	No. 4a	... " " 3d.
R.A.C. Motor Cycle Patrol ...	" "	No. 43b	...	" "	9d.	Male Hiker	" "	No. 3c	... " " 3d.
A.A. Motor Cycle Patrol ...	" "	No. 44b	...	" "	9d.	Dogs (2)	" "	No. 6b	... " " 2d.
Breakdown Car	" "	No. 30e	...	" "	9d.	Fitter	" "	No. 4b	... " " 3d.
Palethorpes Sausage Van ...	" "	No. 28f	...	" "	6d.	Greaser	" "	No. 4d	... " " 3d.
"Manchester Guardian" Van	" "	No. 28c	...	" "	6d.	Guard	" "	No. 1b	... " " 3d.
"Kodak" Cameras Van	" "	No. 28g	...	" "	6d.				

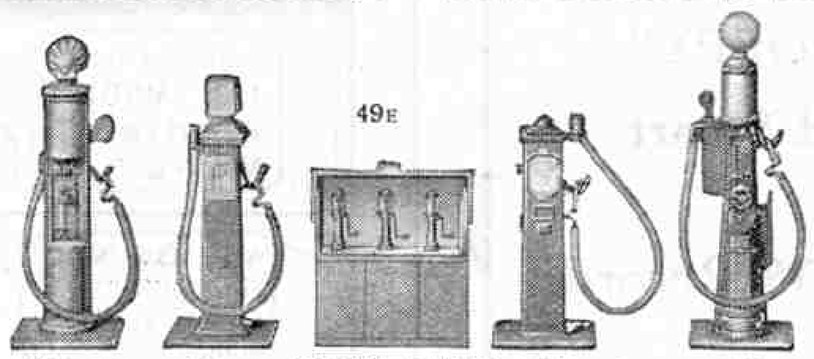
HORNBY ACCESSORIES: Trees, with Stands, assorted, per doz. 3/-. Miniature Posters, 6d. per packet of 51 Milk Cans (3), 2 for 3d



MOTOR VEHICLES
Dinky Toys No. 30
Fitted with rubber tyres and silver-plated radiators

No. 30a	Chrysler Airflow Saloon ...	each	9d.
No. 30b	Rolls-Royce Car	"	9d.
No. 30c	Daimler Car	"	9d.
No. 30d	Vauxhall Car	"	9d.
No. 30e	Breakdown Car	"	9d.
No. 30f	Ambulance	"	9d.

Price of complete set 4/6



PETROL PUMPS
Dinky Toys No. 49
Scale models fitted with rubber hose pipes. Finished in correct colours

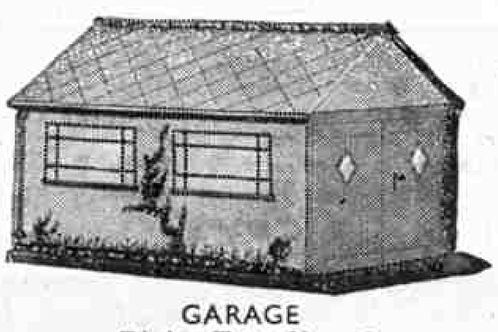
No. 49a	Bowser Pump	each	4d.
No. 49b	Wayne Pump	"	4d.
No. 49c	Theo Pump	"	4d.
No. 49d	Shell Pump	"	4d.
No. 49e	Oil Bin (Pratts)		3d.

Price of complete set 1/6

DELIVERY VANS
Dinky Toys No. 28/1

No. 28a	Hornby Train Van ...	each	6d.
No. 28b	Seccotine Van	"	6d.
No. 28c	"Manchester Guardian" Van	"	6d.
No. 28e	Firestone Tyres Van ...	"	6d.
No. 28f	Palethorpes Sausage Van	"	6d.
No. 28n	Atco Lawn Mowers Van ...	"	6d.

Price of complete set 3/-



GARAGE
Dinky Toys No. 45
Fitted with opening double doors. Will accommodate any two Dinky Toy Motor Cars.
Price 1/6 each

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

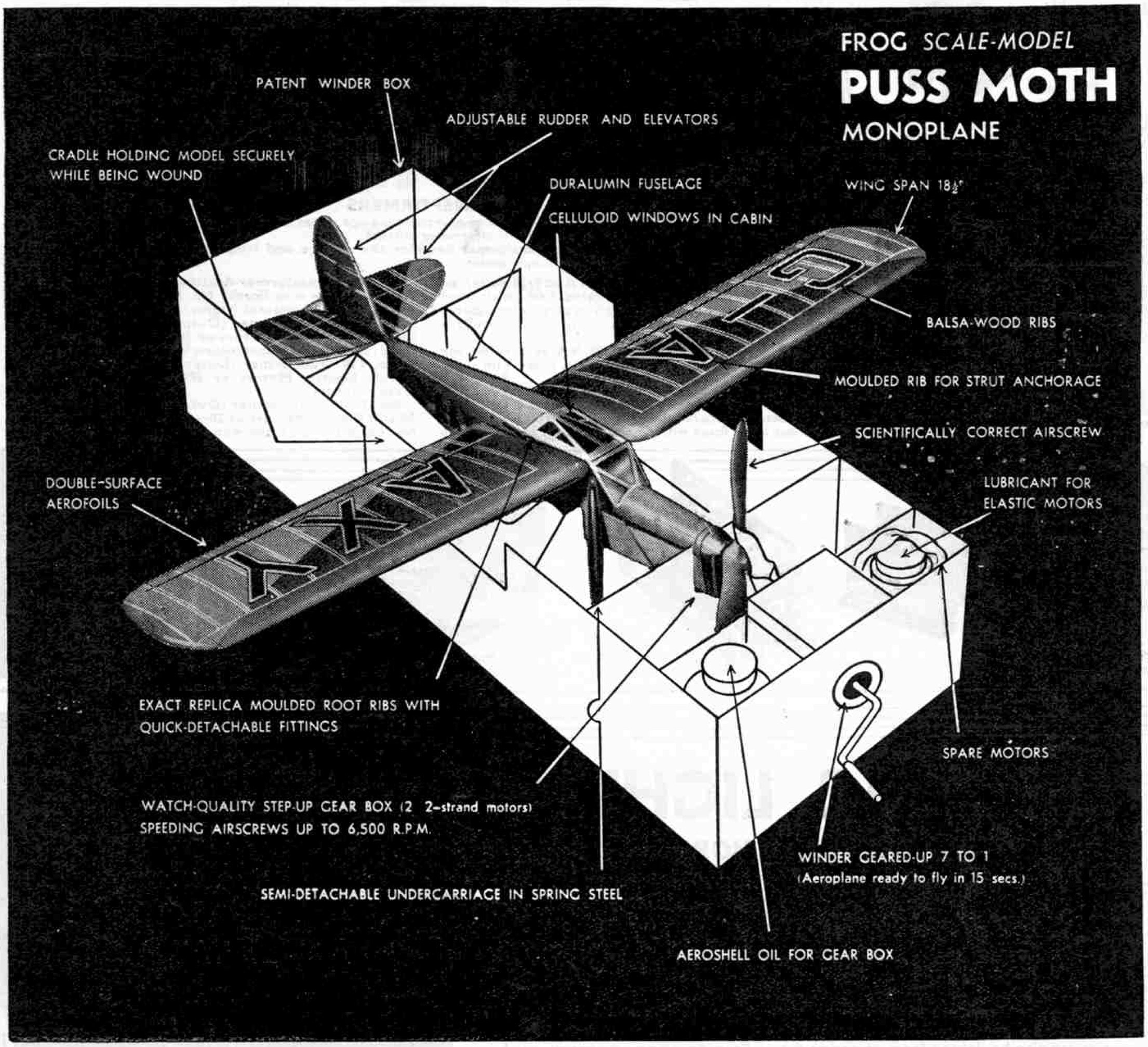
RAILWAY MECHANICAL HORSE AND TRAILER VAN
Dinky Toys No. 33R
Price complete, L.M.S.R., L.N.E.R., G.W.R., or S.R., 1/6

PILLAR LETTER BOX AIR MAIL
Dinky Toys No. 12b
Price 3d. each

PETROL STATION
Dinky Toys No. 48
Accurate reproduction of a filling station. Tastefully printed in appropriate colours
Price 1/6 each

Manufactured by • MECCANO LTD. • BINNS ROAD • LIVERPOOL 13

This patent FROG box eliminates tedious winding



The proud owner of a Frog PUSS MOTH gains one further step in rank as a flying man. This wonderful model is a correct scale reproduction of the favourite civil aircraft of the keen amateur aviator. It is the "sports car" of the air. The performance of this model is phenomenal; with practice it will fly 600 ft. with a ceiling of 30 ft.

FREE FLIGHT INSTRUCTION Lines Bros. will give free flight instruction by appointment on the Frog aerodrome at Merton. Telephone—Liberty 1041

FROG PUSS MOTH MONOPLANE 17'6

Frog scale model aircraft. Designed and made by International Model Aircraft Ltd. Patented throughout the world

Sole Concessionaires: LINES BROS. LTD., Tri-ang Works, Morden Road, S.W.19

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 of how to obtain handsome enamelled Air Force pilot badges

NAME.....

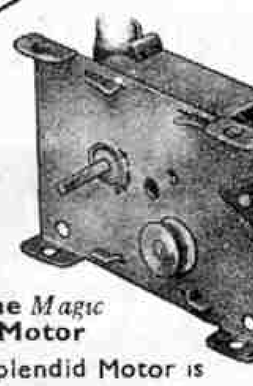
.....

ADDRESS.....

.....

Please write in block letters.

3/36



The *Magic* Motor

This splendid Motor is capable of driving models made with Meccano Outfits A, B and C. It costs only 2/–.

MECCANO

MOTORS FOR DRIVING MODELS

If you want to obtain the fullest enjoyment from the Meccano hobby you must operate your models by means of one of the Meccano Clockwork or Electric Motors listed below

CLOCKWORK MOTORS

The *Magic* Motor (non-reversing)	Price	2/-
X Series Motor (non-reversing)	„	2/-
No. 1 Clockwork Motor (non-reversing)	„	5/-
No. 1a Clockwork Motor (reversing) ...	„	7/6
No. 2 Clockwork Motor (reversing) ...	„	9/-

ELECTRIC MOTORS

No. E1 Electric Motor (6-volt). Non-reversing	Price	9/-
No E6 Electric Motor (6-volt). Reversing ...	„	15/6
No. E120 Electric Motor (20-volt). Non-reversing	„	10/-
No. E20B Electric Motor (20-volt). Reversing	„	18/6

TRANSFORMERS

The Transformers made by Meccano Limited provide a convenient and safe means of driving 6-volt or 20-volt Electric Motors and Train Sets from the mains supply where this is alternating current.

When ordering a Transformer or a Transformer-Rectifier the voltage and frequency of the supply must be stated These particulars are given on the supply meter.

No. T6A Transformer (Output 40 VA at 9/3½ volts) for 6-volt Electric Motors or 6-volt Trains. Fitted with speed regulator and separate circuit for supplying current for eighteen 3½-volt lamps... ... ... Price 22/6

No. T6 Transformer (Output 25 VA at 9 volts) for 6-volt Electric Motors or 6-volt Trains. Fitted with speed regulator ... ... Price 17/6

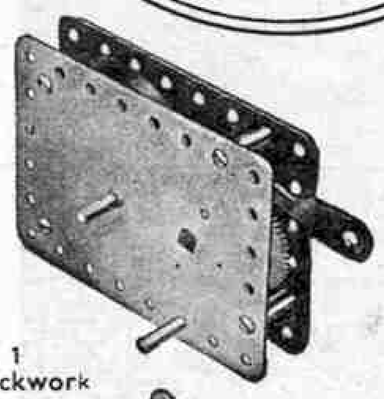
No. T6M Transformer (Output 25 VA at 9 volts) for 6-volt Electric Motors or 6-volt Trains. This is similar to No. T6, but is not fitted with a speed regulator ... Price 12/6

No. TR6 Transformer-Rectifier (Output 6 volts at 1½ Amps.) for use with Hornby No. EPM16 Special Tank Locomotive (6-volt, Permanent Magnet) ... ... Price 29/6

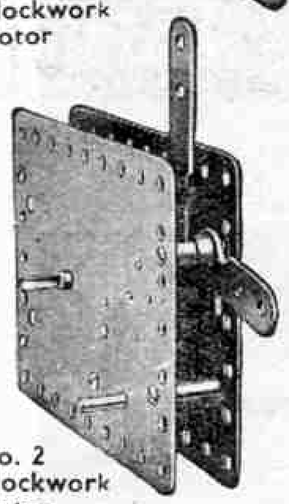
No. T20A Transformer (Output 25 VA at 20/3½ volts) for 20-volt Electric Motors or 20-volt Trains. Fitted with speed regulator and output sockets for lighting lamps. Price 22/6

No. T20 Transformer (Output 20 VA at 20 volts) for 20-volt Electric Motors or 20-volt Trains. Fitted with speed regulator ... ... Price 17/6

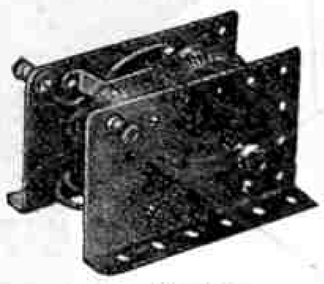
No. T20M Transformer (Output 20 VA at 20 volts) for 20-volt Electric Motors or 20-volt Trains. This is similar to No. T20 but is not fitted with speed regulator... Price 12/6



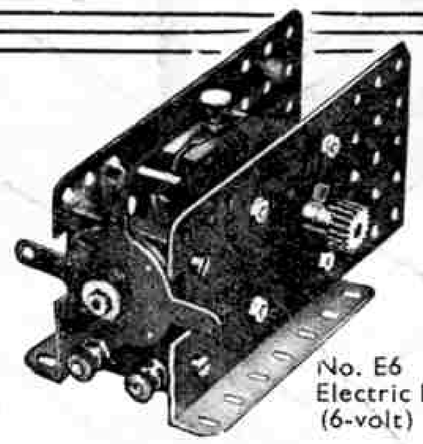
No. 1 Clockwork Motor



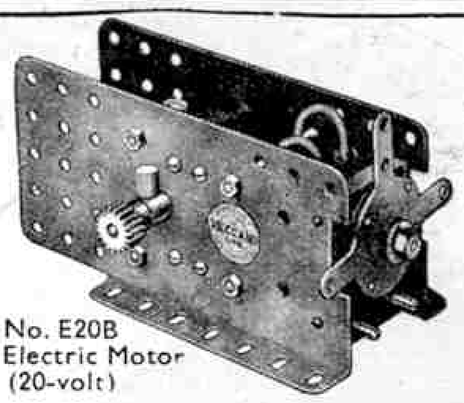
No. 2 Clockwork Motor



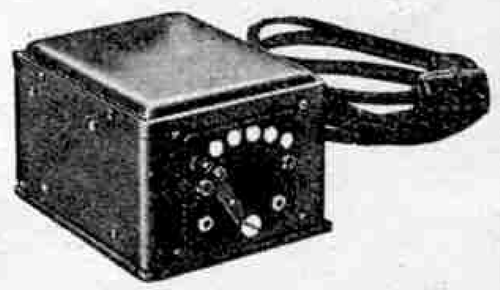
No. E1 Electric Motor (6-volt)



No. E6 Electric Motor (6-volt)



No. E20B Electric Motor (20-volt)



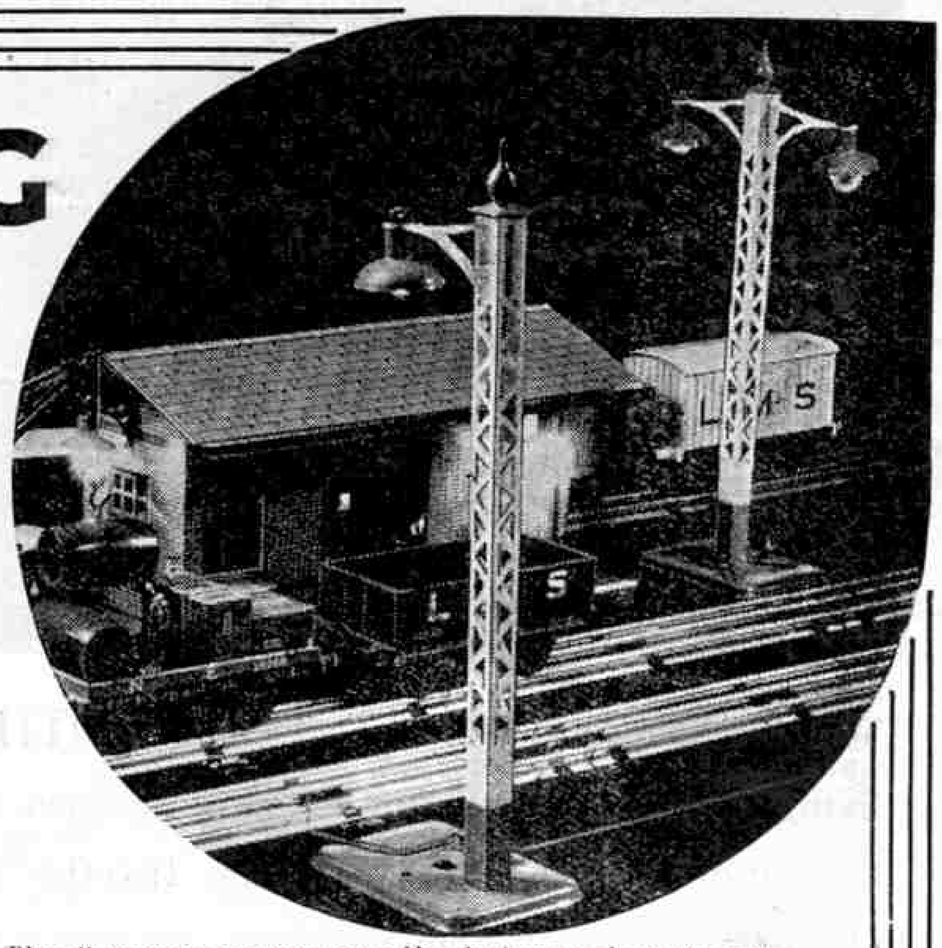
No. T20 Transformer

ELECTRIC LIGHTING SYSTEM FOR HORNBY ACCESSORIES

BRILLIANT, SAFE AND INEXPENSIVE

The following is a complete list of the Hornby Accessories available fitted or electric lighting. These accessories are specially designed for lighting from the 3½-volt circuit of a Meccano T20A or T6A Transformer, and with each of these Transformers are packed for the purpose a pair of Plugs, an Earthing Clip and a coil of Wire, together with full instructions. The Accessories can also be lighted from an accumulator. Each Accessory is accompanied by an Earthing Clip and a Leaflet giving full instructions for use. Lamp bulbs are not provided with the Accessories.

No. E1E Engine Shed	Price	15/6	No. 2E Signal Gantry	Price	12/9
No. E2E Engine Shed	„	23/-	No. E1E Level Crossing	„	5/3
No. 2E Station	„	9/3	No. E2E Level Crossing	„	9/-
Island Platform E	„	6/3	No. 1E Buffer Stops	„	1/6
No. 2E Goods Platform	„	11/6	No. 2E Buffer Stops	„	6/-
No. 2E Signal Cabin	„	4/3	No. 2E Water Tank	„	6/6
No. 2E Signal	„	2/9	No. 1E Lamp Standard	„	2/11
No. 2E Double Arm Signal ...	„	3/11	No. 2E Lamp Standard	„	3/3
No. 2E Junction Signal	„	6/-			



This illustration of a scene on a Hornby layout, shows the striking effects obtainable with the Hornby Electric Lighting System.

The following items used in connection with the latest system of Accessories lighting are available:
Plugs for Sockets of Transformers T20A and T6A. Price per pair, 6d. Earthing Clips, each 3d Connecting Wire. Price per coil, 4d.

ACCESSORIES FOR LIGHTING WITH DISTRIBUTION BOX AND FLEXIBLE LEADS

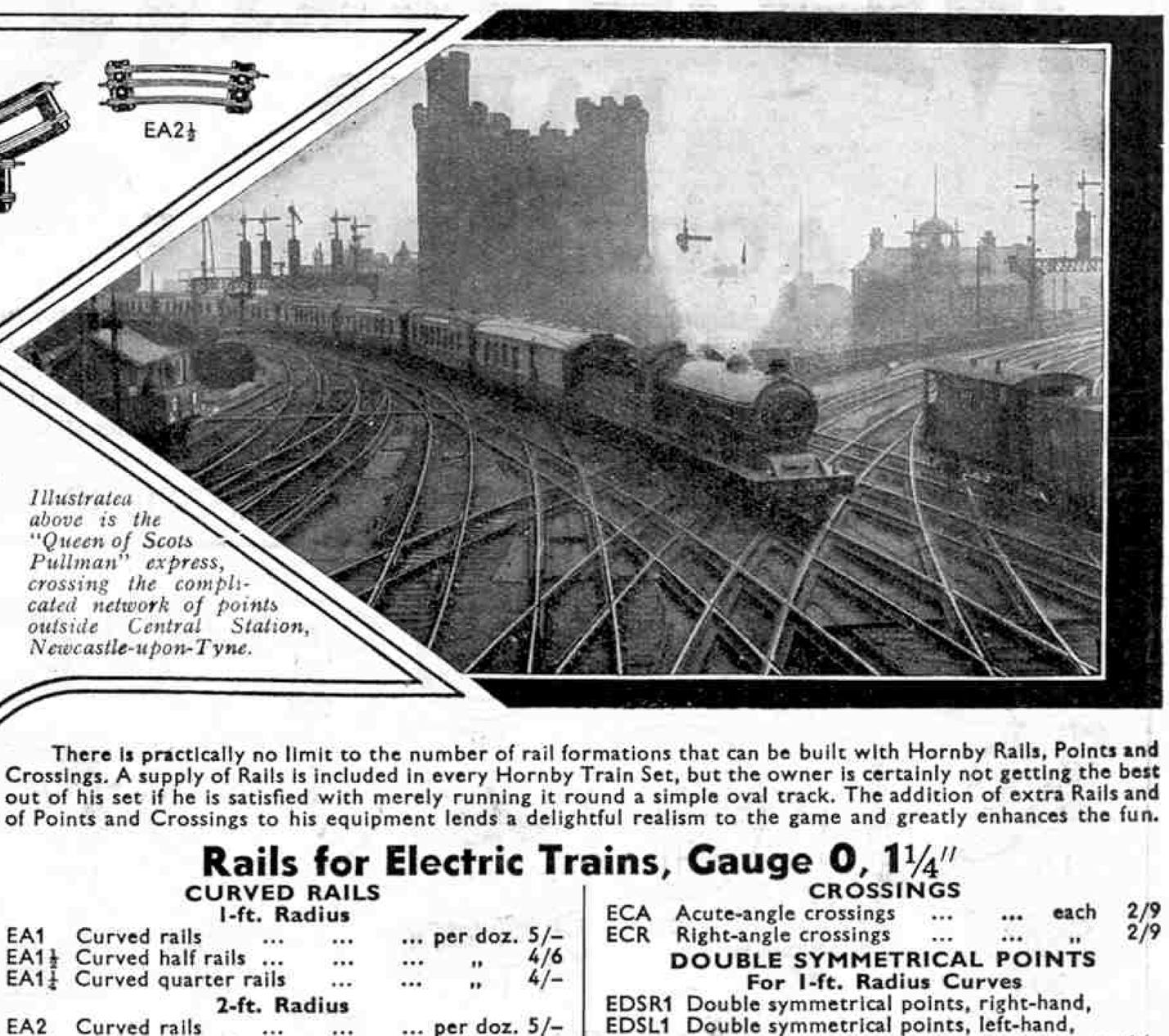
The old type Accessories fitted for lighting by means of a Distribution Box and Flexible Leads with plugs and sockets are still available at the following prices:

No. E1E Engine Shed	Price	18/6	No. 2E Double Arm Signal	Price	6/6
No. E2E Engine Shed	„	26/-	No. 2E Junction Signal	„	9/-
No. 2E Station	„	11/6	No. 2E Signal Gantry	„	18/-
Island Platform E	„	9/-	No. E1E Level Crossing	„	7/-
No. 2E Goods Platform	„	15/-	No. E2E Level Crossing	„	11/-
No. 2E Signal Cabin	„	5/6	No 1E Buffer Stops	„	2/-
No. 2E Signal	„	4/3	No. 2E Buffer Stops	„	7/-

No. 2E Water Tank	Price	10/-
No. 1E Lamp Standard	„	3/6
No. 2E Lamp Standard	„	4/3
Flexible Leads, 9", 18", and 36". Prices 1/4, 1/5 and 1/6 respectively.		
Distribution Box	Price	2/6

Manufactured by MECCANO LTD., BINNS ROAD, LIVERPOOL 13

HORNBY RAILS, POINTS AND CROSSINGS



Illustrated above is the "Queen of Scots Pullman" express, crossing the complicated network of points outside Central Station, Newcastle-upon-Tyne.

There is practically no limit to the number of rail formations that can be built with Hornby Rails, Points and Crossings. A supply of Rails is included in every Hornby Train Set, but the owner is certainly not getting the best out of his set if he is satisfied with merely running it round a simple oval track. The addition of extra Rails and of Points and Crossings to his equipment lends a delightful realism to the game and greatly enhances the fun.

Rails for Electric Trains, Gauge 0, 1¼"

CURVED RAILS

1-ft. Radius

EA1	Curved rails	... per doz.	5/–
EA1½	Curved half rails	... „	4/6
EA1¼	Curved quarter rails ...	... „	4/–

2-ft. Radius

EA2	Curved rails	... per doz.	5/–
EA2½	Curved half rails	... „	4/6
EA2¼	Curved quarter rails ...	... „	4/–
EDC2	Curved rails, double track	... ½ doz.	9/–

STRAIGHT RAILS

EB1	Straight rails	... per doz.	5/–
EB½	Straight half rails	... „	4/6
EB¼	Straight quarter rails ...	... „	4/–
EDS1	Straight rails, double track	... ½ doz.	8/6

POINTS

For 1-ft. Radius Curves

EPR1	Right-hand points }	... ...	per pair 5/9
EPL1	Left-hand points }		

For 2-ft. Radius Curves

ESPSR2	Right-hand points }	... ...	per pair 7/6
ESPSL2	Left-hand points }		

CROSSINGS

ECA	Acute-angle crossings	each	2/9
ECR	Right-angle crossings	„	2/9

DOUBLE SYMMETRICAL POINTS

For 1-ft. Radius Curves

EDSR1	Double symmetrical points, right-hand,	
EDSL1	Double symmetrical points, left-hand,	per pair 6/–

For 2-ft. Radius Curves

EDSR2	Double symmetrical points, right-hand,	
EDSL2	Double symmetrical points, left-hand,	per pair 7/–

PARALLEL POINTS

EPPR2	Parallel points, right-hand }	per pair 7/–
EPPL2	Parallel points, left-hand }	

CROSSOVER POINTS

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

EMC20	Switch rail (20-volt)	each	1/3
EMC6	Switch rail (6-volt)	„	1/3
TCP20	Terminal connecting plates (20-volt)	„	1/3
TCP6	Terminal connecting plates (6-volt)	„	1/3

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

CURVED RAILS

M9	Curved rails (9-in. Radius) ...	per doz.	2/6
MB9	Curved brake rails	each	3d.
A1	Curved rails (1-ft. Radius) ...	per doz.	3/6
A1½	Curved half rails „ ...	„	3/–
A1¼	Curved quarter rails „ ...	„	2/6
AB1	Curved brake rails „ ...	each	4d.
A2	Curved rails (2-ft. Radius) ...	per doz.	3/6
A2½	Curved half rails „ ...	„	3/–
A2¼	Curved quarter rails „ ...	„	2/6
AB2	Curved brake rails „ ...	each	5d.
DC2	Curved rails, double track „ ...	½ doz.	6/–

STRAIGHT RAILS

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

CROSSINGS

CA1	Acute-angle crossings (for 1-ft. radius track)	each	1/9
CA2	Acute-angle crossings (for 2-ft. radius track)	„	1/6
CR1	Right-angle crossings (for 1-ft. radius track)	„	1/9
CR2	Right-angle crossings (for 2-ft. radius track)	„	1/6

POINTS

9-in. Radius (for MO Trains)

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

For 1-ft. Radius Curves

PR1	Right-hand points ... ... }	per pair	3/–
PL1	Left-hand points ... ... }		

For 2-ft. Radius Curves

PR2	Right-hand points ... ... }	per pair	3/–
PL2	Left-hand points ... ... }		
PSR2	Points on solid base, right-hand }	per pair	8/6
PSL2	Points on solid base, left-hand }		
SPSR2	Points on solid base, right-hand }	per pair	5/–
SPSL2	Points on solid base, left-hand }		

These points are similar to Points PSR2 and PSL2 but they are not fitted with ground disc or for Hornby Control.

PARALLEL POINTS

PPR2	Parallel points, right-hand }	per pair	3/6
PPL2	Parallel points, left-hand }		

DOUBLE SYMMETRICAL POINTS

For 1-ft. Radius Curves

DSR1	Double sym. points, right-hand }	per pair	3/6
DSL1	Double sym. points, left-hand }		

For 2-ft. Radius Curves

DSR2	Double sym. points, right-hand }	per pair	3/6
DSL2	Double sym. points, left-hand }		

CROSSOVER POINTS

COR2	Crossover points, right-hand }	per pair	12/–
COL2	Crossover points, left-hand }		
RCP	Rail connecting plates ...	½ doz.	2d.

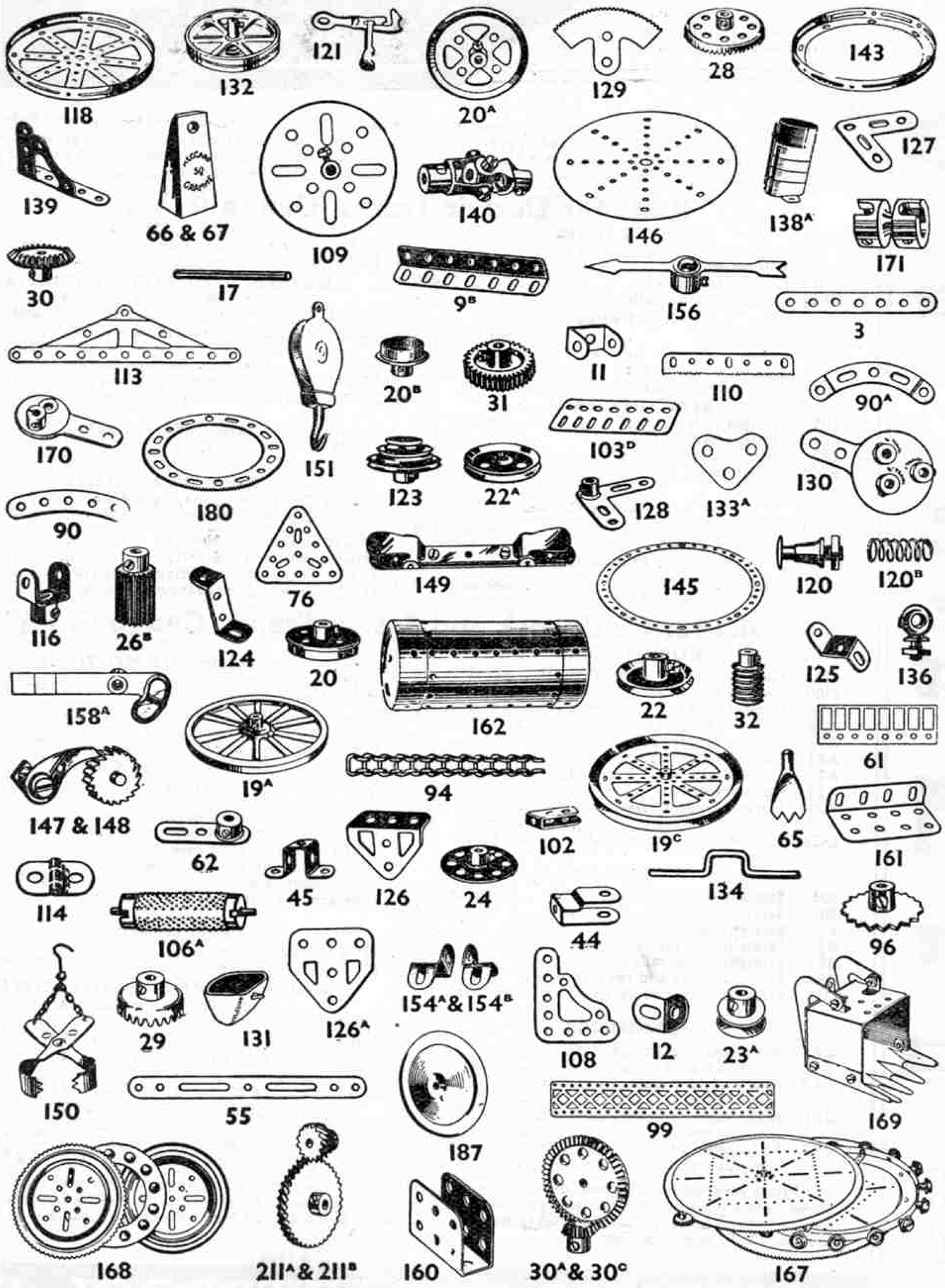
Many interesting illustrations and much useful information regarding Hornby Railway layouts are given in the booklets "How to plan your Hornby Railway," and "Hornby Layouts—100 Suggestions." Each of these booklets is obtainable from your dealer, price 3d., or from Meccano Ltd., Binns Road, Liverpool 13, price 4d. post free.

MECCANO LTD., LIVERPOOL 13

MECCANO
PARTS AND ACCESSORIES

Meccano parts, many of which are illustrated below, combine to form a complete miniature engineering system with which practically any movement known in mechanics can be correctly reproduced. New parts are always being introduced in order to keep Meccano model-building in line with the most modern engineering requirements. The greatest care is taken in the designing of these parts to ensure that they function exactly as their counterparts in actual engineering practice. Ask your dealer for the latest complete illustrated price list.

MECCANO LTD., Binns Road, LIVERPOOL 13



Prices of Parts Illustrated

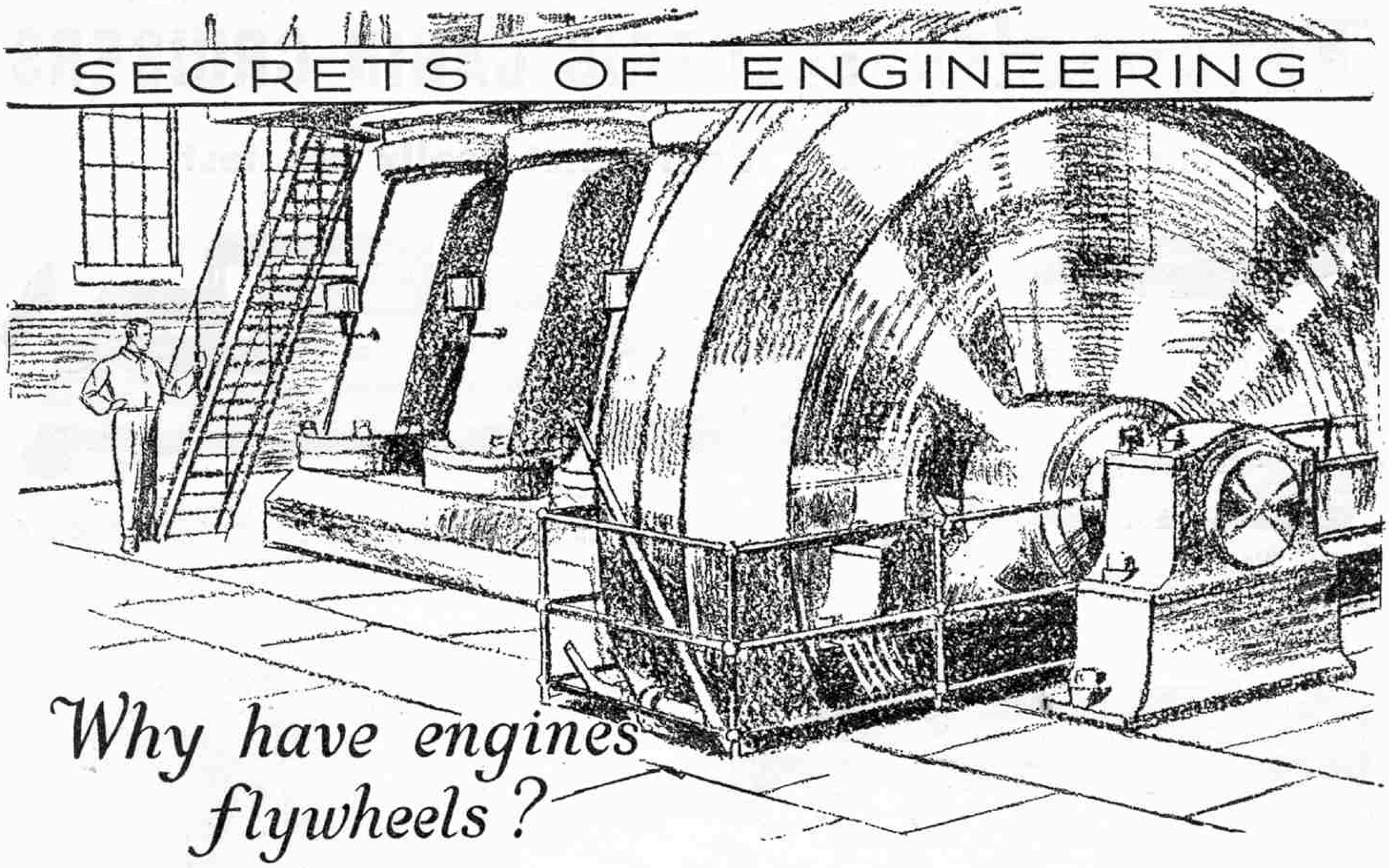
No.			s.	d.
3	Perforated Strips, 3½" ...	½ doz.	0	4
9b	Angle Girders, 3½" ...	„	0	8
11	Double Brackets	doz.	0	3
12	Angle Brackets, ½" × ½" ...	„	0	2
17	Axle Rods, 2"	3 for	0	1
19a	Wheels, 3" diam. ...	each	0	6
20	Flanged Wheels, 1¼" diam.	„	0	5
20b	„ „ ¾" „	„	0	3
	Pulley Wheels			
19c	6" diam., with centre boss and set screw... ...	„	1	9
20a	2" diam., with centre boss and set screw... ...	„	0	4
22	1" diam., with centre boss and set screw... ...	„	0	3
23a	½" diam., with centre boss and grub screw ...	„	0	3
22a	1" diam., without centre boss and grub screw...	„	0	2
24	Bush Wheels	„	0	4
26b	Pinion Wheels, ½" diam., ¾" face...	„	0	6
28	Contrate Wheels, 1½" diam.	„	0	9
29	„ „ ¾" „	„	0	6
30	Bevel Gears, ¾", 26 teeth	„	0	7
*30a	„ „ ½", 16 „	„	0	6
*30c	„ „ 1½", 48 „	„	1	6
31	Gear Wheels, 1", 38 teeth	„	0	10
32	Worms	„	0	4
44	Cranked Bent Strips ...	„	0	1
45	Double „ „ ...	„	0	1
55	Perforated Strips, slotted, 5½" long	doz.	1	6
61	Windmill Sails	4 for	0	6
62	Cranks	each	0	3
65	Centre Forks	„	0	1
66	Weights, 50 grammes ...	„	0	9
67	„ 25 „ ...	„	0	6
76	Triangular Plates, 2½" ...	„	0	2
90	2½" Curved Strips, 2⅜" rad.	„	0	1
90a	2½" cranked, 1⅜" rad.	„	0	1
94	Sprocket Chain, per 40" length		0	6
96	„ Wheels, 1" diam.	each	0	3
99	Braced Girders, 12½" long	½ doz.	2	6
102	Single Bent Strips ...	each	0	1
103d	Flat Girders, 3½" long ...	½ doz.	0	7
106a	Sand Rollers	each	1	9
108	Architraves	doz.	1	6
109	Face Plates, 2½" diam. ...	each	0	4
110	Rack Strips, 3½"	„	0	2
113	Girder Frames	„	0	3
114	Hinges	pair	0	4
116	Fork Pieces, Large ...	each	0	3
118	Hub Discs, 5½"	„	1	3
120	Buffers	„	0	2
120b	Compression Springs ...	„	0	1
121	Train Couplings	„	0	1
123	Cone Pulley	„	1	3
124	Reversed Angle Brackets, 1"	½ doz.	0	4
125	Reversed Angle Brackets, ½"	„	0	2
126	Trunnions...	pair	0	3
126a	Flat Trunnions	each	0	1
127	Simple Bell Cranks ...	„	0	1
128	Boss Bell Cranks... ...	„	0	3
129	Rack Segments, 3" diam.	„	0	5
130	Eccentrics, Triple throw	„	1	0
131	Dredger Buckets... ...	„	0	2
132	Flywheels, 2¾" diam. ...	„	2	0
133a	Corner Brackets, 1" ...	„	0	1
134	Crank Shafts, 1" stroke ...	„	0	2
136	Handrail Supports ...	„	0	3
138a-z	Ships' Funnels, Raked ...	„	0	9
139	Flanged Brackets (right)	„	0	2
140	Universal Couplings ...	„	0	10
143	Circular Girders, 5½ diam.	„	1	0
145	Circular Strips, 7½" diam.	„	0	9
146	Circular Plates, 6" diam.	„	1	0
147	Pawls	„	0	3
148	Ratchet Wheels	„	0	6
149	Collecting Shoes	„	1	3
150	Crane Grabs	„	0	7
151	Pulley Blocks, Single Sheave	„	0	8
154a	Corner Angle Brackets, ½" (right hand) ...	½ doz.	0	6
154b	Corner Angle Brackets, ½" (left hand)... ...	„	0	6
156	Pointers, 2½" over all ...	each	0	4
158a	Signal Arms, Home ...	„	0	5
160	Channel Bearings, 1½" × 1" × ½"...	„	0	2
161	Girder Brackets, 2" × 1" × ½"	2 for	0	3
162	Boiler, Complete ...	each	1	0
167	Geared Roller Bearings ...	„	20	0
168	Ball Bearing, 4" diam. ...	„	3	0
169	Digger Buckets	„	1	6
170	Eccentrics, ½" throw ...	„	0	9
171	Socket Couplings ...	„	0	9
180	Toothed Gear Rings, 3½" diam. 133 teeth external. 95 teeth internal...	„	2	0
187	Road Wheels	„	0	3
*211a	Helical Gear, ½" ...	„	0	9
*211b	„ „ 1½" ...	„	2	0

*Can only be used together.

The series includes 26 different Funnels.

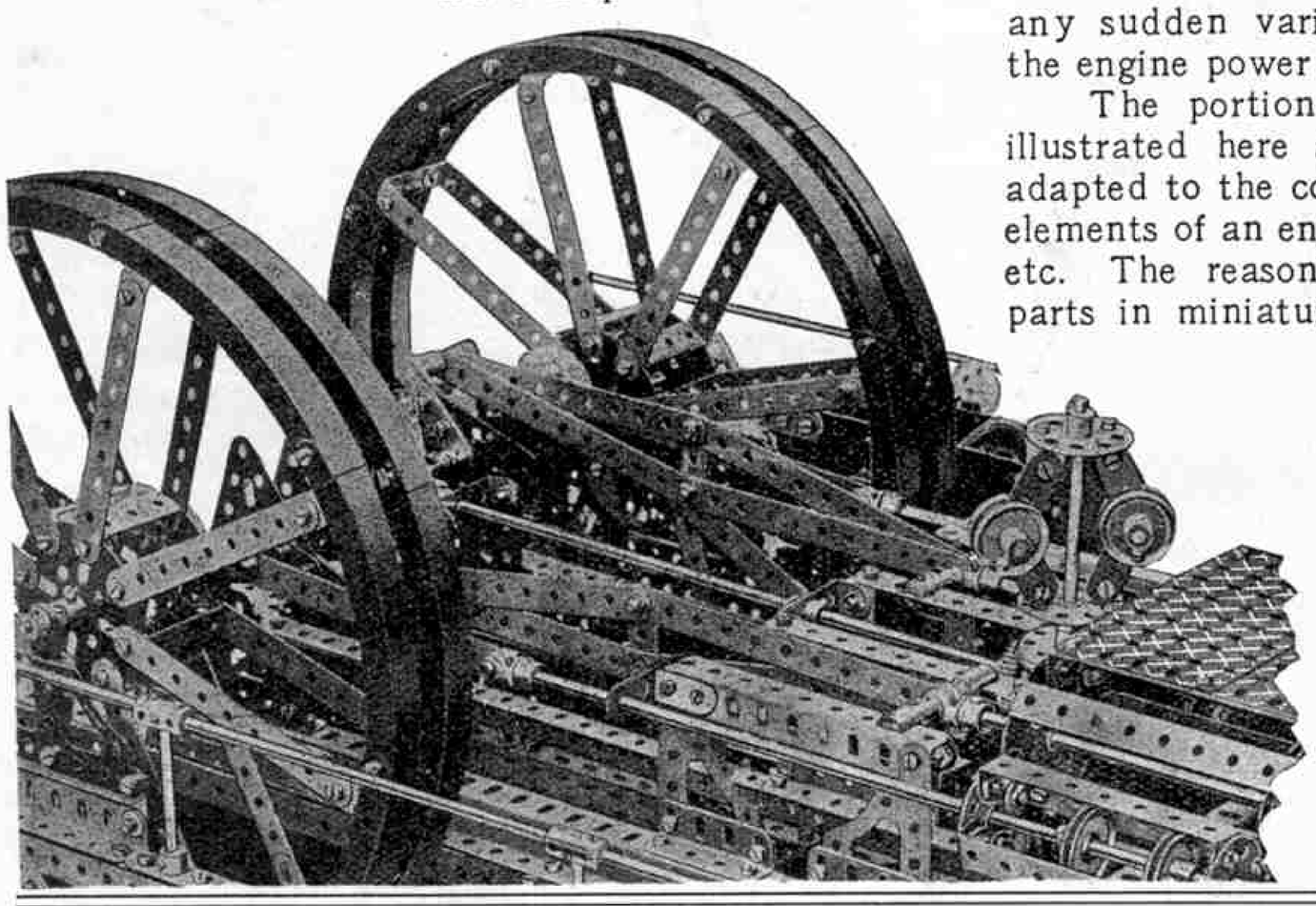
MECCANO

SECRETS OF ENGINEERING



Why have engines flywheels?

Many types of engines are provided with flywheels in order to distribute their power evenly. A rapidly spinning wheel tries to maintain a uniform speed and resists any force that tends to make it spin faster or slower. In this manner the flywheel of an engine prevents to a large extent any sudden variations in speed resulting from fluctuations in the engine power or in the load.



The portion of a Meccano Twin Cylinder Steam Engine illustrated here shows how effectively Meccano parts can be adapted to the construction of flywheels and to other important elements of an engine, such as centrifugal governors, crankshafts, etc. The reason is that Meccano parts are real engineering parts in miniature—they can all be used in exactly the same manner as the corresponding parts in real engineering practice. More important still, they are all standardised and interchangeable, and thus can be used to make hundreds of different engineering models.

Ask your dealer to show you the atest Meccano Outfits

There are Meccano Outfits at all prices from 2'6 to 400'-

MECCANO LIMITED — BINNS ROAD — LIVERPOOL 13

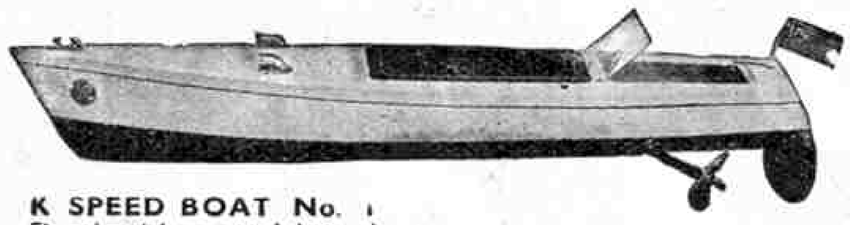
K YACHTS & SPEED BOATS

TRI-ANG ELECTRIC CABIN CRUISERS

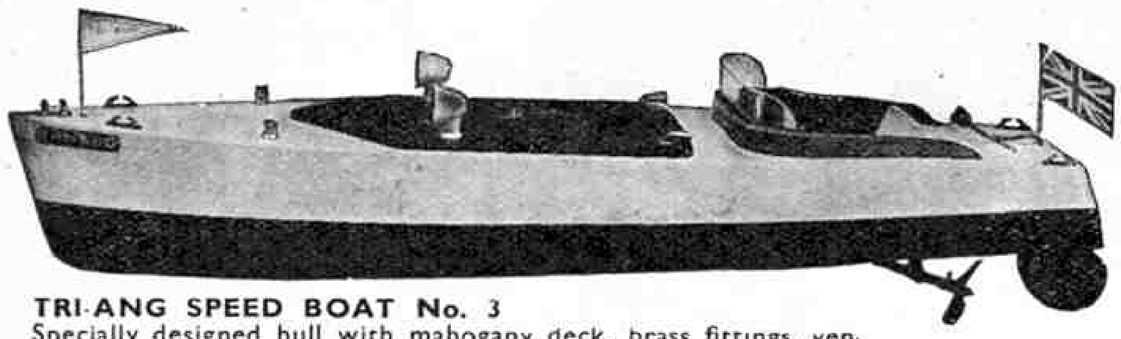
For Boys who want Boats that really are fast

K SPEED BOAT No. OO
Strong clockwork motor, dummy ventilators and imitation deck. Windscreen and adjustable rudder. Hull 11 in. overall. **2/6**

OTHER MODELS 1/-, 4/6



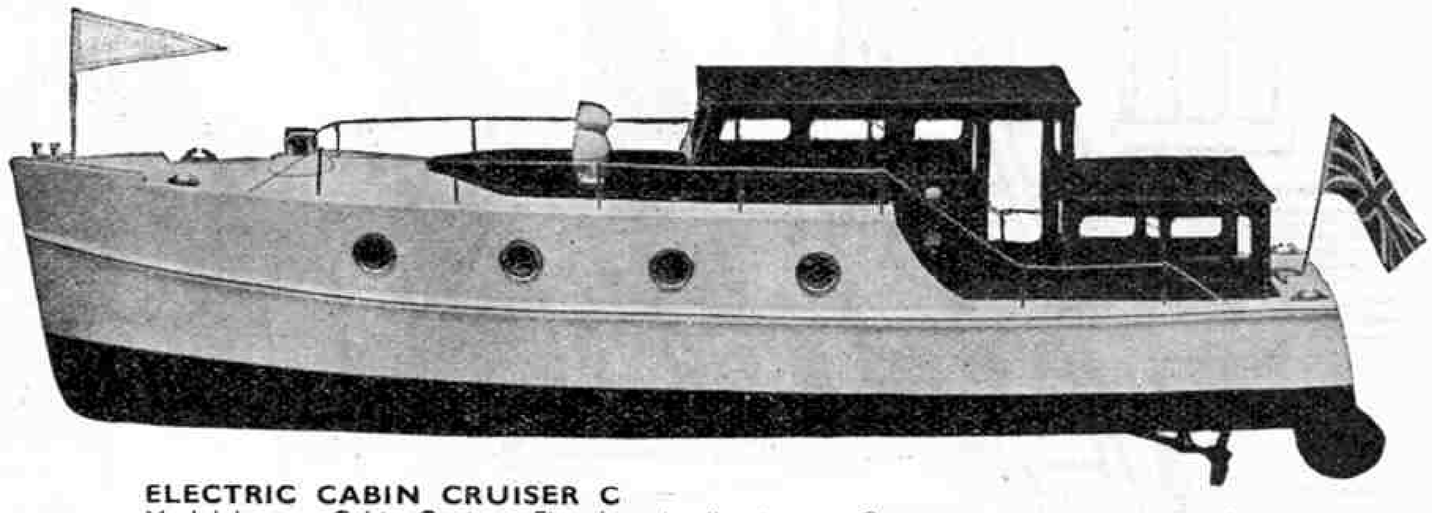
K SPEED BOAT No. 1
Fitted with powerful mechanism, windscreen, dummy ventilators, control lever and adjustable rudder. Hull 16 in. overall. **6/6**



TRI-ANG SPEED BOAT No. 3
Specially designed hull with mahogany deck, brass fittings, ventilators and detachable motor cover. Very powerful clockwork mechanism. Complete with bow pennant and stern flag. Hull 20½ in. overall. **21/-**

FITTED WITH ELECTRIC MOTOR 25/-

OTHER MODELS 10/6, 29/6, 35/-, 39/6



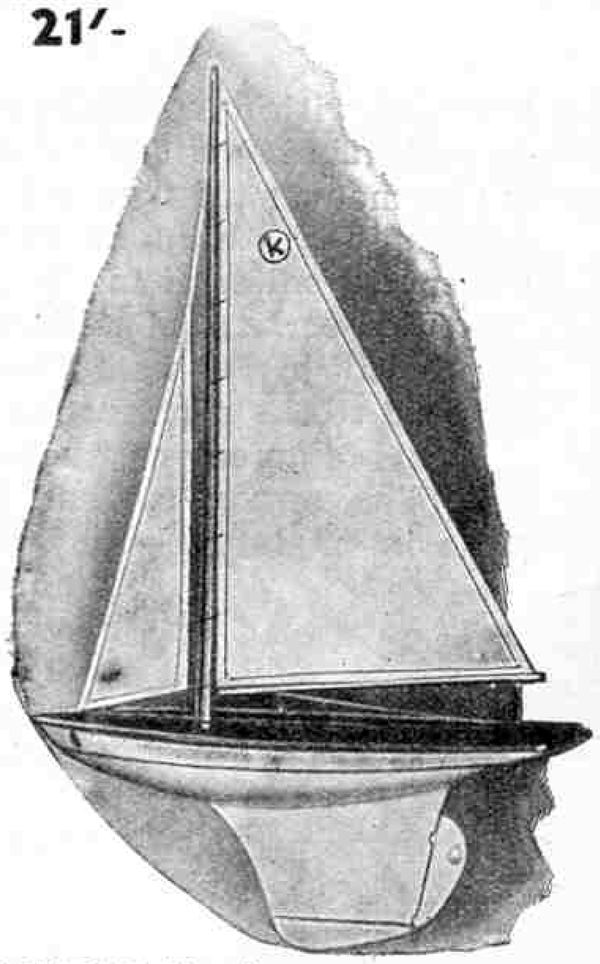
ELECTRIC CABIN CRUISER C
Model luxury Cabin Cruiser. Fitted with illuminated Cabin, port and starboard lights, detachable mahogany superstructure. Separate switches for lights and motor. Complete with bow pennant, stern flag and dummy ventilators. Length of hull 28 in **49/6**

OTHER MODELS 32/6 39/6

Ask your Dealer to show you the full range including the new COASTAL STEAMERS. Obtainable from all good Toy Shops and Stores.

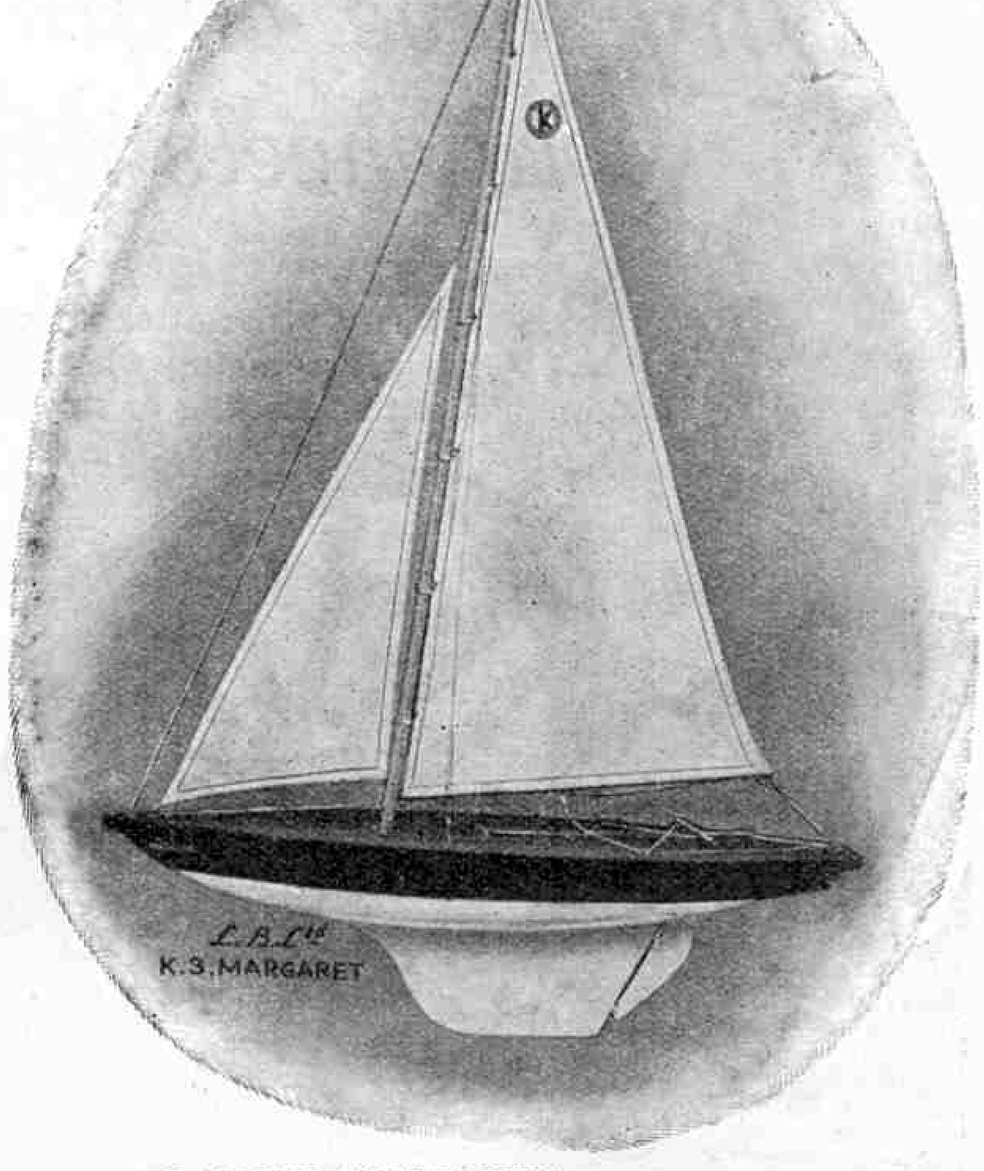
K YACHT No. OO
All steel hull, will not capsize. Fully adjustable sails. The decks are realistically embossed with dummy hatches, etc. Nicely finished in colour. Length of hull 12 in. **1/-**

OTHER MODELS 2/6, 3/6



K YACHT No. X
Splendid yacht correctly rigged Bermuda fashion. With best quality masts and selected boom. Metal keel with swinging rudder. Pressed hull nicely finished in white enamel. Mahogany deck. Length of hull 18⅛ in. **7/6**

LARGER MODEL 10/6



K YACHT "MARGARET"
Magnificent craft with AUTOMATIC STEERING. Patent lightweight weather resisting hull. Solid mahogany polished deck. Mast and boom made from finest selected material, best quality sails, fully adjustable. Beautifully finished in Blue and White. Length of hull 26 in. **22/6**

OTHER MODELS 15/-, 32/6

Made in England by

Lines Bros. Ltd., Tri-ang Works, Morden Rd., London, S.W.19

NEXT MONTH: "GUIDING THE NIGHT PILOT." PUBLISHING DATE: 1st APRIL

MECCANO MAGAZINE

Editorial Office:
Binns Road, Liverpool 13
England

Vol. XXI. No. 3
March, 1936

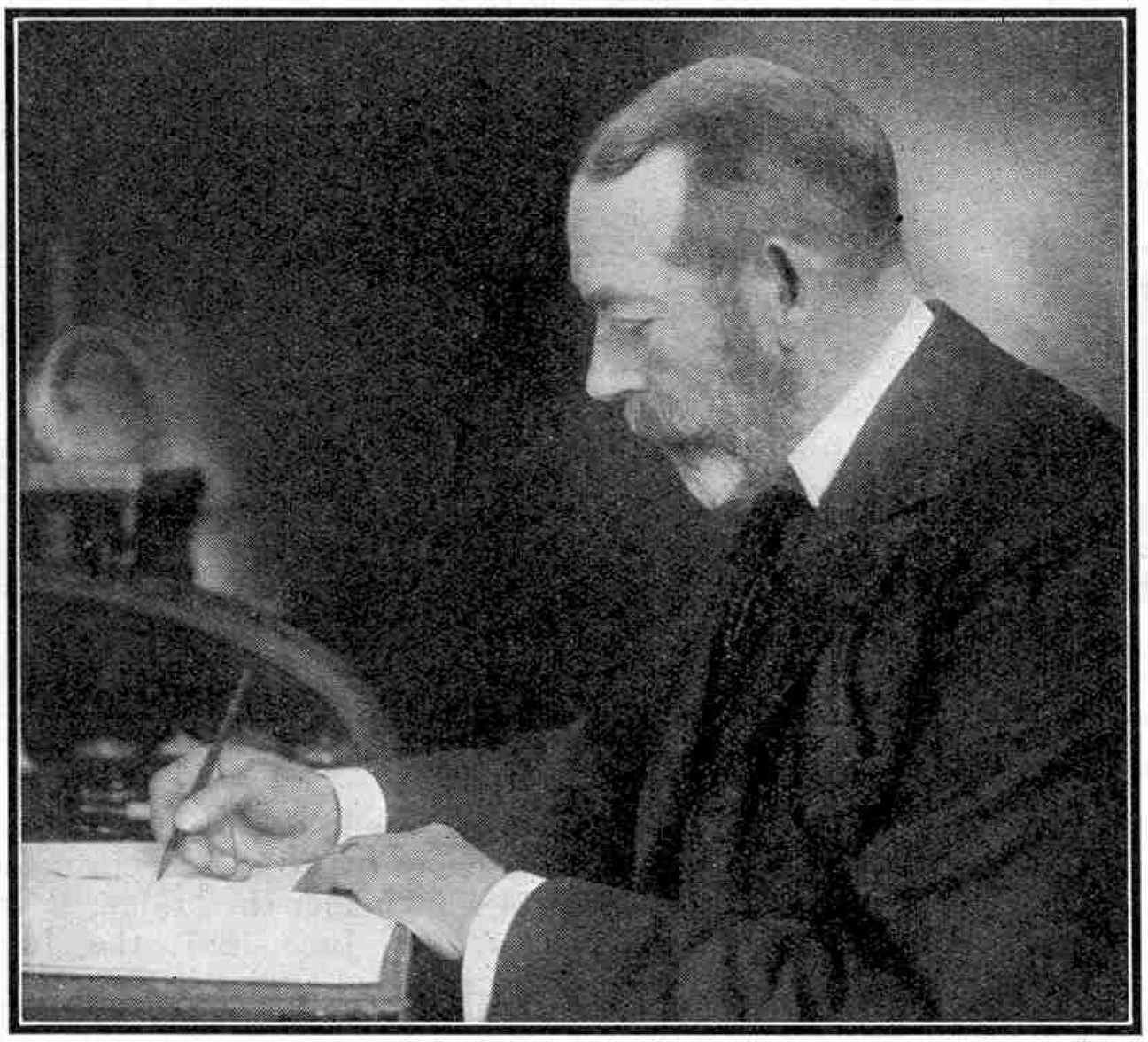
With the Editor

The Passing of King George V

The death of his late Majesty King George V occurred too late for me to make reference to it in the February issue of the "*M.M.*" I cannot allow the event to pass by without comment, however, and I am sure that every reader of the "*M.M.*" at home and overseas will desire to join me in this expression of regret. belated though it necessarily is.

The late King came nearer to the hearts of his people than any of his predecessors, and the loyalty and affection of his subjects continually increased during the 25 years of his reign.

King Edward VIII undoubtedly will maintain the splendid tradition created by his father. He has visited almost every part of the Empire and has come into intimate contact with people of all ranks and conditions of life. More than this, he has travelled in many European countries, in the United States, the Argentine and other lands, and everywhere has aroused the greatest enthusiasm by his fine personal qualities and his keen interest in everything he saw around him.



His late Majesty King George V. *Hoppé*

Britain's Great New Liner

We are all looking forward eagerly to the appearance in service of Britain's new giant liner, "*Queen Mary.*" The great interest she has aroused is scarcely surprising in view of her size and our expectations of great achievements on the historic North Atlantic route. The capabilities of her engines and her speed will not be known until towards the end of the present month, when she will be taken down the Clyde for her official speed trials.

I am now making the necessary preparations to provide my readers with full information and interesting illustrations of this fine vessel.

Across the Atlantic by Air

By a strange coincidence, "*Queen Mary*" will make her maiden voyage at about the time when the new German airship will be completed. As my readers know from the article published on page 20 of the January issue, this vessel is intended for the service between Germany and South America that has been maintained regularly for the past four years by the "*Graf Zeppelin*" alone. Her builders are confident that the years of pioneer adventure in the airship world are now over, and that we are now on the eve of the establishment of regular transatlantic airship services.

This of course is an entirely new development, and further changes must be looked for when the plans now under consideration by Imperial Airways for aeroplane services between England and America take practical form. It seems to me that before many years have passed those who wish to cross the Atlantic will have the choice of travelling by sea or by air. It is difficult to forecast what the future will bring. Many difficulties have to be faced before regular air services will be available, and for a time at least the accommodation available in the flying boats and airships that will be used will be comparatively limited. The Martin flying boats designed for American transoceanic services carry 48 passengers. The new German airship will provide quarters for 50 passengers and 35 members of the crew, but the great Cunarder will carry over 4,000 people, including a crew of about 1,500. There is no doubt therefore that great ships such as the "*Queen Mary*" will find ample scope for the work for which they are designed, in spite of the greater speeds of which aircraft are capable.

Famous Bridges of the World

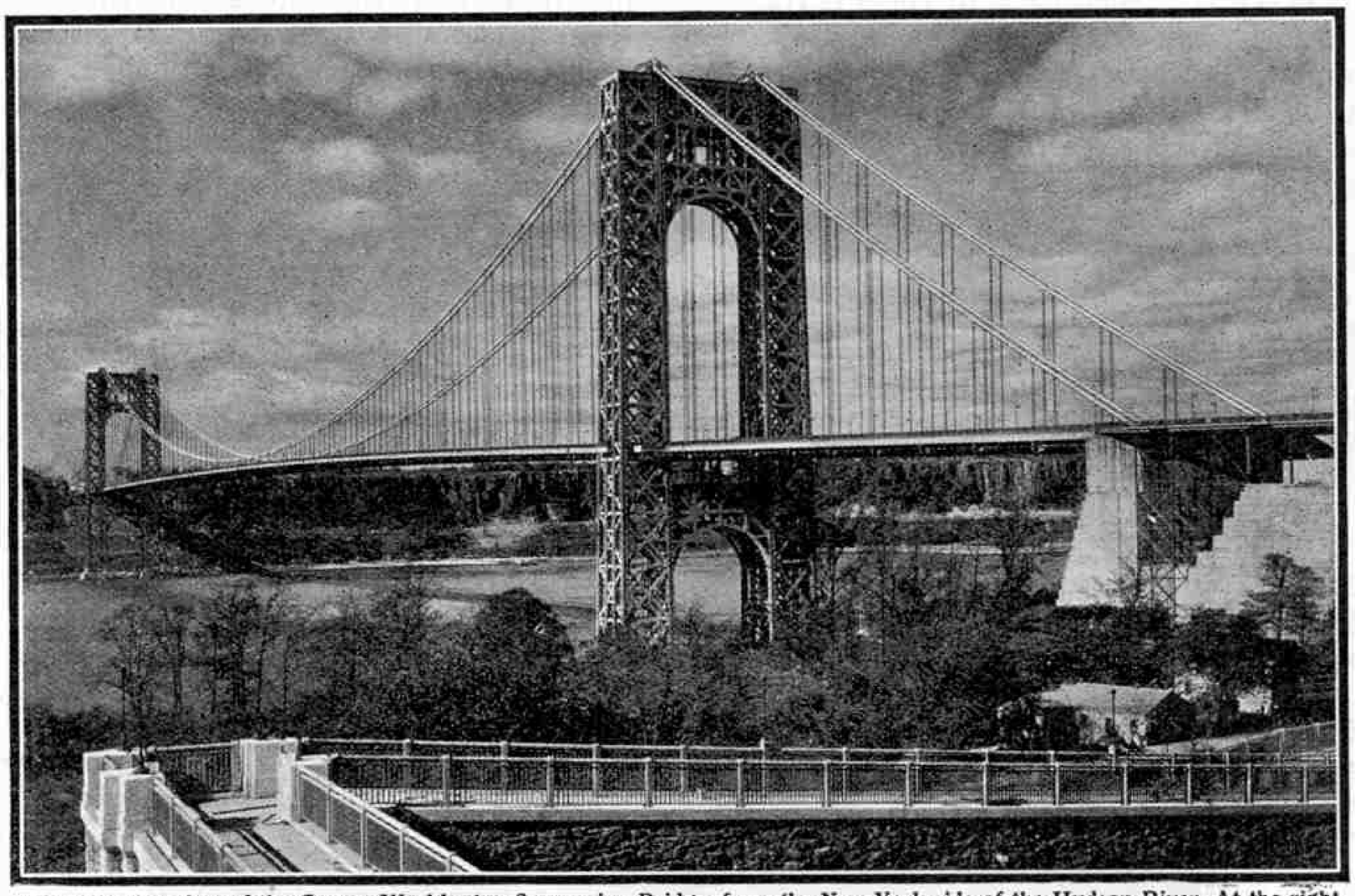
Steel Structures combine Strength and Beauty

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

Many of the most famous steel bridges combine strength and beauty of design to a remarkable degree. Perhaps the most beautiful of all types is the arch bridge, of which the largest and the most famous example is the Sydney Harbour Bridge, Australia. It took eight years to build and was opened on 19th March 1932, and is one of the greatest engineering feats of recent years. The bridge has an overall length of 3,770 ft. and its huge arch, springing from granite abutments on each side of the harbour, crosses the water in a single span 1,650 ft. long, and at its crown it has a clear height of 170 ft. above high water. The arch rests on four main bearings each weighing 296 tons and sustaining a load of 19,700 tons, and the thrilling story of its construction was told in the "*M.M.*" of October last. The four pylon towers, two at each end of the arch, are 285 ft. in height, and their erection involved the quarrying of 20,000 cu. yd. of granite, which was brought 100 miles by sea from Moruya on the south coast of New South Wales.

The deck of the bridge carries a roadway 57 ft. in width, providing for six lines of the heaviest vehicular traffic, two lines of main electric railway on each side of the roadway, and two 10 ft.-wide footpaths on the outside of the permanent way, making a total width of 159 ft. 6 in.—the heaviest deck ever constructed.

In extreme contrast to the bold sweeping line of the Sydney Harbour Bridge is the severe horizontal line of the girder bridge across the Firth of Tay at Dundee. In spite of its severity it has a beauty of its own, as the accompanying illustration shows. The present Tay Bridge is actually the second to bear that name. The first one was a lattice girder bridge designed by Sir Thomas Bouch and built during the years 1870-6 at a cost of £350,000. It consisted of 85 spans, with a total length of 10,700 ft., and carried a single line of railway. During a gale on the night of 28th December 1879, 18 months after the bridge was opened, its 13 central spans, each 245 ft. long, were blown down while a mail train was crossing. The train was precipitated into the water 90 ft. below and 75 people perished.



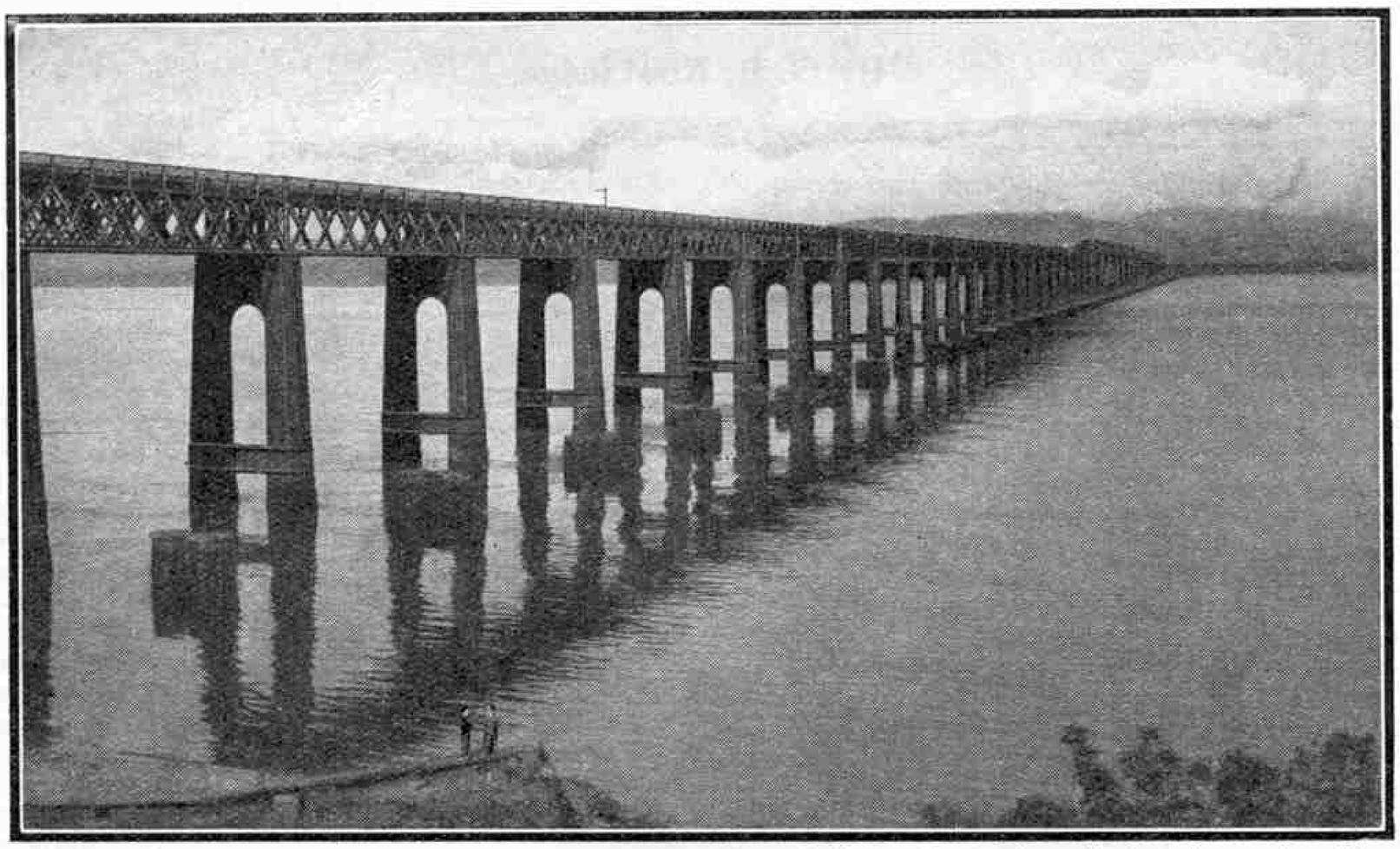
An impressive view of the George Washington Suspension Bridge, from the New York side of the Hudson River. At the right the main cables can be seen extending into the massive concrete anchorage. Photograph reproduced by courtesy of the Port of New York Authority.

The collapsed portion of the bridge was not rebuilt, but a new bridge of greater width and lower elevation was built about 60 ft. from the first one. Much of the material in the old bridge was utilised in this work. The present Tay Bridge is just over two miles long and carries a double railway track. Over most of the spans the lines are carried on the tops of the girders, but across the 13 centre spans they are laid between the main girders so as to allow a clearance of 79 ft. for the passage of ships under the bridge. It was opened for public use on 20th June 1887, the Jubilee anniversary of the accession of Queen Victoria.

It is an interesting fact that the disaster to the old Tay Bridge led to the erection of one of the most striking structures in the world, the cantilever bridge across the Firth of Forth. Originally it was planned to erect a suspension bridge designed by Sir Thomas Bouch. It was to have two spans of 1,600 ft. each, a clear headway of 150 ft., and towers 550 ft. above high water on the island of Inchgarvie and on the two shores. A start had been made on the foundation of the main pier on Inchgarvie island, but the appalling calamity to the Tay Bridge destroyed all confidence in Sir Thomas Bouch and work on the new bridge was stopped immediately. Various other means of crossing the Forth were then considered, and finally a bridge on the cantilever system was built. It was opened on the 8th March 1890 by King Edward VII, then Prince of Wales. The ceremony took place during a fierce gale,

the sound of which, roaring through the steel framework, provided an object lesson in the enormous strength and stability of the giant structure, an imposing view of which forms the subject of our cover.

The Forth Bridge consists of two approach viaducts; three double cantilevers resting on two piers near the shore and on a central pier on the island; and two pairs of girders spanning the intervals between the ends of the central and side cantilevers over the channels. The South Approach viaduct has 10 spans of 168 ft. each and four arches of 66 ft. each, and the North Approach viaduct has five spans of 168 ft. and three arches of various sizes. The total length of the bridge, together with the approach viaducts, is about 8,296 ft., and the piers carry a total weight of 50,958 tons of steel.



This photograph of the famous Tay Bridge shows the severe lines of this lengthy structure. Photograph reproduced by courtesy of the L.N.E.R.

The cantilever portion of the bridge, including the two suspended spans, measures about 5,349 ft. 6 in. The three double cantilevers are symmetrical steel structures rising 361 ft. above high water level, that is, nearly as high as St. Paul's Cathedral. They are composed of a central portion over the piers from which two cantilever arms extend out on each side for a distance of 680 ft., tapering at their extremities, both horizontally and vertically.

The central parts consist of four vertical columns each resting upon a circular granite pier, and connected at the top and the bottom and braced together horizontally and vertically. The cantilever arms consist of two massive curved steel tubes at the bottom, in compression, and two flanged lattice steel ties at the top, in tension, braced together vertically and horizontally.

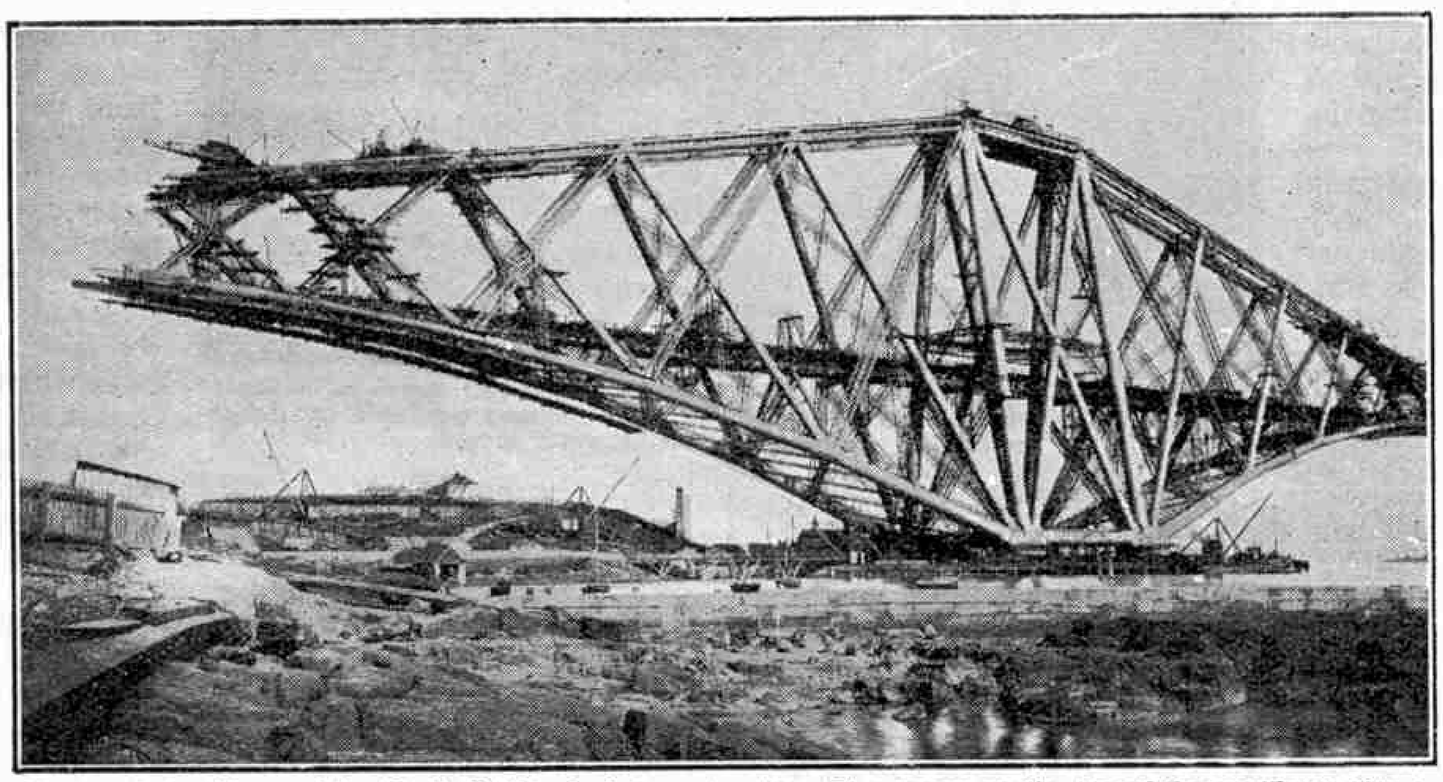
The ends of the cantilevers reaching out over the channels serve to support girders of 350 ft. span that complete the communication between the cantilevers over the channels, the whole thus forming a bridge with two clear openings of 1,710 ft. between the piers. Two lines of railway, with a footpath on each side, run through the cantilever arms.

The Forth Bridge is of never-failing interest to the thousands who cross it by rail, but for complete appreciation of the bridge one should see it from a small boat.

For sheer gracefulness the suspension type of bridge has many claims to supremacy. Several notable suspension bridges have been built during the past 10 years, and each has had the distinction, for a time, of being the longest of its kind in the world. The record is held at present by the George Washington Bridge illustrated on the previous page. This fine structure crosses the Hudson River in a single span 3,500 ft. long, in the vicinity of Fort Washington Point on the New York side and Fort Lee on the New Jersey side. The situation is ideal for a bridge of this type, as on the New York side the land reaches a height of 200 ft. about 1,000 ft. from the shore, and on the New Jersey side it is 280 ft. high only 500 ft. inland.

The bridge was planned to have two decks, the upper deck to carry a roadway wide enough for eight lines of traffic, flanked by footwalks for passengers, and the lower deck to carry four electric railway tracks. As constructed, however, the bridge has only the upper deck, and the lower deck is to be added later.

The main span is suspended from four main cables that pass over towers at the ends of the span and are led down to, and secured in, massive anchorages. The towers carrying the main cables are 635 ft. high, above the river level, and differ from those of previous suspension bridges. At the New York end the bridge terminates about 100 ft. above the land, and the bridge approach was therefore built in the form of a long ramp 60 ft. wide. The construction of the New Jersey approach to the bridge presented an entirely different problem, for there the bridge terminates about 50 ft. below the top of the rocky cliffs. A deep cut at a fairly steep gradient was excavated to carry the approach roadway up to the surface.



The north cantilever of the Forth Bridge during construction. The cranes on the top of the cantilever give a good idea of the immense size of the bridge.

The George Washington Bridge does not lack company, as there are close upon 60 bridges and viaducts within the bounds of the city of New York.

Recording and Predicting Tides

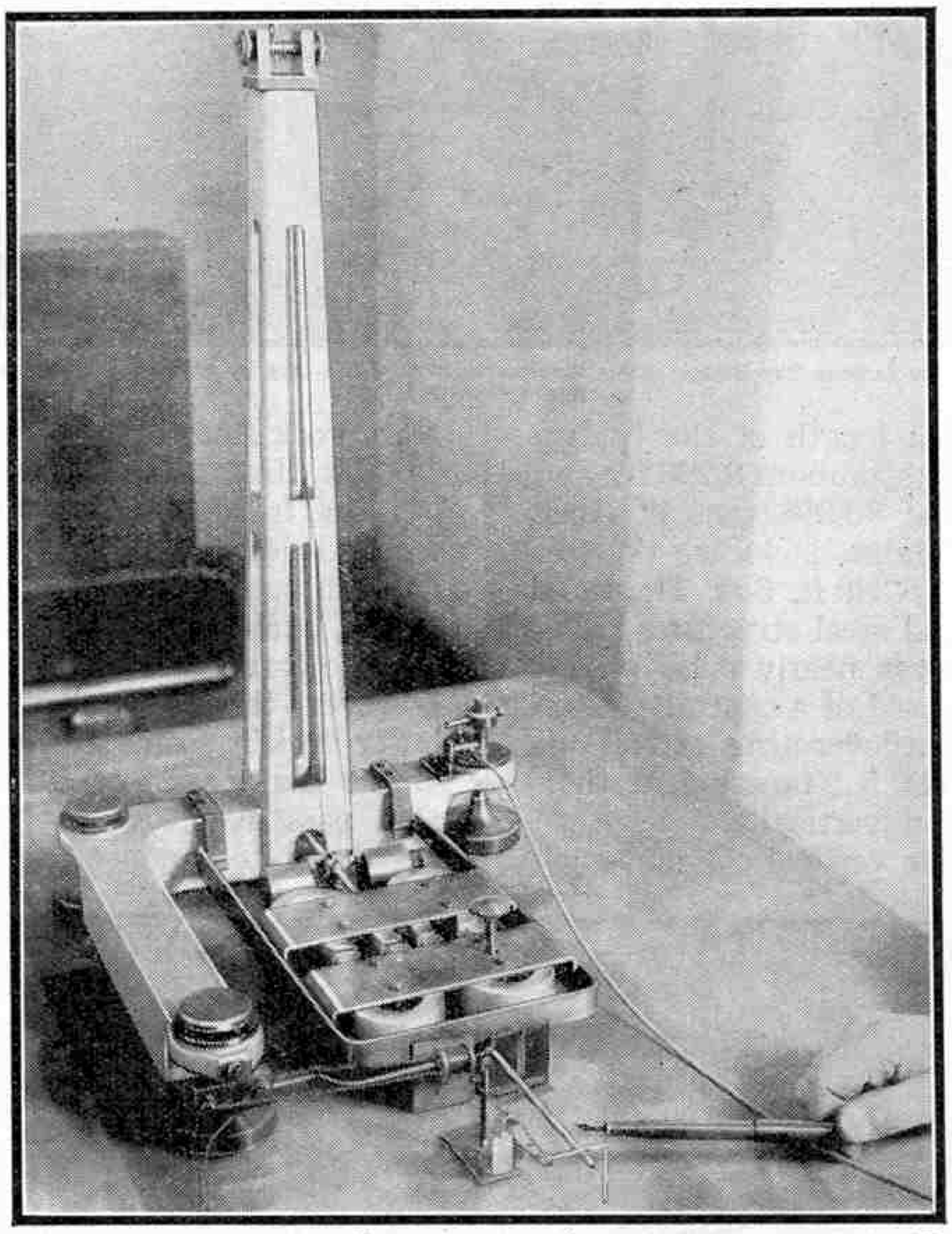
The Work of a Modern Observatory

By G. R. Rookledge

OBSERVATORIES may be divided roughly into two classes. In one class purely astronomical work is carried out, telescopes and other instruments being employed for studying the movements and composition of the Sun, Moon and stars. A famous observatory of this kind is that on Mount Wilson, California, where the largest telescope in the world is installed. This is a reflector with a mirror 100 in. in diameter, but even this giant instrument will be surpassed in a few years, when a new telescope will be erected there that incorporates the 200 in. glass disc the casting of which was described on page 512 of the "*M.M.*" for September 1935.

Observatories of the second class are devoted to such purposes as exact time-keeping, and the improvement of navigation at sea. The Royal Observatory at Greenwich is largely concerned with work of this kind, and actually was founded by Charles II in 1675 for the purpose of making the seas safer by providing sailors with information about the positions of the stars that would enable them to find their way more easily.

Measurements of the rise and fall of the tides and the preparation of tide tables also are carried on in observatories of this kind, and near the port of Liverpool there is an observatory where predictions are made of the tides at the chief ports of the British Empire, with the exception of those in India. It is built on Bidston Hill, Birkenhead. This hill is about 200 ft. in height and commands a view of the estuary of the Mersey and Liverpool Bay, and in the great days of sailing ships was used as a station from which the arrivals of vessels off the port of Liverpool were signalled to their owners. The observatory now built on its summit was established in 1828 for the purpose of rating ships' chronometers, and was taken over in 1856 by the Mersey Docks and Harbour Board. To-day exact Greenwich time is broadcast from the Post Office Wireless Station at Rugby, and from other similar sources, so that the rating of chronometers is not now of so much importance, but other practical work of wide range and great value is carried on regularly in the observatory.



The seismograph at Liverpool Observatory, on which the occurrence of earthquakes is recorded. The instrument is so sensitive that in hot summer weather it can detect the bending of the rock strata on which it rests.

An unusually interesting task that falls to the staff of the Liverpool Observatory is that of controlling the time gun heard daily on Merseyside at one p.m. The gun itself is mounted on the river wall at Morpeth Dock, Birkenhead, and after the discharge the smoke can be seen hovering over the water of the Mersey alongside the dock. It is fired electrically from the Observatory, however, although this building is about three miles away. There a special clock with an average error of only half a second a day is carefully checked and corrected by means of time signals from Greenwich and the Eiffel Tower, and when its second hand reaches the position indicating one o'clock a circuit is automatically completed that instantaneously ignites a fuse in the gun and so fires its charge.

There is little risk of a misfire with this well-known time gun, for the circuit is tested every day at 12 noon, an hour before the time signal is to be given. Shortly before mid-day a dummy fuse is put in the gun and a switch on the side of the clock in the Observatory, three miles away, is closed so that the firing circuit is completed as the second hand reaches the hour. If all is in order an official at the dock signals back to that effect. The switch is then opened out again, the gun is loaded and a live fuse inserted. Immediately before one o'clock the switch is again closed and this time the gun is fired when the second hand indicates the hour.

The gun is loaded with 5 lb. of powder for each signal. After 100 discharges it is carefully examined and wax casts are taken of the bore in order to find if it is necessary to replace the gun.

The Liverpool Observatory also is one of the places from which we receive news of earthquakes, in whatever part of the world these may occur. The waves in the ground created by shocks of this kind travel rapidly through the Earth, and write their own messages on an instrument known as the seismograph, a long word that simply means earthquake writer. This of course must stand on a firm foundation, so that it is shaken as little as possible by accidental disturbances, and for this reason the Bidston instrument is placed in a basement, where it stands on the top of a masonry pillar built on the rocks underlying the hill. It also is carefully protected by means of covers, but these were removed before the photograph of the instrument on this page was taken in order to show the chief working parts.

The central feature of the seismograph, and the one that actually detects earthquakes, is a long light rod, known as the boom, and in the accompanying illustration this is pointed out by the fountain pen seen on the right. A heavy counterpoise is attached to the boom, which can be described as a horizontal pendulum suspended by means of two hinges in a similar manner to that in which an ordinary gate is hung. One of the hinges takes the form of a wire from the top of the rigid pillar of the seismograph to a suitable point along the boom. The other is an agate cup on the side of the pillar, in which a needle point on the end of the boom rests.

A rod suspended in this manner swings to one side when the ground beneath it is tilted, just as a gate automatically closes or opens if its upper hinge is not vertically above the lower one. The boom of the seismograph therefore swings first in one direction and then in the other with a vibratory motion when the rock on which it is supported is disturbed by an earthquake.

A seismograph of course must watch for earth movements day and night, and its records must be automatic and continuous. For this reason it is made to write its own record by attaching a light mirror to the free end of the boom and reflecting a beam of light from this to a sheet of sensitive paper. The beam of light comes from a box containing an electric lamp, the rays of which pass outward through a narrow slit to the mirror, which can be seen on the left of the boom in the illustration on this page. The sensitive paper on which the light reflected from it acts is wrapped round a drum that is housed in a second box, and is rotated slowly by clockwork at the rate of one revolution a day.

While the boom and its mirror remain at rest the photographic record consists of a series of parallel lines, for the drum is moved slowly to one side as it is rotated. Vibration due to an earthquake causes the beam of light to swing backward and forward across its normal path, however, and the distance to which the action of the

light beam on the sensitive paper spreads on both sides of the central line shows whether the disturbance is serious or not.

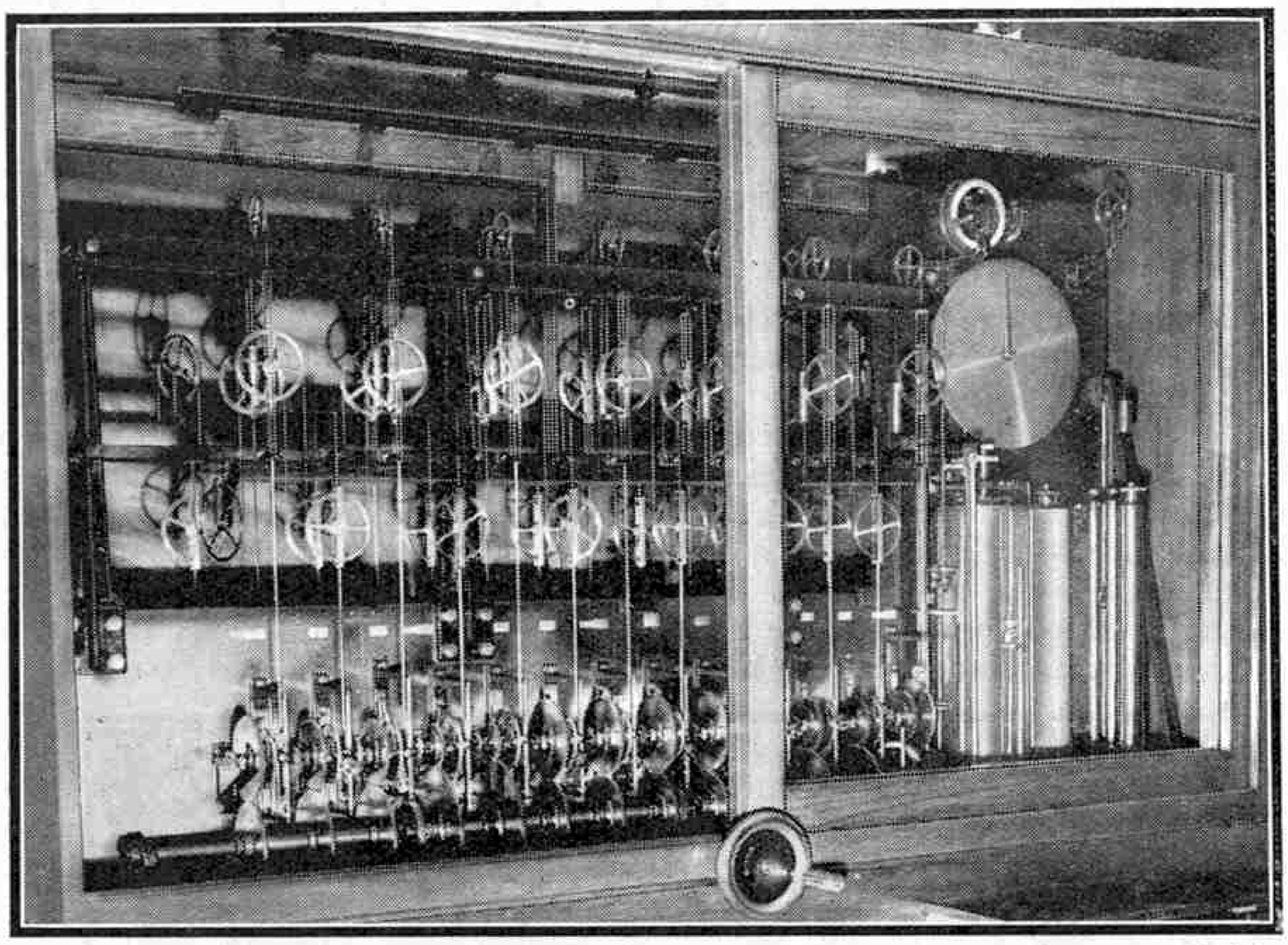
The seismograph not only detects the occurrence of an earthquake, but records the time at which the indications are received and enables the distance of the centre of the movement to be calculated. For these purposes a shutter in front of the slit through which the beam of light leaves the lamp house is connected electrically with a clock in such a manner that it is closed automatically for five seconds in every minute, and for 20 seconds at the end of each hour. During these eclipses no record is made on the sensitive paper and the breaks thus produced provide a time scale for the instrument.

The vibrations due to an earthquake travel along two paths, one group of waves passing directly through the earth and the other following its surface. Since the two groups travel at equal speeds they do not reach the seismograph at the same time, but make separate records on the sensitive paper. The interval between the records is readily measured on the ingenious time scale of the instrument, and from this the distance they have travelled can be calculated. In this way it is possible to suggest where a serious disturbance has taken place before news of its occurrence arrives by ordinary channels.

The seismograph on Bidston Hill is so delicate that it can detect the tilting of the ground that follows the rise and fall of the tide in Liverpool Bay and in the Mersey Estuary. An even more delicate performance of which it is capable is the demonstration of the movements of the rock strata of Bidston Hill itself on a hot summer day. The layers of rock then bend as they expand and the instrument can be set to show when this happens.

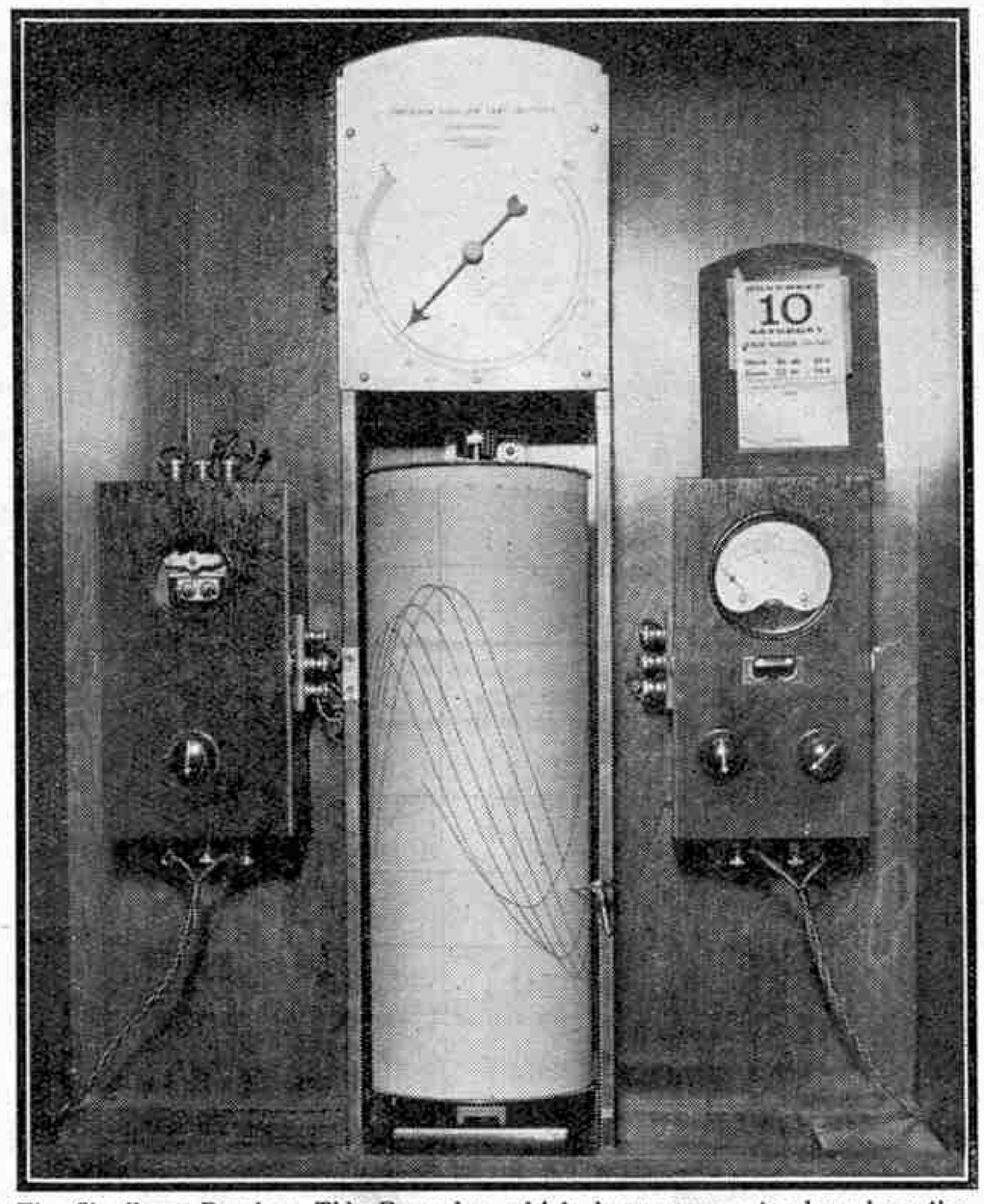
The tides are the chief concern of the Liverpool Observatory, which is equipped with special instruments for studying them and for preparing the tables that give in advance the times of high and low water at the principal ports of the Empire, with the exception of those in India. One of the instruments registers the state of the tide in the Mersey continuously and thus enables its ebb and flow to be followed accurately. It was invented by Dr. A. T. Doodson, F.R.S., Associate Director of the Observatory, and is known as the Chadburn-Doodson Tide Recorder. Like the time gun mechanism, it is in two parts, the recording end at the Observatory being electrically connected with a mechanism at Morpeth Docks that registers the height of the water in the Mersey.

At the dock a shaft has been sunk that has an outlet communicating with the tidal water of the estuary, and in it is a float that rises and falls with the tide. A wire from the float turns a pulley that is geared by means of a small differential and pawl mechanism to two sets of switches, one of which operates when the tide is rising, and the other when it is falling. Signals are thus transmitted along a Post Office telephone line to the recorder at the Observatory at the rate of 20 for each rise or fall of 1 ft. They are received by the instrument shown in the lower illustration on this page, in which they act on a step-by-step mechanism, similar to a ship's telegraph, that moves a pen up and down in accordance with the state of the tide, causing it to draw curves on sheets of squared paper wrapped round a rotating drum. The tidal changes for 14 days are recorded on one chart and the mechanism that controls the pen also rotates the pointer of a dial at the top of the instrument to show the height of the water at any moment.



The tides are the chief concern of Liverpool Observatory and our photograph shows one of the two wonderful Kelvin Tidal Predictors installed in it. Forecasts are made of tide times and heights at the chief ports in Great Britain and throughout the British Empire, with the exception of those in India.

Predictions of the times and heights of the tides at any port are based on calculations of the relative positions of the Sun, the Moon and the Earth, but other factors, such as the shape of the land around the port and the positions of the land masses in the area, also have to be allowed for. These factors, or "constants," vary from place to place and for each port are found by taking observations of the tides for a complete year. The calculations are very laborious, but fortunately it is unnecessary to carry them out in detail, for a wonderful machine invented by Lord Kelvin does the work easily and rapidly. There are only 12 tidal predictors in the world, and two of these are installed in the Observatory on Bidston Hill. They are valued at £2,000 each, but it is impossible to over-estimate their importance to navigators, who at any time may require to know with precision the state of the tide at a port in Great Britain or in some distant part of the Empire.



The Chadburn-Doodson Tide Recorder, which draws curves to show how the tide rises and falls in the Mersey estuary, three miles away. Electrical impulses transmit changes in the level of the water practically instantaneously.

The upper illustration on this page shows one of the tidal predictors at Liverpool Observatory. To the ordinary visitor it presents a bewildering array of pulleys and dials, but it makes its complex calculations rapidly and efficiently. The constants for the port for which predictions are required are introduced by making adjustments to the geared dials at the base of the predictor and the rises and falls of the pulleys above are then combined to move a pen that traces a curve showing how the height of the water will vary from hour to hour.

Calculations of this kind can be made for years in advance, and the story of the tides during past centuries also can be read on the machine. An interesting example of this power to peer into the past was given recently when it was desired to confirm an account of the invasion of Jersey, in the Channel Islands, in 1781. It was said that the retreating army of invasion was cut off because its ships were left high and dry by the tide, and on appeal to the tidal predictor it was discovered that the tide in fact was low at the time of the incident. The machine works swiftly and with unerring accuracy both in securing such records of past tides and in making predictions.

How a Great Ship is Launched

A Triumph of Simple Mechanism

By B. S. Davies

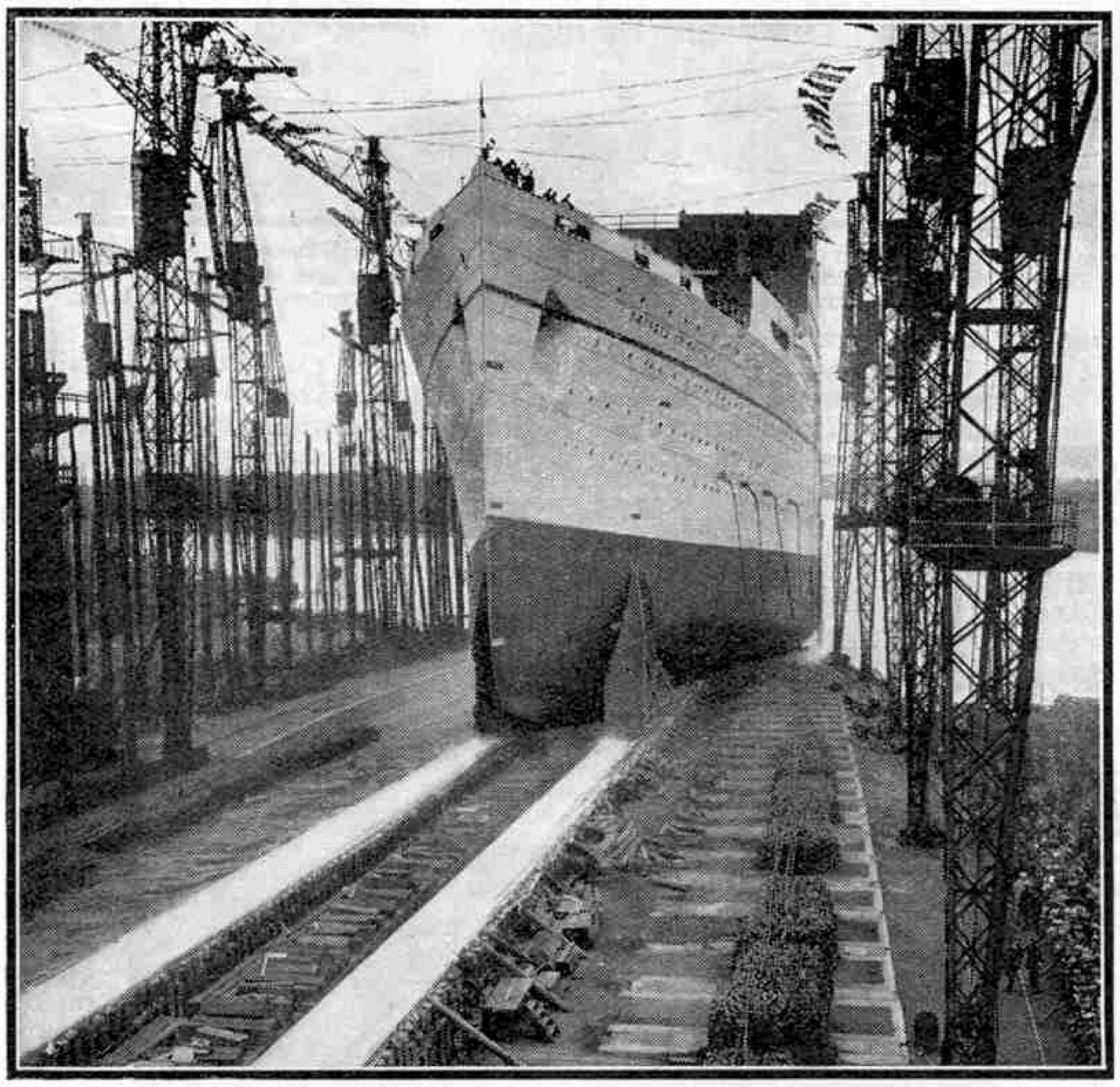
MOST ships in the British Isles are launched stern first, and the slipway is constructed where a river or estuary is deep and fairly wide and clear of such obstructions as sandbanks. The slipway is built so that there is a gradual slope down to the edge of the water, and consists of a large clear piece of ground covered in concrete. A line of heavy wooden blocks, called keel-blocks, runs down the centre of the slipway, and on this the keel is laid. The keel forms the backbone of the ship, from which the hull is built up; and as the ship gradually takes form the keel-blocks take the whole weight of the ship. On each side of the line of keel-blocks, and running parallel to them, are the "ground-ways," which take the whole weight of the ship when she is being launched. These ground-ways, as their name implies, are secured rigidly to the ground in the slipway, and the distance between them is about one-third of the beam of the ship under construction. They are made of very strong pieces of timber, and look like huge wooden railway lines.

On top of the ground-ways are fitted the "sliding-ways." They are exactly similar to the ground-ways except that they are not fixed to the slipway, and they form the base of a framework called the "cradle," which is built up round the ship. The cradle takes the weight of the completed hull off the keel-blocks when the ship is ready for launching. In order to prevent the sliding-ways from slipping off the ground-ways a long piece of timber is bolted to the outer edge of each ground-way, so that it stands up and overlaps the edge of the sliding-way, rather like the flange of a train wheel. It also acts as a guide for the sliding-way when the launch takes place. The remainder of the cradle is built up on top of the sliding-ways.

It must be clearly understood that the cradle does not extend right under the ship, but is built up in two distinct parts, one for each side of the ship, that are exactly alike.

So far, then, we have the keel-blocks down the centre of the slipway with the ground-ways on each side, all of which are fixed rigidly to the ground. The sliding-ways rest on top of each ground-way and form the base of the cradle.

We will now follow the construction of the cradle in more detail, and in order to simplify this we will consider one side only. On top of the sliding-way, and extending along its whole length, a thick flat piece of timber is laid. This is called a "poppet-board," and it forms the base for large upright baulks of timber that are bolted together and placed at intervals on top of the poppet-board. These baulks are called "poppets," and are used near the bow and the stern of the ship. As they approach the midship portion of the ship they gradually diminish in height, until at the midship portion they are replaced by a large piece of timber cut to fit the swell of the ship's side. This is called the "stopping-up." The function of these various components will become evident later on.



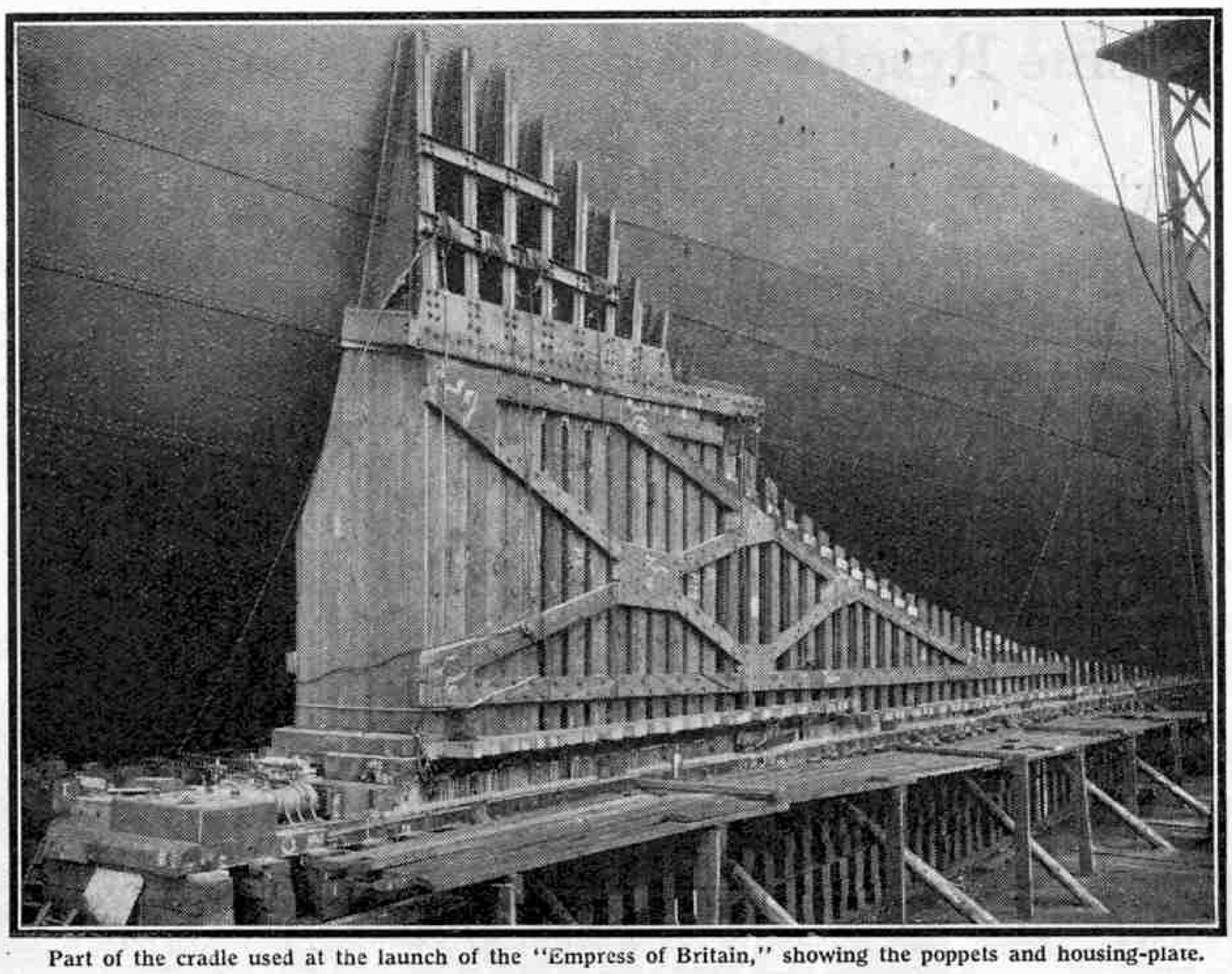
The "Empress of Britain" moving down the slipway when she was launched at Clydebank. Note the ground-ways and the keel blocks between them. The illustrations to this article are reproduced by courtesy of John Brown and Co. Ltd.

Just above the tops of the poppets a steel plate is riveted to the ship's side so that it projects and the tops of the poppets fit neatly underneath it. Brackets on the upper side of this plate, which is called the "housing-plate," keep it rigid. The stopping-up is kept in position by means of another plate riveted to the ship and called the "housing-angle." Outside the poppets a long narrow plate of steel is secured to hold them rigidly in position and to prevent them from falling over. All this is duplicated on the other side of the ship.

The cradle, as these assembled components are called, is now a fairly slack fit, but it is all ready to take the weight of the ship. The means by which the weight is transferred from the keel-blocks to the ground-ways and the sliding-ways is very simple. All the builders have to do is to drive in a series of long tapered wedges between the poppet-board and the sliding-way. As the wedges are driven in, the poppet-board is forced up. It lifts in turn the poppets and the stopping-up, and these, bearing up under the housing-plate and housing-angle respectively, lift the ship. Thus the ship is lifted off the keel-blocks and rests in the cradle. It must be borne in mind that at this stage the ship is a mere shell having no machinery inside, so that comparatively speaking the weight to be

lifted through this small distance is quite light.

Several days before the ship is to be launched the cradle is taken to pieces and the top surface of the ground-ways and the bottom surface of the sliding-ways are covered with a thick coating of special grease. The cradle is then reassembled, but the wedges are not driven home. Large baulks of timber, called shores, are placed in various positions round the ship and the cradle to prevent the latter from sliding down the ground-ways now that their surfaces are greasy and slippery; and two specially constructed shores, 8 ft. or 9 ft. long, called "dog-shores," are put in certain positions to fulfil two very important functions. These are to lock the sliding-ways to the ground-ways when the ship rests in the cradle, and so prevent a premature launch when the other shores have been removed; and conversely, to unlock the sliding-ways from the ground-ways by some simple method when the time for the launch arrives.

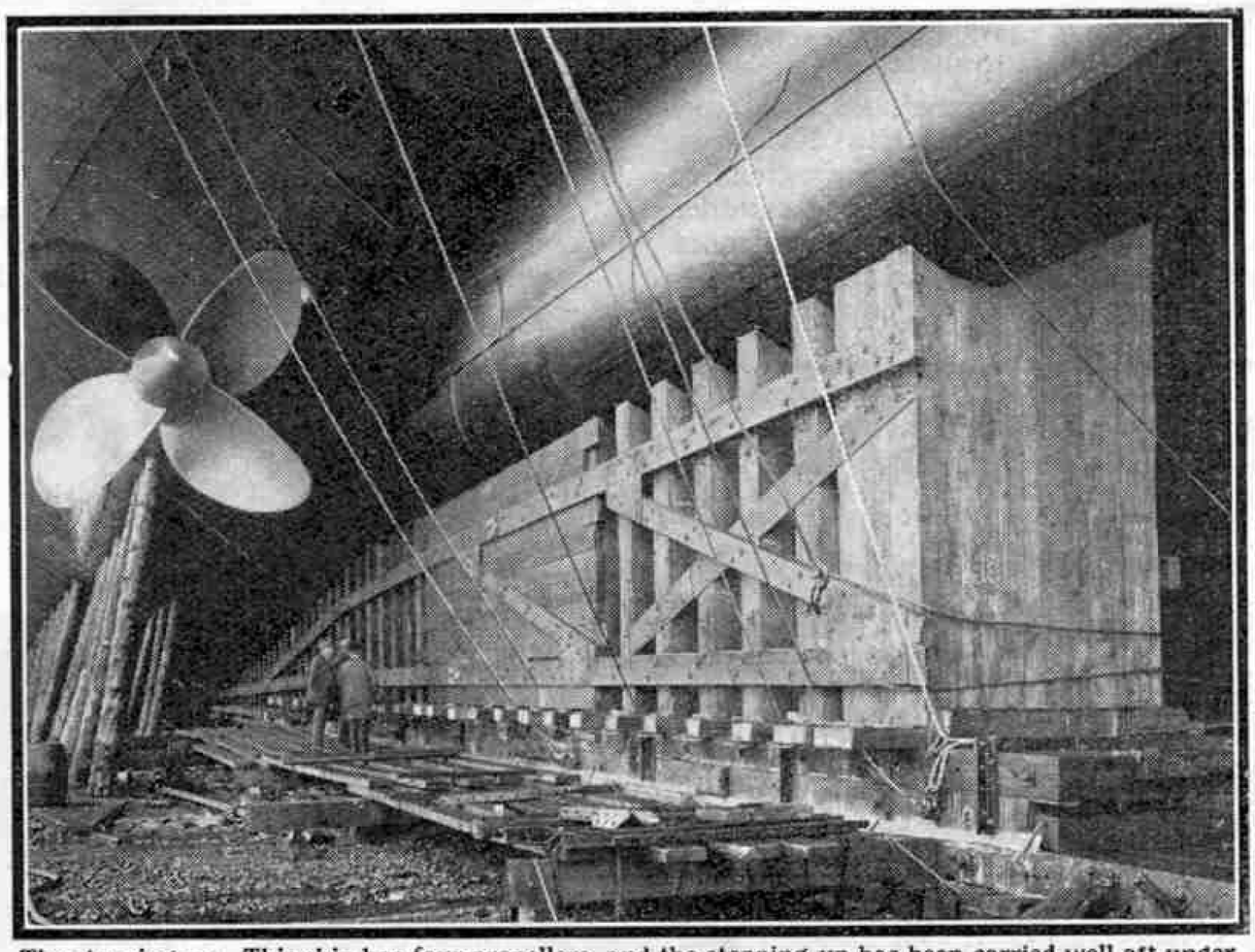


Part of the cradle used at the launch of the "Empress of Britain," showing the poppets and housing-plate.

The method of fitting them is simple. Near the ends of the sliding-ways farthest from the water, and on their sides, are bolted large pieces of timber called "cleats." Similar pieces are fastened to the ground-ways, leaving a lateral space between them, and the two dog-shores are wedged in these spaces, one on each side of the cradle. Therefore any weight on the sliding-ways that tends to move towards the water causes the cleats thereon to push against the higher ends of the dog-shores which in turn push against the cleats on the ground-ways. The latter, being rigidly fixed to the ground, resist the pressure and keep everything in position. All that is required, therefore, is some simple arrangement whereby the upper ends of the two dog-shores are knocked down simultaneously in order to free the sliding-ways from the ground-ways. It is done by suspending two heavy weights, one on each side, over the upper ends of the dog-shores. The weights are supported by a piece of rope, one end of which is fastened to one of the weights, led through a pulley fixed to the housing-plate, and thence along the ship's side to the bow. From the bow it is led across the ornamental "launching block" and back along the opposite bow to the weight suspended above the dog-shore on the other side.

The launching platform, from which the launching ceremony is carried out, is built round the bow of the ship, and the ornamental launching block is placed on this.

On the day of the launch the wedges are driven home between the poppet-boards and the sliding-ways so that the ship is lifted from the keel blocks and its weight taken by the cradle. Next all the shores are removed, except the dog-shores, which remain firmly wedged between the cleats on the sliding-ways and ground-ways. They are now the only means of preventing the ship in the cradle from sliding down to the sea.



The stopping-up. This ship has four propellers, and the stopping-up has been carried well aft under the shaft housing tube of the inner port propeller shaft. The observer is standing at the stern and is looking towards the bow, port side.

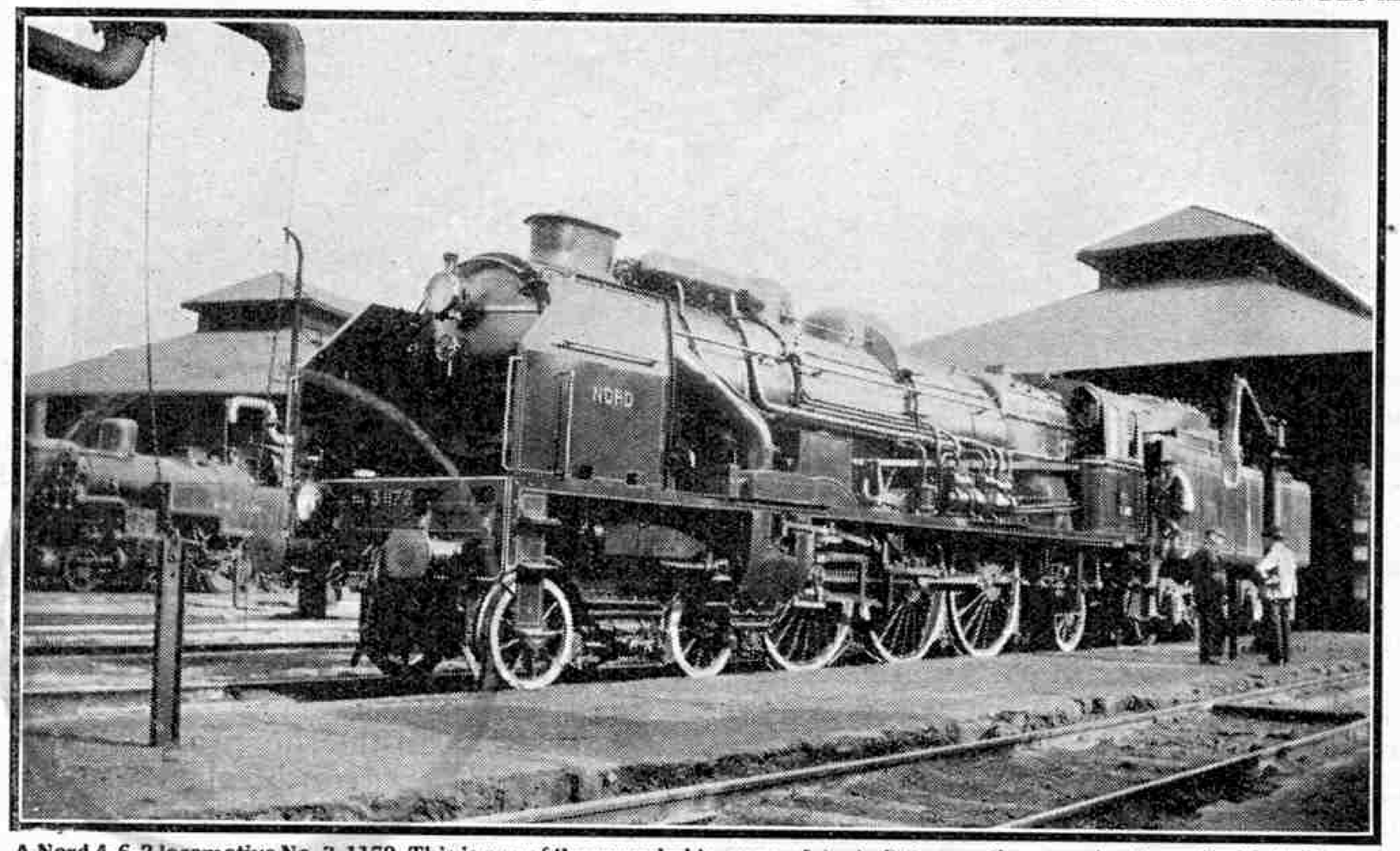
A sharp knife is placed on the rope supporting the weights suspended above the dog-shores, where it lies on the launching block. The blade is given a sharp tap with a special hammer, thus severing the rope. The released weights drop on the dog-shores, knocking them from between the cleats on the sliding and ground-ways, and thereby unlocking them. The sliding-ways with the cradle and the ship glide down to the water over the ground-ways, gathering speed until, in a smother of foam, the ship takes the water. In order to check the way of the ship after her initial plunge, huge piles of chain cable are dumped alongside her on the slipway before launching, and the ends of the cables secured on board. Then as the ship moves down the slipway she drags the cables after her and the weight is sufficient to reduce her speed. As the vessel floats, the cradle falls away from her, and she is taken in charge by tugs.

Locomotive Development on French Railways

Some Results of Scientific Rebuilding

By a Railway Engineer

DURING the past few years some striking developments in locomotive design have taken place on the French railways. Continued use of the compound system of propulsion, and intensive research into almost every detail of the machine, have produced engines that can safely be described as the most efficient in the world. It is remarkable, too, that none of these is new; scientific rebuilding of comparatively old engines, whose usefulness was on the wane, has been carried out with conspicuous success, so much so that many recent feats of haulage that stand to their credit would have been thought utterly impossible, with steam, a few years ago.



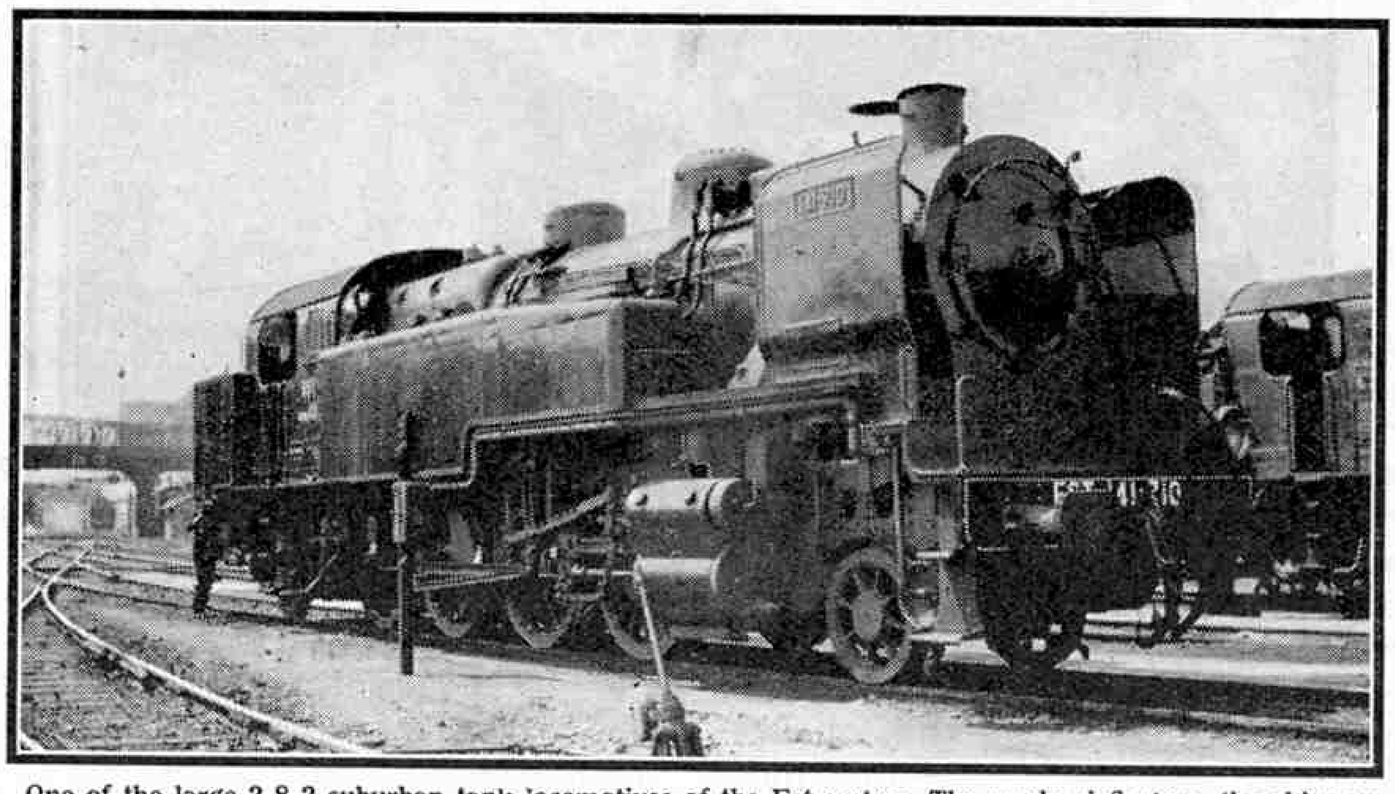
A Nord 4-6-2 locomotive No. 3-1172. This is one of the remarkably successful rebuilt locomotives acquired from the Paris-Orleans Railway. Characteristic features include the double chimney and very large outside steam pipes.

Pride of place in this enterprising programme of rebuilding must undoubtedly be given to the Paris-Orleans Railway, and it is largely the results of this company's conversions that have inspired equally notable changes on the Est and the Etat Railways. The first rebuild on the Orleans line consisted of a very extensive alteration to one of that company's standard 6 ft. 3 in. 4-cylinder compound "Pacifics"; this has now been followed by a still more remarkable conversion of one of the similar engines with 6 ft. wheels into a 4–8–0. New cylinders have been fitted, with poppet valves; great care has been taken to provide very large and direct passages for the steam; the boiler has been fitted with a greatly enlarged superheater, and a "Kylchap" blast pipe with a double chimney has been included.

One of these engines was recently put through a test of the most vigorous kind on the "Nord" railway between Calais and Paris, and achieved a performance that has never been equalled with steam. Normally speed is limited by law to 120 kilometres per hour, that is 74½ m.p.h.; but this strict rule was relaxed on the occasion of the test run, and with the exceedingly heavy load of 635 tons behind the tender, the engine ran the 102.9 miles from Calais to Amiens in the astonishing time of 85½ minutes! For some distance speed was sustained at 84 m.p.h. on the dead level. Restarting, the 80.8 miles from Amiens to La Chapelle depot, Paris, were run in 70½ minutes. On this last section the engine sustained 70 m.p.h. up the 1 in 200 bank to Survilliers, and fitly concluded an astounding performance with a maximum of 91 m.p.h. on the descent into Paris, where the gradient is 1 in 200.

During a recent visit to the French capital I was privileged to inspect a number of very interesting locomotives, including one of these remarkable Paris-Orleans rebuilds. The main line of the latter company is electrified as far as Orleans, but since electrification has taken place several of the steam locomotives have been transferred to the Nord, and although there is no steam locomotive depot of the Orleans line in Paris, I was able to inspect and photograph several of the company's former engines at the La Chapelle depot of the Nord.

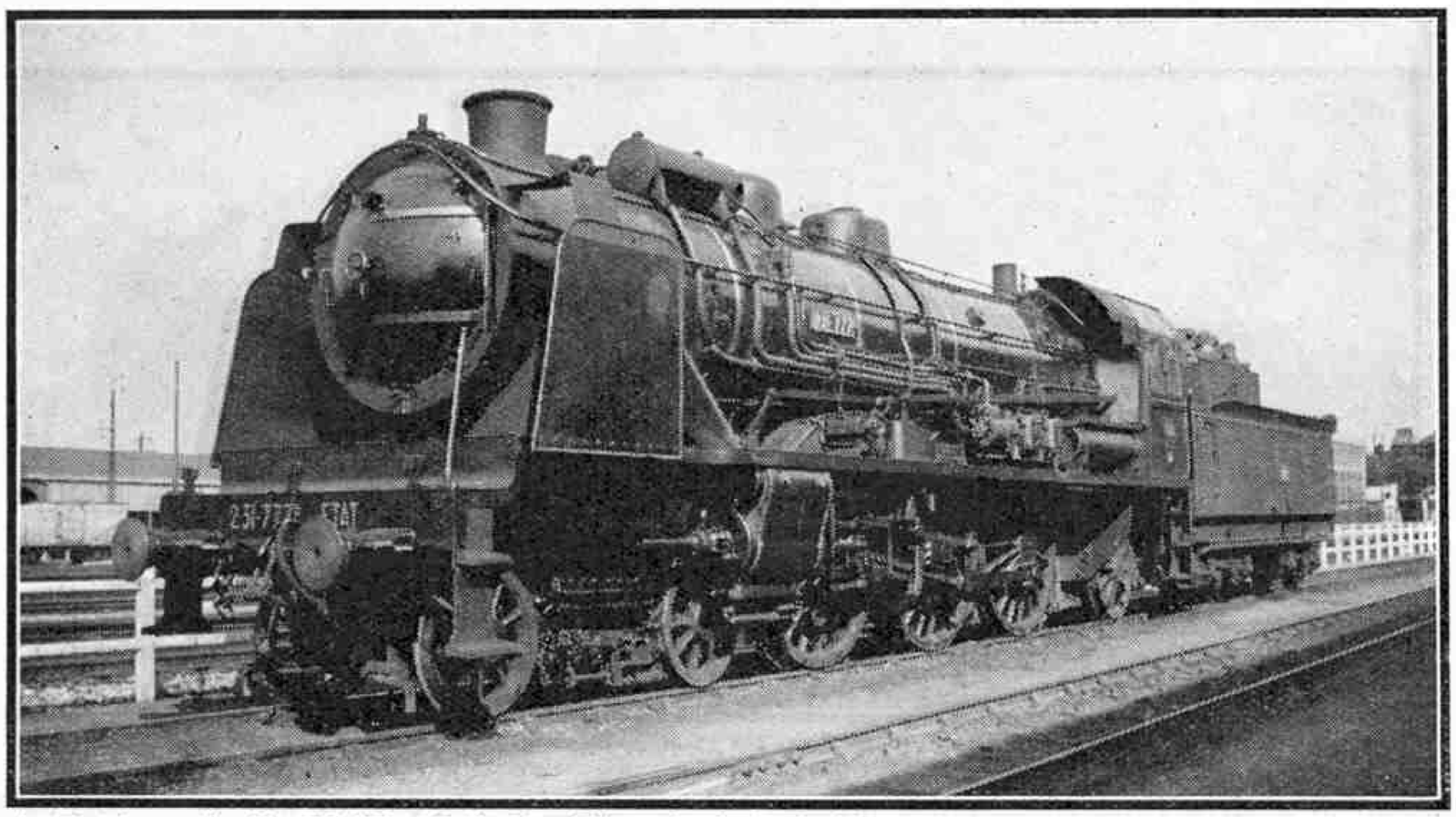
In making a tour of the Parisian running sheds, let us first of all repair to Bercy, on the Paris, Lyons and Mediterranean Railway. The express services of this company are largely worked by "Pacifics," but about 10 years ago, in order to cope with increasing train loads, a colossal 4–8–2 "Mountain" type was introduced. One of these engines was standing in the yard, and it took a considerable time to appreciate fully its vast proportions. They are, of course, 4-cylinder compounds, but they differ in certain important respects from the usual French practice. The high-pressure cylinders, which are 20 in. diameter by 25½ in. stroke, are placed inside the frames, while the low-pressure, which have the enormous diameter of 28⅜ in., are outside. The outside cylinders drive the leading pair of coupled wheels and the inside drive the second pair. The front of the smokebox is cone-shaped, in a rather similar way to the partly streamlined engines put into service last year on the English G.W.R., but otherwise there is no attempt at streamlining. However, these engines have considerably fewer "gadgets" mounted externally than most French locomotives. One point that struck me forcibly was the very restricted space in the cab. Although from outside it appears to be fairly roomy, the fire-box actually projects some distance in, and there is no greater space than on an L.N.E.R. (G.N. section) "Atlantic." The fire-door is placed much higher than on English locomotives; this I found to be a feature common to most French engines, and would appear to make the fireman's task more strenuous.



One of the large 2-8-2 suburban tank locomotives of the Est system. The smoke deflectors, the chimney cover and the generally "lofty" appearance make these engines very different from British tanks.

Only two other types are stationed at Bercy, a mixed traffic 2–8–0 design, and a powerful 4–8–4 suburban tank. In France, by the way, wheel arrangements are classified by the number of axles instead of the number of wheels, so that a "Pacific" is a 2–3–1, an "Atlantic," a 2–2–1; French forms of the same class names are used, for example "Pacifique," "Atlantique" and "Montagne."

Next comes the Est, the Paris running sheds of which are situated at La Villette. Here again the premier engines of the company are of the "Mountain" type. The design differs in many respects from that of the P.L.M.; the high-pressure cylinders are outside and drive the second pair of coupled wheels, whereas the low pressure are inside and drive the leading pair. The high boiler pressure of 290 lb. per sq. in. is used, while several familiar English fittings are employed such as the Worthington feed water heater and a Davies and Metcalfe exhaust steam injector. The weight of the engine alone, in working order, is 117 tons.



An Etat locomotive No. 231-777 at Batignoles. This engine is fitted with a special clear-vision cab outlook device which is prominent in front of the cab.

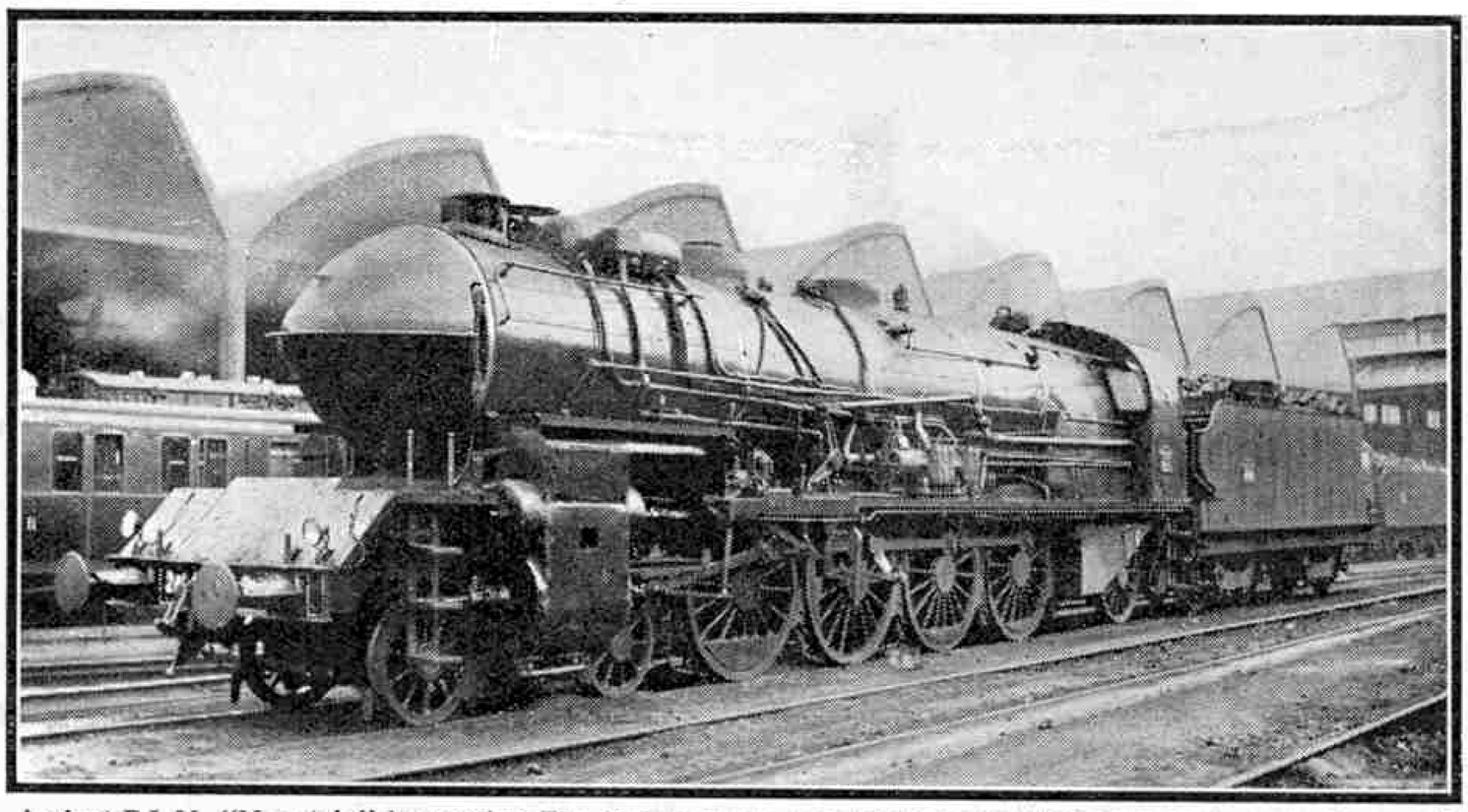
Another outstanding Est type is a 4-cylinder compound 4–6–0. As originally built these were admirable engines in every way, but with increasing loads they had to be superseded on the heaviest duties. Inspired no doubt by the results obtained on the Paris-Orleans, several of these engines have recently been rebuilt extensively. The original low-pressure cylinders have been retained, but new high-pressure cylinders with piston valves having double admission and exhaust passages have been fitted. Various other changes have been made, such as the inclusion of a Worthington feed water heater and modified blast pipe, the net result of which has been simply to revolutionise the performance of the engine. One of them sustained a speed of 70 m.p.h. on the level with 600 tons behind the tender.

All these French compounds are arranged so that the cut-off in the high- and low-pressure cylinders can be adjusted independently. In this way they differ from the English Midland Compounds in which one reversing gear is used for both. The French arrangement calls for very skilful handling on the part of the driver, for unless the ratio of volumes between the high- and low-pressure cylinders is kept correct the engine is liable to become choked. As in the case of the P.L.M. engines, the cabs are not only cramped, but very exposed to the weather as compared with modern British practice. Scant attention seems to be given to the enginemens' comfort, while the fuel employed makes the conditions on the footplate still more unpleasant. Powdered coal in the form of briquettes is used; this is easy to handle as the lumps are of a uniform size, but it is extremely dusty, and a great number of French enginemen wear goggles to protect their eyes.

Several very fine 2–8–2 suburban tank engines were in the yard at La Villette. These are 3-cylinder simples of great power. The cylinders are 20 in. diameter by 26 in. stroke, and these, combined with small driving wheels only 4 ft. 8 in. diameter and a boiler pressure of 203 lb. per sq. in., produce the very high tractive effort of 48,070 lb. at 85 per cent. of the boiler pressure. The local trains out of Paris are, however, exceedingly heavy, loading up to 600 tons, and with these trains the 2–8–2 tanks often attain speeds of 60 m.p.h. From the illustration on page 136 it will be seen that they carry smoke deflecting plates at the front end and the characteristic hinged cover to the chimney.

From the east, we now move over to the west of the city to visit the Batignoles sheds of the Etat system. This company recently added a large number of "Mountain" type express engines to its stock, of identical design to those of the Est; but perhaps the most striking Etat development has been a very successful rebuilding of some of the standard "Pacifics." The general plan has been much the same as that carried out by the Paris-Orleans. In this case the original high-pressure cylinders with their piston valves have been retained, but the engines have been fitted with new low-pressure cylinders having poppet valves. The rebuilds have been found capable of hauling loads of 100 to 150 tons more than previously, without any increase in coal consumption.

One of these engines, No. 231–777, was especially interesting in being fitted with a clear-vision cab outlook, a most ingenious device that does away with the necessity of having glass screens. A series of curved plates are arranged in such a way that the airstream caused by the motion of the train is deflected across the driver's outlook so that no air, rain, or snow enters the cab. Trouble has always been experienced on locomotives with the glasses becoming obscured, but this form of aero-dynamic screening completely solves the problem, for the driver looks out through a perfectly clear opening. The upward current of air created also counteracts any tendency for the exhaust steam to beat down, although most modern French engines have deflecting screens alongside the smokebox. Although, to quote the shed foreman at Batignoles, *"Ce n'est pas beau!"*, the device has proved a great boon, and it will be interesting to see whether it is tried in this country.



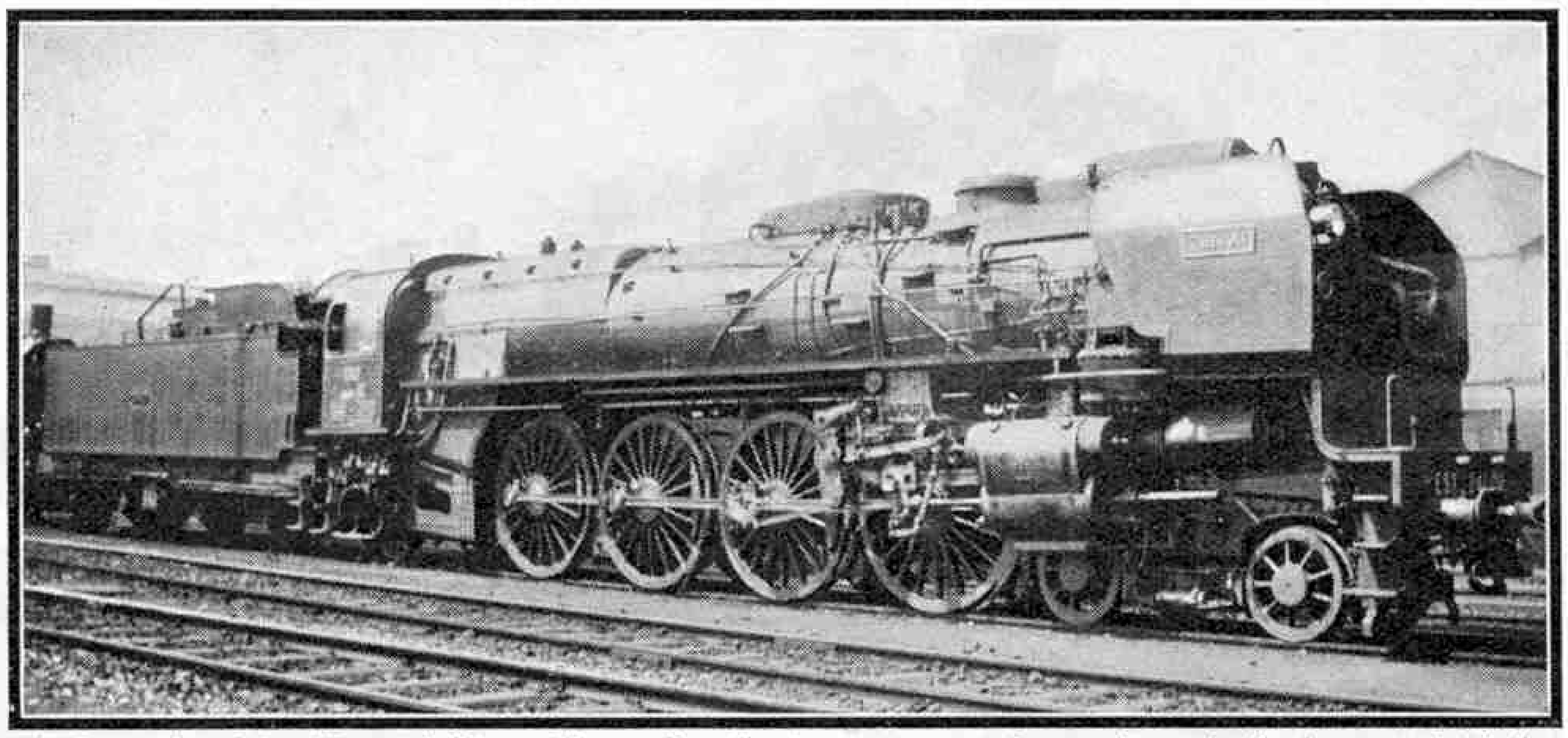
A giant P.L.M. "Mountain" locomotive. The conical smoke-box door is a notable feature, and recalls the use of these fittings on the P.L.M. locomotives of many years ago.

The Etat, like the Est, has a very heavy suburban traffic, and, in order to increase the accommodation in the trains, has put into service a large number of double-decker coaches. Practically all these trains are operated on the "push and pull" principle, whereby the engine is permanently coupled to one end of the train and in one direction of running is at the rear. This principle has been widely adopted in this country for light branch trains of two or three coaches, propelled by a 2–4–2 tank engine for example, but it is a thrilling sight indeed to see a Paris suburban train of 500 tons tearing along at 55 m.p.h. with a huge 2–8–2 tank engine bringing up the rear!

The Etat system serves Normandy and Brittany, and some very

fine locomotive work is put up on the boat expresses to Cherbourg, Havre and Dieppe. The Etat engines, like those of the Est, are painted black, relieved by a simple white lining. All the French railways use a rather sombre colour-scheme; the P.L.M. engines are painted olive-green of a rather more yellowish tinge than the English Southern Railway; the Paris-Orleans uses a slate grey, while the Nord locomotives are almost exactly the same colour as the London Brighton and South Coast in pre-grouping days, a deep sepia brown.

Last of all we come to the Nord, perhaps the most familiar of all foreign railways to English people. Appropriately enough, La Chapelle sheds were the most fascinating of all, for here were to be found engines of all ages, ranging from veteran De Glehn compound "Atlantics," to one of the very latest Paris-Orleans rebuilt "Pacifics," which had been recently acquired by the Nord.

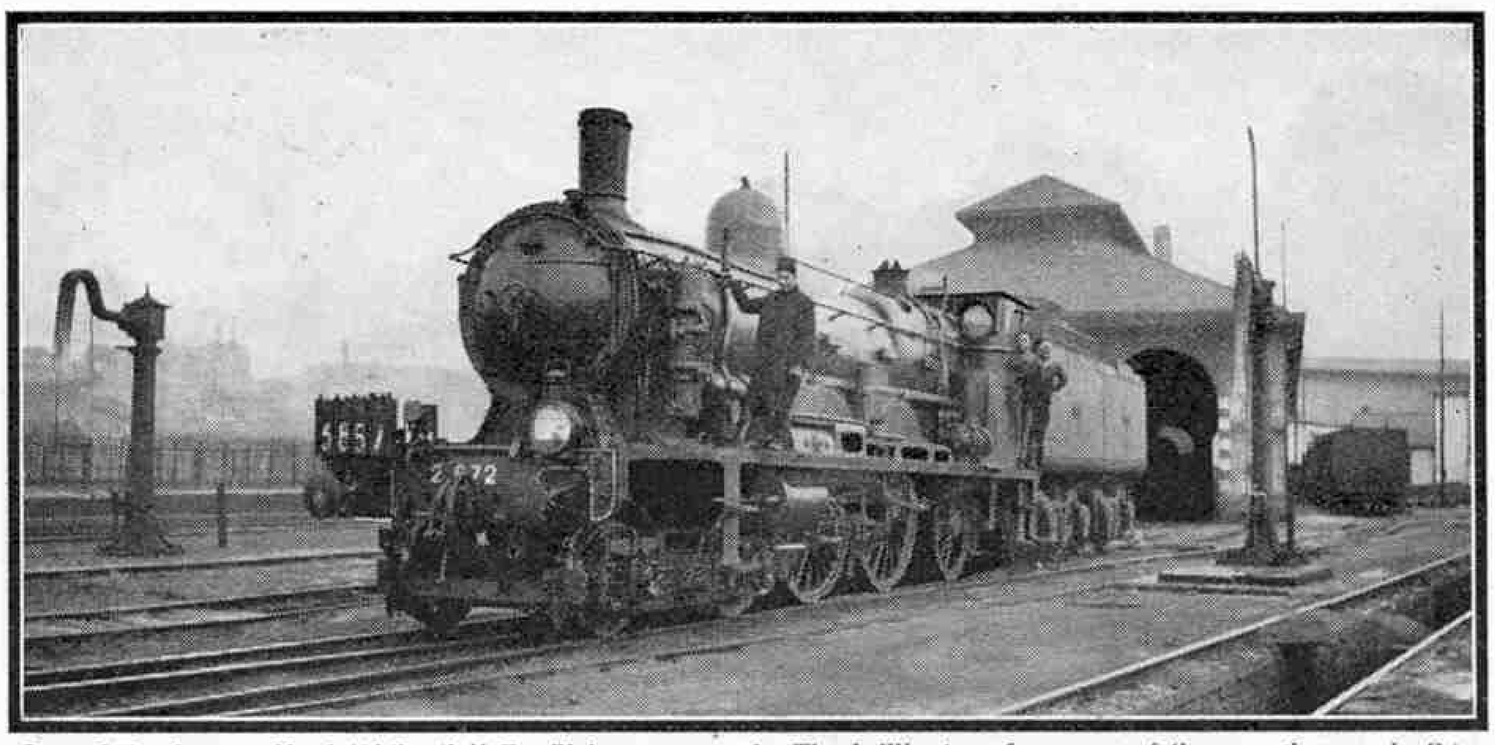


An Est version of the "Mountain" type of locomotive. The chimney seems to be conspicuous by its absence owing to the smoke deflectors and other apparatus in the neighbourhood of the smoke-box.

Just as the foundations of modern British locomotive practice were laid when the Great Western 4-cylinder 4–6–0s of the "Star" class came out in 1907, so equally modern French practice has gradually developed from the amazingly successful 4-cylinder compound "Atlantics" of the Nord, built as long ago as 1900. Slender and graceful, the Nord "Atlantics" are surely the most handsome French locomotives ever built.

Altogether contrasting was a tremendous Paris-Orleans rebuilt "Pacific." The huge outside steam pipes and ingenious valve gear, combined with the numerous other appliances that have been added to increase efficiency, make these engines an awe-inspiring sight. On the Nord they are known by the class name of *"P.O. Transformation"*; certainly "transformation" most aptly describes the improvement in the performance of the engines that has been effected, though actually *"transformation"* is merely the technical French word for "rebuild."

The success of these Paris-Orleans experiments has already influenced locomotive practice far beyond the confines of France. The most notable examples that occur to mind are the L.N.E.R. "Mikados"; in the design of *"Cock o' the North"* and *"Earl Marischal."* Mr. Gresley freely acknowledges his inspiration as having come from the Paris-Orleans, and French locomotive engineers in their turn have taken the keenest interest in the exploits of the L.N.E.R. engines, quite apart from the visit of No. 2001 to France.



One of the famous Nord "Atlantic" De Glehn compounds. The brilliant performance of these engines early this century aroused considerable interest, and a locomotive of similar type was built for the G.W.R.

Although the magnificent P.O. rebuilt engines have become the premier locomotives of the Nord, the "Super-Pacifics" of the latter company are capable of superb work and are easily the finest *new* French locomotives that have been put on the road in recent years. They represent the highest development of the De Glehn compounds and embody 30 years of hard experience and intensive research. The boiler pressure is 246 lb. per sq. in., and the total weight of the engine in working order is 99 tons. Externally they are of striking appearance. The chimney is wedge-shaped at the front, to assist in throwing the smoke clear; the fire-box is long and narrow, and once again the space on the footplate is rather cramped. One of the most noticeable points is their extraordinary silence when starting away, even when hauling loads of over 500 tons.

In returning to England I was treated to a really splendid example of French locomotive performance, on the 10.30 a.m. Boat express from Paris (Nord) to Boulogne. The load was a heavy one of 520 tons behind the tender, and included a through sleeping car from the Riviera. The engine was a Nord "Super-Pacific," No. 3-1284. The schedule is a fast one, for the 140.6 miles from Paris to Etaples have to be run in 142 minutes; but although for the last 60 miles of this section we encountered a very strong west wind off the sea, we reached Etaples exactly five minutes early.

The start from Paris is on falling grades, and getting away smartly we were through St. Denis, 3.8 miles, in 6 minutes, at 61 m.p.h. From here there is a continuous ascent of 14 miles, at 1 in 200, to Survilliers. The climb is made slightly easier by short level strips, but even so involves some hard work. On the bank speed fell off steadily at first, but on passing Villiers the exhaust sharpened into a roar, and in less than 3 miles, climbing at 1 in 200, we had accelerated to 62 m.p.h.! On the last three miles there was a very slight falling off, but even so we breasted the summit at 59 m.p.h.—a magnificent piece of work with 520 tons.

On the ensuing descent speed rose rapidly to the legal maximum of 74½ m.p.h. The driver then maintained this rate unvaryingly for mile after mile. All French express locomotives are fitted with speedometers, and this enables the engines to be run exactly at the speed limit, without the slightest excess. So, we were through Creil, 31.2 miles, in 31½ minutes, speed being carefully reduced to 53 m.p.h. for the junction.

Another long climb follows, though at rather easier grades, beginning at 1 in 415 and finishing with some lengthy stretches at 1 in 250. This 23 miles from Creil up to Gannes was covered at an average speed of 59 m.p.h., and the summit point, 54.2 miles from Paris, passed in 55¼ minutes. A long spell at 72 to 74 m.p.h. followed, on easy down grades, and Longeau, 78.2 miles, was passed in 75½ minutes. Then came the severe service slack to 20 m.p.h. through Amiens, this important centre being passed in 79 minutes for the 81.1 miles from Paris.

From here the line is almost dead level right on to Etaples, and maintaining a general average of 65 to 67 m.p.h. we passed Abbeville, 108.9 miles, in 106½ minutes, and reached Etaples in 137 minutes. In the short run thence to Boulogne some hard running is needed. As far as Dannes-Camiers, 4.6 miles out, the line rises at 1 in 350, and here we attained 53 m.p.h. Then 2½ miles at 1 in 133 follow up to Neufchatel, and this bank was mounted at the splendid minimum speed of 44½ m.p.h. We swept down the corresponding fall to Hesdigneul, touching 73½ m.p.h., and despite a bad signal check reached Boulogne (Ville), 16.9 miles, in 21¾ minutes—a very smart piece of work with a 520-ton train.

On restarting from the town station we crawled down a main thoroughfare, with the engine's high-pitched squeak of a whistle repeatedly sounding, and so into the Maritime station, where the Southern Railway steamer *"Biarritz"* was waiting to take us across to Folkestone. This splendid example of French locomotive performance made a very impressive finish to a visit of exceptional interest.

The L.M.S.R. "Jubilee" Class Locomotives

Names of Empire and Naval Interest

IT has been decided by the L.M.S.R. to provide names for all the locomotives of the three-cylinder 4–6–0 "Jubilee" class. This step no doubt will be very popular with railway enthusiasts, especially those whose favourite railway is the L.M.S.R. Two of the engines had already been named before the decision to deal with the class as a whole was made public. These were No. 5552, *"Silver Jubilee,"* the first one built, which was so named in connection with the Royal Silver Jubilee celebrations of last year; and No. 5665, *"Lord Rutherford of Nelson,"* specially named on the occasion of the recent opening of the new L.M.S.R. research laboratories at Derby by Lord Rutherford.

The engines yet to be constructed will be put into service complete with nameplates, but the names are being added as convenient to those of the class already running. This accounts for some of the engines being observed with names and others without, a feature that has puzzled some of our readers. The list on this page gives the names selected for the whole series of 179 engines, either built, under construction or proposed.

In their design as three-cylinder 4–6–0 locomotives the "Jubilee" class follow the very successful "Baby Scot" series Nos. 5500 to 5551. The parallel boiler of the latter engines however is replaced by the tapered form favoured by Mr. Stanier, the Chief Mechanical Engineer of the L.M.S.R. This carries a higher pressure—225 lb. per sq. in.—against the 200 lb. of the "Baby Scots." As the three cylinders are reduced in diameter to 17 in., from the 18 in. bore of the "Baby Scots," the difference in the respective tractive efforts is only slight. The figure for the "Jubilee" class is 26,610 lb., and for the "Baby Scots" 26,520 lb., at 85 per cent. of the working pressure in each case.

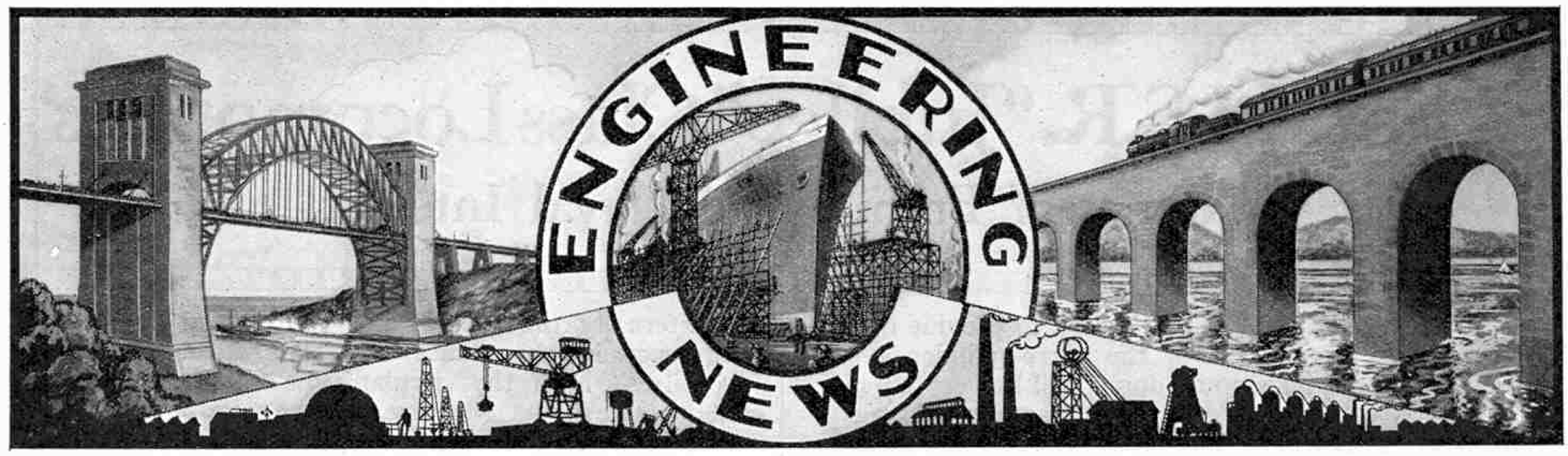
Names of L.M.S.R. "Jubilee" class Locomotives

5552	Silver Jubilee	5612	Jamaica	5672	Anson
3	Canada	3	Kenya	3	Keppel
4	Ontario	4	Leeward Islands	4	Duncan
5	Quebec	5	Malay States	5	Hardy
6	Nova Scotia	6	Malta	6	Codrington
7	New Brunswick	7	Mauritius	7	Beatty
8	Manitoba	8	New Hebrides	8	De Robeck
9	British Columbia	9	Nigeria	9	Armada
5560	Prince Edward Island	5620	North Borneo	5680	Camperdown
1	Saskatchewan	1	North Rhodesia	1	Aboukir
2	Alberta	2	Nyasaland	2	Trafalgar
3	Australia	3	Palestine	3	Hogue
4	New South Wales	4	St. Helena	4	Jutland
5	Victoria	5	Sarawak	5	Barfleur
6	Queensland	6	Seychelles	6	St. Vincent
7	South Australia	7	Sierra Leone	7	Neptune
8	Western Australia	8	Somaliland	8	Polyphemus
9	Tasmania	9	Straits Settlements	9	Ajax
5570	New Zealand	5630	Swaziland	5690	Leander
1	South Africa	1	Tanganyika	1	Orion
2	Irish Free State	2	Tonga	2	Cyclops
3	Newfoundland	3	Trans-Jordan	3	Agamemnon
4	India	4	Trinidad	4	Bellerophon
5	Madras	5	Tobago	5	Minotaur
6	Bombay	6	Uganda	6	Arethusa
7	Bengal	7	Windward Islands	7	Achilles
8	United Provinces	8	Zanzibar	8	Mars
9	Punjab	9	Raleigh	9	Galatea
5580	Burma	5640	Frobisher	5700	Britannia
1	Bihar and Orissa	1	Sandwich	1	Conqueror
2	Central Provinces	2	Boscawen	2	Colossus
3	Assam	3	Rodney	3	Thunderer
4	North West Frontier	4	Howe	4	Leviathan
5	Hyderabad	5	Collingwood	5	Seahorse
6	Mysore	6	Napier	6	Express
7	Baroda	7	Sturdee	7	Valiant
8	Kashmir	8	Wemyss	8	Resolution
9	Gwalior	9	Hawkins	9	Implacable
5590	Travancore	5650	Blake	5710	Irresistible
1	Udaipur	1	Shovell	1	Courageous
2	Indore	2	Hawke	2	Victory
3	Kolhapur	3	Barham	3	Renown
4	Bhopal	4	Hood	4	Revenge
5	Southern Rhodesia	5	Keith	5	Invincible
6	Bahamas	6	Cochrane	6	Swiftsure
7	Barbados	7	Tyrwhitt	7	Dauntless
8	Basutoland	8	Keyes	8	Dreadnought
9	Bechuanaland	9	Drake	9	Glorious
5600	Bermuda	5660	Rooke	5720	Indomitable
1	British Guiana	1	Vernon	1	Impregnable
2	British Honduras	2	Kempenfelt	2	Defence
3	Solomon Islands	3	Jervis	3	Fearless
4	Ceylon	4	Nelson	4	Warspite
5	Cyprus	5	Lord Rutherford of Nelson	5	Repulse
6	Falkland Islands	6	Cornwallis	6	Vindictive
7	Fiji	7	Jellicoe	7	Inflexible
8	Gibraltar	8	Madden	8	Defiance
9	Gilbert and Ellice Islands	9	Fisher	9	Furious
5610	Gold Coast	5670	Howard of Effingham	5730	Ocean
1	Hong Kong	1	Prince Rupert		

Externally the tapered boiler makes a considerable difference in appearance and the smoke-box of the "Jubilees" is of the circular type finished flush with the outside boiler sheeting. In the "Baby Scots" the smoke-box is horse-shoe shaped in section, and in accordance with the former Derby practice it is raised above the surface of the boiler. The boiler fittings are different in the new engines and include top-feed apparatus. The cab too is altered to the double-window kind and among minor details a Caledonian type hooter is fitted in place of the Derby whistle.

Differences are noticeable too between the tenders fitted to the respective classes. The "Baby Scots" have the older standard tender developed from Midland practice, holding 5 tons of coal and 3,500 gallons of water. The earlier "Jubilees" had a further development of this type, with higher sides which raise the coal capacity to 7 tons. The later engines have however been provided with the more imposing 9-ton, 4,000-gallon vehicles which are longer and wider and have their very high sides turned inwards at the top. One of these was also attached to No. 5552 *"Silver Jubilee"* at the time of its exhibition at Euston last year. It still retains this vehicle as, in view of the special finish of the engine and tender in black and chromium plate, no other tender would be suitable. It is reported that some of the "Jubilee" class are now to lose their 4,000 gallon tenders as these are to be fitted to the "Royal Scots." The "Jubilees" will receive in exchange the older standard 3,500 gallon tenders discarded by the latter engines.

The "Jubilees" have proved themselves speedy and efficient locomotives. Engines of the class are in use on practically all sections of the L.M.S.R. and undertake all but the heaviest duties.



Constructing World's Largest-Bore Tunnel

In connection with the San Francisco–Oakland Bay Bridge scheme, now being carried out in the United States, a huge tunnel is being constructed, which when completed will be the world's largest bore. The tunnel is being built through Yerba Buena Island, and without its concrete lining will be 76 ft. wide by 58 ft. high, and will accommodate two traffic decks, the upper one with six lanes for fast automobile traffic, and the lower with three lanes for heavy trucks and two tracks for interurban trains.

Some idea of the great size of the tunnel may be had from the fact that a four storey building could be pulled upright through it. When completed the tunnel will be continuously lined and will be 540 ft. in length, and the roof will be supported by 16-in. steel arched ribs embedded in concrete and placed 3 ft. apart.

A novel method of excavating the tunnel is being employed. Three bores were first drilled through the island, one at each lower side and one above and between them to form the crown. These were then blocked out into a horseshoe-shaped excavation, and this is now being concrete- and steel-lined from 3 ft. to 5 ft. thick before the core is dug out. About 250 ft. of the total length has now been lined, and a power shovel, which enters from one of the portals, is being used to remove the thousands of cubic yards of rock within the lining.

Australian Submarine Cable Completed

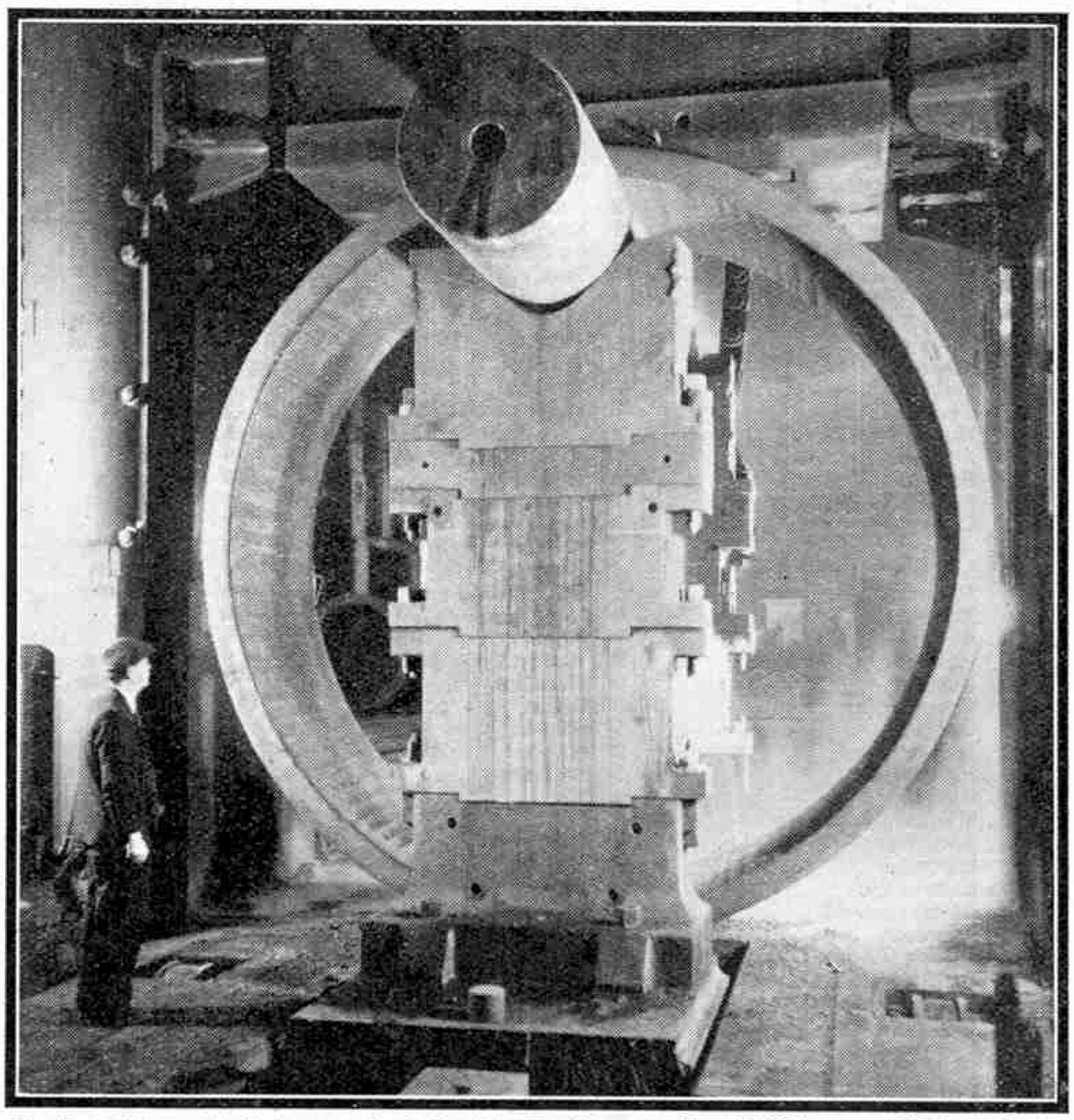
A new submarine cable has been laid across the Bass Straits between Australia and Tasmania. It connects the land lines of the Australian mainland with those of Tasmania, and completes the network of telephonic communication between all the States of the Commonwealth. The cable is 161 nautical miles in length, and will enable the simultaneous operation of at least five telephone circuits, a broadcast programme, and seven high-speed telegraph channels over a single insulated conductor. A full description of th cable will appear in the *"M.M."* in due course.

Largest Gear Rims Ever Forged in England

The illustration on this page shows a giant gear wheel rim 14 ft. 3 in. in diameter that was made recently at the Vickers Works of the English Steel Corporation. This is the first time in this country that a gear rim of such great size has been forged. The forging operation was carried out under a new 7,000-ton electro-hydraulic press recently installed at the works, which makes possible the forging of even larger rims of this type.

The portion of the ingot required for two rims, after being trepanned with a 24 in. hole, was expanded under the press to slightly over 10 ft. in diameter. It was then re-heated and forged to 14 ft. 3 in. diameter, the forging being subsequently heat treated and machined into two rims. The expert knowledge required for carrying out this operation will be appreciated when it is realised that the machining allowance is about 1 in. on all surfaces, and that as measurements have to be taken while the forging is hot, allowance has to be made for the contraction that takes place as the forging cools. In this case the forging was $1\frac{3}{4}$ in. larger on the internal diameter when finish forged than it was after cooling.

The gear wheel rims have been made for a single reduction geared turbine that is under construction for the Ellerman Line at the Birkenhead yard of Cammell Laird and Co. Ltd.



The largest gear wheel rim ever forged in this country, under the 7,000 ton press at the maker's works. Photograph by courtesy of the English Steel Corporation Ltd., Sheffield.

Shipbuilding News

The owners of the French liner *"Normandie,"* the Compagnie Générale Transatlantique, have recently put into commission on their Marseilles-Algiers service, the *"Ville D'Alger."* This vessel, which is of the twin screw type, is propelled by geared turbines of 20,000 h.p. and has an overall length of 484 ft. and a gross tonnage of 9,764. The vessel, which is larger than any previous ship operated in trans-Mediterranean service is equipped for carrying mails, passengers and cargo, and having a speed of 22/23 knots will be able to make the crossing in 20 hours. Among her outstanding features are elaborate fire prevention equipment and luxurious passenger accommodation.

A new motor-driven tanker, which will be capable of carrying 27 grades of oil at one time, is being built for the Anglo-American Oil Co. Ltd. The ship will have a deadweight tonnage of 10,200, and the tanks will hold about 2,500,000 gallons of oil.

A new icebreaking and buoyage vessel is to be built for the Swedish Government, and a novelty in its equipment will be a magnetic coupling between the engine and propeller shaft. The purpose of the coupling is to eliminate mechanical connection between the engine and propeller and so reduce the risk of damage in ice. By means of special control apparatus it will be possible to obtain any desired degree of slip in the coupling from zero up to full speed of the engine.

Harland and Wolff Ltd., Belfast, recently launched the *"Dunnottar Castle,"* a 15,000 ton passenger and cargo motorship for the Union-Castle Mail Steamship Co. Ltd. The vessel is 560 ft. in length, and will be used for service between Great Britain and South and East Africa.

Novel Automatic Rammer

The device shown in the lower illustration on this page is known as the "*Kangarammer*," and is used to great extent in road-making and light pile driving. It is made by C. H. Johnson and Sons Ltd., of Manchester, and, as its name implies, is a rammer. It is entirely self-contained and is fitted with a special type of internal combustion engine. The firing of the charge in the engine cylinder causes a piston to be forced downward against the pressure of a return spring, and the whole device is thereby made to "jump" upward about 18 in. Ramming is effected by the drop from this height and by the weight of the tool, which, depending on the size in use, is between 140 lb. and 230 lb. Pure benzole is carried in a tank at the base of the tool, and a simple but efficient carburetter is provided by wire metal sponges and steel spiral wire contained in the tank. The charge is fired by a sparking plug controlled by a press button, and each time this button is operated an explosion occurs, and the tool is "jumped." About 60 blows can be delivered per minute, and a 230 lb. machine can be operated for about eight hours with half a gallon of benzole. By adaptation of the base the machine can be made suitable for concrete breaking and similar purposes.

The Zuyder Zee to Become Dry Land

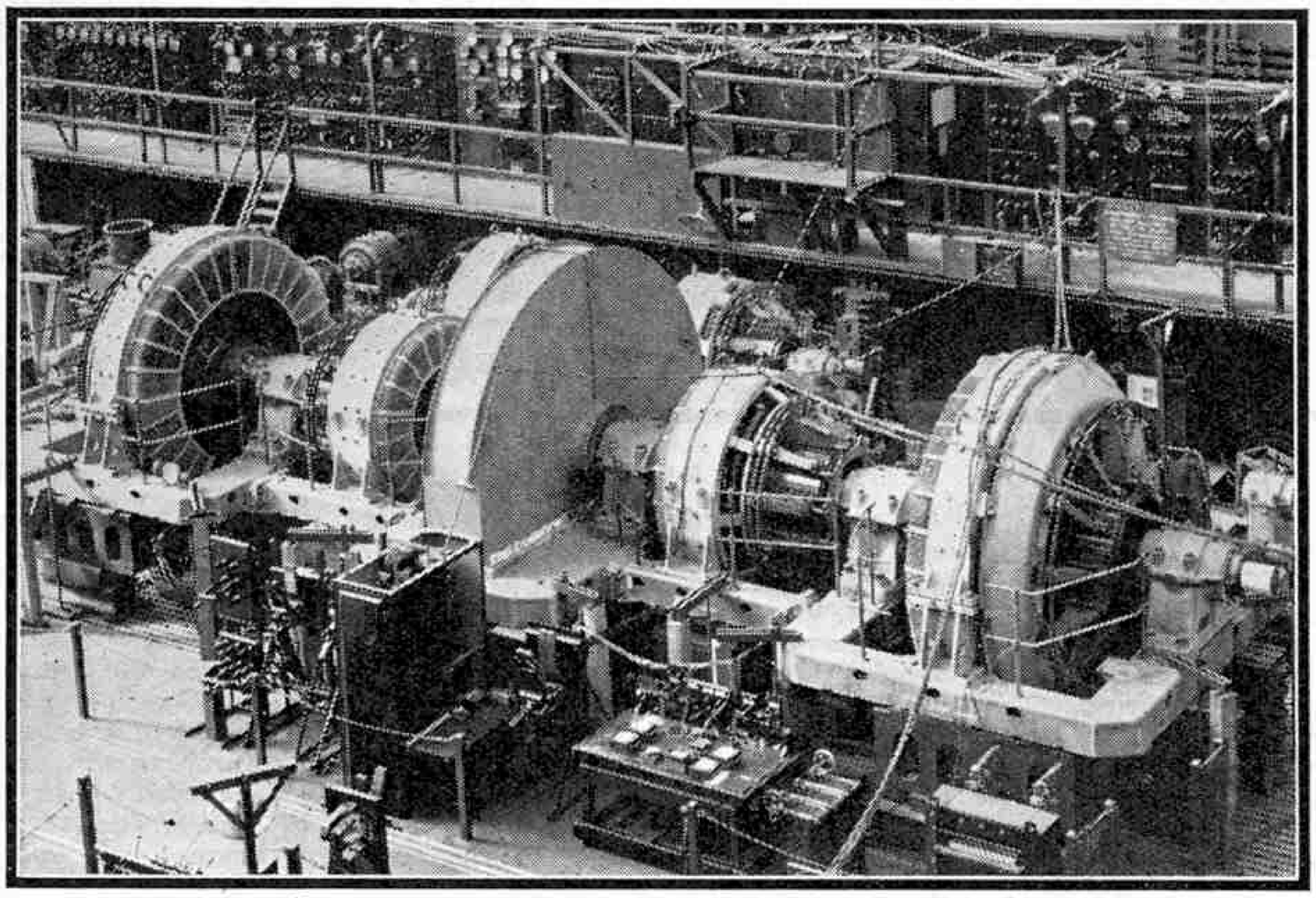
The Dutch Government have in hand a big scheme of reclamation which when completed will make the famous Zuyder Zee, the great semi-inland lake, dry land. The work of reclamation was started in 1920 and the first part of the scheme consisted in draining the north-western area and turning it into fertile land. This work was completed in 1931, and the Government have now decided to start on the north-eastern area, which covers about 117,500 acres. This work will take five years and will cost about £17,000,000, and when it is completed there will be land available for nearly 500,000 people. The entire reclaimed Zuyder Zee will provide sufficient land for 2,500,000 people, and when the work is finished the two islands of Urk and Schokland will become part of the mainland.

A New British Light Cruiser

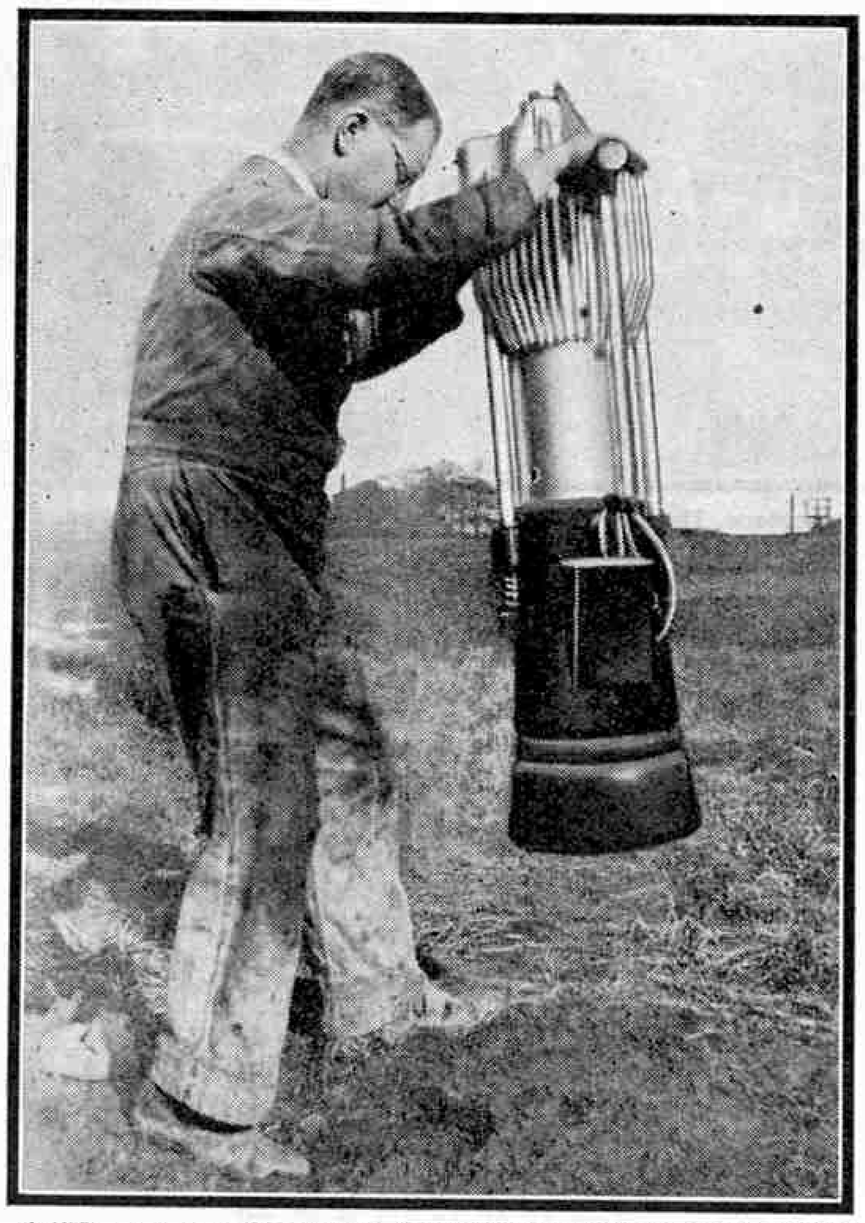
Among the new naval vessels recently launched is the light cruiser H.M.S. "*Penelope*," which was built by Harland and Wolff Ltd., at Belfast. The vessel is 480 ft. in length and has a displacement of 5,200 tons, and will be propelled by 64,000 s.h.p. turbines, which will give her a speed of 32¼ knots. She will be equipped with six 6 in. guns, four 4 in. anti-aircraft guns, two three pounder guns, and a catapult for launching seaplanes.

Fine Plant for Steel Rolling Mill

The upper illustration on this page shows part of a large rolling mill plant erected on the electrical machine test bed at the Trafford Park Works of Metropolitan-Vickers Electrical Co. Ltd., Manchester. The plant has been made for the Briton Ferry Steel Company, and consists of two 2,900/9,000 h.p., 60/150 r.p.m. reversing motors, and a flywheel set comprising two 4,200 h.p. geared high pressure turbines, a 28½ ton flywheel, two 2,400 k W., d.c. generators and two 1,000 k W., d.c. generators. It will drive large bar mills.



A tour machine flywheel Generator Set that forms part of a rolling mill equipment for the Briton Ferry Steel Company. The plant is shown on the test bed at the Trafford Park Works, Manchester, of Metropolitan-Vickers Ltd., to whom we are indebted for the photograph.



A "Kangarammer" in action. A description of this ingenious device is given on this page. Photograph by courtesy of C. H. Johnson and Sons Ltd., Manchester.

A Fire-Testing Station

An interesting fire-testing station is now in service at Boreham Wood, Elstree. It consists of two separate buildings constructed of reinforced concrete filled in with panels of "foamed-slag," a new form of concrete. One of the buildings is the fire-testing building proper, while the other is used for fire-fighting appliances and offices. In the fire-testing building there are three gas-fired furnaces for testing floors, walls, and columns. In the case of the floor furnace, the specimen to be tested is laid on top of a raised pit, and submitted to a load on top and heat underneath. Wall specimens are placed under a ram capable of exerting a pressure up to 500 tons, and a movable testing furnace is then wheeled against them, heat and pressure to the required degree thus being obtained. For testing columns two semi-circular banks of burners are used and water is applied to the specimens while still under load by means of hoses. A raised control room, from which the entire floor area is visible, contains the whole of the governing and recording mechanism for the building.

British Cars in Demand

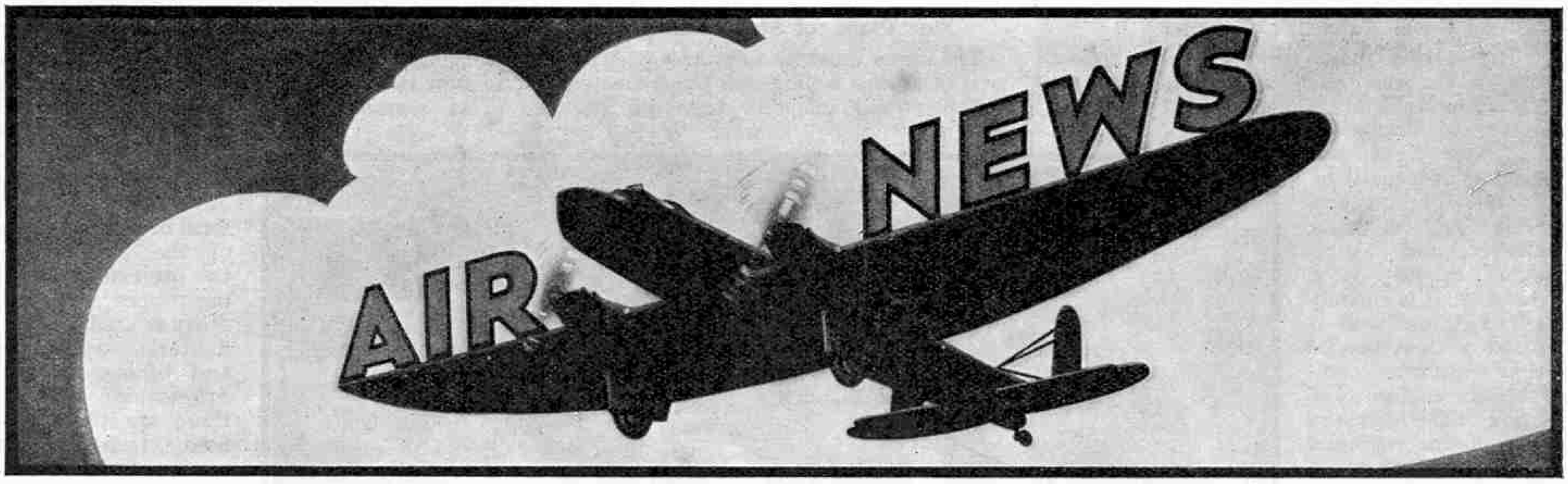
As an indication of the growing popularity of British cars abroad, it is interesting to learn that during the month of December, 1935, M.G. Cars were shipped to no less than 11 different countries, including Java, Czecho-Slovakia, Germany and the United States of America.

Roads of Salt

Several experimental highways in the surfacing of which common rock salt was used have been constructed in the United States. The roadways are made of clay and gravel treated with a compound made of ordinary rock salt, and they survived the recent devastating floods in that area without appreciable effect. About 100 miles of these salt highways have been laid down in various parts of the country, and after several months' use carrying heavy traffic they have proved entirely satisfactory. The rock salt not only compacts the clay but also crystallises in the road surface and retards evaporation of moisture, thereby keeping the surface moist and firm and providing practically a non-skid road.

Record Lifting Magnet

A remarkable electro-magnet that is believed to be the largest lifting magnet ever constructed in this country was recently made at the works of the Igranic Electric Company. It measures 65 in. in diameter, weighs 4 tons 5 cwt., and is capable of lifting over six times its own weight.



An Improved "Eagle"

The B.A. "Eagle" illustrated on this and the opposite pages is an improved version of the British Klemm "Eagle" described in the "*M.M.*" of January 1935. It is a low wing cantilever monoplane with wings of 39 ft. 3 in. span, which taper in chord and thickness and are arranged so that they can be folded back, in which condition the overall width is only 14 ft. 10 in., or less than half their span when spread.

The retractable undercarriage of the "Eagle" is not arranged to be lifted up vertically as are most English undercarriages of this type, but, by turning a handle in the cockpit, is lifted up sideways until each wheel and leg is completely encased in a special receptacle provided in the wing. It can be raised in 10 seconds, and lowered even more speedily. The winding mechanism is inter-connected with the throttle control, and this ensures that the pilot cannot fully throttle back to land unless he has previously wound down the undercarriage.

The cabin is roomy and comfortable, with the pilot's seat placed centrally in the front part and a double seat for two passengers behind it. In the improved "Eagle" the doors are much higher than previously and meet over the centre of the cabin. When both are open there is therefore unrestricted access and exit on each side of the cabin, as shown in the illustration on this page.

A D.H. "Gipsy Major" engine is fitted, and gives a cruising speed of 130 m.p.h. The take-off run, with a full load, is 195 yd., and the rate of climb is 700 ft. per min.

New Japanese Air Service

The Japanese Air Transport Company have increased their air service between Hekuoka and Daihoku, Formosa, and three trips are now made each week. Until this increase only mails were carried, but the service is now available to passengers, who are conveyed in a Douglas D.C.2.

The B.A. "Eagle" low wing monoplane. The doors meet over the centre of the cabin, and when both are open, as shown, there is unrestricted access and exit on each side of the cabin. This aeroplane is an improved version of the British Klemm "Eagle." This illustration and the upper one on the opposite page are reproduced by courtesy of "The Aeroplane."

Record American Flight

A new record has been set up for the trans-continental flight from Los Angeles to Newark, New Jersey, by Howard Hughes, the well-known American airman. He flew a Northrop monoplane, and covered the 2,450 miles in 9 hr. 27 min. 10 sec., at an average speed of 260 m.p.h. The previous time was 11 hr. 34 min., and was accomplished in February 1935 by Leland S. Andrews and a crew of two, who flew in a Vultee V–IA monoplane from Burbank, California, to the Floyd Bennett Field, New York.

Hughes is also the holder of the world's speed record for landplanes, as in September last, using a Hughes special monoplane fitted with a Whitney "Wasp Junior" engine, he attained a speed of 352 m.p.h. This beat the previous record, set up a year previously by another American, James Wedell, in a Wedell-Williams monoplane, by 47.2 m.p.h.

A Chance for Inventors

One of the things an air pilot often would be glad to know, especially during the closing stages of flights over long distances or in bad weather, is the exact amount of fuel in the tank or tanks of his aeroplane. The problem of devising a means of indicating this information at all times, irrespective of whether the aeroplane is in flight or on the ground, probably has already been considered by inventors interested in aeronautical matters. If so, they will be spurred to greater endeavour by the German Air Ministry's recent offer of £10,000 for any invention that will solve the problem.

More 1935 Air Traffic Figures

Air traffic figures for 1935 continue to be published, and without exception show steady increases in both passenger and freight traffic.

K.L.M. report that last year they carried 100,196 passengers, an increase of 14,227 over the 1934 total; and that nearly 96,000 of the people were carried on the European services. The quantity of freight conveyed by air last year was nearly 315 tons greater than in 1934, and the total amount of mail similarly transported increased by 65 per cent. on their European services.

The aircraft of Highland Airways Ltd., last year carried 97,937 lb. of mail, which was 450 lb. more than in 1934; and 3,815 passengers were carried, as compared with 3,007 during the previous year. The Kirkwall - Aberdeen service is to be extended to the Shetland Islands this spring, the actual date depending upon the completion of wireless stations at Kirkwall and Shetland. The company's three D.H. "Dragons" have been fitted with wireless equipment in readiness for work on the extended route. The Kirkwall-Aberdeen service was operated last year from May until the end of October.

Beacon for Blackpool Tower

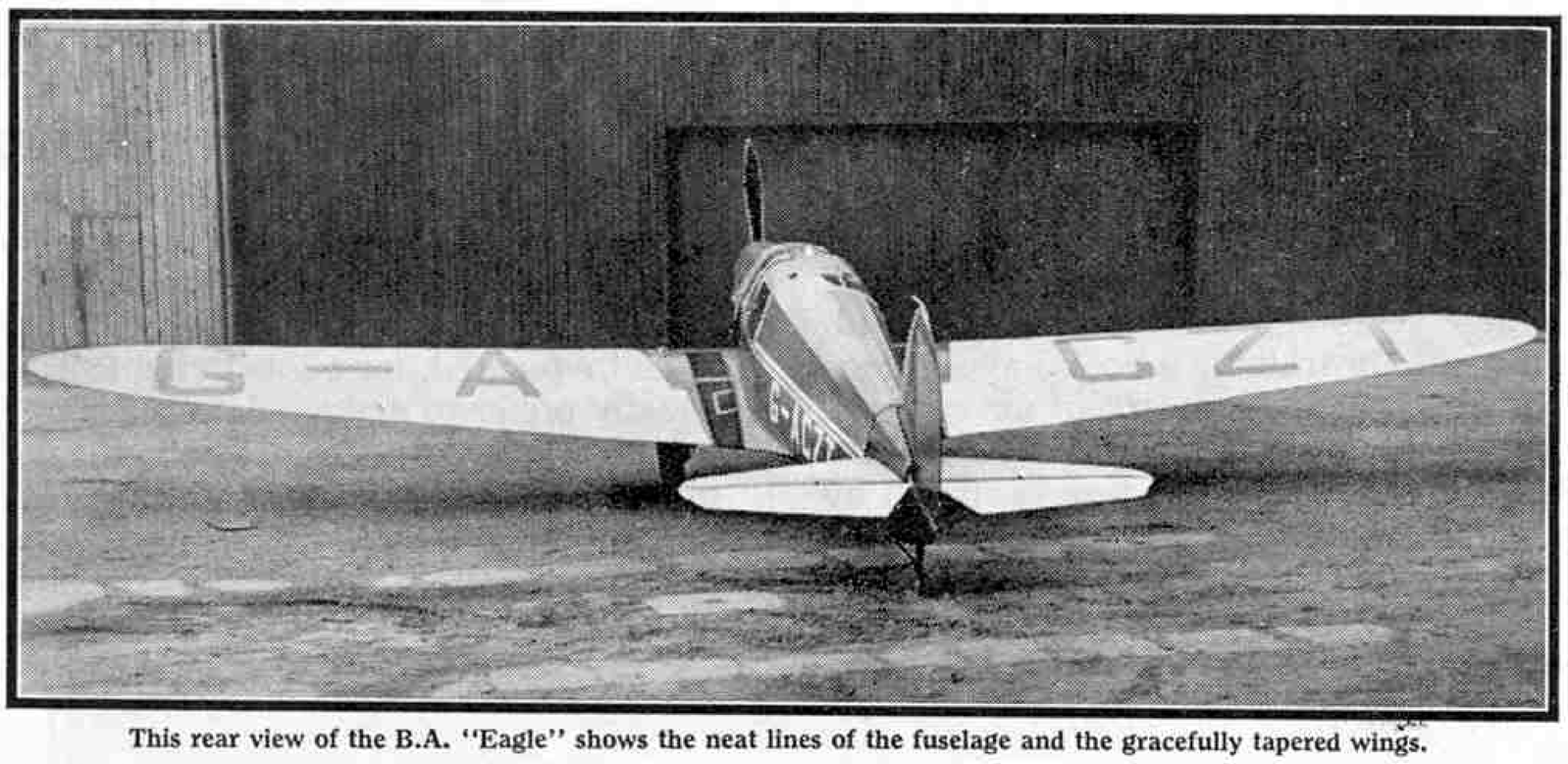
A well-known landmark on the Fylde coast, Lancashire, is the Blackpool Tower, 550 ft. in height. It contains a passenger lift by which visitors can ascend to a gallery almost at the top, from which a remarkable view is obtained on clear days. The Tower is soon to serve an additional and more serious purpose, as it is to be surmounted with a beacon that will be used to guide aircraft flying in fog

Named U.A. Machines

The three D.H.86 aeroplanes of Union Airways Ltd., New Zealand, have been named "*Karoro*," "*Kotuku*" and "*Korimaka*" respectively. They are being used on the new daily service between Palmerston North and Dunedin.

D.H. Aircraft Progress

Some interesting facts showing the great popularity of de Havilland aircraft were revealed at the recent annual general meeting of the de Havilland Aircraft Co. Ltd. It was mentioned that the D.H.86 Express air liner is in use on the services of nine important air transport concerns, and that 16 more aeroplanes of this type are on order. The D.H.86 is a four-engined biplane, and a fleet of this type of aeroplane was supplied to Quantas-Empire Airways Ltd. in 1934 for the Singapore-Brisbane section of the England-Australia Empire air service. The D.H. "Dragon Rapide" is even more popular, and is being used by 28 commercial air companies. Many machines of both types have been sold to private owners.



This rear view of the B.A. "Eagle" shows the neat lines of the fuselage and the gracefully tapered wings.

The latest de Havilland civil aeroplane to be put into production is the "Dragon Fly," a twin-engined five-seater biplane with wings of unequal span. The upper wings are attached directly to the top of the fuselage and are provided with ailerons, and the lower wings are built out from the bottom of the fuselage and have split flaps along their trailing edge between the engine nacelles. The arrangement of the seating in the cabin is rather unusual. There are two seats side-by-side, a single seat immediately behind them, and to the rear of this a seat giving room for two people extends across the back of the cabin.

Work now in hand also includes the designing of a high-speed four-engined passenger monoplane that will be more than twice the size of the D.H.86. The construction of the first machine of this new type will begin immediately plans are ready, and it may be completed in time for trial flights next autumn.

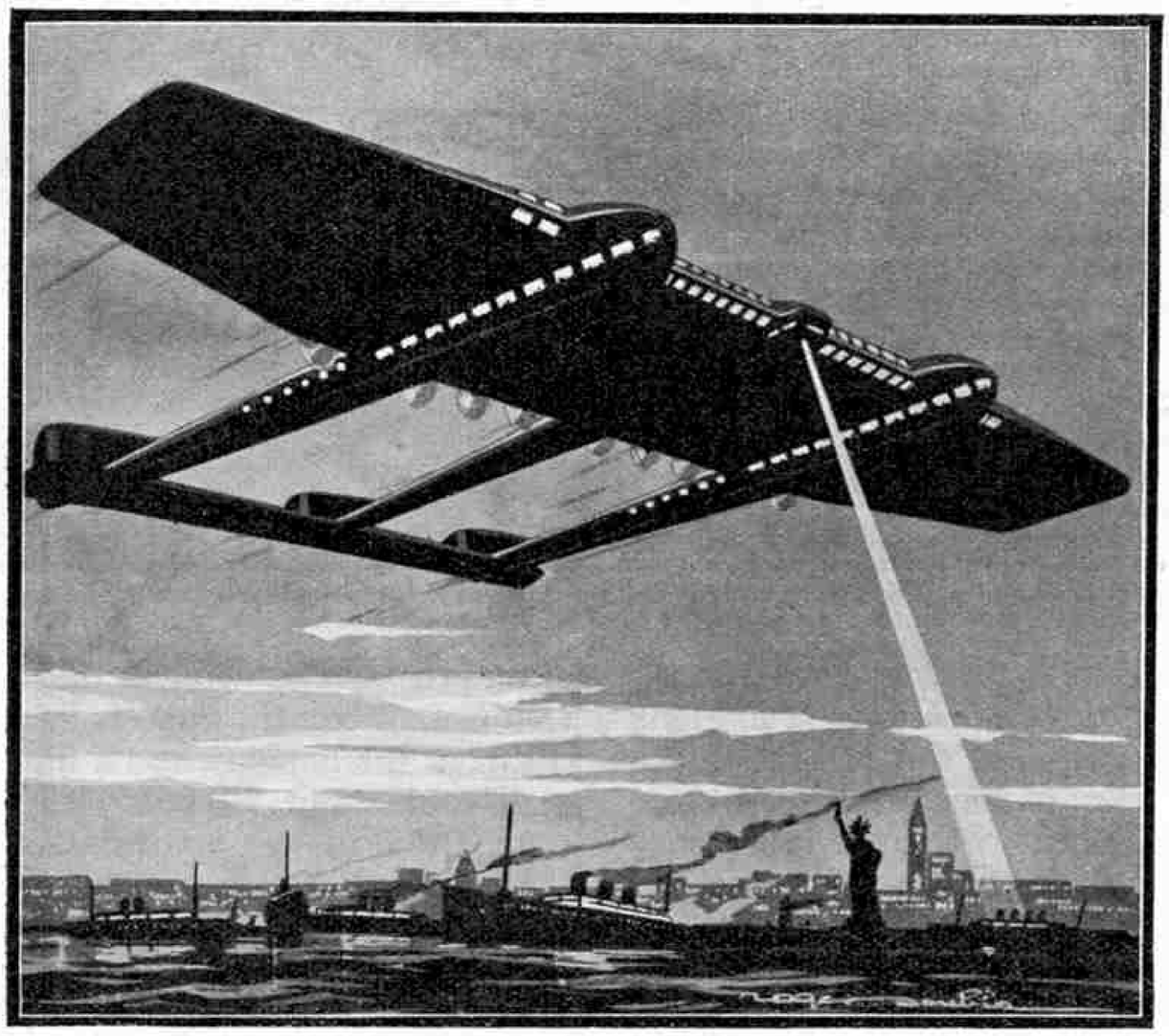
New D.L.H. Depot Ship

Further details are now available about the new depot ship being built for the D.L.H. by the Hamaldt shipyard at Kiel. The ship will have a displacement of about 2,000 tons, and the propelling machinery will consist of two M.A.N. 1,000 h.p. Diesel engines. The special deck fittings will include a crane for hoisting flying boats on board and a catapult for shooting them off.

R.A.F. Firing Range at Chesil Bank

The announcement last year of the Air Ministry's intention to establish bombing and air-gunnery ranges at Chesil Bank brought forth many protests from the local fishermen, and also from ornithologists who declared that the swans near there would be seriously disturbed and even endangered by the bombing practices.

The Air Ministry have now decided that the bombing targets shall be placed a quarter of a mile farther seaward than had been planned, and that during the winter months the firing range shall be established farther west than at first proposed. It is anticipated that these measures will avoid any disturbance or danger to the swans. The fishermen also have been considered, and when they wish to pass to and from their fishing grounds while R.A.F. practices are going on, a request to the officer in charge will be sufficient to suspend operations until they are out of range.



An artist's impression of a trans-Atlantic aeroplane of the future. It would be necessary for such machines to be fitted with powerful searchlights in order to carry out regular night flying.

Autogiro for Danish Air Force

The Danish Government continue to favour British aircraft, and their latest purchase is a British-built autogiro. Two D.A.F. pilots were sent to this country for instruction in the flying of this type of aircraft, and on completion of their training they flew the purchased machine to Copenhagen.

Belgian Fairey Military Aeroplane

The Belgian works of the Fairey Aviation Co. Ltd., have produced a large military aeroplane, the design of which is based on the well-known Fairey "Fox" two-seater fighter produced at the English works of the company.

The new Belgian aeroplane is a low wing monoplane with an 860 h.p. supercharged engine, and can attain a top speed of 236 m.p.h. at 14,000 ft. It can climb to a height of 37,700 ft., and the cockpit can be warmed when the aeroplane is flying high. The Fairey "Monofox," as it is called, is adaptable for use either as a single-seater fighter or a two-seater reconnaissance-fighter or light bomber. When used as a single-seater fighter its armament consists of four machine guns, arranged one on each side of the nose and firing through the airscrews, and one in each of the upper wings. When used as a two-seater fighter it is provided with an additional gun, which is mounted in the observer's cockpit and can be fired in many directions. The machine carries wireless and is equipped for night flying and "blind" flying.

British Aerodrome Schemes

The development of civil aerodromes in this country is continuing steadily. The Leeds-Bradford municipal aerodrome at Yeadon is to be almost doubled in size, and is to have a control tower and beacons, Customs offices and a new hangar, so that it will be adequately equipped for use by both day and night air services. The Air Ministry are going to instal direction-finding apparatus and teleprinting instruments, and the aerodrome will then be able to receive regularly weather reports issued by Barton (Manchester) aerodrome, the chief wireless signalling station in the North. When the improvements are completed Yeadon will probably be used by Railway Air Services as a calling point in their proposed London-Glasgow service.

A municipal aerodrome is to be constructed at Luton, about two miles from the heart of the town. Keswick also has decided to have an aerodrome, but a site for it has not yet been obtained. Air Ministry officials recently visited the Newcastle aerodrome at Woolsington in connection with a proposed installation of direction-finding apparatus, at an estimated cost of £1,500.

Swansea is also to have a municipal airport, and an effort is to be made to get the landing ground ready for use by early summer.

Heston Airport

Growing Importance for Internal Air Routes

THE rapid growth of internal air services in this country during the past three years has hastened the provision of well-equipped aerodromes at the various termini. Aerodromes that a few years ago were merely the headquarters of civil flying clubs or training schools have become important points in an extensive network of air services.

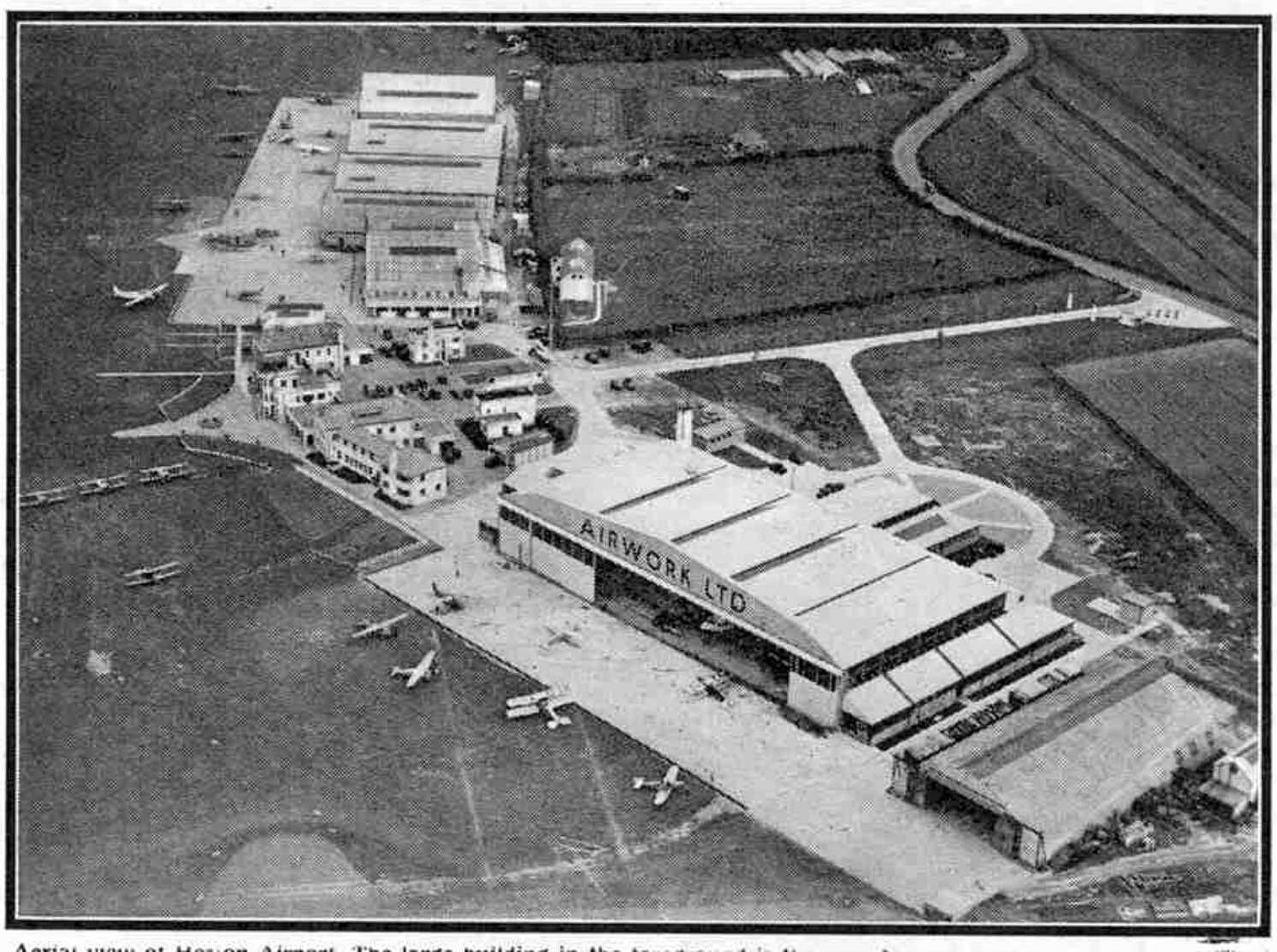
The best example of this swift development is Heston Airport, in Middlesex. In 1928 the land now occupied by this airport was a market garden. A company called Airwork Ltd. was founded in that year to buy the site and to lay it out as an aerodrome, for a training school for civilian pilots. This work was completed in 1929 and the training school was established. The Household Brigade Flying Club also made use of the new aerodrome, and in addition it became the headquarters of the Heston Aero Club.

In 1933 regular internal air services were introduced in this country. One of the pioneer companies was Spartan Air Lines, and they adopted Heston as the London terminus for their services between London and the Isle of Wight. This was the beginning of Heston's history as an airport. Other newly-formed air transport companies were not long in realising the favourable situation of this airport and in adopting it as one of the termini of their services. By the end of 1934 it had become second to Croydon in importance as a Customs airport. During that year 3,700 aircraft and 12,307 persons cleared Customs at Heston, an increase of 182 per cent. on the figures for 1933.

Last year this development was continued and a new record set up in the amount of traffic dealt with, 17,903 passengers passing through the airport on the regular air services. These services included the London–Isle of Wight one already mentioned, and a similar one run by Portsmouth, Southsea and Isle of Wight Aviation, a service to Blackpool operated by United Airways Ltd. and a service to Jersey operated by Jersey Airways Ltd.

Heston owes its popularity as an airport to its accessibility, freedom from fog, and the ample provision made for expansion. In regard to accessibility, the airport is near the main traffic route to the West of England and is only 30 minutes' drive by car from Hyde Park Corner. From the pilot's point of view it is equally convenient, as the populated areas that are avoided by airmen whenever possible lie to the east, in which direction the airways are little frequented, for pilots flying to Holland and Germany usually prefer to make a detour across the North Sea. The principal internal air routes lie to the north, south and west of London, and Heston is ideally situated as a terminus for all traffic of this nature.

Its freedom from fog is due to the fact that the prevailing wind is south-west, and the smoke and the dust particles that are the main causes of the dreaded London fogs are blown to the north-east, in a direction away from Heston.



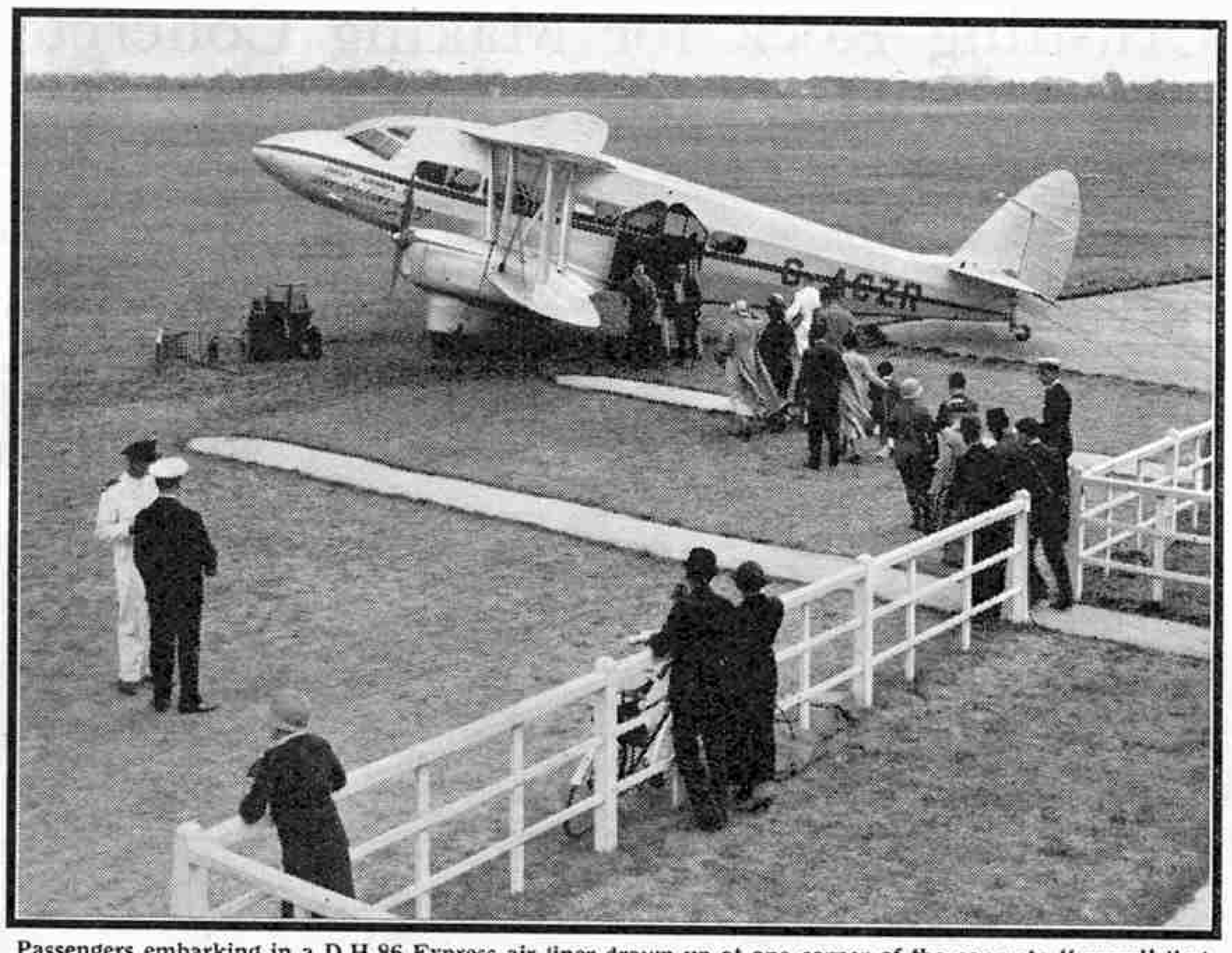
Aerial view of Heston Airport. The large building in the foreground is the new Airwork central repair station. The illustrations to this article are reproduced by courtesy of Airwork Limited, Heston Airport, Hounslow.

The "heart" of an airport is the control tower, from which aircraft are guided in their arrival and departure, and traffic congestion is reduced to a minimum. An elementary control system at Heston was introduced on 1st May, 1934. Under this system control is exercised from 10.30 a.m. until one hour after sunset, and is indicated by a yellow cube displayed on the wireless mast that surmounts the control tower. When the cube is in position the area enclosed between the hangars and a line of concrete blocks set in the ground about 50 yds. clear of the concrete "apron" is regarded as a neutral zone, and no aeroplanes are permitted to land within this area.

The continued growth of air traffic at Heston made it necessary last year to provide full airport control, and an enlarged control system involving wireless communication came into force on the 15th April 1935. This system was at first handled by Airwork Ltd., but on 11th November last it was taken over by the Air Ministry, and the control of London's two leading airports, Croydon and Heston, thus became centralised under one authority. Wireless communication and direction-finding facilities were also introduced at Heston last April when a new wireless station for ground-to-air telephone and telegraphy on a wavelength of 862 metres was put into service by the Air Ministry. The success of this improved control is shown by the fact that the movements of 94 aircraft have been directed by

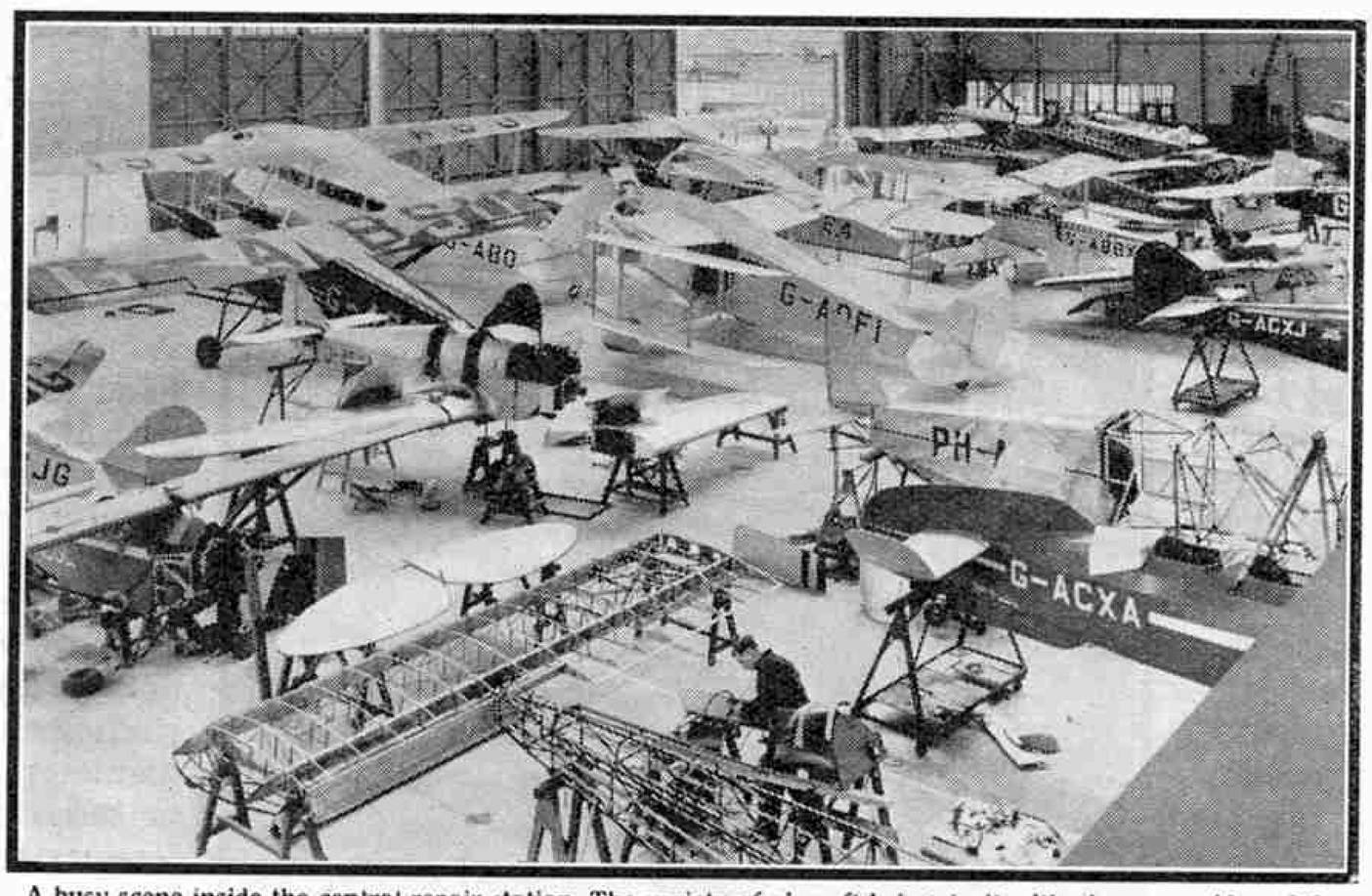
wireless from the station at the airport in one day.

Another important addition to these facilities for helping aircraft in bad weather is now being made by the installation of the Lorenz blind-landing system. It will be the first of its kind in this country, and is expected to make possible the safe approach and landing of suitably equipped machines when visibility is practically nil. A detailed description of the system would be extremely technical, but sufficient can be said here to give a general idea of the method of operation. The system makes use of ultra-short waves, and the main beacon transmits on a wavelength of nine metres. Vertical guidance is provided by a series of curves, each distinguished by a different strength of signal. By maintaining the indicator at a certain signal strength, the aircraft is guided down whichever of those curves provides the most suitable angle of approach. Directional guidance is provided by two zones, to the right and left of the approach path, distinguished by oral signals, either dots on the one side or dashes on the other. These zones overlap along the correct approach path, where the dots and dashes merge into a combined signal.



Passengers embarking in a D.H.86 Express air liner drawn up at one corner of the concrete "apron" that extends along the front of the hangars.

Night landings are frequently made at Heston, and the airport has therefore been equipped with powerful floodlights. There are three floodlights, each of 1,250,000 c.p., on the boundaries of the airport. They are operated from the control tower, and their direction is varied according to that of the wind, the light facing the incoming pilot being switched off to avoid dazzle. A number of boundary lights are also provided, of which the general arrangement consists of two 6.6-volt electric lamps, the upper one enclosed by an amber glass globe and the lower one illuminating a wide opal glass cylinder that extends to a height of 3 ft. above the ground. This illuminated cylinder shows the height of the boundary light and gives the pilot of an aeroplane an indication of perspective. The lights are operated on a distribution voltage of 230, which is stepped down to six volts by a separate transformer installed at the base of each light.



A busy scene inside the central repair station. The variety of aircraft being dealt with gives some idea of the interesting work carried out in this great building.

The aerial view of Heston airport on the previous page shows the general layout of the buildings. At what may be described as the "arrow head" is the control tower just referred to. Beneath it is the Terminal building, in the east wing of which are the Traffic and Customs offices. The building contains the clubhouse of the Heston Aero Club, a restaurant and a hotel, and private rooms are also provided for the Household Brigade and Old Etonian flying clubs. Plans are under consideration for the complete re-building of the structure to provide more room. The Airwork School of Flying is in a new western extension of the Terminal building. The flying equipment of this school consists of Avro "Cadet" and de Havilland "Moth" open-cockpit training machines.

In the south-east corner of the aerodrome is the Public Enclosure, arranged so that visitors can watch the flying in comfort and from an unobstructed viewpoint; and there is indoor accommodation in case of sudden showers.

East of the Airwork school are five aeroplane hangars, which have a total garaging space of 89,000 sq. ft. The hangar nearest the school is 100 ft. wide and 80 ft. long, and was the first all-concrete hangar to be built in this country; it has two storeys. Each of the next three hangars contain two rows of "lock-ups" for housing aeroplanes with folded wings, and the space between the two rows is large enough for aeroplanes with wings that cannot be folded. The fifth or end hangar accommodates aeroplanes of up to 90 ft. wing span. In front of the hangars is 58,000 sq. ft. of concrete "apron." Last year the equipment at Heston was increased by the construction of a new hangar 100 ft. in width and 200 ft. in length, to the north-west of the landing area.

The most outstanding building is the Airwork Central Repair Station. All overhaul and repair of aeroplanes is carried out there, and the engine workshops are equipped with the most modern plant and machinery. Complete aeroplanes can also be built on the premises.

Gravel Washing and Grading Plant

Crushing Rock for Making Concrete

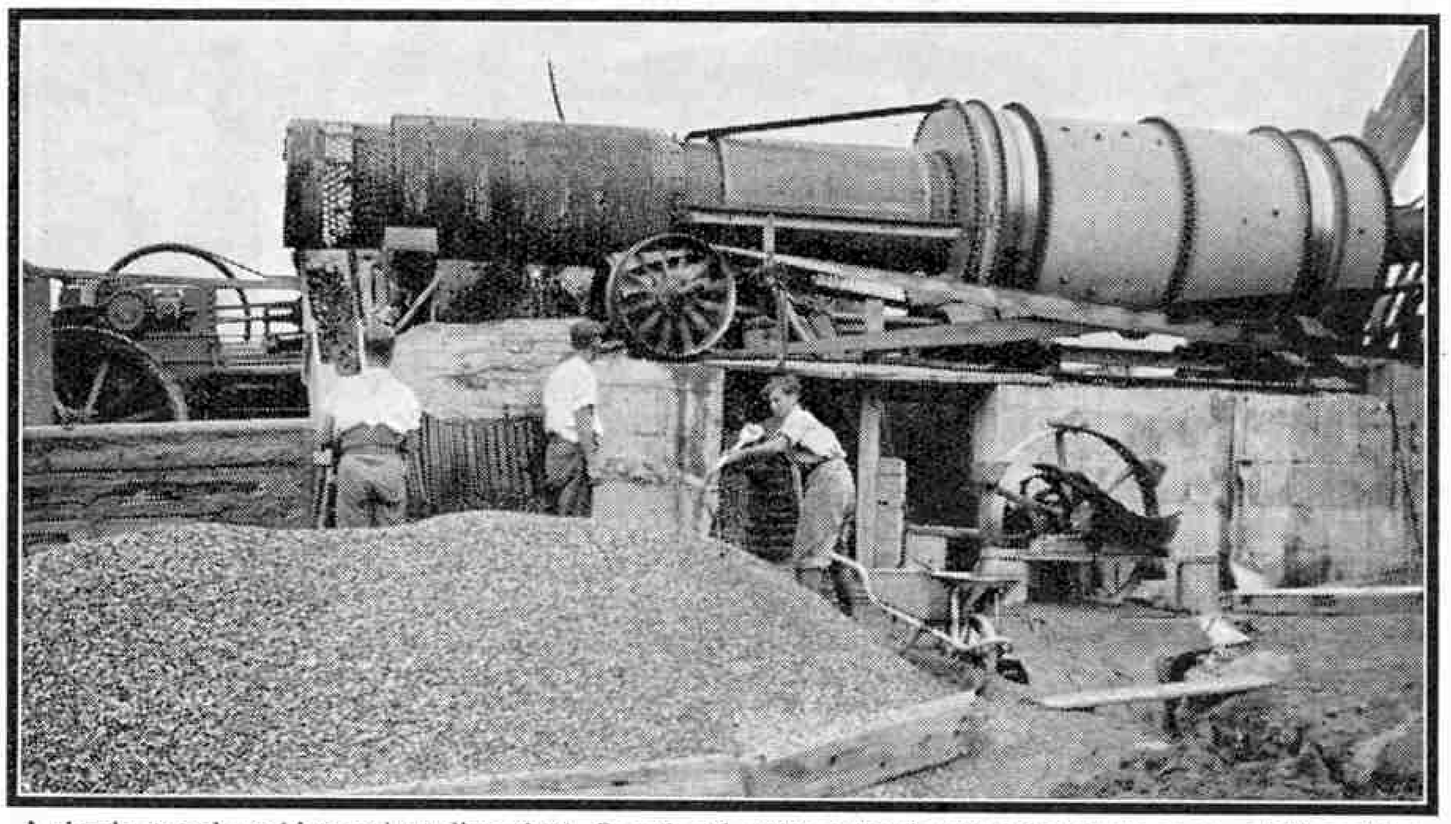
By W. A. and T. A. Evershed

CONCRETE is now used to such an extent for road making, building and other purposes that we may almost be said to live in the Age of Concrete. Its base is Portland cement, which is manufactured by grinding clay and limestone or chalk with water, and calcining the mixture in huge rotary kilns at a temperature of about 2,800 deg. F. The product is ground to a fine powder and concrete is made by mixing this with sand and gravel or small stones of uniform size to which the name "aggregate" is given. The surfaces of these added materials are coated with cement, which also fills the spaces between them and sets to bind them firmly together.

The material mixed with cement must be chosen very carefully if concrete of sufficient strength is to be produced, and for most purposes is specially treated before use. Its chief source is the gravel beds found in most parts of the country. Gravel consists of small pebbles of varying sizes that have been worn round and smooth by the action of water, and the deposits forming the beds were laid down in prehistoric times, some of them by the action of water melting from the glaciers of the Ice Age.

Typical gravel beds are to be found in East Anglia, and the material in these varies from a fine sand to large flints weighing several pounds each. When a deposit of gravel is being worked it is necessary to grade the product, that is to divide it into portions consisting of grains falling within certain definite limits of size, for each grade is specially adapted for the formation of a particular type of cement. It is equally important that the material should be thoroughly cleaned, for it may be contaminated with soil containing salts and chemicals that would interfere with the chemical changes taking place during the setting of the cement. Engineers and others using concrete specify carefully cleaned and graded material, and the plant at a gravel bed must be designed to give a product satisfying their requirements.

The usual plan adopted for these purposes is to wash the gravel thoroughly with water and then to pass it through sieves of different meshes. This of course is done mechanically, and the two illustrations on this page show a simple plant devised for this purpose. This is erected at a gravel pit in East Anglia, where the raw material excavated from distant working faces is brought by lorry to an elevator. The gravel is carried upward and delivered into a chute that leads it into a large revolving drum, shown in the upper illustration on this page. Water pumped up from the lowest point in the bed is admitted with it, and the gravel is well washed as it passes through the drum. Thorough cleansing is ensured by the use of internal ribs that lift the gravel and give it a push forward as they pass under it.



A simple gravel washing and grading plant. Gravel and water enter the revolving drum on the right and the cylindrical screen on the left separates sand and gravel from flints and large stones

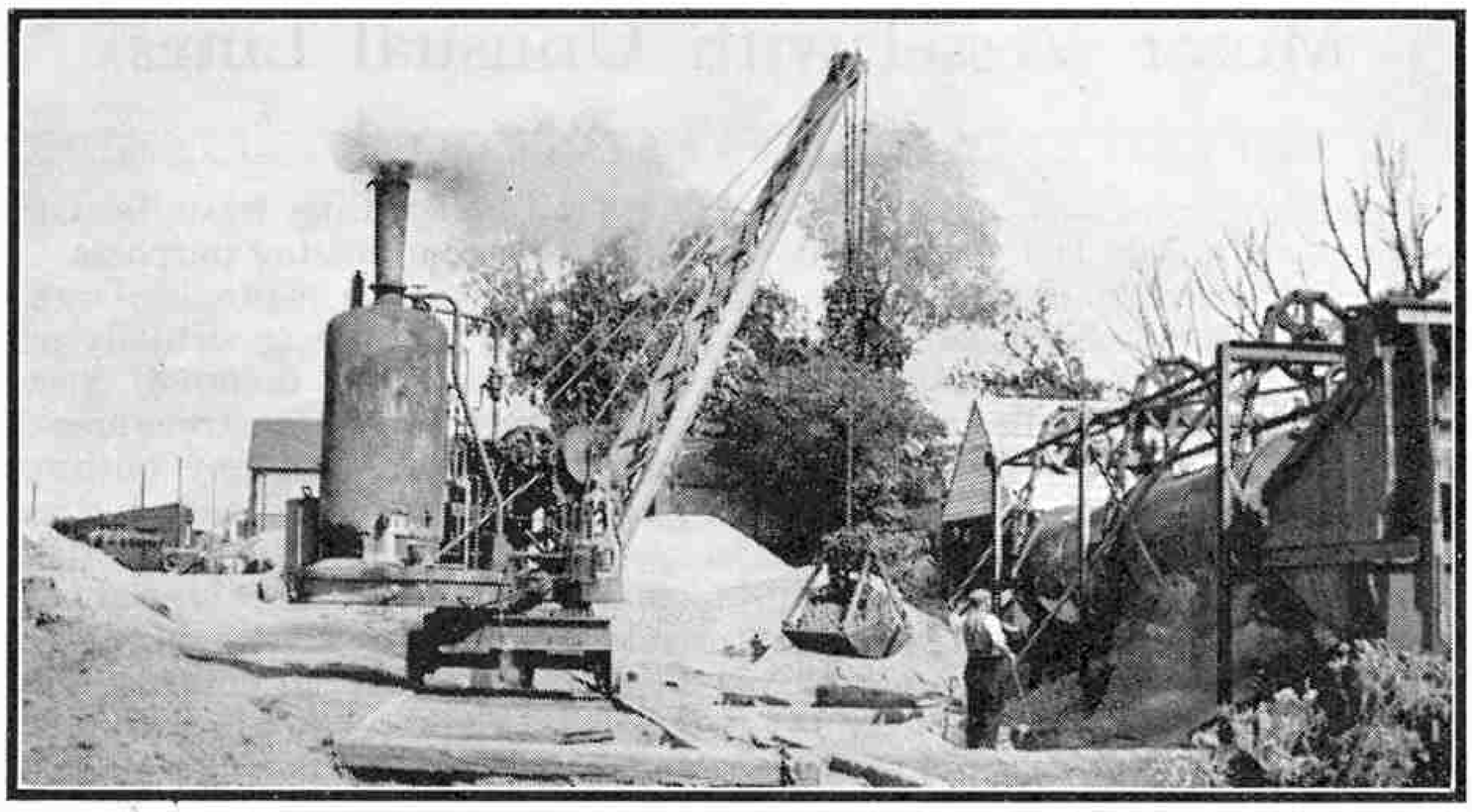
A bucket elevator feeding gravel into a washing and grading plant.

The separation of the washing water and the grading of the material follow immediately. The gravel and water enter a cylindrical screen or sieve that is fixed to the drum and rotates with it. At the end of the screen nearer the drum the holes are so small that only water and the finest sand can pass through them. The next two sections are perforated with larger holes and deliver fine gravel, consisting of particles up to about an inch in diameter, and a pile of this material can be seen in the left foreground of our illustration. The final section of the screen allows flints and larger stones up to about $2\frac{1}{2}$ in. in diameter to fall out, and in our photograph these are seen being collected in a wheelbarrow ready for removal and stacking elsewhere. Larger stones and flints drop out of the open end of the screen.

The drum rests on four rollers, each about 9 in. in diameter, and is held in position by means of tracks formed by angle irons, riveted on it and encircling it, in which the

rollers run. Great care is necessary in assembling a plant of this type in order to ensure that the axis of the drum is exactly horizontal and no strain is transferred to the angle guides. The rollers are set in pairs at opposite ends of the drum. One pair rotates idly, and the others are driven by means of bevel gearing and so cause the drum itself to rotate. The screen cylinder is bolted to the end of the drum and is supported on the cantilever principle, and a portable steam engine is employed as the source of power.

The sand, and other products of this plant serve various purposes. The finest washed sand is used exclusively for cement concrete, and the fine and coarse gravels are employed as aggregates for cement for paths and similar purposes. The small flints also can be utilised as aggregate in coarse concrete, and those that are too large for this purpose are in demand for banking up roads at corners, constructing foundations, and similar work.



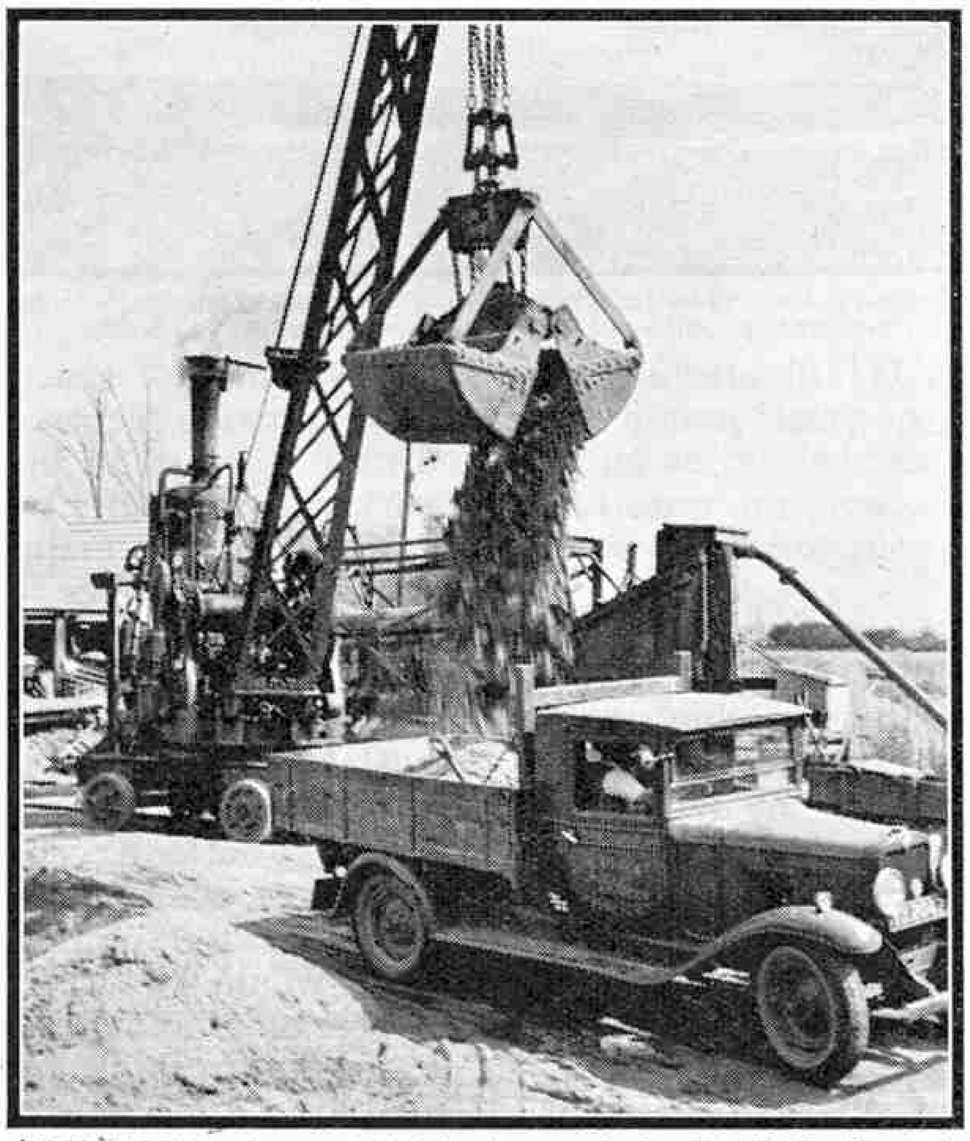
A travelling grab that loads gravel into waiting lorries. The washing and grading cylinders are seen on the right.

In another type of plant employed in an East Anglian gravel works the drum and screen cylinder are slung on a form of chain that transmits the power needed to revolve them. At this pit a travelling grab is in use to load the grade of sand or gravel required into waiting lorries, and the two photographs on this page show this grab in action.

Gravel pits are not the only source of the aggregates and sand required for concrete, and work in the quarries in the sides of the Malvern Hills illustrates another method of providing the necessary material. There granite is blasted away from the hillside, and when blasting is not in progress men can be seen clambering about high up the quarry face, prising loose rocks away until they crash down to the bottom of the quarry, bouncing from rock to rock as they fall and breaking into fragments under the terrific impacts. Some of the rocks dislodged weigh several tons each, and pieces from these that are too large to be handled are subsequently drilled and blasted to a convenient size.

The broken stone is loaded into deep wagons and conveyed to the crushers. These are of various types, but in practically all of them the rock fragments are literally squeezed between two jaws, with serrated faces made of specially hardened steel. One of the jaws is fixed and has a vertical face. The other is set at a small angle and swings alternately towards and away from the fixed one, gradually reducing the size of the stones as it works them downward and finally allowing them to drop out when they are of the correct size. The moving jaw is driven by an eccentric on a stiff shaft suitably geared to the power unit. Its range of movement is remarkably small, perhaps not more than half an inch, but is sufficient to enable it to do its work.

The stone is reduced to the size of road metal when it emerges from the jaws of the crushers and is then crushed further, this time to form a kind of gravel, known as gravel chips. The machines in which the second crushing is carried out are of various types. Spring loaded rollers are used in one of them, and stone that is ejected by the screen that sorts the product is automatically returned to the rollers; in another the stone passes through a cylinder, with specially hardened internal ribs, that revolves at high speed and hurls it about violently until it is crushed into fragments small enough to fall through the screen; but perhaps the most interesting consists of two steel tubes, one of which is set eccentrically within the other, the stone being relentlessly crushed between them as it reaches the sectors where the distance between them is decreased.



Loading a lorry with gravel that has been washed and graded in the plant shown in the upper illustration on this page.

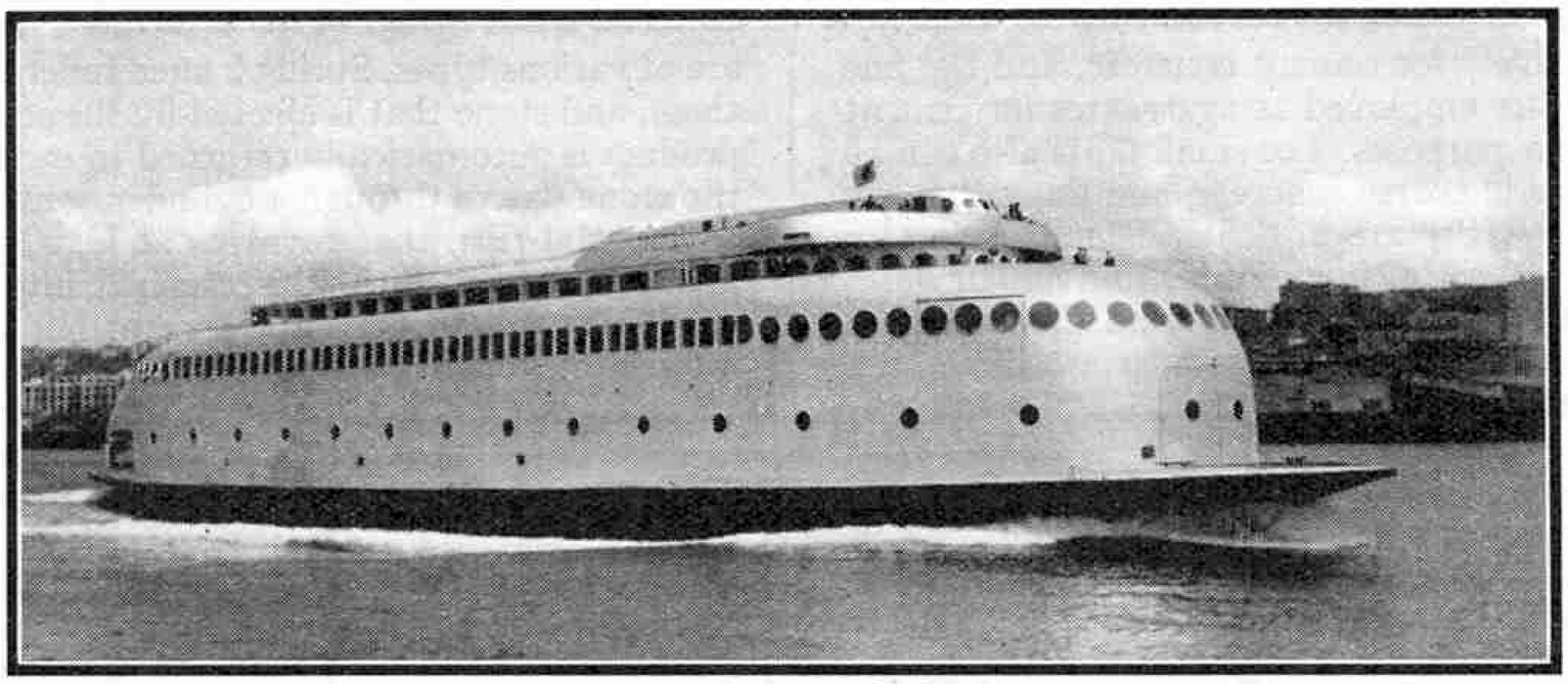
The plant used for providing sand for work on the Lloyd Dam, at Bhatgar, near Poona, India, was an interesting example of overseas practice in stone crushing and grading. When it was completed in 1928, this dam was the largest mass of artificial masonry in the world. It is 5,333 ft. in length, 190 ft. in height and at its base is 124 ft. in width, the total volume of masonry in it being 21½ million cu. ft.

The Lloyd Dam was built of stones specified to weigh not less than 40 lb. each, and these were laid by hand in lime mortar. It was necessary to start several quarries to furnish the stone in order to keep up the rate of progress required, and the quarry chips, consisting of pieces less than 40 lb. in weight, were used for crushing into sand, for the river sand was not clean enough and was not available in sufficient quantity. The crushers were of the type with fixed and movable jaws, and the small stones from them were carried to the top of a series of spring loaded roller mills that transformed them into sand. This passed along a revolving screen cylinder and rejected material was returned to the rolling mills.

A Streamlined Ferry Boat

Motor Vessel with Unusual Lines

THE world's first completely streamlined motor ferry made her initial appearance in July last year, when she was put into service on the almost landlocked waters of Puget Sound, Washington, on the Pacific Coast of the United States. This vessel is called the "*Kalakala,*" a name that in the language of the Chinook Indians, who formerly flourished in the north west, means "*Flying Bird,*" and is pronounced "Kah-lock-ah-lah." She is 276 ft. long, with a beam of nearly 60 ft., and has five covered decks. She has been built for service between Seattle and Bremerton, a distance of about 15 miles, and her speed of 18 knots enables her to complete each trip in 45 minutes. Her passenger carrying capacity is 2,000 and in addition she has accommodation for 110 motor cars.



The "Kalakala," the streamlined motor ferry boat in service between Seattle and Bremerton, Washington, U.S.A. Photograph reproduced by courtesy of the Puget Sound Navigation Co., Seattle.

The "*Kalakala*" presents a striking appearance as she slips through the water, for she is painted aluminium and this, in conjunction with her gracefully curved outlines, attracts instant attention. Her hull is made of steel throughout and is electrically welded. It is divided into 25 water-tight compartments, making the vessel practically unsinkable, and the streamlining is carried out as far as possible below the water as well as above, the waterline shape having been carefully worked out to reduce wave action to a minimum.

The wheelhouse on the top deck is built entirely of copper and the steering gear installed in it is hydro-electric in type and is very sensitive, giving great manœuvring power. Communication between the wheelhouse and the engine room is maintained by telephone and an automatic telegraph system also is installed for this purpose. This system is believed to be the first of its type to be incorporated in a vessel that plies on inland waters.

The main engine of the "*Kalakala*" is a Busch Sulzer Diesel unit of 3,000 h.p. working on the two-stroke cycle. It has 10 cylinders and is said to be the largest engine of its type installed in a vessel on ferry service. A second Diesel engine furnishes power for auxiliary service. This has six cylinders and works on the four-stroke principle, developing 600 h.p. It is directly connected to a 400 k.w. generator that supplies current through the vessel, but when in port shore lines may be connected in order that the necessary current supply may be received in this manner. Fresh water cooling is used for the engines, the temperature being carefully regulated and controlled, and a special boiler using waste heat from the engine is devoted to steam heating purposes. In very cold weather additional heat can be provided by a special booster boiler.

In addition to being virtually unsinkable, the "*Kalakala*" is practically fireproof. Special precautions have been taken to avoid disastrous fires that might start on the motor car deck, and any outbreak there can be extinguished in a few seconds by means of a deck spray system. Other safety devices include the provision on the main deck of lifeboats equipped with gear allowing them to be launched in a very short time; and there is a life-preserver in a special compartment in each of the upholstered chairs with which the saloons and lounges are furnished, in addition to life-preserver racks of the usual type fitted on all ships. The comfort as well as the safety of passengers has been carefully considered in planning the vessel and an air conditioning plant maintains a healthy atmosphere on all her decks.

The changes in outline due to streamlining have not led to any sacrifice of space in the "*Kalakala,*" and her five decks provide plenty of room for all purposes. The main deck is devoted to the storage of motor cars, which are parked in six lanes separated by raised walks of corrugated steel. The main passenger cabin is furnished with upholstered settees accommodating 700 people, and forward of these is an observation room. Other observation rooms are placed fore and aft on the upper deck, and all are provided with wide plate glass windows to allow passengers to obtain good views of the scenery of Puget Sound. A dining room that also gives its occupants an excellent outlook occupies part of the upper deck, and the passenger accommodation generally is furnished with luxury in all respects equivalent to that in an ocean liner.

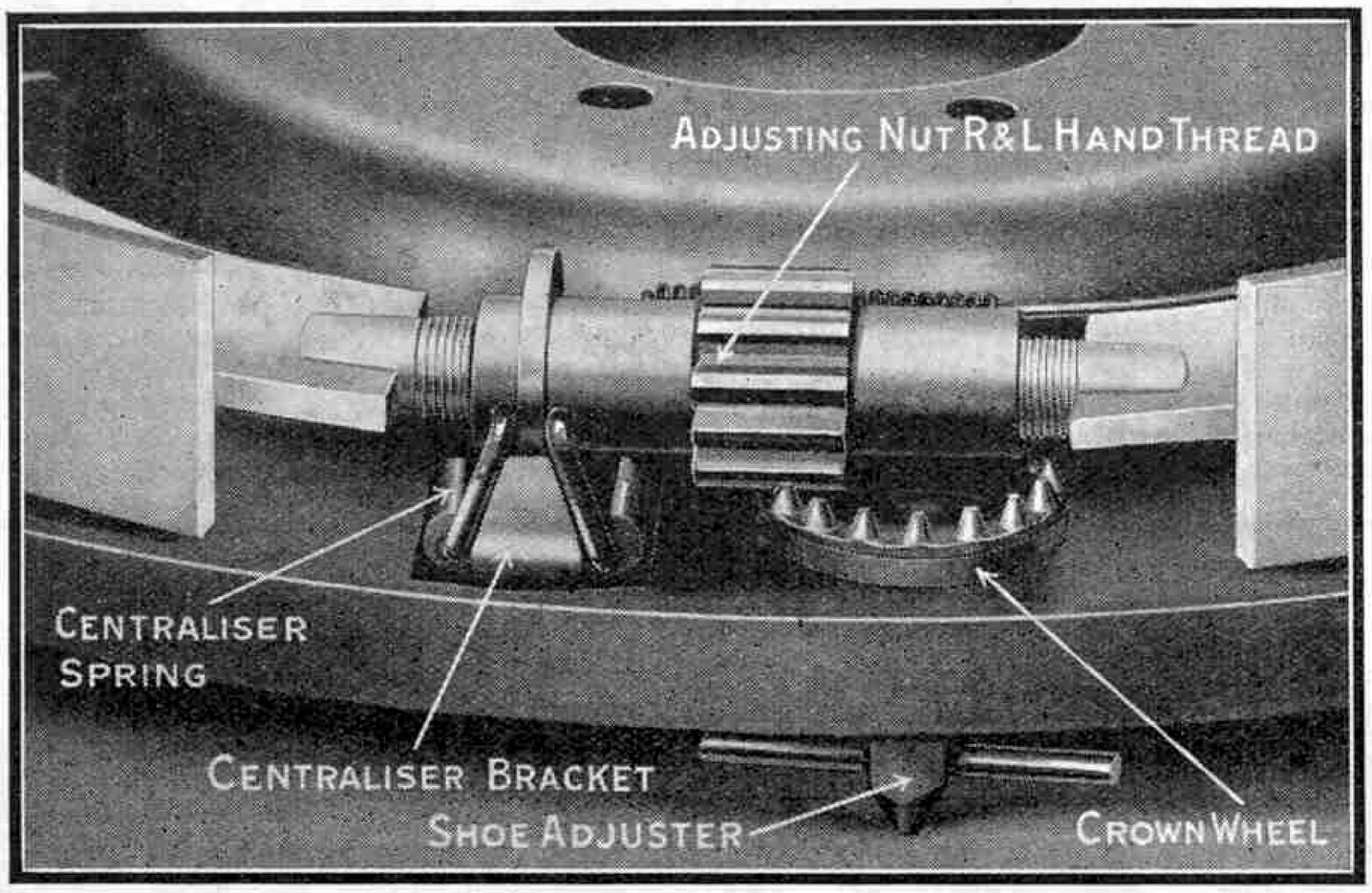
As would be expected in a vessel with the modern appearance and equipment of the "*Kalakala,*" the interior furnishing and decoration of the vessel are of strikingly up-to-date type. The interiors of the cabins are of steel that has been given an attractive appearance by the use of lacquers of various colours sprayed on the metallic surfaces, and each room has its own colour scheme, with distinctive suitable draperies. An efficient form of indirect lighting is used throughout the vessel. The galley also shows the influence of modern ideas, for this is finished in the nickel-copper alloy known as Monel metal and cooking is carried on solely by electrical means.

The Bendix Servo Brake

Balanced Action Helps to Avoid Skidding

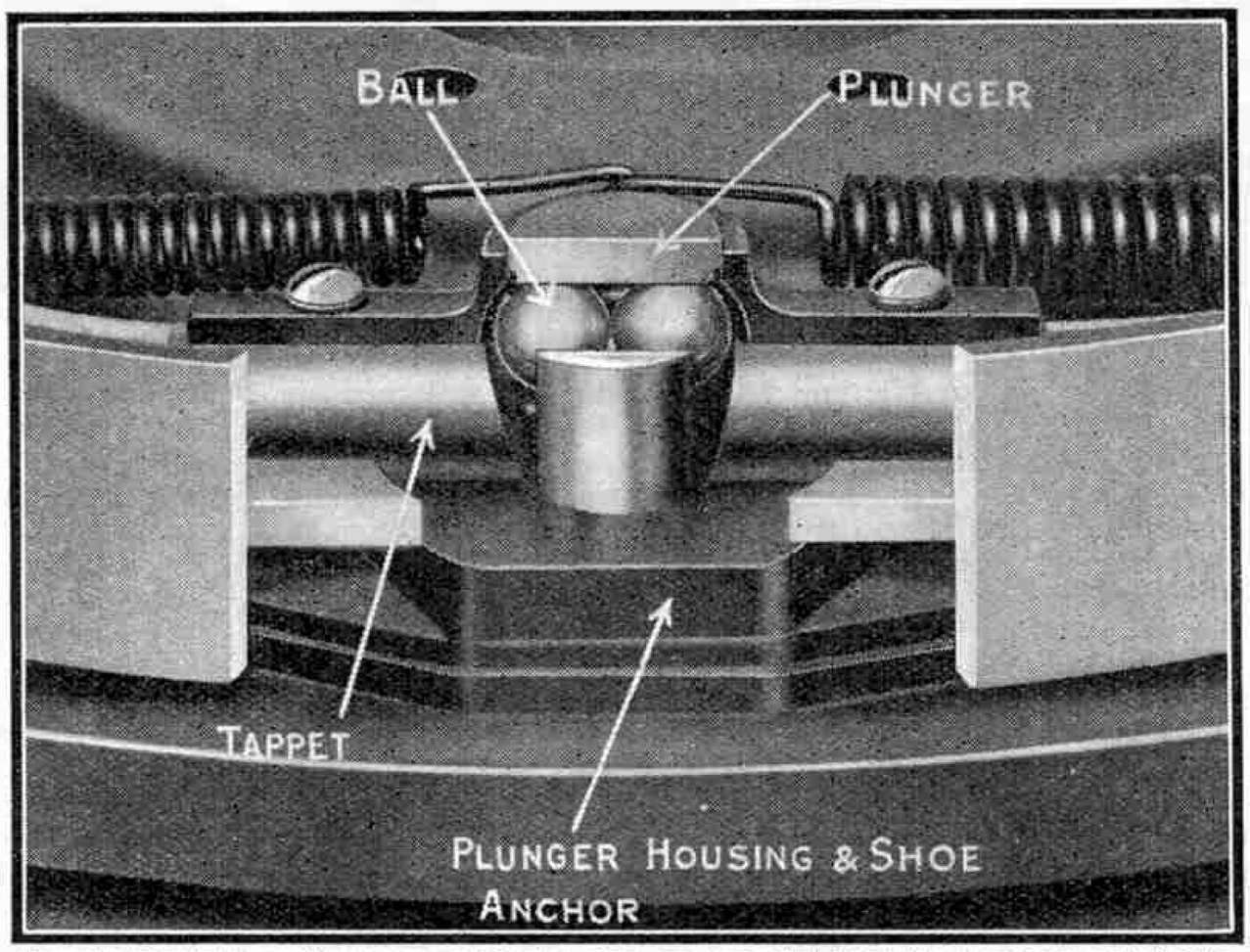
NO feature of a motor car is of greater importance than its braking system, and this must enable its driver to pull up smoothly and easily in a comparatively short distance without violent pressure on the brake pedal. There is little need to emphasise the danger of bad braking, especially for those who have experienced the alarming sensation of being in a car that has skidded violently to one side immediately the brakes have been applied, or even has turned completely round so that it is facing in the direction from which it came.

Skids of course are particularly prevalent on wet and slippery roads, but may be avoided even in these conditions. Brakes may be so designed that they exert their full power with the slightest pedal pressure, however, and in these circumstances they do not lock the wheels, as they may when applied by brute force in cases of emergency. An even more important cause of skidding is uneven braking, for if the action takes effect on one wheel before the others, there is a great tendency to pull the car out of its line of travel. For instance, this is the case when one of the back wheels is heavily braked before the other wheels are affected. The effect is exaggerated if the second rear wheel is still driving the car and skidding often is the result. Similarly a car tends to revolve round a front wheel if braking takes effect first on it, producing a front wheel skid.



The adjusting mechanism of the Bendix Servo Brake. The illustrations to this article are reproduced by courtesy of Bendix Limited, Birmingham.

An interesting modern braking system that requires comparatively little effort on the part of the driver, and affects all four wheels equally and at the same time, is illustrated on this page. It is the Bendix Balanced Servo Brake. The brake shoes of this mechanism are of the usual internal expanding type, but they are fixed only at the ends where the brake mechanism is applied, the floating ends being connected by an adjuster. Only one of the two brake shoes is brought immediately into contact with the brake drum when the brakes are applied. This shoe is known as the primary shoe. It is carried round slightly by the friction between its lining and the drum, and this movement is used to apply the second shoe. In ordinary brakes the power of this turning effect is completely wasted, but with the Bendix servo brake only about one third of the effort needed to apply the usual type of two-shoe brake is required.

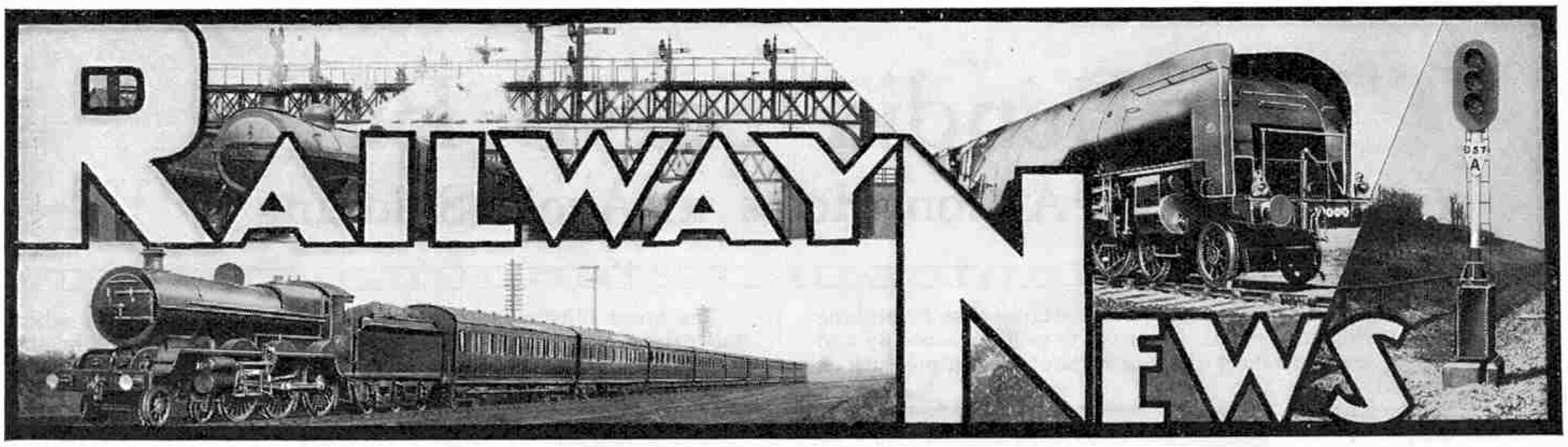


How the Bendix Servo Brake is applied. The shoes are expanded when the plunger is pulled into its housing.

The lower illustration on this page shows what happens when the driver applies the Bendix brake. The plunger seen in the illustration is then pulled into its housing. This plunger is made of hardened steel and through its shank a hole is drilled to accommodate two hardened steel balls in contact with each other. They project from the plunger on each side and as they are carried down they press on the inclined faces of hardened steel tappets that are pushed apart and carry the movement to the primary shoe, and thence to the secondary shoe by the servo action already described. Springs return the brake shoes to their normal position when the brake is released.

All brakes require adjustment from time to time to keep their efficiency, and this is remarkably simple in the case of the Bendix servo brake. As shown in our upper illustration, the free ends of the brake shoes are connected by means of an adjusting nut, with right hand and left hand internal threads into which are screwed plungers with slotted upper ends fitting over the tongued ends of the brake shoe. The nut is rotated in order to bring the shoes nearer together or farther apart as required, and this is easily carried out by means of the shoe adjuster, which acts through a crown wheel and a gear on the adjusting nut. The crown wheel is fitted with an automatic ratchet device that retains the setting of the brake shoes. When adjustment is necessary the adjuster is turned in a clockwise direction until the shoes come into contact with the drum. It is then reversed through half a turn, an amount that is readily measured by turning until four clicks of the ratchet mechanism have been heard.

The brake operating mechanism is provided with compensators between the front and rear brakes as well as between the two brakes on each axle. This ensures easy and even braking on all four wheels and it is possible to pull up, even in difficult circumstances, without skidding or changing direction, even when the linings of the brakes are unevenly worn or the shoes are in faulty adjustment. The foot pedal operates brakes on all four wheels, and the hand lever can be arranged to act on the rear brakes only, or on all four. For normal driving the foot brake is the one most in use, and with any arrangement the hand brake gives sufficient power to hold a car on any hill.



Railways and The Royal Funeral

The arrangements for the funeral of His late Majesty King George V depended to a great extent on railway services. In addition to the running of the Royal Funeral Train first from Sandringham up to London and then from London to Windsor, and the special trains for guests on the latter occasion, suitable arrangements had to be made for the numerous foreign royal personages and delegations arriving from the Continent.

Chief interest of course centred on the operation of the Royal Funeral Train. On 23rd January last this left Wolferton, the station for Sandringham, drawn by L.N.E.R. 4–6–0 locomotive No. 8520, manned by Driver Thurston and Fireman Tobell. At King's Lynn No. 2847, "*Helmingham Hall*," a three-cylinder 4–6–0 of the "Sandringham" class, came on in charge of Driver Collis and Fireman Foister. The usual route by way of Ely, Cambridge and Hitchin to King's Cross was followed and L.N.E.R. stock was used. Nine coaches made up the train.

The same train was used on the G.W.R. from Paddington to Windsor on the day of the funeral, and on 25th January was transferred to that system via Canonbury and Acton. On Tuesday 28th January it left the G.W.R. depot at Old Oak Common for Paddington with the 4–6–0 locomotive No. 4082, "*Windsor Castle*," attached at the rear. This was the engine that was driven by His late Majesty on the occasion of his visit to Swindon Works in 1924. On arrival outside Paddington, the engine heading the train having been detached, "*Windsor Castle*" propelled the train into No. 8 platform. In addition to this train, there were five specials, scheduled to leave before it, that conveyed the invited guests to Windsor. Mr. J. M. Craig informs us that these were drawn respectively by "Castle" class engines, "*Tregenna Castle*," "*Raglan Castle*," "*Dorchester Castle*," "*Goodrich Castle*," and "*Llanstephan Castle*"; "*Morlais Castle*" was attached to a supplementary special that was not required, however.

"*Windsor Castle*," in charge of Driver Sparrow and Fireman Miles, was draped with the Royal Arms and carried the special Royal headlamps with crowns on top. When the train was re-assembled for the return journey, L.N.E.R. men were available to deal with the couplings. Only four specials in addition to the Royal Train were required for the journey to Paddington, the Royal Train departing after the first special. Several speed restrictions to 10 m.p.h. were enforced for the occasion and supplementary signalling instructions were issued.

In connection with the royal visitors and delegations from the Continent the S.R. provided 10 special trains, seven special steamers and 13 special coaches.

An L.M.S.R. local train hauled by the 0–6–0 Standard freight locomotive No. 4288. When required these engines do useful work on the slower passenger and excursion trains. (H.R.C. Prize-winning photograph.)

Names of New G.W.R. "Castles"

The names selected for the 25 locomotives of the "Castle" class that are to be built this year are as follows: "*Beverston Castle*," "*Bridgwater Castle*," "*Barbury Castle*," "*Compton Castle*," "*Cranbrook Castle*," "*Clifford Castle*," "*Denbigh Castle*," "*Devizes Castle*," "*Dryslwyn Castle*," "*Eastnor Castle*," "*Hatherop Castle*," "*Lamphey Castle*," "*Lydford Castle*," "*Ogmore Castle*," "*Picton Castle*," "*Penrice Castle*," "*Powis Castle*," "*Sarum Castle*," "*Sudeley Castle*," "*Tenby Castle*," "*Tretower Castle*," "*Thornbury Castle*," "*Wardour Castle*," "*Wilton Castle*," "*Upton Castle*."

Progress of S.R. Engineering Works

The Southern Railway are making good progress with a scheme that will greatly facilitate the handling of traffic on the Western section between Waterloo and Wimbledon. This scheme includes the rearrangement of the existing track and the construction of a flying junction and an immense ferro-concrete bridge near Wimbledon. Extensive signalling alterations are involved and colour-light signals are being installed between Waterloo and Hampton Court Junction.

A new power-operated signal cabin is to be built at Waterloo, and this will undertake the duties at present performed by six other cabins. The increase and acceleration of train services as the result of electrification, and the necessity of providing for the future, have been the chief reasons for the preparation of this scheme, which will cost approximately £500,000 to complete. Ten years ago 1,046 trains were dealt with at Waterloo during a normal day of 24 hours; to-day 200 more have to be moved over the same layout of lines in the same time. This explains the urgent nature of the operations, which are expected to be completed at the end of next May.

Extensive station alterations, permanent way and signalling work are already in hand in preparation for the electrification of the lines between London and Portsmouth. It is planned to complete the work in three years.

"Right Away!"

From "*The Railway Gazette*" we extract the following:

"It is told of a certain Midland Railway guard, residing in a small town in the Midlands, that one night, while sleeping in a chair by the fire, he surprised his wife and family by suddenly jumping up, seizing the cat, who was asleep on the rug, bundling her into the oven, banging the door to, and then shouting "Any more for Nottingham?"—"*The Windsor Magazine*" of March 1897.'

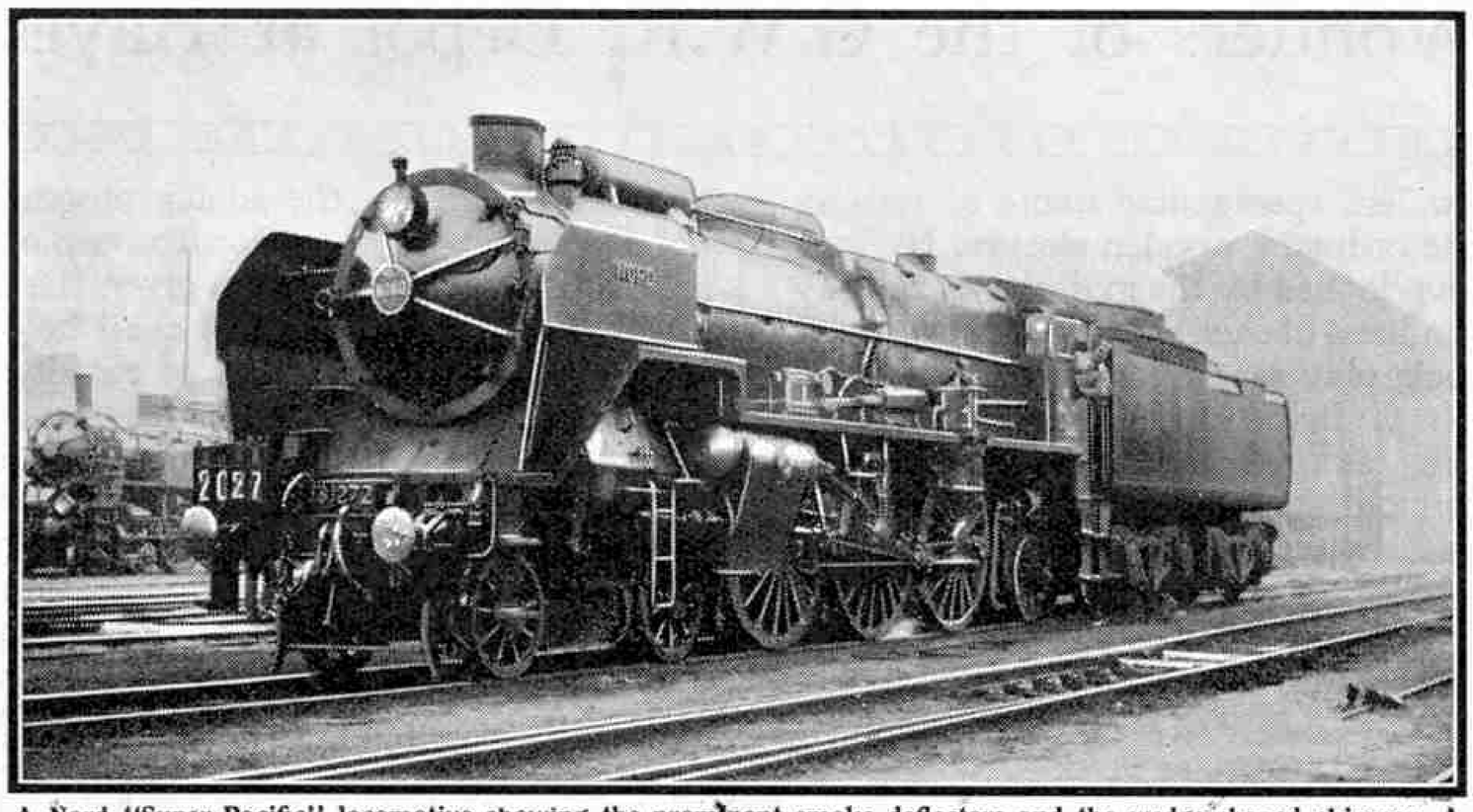
Good Running on Anglo-Scottish Trains

We have received details of the following runs from Mr. O. S. Nock.

On the L.N.E.R. 5.45 p.m. express from King's Cross, "Pacific" No. 2561, *"Minoru,"* with Driver Sparshatt in charge had a load of 410 tons and started well, passing Potters Bar 12.7 miles in 18½ min. Adverse signals at Hatfield and Welwyn North cost fully 8¼ min. altogether, but from Hitchin to Fletton Junction the 43.1 miles were run at an average of 73.7 m.p.h., 82 m.p.h. being attained on four separate occasions. Peterborough, 76.4 miles, was passed in 81¾ min., and 60 m.p.h. was maintained throughout the ascent from Werrington Junction to Stoke Summit. Grantham, 105.5 miles, was reached in a net time of 104¾ min.

Coming up on *"The Flying Scotsman,"* No. 2552, *"Sansovino,"* with Driver Payne, had a load of 520 tons. Even so an acceleration to 45 m.p.h. was recorded up the 1 in 200 ascent to Stoke, and the 18.6 miles from Corby to Werrington Junction were covered at an average speed of 80.6 m.p.h., the maximum being 86.5 m.p.h. Peterborough, 29.1 miles, was passed in 28 min. 55 sec., and an average of 63.3 m.p.h. was made over the 58.1 miles from Yaxley to Brookmans Park. Up the long 1 in 200 rise to Stevenage, speed did not fall below 51 m.p.h. Notable speeds were 74 at Huntingdon, 72 at Tempsford, and 78 at Hatfield. In spite of checks at Potters Bar and Hadley Wood the run finished brilliantly, a maximum of 75 m.p.h. at Wood Green bringing the train into King's Cross in 110½ min., thus improving on schedule by half a minute. The net time was 104 min. It is remarkable that on this run, apart from the start from Grantham and the recovery from the slack through Peterborough, no longer cut-off than 25 per cent. was employed, of course with the regulator full open.

On the L.M.S.R. No. 6119, *"Lancashire Fusilier,"* of the "Royal Scot" class, working through from Crewe to Perth on the 7.30 p.m. from Euston, had a gross load of 420 tons. In the latter stages of this long run a splendid start from Stirling produced an acceleration to 46 m.p.h., before the ascent to Dunblane. On the 1 in 75 grade the minimum was 27.5 m.p.h. The gradually rising length to Gleneagles was covered at 50–54 m.p.h., the 17.2 miles to that place taking 27 min. 13 sec. In a thrilling finish a maximum of 83.5 m.p.h. was recorded below Auchterarder and several miles through Strathearn were covered at 75–76 m.p.h. The 33 miles from Stirling into Perth were completed in 41¾ min., 13.8 miles from Gleneagles to Hilton Junction having been covered at an average of 74.2 m.p.h. Driver Garrett of Crewe was responsible for this fine performance.

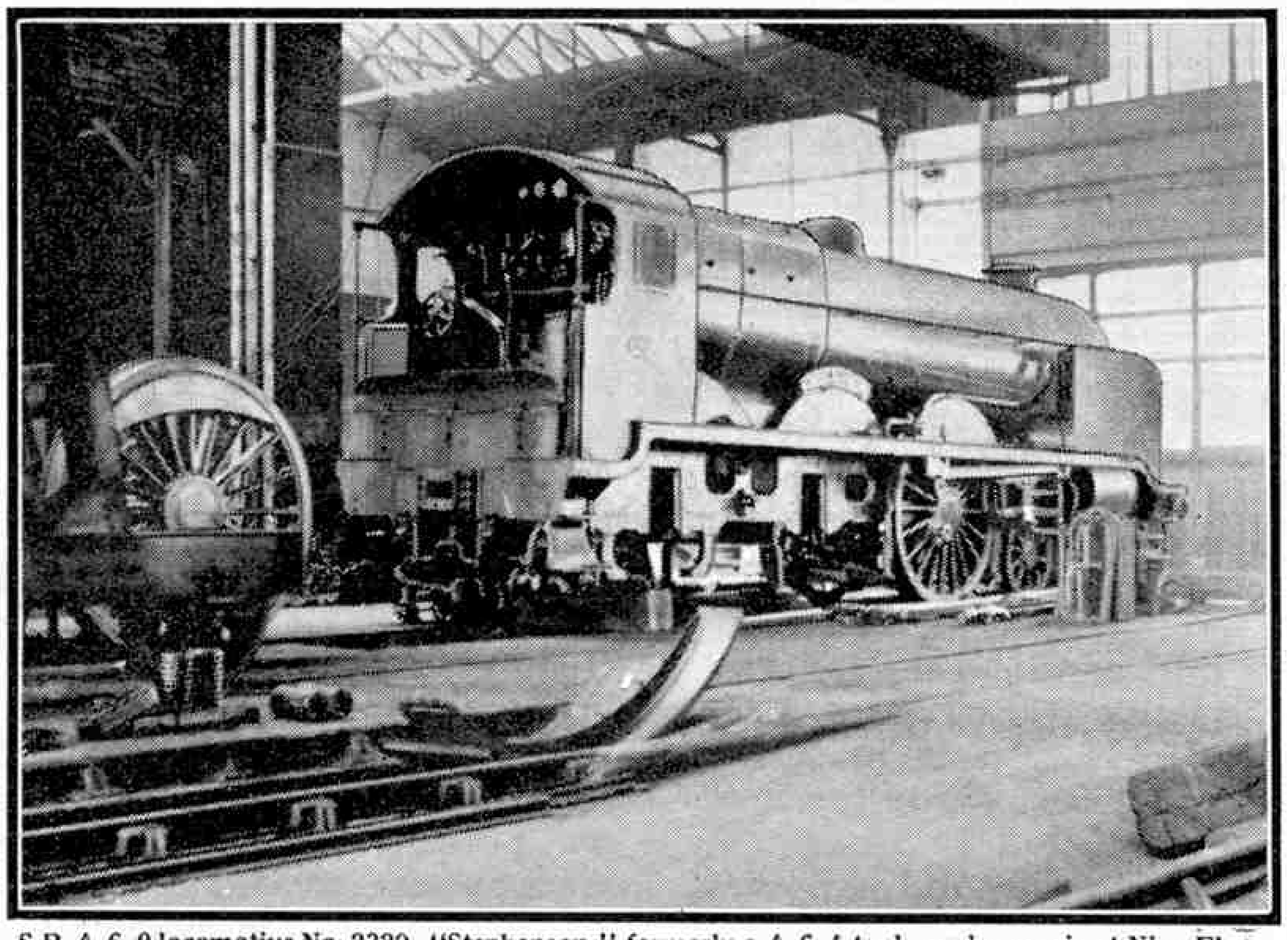


A Nord "Super-Pacific" locomotive showing the prominent smoke deflectors and the wedge-shaped chimney. A splendid run behind one of these engines is described on page 138 of this issue. Photograph by Mr. O. S. Nock.

Another Crewe engine No. 6118, *"Royal Welch Fusilier,"* made some fine running with a gross load of 380 tons on the 11.30 a.m. Sunday express from Glasgow to Euston. The 102.3 miles to Carlisle were covered non-stop in 123¼ min. Up the heavy ascent to Craigenhill Summit speed was maintained at 36 m.p.h. On the final pitch of the rise to Beattock Summit speed fell to 40½ m.p.h., but the 52.6 miles from Glasgow to that point were covered in 73½ min.—2½ min. under time. The average speed from the start had thus been 43 m.p.h. and the train had been lifted a clear 1,000 ft. On the descent 80½ m.p.h. was recorded before Beattock Station, and with 72.5 m.p.h. at Kirtlebridge and 73 m.p.h. at the Solway Firth Gretna was passed 7½ min. early, 93.7 miles in 112.5 min. Beyond Carlisle the locomotive work was spoilt by checks.

* * *

The "Royal Scot" locomotives are to be provided with larger tenders.



S.R. 4–6–0 locomotive No. 2329, "Stephenson," formerly a 4–6–4 tank, under repair at Nine Elms. The second and third pairs of coupled wheels have been removed, the rear end of the engine being supported on jacks and timber packing. (H.R.C. Prize-winning photograph.)

Recent G.W.R. Train Workings

Mr. J. M. Craig sends us the following observations:

During recent heavy rains in the South of England the *"Cornish Riviera Limited"* and similar trains were worked by "Castle" class engines instead of "Kings," and Weymouth trains had "Moguls" in place of "Halls." An interesting instance of these workings was on Saturday 11th January, when at 10.20 a.m. and 10.25 a.m. respectively two specials to Bristol for a Cup-tie enjoyed the services of "King" class engines; but the *"Cornish Riviera Limited"* had *"Shirburn Castle,"* and *"Kilgerran Castle"* took *"The "Cornishman."* *"Tintagel Castle"* and *"Llanstephan Castle"* were also seen on the *"Riviera"* train.

Owing to the closing of the Severn Tunnel on Sundays, passengers travelling by half-day excursion trains to Newport and Cardiff from London enjoy an extra bit of travel on the outward run, the train proceeding after Swindon via Gloucester. A stop is made at this latter station, but no passenger business is done. The return is made by the direct route as the Tunnel is opened again about 8 p.m. The difference in time for the two routes is exactly half-an-hour, and on 12th January *"Wigmore Castle"* kept time quite easily on the longer outward trip.

Streamlined Locomotives for the L.N.E.R.

A further 17 4–6–2 locomotives, generally similar to those of the "Silver Link" series already in service, are to be constructed by the L.N.E.R. Remarkable success has attended the working of the existing streamlined engines and it is understood that these new locomotives also will be streamlined. Streamlining has solved the problem of lifting the exhaust steam and smoke clear of the cab so that the driver's view is not obstructed; and the reduction of wind resistance effected by streamlining at speeds in excess of 60 m.p.h. has been found to result in improved coal consumption.

Four further 2–8–2 "Mikado" locomotives of the "Cock o' The North" pattern are under construction for service on the difficult Edinburgh and Aberdeen route.

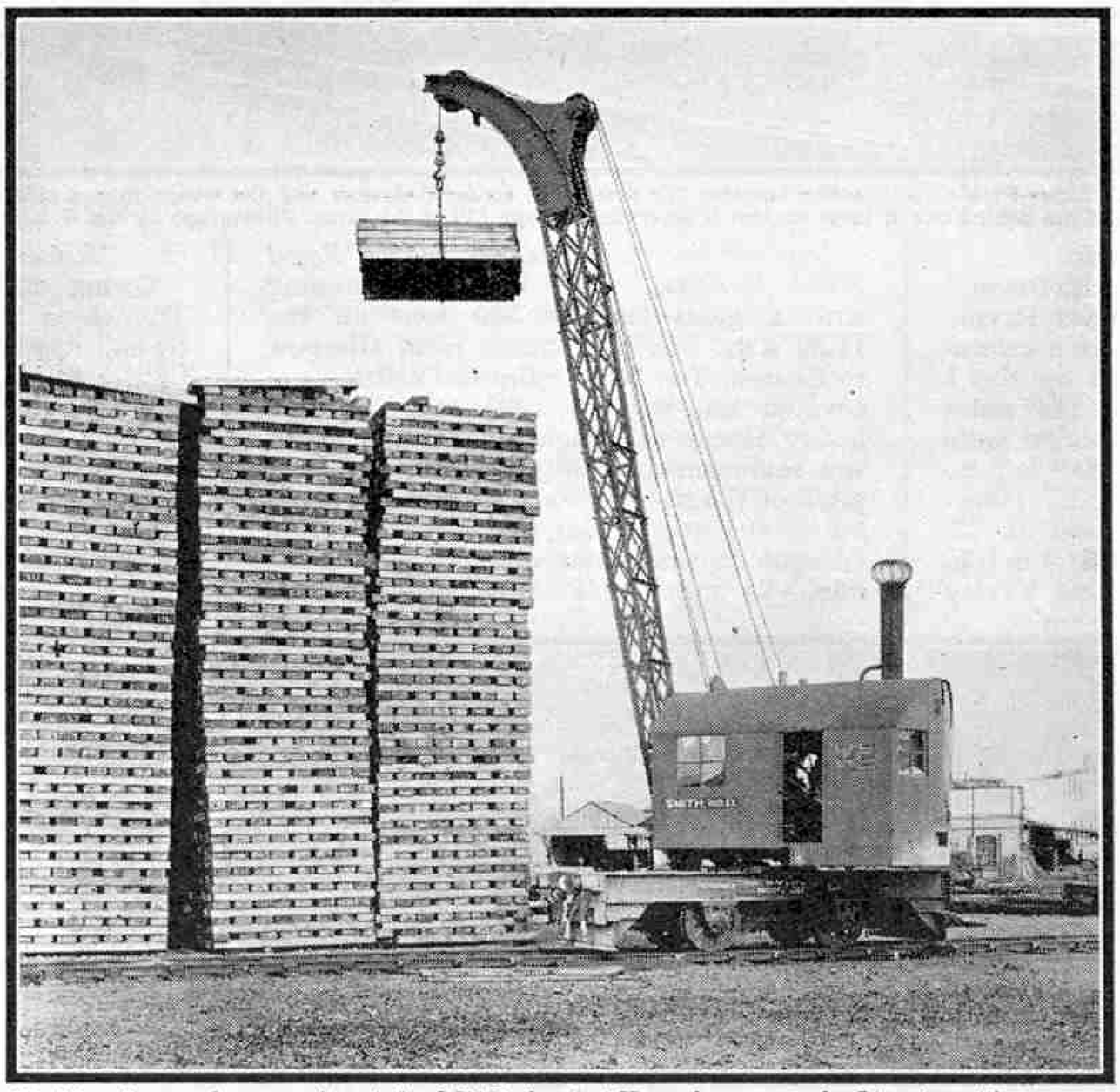
Vehicles to be constructed under present orders include a number of restaurant and sleeping cars, together with 214 vestibuled coaches for first and third class passengers. In addition contracts have been placed for the construction of 160 of the passenger coaches to be built under the Government loan scheme.

How Railway Sleepers are Prepared

Wonders of the G.W.R. Depot at Hayes

THERE can be few less spectacular items of railway equipment than the ordinary wooden sleeper. Its very existence probably is overlooked by the majority of railway passengers; yet the soundness of each sleeper and its correct application in the track play an important part in preserving the reputation of British railways for safe and smooth travel. Wooden sleepers still represent typical British practice, although steel ones have been used experimentally to some extent by all four groups.

The importance of wooden sleepers may be judged from the fact that the G.W.R. have recently put into operation at Hayes, 11 miles from Paddington, a new depot for their handling and preparation; and this installation is designed to deal with half a million sleepers annually. Incidentally the G.W.R. relaying programme for the current 12 months calls for some 623,000 sleepers.



Stacking sleepers for seasoning at the G.W.R. depot at Hayes by means of a 5-ton travelling crane. The illustrations to this article are by courtesy of the G.W.R.

Wooden sleepers, which are 8 ft. 6 in. long, 10 in. wide and 5 in. thick, are usually of Baltic pine from Russia, Douglas fir from British Columbia, or Jarrah from Australia. The Baltic pine trees are about 14 in. in diameter, and when cut down they are hewn lengthways to produce a log roughly 10 in. square. These logs are cut off to length and thus form sleeper blocks and it is in this state that they arrive in this country. They are sawn in half lengthways, so that a Baltic pine sleeper has one sawn side and three hewn sides. Douglas fir or Jarrah sleepers are cut from much larger trees and are therefore sawn on all four sides.

Sleepers reaching the Hayes depot arrive in barge loads of about 1,100 on the Paddington Canal. They are unloaded by crane and placed in the seasoning and stacking yard, which is conveniently adjacent to the canal and can accommodate about 750,000 sleepers. The sleepers are so stacked that the air has access to all sides of them and they remain in the yard to dry or season for a period of about six months.

When required for use the sleepers are taken from the stacks on flat wagons and are unloaded by crane on to a staging outside the main depot building. Thence they pass inside along a roller conveyor which delivers them at a convenient point close to what is known as an "adzing and boring" machine. This machine makes them ready to receive the chairs, the adzing process being the formation of the seating or recess on the top of the sleeper for each chair. Each sleeper is thus given the same effective depth, so that a uniform length of chair bolt can be used. Adzing is carried out by a series of rapidly revolving knives or adzing drums under which the sleepers pass on an endless chain that conveys them through the machine. As the bases of the chairs are serrated, or formed with small projections, the knives of the adzing drums are profiled to produce a similar surface on the sleeper. Thus any tendency to movement sideways on the part of the chairs is restrained.

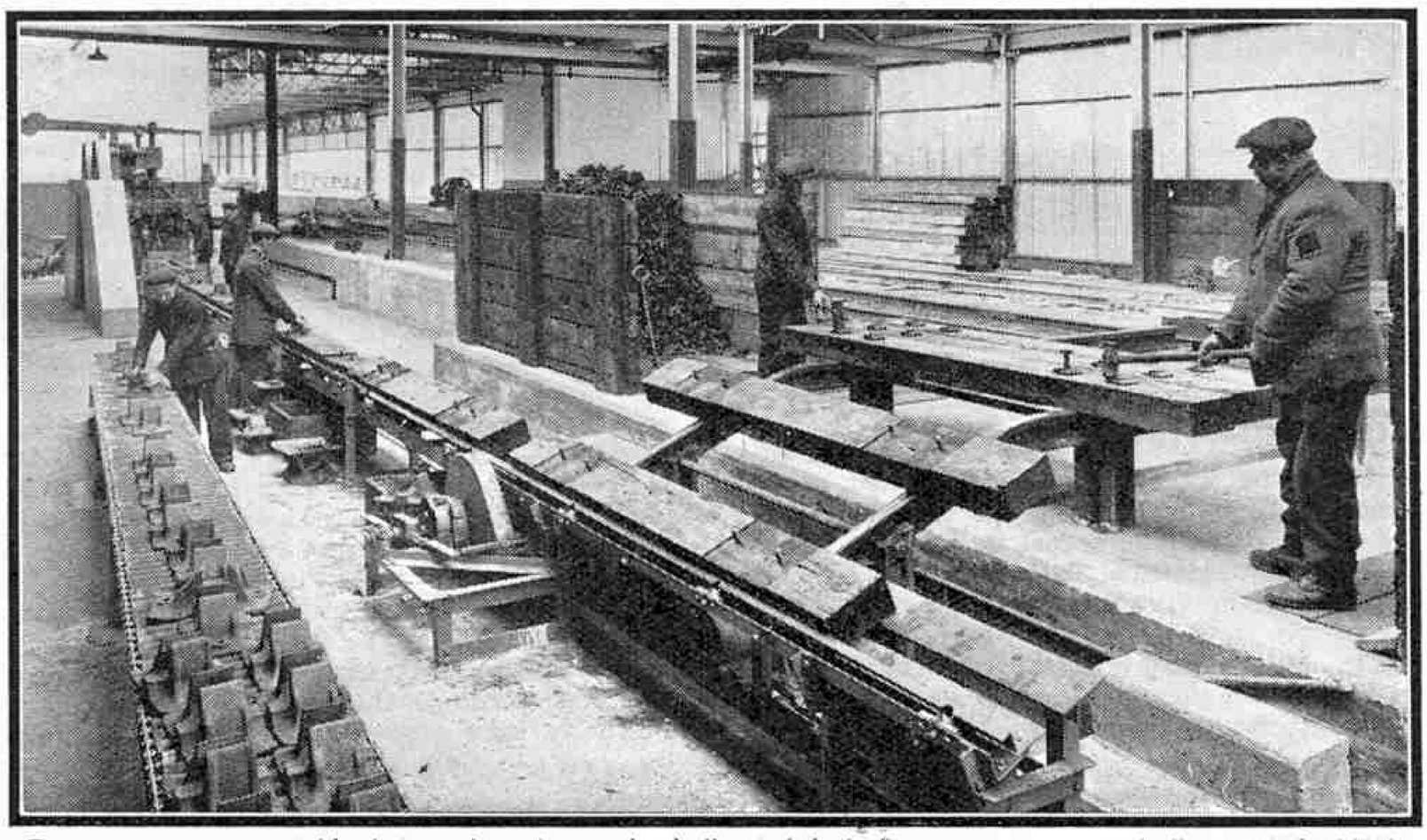
From the adzing knives the sleepers pass to the other side of the machine and there have drilled through them four holes for the chair bolt holes. A brush, also part of the machine, removes the shavings and borings. Six sleepers a minute can be dealt with by the adzing and boring machine, which also saws them to the standard length of 8 ft. 6 in. and automatically rejects any sleeper over $5\frac{1}{4}$ in. thick. Passing off the machine, which is situated in a bay at one end of the depot building, the sleepers are loaded on to trolleys running on narrow gauge rails to undergo one of the most interesting processes involved in their preparation for use.

To obtain as long a life as possible from the pine or fir sleepers, which are soft wood, they must be treated with a preservative. Creosote, a by-product of the manufacture of coal gas, is the medium used. This impregnation is carried out in two big cylinders which resemble boilers in appearance and are situated at one end of the depot. A stout door at each end of the cylinder, hung on a massive hinged frame, allows the sleepers to be run in on the trolleys and then out again when creosoting is over. The capacity of each cylinder is 600 sleepers or 10 trolley loads. The cylinders at Hayes are the largest in the country and are 90 ft. long and 6 ft. 9 in. in diameter.

When the sleepers are inside and the doors are shut, a vacuum is created inside the cylinder, and then creosote heated to 150 degrees Fahrenheit is drawn up from the service tanks below. Pressure pumping now commences, the maximum pressure being 200 lb. per square inch; but the figure worked to depends on the nature of the timber.

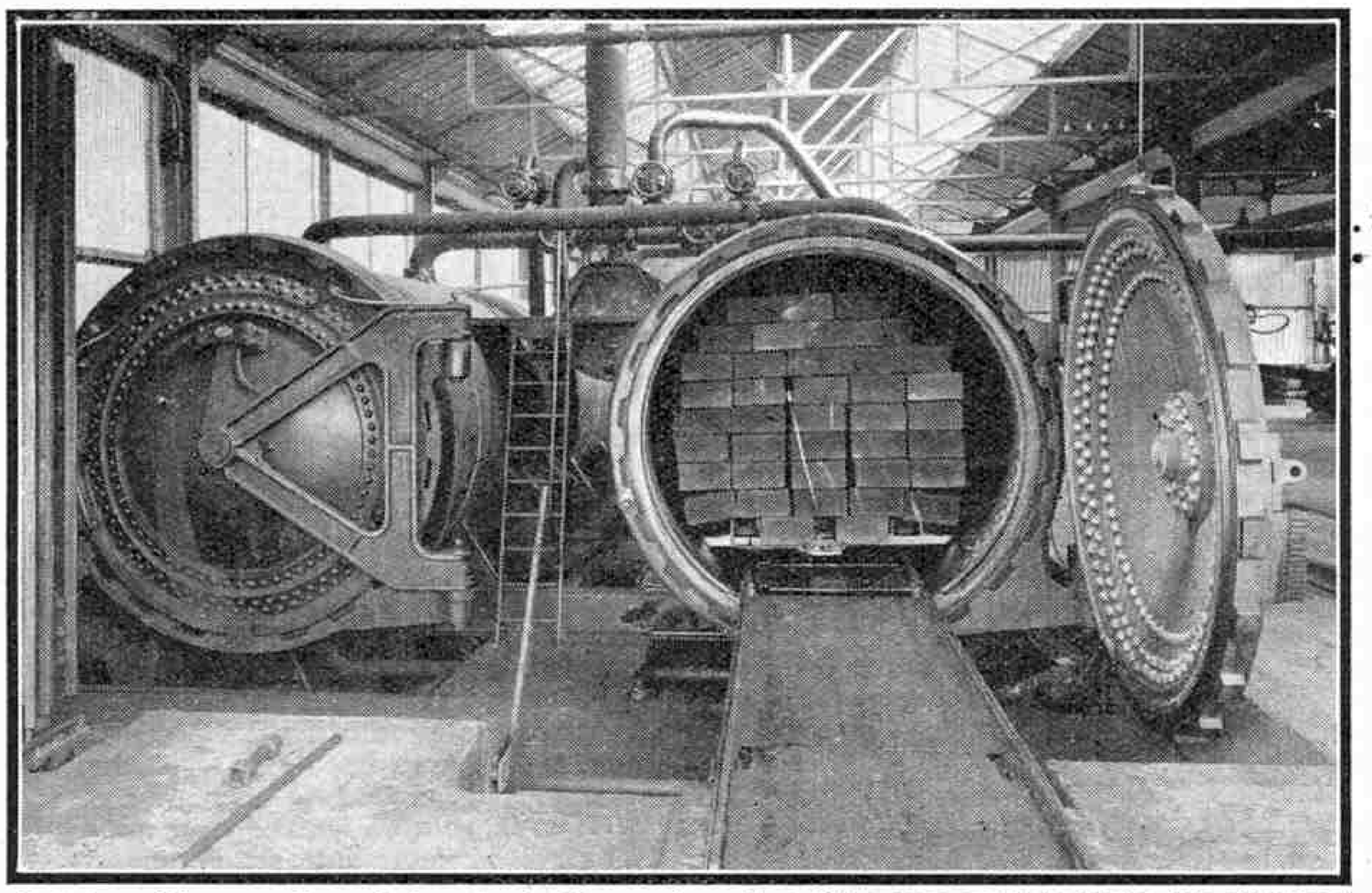
Baltic pine is rapidly impregnated and requires only an hour to an hour and a half for each sleeper to pick up about three gallons of creosote. A lower pressure is thus sufficient for such timber than for Douglas fir, which takes about four hours but does not absorb so much creosote. Jarrah hardwood sleepers are not treated, but are used "clean."

When the time is up, according to the type of timber, pumping ceases and the creosote is allowed to run off. Then a vacuum is created and maintained for about a quarter of an hour to dry the sleepers. The trolley loads are then hauled out at the opposite end of the cylinders from which they entered and remain to drain for a short time.



The men on the right of this photograph are hammering in the chair bolts. The sleepers then pass to the chairing machine at the far end of the conveyor, the chairs being slipped over the bolts and the nuts started on the way.

The sleepers now proceed down the building to the chairing plant. The chairing machine is situated at the side of the building, so that the sleepers are now unloaded in an outward direction from the tracks that pass down the centre of the depot. They are placed, several at a time, bottom side uppermost, on the bolting table where operators at each end of the sleeper insert the chair bolts, threading them through the ribbed washers that prevent the bolt heads working on the sleeper itself. The bolts are hammered home, and the sleepers, now turned right way up and with the bolt heads below, are skidded down on to a conveyor that leads them to the chairing machine. On their way there they have the chairs slipped over the bolts and the nuts are given a start on the bolt threads. The chairs are taken from a parallel conveyor that enters the building from the chair storage bank outside, and delivers them conveniently to hand for the men standing between the two conveyors.



End view of the creosoting cylinders, showing the massive nature of the doors and their hinges. The right-hand cylinder holds a charge of sleepers ready for creosoting.

Arriving at the chairing machine, each sleeper is stopped on the bed of the machine. An operator causes hydraulic rams to descend and engage the jaws of the chairs, setting them correctly to gauge and pressing the chairs on to the sleeper with a force of 10 tons on each ram. While they are thus secured four revolving spanners are operated through a friction drive which automatically slips when the nuts have been tightened sufficiently.

Now completed, the chaired sleepers pass off the machine on to a conveyor leading to a projecting wing of the building through which runs a siding. An elevator lifts them on to the sleeper trucks waiting there to receive them. As a rule the G.W.R. employ special "crocodile" sleeper wagons, each holding 160 sleepers. The sleepers which we have followed from the first stages of their preparation are now ready to be sent to wherever they may be required for new lines or for relaying.

The Hayes works cover an area of 19 acres. The machinery is electrically operated and the arrangement is such that the movement of the sleepers is progressive. Unnecessary man-handling is eliminated by the use of the conveyors and the other labour-saving devices. In addition to the creosoting service tanks inside there are storage cylinders outside with a total capacity of 65,000 gallons.

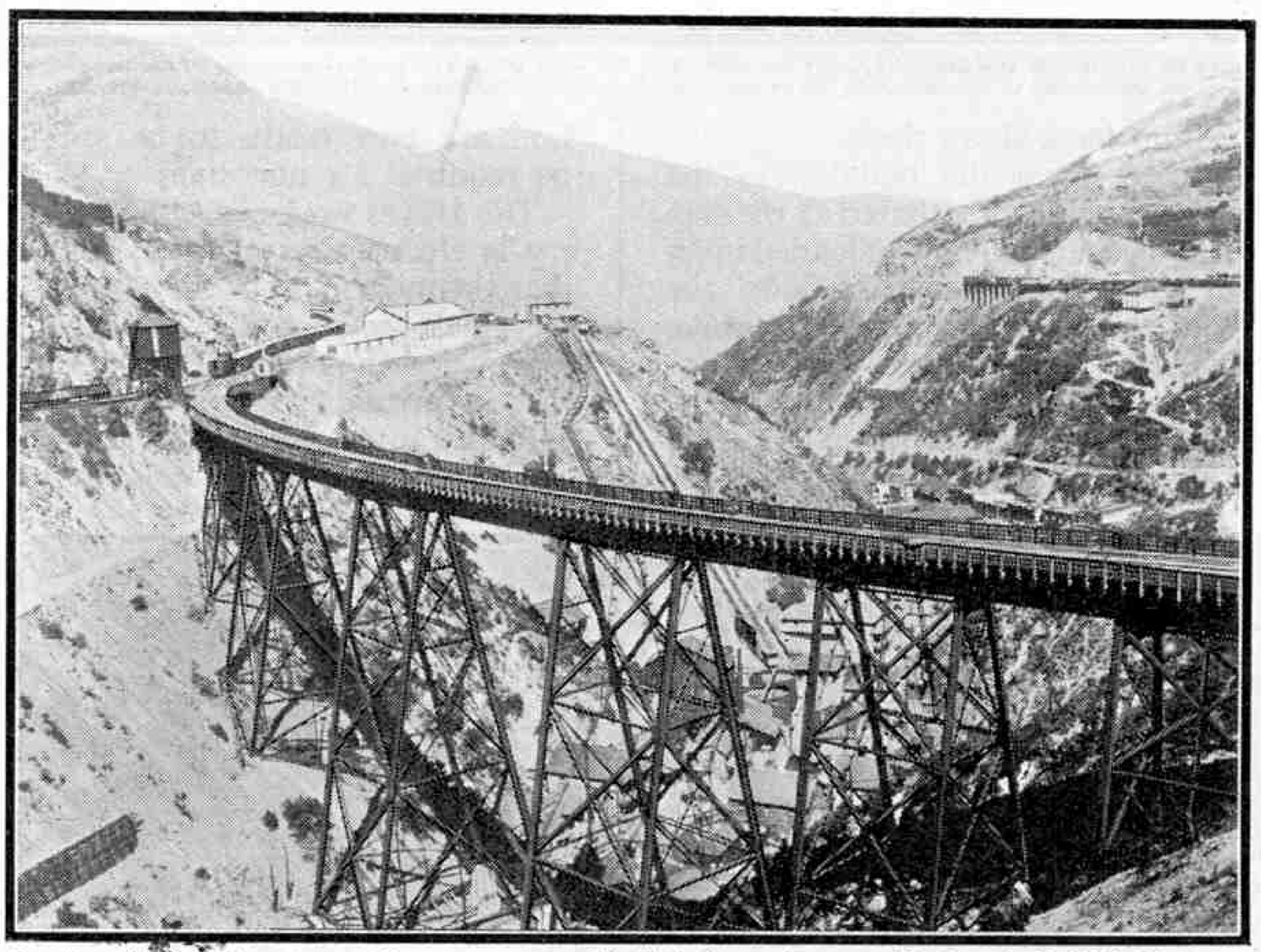
The average life of a creosoted sleeper is from 20 to 25 years. A Jarrah sleeper, although untreated, will last from 20 to 30 years, but these sleepers have the disadvantage that they induce harsher running than soft wood kinds, and the fastenings inserted in them are more liable to become rust-bound. The length of service obtained from a sleeper naturally varies with the situation and conditions. A damp spot such as in a cutting will shorten their service; but a dry stretch subject to breezes is more favourable to a longer life. Sleepers are not in first class tracks for the whole of their lives. After they have been removed from the main line they can usually be employed for a further period in sidings or in other places where traffic moves slowly

World's Largest Electrified Metal Mine

The distinction of being the world's largest electrified metal mine is claimed for one at Bingham, Utah, in the United States, in which copper ore is extracted. There actual mining operations are carried on by means of giant electrical shovels and the haulage system employs electrical locomotives and equipment of the most up-to-date type.

The mine is situated in a canyon, on both sides of which copper ore is found, and open cut working on a very large scale is practised, electric shovels cutting successive terraces in the face of the mountain as they remove first the overburden that covers the ore, and then the ore itself. The overburden is deposited in cars that are hauled away by the electric locomotives and dumped down another side of the mountain, while the ore itself is hauled to mills 17 miles away for treatment.

All the locomotives employed are specially designed for this service and are of very heavy construction, each being rated at 75 tons. A striking feature is that they can obtain power through an overhead conductor, side rails, or a trailing cable that is automatically unwound to the required length from a reel under the platform of the cab, and can be extended to allow working at a considerable distance from the supply point. In addition, the locomotives are suitable for operation by means of accumulators.



A section of the electric railway at the copper mines of the Utah Copper Company, Bingham, in the United States. Photograph by courtesy of the General Electric Company of New York.

An interesting feature of the mining town of Bingham is that it consists of one long street stretching along the floor of the canyon, the sides of which are too steep to allow side streets to be made. The town is believed to be the longest of its size in the world. The slopes above it are scarred by workings, and narrow shelves have been scooped out of them for the railways along which ore and overburden are transported

Electric Sparks in Threshing Machines

Electricity at times makes its appearance in unexpected places. An excellent instance of this is the electrification of a steam lorry running on rubber tyres. This can readily be caused by the emission of steam and products of combustion from the funnel, the friction electrifying both the escaping materials and the funnel in the same manner as an ebonite rod and a piece of flannel become oppositely electrified when rubbed together. The electrical charge on the funnel is retained by the lorry, the rubber tyres of which act as insulators, and instances have been known in which people on the ground touching the lorry have been surprised to receive electric shocks. The remedy is to hang a trailing chain from the lorry itself, when the electrical charge is continuously earthed.

Paper passing through printing machines or between the metal rollers of calendars also may become electrified by friction, and then is liable to curl up in a manner that is exasperating to those who wish to make use of it. Another strange place in which electricity may make its appearance is in a threshing machine, where it may be generated by the rubbing of the straw during its passage through the machine. In really dry weather sparking actually may take place, and several disastrous explosions due to this cause have occurred in the United States. In these cases the explosive medium was dust in the machine, which was ignited by the electric sparks, and the use of fans to remove the dust and of earth wires to dissipate the electric charges prevented further disasters of this kind.

Allowing Explosions to Escape

I scarcely think that the dangers of dust explosions are fully realised. Explosive mixtures are formed when finely divided particles of flour, starch, powdered milk and even chocolate are mixed with air, and an atmosphere in which dust from products of this kind is present in large proportion may explode when a match is struck, when an electric spark occurs, or even when an electric lamp breaks.

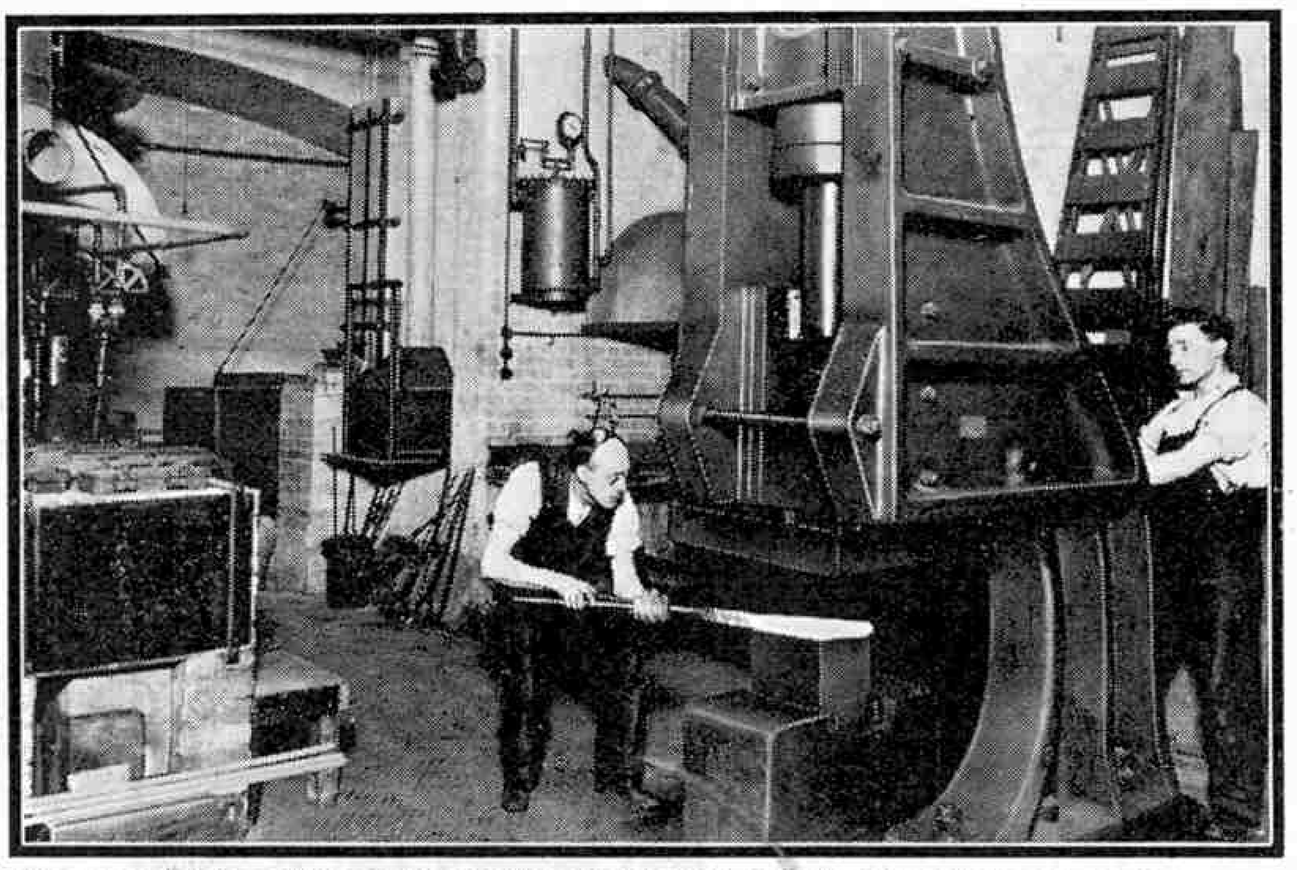
One way of preventing explosions of this kind is to keep down dust as far as possible, but this cannot always be done, and other means then must be adopted to cope with the danger. Flames must be carefully excluded from buildings in which dust explosives are possible. Care also should be taken to prevent the generation and accumulation of frictional electricity that may cause a spark, and it has even been suggested that special electric lamps with double bulbs should be used in order to prevent the flash from a broken lamp from igniting an explosive mixture.

An even more interesting method of avoiding damage from disasters of this kind is to allow dust explosions to escape from the plants in which they occur. If an explosion is confined within the walls of a building damage of enormous extent may follow the immense increase in pressure. This pressure can be released by fitting automatic or self-opening windows, and the power of an explosion may then be dissipated comparatively harmlessly. The value in practice of this remarkable method of dealing with explosions has been shown when dust has exploded in grain elevators and other grain-handling plants equipped with opening devices

How Man Loads the Earth's Crust

I wonder how many of my readers stop to consider how the building of large cities adds to the loads carried by certain areas of the Earth's surface, particularly in the United States, the home of the skyscraper and giant buildings. For instance, it has been calculated that the extra weight imposed per square mile on the Earth's skin by the buildings of New York and the cities immediately surrounding it amounts to no less than 45 million tons. Fortunately, the surface layer of the east coast of America is so strong that even the weight of New York and its neighbours does not trouble it greatly.

There is one place in the United States where Man's activities are expected to cause the Earth's surface to sink, however. This is in the course of the Colorado River, immediately above Boulder Dam, where an artificial lake that will be 115 miles long is now being formed. The weight of the water in this lake will be about 42,000 million tons, and on the average each square mile of the bed of the lake will be called upon to carry an additional weight of 190 million square tons. This immense load is expected to cause sinking to the extent of 2 ft. over a wide area.



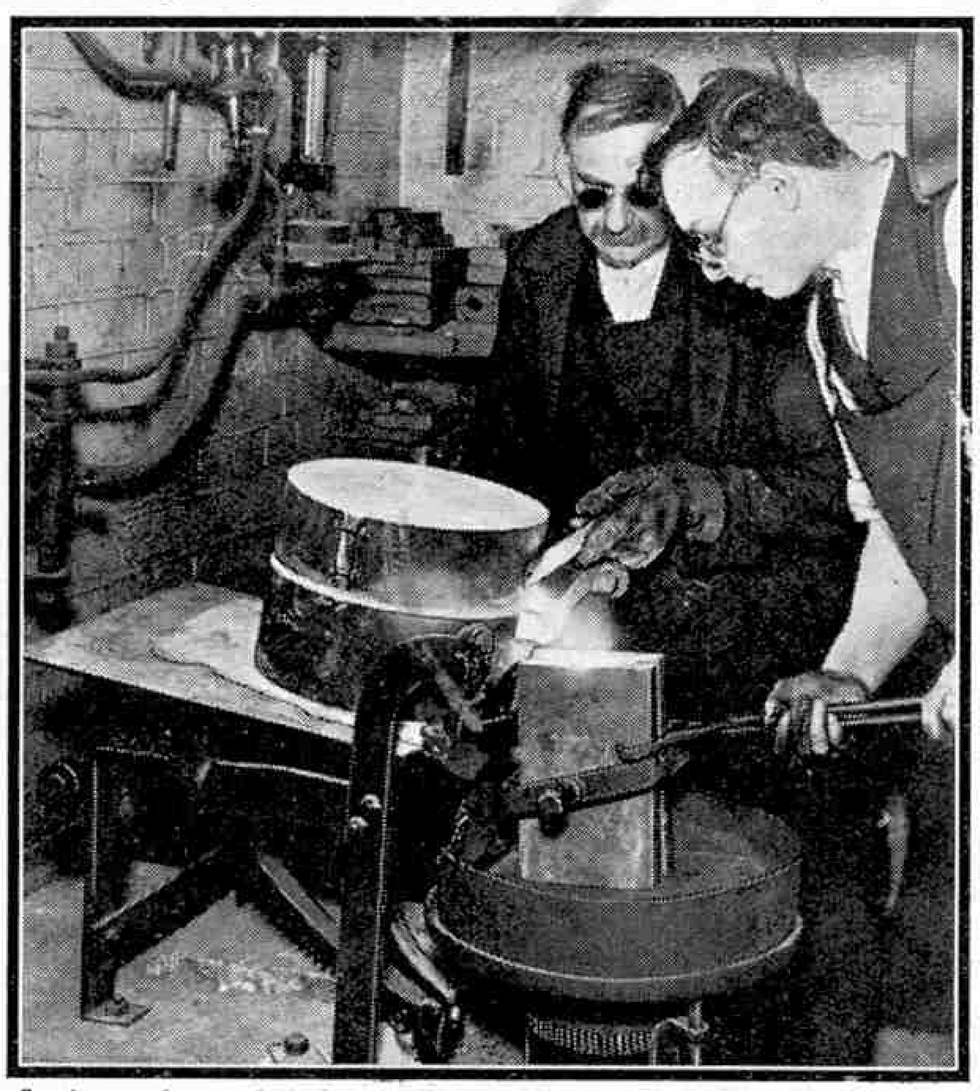
Forging an ingot of platinum before rolling it into wire. Lengths of platinum rod can be seen on the left. The photographs on this page are by J. F. Stirling, Manchester.

A Really Precious Metal

Throughout the ages gold has always been regarded as the most precious of metals, and our respect for it has greatly increased since the withdrawal of gold coinage and the great rise in the value of the sovereign and of articles made of the metal. To-day gold has many rivals, however, and of course is far less precious than radium, the value of which is about £7,000 an ounce.

Another interesting precious metal is platinum. In the 18th century the bulk of the supply of this white metal came from South America, and its name is derived from the Spanish word "*platina*," which simply means "little silver." It was then regarded as practically worthless. Comparatively large quantities were thrown away in order to prevent its use in adulterating gold, and little more than 100 years ago, when the metal was discovered in Russia, swindlers in that country were alleged to have sold gold bricks that were really gilded platinum and were of much less value to their unsuspecting purchasers than the more familiar metal. To-day platinum is worth nearly £30 an ounce and is considerably scarcer than gold.

Platinum also is a rival to gold as a "noble" metal. This name marks the resistance offered by gold to the attack of acids and corrosive agents, and platinum is equally remarkable in this respect, the only liquid that can dissolve it being a mixture of hydrochloric and nitric acids to which the name of *aqua regia*, or royal water, is given because of its effect on these noble metals.



Casting an ingot of platinum. The molten metal is being poured from an electric furnace in which it is heated to a temperature of nearly 2,000°C.

Twice as Heavy as Lead

Most of our present supply of platinum comes from Russia, but in view of its scarcity and high price eager search is being made for it in all parts of the world. At present anyone who set out to corner the supply, and was successful in obtaining sufficient of the metal to melt down into a cube with an edge of 1 ft., would find that he possessed the greater part of platinum in existence, and he would be able to consider himself a millionaire. His cube would be a very unwieldy possession, however, for it would weigh more than a ton, the metal being one of the heaviest in existence and twice as dense as lead. A cube of coal of the same size would weigh only 40 lb.

No doubt many of my readers know that platinum is largely used in making laboratory apparatus, particularly for crucibles in which chemicals are raised to very high temperatures. It is particularly suitable for this purpose because it has the very high melting point of 1,755 deg. C. Another peculiarity is that it expands at about the same rate as glass. For this reason glass vacuum tubes through which platinum wires are passed to conduct electric currents to the gases inside them remain sealed when the temperature rises, because the metal expands sufficiently to fill up the hole as this increases in size. For purposes of this kind it can now often be replaced by an alloy of nickel and iron, however. This is called platinite, and of course is not so costly as the much rarer noble metal for which it is a substitute.

Record Shipment of Quicksilver

While dealing with this interesting metal, I am reminded of a recent record shipment of another comparatively rare and costly element of this kind. This is mercury, or quicksilver, the only metal that is liquid at ordinary temperatures. This metal has recently found a new use in the mercury turbine, in which its vapour plays the same part as does steam in an ordinary turbine engine. The only mercury turbine in the world is being erected in the United States and the 120 tons of mercury required for it reached New York in two instalments, each in 3,553 iron flasks containing 76 lb. of the metal. The total quantity is sufficient to fill 50 million ordinary thermometers, and its value is more than £70,000. The plant in which it is being installed will develop 20,000 Kw. and needless to say great care is being taken to condense the whole of the mercury vapour used in the turbine and to return it to the boiler in which it is evaporated.

Island that Disappears in Winter

Some time ago I mentioned a curious lake in Styria that disappears every summer, when hay and other crops are grown on its bed. There is an equally remarkable lake in Latvia, on which a large island appears every spring, only to vanish when winter approaches. Good use is made of the temporary island, for it yields excellent crops of hay, but even the people who work on it every summer declare that they have never yet witnessed its actual disappearance.

There is a natural explanation for the appearance and disappearance of this strange island. It is believed that a part of the marshy soil at the bottom of the lake has become detached and is lifted to the surface by the gases generated in it in spring, when the temperature is rising and the chemical action producing the gases is becoming more vigorous. The island loses its buoyancy and sinks, when the cold weather of late autumn stops the evolution of gases. The island is not lost, like the grass islands carried down by the River Amazon in the flood season, but reappears next year.

A High Speed Automatic Lathe

Mass Production of Small Turned Parts

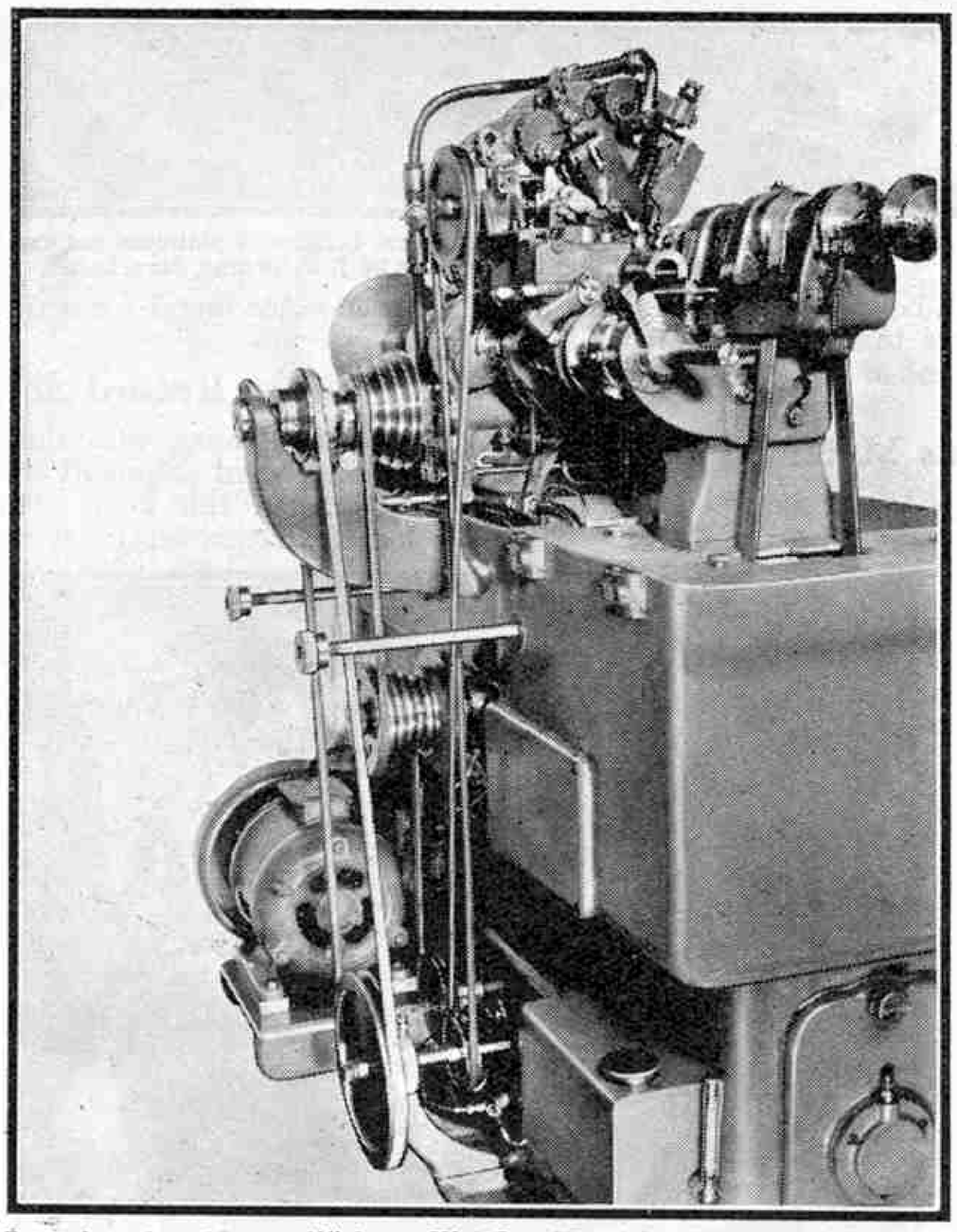
IN modern engineering works operations are carried out with remarkable speed and precision, largely by means of automatic machines of various kinds. Great accuracy is necessary in these operations, irrespective of the size of the work, and it is particularly important to keep within fine limits in the production of small parts, such as the screws and other parts that are required for clockwork mechanisms, electric meters and instruments of all kinds, and for use in wireless receivers. The manufacture of such parts as these on a mass production scale demands the use of intricate automatic machinery capable of repeatedly performing various operations at high speed for long periods.

The small parts that have been specially mentioned and others of a similar kind are turned, that is they are produced by means of automatic lathes, and the Wickman 10 m.m. High Speed Precision Automatic Machine illustrated on this page provides a suitable means of manufacturing them with the required accuracy and speed. This lathe is a small one of British manufacture, designed by A. C. Wickman Ltd., Coventry, and made by Bryant Symons and Co., London. It is capable of dealing with a wide variety of work, and the cutting tools required for any operation can be fitted or changed with ease.

The Wickman Automatic Lathe is strongly built, and hardened chrome nickel steel is used for parts that are heavily stressed. All high speed shafts are mounted on ball bearings. The machine is 4 ft. in length and 4 ft. 2 in. in height, and weighs 15 cwt. It may be driven either from a countershaft or by means of a 1 h.p. electric motor running at a speed of 1,410 r.p.m. It takes steel bars up to 4 in. in length and 10 mm., or little more than one third of an inch, in diameter, but contains the mechanism for all the operations that can be carried out on larger lathes.

The machine can be used as a universal lathe controlled by hand, but also can be made entirely automatic in action, when one operator is able to attend to several machines. Push buttons for starting and stopping are placed in a convenient position on the front of the lathe when this is driven by motor, and in addition there is a limit switch that stops the machine when the bar on which work is being carried out is used up. This switch is very sensitive and is brought into action immediately the bar feeding arrangement comes into contact with it.

The headstock, or spindle head, of the lathe is of the sliding type, working on hardened ground surfaces, and for small movements, when the work being turned is up to $2\frac{3}{4}$ in. in length, its motion is controlled by a lever actuated by a plate cam. A separate bell cam is provided for use with longer work, up to the maximum of 4 in. The return movement is obtained by the use of a weight fastened to the headstock by means of a chain. Three spindle speeds are provided, these being 8,967 r.p.m., 6,676 r.p.m. and 4,520 r.p.m. respectively, and for each speed there are available no fewer than 117 changes in feed, or the rate at which the tool advances along the work.



Rear view of the 10 m.m. Wickman High Speed Precision Automatic Lathe with back cover removed to show the motor drive and the drive to the camshaft. Photograph by courtesy of A. C. Wickman Ltd., Coventry.

There are four tool slides, and a micrometer adjustment is provided to enable the tools to be set with great precision in readiness for carrying out operations. The high speeds employed and the robust and rigid construction of the machine allow the use of high speed cutting alloys, and as each part is finished it falls into a work catcher equipped with a device that separates it from the swarf or turnings.

The automatic movements of the tool slides, by which each tool is brought into correct position when required, are controlled by cams mounted on a camshaft. This shaft is driven from the main driving shaft of the machine in such a manner that the rate of feed may be varied within the wide limits already referred to, and the cams are so designed that they can easily be removed without disturbing the camshaft.

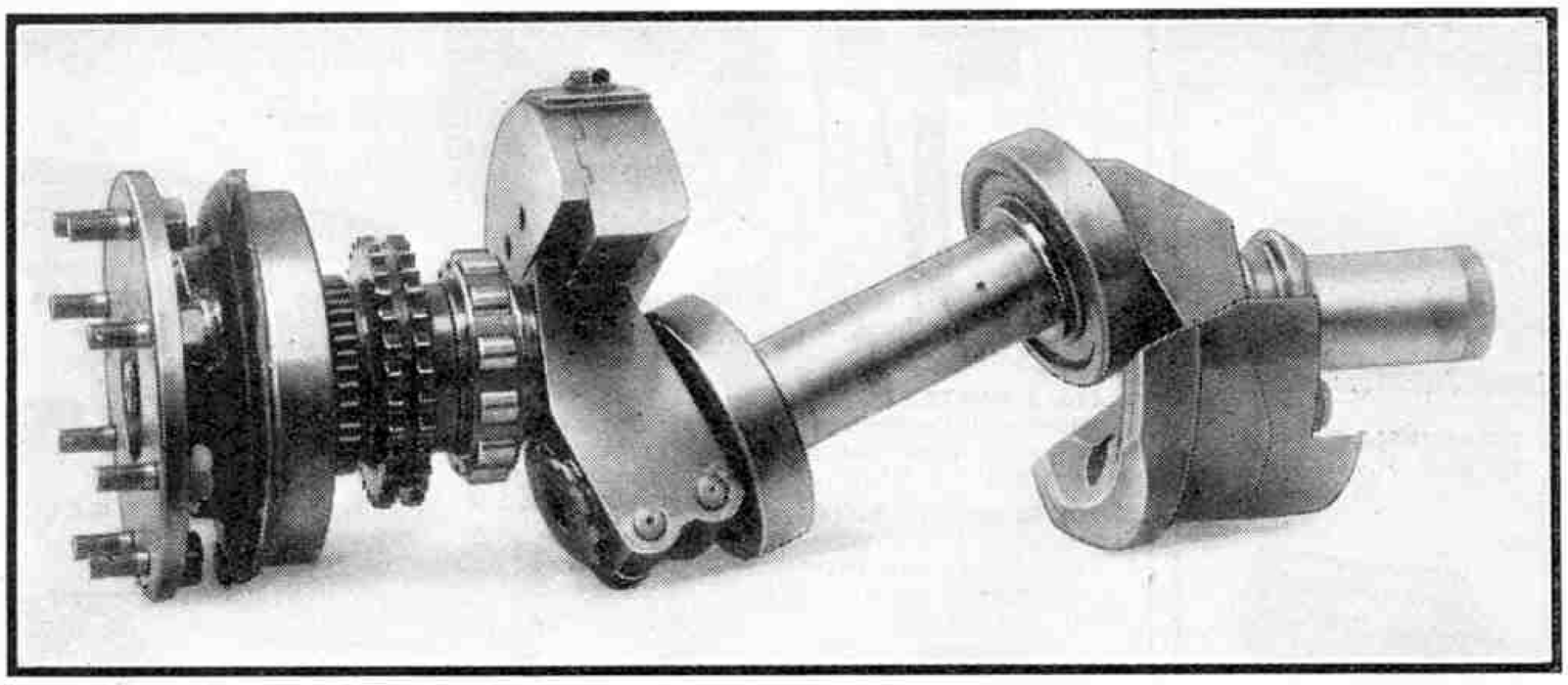
Lubrication of all moving parts, with the exception of the main spindle bearings, is by the "one shot" system, and some of the gears incorporated in the machine run in an oil bath. If no provision were made for cooling the work in progress, this would become over-heated during the high speed operations carried out on it, and a centrifugal pump therefore is incorporated to pour over it a stream of coolant, the liquid usually employed for this purpose being oil or an emulsion of oil and water.

An interesting safety device is incorporated in the camshaft mechanism of the lathe. This operates a limit switch that breaks the circuit immediately if the belt driving the spindle is broken.

The "Bristol" Axial Engine

A New Power Unit for Motor Buses

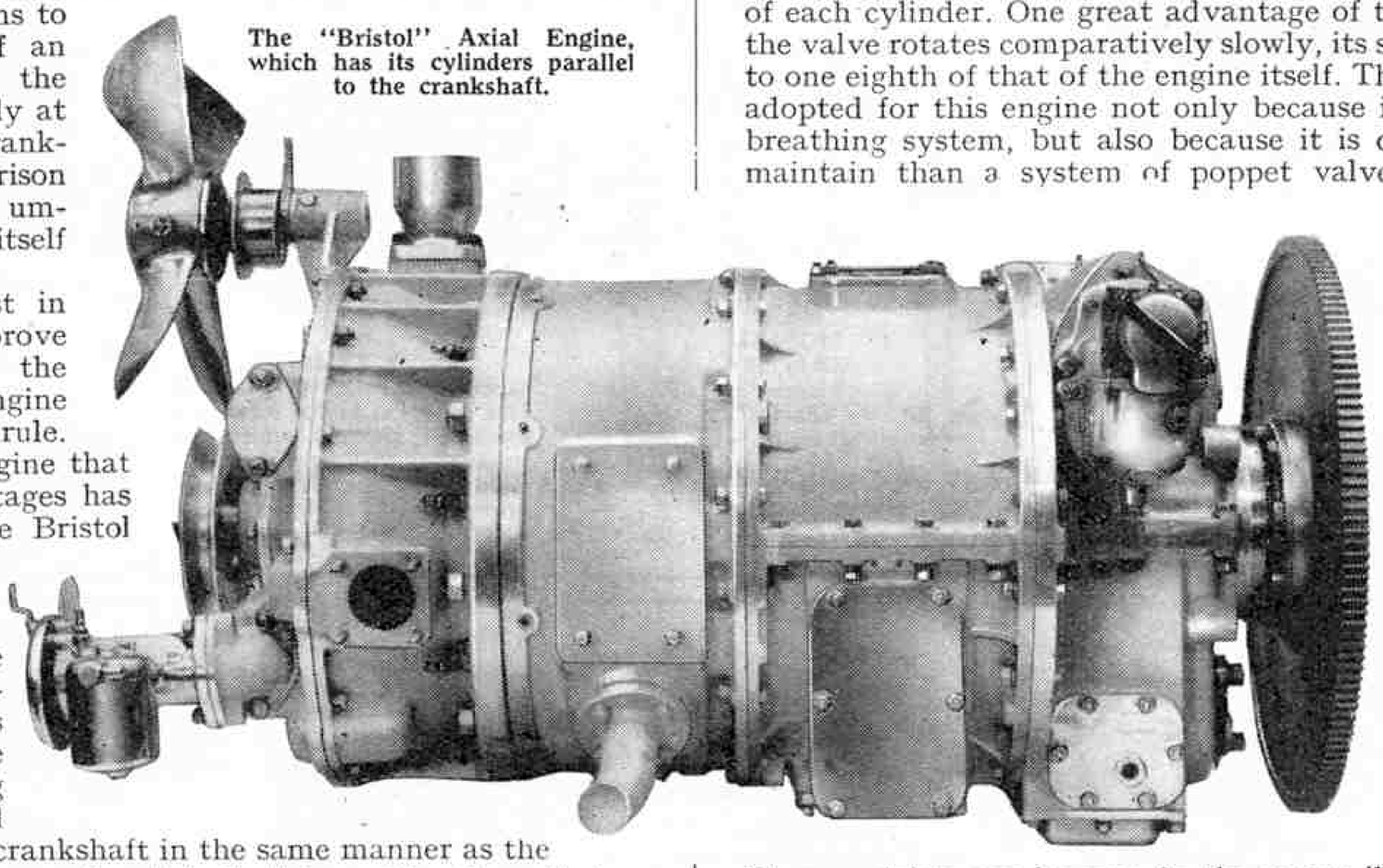
INTERNAL combustion engines have been designed in several forms, the one most familiar to readers being that usually adopted in the engines of motor cars, in which the cylinders are placed in line with their pistons and connecting rods acting on a long crankshaft. Most engines of this type have four or six cylinders, and the greatest number that can conveniently be arranged in this manner appears to be eight. When a larger number of cylinders becomes necessary, in order to give either increased power or greater flexibility, the V-shaped engine is adopted. In this two blocks of cylinders in line are placed at an angle to each other in order to allow of the use of a single common crankshaft, which is shorter than would be required if the same total number of cylinders were used in a single line. A noteworthy example of an engine of this type is that installed in the Rolls-Royce 40 h.p. car introduced in September, 1935, which has 12 cylinders in two blocks of six each.



The crankshaft of the "Bristol" Axial Engine. The crank pin is set at an angle of 22½ deg. Illustrations by courtesy of the Bristol Tramways and Carriage Co. Ltd., Bristol.

Many aeroplane engines are of one of the two types just mentioned. Another type that has been largely used for aircraft is the radial engine. In this the cylinders and crankshaft occupy roughly similar positions to the ribs and stick of an opened umbrella, but the cylinders are set exactly at right angles to the crankshaft, and in comparison with the stick of an umbrella the crankshaft itself is very short.

The "Bristol" Axial Engine, which has its cylinders parallel to the crankshaft.



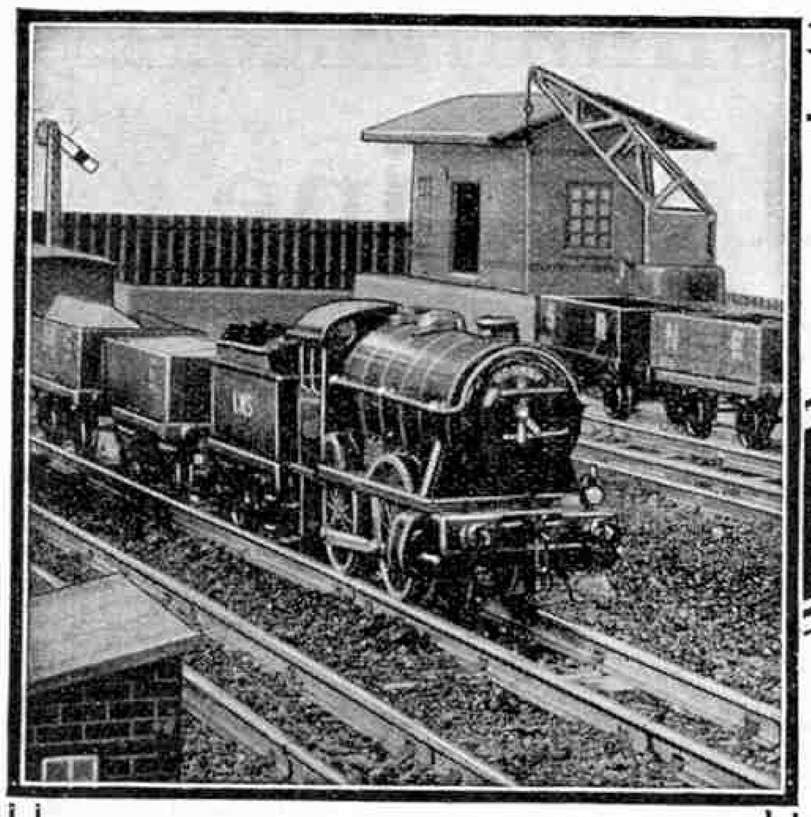
Engineers never rest in their endeavours to improve their products, and the internal combustion engine is no exception to this rule. Now a new type of engine that possesses many advantages has been developed by the Bristol Tramways and Carriage Co. Ltd. for use in their fleet of motor buses. It is called the "Bristol" Axial Engine, and an idea of its layout can best be obtained by imagining the cylinders of a radial engine closed over the crankshaft in the same manner as the ribs of an umbrella fold over the stick. In this position the cylinders lie in a circle round the crankshaft, and the resulting engine in its casing to some extent resembles an electric motor in appearance. As the lower illustration on this page shows, it is compact, occupying only two-thirds of the space of one of similar capacity with its cylinders in line, and there is an even larger proportional reduction in weight.

The pistons of an axial engine move parallel to the crankshaft, and it seems remarkable that motion in this direction can be transformed into the necessary rotation. This is effected very simply by means of a star member, or "wobble plate," acting on a crank pin that slopes at an angle to the line of the main shaft, as illustrated in our upper photograph. The star member is attached to ball bearings on the ends of the crank pin, which it encloses like a sleeve; and its points project outward, each being attached to the outer end of the connecting rod of one of the cylinders. As the pistons move backward and forward along the cylinders they are at different stages of their cycles of movements, and when the piston in any one cylinder has completed its "downward" motion, that in the opposite cylinder is at the "top" of its stroke. The star member therefore executes a peculiar motion, from which its name of wobble plate is derived. It does not itself rotate, but its action causes the slanting crank pin to turn, carrying the crankshaft with it.

The arrangement of the cylinders in a circle round the crankshaft allows a simple and efficient rotary slide valve system to be used. There is a single port in the end of each cylinder, and the nine ports of the engine are set in segments that together form a circular path for a valve rotating over the heads of the cylinders. The valve has four pairs of inlet and exhaust ports, and these are placed alternately in communication with the single port of each cylinder. One great advantage of this arrangement is that the valve rotates comparatively slowly, its speed being geared down to one eighth of that of the engine itself. The rotary valve has been adopted for this engine not only because it forms a very efficient breathing system, but also because it is cheaper to produce and maintain than a system of poppet valves.

One of the greatest problems in the design of internal combustion engines is that of balancing the reciprocating motion of the pistons and connecting rods against the rotary motion of the crankshaft and other revolving parts. This is essential if undue vibration and wear are to be avoided. The "Bristol" Axial Engine can be balanced with comparative ease by fixing bob weights to the crankshaft at points opposite to the ends of the slanting crank pin. These weights can be seen in the upper illustration on this page, and as they rotate they set up centrifugal forces that tend to turn the engine in the opposite direction to that due to the movements of the pistons and connecting rods.

The capacity of the "Bristol" Axial Engine is seven litres, and it gives more power for a lower consumption of petrol than the "Bristol" engine of the same capacity with its cylinders in line. Other advantages claimed for the new engine are lower maintenance costs, owing to the simplicity of its design and the comparatively small number of its working parts; and high mechanical efficiency. High crankshaft speeds also can be employed because of the use of light reciprocating parts and a geared rotary valve.

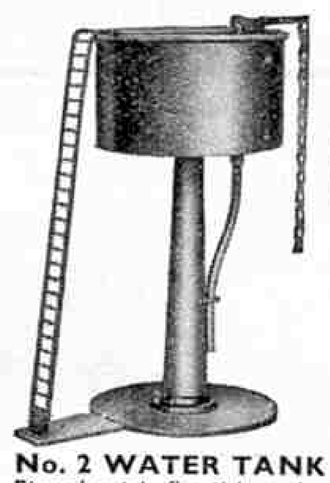


HORNBY SERIES

HORNBY ROLLING ST

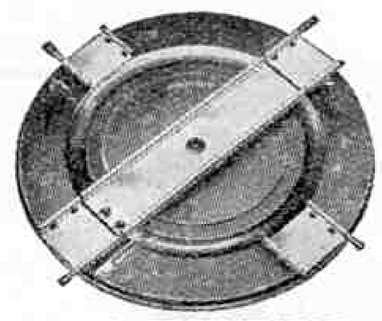
KEEP ADDING TO Y

A real railway system is constantly expanding and developing. New rolling s
signal cabins and goods sheds are built: new tunnels and viaducts are construct
Your Hornby Railway, too, can be run in the same progressive manner. One by one
Signals, Bridges, and Engine Sheds that will gradually convert your pre
Remember, the more complete your model rail



No. 2 WATER TANK
Fitted with flexible tube and valve lever. Stands 8½ in. high. Price 5/9

No. 2E WATER TANK
Similar to No. 2 Water Tank, but suitably fitted for electric lighting. Price 6/6



No. 1 TURNTABLE
(Illustrated). Price 2/6

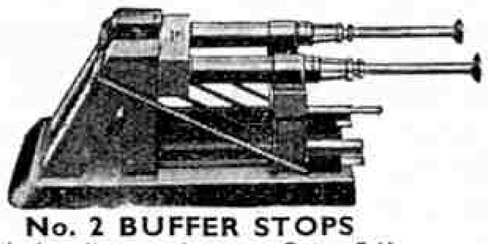
No. 2 TURNTABLE
Price 3/9

No. E2 TURNTABLE
(Electrical)
Similar to No. 2 Turntable, but fitted with electrical rails. Price 5/6

ISLAND PLATFORM
Length 32¼ in., height 6¾ in., width 3 in. Price 5/6
The Ramps can be purchased separately.
Price per pr. 1/9.

E ISLAND PLATFORM
This Platform is suitably wired for electric lighting. Otherwise it is the same as the Island Platform illustrated above. Price 6/3

No. 1 RAILWAY ACCESSORIES
Miniature Luggage and Truck. Price 1/-



No. 2 BUFFER STOPS
(Hydraulic type). Price 5/6

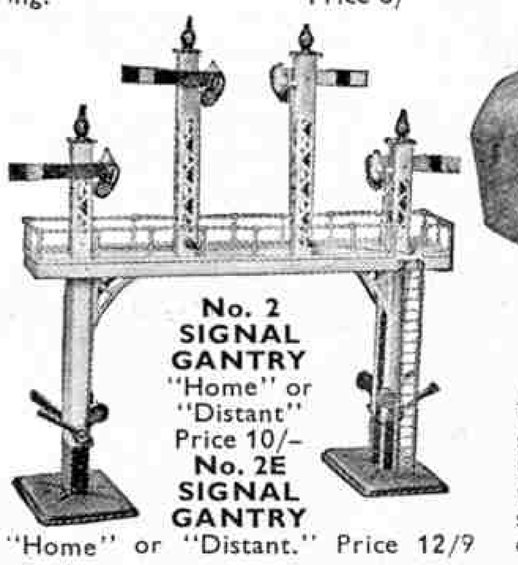
No. 2E BUFFER STOPS
Similar to No. 2 Buffer Stops but suitably wired for electric lighting. Price 6/-

LOADING GAUGE
(Illustrated). Price 2/3

M LOADING GAUGE
Price 1/-

M Series FOOTBRIDGE
Price 1/3

No. 7 RAILWAY ACCESSORIES
Watchman's Hut, Brazier, Shovel and Poker. Price 10d.

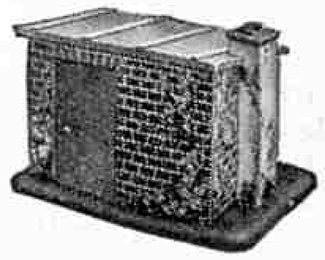


No. 2 SIGNAL GANTRY
"Home" or "Distant"
Price 10/-

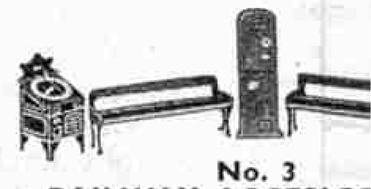
No. 2E SIGNAL GANTRY
"Home" or "Distant." Price 12/9

No. 5 Tunnel

No. 5 TUNNEL (LEFT-HAND, CURVED)
This tunnel is in the form of a small hill, through which the track runs obliquely. For 2 ft. radius track only. Base measurement—15⅞ x 14¾ in. Length of track 14¾ in. Price 6/9



PLATELAYER'S HUT
Price 1/-



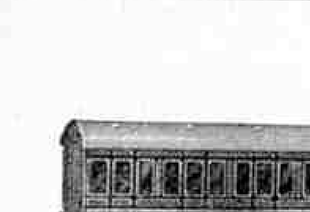
No. 3 RAILWAY ACCESSOR
Platform Machines, etc. Pr

No. 2 STATI N
Built up with three detachable sections. Length 2 ft. in.,

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

MO SIDE TIPPING WAGON
Tips either side. Price 1/-

GAS CYLINDER WAGON
Finished in blue and red, lettered gold. Price 1/11



No. 1 CRANE TRUCK
Finished in gold and blue. The Crane revolves on its base. Price 2/11

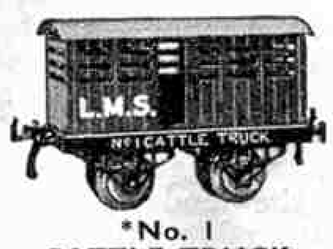
WINE WAGON DOUBLE BARREL
Price 4/6

No. 1 SIDE TIPPING WAGON
Price 2/-

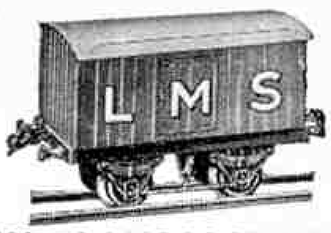
MO PULLMAN COACH
Price 9d.

MI PULLMAN COACH
(Illustrated). Price 1/-

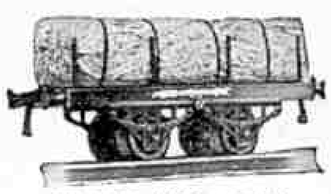
No. O PULLMAN COACH
Price 1/3



***No. 1 CATTLE TRUCK**
Fitted with sliding doors
Price 2/9

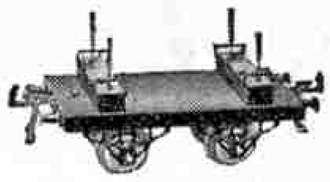


***No. 1 LUGGAGE VAN**
With opening doors. Price 2/9

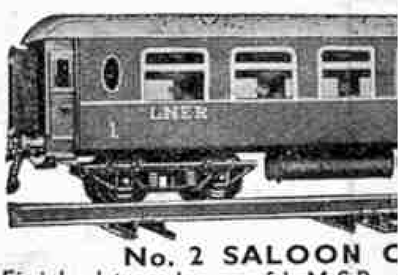


FIBRE WAGON
This is an interesting model of a type of wagon used in France and other Continental countries.
Price 1/3

BITUMEN TANK WAGON "COLAS"
Finished in blue. Price 3/6



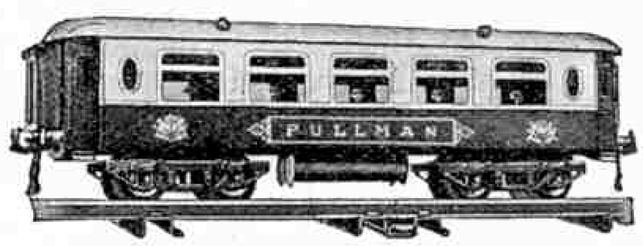
No. 1 LUMBER WAGON
Fitted with bolsters and stanchions. Price 1/6



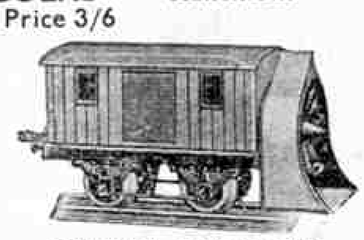
No. 2 SALOON C
Finished in colours of L.M.S.R. c
Coaches. Suitable for 2 ft. radius r

OIL TANK WAGON "CASTROL"
Enamelled green with lettering in red. Price 2/-

MO PETROL TANK WAGON "SHELL MEX'
Finished in cream with lettering in black. Price 1/-



No. 2 PULLMAN COACH
Suitable for 2 ft. radius rails only. Price 9/6



SNOW PLOUGH
With revolving plough.
Price 3/9

TROLLEY WAGON
Suitable for 2 ft. radius rails only. Price 3/9

Lettered L.M.S., N.E., G.W. or S.R.

MECCANO LIMITED, BINN

TOCK & ACCESSORIES

HORNBY SERIES

O YOUR RAILWAY

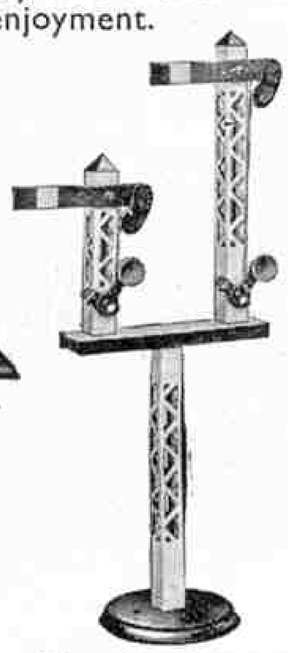
lling stock and new equipment are added: new tracks are laid: new stations,
structed—every effort is made to cater adequately for modern requirements.
one you can add Coaches, Trucks, Wagons and Vans of the latest types; and Stations
ur present Hornby Railway into a really fine model Railway System.
el railway, the greater your fun and enjoyment.

No. 1A FOOTBRIDGE
Complete with Signals. Price 4/6

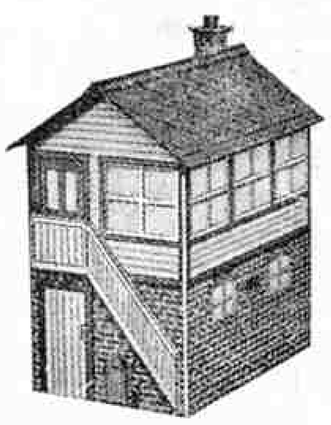
No. 1 FOOTBRIDGE. Without Signals. Price 2/11

No. 2 RAILWAY ACCESSORIES
Milk Cans and Truck. Price 1/3

No. 4 CUTTING (Straight)
This is a Double Cutting, mounted on a base over which the railway track may be laid. Length 15⅞ in., width 15 in. Price 6/-



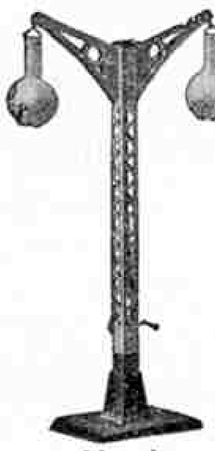
No. 1 JUNCTION SIGNAL
"Home" or "Distant." Price 2/9



No. 1 SIGNAL CABIN
Price 2/6

No. 1E LAMP STANDARD
Electrical (Single)
Price 2/11

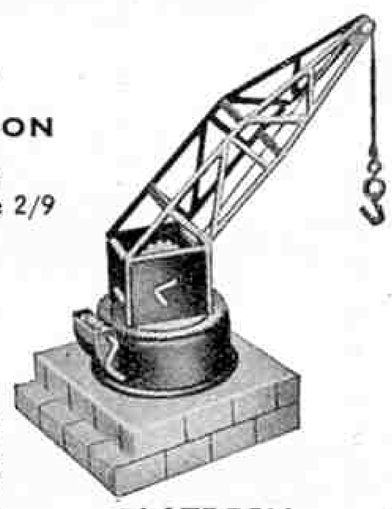
LAMP STANDARD No. 2E
Electrical (Double)
Price 3/3



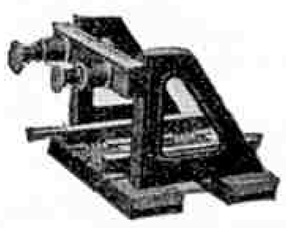
No. 1 LAMP STANDARD
(Single)
Price 3/3

No. 2 LAMP STANDARD
(Double, as illustrated)
Price 3/9

MANSELL WHEELS
These solid die-cast Wheels can be fitted to Hornby Coaches, Vans, etc. Price per pair 3d.



PLATFORM CRANE
Price 3/11

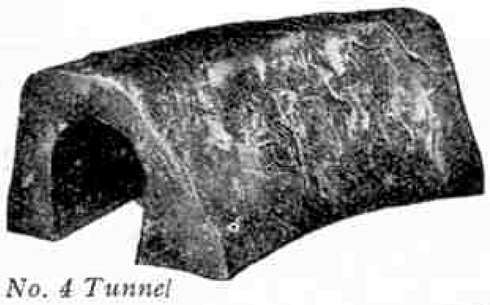


No. 1 BUFFER STOPS
(Spring type). Price 1/-

No. 1E BUFFER STOPS
as No. 1, but suitably fitted for electric lighting. Price 1/6

STATION HOARDING
Price 6d.

TION
ft. in., breadth 6 in., height 7 in. Price 8/-

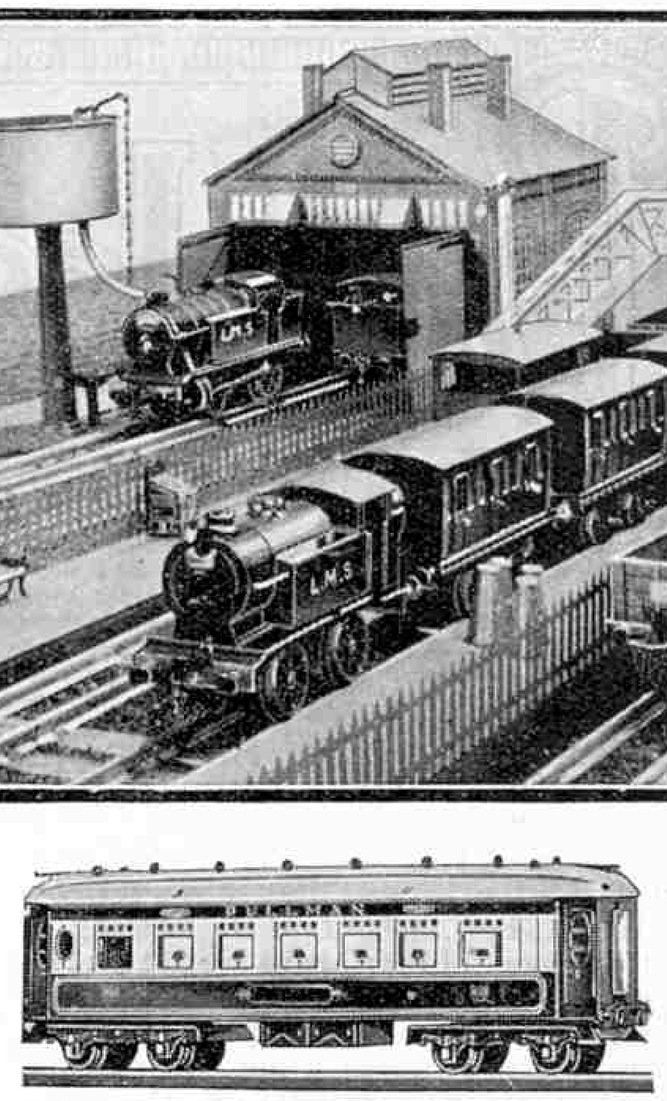


No. 4 Tunnel

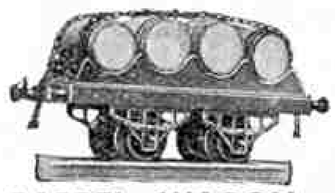
No. 3 TUNNEL (Curved)
Base measurement—Length 15 in., width 9½ in. Price 4/-

No. 4 TUNNEL (Curved)
Base measurement—Length 20 in., Width 9½ in. For 2 ft. radius track only. Price 4/9

No. 1 GOODS PLATFORM
Length 13 in., height 6⅝ in., width 6 in.
Price 5/11

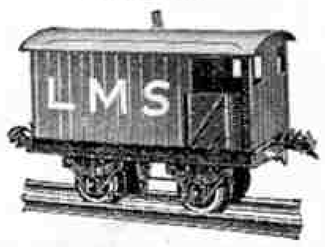


No. 2 SPECIAL PULLMAN COACH
Suitable for 2 ft. radius rails only. Price 13/-



BARREL WAGON
An interesting model.
Price 2/6

CHOCOLATE VAN "CADBURY'S"
Opening doors. Price 2/9

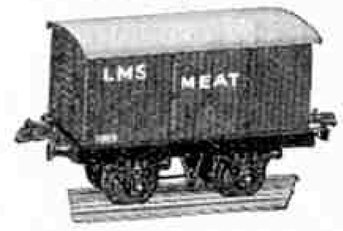


BRAKE VAN
Lettered L.M.S. or G.W. Price 2/11

***FLAT TRUCK**
Without Cable Drum.
Price 1/6
Complete with Cable Drum. Price 1/9

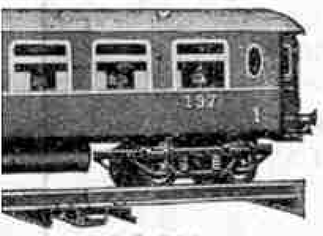
COAL WAGON
Fitted with an embossed representation of coal.
Price 2/3

FISH VAN
Lettered N.E.only.Price 1/9

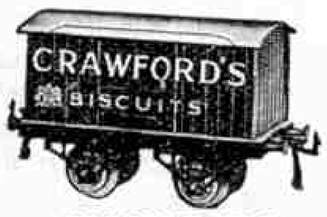


MEAT VAN
Lettered L.M.S. only
Price 1/9

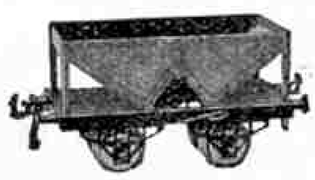
No. 1 ROTARY TIPPING WAGON
Finished in blue and pale gold. Price 2/6



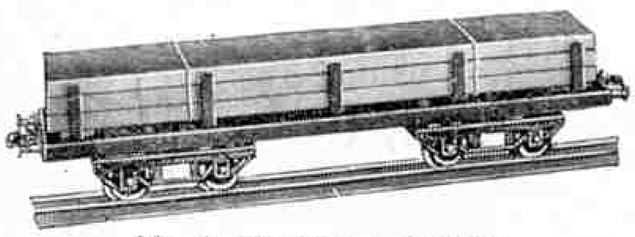
ON COACH
M.S.R. or L.N.E.R. Saloon
radius rails only. Price 9/6



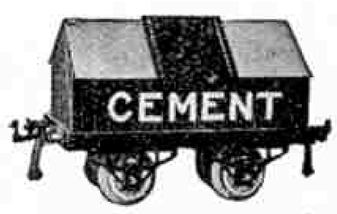
CRAWFORD'S BISCUIT VAN
Opening doors. Price 2/9



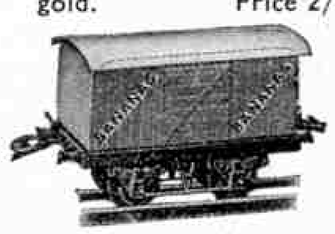
***HOPPER WAGON**
Mechanically unloaded.
Finished in green.
Price 3/6



No. 2 TIMBER WAGON
Suitable for 2 ft. radius rails only. Price 2/6
Enamelled in green and red.

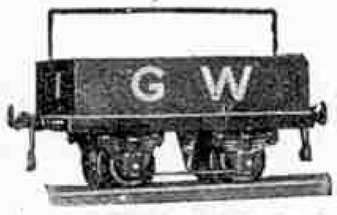


CEMENT WAGON
The door at the top opens. Price 2/6

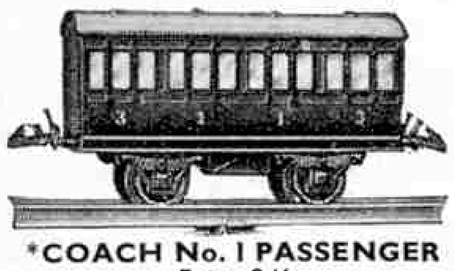


No. 1 BANANA VAN
An attractive model, finished in yellow and red. Price 2/9

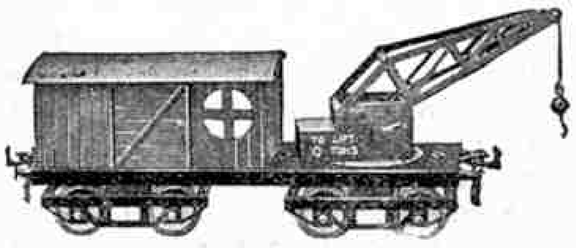
ice 3/9
.R.



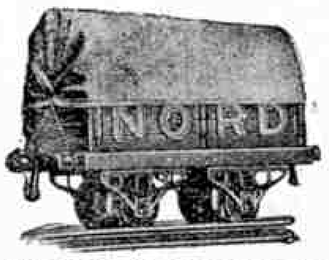
***OPEN WAGON "B"**
Price 2/-



***COACH No. 1 PASSENGER**
Price 2/6



BREAKDOWN VAN AND CRANE
Opening doors. Suitable for 2 ft. radius rails only. Price 5/11

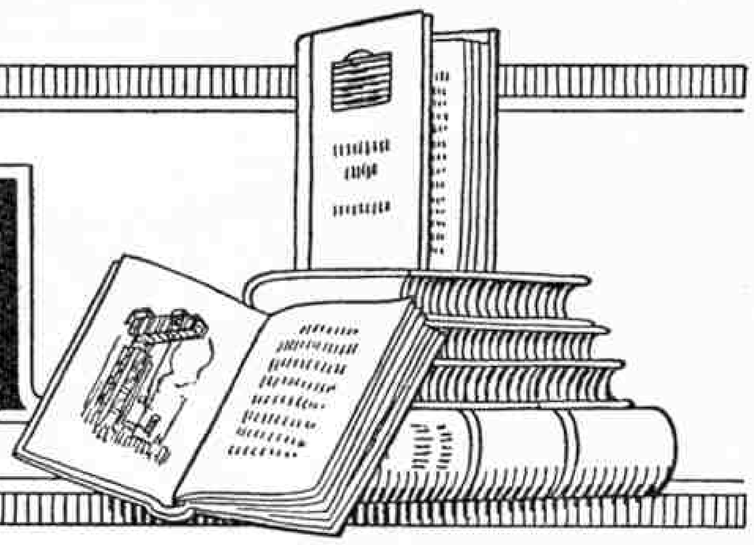


WAGON, COVERED (FRENCH TYPE)
Price 2/6

BRAKE VAN
Finished in brown, with opening doors. Obtainable in N.E. or S.R. lettering. Price 2/11

NNS ROAD, LIVERPOOL 13.

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.

"L.M.S.R. Enginemen's M.I.C. Papers, 1935"

(L.M.S. Magazine. 4d., post free)

On page 374 of the *"M.M."* for June last year attention was drawn to a booklet, published by the *"L.M.S. Magazine,"* that consisted of reprints of special articles appearing in that journal during 1934 on subjects of practical interest to enginemen. We have now received a copy of a similar reprint containing articles of the same type that were published in the *"L.M.S. Magazine"* during 1935. Like its predecessor, this is intended to convey to railwaymen exact information on locomotive mechanisms, but also will be attractive to all readers of the *"M.M."* who are railway enthusiasts.

The most prominent feature of the booklet is an article on Diesel locomotives, contributed by D. C. Urie, L.M.S.R. Superintendent of Motive Power. This is in two parts, one explaining the general principles of internal combustion engines, and the other dealing more particularly with the Diesel engine and the transmission gear of Diesel locomotives.

Other topics dealt with include the latest form of L.M.S.R. Walschaerts valve gear, the new standard brake valve of the company, and the exhaust steam injector, the working of which is explained at length. Instructive diagrams help to make clear the operation of each of the appliances described, and as far as space allows notes are included on the course to be followed in the event of failure on the road.

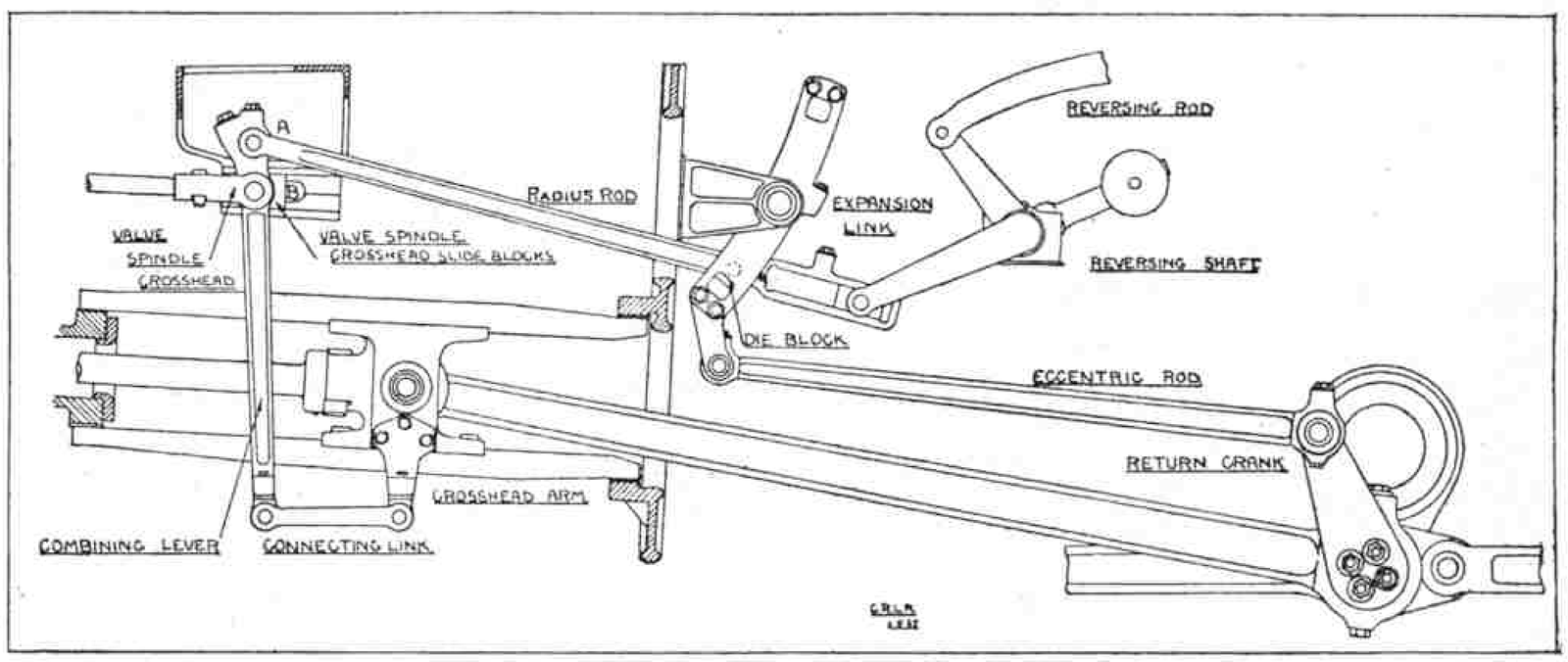


Diagram showing the Walschaerts valve gear employed on the most recent L.M.S.R. locomotives. (From "L.M.S.R. Enginemen's M.I.C. Papers, 1935," reviewed on this page.)

"Aeronautics"

By M. J. B. Davy, A.F.R.A.E.S.
(H.M. Stationery Office. 2/6 net)

This publication is intended to serve as an introduction to the study of the development of heavier-than-air craft, with special reference to that section of the National Aeronautical Collection at the Science Museum, London, which has been formed to illustrate this branch of science. The aim of the author has been to indicate the more important stages in the evolution of mechanical flight by providing a brief account of the early speculations and experimental work that led to the invention of the aeroplane and its subsequent development. This historical survey is followed by a detailed catalogue of the heavier-than-air craft exhibits in the Science Museum. The book is illustrated with many excellent photographs of early and present types of aircraft, and is rounded off by a very useful index.

"The Revolution in Physics"

By Ernst Zimmer. (Faber and Faber. 12/6 net)

We have long been accustomed to the idea that everything is built up of atoms, and in recent years we have probed more deeply into this problem and discovered the electrons, protons and other particles from which the atom is built up. The most recent discoveries in this field can fairly be described as sensational, for they show that at times matter appears to consist of waves instead of the solid particles that we have previously imagined. The author of this account of modern physics therefore is justified in making use of its startling title.

The book is one of the best of its kind, and the explanations given in it of modern scientific ideas are remarkably clear and simple, as far as accounts of such complicated matters can be. It is not one for beginners in science, but rather for those who already have some knowledge of physics, to whom it will give clear ideas of recent advances, and will appeal to all who are attracted by the scientific world picture.

"Elementary Craftwork in Metal"

By Alfred J. Shirley
(B. T. Batsford Ltd. 5/- net)

The author's aim in preparing this book was to provide a basis on which teachers and students might work in the early stages of handcraft in metal. Its first two sections deal with design and with the chief materials and processes, and then follows a graded course of models, each illustrated by a full-page plate of drawings, and an appendix containing a miscellaneous collection of useful information. Apart from its main purpose the book will be of great interest and value to all who are interested in metalcraft.

"Science in Wonderland"

By Professor A. M. Low. (Lovat Dickson. 5/- net)

With this book Professor Low breaks new ground to a large extent in abandoning the usual popular descriptions of various scientific wonders, and instead taking the twins John and Betty into the heart of things by changing them into molecules, electric charges, sound waves, etc., and relating their physical and chemical adventures. The author writes interestingly, and generally speaking his experiment is a success. The book should make a definite appeal to the average boy or girl with scientific interests, and certainly should arouse their curiosity to seek further information on the various topics. The illustrations by Gilbert Dunlop are well suited to the text.

"The Book of Speed"

(B. T. Batsford Ltd 5/- net)

This volume was first published in 1934, and met with so great a demand that a further edition has now become necessary. The opportunity has been taken of bringing it up to date by the inclusion of an additional chapter, appropriately entitled *"The Pace in 1935,"* dealing with the records established in the past year, and of many new photographs illustrating the additional speed events described in it.

The successive chapters of the book describe great speed achievements in aeroplanes, airships, motor cars, motor cycles, steam ships, speed boats and railway trains, explaining how the records established have been raised as Man's mastery over his materials has increased. Thrilling accounts are given of famous speed events, such as the creation of the world's land speed record by Sir Malcolm Campbell, and the flight in which 400 m.p.h. was reached for the first time in history. These are contributed by the men who actually took part in them, and readers can appreciate the difficulties of their tasks and the sensations they experienced while engaged in efforts that have "caused the world to shrink, and increased the pace of life," as the effect of their work is described in the foreword to the book, which is written by Comdr. Stephen King-Hall.

One of the most attractive features of the book is its wealth of photogravure illustrations. There are 150 of these, many of them occupying a full page. All are reproductions of actual photographs and they cover every phase of the world of speed.

"Chemical Discovery and Invention in the 20th Century"

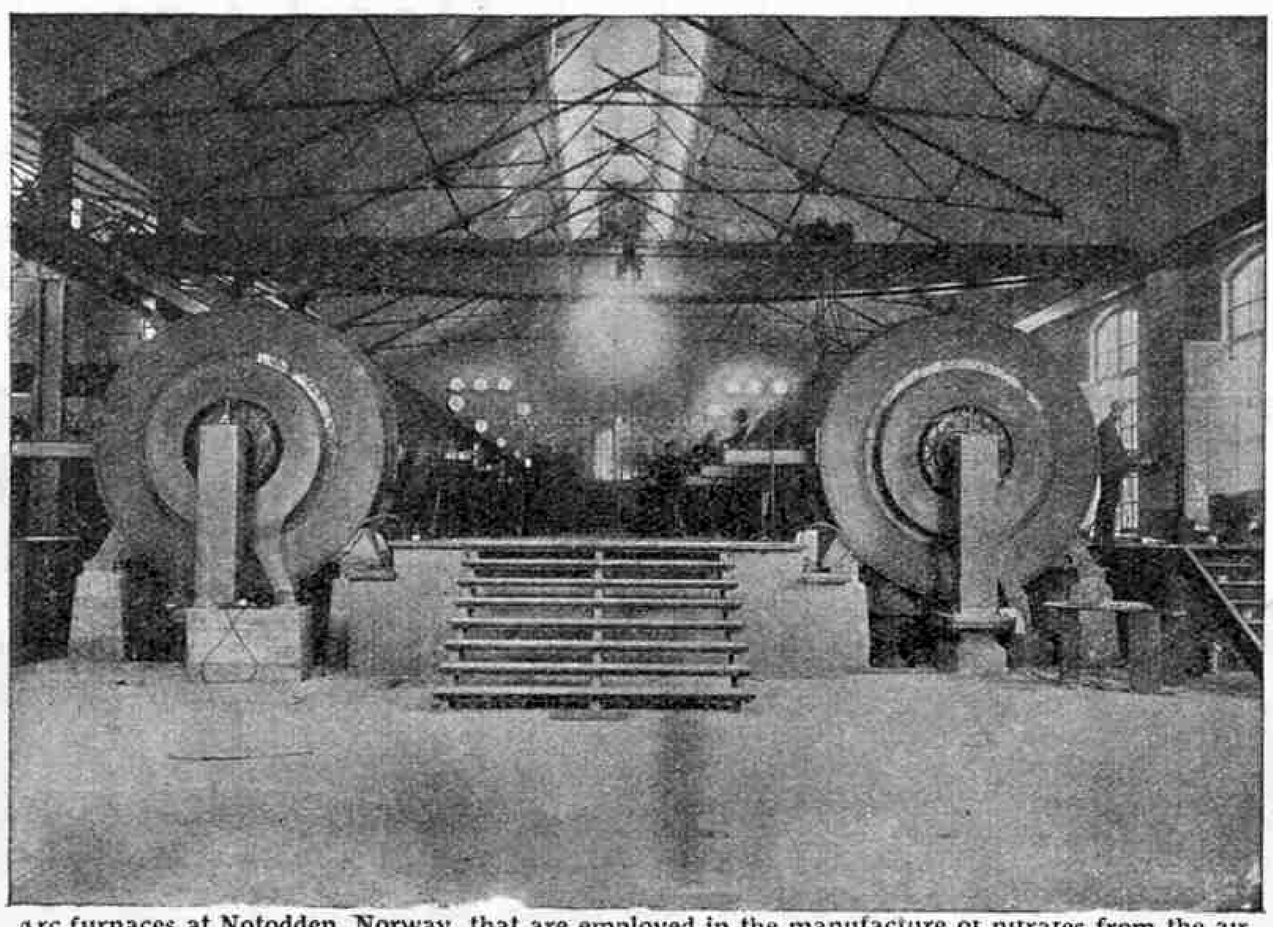
By Sir W. A. TILDEN, F.R.S. (Routledge. 15/- net)

This remarkable book by the late Sir W. A. Tilden was first issued in 1917, and has now been revised by Mr S. Glasstone, who has brought each section thoroughly up to date. The book is a complete survey of chemical progress since the beginning of the present century. It is invaluable to students who wish to look ahead and see something of the more complicated regions of the chemical world into which they have entered, and also will provide fascinating reading for all readers of the *"M.M."* who wish to know how chemists work and what they are doing.

The plan adopted by the author is distinctly original, for he begins with descriptions of famous modern laboratories and explains how the equipment provided is employed in chemical work of all kinds. This section in fact forms a complete guide to the activities of the chemist, in whatever branch of work he may be engaged, and enables the reader to picture the scene within the chemist's workshop.

An excellent account of modern discoveries and theories then follows. This deals with many subjects of absorbing interest, including the discovery of radium, the structure of the atoms and the architecture of molecules, and the properties of colloids. Modern applications of chemical discovery in daily life and industry are then dealt with, and to many readers it will be a revelation to find in how many places the chemist is in contact with his everyday activities. Particularly striking chapters deal with hormones and vitamins, those mysterious chemicals that are essential to bodily health, the development of the plastic industry that has given us insulating compounds that can readily be moulded to artistic shapes, and the production of plant food by electrical means from the nitrogen of the air.

Although chemical formulæ are used, as of course they must be in dealing with the more complicated substances, it is not necessary to have a deep knowledge of chemistry to be able to appreciate the contents of the book. Illustrations have been used freely, for in addition to portraits of 12 famous chemists closely associated with the developments dealt with, the book contains 131 drawings and plates, most of the latter being photographic reproductions of scenes in famous laboratories and in chemical works.



Arc furnaces at Notodden, Norway, that are employed in the manufacture of nitrates from the air. (From "Chemical Discovery and Invention," reviewed on this page.)

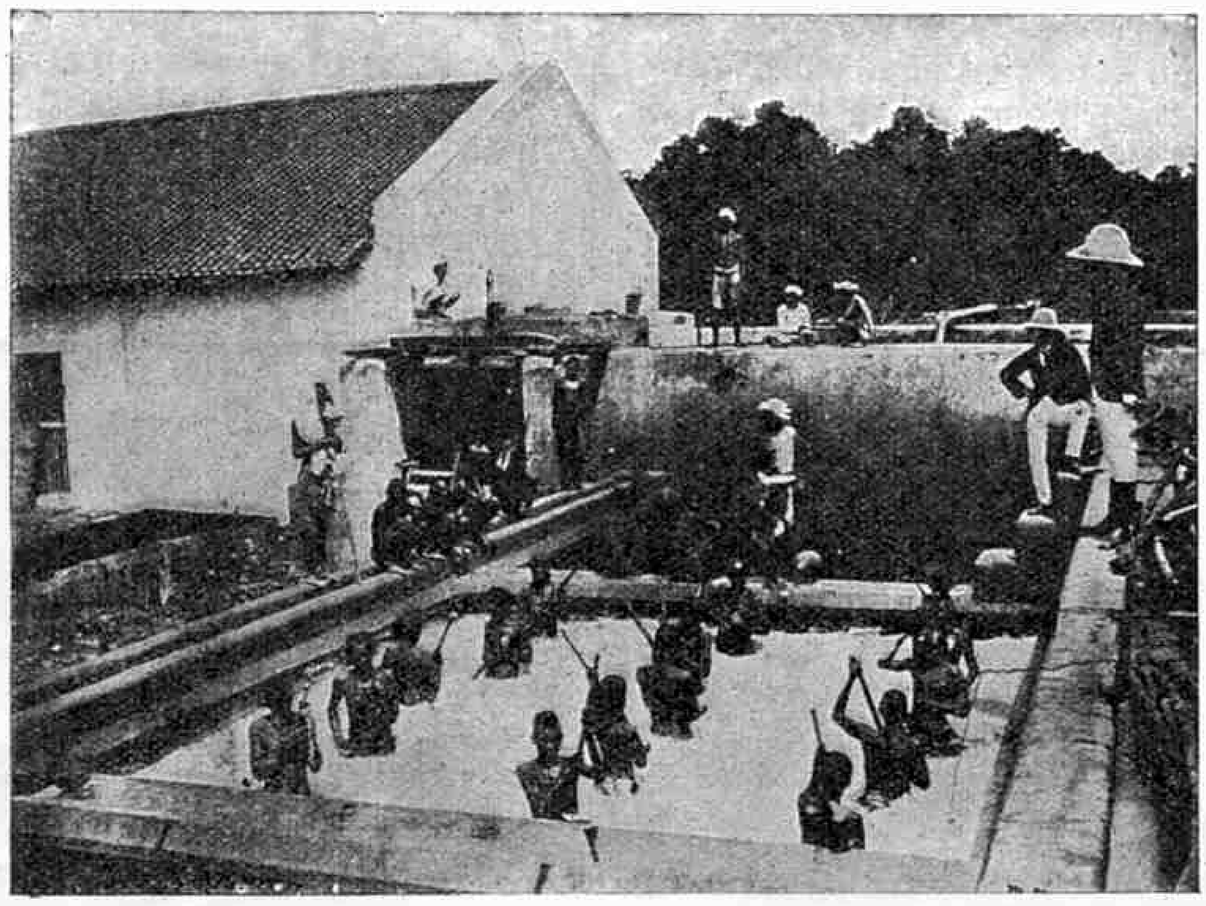
"Science in the Making"

By GERALD HEARD. (Faber and Faber Ltd. 7/6 net)

The material of this book is made up largely of the talks on science that were broadcast some time ago by Mr. Heard. The author's idea is that whereas the specialist is steadily pushing forward science in its various branches, he has neither the time nor the inclination to bring his work before the general public in a form that they can understand. Still less is it the job of the specialist to link up his work with that of other investigators, in such a manner as to place before the public a picture of the advance of science as a whole. The author therefore concludes that this job is one for the layman—hence the present book.

Mr. Heard is in close touch with the scientific literature of the day, and he has set himself the task of passing on, as one layman to another, the most striking and interesting facts he has gleaned. The result is an exceedingly interesting account of recent scientific discoveries and tendencies, covering practically every branch of science in which the average man is likely to be interested. The book can be thoroughly recommended to all who wish to know what is going on in the scientific world without struggling through the complexities of scientific literature.

A volume of this size is a little forbidding without a single illustration, and the sections would have been easier to read if broken up into shorter paragraphs.



Natives agitating the contents of an indigo vat by beating the liquid with paddles in order to cause the dyestuff to separate from it. (See above.)

"Track Topics"

By W. G. CHAPMAN. (Great Western Railway, Paddington Station, London, W.2. Price 1/-)

The shilling handbooks issued by the G.W.R. "For Boys Of All Ages" are well known and deservedly popular. The latest addition to the series, "Track Topics," is fully up to the standard set by its predecessors, and is accurately described by its sub-title: "A Book Of Railway Engineering." It is arranged as a series of talks, and in the first one we are given some idea of the extent and variety of the activities of the G.W.R. Engineering Department, which has to deal with a total of over 9,000 miles of track, 1,675 stations for passenger and goods traffic, 12,000 bridges, and a total tunnel length of 60 miles.

We are told much about Brunel, that giant among the early engineers, and his various G.W.R. achievements, culminating in his remarkable Royal Albert Bridge at Saltash, whereby he linked Devon with Cornwall. The components of the track of to-day are dealt with, including a description of their manufacture; and in addition to ordinary track, the various types of crossings in use are dealt with by diagram and description.

The maintenance work involved on the way and works generally leads up to a complete account of the Severn Tunnel, in view of its special position in regard to constructional difficulties and the elaborate plant necessary for keeping it in a fit condition Viaducts and bridges come in for their share of attention, also the special means necessary for the safe carriage of exceptionl loads whose weight or bulk necessitate engineering restrictions on the route. Finally there is a general talk on railway buildings.

Altogether it is a most interesting and entertaining book, very well illustrated, that will be read and referred to time and again by *"M.M."* readers generally and in particular by G.W.R. enthusiasts

"The World of Nature"

By H. C. KNAPP-FISHER (Gollancz. 6/- net)

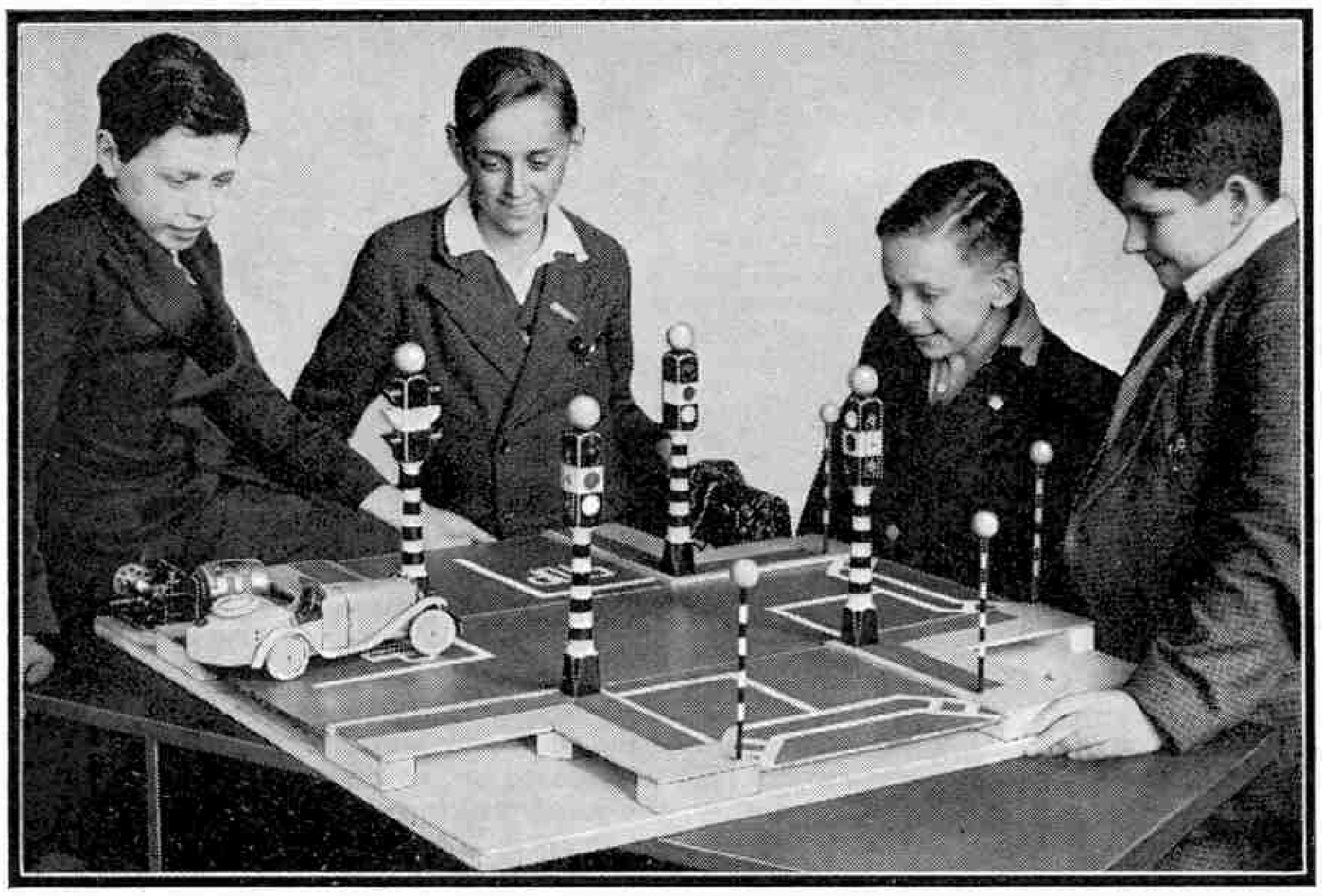
Mr. Knapp-Fisher has set out to explain the world of nature for readers who have had no special scientific training, and has written an attractive and accurate account of the forms and lives of the many creatures inhabiting it. He begins with a study of living things on the sea shore, and after dealing in a short section with what we know of the manner in which life is affected by its surroundings, he passes on to discuss the plant world, insect life and the creatures that can be summed up under the title "Fish, Flesh and Fowl." Thus he covers a very wide field, with satisfaction to his readers, who also will greatly appreciate the well executed line drawings in the book that provide illustrations of more than 500 forms of life.

Traffic Signals in Miniature

Automatic Control of Model Crossing

By S. B. Johnson and N. B. Fortune

AS schoolmasters in charge of classes of keen and enquiring boys, we are expected to know something about everything, and in particular are continually being asked how things work. With the growing use of automatic traffic control signals, it was only natural that we should be called upon to explain their operation, and we decided that this could best be done by making a demonstration model. Some of our enquirers were boys from 13 to 14 years of age, and with them we tackled the problem of designing and constructing such a model. No published instructions were available, but a highly successful scheme was evolved, working from first principles, and the constructional work gave ample scope for the skill and ingenuity of the wood worker, the metal worker, the electrician and the engineer.

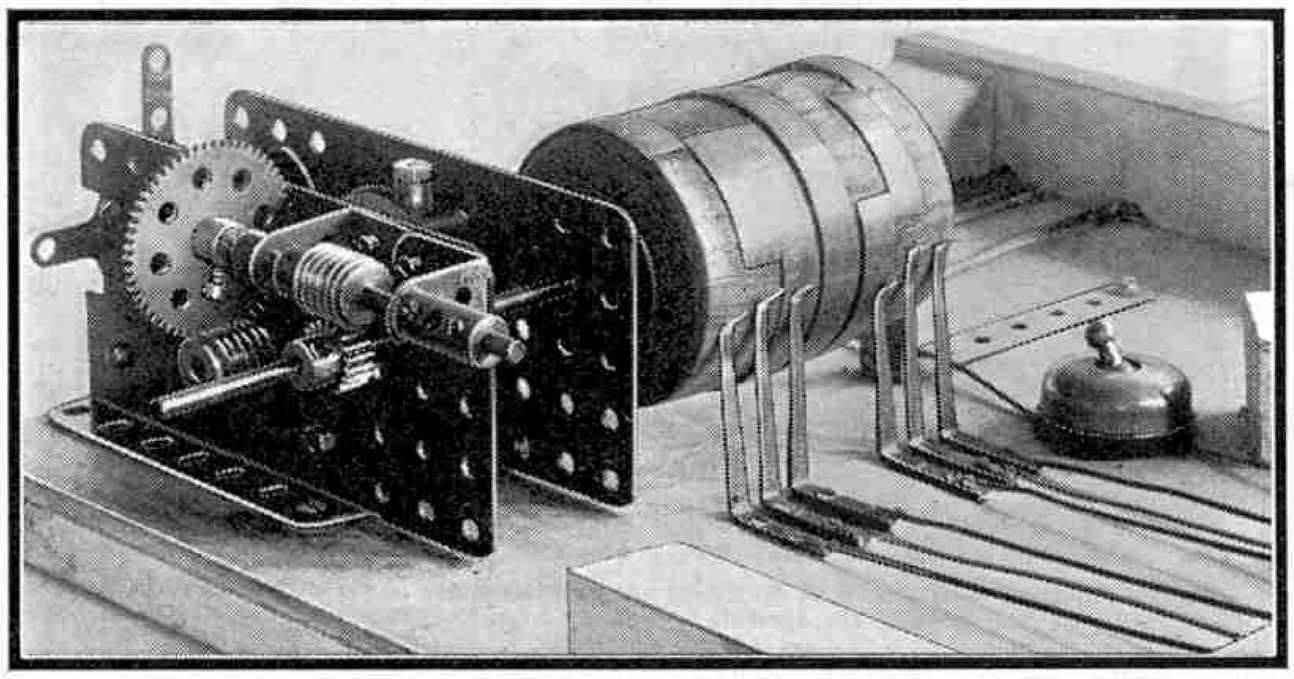


A model of an automatically controlled traffic crossing, with a Meccano Motor Car Constructor model waiting for the signal to cross. The model was constructed by pupils of Lapage Street Modern School, Bradford, under the supervision of the authors of the accompanying article.

A sheet of plywood one yard square, strengthened with battens underneath it, provided the foundation for the model, and across it four substantial strips of wood were screwed to outline the crossing. The road surfaces are represented by pieces of plywood 1 ft. in width. These are made to slide in grooves in the cross-strips, and can be removed when desired to reveal the wiring, which is laid in the space, about 1 in. in depth, beneath them.

Making the signal standards provided a satisfying exercise for the ingenious constructors. They were turned in the workshop lathe from $1\frac{1}{4}$ in. square section oak, and orange lacquered wooden globes were added as a final embellishment. A section at the top of each of course was left rectangular in shape. Three holes $\frac{3}{4}$ in. in diameter and about $\frac{3}{8}$ in. in depth were bored in these sections, and three further holes $\frac{3}{4}$ in. in diameter were drilled at right angles to the first set to form the lamp chambers. Meccano $3\frac{1}{2}$-volt lamps were easily inserted in these chambers by a screwing action, so that the central contacts projected slightly outside.

A flat drill was next passed up the centre of each pylon from the base to break into the first lamp chamber, this work also being carried out on the lathe. The holes made in this manner house the wiring. As the model is intended for demonstration purposes, it is desirable that the leads to the lamps themselves should be visible. For this reason they were brought to the outside of the pylon through small holes, and run in grooves cut with a blunt mechanical gauge to their respective lamps, and soldered directly to the central contacts. The common return lead was looped across to make contact with the screw fittings when the lamps were inserted. Before wiring, the black and white strips were applied to the pylons with lacquer, the work on the curved surfaces being adroitly accomplished while each standard was rotated in the lathe.

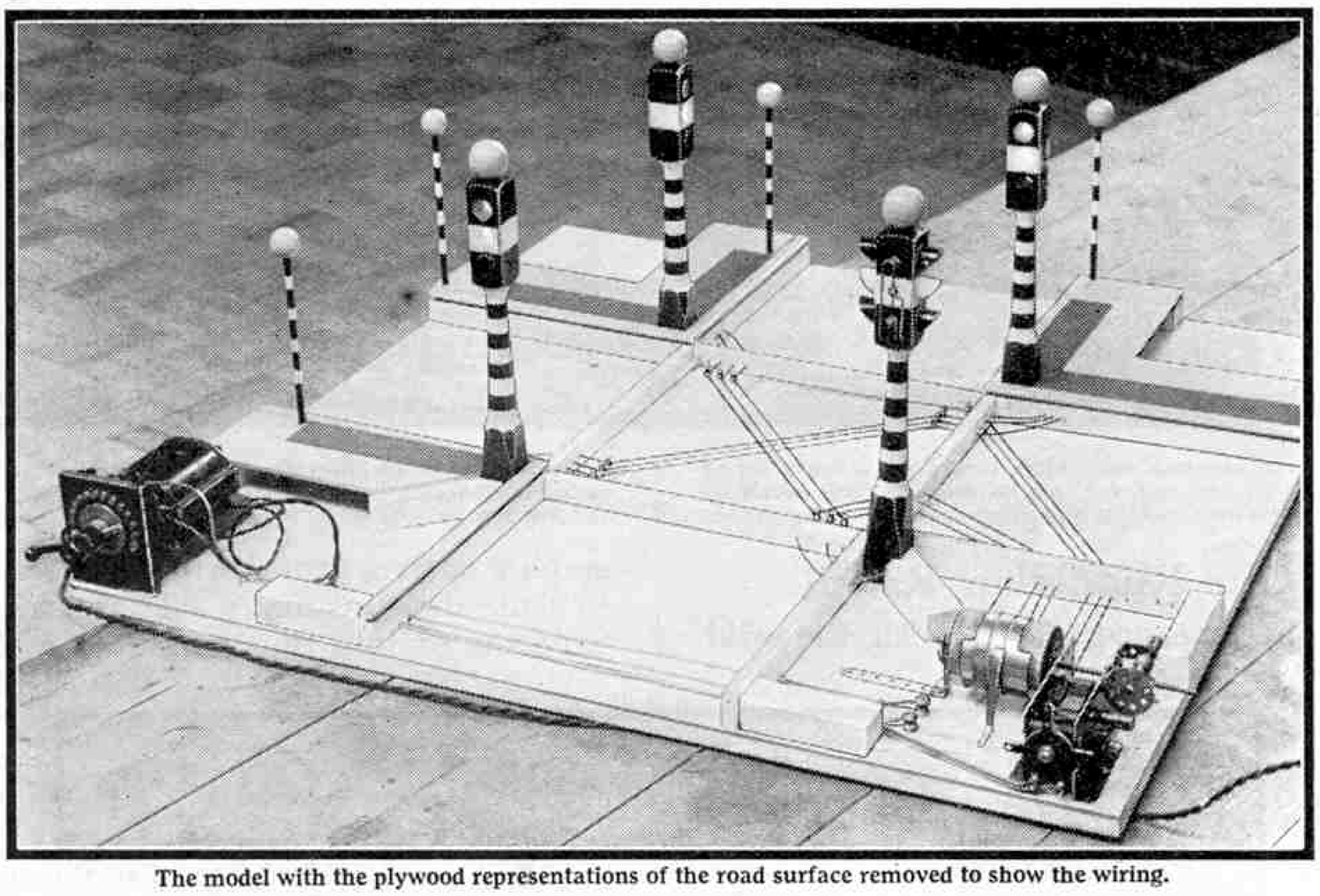


The rotating switch controlling the signals. This is driven by a Meccano E6 Electric Motor and current for the various circuits is picked up by copper brushes.

Metal facings were next cut from sheet copper to cover the open sides of the lamp chambers, and holes were bored in them to correspond with those in the standards. Cowls of the same material were soldered on and painted. The next problem was to add the coloured media for the lamps. At first we thought of using coloured glass, but finally decided in favour of sheet gelatine. This is too transparent to be satisfactory by itself, and small squares of the material in appropriate colours therefore were glued on to strips of thin semi-opaque paper—jam covers actually were used—and these in turn were glued in position on the backs of the prepared metal facings. The result proved entirely satisfactory, the

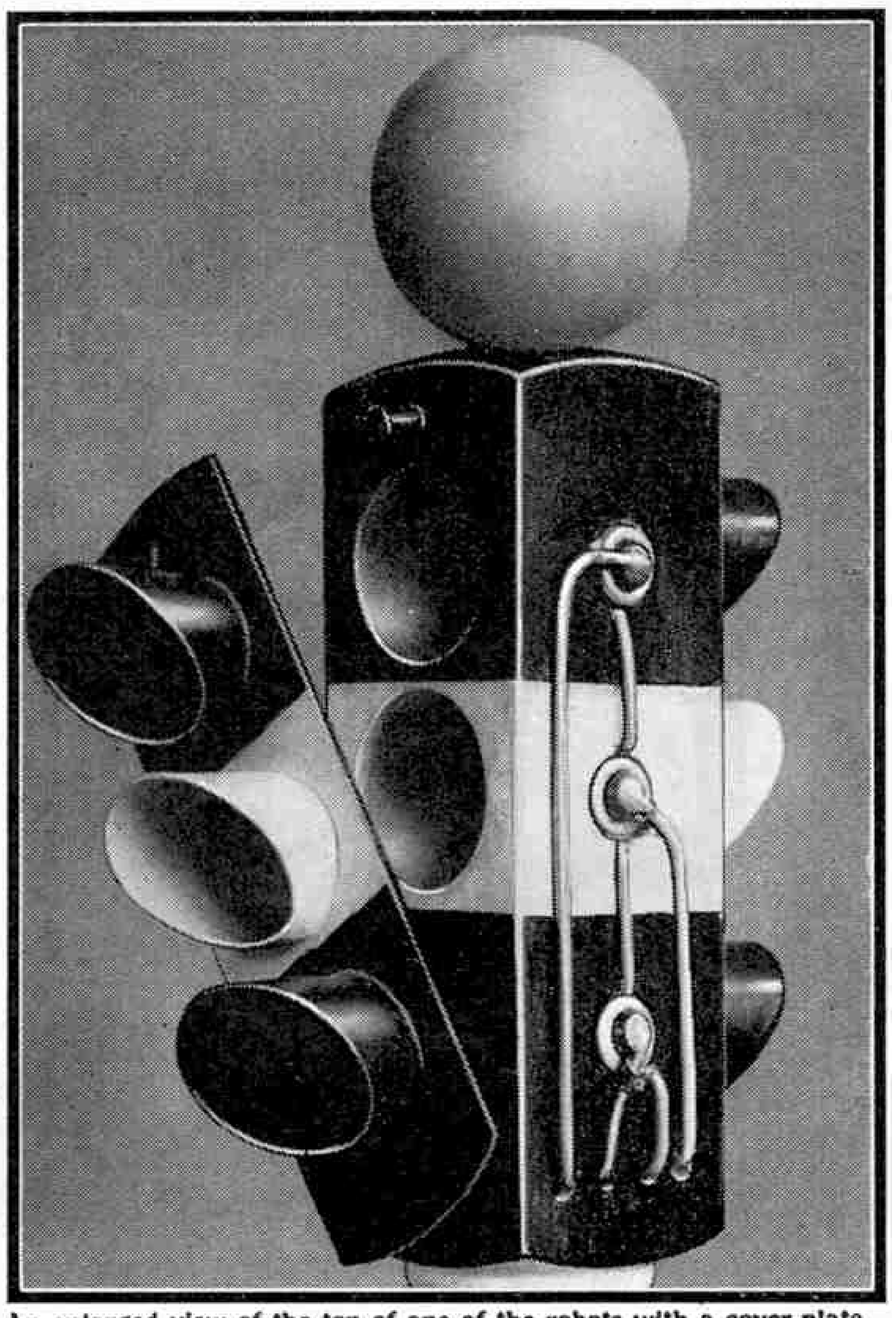
light being well diffused and sufficiently powerful.

There are 12 lamps in the four robots, and our first idea was to wire them in parallel and control them with a four-contact rotary switch. After many experiments this proposal was abandoned, for we realised that we could not reproduce the correct sequence of colours in this manner. As readers probably know, the full changing sequence is amber alone, red alone, red and amber together and green alone, amber alone again showing when the green light disappears. When amber is showing on one pair of diagonally opposite signals, the other pair must show amber and red. These changes cannot be accomplished with the circuit we had in mind originally, and in the end we decided to wire each pair of diagonally opposite signals in separate parallel circuits, both of which themselves were in parallel.



The model with the plywood representations of the road surface removed to show the wiring.

A distributor had then to be designed in order to supply each lamp with current at the correct moment and to maintain it for the required period. This took the form of a cylinder of wood on which we screwed seven curved brass strips to make contact with brushes leading current to the lamps. The strips were soldered together to make electrical contact, so that when current is applied to any one part of the strips it can be picked up again at any other part. The central strip passes right round the cylinder and provides the common pickup. On each side of it are the three strips required for each of the two circuits, and the lengths of these and their positions were so adjusted that contact was made with their respective brushes at the exact time required, and for the correct period, as the drum was slowly rotated. The brush leading current into the common pickup strip was placed on the opposite side of the drum to the two sets of three brushes by means of which current is led to the lamps.



An enlarged view of the top of one of the robots with a cover plate removed to show the lamp chambers.

The drum is driven by a Meccano E6 motor through simple gearing employing a Worm, Part No. 32, meshing with a 57-teeth Gear Wheel, Part No. 27A, that is carried on a $3\frac{1}{2}$" Axle Rod suitably supported on two Angle Brackets, Part No. 12A, bolted to the motor casing. On the same shaft and between the Angle Brackets is another Worm that engages with a Pinion Wheel, Part No. 26, fitted to the end of a $6\frac{1}{2}$ in. Axle Rod that passes through the motor frame and forms the axis of the drum. The Axle Rods are positioned by Collars and the drum end of the $6\frac{1}{2}$ in. Axle Rod is supported by a Bracket. Bush Wheels screwed to the ends of the drum secured it to its axis. This construction is shown in the lower illustration on the opposite page.

Current is supplied through a mains transformer that had previously been built by one of the boys engaged in making the model. This transformer has two output circuits, one of 4 volts that is employed for lighting the lamps, and another of variable voltage that is adapted to drive the Meccano E6 Motor. A Meccano T6A Transformer would be ideal for use with the model. Accumulators also could be employed, and a clockwork motor would serve to drive the drum if an electric motor were not available.

The wiring is carried out in the coloured connecting medium employed by radio constructors, the insulation of the leads to the red, amber and green signal lamps being red, yellow and green in colour respectively. The return lead is common to the two parallel circuits and is in blue. The actual layout of the connecting wires is shown in the upper illustration on this page. The ends of all wires leading to the brushes were soldered in position. The brushes were made of copper strip hammered flat at the end and were carefully bent to the height necessary for correct timing.

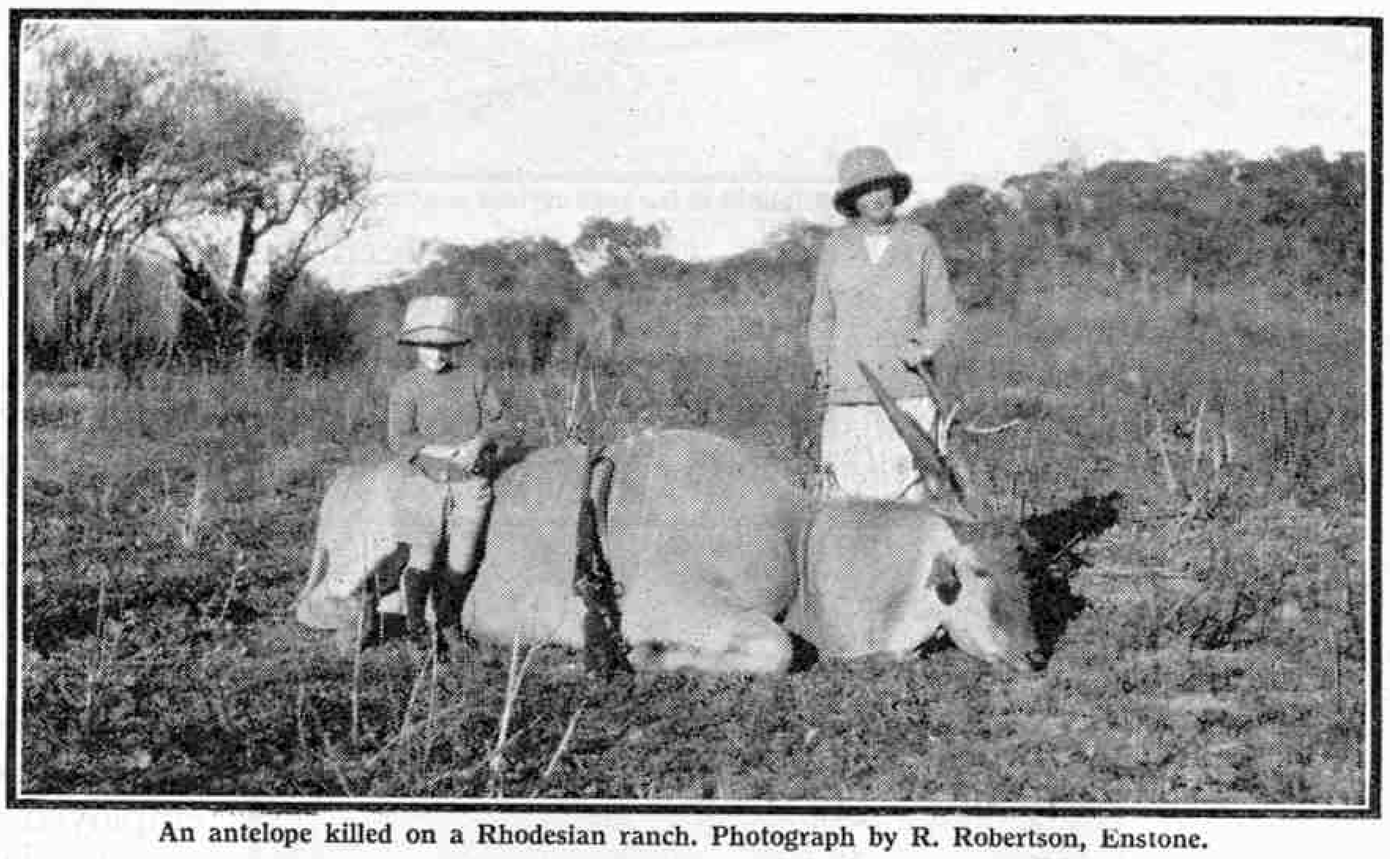
An independent switch was incorporated in the lighting circuit, and we also found it advisable to insert a small resistance, for surges in the current provided by the transformer caused a tendency to burn out the lamps. Pedestrian crossings with miniature beacons, white lines on the roadways, and pavements partly covered with coloured sandpaper to represent grass verges were added to the model. These are not essential, but they enhance the appearance and realism of the structure.

These pages are reserved for articles from our readers. Contributions not exceeding 600 words in length are invited on any subject of general interest. These should be written neatly on one side of the paper only, and they may be accompanied by photographs or sketches for use as illustrations. Articles that are published will be paid for at our usual rates. Statements contained in articles submitted for these pages are accepted as being sent in good faith, but the Editor takes no responsibility for their accuracy.

Animals on Our Rhodesian Ranch

Many boys have become acquainted with the wild beasts of other countries by seeing them at zoos. It is interesting to watch them through the bars of a cage or enclosure, but it is much more fascinating to observe them in their natural homes.

Out in Rhodesia, where I lived for some years on a farm with my parents, there were many wild animals, and on our walks we often saw antelope, the most common being duiker, koodoo and bushbuck. It is pretty to see two or three duiker playing together or grazing. If we wanted them to look up, a sharp whistle would attract them; but the smallest movement on our part caused them to bound quickly away. They are about two feet in height and very graceful. Their fawn coats tone in very well with their surroundings, especially in the dry season. It is a fine sight to see a herd of koodoo, with the white stripes on their grey bodies showing up in the sunlight. The bulls are distinguishable by their long spiral horns, sometimes measuring as much as 52 or 53 inches. Koodoo cows do not carry horns. The chief enemies of the antelope are lions, leopards, and wild dogs. We seldom saw any of these animals in the daytime, as they hunt their prey at night.



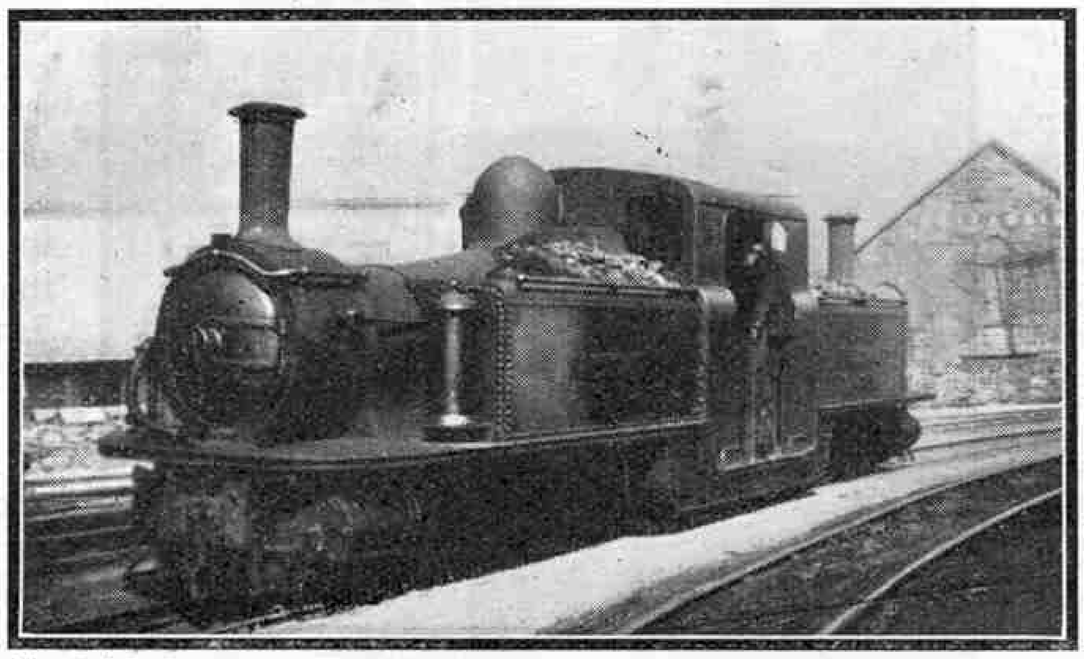
An antelope killed on a Rhodesian ranch. Photograph by R. Robertson, Enstone.

Wild pigs are common in all parts of Rhodesia, and are a trouble to any farmer who grows maize. They raid the crops at night, eating large quantities of cobs and trampling down the plants. Farmers are therefore obliged to employ natives armed with guns to guard the crops, and to shoot down as many wild pigs as they can. My father gave the natives thus employed a shilling for every pig they killed, and all the meat except the hams, which had to be brought to him.

We often saw monkeys, generally swinging from one branch to another among the trees. There were some rocky hills on the farm on which dwelt colonies of baboons, and their barking cries could be heard from a considerable distance. Often, at night, might be heard a baboon screaming because it was evidently being attacked by a leopard. Driving near these hills it was quite a common sight to see groups of baboons. As they heard the approach of the car, male baboons about the size of small men would hurry across the road, followed by mother baboons with babies hastily hoisted on their backs.

The rhinoceros is not often seen in civilised parts. My father shot one once on our farm, however, which was situated only 23 miles from the nearest town. We all went to see the great beast, and I noticed how small its eyes were in comparison to its great bulk, and how thick the skin.

R. ROBERTSON (Enstone).



The Fairlie locomotive "Merddin Emrys," of the Festiniog Railway, North Wales. Photograph by P. V. Davies, Penmaenmawr.

The Festiniog Railway

The Festiniog Railway in North Wales has the distinction of being the pioneer of narrow gauge railways. It was constructed in 1836 for the conveyance of slate from the quarries at Blaenau Festiniog down to Portmadoc, 14 miles away, for export, and is only 1 ft. 11½ in. in gauge.

The average gradient is 1 in 92 and the steepest 1 in 68.

At first the loaded slate trains travelled down to Portmadoc by gravity and the empty trucks were hauled back to the quarry by horses. Steam engines of the ordinary rigid frame type, tried on the route in 1863, proved unsatisfactory, but in 1869 a Fairlie articulated double-boiler locomotive was acquired, and was a great success. It was called *"Little Wonder,"* and its excellent performance attracted the attention of railway engineers all over the world. In 1870 a Royal Commission visited the district to study the railway and particularly its locomotive, and they were accompanied by representatives of many foreign countries.

A fine view of New York's skyscrapers. Photograph by D. Rebbeck, Knock, Co. Down.

The Festiniog line now has three Fairlie engines, one of which, the *"Merddin Emrys,"* is illustrated on the opposite page. They are very powerful and accomplish the up journey in an hour. A few 0–4–0 tender engines are used for slate traffic and for passenger trains when no "Fairlie" is available. The company have built all their own locomotives and rolling stock at their works at Boston Lodge, near Portmadoc. The line is very popular with tourists, and 64,000 passengers were carried along it in 1934.

P. V. Davies (Penmaenmawr).

A Free Trip Across the Atlantic

Each summer several of the large shipping companies take undergraduates from British Universities as supernumerary engineers on their ships. They give them a free passage out and home again, plenty of practical experience, and all the comforts of a first-class passenger. I had the good fortune last summer to enjoy this privilege, and made a free trip to New York and Bermuda and back, through the courtesy of the Cunard White Star Line.

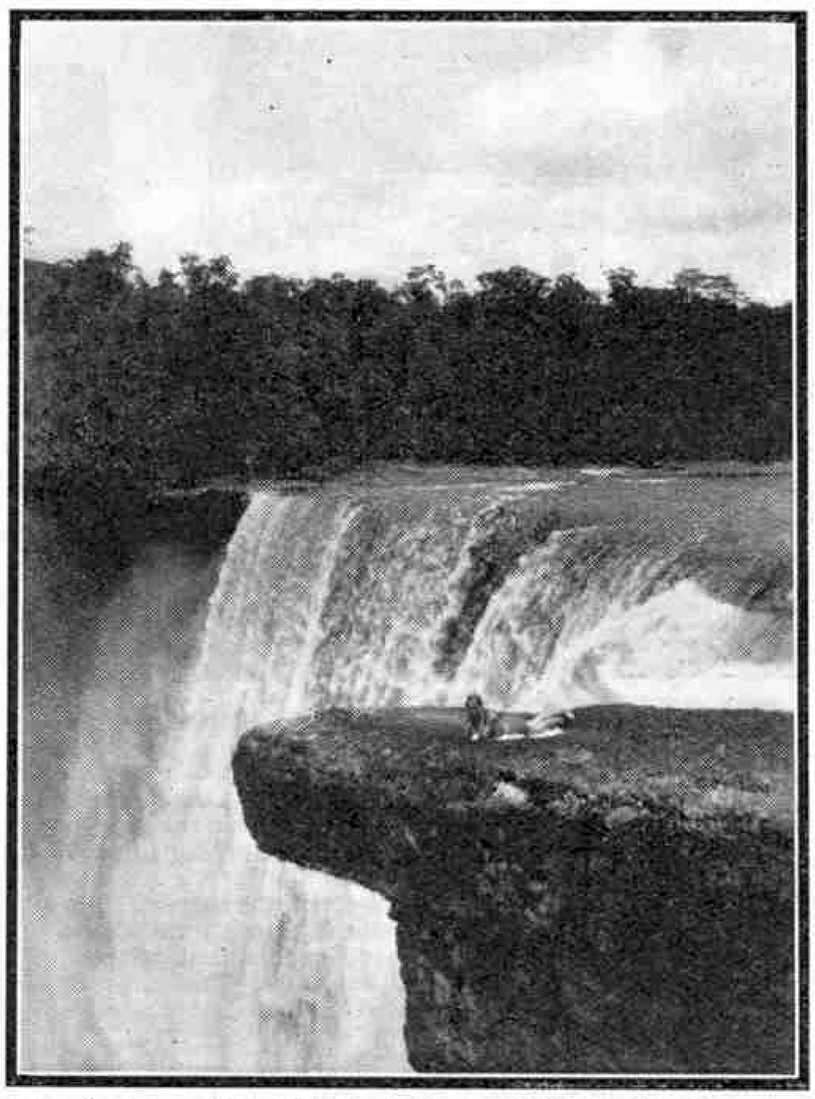
Being greatly interested in Diesel engines, I was delighted to be aboard the fine motor liner *"Britannic,"* when she sailed from King George V Dock, London, on 12th July last year. After making calls at Le Havre, Southampton and Cobh, we set out across the Atlantic, with 450 passengers. The voyage was uneventful, and there was rather too much fog for my liking. I was on the four to eight watch, and when not down in the engine room I had lots of fun playing tennis, quoits, etc., on deck.

We arrived in New York at 9 a.m. on 21st July, and as we were due to sail the next evening I had not long to explore this great city. I managed to do quite a lot in the time, however, and my adventures included an ascent to the top of the Empire State building, the tallest building in the world, and a visit to Radio City, where I had the thrill of broadcasting for 10 minutes as a visitor "from the other side."

We sailed from New York on 22nd July at 5.30 p.m. for a week's cruise to Bermuda, with 1,250 passengers. During the three days we were at Bermuda I saw a wonderful display of fish and live coral at the aquarium, viewed the coral reefs through glass - bottomed boats, travelled many miles on coral roads and on an interesting narrow gauge railway, and surf bathed from beautiful beaches.

I had two more days in New York before sailing for home on the 26th July, and during that time I saw the *"Normandie"* arrive. I saw her again at Le Havre when the *"Britannic"* called there on the homeward trip. My arrival back at London on 7th August ended a most interesting trip.

D. Rebbeck (Knock, Co. Down).



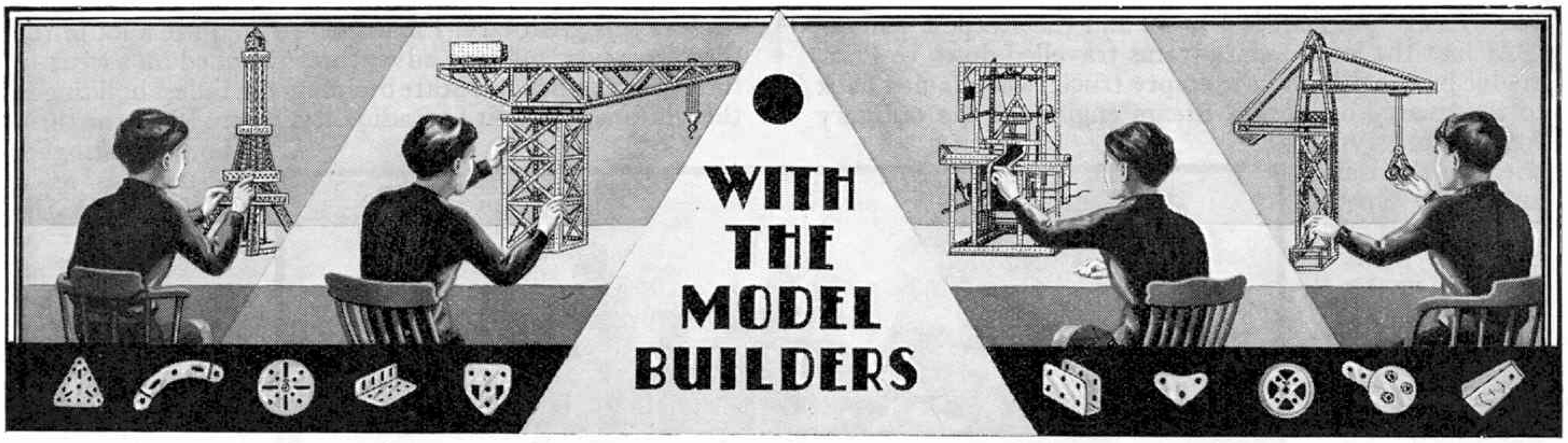
The Kaieteur Fall, British Guiana, which is five times as high as Niagara. Photograph by R. Weil, Capetown.

Guiana's Mighty Cataract

One of the most magnificent cataracts in the world occurs on the Potaro River in British Guiana. It is the mighty Kaieteur waterfall which, until the recent introduction of air services provided better travelling facilities to tourists, had been visited by very few people since its discovery just over 60 years ago. The first white person to see the Fall was a Mr. C. Barrington Brown, who came upon it in April 1870, while engaged in a geological survey.

The breadth of the Fall at the brink varies according to the season, and the maximum width attained is about 400 ft. The total drop is 822 ft., and 740 ft. of this is a sheer perpendicular plunge, the remaining 82 ft. being a sloping cataract. Kaieteur is thus five times higher than Niagara. It is produced by the swiftly flowing river leaping over an immense escarpment of sandstone and conglomerate into a deep gorge. In the flood season the magnificence of this vast curtain of seething water amid a tropical landscape of great beauty is beyond description.

The name "Kaieteur," sometimes spelt "Kaieteuk," is a Red Indian word meaning "Old Man"; and the Fall got its name from the Carib custom of getting rid of the "old men" by sending them down the Falls, to be battered to death in the maelstrom below. R. Weil (Capetown).



BRIDGE MODELS

On another page of this issue the model-building possibilities offered by bridges are dealt with, and here we illustrate an unusual view of a model of the new Sydney Harbour Bridge that is of special interest on account of the new use for Dinky Toys. This fine model closely reproduces the features of the massive arch spanning the harbour at Sydney, and the illustration shows how the Dinky Toy Cars are made to travel from end to end. The miniature vehicles are guided along the roadways between Strips at the outsides and a long Rod down the centre. Flat Girders are used for the roadways and are so arranged that a slot is formed in the centre of each. A small sheet of tin is cut to the size and shape required and inserted at each end of the bridge to extend the roadways.

A 2" Sprocket is fixed on a vertical Rod at each end of the bridge, and a continuous Chain running between them is arranged immediately beneath the slots in the roadway. A tensioning device is fitted to take up slack in the Chain by mounting the Rod of one of the Sprockets in a pivoted frame controlled by Springs. A short length of wire is attached beneath each Car near the front, and secured to the Sprocket Chain in such a manner that it does not interfere with the Chain passing round the Sprockets. The Rod of each Sprocket projects upwards above the level of the roadway and carries a Coupling, and the Rod that is in fixed bearings is driven from a Motor. As the Chain moves between the Sprockets the Cars are hauled along the bridge. On reaching the ends of the bridge they swing round the Couplings, Curved Strips being arranged to guide them into the roadways again. One of the Curved Strips can be seen on the left of the illustration.

The wires joining the Cars to the Chain should not be too long or the Cars will strike the Curved Strip at a wide angle and will not turn properly. In fixing them to the Chain the joints should be made neatly so as not to interfere with the smooth running of the Chain.

CURVED STRIPS

The present Meccano range of Curved Strips makes it possible to build many different curved structures, and among the several sizes available suitable parts will generally be found for almost any purpose. Occasionally, however, it is found that the Strips make curves slightly smaller or larger than those required for special purposes, and in cases where it is not possible to vary the construction slightly to accommodate existing Strips the model builder must devise substitutes. Very good curved strips can be made by bolting Flat Brackets together. By this means a strip of any length can be formed, it being possible to adjust the length within very fine limits owing to the play allowed in the slotted holes of the Strips. It is obvious that curved strips made up in this manner can be of large or small radius. In special cases they can be used for the rims of wheels. Flat Brackets can thus be resorted to for solving many small difficulties of construction, and it will be realised that their applications are not limited to the construction of regular curves as they can be used for forming almost any shape.

FUNNELS FOR SHIP MODELS

Funnels form one of the most conspicuous features of a model steamship or motor ship, a fact fully realised by shipbuilders who sometimes employ dummy funnels in order to improve the appearance of a vessel. Builders of small motor ships can greatly enhance the appearance by using the Meccano Ships' Funnels. These are available in two forms, No. 138, which is an upright cylindrical funnel, and Nos. 138a-z, which are of the raked type of oval cross section. The latter are available in correct colours representative of 26 different steamship companies.

Larger funnels can be made from Strips with which it is possible to make a number of different sizes and shapes to suit the vessel under construction. The best method of using these is to arrange them longitudinally and to join them together by Flat Brackets or Obtuse Angle Brackets. It will thus be apparent that by this means the tall slender funnels of the older steamships can be reproduced just as well as the modern fat and stubby funnels of motor vessels.

For large ships excellent funnels can be made from Boilers, and as these are made of fairly pliable metal they can be compressed to form funnels narrower than the standard diameter of the Boiler. The parts can be mounted at an angle, and if the ships are intended to represent those of particular steamship companies the Boilers can be enamelled in the correct colours. There are many model-builders who prefer not to enamel the Boilers as this rather spoils them for further use, and for these constructors there is the alternative of covering the parts with suitably coloured paper.

LARGE GEARS FOR ROLLER BEARINGS

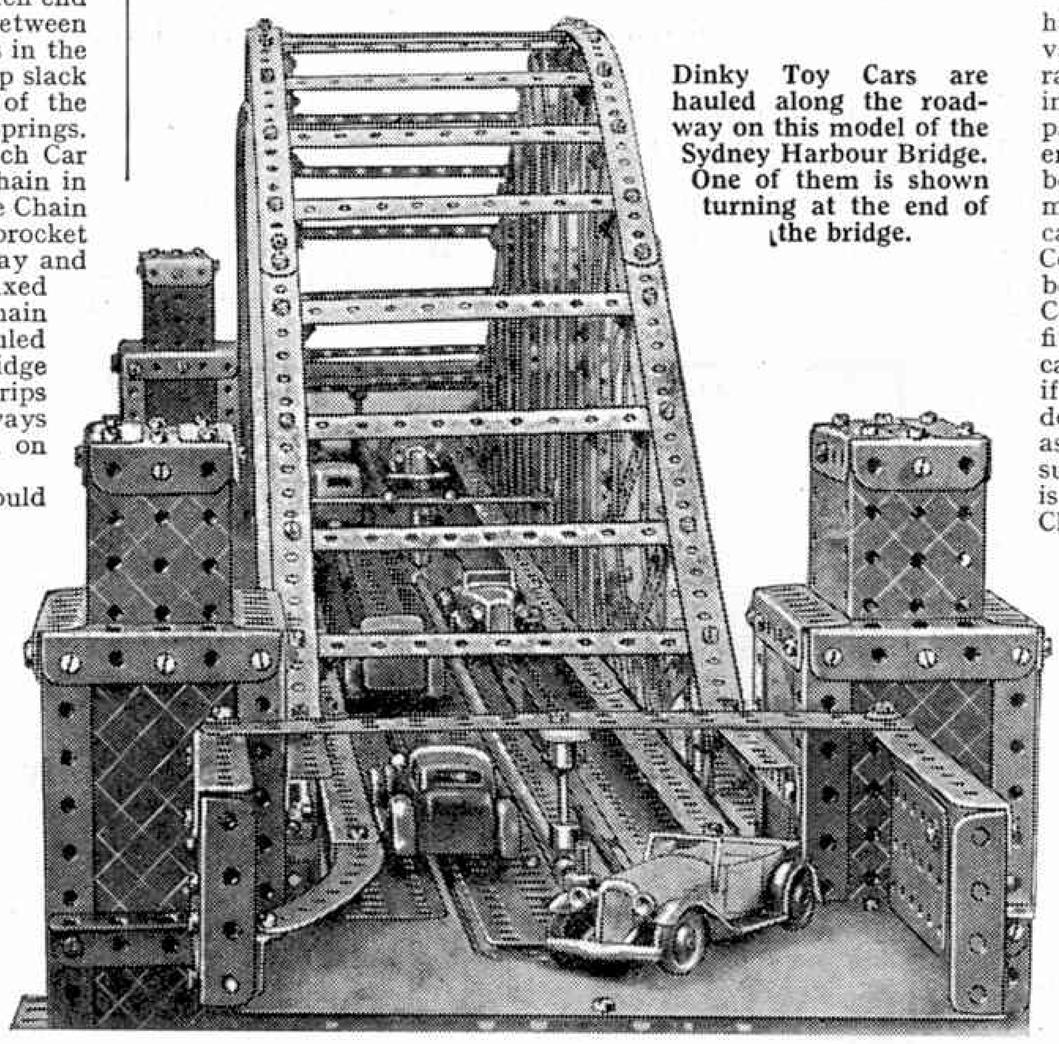
Roller bearing units using Ring Frames or Hub Discs for races can be rotated through friction drive by using a rubber shod pulley that bears on the rim of one of the races. An extra large gear for providing a positive drive can be made by fixing Sprocket Chain round the rim of the roller race. The Chain should be a tight fit round the rim and can be held in place by short loops of wire. The wire should be passed through the holes on the inside of the race and a Washer may be inserted to prevent the loop pulling through. The ends of the loop are then passed through the Chain and bent over in a similar manner to that adopted for fixing the Dredger Bucket clips. The clips of Dredger Buckets can be used instead but the wire will generally be found more satisfactory.

Sprocket Wheels engage the Chain to drive the race. The race is thus converted into a large gear wheel and can be used in any model where an extra large gear is required. Sprocket Chain can be used in this manner for making up large gears of several different sizes, but the most suitable parts to use will be found to be Hub Discs and Ring Frames.

ROLLER BEARING FOR SMALL OUTFITS

The usual method of supporting rotating structures in models built with small Outfits is to place one 3" Pulley over another to form a substitute for the more satisfactory roller bearing. There is considerable friction between the rims of the two Pulleys and much better results are obtained when a roller bearing or ball bearing unit is used. The objection to such a bearing is that of the number of parts required, but it is possible to make quite a useful roller bearing by using 3" Pulleys and ¾" Flanged Wheels. The Flanged Wheels are free to rotate on Rods carried in a Coupling. One Rod is passed through the centre transverse hole of the Coupling and two shorter Rods are fixed at right angles to the first in each end hole. The Flanged Wheels are retained in position by Collars or Spring Clips. A Threaded Pin screwed into one of the centre tapped holes in the Coupling is passed through the boss of one of the Pulleys, and another Threaded Pin can be used in the opposite tapped hole of the Coupling, or if two Threaded Pins are not available a long bolt can be used instead.

No difficulty occurs in arranging a drive for rotating the upper Pulley. It can be driven from a ½" or a 1" Pulley by a length of cord or a rubber band, and if Cord is used it will be found advisable to pass it twice round each Pulley to ensure a good grip.



Dinky Toy Cars are hauled along the roadway on this model of the Sydney Harbour Bridge. One of them is shown turning at the end of the bridge.

MECCANO CAMS.—A number of readers have put forward suggestions for cams of various shapes to be introduced to the Meccano range. Cams can be applied to many purposes in model building, but the present range of parts is so adaptable that we have not yet encountered a case where standard parts cannot be used for making cams to reproduce the movement required. The functions of a small cam such as you propose are fulfilled by a Collar fitted with a 7/32" Grub Screw or with a bolt. The length of the projection above the Collar governs the lift of the cam and by fitting a longer or shorter bolt different lifts can be obtained. This would not be possible if a special part were introduced. The bolts do not give quite such a smooth movement as a properly designed cam but they are quite suitable for most purposes, and if a gentle lift is required for the tappet, the Kemex Stand Clamp (Part No. K31) can be used. This part is in the form of a large boss that is drilled eccentrically and fits snugly on a Meccano Collar or Coupling.

Larger cams can be built up to obtain almost any movement. Bush Wheels are usually the most useful parts for this purpose, and by bolting to them Flat Brackets, 1" Triangular Plates, Pawls without bosses, etc., a large variety of cams can be made. (*Reply to G. Meyer, Johannesburg.*)

SHIPS' VENTILATORS.—Ventilators add a note of realism to model ships and the proposal that these parts should be introduced to the Meccano range is quite interesting. It is, however, doubtful if the demand for them would justify their production as it is unlikely that they would be so popular as the Ships' Funnels. It is possible to make quite realistic representations of ventilators from existing Meccano parts such as Sleeve Pieces and Chimney Adaptors, or if very small ones are required Collars can be fitted on the ends of Screwed Rods. Most model builders obtain more satisfaction from building a model in which such items as these must be thought out and built up with standard parts, than they would if the essential parts were already made for them. (*Reply to H. M. Hodge, Plymouth.*)

WIDE-FACE GEARS.—Gears having face widths the same as the Pinions would have doubtful advantages in gear-box construction. Owing to their extra width they would necessitate greater sliding movement to disengage Pinions and would consequently make gear-boxes rather cumbersome. In certain cases wider Gears would be useful but these few instances would scarcely justify the cost of manufacture, and as this would be comparatively high the demand for the parts would be very limited. Two Gears can be butted together to give a double width face for use in special cases. (*Reply to W. H. Ward, Birmingham 15.*)

RATCHET SPANNER.—This is an interesting idea as no doubt such a tool would have certain advantages over the present type, but it is rarely that a case arises where a ratchet spanner seems really necessary. Owing to its special design the standard Spanner fulfils requirements for all ordinary model building, and we do not think that the restricted uses for a ratchet spanner would warrant its manufacture. (*Reply to S. Wilson, Southampton.*)

Motor Car Transmission Mechanism

A New Type of Differential Unit

SOME of the most interesting problems in connection with the construction of modern motor cars arise in designing the means of transmitting the power of the engine to the road wheels. A purely mechanical transmission usually is employed. This incorporates a clutch, gear-box, propeller shaft and a differential. Of these mechanisms the differential probably is the most ingenious and interesting. Its purpose is to divide the final drive and carry the power of the engine to each rear wheel independently. This is necessary, for when a car is steered to the right or left the outer road wheels travel over a greater distance than the inner ones and therefore turn faster. The use of a differential allows each of the driving wheels to rotate at its correct speed.

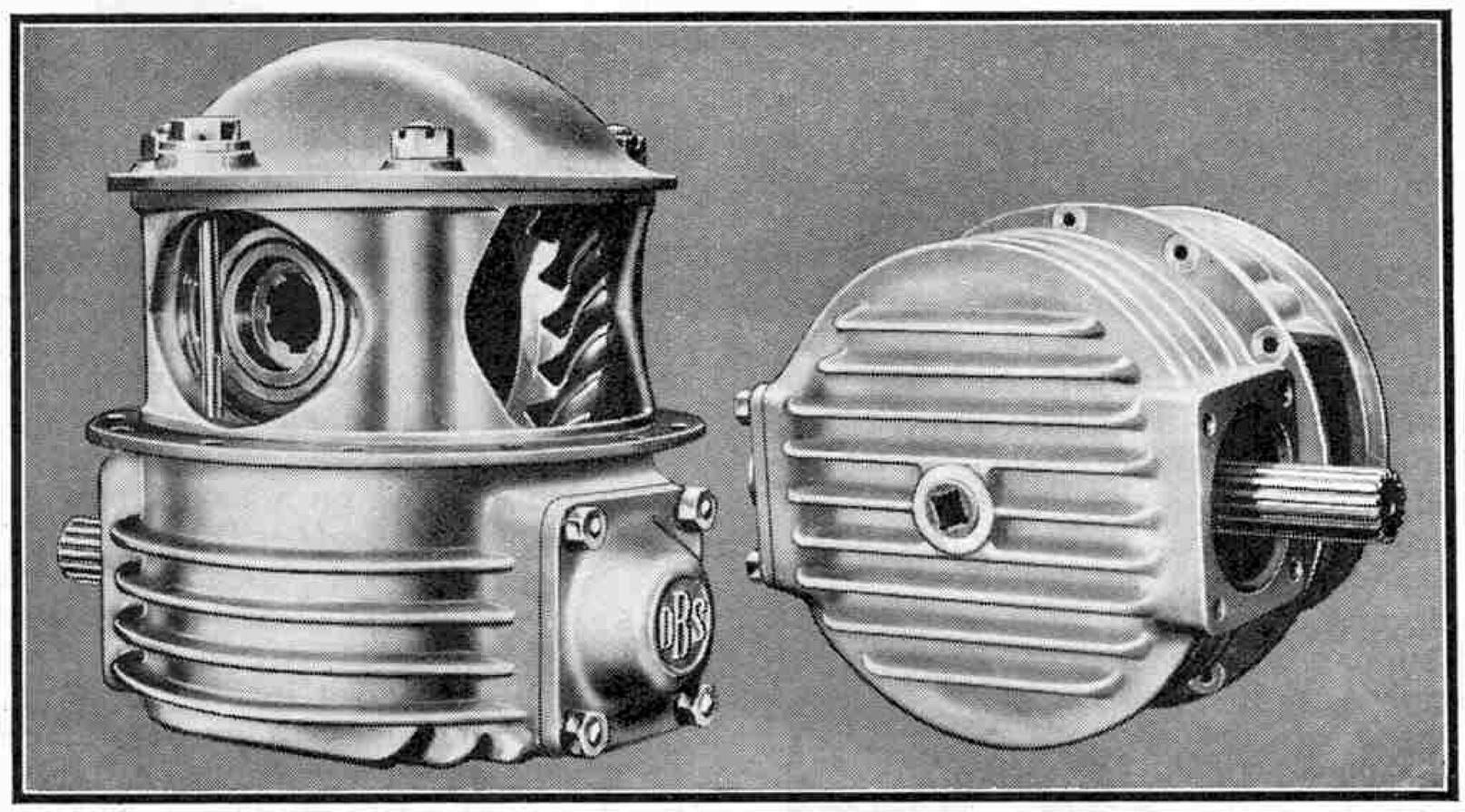
Several types of differential gear are in use, the most common being an arrangement of bevel pinions and wheels. The rear axle is in two sections, each shaft driving one of the road wheels at its outer end and carrying a small bevel wheel at its inner end. In mesh with these bevel wheels are others that form a link between them, and therefore between the two axle shafts. These connecting bevels are mounted on pins in a casing, called the differential cage, which encloses them and also carries the bevel crown wheel, if bevel drive from the propeller shaft to the rear axle is employed, or the worm wheel rim, in cars in which worm drive is used.

When the engine is started, the crown wheel or worm-wheel carries round the differential as a solid mass. The connecting bevels do not revolve, but simply link the shaft bevels together, so that an equal amount of power is transmitted to each road wheel. If one road wheel is now completely stopped, the connecting-bevel revolves and runs round the bevel on the stationary shaft, with the result that the other shaft-bevel is driven at double speed.

When the one wheel is not completely stopped but merely slowed, the other road wheel automatically is speeded up in exactly the right proportion. This is exactly what happens when a car turns a corner and the inner road wheel is slowed by the resistance of the tyre on the road.

In recent years there has been a tendency in car design towards very low hung bodies, and this has necessitated specially designed differentials that "fit in" with the chassis requirements. The mechanism illustrated on this page is a typical example of this. It is a new type of differential unit made by David Brown and Sons (Hudd) Ltd., Huddersfield, and it has been developed to suit modern low hung car bodies without necessitating an interior tunnel to clear the propeller shaft.

The new gear makes use of worm gear and pinions, and is intended primarily for use as an underslung drive, but if necessary it may be inverted for overtype drives. The underslung arrangement permits a very low position for the propeller shaft and consequently a low centre of gravity and stability. The new unit is particularly useful for incorporation in pleasure cars, for low hung body work can then be combined with ample head room, while at the same time the ground clearance is ample for modern road conditions.



Two views of the Worm Gear Differential Unit described on this page. In that on the left the worm wheel can be seen in the upper half of the housing of the unit. Photograph by courtesy of David Brown and Sons (Hudd) Ltd., Huddersfield.

The gear housing forms a self-contained unit and includes all the bearing seatings of both worm and wheel, thus avoiding loose bearing caps, and providing great rigidity. The differential is of the four planet bevel type, and the pinions are carried on a star piece driven by the differential cage. The tooth form is of special shape designed to give maximum strength and durability, and carefully positioned oil grooves are provided to ensure efficient lubrication.

The worm wheel rim is fastened by high tensile steel bolts to flanges on the differential cage, in which are disposed the differential bevels on their cross piece, the whole forming a complete element, which is carried on two double purpose bearings in the housing. The worm is mounted at the rear end in two bearings, one of which takes the radial load, while the other carries the axial load only. The forward end of the worm shaft is carried on a single lip roller bearing.

The worm wheel is made from a special high tensile alloy, known as "Taurus" bronze, and the teeth are accurately cut and shaped to ensure that all wheels are interchangeable.

The aluminium housing is of light yet robust construction and is made in halves, which are held together by steel bolts. The bearing caps are cast in one piece with the top half, which is fitted with an accurately machined spigot that registers in a hole in the lower half, known as the axle banjo. This simplifies assembly of the unit and makes the differential unit and the axle banjo into what is virtually one complete axle unit.

In Search of New Models

Helpful Hints for Bridge Builders

BRIDGES are particularly good subjects for models, since Meccano parts are so well adapted for reproducing the girders, tie-rods and other members that make up these structures. The range of subjects available for models also is extensive, for there are many different types of bridge in use throughout the world and various materials have been employed in their construction. In this respect much depends on local conditions. In Canada, where wood is plentiful, many famous trestle bridges have been built of lumber hewn from forests in the vicinity. The trestle bridge is perhaps not so interesting as a subject for models as other types of bridge, but it can easily be reproduced with the aid of Meccano parts.

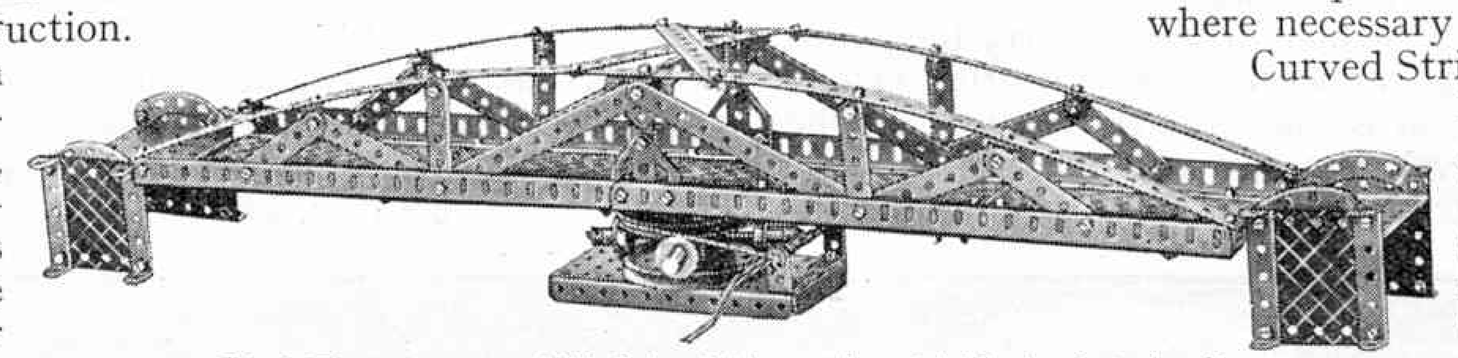


Fig. 1. The centre span of this Swing Bridge can be rotated by turning a handle.

The materials generally used in modern bridge building are stone and steel. The extensive use of stone is restricted to comparatively small structures, and these can be modelled very well by combining Plates and Girders. Strip Plates and Flexible Plates prove their worth in such models. Steel bridges make the best subjects for copying in model form, however. Among the best-known types are arch bridges, suspension bridges, and cantilever bridges. The arch bridge relies for its support upon massive arched girders that span the gulf to be bridged. The arches are placed one on each side of the bridge, the deck of which may be above or below the top of the arches. If the span is great it is more usual to suspend the deck from the arch girders by means of tension cables, and when the deck is above the arch all the members supporting it are in compression. In each case the arch girders are subjected to compression.

When a suspension bridge is being built, two towers, generally of masonry, are erected at each end and suspension chains are slung between them. The chains are extended downward beyond the towers and terminate in anchoring blocks. The deck of the bridge is then supported by tension members hanging from the chains, and the chains also are in tension.

On a bridge of the cantilever type the deck usually is supported at a level near the centre of the cantilevers. The structure below the deck is then subject to compression, as in an arch bridge, while the upper structure is in tension, as in a suspension bridge.

By considering the forces the different members of a bridge are called upon to withstand, a new interest is given to the building of the models. Members subjected to compressive forces should be represented in the model by Angle Girders, and if the loads are heavy, built-up girders of channel section—or of other suitable cross section—should be employed. In the case of curved girders that are in compression, as in an arch bridge, some substitute must be found for Angle Girders. In most cases Strips must be used, reinforced where necessary by further Strips or Curved Strips attached to Angle Brackets. The tension members of a bridge are more slender than the parts in compression, and Strips can be used to represent them. In some cases Cord is sufficient, but it may be found advisable to use string instead in order to preserve correct proportions.

These bridges give the model-builder good opportunities for using Meccano parts to advantage, and when completed they can be employed in a model railway system or can be used in conjunction with Dinky Toys. The interest of the models is greatly increased if they can be applied to purposes such as these. A novel way of using Dinky Toys on a model bridge is shown on the *"With the Model Builders"* page of this issue.

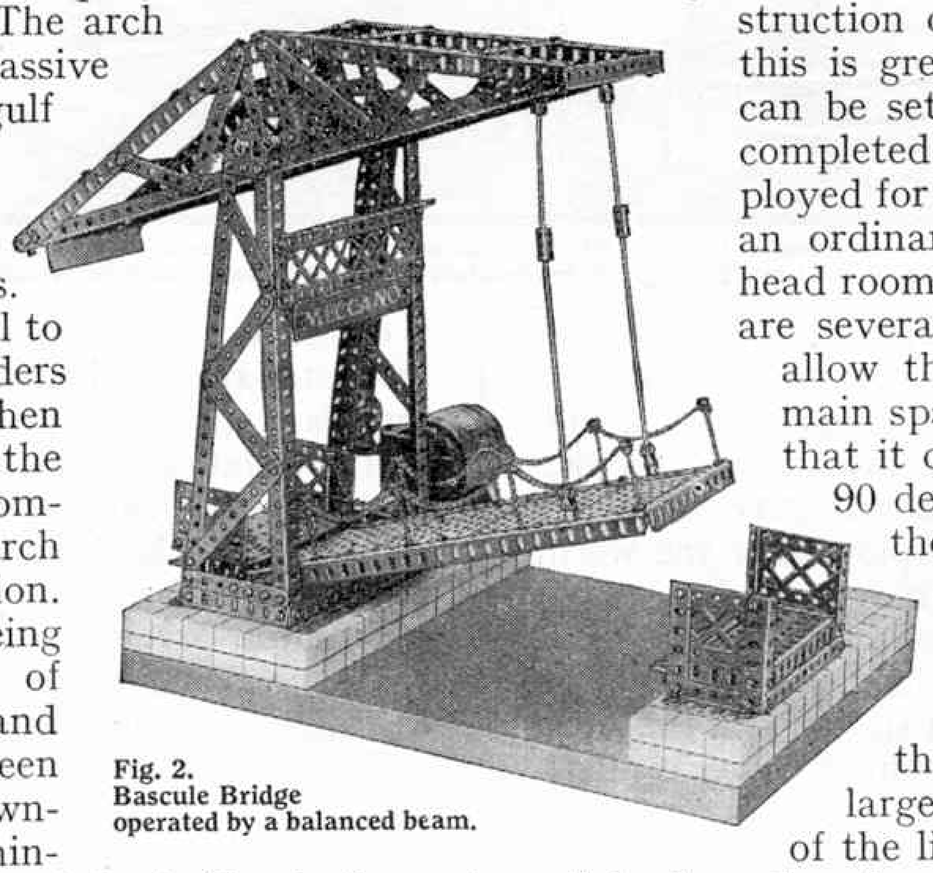


Fig. 2. Bascule Bridge operated by a balanced beam.

A great deal of pleasure is obtained from the construction of almost any type of bridge, but this is greatly increased when the structure can be set in motion in some manner when completed. Opening bridges are often employed for spanning waterways in cases where an ordinary bridge would leave insufficient head room for vessels to pass beneath. There are several methods of opening a bridge to allow the passage of ships. In some the main span is mounted on roller bearings so that it can be rotated through an angle of 90 deg. to take up a position parallel to the waterway. In another type the span is hinged at one end and the other end is raised until the moving span takes up the vertical position. A variation of this type occurs in the rolling lift bridges, which have large rolling sectors built on to the end of the lifting span. These bridges actually roll backward and upward at the same time. In some cases the moving span is raised vertically so that although still spanning the waterway vessels can pass beneath it.

There is another type that is used less frequently than the foregoing but has advantages peculiar to certain conditions. When a very long span is necessary it is obvious that the moving bridges of the kinds referred to are unsuitable, and if it is impossible to build a bridge with a continuous roadway, the transporter bridge is sometimes used to meet the requirements of the situation. This type of bridge has a main span supported high

enough to avoid interference to shipping, and a trolley runs on rails beneath the bridge. Suspension cables attached to the trolley support a car at the level of the roadway below. By this means vehicles and passengers can be taken to and fro across the bridge without interfering with navigation.

Many of these models can be built up in Meccano, and if a Motor is available, made to operate under power. The fascination is not lost if a Motor is not at hand, for they can be operated quite well by means of a handwheel. Good examples of moving bridges are shown on these pages. Fig. 1 shows a simple model Swing Bridge in which the centre span is supported on a roller bearing. As the handle is turned the bridge rotates about its pivot, thus making way for water borne traffic.

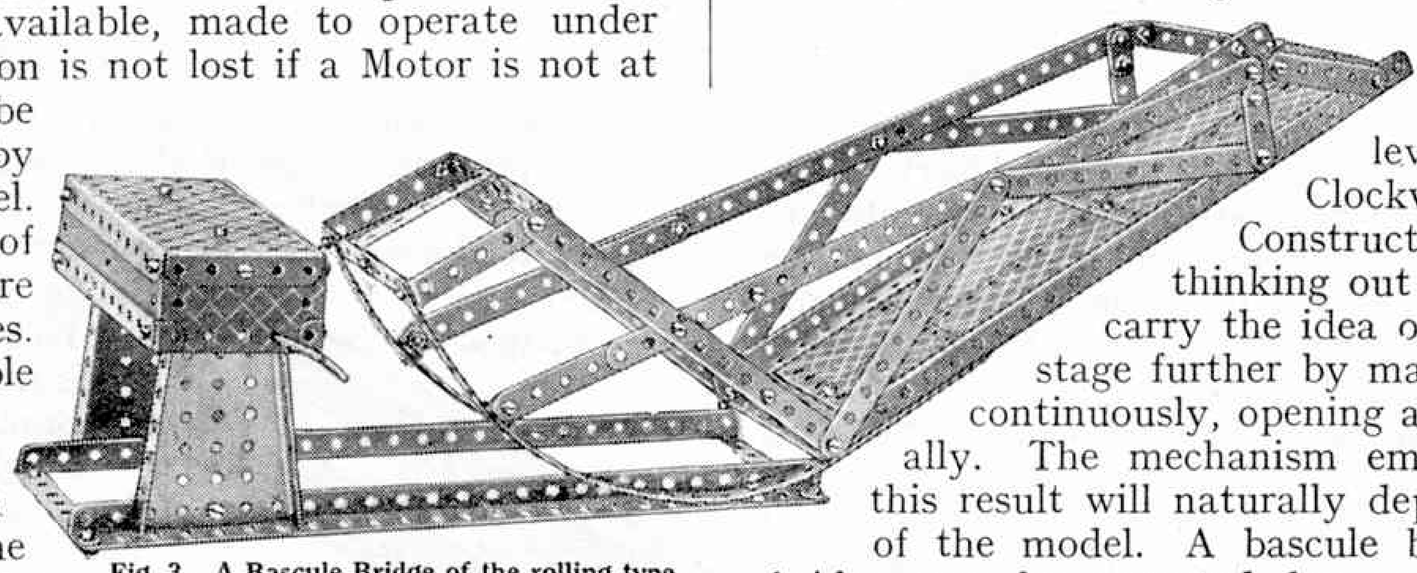


Fig. 3. A Bascule Bridge of the rolling type.

Fig. 2 shows a Lifting Bridge operated by a balanced beam. In this case a pivoted beam is connected at one end to the bridge, and at the other end carries a balance weight that helps to counterbalance the weight of the bridge, thus minimising the load on the Motor. With this arrangement a Motor of smaller power than would otherwise be necessary can be used.

An opening bridge of the rolling bascule type appears in Fig. 3, and its method of operation is apparent from the illustration. In actual practice the rolling sectors are generally provided with studs that fit into recesses on the rails carrying them. This is to prevent the sectors slipping on the rails, but on a Meccano model of such small size a similar method cannot be adopted. An ingenious arrangement has been employed to prevent the sectors slipping on the Strips supporting them. Cords are tied to each end of each sector and then to the opposite ends of the rails supporting them. On these bridges the balance weights are fitted at the rear of the rolling sectors.

A Vertical Lift Bridge is shown in Fig. 4. The centre span slides in vertical Girders and can be raised by means of four cords. A cord is secured at each corner of the span and they pass over Pulleys at the top of the towers, then passing down to the control cabin. A Worm drive operates the hoisting shaft, thus ensuring that the shaft cannot unwind owing to the weight of the bridge. Worm gearing is very useful in cases like this, as the driven shaft is automatically braked, without affecting the drive.

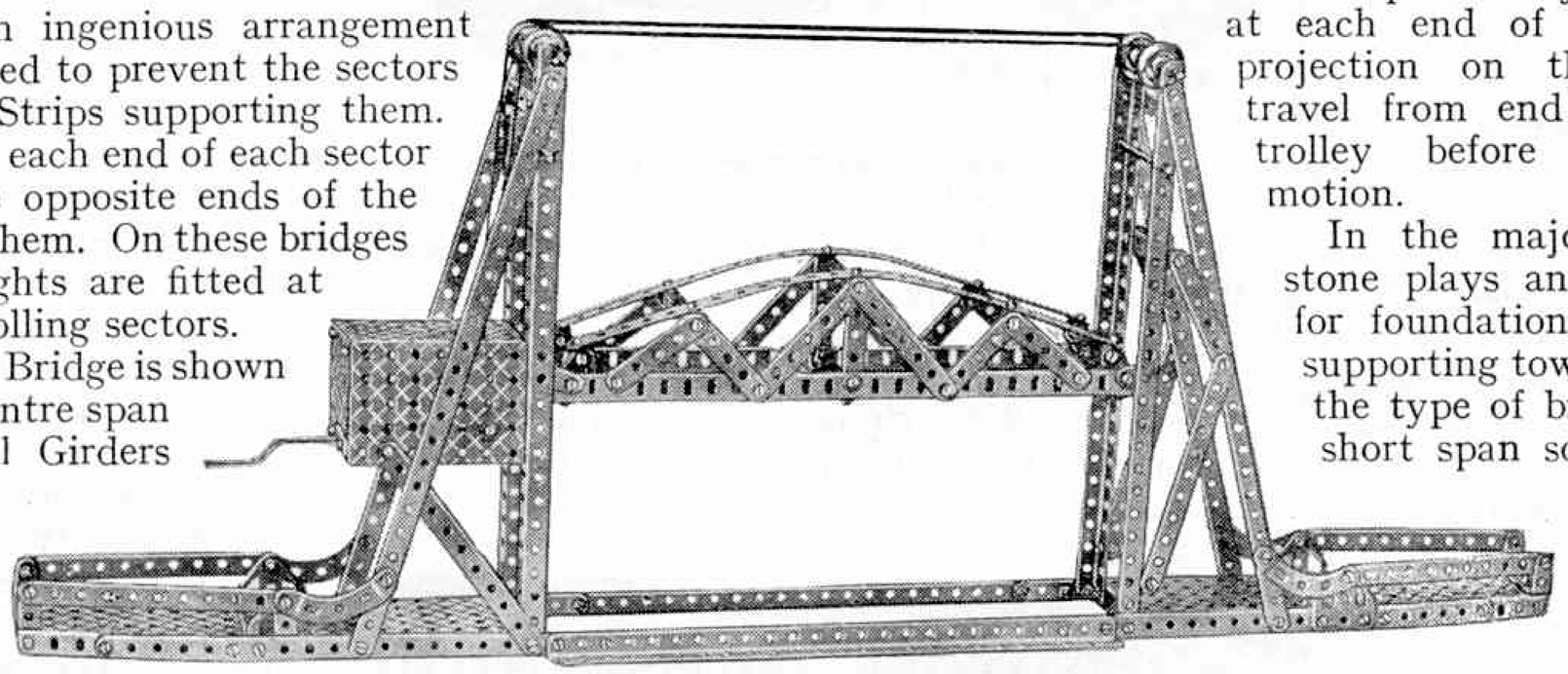


Fig. 4. Vertical Lift Bridge with centre span in raised position.

Much more fun is to be had from the models when they can be operated under their own motive power. Clockwork or Electric Motors can be used for driving them and should be geared to give a slow powerful drive. The movement of the actual bridges is invariably slow, so the models are true to type when driven slowly. A refinement that can be fitted to the models, adding to their interest in both construction and operation, is an automatic control to prevent overwinding. The device may consist of a stop that is tripped when the moving span reaches a certain position, thus stopping the Motor. Automatic control is simplified if an Electric Motor is used, but it is by no means impossible with a Clockwork Motor. In the former case electrical switches can be arranged to cut off the current for the Motor, or trip gear can be made to operate the Motor lever as in the case of a Clockwork Motor.

Constructors who delight in thinking out new mechanisms can carry the idea of automatic control a stage further by making the bridge work continuously, opening and closing automatically. The mechanism employed for achieving this result will naturally depend upon the design of the model. A bascule bridge or vertical lift bridge can be operated by an automatic reversing hoist as in S.M.18 (Standard Mechanisms Manual). Operation of a swing bridge could be controlled by a reversing gear or by a crank and lever movement. Other ideas for automatic continuous operation will occur to the model builder. Slow motion is desirable, and if possible there should be a pause when the span reaches the open and closed positions.

On a transporter bridge an automatic reversing gear can be fitted. In the Meccano super model (No. 21) a simple reversing gear of Contrate Wheel and Pinions is used and is controlled by trips at each end of the bridge. The trolley carrying the travelling car strikes one of the trips on reaching the end of its travel and a spring-controlled lever changes the direction of the drive. A pause is obtained by allowing the driving chain to pass freely through guides at each end of the trolley. A projection on the chain must travel from end to end of the trolley before setting it in motion.

In the majority of bridges stone plays an important part for foundations, abutments or supporting towers, according to the type of bridge. Bridges of short span sometimes consist of stout girders of I section supported on stone abutments, and even in long bridges of elaborate girder construction stone is generally used extensively for foundations, although these may not be exposed. Where stone is used to any great extent in the prototype of a model it should be reproduced by judicious use of Strip Plates or Flexible Plates, but in cases where it is applied to foundations only it is often more effective to use wood suitably painted to represent stone work. Wooden blocks cut to size and shape make excellent piers for supporting "mid-river" sections of a bridge.

A model bridge is set off to advantage when mounted on a baseboard that is made to represent part of the situation in which the bridge is used. Fig. 2 shows how this can be done with a lifting bridge. This model is supported on a wooden base painted to represent stone foundations, and a sheet of rippled glass represents the water of a canal.

Two New Meccano F Outfit Models

A Telescope and a Six-Wheeled Lorry

THE two new Meccano models dealt with in this article are a reflecting telescope and a six-wheeled lorry. These differ widely in type, but have attractive movements and illustrate interesting constructional methods. Both can be built with the parts included in Outfit F, with the exception that two 2" Dunlop Tyres, Part No. 142A, also are required for the second model.

The Reflecting Telescope is similar to that installed at Melbourne Observatory, which has a mirror 48 in. in diameter. The mounting is of the equatorial type, in which the telescope itself is placed on one side of an axis, called the polar axis, that is set parallel to the imaginary line joining the Earth's north and south poles, and is capable of rotation about it. The weight of the telescope is balanced by that of a counterpoise and the instrument can be turned about a second axis so that it can be directed to any part of the heavens. No mirror is fitted to the model, but all the movements of the prototype are reproduced and the general appearance and operation of an instrument of this type is admirably illustrated.

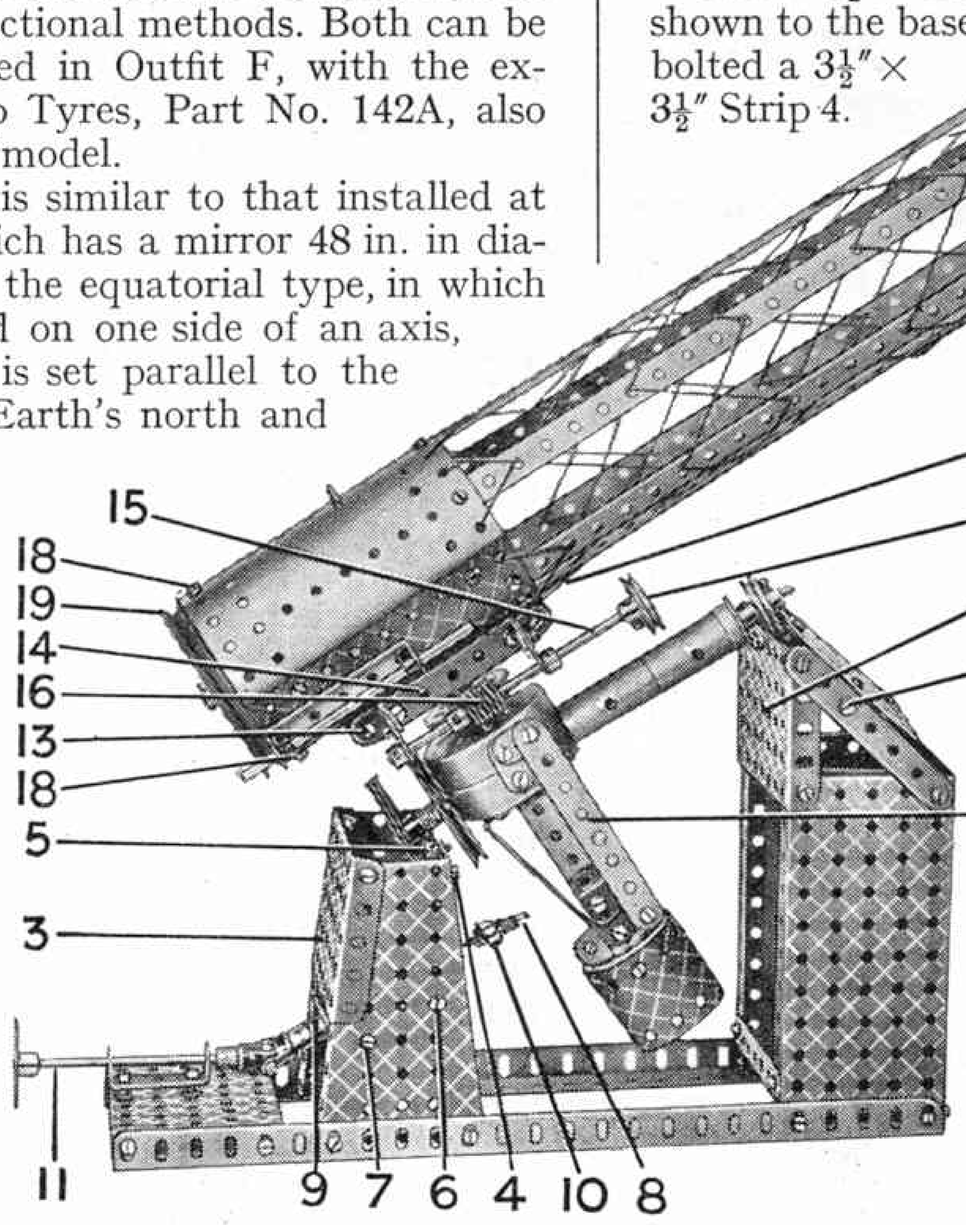


Fig. 1. A Meccano Reflecting Telescope that reproduces the movements of a real instrument.

The base of the model is first constructed. This consists of two $12\frac{1}{2}$" Angle Girders, laid parallel and secured together at one end by means of a $3\frac{1}{2}" \times 2\frac{1}{2}"$ Flanged Plate. At their opposite ends the Girders are fitted with $3\frac{1}{2}" \times 2\frac{1}{2}"$ Flanged Plates, which are joined by means of two $5\frac{1}{2}" \times 2\frac{1}{2}"$ Strip Plates. The edge of one of these Strip Plates is shown in Fig. 1. A $3\frac{1}{2}"$ Strip is bolted to the bottom of the visible flanges of the Flanged Plates, and to the top is secured a $3\frac{1}{2}" \times 2\frac{1}{2}"$ Flanged Plate 1.

Two $3\frac{1}{2}"$ Strips are bolted to the Plate 1 and to these are secured two $\frac{1}{2}" \times \frac{1}{2}"$ Angle Brackets. The securing bolt of one of these is indicated at 2, Fig. 1. Two $2\frac{1}{2}" \times 2\frac{1}{2}"$ Flexible Plates overlapping three holes are now secured to the Angle Brackets between the $3\frac{1}{2}"$ Strips, and to the lower edges of the Flexible Plates are clamped two similar Plates by means of a nut, bolt and Washer. The two last mentioned Plates overlap the $5\frac{1}{2}" \times 2\frac{1}{2}"$ Strip Plates, already mentioned, for a distance of three holes and they are bent slightly in order to fill in the gap between the Strip and Flexible Plates. A bolt in the centre top hole of the $3\frac{1}{2}" \times 2\frac{1}{2}"$ Flanged Plate 1 holds in place an Obtuse Angle Bracket that will later support the upper end of the Rod forming the polar axis.

Two $4\frac{1}{2}"$ Sector Plates are now secured as shown to the base of the model, and to these is bolted a $3\frac{1}{2}" \times 3\frac{1}{2}"$ Strip 4. To the centre of the Strip 4 is attached an Obtuse Angle Bracket 5, the purpose of which is to support the lower end of the polar axis.

Two $3\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strips are held in place between the $4\frac{1}{2}"$ Sector Plates by nuts and bolts, the two on one side being shown at 6 and 7. These Double Angle Strips form journals for the $3\frac{1}{2}"$ Rod 8 that is prevented from sliding laterally in its bearings by means of a 1" Pulley 9 and a Collar. A Collar 10 on the Rod 8 will be used later as a securing point for the cords by means of which the telescope is rocked, or turned about the polar axis.

The lower end of the Rod 8 carries a universal coupling that is constructed from a Small Fork Piece, a Swivel Bearing and two bolts. The free end of the universal coupling accommodates a $3\frac{1}{2}"$ Rod 11, on the outer end of which is carried a Bush Wheel forming the operating handle. The Rod 8 must be made fairly difficult to rotate by gripping the $3\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strip forming its lower journal between the 1" Pulley 9 and Collar. This expedient is necessary in order to keep the telescope at rest in any desired position. The $1\frac{1}{2}" \times \frac{1}{2}"$ Double Angle Strip, forming a journal for the Rod 11, is attached to the base by means of two $\frac{3}{8}"$ Bolts. The Bolts are locked in the end holes of the Double Angle Strip by nuts, and two further nuts are used on each Bolt to secure them to the base.

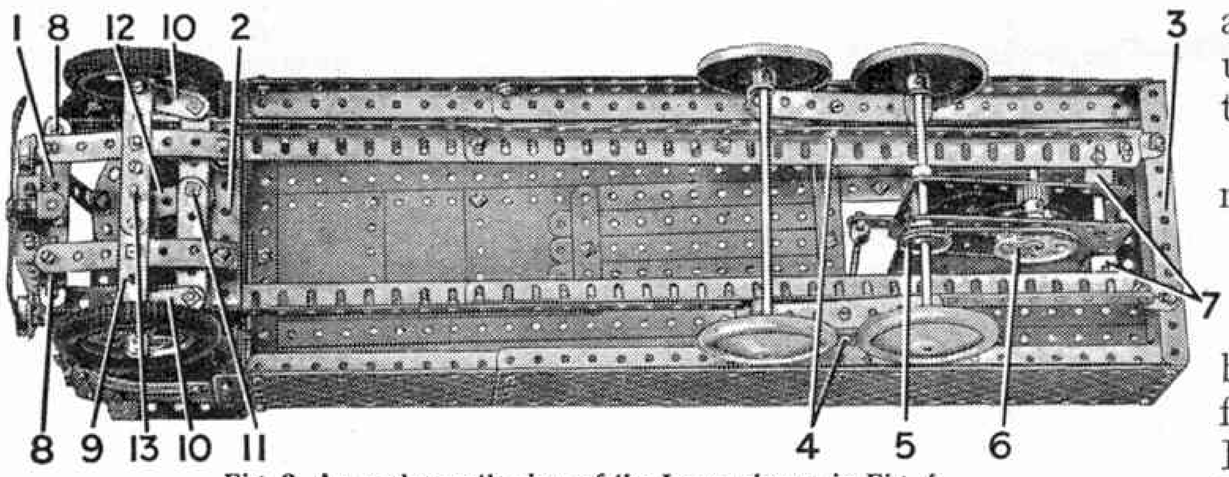


Fig. 2. An underneath view of the Lorry shown in Fig. 4.

The telescope proper is next constructed. A Boiler without ends is opened out until it has a diameter of 3", and the gap between its two edges is filled in with two $5\frac{1}{2}" \times 2\frac{1}{2}"$ Flexible Plates. These Plates overlap one hole each and where they are joined a $5\frac{1}{2}"$ Strip is secured in place. The end of this Strip is shown at 12, Fig. 1.

Two Double Brackets are now bolted to the $5\frac{1}{2}"$ Strip and these carry two $3\frac{1}{2}"$ Strips one of which is indicated at 13. This last mentioned Strip 13 forms a support for a $2\frac{1}{2}" \times 1"$ Double Angle Strip 14 that carries at its extremities two Flat Brackets. These form bearings for the Rod 15 on

which are locked a Worm 16 and 1″ fast Pulley 17.

A $2\frac{1}{2}''\times\frac{1}{2}''$ Double Angle Strip is now bolted to the telescope as shown, and this supports a 4″ Rod held in place by Spring Clips that represent the "finder." In practice the "finder" is a small telescope parallel to the large one, and a star or other object to be examined is first picked up by it, the large telescope then automatically pointing in the desired direction.

The two Bolts 18 hold in place two $\frac{1}{2}''\times\frac{1}{2}''$ Angle Brackets, in the unoccupied holes of which are locked two $\frac{3}{8}''$ Bolts. These Bolts are used for securing the 3″ Pulley 19 in place when the model is completed.

In Fig. 3 the polar axis and balance weight are shown. The polar axis consists of two Rods, 2″ and 5″, inserted in the Coupling 20 and carried in the Boiler End 21. The Boiler End is prevented from sliding on the Rod by means of four Spring Clips as shown. A 2″ Pulley 22 is locked on the 2″ Rod and it is prevented from turning by the Bolt 23 that engages one of the holes in the Boiler End 24. This latter part is carried on a 5″ Rod to which it is secured by a 57-teeth Gear and two $\frac{3}{8}''$ Bolts. The $\frac{1}{2}''$ loose Pulley 25 is used for spacing purposes.

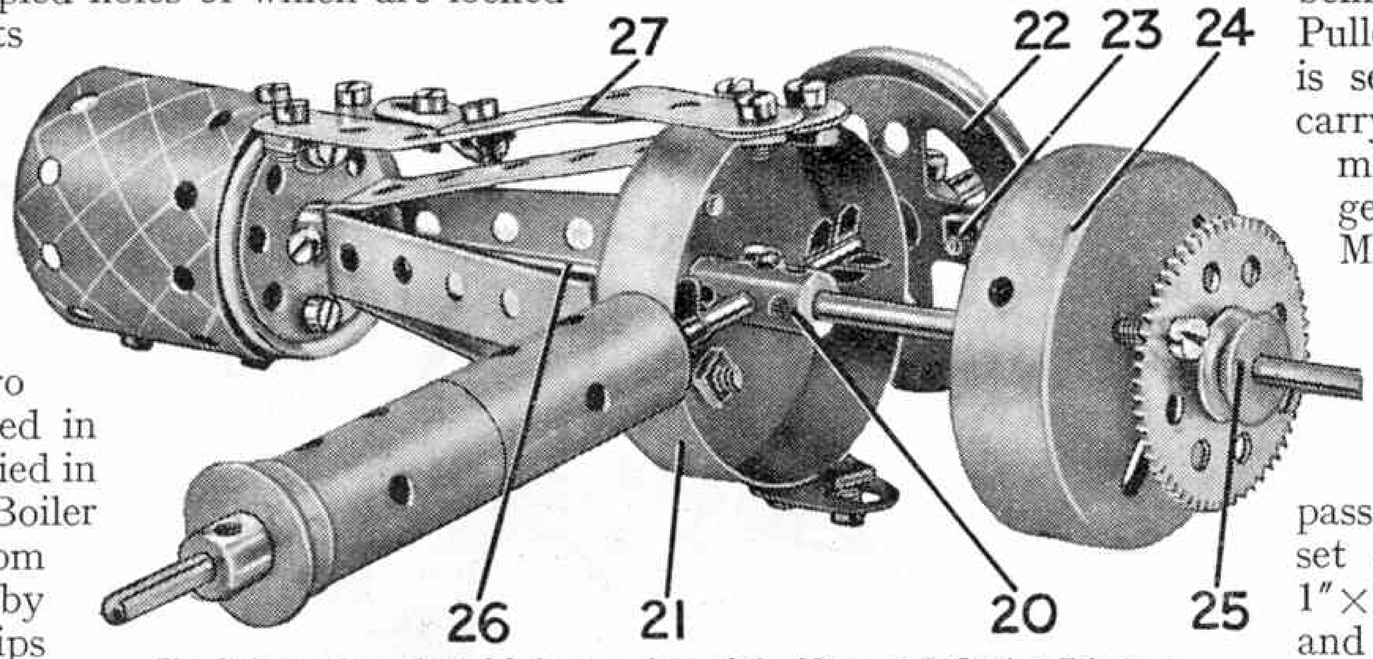


Fig. 3. The polar axis and balance weight of the Meccano Reflecting Telescope.

Two Flat Brackets are now bolted to the Boiler End 21, from which each is spaced by a Washer. These carry in their slotted holes nuts and bolts that secure the upper Boiler End to the lower one in the manner shown in Fig. 1.

The Rod carrying the Boiler End 24 is now passed through the telescope in the manner shown in Fig. 1, a 1″ fast Pulley pressing against the bottom inner surface of the telescope to hold the two units tightly together. The Worm 16 will now be found to mesh with the 57-teeth Gear secured to the Boiler End 24.

To complete the model the Rod forming the polar axis is journalled in the two Obtuse Brackets mentioned earlier, a second 2″ Pulley being fitted. The rocking cords, which pass round the two 2″ Pulleys in opposite directions and are secured thereto, are wound on the Rod 8, one being fitted clockwise and the other anti-clockwise. The two ends are secured to bolts in the Collar 10.

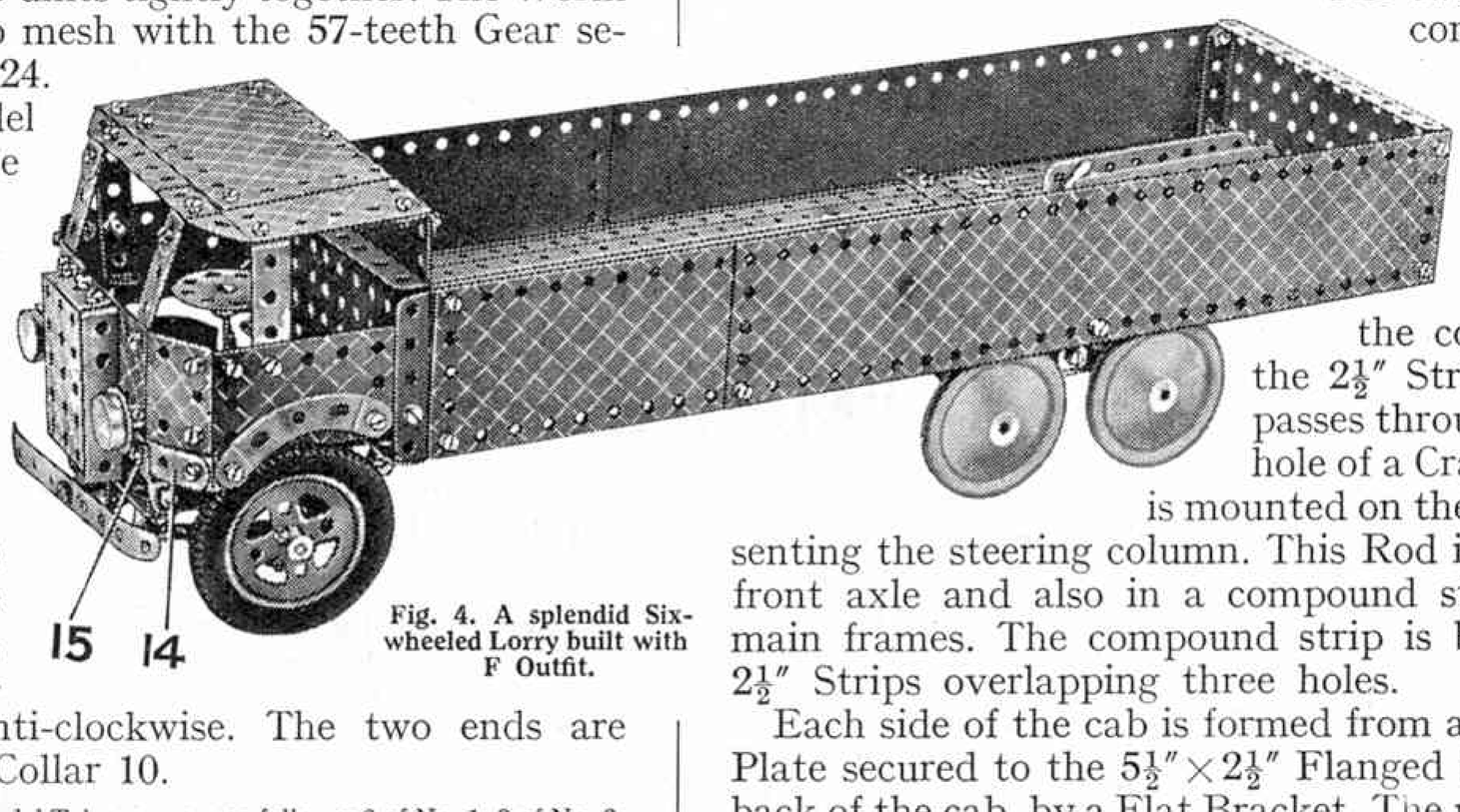


Fig. 4. A splendid Six-wheeled Lorry built with F Outfit.

The parts required to build the model Telescope are as follows: 6 of No. 1; 3 of No. 2; 6 of No. 3; 1 of No. 4; 1 of No. 6a; 2 of No. 8; 6 of No. 10; 2 of No. 11; 7 of No. 12; 3 of No. 12c; 2 of No. 15; 2 of No. 15a; 2 of No. 15b; 1 of No. 16; 1 of No. 17; 1 of No. 19b; 2 of No. 20a; 1 of No. 20b; 1 of No. 21; 2 of No. 22; 1 of No. 23; 1 of No. 24; 1 of No. 27a; 1 of No. 32; 6 of No. 35; 90 of No. 37; 10 of No. 37a; 13 of No. 38; 1 of No. 46; 1 of No. 48; 5 of No. 48a; 2 of No. 48b; 2 of No. 52; 3 of No. 53; 2 of No. 54; 4 of No. 59; 1 of No. 63; 2 of No. 111; 4 of No. 111c; 1 of No. 116a; 1 of No. 162; 2 of No. 163; 1 of No. 164; 1 of No. 165; 1 of No. 189; 4 of No. 190; 2 of No. 191; 2 of No. 195.

The second model is a miniature reproduction of a type of motor lorry that plays a very important part in modern road transport. Its construction is begun by building the main frames, each of which consists of two $12\frac{1}{2}''$ Angle Girders overlapping ten holes. They are connected together at the front by means of two $3\frac{1}{2}''\times\frac{1}{2}''$ Double Angle Strips 1 and 2, and at the rear the Girders are secured to a $5\frac{1}{2}''\times2\frac{1}{2}''$ Flanged Plate 3 by Flat Brackets.

Two Double Brackets are now pivotally attached to the main frames by means of $\frac{3}{4}''$ Bolts 4. These Double Brackets carry the rear wheel springs, each of which is represented by one $3\frac{1}{2}''$ Strip and one $2\frac{1}{2}''$ Strip. The ends of the $3\frac{1}{2}''$ Strips are fitted with $\frac{1}{2}''\times\frac{1}{2}''$ Angle Brackets that form journals for the 5″ Rods forming the rear axles. One of these Rods supports one end of a No. 1 Clockwork Motor, the drive being taken to the 1″ fast Pulley 5. The $1\frac{1}{2}''$ Pulley 6 is secured on a $1\frac{1}{2}''$ Rod carrying a $\frac{1}{2}''$ Pinion that meshes with the main gear of the Clockwork Motor as shown.

The rear end of the Clockwork Motor is supported by a $1\frac{1}{2}''$ Rod carrying a Collar at one end. This Rod passes through the upper set of holes of a pair of $1''\times1''$ Angle Brackets 7 and also through two suitable holes in the Motor side plates. This Rod is removed when winding the Motor.

The construction of the front springing and steering unit is carried out in the following manner. The $3\frac{1}{2}''\times\frac{1}{2}''$ Double Angle Strip 1 carries two $\frac{1}{2}''$ Reversed Angle Brackets 8, the projecting flanges of which point towards the centre of the chassis and carry the springs.

The front axle 9 consists of two 3″ Strips, overlapping three holes and bolted three holes from each end to the springs, as shown in Fig. 2. Each end hole of the front axle accommodates a $\frac{3}{8}''$ Bolt on which a $\frac{1}{2}''\times\frac{1}{2}''$ Angle Bracket and the $1\frac{1}{2}''$ Strip 10 are secured by lock-nuts. Two Washers are carried for spacing purposes on each $\frac{3}{8}''$ Bolt.

The two $1\frac{1}{2}''$ Strips 10 are connected together by a tie-rod built up from two $2\frac{1}{2}''$ Strips overlapping two holes. A Threaded Pin 11 forms the connection between the $2\frac{1}{2}''$ Strips, and its shank passes through the end slotted hole of a Crank 12. This Crank is mounted on the $3\frac{1}{2}''$ Rod 13 representing the steering column. This Rod is journalled in the front axle and also in a compound strip bolted to the main frames. The compound strip is built up from two $2\frac{1}{2}''$ Strips overlapping three holes.

Each side of the cab is formed from a $2\frac{1}{2}''\times1\frac{1}{2}''$ Flexible Plate secured to the $5\frac{1}{2}''\times2\frac{1}{2}''$ Flanged Plate, forming the back of the cab, by a Flat Bracket. The mudguard is represented by a $2\frac{1}{2}''$ large radius Curved Strip that is attached to a $5\frac{1}{2}''$ Strip 14 by an Obtuse Angle Bracket. The $5\frac{1}{2}''$ Strip is secured to the main frame by two $2\frac{1}{2}''\times\frac{1}{2}''$ Double Angle Strips, one of which is shown at 15. The inner turned up ends of these two parts project into the cab.

The parts required to build the model Six-Wheeled Motor Lorry are as follows: 6 of No. 1; 17 of No. 2; 6 of No. 3; 2 of No. 4; 9 of No. 5; 2 of No. 6a; 8 of No. 8; 7 of No. 10; 4 of No. 11; 13 of No. 12; 4 of No. 12a; 4 of No. 12c; 2 of No. 15; 1 of No. 16; 2 of No. 17; 1 of No. 18a; 2 of No. 20a; 2 of No. 20b; 1 of No. 21; 1 of No. 22; 1 of No. 24; 1 of No. 26; 118 of No. 37; 10 of No. 37a; 12 of No. 38; 6 of No. 48a; 2 of No. 48b; 1 of No. 51; 2 of No. 52; 4 of No. 59; 1 of No. 62; 4 of No. 90a; 2 of No. 111; 6 of No. 111c; 2 of No. 115; 1 of No. 116; 2 of No. 125; 1 of No. 186; 4 of No. 187; 2 of No. 188; 2 of No. 189; 4 of No. 190; 2 of No. 191; 1 of No. 193; 2 of No. 195; 2 of No. 197. Not included in Outfit: 2 of No. 142a and No. 1 Clockwork Motor.

Simple Models of Familiar Objects

An Ingenuity Contest

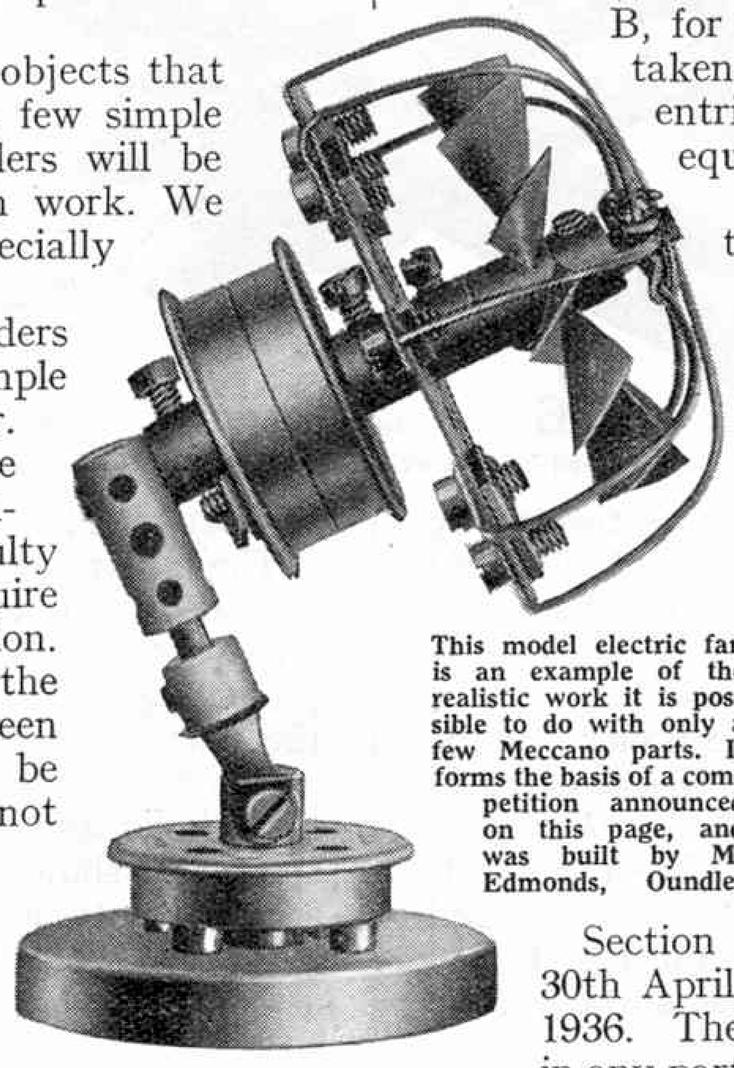
On this page is illustrated a simple and realistic model of an electric fan, an article with which every reader will be familiar. The outstanding feature of the model is its striking likeness to a real fan, and this is due to the skilful use that the builder has made of the few parts of which the model is constructed.

There are hundreds of other familiar objects that can be realistically represented with a few simple parts, and we think that model-builders will be interested in trying their skill in such work. We therefore announce a competition specially for entries of this type.

In entering the competition model-builders are asked to build models of any simple articles with which they are familiar. Models may represent objects used in the home, shops, or elsewhere, and competitors should not experience any difficulty in finding interesting subjects that require only a few parts for their construction.

Most readers will be familiar with the "Simplicity" Contests that have been organised in the past, and it should be understood that the present contest is not strictly a "Simplicity" Contest. Competitors may use as many parts as they wish in building their models for this contest, but models that incorporate unnecessary or non-Meccano parts will not win prizes. The quantity or nature of the parts used is left entirely to the competitor's discretion, and the aim should be to make the most realistic model possible using just as many parts as are necessary to that end.

Competitors may send in more than one model if they wish, and it is only necessary to submit either a photograph or a drawing. The actual model must not be sent. Each photograph or drawing should bear the competitor's full name, age and address, in capital letters.



This model electric fan is an example of the realistic work it is possible to do with only a few Meccano parts. It forms the basis of a competition announced on this page, and was built by M. Edmonds, Oundle.

The competition will be divided into two Sections: A, for competitors living in the British Isles, and B, for competitors living overseas. Age will be taken into consideration when judging the entries in order to give all competitors an equal chance of success.

The prizes to be awarded in each Section are as follows: First, Meccano Products value £3/3/–; Second, Products value £2/2/–; Third, Products value £1/1/–. There will also be five prizes of Products value 10/6 and five prizes of Products value 5/–.

It should be noted that photographs or drawings of prize winning models become the property of Meccano Ltd., but unsuccessful entries will be returned to competitors as soon as possible after the closing dates provided that a stamped addressed envelope is sent for that purpose.

Section A will remain open for entries until 30th April, 1936, and Section B, until 30th June, 1936. These dates ensure that readers living in any part of the world have ample time to prepare and send in their entries. Envelopes should be addressed to "Ingenuity" Contest, Meccano Ltd., Binns Road, Liverpool 13.

Correspondence relating to any subject not connected with the competition must not be enclosed in the same envelope as a competition entry.

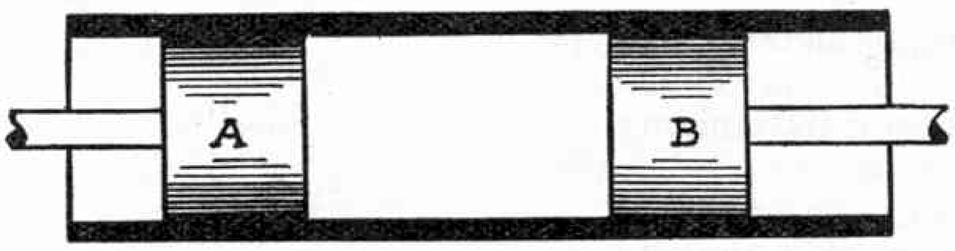
Meccano "Mechanism" Contest

In this contest competitors are asked to solve a problem that might be met in certain specialised engineering practice, and prizes are offered for the best solutions submitted.

The accompanying diagram shows two pistons, A and B, that work in an enclosed cylinder. Piston A has a stroke of 3 in. The problem is to design in Meccano suitable coupling gear connecting the two pistons, so that each stroke of the piston rod connected to piston A will cause piston B to move through a distance of about 14 in. Both pistons must move simultaneously in opposite directions.

Competitors need build only the cylinder with its two pistons and the necessary coupling gear. A complete machine is not required.

Actual models must not be sent. It is only necessary to submit either a clear photograph or a good drawing, together with a detailed explanation of the mechanism. Neither photographs nor drawings need be the competitor's own handiwork, but it is absolutely essential that the mechanism itself is his or her own unaided work.



There will be one Section only, and readers living in any part of the world may enter. The competitor's age, name, and address must be written clearly on the back of each photograph or drawing sent in. Envelopes should be addressed to March "Mechanism" Contest, Meccano Ltd., Binns Road, Liverpool 13.

Prizes will be awarded to the senders of the best solutions as follows: First, Meccano Products value £2/2/–; Second, Products value £1/1/–; Third, Products value 10/6.

The closing date for all competitions will be 30th June, 1936, so that readers living in the most remote parts of the world will have ample time to prepare and send in their entries.

Meccano Model-Building Contest Results

By Frank Hornby

"Autumn" Competition (Home and Overseas)

A feature of recent contests has been the excellent work done by the younger competitors, and it is a surprising fact that in many cases the standard of work in the Section for boys and girls under 14 has been far higher than that in the Section for older competitors. While I am delighted to know that even the youngest enthusiasts are capable of building really good models and of finding original subjects, I should like to see some of the older competitors taking more interest and care in the finishing of their work.

Very often an otherwise good model is spoilt for the sake of a little time spent in applying those finishing touches that make all the difference. The present competition, I am glad to say, shows an improvement in this respect, but considering the great number of entries submitted, the proportion of really first-class models was not quite as high as it should have been.

The prizes were awarded to the competitors named in the following lists:

Section A (competitors over 14)

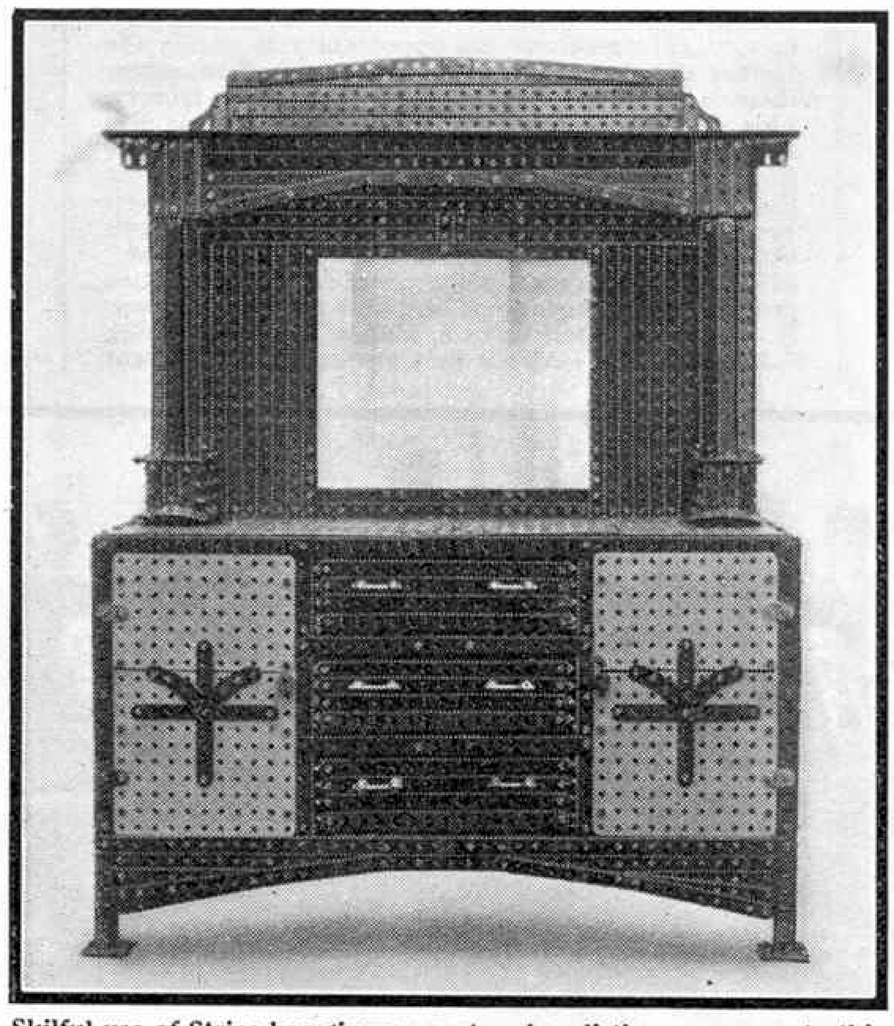
1ST, Meccano Products value £3/3/–: R. Thorpe, Preston. 2ND, Products value £2/2/–: J. Smith, Leominster. 3RD, Products value £1/1/–: G. Sercombe, Exeter.

Products value 10/6: R. Byers, Barnsley; R. English, Parkstone, Dorset; S. Griffiths, Liverpool 15; C. Lynch, Clifton, Yorks.; D. Marston, New Ferry, Birkenhead; K. Pim, Exeter.

Section B (competitors under 14)

1ST, Meccano Products value £2/2/–: E. Clements, Farnborough. 2ND, Products value £1/1/–: A. Aikman, Worthing. 3RD, Products value 10/6: T. Smith, Exeter.

Meccano Products value 5/–: J. Franks, Exeter; N. Fuller, Dagenham; P. Hands, Hillingdon; A. Horsfall, Edinburgh 10; J. Paterson, Roslin, Midlothian; P. Wickham, Leicester.



Skilful use of Strips has given a neat and realistic appearance to this model sideboard. It is the work of E. D. Clements, Farnborough, and won a First Prize in the "Autumn" Competition.

First Prize in Section A was awarded for a model that is a splendid tribute to its builder's powers of observation and attention to detail. It represents an elephant, with two impertinent-looking children on its back, being led by its keeper, and it was built by R. Thorpe. Each side of the elephant's body and head is made from Flat Plates, and its trunk, tusks, legs and tail are made from Strips and Curved Strips cleverly arranged and bolted together. The ears are Flat Trunnions. The figures of the keeper and children are made chiefly from Strips, Flat Brackets and Angle Brackets, and their heads from 1″ fast Pulleys.

The model that won Second Prize owes its success to its originality of subject. It is a reproduction of a ruling machine, of the kind used for printing the lines and margins on bill heads, foolscap and notebooks. The inkers are a row of reservoir type pen nibs that are held in a special frame borne on springs, which make the nibs press firmly against the paper. The sheets of paper are fed beneath the nibs by two sets of multiple cords, and after printing they pass round a roller, the surface of which is covered with blotting paper. This soaks up the ink and prevents smudges.

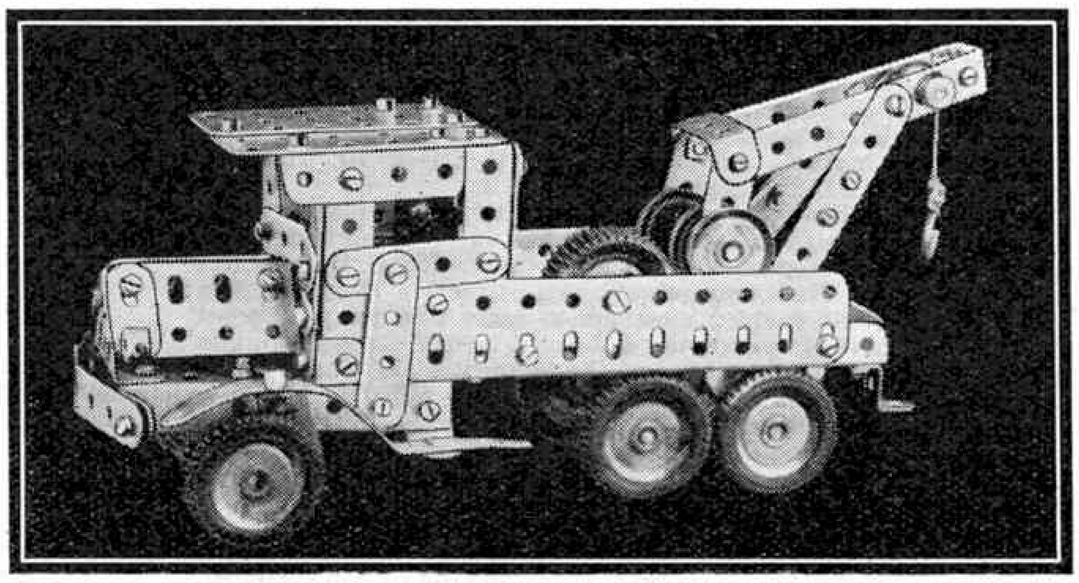
Third Prize in this Section was won by G. Sercombe, with a fine model of a radio gramophone. The model has hinged doors, and a lid that opens and is fitted with automatic lidstays. A fancy fret design, of the kind with which gramophone cabinets are usually decorated, is reproduced with an arrangement of Braced Girders. The record turntable is made from a Hub Disc.

The two models illustrated on this page are successful entries from Section B and were built by E. Clements and T. Smith respectively. Clements' model won First Prize and is a reproduction of a sideboard that forms part of the furniture in the dining room at his house. The model is plain in construction and I like it because it does not incorporate any unnecessary parts. The pillars on each side of the mirror—which incidentally is represented by a sheet of polished tin-plate—are made from Strips bolted round further Strips bent into circles. Curved Strips are used at the bottoms of the pillars to represent ornamental beadings that are a feature of the actual sideboard.

The model has two cupboards and drawers, all of which can be opened, the former being mounted on Hinges and held closed by means of a movable catch. The drawers are made from Flat Plates and Strips, and the nuts and bolts are so arranged that the sides are left perfectly free from projections, which would prevent the drawer from sliding easily. The handles are made with pairs of Handrail Supports connected by 1½″ Rods. The model is 2 ft. long, 1 ft. 10 in. high and 8 in. deep.

It was the simple construction and clean design of T. Smith's model breakdown lorry that attracted the judges' attention and earned it Third Prize. For the sake of compactness the chassis of the lorry is omitted, and the four rear wheels are attached to imitation leaf springs bolted directly to the rear platform of the lorry. The front wheels are not steerable but are mounted on a Rod that is journalled in bearings attached to two 3½″ Angle Girders. These Angle Girders form the foundation for the bonnet and driving cab. The breakdown crane is built up from Strips and has a winding drum made from a Rod and 1″ fast Pulleys.

A. Aikman did splendid work in building a model of a six-wheeled articulated lorry of the latest type, and if his subject had been more original he would no doubt have won First Prize. His workmanship is really remarkable for a model-builder of his age, and I hope he will continue to send in entries for these monthly competitions. The model he sent for the present contest is provided with a three speed and reverse gear box, clutch and differential gear, and the rear wheels are fitted with band brakes, which can be operated from the cab.



T. Smith, Exeter, won a Third Prize with this small model motor break-down lorry.

August "Errors" Contest (Overseas Section)

The following competitors were successful in winning the chief prizes in the "Errors" Contest announced in the August, 1935, issue of the *"M.M."*:

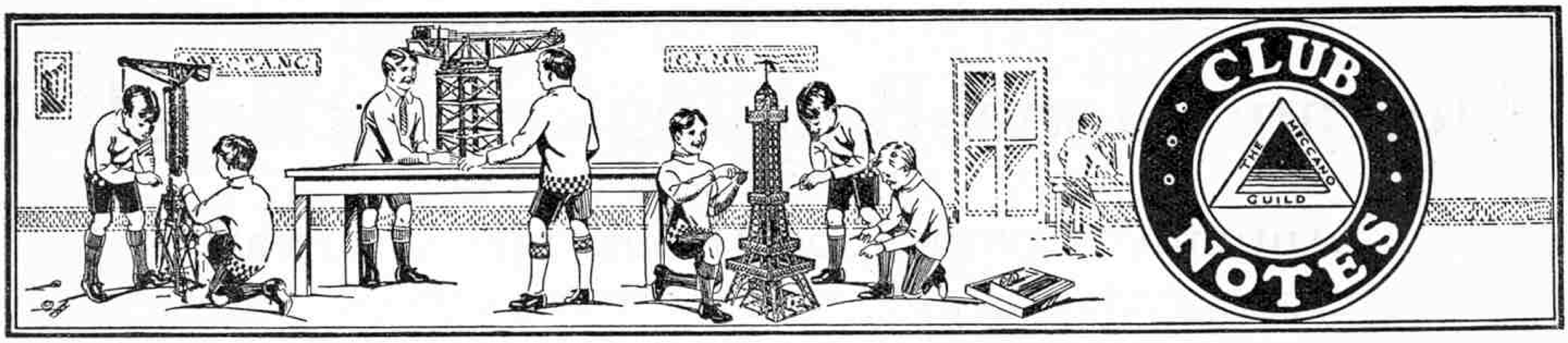
1ST, Meccano Products value £2/2/–: P. Demanuele, Hamrun, Malta. 2ND, Products value £1/1/–: J. Rodriguez, Montreal. 3RD, Products value 10/6: W. Bladergroen, Amsterdam.

Meccano Products value 5/–: D. Parker, Brussels; Ontario, G. Russell, Marton, New Zealand; R. Wille, Capetown; J. Capelli, Buenos Aires; D. Murison, Buenos Aires.

Summer "Realism" Contest (Overseas Section)

The chief prizewinners in the Summer "Realism" Contest are as follows:

1ST, Meccano Products value £3/3/–: C. Astrom, Morko, Sweden. 2ND, Products value £2/2/–: R. Myburgh, Capetown. 3RD, Products value £1/1/–: R. Hill, Toronto.



Exeter M.C.—Club statistics show that 200 models were built by the members last year, and that the average attendance at meetings was the highest since the club was affiliated in April 1925. The exhibits at a model Olympia Motor Show included racing cars, streamlined touring cars and several buses. Visitors to the show included motor engineers, and their compliments made the builders of the models blush with pride! Another attractive exhibit was a Meccano garage in which were 12 Dinky Toy motor vehicles. Club roll: 45. *Secretary:* T. W. A. Smith, 98, Ladysmith Road, Exeter.

Sid Vale (Sidmouth) M.C.—The first Winter Session closed with a Monster Competition, for which many models were built and the best of them illuminated. The event was a great success. The present Session opened with the annual New Year party, and everybody had a most enjoyable time. Club roll: 25. *Secretary:* L. R. J. Gliddon, Sheffield House. Sidmouth.

Stationers' School M.C.—This club has recently been revived and is now divided into General Engineering, Model Railway, and Electricity and Wireless sections respectively. The majority of the members belong to at least two of the sections, and this unity of interests, together with the general enthusiasm, has resulted in all meetings being well attended. At the second meeting a Lecture was given on "*The Progress of Engineering*" and later Lectures dealt with "*Scale-Model Coach Building*," "*Making Model Cars in Meccano*," "*Simple Circuits*" and "*Oil From Coal.*" The Model Railway section is constructing a scale model O-gauge scenic railway for exhibition at the school's Open Evenings. A visit to the Stratford Locomotive Works has been arranged. Club roll: 15. *Secretary:* R. J. Post, 8, Bourne Road, Crouch End, London, N.8.

Fraserburgh M.C.—The committee now meet each week. A recruiting campaign in December last proved very fruitful and many junior members were enrolled. The juniors now hold their own meetings, and these are being very well attended. The club's first birthday was celebrated by a party and dance, at which refreshments were provided. The club funds are in a flourishing state, and therefore additions are to be made to the club's stock of Meccano. Club roll: **34.** *Secretary:* W. J. Dawson, Phingask, Fraserburgh.

Wednesbury and District M.C.—An invitation from the Kidderminster Model Railway Club was accepted, and a very enjoyable time was spent with that organisation. Members obtained several new ideas that will help in running their own club more efficiently. An intensive recruiting campaign is being carried on, and it is hoped that it will result in a greatly increased membership. Club roll: 7. *Secretary:* A. L. Morgan, 17, Cobden Street, Fallings Heath, Wednesbury.

Hornsea M.C.—This club is divided into four sections called the Senior Scientists, Junior Scientists, Senior Engineers and Junior Engineers respectively. Several interesting Lectures and Cinema Evenings have been held, and the Junior Scientists' Section have held a series of Lectures each dealing with the history of a particular century. Another series has been concerned with Chemistry. Occasionally meetings of the Junior Engineers' section are devoted to Hornby train operations. Club roll: 13. *Secretary:* P. Thom, 5, Alexandra Road, Hornsea.

Old Charlton M.C.—A club Magazine has been started under the name of "*The Meccanic*," and it is hoped to publish it monthly. The first number contains contributions from several members of the club, and the Editorial staff are confident that every member will eventually discover himself to be a budding author! Club roll: 20. *Secretary:* W. Jaques, 60, Gurdon Road, London, S.E.17.

Bristol Grammar School M.C.—Model-building has been continued enthusiastically, and members took special pride in a fine model of a motor lorry which they built. An Exhibition was to have been held last Christmas but it was unavoidably postponed until the present session. Great preparations are being made to ensure it being an outstanding success. Club roll: 46. *Secretary:* N. E. Ricketts, 10, Belgrave Road, Clifton, Bristol 8.

Mallow M.C.—A second visit to the local sugar beet factory gave members the opportunity to obtain the further details of the plant they required to enable them to accurately complete their model of the factory. This model was displayed at the club's recent Exhibition, and was the subject of many compliments from visitors. Several new recruits were enrolled. At the close of the Exhibition the parents of members were entertained to tea in the club-room and afterwards witnessed a play entitled "*A Visit to Meccanoland*," which was presented by the members. An attractive programme is being carried out. Club roll: 16. *Secretary:* D. Hickey, 42, Ballydaheen, Mallow, Co. Cork, I.F.S.

Islington M.C.—At the first meeting of the present session an interesting lecture on "*Bridges*" was given by the Leader, and was listened to very attentively by the members. A topical talk about "*Frost and its Handiwork*" was given at a later meeting. New club officials have been elected, but they will be in office for only six months. This arrangement is considered to give all members a chance to attain office within a reasonable period. Model-building and Games evenings are held regularly. By way of further variation a club Tea Party has been held, and everybody had a great time. Club roll: 14. *Secretary:* K. V. Dines, 70, Thornhill Road, Barnsbury, London, N.1.

Middlesbrough M.C.—Further reorganisation has taken place, and the club has again been divided into the original four sections called Rods, Bolts, Clips and Nuts respectively. An attractive Hornby Train Night enabled members to carry out many different railway operations on the club layout. Games maintain their popularity, and the favourites are Kim's Game, Draughts and Table Tennis. Club roll: 36. *Secretary:* L. Shepherd, 29, High Street, North Ormesby, Middlesbrough.

Members of the Tynecastle School (Edinburgh) M.C. This club was affiliated in February 1929, and its activities include model-building, Hornby train operations, and games. A Dramatic Section is responsible for the production of short plays at the club's Exhibitions.

AUSTRALIA

Melbourne M.C.—Meetings have chiefly been devoted to Hornby train operations. The club electric control board has been rebuilt and the system extended, nearly all points and track sections now being electrically interlocked, so that all tracks are worked under single line conditions and the probability of collisions is thereby greatly reduced. A scheme of "master control" colour-light signals based on that used on the Victorian Government Railways has been introduced, and each member acting as a "driver" has to obey them. There is one master signal for each oval or section of track, and it is operated with a Hornby resistance controller. The club were pleased to receive a copy of "*The Sydney Meccanomag*," published by the Sydney M.C. Club roll: 12. *Secretary:* L. Ison, 8, Hayes Street, Northcote, N.16, Victoria, Australia

CANADA

Montreal Central Y.M.C.A. M.C.—Most of the recent meetings have been devoted to model-building, and instructive talks and demonstrations in the use of Meccano Parts have been given. A large cupboard has been installed in the clubroom for the storage of members' Meccano and Hornby equipment. Plans have been made for visits to the works of the "*Montreal Daily Star*" and the Gillette Razor Blade Company. At the moment the club is without a secretary, as the former holder of this office has left Canada. A successor is to be appointed shortly. Club roll: 12. *Leader:* Mr. J. Rodriguez, 1900, Tupper Street, Apartment 4 Montreal, P.Q., Canada.

EGYPT

Cairo M.C.—Several new members have recently been enrolled. Model-building is being continued enthusiastically, and models completed recently have included a large monoplane, upon which members have been complimented by visitors to the club. A library has been started, and is already very popular. Club roll: 25. *Leader:* Mr. Mohamed F. Awad, 7, Atfet El Zawia Haret El Gameh, Cairo.

ITALY

Milan M.C.—The name of the Photo-Chemical-Electrical Section has been changed to Scientific Section, and that of the Cinema and Sports Section to Amusement Section. The second Ping-Pong Tournament was concluded recently. It proved immensely popular, and was an even greater success than the first one. The Programme Committee called a special meeting to consider future programmes, and a very useful discussion took place. Club roll: 14. *Secretary:* E. Vigo, Corso Genova 19 Milan.

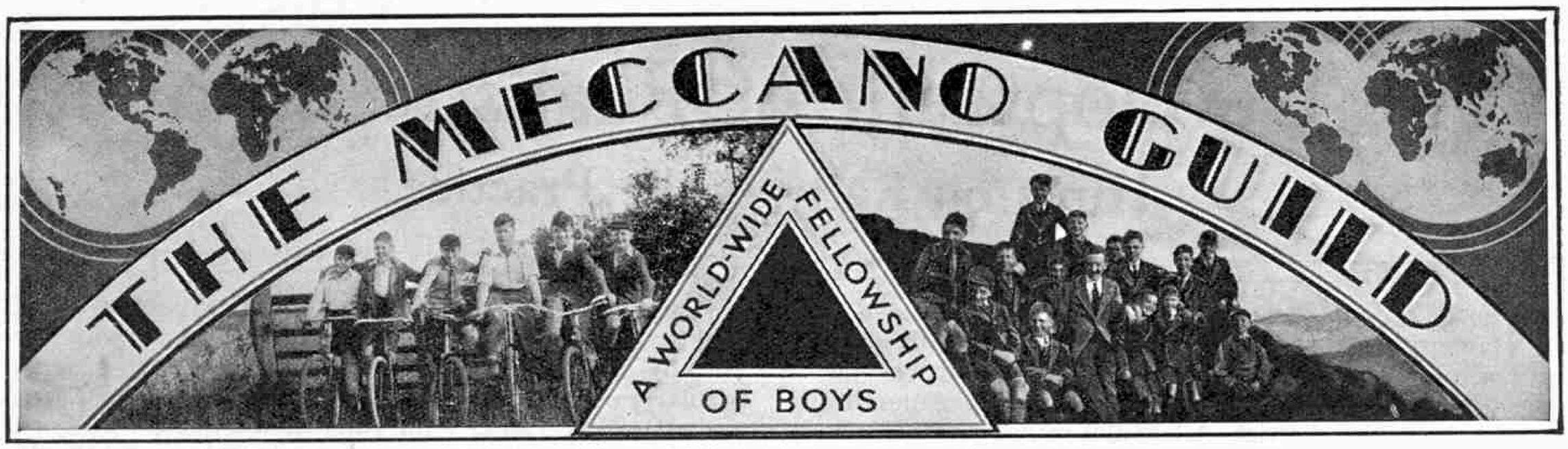
NEW ZEALAND

Christchurch M.C.—Mr. R. A. Handisides, for so long Leader of the club, has been elected President, and Mr. J. Ancall appointed to succeed him as Leader. Most meetings are held out-of-doors at present, as it is summer in New Zealand. Cycle runs, picnics and games such as Cricket are the chief activities of the members. During a recent holiday the members went on a ramble round Lyttleton Harbour and in the course of their travels they were permitted to make a tour of the liner "*City of Tokio*," which was in port. The club has become acquainted with an invalid boy who is a keen Meccano enthusiast, and visits are being paid to him. On a recent visit by several members some large models built in the clubroom were taken, and the invalid enjoyed the surprise immensely. Club roll: 20. *Secretary:* L. W. Best, 28, Circuit Street, Strowan Christchurch.

SOUTH AFRICA

Pioneer M.C.—A fine display of models was arranged at the Maritzburg Amateur Horticultural Society's recent Exhibition in the City Hall, and attracted a great deal of attention. Club roll: 12. *Secretary:* A. H. Alley, 461, Burger Street, Pietermaritzburg.

Berea M.C.—Many enjoyable meetings have been held and the attendance has been very good. The Girls' Section has been disbanded, but the girls who still remain in the club continue to take a very keen interest in its activities. A dance has been held and the visitors included Mr. Sykes and several members of the Malvern M.C. The club co-operated with the Malvern M.C. in staging a splendid display at the Johannesburg "*Star*" Models and Hobbies Exhibition. The display took the form of a model of a Swiss mountain railway, and Hornby Riviera "Blue Trains" were operated over the track. Occasionally Games Evenings have been held, and two outdoor Tennis Tournaments have been played on a court kindly loaned by one of the members. An effort is being made this session to recruit more members. Club roll: 20. *Secretary:* L. Michelow, 74, Hillbrow Street, Berea, Johannesburg.



Planning Well Ahead

The second of the two winter sessions ends this month, and although it is so early in the year Leaders and officials of Meccano clubs are beginning to think of summer programmes. This is a very sound policy. A great deal of the falling-off in attendance of which some Leaders complain during the summer is due to failure to prepare a plan of campaign sufficiently far in advance. Although Meccano has so sure a hold on the affections of all Meccano boys, it takes second place during the bright days and long evenings of summer, when members naturally prefer to be out-of-doors. If they get the feeling that there is nothing very definite ahead they immediately lose interest, and this, of course, is fatal to the success of the club.

I therefore earnestly recommend those club Leaders and Secretaries who have not already done so to make arrangements for continuing their clubs during the summer months. It is not too soon to begin to form these plans, as practically all outdoor activities require a certain amount of preparation, and their success depends entirely on the efficiency with which this is carried out.

Cycling and Rambling

The importance of early preparation is perhaps greatest in the case of clubs that intend to run a Cricket team, as nothing is more disheartening to a club than to find that it cannot obtain even a moderately full programme of fixtures, because application has been left until the beginning of the season. Cricket fixtures should be drawn up in good time, therefore, otherwise it will be found that local clubs are booked up and there will be little opportunity of securing a good fixture list.

If it is proposed to form a Cycling section, every effort should be made to get the members together and map out the programme for at least the first part of the season. It will be found that members will be much more enthusiastic when a definite programme has been arranged, as they will then know exactly what is going to take place. It may happen that some members are more keen on walking tours and do not wish to take part in Cricket or Cycling. In these cases walking expeditions may be arranged to take place once a week, when the surrounding country can be explored.

The Problem of the Small Club

It is a comparatively easy matter for a large club to plan out a comprehensive outdoor programme, because it has sufficient members to carry out a great variety of schemes. The position is much more difficult for small clubs, however. There are many clubs whose membership does not permit of the formation of a Cricket team or even of a Cycling section, and there is a danger that the Leaders of these clubs may come to the conclusion that it is not worth while to try to struggle on through the summer, and that the best plan is to close down until the first winter session arrives.

I admit that in a few cases local circumstances make it practically impossible to carry on during the summer, but as a general rule it is not only possible but preferable to have regular meetings throughout the long days, although perhaps at less frequent intervals than during the winter.

An interesting snapshot from New Zealand. Mr. W. C. Taylor (wearing cap), leader of the Ashburton M.C., and Mr. R. A. Handisides, President of the Christchurch M.C., enjoying a friendly chat, probably about the progress of their respective clubs.

The Value of Interesting Club Reports

Club reports that reach me by the same mail sometimes present striking contrasts. The other morning, for instance, I received very different reports from two clubs that have been established a considerable time and have fairly large memberships.

The first report mentioned the more important of the models built by the members during the month, and included some interesting comments on a club Model-building Competition that had proved very popular. The names of the winners and the types of their models were also given. Lantern lectures are liked at this club, and the secretary gave me a list of those held since his previous report, and added a few details about them. Recent Games Nights were also considered worthy of mention, and I was very interested to read that during the month some new games had captured the members' enthusiasm, and that a few that had been very popular have been dropped for a while. This excellent report thus gave me both an adequate summary of the month's happenings and an insight into the members' reactions to them.

The second report was very brief, and merely told me that "during the month the club has made steady progress and the meetings have been well attended." I could not help feeling that the secretary of this club had missed his opportunity of giving his club a chance of well-merited publicity in the "Club Notes" page of the *"M.M."* I was certainly disappointed, as from what I know of this club I am sure that its activities are fully as interesting and varied as those of the other club I have mentioned.

There is a moral in all this, of course, and I think it is a fairly obvious one. I hope, therefore, that those secretaries who have not been in the habit of sending me really interesting reports will try to do so in future, and thus help me to make the club's enterprise and activities known to all the Guild. There can be no better means of conveying to Meccano enthusiasts some idea of the enjoyment of club life than a description of recent activities which show that a club is really alive.

The Correspondence Club

Last month I referred to the many boys in France and Egypt who desire to write to members in this country. Several English boys have since applied for correspondents in those foreign countries, but the waiting list is still long, and I shall be glad to hear from other members who would like correspondents in France or Egypt.

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:

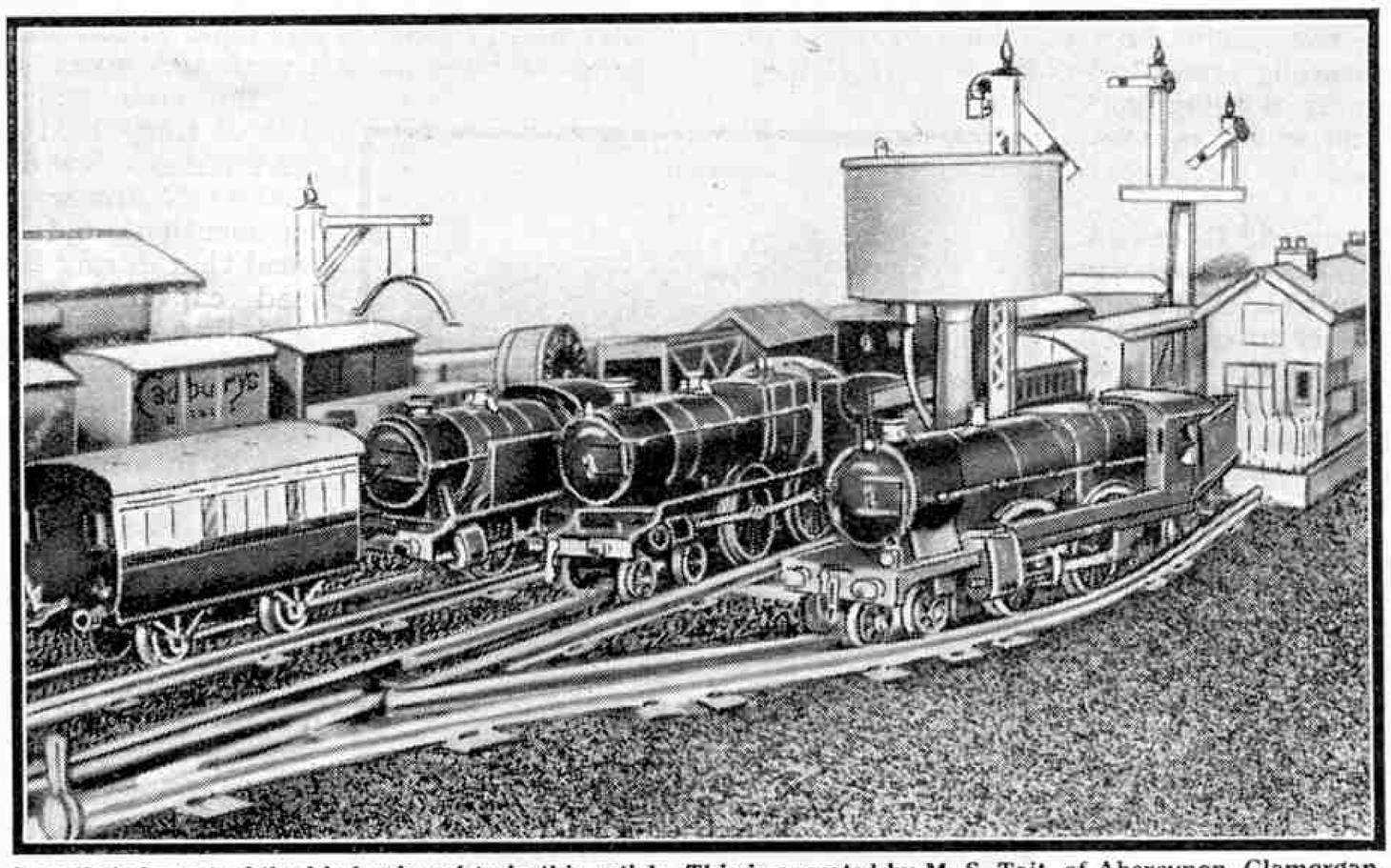
BARNARD CASTLE—S. W. Telfer, York House, The School.
GREAT YARMOUTH—N. F. Gowther, 28, Hamilton Road.
HASTINGS—G. Hills, 21, Wellington Road.
NEW GALLOWAY—G. Warnock, "Dalgowan," New Galloway.
ROMFORD—L. Jones, 39, Rosedale Road.
SOUTH AFRICA—W. Ingle, 1, Queen Street, Malvern, Johannesburg.
THORNTON HEATH—J. E. Baker, 53, Westminster Avenue.

The Development of Realistic Layouts

Hints on Railwaylike Practice

NEARLY all miniature railway owners have a favourite real system. Some might find it difficult to say why one railway group appeals to them more than the others, but usually the favourite group is the one that serves their own district. All model railway enthusiasts are agreed on one point, however, and that is the desirability of reproducing as closely as possible the features of their favourite system on their own Hornby Railway layouts. In this article we give a few general hints on the development of layouts of this kind, for the special benefit of new readers.

As a rule it is best to adopt one's local railway as a prototype, for then traffic can be actually observed, and the favourite pastime of "watching the trains" turned to good account. If the traffic commonly handled is noted, also the rolling stock, then similar arrangements can be made in miniature. The range of rolling stock in the Hornby Series is such that little difficulty is experienced in representing almost any kind of train.



A realistic layout of the kind referred to in this article. This is operated by M. S. Tait, of Abercynon, Glamorgan, and reproduces the practice of the G.W.R.

Passenger trains are frequently given chief attention and, as pointed out in the article on pages 118 and 119 of the "*M.M.*" last month, it is possible to make up most realistic passenger trains ranging from luxurious Pullmans down to the ordinary locals. Mixtures of passenger rolling stock from different groups should be avoided, unless the section or group concerned is one where joint and through working is extensively practised. If the layout is intended to be a joint concern from the outset, and always to be so operated, then of course it is necessary to provide the passenger vehicles of two or more Companies.

With freight stock however the situation is different. One frequently sees the wagons of all groups intermingled on the one train. But it should be remembered that any special types of wagons peculiar to one group that work through to another system are always returned to their owners as soon as possible. They are not despatched elsewhere, as are the ordinary vehicles whose working is shared by the different Companies.

In selecting the rolling stock for a system care should be taken that the right types of vehicles are chosen, according to the traffic to be dealt with. In mining districts for instance numbers of vehicles say for fruit or other special perishable traffic will not be common objects in the sidings. Open wagons will be required and if coal or minerals for shipment are to be dealt with the Hornby Hopper Wagon is a useful type to possess. Similarly in making up trains odd vehicles of special type such as a Milk Van or Milk Tank should not generally be included in an ordinary pick-up goods train. They should be conveyed in a fast freight service or, if convenient, by passenger train.

The layout of which part appears in the illustration on this page is one of many that we know of where the features of an actual system are carefully observed. This is operated by M. S. Tait of Abercynon, Glamorgan, and as might be expected it represents the G.W.R. Typical G.W.R. stock is therefore employed and for the haulage of the trains Hornby G.W.R. Locomotives are exclusively employed. Three of them appear in the photograph, a No. 3C "*Caerphilly Castle*," a No. 2 Special "*County of Bedford*" and a No. 1 Special Tank, the last-named representing the numerous "Prairie" tanks of actual practice. The domeless boilers and characteristic appearance of these engines alone suggest the correct "Great Western" atmosphere.

As with the locomotives themselves so should the duties of the different engines be correctly arranged, as far as possible. Tender engines are necessarily used for main line work but a feature of modern locomotive operating is the use of them also on local work, in order to fill up time between more important turns. This is an advantage from the point of view of the Locomotive Running Superintendent of a miniature railway for it allows him to make the utmost use of a number of engines that appears comparatively small for the amount of work to be done.

Other features to watch are the practices of different Companies with regard to the use of two locomotives on one train. For instance on the G.C. and N.B. sections of the L.N.E.R. the assistant engine is attached to the train itself, not in front of the train engine. The latter therefore occupies the leading position; this custom ensures that the driver of the engine booked to work the train retains full control of affairs at the front end.

In the arrangement of accessories it is desirable to make the station layouts and such items as level crossings as much like the real thing as possible. Signals and signal cabins, cuttings and tunnels also play important parts.

The Mechanical Handling of Freight Traffic

Bale Stacking and Transporting Truck

THE use of mechanical equipment for the handling of freight at terminal and transfer points has been greatly extended by railways in recent years. In certain conditions where a particular type of traffic is heavy and more or less constant, special plant for its handling is necessary. A most interesting special appliance has recently been adopted by the L.M.S.R. This is known as a Bale Stacking Truck and two are in use at the goods depot at Frizinghall, near Bradford. This truck has been developed and manufactured by the firm of Wingrove and Rogers Ltd., of Liverpool. It is designed to grasp, elevate, and stack bales of wool or other items of freight of a similar nature. It can also pick a bale from a stack and convey it to a required spot, the whole of the operations being under the control of one man.

The miscellaneous nature of the freight dealt with by the L.M.S.R. at Frizinghall—a common characteristic of railway goods traffic—results in the bales there being of numerous shapes and as many different sizes. The stacking trucks however handle them all equally easily and are capable of dealing with bales up to five tiers high. At Frizinghall there is a roller conveyor for transporting bales in and out. A section of the conveyor is removable, as shown in the photograph on this page, in order to allow free movement on the part of the truck and the staff.

One of the Bale Stacking Trucks in use at Frizinghall, L.M.S.R., stacking bales of wool. Illustration by courtesy of Wingrove and Rogers Ltd. of Liverpool, the makers of the truck.

The vehicle consists essentially of a battery driven truck of the type commonly used for factory work, on which a framework and jib are mounted very much after the style of a crane. The chassis and jib of the truck are largely fabricated by electric arc welding. The jib can be elevated or lowered as required by means of a rope connected to the winding drum or winch. At the head of the jib are fitted special jaws for grasping the bales to be dealt with. These jaws are kept open by spring gear except when rope pressure is applied. On the latest trucks, such as those in use at Frizinghall, a special parallel motion device ensures that the jaws keep the bales level. It is of particular interest that the application of this motion was worked out experimentally by means of a model made of Meccano Parts, yet another instance of the use of Meccano in invention and industry.

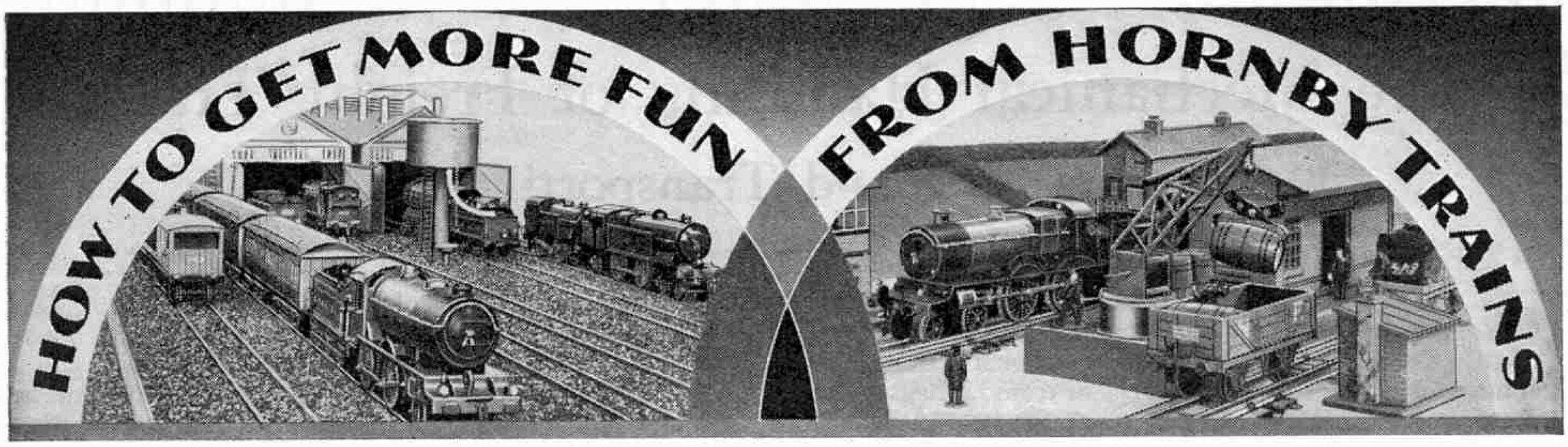
Two electric motors are mounted on the truck chassis. One is for propelling purposes and is connected to the driving wheels by means of chains. The other motor is for hoisting and from this the drive to the winch is taken first through a worm reduction gear and then by means of a guarded spur gear. The winch gear has an automatic solenoid brake which will hold the load in any position when current is off.

Two controllers operate the motors, and there are three speeds of operation for the lifting gear and three speeds for travelling. When the jib reaches the limit of its travel an automatic switch comes into action and cuts off the power. The brakes fitted to the driving wheels are interconnected with the travelling controller and when the truck is not travelling they are always on. They are released by the depression of a foot pedal on the driving platform, which must be kept down all the time the truck is in motion. If the truck is stopped suddenly by means of the brake alone, the travelling controller handle must be brought back to the "off" position and the brake released before power can be applied to start the truck.

The speed of operation of the truck is striking. On an average it takes 2 sec. for a bale to be picked up and, without a pause in the motion, it can be lifted to the top tier of a stack in 8 sec. The travelling speed of the truck is 5 m.p.h. with a load, although the truck is not primarily intended for carrying purposes but is essentially for stacking. In certain warehouses the bales are hand-trucked to the pile and the stacking truck is then used solely for its designed purpose. On this work, stacking to three tiers high, 200 bales an hour can be dealt with.

The battery which provides the power supply for the motors consists of 16 lead cells of 161 ampère-hours capacity. It is contained in a steel box below the truck. The battery container itself is mounted on roller-bearing steel wheels and slides out sideways when it has to be removed for re-charging. A hand trolley is placed to receive it and the removal of one discharged battery and its replacement by a freshly-charged one can be carried out in 5 min. As a general rule 1,000 bales can be stacked before a further charging of the battery is necessary.

The whole truck with its hoisting gear can be turned within a circle of 8 ft. radius.

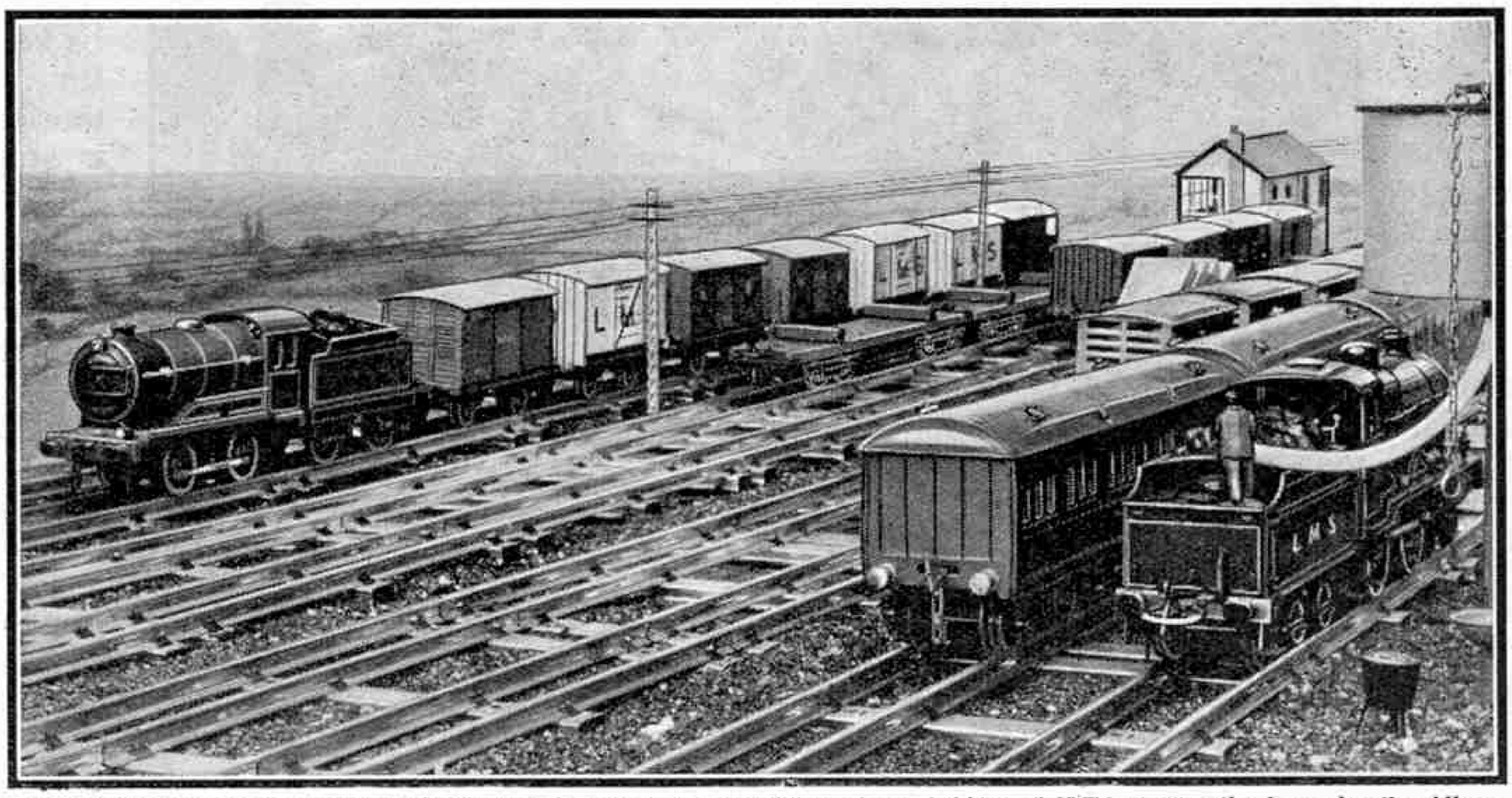


A JOINT RAILWAY SYSTEM

ON many occasions recently we have received requests from readers that we should deal with suggestions for joint railway working of an interesting character. We have therefore decided this month to consider the working of the Cheshire Lines Railway, the largest of all the British joint lines. This is familiar, at least by name, to many readers in the North of England, but perhaps not so well known elsewhere. The L.N.E.R. and the L.M.S.R. are the partners in this concern, which is managed by the Cheshire Lines Committee, two-thirds of whom are L.N.E.R. representatives and the remainder L.M.S.R. This proportion is explained by the fact that in pre-grouping days the Great Central, Great Northern and Midland Railways each had a one-third interest in the system, the two first-named companies being now part of the L.N.E.R.

Although the system is known as the Cheshire Lines, its chief main line stretches from Manchester to Liverpool, the station in each city being called "Central." Connection is made intermediately with a line from Godley Junction on the L.N.E.R. (G.C. Section). Cheadle Heath is the point where connections are made with the L.M.S.R. (Midland Section), as we mentioned in April 1932 in the article "A Miniature Midland Section," which dealt with the operation on a Hornby layout of the Manchester services from St. Pancras. These trains are known familiarly as the "Twenty-fives" from the fact that they all depart from London at 25 minutes past a particular hour.

Although the Cheshire Lines has no engines of its own, it has its own rolling stock. The L.N.E.R. therefore provide the motive power for all joint trains and for those working through to the L.N.E.R. system. Through services to the Midland Section of the L.M.S.R. are handled by engines of that company. This adds to the interest and variety of the locomotives to be seen. The coaches in use vary from the oak brown vehicles of the Cheshire Lines to the familiar red of L.M.S.R. stock. On a Hornby layout the working on the same system of L.N.E.R. and L.M.S.R. locomotives will follow actual practice, and some really good fun is to be had in this way, especially when two or more Hornby Railway owners combine their stock to form a joint layout of this description and operate suitable services.

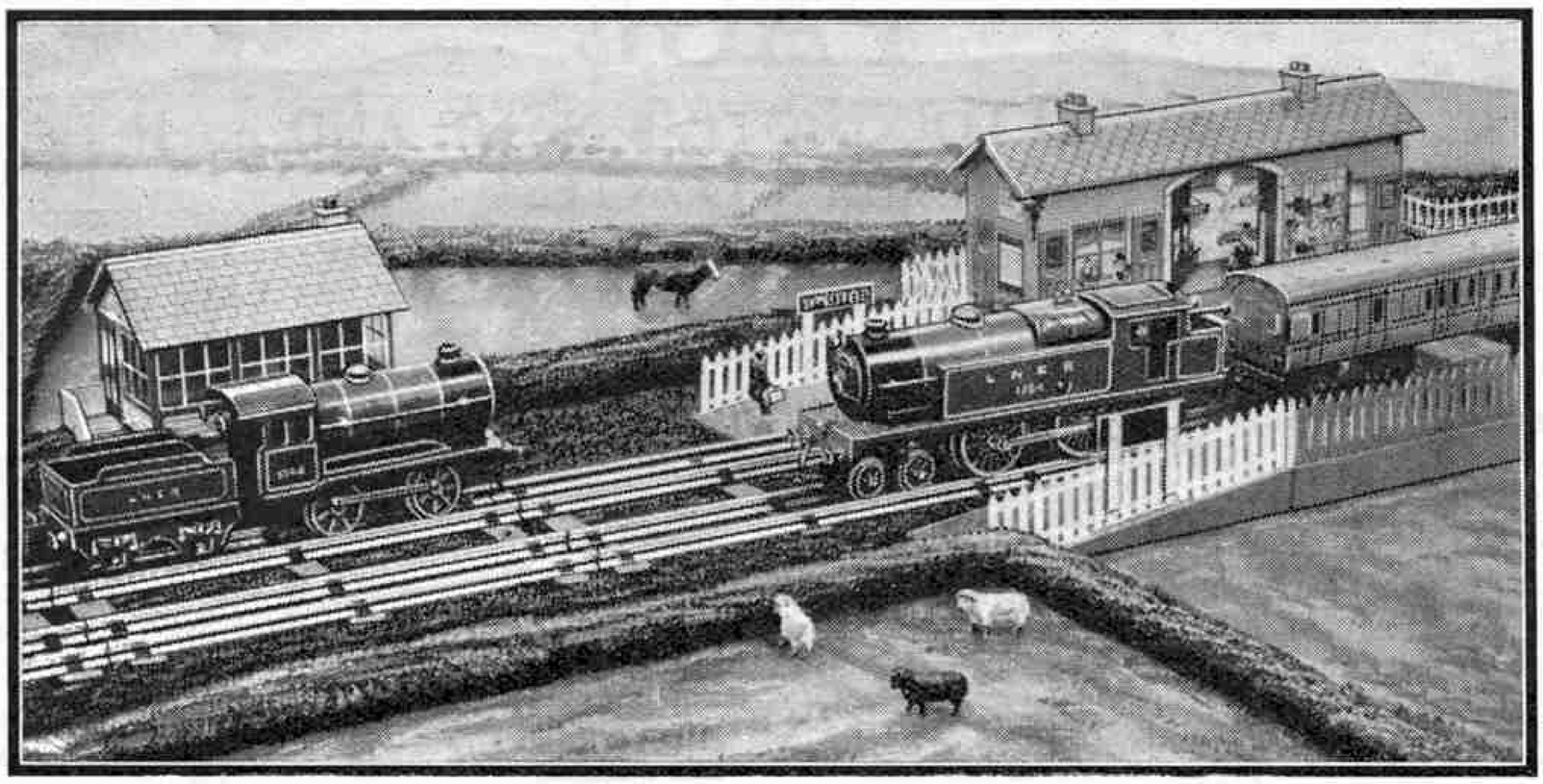


An interesting scene on a jointly-operated Hornby layout. A fast freight train hauled by an L.N.E.R. locomotive is passing the sidings where an L.M.S.R. No. 2 Special Locomotive is about to "take water" from the Tank.

The chief expresses of the Cheshire Lines are those connecting Manchester and Liverpool. They were the first to provide an hourly service between the two cities, and their clockwork-like regularity has earned for them the nick-name of the "Punctual" service. For the make-up of these trains in miniature Hornby No. 2 Coaches in L.N.E.R. colours can be used very well, as their finish is similar to that of the Cheshire Lines stock. Alternatively those who possess Hornby Metropolitan Coaches can use these and, in addition, they can employ them to represent L.N.E.R. vehicles when required. L.N.E.R. locomotives are always used for these trains.

Very important too are the "North Country Continental" trains whose running was described in detail in the "*M.M.*" for February 1929. As far as the Cheshire Lines system is concerned these provide a through connection once each way daily between Liverpool and Parkeston Quay, Harwich. As these are corridor trains with restaurant facilities Hornby No. 2 Saloon Coaches will be best for representing them in miniature. For the kitchen portion of the Saloon Coach doing the duty as a restaurant car we can make use of a scheme previously suggested in these pages. If a strip of tracing paper is

inserted between the celluloid "glass" and the sides of the vehicle, so that two windows at one end on both sides of the coach are covered, it will give the effect of the frosted finish frequently used on such windows in actual practice. To insert the paper it is necessary to remove the roof, but there is no difficulty in this as the roof is secured by four brass "ventilators." These can be unscrewed and later replaced without trouble.

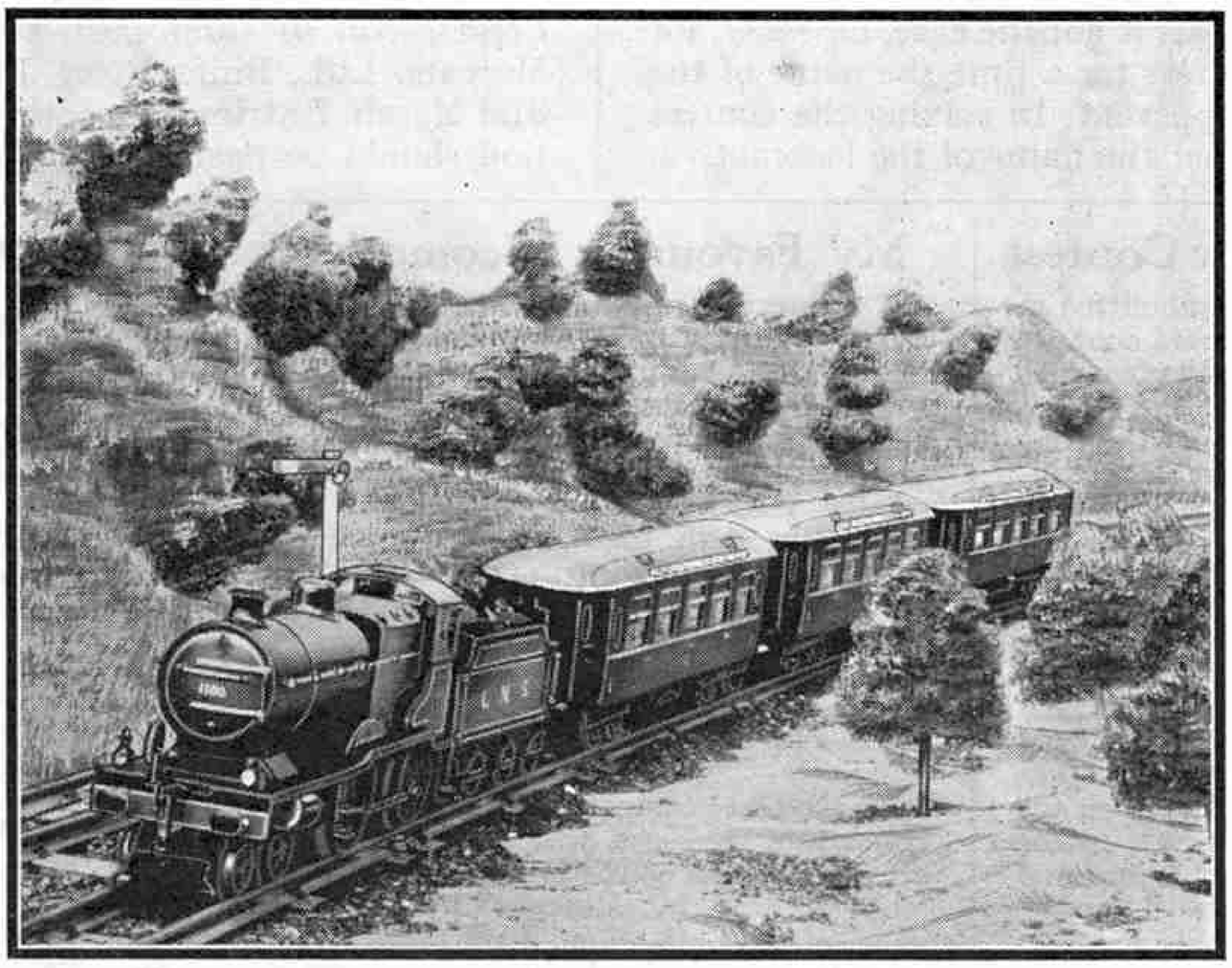


Passenger and goods trains passing at a wayside station. The passenger train is a local of Hornby No. 2 Coaches, with a No. 2 Special Tank Locomotive; the goods engine is a Hornby No. O Locomotive.

For the through L.M.S.R. services between "Liverpool" and "Cheadle Heath," where they could connect either actually or in imagination with miniature "Twenty-fives," No. 2 Saloon Coaches in L.M.S.R. colours can be used. These represent end-vestibuled corridor stock with wide windows as now commonly used on L.M.S.R. main line trains. A Hornby No. 2 "Standard Compound," a typical Derby design, could be employed as representing the Midland engines employed.

Local and goods trains on the Cheshire Lines are handled by L.N.E.R. locomotives, chiefly of G.C. design, although standard L.N.E.R. types are employed to some extent. There is thus every reason for the employment in miniature of the standard types of Hornby Locomotives in L.N.E.R. colours. L.M.S.R freight engines also appear on through trains. The Cheshire Lines System is connected with the Liverpool Docks and thus deals with a heavy import and export traffic.

The greatest occasion in the year for special working on the Cheshire Lines is in connection with the Liverpool Spring Race Meeting, particularly on the day of the Grand National Steeplechase. The Cheshire Lines is then honoured by the visit of an all-Pullman Special from King's Cross that is always hauled by an L.N.E.R. "Pacific." This is the only occasion in the year when either this type of engine, or car, is seen in that part of the country. This working through is certainly deserving of reproduction on a miniature system for the Hornby Pullmans are very representative of the actual cars used. For the locomotive a No. 3 "*Flying Scotsman*" would be the obvious choice and the appearance of such a train will be very fine, especially if the coaches are provided with suitable name-boards bearing the words "Pullman Race Special." Suitable boards can be made at home from strips of card, the necessary lettering being put on with ink or paint as preferred.



An L.M.S.R. express in miniature. The Hornby No. 2 Saloon Coaches that compose it represent in an appropriate manner the end-vestibule corridor stock of actual practice.

In addition to this "Super-Special" other trains of ordinary stock are run in great numbers from practically all sections of the L.N.E.R., with a corresponding variety in the types of engines to be seen. A regular feature of this race traffic is the operation of a special train of horse-boxes which is run from Newmarket on the G.E. Section of the L.N.E.R. This running would be interesting in miniature although No. 1 Cattle Wagons would have to be used to make up the train, as the Hornby Series does not yet include horse-boxes. In this connection the Horses of the Series of Meccano Dinky Toys (Dinky Toy No. 2a) could be employed quite well in arranging realistic loading and unloading scenes with suitable figures in attendance.

Although the L.M.S.R. has its own station at Aintree, where the Meeting takes place, trains from the Midland Section are worked over the Cheshire Lines and use their station. All of them are heavy and as a rule a great deal of double-heading is seen in accordance with Midland tradition. Many of the engines are Compounds, so that in representing the working in miniature a gathering of Hornby No. 2 Special Locomotives would be interesting and realistic. Those readers who may have rebuilt such engines in the manner described in the "*M.M.*" for February 1933, to represent the inside cylinder 4–4–0s of class "2P," can use these rebuilt engines also. Real class "2P" locomotives frequently appear as pilots to the Compounds and such a combination in miniature would look extremely interesting.

All these locomotives, both L.N.E.R. and L.M.S.R., are accommodated at the Cheshire Lines depot, at Walton-on-the-Hill, where a very busy afternoon's work is carried out on Grand National day. Coaling and watering is carried out there in readiness for the return journey.

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.

SIXTH LOCOMOTIVE NAME AND NUMBER CONTEST

This month we have pleasure in announcing our return to an old favourite among H.R.C. competitors, the well-known Name and Number Contest, in which competitors are invited to decipher jumbled locomotive names and numbers. Enthusiastic reception is always given to these contests, and we have no doubt that this month the response will be even greater because members will be keen to show us they are up to the minute and not lacking in their knowledge of locomotive names and numbers.

The accompanying panel contains the names and numbers of 40 locomotives, in which the letters and figures respectively have been jumbled up. Competitors are required to re-shuffle these into their correct positions, and to make a list of the names and numbers thus obtained. Solutions must be written out in the same order as they appear in the panel.

Many of the jumbled words appear to be a senseless collection of letters which would never resolve themselves into a locomotive name. This is not the case, however, for after juggling with the letters for a time the name of the locomotive will become apparent. In solving the contest readers should first decipher the name of the locomotive, and then its number can readily be found. For example, the letters of the first name on the list when correctly rearranged become "*British Legion*," and when this name has been settled it is an easy matter to find the engine's number.

7016	Libtirgioshen	2854	Ftyvrooilcoilpe
4324	Cfunliblh	6169	Belolil
291	Wuheysrbsr	7445	Yixglonff
1585	Darhinsoairabs	2660	Joghiknn
791	Torhurptiesinp	293	Bardefild
5792	Gonabighours	4201	Tipvopliener
7265	Nersareiloe	1086	Thighforsandhelera
4869	Honrahlnocc	3205	Casklutes
9145	Lanhipcomal	927	Divelsrieresherv
1614	Ecolnaland	5539	Lauphork
386	Yondorlder	1512	Niksliverg
8240	Sawinderstocl	2645	Scabnowe
5817	Throndeadgu	4439	Pillhandhil
2016	Nareyemuq	796	Saleandgavedirsois
5086	Thasnoatcelt	6170	Bearbanaled
5338	Yanterem	2569	Sanelugdogl
5287	Dnalrebmuhtron	2945	Hipnecenyrr
274	Lometac	6735	Dilrawnidswands
8342	Kingbrinoocheh	6048	Babyennathlylo
2426	Bestlanadahs	398	Staleovs

When a competitor has solved all the jumbled names and numbers, or at any rate as many of them as he is able to manage, he should make a neat list of them on a sheet of paper, together with his name, full address, and H.R.C. membership number.

The contest will be divided as usual into two Sections, Home and Overseas. Prizes of any products manufactured by Meccano Ltd., to the value of 21/–, 15/– and 10/6 respectively will be awarded to the three best entries submitted in each section. In the event of a tie for any prize, neatness will be taken into consideration when the judges make the final decision.

Envelopes containing entries should be marked in the top left-hand corner "*H.R.C. March Name and Number Contest No. 6*," and posted to reach Headquarters at Meccano Ltd., Binns Road, Liverpool 13, not later than 31st March. Entries from competitors in the Overseas Section should be posted to arrive on or before 30th June.

Railway Photographic Contest

The wide range of subjects submitted in the winter series of photographic contests shows that many interesting photographs would have been lost to us if the photographic contests were abandoned during the winter months. One of the main reasons why these contests are so popular is that competitors are not tied down to any particular subject, and because they are permitted to send as many prints as they desire so long as they have a railway atmosphere.

Although a competitor may submit any number of prints he cannot win more than one prize in one contest. It is important that each print sent in should have on the back a description in a few words of the railway scene shown, the age, name and full address of the sender, and most important of all his H.R.C. membership number.

The Contest will be divided as usual into two sections, Home and Overseas, and prizes of any products manufactured by Meccano Ltd., to the value of 21/–, 15/– and 10/6 respectively will be awarded to the three winners in each section. In addition a number of consolation prizes will be awarded.

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

My Favourite Locomotive

To almost all railway enthusiasts there is usually one locomotive or class of locomotive which has a special attraction and is held in higher esteem than any other. The merit of such favourites is not necessarily their power or appearance, but sometimes results from personal association and familiarity with their work. We present therefore "*My Favourite Locomotive*" as the subject of this drawing contest.

Competitors may submit either pencil or coloured drawings as desired, but the judges will not necessarily award the prizes to the senders of sketches in colour.

To the three competitors in each Section, Home and Overseas, who submit the best drawings, prizes consisting of any products manufactured by Meccano Ltd. to the value of 21/–, 15/– and 10/6 respectively will be awarded. On the back of each entry must be clearly written the competitor's name, age, full address and most important of all his H.R.C. membership number. Unsuccessful entries will be returned if they are accompanied by a stamped addressed envelope of suitable size. Prizewinning entries become the property of Meccano Ltd., and are not returnable.

Entries should be marked "*H.R.C. March Drawing Contest*" and posted to reach Headquarters at Meccano Ltd., Binns Road, Liverpool 13, before 31st March. The closing date for competitors in the Overseas Section is 30th June.

COMPETITION RESULTS

HOME

January "Missing Words Contest."—First: D. H. Earle (41617), Wembley Park, Middx. Second: K. W. Ashberry (14344), Cambridge. Third: T. F. Fletcher (6057), Perry Barr, Birmingham 20. Fourth: C. Stevens (46092), Leyton, London, E.10. Consolation Prizes: K. Gandy (7571), Sheffield 8; H. Woolgar (29656), Shoreham-by-Sea, Sussex; R. Garner (43574), New England, Peterborough; R. Lumley (20253), Plymouth; T. Edwards (46484), Thetford, Norfolk; K. Scott (45479), Goswick, Northumberland.

January "Railway Photo Contest."—First: C. Spencer (44179), Sheffield 11. Second: E. C. Morgan (10735), Wandsworth Common, London, S.W.18. Third: J. C. Button (10335), Crewe, Ches. Fourth: D. Kelk (28579), Staplehurst, Kent. Consolation Prizes: D. S. Wakely (17486), Cheam, Surrey; D. J. Muirhead (41880), Hendon, London, N.W.4; F. G. H. Kennedy (25074), Tonge Moor, Bolton, Lancs.

January "Voting Contest."—First: T. W. Chatfield (9197), W. Worthing, Sussex. Second: B. O. Palmer (34301), Highcliffe, Hants. Third: D. Brooks (25150), Alveston, Nr. Bristol. Fourth: K. Paine (46145) Eltham, London, S.E.9.

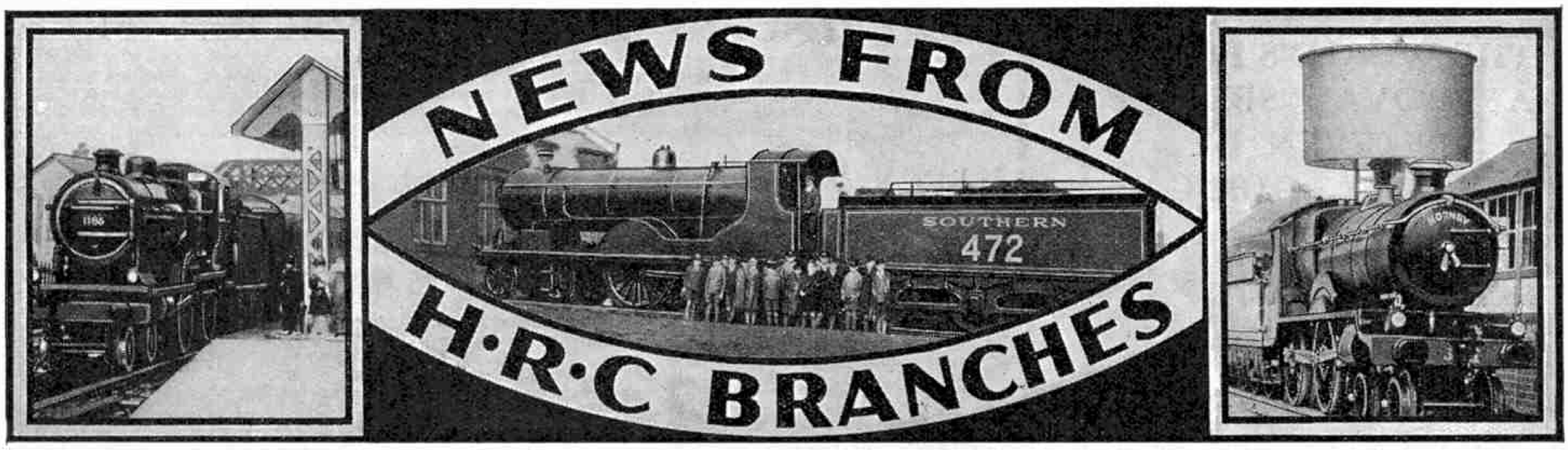
OVERSEAS

September "Errors Contest."—First: J. Rodriguez (3647), Montreal, P.Q., Canada. Second: D. Murison (37642), Buenos Aires, South America. Third: D. Parker (38595), Brussels, Ontario, Canada. Fourth: J. Stanbridge (10236), Perth, W. Australia.

September "Railway Photo Contest."—First: G. E. Schulz (15425), Coromby, Victoria, Australia. Second: Marcus De Lima (34925), Poona, India. Third: G. Healy (43145), Prince Albert, Sask., Canada. Fourth: B. Forbes, Johannesburg, S. Africa.

October "Articles Suggestions Contest."—First: G. Healy (43145), Prince Albert, Sask., Canada. Second: G. Yule (34970), Melbourne, Australia. Third: J. A. Mallia (43679), Vittoriosa, Malta. Fourth: M. De Lima (34925), Poona, India.

October "Missing Links Contest."—First: H. C. Key (24764), Park Circus, Calcutta, India. Second: I. Brough (9112), Preston N.18, Victoria, Australia. Third: W. G. Hallack (17578), Capetown, South Africa. Fourth: R. A. Wragg (7913), Bandikui, Rajputana, India.



Branch News

ST. STEPHEN'S (SALTASH).—Several meetings have been devoted to the renewal of the track. The double track sections are to be extended and it is hoped that eventually the whole layout will be provided with separate up and down lines. The Branch stock has been increased by the addition of two new locomotives. Visits have been paid to the Branch by members of the Plymouth M.C. and on one of these occasions a useful talk was given on the maintenance of Hornby railway material. Facilities for games are available and continue to be popular; table tennis matches have been arranged with the local Y.M.C.A. Secretary: B. Braund, 9, Homer Park, Saltash.

CLAREMONT (NOTTINGHAM).—The first few meetings have been devoted to an examination of the rails and other material contributed by the members. After some experiments, a suitable layout has been devised and the train working has been greatly enjoyed by all. A station, engine shed and tunnel have been constructed by the Chairman. The Branch library has been commenced and a Branch Magazine is now produced regularly. It is hoped to pay a visit to the L.N.E.R. locomotive depot at Nottingham. Later on in the year, an Open Night will be held at which a play will be presented. Secretary: R. Ingham, 132, Mansfield Road, Nottingham.

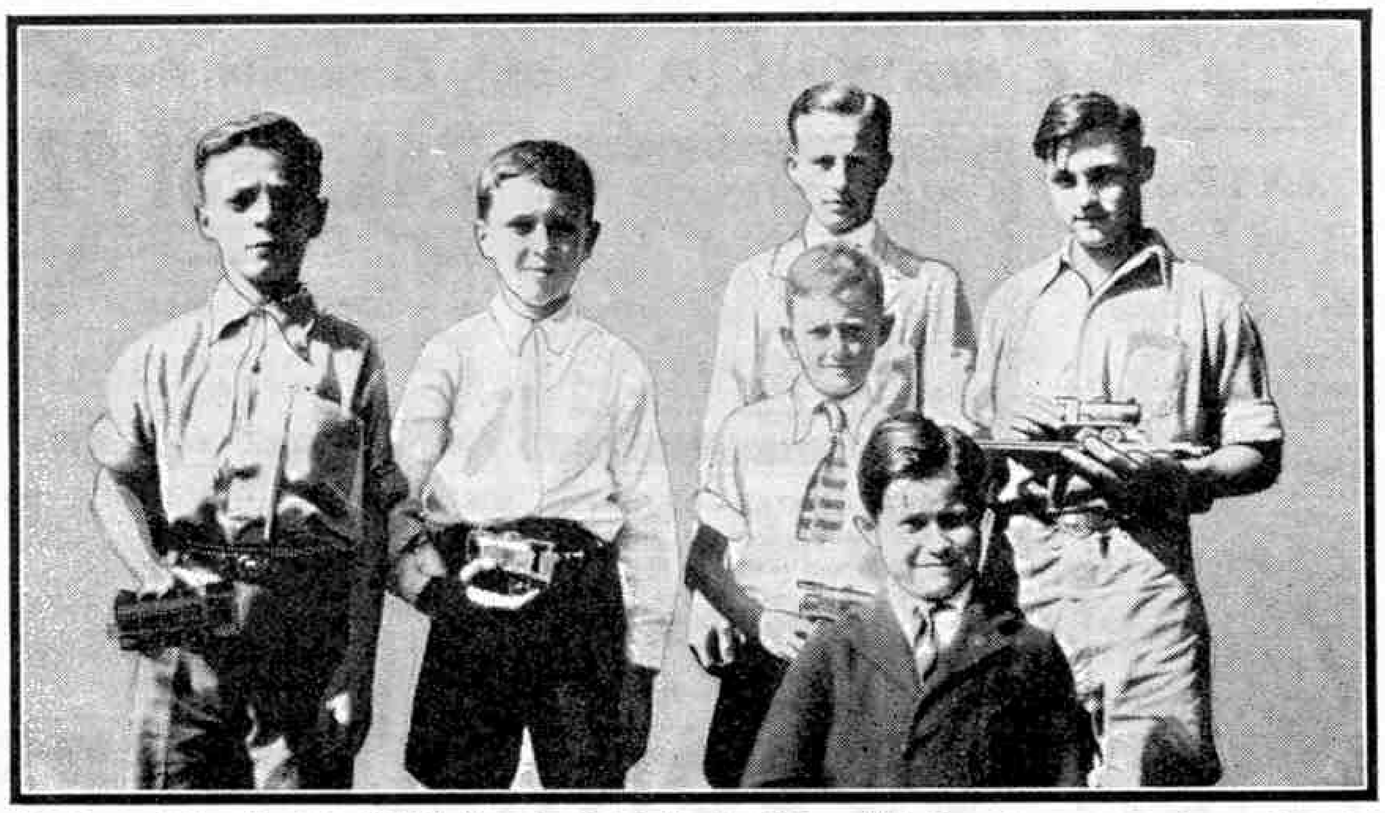
PRIORY (HIGH WYCOMBE).—Timetable arrangements have been overhauled, and better working has been secured as a result. An overhead branch line has been completed and a "pull and push" train works the service, operating in conjunction with the main line trains. Trials have been carried out with various locomotives hauling different loads. A feature of recent meetings has been the operation of the system with only the accessory lights in use. A visit has been paid to the Holywell Branch; two locomotives were taken, each acquitting itself well on "foreign" metals. Work on an outdoor track, already commenced some time ago, is expected to be resumed in a month or two. Secretary: J. T. Cosgrove, 54, Priory Road, High Wycombe.

HOLYWELL.—Meetings have been resumed after a temporary suspension owing to various epidemics. Timetable operations have been conducted with success, and some additional locomotives have been put into service. Work is now in hand on an outdoor track in the Secretary's garden, but this is not expected to be completed until later in the year. Secretary: J. Spicer, 28, Holywell, Oxford.

PAIGNTON.—A satisfactory layout has been arranged with a continuous main line and a terminal station. Some experimental train running has been carried out on this, but no definite running arrangements have yet been decided on. Rules for the conduct of the Branch generally, and for track meetings are being formulated. Secretary: H. M. Anderson, 22, Laura Grove, Paignton.

PATRICROFT.—Considerable enthusiasm has been stimulated as a result of the institution of the Branch library and a games programme. It is hoped to include in the library copies of all the latest railway publications. Ordinary activities have continued as usual and additional locomotives and rolling stock have been put into service. New rails have been obtained and with these most of the existing layout has been relaid. Secretary: A. Howarth, Jnr., 42, Nelson Street, Patricroft, Manchester.

FOREST ROAD CABIN (SOUTHPORT).—Several meetings have been held and discussions have taken place on suggested track and working improvements. An experimental timetable has been devised and track operations have been carried out according to it. A new timetable giving more intensive working is in course of preparation. Secretary: D. R. Moss, 141, Forest Road, Southport.



Members of the Umzinto H.R.C. Branch, Natal, South Africa. This Branch commenced operations in February, 1935, but is not yet an incorporated Branch. Regular meetings are held and the equipment brought by the members is combined to form a large layout.

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:

ANGLESEY—I. Jones, Trefnan, Menai Bridge.
BARNSLEY—G. Atkin, P.O. Platts Common.
BLACKROCK—P. Doris, 74, Temple Road.
CARDIFF—H. K. Lloyd, Milverton, St. John's Crescent, Whitchurch.
GLASGOW—I. Stevenson, 4, Mariscat Road, Pollokshields, S.1.
GOUROCK—B. Higgins, Fairlight, Ashton.
HOUNSLOW—B. Smith, 83, Clifford Road,
HUCKNALL—J. Hopkinson, 55, Long Hill Rise.
LIVERPOOL—E. S. Green, 63, Sheil Road, Fairfield, 6.
LIVERPOOL—H. A. Howard, 61, Springwood Avenue, Allerton, 19.
LIVERPOOL—P. D. Weymont, 4, Eversley Street, Princes Avenue, 8.
LONDON—D. Watkins, 22, Birkbeck Grove, Acton, W.3.
MONKSTOWN—R. D. Pierce, 20, Monkstown Road, Co. Down.
PETTS WOOD—E. C. Smith, 144, Petts Wood Road.
RAYLEIGH—V. Cocks, "Valsior," Kings Road.
STOKE-ON-TRENT—H. Allen, 22, Wise Street, Longton, Stoke-on-Trent.
TEIGNMOUTH—J. Gibbings, The Beacon School.
WHYTELEAF—S. Allen, 15, New Barn Lane, Whyteleaf, Surrey.
COVENTRY—P. Whitehouse, 9, Rochester Road, Earlsdon, Coventry.

Branches Recently Incorporated

298. RAVENSBURY (MORDEN)—A. M. Evans, 31, Arras Avenue, Morden.
299. CLAREMONT (NOTTINGHAM)—R. D. Ingham, 132, Mansfield Road, Nottingham.
300. FISHPONDS (BRISTOL)—A. N. Ewing, 154, Thingwall Park, Fishponds, Bristol.
301. RUTHERGLEN (GLASGOW)—R. G. Langmuir, 11, Afton Street, Shawlands, Glasgow, S.1.

THE WORLD'S FINEST APPROVAL SERVICE IS GIVEN BY STANLEY GIBBONS

Whatever collecting stage you have reached we can help you.

Start with our magnificent Approval Sheets (world-famous for their quality and variety) and, when you have outgrown them, continue with our Blue Approval Books of individual countries and groups.

Send us your Want Lists also: our extensive stock enables us to supply almost anything wanted.

Finally there is the S.G. "New Issues on Approval" Service—absolutely the best way of getting what you want of the world's new issues as they appear.

Write to-day, stating what countries interest you to:

Dept. S.15

391 STRAND, LONDON, W.C.2

THE PRINCESS ELIZABETH PACKET FREE!

This packet contains the stamp you have been waiting for. 47 different, including the only stamp issued that portrays our beautiful Princess Elizabeth. Long sets of 9 Bohemia and 3 Japan (Flower), Iran, many fine unused, also the large stamp depicting the Princess's Grandparents, our late King and Queen. Sets of 6 Spain and 4 Magyar. Finally, we are including the stamp showing the Princess's Uncle, King Edward VIII, wearing the Grenadiers' uniform. As stocks are limited, early application is advisable. Just send 2d. postage, requesting approvals.

LISBURN & TOWNSEND LTD. (Dept. M.M.), LIVERPOOL 3

FREE WONDERFUL 1936 OFFER 25 NEW ISSUES AND NOVELTIES

Including **Andorra** (1935), fine new **Cayman Islands** (map of the Islands), obsolete Austria, China, Denmark, **Gwalior** Service, Hungary (Statesman Szechenyi), **new Kenya** (Kavirondo Cranes), **Roumania** (new portrait of King Carol), and many others. I will send this collection **absolutely free** to all stamp collectors sending 2d. postage (abroad 4d.).

G. P. KEEF, Willingdon, EASTBOURNE

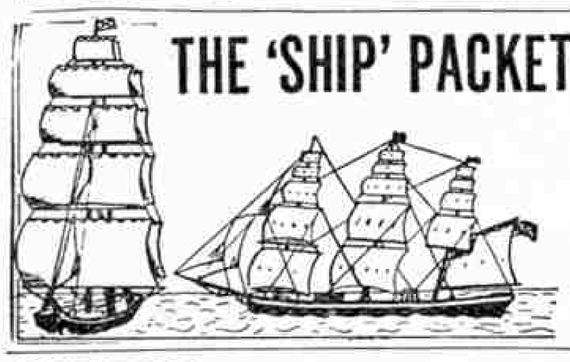
THE "DIAMOND" PACKET IS THE ONLY PACKET

OF UNSORTED STAMPS ON THE MARKET with 15 years' reputation behind it. It contains approx. **1,000 UNSORTED STAMPS** from Convents abroad. **MANY RARE STAMPS** have been found in it. 1 pkt., 1/6; 3 pkts., 3/9; 5 pkts., 6/–. All post free inland. Colonies 3d. per pkt. extra. Foreign, 6d. extra.

Ask your stationer for the "Diamond" packet.

O. NERUSH (Dept. A), 68, TURNPIKE LANE, HORNSEY, LONDON, N.8

THE 'SHIP' PACKET



This marvellous packet is offered under cost as an advertisement, **45 different stamps each with a ship on it.** A regular armada. **GABOON,** a rare **FOOCHOW** (War Canoe) wonderful flotilla of caravels from **DENMARK** (complete set), **SENEGAL** (new pictorial), **NEW CALEDONIA, IVORY COAST, COSTA RICA,** a fleet of **7 CHINESE** junks usually sold at 10d., **TRINIDAD & TOBAGO, MAURITIUS, SOUTH WEST AFRICA, NEWFOUNDLAND, U.S.A., B. GUIANA,** set of **S. AFRICA, GREECE, POLAND, INDO-CHINA, F. OCEANIA,** etc. Price 4½d., postage 1½d. (abroad 3d. extra). Purchasers of this packet asking for approvals receive **FREE** set of **4 SPAIN** (Columbus, each with his ship on it). Senders of addresses of stamp collectors receive **FREE** set of **6 VENEZUELA** or **6 PERSIA, 100 BRITISH COLONIALS 1/–, 20 AIRPORT 6d., 6 TRIANGULARS 6d., 50 PERSIA 4/–, 2 ASTRID** (mourning stamps) **2½d., VOLUMES OF B.O.P. CHEAP.**

H. C. WATKINS (M. Dept.), Granville Road, BARNET

SETS (POSTAGE EXTRA)

3 Abyssinia	...	2d.	10 Tunis	...	3d.
3 Albania	...	2d.	4 Memel	...	3d.
5 Algeria	...	2d.	8 ,,	...	7d.
5 Armenia	...	3d.	5 Silesia	...	2d.
10 Australia	...	2d	10 ,,	...	4d.
5 Barbados	...	2d.	10 Canada	...	2d.
5 Brit. Guiana		3d.	4 Cayman Is.	...	6d.
10 Bavaria	...	2d.	5 Cyprus	...	2d.
5 Bulgaria	...	2d.	10 ,,	...	5d.
5 Bosnia	...	2d.	5 Deccan	...	2d.
5 Crete	...	2d.	10 Egypt	...	2d.
20 Czecho	...	2d.	5 Ecuador	...	2d.
10 Ceylon	...	2d.	20 France	...	2d.
10 China	...	2d.	20 French Col.	...	3d.
	5 Gold Coast	...	3d.		

J. RUSSELL

23, Shanklin Drive, Westcliff-on-Sea

ZAMBESI PACKET FREE!!

Included are the beautiful Silver Jubilee issue of **S. RHODESIA** showing King George V in the uniform of the Black Watch, the famous Victoria Falls and various animals; **BELGIAN CONGO;** Mozambique (Lusiad); **N. RHODESIA;** Gaboon (raft); new **KENYA-TANGANYIKA-UGANDA** pictorial (Dhow on Lake Victoria); Angola; **MOZAMBIQUE CO.** pictorial (native village), etc. This splendid packet is free **ONLY** to those who request Approvals and send 2d. postage (abroad 1/-).

HELY. HUTCHINSON

(M.7), HURROCK WOOD, KENTS BANK, GRANGE-OVER-SANDS.

ROYAL HOSPITAL, RICHMOND, SURREY, appeals to the readers of the Meccano Magazine to collect used postage stamps (British and Foreign) towards the new Extension Fund. These stamps should be sent to the Secretary-Superintendent.

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

NO GIFTS

The value is in the stamps. Send for approvals and find out for yourself.

EDWARD LORD, GRAFTON ROAD, KEIGHLEY.

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

ALL BRITISH COLONIAL APPROVALS

Fine **BRITISH COLONIAL PICTORIAL SETS OF CAYMAN ISLANDS AND GAMBIA FREE** to all Collectors sending 1½d. stamp and requesting **ALL BRITISH COLONIAL APPROVALS, BRITISH COLONIALS ONLY** on approval at bargain prices, including Jubilee issues, West Indians, East and West Africa, Cyprus, Gibraltar, Iraq, Papua, Samoa, and many other fine Colonials. (No stamps sent abroad.)

C. H. SHAW (Dept. M.3), 95, CHRISTCHURCH AVENUE, KENTON, HARROW.

JUBILEE STAMPS

23 Different 2/-

A splendid pictorial packet containing used and unused items. Many of these stamps are already scarce.

Some other attractive offers:

*9 **Abyssinia, 1919.** Large pictorials. (Cat. 3/10)	1/-
*4 **Egypt, 1933.** Air Mails, Plane over Pyramids	6d.
*1 **Iceland Triangle, 1930.** Air Mail	3d.
3 **Latvia Triangles, 1931-32.** Air Mails	6d.
*5 **Lithuania Triangles, 1932.** Air Mails, Map, etc.	1/-
9 **Roumania, 1928-30.** Schoolboy King issue ...	4d.

*Unused. **Postage 1½d. extra.**

Money and all postage will be returned if not satisfactory. Numerous other items are available at low prices. Hundreds of unsolicited testimonials have been received.

W. BENNETT,

53, MARLBOROUGH ROAD, LONDON, E.8.

ONE THOUSAND STAMPS ON APPROVAL

From which you may select any 100 for 3/–.

This selection is not made up of the very commonest varieties, but contains stamps catalogued at 1/- each or more. (I do not sell less than 100.)

Special offer: BRITISH GUIANA 1899 PICTORIAL 2c. on 10c. and 2c. on 15c. MINT cat. 2/6, post free 7½d.

H. HARDY, "Hoyland," Potter Heigham, Norfolk.

THREE NEW ISSUES FREE

MOZAMBIQUE air mail, new **PERSIAN** air mail overprinted **IRAQ,** beautiful **KENYA** and **UGANDA** 5c. stamp depicting boat on lake and the late King's head, also packet of **15** all different **PORTRAITS** of the **KING,** free to those who request our approvals and enclose 2d. for postage and packing.

SHOWELL BROS., 42, Vanbrugh Hill, BLACKHEATH, S.E.3.

THE FIRST STAMP Ever Issued

(British 1840 Penny Black) for P.O. 2/–! It is guaranteed genuine in every respect. Its companion stamp (1840, 2d. blue) for a further 5/– (cat. 15/–)! Other "Classics" which every Collector should have are the **Cape of Good Hope Triangulars;** we offer 1d. rose (cat. 40/–) for 12/6; 4d. blue (cat. 15/–) for 5/–; and 6d. pale lilac (cat. 40/–) at 12/6. Superb approvals of any country against approved English References or a deposit. **Full Lists Free.**

NORRIS & CO. (Dept. M), NORWOOD, LONDON, S.E.19

SPECIAL OFFERS

NEW ISSUES

5 Zanzibar, 5c.–10c. 1/-

Sets of 5. **Malaya, Pahang, Perak, N. Sembilan,** 1c.-10c. **9½d.** each. The 4 Sets for **3/-**

5 Nigeria Pictorials, ½d.-3d. **K.G.** ... **1/-**

4 Belgium, Queen Astrid Mint ... ... **6d.**

8 Belgium. Queen Astrid Mint **1/10**

Jubilees—Mint Sets—**N. Rhodesia, 2/–; Nauru, Ceylon, St. Settlements, 2/6 ea.; Fiji, 3/-**

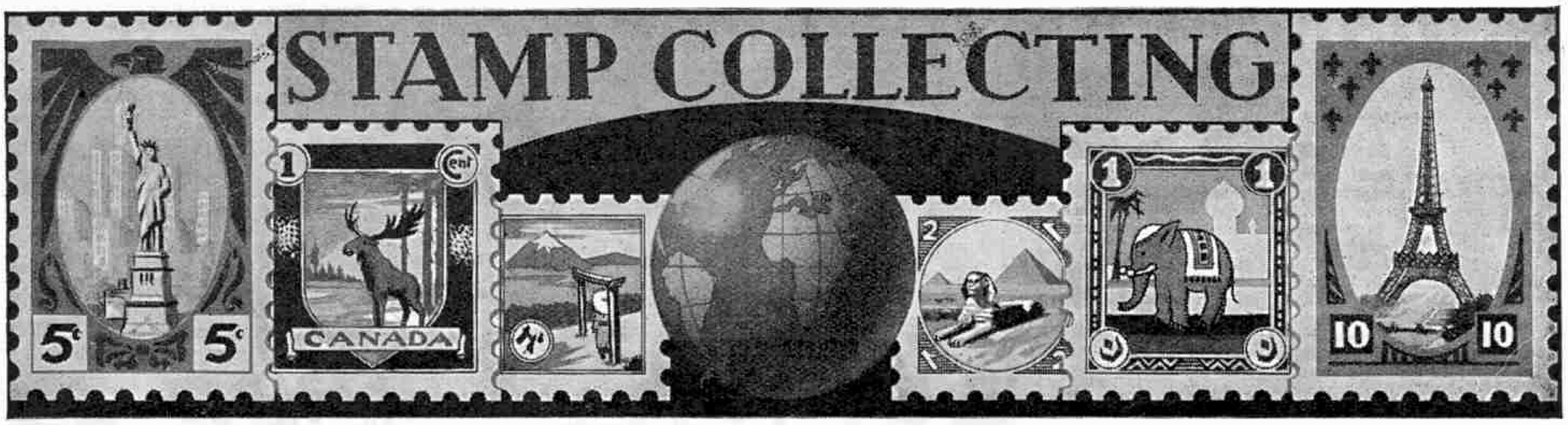
Cash with order. Postage extra.

T. R. HUGHES, 7, Winchester Road, N.W.3

EVERY COLLECTOR NEEDS THIS ILLUSTRATED BOOK

Zoo in a Stamp Album—Ship Stamps—Watermarks—The Aerodrome—Single Country Collections—Olympic Games—Loose-Leaf Albums—Earthquake Stamps—Washing Day in the Stamp World—Three-cornered Market Place—British Empire Albums—Rare Stamps—Overprints and Surcharges—To Correspondents Abroad—Treasure Trove—Triangular Packets—Packets of British, French, Italian, Portuguese, Spanish and German Colonials—Building a Collection—West Indian Packets—Triangular Stamps—Philately Royal—Albums for Beginners—Penny Sets—English Men on Foreign Stamps—Emergency Papers—Shilling Sets—Advertising Stamps—Strip Pocket Books—Glossary—Stamp Tongs—Punctured Officials—etc., etc., etc. These are only a few Headings out of my **NEW SIXTY-PAGE BOOK,** which is **WELL ILLUSTRATED THROUGHOUT** and so full of the right sort of useful and interesting Philatelic information that **EVERY STAMP COLLECTOR MUST HAVE THIS BOOK,** FREE and POST FREE from

EDWARD SANDELL, 10, EVELYN GROVE, SOUTHALL, MIDDLESEX, ENGLAND.



THE GREATEST ROYAL PHILATELIST

This portrait of King George V is possibly the best of all his stamp portraits. It is taken from the Falkland Islands centenary commemorative issue of 1933.

THE death of His Majesty King George V has taken one of the greatest philatelists of all time from the ranks of stamp collecting. There have been other Kings who have collected stamps but King George was outstanding among royal philatelists. His collection has been valued at various figures between £250,000 and £400,000, and it is the fact that King George's collection of British Colonial issues is the greatest and most nearly complete in the world. It is pleasing to know, therefore, that the collection is to be kept intact and, for the present at least, will remain in the care of its present curator, Sir Edward Bacon.

We dealt with King George's collection at moderate length in an article in our issue for May last, and in this short article we feel it would be appropriate to deal with his life and reign as shown in stamp designs. There is an enormous quantity of material available, of course, for until recent days almost every British Dominion and Colony used the King's head in its stamp designs as a matter of ordinary routine.

King George's first appearance in the stamp album was in 1897 when his portrait, as Duke of York illustrated here, was used as the design for the 5c. value of a new issue for Newfoundland. This set was devoted to portraits of the Royal Family and included also Queen Victoria; King Edward VII and Queen Alexandra, then Prince and Princess of Wales; Queen Mary, then Duchess of York; and Prince Edward, now King Edward VIII, four generations of the Royal House.

King George as Duke of York. This portrait is from Newfoundland's Tercentenary commemorative of 1897.

King George in the uniform of an Admiral of the Fleet. This design was used for Southern Rhodesia's 1924 issue.

Newfoundland has shown a penchant for using portraits of the Royal Family on its stamps and subsequent to the 1897 issue, portraits of King George, as Prince of Wales, appeared on the 1910 issue commemorative of the tercentenary of Newfoundland's colonisation; in 1911, to celebrate his coronation; in 1932, and, of course, in the 1935 Jubilee series.

The 1897 stamp had a special appeal to philatelists, however, in that just about the time of its issue, King George was president of the Royal Philatelic Society. His presidency was no mere matter of form, and his association with the Society was closely maintained throughout his reign. For many years past at the opening meeting of each year's session the members have had the privilege of inspecting a part of the King's collection. This 1897 issue is the only stamp available showing the King in civil attire.

Canada's Quebec Tercentenary issue of 1908 was the occasion of King George's second stamp portrait. In this, as our illustration shows, he was featured with Queen Mary as Prince and Princess of Wales on the ½c. value.

King George V and Queen Mary as Prince and Princess of Wales. These portraits are from Canada's Quebec Tercentenary issue of 1908.

King George and Queen Mary in their state robes. This stamp is from Canada's Silver Jubilee issue.

Two years later King George ascended the throne and by the end of 1912 the change-over from King Edward stamps to those bearing King George's portrait had been completed throughout the Empire, except in a small number of cases in which the change was not made until early in 1913.

Thus there came portraits of the King in a variety of uniforms. There have been many striking pictures, of which the best, possibly, is that on the £1 value of the Falkland Islands centenary issue of 1933. In the space available here it is impossible to list them all, and instead we have chosen a representative selection for illustration here.

It is fitting that the greatest royal philatelist should have for his memorial among his stamp collection subjects a place on almost every page of their albums, but one could wish that British stamp issuing policy had permitted a freer use of commemorative issues during King George's reign. The Silver Jubilee alone, in a reign crowded with outstanding incidents, was marked by a special stamp issue.

King George mounted on his charger "Anzac." This design was used for the Australian Silver Jubilee commemorative issue.

King George as Field-Marshal, as shown in New Zealand's 1926/35 issue.

This portrait of King George is from Newfoundland's 1935 issue.

King George in his robes as Emperor of India, as shown on each of India's New Delhi Inauguration commemoratives of 1931.

In his younger days King Edward too was interested in stamp collecting and on one occasion exhibited a portion of his collection. He was never an enthusiast, however, and the calls upon his time now will be too heavy to permit him to take more than a general interest in the hobby.

"1,000 PACKET" A WONDERFUL OFFER FOR 6D.

Postage 2½d. ex. Abroad 6d. ex.

The "1,000 Packet" contains 500 excellently assorted Stamps; **a complete Sheet of 100 Unused** (very useful for exchange purposes); a neat 12-page booklet for duplicates; 25 British Colonials usually sold at ½d. to 1d. each, including new issues; 375 Magic "Strip" mounts, very quick for mounting stamps, and list of stamp bargains. Free sets will be sent to those who send addresses of stamp-collecting friends. *Ask for Approvals.* 100 B. Colonials 1/–. 20 Air Post 6d. 10 Abyssinia 1/6. 10 Mozambique Triangulars (just out) 1/6. "B.O.P." and "Captain" monthly parts cheap.

H. C. WATKINS, M, DEPT., GRANVILLE ROAD, BARNET.

The "TRANSPORT" Packet

contains a wonderful assortment of 44 all different Foreign and Colonial stamps and includes the following which depict various means of transportation: **Tunis** (Water Carrier), **Mozambique** (Aeroplane), **Jamaica** (Troopship), **Madagascar** (Native Transport), **Greece** (Steamer), **Indo-China** (Boat), **Mauritania** (Crossing Desert), **Transvaal** (Waggon), **Brazil** (Aeroplane), **Middle Congo** (Train), **Sudan** (Camel), **Austria** (Horseman), **Dutch Indies** (Steamboat), **Australia** (Aeroplane), **Gaboon** (Raft), **Colombia** (Natives with Panniers), **South Africa** (Ship), **French Guiana** (Native Carriers), **Germany** (Aeroplane), and **Belgium** (Train). Price **6d.** (abroad extra). All purchasers of this packet asking for approval sheets will be presented with **India** Silver Jubilee Stamps.

Burdock & Flury, 4, Marlborough Rd., London, S.W. 19

TRIANGULAR PACKET

This rare and beautiful stamp was issued by Spain to commemorate the explorer Columbus, and shows his Flagship—Santa Maria. I am presenting it FREE, together with a collection of **10 other fine Spanish stamps** to all readers requesting approvals and enclosing 2d. postage (abroad 6d. P.O.). Send **to-day** for this extraordinary offer which can **never be repeated, as stocks are limited.**

MICHAEL HERBERT, 8, Woodstock Road, WALTHAMSTOW, LONDON.

STAMP BARGAINS

Colonial and Foreign from 1/3rd to 1/8th cat. being offered on approval. Everything from attractive "space fillers" at ½d. each to rare items at £1 each and over. No gifts but real bargains!

CAMPBELL, 1, HALDON AVE., TEIGNMOUTH.

JOIN THE "INVESTORS' STAMP CLUB"

Shares 6d. per month, plus 1½d. postage.

Show this to Dad. Jubilee Year was a good one for Investors. Every Shareholder receives 6d. worth stamps each month, principally new issues. March packet, for example, includes new pictorial Nigeria and eleven other Colonial pictorials. You will never get the same stamp twice. Money returned if not satisfied with value.

Dividend (minimum 4 per cent.) declared twice yearly and paid in cash or stamps.

Shares may be fully paid-up in advance—5/– per annum. **FIRST TWELVE** paid-up shareholders will be appointed **DIRECTORS** with valuable privileges.

Apply for full particulars to:

A. F. McQUARRIE, 83, Cliff Road, WALLASEY, Ches.

KING GEORGE V—Important Notice

THE STAMP OF TO-DAY IS THE RARITY OF TO-MORROW

Owing to the death of His Majesty King George V, all current British Colonials will shortly be obsolete. So now is your chance to obtain them before they become scarce.

I am therefore introducing EMPIRE MIXTURE guaranteed to contain only British Colonials, sent out exactly as received from Banks, Trading Stations and other Outposts of the Empire.

EMPIRE MIXTURE is the cheapest and best way to fill up the gaps in your British Colonial Collection, includes Silver Jubilees, Commemoratives, New Issues, Provisionals and heaps of other scarce stamps.

100 for **1/–**, 250 **2/–**, 500 **3/9**, 1,000 **7/3.** All post free (abroad 3d.).

As a special introductory offer I am giving to all purchasers of **3/9** or over a Queen Victoria Labuan stamp, cat. **5/–.**

Remit by Postal Order only.

K. HUMPHRIES, Dept. M., East Wittering Rd., East Wittering, Chichester, Sussex.

HISTORICAL PACKET FREE!

Contains 20 diff. Commemoratives, Centenary, War, Charity, Jubilee, Exhibition, etc., Stamps **Only.** Don't miss this opportunity. To all genuine applicants for cheap, attractive appros. enclosing 1½d. postage.

R. Kippen, 52, Cowley Road, Leytonstone, E.11.

ODDS & ENDS—ALL MINT

4 Basutoland Jubilee 2/3	4 Newfoundland Jubilee ... 4/–
4 Bechuanaland Jubilee 2/3	3 New Zealand Air Mails 1/2
4 Cyprus Jubilee ... 3/3	9 Spain "Press Association" ... 1/6
4 Hong Kong Jubilee 2/–	4 Swaziland Jubilee 2/3
4 Japan 1934 Red Cross 1/–	

Cash with Order. Postage extra.

H. L. GOMM,

41, Upper Cranbrook Road, Redland, Bristol, 6.

FREE STAMP WALLET

(Size 3½ by 5½ inches) fitted with Perforation Gauge, etc., and containing **MINT SET OF BRITISH COLONIALS** (1d.-1/–) to approval applicants enclosing 3d. (in stamps) for postage and packing.

A. B. LEWIS, Dept. C.31,

16, Cricklewood Lane, LONDON, N.W.2.

FREE

We are presenting this month the third packet of our new alphabetical series, the greatest gifts ever offered.

SEND A POST CARD

FREE

This month's packet contains stamps of countries from N to S and includes many beautiful pictorials. You must not miss this magnificent offer.

TO-DAY FOR APPROVALS

UNIVERSITY STAMP CO.

13, Walton Well Road, OXFORD

KING GEORGE V

Owing to the death of His Majesty, King George the Fifth, on January 20th, all the stamps of the Colonies and Dominions bearing his portrait will soon be obsolete. We are offering, free, a collection of stamps all of which show the Head of His late Majesty, including Australia, Canada, Ceylon, Fiji, Gold Coast, Gwalior, Hong Kong, Jamaica, Newfoundland, New Zealand, Straits Settlements, etc., to all applicants who send for a selection of stamps on approval and enclose 2d. In addition, we are giving the famous Newfoundland stamp showing the new King, Edward VIII, as Prince. Price of this packet without Approvals, 1/–. SPECIAL OFFERS of new sets: 3 Finland Red Cross, 1/1; 4 Holland Xmas Charity, 1/6; 6 Zanzibar 1936 (5c.–1/–), 3/–. Postage extra. Particulars of our big new Stamp Competition also sent free with Approvals.

WINDSOR STAMP CO.

(M.M. Dept.), 59, LEE ROAD, BLACKHEATH, S.E.3.

THE MYSTIC PACKET

1000 UNKNOWN UNUSUAL UNSORTED 1/3

Stamps on paper, etc., just as received from Convents, Missions, Bankers, etc. Guaranteed unpicked. Chance of a **FIND** in every lot. Send to-day for your treasure hunt to-morrow, **3** for **3/6, 6** for **6/6.** Abroad, **1/6** packet. **FREE!** 25 Br. Cols., including Jubilees, to approval Applicants, also **FREE EXCHANGE.** Send postage only. Overseas **3d.**

ASTLEY & CO.

(M25), Lowhill, WOLVERHAMPTON

GLOBE-TROTTER'S JUBILEE OFFER TO YOU

FREE.—AMAZING SILVER JUBILEE PACKET, including Silver Jubilee varieties, Air Mails, Large Italian and Russian Pictorial Commemoratives, New Issues, Colonials—60 Magnificent Stamps—the most sensational offer yet. Send 1½d. postage for "Globe-Trotter" approval selections—amazing value, ¼d., ½d., and 1d. upwards—and particulars of how **you can have FREE stamps every 14 days!!** Write Now—there's a stamp treat in store for you. **Special Offers.** "Globe-Trotter" Mystery Mixture—world-wide collected—old and new issues, pictorials, etc., 1,000 unsorted, unbeatable, 1/3. 10 Jubilees, 1/–, 50 Airmails, 1/11. 50 Soviet Russia, many large pictorials, 1/5, 25 9d. "Globe-Trotter" for sheer value.—**GLOBE-TROTTER, 17, Winchester Road, BIRCHFIELD, BIRMINGHAM.**

4 DIFF. QUEEN ASTRID MOURNING STAMPS, 3d. —J. Sanders, 90, Newlands Avenue, Southampton.

AERO-SHIP PACKET FREE!

This huge gift parcel contains **508** Unsorted Foreign Stamps, many scarce from **Mozambique** (Pictorial Air Mail), **Brazil** (Aeroplane), **New Caledonia** (Yacht), **Fr. Oceania** (Native Punt), **China** (Junk), **Br. S. Africa** (Frigate), etc., etc. Just send 2d. for postage and request my famous **Extra-Large-Discount Approval Sheets.** (Abroad 6d. P.O.)

E. EASTICK, 22, Bankside Road, BOURNEMOUTH.

FINE SURPRISE PACKET

Including beautiful Mint Set Columbus Ships given to all applicants for my Approvals enclosing 4d. postage.

If you are not on my Register—be sure to send and continue to receive more good things with further selections.

G. W. GREEN, 414, PADIHAM ROAD, BURNLEY.

CHEAP APPROVALS

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

A. V. TAPP,

108, CHESTERFIELD RD., BRISTOL

100 "WORTH WHILE" 1/– Post Free

DIFFERENT BRITISH COLONIALS INCLUDING JUBILEES. Covering Gold Coast Pictorials, ½d., 1d., 1½d., 2d.; Northern Rhodesia, Nigeria, ½d., 1d., 1½d., 2d., 3d.; Mauritius, 2c., 4c., 5c.; Iraq, ½, 1, 3 annas; N. Zealand, ½d., 1d., 1½d., 2d., 3d., 4d., 6d., 1/–; Newfoundland; Palestine; Fiji; Bahamas, etc., etc. Finest Packet **you** have ever had. **Money Back** if not satisfied. With **"Worth While"** Approval Sheets **only.**

JOS. H. GAZE, DIDSBURY, MANCHESTER.

BRITISH COLONIAL APPROVALS from ½d. Mint Papua Free.—Wilson, 48, Lambeth Rd., Middlesbrough.

Edward VIII Packet and Stamp Outfit free to Approval purchasers.—G. Kingsmill, New Barnet, Herts.

500 Stamp Mounts Free to ¼d., ½d. or 1d. Approval applicants.—Winter, 89, Cobham Road, Seven Kings.

FREE. 9 Nyassa Triangles to genuine approval applicants enclosing 3d. for postage.—J. Hayes, Meadfoot, Rosemary Hill Road, Sutton Coldfield.

ALL FOR 1/–

25 "ANIMAL" stamps illustrating Camels, Elephants, Giraffes, Monkeys, Tigers, etc. Also 1,000 Good Quality Stamp-Mounts. Postage 1½d.

D. Brenchley, 16, Gloucester Place, Greenwich, S.E.10.

14 Tannou Touva 1935, 9 Triangles, mint ...	2/3
4 Belgium Queen Astrid Mourning, mint ...	5d.
3 Belgium, Mail Coach Pictorial, mint	5d.
3 Belgium, Railways, Pictorial, mint	2½d.

Post 1½d. extra. Cheap Sets. Approval if desired.

J. R. MORRIS, 9, Audley Road, Folkestone, Kent.

THE JUBILEE PACKET

Contains 60 **Diff.** All Superior stamps (**NO** Unused German, etc.), including 7 **Large SILVER JUBILEE PICTORIALS** from **HONG KONG, KENYA, UGANDA, TANGANYIKA, JAMAICA, CEYLON, Australia, INDIA and CANADA (Princess Elizabeth);** also a Beautiful **Queen Astrid** Commemorative illustrated in Jan. "M.M."; a **Large MOZAMBIQUE AIR MAIL pictorial; Set of NEW CEYLON pictorials; New TANGANYIKA; New CHILE AIR MAIL pictorial; NEWFOUNDLAND,** our new King; and **Pictorial NYASALAND,** etc., Price **1/–** only, post 1½d. extra. Satisfaction or Money refunded in full. Ask to see our Bargain approvals. **THE PUKKA STAMP Co., 27, Normandy Ave., BARNET.**

Stamp Gossip

and Notes on New Issues

Malayan Postal Union Issues

After 35 years of unification of their postage stamp issues, the four federated Malay States, Pahang, Perak, Negri Sembilan and Selangor, have re-adopted separate issues for their individual states. The four new issues have just appeared, each with one design only covering a full range of nine values from 1c. to 40c.

The designs for the Pahang and Perak issues both bear portraits of the respective Sultans. The Negri Sembilan design, illustrated here, embodies the emblem of the State, a shield bearing rice-stalks above a Star, the shield being surmounted by a Malayan dagger and sheath.

The Selangor design, also shown here, differs from the other three in that it shows the name of the State in native characters and only the word "Malaya" in English. The effect is rather misleading. The true reason for this departure is not officially stated, but it may be a gesture to the political importance of Selangor. The main feature of the design shows the mosque at the Sultan's palace at Klang.

Although each of the four States will maintain and sell only its own stamp issues in future, the stamps of one State will be usable in any of the other three. This facility will also apply to the new issue that is to be produced for the Straits Settlements.

The four States and the Straits Settlements will use a common series of postage due stamps, bearing the inscription "Malayan Postal Union."

Jubilee Issues

Readers who have a liking for figures will be interested to know that the total issue of Silver Jubilee stamps in Great Britain amounted to no less than 1,008,000,000! There were 353,400,000 at ½d., 150,400,000 at 1d., 490,000,000 at 1½d., and 14,200,000 at 2½d.

In a number of the general Colonial issues showing the view of Windsor Castle, as in the Straits Settlements 12c. stamp illustrated in our May issue, there is a variety that has come to be known as the "double flagstaff." A flaw in the printing plate produced a line suggesting another flagstaff to the left of the small central tower in the illustration. This variety has been very eagerly sought after, but Stanley Gibbons Ltd. do not intend to catalogue it.

King Edward VIII Issues

Several readers have written to enquire when they may expect the appearance of stamps bearing the effigy of our new King, Edward VIII. It is impossible for any statement on this matter to be made yet, but it is safe to say that, unless a royal mourning stamp in honour of King George is issued, there will be no further issues of Georgian stamps. Many months, of necessity, must pass before King Edward's portrait takes his father's place upon our stamps. It was almost 12 months after the date of his accession that King George's head was featured on British stamps generally, but Newfoundland and South Africa did produce a single stamp each in 1910.

Considerable work has to be done before the new stamps can be produced. Invitations must be issued to artists to submit designs for a complete new series, and these must be approved by the King himself. Designs having been chosen, the method of production must be decided upon, master dies engraved and printing plates prepared, all of which processes take considerable time. The same course must be followed for each of the Dominions and the Crown Colonies, so that it seems probable we shall have to wait until the closing months of the year before stamps of the new reign appear.

It is just possible that one or two of the Colonies may be able to feature an Edwardian stamp at an early date. Bermuda, for example, has a new pictorial series on order. Each of the stamps, we understand, was intended to include in its design a small medallion portrait of King George, and it may not be a matter of great difficulty to change the portrait to that of King Edward.

Swedish Postal Tercentenary

Those readers who are interested in the postal history of the world will welcome the postal tercentenary commemorative issue that has just appeared in Sweden. Sweden was the fourth country in Europe to have a Government Post Office, and the various developments in mail carrying services are featured in the series of 12 stamps which have designs as follows: 5 öre, Axle Oxenstierna; 10 öre, a mail runner; 15 öre, a mounted courier, 20 öre, mail-carrying sailing vessel; 25 öre, paddle steamer; 30 öre, a mail coach; 35 öre, Swedish Coat of Arms; 40 öre, a modern locomotive; 45 öre, A. W. Roos; 50 öre, mail 'bus; 60 öre, line; 100 öre, air mail 'plane.

New Greek Air Mails

As promised in our last issue, we reproduce this month specimens from the new Greek air mail series, brief descriptions of the mythological subjects of the designs of which appeared in our earlier note.

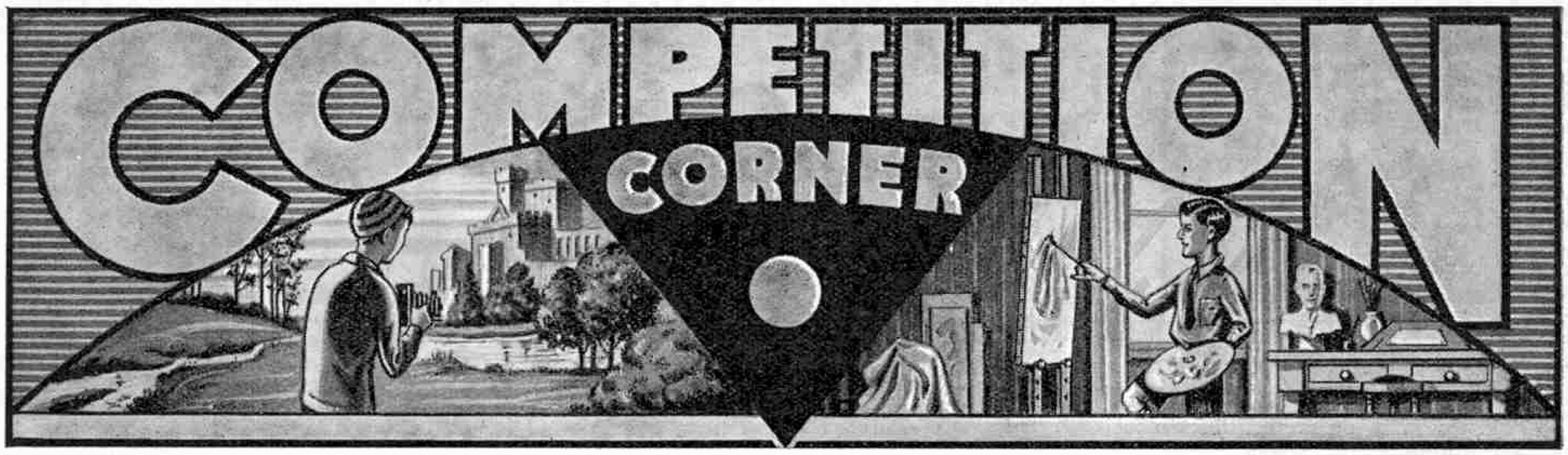
Our illustrations show the 1 dr. value featuring the Chariot of the Sun. The Greeks believed that daylight came when the Sun Chariot was driven across the sky by Helios, who is shown in the design controlling his fine steeds. The 5 dr. shows Daedalus fastening wings to his son, Icarus, preparatory to their attempt to escape by flying from the Island of Crete. The 30 dr. design shows Triptolemus and his flying dragon chariot. Triptolemus was not one of the Olympic gods, but he became the favourite of the goddess Demeter, who taught him the arts of farming. She gave him the chariot so that he might travel about the world teaching mortals the science of agriculture. Later he became King of Eleusis, and when he died was made a judge in Hades.

Austrian Heroes Series

The latest charity series from Austria is probably the finest that this country, renowned for its charity stamps, has ever issued. The designs introduce Austrian martial heroes, including several whose fame is world-wide. We illustrate the 12gr. value, which shows Prince Eugene of Savoy (1663/1736), the friend and ally of our own great Duke of Marlborough at the battles of Blenheim, Oudenarde and Malplaquet.

The remaining designs are as follows: 24gr., Field-Marshal Gideon Ernst Laudon (1717/1790), an Austrian of Scotch descent, whose greatest victory was against Frederick the Great at Kunersdorf in 1759; 30gr., The Archduke Karl (1771/1847). His greatest distinction was his brilliant campaign against the French army. In 1799 he was responsible for the defence of Vienna and ten years later he fought two battles with the mighty Napoleon, inflicting losses of upwards of 50,000 men; 40gr., Field-Marshal Josef Radetzky (1766/1858); 60gr., Vice-Admiral Wilhelm von Tegetthof (1827/1871); 64gr., Field-Marshal Franz Conrad von Hötzendorf, who was at the head of the Austro-Hungarian armies during the Great War.

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



MECCANO LIMERICKS

No form of verse has attracted the humorist so readily as the limerick. The gay swing of its rhythm lends itself to fun making and as a result the limerick competitions we have featured on past occasions have always enjoyed great popularity.

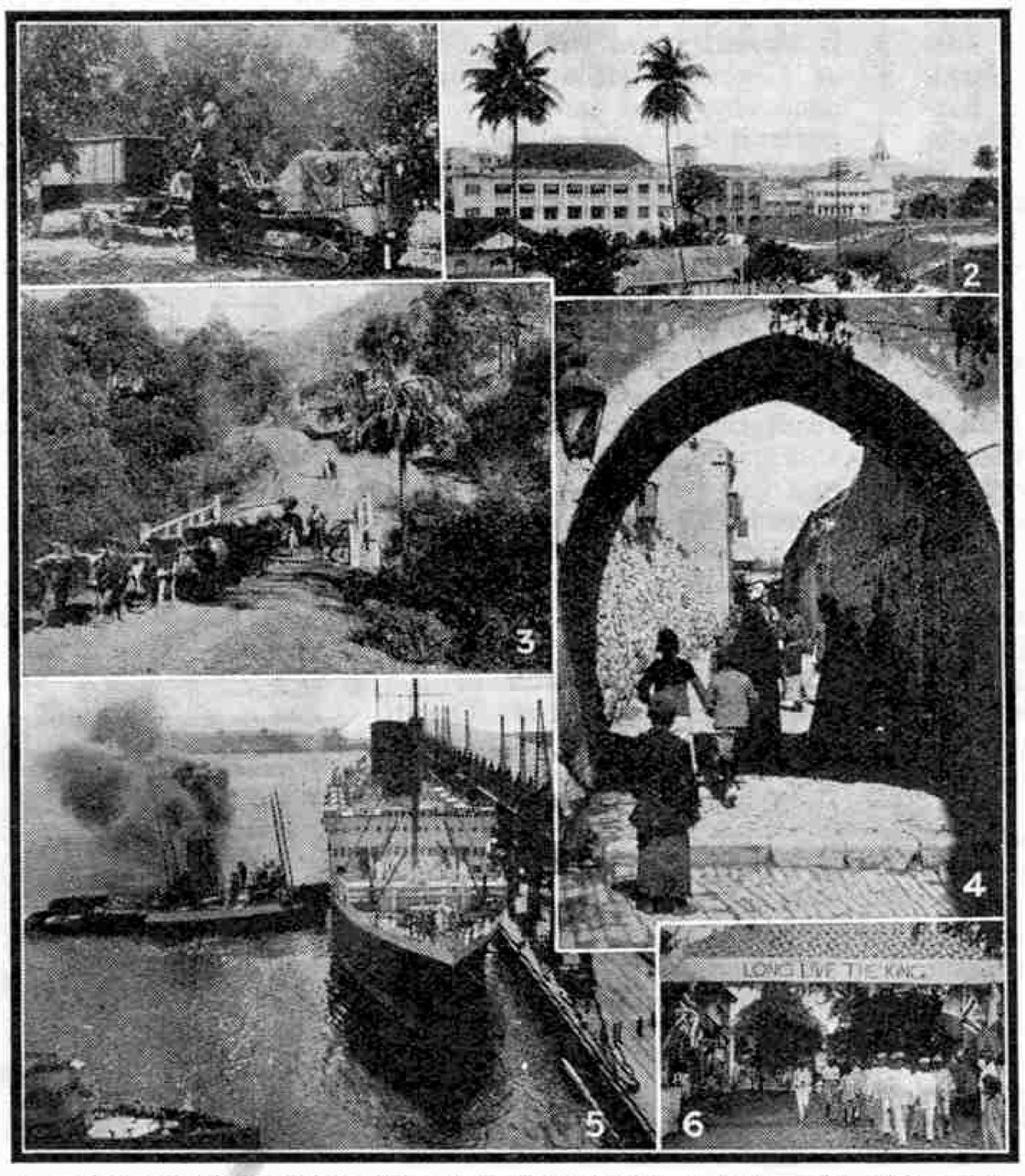
This month we set our rhymester readers a new task—that of providing a suitable last line for a Meccano limerick, four lines of which are given here:—

Of Meccano a schoolboy once said,
As he dreamed of his birthday in bed,
It's undoubtedly clever
The best idea ever

* * * * *

No restrictions are imposed as to the form given to the last line. Readers may feature any one of Meccano's many merits to round off this excited young schoolboy's anticipatory joy. The line must rhyme with the first two lines, of course.

Cash prizes of 21/–, 15/–, 10/6 and 5/– respectively will be awarded to the senders of the four best entries in order of merit.



A selection of prize-winning prints from the Overseas Sections of the 1935 Photo Contests. The first of the 1936 competitions will be announced in our next issue. 1. "Spraying" (Miss N. Milne, Hawkes Bay, N.Z.). 2. "The Growing City" (B. B. Silan, Perak, F.M.S.). 3. "The Timber Hauler" (C. J. McCain, Sydney, N.S.W.). 4. "Old Jerusalem" (R. H. Warr, Cairo). 5. "Journey's End" (J. Credie, Capetown). 6. "Jubilee Spirits" (A. A. Olowu, Ibadan, Nigeria).

Some of our readers may feel that they can improve upon the specimen limerick we provide, and as an encouragement to them to try their hands we offer also cash prizes value 21/–, 15/–, 10/6 and 5/– respectively for the best complete limericks dealing with Meccano or any of its allied productions.

This competition is entirely separate from the "last line" contest, and competitors may submit entries and will be eligible to gain a prize in both.

Entries for both competitions may be sent in one envelope. They should be addressed to "Meccano Limericks, Meccano Magazine, Binns Road, Liverpool 13," and must reach this office not later than 31st March. Separate sheets of paper must be used for the separate competitions, of course.

Separate sets of prizes to the same amounts will be reserved for entries from Overseas readers. Overseas entries must arrive not later than 30th June.

March Drawing Competition

This month we are featuring the last of our 1935/36 series of Drawing Competitions, and those of our artist readers who have not yet taken part are urged to make use of this final opportunity of the season. No special subject is set, and the prizes are offered simply for the best drawings or paintings submitted during the month.

Entries will be divided into the usual two sections, A for readers aged 16 and over, B for those under 16, and cash prizes value 21/– and 10/6 respectively will be awarded to the best entries in each section.

A separate set of prizes, awarded in similar conditions, will be reserved for entries from Overseas readers, that is, those living outside Great Britain, Northern Ireland, the Irish Free State and the Channel Islands.

Entries to this month's competition must be addressed "March Drawing Contest, Meccano Magazine, Binns Road, Liverpool 13," and must arrive not later than 31st March. Overseas closing date, 30th June.

1936 Photo Contests

Amateur photographers among our readers will be pleased to know that we shall be commencing a new series of photographic competitions in our next issue.

The competitions, a separate one each month, will be featured throughout the Spring and Summer.

COMPETITION RESULTS

HOME

Cover Voting Contest.—1. J. F. Burrell (Bristol); Jt. 2 and 3. A. A. Warren (Norwich); A. J. Warren (Norwich); 4. C. P. Bruce (Larkhall).

January Drawing Contest.—First Prizes: Section A, A. Marsh (Coventry); Section B, A. Audsley (Cobham). Second Prizes: Section A, J. E. A. Burley (Birmingham); Section B, A. Briggs (Burnley). Special Prize: J. S. Taylor (Burnley). Consolation Prizes: G. Cooper (Jordans); P. Findlay (Leeds); B. C. Fountain (Hoddesdon); G. M. Gillespie (Peterborough); B. Kett (Upminster); K. A. Marshall (Weymouth).

OVERSEAS

October Doublets.—1. B. E. Harrison (Victoria, B.C.). 2. D. Tolkowsky (Palestine); 3. D. Murison (Buenos Aires); 4. E. K. Shorrock (Vancouver, B.C.).

October Drawing Contest.—First Prizes: Section A, W. Figgins (Wellington, N.Z.). Section B, G. F. Emmerson (Greymouth, N.Z.); Second Prizes: Section A, W. F. Bladergroen (Amsterdam); Section B C. A. Astrom (Morko).

BY SPECIAL REQUEST

"Run away from my window at once."
"But it says 'Watch repairs' on your window, sir."

* * * *

The typist had addressed a letter to Newport, Mon., as Newport, Monday, and in due course the letter was returned by the Dead Letter Office. On being asked sarcastically by her chief whether she had ever heard of such a place as Newport, Monday, she replied: "No, but I thought it was all right, because there is such a place as Sheffield Wednesday."

* * * *

It was the oldest inhabitant's hundredth birthday, and the local paper sent a reporter to interview him.

"To what do you attribute your long life?" he was asked.

"To the fact that I was born so long ago," he replied.

* * * *

"Your watch may be good, but I dropped mine in the Thames a year ago and it's been running ever since."

"What, your watch?"

"No; the Thames."

* * * *

Peter: "Where are you going, mamma?"

Mother: "Father and I are going to a surprise party."

"Can't I go, too—and can't we take Mary along!"

"No, you weren't invited."

"Well, don't you think they'd be lots more surprised if you took us all?"

* * * *

The vicar of a country parish had succeeded in reconciling two old women who had been quarrelling for years, and he induced them to meet under the vicarage roof. In his drawing-room they shook hands.

After an awkward silence one of them said: "Well, Mrs. Jones, I wish you all you wishes me."

"An' who's saying nasty things now?" snapped Mrs. Jones.

* * * *

Mother: "I put Bobby in the store-cupboard for being a naughty boy this afternoon, and he won't come out."

Father: "Of course, he won't; I've stored all the apples in there!"

* * * *

A visitor to the asylum had been asked by a patient to take a letter to the outside world, complaining that he was being unlawfully detained.

"You won't forget to deliver it to the mayor, will you?" emphasised the patient.

"No, I'll not forget."

As he turned to go, the visitor received a violent kick. "What's that for?" he demanded of the inmate.

"Just to remind you not to forget," he replied. "The last chap forgot."

* * * *

He was not used to taking meals in restaurants, but being in London he thought he would visit a famous old eating-house.

"Bill of fare, sir?" queried the waiter, as he sat down.

"Er—no, thanks," he replied. "I'll look at that after the meal."

HIS IDEA!

A negro was being examined for a driving licence. "And what," asked the examiner, "is the white line in the middle of the road for?"

"For bicycles," was the reply!

* * * *

Tom: "If you wanted to preserve a document for all time, how would you set about it?"

Bill: "I should leave it in a dentist's waiting-room."

* * * *

Teacher: "There's no difficulty in the world that cannot be overcome."

Pupil: "Have you ever tried squeezing tooth paste back into the tube?"

* * * *

A crowd had gathered at a fire. The policeman was moving them on, but one man objected. "Why should he stay," he said, pointing to a man in front, "while I have to move on?"

"Well," replied the policeman, "It's his fire."

* * * *

Examiner: "What is the distance between London and Glasgow?"

Candidate for the Police Force: "I don't know, but if that's going to be my beat, I'd rather not go on with the matter."

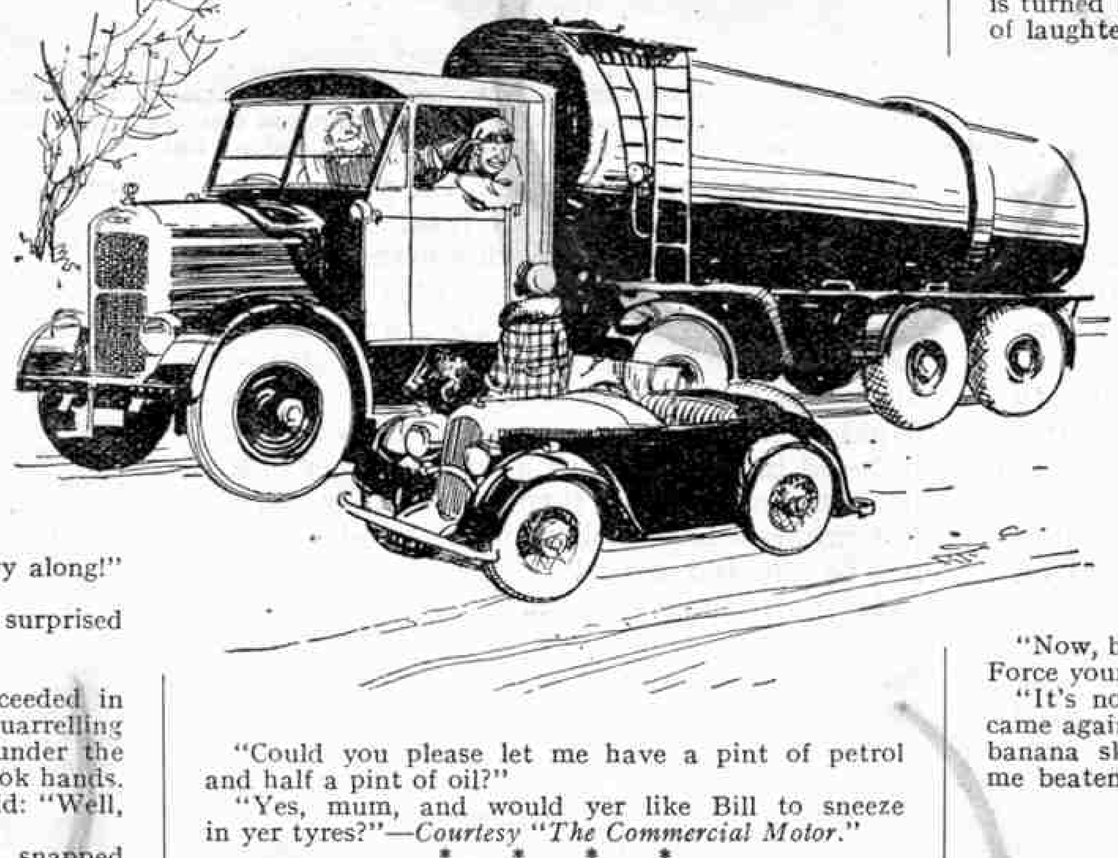
* * * *

"Is a ton of coal very much, papa?"

"That depends, my son, on whether you are shovelling or buying it."

* * * *

SERVICE!



"Could you please let me have a pint of petrol and half a pint of oil?"

"Yes, mum, and would yer like Bill to sneeze in yer tyres?"—*Courtesy "The Commercial Motor."*

* * * *

Jinks: "I suppose your landlord asks a lot for the rent of this place?"

Blinks: "A lot! He asks me for it nearly every day."

* * * *

"Shall I go to a mind-reader or a palm-reader?"

"A palm-reader; it's obvious that you've got a palm."

* * * *

A man received an indecipherable prescription from his doctor. After it had been made up for him by the chemist it was returned to him and he used it for two years as a pass on the railway, gained admission to dances, cinemas and theatres, while, in the evenings his daughters used to practise it on the piano.

* * * *

Teacher: "Now, Thomas, what are you doing—learning something?"

Thomas: "No, sir; I'm listening to you."

* * * *

"Tact," said the lecturer, "is essential to good entertaining. I once dined at a house where the hostess had no tact. Opposite me was a modest, quiet man. Suddenly he turned as red as a lobster on hearing his hostess say to her husband: 'How inattentive you are, Charlie! You must look after Mr. Brown better. He's helping himself to everything.'"

THE RIGHT SPIRIT!

Busy Man: "I am sorry that my engagements prevent my attending your charity concert, but I shall be with you in spirit."

Ticket Seller: "Splendid; and where would you like your spirit to sit? I have tickets here for a half-crown, five shillings and half-a-guinea."

* * * *

Yankee: "Yeah, I sure belong to New York."

Englishman: "Oh; now I understand. I thought New York belonged to you."

* * * *

Land Lubber: "Tell me your story, Ancient Mariner."

A.M.: "Well, once we were stranded—had to eat our belts and shoes to live."

L.L.: "No!!"

A.M.: "And then the boat turned turtle and we lived on that for six days."

* * * *

Angus (to Donald, who has bought a second-hand car): "Man, it'll be costing you a bit in petrol."

Donald: "Not so much. It's downhill to the town, and I can get a tow home most days."

* * * *

Patient: "Doctor, are you sure I have pneumonia? Sometimes doctors prescribe for pneumonia and patients die of something else."

Doctor: "When I prescribe for pneumonia you die of pneumonia."

* * * *

"You will notice," said the professor as he seized the handle of a piece of mechanism, "that this machine is turned by a crank." And he wondered why a ripple of laughter ran round the class.

* * * *

Black: "Have you ever wondered what you would do if you had Rothschild's income?"

Blue: "No; but I have often wondered what he would do if he had mine."

* * * *

Some street musicians, more noticeable for their vigour than their harmony, were taking a short rest before starting another tune. The trombonist turned to his mate. "What's the next tune?" he asked.

"The Blue Danube," was the reply.

"'Blue Danube' be blowed," said the trombonist. "I just played that."

* * * *

Grocer: "Did that piece of boiled ham I sent along the other day do for the whole family?"

Mrs. Brown: "Almost, but they're getting better now."

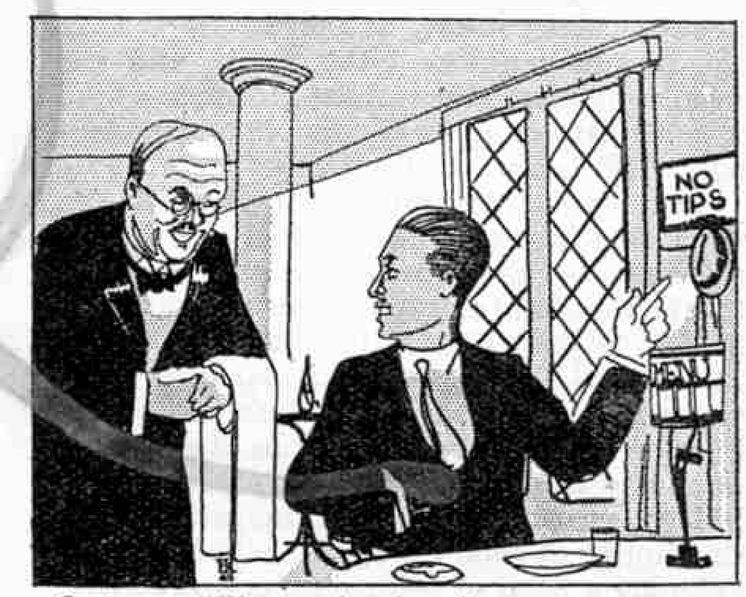
* * * *

"Now, be sure and eat the skins when you have fruit. Force yourself to do it," the doctor advised.

"It's no good, doctor," the patient said when he came again. "I simply can't eat the skins. I managed banana skins, but pine-apples and coco-nuts have me beaten."

* * * *

A BROAD HINT



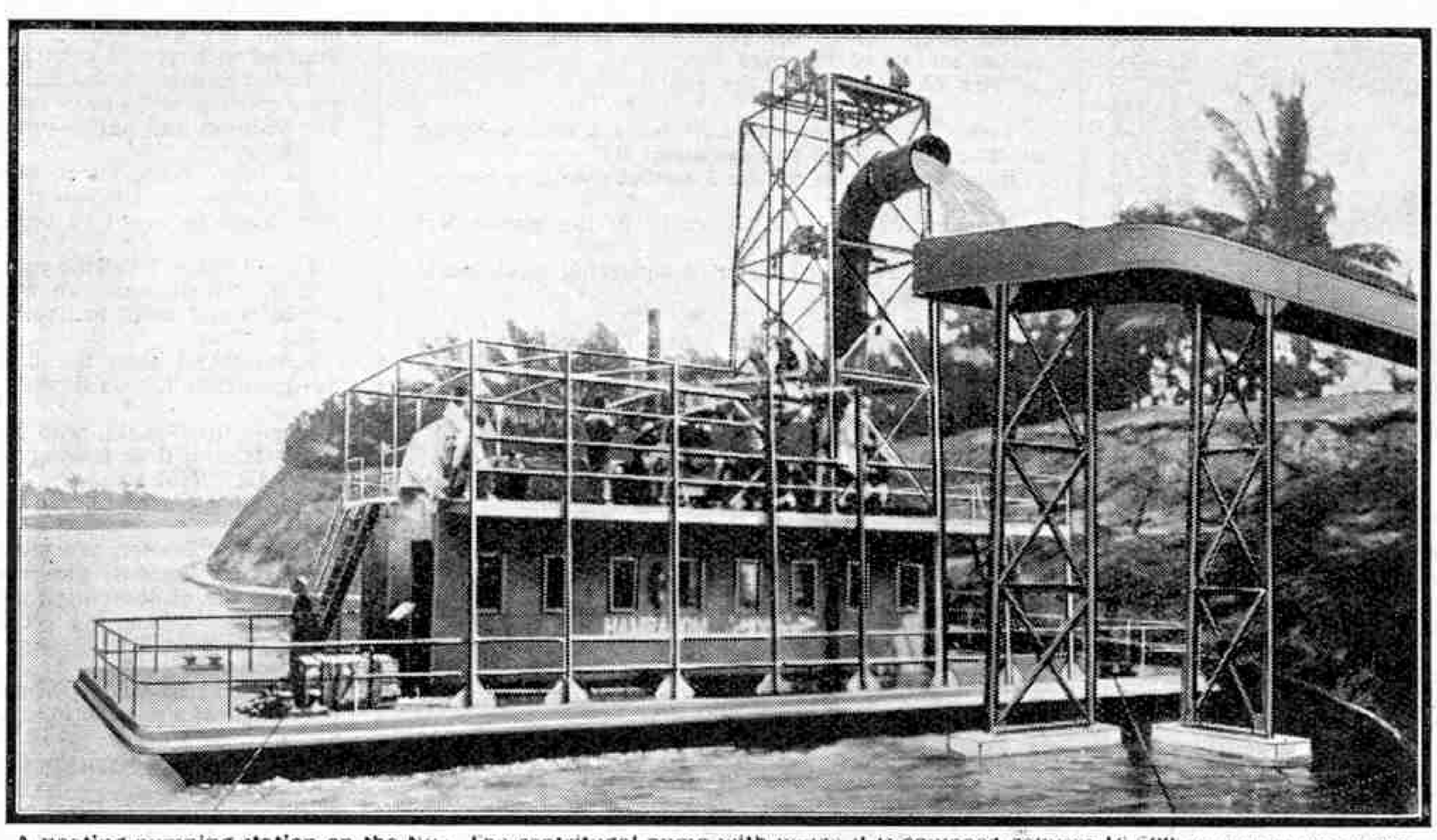
Customer: "H'm; no tips, I see."

Waiter: "Yes, sir. Gives a gentleman a chance to show 'is independence, sir."

A Floating Pumping Station in Egypt

In countries where it is necessary to pump water from a river for irrigation purposes, trouble often arises from variations in level of the water and from the silting up of the channels along which it is led to the pumping station. Trouble of this kind was encountered in irrigating an estate, belonging to Prince Youssouf Kemal, on the banks of the Nile at Moeris, near Luxor, Egypt. Water for irrigation purposes formerly was supplied by a steam pumping plant. At the point where it is taken from the Nile extensive sandbanks are uncovered when the river is low and the bank is then 850 ft. from the edge of the water. The annual cost of dredging the canal that had to be cut to give access to the pump was £1,500.

The difficulties encountered in drawing water from the Nile for this estate have now been overcome by the use of a floating pumping station, which is moored in the river and rises and falls with the water. The new station is illustrated on this page. It is complete in itself, both the pump and the motor driving it being installed on the float. The pump is of the Sulzer centrifugal type and delivers 16,500 gallons per minute when running at 325 r.p.m. against a head of 33 ft. and absorbing 208 h.p. The water is delivered into a chute down which it flows into the irrigation system.



A floating pumping station on the Nile. The centrifugal pump with which it is equipped delivers 16,500 gallons of water per minute. Photograph by courtesy of Sulzer Bros. (London) Ltd.

Floating pumping stations had already proved their value, particularly for hydro-electric power stations and for works in which provision is made for the storage of water in reservoirs for power purposes. In a remarkable plant of this kind installed on Lake Gosau, in upper Austria, by Sulzer Bros Ltd., five cylindrical floats, each about 20 ft. long and 7 ft. in diameter, and two others of the same diameter but with lengths of 46 ft. keep the entire station afloat. This station is equipped with two sets of Voith-Sulzer pumps, each delivering 26,400 gallons per minute against a head of water of 148 ft. when running at 960 r.p.m. One of the pumps requires 1,430 b.h.p. and the totally enclosed three-phase motor to which it is directly coupled is capable of developing 1,700 b.h.p. continuously.

Two similar floating power stations also were used for lowering the level of a lake in the Pyrenees that now serves as a reservoir for the pumping storage power station of the Societe Hydro-Electrique du Midi. These also were built by Sulzer Bros. Ltd. Each comprises four groups of Sulzer pumps delivering a total of 29,600 gallons of water per minute against a head of 49 ft. and requiring 544 b.h.p., and the electric motors driving the pumps of each group are capable of developing a total of 600 r.p.m. continuously. Each installation weighs about 55 tons and is supported on 12 floating cylinders.

Electric Furnace in which White Mice can Live

We are so accustomed to think of a furnace as a centre of intense heat, close approach to which is painful if not impossible, that it is a little startling to hear of an electric furnace that melts metals with the greatest ease and yet into which one may thrust the bare hand without the slightest inconvenience or danger. This can be done with a high frequency induction furnace, which heats only electrical conductors, and white mice have actually lived in a furnace of this kind used by the General Electric Company of New York for experimental purposes.

An induction furnace may be likened to a special transformer in which the primary is a coil of copper conductor inside which is placed the mass of conducting material that is to be heated or melted. This material serves as the secondary of the transformer, and is rapidly heated to the melting point—and even higher if desired—because of the rapid changes or oscillations in the current induced in it. A gold ring on the finger of a hand thrust into the furnace would become hot immediately, although the hand would not be affected directly.

High frequency furnaces have been in laboratory and commercial use for years, but an application of special interest is in the manufacture of radio tubes. It might be thought that in order to obtain the necessary high vacuum within a tube it was merely necessary to remove all the gas by means of an efficient vacuum pump. In actual fact the operation is by no means simple, because metals and glass absorb large amounts of gas and water vapour that can only be driven out by heating. The metal parts used must be subjected to a higher temperature than the glass can withstand, and for this reason they are heated locally while the tube is being exhausted by placing it for a moment within a high frequency coil attached to a wooden handle. This forms a miniature induction furnace. The metal parts of the tube immediately become red hot, and the bubbles of gas and vapour are boiled out. The tube is then sealed from the pump with the knowledge that later heating of the tube by the passage of current through the filament will not cause any further release of gas.

Gibbons' Simplified Stamp Catalogue

One of the most interesting signs of the growth o interest in the stamp collecting hobby is the announcement by Stanley Gibbons Ltd. that they have found it necessary to produce a fourth edition of their Simplified Stamp Catalogue, although it is only five months since the third edition appeared.

The new edition is to be published on the 11th of this month and the information contained in it will be nearly five months in advance of that in any other current catalogue. It will include all the Empire issues of King George's reign, in addition to the latest values of the popular Silver Jubilee stamps, and in comparison with the third edition will list 556 more stamps and include 117 additional illustrations.

Those of our stamp collector readers who do not already possess a catalogue would find this a helpful addition to their stamp collecting equipment. Its price is 5/– and it may be obtained from any stamp dealer or direct from Stanley Gibbons Ltd., 391, Strand, London, W.C.2.

Ship Photographs

With the approach of spring and summer holidays, readers who live along our sea coasts, and particularly in our ports, will have increased opportunities of observing the movements of ships. Interest in shipping extends also to many readers who live inland, and practically all who share in it welcome opportunities of adding to their collections of photographs of liners and other vessels. A catalogue issued by our advertisers B. and A. Feilden, 12, Harlech Road, Blundellsands, Liverpool 23, gives lists of postcard photographs of liners and freighters of almost every British Line, and also of many of the foreign Lines.

The photographs themselves are of particularly fine quality, and those who are attracted by the hobby should write for this catalogue. Provided the "*M.M.*" is mentioned, B. and A. Feilden will send a specimen real photograph postcard and the catalogue for 3d. only.

Cycling Comfort

Cyclist readers of the "*M.M.*," particularly those with a passion for long-distance runs at high speed, will find special interest in the little booklet "*Cycling Comfort*" issued by Herbert Terry and Sons Ltd.

The principal feature of the booklet is an account of the attack on the English road racing records, made last year by the famous Australian team of riders, Hubert Opperman, familiarly known as "Oppy," Stuart and Milliken. The team was brought over from Australia specially for the attack by the B.S.A. Company, who also provided the machines, which were equipped with Terry Spring Seat Saddles.

The booklet can be obtained from Herbert Terry and Sons Ltd., Redditch, free of charge, if the "*M.M.*" is mentioned in the application.

Electrical Specialities

Our advertiser Mr. L. Wilkinson has just sent us a copy of the new "Wilco" electrical catalogue. Almost every conceivable electrical accessory, from insulated staples to mains motors, cycle lighting sets to vacuum cleaners, and shocking coils to voltmeters is included in the range of "Wilco" products, and illustrated in this useful and well-produced catalogue.

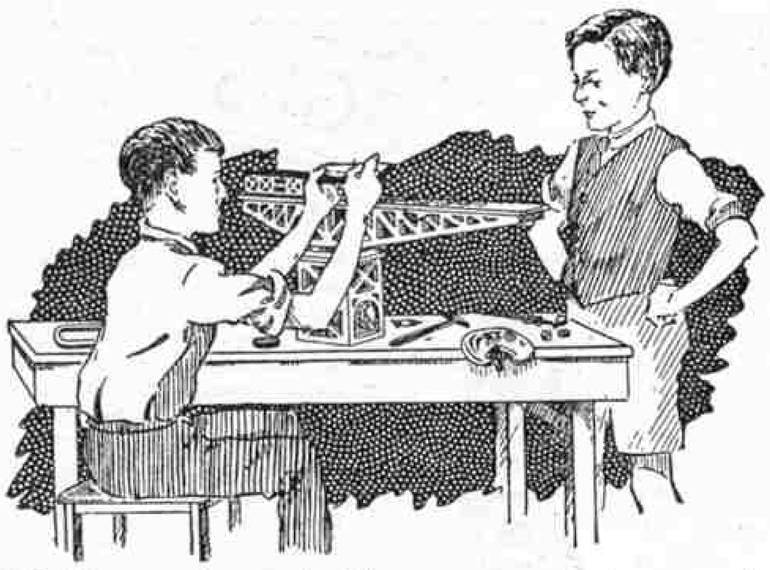
Mr. L. Wilkinson, 8, City Road, London, E.C.1, will send a copy of the catalogue, free of charge, to any applicant who refers to the "*M.M.*" when writing.

Leeds Model Railway Society

The Leeds Model Railway Society are endeavouring to extend their Junior Section, and invite Hornby Railway Company members of 14 yea s of age and more who live in Leeds and district to join this Society. Any H.R.C. member who is interested should write to Mr. H. Stonebridge, 12, Wakefield Road, Drighlington, Nr. Bradford.

* * * *

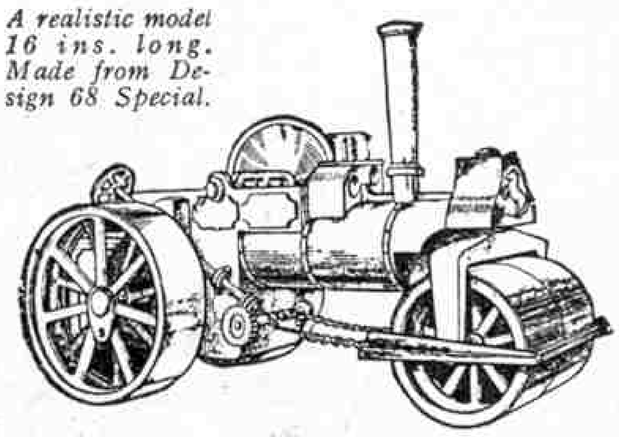
In reviewing Charles Letts' "Schoolboy's Diary" on page 68 of the January "*M M.*," we inadvertently gave the price of the leather edition with pencil, maps and pocket as 2/6. The correct price is 2/–.



Models you can make in wood

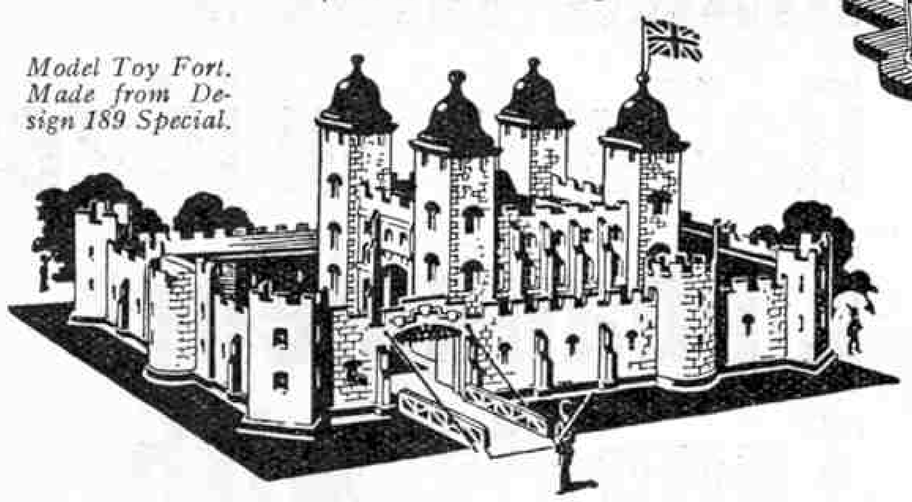
JOLLY good fun too. Cutting them out from the patterns provided is quite easy, and fitting the parts together is as good as any builder's job. Ships, locomotives, buildings, cranes—lifelike and workable—cut out in wood with a fretsaw. A great game for spare time—to say nothing of prizes to be won with the models at the school exhibitions. A set of necessary tools—a Hobbies Fretwork Outfit—costs as little as 1/6, and free patterns are given with Hobbies Weekly.

A realistic model 16 ins. long. Made from Design 68 Special.



LISTS FREE A new illustrated list of models you can make, with full particulars, sent free on request to the address given below.

Model Toy Fort. Made from Design 189 Special.



St. Paul's Cathedral, 16 ins. long. Made from Design 187 Special.

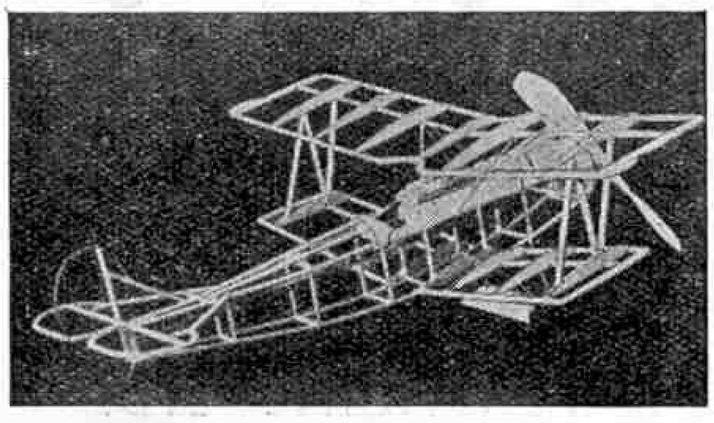
HOBBIES DESIGNS

You should read Hobbies Weekly for helpful spare time hobbies. Price 2d. every Wednesday. A free specimen copy sent to any reader of the Meccano Magazine who writes to Dept. 96, Hobbies Ltd., Dereham, Norfolk.

OVER 500 THINGS TO MAKE

The 1936 Hobbies Handbook has 268 pages of different pastimes and things to make, with free charts for a Model Farm, a Motor Car Delivery Box, and a novel Calendar in colour. Price 6d. from any newsagent. Sent post free for 9d. from Hobbies as below.

Build your own FLYING MODELS

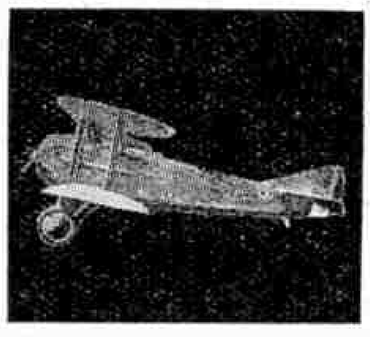


FOKKER D.7 3/-

Wingspan 15 ins. Build this real flying scale model from the full size plan and instructions given. The kit is complete and has everything needed including quick drying cement. Easy model to build. Complete kit, carriage paid for 3/-.

CURTISS ROBIN 3/-

Wingspan 17½ ins. This kit makes a really marvellous flying model giving steady flights of over 600 feet. Simple to build. Kit has everything needed, including shaped balsa flying prop, quick drying cement, full size plans. We strongly recommend this kit to anyone who wants a really good flying performance. Complete kit, carriage paid, for 3/-.



SPAD 2/-

Wingspan 12½ ins. This kit makes a really attractive flying model of the famous war fighter. The kit is complete and includes everything needed; quick drying cement, shaped balsa flying prop. Complete kit, carriage paid, for 2/-.

Send two 1d. stamps for the finest flying scale model aeroplane catalogue in England—16 pages with four pages of special building instructions.

Send your Postal Order for a kit NOW.

We guarantee you will be satisfied or money refunded.

M. SWEETEN LTD.
Bank Hey Street, BLACKPOOL.

BOND'S

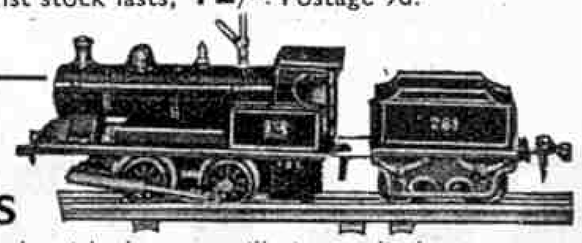
SPECIAL LOCOMOTIVE OFFER

Will run on any Gauge "O" or Hornby Track

20-VOLT ELECTRIC

0-4-0 Tender Locomotive

These locomotives are fitted with a powerful reversing mechanism having all driving wheels geared together, fitted **electric light** in front and painted in green. Complete with tender. Length 12". Usually sold at 21/-. **Price,** whilst stock lasts, **12/-**. Postage 9d.



STEAM LOCOMOTIVES

These locomotives are fitted with large oscillating cylinder, steam whistle and efficient safety valve. Painted in all companies' colours. All locomotives are complete with methylated spirit lamp, cylinder oil, spanner, measure and filling funnel.

Prices:

Tender Locomotive. Length 11". Usually sold at 20/-. Whilst stock lasts **11/6**. Postage 9d.

Tank Locomotive. Length 7½". Similar construction to above. Usually sold at 19/-. Whilst stock lasts **11/9**. Postage 9d.

If you are interested in any type of Model Making or Light Engineering, write to Bond's for your parts. Also all Tools and Materials. All these parts are listed in Bond's 180-page Catalogue, Price 6d. post free.

BOND'S O'EUSTON ROAD LTD.
254, EUSTON ROAD, LONDON, N.W.1.
'Phone: Museum 7137. Est. 1887.

French Agents—Messrs. J. Fournereau, 60, Rue Alphonse-Pallu, Le Vesinet (S-&-O.)

S. African Agents—Messrs. J. Alcock & Co., 69, Mooi St., Johannesburg.

A CHALLENGE !

Like the Knights of old, Seccotine sends out a challenge to Trial by Strength! There isn't another adhesive dare accept, for Seccotine is twice as strong as any of them. There's no exaggeration about that, because it has been proved by laboratory tests. You wouldn't find people like the Air Force and the Navy using Seccotine if it were not the best.

It's been the best since your Grand-dad's days—over fifty years ago, and it has never been beaten. There's one thing you must be careful about though—don't be put off with anything in a tube. It must be real Seccotine with the name clearly on the tube. Just keep your eyes open for the real thing.

Obtainable in tubes, **4½**d., **6**d. and **9**d., from all good Stationers, Ironmongers and General Stores.

MADE BY BRITISH WORKPEOPLE.

SECCOTINE REGD

THE DOUBLE STRENGTH ADHESIVE

STICKS EVERYTHING

POST THIS COUPON to: Dept. M.,

M'Caw, Stevenson & Orr Ltd.,
Belfast.

I should like to have, post free, a copy of your Free Booklet.

NAME.....

ADDRESS .....

.....

Here is a new and interesting booklet produced in answer to the popular demand of Hornby Railway enthusiasts. It contains a wide selection of attractive rail formations, varying from quite simple layouts to more ambitious designs with double track. The best possible uses of Hornby Rails, Points and Crossings are clearly demonstrated.

The booklet is obtainable (Price 3d.) from any Meccano dealer, or (Price 4d.) post free, direct from

MECCANO LIMITED
Binns Road, Liverpool 13

Make those Railway bridges Embankments Tunnels with

HARBUTT'S *Plasticine*

Write for full illustrated price list to

HARBUTT'S PLASTICINE LTD.
99, Bathampton, Bath

SPECIAL OFFER

With every order for kits value 5/- or more, we will send free an all-balsa glider, 10" span.
KEELBILD Models are the models you will eventually build. Why not order yours now? and be ready for the Spring.

KEELBILD Models are the finest in appearance, the easiest built, and have the best flying performance of any Scale Models on the Market to-day.

Modified Hawker Super-Fury (*illustrated*) 22" Span
Arrow Active 24" ,,
Pfalz D.XII ... 22" ,,
Construction Sets **10/6** each, Plus 9d. Carriage.

Lockheed-Vega, 36" Span Construction Sets, **30**/–, Plus 1/– Carriage.
Scale flying Model of the "Flying Flea," 21" Span. **7/6**, Plus 6d. Carriage.
Also "Homebuild" Kits, Solid and Scale Flying Models, **10d.** to **5/6** post free.
Obtainable from High Class Dealers, or direct from The Model Shop
Fully illustrated Catalogue 2d. post free.

THE MODEL SHOP, 3, College Road, Barras Bridge, Newcastle-upon-Tyne.

A BUMPER SPRING HANDBOOK!

• The New Bassett-Lowke Catalogue

WHITE Sails tossing! Long grey battleships cutting swiftly across the sea! Great liners with their freight of travellers, plying the ocean routes of the world!

Visions like THESE flash before your eyes as the pages fly by!

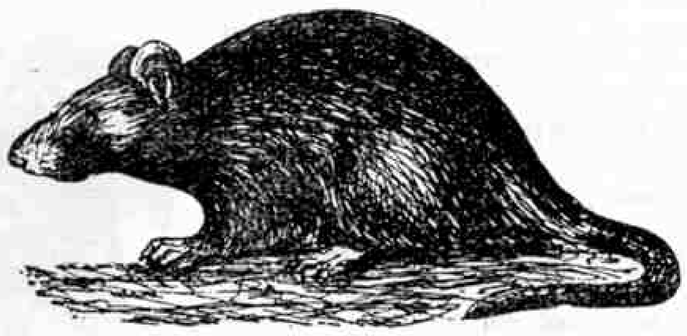
Let us study some of them. Why yes, here are the two greatest ships of the world in miniature, the famous "NORMANDIE" and our own "QUEEN MARY." And here, the Exploration Ship that might have been used by Nansen, Scott or Shackleton; the Life Boat with its heroic tradition, and the useful Oil Tanker Tug and Cargo Boat; while, skipping back the years, we discover Drake's "GOLDEN HIND" and Columbus' "SANTA MARIA."

There is not room here to tell you more of BASSETT-LOWKE'S splendid new catalogue "Scale Model Ships," but if you send sixpence to their Head Office at Northampton **now** you will be sure of your copy. Ask for **New S.17**, which beside complete ships, gives you details of thousands of fittings for making your ship like the real thing.

Model Railways, A.17, 6d. Model Engines, B.17, 6d.

BASSETT-LOWKE LTD.
NORTHAMPTON London: 112, High Holborn, W.C.1. Manchester: 28, Corporation Street.

Boys! Kill rats and other pests with a B.S.A. Air Rifle



Get a B.S.A. Air Rifle and do your share of rat killing. Rats are destructive pests and sport-loving boys will enjoy excellent sport and at the same time get good, useful practice, thinning them out.

The B.S.A. "Breakdown" Air Rifle is designed specially for boys. It handles nicely, is easy to load and will kill outright up to 30 yards.

Ask your father to get you a B.S.A. Air Rifle. Mention that B.S.A. Pellets .177" bore, cost only 2/3 per 1,000—37 accurate shots for one penny.

Prices from **45/-** or only **4/3** a month

B.S.A. "Breakdown" Air Rifle .177" bore

POST THIS COUPON TO-DAY

B.S.A. Guns Ltd., 92, Armoury Road, Birmingham, 11.
Send me the B.S.A. Air Rifle Leaflet.

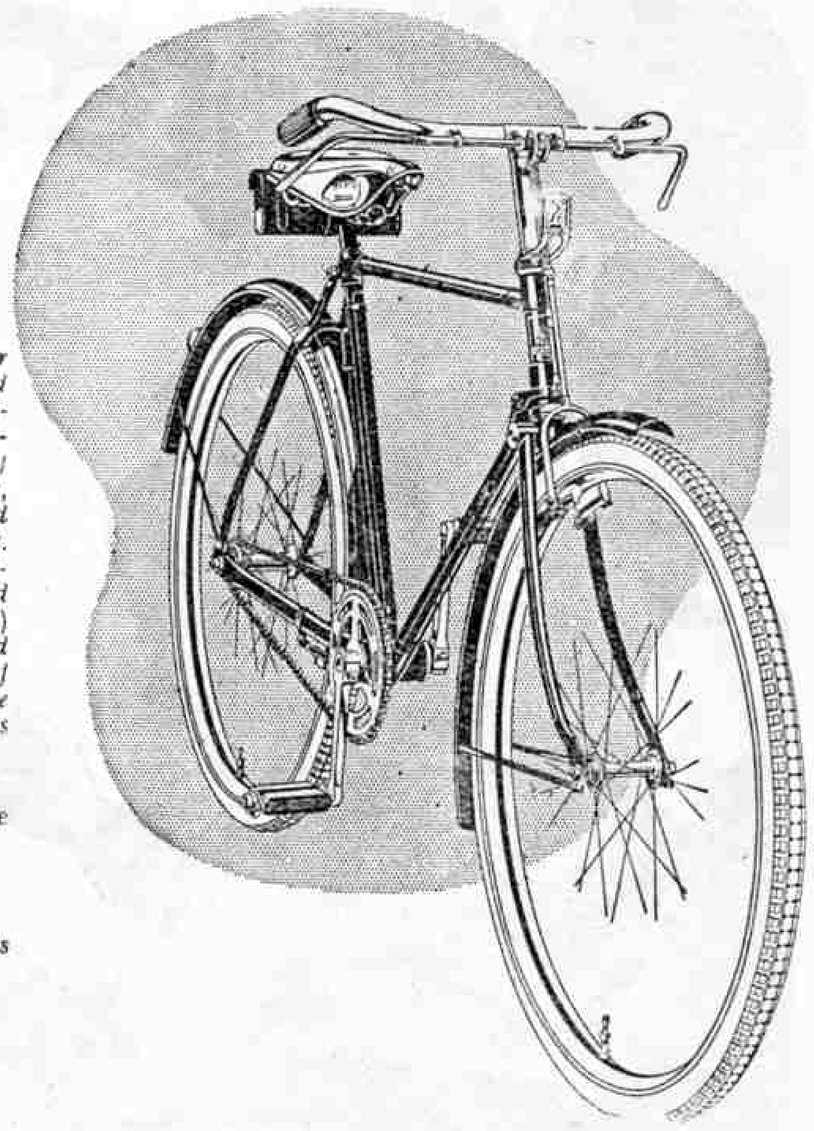
Name.....

Address.....

Join the Raleigh Boys

THEY CAN GO FASTER!

Tom, Dick and Sam, the boys who ride Raleighs, have been making the gang look foolish again! Some of the other boys challenged them to a race—and the Raleigh boys won looking round. And the funny thing was the losers were absolutely whacked, whilst the Raleigh boys were as fresh as the paint on their machines. That's the beauty of a Raleigh. You never get tired when riding because a Raleigh is scientifically built to prevent fatigue. And it's the easiest running of all bikes. Join the Raleigh boys. It only costs 5/- down and 2/- a week. Speak to Dad about it—and don't forget to tell him that a Raleigh is guaranteed for ever.



From **£4.7.6** *Cash, or* **5/-** *down and 12 monthly payments of* **8/4**. *Dunlop Tyres, Brooks' Saddle and the best of everything. Specify the Sturmey-Archer Three-Speed Gear,* **20/-** *extra (cash) or* **2/-** *monthly. Send postcard for copy of "The Book of the Raleigh" and address of nearest dealer.*

The Raleigh Cycle Co. Ltd., Nottingham.

Depots and Agents everywhere.)

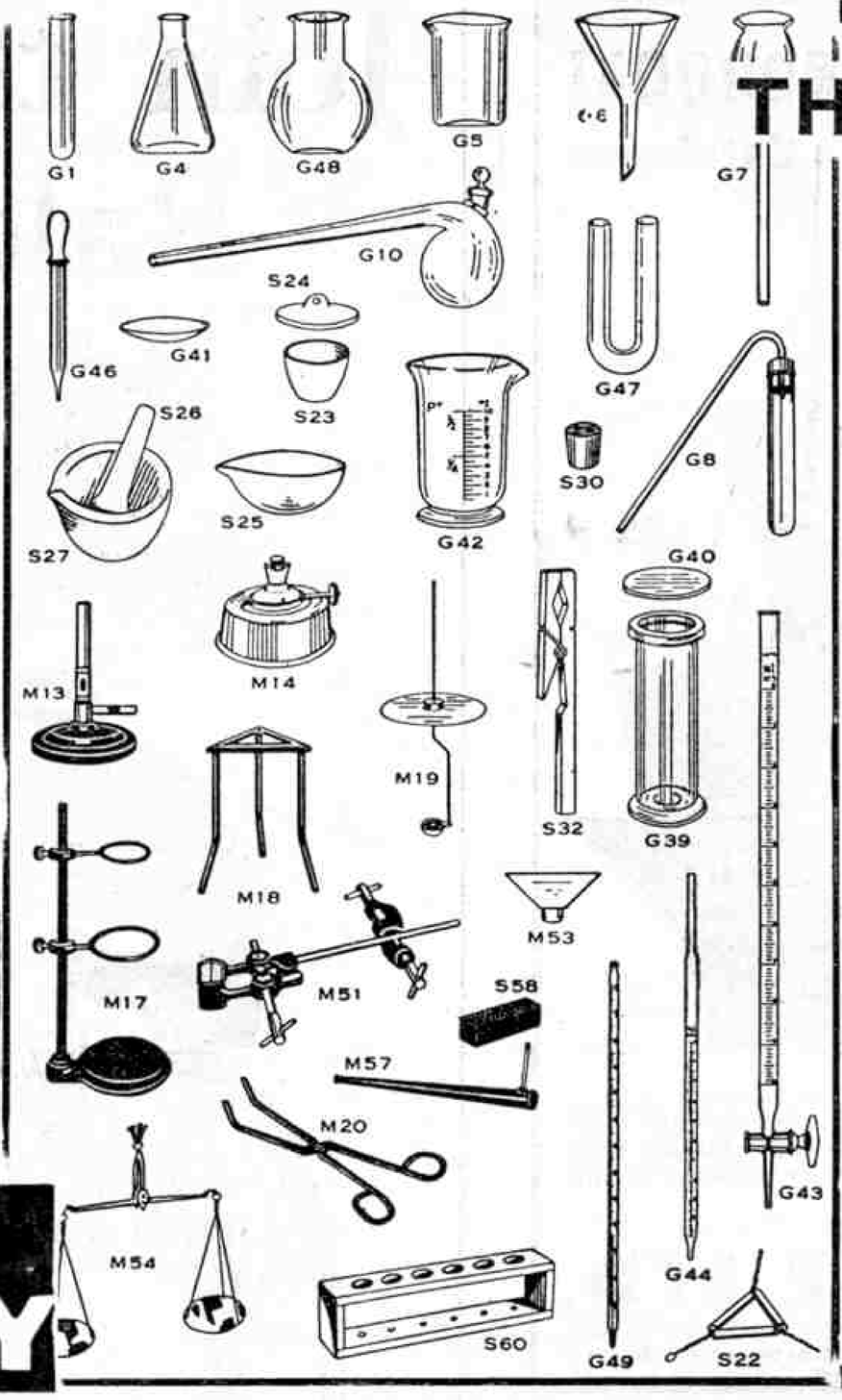
RALEIGH
THE ALL-STEEL BICYCLE

Fit the Sturmey-Archer 3-speed gear—the gear that "makes cycling easy"

STILL MORE FUN AND INTEREST

from your

LOTT'S CHEMISTRY



THIS is a page from LOTT'S CHEMISTRY SPARES PRICE LIST, which every Lott's Chemistry enthusiast ought to have by him. It shows all the extra apparatus that you can buy, piece by piece, to make your 'home laboratory' more interesting and complete. They are obtainable at all shops stocking Lott's Chemistry Sets. Extra supplies of chemicals as supplied in the sets are also listed.

Don't be hindered in your more important experiments by lack of apparatus—write for this list now.

Write on a penny postcard or, if you send a letter, use a 1½d. stamp. The address is:

Dept. M.M.,

LOTT'S BRICKS LTD.
WATFORD, HERTS.

A fascinating building hobby

FOR BOYS AND GIRLS

Dinky Builder Outfits are great favourites with boys and girls. The parts contained in them provide a most fascinating constructional hobby, specially designed for the younger children. These brightly coloured parts are fitted together in a most simple and ingenious manner without the use of any nuts and bolts.

There are three Outfits in the series: No. O Outfit is available in bright red and green finish, while No. 1 and No. 2 Outfits can be obtained in bright red and green or in salmon pink and jade green finish.

No. O DINKY BUILDER OUTFIT

This is an excellent Outfit with which a splendid range of models can be built. The Instruction Folder included gives examples of 40 delightful models. Price 2/6

No. 1 DINKY BUILDER OUTFIT

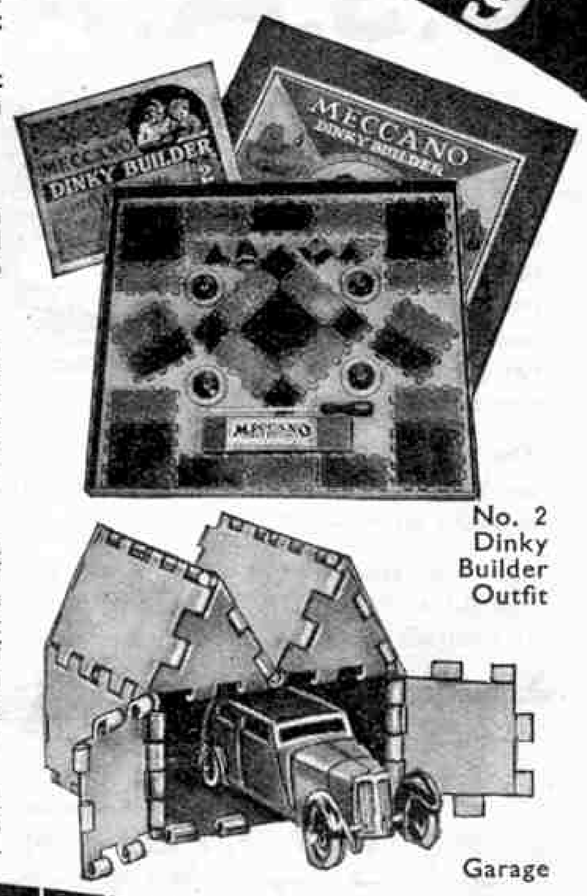
This fine Outfit contains a varied selection of parts, including a set of four road wheels for constructing miniature wheel toys, many examples of which are illustrated in the Instruction Folder. These instructions show a total of 70 fine models that any boy or girl can build. Price 4/11

No. 2 DINKY BUILDER OUTFIT

The No. 2 Dinky Builder Outfit is the largest Outfit in the series. It contains a comprehensive selection of parts with which all the No. O and No. 1 Outfits models can be built. In addition, the parts in this fine Outfit make possible the construction of seven groups of miniature model furniture. Full instructions are given in the Instruction Folders included in the Outfit. Price 7/11

DINKY BUILDER "A"

The Dinky Builder "A" packet contains a useful assortment of Dinky Builder Parts with which Outfits No. O, No. 1 and No. 2 may be supplemented. Price 1/-



No. 2 Dinky Builder Outfit

Garage

PRODUCT of MECCANO LIMITED LIVERPOOL

DINKY BUILDER

Manufactured by Meccano Limited, Binns Road, Liverpool 13

I'm exchanging my old Hornby engine for a new one!

Boys! Here is a plan to secure a fine new Hornby Locomotive in exchange for your old one.

First of all, study carefully the latest Hornby Train Catalogue, and select from it the new up-to-date Hornby Locomotive you want. Then pack up your old Hornby Locomotive and send it to us addressed "Special Service Department," Meccano Ltd., Binns Rd., Liverpool 13. Your order for the new Locomotive and the necessary remittance should be enclosed. You can easily ascertain how much to send by deducting the part exchange allowance indicated in the list given below from the price of the new Locomotive, and adding 1/– for postage on the new model you purchase. It is important to note that the catalogue price of the new Hornby Locomotive you purchase **must not be less than double the Part Exchange allowance made for your old Locomotive.**

If you prefer to do so, you can effect the exchange through your dealer, who will be very pleased to give you any information you require.

Part Exchange allowances for Hornby Locomotives

CLOCKWORK MODELS	
M2930 Locomotive	1/–
MO Locomotive...	1/4
M1/2 Locomotive	2/3
*George V Locomotive ...	3/3
*No. OO Locomotive	3/3
M3 Tank Locomotive	3/9
M3 Locomotive	4/3
Zulu Locomotive	5/3
No. O Locomotive	5/3
LEC 1 Locomotive (Swiss Type)	5/3
Zulu Tank Locomotive... ...	6/3
No. 1 Tank Locomotive ...	6/3
No. 1 Locomotive	6/3
No. 1 Locomotive, fitted for Hornby Control	7/6
No. 1 Tank Locomotive, fitted for Hornby Control	7/6
No. 1 Special Locomotive ...	8/3
No. 1 Special Tank Locomotive	8/3
No. 2 Locomotive	10/–
No. 2 Tank Locomotive ...	10/6
No. 2 Special Tank Locomotive	10/6
Metropolitan C Locomotive ...	10/6
No. 2 Special Locomotive ...	11/3
No. 2 Locomotive, fitted for Hornby Control	11/3
No. 2 Tank Locomotive, fitted for Hornby Control	11/9
No. 3C Locomotive	12/–
No. 3C Riviera "Blue" Locomotive...	12/–

*These models were identical.

ELECTRIC MODELS	
EM16 or EM120 Locomotive ...	4/3
No. 1 Electric Tank Locomotive, Permanent Magnet	7/6
EM36 or EM320 Tank Locomotive	8/3
LST M3/20 Tank Loco (20 volt)	8/3
LE 120 Locomotive	10/–
LE 1/20 Loco (Swiss Type), 20-volt	10/–
E06 or E020 Locomotive ...	11/–
E16 or E120 Locomotive ...	12/–
E16 or E120 Tank Locomotive...	12/–
LST 1/20 Tank Locomotive (20-volt)	12/–
LST 2/20 Tank Locomotive ...	12/6
E3/20 Locomotive	12/6
E3/20 Riviera Locomotive ...	12/6
EPM16 Special Tank Locomotive	13/9
Metropolitan L.V. Locomotive	15/–
E26 Special Tank Locomotive ...	15/–
E36 Metropolitan Locomotive...	15/–
E120 Special Locomotive (automatic reverse)	15/–
No. 2 Electric Tank Locomotive	15/–
E120 Special Tank Locomotive (automatic reverse)	15/–
E36 Locomotive...	16/3
E36 Riviera "Blue" Locomotive	16/3
E220 Special Tank Locomotive (automatic reverse)	16/3
LE2/20 Locomotive	16/6
LE220 Locomotive (automatic reverse)	16/6
E320 Locomotive (automatic reverse)	17/6
E320 Riviera Locomotive (automatic reverse)	17/6
E220 Special Locomotive (automatic reverse)	18/9
Metropolitan H.V. Locomotive	18/9

HORNBY TRAINS

BRITISH AND GUARANTEED

Manufactured by

MECCANO LTD. - LIVERPOOL 13

SKYBIRDS

THE MOST MODERN OF ALL HOBBIES
SCALE MODEL AEROPLANE CONSTRUCTION

MAKE MODEL AEROPLANE CONSTRUCTION EASY

This fascinating hobby has captured the imagination of air-minded men everywhere. No other model aeroplanes can compare with these beautifully made, easily constructed machines. The components are wood, metal and celluloid, precision made—true to scale (1/72)—and perfectly finished. Start your collection to-day!

NEW! THE HESTON "PHŒNIX" Constructive Set, 2/6

Assembled and Painted, **8/6**

Decorative **SKYBIRD COLUMNS** for Airport Gateways, per pair **6d.**

TRENCH LAY-OUT, 15" x 12", incorporating No-man's Land with Mine Crater, Shell Holes, Wire Entanglements, Front Line Trench with Concealed Nest for Machine Gun, Firing Steps, Communication and Supporting Trenches, Gun Emplacements and Bomb-proof Shelter, **5/–.**

Made to scale for **SKYBIRD** Figures, Guns, etc.

JOIN THE SKYBIRD LEAGUE AND HELP YOUR FRIENDS TO BECOME AIR-MINDED. For particulars, write The SECRETARY, SKYBIRD LEAGUE, 3, Aldermanbury Avenue, LONDON, E.C.2.

SHIPSERIES

A sister series to SKYBIRDS. Constructive waterline models of famous ships and accessories. Scale 100 feet equals 1 inch.

SHIPS OF THE ROYAL NAVY, Sets **1/6** to **3/–** each

SHIPS OF THE MERCHANT SERVICE, Sets **4/6** to **5/–** each

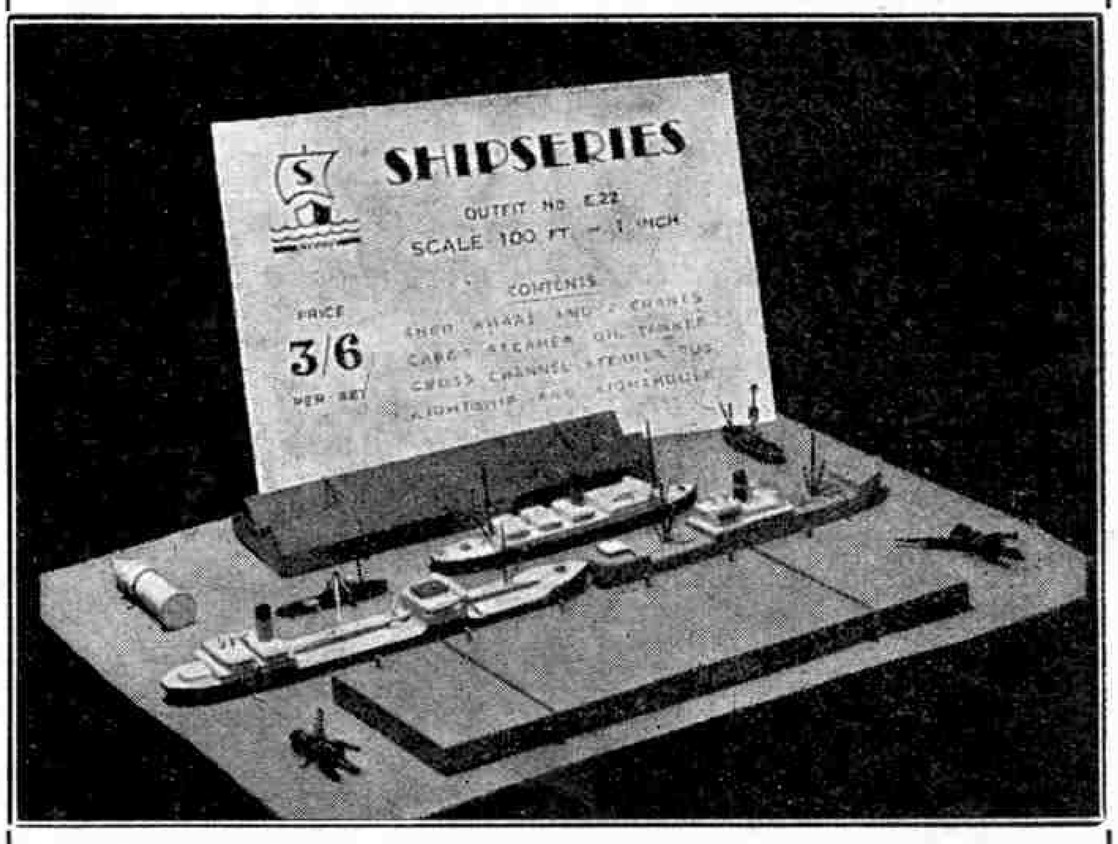
AT LAST!

A Shipseries Model of the R.M.S. "QUEEN MARY"

As she really will be, with the final arrangement of the superstructure and ventilators. This model has been held up awaiting the authentic drawings of the final modifications.

A SHIPSERIES MODEL MUST BE CORRECT.

"QUEEN MARY" Constructive Set, 5/–



THE LATEST SET—complete castings with Dock Shed, Wharf, Two Cranes, Cross Channel Steamer, Oil Tanker, Cargo Steamer, Tug Boat, Lightship, and Lighthouse. Price **3/6**

----------POST THIS COUPON TO-DAY----------

Messrs. A. J. HOLLADAY & CO. LTD. (Desk B), 3, Aldermanbury Avenue, LONDON, E.C.2.

Please send me the latest copy of the "AERO MODELLER" containing a complete list of SKYBIRDS and SHIPSERIES Models for which I enclose 7d.; also send me the address of nearest agent.

Name .....

Address .....

.....

HORNBY RAILWAY COMPANY

The Hornby Railway Company is a world-wide fellowship of Hornby Train owners, and was formed to enable members to get as much fun as possible from their miniature railways. Its President is Mr. Frank Hornby, inventor of Meccano, and Managing Director of Meccano Limited.

A REAL RAILWAY COMPANY WITH BOY DIRECTORS AND OFFICIALS

How to Become a Member of the Hornby Railway Company

Every boy who possesses a Hornby Train Set should join the H.R.C. and thus become entitled to wear the badge of membership, which is beautifully enamelled in colours and has as its central feature a tiny representation of a train. All that he has to do is to fill in the application form—a copy of which is enclosed in every Train Set, or may be obtained from the Secretary of the H.R.C., Liverpool—and to return this together with a remittance of 6d. (overseas 10d.) to pay for the badge. Immediately on receipt of the completed form the applicant is enrolled as a member of this great organisation, and a handsome certificate to that effect is forwarded to him along with his badge.

Members of the H.R.C. are entitled to many privileges. The chief aim of the Company is to enable its members to get as much fun as possible from their miniature railways. This can best be done by helping them to make their layouts and operations as realistic as possible, and competent railway experts on the staff at Headquarters therefore are continuously engaged in advising members how to make the best use of the material at their disposal.

Join a Local Branch

The greatest fun is obtained from Hornby Trains by joining one of the many local Branches that have been formed in various parts of this and other countries. These Branches are composed of Hornby Train owners who meet together in order to carry out railway operations on a more extensive scale than is possible for a single individual. Every member should join a Branch immediately, or if one does not exist in his neighbourhood, he should try to induce other enthusiasts to help him to found one.

Write for full details to the Secretary, Hornby Railway Company, Binns Road, Liverpool, 13.

TOYS OF QUALITY MADE BY MECCANO LTD.

AEROPLANE CONSTRUCTOR OUTFITS

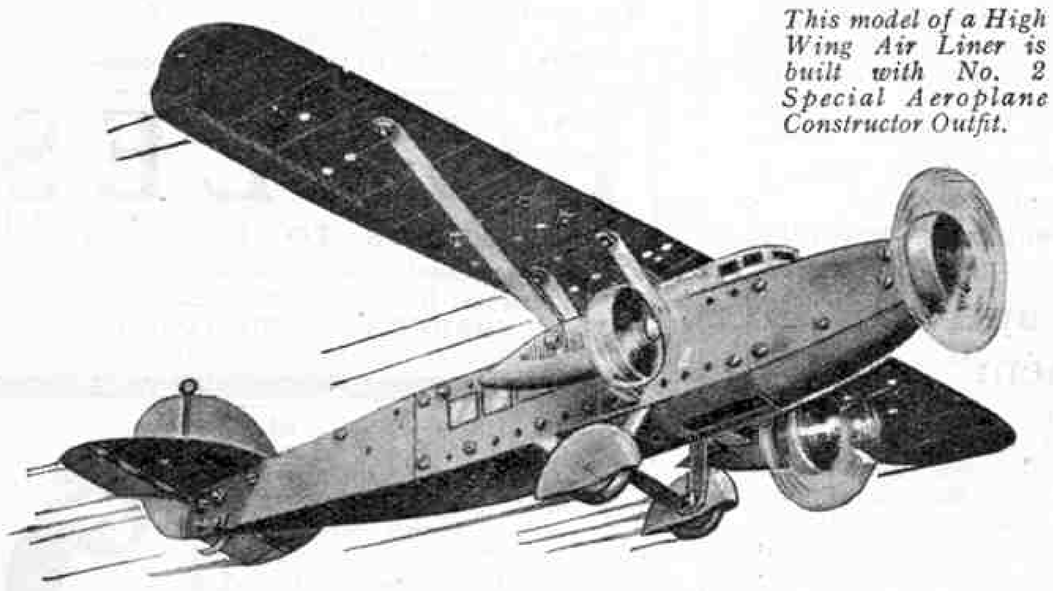
No. 2 Aeroplane Outfit. Price **12/6**

BOYS-BUILD YOUR OWN MODEL AIRCRAFT

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

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.



This model of a High Wing Air Liner is built with No. 2 Special Aeroplane Constructor Outfit.

Price List of Aeroplane Outfits

Standard Series.

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

Special Series.

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

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

AEROPLANE HANGARS

No. O1 AEROPLANE HANGAR will accommodate one model made with the No. O or No. O1P Outfits. Length 11⅛ in. Depth 10½ in. Height 4¼ in. Price **4/6**

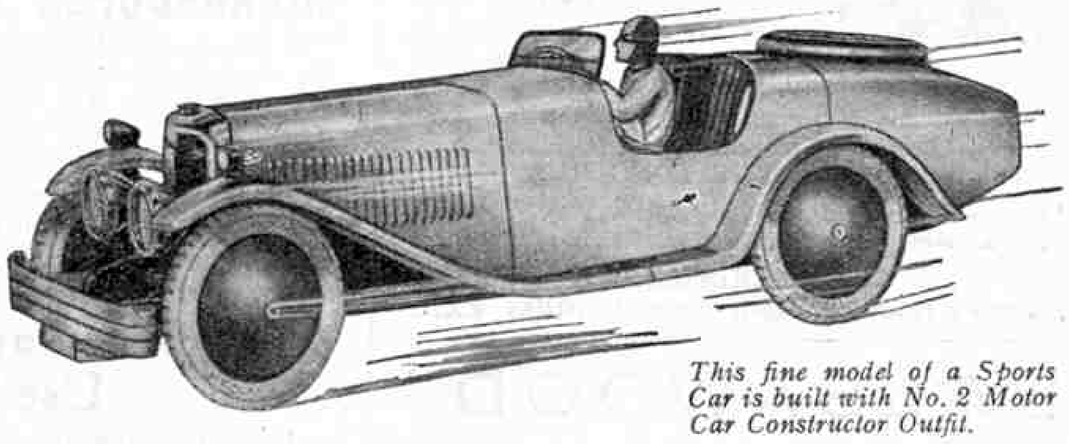
No. O2 AEROPLANE HANGAR will accommodate two models made with the No. O or No. O1P Outfits. Length 21⅛ in. Depth 11 in. Height 6¼ in. Price **5/11**

MOTOR CAR CONSTRUCTOR OUTFITS

YOU WILL BE KEEN TO HAVE ONE!

Boys, as soon as you see these fine Motor Car Constructor Outfits you will be keen to have one. The models they build are superb. Sports four-seaters, coupés, speed cars and other perfect miniature reproductions, each one a beautiful model of its prototype. All the models are driven by a powerful Clockwork Motor (included in the Outfit), giving a long, speedy and realistic run on each winding.

The motor car parts are finished in rich enamel, nickel-plate and chromium, the complete Outfits being masterpieces of miniature automobile craftsmanship.



This fine model of a Sports Car is built with No. 2 Motor Car Constructor Outfit.

No. 1 MOTOR CAR CONSTRUCTOR OUTFIT

The motor car models that can be built with this Outfit are the finest you ever saw. 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 above.

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

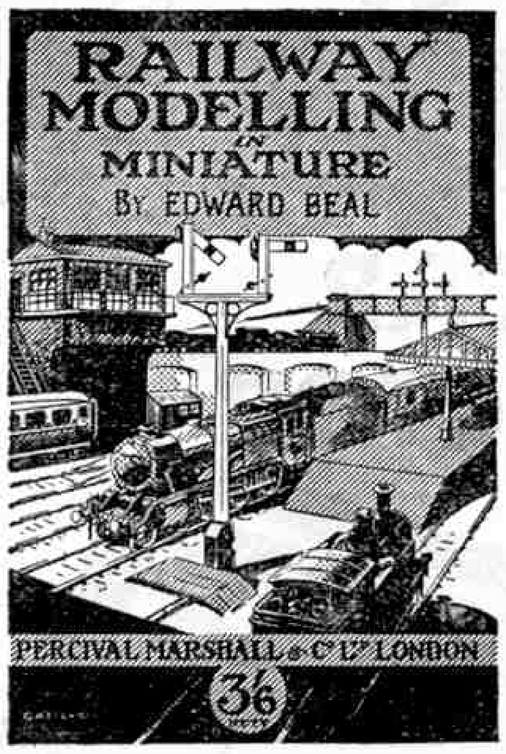
MOTOR CAR LIGHTING SET

With this Lighting Set the headlamps of Motor Car models built with the No. 2 Motor Car Outfit 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**

MECCANO LTD., BINNS ROAD, LIVERPOOL 13



A Marvellous New Book on Model Railway Planning and Construction.

270 Drawings, 20 Pages of Fine Photographs.

Every "Hornby" owner should get it and add to the realism of his Railway.

Price 3s. 6d. Post Free, 3s. 10d.

Percival Marshall & Co. Ltd.,
15M, FISHER STREET, LONDON, W.C.

Send a post card for our 40-page Book List.

Patents for Inventions, Trade Marks: Advice, Handbooks, and Cons. free. B. T. King, Regd. Patent Agent, 146a, Qn. Victoria St., London, E.C.4. 50 years' refs.

CYCLING WITHOUT A VEEDER IS LIKE LIVING WITHOUT A WATCH

Insist upon the genuine

Fit a Veeder

A new interest awaits you if you fit a "Veeder." It tells you to a fraction how far you've travelled—how far to go. The exact mileage from one place to another—the entire distance covered—service your tyres give—are to mention only a few things every cyclist ought to know.

"The best always costs a little more but is cheaper in THE LONG RUN."

Prices—Regular, all sizes 7/-
Trip, all sizes 15/6

F. E. DICKINSON,
St. Andrew's House, Holborn Circus, LONDON, E.C.1.

"BALSAWOOD"

Dealers! There is big business coming along to those of you who will cater for the Model Aircraft builders. First grade strip, sheet and block balsa stocks at the right prices. 'Phone, Eagley 323, or write works.

Lancashire Model Aircraft Supplies
134, Holland Street, Bolton, Lancs.

WATKINS & DONCASTER

Stock everything for the Collector of Birds' Eggs, Butterflies, Plants, etc.

FULL CATALOGUE PER RETURN OF POST.

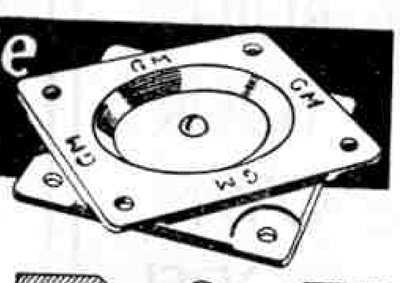
Silkworm Eggs, 1/3 per 100; Zinc Cages for Breeding, 6/3 each; Handbook on Keeping and Breeding, 2/3; all post free.

Large stock of Books on all branches of Natural History.

36, STRAND, LONDON, W.C.2.
P.O. Box 126. 'Phone: Temple Bar 9451.

MOVIES AT HOME. How to make your own Cinema Projector. Particulars free.—Moviescope (V), Pear Tree Green, Doddinghurst, Essex.

Ball Race TURNTABLE



1/9 POST FREE

The manufacturers of G.M. Components have held responsible positions for many years in design construction and maintenance with some of the largest and varied machinery both ashore and afloat.

Gear Wheel to fit, **1/2** Post Free.

If any difficulty in supply write direct.

G.M.2 size, 2½" sq. Fits Meccano. G.M. Models and Components are now stocked by the largest and best Stores in the country. Write for our Booklet giving full details of our Turntables, also Propellers, for your own Boats.

G.M. PATENTS Co.,
26, New Buildings,
Price Street, Birmingham, 4.

MICROSCOPES AND TELESCOPES

Our famous Model Microscopes advertised in the M.M. for several months have proved a great success, 100x **5/6**, 150x **8/6**, plus 6d. post. Our wonderful Telescopes are equal value, 12x **15/-** (12x, 15x, 18x), Three power, **35/-**, Standard Model, 20 and 30x for astronomical or terrestered use, **57/6** (by Dolland). Satisfaction or money back.

C. A. MAXWELL, F.S.M.C., Optician, SCUNTHORPE.

"Meccano Parts and How to Use Them"

Every keen Meccano enthusiast wishes to carry out his model-building operations in accordance with correct engineering principles. In order to do this he must know the special functions of each of the parts that comprise the Meccano System, and to assist him in acquiring this knowledge there is published a manual entitled "*Meccano Parts and How to Use Them.*" In this manual all the parts in the system are listed and classified, and the uses of each individual part are described in detail. The descriptions are assisted by half-tone illustrations and sectional diagrams showing the parts actually in use in Meccano structures and mechanisms.

Ideal for the Model-Builder

An important section of the book is devoted to the various forms of Meccano motive power, and gives much useful information regarding the use of the Meccano Electric and Clockwork Motors. This manual forms an ideal constructor's guide and book of reference, and should be in the possession of every Meccano boy.

"*Meccano Parts and How to Use Them*" may be obtained, price 6d., from any Meccano dealer, or direct from Meccano Ltd., Binns Road, Liverpool 13, price 7d. post free.

Are you interested in

Model Railways?

—then we can convert you into an enthusiast!

Send for our Catalogue (price 6d. post free) and wander into the interesting sphere of

MODEL RAILWAY ENGINEERING

The models illustrated in this catalogue will hold your interest, and fire you with the desire to construct your ideal railway.

Every phase of Model Railway Engineering is covered and should you require helpful suggestions at any time we shall be pleased to hear from you.

Send right away to

MILLS BROS. (Model Engineers) LTD.
Dept. M.M.,
129, St. Mary's Rd., SHEFFIELD, 2

'Phone 25742. 'Grams: MILLS 25742 Sheffield.

COLLECT PHOTOGRAPHS OF RAILWAY TRAINS, AEROPLANES AND SHIPS. 1/- for six, 2/- per doz. Any quantity of cards less than six 3d. each. Send 4d. for full list of titles, specimen and booklet.
Real Photographs Co.
(Dept. M.), 9, Union Court, Liverpool 2.

FOYLES
Booksellers to the World
New and second-hand books on every subject.
Catalogues free on mentioning interests.
119-125, CHARING CROSS RD., LONDON, W.C.2.
Telephone: Gerrard 5660 (12 lines).

THE "DOLLA" AIR PISTOL. No license required. The Best 5/- Air Pistol Made. **Junior Model.** Fires Darts, Slugs. Length 10 ins. Nickel Finish, with ammunition, **5/-**.

5/- Post 6d.

Senior Model, with ammunition, **7/6.**

AIR GUNS. Best make with ammunition at **6/-, 8/-, 10/-,** and **12/-** each. **Extra ammunition for any of above, 1/-** and **2/-.** Postage 6d. each article. (Colonial, **2/-.**)—**HERBERTS & CO. (Dep. F93), 81, Clapham Park Road, London, S.W.4.**

BE TALL Your Height increased in 14 days or money back! 3-5 inches rapidly gained. Amazing Complete Course sent for **5/-** P.O., or details free. Write: **Stebbing System, Dept. M., 28, Dean Road, London, N.W.2.**

CASTING MOULDS

Make your own lead soldiers, animals, Indians, etc. Sample Mould, 2/9. Catalogue Free.
Industries, 13, Gordon Av., Twickenham.

SCALE MODEL CONSTRUCTION SETS

PRICES RANGE FROM 3/- to 7/6

Sopwith "Camel."

Hawker "Hart."

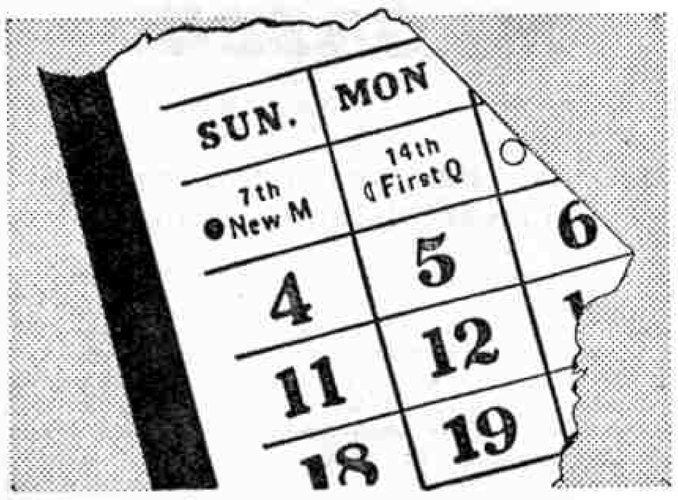
1/24th ACTUAL SIZE

Please send me free illustrated literature containing full details of all Aeromodel Sets.
Name.....
Address.....
.....*M.*

AEROMODELS LTD. Hooton Road, Willaston, Wirral, Cheshire.

Fill in the coupon and post it to-day. A ½d. stamp is sufficient if the envelope is unsealed

EVERY DAY



another opportunity

SLIPS BY

When to-day ends, part of your life has gone for ever. If you have not made any definite move towards bettering your position, another opportunity has slipped by.

There are only a few short years in which to prepare for a successful career. Success is a matter of Vocational Training, which will give you **specialized** knowledge fitting you for advancement. **Things will begin to come your way,** once you have settled down to a suitable course of study.

That is the actual experience of thousands of men who are now studying I.C.S. Courses. They are gaining on those of their fellows who are wasting precious time. Why not join the progressive minority who devote some of their spare hours to qualifying for the enviable rewards of responsible positions? But you must start NOW. Don't miss to-day's opportunity.

Write for our free booklet and free advice on any of the following subjects:

BUSINESS AND GENERAL

Accountancy
Advertising
Book-keeping
Commercial Art
Commercial Training
French and Spanish
General Education
Insurance
Journalism
Salesmanship
Scientific Management
Secretarial Work
Shorthand-Typewriting
Short-Story Writing
Window Dressing
Works Management

TECHNICAL AND INDUSTRIAL

Aeronautical Engineering
Agriculture
Air Conditioning
Architecture
Boilermaking
Building
Chemical Engineering
Civil Engineering
Dairy Farming
Draughtsmanship
Electrical Engineering
Engineering Shop Practice
Gas-Power Engineering
Horticulture
Heating and Ventilating
Marine Engineering
Mechanical Engineering
Mining
Motor Engineering
Municipal Engineering
Pattern-making
Plumbing
Poultry Farming
Radio
Sanitary Engineering
Sheet-Metal Work
Steam Engineering
Structural Engineering
Surveying
Textiles
Welding, Gas & Elec.
Woodworking

EXAMINATIONS

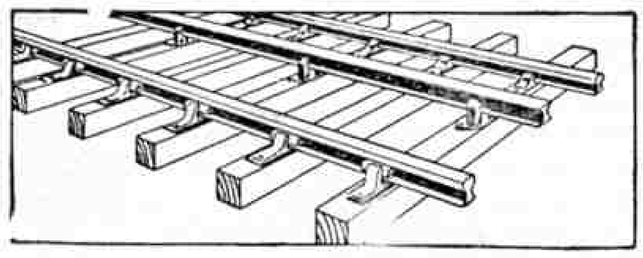
Technical, Professional, Matriculation, Civil Service (State which)

INTERNATIONAL CORRESPONDENCE SCHOOLS LTD.

218 International Buildings, Kingsway, London, W.C.2.

Model Makers!

Add to the realism of your railway by making your own permanent way of solid steel rails on wooden sleepers.



Rails, Solid Steel, 3′ long... ...	...	1/6 per doz.
„ „ Brass, 3′ „ ...	...	4/6 „ „
Battens, Wood, 3′ „ ...	...	1/9 „ „
Fishplates, Brass or Steel	...	4d. „ „
Chairs, Spring Steel ...	...	1/1 „ 100
„ Die Cast ...	...	1/2 and 1/6 „ 100
„ for Centre Rail ...	...	2/- „ 100
Spikes, Brass or Steel ...	...	3d. per pkt.
Track Gauge ...	...	6d. each

(Postage 6d. extra on rails and battens.)

Write for free illustrated list showing all components with prices.

LUCAS'S, THE BOYS' ARCADIA,
17, Houghton Street, Clayton Square, Liverpool, 1.
Telephone. Royal 562.

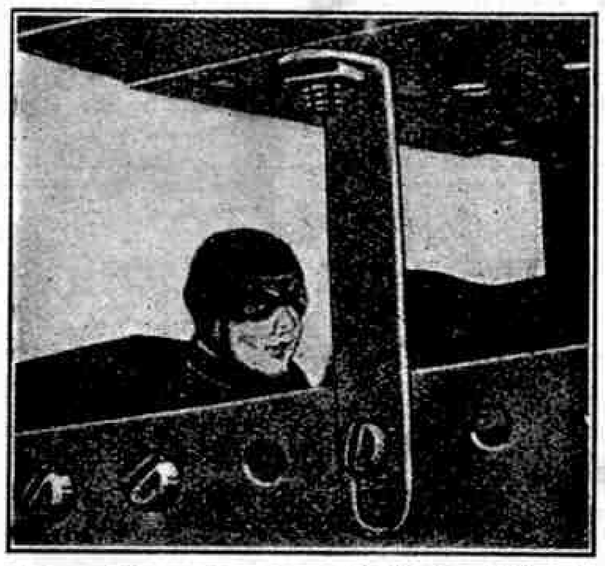
Standard Films for Sale or Hire, from 5/-.—Baers, 176, Wardour Street, W.1. Established 1907.

BOYS WHAT IS THIS?

A complete Morse Transmitting and Receiving Set ready to connect to pocket lamp battery including full instructions and the Morse Code. Send for this Set now and become an efficient Morse Telegraph Operator capable of sending and receiving messages in the Morse Code at Regulation speeds.
Dept. GI, The ELECTRIMEK Co.
122, Greyhound Lane, London, S.W.16.
5/- Post Free

MINIATURE AEROPLANE PILOTS

Aeroplane Parts Nos. P99 and P100



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

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

Prices:

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

Meccano Ltd., Binns Road, Liverpool 13

FOLBOT
CANOE TOURING

Touring by Folbot is the ideal out-o-doors sport. A Folbot is comfortable and effortless to paddle. Thrilling, yet safe in rapids, shallows and surf. There are models to carry up to 3 passengers and luggage enough for a long tour.

A Folbot packs into two handy bags for storage and is carried like ordinary luggage by rail, car or bus. Assembling takes about 15 minutes and requires no tools. Then you have a rigid, seaworthy canoe ready to take you anywhere. Meccano readers will appreciate the scientific and ingenious design.

There is a Folbot to suit you and your pocket and remember—holidays will cost you less and give you more for many years to come!

Popular Single-Seater, **£7/7/-**; Popular Two-Seater, **£8/8/-**; Popular Three-Seater, **£10/10/-**; Sports Two-Seater, **£12/12/-**. Hulls blue—Decks gold.

Write for free illustrated booklet M.M. to:

FOLBOT FOLDING BOATS
21/27, Hatfield Street, Golden Lane, London, E.C.1.

BECK'S CHEMISTRY
EQUIPMENT
APPARATUS & CHEMICALS
FOR STUDENTS' LABORATORIES

SPECIAL PARCEL OF APPARATUS:

1 Flask, flat bottom, 150 c.c.; 1 Beaker, spouted, 100 c.c.; 3 Test Tubes, 4 in. × ⅝ in.; 1 Thistle Funnel, 20 cm.; 3 ft. Glass Tubing; 1 Rubber Cork, 2 holes; 4 inches Rubber Connection Tubing; 1 Glass Stirring Rod: *1936 Catalogue.*

2/6 Post Free

If this selection of apparatus is not what you require, write for our 1936 CATALOGUE containing full details of other sets from 2/6 to 105/-.

BECK (Scientific Dept. G) **60, High Street, Stoke Newington, London, N.16.**

Booklet of Experiments, 6d. (P.O.) post free.

3d. LISTS of good cheap Movie Films for sale or hire from—W.F.S., 78, Cox Street, Coventry.

BIRDS' EGGS and **DECOY CALLS.** Write for free lists.—Forbes, Dept. M., Clutton, Chester.

Butlers ½ h.p. Petrolmotor castings, 9/9. Lists, 3d. Butlers, Wade Street Works, Littleover, Derby.

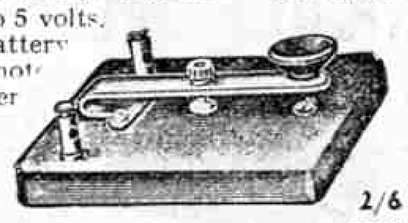
CINEMATOGRAPHS British Made from 37/6
CINEMATOGRAPH FILMS
Standard Size only. Write for Catalogue, post free. Sample Film and Catalogue 1/- and 2/6.
Filmeries Co., 57, Lancaster Rd., Leytonstone, E.11

SEND OR RECEIVE MORSE MESSAGES

The "Wilco" complete self-contained set including flash light bulb, buzzer, transmitting Key and Morse code is ideal for Scouts, radio amateurs and all who wish to perfect reading and sending Morse messages. Complete for... ... *Post 6d.* **4′6**

BUZZER No. 122 Miniature iron buzzer, as above **1/3** *Post 3d.*

SPECIAL BUZZER. 3 to 5 volts. Works off Pocket Battery. Gives crisp penetrating note. Fitted with Tone adjuster. Excellent for high speed work. Dust-proof bakelite case, 2¾″ dia. Price **6/6.** *Post 4d.*



2/6

MORSE KEY. A service... job on polished wood base as illustrated. **2/6.** *Post 3d.*

40 page catalogue "M" free with all orders or sent for 3d. in stamps.

L. WILKINSON, 8, CITY ROAD, LONDON, E.C.1

READERS' SALES

Bowman Steam Locomotive. Cost 27/6. Used three times. Perfect condition, 12/6.—Oglethorpe, 14, Grafton Road, Harrow, Middlesex.

Collector has numerous Stamp Duplicates for disposal by sale or suitable exchange.—Price, "Springfield," 22, Tyrfran Avenue, Llanelly.

Stamp Album containing 1,200 approx., £1.—Rivers, 7, Sydney Road, Bexleyheath, Kent.

Album holds 400, containing 140 different Postcards Ships for good collection Stamps.—I. MacDonald, 58, South Laverockbank Avenue, Edinburgh.

Sale. Bowman Steam Engine and Tender, cost 37/6, perfect condition, 15/-; Rails, 3/-.—G. Risley, 34, Court Hill, Sanderstead, Surrey.

Sale. "Meccano Magazines" (unbound), Sept. 1924–Dec., 1935. Will sell separately.—Lusk, 102, Oxford Road, Acocks Green, Birmingham.

Sale. "The Modern Boy's Book of Railways," bought January 1936. "Locomotives of the World." Both excellent condition. What offers?—Burgess, 19, Woodgrange Gardens, N.12.

Large complete Chemistry Set for sale, cost £3, very little used. Accept 35/-.—R. Hickman, 7, Oakwell Drive, Ilkeston.

"M.M.," 1935, 3/-; 9 issues "Wings," 4/-; "Railway Wonders of World," complete set, new, 20/-; "Modern Motor Cars," 3 vols., 5/-.—86, Denbighrd, London, E.6.

Wireless Bargains: 3-valve set, 15/-; 2-valve, 10/-; cabinets, valves. Two large boxes wireless parts, valves, 5/6. Transformers, 2/6. Valves, 1/9. Send your want list.—60, Avenue Approach, Bury St. Edmunds.

Stamp collection for sale. In bulk. Inspect on approval.—John Gray, 6, Ina Street, Belfast.

Hobbies Gem Fret Machine, like new, 19/-. Bowman Aeroboat Hull, sound, 6/-.—Harrill, High Street, Wells, Somerset.

Sale. "M.M.s" 1924-1931, bound; 1932-1935, loose. Perfect condition. £5.—Hood, 18, Radcliffe Road, Coventry.

Sale. Two Valve All Mains K.B. Wireless Set, 25/- or near offer.—Spink, 72, Wennington Road, Rainham, Essex.

"Diana" Airgun No. 15 (brand new); 800 Cigarette Cards; 107 Coins; 15 "Hobbies" Weekly; exchange Stamps. Wanted Loose-leaf Albums.—Philatelist, 3, Dawson Road, Birmingham 21.

85 copies "M.M." January 1924—February, 1931. Fair condition, £1 post free; below.

"O" gauge Railway, 3 clockwork Locos, Rolling Stock, 6 Points, Turntable, Accessories, 30/- carriage paid. Stamp full particulars.—Simpson Chaul End Lane, Luton.

Sale. Model Destroyer, 6 ft. 3 in., speed 6.5 ft. per second, £40 or offer.—Ivison, 8, Oakdene Drive, Tolworth, Surrey.

Pathe Cine Camera, used twice. What offers?—Binning, 2, Westbourne Crescent, London, W.2.

40 "M.M.'s," from June 1931—September 1934. Excellent condition, 10/- lot.—E. Stacey, Bekesbourne, Canterbury, Kent.

Stamp Traders, Club Secretaries, and others—Lion Foolscap Flat Duplicator, as new, all accessories, 50/-. Produces superb work. Send for samples. Barlock Typewriter, splendid writer, £2/17/6.—85, Killinghall Road, Bradford. 'Phone 8547.

Wanted. Second-hand portable typewriter. Reasonable price.—K. Rose, 2/3, South Cranleigh School, Cranleigh, Surrey.

For Sale. 8′ × 4′ Table Tennis Table, complete with correct Folding Trestles. Unused condition. Cost £2/5/-. Accept 30/-.—Gee. 14, Manor Drive, Wembley Park, Middlesex.

Offers—37/6 Bowman Steam Engine, drilled base, hardly used.—Bullock, 99a, Alexandra Road, Hampstead, N.W.8.

"MECCANO MAGAZINE" SPRING BACK BINDER

There is no better way of keeping your Magazines clean and tidy than by binding them in one of the special binders we supply.

These binders have strong stiff backs, covered with black imitation leather, tastefully tooled, and are lettered in gold. The large binder holds 12 Magazines — price 3/6 post free. The small binder holds 6 Magazines — price 2/6 post free.

Meccano Ltd., Binns Rd., Liverpool 13

This Month's Special Articles

	Page
Air News	142
Books to Read	160
Bendix Servo Brake	149
"Bristol" Axial Engine	157
Competition Page	186
Development of Realistic Layouts	176
Engineering News	140
Famous Bridges of the World	130
Fireside Fun	187
From Our Readers	164
Gravel Washing and Grading Plant	146
Guild Pages	174–175
Heston Airport Development	144
High-Speed Automatic Lathe	156
Hornby Railway Company Pages	178–181
How a Great Ship is Launched	134
How Railway Sleepers are Prepared	152
In Search of New Models	168
L.M.S.R. "Jubilee" Class Locomotives	139
Locomotives on French Railways	136
Meccano F Outfit Models	170
Mechanical Handling of Freight Traffic	177
Model-Building Contests and Results	172–173
Motor Car Transmission Mechanism	167
Of General Interest	154
Railway News	150
Recording and Predicting Tides	132
Stamp Collecting and Stamp Gossip	183, 185
Streamlined Ferry Boat	148
Traffic Signals in Miniature	162

COLLECT SHIPPING PHOTOGRAPHS

Send 3d. for specimen postcard and Illustrated List of 600 different real photograph postcards of Liners, Freighters, Sailing Ships, Cunard-White Star, Harrison, Blue Funnel, Lamport and Holt, Blue Star, Elder Dempster, Booth, Bibby, Clan, C.P.R., Furness Withy, Ellerman Lines, etc., **2d.** each, **2/-** per doz., postage free.

B. & A. FEILDEN

(M.5), 12, Harlech Road, Blundellsands, Liverpool, 23.

CIGARETTE CARDS

SEND FOR

OUR 1936 COMPLETE CATALOGUE

Over 2,000 British and Foreign Series listed. Price 8d. post free.

WE ALSO PUBLISH

A FREE ABRIDGED CATALOGUE

of 600 Popular Price Series

A copy will be sent Post Free on application.

"THE CIGARETTE CARD NEWS."

A monthly journal devoted to the Hobby. Current copy **2½d.**, 6 months **1/3**. Post free.

THE LONDON CIGARETTE CARD CO. LTD., Room E, Cambridge House, Cambridge Road, Chiswick, London, W.4.

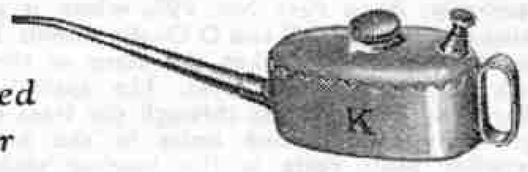
MECCANO LUBRICATING OIL

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

Meccano Ltd., Binns Road, Liverpool 13.

OIL CAN No. 2 ("K" Type)

In Polished Copper



Every Meccano and Hornby Train enthusiast should add a miniature "K" type oil can to his equipment for the purpose of oiling Meccano models, Hornby Trains, etc. The oil is ejected drop by drop by depressing the valve, as in the full-sized model, and in all other respects the oiler is perfect. Price 3/6

Meccano Ltd., Binns Road, Liverpool 13.

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.

Advertisers are asked to note that private advertisements of goods manufactured by Meccano Limited cannot be accepted.

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.

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

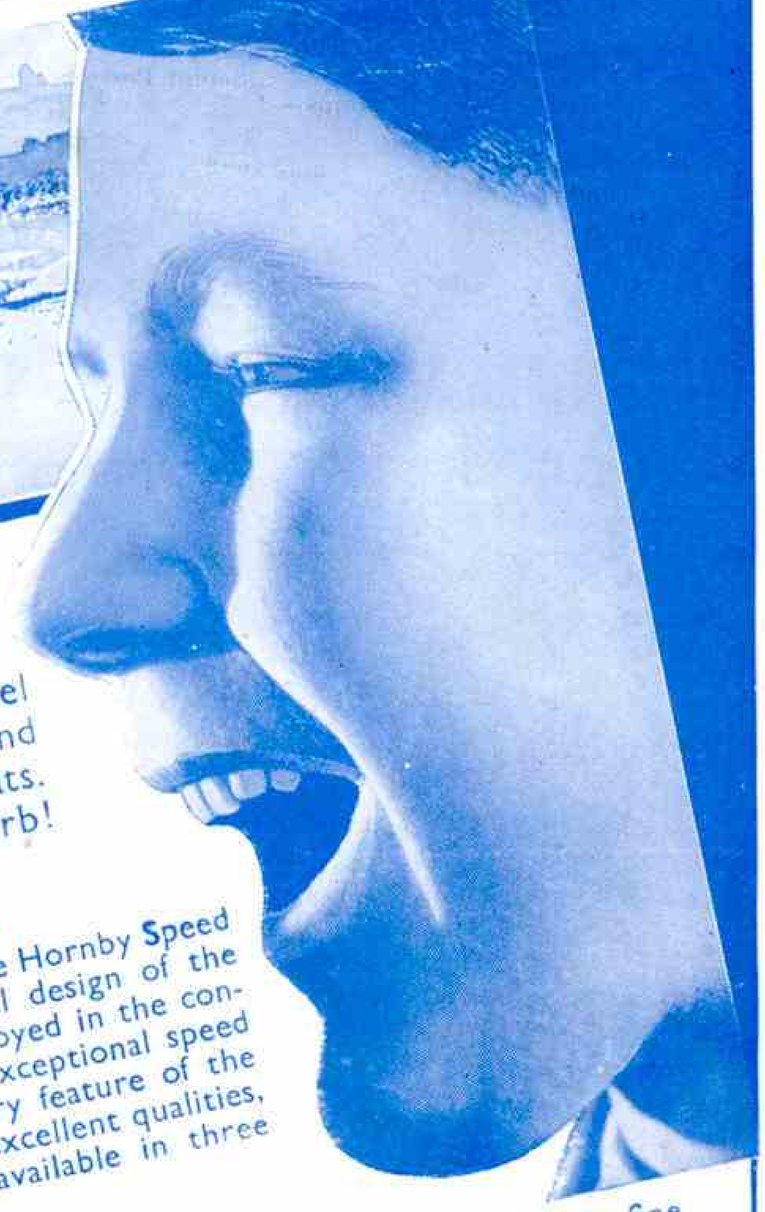
Marvellously accurate for target practice.

No license required to purchase.

Senior 45/-, Mark 1 30/-, Junior 20/-, Webley Air Rifle 80/-

Write for List. WEBLEY & SCOTT LTD., 87, WEAMAN STREET, BIRMINGHAM, ENG.

HORNBY SPEED BOATS



The Best that you can Buy

Hornby Speed Boats and Racing Boats are the finest examples of model craftsmanship ever produced. Exceptional performance, graceful lines and beautiful finish are the outstanding characteristics of these splendid boats. They introduce a new standard of excellence in British toys. They are superb!

Hornby Speed Boats

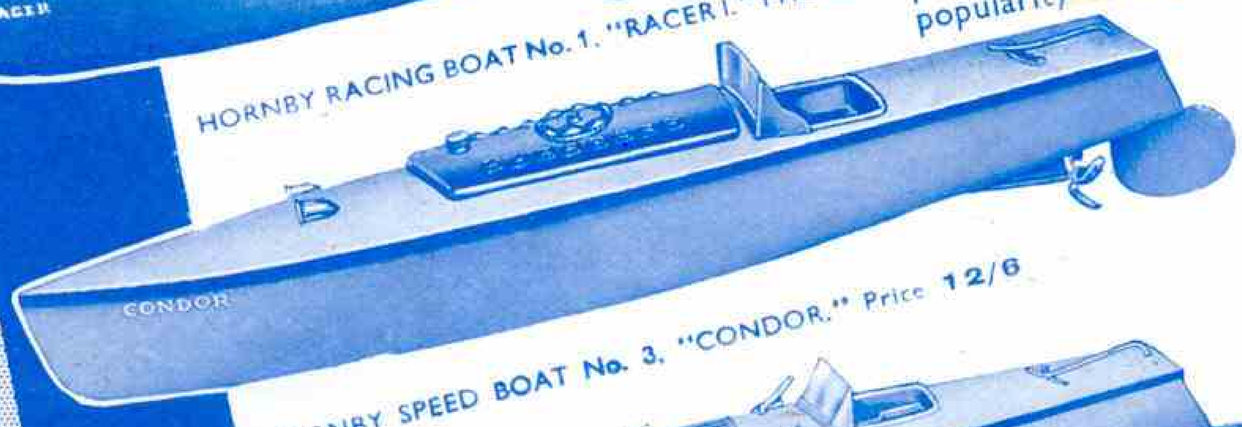
When other boats are slowing up, the Hornby Speed Boats are still going strong. The special design of the propeller and the unique methods employed in the construction of the hull give each model exceptional speed and length of run. Every line and every feature of the Hornby Speed Boats emphasises their excellent qualities, speed and reliability. Each model is available in three different colour combinations.

HORNBY WATER TOY (DUCK). Price 2/6

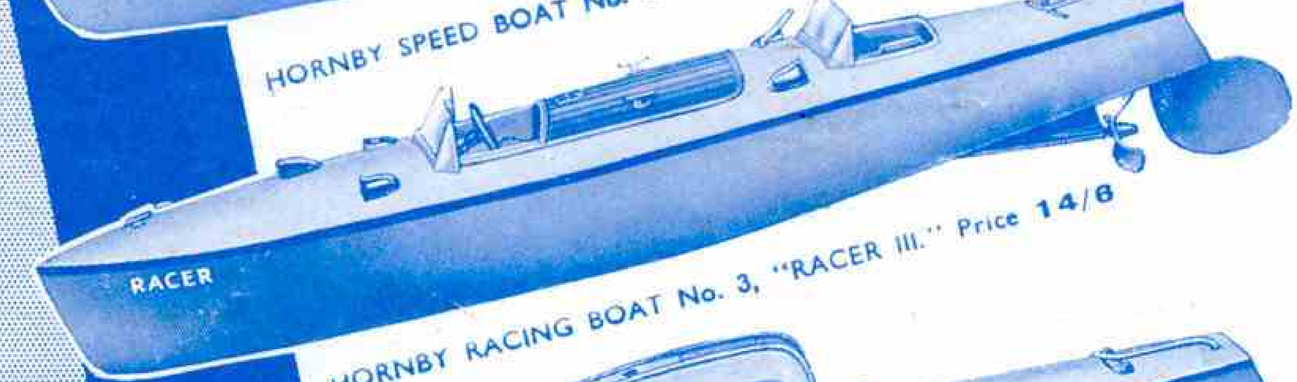
Hornby Racing Boats

The series of Hornby Racing Boats is composed of three exceptionally fine models that are considerably faster than the corresponding standard Hornby Speed Boats. They are "quick off the mark," and they maintain a high rate of speed throughout the whole length of their run. Their remarkable performance, perfect design and beautiful appearance have already gained for them a unique popularity amongst boys.

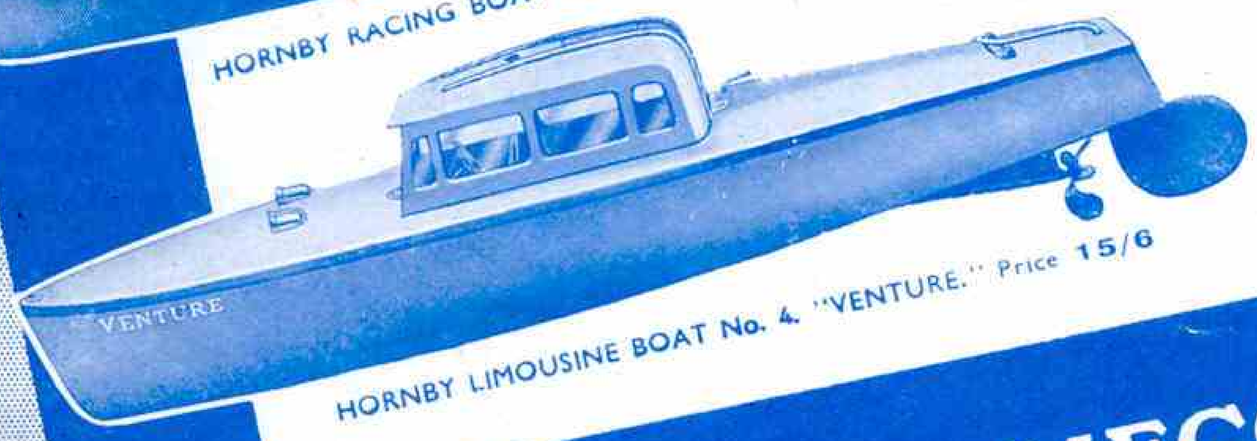
HORNBY RACING BOAT No. 1, "RACER I." Price 4/6



HORNBY SPEED BOAT No. 3, "CONDOR." Price 12/6



HORNBY RACING BOAT No. 3, "RACER III." Price 14/6



HORNBY LIMOUSINE BOAT No. 4. "VENTURE." Price 15/6

Price List

HORNBY SPEED BOATS

HORNBY SPEED BOAT No. 1, "HAWK." Price **2/11**. Travels over 100 ft. on one winding.

HORNBY SPEED BOAT No. 2, "SWIFT." Price **7/6**. Travels over 300 ft. on one winding.

HORNBY SPEED BOAT No. 3, "CONDOR." Price **12/6**. Travels over 500 ft. on one winding.

HORNBY LIMOUSINE BOAT No. 4, "VENTURE." Price **15/6**. Travels over 500 ft. on one winding.

HORNBY CABIN CRUISER No. 5, "VIKING." Price **16/6**. Travels over 500 ft. on one winding.

HORNBY RACING BOATS

HORNBY RACING BOAT No. 1, "RACER I." Price **4/6**. Travels over 120 ft. at high speed on one winding. Finished in Cream and Green.

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

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

HORNBY WATER TOY

HORNBY WATER TOY (DUCK). Price **2/6**. Travels over 100 ft. on one winding. Finished in appropriate colours

Ask your dealer to show you the Hornby Speed Boats and Racing Boats

MANUFACTURED BY
MECCANO LIMITED
LIVERPOOL 13

HORNBY ELECTRIC & CLOCKWORK TRAINS

These are the famous Hornby Trains!

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.

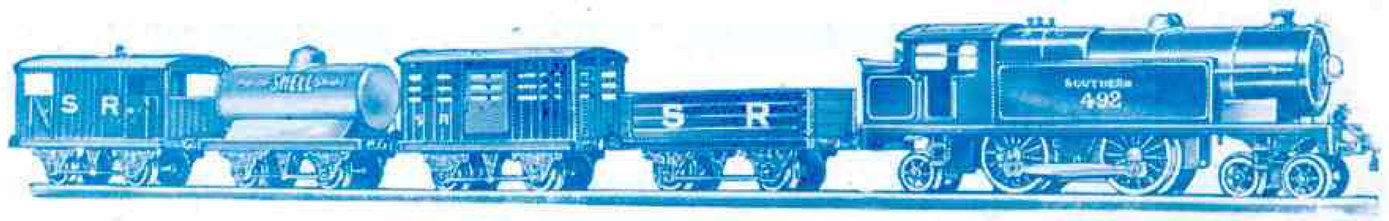
The Accessories are now better than ever before, while the Rails, Points and Crossings enable an endless variety of layouts to be constructed, both for Electric and Clockwork Trains.

Ask your dealer for a copy of the latest Hornby Train price list.

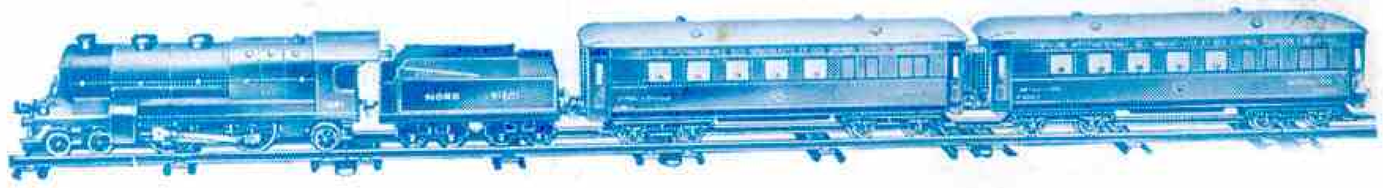
Manufactured by
MECCANO LTD.
Binns Road
LIVERPOOL 13

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

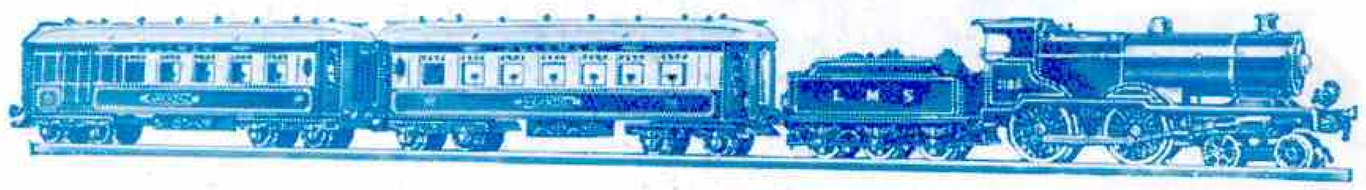
Hornby No. 1 Passenger Set (Clockwork) ... ... Price 25/-



Hornby E220 Mixed Goods Set (20-Volt Electric) ... ... Price 47/6



Hornby No. 3C Riviera "Blue" Passenger Train Set (Clockwork) ... Price 57/6



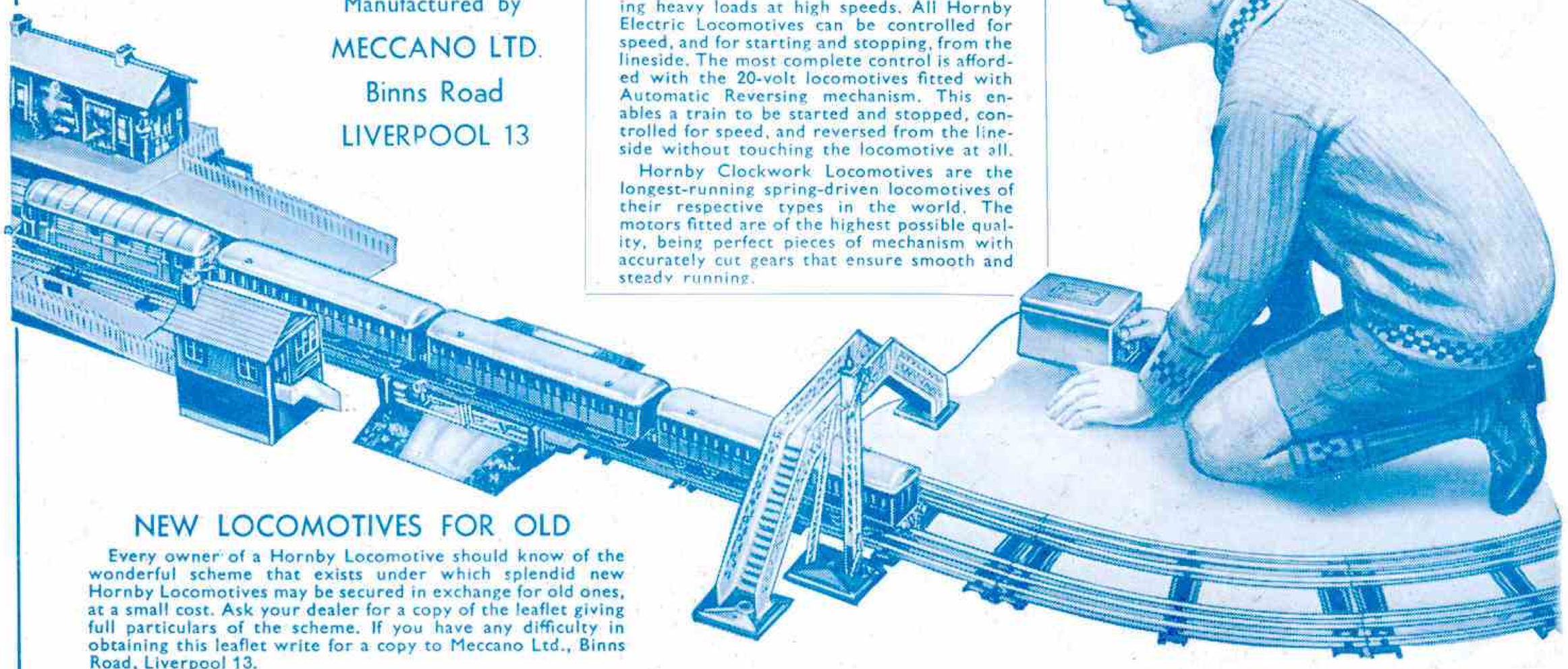
Hornby No. E220 Special Pullman Set (20-Volt Electric)... ...Price 75/-

Prices of Hornby Electric Trains Sets from 15/- to 75/-
Prices of Hornby Clockwork Trains Sets from 4/11 to 65/-

HORNBY LOCOMOTIVES
Electric and Clockwork

Hornby Electric Locomotives are fitted with powerful and efficient motors capable of hauling heavy loads at high speeds. All Hornby Electric Locomotives can be controlled for speed, and for starting and stopping, from the lineside. The most complete control is afforded with the 20-volt locomotives fitted with Automatic Reversing mechanism. This enables a train to be started and stopped, controlled for speed, and reversed from the lineside without touching the locomotive at all.

Hornby Clockwork Locomotives are the longest-running spring-driven locomotives of their respective types in the world. The motors fitted are of the highest possible quality, being perfect pieces of mechanism with accurately cut gears that ensure smooth and steady running.



NEW LOCOMOTIVES FOR OLD

Every owner of a Hornby Locomotive should know of the wonderful scheme that exists under which splendid new Hornby Locomotives may be secured in exchange for old ones, at a small cost. Ask your dealer for a copy of the leaflet giving full particulars of the scheme. If you have any difficulty in obtaining this leaflet write for a copy to Meccano Ltd., Binns Road, Liverpool 13.

PUBLISHED BY MECCANO LTD., BINNS ROAD, LIVERPOOL 13, ENGLAND
Printed by John Waddington Ltd., Leeds and London.