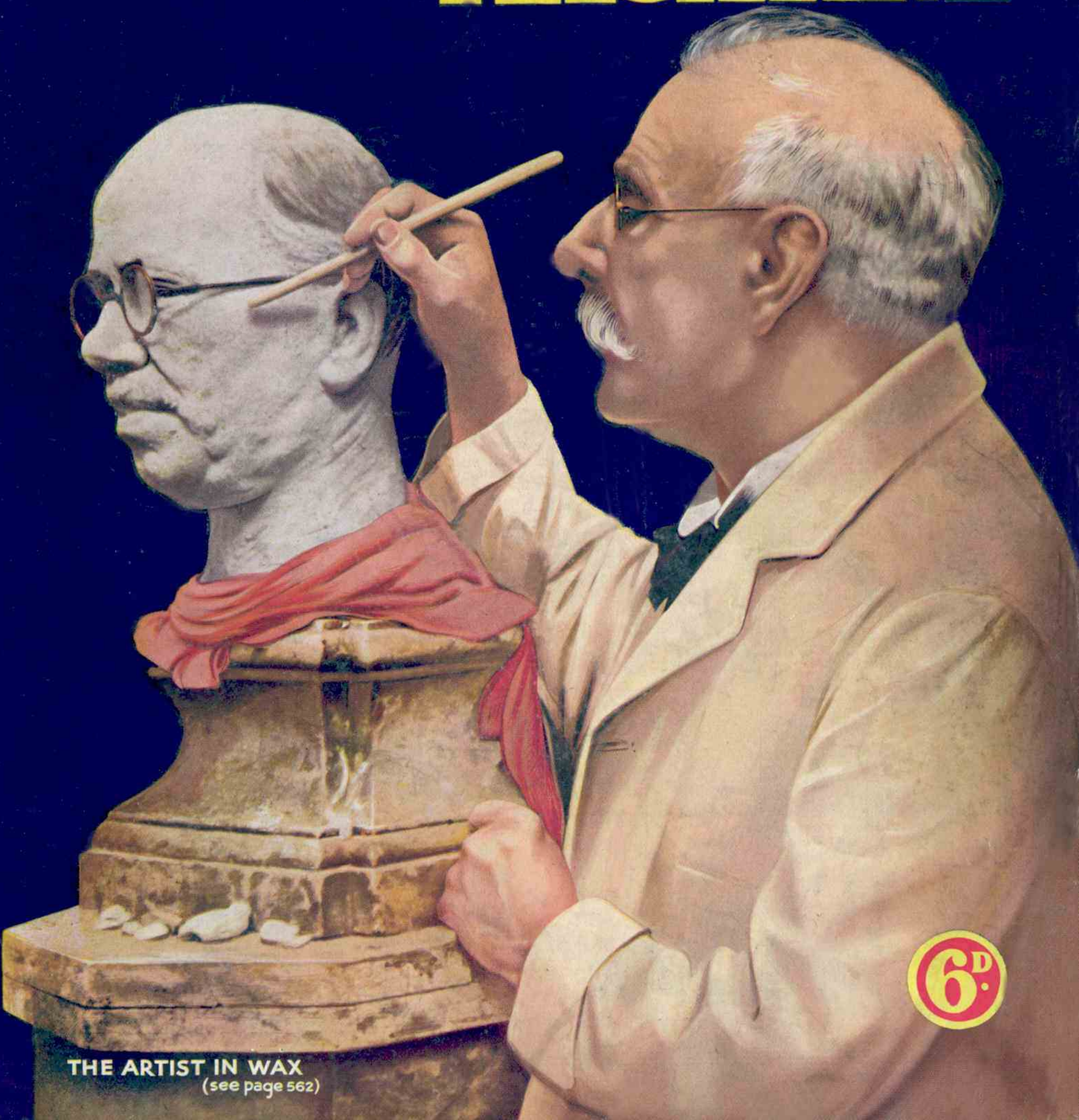
VOL. XX. No. 10

OCTOBER 1935

MECCANO MAGAZINE

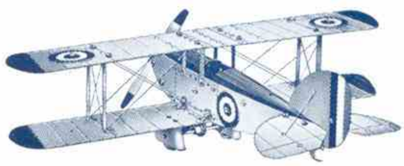


6D.

THE ARTIST IN WAX
(see page 562)

ANOTHER OF **MECCANO LTD'S** FAMOUS TOYS

No. 1 Aeroplane Outfit. Price **7/6**



Model of a Standard Light Biplane built with No. 1 Aeroplane Outfit.

Model of a Light Biplane built with No. 2 Special Aeroplane Outfit.

No. 2 Special Aeroplane Outfit. Price **21/-**

AEROPLANE CONSTRUCTOR

Boys, Aeroplane Outfits are great! They enable you to build wonderful models of aeroplanes—the most realistic you ever saw.

If you want to know something about aeronautics the first step is to understand how aeroplanes are designed and constructed, so that you may be able to recognise at a glance the different types of machines.

A beautifully illustrated Manual is included in each Aeroplane Outfit showing how to build a number of different models, both monoplanes and biplanes. Many other splendid models may be built by varying the position of the parts, which are all interchangeable on the famous Meccano principle. The parts in the Nos. 1 and 2 Outfits can be used in conjunction with the standard Meccano parts.

All Aeroplane Constructor Outfits have been reduced in price

Price List

Standard Series

No. OO AEROPLANE OUTFIT

This splendid new Outfit contains a good selection of Aeroplane parts with which realistic Aeroplane models can be built. It is an ideal present for young boys who are keen on Aeroplanes. Price 3/3

No. O AEROPLANE OUTFIT

An interesting range of models can be built with this Outfit, including high and low wing monoplanes, seaplanes and standard light biplanes. All the parts are interchangeable. Price 4/6

No. O1P HANGAR OUTFIT

This novel and attractive Outfit consists of the complete range of No. O Aeroplane Outfit parts packed in a No. O1 Aeroplane Hangar, instead of in a carton. Price 8/9

No. 1 AEROPLANE OUTFIT

Magnificent models of high and low wing monoplanes, and interesting model biplanes representing standard types can be built with this fine Outfit. Price 7/6

No. 1a Aeroplane Accessory Outfit, costing 6/-, will convert a No. 1 Outfit into a No. 2.

No. 2 AEROPLANE OUTFIT

This Outfit enables a much wider range of models to be built, including triple-engined monoplanes and biplanes, and a racing seaplane of the type that was used in the Schneider Trophy Contests. Price 12/6

Note. The parts in the No. OO, No. O and No. O1P Aeroplane Outfits are smaller than those in the other Outfits in the series and are not intended for use with these Outfits.

Special Series

No. 1 SPECIAL AEROPLANE OUTFIT

The parts in this super Aeroplane Outfit will build over 20 realistic models of different types of aircraft. The range of special parts includes main planes fitted with ailerons, tail planes with elevators, movable rudder, radial engine cowling, etc. Price 12/6

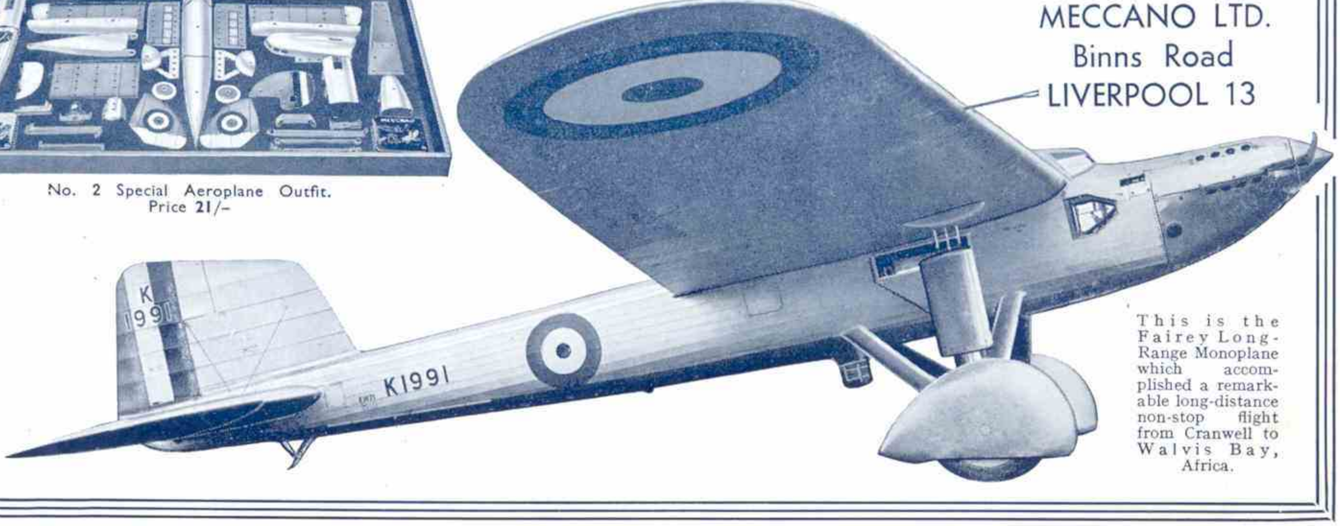
A No. 1a Special Aeroplane Accessory Outfit, Price 10/-, will convert a No. 1 Special Outfit into a No. 2 Special.

No. 2 SPECIAL AEROPLANE OUTFIT

This is the finest and most attractive Aeroplane Constructor Outfit on the market. It contains a big range of aircraft parts, with which numerous models of practically any type of machine may be built—44 examples are shown in the Manual of Instructions. All the parts that are features of the No. 1 Special Outfit are included, also a number of other parts of special design. Price 21/-

All Aeroplane Constructor Outfits are available in three different colour combinations.

MECCANO LTD.
Binns Road
LIVERPOOL 13



This is the Fairey Long-Range Monoplane which accomplished a remarkable long-distance non-stop flight from Cranwell to Walvis Bay, Africa.

Hamleys News

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

Number Thirty *October, 1935*

OCTOBER—The Month for Indoor Hobbies

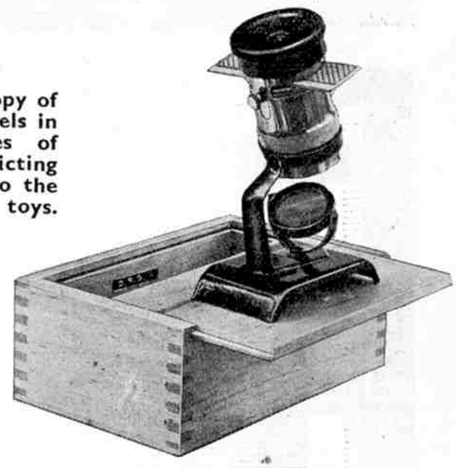
"Aeroplanes and cars that you can make yourself." Sounds interesting doesn't it. On this page we show two constructional sets, one makes the Lindbergh plane and the other, three scale model cars. They are examples of our big constructional range, in which you will find the most fascinating models to make during the winter evenings.

BUILD THE FAMOUS LINDBERG FLYING SQUADRON
Each kit contains: Balsa strips cut to correct size, curved parts clearly printed on best balsa. Complete with full size working plan, cement, wire, tissue, finished wheels, 12 inch wing span. Models obtainable: S.E.5, Curtiss Goshawk, Boeing P26A, U.S. Navy Racer, Monocoupe. (Foreign.) Price each **1/6** Post 3d.

MINIC CARS WITH GARAGE
Two scale model clockwork cars, front wheel drive. Specially constructed garage with model petrol pumps. Price complete **3/11**
With one car - Price 2/11. Post 6d.

TRIMECHANIX
A new car construction outfit, this set will build three interchangeable scale models: streamlined car, Royal Mail van, racing or open car. No nailing, painting or glueing, just screw together. Price per set **2/6** Post 4d.

Every boy should have a copy of our latest catalogue, "Models in Miniature," sixteen pages of interesting illustrations depicting the very latest additions to the large range of scale model toys. Post free on request.

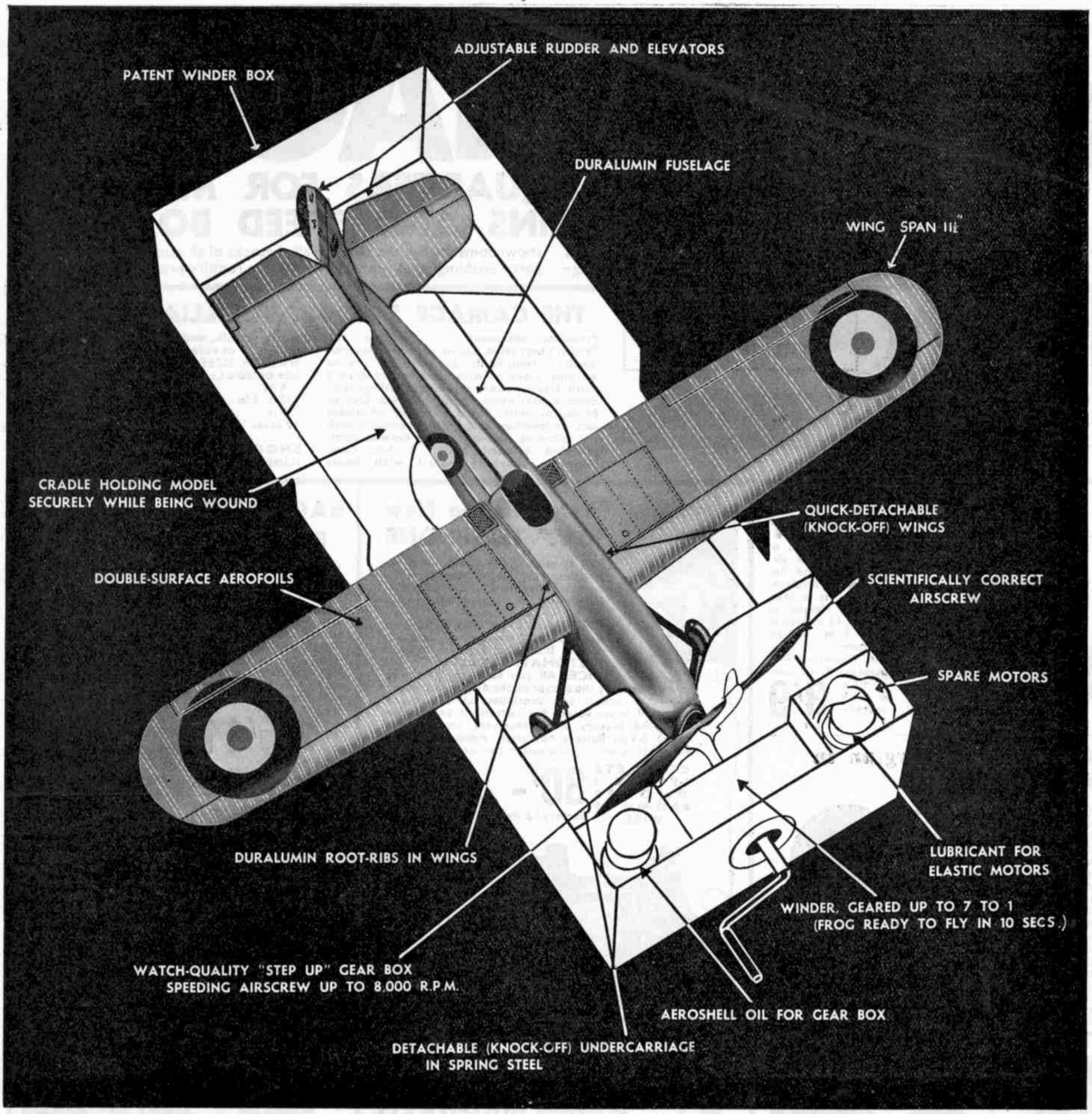


BRILLIANT MICROSCOPE
On stand, 50 × linear magnification. Complete with mounted slide and two slide glasses, strong wooden case with slide lid. (Foreign.) Price **5/6** Post 4d.

THREE COLOUR SIGNALLING TORCH

With special green and red slides. Complete with battery and bulb. (Foreign.) Price **1/6** Post 3d.

THE WORKING MODEL AUTOGIRO. CIERVA C30
This realistic working scale model is an entirely new addition for the model aeroplane enthusiast. Stretch wire tightly between any two points, one slightly higher than the other, attach plane which will run along the wire with realistic rotation of the blades. Price **2/6** Post 6d.



"FROG" INTERCEPTOR FIGHTER

Correctly coloured with British Service markings and aluminium finish to Air Ministry specification. Also obtainable with the correct national markings of six other countries.
Each model is flight tested before leaving the factory.

NOW ONLY 5/-

British made by INTERNATIONAL MODEL AIRCRAFT LTD.
Sole Concessionaires: **LINES BROS. LTD.**
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FREE COUPON
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.

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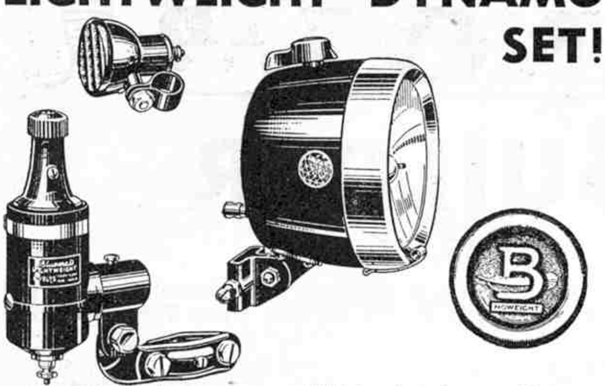
ADDRESS...

"LIGHTWEIGHT" DYNAMO SET!



A head light like a motor car! This is what the new Bluemel "Lightweight" Dynamo set gives you. You generate your own electric power as you ride.

- Dynamo over 20% lighter than average.
- Made of shock-proof material.
- Well-designed dynamo ensures smooth running.
- Modern black and chromium twin-bulb headlamp with two-way switch.
- Combined rear lamp and officially approved reflector—can be used as either.

PRICE
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COMPLETE
Less Battery

Bluemel's

BLUEMEL BROS. LTD.,
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Send postcard for complete new list of "Featherweight" and "Noweight" Accessories — mudguards, reflectors, lamps, horns, etc.

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ANGLO-AMERICAN OIL COMPANY LTD., WESTMINSTER, S.W.1
Established 1888

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CYCLE LAMP AND BATTERY

Prices from ***2/6*** *complete.* *Refill Batteries Type C60—8d*

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CONSTRUCTIONAL OUTFITS

OUTFIT No. 10

CONSTRUMENTS

PRICES: 4/6 to 39/6

BUILD YOUR OWN:
MICROSCOPES,
CAMERAS,
CINEMA PROJECTORS,
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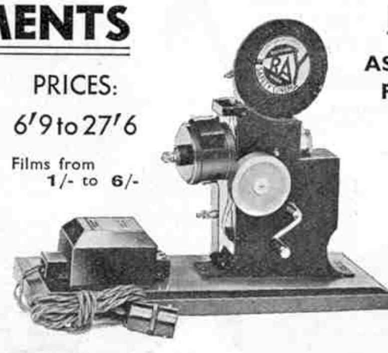
Countless Models of interest to everyone.
THE HOBBY OF A THOUSAND THRILLS

PRICES:
6/9 to 27/6

Films from 1/- to 6/-



RAY CINEMAS

ASK YOUR PALS TO THE PICTURES AT HOME

WATCH FOR ANNOUNCEMENT OF NEW CINEMA CONSTRUCTIONAL OUTFIT

YOU ARE SURE TO BE INTERESTED

WRITE FOR FREE CATALOGUES AND NAME OF NEAREST DEALER TO: **CONSTRUMENTS LTD. (Dept. M), 18, Gray's Inn Road, London, W.C.1**

TOYS OF QUALITY MADE BY
MECCANO LTD

DINKY BUILDER

A FASCINATING BUILDING HOBBY FOR BOYS AND GIRLS

This is one of the most fascinating building systems ever devised for young children to play with. The beautiful enamelled parts enable boys or girls to build very real-looking Coaches, Aeroplane Hangars, Garages, Towers, Bridges, Wheel Toys, Windmills—hundreds of toys, each one a real strong plaything.

Meccano Dinky Builder Plates are hinged on all sides, with intervening spaces so that when two are placed side by side the hinged part of one Plate fits into the corresponding space in the other. There are now three Outfits in the series, each of which is supplied in two colour combinations, bright red and green, and salmon pink and light green.

MECCANO LTD., Binns Road, LIVERPOOL 13

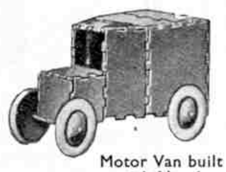
No. 1 Dinky Builder Outfit.

No. O DINKY BUILDER OUTFIT

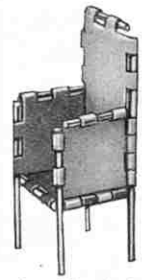
This is an excellent Outfit, containing a good assortment of Dinky Builder parts (including two road wheels), with which a splendid range of models can be built. The Instruction Folder included gives examples of 40 models, but many others of an original character can be constructed by the inventive boy or girl. Price 2/6

No. 1 DINKY BUILDER OUTFIT

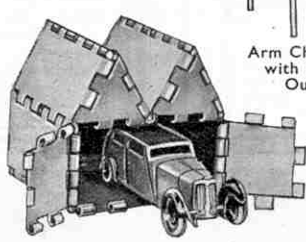
This splendid Outfit contains a varied selection of parts, including two trees on die-cast stands that lend the correct atmosphere to models of farm buildings, churches, etc. A further attraction is a set of four road wheels for constructing miniature wheel toys, many examples of which are illustrated in the Instruction Folder. These instructions show a total of 70 fine models that any boy or girl can build. Price 4/11



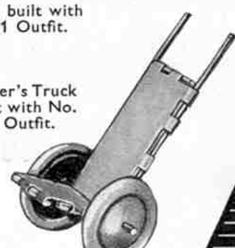
Motor Van built with No. 1 Outfit.



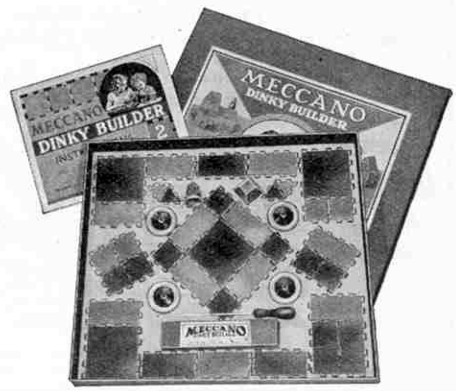
Arm Chair built with No. O Outfit.



Garage built with No. 1 Outfit.



Porter's Truck Built with No. O Outfit.



No. 2 Dinky Builder Outfit.

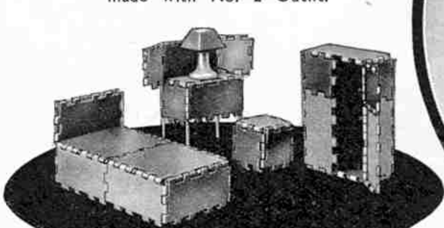
No. 2 DINKY BUILDER OUTFIT

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. The small table lamp and shade that are also included add greatly to the realism of these groups. Full instructions for building the complete range of models are given in the Instruction Folders included in the Outfit. Price 7/11

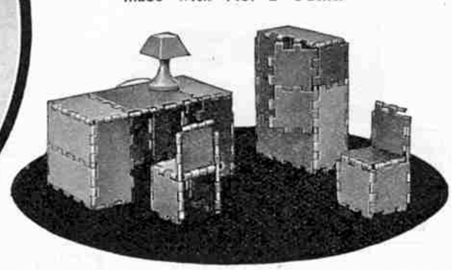
DINKY BUILDER "A"

The Dinky Builder "A" packet contains a useful assortment of Dinky Builder Parts for supplementing Nos. O, 1 and 2 Outfits. Price 1/-

Group of Bedroom Furniture made with No. 2 Outfit.

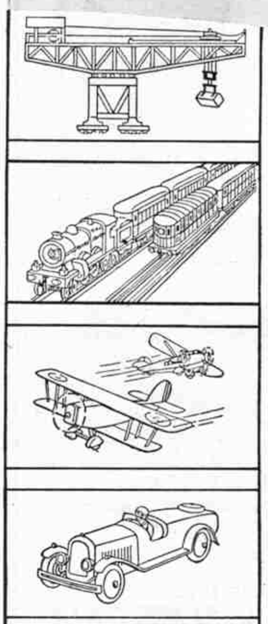


Group of Office Furniture made with No. 2 Outfit.



Get this WONDERFUL BOOK of TOYS

READY EARLY IN OCTOBER



Brimful of Good Things

The new "Book of Hornby Trains and Meccano Products" is the finest catalogue we have ever produced. It is beautifully printed in full colour throughout on finest quality white art paper, and its sixty pages contain the complete range of Meccano Products.

On the Meccano Outfit pages are examples of the fine models that can be built with the new-style parts finished in blue and gold. The Hornby Trains section (comprising thirty pages) will delight and satisfy the ever-increasing number of model railway enthusiasts. On other pages are featured Motor Car and Aeroplane Constructor Outfits, Dinky Builder, Kemex Chemical and Elektron Electrical Outfits, Hornby Speed Boats and Dinky Toys. We are confident that this remarkable production will be received with the greatest enthusiasm and interest, and we hope that every boy in the country, and especially readers of the "M.M.," will make a point of securing a copy.

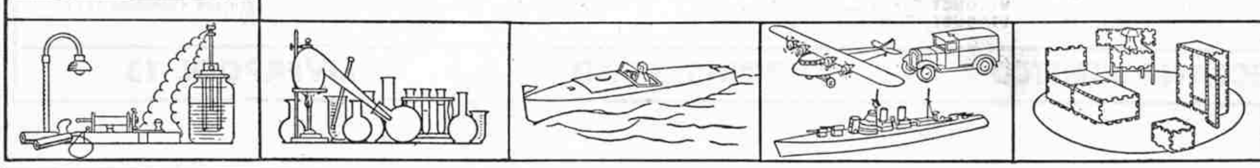
HOW TO OBTAIN THE BOOK

"The Book of Hornby Trains and Meccano Products" may be obtained from any Meccano dealer, price 9d. Alternatively, you can send in a remittance of 9d. to Meccano Limited (Dept. No. 70), Binns Road, Liverpool 13, and we will arrange for a copy of the book to be forwarded immediately, post free.

GET YOUR COPY TO-DAY

Published by

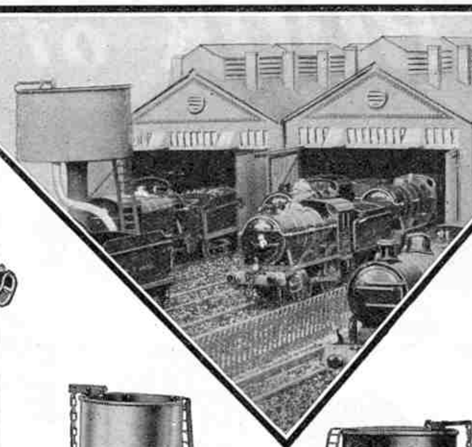
MECCANO LTD. (Dept. No. 70), BINNS ROAD, LIVERPOOL 13

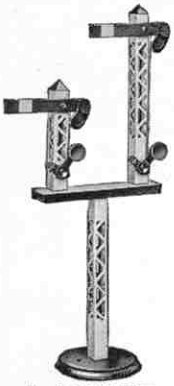


Toys of Quality made by Meccano Ltd. Liverpool

Hornby Series **HORNBY ACCESSORIES** Gauge O

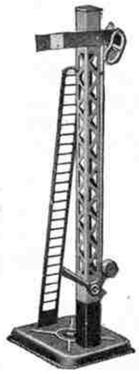
There is a splendid range of Railway Accessories in the Hornby Series, built in perfect proportion and beautifully finished. With these realistic accessories the most elaborate model railway may be constructed and operated in exactly the same manner as a real railway. A selection of Hornby Accessories is shown on this page. Ask your dealer to show you the full range.





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

No. 1 SIGNAL
"Home" or "Distant."
Price 1/-



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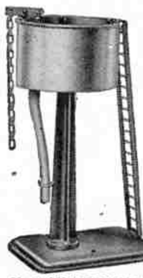
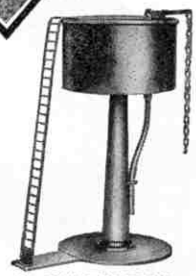
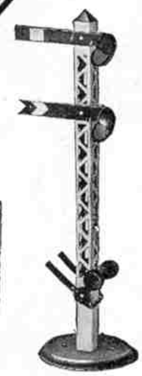
Price 2/-



No. 1 WATER TANK
Height 7 in.
Fitted with flexible tube and valve lever.
Price 3/-



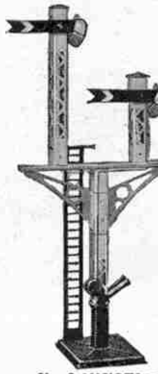
No. 2 WATER TANK
Height 9 in.
Fitted with flexible tube and valve lever.
Price 5/9



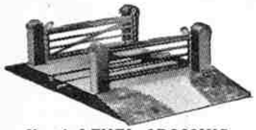
No. 1 SIGNAL, DOUBLE ARM
"Home" and "Distant."
Price 1/6

MECCANO LUBRICATING OIL
Price per bottle 6d.

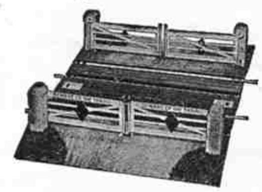
No. 2 SIGNAL, DOUBLE ARM
"Home" and "Distant."
Price 2/6



No. 2 JUNCTION SIGNAL
"Home" or "Distant." Signal arms operated by levers at base. A very realistic model. Price 4/9

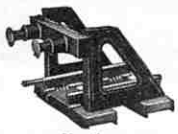


No. 1 LEVEL CROSSING
Suitable for a single track only and has gauge O rails in position.
Price 2/11



No. 2 LEVEL CROSSING
Measures $13\frac{1}{2} \times 10\frac{1}{2}$ in., with two tracks of gauge O rails in position.
Price 5/6

No. E2 LEVEL CROSSING (Electrical)
Similar to Level Crossing No. 2 excepting that a third rail is fitted in each of the two tracks.
Price 7/6



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

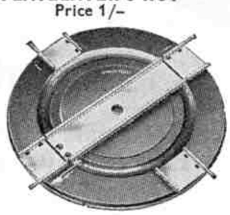
No. 1 OILCAN
Price 6d.

PLATELAYER'S HUT
Price 1/-

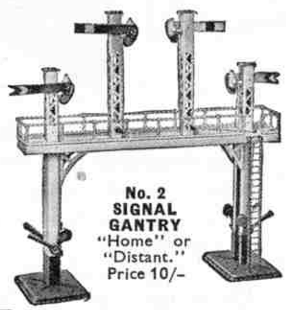
No. 2 OILCAN
("K" Type). The oil is ejected drop by drop by depressing the valve. Polished copper. Price 3/6

No. 1 SIGNAL CABIN
Finished in colours.
Price 2/6

No. 1 SIGNAL GANTRY
"Home" or "Distant."
Price 4/11

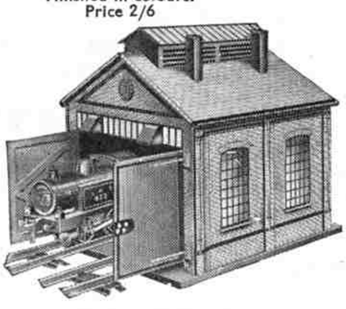


No. 1 TURNTABLE
Price 2/6



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

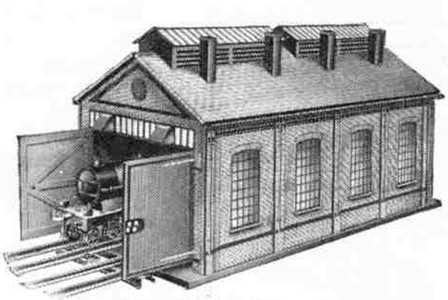
No. 2 SIGNAL CABIN
Dimensions: Height $6\frac{1}{2}$ in., width $3\frac{1}{2}$ in., length $6\frac{1}{2}$ in. Roof and back open to allow Lever Frame to be fitted inside cabin if desired. Price 3/9



No. 1 ENGINE SHED
This Shed will accommodate any Locomotive and Tender with an overall length not exceeding $8\frac{3}{4}$ in. Price 15/-

No. 1 STATION
Length $16\frac{3}{4}$ in., width 6 in., height 6 in. Price 4/6

VIADUCT Price 6/6 **VIADUCT** (**Electrical**) Price 7/6
VIADUCT Centre Section only ... ... Price 4/-
VIADUCT (**Electrical**) Centre Section only ... ... Price 4/6



No. 2 ENGINE SHED
This Shed will accommodate any Locomotive and Tender with an overall length not exceeding $17\frac{1}{2}$ in.
Price 22/6

MECCANO LIMITED — BINNS ROAD — LIVERPOOL 13

TOYS OF QUALITY MADE BY MECCANO LTD

DINKY TOYS

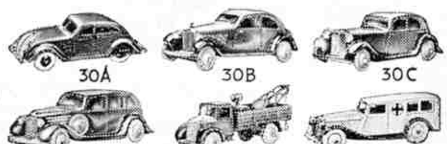
200 VARIETIES

STREAMLINE SALOON
Dinky Toys No. 22h
Assorted colours. Fitted with rubber tyres.
Price 6d. each

A FASCINATING COLLECTING HOBBY

Dinky Toys are the most realistic and the most attractive models in miniature ever produced. These wonderful toys are unique in their perfection of finish, and their range is so wide as to appeal to all tastes. Start now to collect these delightful little models.

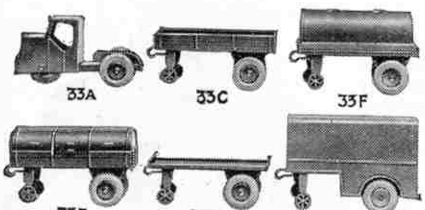
ROYAL MAIL AIR SERVICE CAR
Dinky Toys No. 34
In correct colours. Fitted with rubber tyres.
Price 6d. each



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.

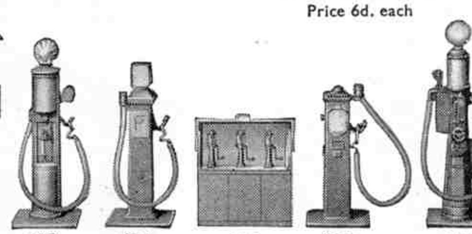
Price of complete set 4/6



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

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

Price of complete set 3/6



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

No. 49a	Bowser Pump	... each	4d.
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No. 49c	Theo Pump	... ,,	4d.
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No. 49e	Oil Bin (Pratts)	... ,,	3d.

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No. 28n	Atco Lawn Mowers Van ...	,,	6d.

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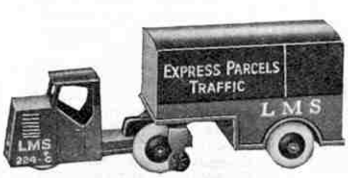

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Price complete, L.M.S.R., L.N.E.R., G.W.R. or S.R., 1/6

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

DELIVERY VANS
Dinky Toys No. 28/2

No. 28d	Oxo Van	each	6d.
No. 28g	Kodak Cameras Van ...	,,	6d.
No. 28h	Dunlop Tyres Van ...	,,	6d.
No. 28k	Marsh and Baxter's Sausage Van	,,	6d.
No. 28m	Wakefield's Castrol Oil Van	,,	6d.
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Assorted colours. Fitted with rubber tyres.
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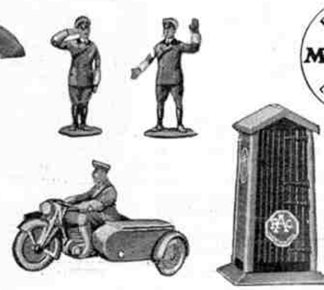

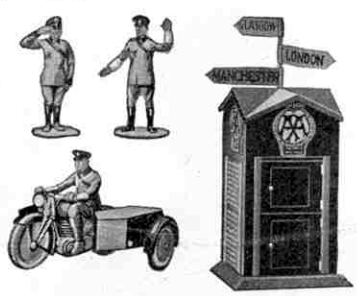

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Assorted colours. Fitted with rubber tyres.
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Price of complete set 1/9

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Dinky Toys No. 44
Every collector of Dinky Toys will find this new addition to the range of particular interest. Each item is finished in correct colours.

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No. 44c	A.A. Guide directing traffic	,,	3d.
No. 44d	A.A. Guide at the salute	,,	3d.

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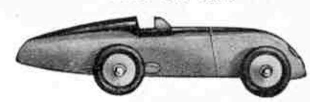

RACING CAR
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This is exactly the same as the No. 2L Meccano Kemex Outfit, except that a highly efficient Bunsen Burner, with the necessary length of rubber tubing, is included in place of the Spirit Lamp. Price 15/-

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Manufactured by
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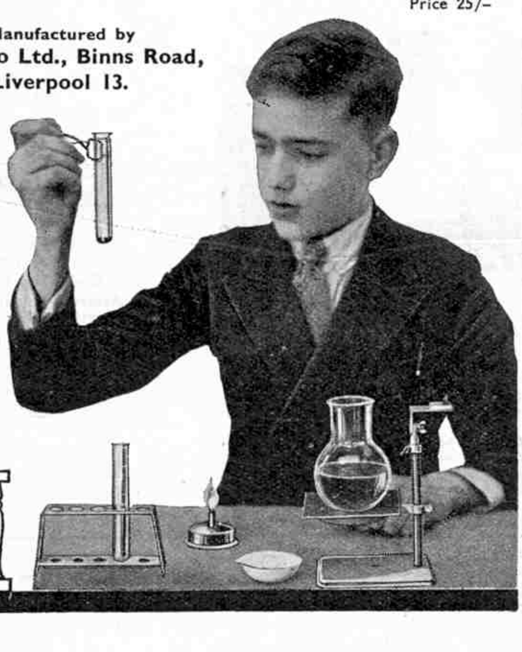
The apparatus included in Kemex Outfits and refills of Kemex chemicals can be obtained separately. Ask your dealer for the leaflet giving a list of Kemex parts and their prices, or write for a copy to the address given above.



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In these days of radio, X-rays and electric trams and trains every boy should have a knowledge of electricity. The only way to gain this knowledge is by means of experiments, and the Elektron Outfits have been produced specially for this purpose. They provide the necessary material for carrying out a series of fascinating experiments in magnetism, frictional electricity and current electricity.

The No. 2 Outfit has the added attraction this year of a considerable price reduction.

In the above illustration is shown an electric bell being made with the contents of Elektron Outfit No. 2.

No. 1 Elektron Outfit Price 6/6

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

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

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New Model with CHROMIUM-PLATED fittings. Strongly made of best weldless steel cycle tubing, ball bearings throughout, leather saddle, tangent spoke wheels, jointless sponge tyres. Fitted with box at rear and special tipping gear. Frame blue. Handlebars, forks, etc., CHROMIUM PLATED. Box finished red. Price 79/6

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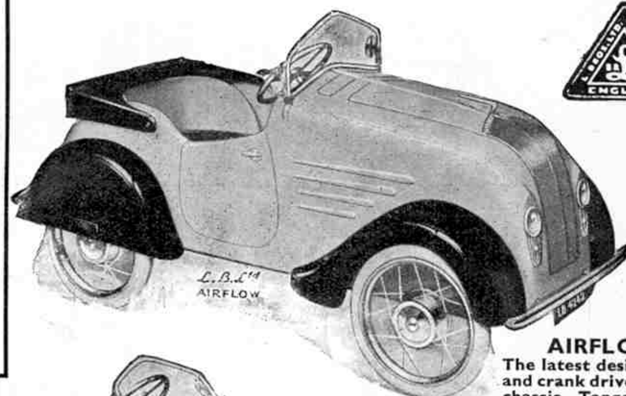

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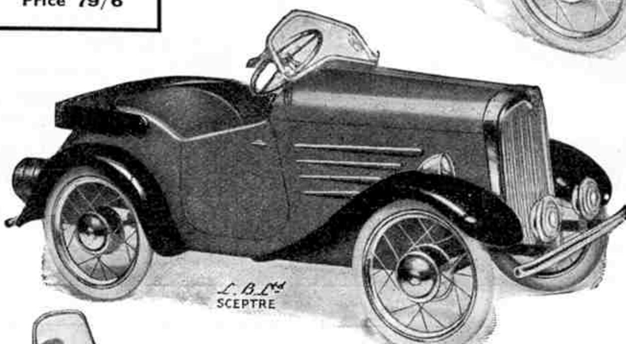
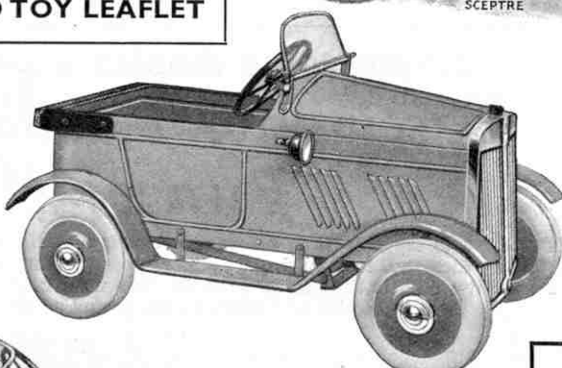
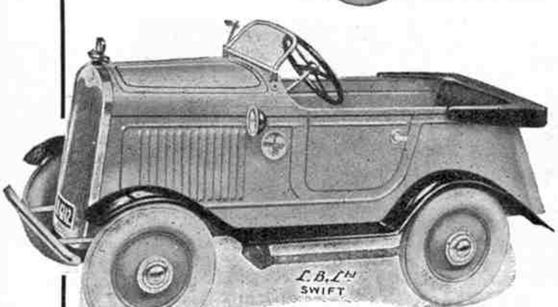
ASK YOUR DEALER FOR THE SPLENDID NEW **TRI-ANG COLOURED TOY LEAFLET**



SCEPTRE
Up-to-date sports design. Chain and crank drive. Tubular chassis. Tangent spoke wheels fitted with latest type Magna hub caps. 10″ x 1½″ jointless sponge rubber tyres. CHROMIUM-PLATED hubs and rims. Modern type radiator with mascot. Two ELECTRIC side lamps embodied on wings. ELECTRIC STOP and GO and BUZZER HORN. Length 45″. Price 84/–



MITCHAM
NOW GREATLY IMPROVED WITH SLOPING RADIATOR AND BALLOON DISC WHEELS. A fine Car for small children. Pressed steel body. Double crank drive. Mudguards and running boards. Equipment includes adjustable windscreen, lamps, petrol and oil cans. Length 32″. Price 21/–



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TRI-ANG TRICYCLE No. 5 (Regd. Trade Mark.)
NOW FITTED WITH REAR MUDGUARDS. Cycle chain drive with free wheel. Frame best quality weldless cycle tubing. 14″ wheels, 1½″ jointless sponge rubber tyres. Rim brake. Coil-spring saddle. CHROMIUM FITTINGS. Black or blue. Price 59/6

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MECCANO MAGAZINE

Editorial Office:
Binns Road, Liverpool 13
England

Volume XX. No. 10
October, 1935

With the Editor

Brains Unlimited

I see that the old subject of brain versus brawn aroused the interest of the scientists who attended the meeting of the British Association at Norwich last month. Nowadays scientists know quite a lot about brains, even if they cannot explain exactly how these enable us to think and invent. Brains are extremely delicate mechanisms, and curiously enough it is this very delicacy that has enabled us to follow their development through the ages, because it has been necessary for Nature to protect them by enclosing them in a thick bony box or case. There are no fossilised brains in the ordinary sense of the word, but the boxes in which they were enclosed have been preserved in the case of many of the creatures of the past, and these boxes show us at least the size of their contents.

We may congratulate ourselves on having the best developed brains of all the creatures that have ruled the Earth. The tyrants of the reptile age grew to huge dimensions, but their brains did not increase in proportion. One of these monsters that weighed about 20 tons had a brain no larger than an egg, which gave it only about a quarter of an ounce of brain to every ton of body and limb. We are much better equipped, for on the average we have nearly half a hundredweight of brain per ton of body. Unfortunately, however, the possession of a large brain does not necessarily mean great ability, for weighty thoughts often arise in brains far below the average in size. A big head is an even less reliable guide!

This revival of interest in brains reminded me of a famous book, *"The First Men in the Moon,"* by Mr. H. G. Wells. In this the author describes the imaginary inhabitants of the Moon, who are supposed to have reached a later stage of development than exists on Earth. Many of the Moon people indeed have developed to such a pitch that their brains have burst the bounds of a comparatively tiny box such as that in which our own brains are confined. Their heads have become wobbling jelly-like masses, so far exceeding their bodies in weight and size that the unfortunate owners are unable to walk and have to be carried about! They are in fact, merely gigantic thinking machines. The greatest of all the Moon people is the Grand Lunar himself, a creature with a dwarfed body and shrivelled limbs, but whose brain is a mighty engine that has to be sprayed by attendants in order to keep it cool! Let us hope that such a fate is not in store for the future inhabitants of our planet.

The G.W.R. "Centenary Special" near Badminton on its run from London to Bristol on 31st August last. The locomotive is No. 6000 "King George V." Photograph by W. Vaughan-Jenkins, Bath.

Are Speed Records Worth While?

The announcement that Sir Malcolm Campbell in *"Blue Bird"* raised the land speed record to 301.129 miles an hour on the Salt Flats at Salduro in the United States has again brought up the question of the value of record-breaking. Some people tell us that efforts to achieve such enormous speeds are sheer waste and have no practical value, for we shall never require to travel so fast in ordinary life. It is certainly interesting that Sir Malcolm's last two efforts to raise the record have come at a time when speeds in built-up areas are being restricted to 30 miles an hour, or only a tenth of his record speed; but that is only one side of the story.

The perfection of the present-day motor car is due largely to the experience gained by automobile engineers in designing engines to attain the ever higher speeds demanded by Sir Malcolm and other record breakers, and by tyre manufacturers in making tyres capable of withstanding the enormous strains involved. If the automobile industry had never been called upon to provide anything faster than the ordinary touring car, it certainly would not have reached its present efficiency.

At any rate I am sure that all readers will join me in congratulating Sir Malcolm in achieving his great ambition to travel at the rate of five miles a minute.

Our "Footplate Trip" Articles

The articles by "A Railway Engineer" describing footplate trips on various well-known locomotives have been received with great enthusiasm, as I felt sure would be the case. There is something specially fascinating about a run on the footplate, and these articles provide a very realistic substitute for an opportunity that comes to few of us. Readers will be interested to know that further articles are in preparation; these will deal with locomotives of the S.R. and the G.W.R. and also with Irish locomotives.

A new feature this month is the account by Mr. O. S. Nock of a trip from Liverpool to Belfast in the motor ship *"Ulster Queen."* Mr. Nock will follow this with other articles dealing with cross-channel services, and with a trip along the West Coast of Scotland and among the islands of the Hebrides. I have often been asked for articles of this kind, and I shall be glad to know what readers think of the new series.

The Romance of Madame Tussaud's

A Century of History Portrayed in Wax

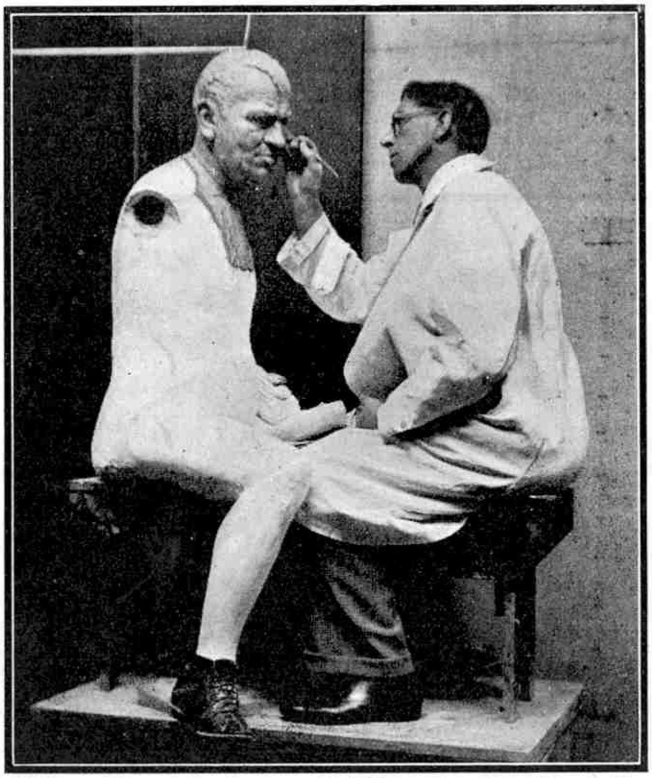
ART and industrial exhibitions of many kinds come and go every year, but the famous Exhibition of Madame Tussaud's, London, remains as popular to-day as when it was established over a century ago. The story of this famous concern is very interesting and dates back to the days before the French Revolution.

Marie Grosholtz, who eventually became Madame Tussaud, was born at Strasbourg on 17th December 1760. Her father, Joseph Grosholtz, a soldier, was killed a few months before her birth, while fighting in the Seven Years' War. She was taken by her widowed mother to Berne, Switzerland, where they lived until 1766, when a relative named John Christopher Curtius, a doctor, took them to his house in Paris.

Curtius was an ambitious man, and one of the means he had adopted to increase his knowledge was that of making wax models of the limbs and organs of the human body. The work appealed to him and he became very successful in it, especially in making models of the human face. His skill in this respect became known, and he gained the patronage of many of the leading members of French society. In 1757 he started a private museum at his home, then in Berne, Switzerland, where privileged visitors were able to see examples of his modelling. One day in 1762 the museum was visited by the Prince de Conti, cousin of Louis XV, who in the course of a tour of Europe was spending a few days at Berne. The Prince greatly admired Curtius' successful work and invited him to remove to Paris, adding that he would undertake to find him a suitable place in which to carry on his work, and see that he received plenty of commissions. Curtius accepted the offer and removed to Paris, where his talent speedily won him success, and his studio in the Hotel d'Aligre, an old mansion, became a meeting place for the fashionable and intellectual life of Paris. The many famous people who were frequent visitors included Voltaire, Diderot, Rousseau, and Benjamin Franklin who at that time was American Ambassador to France.

In 1766 Curtius visited Berne and brought back to Paris his niece, Marie Grosholtz, and her mother. When his niece was old enough he taught her the art of modelling in wax, in which she became remarkably proficient and was soon able to take an active part in his work. Little is known of the first 20 years of her life as a modeller, but a few models made during that period that still exist show that Curtius and she produced coloured wax miniatures, modelled in fairly high relief, and framed and glazed like pictures.

Curtius made also many life-size models in coloured wax of men and women of high position, and in 1776 he opened an exhibition of these portraits at the Palais Royal, Paris. The exhibition was such a great success that he opened a second and larger one on the Boulevard du Temple, where wax portraits of famous persons, living and dead, attired in their everyday costumes and carefully posed to look as natural as possible, were on view. In 1783 he added to this second exhibition a section devoted to models of notorious scoundrels. The section was called the "Caverne Des Grands Voleurs," or "Cave of the Big Thieves," and was the forerunner of the present "Chamber of Horrors" at Madame Tussaud's.

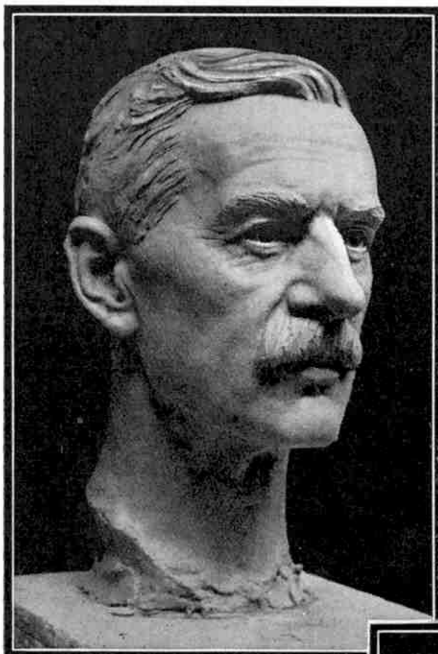


Mr. Bernard Tussaud at work on a model of Wallace Beery, the well-known film star, for Madame Tussaud's famous exhibition. The illustrations to this article are reproduced by courtesy of Madame Tussaud's Ltd., London.

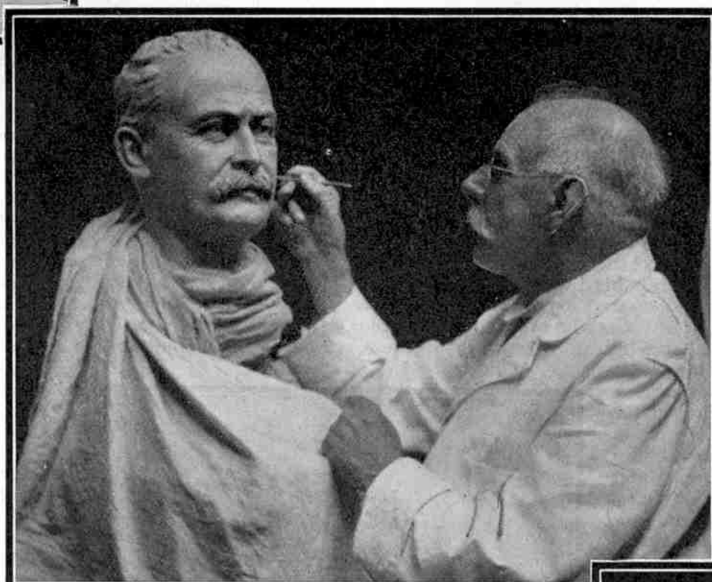
Modelling in wax became one of the fashionable crazes of the day, and Marie Grosholtz was invited by Madame Elizabeth, sister of Louis XVI, to take up her residence at Versailles and give lessons to the ladies of the Court. She accepted the invitation, and the next nine years of her life were spent in these royal surroundings.

Curtius was always on the alert for topical subjects to add to his exhibitions, and during the years immediately preceding the French Revolution he made wax models of many of the men who supported the public in their protests against unjust government. Two of these additions were models of Necker, Minister of Finance, and Philippe, Duke of Orleans, both heroes of the people at that time.

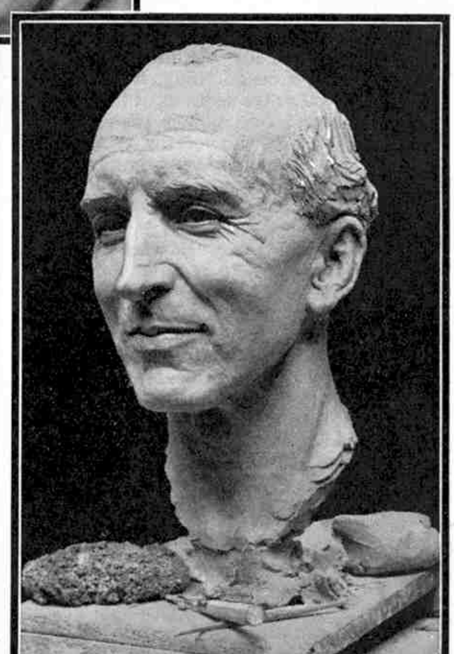
When it became evident in the summer of 1789 that serious trouble was imminent, Curtius recalled his niece from her perilous surroundings at Versailles to the safety of his house. The storm broke on Sunday, 12th July 1789, following the dismissal of Necker by the Court. When the fall of the people's favourite became known, theatres and other places of entertainment were closed as a sign of mourning. A frenzied mob besieged Curtius' exhibition on the Boulevard du Temple and demanded the busts of the "friends of the people." Curtius handed over the busts of Necker and Philippe, which



the crowd covered with crepe, set on a pedestal, and paraded triumphantly through the streets of the city. In the Place Vendome the mob, by then numbering about 5,000, were opposed by royal troops, and the first bloodshed occurred. Two days later the Revolution broke out in its full fury with the storming of the Bastille.



(Top and bottom) Clay models of heads of Mr. Neville Chamberlain, Chancellor of the Exchequer, and Sir John Simon, Home Secretary. (Centre) One of Madame Tussaud's artists working on a head of M. Lebrun, ex-President of France.



The revolutionaries demanded models of their victims, and forced Curtius' niece to make them. In this dreadful work she was compelled repeatedly to take impressions of the dead features of many who had been her friends at Versailles, and the horror of the task remained with her to the end of her life. When the Terror rose to its height, and those who had provoked it in turn became its victims, she was called upon to copy the features of many of them. The head of Robespierre was brought to her within an hour of his execution on 28th July 1794. Casts from several of the death masks she was compelled to make may be seen in the Exhibition to-day. In spite of her compulsory service to the revolutionaries she herself was eventually thrown into prison. Curtius died before peaceful times returned to France.

In 1795 Marie Grosholtz married Francois Tussaud, and it is as Madame Tussaud that she is best known. France remained to her a country of tragic memories, and after the signing of the Treaty of Amiens in 1802 she left the country for ever and came to London, bringing with her many moulds and effigies from her uncle's exhibition, including the "Cave of the Big Thieves." At first she exhibited her collection in the Strand, but subsequently it was removed to Blackheath, then the residence of the Princess of Wales, who later became Queen Caroline. The Exhibition attracted great attention, chiefly on account of the models of the leading figures in the French Revolution; and later it visited almost every important town in the United Kingdom. A mishap while crossing to Dublin almost put an end to the enterprise, as the ship was partly wrecked and many of the valuable models were lost. The Exhibition did not find a permanent home in London until 1835, when it became established in Baker Street.

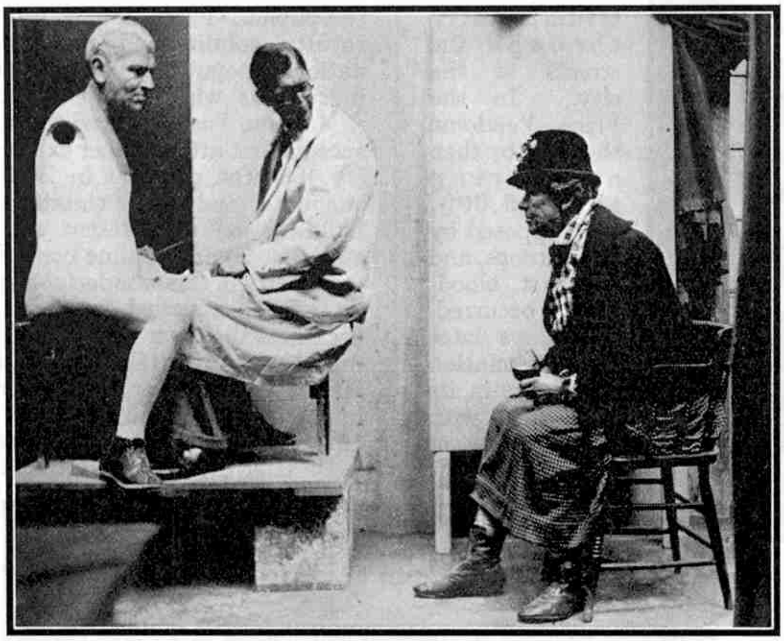
It was a principle of Madame Tussaud that the exhibition must keep up to date if it was to continue to attract the public. From time to time therefore new models of royalty, nobility and less exalted persons who attained national popularity were added, and also models of individuals who became infamous.

Madame Tussaud lived to the great age of 90, and the success that attended her exhibition is a matter of history. By 1884 the premises in Baker Street had become inadequate, and the Exhibition was transferred to new buildings on the present site adjoining Baker Street station. Even wartime conditions did not diminish the popularity of this wonderful display; and indeed many of its effigies assumed greater significance. On several occasions the portrait of the Kaiser received rough treatment, and ultimately it had to be removed from public view! The post-war period brought with it many changes in popular taste, but Madame Tussaud's still went on. In 1924 720,000 people passed through its doors.

Disaster overtook the Exhibition on 18th March 1925, when it was practically destroyed by fire. A curious feature of the calamity was that the Chamber of Horrors received the least damage. Fortunately the priceless moulds of the figures were saved, and it was possible to reconstruct the many interesting portraits. Only the people who were intimately concerned in this task can realise its magnitude, but eventually it was completed, and the Exhibition rose again upon its old site. The new display was opened on 26th April 1928, and since that date it has been visited by more than 5,000,000 people.

The work of modelling the exhibits that was begun by Madame Tussaud has been carried on by successive generations of the family, and the present artist to the Exhibition is a great, great grandson of the founder. It is exacting but fascinating work, and calls for a high degree of skill ; indeed, more than skill is required, for the ability to model perfect portraits is a gift. An artist may model a perfect head that will be admired by all who see it, but at the same time it may fail to be a likeness of the original. Another artist, although ranked as a man of lower attainment, may possess the gift of portraiture to a high degree. The wonderfully lifelike character of the models at Madame Tussaud's testifies to the remarkable gifts of the successive artists.

We must now see how these wonderful wax models are produced. The first step is to make a model of the head, not in wax but in clay. If the artist is fortunate enough to secure a sitting, and thus have his subject actually before him, his task is much easier than if he has to work from photographs. It frequently happens that a sitting cannot be arranged, however, and then the artist obtains photographs showing his subject in a variety of positions, lightings and circumstances. Studio photographs, with all the character retouched out of them, are of little use. In all the photographs of the subject, no matter how diverse the attitudes and expressions shown, the artist's experienced eye will detect the same basic formation. One of the photographs is selected as a master picture, and the others serve as memoranda. If the artist has never seen the personage he is endeavouring to portray, his difficulties are increased a hundredfold ; but he struggles along and eventually produces a head which, by general agreement of those who are well acquainted with the original, is regarded as a more or less " speaking " likeness.



Another view of Mr. Bernard Tussaud at work on his model of Wallace Beery. He is turning to ask Marie Dressler, who partnered Beery in many films, what she thinks of it. Marie cannot reply, however, as she is merely wax !

The next step is to make a mould of this clay head, and the process is carried out by trained craftsmen working under the supervision of the artist. When the craftsmen have finished their labours they hand to the artist a mould in which he can cast a replica in wax of his clay model. A sufficient quantity of wax is then melted, poured into the mould and allowed to set ; and after removal of the mould there is revealed a wax replica of the head. At first sight this seems rather a crude thing, for it bears the marks where the sections of the mould have met, and fine points such as the curves of the ears, the nostrils, the mouth and the eye cavities may be rough. The artist again takes control, and from this point onward the process is a purely artistic one.

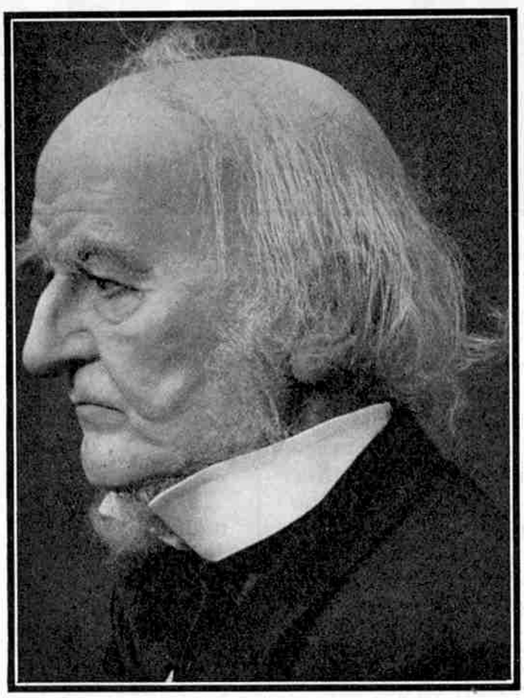
The first step is to work over the head with suitable tools to remove the rough parts and to bring out all the subtleties that were reproduced in the original clay and gave life to the head. When this job is finished the artist turns his attention to the delicate operation of inserting the glass eyes. The proper placing of two eyes in a wax head may cost the artist many anxious and troublesome hours before he obtains the degree of naturalness and the precise angle and expression at which he is aiming.

The next process is to place hair upon the bald wax head, as Madame Tussaud's models do not wear wigs. Real human hair is used for this process, and each hair is inserted separately into the wax. This work is carried out by Madame Beatrice Tussaud, who has been inserting hair into portrait models all her life. The same painstaking method that is used to cover the skull is employed to add the eyebrows, eyelashes, and if necessary moustache and beard. It is not sufficient merely to insert hair of approximately the correct colour. There is a great deal of character in hair, ranging from the frizzy, upstanding, vigorous coiffure, to the long, lank variety. Similarly there is character in eyebrows, ranging from bushy, vigorous protruding growths, to faint smears of almost imperceptible hair. Moustaches, of course, everybody notices.

The head is now ready for colouring, and this operation consists of applying the correct pigment, which may range from the ruddy tint of the athlete to the pallor of the student. Finally any personal accessories, such as eye-glass, spectacles, etc., are added.

In all these processes it is possible to lose the perfect likeness that the artist had impressed upon the clay. Each of the processes has its own particular part in building up that lifelike resemblance, and the slightest slip, such as an almost unnoticed loss of character in the setting of the hair, a slight over- or under-colouring, or the placing of a pair of spectacles too close to the eyes or too far down the nose, will cause the likeness to vanish. Even when all these things have been accomplished to satisfaction in the studio, there still remains the problem of illumination. A light falling too full upon the face, or from a wrong angle, will produce a mixture of shadows in which the elusive resemblance will disappear. Equally, of course, clever lighting will enhance every beauty in a good head.

The modelling of the body is equally important, and it also has to be built up to character. It would never do to put the head of a corpulent man upon the lanky body of another, and vice-versa. Such things as the stoop of shoulders, or a peculiar attitude when standing or sitting, have to be taken into consideration. When the body has been built there is the problem of clothing it, and this also is a matter in which character must be considered in every detail. A man who is notoriously slovenly in his dress must not be attired in dandified garments. All suggestion of a tailor's dummy must be avoided, but the clothing must be good. A suit of clothes built by a Savile Row tailor has often been worn for many days by a member of Madame Tussaud's staff in order to impart to it that slightly shabby appearance that is so necessary if an illusion of reality is to be achieved.



A wonderfully lifelike model in wax of Mr. Gladstone.

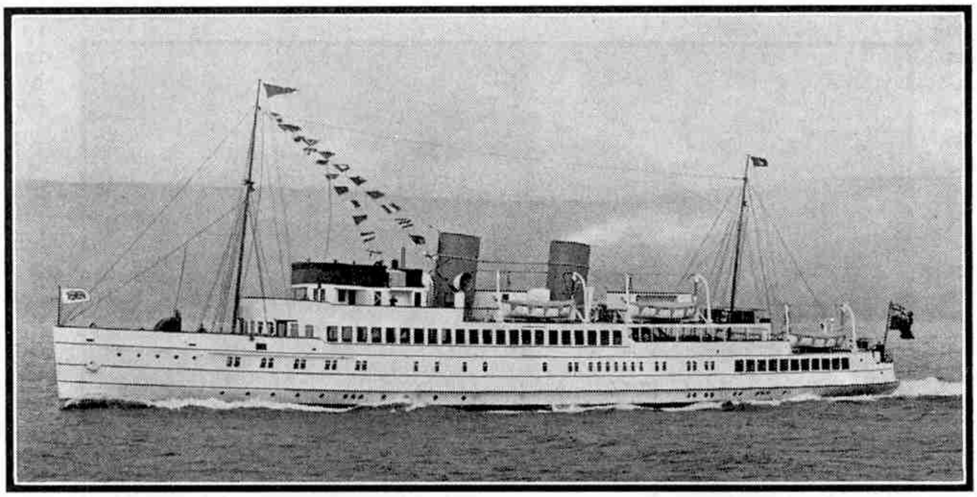
The two processes, the making of the head and the making and clothing of the body, are carried out simultaneously in the studio. When the head and body are completed they are joined together, and the finishing touches, such as the adjusting of the collar and tie, are given. The completed model is then transferred to its place in the exhibition, the lighting is carefully adjusted, and until the next addition is made the model enjoys the distinction of being " the latest exhibit."

For the information on which this article is based we are indebted to the courtesy of Madame Tussaud's, and to "*The Romance of Madame Tussaud's*" by John T. Tussaud, a book that enshrines the romantic early history of the remarkable lady whose name is world renowned, and tells in great detail the story of her early days in England and of the establishment of the famous Exhibition.

New Twin Screw Cross-Channel Ship

Direct-Drive Diesel Propulsion

THE illustration on this page shows the *"Queen of the Channel,"* a twin screw motorship owned by the London and Southend Continental Shipping Co. Ltd., and employed on summer passenger service to the Continent and in the Thames estuary. She has been built at the Dumbarton yard of William Denny and Bros., Ltd., to whom we are indebted for our information; and she is the first vessel of her size and type owned in this country to be fitted with direct-drive Diesel propelling machinery. The success of this method of propulsion was shown in the excellent results of her recent trials when she slightly exceeded the contract speed of 19 knots. The main engines and all auxiliary machinery ran exceedingly well, and there was a noticeable absence of vibration.



The twin screw motorship "Queen of the Channel," built by William Denny and Bros. Ltd., Dumbarton, to whom we are indebted for this illustration. She is fitted with direct-drive Diesel propelling machinery.

The twin screws are driven by two sets of Sulzer-Diesel engines each developing 1,500 b.h.p. at about 320 r.p.m. The eight cylinders of each set are of 14 in. bore and 23.6 in. stroke, and are operated on the two-stroke cycle principle, with direct injection of the fuel. The expulsion of the gases through the exhaust ports of the cylinders is assisted by the admission of air, at a pressure slightly above atmospheric pressure, through valves in the cylinder heads. This operation is called scavenging, and in the *"Queen of the Channel"* scavenge air is supplied to each main engine by a tandem reciprocating type air pump driven by a separate crank at the forward end of the engine. There is also an air compressor fitted to the top end of the scavenge pump.

The main engines are forced lubricated by geared type lubricating oil pumps driven off the forward end of each engine. The pumps are arranged to supply the oil through filters and an oil cooler to the main, crank and gudgeon-pin bearings, and to supply cooling oil to the working pistons. Each working cylinder has its own fuel pump, which delivers a measured quantity of fuel oil direct to the cylinder. The engines are cooled by sea water circulated by a motor-driven centrifugal pump, and a second similar pump is provided in reserve. They are started and manœuvred by compressed air stored in four receivers at a pressure of 600 lb. per sq. in., and pressure is maintained in these receivers by an air compressor.

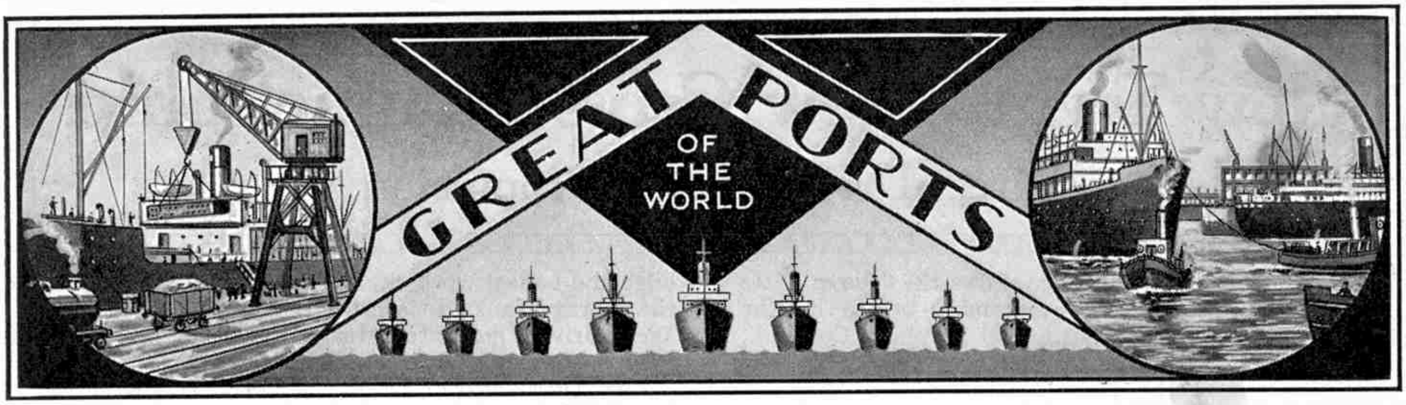
The auxiliary machinery includes motor pumps for bilge and ballast work, and for transferring fuel oil from the storage tanks to service tanks; and three 50-kW Diesel-driven generators for supplying power to the pumps, steering gear, electric cookers, etc.

The *"Queen of the Channel"* is 255 ft. in length, 34 ft. in breadth and 11 ft. 6 in. in depth to the main deck, and the hull is divided into a series of watertight compartments by 10 transverse bulkheads. Her straight, almost vertical stem, cruiser stern, and white painted hull and superstructure give her a very attractive appearance. She has four decks. The main and promenade decks extend from the bow to the after peak bulkhead, and the ships sides at the forward end of the promenade deck have been closed in to form a roomy observation lounge with large windows and seating for 92 persons. When employed on Continental trips the vessel carries 1,162 passengers, and when on service in the Thames estuary 1,600 passengers.

The two large dining saloons are on the main deck and, with the vestibule leading to them, are panelled in polished mahogany. The ceilings of the saloons are flush panelled below the bottom of the beams, and the floors are covered with coloured linotiles designed in large squares. The forward saloon can accommodate 88 diners and the other one 116 diners. There are two auxiliary or private dining saloons on the lower deck each capable of dining 32 persons. They are panelled in polished oak and have been specially arranged for the convenience of private parties. The public rooms below the passenger deck are equipped throughout with a trunk system of mechanical ventilation. The galleys equipment includes an anthracite-burning range and electric boilers, steaming ovens and toasters.

The vessel carries six 24 ft. 6 in. lifeboats, and in addition there is a large number of buoyant deck seats. The fire-fighting equipment is very complete, and includes two fire resisting curtains, one on each side of the main deck alleyways amidships.

An interesting feature of the ship is the provision of a bow rudder, in addition to the usual one at the stern. This bow rudder is controlled by hand gear on the promenade deck forward and is used for guiding the vessel into and out of harbour. The stern rudder is controlled by electric steering gear.

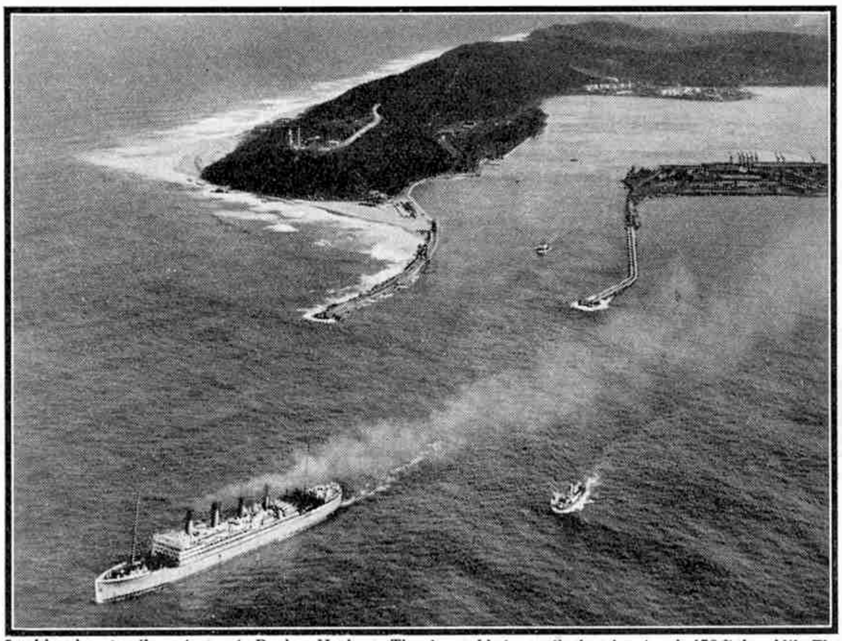


XVI.—DURBAN

In the *"M.M."* of August last we concluded our descriptions of the chief Canadian ports. We now pass to South Africa, and this month deal with the port of Durban.

A century ago the site of Durban was covered with thick bush almost to the water's edge, and Durban harbour was only a shallow reed-grown lagoon, its shores lined with mangrove swamps, where lions and elephants roamed at large. The site was practically unknown to Europeans, as indeed was the entire province of Natal.

The province owes its name to the fact that Vasco da Gama, the famous Portuguese navigator, sighted the coast on Christmas Day 1497, while sailing round the south of Africa in quest of a sea route to the Far East. For centuries Natal remained merely a name on the map, and its real history may be said to date from 1824, when a small party of Englishmen, led by Lieut. Farewell, hoisted the Union Jack on the Bluff, the commanding headland that screens Durban Bay from southerly squalls. Natal was then part of the great Zulu kingdom under T'Chaka. Farewell entered into negotiations with the Zulu despot, who ceded to him 25 miles of the coast of Natal, together with 100 square miles of its interior. The first white settlement in Natal was founded on this territory, with "D'Urban," so named in honour of the then Governor of the Cape Colony, as its port.



Looking down on the entrance to Durban Harbour. The channel between the breakwaters is 450 ft. in width. The illustrations to this article are reproduced by courtesy of the High Commissioner for the Union of South Africa.

Natal was not wrested from barbarism and transformed into a flourishing modern settlement without strife or adversity, and permanent memorials of those strenuous days are among the cherished possessions of the city. On the Esplanade, facing the waters of the Bay, there is a fine statue of Dick King on horseback. King is remembered as the "Saviour of Natal," for in 1842 he rode 600 miles through dangerous country to the nearest British garrison, at Grahamstown, Cape Province, to bring relief to the besieged British force at the Old Fort.

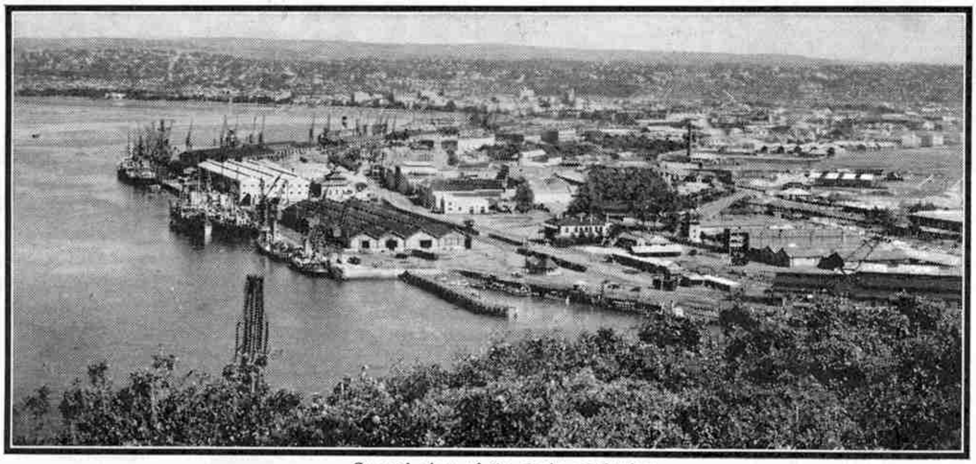
The province of Natal was finally declared British territory in 1843. Durban was incorporated as a borough, and from that time its development both as a port and as an industrial centre has continued steadily.

The first step in making Durban an efficient port was to secure a safe entrance for shipping by clearing away a formidable sandbank, and constructing training walls at the mouth of the harbour, and after a long and stern struggle with the forces of Nature this work was completed. Subsequently two parallel breakwaters extending from the north and south shores respectively into the Indian Ocean were built, and the northern one was equipped as a pier. The navigable width of the entrance channel between the two breakwaters is 450 ft., widening immediately inside the harbour to 500 ft. The channel has a depth of 37 ft. at low water, sufficient to admit the largest ships trading in the Southern Hemisphere.

Durban, in common with other South African ports, was administered by its own harbour board until the South Africa Act came into force on 31st May, 1910. Under this act the self-governing colonies of Natal, Cape of Good Hope, Transvaal and Orange River became united into one government under the name of the Union of South Africa. The ports, harbours and railways of the four provinces are now administered and operated by a body known as South African Railways and Harbours, under the control of the Minister of Railways and Harbours.

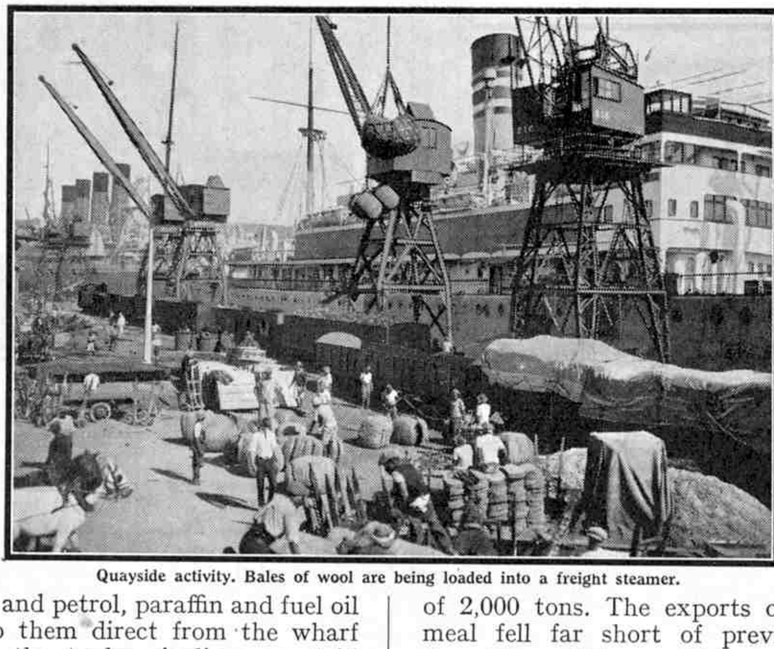
In the early days of the port practically the whole of the harbour development was centred at the Point, the narrow promontory forming the east side of the harbour, and this is still the main centre of the port's traffic. The wharves at the Point provide berths for about 30 ships, and are equipped with numerous stationary and travelling cranes, including an 80-ton electric crane. There are also two floating cranes of 15 tons and 25 tons lifting capacity respectively. The depth of water alongside the wharves ranges at low water from 38 ft. 6 in. to 23 ft.

As the commerce of the port increased, additional facilities became urgently necessary. Deepwater channels were therefore dredged from the harbour mouth to Congella, the north shore, and the reclamation of the swampy land there was put in hand. An extensive wharf was built along the improved waterfront, and large warehouses were erected on it. A fine grain elevator was completed in August 1928. It has a storage capacity of 42,000 tons and is equipped with an overhead shipping conveyor by means of which grain can be delivered direct into ships at the rate of 1,000 tons an hour. The wharf is steadily increasing in length as further areas of foreshore are reclaimed and enclosed.



General view of the docks at Durban.

The opposite side of the harbour is formed by the headland known as the Bluff, and is reserved for the coal and oil traffic of the port. The coal storage bins have a total capacity of 70,000 tons, and the coaling appliances can deliver the fuel at the rate of 1,000 tons per hour, enabling several ships to be dealt with at the same time. Farther inland, beyond the part of the Bluff allocated to coaling facilities, an area of 80 acres has been reclaimed to provide sites for oil storage plants. It has its own water frontage, consisting of a timber wharf 1,000 ft. long with a depth of 30 ft. to 35 ft. of water alongside. Many privately-owned storage tanks, with a total capacity of over 25,000,000 gallons, have been erected on this land, and petrol, paraffin and fuel oil in bulk are pumped into them direct from the wharf through pipelines. From the tanks pipelines are laid which enable the bunkers of oil-burning ships to be replenished easily and quickly.



Quayside activity. Bales of wool are being loaded into a freight steamer.

An essential feature of a modern port is provision for repairs to ships, and at Durban a fine graving dock was completed in 1924 at a cost of £1,350,000. The dock is situated at the western end of Congella and has a total length of 1,150 ft., a width of 110 ft. at the entrance, and a depth over the sill of 35 ft. at low water. It can be divided into two compartments, the outer one 678 ft. 10 in. long and the inner one 450 ft. The equipment at the dock includes one 25-ton crane with a radius of 90 ft., and one 10-ton and two 5-ton cranes. In addition there is a floating dock 475 ft. long by 60 ft. internal breadth, with a lifting capacity of 5,000 tons.

The commerce of the port is very considerable, and during the year ended 31st March, 1934, exports totalled 2,129,355 tons and imports totalled 1,147,027 tons. The industrial greatness of the port has been built up on the products of the vast mining and agricultural industries upon which the national prosperity of South Africa is mainly dependent. Durban is the chief outlet for the rich coalfields of north Natal and for the vast sugar plantations that now extend almost from end to end of the coastal belt. The coal is shipped to East and West African and Indian ports, to South American ports and to many places in the Far East. The exports of coal during the year just mentioned totalled 720,094 tons, and an almost equally large quantity, 634,447 tons, went into the bunkers of ships using the port.

The amount of sugar exported from Durban during the year ended 31st March, 1934, was 282,077 tons, and although this figure is far below that of the coal shipped, it is a record for the port. Another record achieved during the same period was the shipment of 52,388 tons of citrus fruit, an increase of nearly 7,452 tons over the previous year. An enormous pre-cooling store for use in connection with the increasing exports of citrus and other autumn fruits has been erected, with a storage capacity of 2,000 tons. The exports of wool, maize and maize meal fell far short of previous years owing to the drought conditions which prevailed throughout South Africa during 1933-4. Only 98,421 tons of wool and 14,761 tons of maize and maize meal were shipped from the port, compared with 135,832 tons and 255,701 tons respectively in 1932-33.

We are indebted to the courtesy of South African Railways and Harbours for the 1934 trade figures, and to the High Commissioner for the Union of South Africa, London, for the remaining information in this article.


IRRIGATION WORKS NEAR KRAWANG, IN WEST JAVA

ENGINEERING NEWS

Launching Bridge Caissons Like Ships

Among interesting bridges constructed recently is one across the Little Belt, Denmark, that has now been completed and carries traffic between Copenhagen and the mainland. It has a total length, including approaches, of 3,865 ft. and carries a double railway track, a splendid roadway for all classes of vehicular traffic and a footwalk for pedestrians.

A special feature of the constructional work was the erection of the bridge piers. Each of these is carried on a reinforced concrete caisson that was built up on shore and then launched like a ship. To sink the caissons into the sea bed when they were in position, a ring of large diameter concrete tubes was placed round each of them. Through these tubes excavation was carried out so that the caissons sank gradually by their own weight to the required depth. Finally the tubes were sealed up with concrete.

Before the bridge was constructed all traffic was transported across the Little Belt by two train ferries, and the new bridge has not only considerably reduced the travelling time between Copenhagen and the mainland, but has permitted the abolition of one of the ferries.

World Records in Electrical Plant

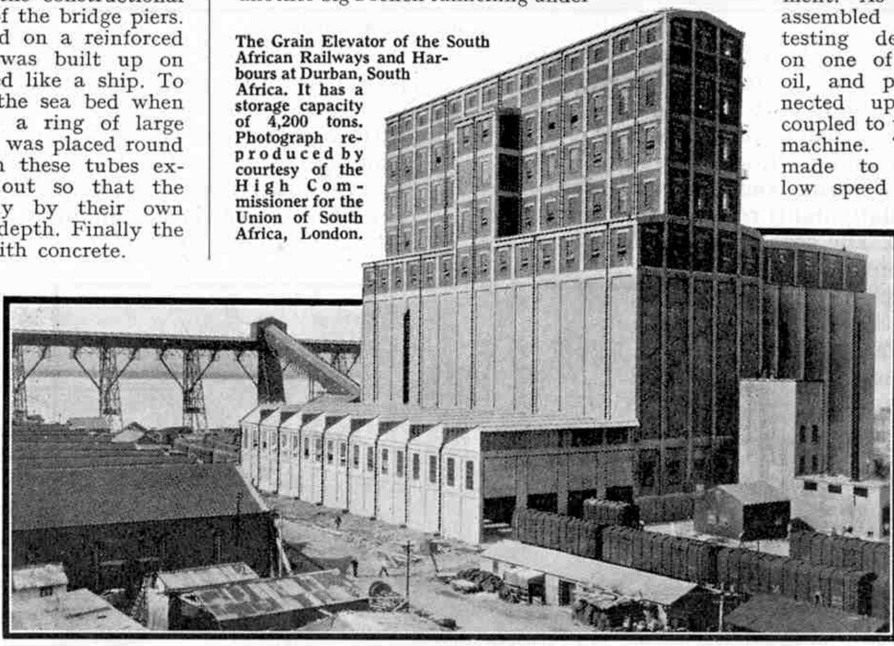
A generator now being built in America by the Westinghouse Electric and Manufacturing Co. is said to be one of the largest ever made. It is rated at 183,333 kVA, and is to be coupled to a steam turbine and run at 1,800 r.p.m. The stator of the machine alone will weigh 225 tons, and the rotor will weigh 125 tons.

The General Electric Company, of New York, claim to have made the world's longest oil-filled electric cable. This is 4,200 ft. long and weighs 22 tons. It will carry 132,000 volts, and for shipping is wound on a reel 11 ft. 2 in. in diameter.

Mountain Tunnelling Projects

One of the greatest projects in the history of modern railway construction is at present under consideration by the Austrian and Italian railway authorities. It is proposed to drive an enormous tunnel 12 miles in length through the Alps, so that a railway line could be built running almost in a straight line between Northern and Southern Europe. Such a tunnel would shorten the present route from Berlin to Milan by nearly 100 miles. If the work is carried out, the northern entrance of the tunnel will be situated near Mayrhofen in the Tyrol, 3,000 ft. above sea level. The tunnel would pass under the famous Drei Zinnen Massive and come out on the Italian side near Bruneck.

While experts are considering the Alps tunnel scheme, work is proceeding on another big French tunnelling undertaking. This comprises the construction of two tunnels through the Vosges in order to improve railway facilities between the two sides of this range. One of the tunnels is at Sainte-Marie-les-Mines and the other at Bussang. The Sainte-Marie-les-Mines tunnel, which forms the first part of the plan, was started two years ago and has just been completed. It is 4¼ miles in length, and is the longest tunnel in France. During its construction 600 men were employed. Work is now proceeding on the Bussang tunnel and it is expected that this will be completed by May, 1937.


The Grain Elevator of the South African Railways and Harbours at Durban, South Africa. It has a storage capacity of 4,200 tons. Photograph reproduced by courtesy of the High Commissioner for the Union of South Africa, London.

Canada's Longest Suspension Bridge

The longest suspension bridge in Canada is now practically completed. It crosses the north branch of the St. Lawrence at a point a few miles east of Quebec. It has a total length of 5,280 ft., with a suspended section 2,370 ft. long, and carries a 20-ft. roadway and two 5-ft. footpaths.

Testing Plant for Austin Motor Car Engines

A new electrical plant for testing the engines of motor cars has been installed in the Longbridge Works of the Austin Motor Car Company Ltd. It comprises 26 testing sets, each of which consists of a direct current electrical machine that can be used either as a generator or motor, a direct-coupled tachometer or revolution counter, and the control equipment. As soon as an engine is assembled it is brought to the testing department and placed on one of the test beds. Water, oil, and petrol supplies are connected up and the engine is coupled to the shaft of the testing machine. The machine is then made to drive the engine at low speed in order to run it in. After a suitable interval the ignition is switched on and the reverse then happens, the engine driving the machine, which acts as a generator and feeds current back into the supply mains. During the run the horse-power absorbed by the generator and the speed of the engine are indicated on special meters.

Suggested Canal from London to Newcastle

The suggestion has been made that a great canal should be built from end to end of England for the purpose of linking up the great industrial centres. Such a canal could be constructed at an elevation of about 310 ft. above sea level throughout its entire length, and would have no locks, thus eliminating a serious cause of delay in canal traffic as we know it to-day.

The proposed canal would start near Hertford, and would extend across country to Manchester, with side branches to Bristol, Birmingham and the River Dee. It would be continued from Manchester to Newcastle, the Pennines being negotiated by means of tunnels, and access to London would be obtained by linking it with the existing Lea Navigation. The total length of such a canal would be approximately 670 miles.

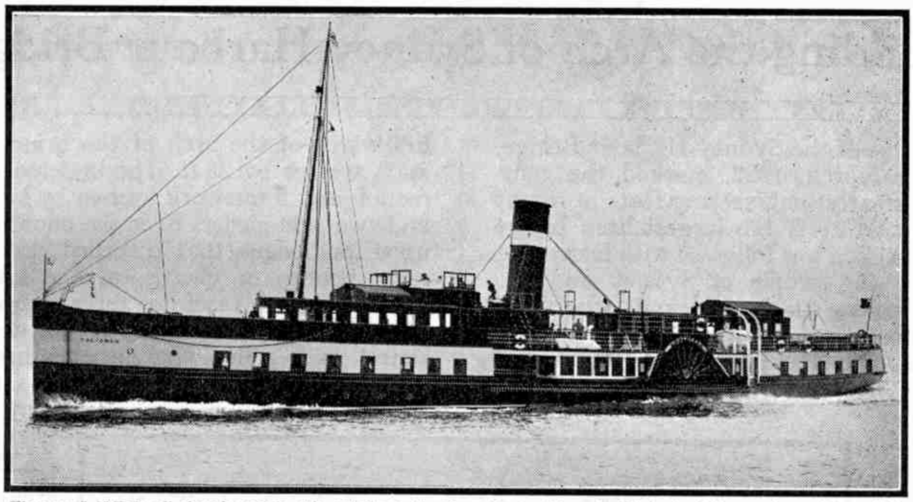
* * * *

A canal, incorporating a fall of about 365 ft., is being built to convey water from the Zambesi River, above the Victoria Falls, to a power house below the falls.

A Novel Paddle Ship

In the "*Engineering News*" pages of the January 1935 "*M.M.*" I referred to an oil-electric paddle vessel then under construction by A. and J. Inglis, of Pointhouse, Glasgow, for the L.N.E.R. This vessel, which is illustrated on this page, has now been completed and is in service between Craigendoran Pier and Clyde estuary ports. The old and the new in marine engineering are combined in this ship, for while she is equipped with the latest oil-electric machinery, the actual drive is derived from paddles, a form of propulsion that nowadays is generally regarded as obsolete. This method of propulsion was selected for the "*Talisman*" because in service she has to move in restricted places and also to negotiate shallow water, and in such cases paddles are more suitable than the orthodox screws.

The "*Talisman*" is fitted with four eight-cylinder oil engines, each with a rated output of 400 b.h.p. at 600 r.p.m., and the main propelling motor has a full load normal output of 1,300 s.h.p. at 50 r.p.m. The paddle wheels are 5 ft. 1 in. in width and 16 ft. 6 in. in external diameter and are fitted with eight steel floats of the usual feathering type.



The new L.N.E.R. oil-electric paddle ship "Talisman" referred to on this page. Photograph by courtesy of A. and J. Inglis Ltd., Glasgow.

Oil Versus Steam for Cargo Ships

There is at present a revival in the demand for cargo ships, and more vessels of this type are being built than for some time. Most of the new vessels are being fitted with oil engine drive, and among the motor freighters now under construction are two 9,000-ton ships for B. J. Sutherland and Co., who recently put into service two other new motor-ships, the "*Sutherland*" and "*Kinross.*"

Although the tendency is to install oil engines in new vessels there is still a good demand for steam-driven ships. The "*Dumfries,*" another vessel being built for B. J. Sutherland and Co., is to be propelled by a quadruple-expansion reciprocating engine, that will be supplied with super-heated steam from cylindrical boilers fired by coal. Another cargo ship that will be propelled by steam reciprocating machinery is the 9,000-ton vessel "*Auretta*" now being built for the Calpean Shipping Company. The engines if this vessel will work in combination with a steam turbo-compressor, the turbine of which will utilise the exhaust steam from the main engines to drive the compressor. The compressor will increase the pressure of the steam during its passage from the high-pressure cylinder to the intermediate cylinder.

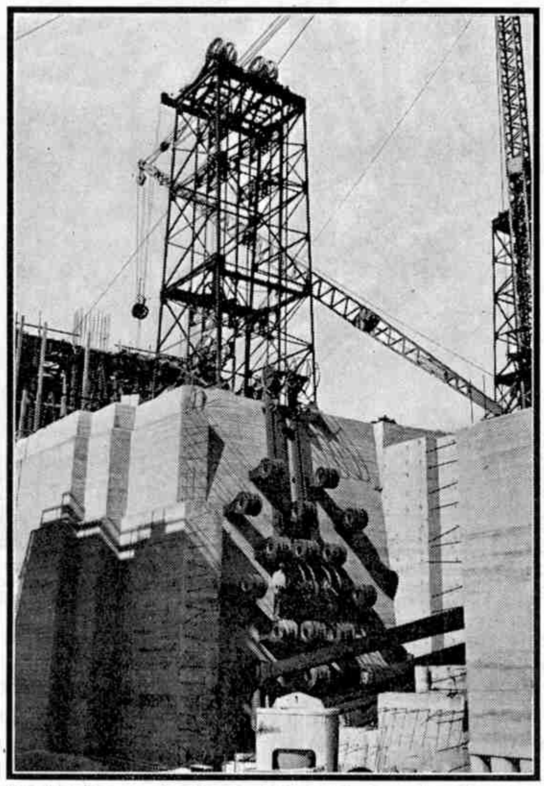
* * * *

A world record recently was made when the cutting shield boring the new tunnel under the Hudson River, New York, was moved forward 250 ft. in one week.

A Distinctive Fog Signal

An interesting fog signal, that can be heard three miles away in the most unfavourable weather, and at a distance of up to 10 miles when the air is calm, has recently been installed in the Tiri Tiri Island Lighthouse, which is the leading light into Auckland Harbour, New Zealand.

The apparatus is operated by means of compressed air supplied by a compressor driven by two 8 h.p. Diesel engines, and it is adjusted to give a blast three seconds in duration every minute. The signal has a distinctive note, differing considerably from that of a steam siren, and the apparatus is automatic in action.



The San Francisco anchorage of the bridge across San Francisco Bay, the construction of which was described on page 514 of last month's "M.M." On top of the tower is the machinery for spinning the main cables, which will be anchored to the eyebars seen below.

New British All-Welded Ships

Although nearly 16 years have passed since the first all-welded ship, the "*Fullagar,*" was launched at the Birkenhead yard of Cammell Laird and Co. Ltd., shipowners generally have shown little inclination to adopt this form of construction in place of riveting. Until a few years ago an all-welded ship was something of a curiosity, and the earliest examples were not entirely satisfactory. Recent improvements in welding apparatus and electrodes, together with the introduction of reliable tests for finished welds, have led to a revival in welded ship construction, and several vessels constructed entirely without rivets have been launched in British shipyards recently. Notable examples are the twin screw cargo motorship "*Joseph Medhill*" and an oil-tank steamer "*Moira,*" both built by Swan, Hunter and Wigham Richardson Ltd. at Wallsend.

The "*Joseph Medill*" is 259 ft. in length and when completed will be the largest all-welded vessel in existence. She will be employed in the carriage of pulp wood, newsprint, and grain on the Great Lakes of North America. Her main propelling machinery consists of two sets of five cylinder single-acting Diesel engines, which together develop 1,000 b.h.p. The deck winches, auxiliary pumps and steering gear, etc., are to be driven electrically.

Huge American Dams

A huge earth dam now being built in Montana, U.S.A., will be the largest ever constructed. The work involved is about five times as great as that of constructing the famous Gatun Dam of the Panama Canal, the largest earth filled dam so far made, and it is estimated that 100 million cu. yds. of earth, more than $1\frac{1}{2}$ million cu. yds. of rock, and 4 million cu. yds. of gravel will be required. The site of the dam is at Fort Peek, just above the junction of the Missouri and Yellowstone Rivers, and it will convert the Missouri valley behind it into a huge reservoir 175 miles in length and 16 miles wide. The dam itself will be $3\frac{3}{4}$ miles in length, of which 8,500 ft. will be the dam proper and the remainder a long curved dyke. The maximum height of the dam above the river bed will be 242 ft. and its greatest width at the base 3,000 ft.

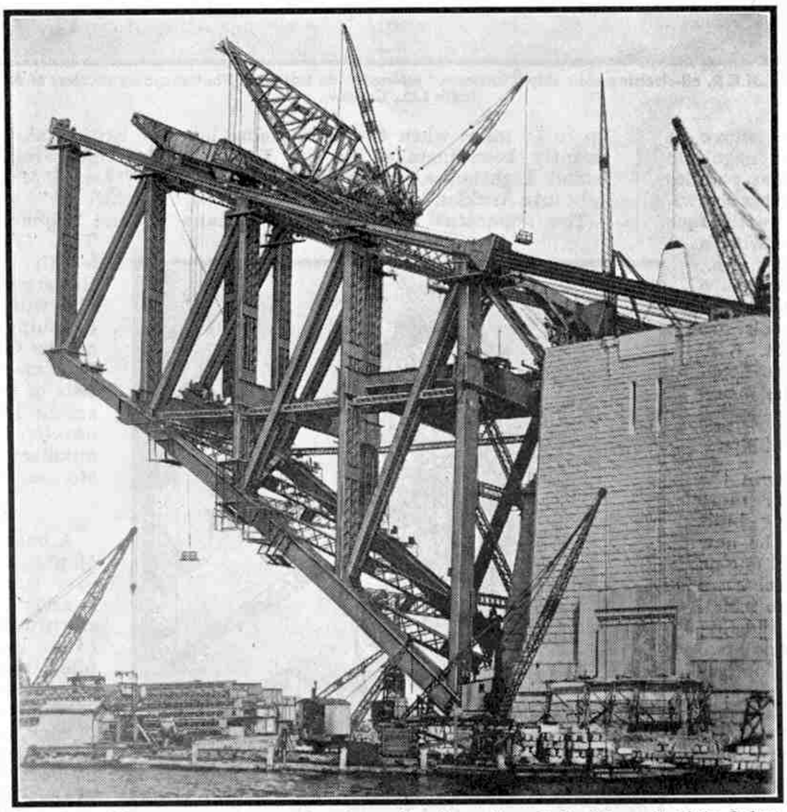
Another great dam now under construction in the United States will, when completed, create the largest artificial lake in the world, which will be 151 miles long and will extend into Canada. This dam is being erected in the Grand Coulee or Grand Valley, in the basin of the Columbia River, which in the United States ranks second to the Mississippi and its spillway will be 325 ft. high and 1,800 ft. in length. The water collected behind the great dam will be used for the production of hydro-electric power, and also for irrigation purposes.

Giant Creeper Cranes at Work

Building the Arch of Sydney Harbour Bridge

THE opening to traffic of the Sydney Harbour Bridge, Australia, on 19th March, 1932, marked the completion of one of the greatest engineering feats of recent years. The mighty structure is the largest arch bridge in the world, and its building was followed with increasing interest, not only by the people of Sydney and the surrounding district, among them thousands who daily crossed Sydney Harbour by ferry steamer to and from their business in the city, but also by engineers and others in all parts of the world.

The most spectacular part of the work undoubtedly was the erection of the great arch that springs from huge granite abutment towers on each side of the harbour and crosses the water in a single span 1,650 ft. long. At its crown this arch has a clear height of 170 ft. above high water. It had to be built without interference with the shipping passing into or out of the harbour, and the builders of the bridge, Dorman Long and Co. Ltd., of Middlesbrough, therefore adopted a method similar to that employed when they erected the arch bridge across the River Tyne, described in the "*M.M.*" of March 1931. The shore ends of the arch were begun simultaneously, and the two sections of the structure were built out from both sides of the harbour with the aid of two immense cranes designed to creep along the arch itself as it was completed and to hoist into position the steelwork for the next section to be erected. These cranes are of the type described as "creeper" cranes and they were specially built for the work by The Wellman Smith Owen Engineering Corporation Ltd., of London and Darlaston. They were first erected at the maker's works, and after being thoroughly tested were dismantled and shipped to Sydney, where they were re-assembled on the approach spans of the bridge.



One of the 120-ton creeper cranes at work, erecting the southern half of the arch of the Sydney Harbour Bridge. This illustration and the upper one on the opposite page are reproduced by courtesy of The Wellman Smith Owen Engineering Corporation Ltd., London and Darlaston.

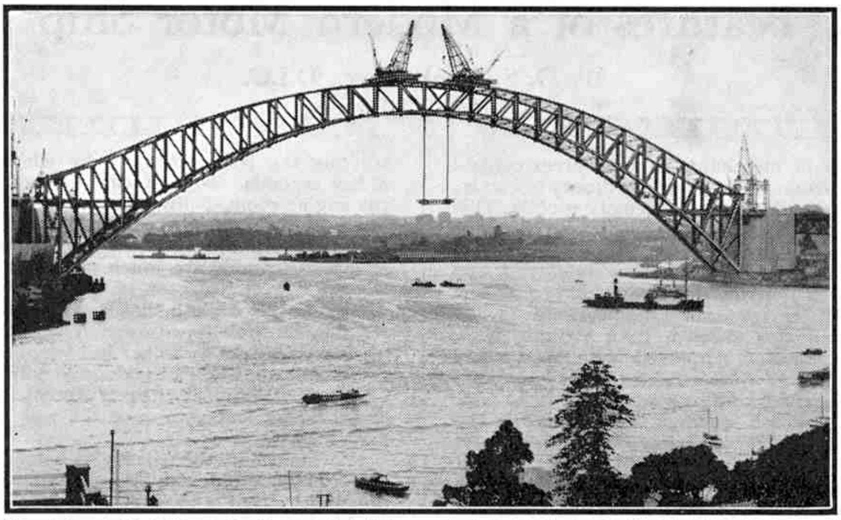
Each crane weighed 600 tons and was capable of lifting 120 tons at a radius of 54 ft., and the special safety gear with which it was provided increased the total weight to 633 tons. It was built up on a structural steel undercarriage 148 ft. wide that extended across the full width of the arch of the bridge and overhung the main trusses by 25 ft. The undercarriage consisted of a rectangular framework formed by two transverse girders and two side girders over the chords, and was mounted upon four bogies that travelled upon the two outer top main booms, or chords, of the arch. Each had four unflanged wheels running directly upon the flange plates of these chords. The front bogies were fitted with horizontal guide rollers that bore against the flange plates, and both front and rear bogies had safety clips to prevent any possibility of the structure tilting.

The gear for hauling the crane up the chords was mounted in the rear part of the undercarriage and consisted of a double drum winch driven by a 50 h.p. motor. The ropes from the drums passed through an 8 to 1 sheave gear to an anchor incorporated in plates attached to the chord in front of the crane, and the winch was provided with ratchet and clutch gear so that if required each drum could be operated independently while the other was kept stationary. The purpose of this was to enable the crane to be hauled centrally along the true line of the bridge.

The main hoist was operated by two 120 h.p. motors and could lift the maximum load of 120 tons at a speed of 12½ ft. per min., so that more than half-an-hour was required to raise a bridge member from the harbour to the upper parts of the arch. Derricking was effected by means of two 50 h.p. motors operating through spur and bevel reduction gearing, and the maximum load could be derricked throughout the full range in five minutes. Cross traverse gear was provided to enable the crane to be moved across the full width of the arch, and this was operated by a 50 h.p. motor geared to toothed wheels that engaged with a rack on the undercarriage. The speed of the traverse with a load of 120 tons was 30 ft. per min., and special switches automatically reduced this speed when the crane came within 10 ft. of either side of the undercarriage.

In addition to the main hoist each crane had a supplementary or "jigger" hoist that was operated from the main jib and could lift a load of 20 tons at a speed of 25 ft. per min. This could be used for light loads, but was chiefly employed in adjusting the angles of bridge members lifted by the main hoists, in order that they could be fitted exactly into their correct positions. Thus it worked in conjunction with the main hoist, and in spite of their great lifting capacity the two cranes were very delicate in action, and the positions of their loads could be controlled to a very small fraction of an inch.

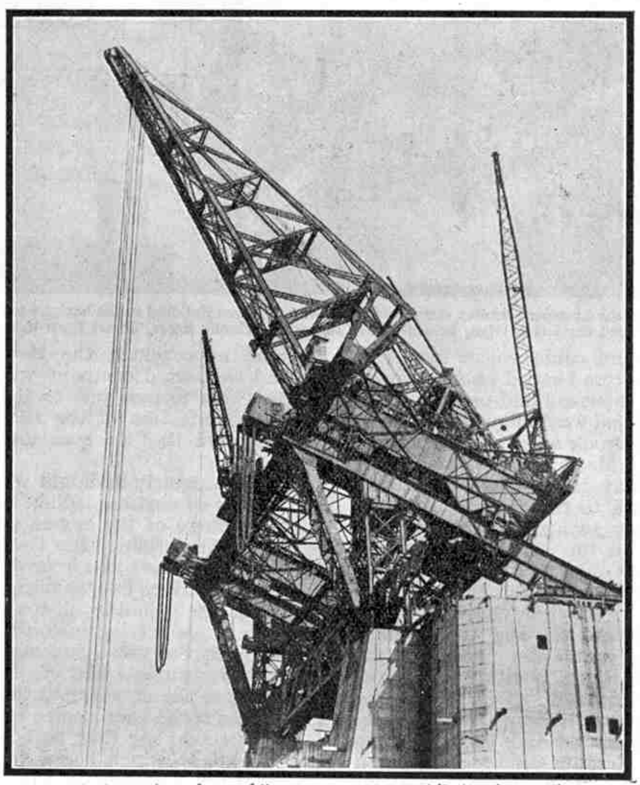
Other smaller cranes included in the equipment of the creeper were two $2\frac{1}{2}$-ton derrick cranes, each driven by a 10 h.p. motor, that were required for dealing with stores, riveting stages and other requirements. They were carried on a frame that was attached to the back of the traversing carriage and was adjustable, so that it could accommodate the two cranes to the varying slope of the upper chord of the arch. These two cranes could be swung completely round, and thus could be used to transfer material from the back of the creeper to the front. They also were used for placing workmen in position to bolt and rivet together the bridge members.



The arch completed. The cranes then worked their way back to the shores, erecting the deck hangers and deck as they went, and this photograph shows the first deck hanger in position.

The crane system was completed by a 5-ton crane that travelled on a track 50 ft. in length laid along the front girder of the undercarriage. It was equipped with slewing gear that enabled it to command the whole breadth of the steel structure as far as the arch trusses, and was of great service as the principal means of access to the working positions on the arch, especially during the later stages of erection.

The creeper cranes were capable of advance up a slope of 20 deg. at the rate of 1 ft. per min. As each weighed 600 tons, any failure of the haulage gear might have had very serious results, and on the steep slope of the chords on which they travelled a slip of even one inch might have given the immense masses sufficient momentum to overcome any practicable resistance. Safety gear therefore was designed to come into action instantly and automatically if any failure of the haulage gear should occur.



A closer view of one of the creeper cranes and its "assistants."

In building the bridge, the construction of the southern half of the great arch was begun first and considerable progress was made in building the first panel on that side before the second creeper crane came into action on the northern half of the arch. When the respective first panels were completed the cranes advanced slowly under their own power over a temporary ramp on to the panels, which at the bottom were bolted to the main bearings of the bridge and at the top were secured by heavy steel cables firmly anchored in concrete. From their new positions the cranes erected the second panel of each half of the span, and afterwards advanced along the top chords of the structure. In this way they travelled forward panel by panel, in each new position building one panel of the arch in advance of themselves.

From the time when each half of the arch began to project well over the water until its construction was completed the steel members required were placed on barges, floated into position beneath the projecting end of the arch and lifted up to the working level by the main hoist of the creeper cranes. All crane movements were controlled by telephonic communication between the cabs of the cranes and the barges hundreds of feet below. The greatest quantity of steelwork lifted from the barges in one day was 598 tons.

Each half of the arch comprised 14 panels, and when these were completed, and the two sections were joined together, the cranes began to work their way back to their starting points, on the way erecting the hangers and other portions of the deck of the bridge and its supporting structure. The largest of the hangers is 193 ft. in length and weighs 38 tons. The railway and roadway stringers for the deck, which are connected to the hangers by pins 14 in. in diameter, were erected in one piece. The scheme of hanger erection adopted enabled rapid progress to be made, and within nine months of the closing of the arch the steelwork erection of the big main span was completed.

Throughout the arduous and exacting task of erecting the two halves of the arch, the deck hangers and deck itself, the cranes operated with the utmost precision.

We are indebted to the Wellman Smith Owen Engineering Co. Ltd. for the information contained in this article.

Liverpool to Belfast by "Ulster Queen"

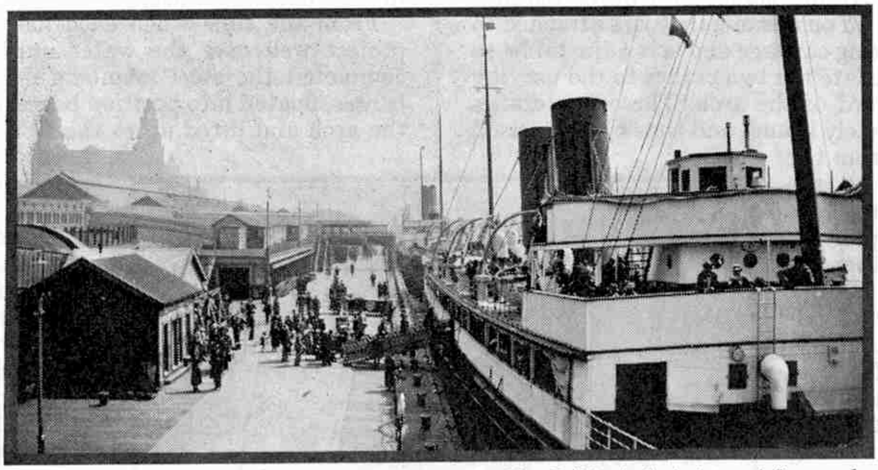
Features of a Modern Motor Ship

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

THE use of Diesel engines in merchant ships involves control methods quite different from those of an ordinary steamer, but at the same time renders such vessels extremely mobile. This is of great value in a cross-channel service, as it enables ships to be readily manœuvred in confined spaces without the assistance of tugs, and at the same time to berth very quickly. I was recently privileged to make a trip on the bridge of one of the fine motor vessels of the Ulster Imperial Line working on the Liverpool-Belfast service, and this showed, in a striking way, the different methods of navigation employed with steam and motor ships.

Two Irish services leave Liverpool landing stage about 10.15 p.m. In addition to the Belfast boat, on which I sailed, there is the Dublin service of the British and Irish Steam Packet Company, on this occasion operated by the "*Lady Leinster*," which is driven by reciprocating steam engines, coal fired. Our ship was the "*Ulster Queen*." This stately vessel, which looks more like an ocean liner than a cross-channel boat, has a displacement of 3,800 tons. Her total length is 345 ft. and her draught 19 ft. She and her two sister ships, the "*Ulster Monarch*" and the "*Ulster Prince*," are the largest cross-channel vessels in the world. The "*Ulster Prince*" was present at the Jubilee Naval Review at Spithead on 16th July last.

For half an hour or so before sailing time the quayside was a scene of tremendous bustle. Van after van of luggage arrived from every railway station in Liverpool. In the entrance hall of the ship, a delightful place panelled in oak, with an Old English-style beamed ceiling, passengers chatted with friends seeing them off; here and there came voices in a rich Irish brogue, while the be-ribboned officers bustled about answering with unfailing good-humour the thousand-and-one questions addressed to them. I left this gay scene and went up to the darkness of the bridge and joined Captain Colebrook and the Pilot. From here the river was an amazing sight. Mersey ferries, brilliantly lighted, manœuvred about like so many taxis. Often three rush towards the landing stage at top speed; to the uninitiated a collision seems inevitable, yet round they swing, and are berthed in a trice. The gigantic Liver birds on top of the Royal Liver Friendly Society building, the stately pile that dominates the Liverpool waterfront, were floodlighted, and added a touch of rare elegance to the scene.



A busy scene on the Liverpool landing stage, with the towering Liver Building in the background. Steamers for Belfast, Dublin and the Isle of Man, in addition to the great Atlantic liners, depart from this floating stage.

The "*Lady Leinster*" sailed just before us, and there was a strong contrast between the way in which the two ships got away. Both were berthed with their bows pointing upstream. The "*Lady Leinster*," dragging her anchors, gradually swung her bow away from the quay, and then steamed very slowly round in a wide half-circle until she was heading straight down the river. As soon as we were all clear, Captain Colebrook executed a very different manœuvre with the "*Ulster Queen*." Without the use of the anchors at all, he kept the bow against the quay and gradually swung the stern out. Then, backing out into mid-stream, the ship was neatly pivoted round until facing nearly downstream, when we went full speed ahead. The accompanying diagram shows the path followed by each ship during this starting operation, which we made in considerably less time than the Dublin boat.

The secret behind this mobility is an ingenious method of starting the Diesel engines, by which full power is obtained in a few seconds. More of this, however, when we come down to the engine room. During the start, Captain Colebrook was making constant changes in the speed and direction of the two engines, with immediate response in the power output. In a steamer, changes in power are much slower in taking full effect after the captain's lever has been moved.

In almost complete silence, and without a trace of smoke from the funnels, we slipped away from Liverpool. The "*Ulster Queen*" was very quickly up to her full speed of 17 knots. In Diesel-driven ships there is often considerable vibration at speed, but in this vessel it was almost entirely absent. The "*Lady Leinster*" ahead of us, was a fast ship once she was under way, and fully maintained her lead.

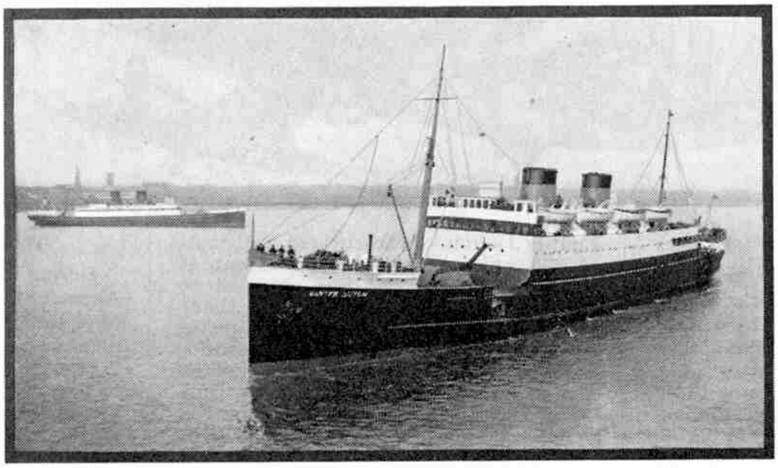
The mouth of the Mersey is a fascinating place at night. For some distance out, shipping is confined to a narrow channel, and the flashing red and white lights of the buoys that mark the course, the lights of incoming ships, and the glimmer of seaboard towns as far away as Rhyl and Southport, made up a very beautiful scene.

Strangely enough, the channel gets narrower as we get further out, and at Crosby Lightship is quite a bottle neck. On both sides are dangerous shallows, and in fog the place is a perfect terror. Beyond Crosby the channel takes an S-curve. The "*Lady Leinster*," black smoke pouring ceaselessly from her funnels, was now silhouetted against the moonlit sky. As she turned, with the moonbeams glinting on her side, she looked for a moment like a phantom ship.

Now, an hour after leaving Liverpool, we were approaching the Bar Lightship. Here the channel ends, and we parted company with the Dublin boat. She veered round due west to pass just to the north of Anglesey, while we headed in the direction of the Isle of Man, or as our Captain quaintly expressed it: "He goes under the Moon, us under that Venus chap."

It was nearly midnight when I left the bridge and descended by a series of vertical ladders into the very depths of the ship. The atmosphere of the engine room, with its thick aroma of hot oil, was at first stifling after the keen exhilarating air up on the bridge. Down here one's first impression is that of a big surprise; in contrast to a ship driven by steam engines, there is nothing visible happening at all. The cylinders, piston rods, and crankshafts of the two main engines are totally enclosed, while it is only right overhead that one sees the valve rocking levers moving up and down with a brisk rhythmical clatter. Each engine is a 10 cylinder airless-injection Diesel, which at the speed of 17 knots develops 3,250 h.p. At this speed each engine is running at 150 r.p.m. Chief Engineer Winter told me that he could get 19½ knots out of the "*Ulster Queen*," at which speed the engines would each be developing 3,600 h.p. Considering that each of these engines develops more power than the largest British express locomotives, such as "*Cock o' the North*" or "*Princess Royal*," they are amazingly compact. Their oil consumption is only 15 tons in sailing from Liverpool to Belfast and back.

Starting up is extremely interesting. It is not possible to start a Diesel engine under load, and in this ship the engines are started by admitting compressed air direct to the cylinders. As soon as the "stand by" signal is received from the bridge, a valve is opened that admits air at high pressure into the starting system, but by the operation of an automatic stop valve, air is not yet admitted to the cylinders. When the "right away" is received, the starting hand lever is moved over to the "start" position on a quadrant rather like a small locomotive regulator. This releases the stop valve, compressed air is admitted to the cylinders, and the engines start. When sufficient speed has been attained, the starting lever is pushed still farther over on the quadrant, the direct air supply is cut off, and the oil pumps are brought into operation and Diesel working begins.



The "Ulster Queen" in the Mersey, with the British and Irish Steam Packet Co.'s Dublin steamer "Lady Leinster" in the distance.

These particular engines, which were built by Harland and Wolff Ltd., of Belfast, work on the 4-stroke cycle. This means that it takes two complete revolutions of the crankshaft, or four strokes of the piston, for the cycle of events to take place in the cylinder. During the first stroke air is sucked into the cylinder; then the inlet valve closes, and on the return stroke the imprisoned air is compressed to about 500 lb. per sq. in. and its temperature rises to about 1,000 degrees Fahrenheit. At the beginning of the third stroke a small quantity of oil is sprayed into the cylinder. At the tremendous temperature of the imprisoned air the oil takes fire at once, and the expanding gases push the piston on the third or working stroke, and provide the motive power. On the fourth stroke, the contents of the cylinder are exhausted ready for the next cycle. Thus there is only one working stroke in four, though of course with a 10-cylinder engine the timing of the various cycles in each cylinder is so arranged that there is a steady output of power. The Diesel is the most efficient of all types of internal combustion engine, having an overall efficiency of about 30 per cent.

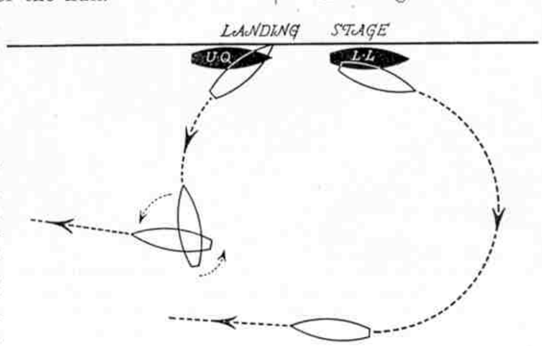
In addition to the main engines, there are three small Diesels, each of which drives a dynamo for supplying electricity for use throughout the ship. All the navigation controls are electrically operated, and of course there is cooking and lighting to be provided for.

The "Chief" then took me throughout a series of watertight bulkhead doors into the very stern of the ship. We were standing right on the keel; on each side were the propeller shafts, two huge rods of gleaming steel, revolving steadily in absolute silence. In these depths the motion of the ship was very marked; you could feel the waves just as if in a rowing boat. It was eerie in the extreme. Our footsteps echoed round among the great naked girders that form the framework of the hull.

It was nearly 1 a.m. when I took leave of the "Chief" and left these vivid, fascinating regions for the luxury of the passenger quarters. I went down to a cosy berth and was soon fast asleep.

* * * *

When I awoke we were just rounding Donaghadee Point and entering Belfast Lough. I dressed hurriedly and went up to the bridge. It was a rough exhilarating morning; the whole lough was covered with white crests. On the eastern shore was the town of Bangor, set amid the rolling green hills of County Down. Westward were the Antrim mountains, dim, grey-green shapes half hidden in mist, yet irresistibly fascinating by their very vagueness.



How the "Ulster Queen" and the "Lady Leinster" start from the landing stage at Liverpool on an ebb tide. The former backs out and turns downstream; the latter makes a wide circling movement.

Far ahead of us was the Heysham steamer that runs in connection with the 6.10 p.m. "*Ulster Express*" from Euston. The First Officer lent me his glasses, and I then saw to my surprise that she was broadside on to us. The waterway abreast of Donegall Quay, Belfast, is so narrow that steamships cannot turn, so they reverse at the entrance to the Belfast channel and make the last part of their journey going astern. For this purpose they are fitted with bow rudders.

Now the City of Belfast began to loom up ahead, its skyline a varied array of factory chimneys, stately buildings and electric shipyard cranes. Unlike that of Liverpool, the channel leading through the upper reaches of Belfast Lough is dead straight. By this time we had gained considerably on the Heysham boat, which was now steaming slowly past the shipyards.

Our speed was reduced to half, and passing between the two small islands known as the Twins, we entered the River Lagan. By putting the engines alternately at "Half-speed" and "Stop," the Captain maintained a dead slow pace up the narrow waterway. We passed the slipway at Harland and Wolff's yard, from which the "*Ulster Queen*" was launched, and so crept up abreast of Donegall Quay. The Heysham boat we had followed was the "*Duke of York*," a fine turbine steamer; she had just berthed as we approached.

Now Captain Colebrook executed a wonderful manœuvre—he turned the "*Ulster Queen*" completely round in her own length, without any assistance from tugs. Opposite Donegall Quay the river is not much wider than the ship is long; slowly we gyrated until broadside on to the stream. At that moment the bow was barely six feet from the landing stage, while the stern was not much farther from the opposite bank! It was a masterpiece of navigation in such a confined space, and was done by having one engine going ahead and the other astern. It is possible only through the characteristic feature of these ships, whereby full power is developed by the engines within a few seconds of the control signal from the bridge being given. I need hardly add that it also needs the utmost skill and judgment on the part of the Captain. Slowly we pivoted round until the ship was facing downstream, and then we gradually edged in alongside the quay.

On this trip, our course had lain to the west of the Isle of Man. Captain Colebrook told me, however, that in certain cases of rough weather the ships of the Ulster Imperial Line keep to the east of the island to gain a more sheltered passage, and then steer between its northernmost point and the Mull of Galloway. This latter course is always followed by the L.M.S. steamers from Heysham.

Out in the Irish Sea at about 2.30 a.m. we had passed the "*Ulster Monarch*," bound for Liverpool. The eastbound ship leaves Belfast at 9 p.m. and reaches Liverpool at about 6.30 a.m. If the arrival in the Mersey is approximately at high tide, the vessel is berthed in Princes Dock instead of at the landing stage. In addition to passengers, quite a lot of cargo is carried, and there are no facilities for unloading this at the landing stage. If the ship can get straight into dock, the goods can be unloaded very much sooner, and thereby catch an earlier market than if she had to lie out in the river and wait for high tide to get into dock.

At normal times, only two ships are needed for the Liverpool-Belfast service, the working being so arranged that all three vessels make an equal number of trips. But at busy periods, just as it is necessary to run famous express trains in duplicate, so two ships are sometimes needed for one service. The third member of the fleet is also used on occasions for cruises and other special trips.

I did not immediately leave the "*Ulster Queen*" when she had berthed at Donegall Quay, Belfast. After breakfast in the saloon, there was time for a leisurely walk around the passenger quarters, the spacious and comfortable lounge, a delightful smoking room in the Tudor style of a country inn, and, perhaps most attractive of all, a verandah cafe with sliding doors opening on to the Boat Deck, also furnished in Tudor style.

The engineering skill that has produced such a beautiful ship, the vivid evening on the bridge, the highly concentrated power plant below and above, and the delightful hospitality shown to me by the Captain and his officers, left me with some very pleasant recollections of my brief voyage in the "*Ulster Queen*."

Tilting Test Stand for "Bristol" Engines

An interesting addition to the extensive engine testing plant at the works of the Bristol Aeroplane Company Ltd., is illustrated on this page. It is a stand of special design incorporating a mounting that allows the engine under test to be tilted either up or down, to reproduce climbing or diving conditions. The mounting is operated from a test cabin and can be revolved through 180 deg., so that the engine can be tilted to the extent of pointing directly up or down.

This new testing device enables the engineers to observe closely the functioning of the engine for all conditions of climbing and diving. Any discrepancies which might materialise owing to these circumstances can therefore be eliminated at the outset and not left until the engine is installed in the aircraft.

New Air Records

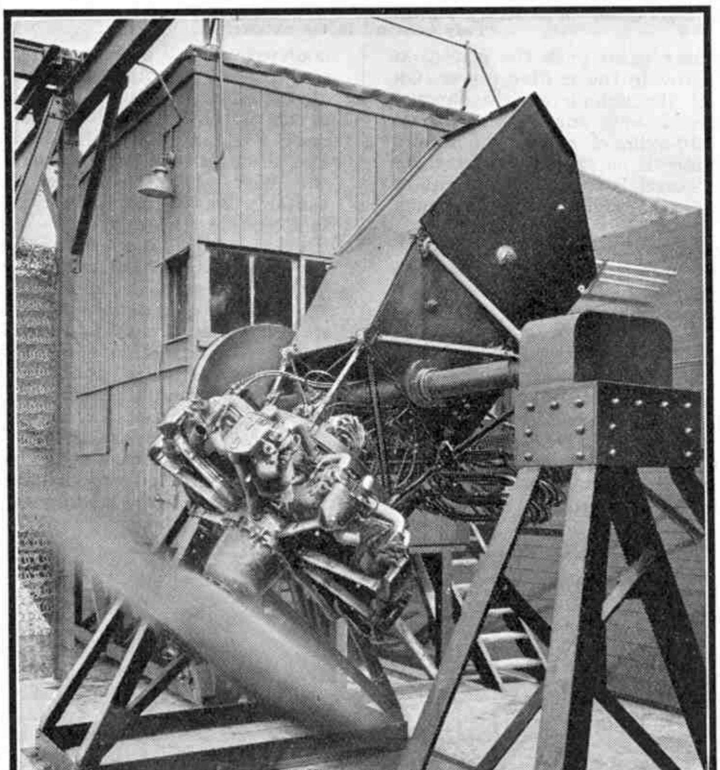
The record non-stop flight achieved by the "Latecoere 300" flying boat "*Croix-du-Sud*," mentioned in these pages last month, has been surpassed by a Cant. 501 monoplane. This machine was piloted by Mario Stoppani, a well-known Italian airman, and flew from Monfalcone, near Trieste, to Berbera in British Somaliland, a distance of 3,104 miles, in 24 hr. 55 min. This is 446 miles farther than the flight of the "*Croix-du-Sud*."

A new height record of 39,500 ft., nearly eight miles, has been established by the Marquesa Carina Negroni, an Italian airwoman; and in America a new endurance record has been created by two brother pilots named Key who ascended at Meridian, Mississippi, and remained in the air for 27 days 5 hr. 33 min.

The record time of 56 min. for the flight from London to Paris, set up when the first of the two D.H. "Comets" purchased by the French Government was delivered, has been improved upon by the second of the machines, which covered the distance of 206 miles in 52 min. This machine is being used by Air France for experiments in connection with high speed air mail flights.

A new world's gliding record was recently set up by a German airman, Ludwig Hoffman, who covered a distance of 305 miles before landing. About 10 days later this record was exceeded by four German pilots who set off simultaneously and flew 310 miles. British gliding records lag far behind. The record soaring flight was made by the late G. E. Collins, who in August last year flew from Dunstable Down to Holkham, a distance of 95 miles. He was in the air for 4 hr. 25 min., and several times he had to dive at 70 m.p.h. to get away from clouds that were drawing him upward. Mr. Collins was killed near Ramsey, Huntingdonshire, on 30th July last, when the left wing of his glider broke away during an exhibition flight. The British gliding duration record is claimed by J. C. Neilan, who has succeeded in remaining in the air for 13 hr. 7 min.

The recent attempt by Mr. T. Campbell Black and Mr. McArthur to accomplish a record London-Capetown-London flight ended in failure, but they are confident of succeeding at their next attempt.



A "Pegasus" aero engine being tested on the new tilting test stand at the works of the Bristol Aeroplane Co. Ltd., to whom we are indebted for our illustration.

The Pilotless "*Queen Bee*"

During the last few years the Royal Aircraft Establishment at Farnborough have been experimenting in the control of pilotless military aircraft by wireless. A D.H. "Tiger Moth" with a wooden fuselage instead of the standard tubular steel structure, and with a "Gipsy Major" engine, has been used for these experiments. They have been increasingly successful, and the "*Queen Bee*," as the machine is called, can now be controlled for a distance of 10 miles from the starting point.

The "*Queen Bee*" takes off in the ordinary way and can climb up to at least 10,000 ft., and while flying at a speed of about 100 m.p.h. it can be made to turn, glide, dive, loop the loop, and perform other manœuvres as desired. The machine can be fitted with either a wheel or a float undercarriage, and it is equipped with the necessary fittings to enable it to be catapulted into the air, and with slinging gear so that it can be lifted out of the water.

It is controlled from a small upright box on the ground or ship's deck. On the top of the box are buttons marked with directions such as "turn right," "turn left," "dive," and immediately any of these buttons is pressed the machine responds immediately in the required manner.

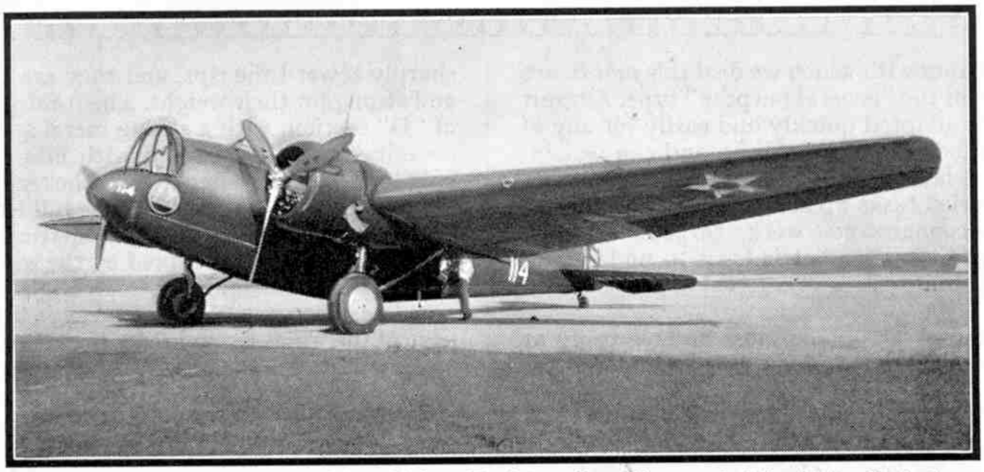
More Letters Sent By Air

A great deal of time is saved by sending letters abroad by air mail, and the latest G.P.O. returns show that this fact is being more generally realised. During the three months March-June last 16.3 tons of mail were despatched by air to European destinations. This is almost six tons more than in the same quarter last year, and as there has been no reduction in the postage rate the increase is obviously due to growing appreciation of the service. The quantity of air mail despatched to Imperial destinations has almost doubled, being 24.87 tons during the March-June quarter this year as compared with 13.65 tons in the same period last year. In this case a reduction of the postage rate in November last has no doubt played a part, and the increase is also partly due to the extension last year of the Imperial air route.

Preventing Ice Formation on Aircraft

Each year an increasing number of important air services continue to operate throughout the winter. The maintenance of many of these services involves long flights at high altitudes and often in bad weather, and among the serious problems associated with such flights is that of ice formation on the wings and tail units of the aircraft. The accumulated ice increases the weight and drag of the machine, and may eventually force it down, perhaps on a mountainside or in some other remote place.

During the past year or so much attention has been given to this problem. The latest device designed to prevent the formation of ice is the "Anticer," in which use is made of a liquid that lowers the freezing point of water. It is the invention of Mr. B. Lockspeiser, M.A., who, with a colleague named Ramsbottom, carried out extensive research into the problem at Farnborough, and it is produced by the Dunlop Rubber Co. Ltd.



A Martin 7B Bomber Monoplane of the U.S. Army Air Corps. The photographs on this page are by J. Cunningham, Londonderry.

The liquid is a mixture of ethylene glycol and ethyl alcohol, and is pumped from a small tank by compressed air from the brake-operating system, or by the pressure supply of the oxygen container, to a perforated rubber tube fixed to the leading edge of the wings and tail-plane, where it wets evenly a leather flap stretched along those edges. If there is only a very thin layer of ice on the leading edges, it quickly melts away when the liquid is applied; while if the ice is fairly thick it is effectively loosened and is then soon blown away as the machine speeds through the air. Tests carried out on a Hawker "Hart" which had some 70 ft. of leading edge protected with "Anticer" proved that only about two pints of liquid per hr. is required to keep that length of edge free from ice.

The massive rudder of the Boeing 247-D, an American 10-seater twin-engined monoplane.

R.A.A.F. Expansion

The Royal Australian Air Force is to be increased by the formation of a "General Purpose" squadron that will be stationed at Laverton, Victoria, a coastal reconnaissance flight that will be established at Point Cook, Victoria, and a squadron of the Citizen Air Force at Perth.

Douglas D.C.2s for Poland

L.O.T., the chief air transport company in Poland, have ordered two Douglas D.C.2 machines. They will be fitted with 690 h.p. Bristol "Pegasus III" engines instead of the Wright "Cyclone" engines that are usually installed in this type of machine.

American Air Lines Buy Lockheed "Electras"

A feature of recent additions to the fleets of American air lines is the large number of Lockheed "Electra" machines acquired or ordered. Pan-American Airways already possess several aircraft of this type, and have ordered three more, which will be equipped with Pratt and Whitney "Wasp" engines. North American Aviation, Inc., have ordered five "Electras" for use on the Eastern Air Lines route, and these will be fitted with Wright "Whirlwind" engines.

New Zealand Air Services

During the coming summer in New Zealand good progress will be made in developing internal air services. New Zealand Airways Ltd., of Timaru, have purchased five Boeing H.4 machines and they will be used on a proposed Auckland-Gisborne service when this has been officially sanctioned.

Union Airways, a new air transport firm and controlled by the Union Steamship Company of New Zealand Ltd., is planning to run a daily service between Wellington, Blenheim and Nelson, and they have ordered three D.H.86 for this purpose. Another new air company, Cook Strait Airways, intend to operate a service between Palmerston North and Dunedin, and they will use two D.H. "Dragon Rapides."

New British Flying Boat

Details have now been published of the Supermarine "Stranraer," the successor to the well-known "Southampton" and "Scapa" flying boats. The "Stranraer" is a twin-engined flying boat of the biplane type, with hull and wings of Alclad. The wings are covered with doped fabric. Bristol "Pegasus" engines are installed in nacelles under the top wing and the two petrol tanks are placed in the centre section of the wing.

A cockpit in the bow of the hull is equipped as a gunner's station, and behind it is the pilot's cabin with a sliding roof and with hinged windscreens to protect the crew in bad weather. The compartment for the navigator and the engineer is aft of the pilot's cabin, and farther back is the wireless operator's station. A second gun station is provided immediately behind it and there is a third one in the extreme stern of the hull.

An illustrated description of this interesting flying boat will be given in a forthcoming issue.

Master Pilots of Imperial Airways

In 1929 the Air Ministry introduced the Master Pilot's Certificate, an award to airmen who have flown for at least 1,000 hrs. as pilots of commercial aircraft during the five years preceding their application for the Certificate. This rule meant that no pilot could become eligible for this official recognition of his services until 1934, and as a result the first awards were not made until last year. Up to the present 12 Master Pilot's Certificates have been awarded, and all the recipients are pilots of Imperial Airways. One of them, Capt. Armstrong, has flown more than 1,000,000 miles. On several occasions he has piloted aircraft in which the Prince of Wales has been a passenger. Capt. Youell, another of the recipients, has flown nearly 1,000,000 miles.

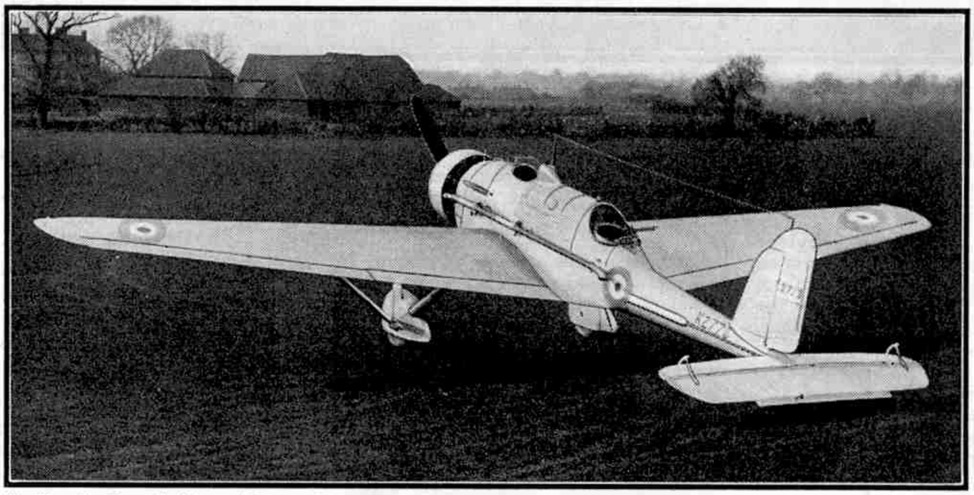
In addition to having flown at least 1,000 hrs. during five years the airman aspiring to possess the Master Pilot's Certificate must have had experience of night flying, including at least 20 night flights over land and sea, and all take-offs and the landings must have been accomplished during darkness. He must possess a current licence as issued to pilots flying for hire or reward, and a licence as an aircraft navigator, and both these must have been in force for at least five years. The Master Pilot's Certificate is one of the most eagerly-sought distinctions in British air transport.

"General Purpose" Aeroplanes

The Handley Page 47 and the Fairey "Swordfish"

THE two aeroplanes with which we deal this month are good examples of the "general purpose" type. Aircraft of this type can be adapted quickly and easily for any of several different kinds of military duty, and can be converted with little delay from a landplane to a seaplane, or vice versa. The varied tasks upon which they can be employed include reconnaissance work, torpedo carrying and bombing expeditions, and it is easy to understand that such adaptability is a very valuable asset in military aircraft.

A "general purpose" aeroplane must be able to fly at high speed for considerable periods and cover long distances without landing to re-fuel, and must provide its crew with a wide and clear view in all directions. Among its chief qualifications must be that of being able to "go anywhere," and it must operate with equal efficiency in different climates and temperatures. It must be capable of using all kinds of aerodromes, for a "general purpose" aeroplane that requires aerodromes with carefully prepared surfaces would be impracticable. It must be capable of taking-off quickly in low or high altitudes, and must possess stability and ease of control to an extent that will enable the pilot to bring it down safely on aerodromes of limited extent, and therefore control at and beyond the stalling point, ample variation in the available angle of glide, and a short landing run are of great importance.



The Handley Page 47 "General Purpose" Monoplane. This three-quarter rear view gives a good idea of the general proportions of the machine. Photograph by courtesy of "The Aeroplane."

The introduction of wing slots and flaps was a big step forward in the development of aircraft to meet these requirements. An aeroplane fully equipped with these devices has a very wide speed range and easy flying qualities, and it can be operated from small aerodromes and those situated in rarified air at a great height. The Handley Page 47 is an instance of this. In it slotted wing devices have been utilised to the fullest extent. It was designed and produced to a British Air Ministry specification and is a low wing single-engined monoplane of all-metal construction. The three-quarter rear view of the machine on this page gives a good idea of its general proportions. It will be realised that it is unusually small for a military aeroplane designed to carry the heavy loads and considerable equipment of a "general purpose" machine. The wings are of single spar construction, and taper sharply toward the tips, and they are exceptionally light and strong for their weight. The front part of each wing is of "D" section, with a strong metal spar and metal wing covering, and ribs covered with fabric extend from the spar to the trailing edge to form the remainder of the wing.

The wings have slots along the full length of their leading edges. These slots open automatically when a certain angle of incidence is attained by the wings as the machine climbs, and close again when an angle equivalent to high speed has been reached. Slotted flaps fitted to the trailing edge of the wings extend from the ailerons to the junction of the wings with the fuselage, and are operated hydraulically by the pilot. The angle at which the flaps are inclined is indicated by a scale and red knob indicator on the upper surface of the port wing, in a position where it can easily be seen by the pilot. The best results for short-run landings are obtained with the flaps set at an angle of 48 deg., and for short-run take-offs with a flap angle of 20 deg.

The wings also are fitted with Handley Page interceptors. These are small narrow slats between the automatic slots at the wing tips and the wing themselves. They come into operation when there is considerable movement of the aileron control, and by assuming an upright position they intercept the airflow over the tip of the wing. This reduces lift and causes the wing to descend again, enabling the pilot to maintain lateral control of the machine.

The fin and rudder are situated slightly forward of the tailplane, which is rigidly secured to the end of the fuselage. The undercarriage wheels, complete with brakes, are almost entirely enclosed in streamlined "spats," and when the machine is required for use as a seaplane they can easily be replaced by floats.

The power unit is a Bristol "Pegasus" engine of 665/680 h.p., fitted with a ring cowling. The petrol tanks are situated in the forward part of the wings, and additional tanks can be slung in the rear parts when it is necessary to increase the range of the machine for exceptionally long flights.

The duties for which the Handley Page 47 is designed include reconnaissance work, aerial photography, torpedo carrying, bombing, and Army co-operation duties. It can be used as an ambulance by hinging back the top of the rear gunner's compartment so that a stretcher can be accommodated. Desert equipment is carried, and there is on board a complete wireless station in miniature, so that a mast can be erected and messages sent after the machine has landed. A collapsible dinghy is stowed in the wing for use if a forced landing has to be made in the sea.

The other aeroplane illustrated here is the "Swordfish," of the Fairey Aviation Company Ltd. It is designed to carry out the varied tasks, including torpedo carrying, of a general purpose aircraft, and is now in production for the Air Ministry.

The Fairey "Swordfish." This Torpedo-Spotter-Reconnaissance machine is now in production for the Air Ministry. The illustrations on this page are reproduced by courtesy of the Fairey Aviation Company Ltd., Hayes.

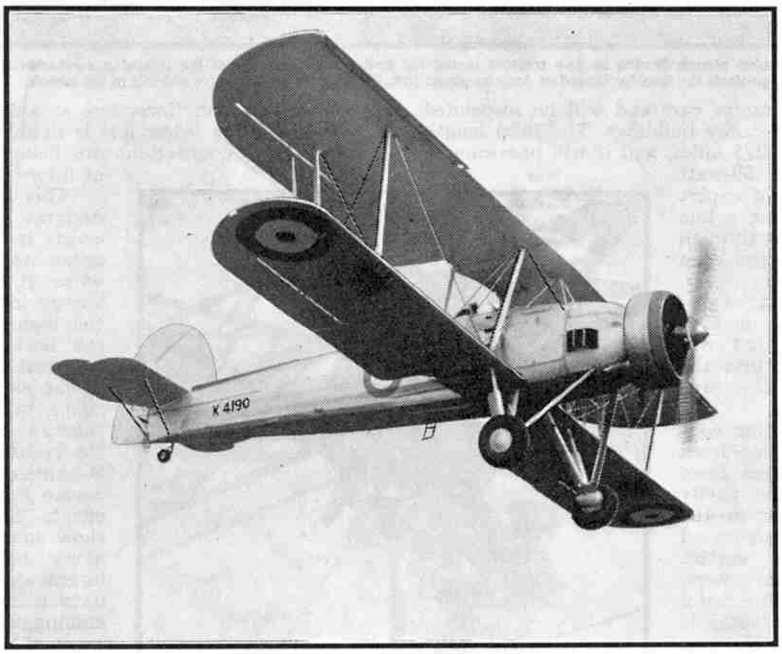
The "Swordfish" is a single-engined biplane of extremely robust construction. All controls have been carefully co-ordinated, and this has resulted in increased stability and in making the machine much more easy to manœuvre than previous types of equivalent weight and size. This ease of handling is maintained whether the machine is flying light or carrying a full load. The structure of the main planes is of conventional design and consists of two spars built up of steel strips, with ribs of steel and duralumin. Ailerons are fitted to all four wings, and the bottom two are operated from the top by means of struts. They are of the balanced type and are of duralumin, with spars of tubular steel. The aileron controls consist chiefly of direct push-pull tubes that work inside the top wings.

The pilot's view has been very carefully studied, and the centre section struts have been brought to an inverted "V" in front of the windscreen, so that the normal line of sight lies between these struts. There are no struts or other obstructions to interfere with the view when the pilot looks over the side during the later stages of landing. The general arrangement is particularly effective when the machine is engaged in torpedo operations, as the centre section has been designed and placed to give the minimum interference during the dive down to the dropping height, when the strut arrangement gives an uninterrupted sighting view of the target.

The fuselage is a rectangular framework of steel tubes, and is built in five sections joined together by bolts. The sections are the engine mounting, front fuselage, cockpits, rear fuselage and tail portion. The rear cockpit has accommodation for two men and is equipped to serve the needs of observer, navigator, wireless telegraph operator, bomb aimer, photographer and Lewis gunner.

The ability to operate easily such navigational instruments as chart boards and bearing compasses is of great importance when the machine is flying over long distances, and comfort for the observer in carrying out those duties is essential. For this reason the rear cockpit has been made very deep to give protection from the slipstream, and great care has been taken in the placing of the equipment. The view for reconnaissance from the observer's cockpit is extremely good, and when the telegraphist is also acting as bomb-aimer he has easy access from the rear telegraphist's seat to the prone bombing position.

The undercarriage is of the divided type, and floats can be fitted instead of wheels so that the machine can be used as a seaplane.



The Fairey "Swordfish" in the air. Floats can be fitted instead of wheels to enable the machine to be used as a seaplane.

The Fairey "Swordfish" is fitted with a Bristol "Pegasus III" moderately supercharged engine. The main fuel tank is in the centre of the fuselage, between the main planes, and to the rear of it, in the top part of the fuselage, is a small tank from which the petrol flows by gravity to the engine. The oil supply also is carried in a tank placed high up in the fuselage. Oil flows direct from tank to engine, and after use returns to the tank through a cooler of Fairey design.

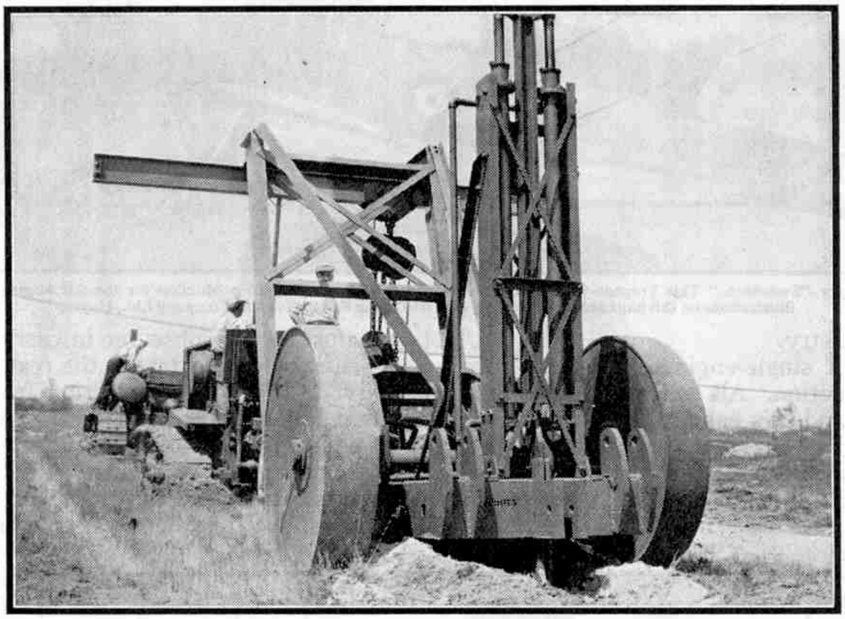
The front gun is placed at the pilot's right side in an accessible position, and is fed from an ammunition magazine stowed in the centre of the cockpit between his knees. Bombs and torpedos are dropped by means of electrically-operated releases controlled by switches in the bomb-aimer's station and duplicated in the pilot's cockpit. Selector switches are provided for each bomb and at each station there is a special switch, operation of which releases the whole load of bombs.

Lightning Conductor 1,000 Miles Long

Guarding a High Voltage Transmission Line

By Andrew R. Boone

A LIGHTNING conductor 1,000 miles long is now being erected to protect the power line that will transmit electric power from the generators at Boulder Dam, on the Colorado River, to Los Angeles, in Southern California. The construction of Boulder Dam was described in articles that appeared in the issues of *"M.M."* for February, March and September, 1934. The water of the reservoir now forming behind this huge structure is to be used to produce hydro-electric power on an enormous scale. Current from the generators, which will be the largest in the world, will be stepped up to from 280,000 volts to 303,000 volts before transmission, and the pressure of the current at the receiving end at Los Angeles will be 275,000 volts.



A double plough hauled by two tractors laying the underground section of the lightning conductor that protects the Boulder Dam-Los Angeles power line. The plough lays the wire and fills in the trench.

The electrical conductors to be employed on this gigantic power line are strong enough to sustain the weight of nine motor cars and will be suspended from steel towers as tall as 12-storey buildings. The total length of the transmission line will be 275 miles, and it will pass enough electricity to light 50 million 50-watt globes at one time. An army of expert electricians is now busy erecting a line of towers across the desert and through the mountains, stringing transmission lines through sheaves on the towers, stretching earth wires intended to dissipate lightning flashes, and making ready to close the switches that will send the high voltage current into the long conducting line across the sage brush and cactus of the desert.

A structural worker making adjustments on the Boulder Dam-Los Angeles power line.

The specially designed lightning conductor that will protect the line from the fury of electrical discharges from the sky is partly overhead and partly underground. Instead of being in the familiar vertical position the overhead portion runs parallel to the earth's surface and is on top of the towers, 150 ft. above the ground. The total length of the protective conductor is 1,070 miles, and the casual observer would scarcely realise that it fulfils the same purpose as the old-fashioned lightning conductor. In spite of its apparent complexity and its much greater extent, however, it acts exactly like the conductors seen on country homes and large buildings.

"Terrific lightning storms occur during parts of the year along the portion of the line between San Bernardino and the power generating plant at Boulder Dam," says Mr. M. O. Bolser, the engineer responsible for the erection of the lightning rod. "Without adequate protection the heavy copper lines would be subject to costly interruptions through damage to insulators or conductors. By placing the earthed wires forming the 'lightning conductor' at the very top of the towers, they will attract lightning before it can strike the costly conductors, carry the terrific charge through the steel towers into the ground, and then actually dissipate its force through a network of copper wires buried underground."

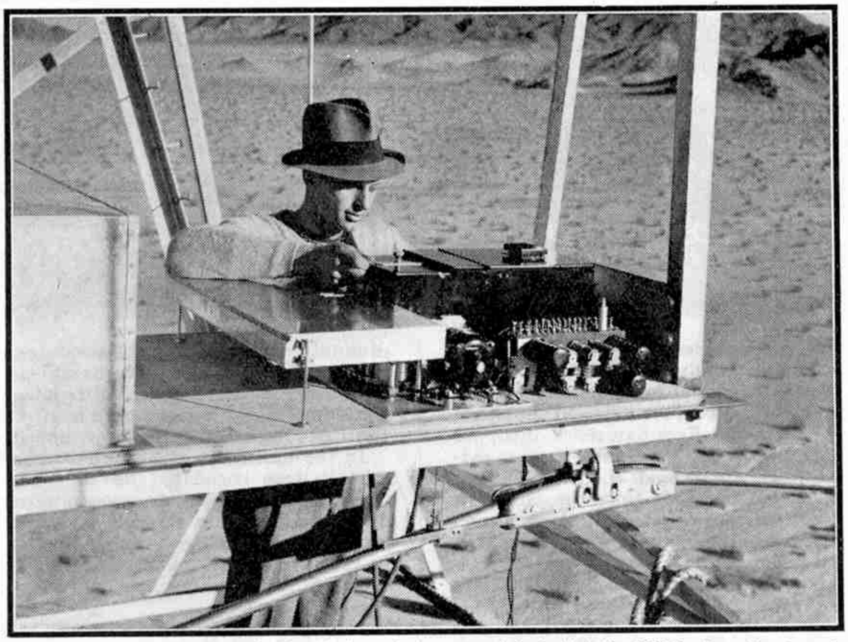
These underground wires are a new feature designed to trap lightning and ensure its ready dispersal through the earth. They are really rods and are buried 3 ft. deep in trenches 3 ft. wide cut by a double plough pulled by two tractors. The process is automatic and continuous, and as the wire is fed down into the ground, it is immediately covered, for the plough returns the excavated earth to the narrow trench. Two copper wires will run underneath each tower line at a distance of 65 ft. on each side, and where the tower line is double, as it is for a length of 230 miles, cross connections are being made between the two rows at intervals of 1,000 ft.

"This intricate system is necessary," declares Mr. Bolser, "because lightning exerts its force in a similar manner to ocean waves. Without the underground wires it would be possible for the energy to travel down the towers, meet the high resistance of the ground and roll back like waves receding from a sea wall. Should that occur, arc-overs of the electrical transmission conductors could take place, thus damaging insulators or conductors. By equalising the resistance along the whole line, it is anticipated that even the most severe lightning storms will have little effect. Similar experiments elsewhere show material improvement in service along large transmission lines. The largest installation of this nature to date is some four miles long. By installing 270 miles of this system, with more than 1,000 miles of conductors, we are taking every precaution to assure continuous flow of power across the deserts and mountains of Los Angeles."

For the underground section, more than a million pounds of hot rolled black copper rod will be buried. Steel cables will serve overhead across the desert, and copper-coated steel wire will take up the burden near the coast, where atmospheric conditions make rust-preventive treatment necessary.

This system, and the use of adequate insulators, will prevent flash-overs between conductors and enable the line to withstand a lightning flash of 16 million volts. The earth-wire system will diminish the lightning's power to a voltage that the insulators will withstand, reducing it in a fraction of a second from 16 million to 3 million volts. Near Boulder Dam the builders anticipate a flash of 19 million volts every two years, and one of 14 million volts once a year. The former may throw a section of the line out of service temporarily, but no material damage is expected.

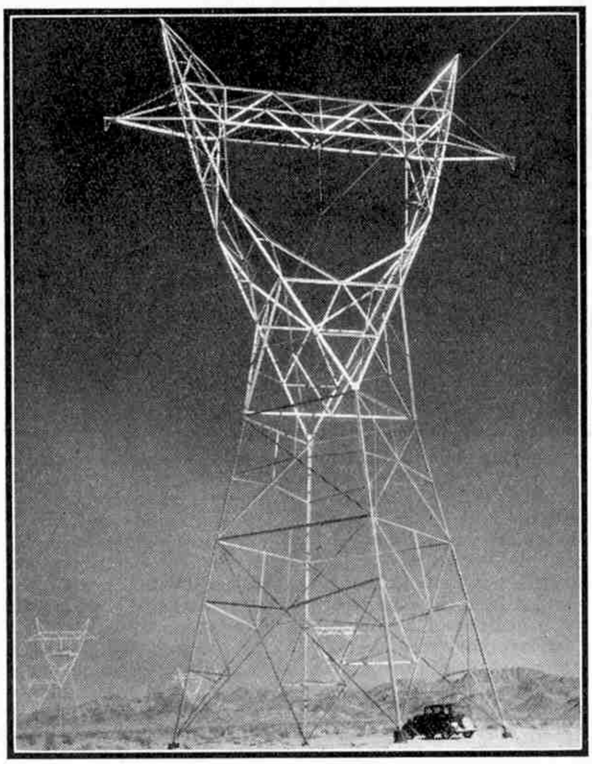
The transmission line itself is of great interest. From the generating plant at the foot of Boulder Dam, power will be brought to a huge switching station on top of the walls of Boulder Canyon through nine circuits, each consisting of three wires. From there two lines of towers will carry six cables 230 miles to a point near San Bernardino, where the two lines are to merge into a double line, each tower carrying six cables in sets of three, mounted vertically on each side. This double line will cover the remaining distance to Los Angeles. Altogether there are 2,530 towers, and the conductors they will support will consist of 10 separate flat copper wires, fitted with tongues and grooves so that they can be brought together to form a single tubular cable. Each wire will withstand a pull of more than 11 tons before breaking.



Photographing the vibrations of a length of conductor suspended at a height of 85 ft. above the ground. A cinematograph camera recorded the movement.

It is probable that never before have such exhaustive tests in laboratory and workshop been made as have been carried out in connection with this power line. The hollow conductor was only adopted after lengthy experiments. Its use marks an important development in American transmission lines, for in the past this type of cable has been used in Europe only, and in transmitting current at 275,000 volts it will be called upon to carry the heaviest electrical load ever borne by a commercial line.

The total length of cable to be suspended from the towers will be 1,626 miles, and experiments have revealed it to be of an excellent size and shape for resisting wind. Its ability to dampen out oscillations and resist failure under forced vibrations was tested in the wind tunnel of the Stanford University. Curiously enough, these trials revealed that winds of such low velocity as one to five miles an hour caused the greatest vibration. The wires can ride out a heavy gale more easily than light winds, because the gentle winds create small eddies that occur at definite intervals. Other vibration secrets were learned by means of a cinematograph camera. Sections of the conductor were made to vibrate and the oscillations set up were photographed and studied with the result that a new type of clamp was devised that straightened the curve and virtually stopped vibration.



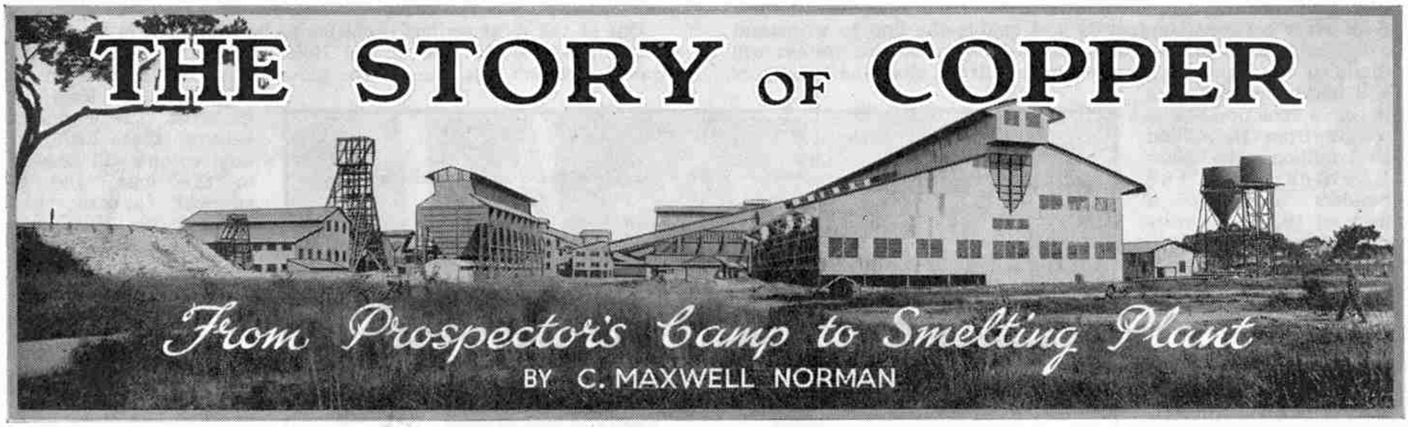
One of the towers of the Boulder Dam-Los Angeles transmission line. The motor car standing at its base gives an idea of the immense size of the tower.

One of the most serious problems to be overcome in work with a conductor of the size of the Boulder Dam transmission line was the corona loss, due to the glow, or corona, to be seen on high-tension lines in darkness. The engineers believe that little, if any, corona will be seen in this case, and of several factors that account for this, possibly the most important are the use of cable of adequate size and cleanliness. Many interesting tests were made when dealing with this question, particularly with the hollow type of cable finally adopted. Even the surface of the cable was studied, and it was discovered that new cables washed in certain soap solutions and then rinsed in clean water showed a substantial decrease in corona loss. One cable was polished with steel brushes until it had a glistening satin finish, and this treatment also helped to decrease the loss. Another was brought to a high polish with cotton buffing wheels and nickel rouge, and gave equally satisfactory results.

These trials did not reproduce actual field conditions, however, so the experimenters dragged a length of cable half-a-mile over fine crushed rock, and erected it without smoothing the consequent rough surface or removing the dirt. Its corona loss was less than that of similar lengths erected without being subjected to this rough treatment. These and similar experiments led to the conclusion that a new cable should be cleaned by washing with a solvent, soap and water, to prevent excessive corona loss. By treating the Boulder Dam-Los Angeles cable in this manner it is estimated that enough energy will be saved to meet the demands of a city of 30,000 people.

In a power line of such length, crossing desert and mountainous country, and subject to sudden and violent storms and earthquake shocks, it was necessary to pay special attention to the towers and their bases as well as the cables. In the laboratories the steel for the towers was pulled apart and buckled under terrific stresses; the concrete was crushed, and copper and steel cables were stretched to breaking point; and bolts and nuts were torn apart to determine when they will begin to yield to the forces of nature. Even in the desert itself elaborate tests were carried out, more particularly in regard to the towers, special attention being given to the strength of their concrete footings. The importance of such tests is obvious. Each tower consists of 325 structural units, made up of 128 different parts, and the failure of any one of them would delay service throughout the line.

The towers in the double row are 109 ft. in height and are spaced 800 ft. to 1,000 ft. apart. Those that complete the long line into Los Angeles are larger, for they have to bear the loads imposed upon them by six cables, and they are 144 ft. high.



THE STORY OF COPPER

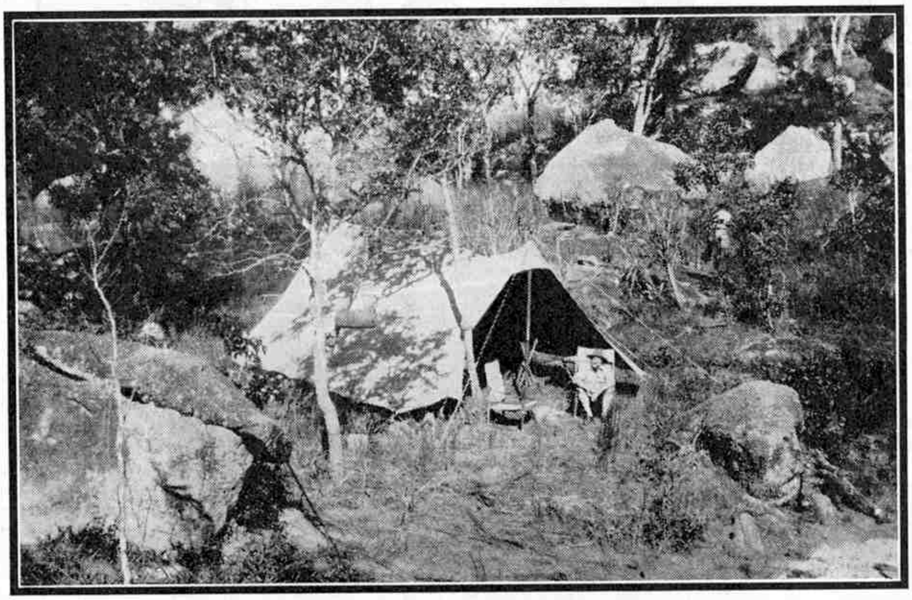
From Prospector's Camp to Smelting Plant

BY C. MAXWELL NORMAN

COPPER is undoubtedly one of the oldest known metals in the history of the world. It was mined and worked long before iron was known, and of course was the principal ingredient of bronze, the metal that gave its name to the period that followed the Stone Age and preceded the Iron Age. Certain Egyptian relics of copper and bronze are believed to date back 7,000 years, and there is evidence that copper tools were made in Ireland about 2,500 B.C. During Roman times the metal was obtained from the Island of Cyprus, and was known to them as *"aes Cyprium,"* which means Cyprian brass. This was abbreviated to *"cuprum"* from which the present name of the metal is derived.

The world consumption of copper to-day is more than 2,000,000 tons a year, but it is only in the past five years that sufficient copper ore has been discovered to satisfy world demand. Thus, until the present day, with demand always exceeding supply, prospectors and engineers the world over have searched for copper almost as diligently as they have looked for gold.

It is interesting to follow the various processes from the time when a company obtains prospecting rights over a large area of ground. To take a typical instance, the area held as a "concession" by Rhodesian Congo Border Concession Ltd. when it first started hunting for copper in Northern Rhodesia was some 52,000 square miles. The ground was forest country in Central Africa that had never been mapped and was almost unexplored, and was inhabited by negroes of the Bantu type, the majority of whom had never seen a white man.



A typical copper prospector's camp in the bush in Northern Rhodesia. The site of this camp is near the position now occupied by the Nkana Mine.

In this case the field organisation started with less than 12 men. A base camp was established as headquarters and from there parties were sent out in all directions. Each party consisted of a young technical engineer and an old "shell-back" prospector, with about 12 native carriers, and was equipped with the roughest of prospecting tools, comprising pick, shovel, pan, 4-lb. hammer, and a few tiny phials of chemicals with which to make mineralogical tests. Bundles of personal gear, a tent, camp bed, and food supplies also were taken, and all these things were done up into 60-lb. loads and carried on the heads of the native porters.

The white men in each party worked separately during the day, meeting and camping together in the evenings. Each covered a certain small area of ground, examining it foot by foot, studying all outcrops of rocks, noting the "dip" of the various strata and their "strike," or the direction of their outcrops, and taking samples for further study in camp. They charted their way by means of a hand compass, which gave them their direction, and the front wheel of a bicycle with a speedometer on it that served to show how far they travelled. This crude distance recorder was pushed about by a diminutive piccanin. In the evenings and at week-ends notes were written up and maps drawn to scale, and once a fortnight a sturdy native runner was despatched to headquarters to carry a report to the Manager and to bring back mail. About every nine months or so the party returned to be re-equipped with stores and provisions.

In the meantime at headquarters all the reports of the various parties were correlated on to one map, and promising places discovered during the dry season were noted for development work during the rains. In this way a comprehensive view of the general geology began to be formed, and certain spots were subjected to rather more intensive prospecting.

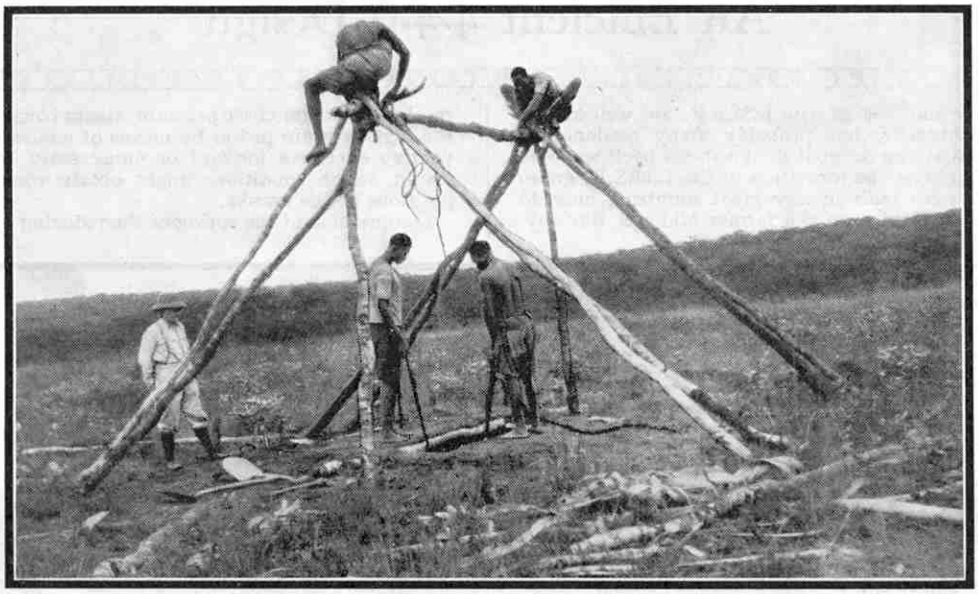
The life that these prospectors led was one that in many ways might seem delightful. Big game shooting was part of their daily routine, for the only meat they could obtain was that of the roan antelope, reidbuck and other creatures they shot. There were occasional villages and groups of dirty looking mud huts where local information could be obtained and supplies of mealie meal for the carriers bought. Throughout there was a constant feeling of terrible loneliness, however. This feeling has to be experienced to be understood, and sometimes it develops into actual fear.

The things the prospectors hunted for most keenly were green or blue stains on rocks, for most of the copper minerals exposed near the surface are changed from the original sulphides, or compounds of copper and sulphur, to carbonates, including malachite, which is green, and azurite, the colour of which is blue. At length traces of the metal were found in the form of odd stones, called "floats," containing a thin paint of malachite on one surface, and then came the scientific following up of the clue. Where did that loose stone come from? Dit it break off some outcrop at the top of the hill and roll down? Had some native dropped it there after carrying it for some purpose from another place altogether? Days were spent in painstaking search; every square inch of the neighbourhood was examined for miles around until, finally, indications of a main ore body were found.

Then came preliminary investigation during the rainy season, when ordinary prospecting would be difficult. For this purpose a great number of small pits were sunk through the soil, down and into bed-rock, and giant trenches were dug in order to expose the supposed mineralised level. Samples of the copper-bearing rocks were taken at regular intervals and sent for assay, and eventually sufficient information was collected upon which to decide whether the size and value of the deposit warranted underground development.

The next step was to establish the nucleus of a mining camp. From what had been learned of the geology of the district, a suitable spot for a shaft was chosen, headgear erected, sinking pumps installed, and a small hoist working off a portable boiler put in place. This shaft was sunk to a depth of perhaps 150 ft. and tunnels were driven in both directions along the "strike" of the copper-bearing strata. In the meantime a diamond drill was brought into use to drill holes at various strategic intervals to cut the mineralised zone, and the cores of rock brought up by these were carefully examined and assayed.

It will be seen that up to this stage of the process we have been following there has been nothing but development work. Even when ore has been found in sufficient quantity to justify actual mining, much remains to be done before production begins. For instance, the future treatment of the ore has to be decided, and to this end a small experimental plant has to be erected. Development work underground also continues and finally enough information is collected and detailed designs are drawn up for a permanent main shaft, mill and smelter.



A stage in the growth of a copper mine. A shaft has been sunk to bed rock to enable underground prospecting to be carried out. The hoisting arrangements consist of rough poles fastened together with bark ropes.

The method of mining followed depends on the kind of ore to be extracted. There are many different types of copper deposits, but of the really large ones there are only two main kinds. One comprises the enormous porphyry deposits of North and South America, in which the minerals are disseminated finely throughout whole hills and mountains of porphyry, and is of low grade. The second consists of the sedimentary rocks of the Northern Rhodesian deposits, in which certain quartzite and sandstone beds are impregnated with copper minerals to form ore of much higher grade.

Some of the large porphyry deposits are simply quarried or worked "open-cast," to use the mining term. Benches are cut in the side of the hill in which the metal occurs and the cliffs thus formed are blasted down, the ore being scooped up by giant electric shovels and loaded into freight cars for shipment to the mill or treatment plant. The buckets of some of these shovels hold as much as 8 cu. yds. of ore.

Another method for mining the big porphyry deposits is known as "block-caving." In order to realise how this is carried out an enormous mass of copper ore, forming a great lump inside a hill, must be imagined. Such a body of ore may measure 2,000 ft. in each direction. It is approached by tunnels driven into the side of the hill at different levels, or by means of a main shaft from which run various levels, each of which forms a main haulage way for the broken ore. The intervals between the levels may be about 150 ft. and on each the ground is divided up into blocks about 250 ft. square.

The hoisting headgear at the central shaft of the Nkana Mine, Northern Rhodesia

Work commences on the first level down, where a system of parallel tunnels is driven under the block to serve as gathering places for the ore. Along each of these, at 25-ft. intervals, raises or narrow shafts are driven upward and a small tunnel is cut right across the block at a height of 30 ft. above its base. A second system of tunnels is driven exactly at right angles to the first, so that a kind of draught board pattern is formed, the lines being represented by the tunnels, and the squares by the pillars of ore left in position.

At the sides of the block the ore is now completely removed in narrow slabs, the excavation being carried right up to the top of the mass. There is now a block of ore completely cut off on all sides, with a mass of loose overburden and soil on top, and only a number of small pillars below it for support. Caving now begins. Commencing at one end the pillars on the undercut level are drilled and blasted in, leaving the part of the block above them unsupported. The ore starts falling in and caving down, and thus the work continues, the pillars being blasted in successively until the opposite side of the block is reached.

Meanwhile the caved and crushed ore falls down the raises, and through "chutes" or control doors is fed into cars on the haulage level below, to be transported underground to the shaft for hoisting to surface. As soon as one of the raises shows signs of waste or overburden it is known that all the ore above it has been drawn off, and it is closed up. When the whole level has been worked out in this manner, operations are begun on the next level and are continued downward as each layer of ore is exhausted. An enormous cavity appears on the surface above a mine worked in this manner, and the bottom of this gradually sinks deeper as more and more blocks are removed.

This remarkable method of mining of course is not suitable for all ores, but generally a system of shafts, levels and haulage ways is tunnelled out. Raises then are put up at regular intervals to divide the ore into small blocks, and the ground between is extracted by one or other of several methods available.

The next problem is the extraction of the actual copper minerals from the ore. Certain low-grade porphyry ores are crushed and treated with sulphuric acid in huge vats. The resulting liquor contains copper salts in solution and an electric current is passed through it to extract the copper, which is deposited on the cathodes, or negative electrodes.

A sulphide ore is more difficult to deal with, for the sulphur and iron it contains can only be removed by a tedious process. Its treatment begins with a long process of gradual concentration in a "mill." It is crushed until it is quite fine, and then fed with water on to a shaking machine, where the light waste is washed away, leaving the heavier sulphide ore itself behind, to be shaken off the machine at a particular point. From such machines "concentrate," "middlings" and waste are obtained. The concentrate is rich in copper, and is preserved for further treatment. The waste is useless, but the middlings contain a proportion of ore, which is separated by grinding them more finely and agitating the product with certain oils and acids. Bubbles are formed and rise to the top, and the heavy minerals, clinging to the oil surfaces of the bubbles are floated away and washed down to join the main concentrate dump, the waste being drawn off below. This part of the process is known as "flotation."

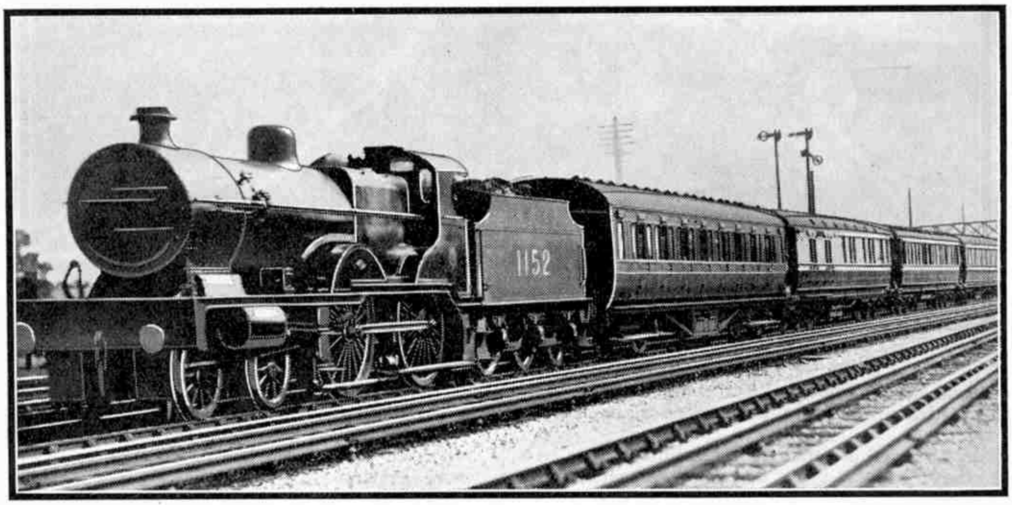
From a mill of this kind copper sulphide is obtained, and this is passed to the smelter for conversion into the metal.

The Story of the Midland Compounds

An Efficient 4-4-0 Design

THE Compound locomotives of the L.M.S.R. are well known to locomotive enthusiasts, but probably many readers will be surprised to hear that the original design dates back some 30 years. It was not until after the formation of the L.M.S.R. group that the Compounds were built in any great numbers, only 45 of them having been in service on the former Midland Railway.

After many years of what we may call orthodox locomotive practice, when the simple two-cylinder 4-4-0 type was built in considerable numbers, Mr. S. W. Johnson, the Midland Locomotive Superintendent, decided in 1902 to adopt the "Smith" system of compounding. The primary purpose of the introduction of the Compounds on the Midland was to deal with the important trains on the difficult Settle and Carlisle line, which attains a height of 1,167 ft. at Ais Gill.



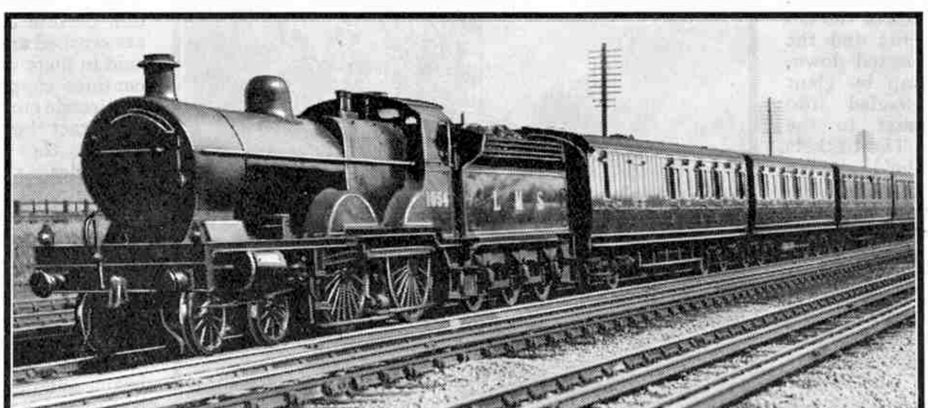
Standard Compound No. 1152 on an Anglo-Scottish express, an instance of the onerous duties to which these engines were put on the Western Division in the early grouping days. This and the lower photograph on this page are by Real Photographs Co., of Liverpool.

The Smith three-cylinder system had been devised and experimentally applied in 1898 on the North Eastern Railway. It involved one high-pressure cylinder inside the frames and two low-pressure cylinders outside, and each of these, on the N.E. and the Midland Smith compound engines, were connected to the leading driving axle of a 4-4-0 locomotive. The outside or low-pressure crank pins were set at the usual 90 degrees to one another, while the inside pin bisected the obtuse angle of 270 degrees between them, thus being set at 135 degrees to the other two.

In order to overcome the starting difficulty experienced with previous compound systems, boiler steam was admitted to all three cylinders at starting, directly to the high-pressure unit, and through a reducing valve to the low-pressure ones. This valve, which could be operated from the cab, was placed on the side of the smoke-box. After the first exhaust from the high-pressure unit the supply of boiler steam to the low-pressure cylinders was automatically cut off, and the exhaust steam from the high-pressure cylinder took its place. If the pressure of this exhaust fell below the limit set by the reducing valve, however, a supplementary supply of live steam from the boiler automatically helped to restore the pressure, in order to ensure that the power output of the low-pressure units would be maintained. At the same time the maximum pressure allowed in the low-pressure steam chest could not be exceeded. Further, if the pressure in the high-pressure cylinder was below the receiver or steam chest pressure, steam could pass to either side of the high-pressure piston by means of non-return valves, thus preventing excessive forward or unnecessary back pressure on this piston, which conditions might obtain when starting at certain positions of the cranks.

Compression of the spring of the reducing valve from the cab by the driver increased the pressure of the steam passing to the low-pressure cylinders. Still further compression resulted in the admission of live steam to the low-pressure cylinders, while the high-pressure piston was placed in equilibrium by steam being admitted to each side of it. A piston valve placed below was used to govern the admission of steam to the high-pressure cylinder, but ordinary slide valves were used for the low-pressure ones. Each valve was operated by its own set of Stephenson's link motion, cut-off and reversing being controlled by hand screw gear from the cab.

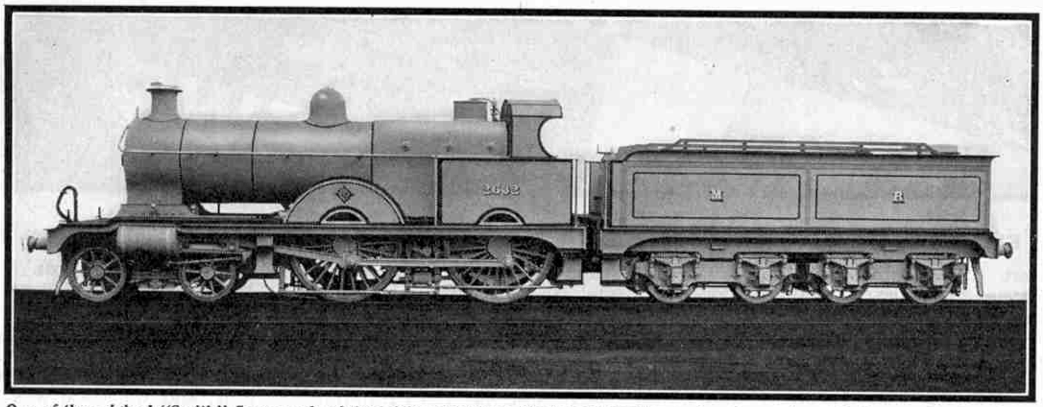
Five engines, then Nos. 2631-35, were built to the original design, and in their early state they were considered among the most handsome engines that ever ran on the Midland. They were provided with large bogie tenders, for water troughs had not been installed at the time on the Midland system. On these five engines the Belpaire pattern of fire-box, then quite a recent innovation in Derby practice, was used, and the steam pressure was fixed at the rather curious figure of 195 lb. per sq. in.



Compound No. 1054 on a down "Two-Hour" Birmingham express, an essentially suitable duty for these engines. No. 1054 ran non-stop from Euston to Edinburgh in 1928, and the special tender then provided is shown in this illustration.

Mr. R. M. Deeley, who assumed command at Derby in 1903 modified the Smith system somewhat in the compound engines—Nos. 1000-1029 — that he built in 1905-6, and the original five of 1902-3 were subsequently altered to suit. The alterations, which resulted in the application of the name "Deeley Compounds," simplified to some extent the main details of the Smith system. The reducing valve arrangement was done away with, and a special form of regulator substituted for it, incorporating three steam ports. One of these is connected with the low-pressure cylinders by means of a small auxiliary steam pipe. The main regulator valve has a small "jockey valve" on the back of it, which, when the regulator handle is first moved by the driver at starting, gradually uncovers two of the ports, one of them being that leading to the auxiliary pipe. Thus steam is admitted to all three cylinders, but as the non-return valve equalising arrangement of the original design is retained on the high-pressure cylinder, it will be realised that the high-pressure piston is maintained in equilibrium with steam on each side of it.

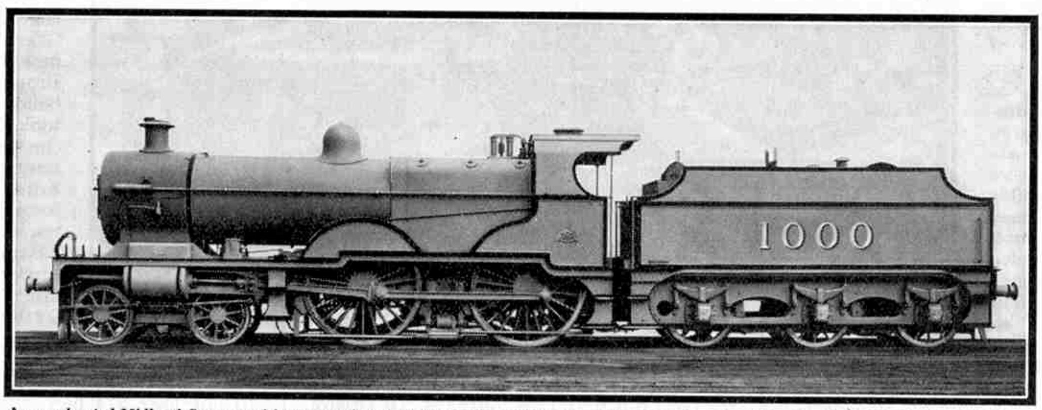
A "Deeley Compound" engine thus starts as a two-cylinder simple with the low-pressure cylinders doing the work. As the regulator handle is moved over, the auxiliary port closes and steam is admitted direct to the high-pressure cylinder only, fully compound working being thus brought into operation. The working pressure was raised to 220 lb. per sq. in. for the Deeley engines, but 200 lb. subsequently became the standard figure for the class, and remains so to-day.



One of the original "Smith" Compounds of the Midland Railway. Their bogie tenders and various external features make these locomotives very different in appearance from the Compounds of the present day.

The external changes from the Johnson "Smith" compounds embodied in the Deeley engines were rather drastic. The shape of the footplates and the cab was altered. The narrow Deeley chimney replaced the more "chubby" Johnson erection that followed the outline familiar on the Midland for so long. In addition, the large brass casing fitted over the safety-valves on the first engines was done away with, and the plain open columns and spring of the Ramsbottom valves were thus exposed to view. The new six-wheeled flat-sided tenders with their large numerals were of course quite different in appearance from the Johnson bogie "water carts," as they were known. In 1907, when the Midland locomotive stock was renumbered on a more orderly basis than the scattered odd numbers and groups of numbers previously in use, the first five compounds Nos. 2631-5 became Nos. 1000-1004, and the Deeley engines originally Nos. 1000-1029 became Nos. 1005-1034.

The "Midland Compounds" remained the chief express engines of the line throughout the rest of its independent existence. The last of them, Nos. 1035-1044, were constructed in 1908-1909, and no new passenger engines were built for the Midland after that, many of the older locomotives being completely rebuilt or renewed and brought up to date. The application of superheaters to the Compounds first occurred in 1913, and the extended pattern of smoke-box, then already a feature of the latest simple engines, was added to the superheated Compounds.



A superheated Midland Compound incorporating the internal and external modifications introduced by Mr. R. M. Deeley. No. 1000 was the original No. 2631 of 1902 and had the same appearance as No. 2632 in the upper illustration.

With the coming of grouping, the Midland Compounds as superheated were to find a wider field for their activities. As the most thermally efficient 4–4–0 locomotives in possession of the group, the Compound type was selected after comparative trials for multiplication for duties where the train loads involved were not unduly heavy. On the Midland main line, where the men have naturally long been familiar with the handling of Compounds, these engines have always given extremely good results, but with the drafting of some of them to the Western Division—the old L.N.W.R.—a good deal of trouble was experienced at first. From some of the duties allotted to them it would seem that it was assumed that the "Compounds" could be used on such heavily-loaded turns as were once commonly taken by the L.N.W.R. simple "George The Fifth" 4–4–0s of similar weight. Owing to the design of the Compounds, however, this was not possible. The double expansion of the steam in compound working results in lowering the pressure at which the exhaust leaves the blast pipe, so that it is practically impossible to "thrash" the Midland Compounds, whereas the simple engines, at the expense of a greatly increased coal consumption, could be made to do heavy work apparently out of all proportion to their size.

Thus until their handling became more familiar to the men the Compounds had a very poor reputation on the Western Division. In course of time, however, with more experience of their working and with their use on services for which they were suitable, such as the fast but moderately-weighted Birmingham and Wolverhampton trains, condemnation gave place to appreciation, and excellent results are now achieved with the "Crimson Ramblers," as these engines became known.

To make them suitable for running within the restrictions of the Scottish loading gauge, No. 1065 and the engines subsequently built were provided with chimneys and domes of reduced height, while Ross "pop" safety valves also made their appearance in these later engines. The Compounds for the Western, Central and Scottish Divisions continue the practice of those lines in being driven from the left-hand side. Thus Nos. 1085-1199 and Nos. 900-939 have the reversing gear and regulator arranged to be handled from that side, whereas right-hand drive has been standard for many years on the Midland and was embodied in Nos. 1000-1084.

In Scotland, much of the work demanded of the Compounds is far in excess of that required on the parent system. The Scottish drivers, with their traditional skill, appear to be able to extract the very best from the engines, for some of the turns operated by Compounds on both Caledonian and G. and S.W.R. sections are extremely hard. Readers will recollect the fine work of No. 1127 on the *"Granite City"* Express described in the *"M.M."* in April of this year.

Two interesting events in which Compounds were concerned occurred in 1926 and 1928 respectively. While the G.W.R. four-cylinder 4–6–0 locomotive *"Launceston Castle"* was in use experimentally on the L.M.S.R. Western Division in 1926, No. 1047 in charge of a Midland driver went over to the G.W.R. It was stationed at Bristol, and worked with success on certain trains suited to its capacity. Then in 1928 was accomplished the spectacular achievement of working the two portions of *"The Royal Scot"* to Glasgow and Edinburgh respectively without intermediate stoppage. The Glasgow train was worked from Euston by a *"Royal Scot"* and the Edinburgh one by Compound No. 1054.

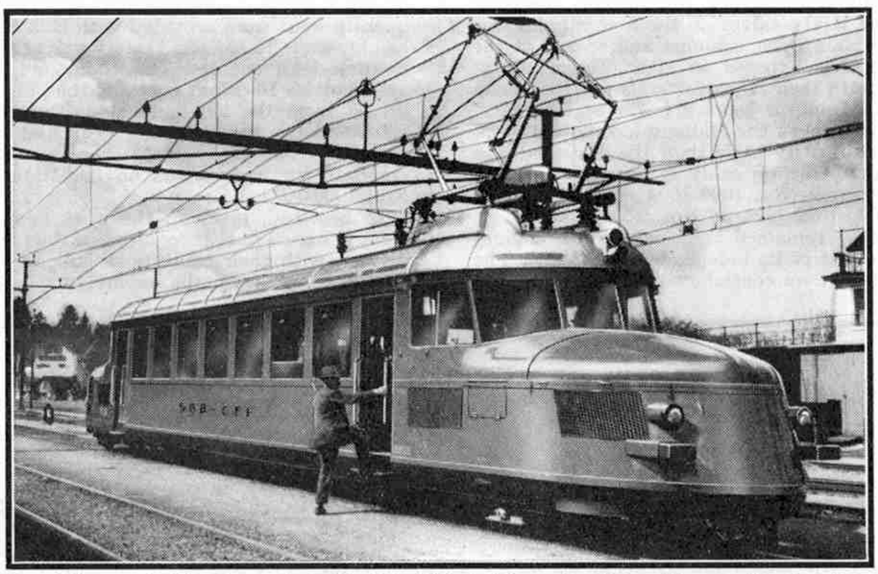
It is of interest that the same "Smith–Deeley" design was applied to the five large 4–4–0 express engines built for the G.N.R. of Ireland in 1932 and described in the August *"M.M."* of that year. In these the Deeley arrangement of regulator is used, by permission of the L.M.S.R. authorities. The cylinders of these locomotives are reduced in diameter from the Derby dimensions but the boiler pressure is increased to 250 lb. per sq. in.

New Swiss Electric Coach

In order to meet the growing competition of road vehicles the Swiss Federal Railways some time ago decided to make a trial of light electric rail coaches with specially powerful motors. Two such vehicles have recently been built, and one of them is illustrated in the photograph on this page. They have been designed for use on sections on which there are but few curves, and rapid acceleration and a maximum speed of 78 m.p.h. are possible. The vehicles seat 70 passengers and are of special construction, the framework being built up of light steel channels. The motors are mounted under a bonnet at one end, and the compressors and other operating gear under a similar bonnet at the other end.

The cars run on four-wheeled bogies and on one bogie are mounted two single-phase motors of about 300 h.p., each geared to drive one of the two axles. When running downhill the motors act as generators, and the energy then produced is absorbed by resistances mounted in the double roof. These resistances of course become heated, and they are cooled by air entering through special openings. The second bogie has electro-magnetic disc brakes, and emergency brake shoes on the wheels are actuated by compressed air. As a further safeguard there is a hand-operated brake acting on all wheels.

The coaches may be driven from either end, so avoiding the necessity for turning. The driver, who is seated, has in front of him a wheel, similar to the steering wheel of a motor car, by means of which he controls the speed and the electric braking.



One of the new electric motor coaches of the Swiss Federal Railways described on this page. They have been introduced specially for high speed services. Photograph by courtesy of the Swiss Federal Railways.

The Longest Railway Tunnel in France

A tunnel nearly 4½ miles long was begun in June 1933 and was completed recently, the work having taken just under two years. Its purpose is to connect the main line of the Alsace-Lorraine Railways, by way of an existing branch to one end of the tunnel, with the main line from Strasbourg. An even longer tunnel more than five miles long is at present under construction in the same district.

New Named Train on G.W.R.

On 31st August last, the date of the G.W.R. Centenary, a special train of Directors and guests left Paddington for Bristol. Both stations were gaily decorated and the train was cheered throughout the journey. A feature of the celebrations at Bristol was the exhibition of a film depicting the foundation and development of the G.W.R. The return journey to London was completed in 105 min.

Since 9th September *"The Bristolian,"* a new express introduced to commemorate the association of Bristol with the G.W.R., has been running regularly to this timing for both down and up journeys. To Bristol via Bath the average speed is 67.6 m.p.h., and to Paddington via Badminton the average is 67.1 m.p.h. The train leaves Paddington at 10 a.m. and Bristol at 4.30 p.m. and makes the fastest run in the country for a distance of over 100 miles.

Appropriately too, in its Centenary year, the G.W.R. timetable of winter services shows a record number of trains. Actually 5,484 trains will be run daily to cover a mileage of 114,462. Weekday and Sunday services are improved for the increasing winter traffic to the West. Some of the trains accelerated for the summer have been retained, and quicker services generally are the rule. There are 18 expresses covering 1,772 miles daily at speeds of 60 m.p.h. or more.

Smart Work by North Eastern Engines

An interesting run was recorded by Mr. O. S. Nock on an occasion during the summer when, for various reasons, the L.N.E.R. down *"Aberdonian"* left Newcastle 35 min. late. The tare load was 482 tons, the full weight being 515 tons, and the train was hauled by a pair of engines unusual on the heaviest services in these days. These were No. 1794, an "Atlantic" of the former North Eastern class "V," and No. 2025, a 4-4-0 of the well-known North Eastern class "R"; both types have long been familiar on the East Coast Route, and were once commonly used on the most important trains.

With these veterans at its head, the train passed Berwick, 67 miles, in 73¾ min. Then, in spite of a p.w.r. check, the next 28.25 miles to Dunbar were run in 35½ min. including the long ascent to Grant's House, mostly inclined at 1 in 200. From Dunbar to Portobello, the 26.25 miles took 25¼ min. and in the end the two engines brought their train into Edinburgh in 141 min. from Newcastle, a distance of 124.4 miles, having reduced the arrears of time to 21 min. The net gain on schedule over this length was about 16 min.

Road Transport Vehicles for Railways

During the coming year the G.W.R. are to purchase 374 new road motor vehicles. Some of these are for the replacement of obsolete stock and some are intended to supersede horses. The remainder will be employed in handling the increasing traffic due to the opening of new factories in G.W.R. territory. Many types of vehicles will be included, from light vans for express parcels delivery up to 6-ton vehicles; also new type articulated stock, tractors and trailers. The total cost of these vehicles will be £144,000.

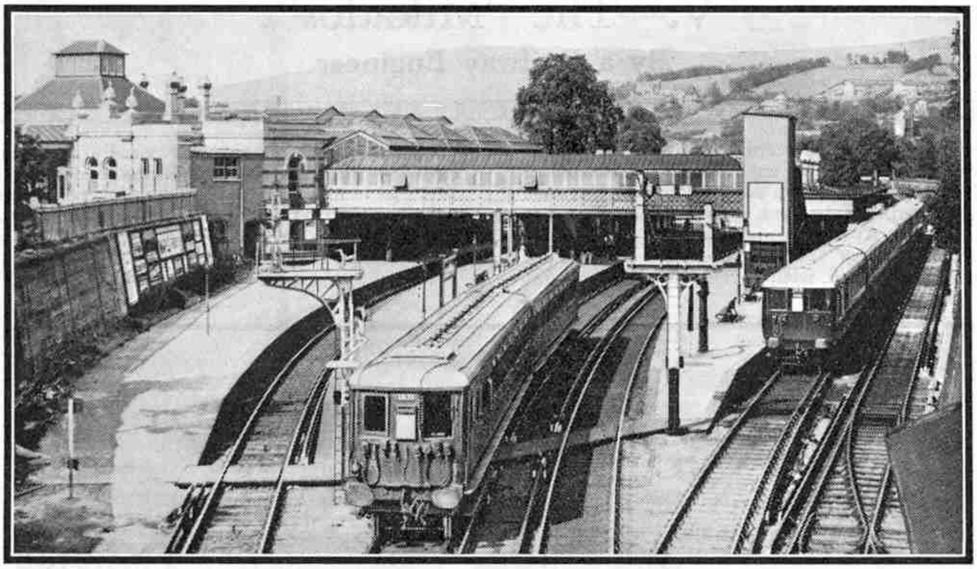
The L.M.S.R. have ordered 100 3-ton van tractors, 155 3-ton trailers 13 ft. long and 55 3-ton trailers 15 ft. long. These are to be supplied by firms engaged in the motor industry, and in addition the L.M.S.R. themselves are to construct 77 3-ton trailers at Wolverton Works.

High Speeds by L.M.S.R. "5X" Locomotives

The L.M.S.R. engines of Class "5X," both of the "Baby Scot" and the Stanier 3-cylinder "Silver Jubilee" series, continue to give convincing proofs of their abilities. During a recent run on the 4.30 p.m. from Glasgow, No. 5547, a "Baby Scot," with 410 tons passed Beattock Summit from Symington, 17.2 miles, in 21¼ min. Up the valley of the Clyde speed averaged 53–54 m.p.h. and the final speed at Summit was 40 m.p.h. The maximum on the descent of the famous incline was 77 m.p.h. and Beattock Station was reached 1¾ min. early. Then came a brilliant start-to-stop run from Beattock to Lockerbie, 14.1 miles in 14½ min., speed ranging from 66 to 73 m.p.h. all the way. For several miles past Gretna 82½ m.p.h. was sustained, the last stage to Carlisle, a distance of 25.6 miles, being run in 27⅓ min.

At Carlisle No. 5573 of the "Silver Jubilee" series came on to an unchanged load and reached Shap Summit in 48½ min., speed falling to 28½ m.p.h. at Thrimby Grange. Fast running followed with speeds of 82 m.p.h. before Tebay, 61 at Grayrigg and 77½ m.p.h. through Carnforth, which was passed in 76½ min. from Carlisle, a distance of 62.9 miles. Unfortunately a severe signal check at Morecambe South was the first of a series of delays due to the heavy holiday traffic converging at Preston. Owing to the bad checks experienced, the 107 min. booked allowance had expanded to 122½ min. by the time Preston was reached. The net time, however, was only 103 min.

We are indebted to Mr. O. S. Nock for the foregoing details.



A photograph of Lewes Station, on the S.R., that was awarded a prize in a recent H.R.C. Photographic Contest. A two-coach electric unit for local and intermediate services can be seen in the centre, and on the right is a six-coach main line train.

Extending L.N.E.R. Electric Services

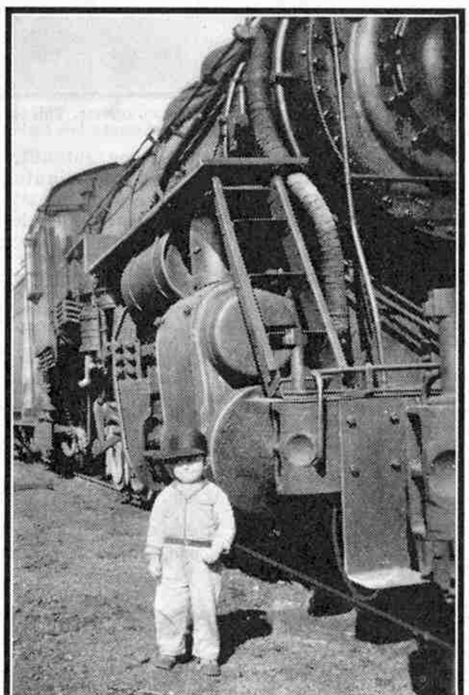
The L.N.E.R. have decided to extend the electrified services in the Tyneside area, where the 11 miles from Newcastle Central to South Shields are to be equipped on the 600-volt direct current system. The modernisation of the older equipment in use on existing electric lines in the district is in progress and new rolling stock also is to be provided.

L.N.E.R. Locomotive Depot Improvements

L.N.E.R. locomotives working from Carlisle are accommodated at Canal Locomotive Depot, and this is being re-organised in order to bring it into line with present-day requirements. The scheme includes the provision of a locomotive coaling plant of 200 tons capacity, and of the latest pattern of sand drier. The yard layout also is to be altered to facilitate the introduction of new working arrangements, and a wheel drop and a new engine pit 135 ft. in length are being installed to speed up repair work. In addition new mess rooms are being provided for the locomotive men and shed staff attached to the Depot.

The "Flying Cologner"

Since July Berlin and Cologne have been connected by a new Diesel railcar service. The train is known as the *"Flying Cologner"* and is a Maybach-engined streamlined unit, similar in general design to the famous *"Flying Hamburger,"* but incorporating certain improvements. It leaves Cologne at 7 a.m., forming a direct connection with the 10.45 p.m. train from Ostend, and the return service leaves Berlin at 7.11 p.m. and also connects with an Ostend train. Passengers between London and Berlin via Calais also can connect with this railcar service by changing at Brussels. On its first run from Berlin, the *"Flying Cologner"* reached a maximum speed of 109 m.p.h.



The giant proportions of this Canadian locomotive are emphasised by the youthful "engineer" seen standing alongside it in this H.R.C. prizewinning photograph.

More L.M.S.R. Fast Schedules

The even two hours timing of the Euston and Birmingham trains has been an institution for many years past, but now four down and three up trains are to perform the journey of 112.9 miles in 1 hour 55 min. including one stop. Start-to-stop timings of 92 min. for the 94 miles between Euston and Coventry and 104 min. for the 107.5 miles from Willesden to Birmingham are involved. The 6.20 p.m. from Birmingham to Euston makes three stops in an even two-hour journey, and for the 65.1 miles between Rugby and Watford takes exactly one hour. This is the fastest booked run on the L.M.S.R. The up *"Lancastrian"* now runs from Stoke-on-Trent to Willesden, 145.9 miles, in 140 min. at an average speed of 62.5 m.p.h.

On the Midland Division some 60 m.p.h. schedules have been introduced on runs from Luton to St. Pancras and from Cheltenham to Bromsgrove.

L.M.S.R. Locomotive News

Further 4–6–2 locomotives of the "Princess Royal" class have been put into service. They are Nos. 6208 and 6209, and are named respectively *"Princess Helena Victoria"* and *"Princess Beatrice."* It is expected that the whole of the series ordered for this year will be in traffic by the date of publication of this issue.

A further member of the "Royal Scot" class is to appear from Crewe Works during the autumn. This will be No. 6170 and will be named *"The British Legion."* It will differ from the existing engines of the class in that it will be fitted with a tapered boiler that will be generally similar to that of the 4–6–0 "Silver Jubilee" class, but will be larger. It will be interesting to see whether existing engines of the "Royal Scot" class will be fitted with tapered boilers when they require new boilers.

Locomotive Erecting Records

The withdrawal from service of L.N.E.R. locomotive No. 7930 recalls the fact that it was originally erected in 9¾ hours. This feat was achieved on 11th December, 1891, at Stratford Works of the then Great Eastern Railway, where the engine was built as No. 930. It was of the standard 0–6–0 class originated in 1883 by Mr. T. W. Worsbell, but it belonged to the series built under the supervision of his successor Mr. J. Holden. When withdrawn from service it had completed a mileage of 1,127,750.

The object of this record erection was to demonstrate how quickly a locomotive could be put together. Such demonstrations seem to have been popular at that time, for a few years earlier one of the L.N.W.R. coal engines built at Crewe to the design of Mr. F. W. Webb was erected and steam raised ready for work in 25½ working hours.

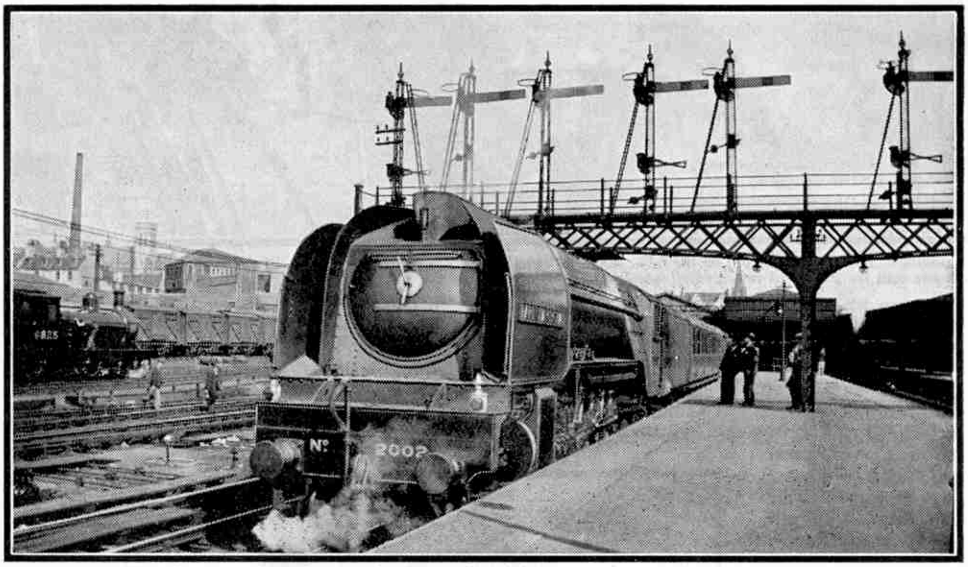
Footplate Runs on the L.N.E.R.

V.—The "Mikados"

By a Railway Engineer

TO say that the new 2–8–2 express engines *"Cock o' the North"* and *"Earl Marischal"* are setting up entirely new standards of performance on the Edinburgh-Aberdeen route is to put the case very mildly indeed. Their superiority even over the "Pacifics," is amazing. Southbound from Aberdeen, where "Atlantics" are limited to 340 tons and "Pacifics" to 420, the new engines are rostered to take 550 tons tare, which, with a well-filled train, would mean a gross load of nearly 600 tons behind the tender. At present *"Cock o' the North"* is stationed at Haymarket, and is making two return trips a day from Edinburgh to Dundee; while *"Earl Marischal"* working from Dundee shed, is making the run from there to Aberdeen and back twice daily.

My first experience of *"Earl Marischal"* was on the down *"Aberdonian."* The load was 482 tons tare and 515 tons gross, and with this heavy train a "Super-Pacific," rejoicing in the appetising name of *"Salmon Trout,"* had had somewhat of a struggle to keep time from Edinburgh. But when *"Earl Marischal"* took over at Dundee, matters were completely reversed. With a load that was only just equal to "Pacific" maximum in this direction, No. 2002 made light of the task. The engine returns to Dundee, however, on the heavy and popular 10.20 a.m. express. The Aberdeen-Penzance through carriage is conveyed on this train, and there is also a portion for King's Cross, which is due at 9.55 p.m.



"Earl Marischal" ready to start from Aberdeen in charge of the 10-20 a.m. express. This photograph shows very clearly the smoke-deflecting side sheets that have been fitted outside the original smoke-box casing plates of this locomotive.

In readiness for a trip on this train, I joined Driver Arbuthnot and Fireman Conning, a Dundee crew, in the locomotive yard at Aberdeen. Here, standing among Caledonian 4–4–0s, Midland Compounds and North British "Scotts," the vast size and unorthodox appearance of *"Earl Marischal"* seemed more pronounced than ever. The cab interior is almost identical with that of the "Super-Pacifics," and there is an excellent look-out ahead. Unlike *"Cock o' the North,"* this engine is fitted with additional smoke deflecting screens at the front end, but these do not interfere with the driver's view in the least.

We backed down to the station to find awaiting us a heavy train of 479 tons tare and 515 tons with passengers and luggage. The running about to be described compares in most interesting fashion with that of the North British "Atlantic" No. 9869 *"Bonnie Dundee,"* whose work, with a 355 ton load, I described in the June number of the *"M.M."* Reference to the gradient profile published in the same article will help readers to appreciate the wonderful hill-climbing of the "Mikado" type of engine.

Like the "Pacifics," the cut-off of these engines in full gear is 65 per cent., but this was used for only a very few yards at the start. On most engines drivers are usually reluctant to open up to full regulator immediately, in order to reduce the likelihood of slipping; and I have known it to be two miles from the start before the wide open position is reached. Driver Arbuthnot was using full regulator 50 yards from the start, however, and a mile out, cut-off was back to 25 per cent.

The climb out of Aberdeen was amazing. Two miles from the start we were doing 39 m.p.h., while on the steepest part of the rise where, with *"Bonnie Dundee,"* working on 53 per cent. cut-off and hauling 355 tons, speed fell to 30½ m.p.h., *"Earl Marischal"* sustained 36 with a load of 515 tons, on 25 per cent. cut-off! I could hardly hear the exhaust, and the smooth, buoyant riding of the engine strengthened the impression of effortless travel. Actually 2,000 horse power was being developed, and when the grade eased to 1 in 160 beyond Cove Bay, the pace rose from 36 to 42 m.p.h. in 1½ miles. Thus Portlethen summit, 7 miles out, was passed in the remarkable time of 13¼ minutes.

The easiest of easy running now followed. A cut-off of 18 per cent. with the regulator less than one-fifth open accelerated this big train to 61 m.p.h. at Muchalls; and Stonehaven, 16¼ miles, was reached in 23½ minutes, a gain of 1½ minutes on schedule.

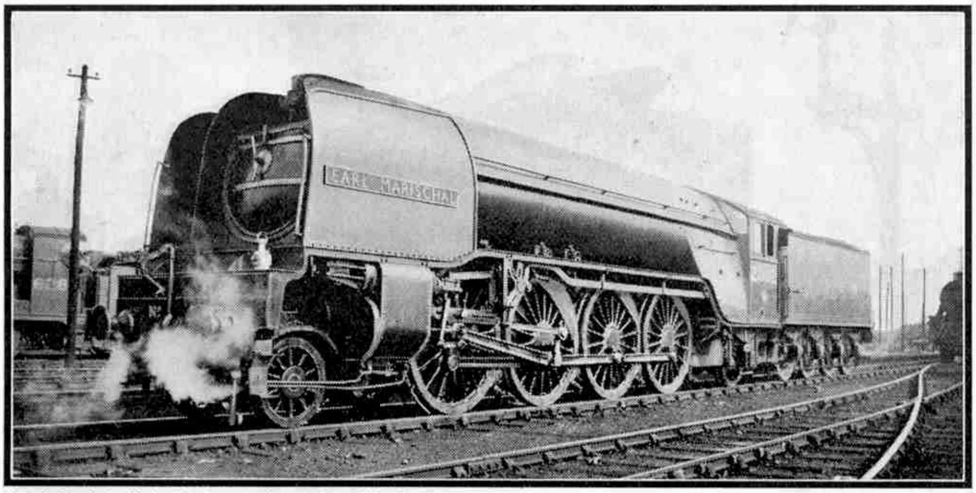
This table shows in comparative form the performances of different engines over the 5.5 miles from Stonehaven up to Carmont Summit.

Engine	Load in Tons	Time of Ascent	Speed at Summit
Caledonian McIntosh Superheater 4-4-0 No. 14442	250	10 min. 40 secs.	37½ m.p.h.
Midland Compound 4-4-0 No. 1143	260	10 min. 30 secs.	36 m.p.h.
North British 4-4-2 No. 9868 "Aberdonian" (now scrapped)	300	11 min. 0 secs.	34 m.p.h.
L.N.E.R. "Pacific" No. 2566 "Ladas"	400	11 min. 40 secs.	31 m.p.h.
"Earl Marischal"	515	10 min. 43 secs.	36 m.p.h.
North British 4-4-2 No. 9869 "Bonnie Dundee" piloted by "Scott" class 4-4-0 No. 9413 "Caleb Balderstone"	565	11 min. 13 secs.	34½ m.p.h.

The restart, up steeply-rising gradients, was magnificent. After 100 yards cut-off was back to 40 per cent., and in three-quarters of a mile to 32 per cent., yet speed rose steadily on the 1 in 90 ascent to 30 m.p.h. by the time Dunnottar Box was passed. Then the grade eases to 1 in 423, for ¾ mile, before the final 1½ miles at 1 in 102 to Carmont summit. On passing Dunnottar, cut-off was reduced to 25 per cent.; we accelerated rapidly to 39 on the easier stretch and breasted the summit at 36 m.p.h.

It is when direct comparison is made with the work of other engines, however, that the astounding ability of the "Mikados" is revealed. In the past few years I have had runs with quite a number of different types of engine over this route, and the ascents from Stonehaven provide some arresting figures. In the accompanying table are details of six southbound climbs, the time given in each case being that of passing Carmont summit from the dead start at Stonehaven, a distance of 5.5 miles. The fastest climb was made by a Midland Compound 4–4–0, but *"Earl Marischal"* practically equalled this, hauling very nearly double the load! Furthermore, all the other engines were being worked extremely hard. The N.B. 4–4–2 *"Aberdonian,"* for example, was being driven with the regulator three-quarters open and 53 per cent. cut-off, whereas *"Earl Marischal"* on 25 per cent. cut-off was taking things very quietly.

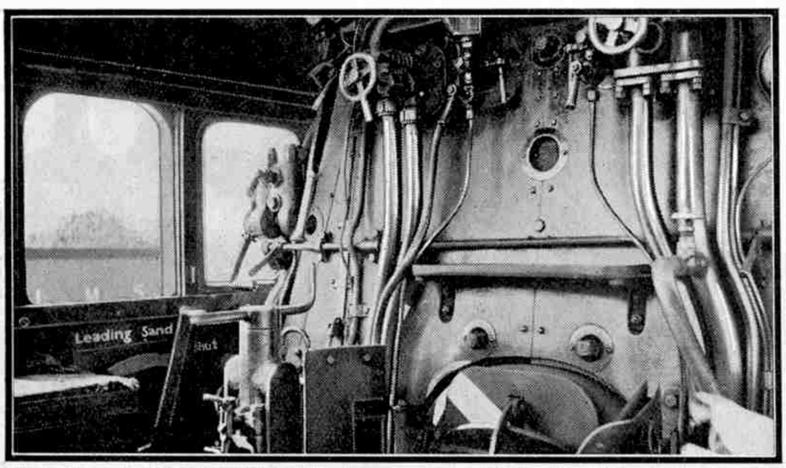
Now, 18 to 22 per cent. cut-off, and the regulator varying between one-fifth and one-half open, took us down the falling grades to Kinnaber Junction at an average speed of 61 m.p.h., the highest rate being 67 at Craigo viaduct. It is due to the fact that *"Earl Marischal"* has such a soft blast that, in addition to the streamlined front end, the extra smoke - deflecting screens had to be provided on each side of the smoke box. These are most effective, and at high speed the lightly drifting cloud of exhaust steam is given a most artistic-looking upward twirl and is thrown high and clear of the cab. We slacked carefully to 15 m.p.h. over Kinnaber Junction, and completed the $24\frac{1}{2}$ miles from Stonehaven into Montrose in exactly 32 minutes.



"Earl Marischal" in the locomotive yard at Aberdeen. Remarkable work is being done by this locomotive and by No. 2001 "Cock o' the North" between Edinburgh and Aberdeen, as is evident from the accompanying article.

Yet another splendid start was made up the steep bank out of Montrose. Working on 32 per cent. cut-off, we accelerated to 30 m.p.h. at Usan. On the trip described in the June *"M.M.," "Bonnie Dundee"* practically equalled this time, with a 355 ton load, but the 4–4–2 was working on 60 per cent. cut-off! *"Earl Marischal"* ran very easily down to Arbroath, arriving there in the excellent time of $20\frac{3}{4}$ minutes for the $13\frac{3}{4}$ miles. No higher speed than $63\frac{1}{2}$ m.p.h. was touched. On the final stage, along the dead level of the Angus coast, hardly any effort worth mentioning was required from the great engine, and Dundee was reached dead on time.

On another occasion I rode on the footplate of the *"Aberdonian"* right through from Aberdeen to Edinburgh. This time *"Earl Marischal"* was in charge of Driver Campbell, who was responsible for the run with *"Bonnie Dundee"* described in the June *"M.M.,"* but in this case assisted by Fireman Dorrard. With a load of 493 tons tare and 530 tons with passengers and luggage, the running was very similar to that made by Driver Arbuthnot on the 10.20 a.m. express. Driver Campbell used rather longer cut-offs with the regulator not fully open, and in consequence his uphill times were not quite so good. The downhill speeds were faster; 67 was touched at Muchalls, 70 at Craigo and 66 on the descent from Lunan Bay. On the last stage adverse signals unfortunately prevented a punctual arrival in Dundee, but the net time was well inside schedule.



Part of the cab of "Earl Marischal." The driver is accommodated on the left-hand side, where the regulator handle, screw-reverse gear and vacuum brake valve are fitted in convenient positions.

At Dundee, No. 2001 *"Cock o' the North"* came on, in charge of Driver Shedden and Fireman Hardisty of Haymarket shed, Edinburgh. Since the introduction of the 2–8–2 engines, the departure of the *"Aberdonian"* has become quite a popular nightly event in Dundee. It provides the only opportunity of seeing these two giants together, and on this occasion a crowd quite forty strong gathered to see us off. On account of the rotary cam poppet valve gear, *"Cock o' the North"* differs considerably from *"Earl Marischal"* in the footplate arrangements. The reversing gear is operated by a vertical wheel, very similar in appearance to that used on modern Southern Railway engines such as the "King Arthurs" and the "Schools." On the right-hand side of the cab is a speed indicator of the Teloc type, which also records the mileage covered.

An even more interesting comparison than in the case of *"Earl Marischal"* is provided between the work of the "Super-Pacific"—*"Windsor Lad,"* whose running on the same express I described in the July number of the *"M.M.,"* and that of the *"Cock o' the North"*; the 4–6–2 was hauling 440 tons and the "Mikado" 530. For 53 out of the $59\frac{1}{4}$ miles from Dundee to Edinburgh *"Cock o' the North"* was working on no more than 18 per cent. cut-off.

Getting away from Dundee up the steep ascent on to the Tay Bridge, Driver Shedden quickly linked up to 35 per cent., while from Esplanade station to the middle of the bridge we were cutting off at only 25 per cent. *"Windsor Lad"* needed 40 per cent., and yet, with 90 tons less load, took $\frac{1}{4}$ minute longer to pass Tay Bridge South Junction.

On my trip with *"Cock o' the North,"* we had left Dundee in the gathering dusk, and as we crossed the bridge a soft bluish haze hung over the Firth; the first lights were twinkling in Dundee and Tayport, making a delightful picture.

Once across the bridge *"Cock o' the North"* got going in great style. We passed St. Fort at 61 m.p.h., and then steam was shut off altogether, the valves were put into mid-gear, and we coasted for two miles at about 58 m.p.h. The slacks to 55 m.p.h. at Leuchars and Cupar were strictly observed, the 1 in 160 rise to Springfield was mounted at 48 m.p.h., and we were through Ladybank junction, 20 miles in $27\frac{1}{2}$ minutes, $1\frac{1}{2}$ minutes early at a reduced speed of 50 m.p.h.

Now we had a remarkable exhibition of *"Cock o' the North's"* hill-climbing ability, for the ascent of Falkland Road bank was made on 18 per cent. cut-off. From the Ladybank slowing we accelerated like lightning to 60 m.p.h. before Kingskettle, and then took the $3\frac{1}{2}$ mile climb at 1 in 100 at a minimum speed of $25\frac{1}{2}$ m.p.h.

On the descent to Thornton a very severe permanent way check was experienced, to 10 m.p.h., but nevertheless we passed that junction slightly before time, $40\frac{3}{4}$ minutes for the $28\frac{1}{2}$ miles from Dundee. Speed was reduced to 25 m.p.h. through the station, and then the driver opened out to 25 per cent. cut-off. On the 1 in 130 ascent that follows, speed had risen to 32 in half a mile, cut-off was brought back to 18 per cent., and we continued to accelerate up to the 1 in 155, passing Dysart summit at 34 m.p.h.

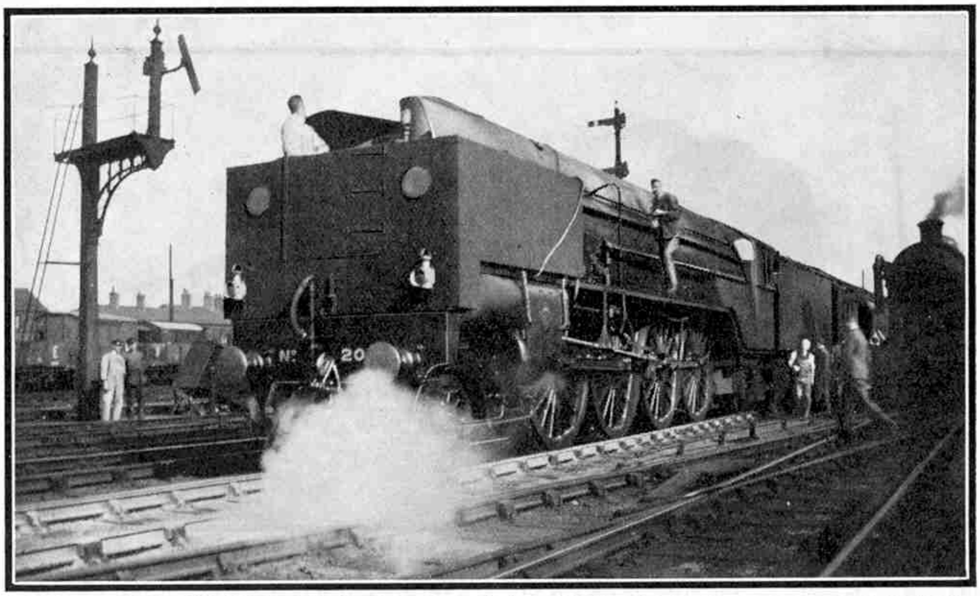
Then came an extraordinary display of the engine's "coasting" ability. On the descent through Kirkcaldy steam was shut off when speed had risen to 55 m.p.h., yet we continued to accelerate and attained 65 m.p.h. Even beyond Kirkcaldy, where the gradient flattens out to 1 in 660, speed was maintained at about a mile a minute, while the average speed over the 5.3 miles from Dysart to Kinghorn was 59.3 m.p.h.—entirely without steam!

We slacked heavily to 25 m.p.h. through Kinghorn and again to the same low speed at Burntisland; and then came a fine ascent to Dalgetty. *"Windsor Lad"* had been worked at 30 per cent. cut-off throughout here, but *"Cock o' the North"* was given only 18 per cent. as far as Aberdour, and opened out to 25 per cent. for the last mile. Yet No. 2001 made slightly faster running with speeds of 45 on the level mile out of Burntisland and $31\frac{1}{2}$ at Dalgetty.

After an easy descent to Inverkeithing, with speed not exceeding 50 m.p.h., the tremendous climb on to the Forth Bridge, 2 miles at 1 in 70, was tackled in great style. Passing Inverkeithing at 24 m.p.h., Shedden used 25 per cent. cut-off until within half a mile of the top; here he opened out to 35 per cent. and *"Cock o' the North"* entered the bridge at 19 m.p.h., again a faster climb than that of the "Pacific," despite much shorter cut-offs and a train 90 tons heavier. *"Cock o' the North"* has a much sharper beat than *"Earl Marischal,"* due largely to the somewhat explosive exhaust of the poppet valves, and going through North Queensferry tunnel and on the Forth Bridge we literally roared. In these conditions, crossing the bridge was a more enthralling experience than ever. Among the many lights on both sides of the Firth, I could just pick out the shipyard at Rosyth where the gallant Cunard liner *"Mauretania"* is being broken up.

And now came a thrilling final burst of speed into Edinburgh. On 18 per cent. cut-off, we accelerated with tremendous rapidity to 68 m.p.h. at Turnhouse, swung over Saughton Junction at 64, and so through Haymarket tunnel and into the heart of Edinburgh. We reached Waverley within 3 seconds of our schedule time, 84 minutes 57 seconds from Dundee. Allowing for the permanent way check near Thornton, our net time was 83½ minutes.

It is difficult to comment adequately on such magnificent locomotive performances as these. As far as weight pulling is concerned, the 2–8–2 engines have solved the difficult problem of the Aberdeen route for many years to come, for it is not possible to handle trains heavier than 530 tare tons at the stations.



A trial run with No. 2001 "Cock o' the North" in the early days of that engine. Its curious appearance at the front is accentuated by the fitting of an indicator shelter for the trial period.

My warmest thanks, and indeed those of every reader, are due to Mr. G. A. Musgrave, Locomotive Running Superintendent of the Scottish Area of the L.N.E.R., through whose kindness I was privileged to make these most interesting journeys.

These L.N.E.R. "Mikados" are of interest as being the first 8-coupled locomotives introduced in this country specially for the operation of express passenger trains. It is just 10 years since the first appearance of the type on the British standard gauge, also on the L.N.E.R. The two engines then built, Nos. 2393 and 2394, were intended to haul mineral trains of 100 loaded wagons. In speed trials between London and Grantham before the building of *"Cock o' the North"* and *"Earl Marischal,"* one of these mineral "Mikados" attained a speed of 65 m.p.h.!

The name "Mikado," originated from the fact that the first 2–8–2 locomotives were built in 1897 for Japan. They were for freight service on the Nippon Railway.

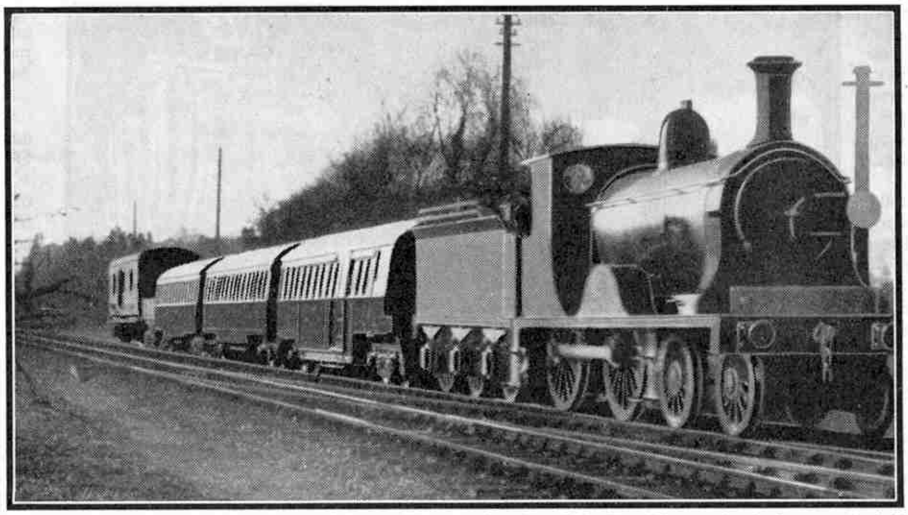
How Southern Stock reaches the "Tube"

By H. C. Raindle

FROM the Southern Railway terminus at Waterloo to the Bank Station in the City there runs a most useful section of the Southern Railway. This was originally the Waterloo and City Electric Railway, but it was amalgamated with the former L.S.W.R. in 1907. It was first opened in 1898, and thus was quite an early "tube" line, its tunnel dimensions and low-built rolling stock being of the restricted size usually adopted for deep-level railways.

In view of its "tube" character, and the number of passengers carried at busy hours, it is commonly referred to as the "drainpipe." Only one class of passengers is catered for, and a curious feature is that tickets are obtained on board the trains themselves.

Thousands of persons travel to the City over the line, but probably few of them ever give a thought to the manner in which the coaches they travel in have reached the "tube," as there appears to be no obvious physical connection at Waterloo. Actually the coaches reach their underground haunts by way of a hydraulic lift situated in the carriage sidings on the Windsor line side of the station, and so out of sight of passengers on the platform.



Waterloo and City rolling stock being hauled up to Waterloo from Eastleigh. The difference in size between "tube" vehicles and those of standard dimensions is very striking.

The rolling stock on this "branch" of the Southern Railway is constructed at the company's own works at Eastleigh. It is also maintained at that place, and on journeys before and after repairs the customary practice is for the coaches to be conveyed as a special train, on their own wheels, of course, between Eastleigh and Waterloo.

The coaches are not numerous, nor are their journeys to and from Eastleigh, so that they are rarely seen above ground. However, I was fortunate enough to obtain some time ago the accompanying photograph of three of these vehicles on their way up from Eastleigh. A close study of this reveals some interesting features in the design of the stock. As they are of "tube" dimensions, their restricted height in relation to the relatively low tender of the locomotive, and the trailing wagon, is very apparent. From the photograph it would seem that the coaches are painted in two colours, but actually they are finished in the standard green of the Southern Railway, the "two-colour" effect being due to the sun.

An unusual feature is that the interior of the stock is not upholstered but plain and rather heavy woodwork is found instead.

The "West Coast Postal"

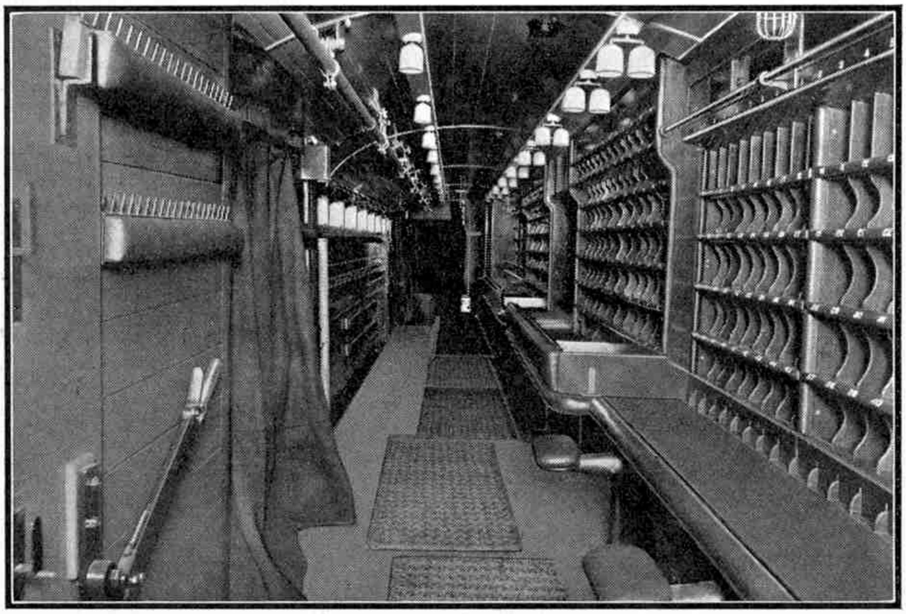
Jubilee of a Travelling Post Office

On 1st of July 1885, there commenced to run between Euston and Aberdeen the special train devoted exclusively to mails that is popularly known as the "*West Coast Postal.*" This famous train therefore celebrated its Golden Jubilee a month or two ago. It was in its exclusively postal character that it differed from the former "Limited Mail," instituted in 1859, for this, in addition to its three sorting carriages and three mail tender vehicles, had carried a strictly limited accommodation for passengers. The partners in the West Coast Route to Scotland, before the formation of the present L.M.S.R. group, were the London and North Western and the Caledonian Railway Companies. Hence the official title for the down special train of "*North Western T.P.O. Night Down,*" or for the up train "*Night Up.*" The letters T.P.O. of course signify "Travelling Post Office," and this exactly describes the purpose of the trains.

The "Postal" was not the first train run exclusively for mails, however, for the G.W.R. had already started a Special Mail between London and Bristol as early as 1855, but this began to carry passengers in 1869. On the other hand, the "Postal" of 1885 was specially designed for the easy and rapid handling of mail and parcel post matter, and in several respects it anticipated the equipment of the "Postal" of to-day. For instance, the vehicles forming it were built with covered connecting gangways, and the doorways were made sufficiently wide to allow of the passage of parcel post matter. The increase in parcel post work, since its commencement in 1883, to some extent led to the institution of the "Postal." It was desired to accelerate the night Mail service from London to the North and Scotland, and for this purpose the sorting of parcels on the way was necessary. Special vehicles were constructed for the purpose, and it was realised that the only satisfactory method of providing the service was for the West Coast companies to place a complete train at the disposal of the Post Office authorities. A revision of the various connections throughout the whole route had to be undertaken. The departure time from Euston was settled at 8.30 p.m., and is the same to-day. The "Postal" then reached Aberdeen at 9.10 a.m., but the arrival is now made at 7.35 a.m., a journey of 11 hrs. 5 min. for the 540 miles.

The "Postal" became a recognised institution on the West Coast Route and, even after a century of postal traffic by rail, the romance of the Mail clings to the 8.30 p.m. from Euston and its corresponding partner in the up direction. The claim of the L.M.S.R. to the title of the Royal Mail Route is a reminder that the first rail-borne mail was carried on the oldest main line portion of the company's line, the Liverpool and Manchester Railway, on 11th November 1830.

The special feature of railway postal traffic of course is the sorting of the mail during the journey and the exchange of mail bags while the train is in motion. In striking contrast to the splendid vehicles of to-day, the first postal sorting carriage, which ran between Birmingham and Liverpool in 1838, was actually a converted horse-box! This was so successful, however, that it was decided on 19th June of that year to establish the Travelling Post Office as a permanent feature, and a sorting carriage was designed for the work, and fitted with apparatus for picking up mail bags at speed.



Inside one of the latest L.M.S.R. Travelling Post Office vans. The lever seen in the left foreground controls the operation of the mail net outside the vehicle. Photograph by courtesy of the L.M.S.R.

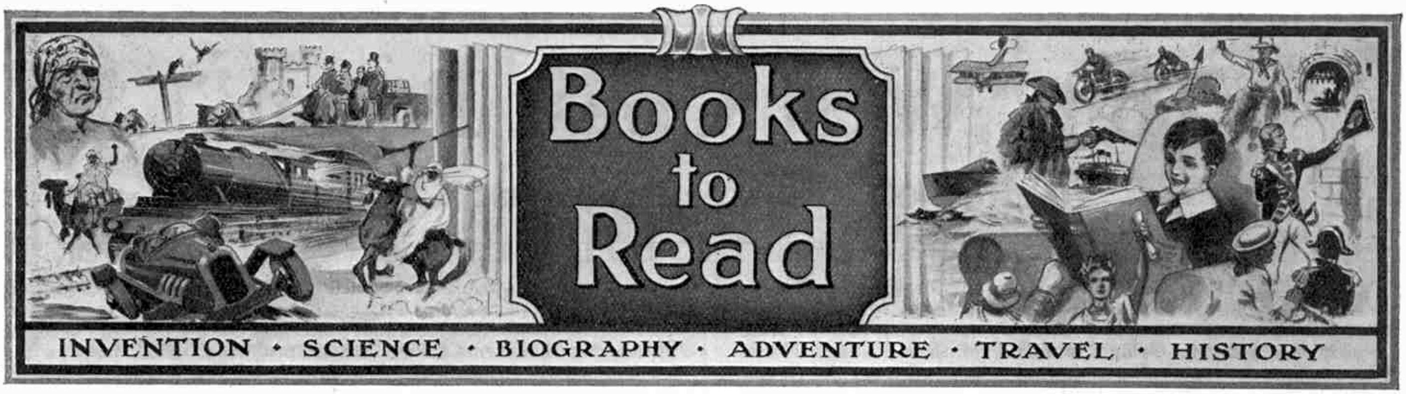
The complete apparatus attached to a travelling Post Office for the exchange of mails includes a hinged net on the side of the vehicle for picking up the pouches in which mail bags are packed, and several spring-governed arms called "traductors" from which pouches to be dropped are suspended. The ground apparatus consists of one or more standards from which the bags to be picked up by the train are hung, and a net to collect the bags from the traductors. The net on the coach normally is folded up flat against a recess in the coach side, and in the recess is an opening into the vehicle that is closed by a sliding door when not required.

When the net is to be used for picking-up purposes it is caused to fall outward by manipulation of a lever inside the vehicle. The net faces the direction of travel so that it literally "scoops" the pouch containing the mail bags from the wayside standard. The sloping bottom of the net conducts the pouch through the opening leading into the coach, the slope being arranged so as to minimise the impact. The traductors project horizontally outward from the coach side when the pouches are suspended on them, but spring back to the vertical portion as soon as the pouches have been collected by the net of the wayside apparatus, which faces the oncoming train.

The general form of the apparatus for collecting and discharging mail bags differs little from that of earlier days. The Post Office sorting carriages that have recently been completed by the L.M.S.R. at Wolverhampton for West Coast duties are much superior to the diminutive stock employed 50 years ago, however. They are 60 ft. long and 8 ft. 8 in. wide, are mounted on steel underframes, and run on steel bogies constructed to the usual L.M.S.R. standards. These new vans have been constructed to the designs of Mr. W. A. Stanier, the Chief Mechanical Engineer of the L.M.S.R.

Every night thousands of letters are picked up by the "West Coast Postal" while the train is travelling at speeds up to 75 m.p.h., and bags of sorted letters are similarly released from the train, to be picked up by postmen waiting at the lineside nets. The first mails are exchanged at Wembley, 8 miles out of Euston, and 10 such exchanges are made in the first 158 miles between Euston and Crewe. At Bletchley is concentrated mail matter from Oxford, Cambridge, Bedford and other towns, so that some 20 pouches or so are collected by the "Postal" from a row of ground standards. A halt is made at Rugby to pick up the Eastern Counties mail, and again at Tamworth, an important centre for mail traffic, where mails from Lincoln, Nottingham, Derby and the Midland districts are received by the "Postal" from the Midland station overhead.

At Crewe a stop is made to pick up mails from the West of England, the Black Country and Wales, and at the same time mail matter for Ireland is transferred into "*The Irish Mail.*" Mails from Liverpool, Manchester and East Lancashire are taken up at Preston in exchange for sorted mails for East and North Lancashire. At Carlisle the English staff are relieved by the Scottish sorters, and at Carstairs the "Postal" is divided. The front portion proceeds to Aberdeen, calling at Stirling and Perth. The middle portion runs to Glasgow and the rear is taken to Edinburgh.



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

"Resident Birds" "Migrant Birds"

By E. F. M. Elms
(Thornton Butterworth. Each 2/6 net)

These two handy little volumes are included in the "How to Know Them" Series, and have been written to enable their readers to recognise British birds on sight. The first deals with birds that are always with us, and the second with our summer and winter visitors, and both follow a simple scheme that the author has worked out for ready identification. The kind of country in which the different birds are met with is the basis of the scheme, their habitats being divided into five groups, comprising respectively gardens and cultivated districts, woodlands, commons and moorlands, streams and marshes, and finally the sea shore. The birds frequenting each region are further classified by colour and size, so that a mere glance at an unknown bird considerably narrows the problem of identifying it. The final choice lies between two or three, or at most seven different birds. For example, a black-looking bird of medium size frequenting a garden is seen to be either a blackbird or a starling. Reference to the descriptions of these given in the book itself then quickly resolves all doubts.

The books are no less useful to those who wish to have in handy form concise but satisfactory accounts of the appearance and habits of the members of our bird population. They are well illustrated by means of photographs showing birds on their nests or in natural surroundings. Excellent examples of these illustrations are the photograph of an angry black-headed gull reproduced on this page from *"Resident Birds,"* and that of the common sandpiper, from *"Migrant Birds,"* shown on the opposite page.


An angry black-headed gull. (From "Resident Birds" reviewed on this page.)

"Wayside Trees"

By Forster Robson
(Thornton Butterworth. 2/6 net)

This little volume is No. 1 in the "How to Know Them" Series already referred to on this page. Its purpose is to enable all who delight in trees to name them and for this purpose these are classified in accordance with the general form of their leaves. This practice may be wrong botanically, but it has the advantage of providing a simple means of identification.

The first chapter explains how the leaves of trees differ in size and shape, and in the characteristics of their edges; and comparison of a leaf from an unknown tree with the examples of each type given by the author leads almost directly to the name of the tree itself. Confirmation of course must then be sought in the fascinating descriptions of trees that form the bulk of the book. These give full details of the general appearance of each tree at different seasons, the manner in which its branches diverge, the markings on its bark, the stages in the unfolding of its buds and other matters of interest. The descriptions are concise and will be specially useful to those who are attracted by trees, but have little time to devote to efforts to learn to know them better.

The illustrations include a coloured frontispiece showing a beech tree in Autumn, and a large number of drawings made by the author from actual specimens.

"British Scientists of the 19th Century"

By J. G. Crowther. (Kegan Paul. 12/6 net)

Mr. Crowther has selected five famous scientists of the last century, and has given full and interesting stories of their lives. He has taken care not to restrict his accounts to the scientific work by which they are chiefly known, but also has tried to show how their careers were affected by the times in which they lived. The result has been to throw new light on the men themselves, and on their work, for in each case we see how the circumstances in which they were brought up moulded their characters and realise that their researches were affected by their surroundings, and not inspired only by love of knowledge.

The five scientists whose careers are described are Davy, Faraday, Joule, Thomson and Clark Maxwell. The selection almost covers the 19th century, for Davy and Faraday flourished in its early years, and the political and social ideas of the French Revolution can be traced in their careers. Davy is revealed as a real genius, and the first man to show how important science was in everyday life. The story of Faraday, Davy's assistant and the founder of the modern electrical industry, is perhaps the most fascinating in the book, and it is easy to see why to this day his reputation as the greatest of all experimental physicists remains unchallenged. Of the remaining subjects of these short biographies, Thomson, afterwards Lord Kelvin, is perhaps the best known, but all contributed largely to technical advances during the century, as well as to pure scientific knowledge; and Clark Maxwell, the subject of the final essay in the book, will always be remembered as the man who foretold the discoveries that have given us wireless.

The book is not easy reading, especially for young people, but will well repay study by all who are interested in scientific men and their work, and especially by those who wish to realise how closely scientific work is connected with social life and industry.

"West Highland Steamers"

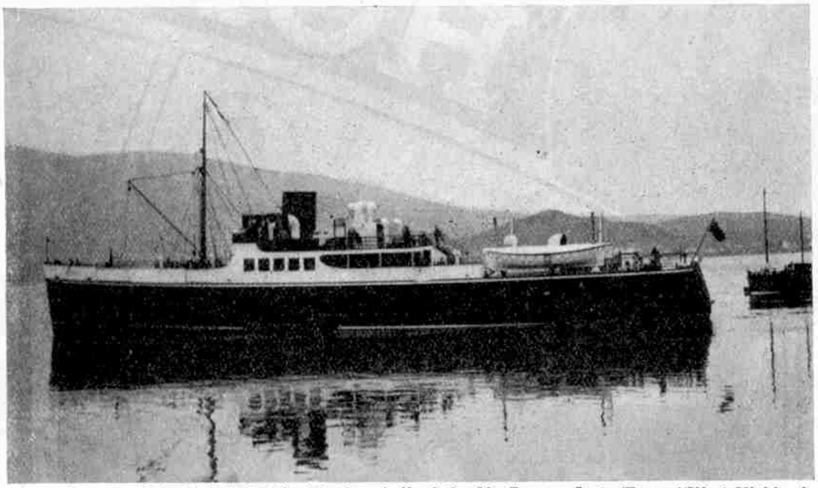
By C. L. D. Duckworth and G. E. Langmuir
(Tilling. 6/- net)

Many readers of the *"M.M."* no doubt have visited the West Highlands, reaching them by steamer from the Broomielaw, Glasgow, or voyaging to and fro between the islands of the Hebrides. To them and to thousands of other holiday makers the steamers of the MacBrayne Line are of never failing interest, for they have served the needs of the population of that wonderful district, and of the thousands who flock thither in the holiday season, for nearly a century. A surprising number of notable vessels have been engaged on this service, and at times the fleet has been of such a varied and interesting nature as to merit the description of a floating museum of modern engineering.

The authors of this book are West Highland enthusiasts and have gone to considerable trouble to trace the stories of the 95 vessels that at different times and for varying periods have been included in the MacBrayne fleet since 1851, the date chosen for the beginning of their survey. Each vessel is briefly described in turn and interesting features of its machinery, its accommodation and its service in the West Highlands are given. Some of these vessels have had remarkably lengthy careers. One of the most remarkable in this respect was the *"Edinburgh Castle,"* later re-named *"Glengarry,"* a veteran with 76 years' service to her credit.

Younger readers will be particularly attracted by the details given of later steamers, and the series ends with the *"Lochfyne"* and the *"Lochnevis,"* the two handsome and luxurious Diesel-electric vessels, with speeds of 16½ and 15 knots respectively, that now maintain important services. The *"Lochfyne,"* built in 1931, was the first British passenger ship to be fitted with Diesel-electric machinery. The *"Lochnevis,"* which is illustrated on this page, was launched last year.

The value of the book to enthusiasts is increased by a carefully compiled table giving the leading measurements of all the vessels dealt with. A coloured frontispiece shows the paddle steamer *"Columba,"* a veteran of 57 years' service, and there are plates showing 26 other MacBrayne vessels.



The twin screw Diesel-electric ship "Lochnevis," of the MacBrayne fleet. (From "West Highland Steamers," reviewed on this page.)

"Pioneering in the Prairie West"

By W. C. Pollard
(A. H. Stockwell Ltd. 3/6 net)

In this book the author endeavours to give a short history of the colonisation of the Prairie West of Canada. He begins in the 17th century, when the Hudson's Bay Company governed much of the region, and describes the dangers and difficulties of the hardy pioneers who lived in the backwoods of what are now the great provinces of Ontario, Manitoba and Alberta. The construction of the Canadian Pacific Railway gave a great impetus to colonisation, and the author deals fully with this phase of Canadian history, following it up with a brief summary of the progress of Canadian government. The book is illustrated with numerous half-tone plates.

"The Background of Geography"

By M. Whiting Spilhaus, F.R.G.S. (Harrap. 7/6 net)

So long as geography is regarded only as a subject to be taught in schools, it will remain unattractive. It is a subject that is full of romance, however, and this has been realised by Mrs. Spilhaus, who in this excellent book sets out to tell the story of the discovery of new lands. The book actually gives more than its title suggests, for it supplies a background to history as well as geography and shows what forces have been at work through the ages to impel Man to travel far and wide by land and sea.

The common sandpiper. (From "Migrant Birds" reviewed on the opposite page.)

The story of exploration is a very old one, and many adventurous voyages and journeys must have been carried out long before records of them could be preserved. In the book we first meet with the races who lived in Mesopotamia and in Egypt in the very dawn of history, and the Phœnicians and early Greek navigators who gradually extended knowledge of the world. The Romans carried this work on, and afterwards it was continued by the Vikings and others. The broadening influence of the voyages of the Crusaders was followed by the toilsome journeys of missionaries and of Marco Polo, the famous Venetian traveller, to Central Asia and China, but the beginning of the great era of exploration came in the 15th century with the voyages southward along the coast of Africa that were inspired by Prince Henry of Portugal, whose achievements have earned him the title of Prince Henry the Navigator. These voyages eventually opened up a sea route to India and the spice islands of the East Indies, but the greatest achievement of this period was the first voyage of Columbus, which revealed a new world to Western eyes. It is surprising how little we really know of this great discoverer, but the few details available are told admirably in the book, which shows how Columbus overcame the difficulties strewn in his path and vividly describes his memorable voyages across the Atlantic Ocean.

Spanish and Portuguese explorers followed the example of Columbus, and in the search for new lands rich in gold and natural products, were rivalled by men of other nations. Their voyages aroused the greatest interest and excitement, and the stories of the aims and adventures of such men as Magellan, the leader of the first expedition to circumnavigate the globe, Vasco da Gama, Drake, Frobisher and others, form the subjects of fascinating chapters in the book. Drake's great voyage round the world and the raids by him and other Elizabethan seamen on Spanish possessions in America are fully dealt with, and the spirit of these famous adventures is well conveyed.

The later voyages in which Australia, New Zealand and the South Sea Islands were discovered and explored are admirably dealt with, and the exploits of lesser men who helped to extend our knowledge of the world also are described. The book thus gives a complete survey of exploration by land and sea from the very earliest times.

The story is simply and attractively told throughout and is well illustrated by portraits of famous travellers and numerous drawings of the vessels in which the great navigators of all ages sailed. In addition there are fascinating old maps that show how our knowledge of the world grew, together with modern maps on which to follow the voyages dealt with.

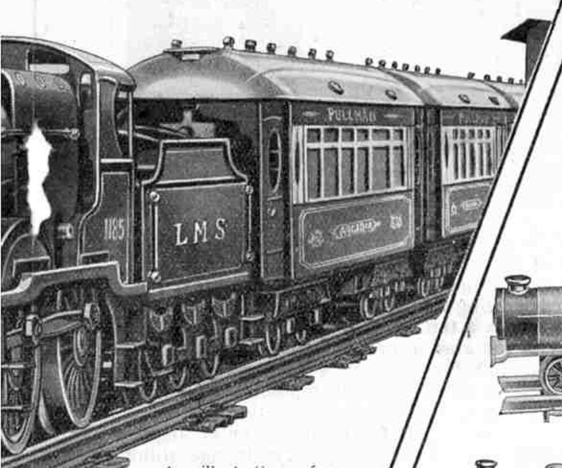
"The Fleeters"

By Walter Wood. (Warne. 5/- net)

The dangers and hardships of life in the North Sea trawling fleet are vividly described in this excellent story. The appalling discomforts the trawler crews have to face in a winter gale, and the tense anxiety experienced during a prolonged fog, have seldom been so graphically depicted. Most thrilling of all is the description of "ferrying," that is the conveyance in small boats of the trunks of fish from the trawlers to the steam carrier waiting to take them at full speed to Billingsgate Market. In bad weather this is a perilous task, and in spite of the wonderful skill of the men many lives are lost. After reading this book one wonders how men can be got to endure so much for so miserably poor a reward.

...ISH and ...RANTEED TRAINS

...D CLOCKWORK



An illustration of a Hornby No. 2 Special Train Set, hauled by a Hornby No. 2 Special Locomotive, the latter a true-to-type model of the real L.M.S.R. Standard Compound Locomotive.

...ature Railways

...ckwork Trains are such great
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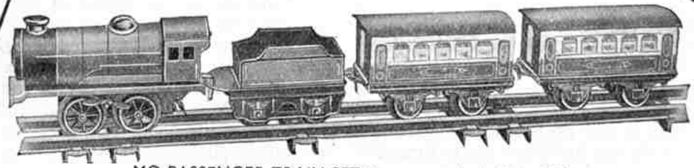
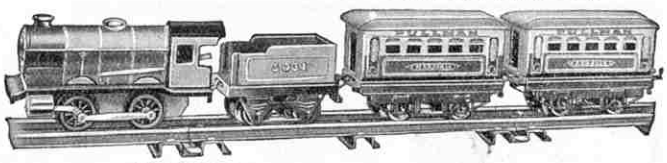
A Selection of HORNBY CLOCKWORK TRAIN SETS



MO PASSENGER TRAIN SET (non-reversing). Price **5/6**



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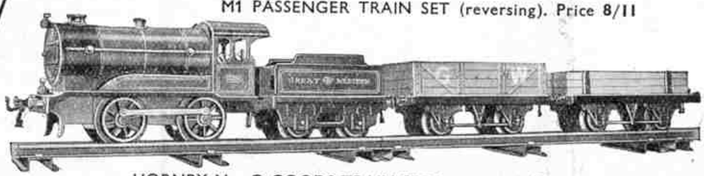

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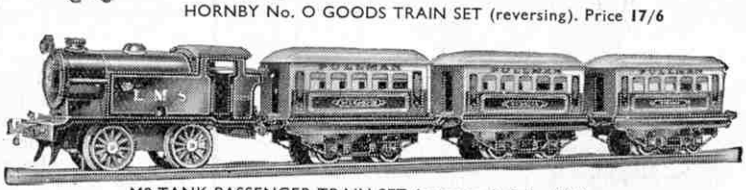
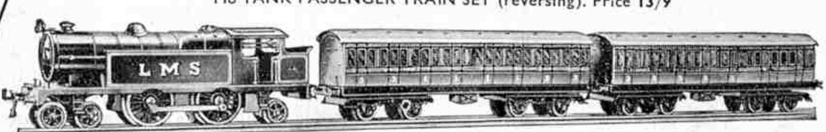


M3 TANK PASSENGER TRAIN SET (reversing). Price **13/9**



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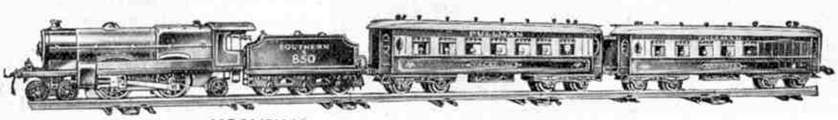
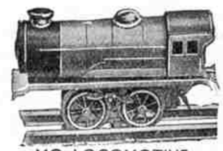


HORNBY No. 3C PULLMAN TRAIN SET (reversing). Price **62/6**

PRODUCT of MECCANO LIMITED LIVERPOOL

A selection of HORNBY CLOCKWORK LOCOMOTIVES



MO LOCOMOTIVE
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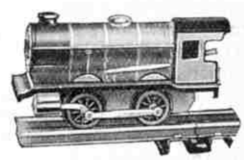

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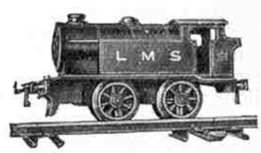

M3 TANK LOCOMOTIVE
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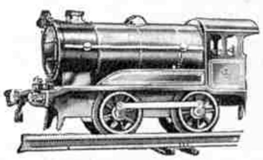

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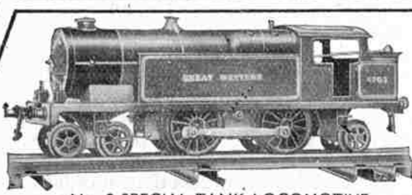

No. 2 SPECIAL TANK LOCOMOTIVE
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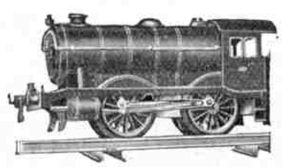
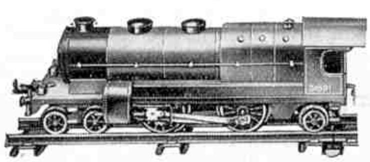


No. 1 SPECIAL LOCOMOTIVE
(Reversing). Price **17/6**



No. 3C RIVIERA "BLUE" LOCOMOTIVE
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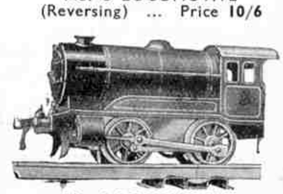

No. 1 LOCOMOTIVE
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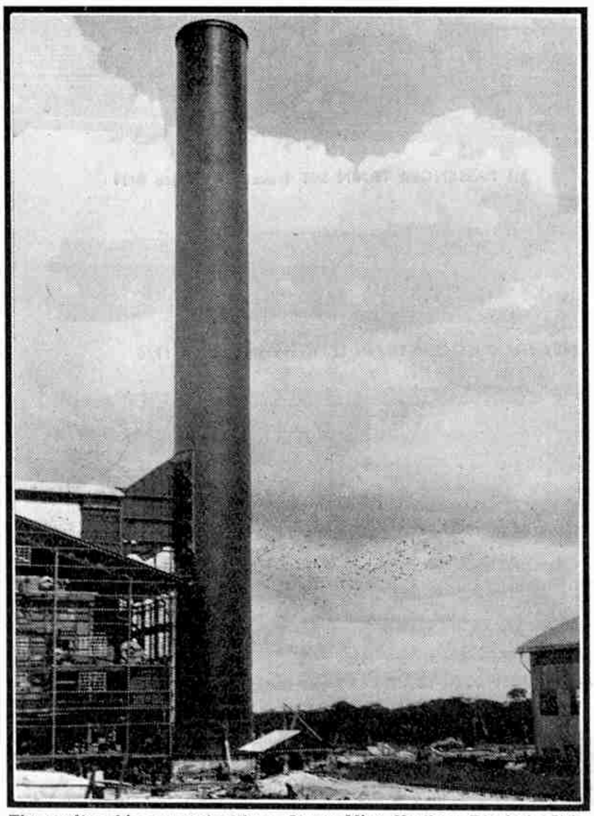
...NNS ROAD, LIVERPOOL 13.

A Giant African Chimney

The illustration on this page shows the smelter chimney at Nkana Copper Mine, in Northern Rhodesia, to which reference is made in "The Story of Copper" on page 580 of this issue. This chimney is made entirely of steel and is the largest in Africa, its height being 300 ft. and its diameter 30 ft. Its purpose is to carry away fumes from the reverberatory furnaces used in the preliminary treatment of the copper ore, and part of the building in which these furnaces are housed can be seen on the left.



The smelter chimney at the Nkana Copper Mine, Northern Rhodesia. It is 300 ft. in height and 30 ft. in diameter, and is the largest chimney in Africa.

Buried Rivers and Drowned Valleys

To speak of a buried river flowing unseen in the depths of the earth conjures up visions of water pouring through passages and caverns worn out of limestone, but there are also buried rivers that once flowed on the surface and are now deeply hidden while apparently striving to remain in their ancient beds. One of these is the Genesee River, in the State of New York. It is believed that at one time this flowed through deeply carved canyons that eventually were filled in by silt and boulders brought down by the glaciers of the great Ice Age. A stream now flows over these deposits, but far below them there is still the ancient river, the flow of which is maintained by water percolating through the material that has filled the ancient canyon.

It is estimated that the underground flow in the old bed of the Genesee is more than 1,000 million gallons a day, and the city of Rochester actually draws its municipal water supply from wells that tap this subterranean stream. There must be other buried rivers of this kind, and it is suggested that efforts should be made to find them and to make use of the water in them before going further afield to find sources of the more usual kind.

In contrast to buried rivers there are many drowned valleys in the world. These are valleys that have subsided until water from the sea or a great lake has flowed over them. The course of the Hudson River below New York is an excellent example. At one time the coast line there was farther to the east than it is now and the valley through which the Hudson River then flowed can be traced under the waters of New York Harbour and farther out to sea.

The Lowest Temperature on Record

I wonder how many of my readers know that a piece of steel becomes hotter when it is magnetised, and cools when its magnetism is destroyed. These changes in temperature cannot be detected by feeling the metal, or even with the aid of a thermometer, for they are too small, but amazingly low temperatures can be reached with their aid. The plan followed is to magnetise a suitable metal by surrounding it with a strong magnetic field and to remove the heat generated in it by cooling in liquid hydrogen or helium, the temperature of which of course is already very low. The metal is then insulated, so that heat cannot pass into it and the magnetising field is removed, the result being a further lowering in temperature.

By this and other methods a temperature as low as .005 deg. C. above what scientists call the absolute zero has been reached. The absolute zero is 273 deg. C. below the better known zero on the Centigrade scale, at which ice melts; and it is impossible to imagine how cold it would be at a temperature of a mere fraction of a degree above it, for even the polar regions are far hotter. Many strange things happen at these incredibly low temperatures. One of the most interesting is that metals seem to lose all their powers of resistance to the flow of electric current. These super-conductors are of no practical importance at present, for the expense of maintaining sufficiently low temperatures is too great, but further experiments along these lines may point the way to valuable discoveries.

The Earliest Known Toll-Bar

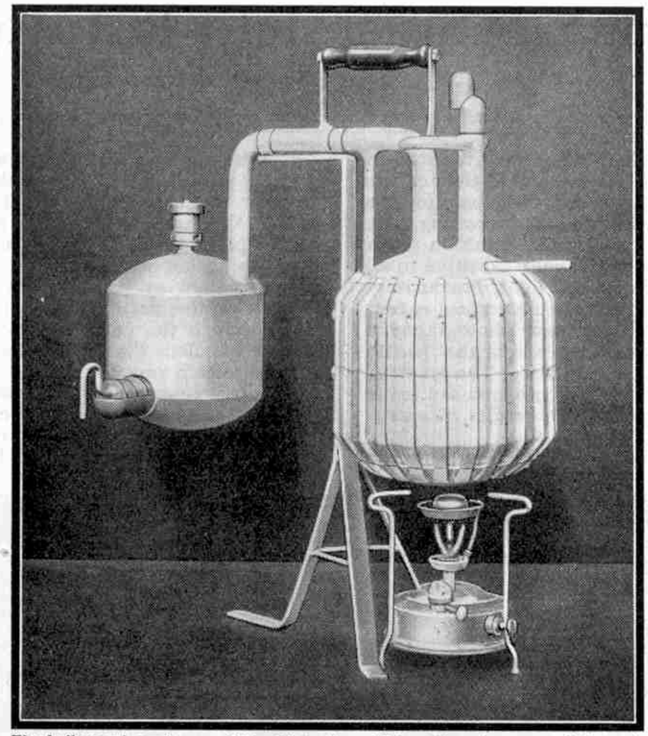
The proposed abolition of bridge tolls in Great Britain will bring to an end a system that has been in operation for more than 600 years. The payment of tolls on roads or bridges began at a time when there were no highway authorities or highway rates, and the idea behind their introduction was that those who used the roads or bridges should pay for them. The earliest known toll-bar was set up in 1346 by King Edward III on what was known as the "Hollow Way," along which pilgrims and worshippers travelled to St. Anthony's Chapel, Highgate Hill, London, but in those days road development was very slow and it was not until nearly 300 years later that a toll gate appeared on a main country road.

Toll-gates played a great part in the romance of the road before the coming of the railway, but they could scarcely have been appreciated by travellers, for there seems to have been no control over toll-gate owners, who charged more or less what they pleased. On the Great North Road the toll for a coach was 6d., for a wagon 1/–, for a horse 1d. and for a score of pigs 2d. Much higher scales prevailed in the Exeter district, where a Trust owning toll-gates charged 2/– each for coaches or carriages drawn by six horses. One peculiar feature of the toll charges was their variation with the breadth of the rims of the vehicles on which they were paid. In the case of a timber wagon, the toll was 4/– if this breadth were 6 in. or more, but was raised to 16/– if the wheels were of less than standard width. The purpose of this increase was to protect the road surface from injury by encouraging the use of wheels that spread the load over a large area. Double charges usually were made on Sundays, but the Exeter Trust, notorious for its high rates, actually halved the fees on that day. The last toll-gates in use on a public highway in Great Britain were on the Holyhead Road, Anglesey, and were abolished as recently as November 1895.

A Novel Domestic Freezing Plant

The upper illustration on this page shows part of an interesting home freezing plant, the outstanding feature of which is that there are no moving parts of any kind. The plant is known as the "Polar" portable refrigerator and comprises an insulated storage cabinet in which the food to be preserved is placed, a refrigerating unit and stand, a water tank and a heating lamp of the Primus type.

The refrigerating unit is made up of a sealed boiler and a condenser, which are connected by a pipe. Inside the boiler is a refrigerant consisting of a special metal that has a low melting point. To prepare the apparatus for freezing, the condenser is immersed in cold water in the tank provided, and the boiler is heated by means of the spirit lamp for about 75 minutes. The boiler is then immersed in the cold water tank until frost appears on the outside of the condenser, which occurs in about 15 minutes. The refrigerator is then ready to do its work and is removed from its stand and placed with the condenser inside the storage cabinet, the boiler remaining outside. The apparatus will maintain a very low temperature inside the cabinet for about 24 hours and at the end of that time the heating process has to be repeated. If desired ice cubes can be made by placing water in a special ice tray that slides into a tunnel provided in the condenser.

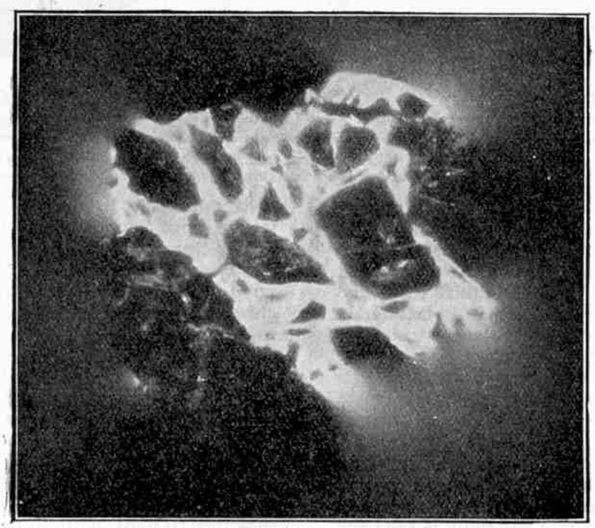


The boiler and condenser of the "Polar" portable refrigerator, a novel domestic freezing plant described on this page. Our photograph is reproduced by courtesy of the Liverpool Refrigeration Co. Ltd.

The explanation of the working of this refrigerator is simple. When the boiler is heated the refrigerant in it is vaporised and passes over into the condenser. Placing the boiler in water to cool it causes the pressure inside to be reduced, and the refrigerant in the condenser again begins to change into vapour and some of this passes back into the boiler. This evaporation requires heat, which is absorbed from the surroundings of the condenser, and as this is fitted into the cabinet, the air and everything that is stored inside the cabinet are thoroughly cooled.

Radium from Arctic Canada

The days of romance in the search for precious stones and metals are not yet over, and prospectors will continue to penetrate into every part of the globe, from the polar regions to the deserts and forests of tropical lands, in search of gold, silver, diamonds and other valuable natural products. The most costly of all the precious metals to-day is radium. This of course was unknown to the pioneers of the gold rush days in California and Australia, but is now eagerly sought, and intense interest was aroused in 1930 by the revelation that in the far north of Canada there were large deposits of pitchblende richer in radium than any ore of this kind previously discovered. The discovery was made by Gilbert Labine, a prospector who has given his name to the point, jutting out into Great Bear Lake where the veins of pitchblende were unearthed. The site was practically an unknown wilderness, so far north that the ground is perpetually frozen to within a short distance of the surface, but aeroplanes give ready access to it practically throughout the year and works have been erected in which to concentrate the ore, ready for despatch to the refinery.



Radiograph of a piece of pitchblende from Labine Point, in northern Canada showing radioactive material between rock fragments. Photograph by courtesy of "Sands, Clays and Minerals."

The lower illustration on this page is a radiograph of a piece of ore from one of the veins of Labine Point. The black section of the mass consists of rock fragments, and the brighter parts show where the pitchblende carrying the radium has filled in the spaces between them. This piece of ore has been made to write its own story on the photographic plate, for it is the rays from the pitchblende that have acted on the emulsion. The ore from this vein is remarkable for the intensity or "fire" shown in its radiographs.

The news of Labine's discovery caused prospectors to flock to the district in the hope of making other rich finds, and deposits of radium ore have been discovered in several places. A curious story is told of one of these discoveries. It is said that the Indians of the district had often noticed a peculiar smell when camping at Labine Point. They declared that they had noticed a similar smell near Beaverlodge Lake, about 100 miles to the south, and offered to point out the spot to a prospector. This they did, but as it was mid-winter nothing but snow was visible on the ground. When this was cleared, however, the vein of pitchblende was speedily discovered.

Telling the Time by the Tide

Every reader of the "*M.M.*" who has visited the seaside knows that in general there are two tides a day, with intervals of a little more than 12 hours between them. The effect of this is that each day's tides are a little later than those of the previous day. The tides do not behave in this regular manner at all places, however. For instance, there is only one high water and one low water every day at Pensacola, Florida.

Even more surprising tides are experienced at Tahiti, in the Southern Pacific Ocean, where high water is nearly always a little after noon and midnight, and low water, both morning and evening, always occurs about six o'clock. There the tide acts as a kind of clock, and in fact boatmen at Tahiti have been known to remark that they could tell the time of the day by simply looking seaward to see where the water stood. The tides are equally regular at Tuesday Island in Torres Strait, which divides Australia from New Guinea, where high water is about 11 o'clock, morning and evening. Both tides are of comparatively low range, that at Tahiti being only 10 in., and it is believed that in each case the tidal effect of the Moon is cancelled out. The pull of the Sun alone is therefore responsible for the tides at these places and of course these must then show the regularity of a clock.

The Greatest Highway in the World

The greatest highway in the world will be about 11,000 miles in length and will run from Alaska and Canada in the north to Chile, the Argentine and Brazil in the south. It is not yet completed, but for 4,500 miles of its length is now passable by motor cars in all weathers, and roads suitable for traffic in dry weather cover the greater part of its route. The road will pass through a remarkable variety of scenery, from Alaska and northern Canada, with their snow-covered mountains, to the jungles of Colombia and Brazil, the sea coasts of Peru and Chile, and the broad expanse of the Argentine pampas. The magnificent heights of the Andes will be passed in its course, and stretches totalling 1,000 miles in length will be at heights varying from 5,000 ft. to 10,000 ft.

The new road will be of the greatest value to citizens of the United States who live in Panama, where 250 miles of improved road have been constructed. The section to be built in Central America will give access to places that at present can only be reached by aeroplane, or by a railway journey from a seaport.

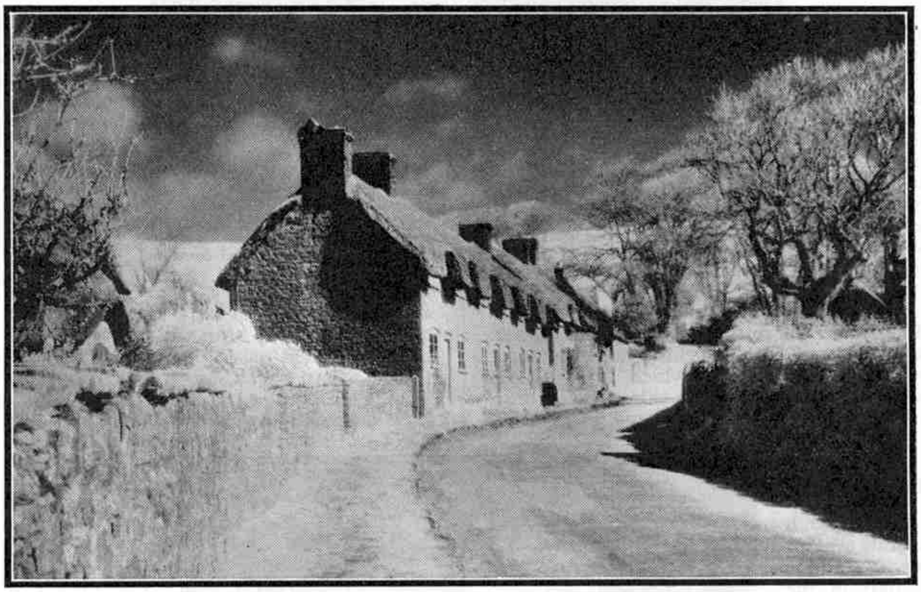
Taking Photographs by Invisible Light

Films Sensitive to Infra-Red Rays

By K. G. Bilbe

READERS of the *"Meccano Magazine"* who are interested in photography are often disappointed by the result of their efforts to photograph an interesting scene that is full of colour, for the prints they obtain are comparatively dull and uninteresting. The reason for this is that the chemicals forming the emulsion of an ordinary photographic plate or film are not equally sensitive to all colours, and in fact are blind to certain rays of light. Fortunately plates and films that correct these inequalities to a certain extent are now available and are largely used by amateur photographers. It is even possible to take photographs in invisible light that has no action whatever on the ordinary photographic plate. The amateur can obtain the equipment necessary for this purpose, and can make use of it in an ordinary box type camera with results of extraordinary interest.

The explanation of this marvel is to be found in the nature of the light ordinarily used in photography. Whatever its source, this is a mixture of different colours. In the case of sunlight, these can be seen in the rainbow, in which their order is red, yellow, green, blue, indigo and violet. This band of colour forms what is called a spectrum, and it can be reproduced by passing a ray of white light through a glass prism, when the rays of different colours are bent or refracted through different angles, the violet rays being bent more than the blue rays, and both refracted through a greater angle than the green rays. Red rays undergo the least bending. The band of colour that is revealed to us by these means is only a part of the entire spectrum, however, for there are rays of invisible light that are bent through a greater angle than the violet rays, and for this reason are described as ultra-violet. In addition there are other invisible rays at the opposite end of the spectrum. These are bent through a smaller angle than red rays on passing through a prism, and the name given to them is infra-red. It is the invisible rays beyond the red end of the spectrum that are now turned to special account in photography.



A scene in the village of Kimmeridge, Dorset, taken by infra-red light. The grass and the young foliage of the trees appear white, as if covered with snow, but the white clouds show up well against the dark sky.

The two kinds of invisible rays differ greatly. The ultra-violet rays have wavelengths much shorter than those of visible light, while the infra-red rays have longer wavelengths. The former strongly affect the emulsion of ordinary photographic plates and films, and as they predominate in daylight, they contribute very largely to the image formed on plates of this type. Of the colours of the visible spectrum, blue and indigo are most active in this respect, but yellow, orange and red rays are useless. The result is that an ordinary photograph fails to record relative colour tones correctly, for in it all yellows, oranges and reds appear as black, most blues are shown as white, and greens are not given their proper tone.

Naturally efforts were made to produce plates that were sensitive to the three ineffective colours, but none of these was really successful until the discovery was made that the addition of certain dyes to the emulsions with which plates are coated has the desired effect. This discovery was made accidentally, for H. W. Vogel, the scientific photographer who was responsible for it, added a yellow dye to the emulsion of one of his plates in an effort to overcome other difficulties. Many dyes have now been tested, and the result of experiments has been the production of the well-known panchromatic plates and films, which give more accurate renderings of colour in black and white than was formerly thought possible. With the new films amateur photographers find that the skies of their pictures are no longer mere dull, white patches, but instead have a darker and more pleasing tone, often with sufficient correction to show up white clouds against the pale grey that on their prints represents the blue of the sky.

Although the panchromatic plate is more sensitive to the full range of colour than the ordinary plate, it is still necessary to tone down certain rays in order to obtain full colour correction. This is done by fitting glasses of various colours, known as light filters, in front of the camera lens. The exact colour required depends on the plate used, and for perfect results it is necessary to have the plate and the filter accurately adjusted to each other.

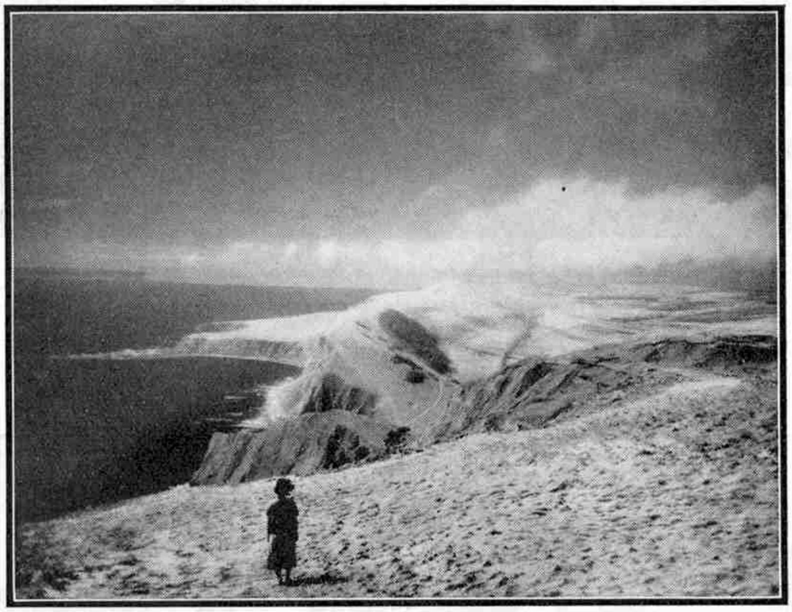
The accompanying photographs of Hornby wagons show vividly the different effects produced on the two kinds of plates. The "Shell" Petrol Tank Wagon provides what is perhaps the most striking example. On an ordinary plate this has an unpleasant black appearance, because the emulsion is practically unaffected by the light reflected from it. In the photograph taken on the panchromatic plate, however, it has its proper tone value, and appears much brighter. Details also are rendered in a much more satisfactory manner. For instance, in the ordinary photograph the black lining of the word "Shell" is indistinguishable from the red background, but is clearly visible in the print from the panchromatic plate.

The Seccotine Wagon and the Side Tipping Wagon included in the two photographs are blue. In the ordinary photograph they appear white, however, and it is only in the print from the panchromatic plate that they have their correct appearance in relation to the bright red "Shell" Petrol Tank Wagon. The Seccotine Wagon is very interesting. To the eye its yellow roof has a lighter appearance than its blue sides. This appearance is faithfully reproduced when a panchromatic plate is used, but on the photograph taken with an ordinary plate the sides appear to be far lighter in tone than the roof, and indeed seem almost as light as the white letters on them.

Readers unfamiliar with panchromatic plates may wonder how these are handled in the dark room, in view of the fact that they are sensitive to light of all kinds. This point has not been overlooked. A screen transmitting a safe green light has been introduced, but light transmitted by it must not be allowed to fall on the plate directly or to act for too long a period. In addition, panchromatic plates can now be obtained that have a de-sensitising compound in the backing. These are developed in total darkness for definite periods with solutions of known strength, and at the end of development may be examined for a few seconds by the faint light of a candle placed a few feet away.

Even in photographs taken on panchromatic plates, the comparative brilliance of the sky seems to make correct exposure for all sections of a picture impossible. The use of orange and pale red filters has brought about an improvement, however. These cause over-correction and give more contrast, darkening the skies further without lightening the greens of the landscape too much.

A striking result of this development was the discovery that the use of filters of reddish tone clarifies distant scenes to a remarkable extent. There is always a certain amount of dust and moisture in the air, and the tiny particles of which these consist scatter light and thus form a kind of screen that makes distant objects obscure to the eye, and far more so to the ordinary photographic plate. Red rays penetrate this screen more easily than blue rays because of their greater wavelength. Sand will not pass through a riddle if the size of the openings in it is less than that of the grains. Similarly, light cannot pass directly through a thick layer of mist if its wavelength is less than the diameter of the particles of dust and moisture, for then much is lost by reflection in various directions from the surfaces of the particles. Violet and ultra-violet rays, which constitute the greater proportion of the light affecting an ordinary photographic plate, are therefore scattered by reflection from these tiny particles. On the other hand, a camera loaded with a plate sensitive to red rays, and focussed upon a distant view through a reddish filter, can see further than the eye, and in these circumstances the camera records views that are only dimly seen, or even are invisible, and cannot be photographed with an ordinary plate.



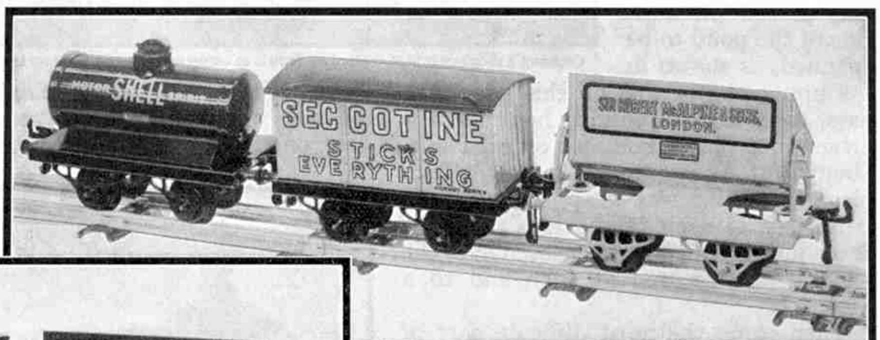
An infra-red photograph taken from the summit of Rings Hill, Dorset, showing the dark colour of the sea. The land shows the curious snow-covered effect characteristic of infra-red photography.

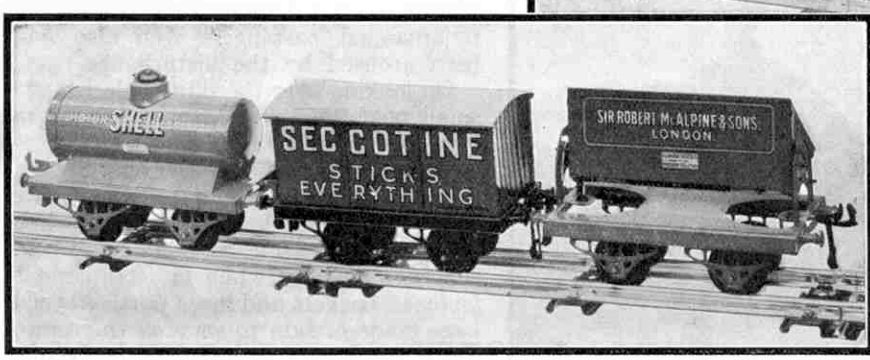
Infra-red rays are even more effective in piercing through a screen of haze, for they are of greater wavelength; and plates that are sensitive to them have been produced by taking advantage of the development of special dyes. Their use in conjunction with red filters gives splendid opportunities of taking long-distance photographs that otherwise would be impossible. The filters used are so dense that they seem to be opaque, and the combination is almost blind to all but the invisible rays beyond the red end of the spectrum.

It seems strange that a picture of any kind can be made with a filter that is practically opaque, but the invisible rays transmitted do their work perfectly when the film employed is one that has been specially prepared for the purpose. Infra-red sensitive films in standard sizes are now available, and with one of these in a small reflex camera of 4-in. focal length, to which a suitable filter was attached, I have obtained excellent photographs with shutter speeds ranging from 1/25 sec. to 1/40 sec., the exposure of course depending on the lens aperture used. I could see nothing whatever on the screen of my reflex camera when the filter was in position, and it was necessary to complete focussing operations before fitting it. An interesting point is that, because of their greater wavelength, infra-red rays are brought to a focus at a point very slightly behind the corresponding focal point for rays of visible light, but this does not give rise to any difficulty when lenses of medium or short focal are employed.

Two of my infra-red photographs are reproduced with this article, and it will be seen that they are strange in appearance in comparison with ordinary photographs. The illustration on the opposite page appears as if it had been taken after a heavy snowfall. This is not the case, however, the explanation being that the green colour of grass and of young leaves of Spring appear white in photographs of this kind. Their green colouring matter, a complex chemical known as chlorophyll, is responsible for this strange effect, for it does not absorb infra-red rays, but strongly reflects them; and masses of foliage and vegetation in which it is present become relatively over-exposed in photography. The darker green colour of coniferous trees is reproduced in tone similar to that shown on an ordinary photograph, but the blue of the sky appears so dark that white clouds stand out in strong contrast to it.

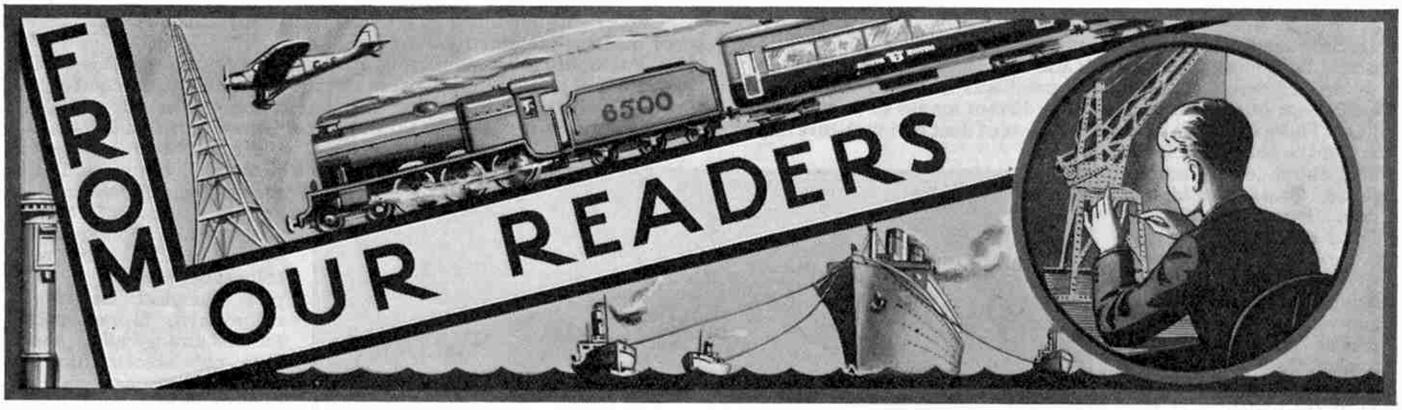
The cliffs in the upper photograph on this page have the usual snow-covered appearance, and the contrast of white clouds and dark sky again is reproduced. A very interesting feature of this photograph is that the stretch of sea included has a darker tone than that of the sky. The low temperature of the water is largely responsible for this. Infra-red rays are heat-producing, and indeed were revealed to us by the discovery, made as long ago as 1800 by Sir William Herschel, that a thermometer placed beyond the red end of a spectrum shows a rise in temperature. All hot bodies radiate infra-red rays, which are given out freely even when the temperature is below that required to produce a visible glow; and can now be photographed by means of the invisible light from them. For instance, photographs have been secured of hot electric irons that are in complete darkness and are invisible, and a kettle full of hot water has been used in similar photographic experiments.





Above is a photograph of three Hornby wagons taken on an ordinary plate. The bright red of the "Shell" Petrol Tank Wagon appears black, and the blue of the Seccotine and Side Tipping Wagons has photographed as if it were white. In the photograph on the left, taken on a panchromatic plate with a filter, each colour is correctly rendered.

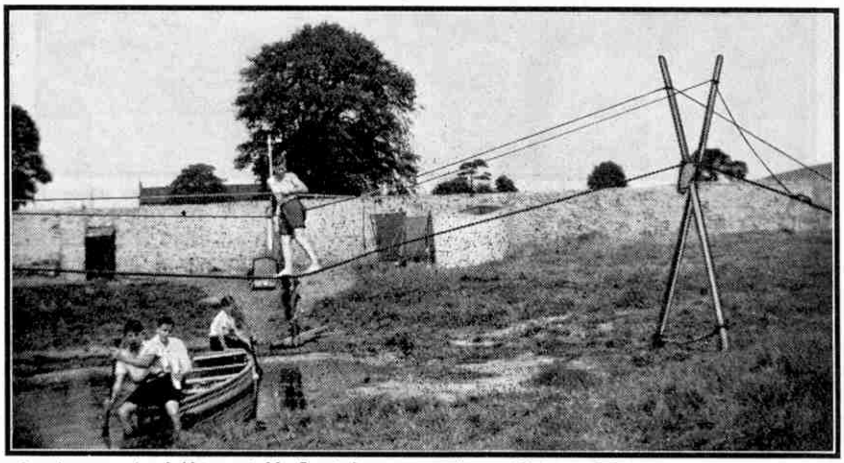
The most remarkable feature of the upper illustration on this page is the extent of country shown in it, for in the conditions prevailing when the photograph was taken, the distant portions of the scene, including the cliffs on the left, would have been unrecorded on an ordinary plate. Amazing long-distance photographs of this kind can now be taken. One of the earliest examples of this type showed Mount Rainier, a peak 14,363 ft. in height in Washington, U.S.A., from a point about 270 miles away.



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

Opening a Monkey Bridge

While in camp last summer at Lewes, I and other Scouts built a monkey bridge with a span of more than 40 ft. Such a span is exceptional for a bridge of this length, and we worked hard for an hour in accomplishing what we regarded as a creditable feat of engineering. Four stout logs, each about 20 ft. long, were used as the transoms of the bridge, and were lashed together in pairs and placed on each side of the pond to be spanned, as shown in the upper photograph on this page. Next two long iron bars, each with a rounded hook on its upper end, were driven into the ground, one on each side of the pond and about 10 ft. away from its banks. A thick piece of sacking was wrapped round the crosspiece of each of the two transoms and a long stout rope was passed over the sacking and secured at each end to a hook.



Crossing a monkey bridge erected by Scouts in camp near Lewes. Photograph by M. J. Higgins, Streatham.

Then came the most difficult part of building operations. The transoms were raised on the edges of the pond and held in position while some of the stronger of us heaved at a pulley block placed in position to tighten the rope over its supports. The loose end of the rope was then lashed back on itself.

There remained the task of putting up the ropes to act as handrails. Our hardy Scoutmaster, more daring than the rest of us, clambered upon one of the transoms and tied the hand ropes to it. With the free ends of these ropes in one hand he then walked across the bridge, balancing himself with the skill of a tight rope walker in a circus. The rest was easy, and soon both hand ropes were in position, with their ends carried down to the iron hooks and securely lashed.

After much argument I accepted the honour of opening the bridge by walking across it. The passage was more difficult than I expected and I laughed so much at my efforts, and at the antics of those who encouraged me, that I lost my balance and toppled off into the pond below. The water abounded in cress and other vegetation, of which I almost swallowed immense quantities.

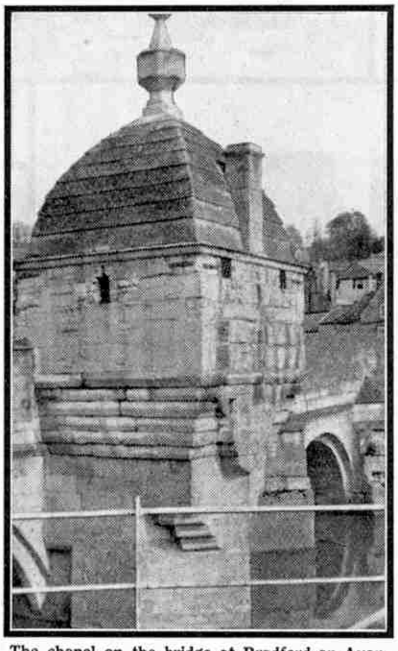
M. J. Higgins (Streatham, S.W.16).

An Ocean Meeting

During a recent voyage from Australia to England I was awakened early one morning while we were crossing the Arabian Sea by a change in the motion of the ship, accompanied by the sound of rushing feet and questioning voices. I rolled out of my bunk and quickly threw on a coat. By this time the vessel lay still, and when I went on deck I found there a group of pyjama-clad passengers who also had been aroused by the disturbance.

On looking over the ship's side I saw a small boat filled with men of the negro type, who were chanting loudly and keeping time by swinging their arms. Soon a canoe with three men put off from the boat. Ropes were lowered to them when they came alongside, and one negro held the canoe steady while his companions fastened baskets and large bottle-shaped bags made of skin to some of the ropes. These containers were hauled on board, where the baskets were filled with loaves of bread and fruit, and the bags with water. Two of the negroes then paddled their craft towards their own boat, while the third held the water bags. The canoe was tied to the stern, and sails were set, the liner remaining motionless until the natives had sailed out of danger from our wake.

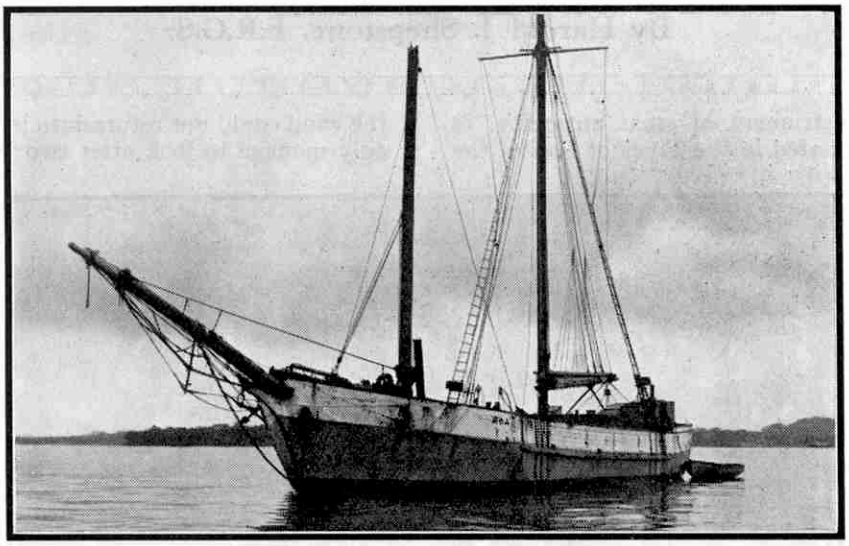
R. S. Hine (Ledbury).



The chapel on the bridge at Bradford-on-Avon, Wiltshire. Photograph by W. G. Gale, Trowbridge.

Historic New Zealand Scow Wrecked

The upper photograph on this page shows the auxiliary scow, the *"Moa,"* a vessel that recently was wrecked by running aground on the bar of Big Wanganui River, on the west coast of the South Island of New Zealand. This vessel was of 99 tons and was built at Auckland in 1907. She was used chiefly for carrying log timber and in September of the year in which she was launched was dismasted in a storm, but managed to anchor until she was picked up by another vessel that took her in tow.



The auxiliary scow "Moa," recently wrecked on the west coast of the South Island of New Zealand. Photograph reproduced by courtesy of the "Auckland Weekly News."

The *"Moa"* is best remembered for her part in the exploit of a party of German prisoners who escaped by launch from an island in the Bay of Plenty in December, 1917. The fugitives were headed by Count Felix von Luckner, who had commanded the German raider, *"Seeadler,"* and under his leadership captured the *"Moa,"* the crew of which were unarmed. The Germans set out for the South Sea Islands, but first made for the Kermadec Islands, where they hoped to get a store of provisions by raiding food depots placed there for castaways. They succeeded in reaching these islands, only to be re-captured by a cable steamer that had been sent in pursuit.

When she was stranded, the *"Moa"* was carrying machinery for box making plant to be erected on the banks of the Big Wanganui River, where there are valuable stands of white and red pine. She crossed the outer bar, but grounded on the inner bar and there was so heavily buffeted by high seas that she became a total loss.

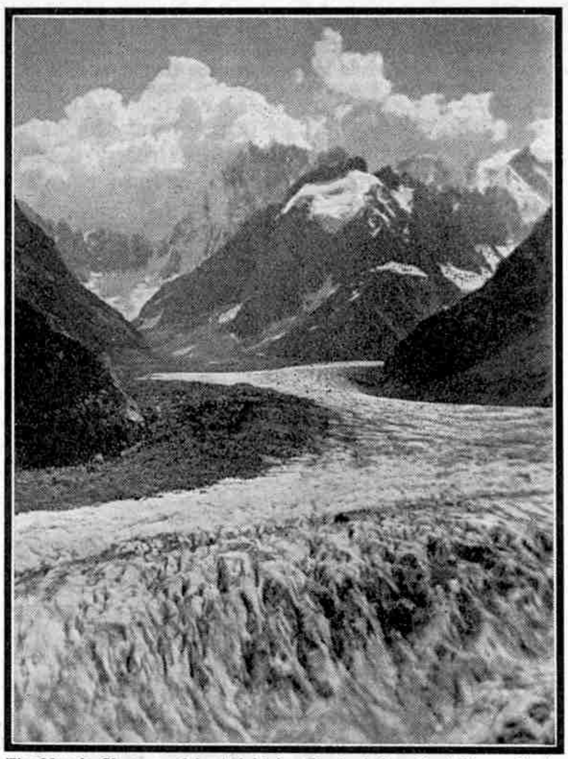
M. GOODWIN (Bay of Plenty, N.Z.).

An Alpine Glacier in Summer

My first sight of the Mer de Glace, the famous Alpine glacier, gave me a surprise. I think I had pictured a glacier as a broad, smooth river of clear blue ice, split here and there into deep crevasses. The real thing certainly was broad, and sloped down in a majestic curve from the mountains above it, but hard crisp snow covered the ice and the whole expanse was seamed and fissured so that it looked like a giant replica of the rough icing sometimes seen on Christmas cakes.

The glacier shone dazzlingly white higher up, but at Montenvers, where I first saw it, the surface was dulled by a covering of gravel, and large boulders were strewn over it. We appreciated the gravel when we climbed on to the glacier itself, for it made the ice a little less slippery, but I was not at all sure of my footing, even with the aid of a spiked stick and woven socks pulled over my shoes. Someone had cut rough steps in the ice, and I clambered up these along a steep slope until the whole stretch of the glacier was visible, with cloudcapped Mont Blanc towering in the background. There were crevasses in plenty, and in their depths I saw the beautiful blue colour I had imagined. I pushed a chunk of ice into one of them, and could hear it bumping against the walls on its way into the depths.

Then I turned my attention to the next slope. The ascent was easy for a while, but the path gradually became narrower until it was a mere ridge 6 in. wide with a dangerous looking crevasse on each side. I dug my stick in firmly, assured myself that I was capable of crossing this narrow section, and then tottered to the opposite end. Once there, the effort proved to have been worth while, for it yielded a magnificent mountain view.



The Mer de Glace, a celebrated Alpine Glacier below Mont Blanc. Photograph by E. M. Dudley, Halifax.

The return journey had lost much of its terror for me, and I felt quite a hardened mountaineer as I discarded my socks, now worn into ragged holes, on leaving the glacier; but I was amused to hear one member of our party assuring her companion that crossing the ridge had taken years off her life.

E. M. DUDLEY (Halifax).

Over the River, but Under the Fish

In former times it was by no means unusual for bridges to have buildings on them. The quaint old bridge shown in the lower illustration on the opposite page is an example. It is to be found in the small town of Bradford-on-Avon, in Wiltshire, and the domed structure on it was built as a chapel.

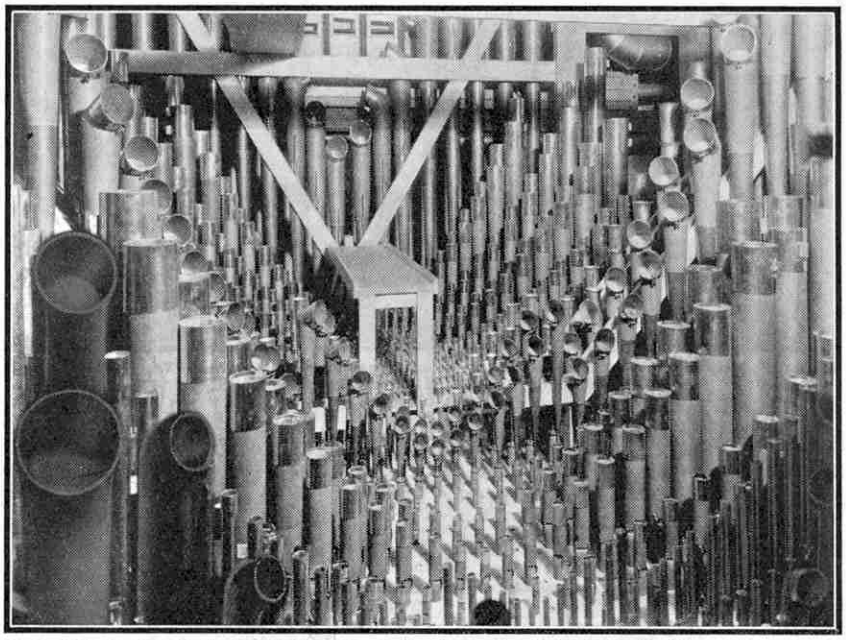
A century ago the bridge chapel was used as a lock-up, and local law breakers who were confined in it were said to be "over the river, but under the fish." This description of their situation was truthful, in spite of appearances, for a model of a fish is mounted on the weathercock above the dome.

W. G. GALE (Trowbridge).

The Mechanism of a Giant Organ

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

THE organ is an instrument of great antiquity. It seems to have originated in the Pipes of Pan of the Ancient Greeks. This instrument usually consisted of a row of seven or more short reed pipes, closed at their lower ends, and fastened together side by side. They were graduated in length in such a manner as to produce the notes of the scale when they were sounded one after the other by blowing across their upper ends. Later this instrument was developed considerably in size, and was fitted with a device for forcing air into the pipes by water power instead of by blowing with the mouth. Keys also were added to open and close the pipes, so that any one could be sounded at the will of the player. A few centuries later bellows came into use, instead of water power, to supply the air, and the number and size of pipes were considerably increased.

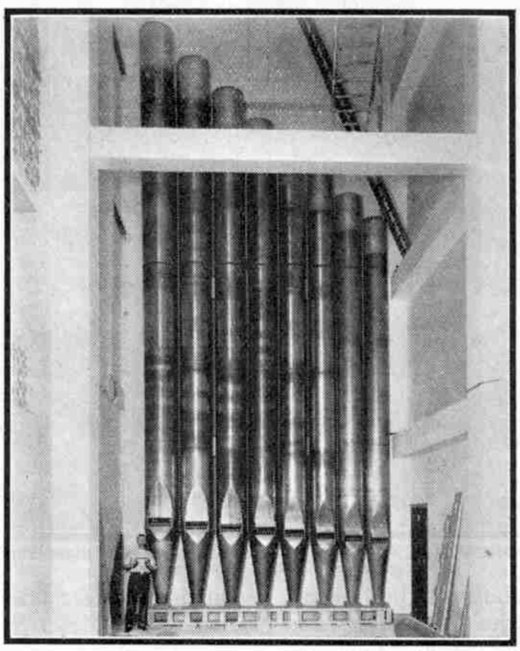


Some of the thousands of pipes of the organ in the Convention Hall at Atlantic City. This organ is electrically controlled, and is described in the accompanying article.

The adoption of the bellows was the actual beginning of the organ as we know it to-day, and before the middle of the fifth century crude instruments of this kind were in use in the churches of Spain. During the latter half of the seventh century the organ was introduced into the church at Rome by Pope Vitalian, and in the course of the next hundred years builders of the instrument flourished in Italy, France, Germany and England. In the 10th century an organ was built for Winchester Cathedral that had a bellows so powerful that 70 men were needed to pump it.

The method of blowing practised about the time when organs began to be provided with keyboards is interesting. According to a 17th century work each organ had a great number of bellows, and each of these had a valve so that the wind could not return into it. An organ blower could only manage to look after two bellows, and many men were therefore required for the job. A blower attached one of his feet to each bellows and held on to a bar above, and by raising each bellows in turn and then resting his weight upon it a constant supply of wind was produced.

It was not until about the 15th century that the organ began to have the proportions and characteristics that have made it unequalled for the volume, variety and grandeur of its tone. The principle on which modern organs operate remains much the same as that of the early organs, but the application of electrical mechanism has enabled many devices and effects to be introduced that were beyond the dreams of the old organ builders. The wonderful instruments to be heard in most big cinemas to-day are a comparatively recent development, and have been made possible only by the widespread use of electrical mechanism. A cinema organ differs in many respects from an ordinary church organ and some of them contain many thousands of pipes, all of which can be controlled by a single person seated at a central console. So much of the mechanism of such an organ is operated by electricity that its inside looks much more like a telephone exchange than a musical instrument. In addition to a vast number of pipes cinema organs contain also attachments for producing the sounds of bells, harps, drums, castanets and dozens of other instruments and effects.



A group of the metal pipes of the organ, the largest of which is 34 ft. 8 in. high. The man is holding the smallest of the pipes.

The organ of to-day is as remarkable from an engineering point of view as from a musical one. It is really a great orchestra with one player instead of many. A notable example of modern organ construction is the instrument that stands in the Convention Hall at Atlantic City, New Jersey, U.S.A. It weighs 120 tons, contains 32,913 pipes, seven keyboards and 1,233 stops, and cost £80,000 to erect. The player of this instrument has to be possessed of considerable agility to operate the multiple keyboard and the rows and rows of stops arranged on each side of it. In addition to 487 keys and over 1,200 stops, the player has to use his feet on a set of 32 pedals that control the bass notes of the organ. The pipes of the instrument, which are unique in many respects, are fashioned either of wood or metal. The largest of the metal pipes is 34 ft. 8 in. long with a diameter of 24 in., and weighs just under a ton. The giant of the wooden pipes has a length of 59 ft. 10 in., and a square top measuring 2½ ft. This pipe possesses a depth and power that must be heard to be believed; on account of its length and air capacity it is capable of producing a sound two octaves deeper than the lowest C on a piano.

The console of the Atlantic City organ, showing the seven manuals.

One of the stops, known as Tuba Maxima, is said to be the most powerful ever made. In order to give some idea of the power of this stop it may be stated that the wind pressure on the average church organ is from 5 in. to 8 in. water displacement, while a 20-in. pressure is considered very high. The Tuba Maxima stop in this organ is on a pressure of 100 in.

The pipes are distributed about the auditorium, the majority being concealed behind screens in the walls. These pipes are grouped in eight different positions, and form in effect eight separate organs that can be played individually or in combination from the console. The immense volume of air required for this colossal array of pipes is supplied by eight electric blowers that develop 404 h.p. These blowers are so arranged that they pump air for the eight units of the organ separately, so that one part of the instrument can be played without making it necessary to run all the other blowers at the same time.

An interior view of one of the four "relays" of the organ. These relays incorporate 26,483 electric circuits.

The organ has two consoles, which were provided for two main purposes—first, to permit of the instrument being operated by two players, and second, to enable it to be operated from different positions. In order to carry out this second requirement the second console, which is normally placed at the west end of the stage, was made on much smaller lines than the first or main console, and can be moved to any position within the limits of 150 ft. of free cable. This second console has five manuals and contains 550 speaking stops, 44 inter-manual couplers, 34 sectional couplers and 18 tremolos. The whole organ can be operated from its keyboards, but it lacks in certain respects the flexibility of the larger console.

The main console, specially planned to contain the delicate electrical mechanisms for the successful handling of this great instrument, has seven manuals, their designation being, from the lowest one, Choir, Great, Swell, Solo, Fanfare, Echo and Bombard. The two lowest manuals are of seven octave compass, the third manual is of six octaves, and the remaining four are of five octaves each.

Electricity plays a very important part in the operation of the organ. The touching of each key and each stop makes an electrical contact that actuates machinery and sends the necessary volume of air blowing or rushing into the proper pipes. Apart from the tons of carefully-selected metal and wood that went into the instrument, the constructional material included enough wire to girdle the Earth twice. To use the organ to the limit of its possibilities requires years of musical training and extraordinary ability as a player.

The home of this great organ, the Atlantic City Auditorium, is one of the largest, but not the largest, hall in America. It is 667 ft. long and 330 ft. wide, rising in the centre to a height of 136 ft. 6 in., and is capable of seating 41,000 people. The floor of the auditorium is often used as a skating rink, and this ice rink is a veritable piece of modern magic. An ice machine is turned on, the floor is flooded and the water is frozen. The ice machine is turned off, the ice becomes water, the water disappears, and there is a dry floor!

Running Small Models Under Power

Increasing the Joys of Model-building

MODEL-BUILDING is much more fun when the models are made to work under their own power. The greatest thrill comes when a new model is set in motion for the first time merely by pushing over a control lever, and the fascination of even the simplest models is greatly increased by thus converting them into working models. How to drive a small model is no longer a problem, for the new *Magic* Motor has been designed specially for use in models built with small Outfits. This useful little Motor will drive all the working models shown in the Manuals for Outfits A and B, and the lighter models built with Outfits C, D and E, and as the illustrations on these pages show, it is small, so that it can be incorporated in almost any model.

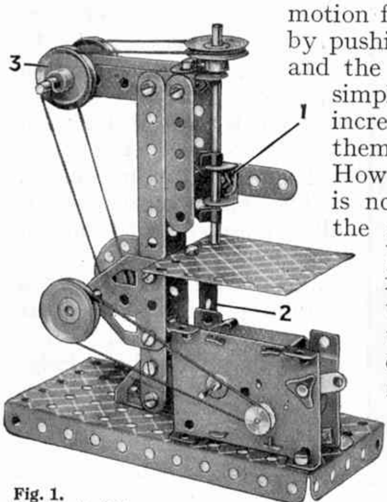


Fig. 1.
The Magic Motor driving a Drilling Machine.

Arranging the drive from the *Magic* Motor is a very simple matter, and three pairs of driving bands of different lengths and a spare ½″ Pulley are supplied for the purpose with each Motor. The rubber bands can easily be slipped over Pulleys to give a smooth non-slip drive.

Typical examples of the uses of the *Magic* Motor are shown in the models illustrated, which give a good idea of the procedure to adopt when fitting the Motor in a model. In the new Meccano Instruction Manuals, a special selection of models incorporating the Motor is shown for each of the Outfits A, B and C, and when the constructor has built these he should try fitting the Motor to other models. In many cases the Motor can be applied to a new model in exactly the same manner as in the examples of its use given in the Manuals, and in others only slight modifications will be found necessary.

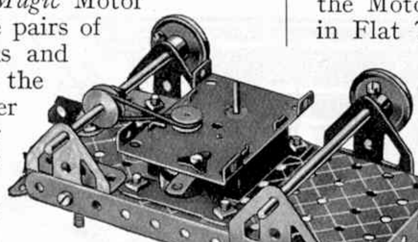


Fig. 2.
Showing how to fit the Motor to a simple Cart.

An example of a simple model that can be propelled along the ground by means of the *Magic* Motor is the Lumber Truck and Horse built with Outfit A. This model is illustrated in Fig. 3, from which it will be seen that the *Magic* Motor is bolted beneath the cart. The underneath view of the cart in Fig. 2 shows how the drive is arranged between the Motor pulley and the special ½″ Pulley, which is carried on the axle of the front wheels. A short rubber band passes round both Pulleys to give the drive, and this should be twisted as shown in Fig. 2, so that the model travels forward when the Motor is started up.

Several models of horses and carts of different types appear in the Manuals, and the Motor can be fitted to most of them in a similar manner. In each case the horse must be mounted on a wheel or wheels so that it travels along smoothly. In the model illustrated a Bush Wheel is mounted on a 2″ Rod passed through the lower holes in the hind legs of the horse. Owing to the limitations of the Outfit only one wheel can be used, so the front legs are kept off the ground by tying the reins to the front Strip of the cart. The construction of the model will be clear from the illustrations, except for the rear of the horse. Two Angle Brackets are attached at 1 in a similar manner to those at the front of the model, and these hold both the 2½″ Strips forming the legs and the Flexible Plate that reproduces the curve of the horse's back.

To arrange a drive for the Drilling Machine illustrated in Fig. 1 is not quite so simple, but the model shows how to overcome little difficulties of position by mounting guide pulleys in suitable positions for leading the rubber band from the driving Pulley to the driven Pulley. The most convenient position in the Drilling Machine for the *Magic* Motor is beneath the drill table, as shown, and two belts are arranged to drive the drill. A medium-sized rubber band is fitted between the Motor pulley and a 1″ Pulley on a Rod journalled in Flat Trunnions behind the drill. This Rod is fitted with the ½″ Pulley supplied with the Motor, and a long rubber band is passed round this to the 1″ Pulley at the head of the drill. To ensure that the rubber band is led on to the driven Pulley at the proper angle, two 1″ Pulleys are mounted on a short Rod to serve as guide pulleys. As these rotate in opposite directions, one must be free on its Rod, so the Pulley 3 is held in place by a Spring Clip.

By arranging guide pulleys in this manner, rubber bands or belts of cord can be made to drive shafts placed at almost any angle to each other. The important thing to remember is that the cord or band should be fed on to a pulley in a direct line with the groove, although the angle at which it leaves the pulley is not so important. This applies to

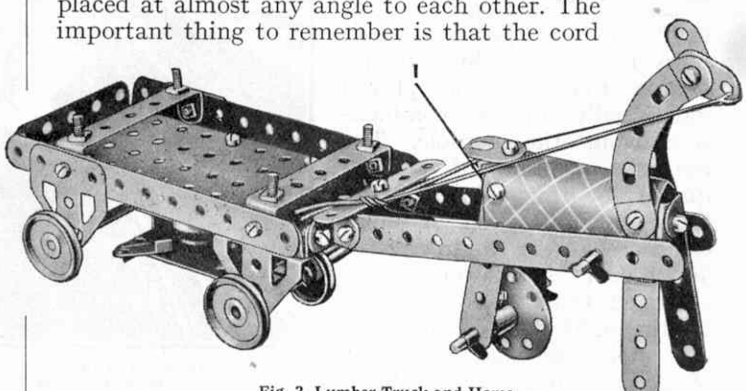


Fig. 3. Lumber Truck and Horse.

all pulley arrangements, and if this simple precaution is taken there will be no trouble due to belts slipping off their pulleys.

Details of the Drilling Machine that may not be clear from Fig. 1 are the method of supporting the drill table, and the bearings for the drill Rod. A $2\frac{1}{2}'' \times 2\frac{1}{2}''$ Flexible Plate forming the table is bolted to a $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip 2 fixed to the base Plate. The $3\frac{1}{2}''$ Rod representing the drill is journalled at its upper end in a Flat Bracket and at its lower end in two Angle Brackets at 1. The two $5\frac{1}{2}''$ Strips forming the drill post are attached by two Trunnions to the base Plate.

To fit the *Magic* Motor to a model crane a somewhat different procedure must be followed. The Motor is not provided with reversing gear and consequently special means must be provided for lowering the load. An ingenious method of overcoming this problem is shown in Fig. 4. In this case the *Magic* Motor is mounted on a pivot, and the driving belt can be slackened off by swinging the Motor forwards. A length of cord must be used instead of the rubber band so that it allows slip to occur when the belt is slackened. A lever consisting of a $2\frac{1}{2}''$ Strip is attached to the Motor and when this is raised the load can be lowered by operating the hand-wheel, or allowed to descend under gravity. A light downward pressure on the end of the lever ensures a good grip for raising the load under power. In addition to its application in cranes, this method of drive can be used in any model in which it is required to disconnect the drive for hand operation.

All bolts 1 on the Jib Crane are fitted with locknuts to make pivots. The jib is mounted on two $\frac{1}{2}''$ Reversed Angle Brackets bolted to the base of the swivelling vertical post, and is raised or lowered by a Crank Handle. A length of cord 2 is passed round a 1″ Pulley on the shaft of the Crank Handle, and one end is tied to the first hole of a $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strip, the other end being attached to a weighted lever 3. This arrangement forms a brake for the Crank Handle.

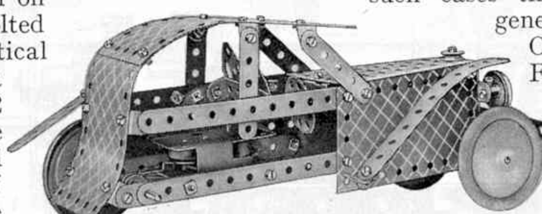


Fig. 5. The Motor fitted in a Sports Coupé.

Two views of the Sports Coupé in Figs. 5 and 6 illustrate how the Motor can be concealed inside a model for driving it. The Motor is bolted by the flanged lugs

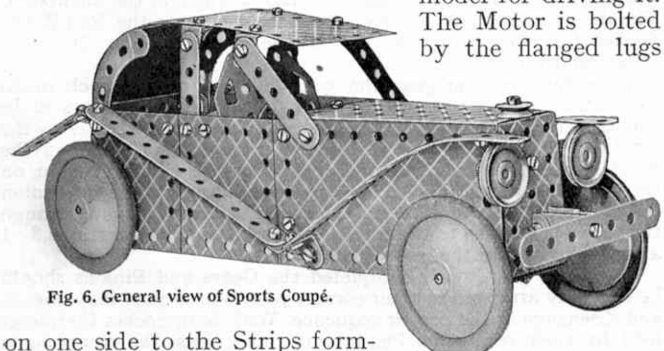


Fig. 6. General view of Sports Coupé.

on one side to the Strips forming the side of the coupé. The drive is arranged in a similar manner to that shown in Fig. 2.

The form of drive shown in Fig. 2 is quite satisfactory for light models, but in cases where a heavier drive is required it will be found necessary to arrange the Pulleys so that a reduction ratio is obtained. To arrange a reduction ratio a small Pulley should be made to drive a larger one, and in such a case the driving Pulley rotates faster than the driven Pulley, the driving force being increased in proportion to the reduction of speed. An example of the use of reduction gearing is shown in Fig. 1, where the small Motor pulley drives a 1″ Pulley, and the reduction of speed so obtained is further reduced by arranging a $\frac{1}{2}''$ Pulley to drive a second 1″ Pulley. Some of the heavier models can be driven quite well in this way, but it should be remembered that the increased driving force is obtained at the expense of speed.

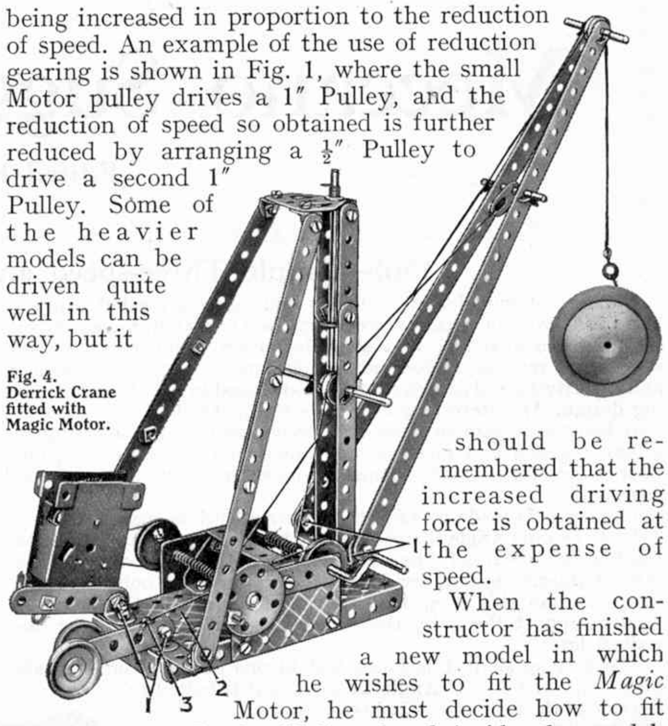


Fig. 4. Derrick Crane fitted with Magic Motor.

When the constructor has finished a new model in which he wishes to fit the *Magic* Motor, he must decide how to fit it in position. It should be placed inside the model, or underneath in the case of a model that travels on wheels, but sometimes the general construction and design will not permit such a neat arrangement. In such cases the Motor must be fitted outside, generally by bolting it to the side. One of the Motor plates has four Flanged lugs, arranged one at each corner, and the other plate is flat and has a hole at each corner. This design makes it possible to bolt the Motor in almost any position.

An important point to remember when mounting the Motor is to place it so that the winding shaft is easily accessible. On a travelling model the best arrangement generally is to mount the Motor so that the winding shaft projects downwards, as in the models illustrated in Figs. 2 and 5. The model can then be lifted off the ground to be wound. It is advisable also to provide for convenient manipulation of the brake lever, but if this is awkwardly placed it can sometimes be extended by a Flat Bracket or other part to facilitate handling. When deciding how the Motor is to be fitted the most important consideration is that driving and driven Pulleys should be in a direct line, and to achieve this it is sometimes more convenient to alter the model slightly, and to change the position of the driven Pulley, than to fit the Motor in the correct position in relation to the Pulley.

If a model does not work satisfactorily after it has been completed and the Motor has been mounted in position, the first step to take to remedy the trouble is to see that the Axle Rods turn freely. There should be no stiffness in rotating Rods and a drop of oil will often improve the running. A possible cause of poor running is that the Motor is being made to drive a model that is a little too heavy for it with the particular form of drive in use, and by fitting a larger Pulley to be driven by the Motor pulley better results will be obtained.

Meccano Suggestions Section

Edited by "Spanner"

(336)—Simple Three-speed and Reverse Gear-box (J. Morton, Edinburgh)

Builders of model motor chassis who have a limited range of parts that will not permit the construction of elaborate gear-boxes, will find this gear-box very suitable for providing three forward speeds and reverse. It does not require many parts to construct, and the driving and driven shafts are arranged in line, thus simplifying design. An interesting feature is the method of mounting the gear lever in a gate to obtain the four positions for selecting the different gears, and ingenuity is shown in the use of Pendulum Connections for normally retaining the sliding parts in the neutral position.

The frame is made up of two 4½" Angle Girders spaced apart by 2½"×½" Double Angle Strips. One of the Girders is spaced from the Double Angle Strips by two Washers on each fixing bolt, and the other Girder is spaced by four Washers on each bolt, ⅜" Bolts being used in this case. Two Flat Trunnions bolted to the one Girder support the gate, the construction of which will be described later.

The driving shaft 1 is journalled in one of the Double Angle Strips and in a 1"×1" Angle Bracket that is bolted to the side of the gear-box. Washers are used for spacing the Bracket away from the Angle Girder to bring the bearings for the Rod 1 into line. The Rod carries a 1" Gear against the Double Angle Strip, and a ½" Pinion that bears against the Angle Bracket, and on the other side of the Angle Bracket one member of a Dog Clutch 4 is fitted on the end of the Rod. The Rod does not occupy the full extent of the bore in the Dog Clutch member, which serves as a bearing for the end of the driven Rod 2.

The Rod 2 is fitted with a ½" Pinion, the boss of which bears against the Double Angle Strip at the end of the gear-box and so prevents the inner end of the Rod from slipping out of the Dog Clutch member 4. The Pinion is in constant mesh with another similar Pinion rotating freely on a ¾" Bolt fixed by two nuts to the end of the gear-box. A Socket Coupling 5 on the Rod 2 carries the second member of the Dog Clutch to engage with the member 4, and a 57-teeth Gear. Two Threaded Pins are attached to the Gear, and engage opposite holes in a Bush Wheel fixed on the Rod. The Socket Coupling unit is able to slide on the Rod but is prevented from rotating by the Bush Wheel and Threaded Pins.

The layshaft 3 is a 6½" Axle Rod that is slideable in bearings at the ends of the gear-box. It carries a 1" Gear, a 57-teeth Gear, two Collars 9, and two ½" Pinions, all of which are inside the gear-box frame; and a Socket Coupling is fitted to the end of the Rod outside the frame by means of two Collars.

Each 4½" Angle Girder carries a 1" Corner Bracket, and these support a 3½" Rod mounted transversely beneath the gear-box. The Rod carries a Double Arm Crank and a Collar. A 3½" Screwed Rod is inserted in one of the tapped bores of the Collar and is locked securely by a nut, the Collar being fixed to its Rod by the Grub Screw. A ⅜" Bolt 7 is attached to the Double Arm Crank by means of two nuts and forms the selector for changing gear. The head of the Bolt can be made to engage between the Collars 9, or the shank can be engaged in the groove of the Socket Coupling 5.

To make the gate for the gear lever, a 1" Screwed Rod is attached by two nuts to the apex of each Trunnion at the side of the gear-box. Another nut is then screwed on each Rod and a 2" Strip is passed over both Rods. Each Rod is next fitted with four Washers, followed by five Flat Brackets and another four Washers. A second 2" Strip is placed on both Rods and is secured by a nut on each. The Flat Brackets are fixed by their elongated holes, and should be arranged as shown so that there is sufficient space between them to allow clearance for the gear lever to pass between their inner ends.

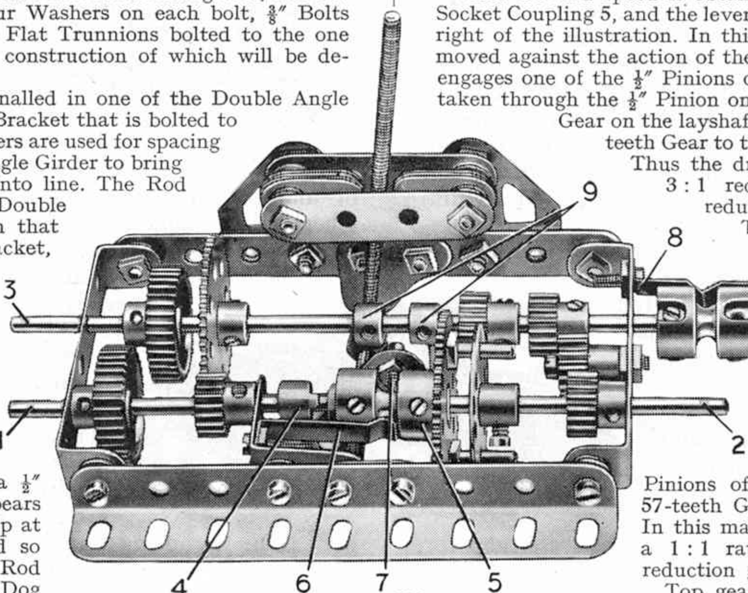


Fig. 336

In the illustration the gear-box is shown with the gear-change lever in the neutral position, so that no drive is transmitted through the gear-box. Sliding movement of the layshaft and the Socket Coupling unit is checked by two Pendulum Connections 6 and 8. These are fixed to the frame of the gear-box by 6 B.A. Bolts, and are bent as shown so that they engage the grooves in the Socket Coupling and normally retain them in position. When the gear lever is in the neutral position, that is in the centre of the gate, the ⅜" Bolt 7 should be in line with the groove of the Socket Coupling 5 and the space between the two Collars 9. By sliding the gear lever to one or other side of the gate the ⅜" Bolt is made to engage the Socket Coupling or the Collars, and thus the gears can be selected.

First forward speed is obtained when the Bolt 7 engages the Socket Coupling 5, and the lever is moved backward, that is to the right of the illustration. In this position the Socket Coupling is moved against the action of the spring 6, until the 57-teeth Gear engages one of the ½" Pinions on the layshaft. The drive is then taken through the ½" Pinion on the driving shaft to the 57-teeth Gear on the layshaft, and through a ½" Pinion and 57-teeth Gear to the Bush Wheel fixed on the Rod 2. Thus the drive is led through two stages of 3 : 1 reduction gearing, giving a total reduction ratio of 9 : 1.

The second forward speed is obtained by moving the lever back to the neutral position, sliding it through the gate so that the Bolt 7 engages the Collars 9, and then moving the gear lever forward (to the left of Fig. 336). In this position the 1" Gear on the layshaft is brought into mesh with the similar Gear on the driving shaft, and also one of the ½" Pinions of the layshaft meshes with the 57-teeth Gear on the Socket Coupling unit. In this manner the drive is taken through a 1 : 1 ratio and a 3 : 1 ratio, the total reduction gear being 3 : 1.

Top gear is a direct drive, and to obtain this the lever is moved back to neutral, through the gate, and then pushed forward so that the Dog Clutch member in the Socket Coupling 5 engages the member 4. The drive is then taken direct from the Rod 1 to the Rod 2, the Socket Coupling being "keyed" to the latter by the Threaded Pins and Bush Wheel.

To engage reverse gear the gear lever is moved back again to neutral, and once more the Bolt 7 engages the Collars 9. In this case the layshaft is slid in the other direction, that is to the right, so that one of the ½" Pinions engages the Pinion on the ¾" Bolt, which is in constant mesh with the similar Pinion on the driven shaft 2. The drive then goes through the ½" Pinion on the Rod 1 to the 57-teeth Gear on the layshaft, and through the three ½" Pinions to the Rod 2. The total reduction ratio is 3 : 1 and the drive is in the reverse direction.

When the gear-box is completed the Gears and Pinions should be carefully arranged in their correct positions so that they engage and disengage in the proper sequence. With both Socket Couplings held by their respective Pendulum Connections, the components should be arranged as illustrated; but slight adjustments may be found necessary when the gear-change lever is brought into operation. It is essential that the Collars 9 be placed directly opposite the Socket Coupling 5; and the Double Arm Crank carrying Bolt 7 is fixed on its Rod in such a position that when the Bolt is in the groove of the Coupling 5 the gear lever is in the neutral position but on the left-hand side of the gate. On moving it to the other side of the gate it will be found that the head of the Bolt 7 fits between the Collars 9, and the shank disengages the Coupling 5. The Pendulum Connections 6 and 8 should be bent very carefully so that the V-shaped portions fit in the grooves of the respective Socket Couplings.

(337)—Intermittent Motion

(F. J. Sanders, Birmingham)

Various forms of intermittent motion have been devised for different purposes, the most common being obtained by pawl and ratchet gearing. A novel method of obtaining an intermittent drive is illustrated in Fig. 337. This mechanism is somewhat similar in principal to the well-known Maltese Cross mechanism employed in cinematograph projectors for imparting the intermittent movement to the film.

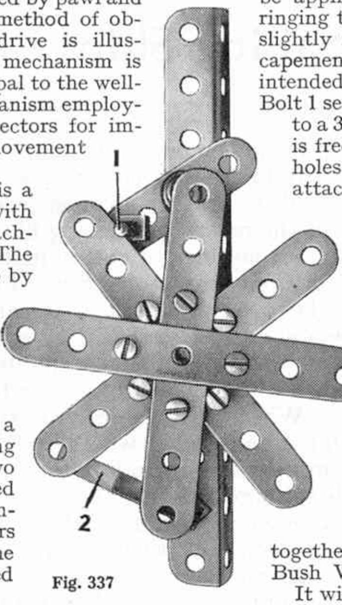


Fig. 337

The driving member 1 is a Double Arm Crank fitted with a Threaded Pin that is attached in the elongated hole. The driven member is made up by bolting four $3\frac{1}{2}''$ Strips to a Bush Wheel. The first Strip is bolted across the diameter of the Bush Wheel, and the second one added at right angles to the first, and fitted with a Washer under each securing bolt. The remaining two Strips are crossed and bolted in position, but there is insufficient room for Washers under these. The Rod of the driven member is spaced $1\frac{1}{2}''$ from the driving Rod.

When the driving member rotates, the Threaded Pin engages the end of one of the $3\frac{1}{2}''$ Strips and rotates the driven member through one eighth of a complete turn. There is a dwell during which the Threaded Pin moves round to engage the next $3\frac{1}{2}''$ Strip, and in order to prevent the driven part from rotating during the time the Pin is not in engagement, a Pendulum Connection 2 is added and bent to engage the Strips as shown. The position of the Pendulum Connection in the illustration is suitable for clockwise rotation of the driving Crank, and the part is curved so that the ends of the Strips slide over it smoothly, but it fits between two Strips to check further movement during each dwell.

Mechanisms of this type are useful in models of automatic machines in which a continuous supply of material is being fed to the machine, but where a pause is necessary while the punching or forming operation is in progress.

(338)—Oscillating Mechanism

(L. Johnson, Southampton)

This interesting mechanism can be made to serve two quite different purposes. It can be applied to alarm clocks, etc., for ringing the bell, or it can be used in a slightly modified form for a clock escapement mechanism. As shown, it is intended for striking the bell. The $\frac{3}{8}''$ Bolt 1 secures two Pawls without bosses to a 3″ Strip forming the striker, and is free to turn in one of the tapped holes of the Coupling 2 that is attached to the frame of the model. As the turning movement of the Bolt is only slight, the tendency for it to screw in or out of the bore is of no importance.

The Rod 3 carries a Bush Wheel that has a bolt secured in each hole. It will be noticed that the Bolt 1 is situated midway between two holes in the frame, and consequently the distance from the Bolt to the Rod 3 is not standard. The Pawls are arranged so that they are slightly too close together to allow the bolts on the Bush Wheel to pass unimpeded.

It will now be found that when the Bush Wheel is rotated, one of the bolts strikes its respective Pawl and raises it, thus rocking the striker. The second Pawl is then struck by one of the bolt heads and is also raised so that the striker is swung back in the other direction. Some form of stop should be provided to limit the movement of the arm so that the Pawls do not engage below the centre lines of the bolt heads. If the Pawls are too close together they will be forced in the wrong direction by the Bush Wheel, which will then become locked. The Pawls exercise a governing influence on the Rod 3, which when turned causes the 3″ Strip to vibrate rapidly.

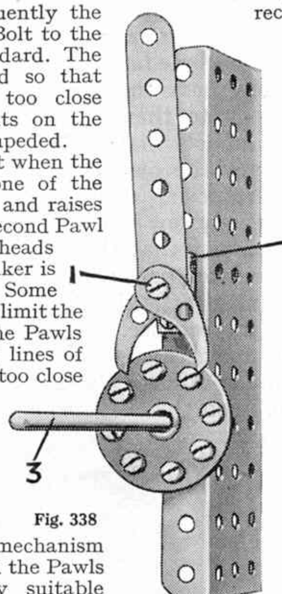


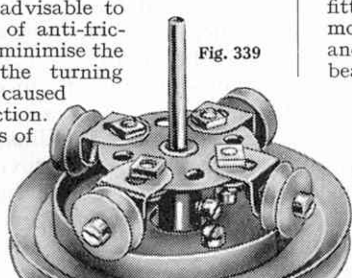
Fig. 338

For use as a clock escapement mechanism the 3″ Strip is not necessary, and the Pawls can be connected up in any suitable manner to the Pendulum. An Angle Bracket can be fixed on the Bolt 1 in place of the 3″ Strip, for this purpose.

(339)—Small Roller Bearing Unit (H. J. Swain, Bromsgrove)

Where it is required to rotate a heavy structure it is advisable to use some form of anti-friction bearing to minimise the resistance to the turning motion that is caused by excessive friction. In small models of swivelling cranes, roundabouts, and other similar structures, two 3″ Pulley Wheels can be fitted together for carrying the rotating portion of the model. Only a small area at the rims of the Pulley Wheels forms the bearing surface, so that frictional resistance is fairly small, but for heavy models it is advisable to fit some other type of bearing operating with less friction.

Fig. 339



The roller bearing unit in Fig. 339 is intended to replace the 3″ Pulley Wheels in small models, and it will be found that by fitting this bearing the superstructure of a model can be rotated much more smoothly and with less power. The essentials of the bearing unit are two Wheel Flanges forming races and a frame carrying four $\frac{1}{2}''$ loose Pulleys serving as rollers. The Pulleys are carried on $\frac{1}{2}''$ Bolts that are attached to Angle Brackets secured to a Bush Wheel.

In the illustration a 3″ Pulley is bolted to the roller race so that the model can be operated from a Motor in the superstructure by passing cord from a rotating Pulley Wheel in the superstructure to the fixed 3″ Pulley. A $2\frac{1}{2}''$ or $3\frac{1}{2}''$ Gear and Pinion can be used instead, and if necessary the rotating portion can be operated from the base of the model by attaching the Pulley or Gear to the upper race and driving it from a Motor in the base.

Miscellaneous Suggestions

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

(M.182.) A Useful Device for Cyclists.—The large saddle bags used by many cyclists often lose their shape after being in use for some time. W. H. Griffith (Warlingham, Surrey) uses a frame built up from Meccano Angle Girders, Strips and Angle Brackets, as a stiffener for his bag, and claims that it entirely prevents sagging. The frame is made to fit exactly inside the bag, which is thus held in shape and made to look much neater.

(M.183.) Cam and Tappet Movement.—Cams are of the greatest utility to the engineer for converting rotary motion to reciprocating motion, and by using cams of different contour many variations of to-and-fro movement can be produced. Different types of cam can be made with standard Meccano parts, and where an irregular reciprocating motion is required it is generally advisable to employ cams in preference to cranks and levers. The cam suggested by R. Thorn (Manchester) produces a slow forward stroke and a quick return stroke. A Pawl is used for the cam and rotates so that the point is always "trailing." A sliding Axle Rod is fitted with a Crank to form the tappet, and some means must be provided for preventing the Rod from rotating so that the Crank always lies in the same direction. The Rod can be attached to a pair of Eye Pieces sliding on a Strip, or alternatively the Rod itself may slide and be prevented from turning by two bolts inserted in Collars and bearing against a Plate or Strip.

The Rod of the Pawl lies immediately in line with the tappet rod and the Crank rests on the outer curved surface of the Pawl. As the Pawl rotates it strikes the webb of the Crank, thus imparting movement to the tappet rod, and when the point of the Pawl moves clear of the Crank the latter returns suddenly to its original position. The return of the tappet rod can be controlled by a spring or by gravity according to requirements.

(M.184.) Preventing Cord from Slipping.—When driving through a belt of cord a certain amount of slip sometimes seems unavoidable, this being particularly apparent when a fairly long length of cord is used. It is advisable to restrict the use of this form of drive to light mechanisms only, and slipping can often be prevented by the use of a jockey pulley flexibly mounted so that it continually presses on the cord to hold it against the rims of the pulleys. The jockey pulley can be mounted on the end of a pivoted arm that is controlled by a spring to give the necessary pressure.

This arrangement is often rather clumsy for small models, and in such cases the method adopted by R. Warner (London, S.W.18) can be used to advantage. Our contributor points out that by applying resin to the cord a positive grip is ensured, and this simple expedient is likely to solve many driving problems experienced by the owners of small Outfits.

In Search of New Models

The Fascination of Sailing Ships

MODEL-BUILDERS often overlook the possibilities of Meccano for building models that may be classified as non-mechanical subjects. Meccano is so excellently suited for reproducing mechanical movements of all kinds that the enthusiast is inclined to regard non-mechanical subjects as not worthy of attention when seeking new ideas for models.

Ships may be said to fall into the non-mechanical group of subjects, and sailing ships in particular are definitely without mechanical interest. This does not by any means disqualify them as subjects for new models, however, and those who do not already realise what an excellent range of subjects is available in sailing ships will soon become fascinated by these models when once they have investigated the possibilities that lie open to them.

A feature of sailing ship models that makes them particularly suitable for the owners of small Outfits is that really imposing models can be built with comparatively few parts. This of course is due to the fact that the rigging and sails form the greater part of the model, and in designing it this feature should receive due importance. The arrangement of the masts and rigging should be given as much attention as the hull itself, as it is on the finished appearance of this part of the work that the effect of the whole model depends.

As there are now comparatively few large ships under sail, the model-builder has little opportunity for examining prototypes in order to build a model; but those who are fortunate to be near a port visited by these ships should seize every chance of inspecting them. Enquiries in the right quarter may result in permission to board a vessel, and if the enthusiast takes his camera he will obtain a selection of views that should enable a true reproduction of the ship to be built in model form. It is not advisable to rely too much on mental notes of different features. Little details are apt to be overlooked or forgotten, so that if a camera is not available a few rough sketches should be made. Many readers have little or no opportunity of seeing sailing ships, but fortunately for them there is no lack of literature giving excellent illustrations of all types of such vessels.

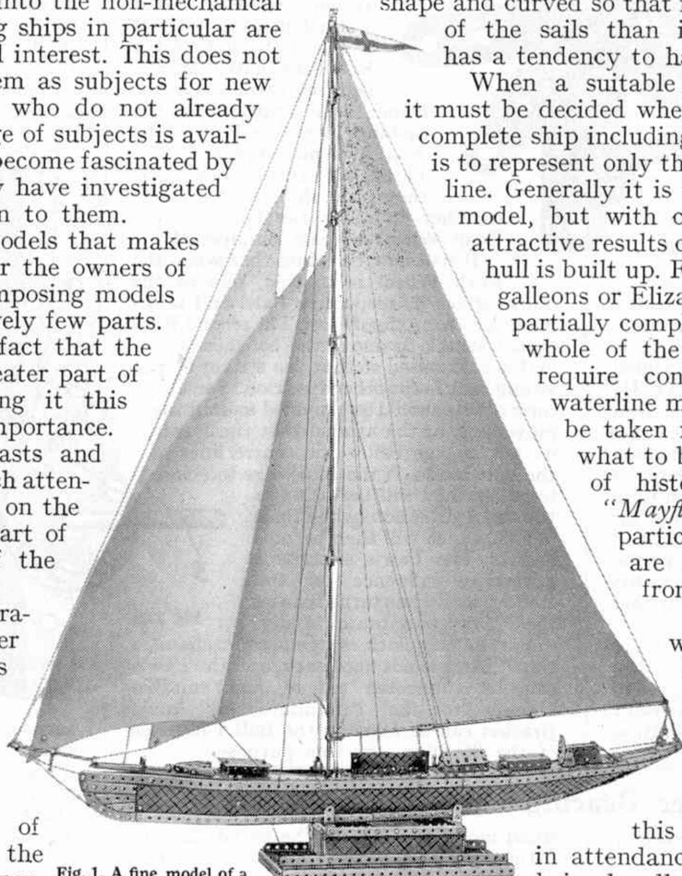


Fig. 1. A fine model of a large Racing Yacht.

Almost all sailing vessels make excellent subjects for Meccano models, and the builder who is looking for a subject will find that he has a most extensive choice from which to select a prototype. Those with small Outfits can first direct their attention to models of sailing dinghies, small racing yachts, fishing smacks, etc. These subjects do not require many parts for the hulls, which are generally of straightforward design and consequently fairly easy to construct; and the rigging is not as difficult to arrange as in the case of larger prototypes.

After the masts and rigging have been added, sails can be made from linen or cotton material or stiff paper, and fixed in their correct positions. For decorative purposes paper is to be preferred as it can easily be cut to any shape and curved so that it gives a better representation of the sails than is produced by cloth, which has a tendency to hang in folds.

When a suitable prototype has been chosen, it must be decided whether the model is to be of the complete ship including the full depth of the hull, or is to represent only the part visible above the waterline. Generally it is advisable to build a waterline model, but with certain classes of vessel more attractive results can be obtained if the complete hull is built up. For instance, models of Spanish galleons or Elizabethan ships would seem only partially complete if not built to include the whole of the hull. Subjects such as these require considerably more parts than waterline models, and of course this must be taken into consideration in deciding what to build. Models of old-time ships of historical interest such as the *"Mayflower,"* the *"Victory,"* etc., are particularly interesting, and there are many vessels in this class from which to select a subject.

Ships that are very popular with model-builders are those known as the tea clippers of which the famous *"Cutty Sark"* is probably the best known. A clipper ship model is shown in Fig. 2. A modern touch of realism is added to this model by the small steam tug in attendance, all large sailing ships now being handled by steam tugs when in port.

The graceful lines of a large modern racing yacht are well reproduced in the model in Fig. 1. This represents a yacht of the "J" class, to which the King's yacht *"Britannia"* belongs. The illustration shows how the appearance of the model is improved by the use of paper sails. In this case the entire hull, with the exception of the deep fin and keel, is built up, and a special stand is provided for displaying the model when completed. Racing yachts vary greatly in size, and there are different forms of rigging; but in all cases there is comparatively little detail work necessary in the hulls and deck fittings, so that this type of vessel commends itself as a prototype for those constructors with small Outfits. The model illustrated can be built with Outfit G.

Most of the early steam vessels were really sailing ships fitted with steam engines so that both steam and wind power could be utilised for propelling the ships. Although a ship in this class is perhaps not a sailing ship in the true meaning of the term, a model of one of these vessels is illustrated as the general construction and design closely follow that of a three-masted barque. The addition of a funnel and bridge considerably alters the appearance of the model, which conforms to that of the forerunners of our present-day steamships.

The first step in making a model ship is of course to build the hull, and Strip Plates and Flexible Plates will be found most useful for its construction. Little difficulty should be experienced in building a waterline model, but the assembly of a complete hull often calls for a considerable degree of skill. It will sometimes be found advisable to use Meccano Strips instead of the Plates where it is required to obtain difficult curves such as at the stern and bows of the vessel. In Fig. 1 the bows are built up from Strips, but the Strip Plates have been used successfully for shaping the stern. The construction of the decks is quite straightforward, and the various deck fittings give scope for ingenuity. In the models in Figs. 1 and 2 the wheel is fitted aft, and in each case the casing for the steering gear is made from a Channel Bearing and Pinions. The companionway on the Racing Yacht is made of a $2\frac{1}{2}'' \times 1\frac{1}{2}''$ Flanged Plate fitted with $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips. Forward of this is a skylight made up of Flat Girders and Double Angle Strips. The hatches on the Clipper Ship model are made of Strips and Plates that are secured to frameworks of Double Angle Strips.

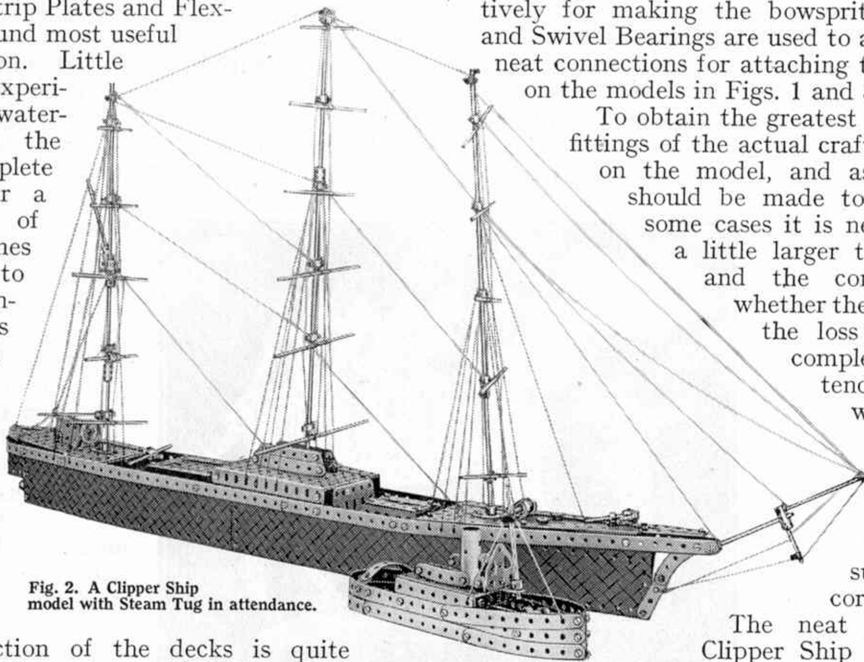


Fig. 2. A Clipper Ship model with Steam Tug in attendance.

Lifeboats are essential features of all ships over a certain size, and the method of making these will of course depend upon the size of the model. The Early Steamship in Fig. 3 carries two very small boats each made from a pair of $2\frac{1}{2}''$ Strips, and the lifeboats of the tug alongside the Clipper Ship are similarly made. Larger boats are shown stowed away on the Clipper Ship, each of these being made up from two $3\frac{1}{2}''$ Strips and a 3″ Strip, the latter being held by Flat Brackets at stem and stern. A $4\frac{1}{2}'' \times 2\frac{1}{2}''$ Flexible Plate has been used for the lifeboat of the Racing Yacht. It will be seen that the Plate is bent over along the middle, and the flexibility of these Plates enables them to be used for other similar purposes. Before bending the parts to the extent shown in this case they should be warmed to prevent them from cracking.

Axle Rods are excellent for making the masts of models of almost any size, and they can be extended to the length required by means of Couplings. The Rods for this purpose should be chosen in suitable lengths so that the Couplings joining them together can be used for carrying the yards. On the Racing Yacht the four Couplings carry short Axle Rods between which cord is tied as on actual yachts in this class for bracing the mast. A Coupling has been used effectively for making the bowsprit of the Clipper Ship, and Swivel Bearings are used to advantage for obtaining neat connections for attaching the booms to the masts on the models in Figs. 1 and 3.

To obtain the greatest realism all the external fittings of the actual craft should be represented on the model, and as far as possible they should be made to the correct scale. In some cases it is necessary to make them a little larger than correct scale size, and the constructor must judge whether the results obtained justify the loss of proportion in the complete model. There is a tendency for pumps, winches, etc., to be built large enough to actually work, whereas dummies, although not so interesting, are more suitable to preserve the correct proportions.

The neat pump fitted to the Clipper Ship is made by mounting a Swivel Bearing on a $\frac{3}{8}''$ Bolt passed up through the deck. A $2\frac{1}{2}''$ Rod forming the pump handle is carried in the "spider" of the Bearing. An anchor for this ship is made from a $2\frac{1}{2}''$ Rod carrying a $1\frac{1}{2}''$ Strip between two Collars. Threaded Pins are carried in the end holes of the Strip and the Rod is mounted in a Collar fixed to the deck. For the winch a 2″ Rod is carried in a Double Bracket on the deck and at one end carries a $\frac{1}{2}''$ fast Pulley and a $\frac{1}{2}''$ loose Pulley, the other end being fitted with a Collar. A $\frac{1}{2}''$ fast Pulley and a $\frac{1}{2}''$ loose Pulley are used also for the capstan on the Racing Yacht. On the Early Steamship a $\frac{1}{2}''$ fast Pulley is used with good effect for the bell that is mounted before the bridge. Small parts such as Collars, Couplings and Pulleys can be applied to many uses for deck fittings as these examples show, and all the essential features of the ship can be represented by suitable combinations of parts.

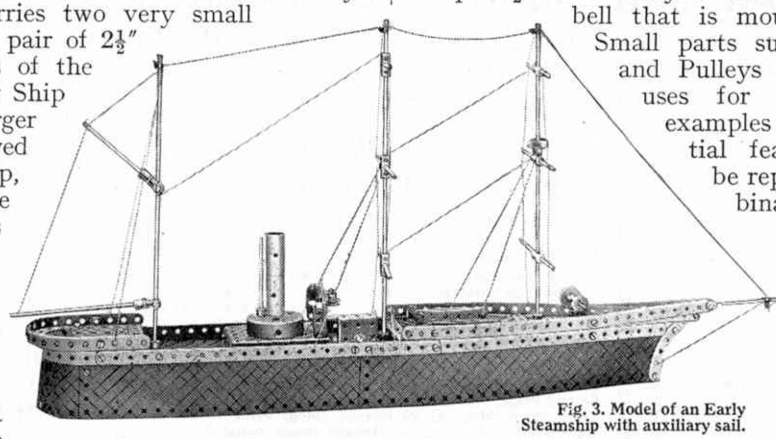


Fig. 3. Model of an Early Steamship with auxiliary sail.

On the model Racing Yacht the running rigging for hoisting the sails has been arranged to conform with actual practice, and pulley block tackle has been cleverly devised by the use of Washers. For each pulley block a Washer is used, one cord being tied to it while another length of cord is free to slide through the Washer. For some models even Washers are too large for pulley blocks, and in these cases slip knots can be formed on the ends of the cord to serve the same purpose, the free cord being passed through the loop.

Meccano Competitions for Indoor Evenings

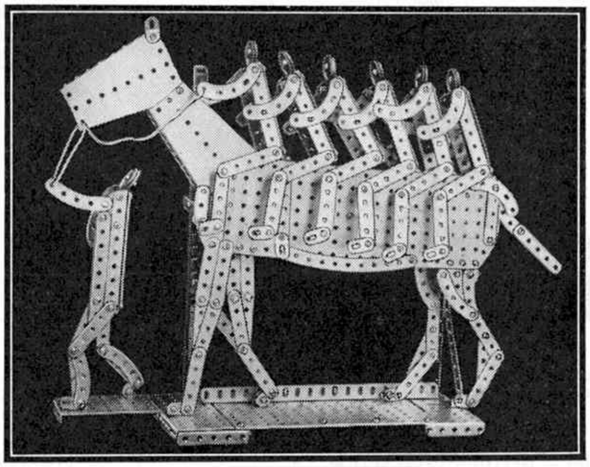
"Autumn" Contest for Models of All Kinds

IN this competition prizes will be awarded for the best built Meccano models of any kind constructed by *"M.M."* readers. Models built from small Outfits will be given special consideration, because we wish particularly to encourage owners of the smaller Outfits to take part in these monthly contests. Any size of Outfit, however, may be used. The contest is open to boys and girls of all ages living in any part of the world, and the models submitted will be grouped into sections according to the ages of their builders.

In regard to the kind of models most likely to win prizes, readers may be reminded that I am continually on the lookout for models of an unusual type, and any model, no matter how small and simple, that represents an unusual subject, will stand a very good chance of success.

There are many simple engineering devices that have never been reproduced in Meccano, and I advise competitors to select their subjects very carefully and to go to some trouble to find a really novel idea. A little time spent in this way is far more likely to place a competitor in the prize list than several days' work on a hackneyed model such as a crane, locomotive, or ship.

Models need not be confined to engineering subjects, however. For some time past our attention has been continually drawn to the number of practical uses to which Meccano lends itself, particularly in the home. One reader sent me details of an ingenious burglar alarm that he had made from Meccano, and another sent photographs of a bookstand and an electric lamp standard. If intending competitors in this contest can think of any original ideas of this kind and can reproduce them neatly in Meccano I should not be surprised to see their names among the prizewinners.



"Off to the Fair"—an amusing Meccano model made by E. Shapland, Exeter. Details of a new competition for models of this kind appear at the foot of this page.

Having designed and built their models, competitors should either obtain photographs of them or make good drawings, and then send these in an envelope addressed "Autumn" Model-building Contest, Meccano Ltd., Binns Road, Liverpool 13. Each photograph or drawing must bear the competitor's age, name and address, and the letter A, B, or C indicating the Section in which he or she is competing. The size of Outfit used in building the model must also be stated.

Entries will be divided into three Sections: (A) for competitors over 14 living in the British Isles; (B) for those under 14 living in the British Isles; and (C) for competitors of all ages living Overseas. The prizes to be awarded in each Section are listed in the panel in this page.

Entries for Section A and B must reach Liverpool on or before 30th November, 1935. The closing date for Section C will be 31st January, 1936, and Overseas readers therefore will have ample time to prepare and post their entries.

Can You Build a Humorous Model?

AMONG the entries in recent competitions I have noticed several models of a humorous type, such as that titled *"Off to the Fair"* shown on this page. These amusing and ingenious examples of the adaptability of Meccano interested me greatly, and I have decided to run a competition for this type of model only. I confidently expect some very amusing entries.

Any size of Outfit may be used and there is no age limit. The only conditions governing entries are that models must be of a humorous character and must be built entirely from Meccano. Other materials must not be used. Photographs or drawings of entries must be sent to "Humorous Model Competition," Meccano Ltd., Binns Road, Liverpool 13, and must bear the competitor's age, name and address and the title of the model.

Several illustrations of humorous Meccano models have appeared from time to time in the *"M.M.,"* one example in particular that comes to mind as I write being the "Scene in a Dentist's Surgery," which appears in page 783 of the *"M.M."* for October 1932.

Entries in this competition will be divided into Home and Overseas Sections. Those for the Home Section must be received on or before the 30th November, 1935, but the Overseas Section will remain open until 31st January, 1936, in order to give readers living abroad plenty of time to prepare and forward their entries.

The prizes to be awarded for the most humorous models received are listed in the panel in this page. Photographs or drawings of unsuccessful models will be returned if a stamped addressed envelope is sent for that purpose, but photographs or drawings of prizewinning models become the property of Meccano Ltd.

Prizes Offered in These Competitions

"Autumn" Contest

Sections A and C.
First Prize: Meccano or Hornby Goods value £3-3s.
Second Prize: Meccano or Hornby Goods value £2-2s.
Third Prize: Meccano or Hornby Goods value £1-1s.
Six Prizes of Meccano or Hornby Goods value 10/6.
Certificates of Merit.

Section B.
First Prize: Meccano or Hornby Goods value £2-2s.
Second Prize: Meccano or Hornby Goods value £1-1s.
Third Prize: Meccano or Hornby Goods value 10/6.
Six Prizes of Meccano or Hornby Goods value 5/-.
Certificates of Merit.

"Humorous Models" Competition

The Prizes in each Section (Home and Overseas) are:
First Prize: Meccano or Hornby Goods value £1-1s.
Second Prize: Meccano or Hornby Goods value 15/-.
Third Prize: Meccano or Hornby Goods value 10/6.

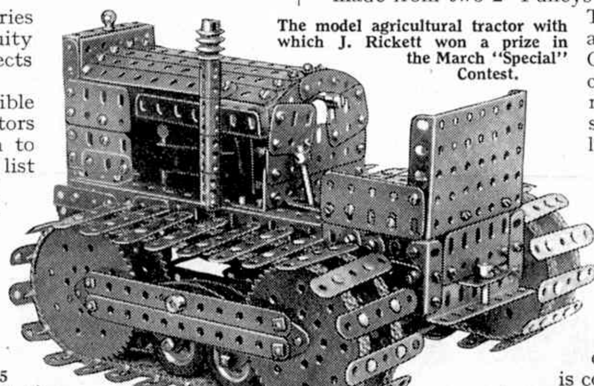
Model-Building Competition Results

By Frank Hornby

March "Special" Contest

Readers may be reminded that in this contest a special method of deciding the prizewinners was introduced. Points to a total of 100 were allotted to each model submitted, according to its merits when considered under the headings of Realism, Originality and Sound Construction. Every competitor who obtained over 55 points was awarded a prize or a certificate. Competitors who obtained over 75 points shared Meccano or Hornby goods value £8 (in proportion to the points obtained), while goods value £4 were divided in proportion between competitors who gained between 65 and 74 points.

I am pleased to say that many entries were received, and considerable ingenuity was shown in selecting original subjects for models.



The model agricultural tractor with which J. Rickett won a prize in the March "Special" Contest.

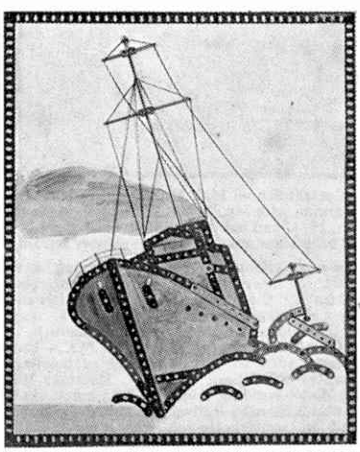
Owing to shortage of space it is possible to give only the names of the competitors who won the chief prizes. In addition to the awards shown in the following list a large number of competitors gained Certificates of Merit, and these have already been despatched.

Section A (Home competitors)

Three competitors obtained over 75 points, and therefore share goods value £8, as follows: J. Nowlan, London, S.E.14 (81 points) £2/15/6; J. Rickett, Takeley, Essex (78 points) £2/13/6; R. Picken, Doncaster, Yorks. (75 points) £2/11/6.

The following competitors obtained between 65 and 74 points and receive proportionate shares of Meccano or Hornby goods value £4: P. Bradley, Stanmore, Middlesex (72 points) 8/–; J. Gooch, Twickenham (72 points) 8/–; E. Wayman, Petts Wood, Kent (72 points) 8/–; A. Fear, Exeter (70 points) 7/6; A. Gunn, Timperley, Cheshire (70 points) 7/6; N. Ray, Benton, Northumberland (70 points) 7/6; L. Smith, London, S.E.13 (70 points) 7/6; K. Pim, Exeter (65 points) 7/–; W. Simmons, Welshpool (65 points) 7/–; A. Storer, Ilford, Essex (65 points) 7/–; R. Williams, Twickenham, (65 points) 7/–.

The model cantilever crane by J. Nowlan, that obtained first place, is a most interesting example of miniature engineering. This competitor has gone to considerable trouble to reproduce the smallest details usual in a crane of this kind, and in view of the good work of which he is capable it is a pity that he did not find a more original subject. Three Meccano Electric Motors are incorporated in the model, one of which is used for driving the travelling mechanism and the gantry bogies, while the other two are coupled together and drive the hoisting gear. The use of three Motors makes the model very powerful and easy to control, and they are supplied with current from two Transformers.



This realistic picture of a warship is composed from Meccano and cardboard. It was made by F. Nunn, Colchester, and won Second Prize in the "Meccano Picture" Competition.

J. Rickett's model, which won second place, is illustrated on this page, and represents an agricultural tractor. The model is actuated through worm reduction gearing and a gear-box by a 6-volt Electric Motor fixed beneath the bonnet. An ingenious method of building the creeper tracks is employed. On the rear driving axle are two pairs of Sprocket Wheels, which together with corresponding Sprockets on the front axle support four lengths of Sprocket Chain. To these, $2\frac{1}{2}''$ Strips are attached by means of paper fasteners pushed through the holes in the Strips and the links of the Chain. Two sets of 1″ Pulley Wheels fitted with Rubber Rings support the track between the Sprockets.

R. A. Picken, whose model was placed third in the contest, is to be congratulated on having found an original subject. It is a reproduction of the once popular "cake walk" fairground attraction, and is complete with celluloid dolls to represent people. The model includes an organ, electric lights, supports for a canvas roof and the usual gaudy lettering and decorations. The dolls are secured to handrails fitted to the sides of the "cake walk," and as the "walk" vibrates they jump about in realistic fashion.

Among the competitors who secured between 65 and 74 points are E. Wayman, P. W. Bradley, and J. Gooch, each with 72 points. Wayman's entry is a small model locomotive. This subject is a very common one for Meccano competition models, and on account of this the model did not obtain many points for originality. The model is well built but unfortunately the wheels are out of scale with each other and with the other parts of the model. The front bogies are Flanged Wheels while the driving wheels and the bogies for the tender are 2″ Pulleys and 1″ loose Pulleys respectively. A fire-engine and escape was sent by P. W. Bradley and it is a really fine piece of work. Portable extinguishers are represented by Sleeve Pieces fitted with Chimney Adaptors and $\frac{3}{4}''$ Flanged Wheels, and a hose reel is made from two 2″ Pulleys with thick cord to represent the piping. The model is worked by an Electric Motor and the escape is elevated by hand. J. Gooch submitted a working travelling crane, which is mounted on creeper tracks made from Sprocket Chain. The model is soundly designed and is capable of lifting considerable loads.

Next in the list are four entries that each gained 70 points. These are a model of the famous racing car *"Blue Bird,"* by L. Smith, a Priestman Universal Excavator by N. H. Ray, a grand piano and Union Jack flag by A. Fear, and a railway breakdown crane by A. Gunn. Of these the Union Jack, complete with Silver Jubilee decorations is the best so far as originality is concerned, but in construction it does not reach the standard displayed in the other models.

If A. Storer had chosen a more original subject for his model and then built it as well as he did the model he entered for this contest, he would have gained many more points. His model is a tramcar and it is obvious from the photograph submitted that this competitor is capable of really good work. Every part of the tramcar is soundly and neatly put together, and excellent judgment has been shown in selecting the most suitable Meccano parts for the various constructional details. If Storer takes my advice he will pay a little more attention to finding uncommon subjects for future models.

There is nothing of particular interest in any of the other models. The great fault with all of these is that their builders have not bothered to search for something new, and while the constructional work is in nearly every case all that I can expect, there is nothing in any of them that attracts particular attention. I am repeatedly asking competitors to model something uncommon, no matter how small the model may be. I am getting rather tired of receiving only locomotives, ships, cranes and motor cars, and in future contests models of this kind will have to be exceptionally well built to stand any chance of success.

MECCANO "PICTURE" CONTEST

This contest was announced in the February 1935 issue of the *"M.M."* and the list of awards is as follows:

Section A (Home competitors)

1st, Meccano or Hornby Goods value £3-3s.: F. Bailey, Scunthorpe. 2nd, Goods value £2-2s.: F. Nunn, Colchester. 3rd, Goods value £1-1s.: N. Whittaker, Burton-on-Trent.

Goods value 5/–: E. Fenwick, Wigton, Cumberland; S. Hutchinson, Liverpool 19; M. Pearson, Sedbergh, Yorks.; E. Ritchie, London, S.W.12; J. Wotherspoon, Liverpool.

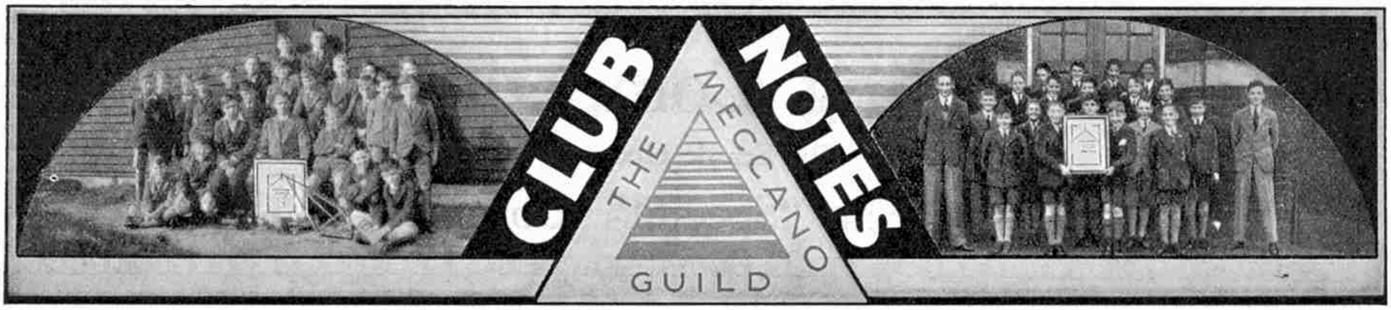
Goods value 2/6: H. Davies, Swansea; B. Le Fevre, Harleston, Norfolk; P. Oppermann, Devizes, Wilts.; W. Smith, Prescot; T. Steer, Hayes, Kent.

Section B (Overseas competitors)

1st, Meccano or Hornby Goods value £3-3s.: W. Jackson, Gatooma, S. Africa. 2nd, Goods value £2-2s.: D. Berkin, Kiangsi, China. 3rd, Goods value £1-1s.: J. Williams, Fielding, New Zealand.

Goods value 5/–: F. Esplan, Perth, W. Australia; B. Kelly, Clarence Park, S. Australia; R. Hill, Toronto, Canada; J. Hulley, Nantes, France; M. De Lima, Bombay, India.

Goods value 2/6: R. Myburgh, Capetown, S. Africa; V. Stewart, Lefroy, Canada; C. Cali, St. Juliana, Malta; T. Davis, Melbourne; S. Jones, Toronto.



Preparatory School (Sedburgh) M.C.—The chief feature of the Exhibition on Prize-giving Day was an original model of a double deck bridge, designed for crossing the Thames. Under the bridge were three locks for barges passing up and down the river. A dock-side crane and a gigantic aerial railway were other attractive models exhibited. Special attention is now being given to the construction of original models of all kinds. Club roll: 9. *Leader:* M. B. Pearson, Preparatory School, Sedbergh, Yorks.

St. Stephen's (Saltash) M.C.—This newly affiliated club has made good progress. Two groups have been formed, known respectively as "Cogs" and "Pulleys." The former have constructed a model of a stone crusher, complete with tar mixer, and this was so impressive that it has been photographed. A steam wagon and other interesting models have been constructed by the members of the second group. An Open Night has already been held and many attractive models were displayed. Club roll: 17. *Secretary:* J. Edgecombe, Tower View, St. Stephens, Saltash.

Kendal M.C.—Members travel long distances to club meetings. The utmost keenness prevails and excellent model-building work is being carried out. Trips to Lake Windermere and Morecambe were greatly enjoyed, members travelling in the Leader's motor car, and a visit has been paid to the Lancaster Branch of the H.R.C. Club roll: 10. *Secretary:* L. Haslam, Middleton, Kirkby Lonsdale, Carnforth.

Enfield Grammar School M.C.—Interest is increasing and a special group of members has been given the task of designing and assembling the club's Hornby Railway track. An interesting visit was paid to York, the train in which members travelled on the return journey reaching a speed of 90 m.p.h. when descending from Stoke summit. Engines inspected at York Sheds included the L.N.E.R. "Pacific" No. 2546 "*Donovan*," which hauled the train in which the trip was made. The Railway Museum and the L.N.E.R. Signalling School also were visited, and at the latter engineers explained the principle of electrical signalling to the visitors. One member of the club recently became junior swimming champion of the school. Club roll: 27. *Secretary:* J. H. Pettifer, 31, Goat Lane, Forty Hill, Enfield.

Well Hall and District M.C.—At the weekly club nights discussions have been held on the design of gear boxes, differentials and other mechanisms, talks by members being illustrated by means of Meccano models. Cycling runs at week-ends have been well attended, and Cricket has been enjoyed on suitable evenings. Visits have been paid to the Model Railway Exhibition and the L.N.E.R. Stratford Works. Club roll: 11. *Secretary:* E. Quinton, 48, Beaconsfield Road, Mottingham, Kent.

Bexleyheath Boys' Central School M.C.—A particularly interesting meeting was devoted to a discussion on radio control of aeroplanes. Other events have included the usual outdoor pursuits, and an Open Day attracted a large attendance of enthusiastic visitors, young and old, who were greatly interested in the club activities they saw in progress. Club roll: 37. *Secretary:* D. Hicks, 4, St. Audrey Avenue, Long Lane, Bexleyheath, Kent.

Islington M.C.—A very full and attractive programme has been followed. Every month special meetings are held for model-building, fretwork and the construction of track for the club's Hornby Railway, work being carried on in sections. Games also are played regularly at the ends of meetings, and also on a special evening once a month. An excellent feature is a meeting to which members can invite their friends, who join in their hobbies and games. Talks have been given on "*A Footplate Trip on 'King George V'*" by Mr. V. Miller, Leader, and on a trip to Denmark and Sweden by two of the members. Other members have made posters for an Exhibition and helped in arranging sideshows. A trip to the seaside was so greatly enjoyed that another one was immediately arranged. Club roll: 21. *Secretary:* S. Ryden, 54, Thornhill Road, N.1.

Regis (Corsham) M.C.—Good attendances have been secured at all meetings. A recruiting campaign is now in progress and preparations are being made for an Exhibition. Among interesting models, one of the D.H. "Comet" was outstanding. Films and slides have been shown by two of the members. Operations on the club track have now been well organised, five Superintendents, each in charge of a section, having been appointed. Club roll: 21. *Secretary:* R. Bidmead, High Street, Corsham.

Sid Vale M.C.—During the holiday season meetings took the form of rambles, their extent depending on the weather, and in the course of these games were played. "Whistle Chase" continues to be popular on these occasions. A member carrying a whistle blows it at intervals and members endeavour to trace him by the sound, the one who is successful taking over the whistle. Club roll: 25. *Secretary:* L. R. J. Gliddon, Sheffield House, Sidmouth.

St. Giles' Cathedral (Edinburgh) M.C.—Increased enthusiasm adds to the enjoyment of meetings and attendances have been excellent. Meetings have included Model-building Evenings and track operations on the club's Hornby Railway. Members are now busily engaged in constructing a new permanent track. Enjoyable visits have been paid to the Haymarket Engine Sheds of the L.N.E.R. and the St. Margaret's Engine Sheds of the L.N.E.R. Club roll: 168. *Secretary:* H. W. Govan, 18, Revelston Park, Edinburgh 4.

South Parade Modern School (Cleckheaton) M.C.—A cricket match was arranged between the club and the remainder of the school, the club being the victors. The Cycling Section have enjoyed several runs, and interesting rambles have formed part of the programme. Many ingenious models were exhibited at an Exhibition on the School's Open Day. Every class in the school attended the Exhibition, which also was visited by the staff of Heaton Avenue School. Club roll: 24. *Secretary:* K. Walker, 12, George Street, Cleckheaton.

Members of the Bexleyheath Boys' Central School M.C. Mr. E. L. Prescott, President of the club and Headmaster of the School, is in the centre of the group, with Mr. H. Jones, Leader, on his right, and D. Hicks, Secretary, on his left. This club was affiliated in March, 1934, and has a splendid record of continued success. Steady interest is maintained in model-building of high standard, and open meetings attract many enthusiastic visitors.

AUSTRALIA

Carnegie Methodist M.C.—The interest of members has been stimulated by the formation of sections, known as "Nuts," "Bolts" and "Washers" respectively. Points are awarded for attendance and for models constructed by members on Model-building Evenings, and at home for exhibition at club meetings. Special subjects, such as cranes, are selected for club work in model-building. A "Picture Night" was organised by Mr. C. Sebire, and on the same evening Mr. L. Ison, Leader of the Melbourne M.C., visited the club and introduced an electric game. A Senior Section for members over 15 years of age has been formed, and members of this recently organised a successful display of working models. Club roll: 37. *Secretary:* A. Daniels, 20, St. Hubert's Road, Carnegie, S.E.9, Victoria, Australia.

Melbourne M.C.—Special attention has been paid to the construction of large working models, including vertical and horizontal steam engines and a breakdown crane, and demonstrations have been given of their working. Special interest was taken in the operations of an electric gantry crane, in preparation for a competition in which entrants were required to load a block of wood into a truck with its aid. The time required by competitors varied from 1½ to 8 minutes. In a second contest that aroused keen interest 10 minutes were allowed for the detection of the Strips and Girders of certain lengths in the 6 ft. Meccano model of the Sydney Harbour Bridge that has been built by the Leader. Club roll: 12. *Leader and Secretary:* L. Ison, 8, Hayes Street, Northcote, N.16, Victoria, Australia.

CANADA

Rosemount (Regina) M.C.—A splendid impression was created by the Exhibition of models built by members, to which complimentary references were made in the local press. The largest models on view were a representation, 12 ft. 6 in. in length and 4 ft. in height, of the Saskatchewan Parliament Buildings, built by the secretary, and a splendid model of a C.N.R. "6000" type locomotive by H. Shorten that contains 2,000 nuts and bolts and weighs nearly 100 lb. Other splendid models were shown by members and a Mechanical Horse loaned by Meccano Ltd. caused great amusement. The demonstration was a financial success, and in view of the interest displayed it has been decided that next year's Exhibition will be open for a longer period. Club roll: 17. *Secretary:* J. Watson, 974, Athol Street, Regina Sask., Canada.

NEW ZEALAND

Christchurch M.C.—The keen work of officials is increasing interest in club work and excellent meetings have been held. The Sixth Birthday Party was remarkably successful. It was attended by many parents and friends, and members of the Ashburton M.C. also were present. An Electric Hornby layout was in operation throughout and working models on view included a derrick crane, traction engine and motor car. An entertainment was given by members and friends of the club, and a birthday cake was kindly provided by Mrs. Gay. Merit Medallions were presented to successful members by Mr. R. A. Handisides, Chairman. Club nights have been devoted to preparations for the Exhibition and to games, and special models were built for display at the Christchurch Winter Show. Club roll: 20. *Secretary:* L. W. Best, 28, Circuit Street, Strowan, Christchurch, New Zealand.

SOUTH AFRICA

Pioneer M.C.—Model-building Evenings, Debates and similar meetings continue to be held regularly. A system of contracting in which estimates are submitted has been introduced, and special attention has been given to discussions on the merits of models, which are then re-built and improved in accordance with suggestions received. Boys' Brigade work is being carried on and a special Concert was organised in aid of the King George V Silver Jubilee Anti-Tuberculosis Fund, returns being £4 9s. 0d. The Leader's birthday was celebrated by a special party. Club roll: 12. *Secretary:* A. H. Alley, 461, Burger Street, Pietermaritzburg, Natal, South Africa.

Members' Friends at Club Meetings

In every club in Great Britain, Canada and the northern hemisphere generally, the meetings of the first winter session are now in full swing, and I have been particularly struck by the evidence in letters from officials and individual club members alike of the enjoyable character of proceedings. In one club the excellent idea has been put into operation of setting aside certain meetings for the admission of friends of members, who take part in all activities as if they themselves were members, and thus share in the pleasures of club life. Friendly acts of this kind are in the true spirit of the Guild, and I should like other clubs to follow this example.

Suggestions for Model-Building Contests

I am often asked for suggestions for Model-building Competitions, which are very popular in all clubs because of the opportunities they give members of measuring their skill and enterprise against those of their friends. Contests of this kind can be arranged in almost bewildering variety, and as far as possible competitions of every type should be included in the course of a session in order to avoid monotony. In what may be called the standard type of competition, special subjects such as cranes, merchant ships, bridges of various types, motor lorries and other road vehicles are selected, and little difficulty should be experienced in keeping a series of contests of this kind going for a considerable time. Simplicity Contests also are very attractive. In these models must be built from a limited number of parts, or in a restricted time, and in one interesting variation, a small simple model is shown to members, who examine it for a period of three minutes or more, according to its complexity, and then are required to reproduce it, with or without a time limit. It is great fun to transform an occasional competition of this kind into a Blindfold Contest, but only very simple models of course should be used for this purpose.

Special contests also should be organised to allow members to display their powers of designing original models, and in these the plan may be followed of allowing the models to be constructed at home, for criticism and judging at a special club meeting. Humorous competitions also can be introduced with advantage. In these quaint appearance and movements are looked for, and the entries in Animal Contests and others of a similar type included among "*M.M.*" Model-building Contests form useful guides to competitors.

One aspect of Model-building Contests that Leaders should never overlook is the possibility of entering the most successful models in the competitions announced in the "*M.M.*" I am glad to find that since my previous note on this subject there has been an increase in the number of entries from clubs in these contests. All models entered of course must be submitted by the individual members responsible for them, but club entries can be collected and forwarded under one cover by the Leader.

Meccano Club Secretaries

No. 33. J. Watson

J. Watson is secretary and treasurer of the Rosemount (Regina) M.C. This enterprising Canadian club was affiliated in August 1932 under the leadership of Mr. J. T. Favelle, who has kindly placed a large store of Meccano parts at the disposal of members. A special feature is made of large models, and these were greatly admired at the club's recent Exhibition.

Super Models for Loan to Clubs

Many clubs end the present session with an Exhibition, either just before Christmas or during the week following. It is not too soon to begin preparations for an event of this kind, and model-building activities in particular should be directed towards making a really fascinating display for the benefit of visitors.

The attractions of an Exhibition can be increased by including in the display one of the splendid super models that can be obtained on loan from Headquarters. These are built and despatched free of charge, and the only expense the club is called upon to bear is that of return carriage, amounting usually to a few shillings. This expenditure is well worth while, for the models are attractively built and work in a very interesting manner. I shall be pleased to send a list of the models available to any Leader who does not already possess one, and those who would like to include a super model in an Exhibition at Christmas or early in the New Year should apply as soon as possible, stating the date for which the model is wanted and giving the voltage and type of their electric current supply.

Announcements of Coming Events

Another point that should not be overlooked by the officials of a club planning an Exhibition or display of any kind is the publicity, especially among Meccano boys, the most useful type of recruits, that follows an announcement in the Guild Pages of the "*M.M.*" I am always pleased to include such announcements and urge Leaders and secretaries to forward details of any event of this kind, including the address of the hall or club room in which it is to be held, the date, the times of opening and the charges for admission. Notes on any particularly striking feature also should be given.

The "*M.M.*" goes to press well in advance of the date of publication, but announcements of events to occur in December can be included in the special Christmas issue of the Magazine if they reach me within the next few weeks, and those for inclusion in the January issue should be forwarded early in November. Announcements of this kind often have been instrumental in attracting Meccano boys who have become valuable club members.

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:

ASKWITH—P. H. C. Walker, Whitbeck Manor, Askwith, Nr. Otley.
AUSTRALIA—H. Templeton, Box 29, South Wagga, Wagga, N.S.W.
BIRMINGHAM—Mr. L. Willington, 24, Holte Road, Aston.
COLWYN BAY—T. Gillard, Stella, Riviere's Avenue.
HARPENDEN—A. D. Tarry, 59, Longfield Road.

New Hornby Vans for Perishable Traffic

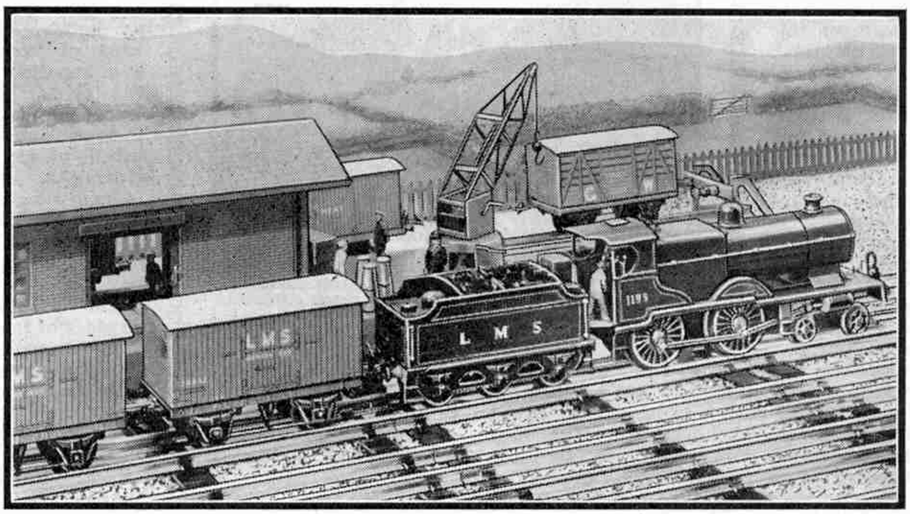
By "Tommy Dodd"

IN my last article I described briefly the new No. 2 Coaches for passenger traffic on Hornby Railways. This month I wish to refer to rolling stock again, but this time for freight services. As readers know, the freight services in actual practice are most important, especially those dealing with perishables and foodstuffs generally; and it is with vehicles for this kind of traffic that we are now concerned.

In the foreground of this interesting photograph appear the No. O G.W.R. Milk Van and the L.N.E.R. Fish Van. The tinprinted finish of the No. O Vans allows of the inclusion of a great deal of realistic detail.

A new van, known as the No. O Banana Van, has been introduced into the Hornby Series this season, forming a further addition to the range of tinprinted Vans that have proved so popular since they first appeared. It is based on the well-known design of the real L.M.S.R. banana van, and with careful attention to detail it has been possible to obtain a most realistic representation of the prototype. The tinprinted finish incorporates a great amount of small detail that could hardly be represented in any other way.

The body of the van is of the vertically boarded type, flush finished, as is the case with most up-to-date vans, with no external timber framing. The various items of ironwork found on the body of the real van are accurately shown. A striking feature on the ends is the provision of louvred shutters or ventilators.



A goods yard scene on a Hornby Railway. The train about to depart is made up of the new Hornby No. O Banana Vans, the realistic appearance of which is clearly apparent.

The colouring and lettering is carried out in accordance with actual practice, the body of the Van being the standard L.M.S.R. light grey with the letters in white. On the door appear the owning company's initials, "L.M.S.," with the purpose of the vehicle below by the words "Banana Van." An appropriate number and the tare or empty weight figures also are included, together with the wording *"To be returned to Avonmouth."*

The new vehicle just described is not provided with actual doors to open, and the same feature has now been extended to the other three No. O Vans previously available. At the same time the opportunity has been taken of redesigning them to represent the latest practice.

The L.M.S.R. No. O Meat Van closely resembles the new Banana Van in design and constructional details. It has all the characteristics of a ventilated Meat Van as used for the transport of freshly-killed meat. Two sets of louvred ventilators are represented at each end of the van, and it is finished in the L.M.S.R. standard style.

The popular Fish Van has been altered slightly in design, and closely resembles the standard L.N.E.R. vehicles for this class of traffic. As a van essentially for the carriage of perishables, it is finished in the "red-oxide" shade used by the L.N.E.R. for vans of this kind that are fitted with continuous brakes, and therefore are suitable for running in express freight trains or in passenger trains if required. With its red-brown body, white roof and white lettering, it has a very striking appearance.

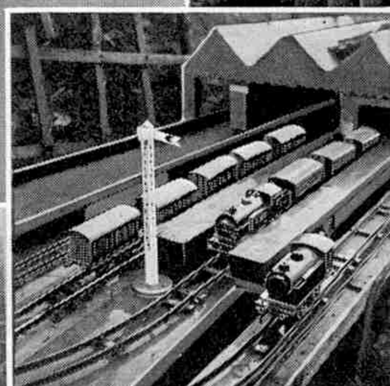
The G.W.R. No. O Milk Van also has been greatly improved in finish and general appearance. It represents the open-boarded ventilated type of van, and is coloured in the "coach-brown" of the G.W.R. that is applied to milk vans, parcel vans and similar vehicles. The lettering is in yellow, and shows up well.

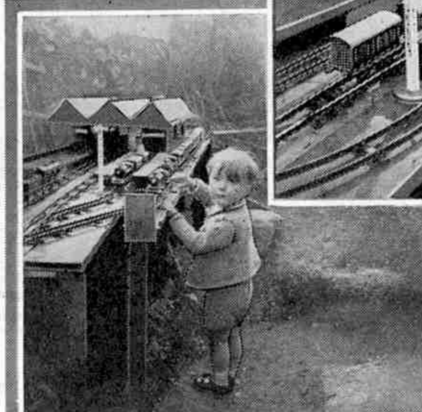
A Notable Layout in North Wales

L.M.S.R. Services in Miniature

AN attractive feature of the miniature railway hobby is the fact that, apart from its general interest there are so many different aspects to which we can devote attention. Rail plans, "engineering" features and scenic effects, train operation and control all play important parts in the development and working of a model railway system. The system shown in the photographs on this page is planned and operated in such a manner as to reproduce the main L.M.S.R. services from Euston to Holyhead, Liverpool and Manchester, Shrewsbury and Swansea, with appropriate through coach, branch and "cross-country" workings. It has been developed by W. Southwell, Holyhead, a member of the H.R.C., with the aid of his father, Mr. J. Southwell, both enthusiastic model railwaymen who greatly enjoy operations on it.

Although traffic working has received the chief consideration of the owner of the line, its engineering features have by no means been neglected. For convenience in handling the trains, the tracks are raised on a wooden substructure arranged in a space measuring 40 ft. by 20 ft. The rails used are of the Hornby standard tinplate type, but in order to make them weatherproof as far as possible each rail and sleeper was thoroughly coated with black stove enamel and allowed to dry before being laid down. This was necessarily a tedious process, for the number of rails required in the layout is very large, but the treatment has proved successful. The track is not allowed to remain out-of-doors throughout the year, but is in use from April to October and is taken up during the Winter.





Parts of the layout of W. Southwell, Holyhead, H.R.C. No. 43323, described on this page. (Top) Looking towards Swansea from Shrewsbury. (Centre) The main and bay platforms at Shrewsbury. (Bottom) A youthful railway official controls the traffic!

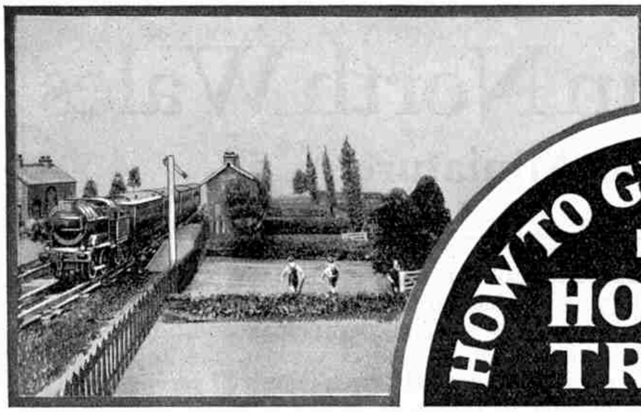
In plan the line is non-continuous and is formed roughly like two sides of a rectangle, with a third shorter side joining them. The central point of the line is "Shrewsbury," situated in the middle of the short side. From that station lines run to "Stafford" in one direction and "Crewe" in the other, these two places being situated approximately half-way along the other sides of the layout. At "Crewe" the line divides into "Liverpool" and "Holyhead" branches. For reasons of space these two branches run more or less parallel to each other and terminate in adjacent stations, but from the operating point of view they are correctly considered as remote and apart from one another, and they are used accordingly.

A similar state of affairs exists on the opposite side of the line, where at "Stafford" lines branch to "Euston" and "Birmingham" respectively. It will be realised that a train from "Euston" or "Birmingham," to "Liverpool" or "Holyhead," has to pass through "Shrewsbury." This divergence from actual geographical conditions was made for reasons of space and in view of the importance of Shrewsbury in the real "cross-country" services which it was desired to represent in the working arrangements. From "Shrewsbury," in addition to the "Crewe" and "Stafford" lines, there are also branches northward and southward respectively to "Manchester" and "Swansea."

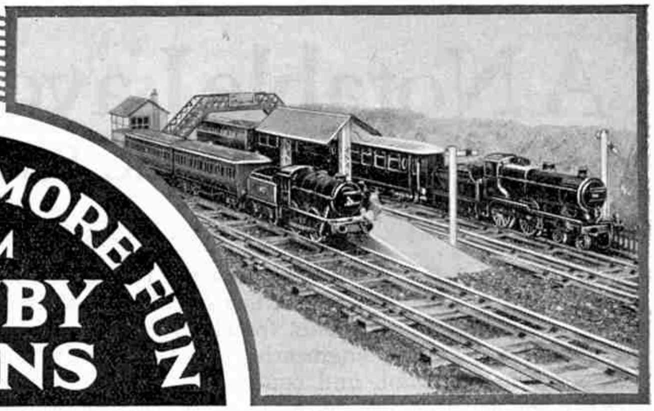
The result of this arrangement of the layout is that the various districts supposed to be served by the line can be provided with services closely following those of actual practice. As a possible example of the working, one train might leave "Euston" and another depart from "Birmingham." The latter, destined for "Manchester" perhaps, might convey a through coach for "Swansea," the "Euston" train being bound for "Liverpool." The two trains might be combined at "Stafford" and run as one to "Shrewsbury," where the "Swansea" coach is detached. Possibly by this time a coach from "Swansea" to "Manchester" or "Liverpool" has arrived and is therefore attached to the appropriate part of the train. The "Manchester" and "Liverpool" sections proceed separately from "Shrewsbury" to their respective destinations. In the meantime the "Swansea" coach detached from the train from "Birmingham" will be held in the bay platform for attachment to a "Swansea" train.

Many variations of course are possible, and very careful working out is necessary to make the best use of stock and to avoid unproductive "mileage" on the part of engines and vehicles. The actual working arrangements indeed are based on the real L.M.S.R. timetables and all the appropriate connections are made. Both "Summer" and "Winter" services are dealt with, the Summer being notable for an increased number of trains.

The method of working may be considered briefly as a series of "episodes." To run off the whole series of episodes one after the other would require approximately 30 hours operation, in order to complete the day and night, weekday and Sunday services for passenger and goods trains.



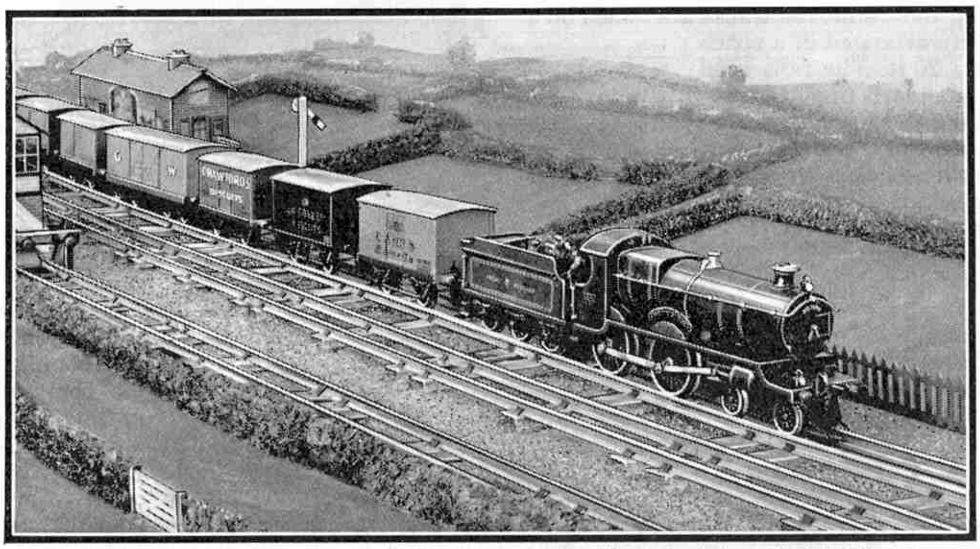
HOW TO GET MORE FUN FROM HORNBY TRAINS



THE HEADLAMP CODE IN HORNBY RAILWAY WORKING

ONE of the many attractive features of a Hornby Locomotive is the provision of lamp brackets to accommodate the miniature Detachable Headlamps that are made specially for them. The possessor of a miniature locomotive naturally wishes to fit lamps on his engine and to be able to alter their positions in accordance with the practice he has observed on real railways. All Hornby Locomotives from the M3 Tank upwards therefore are provided with lamp brackets in the appropriate positions, and Detachable Headlamps are available for them and indeed are supplied as standard equipment with the larger models.

As most readers know, different classes of trains are indicated by various arrangements of the headlamps in accordance with the British Standard Headlamp Code. For this purpose three lamp brackets are fitted on the footplate above the buffer beam of the engine, so that one is in the middle, above the coupling hook, and the others are above the buffers. A single bracket also is placed centrally in front of the chimney, or below it, on the upper part of the smoke-box door. A similar set of brackets is provided in corresponding positions at the rear of the tender, or the bunker of a tank engine, to allow the necessary indications to be displayed when running backwards. The code employed is given in the H.R.C. Senior Booklet and the purpose of this article is to explain fully what each indication means and to show how to use the code in miniature railway working.



Several different headlamp indications are used for fast freight trains, according to the stock employed. In this photograph of a train of Hornby Biscuit and Luggage Vans the position of the headlamp on the G.W.R. "County of Bedford" at its head shows that the train is regarded as "brake-fitted" throughout.

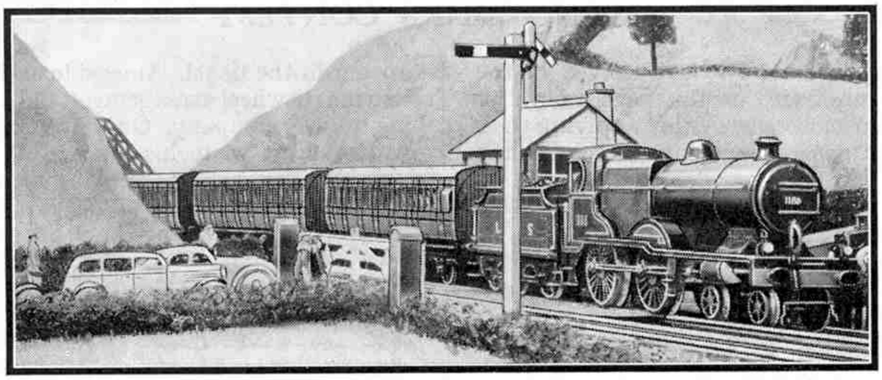
It will be realised that with the use of one or more lamps, in conjunction with the four brackets, a variety of indications can be given. Under the British Standard Headlamp Code, no more than two lamps are required at once. As keen Hornby Railway operators let us suppose we are about to run an express train. The headlamp indication for this involves the use of two lamps, one placed on each of the brackets above the buffers. This is not a difficult arrangement to remember and is one that most readers frequently employ. This indication also has two emergency uses. It is displayed by the locomotive on a breakdown train that is on its way to deal with a mishap. The same code is carried also by a light locomotive that is required to assist a train, the locomotive of which has been disabled in some way.

A familiar indication is that carried by the locomotive of an ordinary stopping train. This requires the use of a single lamp displayed on the bracket below the chimney. In the case of engines travelling backwards the lamp is placed on the corresponding bracket on the tender or bunker. This indication is carried by any train to which the general term "ordinary passenger train" can be applied, whether it is a main line stopping train, a train in an intensive suburban service or an ordinary slow branch line train.

In addition to covering all "ordinary passenger trains," a single headlamp placed below the chimney also identifies a breakdown train that is not on its way to a mishap. It is carried by such a train when returning to its depot after such an occurrence, or when proceeding to the site of some engineering operation down the line, where the services of the crane are required.

Coming now to non-passenger trains, the indications become very varied, since there are more classes of trains to be provided for. In real practice a locomotive having one lamp below the chimney and one over the right-hand buffer might be hauling one of several different classes of train, but in each case the vehicles would be found to be fitted with continuous brakes throughout. Thus any train so fitted that is carrying perishables, such as meat, fruit, or fish, or livestock, would display this indication, which also applies to a train of empty coaches if this is proceeding for a reasonable distance, and is not merely being shunted or moved between a station and a siding. In addition, this comprehensive indication distinguishes mineral, goods and even ballast trains, that happen to be made up exclusively of brake-fitted vehicles.

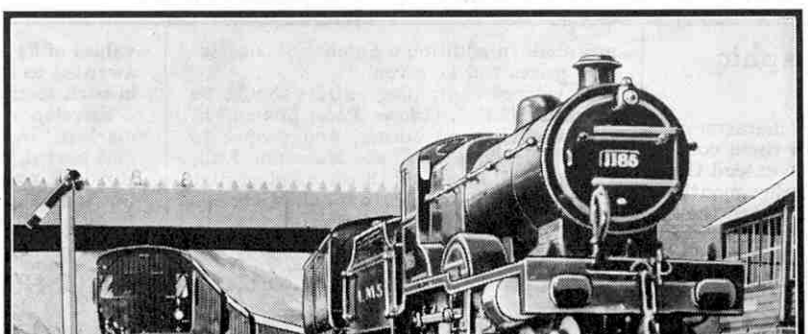
On a Hornby Railway the provision of brake-fitted vehicles of course must be left to the imagination, and the miniature railway owner therefore should classify his goods stock according to whether they are supposed to be brake-fitted or not. In general covered Vans can be considered as brake-fitted, but open Wagons, Timber, Lumber, Trolley and Tipping Wagons should be regarded as non-fitted. Milk Tanks also should rank as brake-fitted wagons, but ordinary Tank Wagons should not.



A miniature L.M.S.R. express train passing over a level crossing. The headlamp code involves the use of two lamps for express trains, one lamp being mounted on each bracket above the buffers.

The next indication to be considered requires a lamp below the chimney and one on the buffer beam, but in this case the lower lamp is placed over the left-hand buffer. This disposition of the lamps is used on trains carrying perishables, on which only some of the vehicles are brake-fitted, and also on fast cattle or general goods trains that are partially fitted with brakes and travel at speeds above 25 m.p.h. The fitted vehicles in this case must be marshalled next to the engine, for otherwise their braking power would be useless. In the composition of trains of this kind on a Hornby Railway the distinction between the vehicles supposed to be brake-fitted and those that are not therefore should be observed carefully.

Trains of the same kind as those just described, and composed of similar stock, but running at speeds lower than 25 m.p.h., carry a lamp below the chimney and one on the central bracket over the buffer beam. This indication also is used for trains carrying ballast or engineering materials for work on the line that are running long distances without breaking bulk.



The locomotive of the approaching train in this photograph displays a single headlamp in front of the chimney, the indication for an ordinary passenger train. The tail lamp is prominent on the other train.

Light engines that are travelling any distance, either singly or coupled together, carry one lamp placed on the central bracket above the buffer beam. Sometimes, however, they display the indication of the train they are to work. This also applies to an engine with a goods brake van coupled to it when proceeding to colliery or dock sidings, for the purpose of collecting wagons to form a train to be taken to a concentration yard for marshalling.

A goods or mineral train taking its load through to its destination without any roadside work displays two lamps over the buffer beam, one in the central position and the other over the right-hand buffer. A similar train stopping at intermediate points carries a single lamp only, and this is placed over the right-hand buffer; and the ordinary local goods train carries exactly the opposite indication to this, namely a single lamp over the left-hand buffer.

As mentioned by "*Tommy Dodd*" last month, suitable tail lamps have recently been introduced into the Hornby Series. These can be fitted to the brackets provided on the latest types of No. 2 Coaches, No. 1 Coaches and Guard's Vans and the No. 1 Pullman Coaches as re-designed this season. In actual practice a train is not considered complete unless it is displaying a tail lamp, and if a train without a tail lamp were observed by a signalman, he would immediately advise the box in advance and also the box in the rear in order to have the matter investigated. The bell code used by signalmen provides for such a contingency, so that the necessary message can be transmitted in both directions without loss of time. On a Hornby Railway therefore it is important to see that wherever possible a train is "completed" by the addition of a miniature tail lamp.

From the signalling point of view light engines constitute "trains" in themselves and so carry tail lamps. This practice therefore should be followed in miniature. One of the engine lamps usually is employed for the purpose, and a movable slide having a red glass is incorporated in these lamps, so that they can be used as tail lamps, or for signalling in emergencies. A lamp with a red slide is also used when an engine is backing an empty train out from a station into the carriage sidings, which may be some distance away. The lamp is placed on the front of the engine which becomes temporarily, when backing, the tail of the train. Such features can be reproduced by using a Hornby Locomotive headlamp with a red-painted "bull" instead of the standard white one, and a lamp so treated should form part of the equipment of each engine on the line. The re-painting of the "bull" is easily carried out, and small features of this kind add greatly to the interest and realism of operations.

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.

MISSING LINKS CONTEST

Judging from the number of entries received in the various competitions announced on this page month by month, it is evident that our readers enjoy applying their railway knowledge and general ingenuity in solving the different problems set before them. This month we announce a *"Missing Links Contest."* It is a considerable time since we held a similar contest and therefore we shall expect to receive an unusually large number of entries. In the panel in the centre of this page are 36 mutilated names and numbers of British locomotives. Various numerals and letters have been omitted, and are represented by dashes, and H.R.C. members are set the pleasant task of identifying the concealed locomotives. There is no catch in any of the names and numbers, and each dash replaces either a figure or a letter.

```
-4-9 -a--s-a-                  ---4 -loo--o---
 -1- -e---a-- -a--o--          --20 -a----s-n
 --0 L--- ---s-n               -0-9 -e------is ---t-e
-54- -i- -o---t -u--b---        -6- ---- C---in-w---
--4- -an---a- --l-              --4 -- -a---nc-
5--0 -a--c--t-- -a----         -95- -o--w--t- C----
-1-- -o--l --l-- --s--i--      -2-- -r--c--- L---s-
-36- S-- --l---m -o--i-t       -0-3 --ee- -i--o---
 --6 E--a--b--                 -36- -i-h -a- -o--
 --6 --- ---i--o--a--           --3 -ra--i---
59-- --l--n --l-               -0-7 ---g -i--a-- -
---8 R----ia- ---ar--          --4- -o-d-- -i---a--e-
--10 --n- ---r-- -             6--- -a---on-a-
 -65 --- -a-e--                -0-2 -u--o- -a----
5--5 -a--ho---                 --22 ----h -o--la-d
-4-3 --e- -u--                 -0-4 ----al---d
 --0 ---g-n -- -a-             ---6 -ha---h---t H---
5--- ---la- -a----             -4-8 -i-- -f -iv--p---
```

When competitors have discovered all the correct names and numbers, or as many of them as they can find, they must make a list of them in the order in which they appear in the panel. Alongside each locomotive must be written its wheel arrangement and the initials of the owning railway company. On the back of his entry each competitor must write his name, full address, and H.R.C. membership number.

The Contest will be divided as usual into two Sections, Home and Overseas. The winners of the four prizes awarded in each Section will be able to choose any products manufactured by Meccano Ltd. to the value of 21/–, 15/–, 10/6 and 5/– respectively. A number of consolation prizes also will be awarded. 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 must be marked *"H.R.C. Missing Links"* in the top left-hand corner, and posted to reach Headquarters at Meccano Ltd., Binns Road, Liverpool 13, on or before 31st October. Overseas competitors must post their entries to arrive not later than 31st January, 1936.

Railway Photographic Contest

Owing to the generally good character of the photographs submitted in these competitions it has been decided to extend the Photographic Contests for another month. Thus those members who have taken their holidays late are afforded an opportunity of submitting their railway photographs. Regular competitors are aware of the rules governing these contests, but for the benefit of new competitors they are repeated below.

As in previous contests in this series, prizes are offered for the best photographs of any *"Railway Subject,"* and the only restriction is that the photographs must have been taken by the competitor himself. The developing and printing may have been carried out by others. Competitors may send as many prints as they desire, but no competitor can win more than one prize.

On the back of each entry submitted must be written the competitor's name, age and address, and H.R.C. membership number. In addition to these a short description of the scene of the picture must be given.

The Contest will be divided as usual into two Sections, Home and Overseas, and prizes consisting of any products manufactured by Meccano Ltd., or photographic material if preferred, to the respective values of 21/–, 15/–, 10/6 and 5/– will be awarded. In addition a number of consolation prizes will be given.

Envelopes containing entries should be marked *"H.R.C. October Photo Contest"* in the top left-hand corner, and posted to reach Headquarters at Meccano Ltd., Binns Road, Liverpool 13, on or before 31st October. The closing date for the Overseas Section is 31st January, 1936.

Articles Suggestion Contest

This month marks the beginning in real earnest of the model railway season, and many H.R.C. members will be considering new ideas for the development of their miniature systems. We should like to be at hand to give advice on the many little problems that crop up in this connection, but unfortunately this is not possible; and the next best thing we can do to assist is to publish really practical articles in the *"M.M."* We want readers to help us in the choice of topics for these articles, and this month we offer prizes for the best six suggestions for articles. The subjects chosen should be those in which the competitor himself has found difficulty, or the need for further information. In most cases a suggested title for an article will be sufficient, but a few words of explanation may be added where necessary.

Prizes consisting of any products manufactured by Meccano Ltd., to the respective values of 21/–, 15/–, 10/6 and 5/– will be awarded to the four successful competitors in each section, Home and Overseas.

Envelopes containing entries should be marked *"H.R.C. October Articles Contest,"* and posted to reach Meccano Ltd., Binns Road, Liverpool 13, on or before 31st October. The closing date for the Overseas Section is 31st January, 1936.

COMPETITION RESULTS

HOME

July "Locomotive Silhouettes Contest."—First: C.E. Wrayford (6039), Moretonhampstead, Devon. Second: A. D. Parr (2844), Leigh-on-Sea, Essex. Third: R. F Embley (41047), St. Annes-on-Sea. Fourth: J. F. Aylard (25864), Old Southgate, London, N.14. Consolation Prizes: E. Woods (31488), Spalding, Lincs.; J. C. Button (10335), Crewe, Ches.; E. Hill (38742), New Eltham, London, S.E.9; J. L. Makin (30933), Penwortham, Preston; F. James (14584), Derby; M. L. Harper (8718), Wood Green, London, N.22; K. Costain (5108), Bolton, Lancs.; C. W. Atkin (13233), West Kirby, Ches.

July "Railway Photo Contest."—First: V. L. Breeze (2134), Kingston, Lewes, Sussex. Second: E. C. Morgan (10735), Wandsworth Common, London, S.W.18. Third: R. C. T. Lyle (30157), Tupsley, Hereford. Fourth: F. G. H. Kennedy (25074), Tonge Moor, Bolton. Consolation Prizes: J. Turley (2589), Tunbridge Wells, Kent; J. W. Hague (1258), Ripon, Yorks.; F. Hodson (9430), Bolton; W. B. Hudson (1733), Weymouth; B. Gerrard (22476), Thornton Heath, Surrey.

OVERSEAS

April "Railway Photo Contest."—First: G. E. Schulz (15425), Coromby, Victoria, Australia. Second: J. A. Coates (23863), St. Lambert, Quebec, Canada. Third: J. Jasper (42664), Manly, Queensland, Australia.

Branch News

ISLINGTON.—Various tracks selected from *"Hornby Layouts—100 Suggestions"* have been laid down and tested, and rails are to be purchased in order to enable this to be continued. Members possess a good store of rolling stock and excellent services are arranged. Two evenings a month are devoted to actual track building operations. At the remaining meetings members carry out operations with their own locomotives, and talks are given and games played. Secretary: E. Muxlow, 7, Regents Park Road, London, N.1.

CHORLTON-CUM-HARDY.—A new service has been introduced in which trains run between King's Cross, Edinburgh and Inverness, with through coaches for Glasgow and Aberdeen. Good running is made at track meetings, but an accident recently occurred to the King's Cross–Inverness train when running late. A breakdown train quickly cleared the line, and services were resumed. New members have been enrolled and arrangements made for visits to engine sheds. Secretary: G. H. Gill, 56, Highfield Road, Chorlton-cum-Hardy.

WHITGIFT SCHOOL—Practical meetings have been varied by competitions. In one of these locomotives were timed over a long straight course that included two steep inclines, and the record was created by a No. 2 L.N.E.R. Special Tank, which required only eight seconds. Shunting skill was tested in a second contest, in which competitors had to assemble rolling stock into correct order. Visits have been paid to the works of Decca Records Ltd., and to the Camden Locomotive Sheds of the L.M.S.R. Secretary: J. Watson, 23, Addiscombe Avenue, Croydon.

FIRST SHEFFIELD.—The Branch track now in use represents the line between Sheffield (Victoria) and Huddersfield. L.N.E.R. trains run between Sheffield and Penistone, and those of the L.M.S.R. between Penistone and Huddersfield. Through coach and restaurant car working is a prominent feature and there is excellent co-operation between the two groups operating the line. Competitions were held during the summer for the greatest number of named L.N.E.R. locomotives, and the largest "collection" of various types of L.M.S.R. locomotives seen by members. Enjoyable visits have been paid to the L.M.S.R. Works, Derby, and to York station. Secretary: W. B. Hutchinson, 35, Linden Avenue, Sheffield, 8.

ELMSIDE (EXETER).—The Branch track and operations on it were reviewed at a special meeting, when the make-up of the principal trains was revised. Railway survey work is to be continued and extended. Summer services have now ended. Those arranged for this year were the best ever organised by the Branch. The track is now being re-organised in order to speed up the services running on it. The Branch entertained Mr. Rush, Accrington, during his visit to Exeter, and Mr. Rush presented a railcar made by himself that gave great satisfaction at trials. All Branch rolling stock was thoroughly overhauled in readiness for the intensive services now being run. Secretary: T. Smith, 98, Ladysmith Road, Exeter.

Members of the Milan Branch, No. 274. Mr. C. Vigo, Chairman, is in the centre with E. Vigo, secretary, on his left. This Branch was incorporated in February of this year, and is closely associated with the Milan M.C. Pullman passenger services are operated at track meetings. An electrical section has been formed, and excellent use is made of the Branch cinematograph projector.

HOLYWELL.—Effective timetable running has been carried out, a frequent and steady service having been maintained on the re-laid track. Long trains, "Specials" and excursions have been run, and interest was added on several occasions by running important passenger trains in two portions. The regular meetings of the winter sessions have again commenced. Secretary: J. Spicer, 28, Holywell, Oxford.

AUSTRALIA

SYDNEY.—A discussion on automatic signals was illustrated by demonstrations of their use, and they are to be incorporated in the Branch layout. Most of the Branch track has been repaired and specially treated for outdoor use. A Branch excursion to Blackheath, in conjunction with the Railway Touring Club, was very enjoyable. Secretary: W. J. T. Watson, 595, Parramatta Road, West Leichhardt, N.S.W., Australia.

HOLLAND

MAASTRICHT.—The number of members has increased and Branch funds show an improving balance. Meetings are held in conjunction with the Maastricht M.C., and model-building and train operations form the chief activities. Mr. F. L. Bingen, Leader of the club, recently missed a meeting for the first time during the last three years. During the summer the World Fair at Brussels has been visited and a Camping Tour enjoyed. Secretary: P. Bosch, Rechtstraat 61, Maastricht, Holland.

ITALY

MILAN.—Cinematograph film entertainments continue to be prominent in Branch affairs. A film that was greatly enjoyed was shown by the secretary and illustrated a lecture on Rome. Football is one of the principal sports followed by members, who have played several games and took part in a great Sports Exhibition in Milan. Secretary: E. Vigo, Corso Genova 19, Milan, Italy.

Branches in Course of Formation

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

BRISTOL—K. Bartlett, 33, Bath Buildings, Montpelier.

LONDON—F. Bishop, 151a, The Grove, London, W.6.

U.S.A.—B. O'Donnell, Jrn., 117, Stone Avenue, Monroe, Louisiana.

SETS (POSTAGE EXTRA)

5 Angola...	... 2d.	5 Cayman Is.	... 7d.
10 „ ...	... 5d.	10 Labuan	... 1/4
5 Azores ...	... 2d.	10 Hong Kong	... 5d.
10 „ ...	... 5d.	10 Cape Good Hope	5d.
5 Cape Verde	... 2d.	10 Ceylon ...	... 2d.
10 „ „	... 5d.	10 Canada	... 2d.
5 Guinea...	... 2d.	5 Johore ...	... 2d.
10 „	... 5d.	5 Kenya ...	... 3d.
5 India Port	... 2d.	4 Kedah ...	... 2d.
10 „ „	... 5d.	4 Iraq ...	... 2d.
5 Mozambique	... 2d.	5 Jamaica	... 2d.
10 „	... 5d.	5 Newfoundland	2d.
5 Mozambique Com.	... 2d.	3 India Jubilee ...	6d.
10 „	4d.	2 Morocco Agencia Jub.	... 2d.

J. RUSSELL
23, Shanklin Drive, Westcliff-on-Sea

ROYAL JUBILEE PACKET FREE!!

This memorable packet is issued as a record of the 25 years' reign of H.M. King George V, and includes stamps issued 25 years ago and some of the newest issues, including Jubilee Equestrian Statue stamp, The King and Queen together on a stamp, the pictorial (sheep) Anzac commemorative, 15c. Tanganyika, Large Trinidad and Tobago, The King in Admiral's uniform, a fine stamp depicting H.R.H. The Prince of Wales, early K.G. Canadian and Australian issues, also an interesting British Guiana. Other countries include—A beautiful bi-coloured IRAN (Shah), an olive unused Turkey (G.P.O. at Constantinople), a large orange Airmail, a beautiful Cracow, and an old Queensland, 60 different stamps. Finally, to the first 500 applicants we will include a useful DUPLICATE ALBUM and an obsolete Jamaica pictorial stamp. All absolutely free. Just send 2d. requesting approvals. You always get the best gifts and stamps from

LISBURN & TOWNSEND LTD. (DEPT. M.M.), LIVERPOOL. **(Collections purchased.)**

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. 20/-)! 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. lilac (cat. 60/-) at 15/-. Superb approvals of any country against approved English References or a deposit. **Full Lists Free.**

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

FOUR RARE VARIETIES (Cat. 25/-) FREE

to purchasers from our A.1 approvals or list of over 400 sets and packets. Send 2d. stamp asking for particulars and approval selection.

Special offer. 60 var. Vasco da Gama pictorials, **only 7/6.** We present the above four stamps to all who buy this splendid packet.

H. & G. H. JOPLING,
44, Risca Road, Newport, Mon.

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. 3/5)...	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.

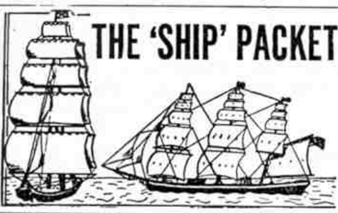
W. BENNETT,
53, MARLBOROUGH ROAD, LONDON, E.8

WHITFIELD KING'S
STANDARD CATALOGUE OF POSTAGE STAMPS OF THE WORLD

NOW READY 5/- Postage 6d. extra Abroad 9d.

Steadily rising sales of this popular reference catalogue have made it possible not only to reduce the price, but also to incorporate many useful and practical improvements. Completely revised and brought up-to-date. More than 6,700 illustrations. 144 page Price List free for the asking.

WHITFIELD KING & CO., IPSWICH, SUFFOLK Established 1869



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), **ITALY** (Naval Academy), **NEW CALEDONIA, IVORY COAST, COSTA RICA,** a fleet of **7 CHINESE** junks usually sold at 10d., **TRINIDAD & TOBAGO, BERMUDA, SOUTH WEST AFRICA, NEWFOUNDLAND, U.S.A., B. GUIANA,** set of **S. AFRICA, GREECE, POLAND, INDO-CHINA,** 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. VOLUMES OF B.O.P. CHEAP.**

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

ALL BRITISH COLONIAL APPROVALS

Fine **BRITISH COLONIAL PICTORIAL SETS OF CAYMAN ISLANDS & 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. (Abroad 6d. in Jubilee stamps.) **C. H. SHAW (Dept. M10), 95, CHRISTCHURCH AVENUE, KENTON, HARROW.**

The "ENGINEERING" Packet

contains an excellent assortment of 44 all different Foreign and Colonial stamps and includes the following which show various engineering feats and masterpieces of ancient and modern times, **Newfoundland** (Ship), **San Marino** (Fortress), **Greece** (Bridge and Liner), **Indo-China** (Plough), **Niger Territory** (Native Wells), **Saar** (Mine), **Turkey** (Cruiser), (Fortress), (Trains), **Ireland** (Barrage), **St. Pierre and Miquelon** (Trawler), **Palestine** (Fortress), **Egypt** (Pyramid), (Sphinx), **Guadelope** (Sugar refinery), **Brazil** (Aeroplanes), **Belgium** (Train), **Middle Congo** (Bridge and 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 Road, London, S.W.19.

FREE. 30 All Different BELGIUM

I will send the above fine collection, **including** the **scarce "Tin Hat" Stamp, absolutely free;** to all Stamp Collectors sending 2d. postage (abroad 4d.). Only one gift to each applicant.

G. P. KEEF, WILLINGDON, EASTBOURNE

Australia Silver Jubilee, Anzac, McArthur, Victoria Centy., Abyssinia, Albania, Eritrea (Camels), Afghan, Latvia, Iraq, Cochin, 140 different, 4d. post free if selection requested. Without approvals, 6d. Up-to-date Stamps from 4 a 1d. (30 for 6d.).

J. R. MORRIS, 9, Audley Road, Folkestone, Kent.

CHOOSE YOUR FREE GIFT

Applicants for approvals may take as many, or as few stamps as they like to the total value of

ONE SHILLING FREE OF CHARGE

By selecting your own gift you can ensure that every stamp is one you want. To take advantage of this Special Offer all you have to do is to send a 1½d. stamp.

E. T. COX, 89, SANDBANKS ROAD, Parkstone, Dorset

I WILL GIVE

a British Colonial stamp, catalogued by Gibbons at 5/-, to all applicants for my new series of approval books. Just send 2d. in stamps for postage (abroad 3d.) to:

C. A. MASTERS,
"TREVARRA," UPTON WAY,
BROADSTONE, DORSET.

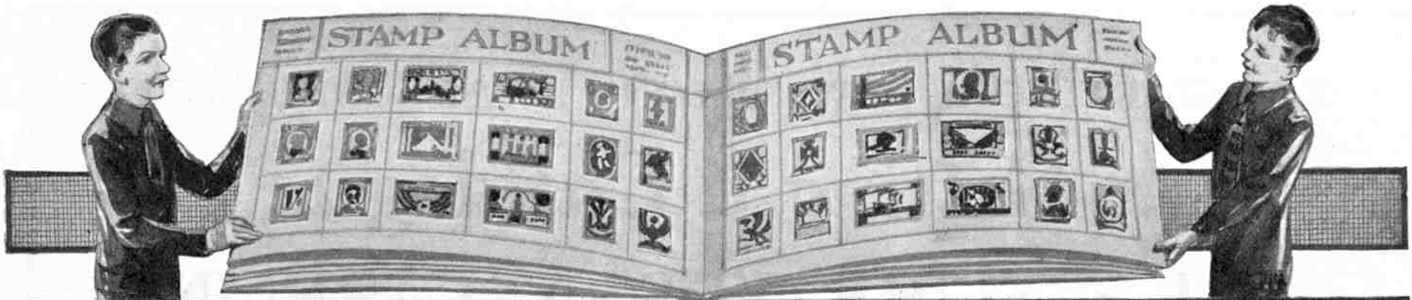
FREE! 100 DIFFERENT BRITISH COLONIALS FREE!

This wonderful offer of the World's most popular stamps, from most of the colonies of our Empire, includes pictorials, commemoratives, high values, bird, ship and animal stamps, out-of-the-way stamps. Long sets, many new issues, etc. ABSOLUTELY FREE TO GENUINE APPROVAL APPLICANTS WHO SEND 2d. FOR POSTAGE. **J. BURTON, 9, Harrison Drive, Bootle, Liverpool 20.**

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.



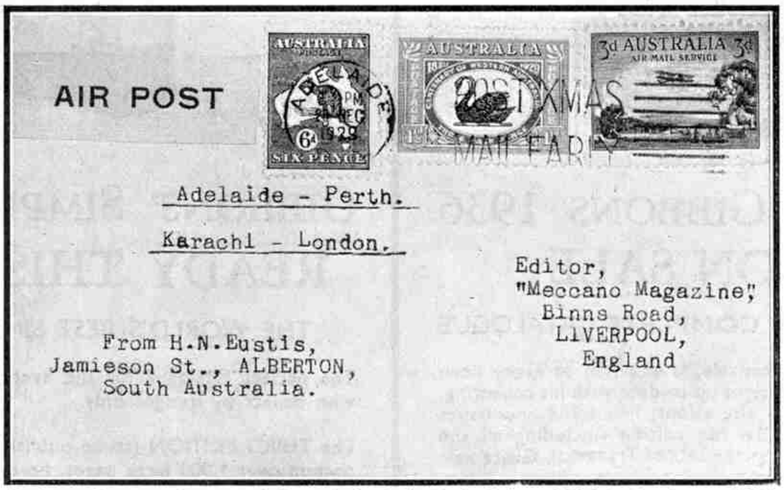
STAMP COLLECTING

WHAT IS PHILATELY?

THERE never was a time when interest in stamp collecting was greater than it is to-day. The Jubilee Stamp issues have introduced thousands of boys to the hobby, and throughout the past summer enthusiasm for stamp collecting has been maintained at a higher level than in any previous outdoor season. The result has been a great increase in recent months in the number of stamp collecting queries that have reached us.

One correspondent, who evidently is bent on taking the hobby thoroughly, has put to us the question that heads this month's article. In elaborating his question he says "Often I see the terms 'philately' and 'philatelist' employed in connection with the hobby and I would like to know whether any stamp collector can be called a philatelist, or whether the use of the term implies a considerable degree of advancement in the hobby?"

The question is a very sensible one. Too often to-day the term philately is employed as synonymous with stamp collecting. Actually there is as great a difference between them as between night and day. One might fairly be described as a stamp collector when one's efforts are devoted merely to the accumulation of stamps. To earn the description of philatelist, one must take the hobby seriously and devote time, not merely to the arrangement of stamps in an album, but to study of the production of stamps, methods of franking correspondence, cancelling stamps, and transporting mail, and generally to the collection of all material that affords enlightenment on the handling of mail. Philately, in fact, is the study of postal services, not the simple collection of postage stamps.



An interesting cover from one of the early Australia-England air mail flights, showing an official advertising slogan.

Because we believe that there is a tremendous amount of interest to be derived from philately, we urge every one of our stamp collecting readers to make a point of studying one feature or another of the story of postal services. For instance, some of the most interesting stories of the hobby are bound up in the development of cancellation marks. The first English penny stamps were black, but the colour was changed to red, solely because it was difficult to secure a legible cancellation mark over a black stamp.

In the early days of postmarks their use was stoutly resisted in many quarters because it savoured of treason to apply an obliterating mark to the portrait of a reigning monarch. The Sicilian monarch, Ferdinand II, who reigned in 1859, was a man of great self-esteem, and after having resisted pressing demands for cheap postage for many years, he consented to its introduction only on the understanding that the stamps should be worthy of his dignity. He banned red and green colours because they were the Italian national colours, for he abhorred anything Italian. Later he was compelled to compromise because these colours were the most suitable for stamp printing, but he insisted that the shades were to be different from those commonly used in Italy.

The comedy was carried a stage further when the question of obliterating the new stamps arose. The King would not agree, in any circumstances, to having his face blacked; in fact, anyone found attempting anything of that nature was to be charged with high treason and presumably could expect a lingering death. But the King gave way when he learnt that the royal revenues would suffer if the stamps were not obliterated, his last scruples disappearing when his advisers agreed to use a postmark that actually framed the portrait when carefully adjusted on the stamp. But woe betide the careless postal employee who dared to hang the frame around the royal neck!

It is a far cry from the period of this amusing incident to modern times, when slogan postmarks are powerful instruments of publicity, and there is a wealth of interesting material in the development of advertising postmarks used by Postal Authorities to stimulate interest in national enterprises. As an allied enquiry, the use of meter franking machines by large business houses could be taken up. There is indeed a special interest in what have become known as meter franks, for metered mail is becoming an increasingly common feature of commercial mail. No statistics are available to show the full extent of the use of meter franking machines in Great Britain, but we are informed by Universal Postal Frankers Ltd. that out of 8½ million letters handled per week in the Inland section of the London General Post Office, covering the whole of the City of London's provincial mail, one million pieces, or approximately 12 per cent., are franked. The Postmaster-General of the United States reported that in the year ended 30th June, 1929, the total letter mail was 15,469,318,926 pieces, and of that number 1,449,614,141 pieces were metered mail, representing 9.4 per cent. of the total mail of the country. Since then the use of the machines has increased greatly, not only in Britain and the U.S.A., but in other parts of the world.

This piece shows an unusual example of commercial advertising with postage stamps. The advertisement is actually part of the stamp and is not detachable.

What will be the effect of the introduction of franking machines on the stamp collecting hobby? The more extensively they are used the fewer will be the number of adhesive stamps employed, but our hobby is not doomed to extinction in consequence. Although the machines may be set to impress any value, only the common values are sufficiently widely used to justify the expense of installing

machines to eliminate the labour of sticking ordinary stamps in position. The stamps displaced will chiefly be those varieties that now are so common as to be valueless from a collecting point of view. Clearly that is not harmful, and, in fact, the extending use of the machines opens up a new and very wide field for stamp collectors. Every machine is licensed by the Post Office and given a distinctive number which, in effect, constitutes a private postmark. The collection of frank meter impressions, therefore, forms an interesting new branch of the hobby.

The formation of a collection containing one specimen of every different identity number would be a formidable task, but readers employed in large commercial houses should find no difficulty in compiling a representative selection of impressions.

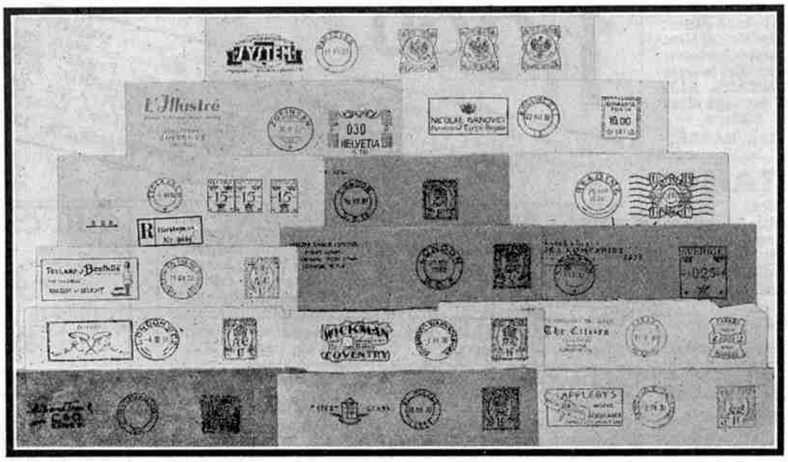
Methods of mail transport are another fascinating study. Horses, dog teams, railway trains, steam-boats, motor cars and aeroplanes have all played their part in the gradual evolution of the high speed services we know to-day, when in many countries all first-class mail matter is carried by air as a matter of course.

Another correspondent has asked us to take an early opportunity of dealing with the financial aspect of stamp collecting. He has read that stamp collecting is one of the most profitable hobbies of to-day and has recalled our reference, in a recent article on the King's collection, to the amazing increase in value of the 2d. blue Post Office Mauritius, which was purchased by the King in 1904 for £1,450 and is valued to-day at something like £5,000.

It would be a great mistake for any reader to imagine that he is certain to make a profit in collecting stamps. The young stamp collector who takes up the hobby with the idea of making money easily will meet with many bitter disappointments, for financial gain comes with certainty only to those who can apply knowledge and skill to their collecting. Instead, the collector would be well advised to regard his hobby solely as a form of amusement and to count the enjoyment he derives from it to be an adequate reward for his efforts.

His early experience necessarily must be among the stamps that are his for the asking, and those provided by exchanges with chums or obtained from friends in business houses. Most of these stamps so acquired will be so common that it is scarcely likely that they will ever alter appreciably in value.

Nevertheless, the experience gained among those common stamps will be invaluable when the collector finds that the only way of building up his collection further is by purchasing stamps from a dealer. The secret of success is the ability to pick up the likely rarities of the future. The boy of limited purchasing power obviously cannot compete with the wealthy collector for rare specimens of old issues, but he can keep his eyes open for specimens of modern issues that are likely to become rare.



An interesting group of covers franked by means of the machines mentioned in this article. The impression shows clearly the use of the meter cancellation for advertising purposes also.

The 1936 Stamp Catalogues

In past years the issue of the new season's catalogues usually was the signal for the re-opening of stamp activities by tens of thousands of collectors whose interest had been more or less dormant since the preceding Easter. This year there will be few who will need reminders of this kind to make them re-enter the stamp collecting circle, however, for Jubilee issues have compelled the attention of collectors throughout the summer. The 1936 catalogues are the more welcome because of this summer activity.

Both the Gibbons and the Whitfield King catalogues have many new features to study and discuss. For example, the size of the pages of the Gibbons catalogue has been altered for the first time in 30 years. The result of the increase is that, although much important new material is included, the volume contains 300 fewer pages than last year and is less bulky and easier to handle. Messrs. Gibbons are to be congratulated on taking this step.

The striking advance in the quality and interest of stamp designs in 1935 is excellently shown in the catalogue, for it lists and illustrates every new issue of the year, including the 245 British Empire Jubilee issues. As compared with the 1935 catalogue, more than 26,000 stamps have been re-priced, most of them having been marked up, and the lists for Transvaal, Greece and Guatemala have been completely revised.

The Gibbons catalogue is indispensable to the collector who is delving deeply into the hobby, for it lists every important variety of every stamp. It can be obtained from all stamp dealers, price 15/–, or direct from Stanley Gibbons Ltd., 391, Strand, London, W.C.2, postage 6d. extra (abroad 1/3).

The catalogue also is issued in two separate parts: British Empire, price 6/6 (postage 6d. U.K., 10d. overseas); Foreign Countries, 10/– (postage 6d. and 11d.).

The outstanding new feature of the "Standard" catalogue of Whitfield King and Co. is the reduction in price from 7/– to 5/–, a bold step made possible only by the steadily rising popularity of the work. Further important improvements are the adoption of a new and clearer type face, the use of which has enabled a catalogue of reasonable size to be produced without sacrificing quality.

As a guide to the young collector, whose interest is mainly in the design of the stamp, and only to a lesser degree in its mechanical features, the Whitfield King catalogue is ideal. Every important stamp variety is listed, including the 2,168 new issues that have appeared since the publication of the 1935 edition, and the catalogue records, describes and prices a total of 60,775 stamps, of which Europ claims 19,210, Asia 11,153, Africa 13,415, America 10,451, West Indies 3,513 and Oceania 3,033. Nearly 6,800 of the stamps are illustrated, including 205 new issues.

This catalogue also may be obtained from any stamp dealer, price 5/–, or direct from Whitfield King and Company, Ipswich, postage 6d. extra.

The Tin Can Mail

Readers who read the note in the April "*M.M.*" concerning the Tin Can Mail service from the island of Niuafoou in the Tongas group will be interested to learn that the service has closed down indefinitely.

It will be recalled that the mail from the island, which is entirely reefbound and harbourless, was placed in a tin can attached to a log and was taken out to the passing mail boats either by swimmers or in a canoe.

Recently the natives have demanded the equivalent of £2 per swim per man with the result that postage costs have become too high to justify the continuance of this unique mail service.

Railway Letter Stamps

Contrary to popular belief among stamp collectors, the labels placed by the railway companies on letters sent by rail for postage at the destination town, are not private labels, but are an official series created at the instance of the Post Office as an alternative to the overprinting of ordinary postage stamps for use on such letters. As such they are a legitimate inclusion in a collection of postal material, although their place is hardly in the album among ordinary stamp issues.

New Canadian Stamps

The outstanding stamp in Canada's new issue is the value illustrated here. It shows an excellent picture of a member of the Royal Canadian Mounted Police, probably the most famous police organization in the world, of whose history it may well be said that truth is stranger than fiction.

The remaining pictorials of the series are as follows: The 13 cents stamp shows a picture of the delegates of the 1864 Confederation Congress at Charlottetown. The 20 cents shows a view of the Niagara Falls as seen from the American side, the 50 cents gives an excellent picture of the Parliament Buildings in Victoria, British Columbia, while the Champlain Monument at Quebec is shown on the $1 value.

As usual, the King's Head design is used for the low values of the series.

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

NYASALAND JUBILEE PKT.

FREE This **wonderful** packet contains a Large **NYASALAND JUBILEE PICTORIAL; a fine EGYPTIAN AIR MAIL pictorial** (unused); **French Peace; Sudan** Pictorial; **China** Sun Yat Sen; **Mexico** Eagle; **New Caledonia** large pictorial; Nigeria; **Gold Coast** (obsolete); **Oubangui** (Tiger); **U.S.A. Bi-centenary;** Ceylonese; and a **Superb** set of **MOROCCO PICTORIALS. ALL FREE!** Just send **1½d.** postage **requesting our high class** approvals containing many **Jubilee** stamps.

THE PUKKA STAMP CO., 27, Normandy Ave., BARNET

COLONIAL JUBILEE STAMPS

In addition to those advertised in Sept. "M.M." I now have the following MINT Sets in stock: **Antigua, 2/4; Basutoland, 1/6; Bechuanaland, 1/6; Falkland Is., 3/3; Fiji, 2/6; Grenada, 2/2; Nauru, 2/6; New Guinea, 6d.; Papua, 1/9; St. Kitts, 2/6.**
NEW ISSUE: Western Samoa, Beautiful Pictorials, ½d. to 1/-. Set of **7, 2/9.**
Cash with Order. Postage extra.

H. L. GOMM, 41, Upper Cranbrook Rd., Redland, Bristol, 6.

TRIANGULAR AIR MAIL & SHIP PACKET FREE

Lithuania Triangular Air Mail, Siam Air Mail, also 15 ships and aeroplanes **free** given **only** to those who request our famous approval books and enclose 2d. for postage and packing.

SHOWELL BROS.,
42, VANBRUGH HILL, BLACKHEATH, S.E.3.

107 PENNY BLACK and CAPE TRIANGULAR PACKET

The most marvellous **Bargain** ever offered to "M.M." readers. Includes 1d. Black 1840, Cape Triangular 1856, Beautiful Pictorials and sets. Mint and used values to 5/-. Big Catalogue value. **All Different British and Colonial.** No foreign. The whole wonderful packet on offer to "M.M." Readers only for 5/-

R. C. ALCOCK LTD., 11, Regent St., Cheltenham, Eng.

100 "WORTH WHILE" DIFFERENT 1/- Post Free

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, ¼, 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.

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.)
During this month, as an additional attraction, a stamp catalogued at least 3/- will be included. Can you find it?

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

NEW SEASON'S OFFERS

Jubilee Colonials—Mint, different 10 for 1/- 15 for 1/6; 20 for 2/3; 25 for 3/-
3 Great Britain. K.G. 2/6, 5/- and 10/- ... 1/6
30 Newfoundland, different, incl. Jubilee ... 1/9
100 British Colonials. Incl. Mint New Issues, Jubilees used and mint, and Stamps cat. to 5/- each and more. Very fine selection **2/6**
4 India Jubilee used ½a, ¾a, 1a, 1¼a ... **4d.**
Cash with order. Postage extra.
T. R. HUGHES,
7, Winchester Road, Swiss Cottage, N.W.3.

UGANDA PACKET—FREE!!

This splendid packet contains the **New Uganda** illustrated (Dhow on Lake Victoria), **New Belgium** (Train drawn by Diesel engine), **New Roumania** (portrait of King Carol), Siam Airmail (Garuda bird), Hungary (Poet Petofi Commemorative), Gold Coast and Australia pictorials and **Ten different Canada** including **Jubilee** and also the **new issue of 1935. All these new stamps free** to genuine applicants for our Approval sheets, who enclose 2d. for postage.

SHIRLEY STAMP CO.
19, SANDRINGHAM AVENUE, LONDON, S.W.20

SILVER JUBILEE PACKET FREE!!

This magnificent free gift contains pictorials; commemoratives; British, French and Portuguese Colonials; stamps from the Near and Far East; mint and used: **CYPRUS,** Ukraine (imperf.), **SYRIA** (pictorial), Italy (labour celebration), **TURKEY** (surcharged), Togo (coconut trees), **GERMANY** (swastika), Canada, **MOZAMBIQUE** (Lusiad), Australia (kangaroo), **FR. SOMALI** (native drummer), Denmark (birthday), newest issues such as **ANDORRA** (1935), **PORTUGAL** (Temple of Diana), large **ROUMANIA** (King Carol), etc., and the fine mint **MALTA SILVER JUBILEE** (H.M. The King and Windsor Castle). Absolutely **FREE** to genuine applicants for my free gift Approvals sending 2d. postage. (Abroad 1/-.)

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We have an accumulation of about 1,000 Free Gifts which are yours for the asking. Many of them were made up long ago and contain quite scarce stamps, all of them consist chiefly of Pictorials, Airmails and British Colonials. Moreover, we have added to each gift the new CAYMAN ISLANDS ISSUE, and the SOUTHERN RHODESIA SILVER JUBILEE STAMP. A p.c. for our approvals is all we **require.** Send To-day—Don't Delay. POSTAGE FREE.

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HERE'S YOUR CHANCE. No gifts, but exceptional value for your money. Thousands of attractive **stamps** at ¼d., ½d. and 1d. each, and **Rare** items for the advanced collectors. Don't miss my **Bargains.** Write immediately. You will be astounded at my ⅛th catalogue prices. **CAMPBELL, HALDON AVENUE, TEIGNMOUTH.**

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regular customers. Collectors who are so satisfied with the value offered in my selections that they will come to me for all their philatelic requirements. AND I have a scheme which will pay them to become **regular** customers.
Send now for my **4-a-penny selections** and full particulars of the new scheme.

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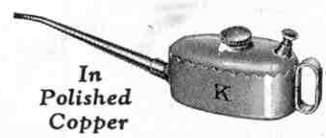
OIL CAN No. 2 ("K" Type)



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.

One of the oil cans was sent to H.R.H. the Prince of Wales, and a gracious letter of acknowledgment was received expressing H.R.H.'s admiration of the beautiful lines and perfect finish of this model. Price 3/6

Meccano Ltd., Binns Road, Liverpool 13.

How to obtain the "M.M."

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

Meccano Magazine, Binns Road, Liverpool 13.

This Space is set to ½ inch s.c. and costs 8/- per month. The sum is the 50th of £20, the price of a whole page advertisement. Over 90,000 copies of the December number were distributed all over the world. You therefore reach this exclusive public for approximately one penny a thousand.

"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 Road, Liverpool 13

LIGHT TALK

At a certain hotel an Englishman, an Irishman and a Scotsman were arguing as to which of their respective countries had the lightest men.

The Irishman said: "We have men of Cork."

"That may be," said the Scotsman, "but we have men of Ayr."

"Well," said the Englishman, "that is certainly very light, but we have lightermen on the Thames!"

* * * * *

"How's your sister getting along with her driving, Tom?"

"She took a turn for the worst last week, Joe."

* * * * *

New Maid: "Please sir, how should I announce dinner? Should I say 'Dinner is ready' or 'Dinner is served!'"

Master of House: "If it's like it was yesterday just say: 'Dinner is burnt.'"

* * * * *

Three deaf gentlemen were in a railway carriage on the way to London. The one by the window looked out when the train came to a standstill. "It's Wednesbury," he said.

The second shook his head. "No, it's Thursday," he replied.

"Thirsty?" said the third. "So am I. Let's all get out and have a lemonade."

* * * * *

Tim, struggling with his homework: "Oh, dear, I can't find the least common multiple."

Father: "Is that thing still lost? The teacher had me hunting for it when I was your age."

* * * * *

Visitor: "Where's the other windmill gone to?"

Native: "We only had wind enough for one, so we took the other one down."

* * * * *

Teacher: "What is one-fifth of three-sixteenths?"

Tommy: "I don't know, but it isn't enough to worry about."

* * * * *

Waiter (to diner): "Are you the filletted kipper, sir?"

Diner: "No, I'm a poor lonely sole with an empty plaice waiting for something to fillet."

* * * * *

Little Freddie watched intently while his grandmother prepared the tea-table. "Do your glasses magnify very much, gran?" he suddenly asked.

"Why, yes, dear," said the old lady.

Freddie looked thoughtful. "Then please will you take them off when you cut me a piece of cake?" he asked.

* * * * *

CHILLED BEEF!

City Boy (seeing a windmill for his first time): "By Jove! Uncle, that's some electric fan you have out there cooling the cows."

THE FINISHING TOUCH

Lady (to mother of girl who has just been reciting): "Your girl recites very well."

Mother: "Yes, all she needs now is a bit of electrocution to finish her off!"

* * * * *

THOSE HOLIDAYS!

Returning Holidaymaker: "Say, Lizzie, look at the weight I've picked up!"

Courtesy L.M.S. Magazine.

Jim: "Hello, Jack, what are you doing these days?"

Jack: "I'm working at a glue and gum factory."

Jim: "H'm, that should be a good permanent job!"

* * * * *

Mrs. Pick: "Your Percy is sulking again, I see. What's wrong this time?"

Mrs. Peck: "Oh, it's too silly. Just because I used his new tennis racket to strain the potatoes."

* * * * *

A talkative young man of the know-all variety was watching the machines arriving and departing at Croydon Airport. Four planes drawn up on the tarmac were making a deafening noise. "What a din!" he bawled. "I can hardly hear myself talking."

"Don't worry," remarked a long-suffering bystander, "you are not missing much."

* * * * *

It was Jill's first visit to the Zoo. "I'm very glad I'm not a giraffe," she said, as she looked at the long-necked creature.

"Why?" asked her mother.

"Just think what a long way it has to cough," the child replied.

* * * * *

Thompson was taking his pal for his first flight. As they neared the end of their journey he put the machine into a steep nose-dive and then suddenly flattened out.

"I expect most of the people down there thought we were falling," laughed Thompson.

"Yes," agreed his friend, "and 50 per cent of the people up here thought so too."

* * * * *

"Poor old Jones, he's working hissel to death."

"How's that?"

"Well, he can't see when the boss ain't looking."

APPLIED SCIENCE

"Any complaints?" asked the orderly officer, looking in at the men's mess.

"Yes, sir," said a young private. "The bread's wrong."

"What's the matter with it?" asked the officer.

"It contradicts the laws of gravity, sir," explained the man. "It's as heavy as lead, but it won't go down."

* * * * *

Magistrate (to witness): "You say you saw defendant standing at the street corner?"

Witness: "Yes, your worship. And while I stood there watching he put his fingers to his mouth and whistled."

"What followed?"

"His dog."

* * * * *

"Are you a native of this place?" asked a traveller in Kentucky of a coloured resident.

"Am I what?" said the puzzled man.

"I say, are you a native here?"

While the man was still hesitating over his answer, his wife came to the door.

"Ain't you got no sense, Sambo?" she exclaimed. "The gen'l'man means was yo' livin' heah when you was born or was you born before yo' began living heah. Now answer the gen'l'man."

* * * * *

Little Horace arrived at school one morning with only one sock on.

"What became of your other sock, Horace?"

"Please, miss, I must have lost it through a hole in my shoe coming to school," answered Horace.

* * * * *

Plumber (arriving late): "How is the leak?"

Householder: "Not so bad. While we were waiting for you to arrive I taught young Thomas how to swim."

* * * * *

Pinch: "Oh, boy! I'd like to be on that boat bound for New York."

Punch: "You'd be a mighty unpopular passenger."

Pinch: "Why?"

Punch: "Because everyone else on board wants to go to Bombay."

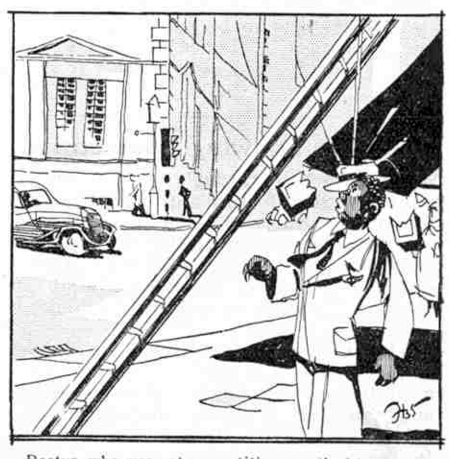
* * * * *

Customer to Baker: "I heard one of your men has been electrocuted."

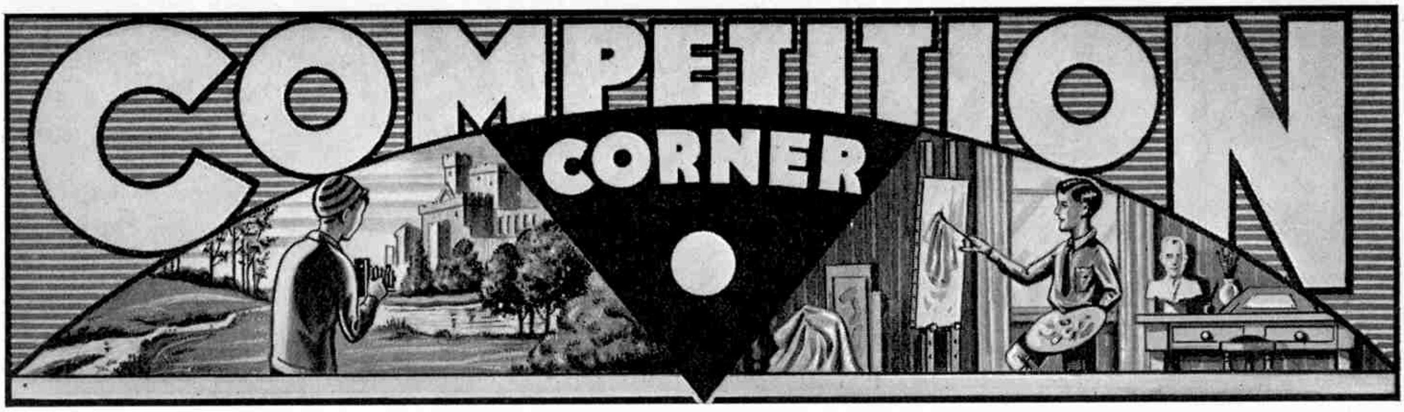
Baker: "Yes, he stepped on a bun and a currant ran up his leg."

* * * * *

A TOUGH GUY!



Rastus, who was not superstitious, walked beneath a ladder. As he did so a brick fell and broke on his head. "Hey! You up dere," he called. "If you don't want your bricks broken just keep dem off my head."



A NEW DOUBLETS CONTEST

The Doublets puzzles that we have set for our readers from time to time have proved exceptionally popular and as it is now almost a year since the last such contest, we are giving a fascinating new series this month.

For the benefit of new readers it must be explained that a Doublet consists of two given words, each containing the same number of letters. The puzzle requires one word to be changed to the other by placing connecting words between. The connecting words are known as links and each link must differ from the preceding one by the alteration of only one letter. The test is to make the change in the smallest number of links.

To make the idea clear we give the following examples:

Put SHOE on FOOT
SHOE—shot—soot—FOOT
Lower DIVER into WATER
DIVER—river—raver—
waver—WATER

In making the links only English words appearing in a standard dictionary may be used. Proper nouns, names of persons, places, etc., are not permitted. It is important to remember that the first solution arrived at is not necessarily the shortest. Competitors should go over their solutions carefully in search of short cuts that will eliminate overlapping links. Close study often reveals links that may be removed to improve the solution.

A selection of prize-winning photographs from the 1935 Photo Contests.

The Doublets to be solved in this competition are as follows:

Put MEAT in OVEN
Draw TUBES from GLASS
Scrub HOUSE with WATER
Place TRAIN on RAILS
Tidy HAIR with COMB
Place LOAD on HOOK
Fashion WOOD into DESK
Bottle MILK from COWS
Run FLAG up POLE
Fit LOCK on DOOR

In judging the entries, the 10 doublets will be considered as one contest, and prizes of Meccano or Hornby Train goods to the value of 21/–, 15/–, 10/6 and 5/– respectively will be awarded to the senders of the four solutions showing the lowest total of links used throughout. In the event of a tie for any of the prizes, preference will be given to the entry having the neatest or most novel arrangement.

It will be observed that the combination of the 10 doublets for judging purposes will ensure that a brilliant solution of one doublet will carry its full weight by offsetting to some extent failure to secure the shortest chain in another.

Entries should be addressed to "Doublets, Meccano Magazine, Binns Road, Liverpool 13" and sent to reach this office not later than 31st October. There will be a duplicate set of prizes reserved for entries from Overseas readers, whose entries must arrive by 31st January, 1936. Late entries necessarily must be disqualified.

Entries must be written on one side of the paper only, and each sheet of paper used must bear the competitor's name and address. The total number of links used must be noted on the first sheet.

October Drawing Competition

Each month throughout the coming winter we shall feature a drawing or painting competition to give readers with artistic ability opportunities to show their skill. No special subject will be set and the monthly prizes will be offered simply for the best drawings or paintings submitted during the month.

The entries each month will be divided into the usual two sections, A for readers aged 16 and over, B for those under 16, and prizes of Meccano products to the value of 21/– and 10/6 will be awarded for the best entries in each section.

A separate set of prizes, to be awarded in similar conditions, will be reserved in special Overseas sections for competitors living outside Great Britain, Northern Ireland, the Irish Free State and the Channel Islands.

Entries to the October competition must be addressed "October Drawing Contest, Meccano Magazine, Binns Road, Liverpool 13," and must arrive not later than 31st October. Overseas closing date, 31st January, 1936.

COMPETITION RESULTS

HOME

August Crossword Puzzle.—1. J. W. Dobson (Northumberland); 2. P. Arch (Cheadle); 3. G. A. Kimberley (Birmingham); 4. Hugh Farrell (Dublin). Consolation Prizes: R. G. Lawson (Greenock); J. Maguire (Belfast); H. Rutter (Blackhill).

August Photo Contest.—First Prizes: Section A, T. Brooks (Halifax); Section B, C. P. Silver (Exeter); Second Prizes: Section A, A. P. Gardner (Kettering); Section B, G. Arnold (Burgess Hill).

OVERSEAS

May Advertisement Contest.—For the benefit of readers who desire to check the accuracy of their entries we append the solution to this competition.

The advertisers' names are given in the exact order in which the slogans were published in our competition announcement: Hovis Flour; Hoover; Persil; Scott's Porage Oats; Stone's Ginger Ale; Wolsey; Standard Cars; Quaker Oats; Anzora; Lux; Singer; Musterole; Pear's Soap; Monkey Brand; Austin Cars; Electrolux; Chivers' Jellies; Rudge Cycles; Triumph Cars; Palm-

(*Continued in preceding column*)

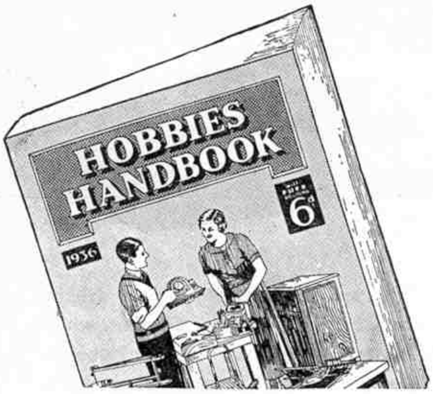
Competition Results

olive; Cadbury's Chocolate; Cadbury's Bourn-Vita; Vapex; Robinson's Patent Barley.

The awards in the overseas section are as follows: 1. Harry C. Key (Calcutta); 2. D. Maver (Maitland, S.A.); 3. Edward J. Brown (Cambridge, N.Z.); 4. E. R. Honey (Palmerston Nth., N.Z.).

May Photo Contest.—First Prizes: Section A, R. H. Warr (Cairo, Egypt); Section B, Asoke Ch. Das Gupta (Bengal, India); Second Prizes: A. A. Olowu (Nigeria); D. Waugh (Johannesburg, S.A.).

HOBBIES 1936 HANDBOOK



There's no other book like it. Every page packed with interest on something to make or do. Make pocket money in your spare time with a fretsaw. Novel little Calendars, Tie or Trouser Presses, Cigarette Delivery Boxes, Trays, Stationary or Working Models—all easily made to sell at a profit. And a large gift pattern sheet (20 ins. x 30 ins.) is given for making a complete Model Farm!

268 PAGES!

1,000 THINGS TO MAKE!

TOY FARM MODEL FREE!

There are chapters on a dozen different pastimes—Fretwork, Woodwork, Model Making, Polishing, Transfers, Furniture, Uses of Stripwood, Tray Making, Jigsaw Puzzles, etc. Last year the 1st edition was sold out and more had to be printed. Do not be too late with this year's issue. The finest value for 6d. any Meccano boy can have. Remember, Father will be interested too.

6D. ONLY

Ask to see Hobbies Handbook at any newsagent or bookseller. Also obtainable from leading ironmongers and all Hobbies Branches.

Or send 9d. to Hobbies Ltd. (Dept. 96), Dereham, Norfolk, and a copy will come by return post paid.

DESIGNS VALUE 2/-!

FREE *A fully illustrated leaflet free if you write to the address given.*

OUR FUSELAGE SQUADRON •

SCUD High Performance Sailplane. Wing span 38". Supplied complete with new launching gear. Will soar distances up to two miles. Retails at **17/6**

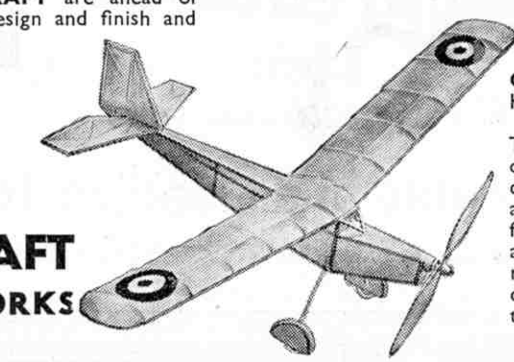
The **SCUD** Silver Eagle, price **35/-**, has a guaranteed performance. Will rise off the ground and has a stable flight of exceptional duration.

The **SCUD** Swallow, wing span 35". Price **£1 1s.**; and Envoy, wing span 28". Price **15/-**. Have single-surfaced aluminium wing and tail unit.

If you are a Model Aircraft enthusiast you ought to send at once for our Illustrated Catalogue. It tells you why **SCUD MODEL AIRCRAFT** are ahead of anything so far produced in design and finish and performance.

SCUD FLYING MODEL AIRCRAFT

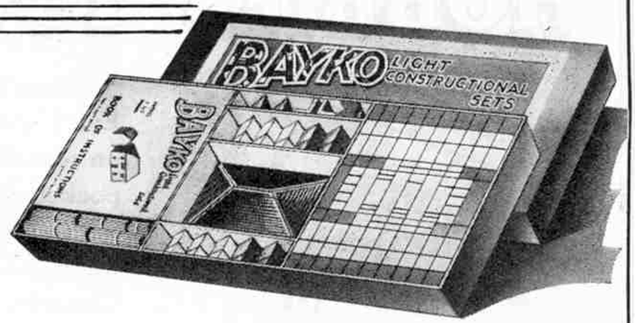
Stocked by Leading Dealers



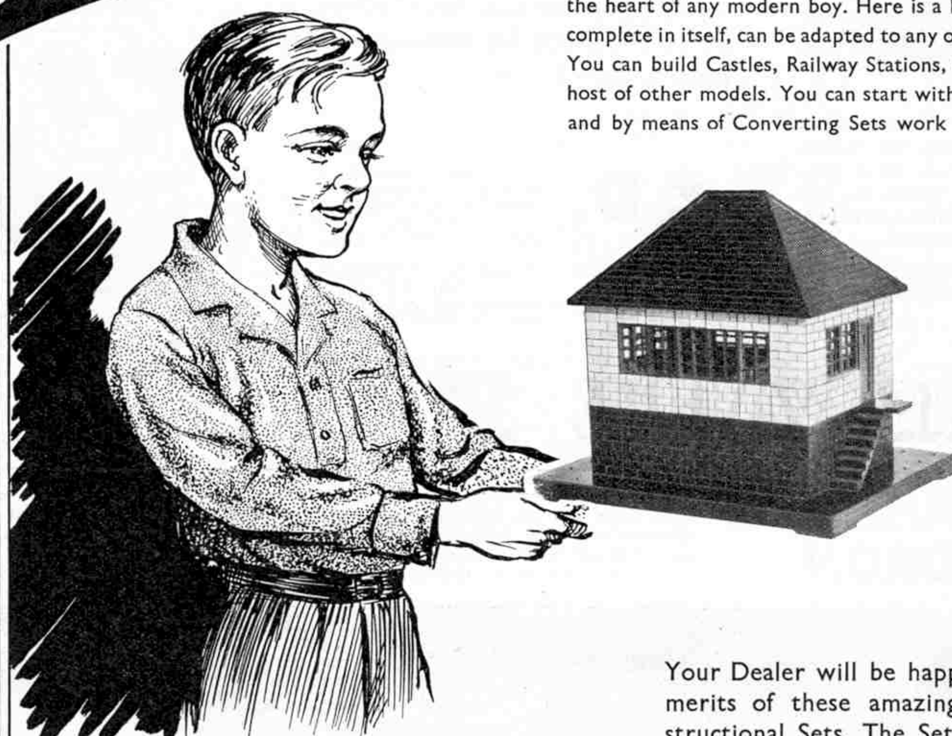
This is the new **SCUD CABIN CRUISER** CONSTRUCTION KIT. Span 23". Length 16½". Price **5/6.**
The Kit comprises ample supplies of selected hard balsa, tissue, cement, dope, rubber for motor and everything you need, including finished airscrew and lightweight aluminium wheels. Difficult parts ready formed for you. Full size drawing and method of construction makes this the easiest model to build.

SCUD
FLYING MODEL AIRCRAFT
LOVAINE CRESCENT MODEL WORKS
NEWCASTLE-UPON-TYNE

Boys! — Here's a new building Toy



Beautifully coloured, realistic, and to scale, Bayko Sets delight the heart of any modern boy. Here is a Building Set that, while complete in itself, can be adapted to any of your present Hobbies. You can build Castles, Railway Stations, Garages, Houses, and a host of other models. You can start with the lowest priced Set, and by means of Converting Sets work up to the larger sizes.



Here is one of the 60 models that can be built with a No. 2 Set. Price 10/6

Your Dealer will be happy to point out the merits of these amazingly ingenious Constructional Sets. The Sets numbered 1 to 6 allow the following models to be built:

No. 1 Set	36 Models	**7/6**
No. 2 Set	60 Models	**10/6**
No. 3 Set	120 Models	**15/-**
No. 4 Set	300 Models	**21/-**
No. 5 Set	600 Models	**30/-**
No. 6 Set over	700 Models	**42/-**

BAYKO

Light Constructional Sets

Made throughout in Coloured Bakelite

MANUFACTURED IN GREAT BRITAIN

Obtainable at all leading Toy Dealers and Stores

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SKYBIRDS

THE MOST MODERN OF ALL HOBBIES

SCALE MODEL AEROPLANE CONSTRUCTION

SKYBIRD Headquarters have arranged a number of Local Competitions, **OPEN TO ALL.**

Here is an opportunity for hundreds of modellers to win SKYBIRD AIRPORTS (value one guinea) and other awards in Local Skybirds Competitions. Full particulars are obtainable from your nearest Skybird Agent. Enquire now! Send stamps for a copy of THE SKYBIRD Magazine Post Free 7d.

SHIPSERIES

FOR NAUTICAL ENTHUSIASTS.

Constructive Waterline Models of Famous Ships. Scale 100 feet equals 1 inch.

SHIPS OF THE ROYAL NAVY Sets 1/6 to 3/- each.
SHIPS OF THE MERCHANT NAVY Sets 4/6 to 5/- each.

Our scale model Docks, Cliffs and Accessories lend great realism to these models.

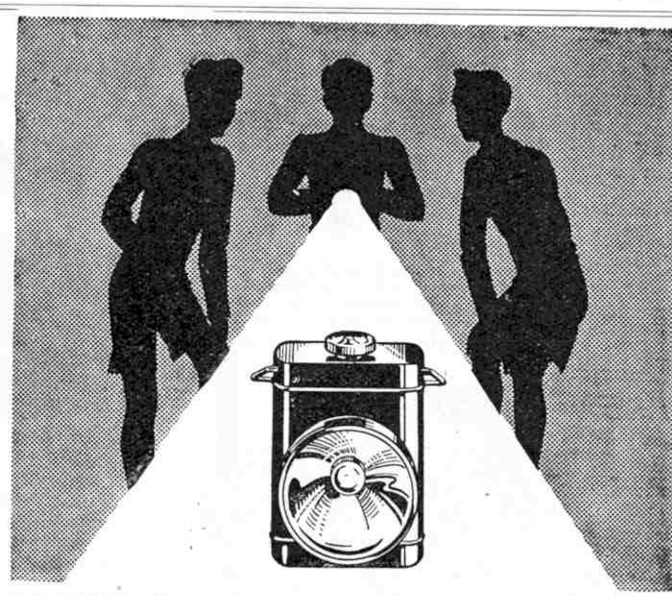
DOCKS, comprising 6 sections complete, Sheds, Wharves, and Cranes, price **6/-**.

METAL CAST MODELS

Submarines, Flotilla of Six, **1/-**.
Cross Channel Steamer "Canterbury," **6d.**
Oil Tanker, **9d.** Tug Boat, **2d.** Lightship, **3d.**

Also write for illustrated list and address of nearest agent to:

A. J. HOLLADAY & CO. LTD. (Desk B.)
3, Aldermanbury Avenue, LONDON, E.C.2



MAKE OTHER BOYS ENVY YOU!

Want the finest torch your money can buy?—that's an Ever Ready! So powerful, so dependable are these Ever Ready electric flash lamps that policemen use them for tracking down real crime. You can use the one pictured here either as a handlamp or for your bike headlamp—only 2/6 too!

EVER READY

Regd. Trade Mark

ELECTRIC TORCHES

From a Fountain Pen Light 1/6, to Spotlights from 5/- to 15/-

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Jolly fine fun - and instructional too!

LOTT'S BRICKS

How would you like to build this attractive house? And hosts of other models as well—Stations, Signal Boxes, Bridges, Goods Sheds. There is no end to the interesting things you can build. LOTT'S BRICKS are miniature Stone Building Bricks—British made.

Prices:
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LODOMO *(with windows and doors)*, **3/6 to 12/6**
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LOTT'S Chemistry Sets

If you are keen on Chemistry, this set is the very thing for you! You will have your own laboratory and be able to carry out scores of interesting experiments. The equipment varies with the size of the set, and includes test tubes, crucibles, Bunsen burner, retort stand and many chemicals. Full instructions are supplied with each set. **Prices 3/6, 6/-, 10/6 to 42/-. Handsome Cabinets from £3/3/- to £5/5/-**

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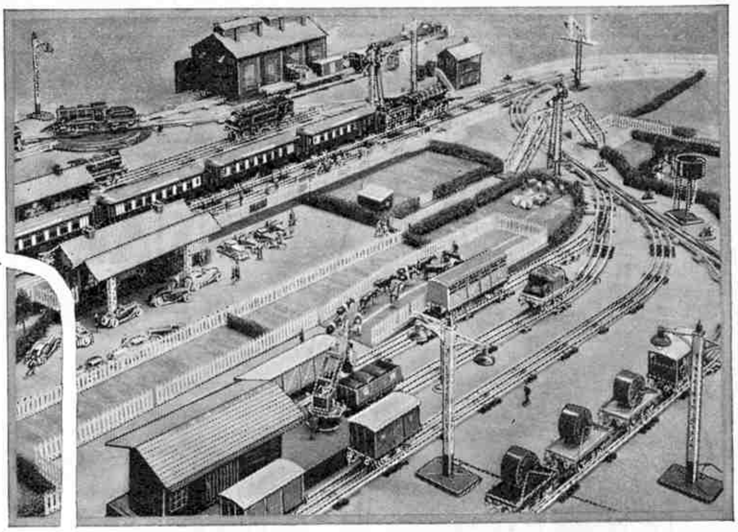
Obtainable at all leading toy dealers and stores. Send for free illustrated list of all Lott's products from Dept. M.M.

LOTT'S BRICKS LTD., WATFORD, HERTS., ENGLAND.

HORNBY
ACCESSORIES FITTED FOR ELECTRIC LIGHTING



NEW SYSTEM

The following is a complete list of the Hornby Accessories available fitted for electric lighting on the new and simplified system adopted this season. 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 Leaflet giving full instructions for use. Lamp bulbs are not provided with the Accessories.

	Price		Price
No. E1E Engine Shed	15/6	No. 2E Signal Gantry	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/-		

The following items used in connection with the new 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.

MECCANO LTD., BINNS ROAD, LIVERPOOL 13

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:

	Price		Price
No. E1E Engine Shed ...	18/6	No. 2E Signal Gantry ...	18/-
No. E2E Engine Shed ...	26/-	No. E1E Level Crossing ...	7/-
No. 2E Station	11/6	No. E2E Level Crossing ...	11/-
Island Platform E	9/-	No. 1E Buffer Stops	2/-
No. 2E Goods Platform ...	15/-	No. 2E Buffer Stops	7/-
No. 2E Signal Cabin	5/6	No. 2E Water Tank	10/-
No. 2E Signal	4/3	No. 1E Lamp Standard ...	3/6
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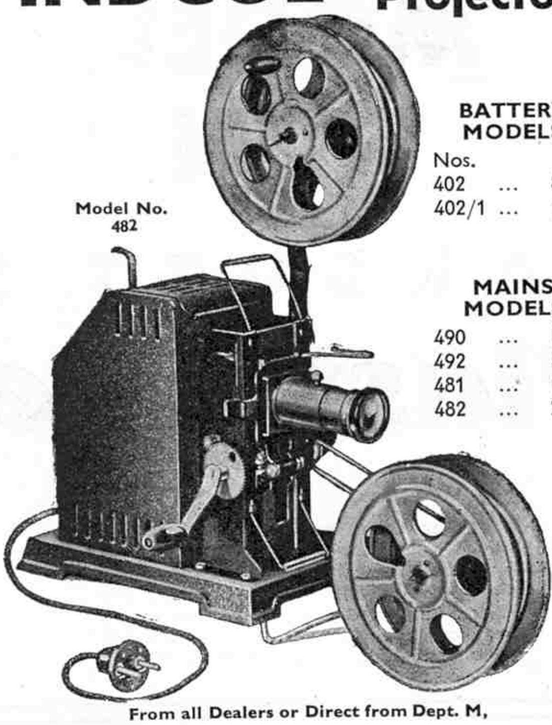

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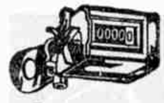

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Publication Date. The "*M.M.*" is published on the 1st of each month and may be ordered from any Meccano dealer, or from any bookstall or newsagent, price 6d. per copy. It will be mailed direct from this office, 4/– for six issues and 8/– for twelve issues.

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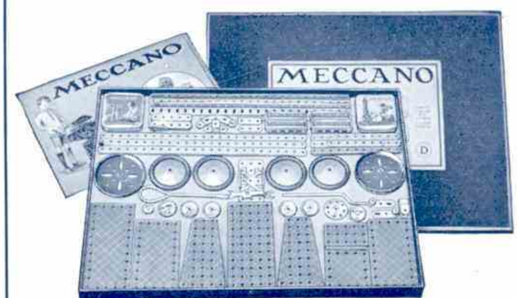

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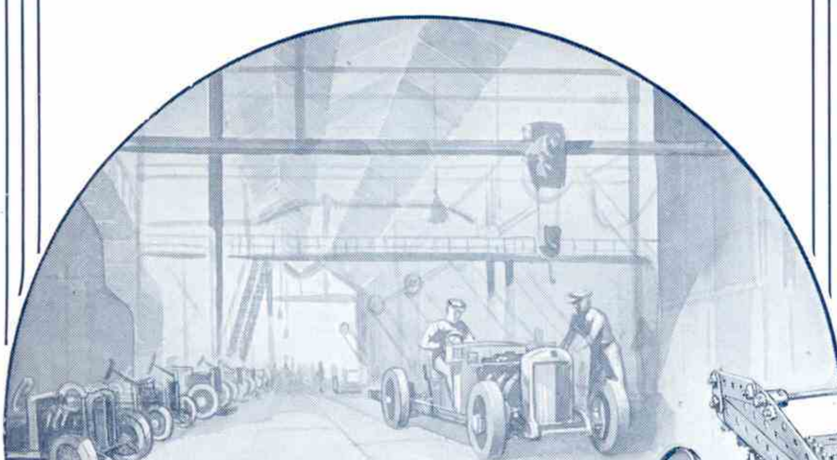
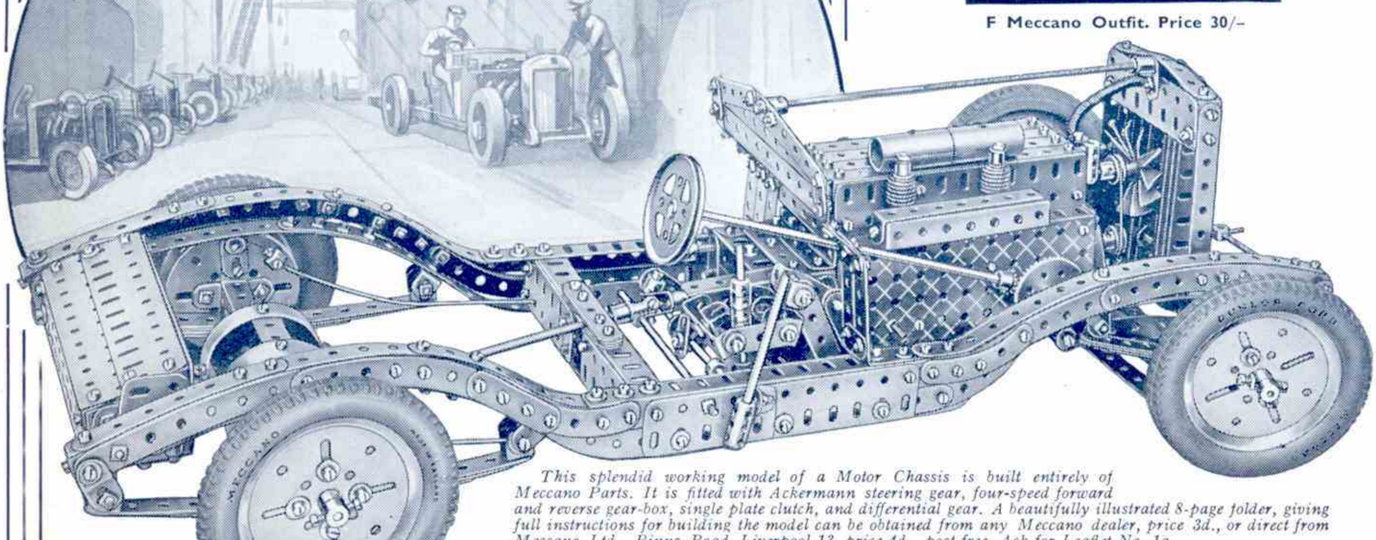

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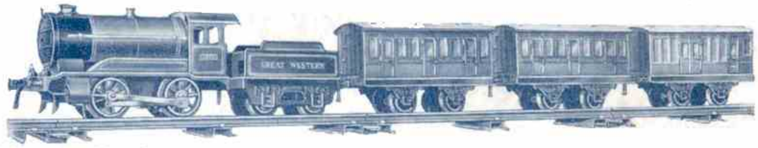

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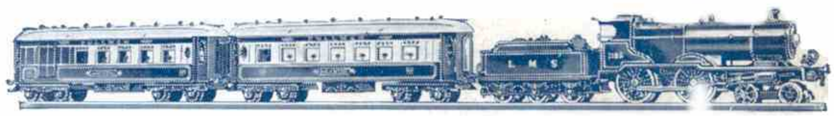

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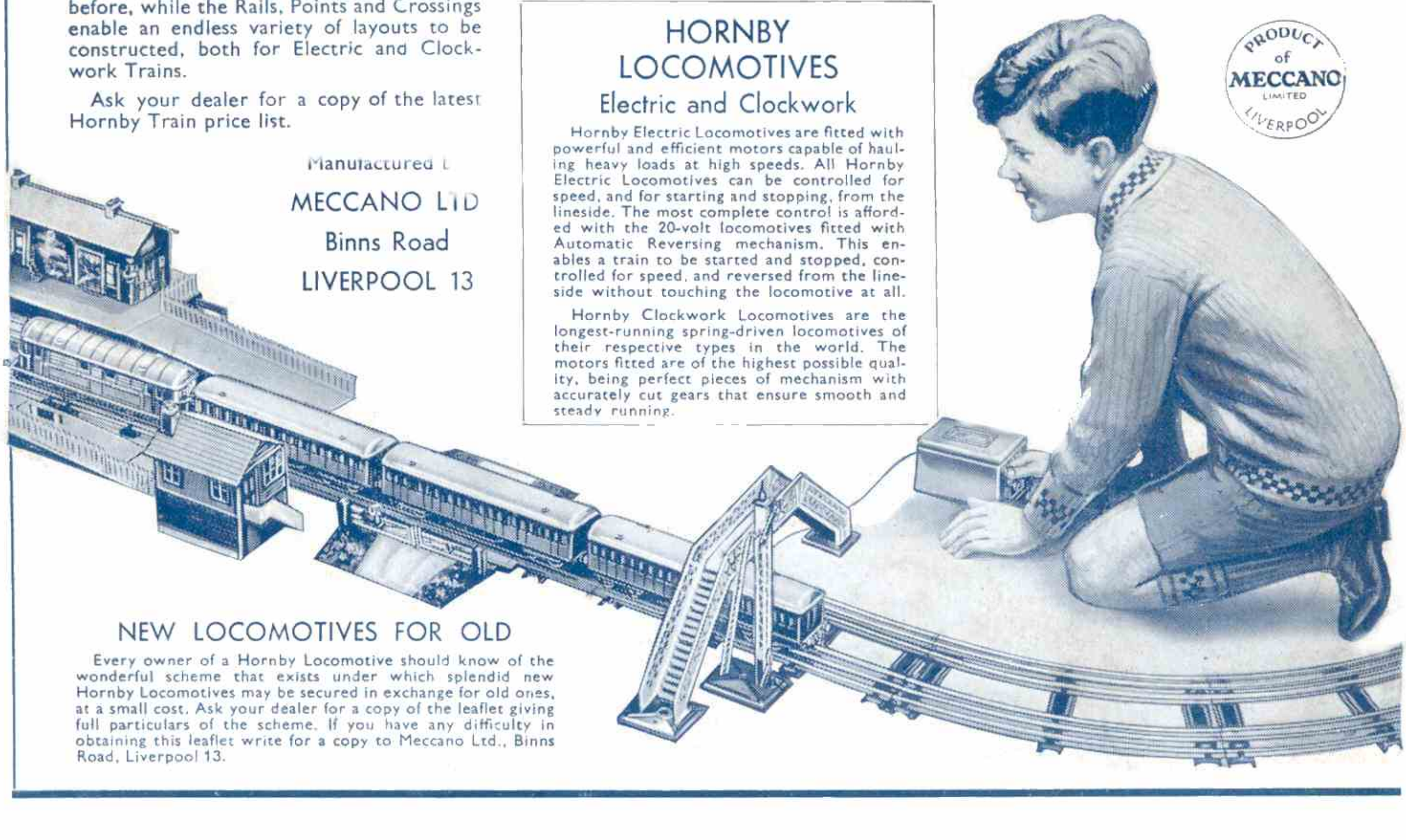

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