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Meccano Magazine, founded 1916

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FRONT COVER

The Swedish car ferry *Black Watch* photographed at Funchal, Madeira. The touch of an old type figurehead on a modern ship is attractive. (*Photo by Alan Bolton*)

NEXT MONTH

Polar bears, cannons, weathervanes, and the forthcoming Olympics are among July's features – plus, of course, another full-size plan for a simple but effective working model.

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CONTENTS

ON THE EDITOR'S DESK 269
An electric car leads to thoughts on power

WILL AIRSHIPS RETURN? 270
Well, what do you think?

INFRA-RED TELEVISION 272
A new tool with a wide application

ELECTRICITY PYLONS 273
Why they're there

SCHOOL FOR THE SEA 274
Seamen and Caterers' Training

AMONG THE MODEL BUILDERS 276
Mechanisms and modellers

MECCANO PARTS AND HOW TO USE THEM 278
Part Six – Gears

SEASHORE HARVEST 280
Remarkable, the uses of seaweed

PLAYBOY OF THE OCEAN 282
The dolphin may be more intelligent than you

FESTIVALS ON STAMPS 284
Christmas, Easter and others

McLAREN M16 285
Full size plans for a working model

BUILD A RULING MACHINE 288
Ink lining made easy

SMALL AND SIMPLE 289
Three attractive and easy Meccano models

AIR NEWS 292
Latest from the aircraft world

THE EMBANKMENT AND HYGIENE 294
A strange connection at first sight

DESIGN AND CONSTRUCTION OF BRIDGES 296
Types of trusses etc.

SCENES IN COLOUR 298
How and Why of Colour Photography

MILESTONE 300
New and different from Dinky Toys

HAVE YOU SEEN? 302
New in the shops

CHAIRLIFT 304
Part one of an advanced Meccano Model

GLOBE-TROTTER COMPETITION 306
A reminder of a £4,000 contest

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21 The German tank destroyer–7.5cm PAK 40/2 auf Sfl. II 'Marder' 1942/43 early and late models based on the Panzerkampfwagen II chassis; British 'Tortoise' 1942/47; British light tank Mk. IA–with drawings of the A4E6, A4E7, A4E8, A4E9, A4E10; 1930/35 American Howitzer Motor Carriage T3 based upon the Combat Car M I, 1939.

22 American heavy 155mm Gun Motor Carriage M 12 'King Kong' with the GMC T6 prototype and 155mm GMC M 12 production model; Cargo Carrier M30 and the T14 prototype. 1941/44; ISU 122–1944/45 Soviet Assault Gun Motor Carriage ISU 122–D195 and A 25 S versions, 1944/45.

23 Bundeswehr main battle tank–Kampfpanzer 'Leopard' Prototype I (Group A), Prototype II (Group A), Production Kampfpanzer 'Standard'–Leopard; Recovery and Engineer Vehicles, Bergepanzer 'Standard' and Pionerpanzer 'Standard' 1962/70.

24 The World War I French Renault FT 17 Fighting tank that shaped the future development of AFV, in service from 1918 to 1945. This most important tank is given detailed coverage. Drawings include the Berliet turret, the normal riveted octagonal turret, with machine gun and 37mm cannon. Also includes version mounting the 75 mm cannon. Drawings and text by Christian Henri Tavard. The well-known Italian Medium tank Carro Amato M 11/39–1939/41, which was the forerunner of the M 13 40.

25 The renowned Soviet T.34 Medium tank of 1939 plus the Churchill Bridge layer and the U.S. Armoured Car T.18E2 'Boarhound' provide a trio of famous AFVs with extensively detailed scale drawings plus supplementary views.

26 Panzerkampfwagen 'Panther' Ausf D and the Befehlspanzerwagen Ausf A in intricate detail plus the Churchills Mks III, IV and V with a special insert for this important Bellona Military Vehicle Print in the form of full 5-view 1/48th scale drawings of the Panthers, so permitting space for extra 1/48th scale Churchill views.

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28 The German half track Leichter Zugkraftwagen 3T–SD KFZ II with its attendant 7.5 cm Panzerjaegerkanon 40 (L/46) fill a long-awaited demand for fine detail on this important vehicle and mobile weapon. Accompanying it is the US Army Combat Car T.7.

29 The French Char Somua S-35 was the medium tank of the three French Divisions Legere Mecanique (DLM) at the outbreak of the German attack on France in 1940, is extensively detailed, together with the German Stumgeschuetz IV (L/48) and the Three Ton Special Tractor Ford 3 ton.

30 The development of the "New Sturmgeschuetz" and "Panzerjaeger Vomag" which plus the Jagdpanzer IV Ausfuehrung F (Sd Kfz 162) and Panzer IV/70 (Sd Kfz 162/1) are fully detailed with technical specification in this 24 page edition.

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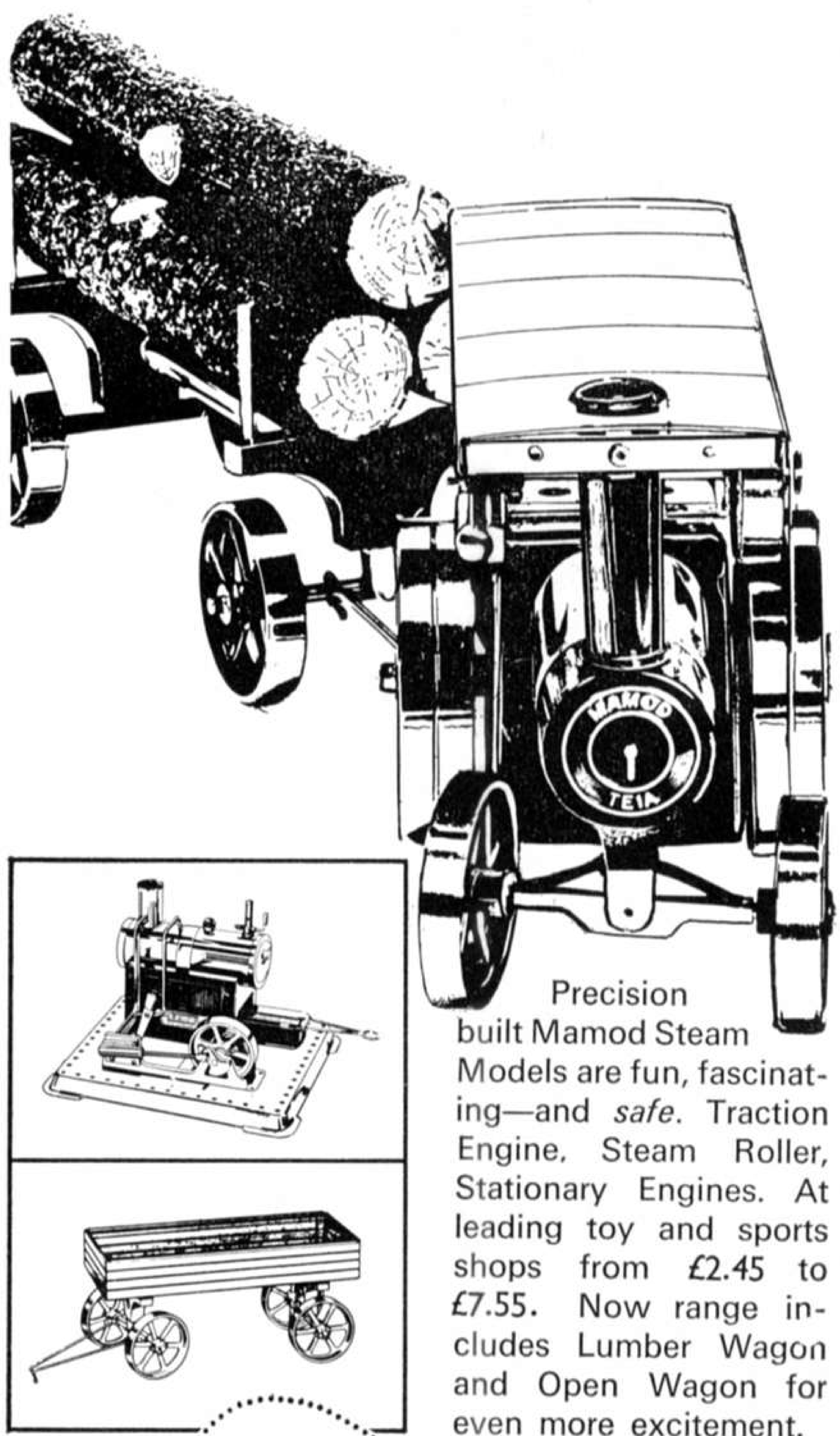

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"Adlerangriff", the German 'attack of the Eagles'. Planned date Tuesday, August 13th 1940. Intention: to crush once and for all the vastly outnumbered Royal Air Force and so 'soften up' Britain for 'Operation Sea Lion', Hitler's planned invasion of England. The invasion that never was.

Up to this time Göring's much vaunted Luftwaffe had had an easy time of it. In Poland and in France, most of the outnumbered aircraft had been destroyed on the ground before the Blitzkreig attack on the cities began. The British army had lost all its heavy equipment at Dunkirk, and the R.A.F. had lost more planes – and more pilots – than the country could afford.

So, on August 13th, with the codeword Adler Tag – 'Eagle Day' – the German attack was launched. At dawn, 84 Dorniers took the air under command of Oberst Johannes Fink. Yet in sight of the English coastline, over Cap Blanc Nez, just South of Calais, the Dorniers – promised clear skies – were met by rising banks of cloud. When the escorting Messerschmitt Bf 110 of fighter group commander Joachim Huth finally appeared, it dived repeatedly past the nose of Fink's Dornier. Fink took this as telling him that the fighters were with him. But this was not the case. The fighter escort was, in fact, returning. *The Eagle Day attack had been postponed until 2 p.m.* So the Dorniers, one key radio out of action, kept on, heading for Eastchurch airfield and Sheerness, Kent.

The British too had their problems. Because of a surprise raid on the previous day by Bf 110 long-range fighters unexpectedly fitted with bombs, Ventnor radar on the Isle of Wight was out of action for weeks and radar installations were damaged at Dover, Rye and Pevensey.

On this occasion little warning was given, and aircraft were still lined wingtip to wingtip on the ground at Eastchurch when Fink's Dorniers arrived. The attack was on. Spitfires of the R.A.F.'s 74 Squadron, Hornchurch, fell on the massed – and unescorted – Dorniers from the rear, but the leaders escaped, and their bombs rained on Eastchurch airfield, smashing the operations block, killing and wounding nearly 40 personnel and writing off five grounded Blenheims. Yet the field was operational again within hours as a result of superhuman effort.

The real 'attack of the Eagles' began in the afternoon, as the Luftflotte groups 2 and 3 arrived over England between 3.45 and 5 p.m., aimed towards Portland, Southampton, Kent and the Thames Estuary. Forewarned by the earlier false start, 11 Group of Fighter Command was ready to meet the threat.

The great battle was joined in the skies over Southern England. 13 Spitfires saw a formation of Junkers 87b bombers below them and dived on them out of the sun, breaking up the escorting Bf 109 fighters and sending at least one down in flames. Score 1 for the R.A.F. Attacked by the Spitfires of 609 Squadron, nine Stukas were destroyed in minutes. The remainder missed their target, the airfield at Middle Wallop, and did little damage to Andover airfield, not a key target.

During this long-awaited Eagle Day the Luftwaffe flew 1,485 sorties – their most active day ever to that date. R.A.F. losses in the air were 13 fighters against 45 German aircraft brought down. Two of Britain's airfields were damaged, but one supposed fighter station turned out in fact to be a Coastal Command air station, 'a major error by German reconnaissance'. The main aim of Eagle Day – to crush Britain's fighter strength – was not achieved.

Yet Eagle Day was decisive. It is possible that the R.A.F.'s victory on this day set the pattern for the remaining days of the Battle of Britain. In this battle, the Nazi Eagle had its wings clipped.

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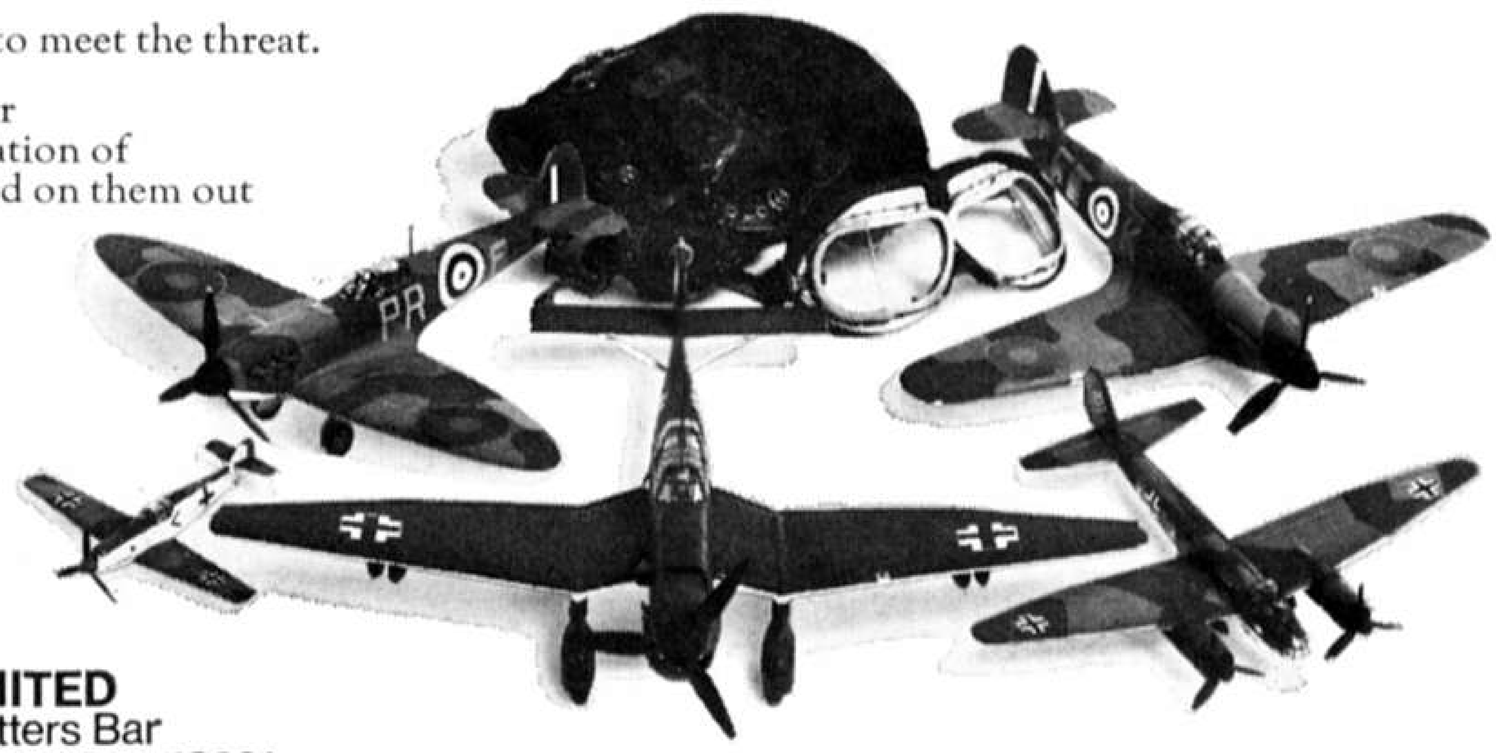

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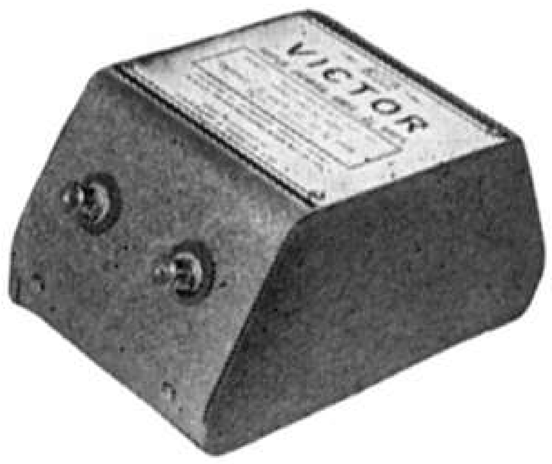

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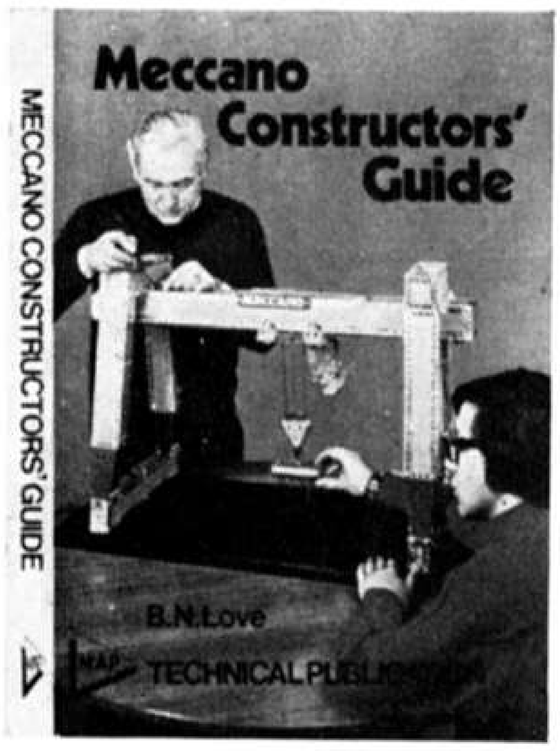

165 MECCANO CONSTRUCTORS' GUIDE

Bert Love, whose name will be familiar to readers of Meccano Magazine, provides a wealth of useful information and ideas for both beginner and expert constructor alike in this fine new work which represents an edited edition of his series of 12 articles in Meccano Magazine. Chapter headings include Basic Construction, Pulleys, Sprockets and Gears, Basic Cranes, Winding Gear, Rotating Superstructures, Movement on Rails, Traction Engines, Crawler Tracks, Vehicle Mechanics and Electrical Circuits for Motors and Lights. covering in detail every possible use and application of this versatile medium.

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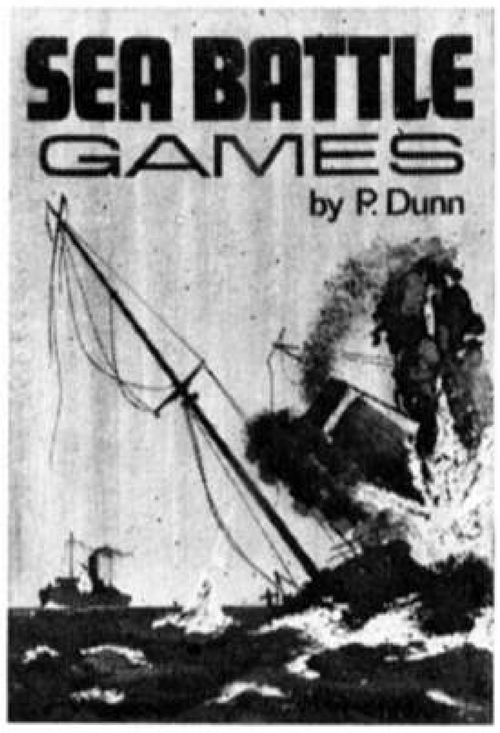

151 SEA BATTLE GAMES

The rather neglected aspect of naval wargaming is here treated in fine detail. Author P. Dunn has been playing sea battle games for a number of years and has wide experience of the various methods of playing advocated. The ideal period for naval wargame ended when ranges got so great that battles were fought with ships over the horizon, so that the author deals in great detail with Napoleonic period. Ironclads and pre-Dreadnought gunnery systems, with a chapter on early periods—armada and similar. Of special interest are his rules for map campaigns and a hypothetical world war game.

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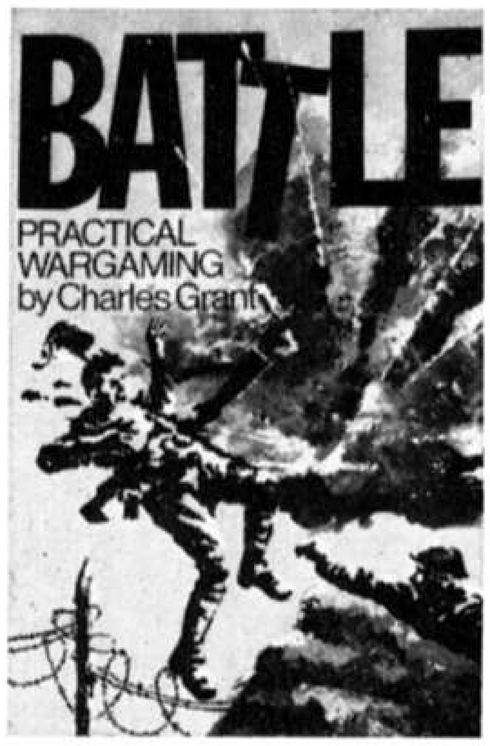

157 THE NEW GLASSFIBRE BOOK

It is now over ten years since the first title on this subject *Glassfibre for Amateurs* was produced and whilst most of the techniques and materials are as originally described a great deal of additional experience has been gained so that a new book treating the subject differently has become desirable. In these pages, which are laid out for very easy reference, the author deals with 'GRP', glassfibre materials, resins, fillers, pigments and parting agents; moulds, tools and equipment, basic techniques, castings, moulded shapes; roof lights and panels, GRP tanks, boats, cars, modelling and domestic applications, garden pools, repairs, trouble shooting; designs in GRP Appendices.

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160 AEROMODELLER ANNUAL 1971/2

Four dozen of the top model aircraft designers culled from a dozen countries give a balanced appraisal of modern aeromodelling. Survey of free-flight contest tactics; How to do aerobatics with control line models; Flying radio-controlled thermal soaring gliders; Making sheet balsa models; The effect of altitude on most model flying; Use of twisted wings; Towing a glider with a Power Model; Variable camber power models; Engine Fuels . . . plus countless hints and tips.

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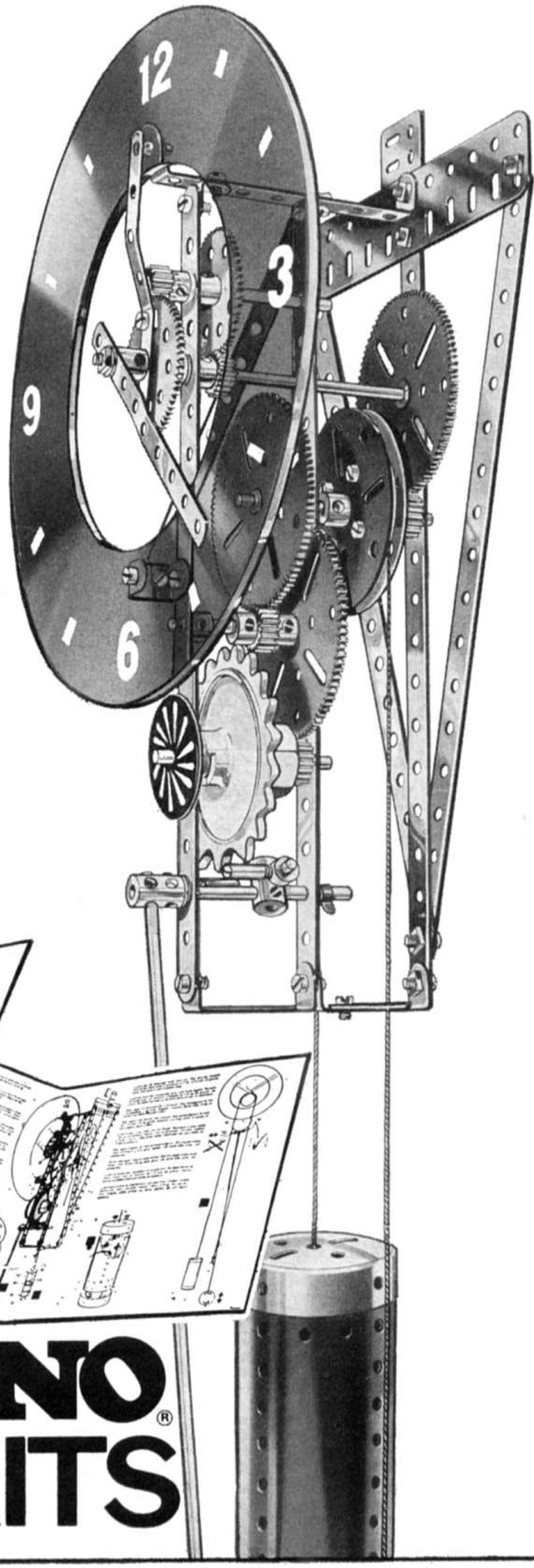

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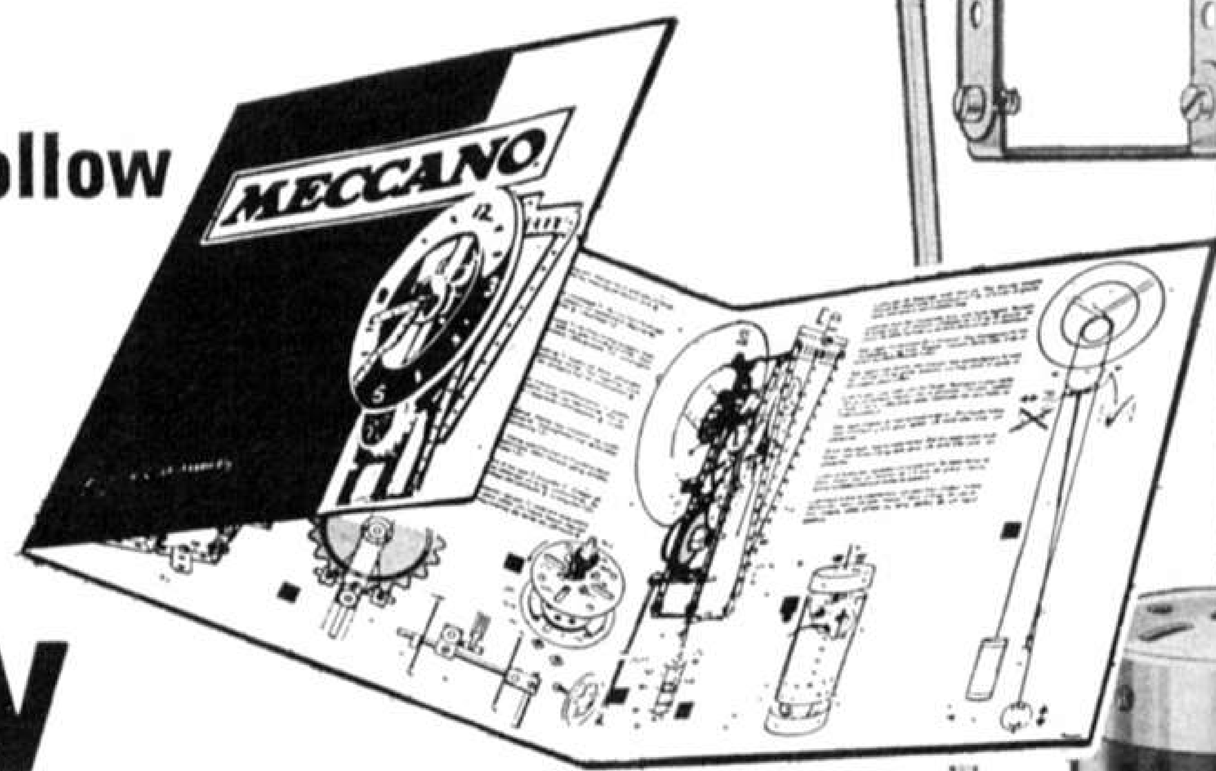

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Electric Car

On show at the Geneva Motor Show in March was the little electric car in the accompanying photograph. Built by Crompton Leyland Electricars and British Leyland, it is purely a research vehicle and is not intended for sale. It is diminutive—just under 9 ft. long and 5 ft. wide—and is largely built from standard Mini parts but with a special Michelotti body.

Running costs are less than half a penny per mile, but top speed is 33 m.p.h. and the range is limited to about 40 miles. Until there is quite a considerable advance in battery technology—a lot more power from a lot less weight—passenger cars like this are not likely to be a viable proposition. However, the little car affords considerable opportunity for research on suspension, instrumentation, and such matters as regenerative braking—what we use on electric slot cars, that is!

With pollution a major problem, and the possibility of the world's oil supplies running out in the not-too-distant future, electric vehicles may well be the ultimate means of transport, whether from a current-generating device yet to be developed or from storage cells of higher capacity and lower weight than we now have. Electricity supply itself should never be a problem, since nature's own forces can be harnessed to produce it, as from waterfalls etc.

Power

Which leads us to consider power supply generally. Have you ever thought that basically all forms of public power supplies could well eventually come down to electricity? Oil has a limit to it, as must have coal. Atomic energy, as far as one can see at present, is of little direct-use value, and has to be converted into electricity. Gas is likely to be around for a long time, because it is produced relatively quickly by natural means (as compared with coal, which takes centuries to form). Solar energy, when commercially harnessed, will no doubt have to be converted, again to electricity. Tide mills may one day reappear as electricity producers, and indirect use of solar energy—evaporation, rain, running water, hence waterfalls and hydro-electric stations—have already been mentioned. Did you know that Norway's most important export was electricity, from its hydro-electric schemes?

Some of these sources provide a heat supply, but this has a relatively limited application. It all seems as though electricity is going to be the main form of power, and the ability to store it must therefore be a priority in many laboratories. This all lends interest to the article on power transmission in this issue, but of course the principal point is that production of electrical power is, or can be, almost entirely pollution-free. We shall have to find a means of dealing with radio-active waste from atomic power stations, but compared with the enormous pollution problems of excavating and burning coal and oil, this should offer difficulties at least restricted to relatively small localities.

In considering the possibilities of storing electricity, the difficulties should not be under-estimated. Such giant concerns as Ford in America and British Leyland in this country would not be spending time and not inconsiderable sums of money in research into steam cars if the problem of economical electricity storage seemed capable of reasonably straightforward solution. What a nice thought it would be if some researcher came up with a process for converting the daily thousands of tons of waste polythene and polystyrene etc. into a fume-free fuel for steam cars. Preferably one which left an ash residue that in itself was an all-round fertiliser for crop-growing!

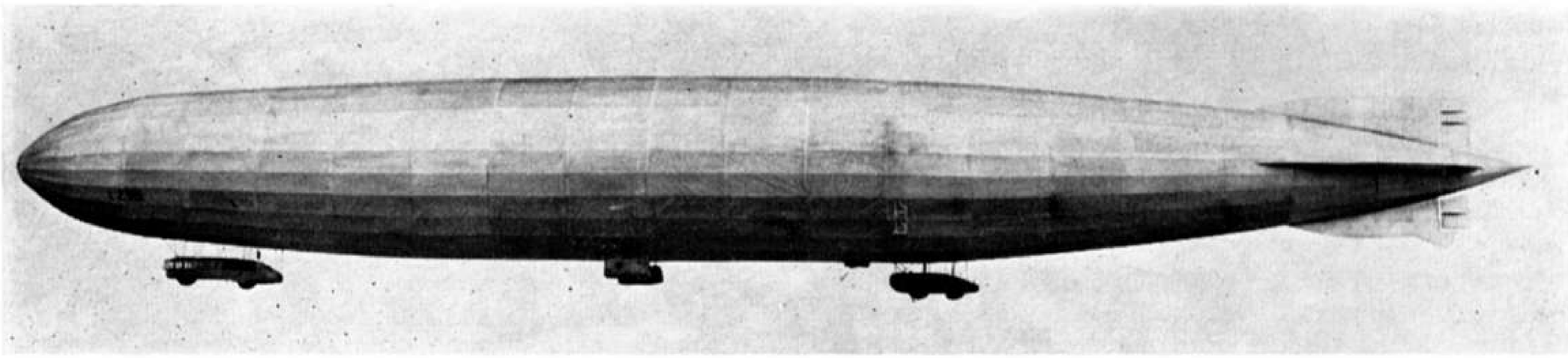
Trans-Americas Expedition

A couple of months ago we gave details of the specially-equipped Range Rovers being used by the Army-backed British Trans-Americas Expedition which is currently attempting a journey from Alaska right through to the tip of South America. The worst part of the trip was expected to be the 250-mile Darien Gap on the Panama Isthmus, and the most fearsome section of this the last 50 miles through the Great Atrato Swamp.

As this is written, the team has hacked its way through and reached the swamp, a hostile, steaming morass said to be 1,000 feet deep in parts and positively swarming with black alligators, anacondas, poisonous toads, and a creature feared by the local Indians, the fresh water sting ray. Clouds of mosquitoes, bubbles of foul gas, either impenetrable jungle or shelterless areas of blistering heat—it sounds a super place to go for a holiday! On top of it all is the question, can they beat the swamp before the tropical rains begin? It seems unlikely, since they have already experienced severe storms and deluges of rain. However, the 64 soldiers and civilians on the trip are still in good spirits, albeit in rags.

The aim is to pioneer a vehicular route through the Gap, thus enabling the two parts of the 14,000 mile Pan American Highway to be joined.

Attractive two-seat experimental electric car, built by Crompton Leyland Electricars, who make milk floats etc. Despite its small size (107 in. long) the car weighs one third as much again as a standard Mini, due to its lead acid battery load.



WILL AIRSHIPS RETURN?

by Alan Major

A BRITISH company, Manchester Liners, has formed a subsidiary, Cargo Airships Ltd., to study the possibilities of airships for carrying cargo. Far from being laughable, airships for this purpose could have a great potential. A Jumbo jet can carry only 100 tons of cargo. With an airship the bigger it is the more efficient it is, so it could be economically viable with a larger tonnage carried, while it also has the advantage of easing some of the environment problems created by other transport systems. Another advantage is that early examples were virtually silent from the ground and to those who flew as passengers aboard them.

There were several snags with previously constructed airships. One was that knowledge of aerodynamics and stresses was limited. This is no problem at all today. But the biggest snag of all was that highly inflammable gas, hydrogen, had to be used because the Americans had the monopoly of the only safe but expensive gas, helium. This, now used in space rockets, is more plentiful and cheaper. After several tragic disasters with airships in the 1920s and 1930s various involved Governments abandoned the airship concept and the idea, as a form of travel, fell out of favour with the public. But now at least five countries, Russia, Japan, Germany, U.S.A., and Britain, are taking a second look at its possibilities.

The first man to suggest a semi-rigid airship principle, as opposed to a balloon, was Sir George Cayley as far back as 1804. In a paper on aeronautics he stated "the bag or balloon containing the gas ought to be in a form approaching that of a very oblong spheroid but varied according to what may be found the true solid of least resistance in the air, that this must be supported by a light longitudinal and two transverse axes of wood braced with cord to give stability to the fabric, with such other stays as may nearly preserve the form intended, without allowing the resistance of the air occasioned by the motion to press out the gas too rapidly." He went on to describe the "car" or "boat' to be suspended beneath and a rudder to be fixed as a control unit. In 1816 and for several years afterwards Cayley designed airships, some of which were remarkably like examples constructed a century later. The first design was to be inflated with hot air, others to have steam engines for propulsion with swivelling airscrews and, amazingly, a hydrogen airship which he originally thought could be made non-inflammable by mixing the hydrogen with nitrogen, but the combination proved too heavy. He even forecast that "when used as permanent vehicles and on the true scale of magnitude airships will probably be made of thin metallic sheets kept firm by pressure with separate light bags of gas within." Later the first metal airship *was* constructed, by Schwarz, of aluminium, both the envelope and rigid structure within and was the first rigid airship as such. But it crashed on its first flight in 1897.

After Cayley's pioneer work on aeronautical subjects, including airships, little effective work was done with them until 1852 when a French engineer, Henri Giffard, constructed a primitive little airship with an airscrew driven by a 3 h.p. steam engine. This he flew over the rooftops of Paris that year at a speed of 5 m.p.h. After this the Tissandier brothers in 1884 did some experimental work on electric propulsion for their airship. Wolfert and Baumgarten built the first dirigible to be fitted with an internal combustion engine in 1879, but the first near-practical dirigible was constructed by Renard and Krebs in 1884. In 1898 Alberto Santos-Dumont, a Brazilian, took to the air in a miniature non-rigid dirigible that was 82½ feet long, held 6,354 cubic feet of gas and was operated by a 3½ h.p. engine. He also constructed a number of other airships, one of which he used to startle France by flying it round the Eiffel Tower in 1901, and in 1905 built a helicopter.

In 1893 Ferdinand von Zeppelin drew up plans for an airship but could find no backers, but in 1897, due no doubt to pioneering work being done in other countries, the Association of German Engineers praised Zeppelin's proposals for an airship and money was raised. His first airship was built in 1899, but did not fly until 1900. It was 420 feet long, divided into 17 sections holding 400,000 cubic feet of gas and carried two 16 h.p. Daimler motors. It was not a success and the credit for the first properly navigable, but unusually shaped, airship went to Lebaudy's built and flown in 1903. But Zeppelin was not daunted by this. In 1905 his LZ2 flew and encouraged by this he built the LZ3 in 1906 which made many successful flights and established Zeppelin's supremacy in airship design, despite several disasters to some of his other airships. During the First World War he organised a Zeppelin service to support the German army and Zeppelin airships raided England fifty-one times, where they were a nuisance but not a serious danger due to their small bomb load and extreme vulnerability against attack.

Before the First World War airships had also been constructed in Britain and flew successfully and unsuccessfully, three early pioneers being the Spencer brothers who had first flown one of their own design in 1903, Barton in 1905, and T. E. Willow, a Welshman, who flew over London in 1910. The latter had been preceded in 1907 by a Colonel Capper, who had flown a British built airship, the *Nulli Secundus*, over Buckingham Palace and around St. Paul's cathedral. But while the German Government was annually paying out half a million pounds on airship projects, in Britain the Government only expended a few hundreds and it was left to private individuals and small companies working in aviation to back and build airships in Britain at this time. No wonder then that the Germans gained immense knowledge of airship construction and aerodynamics, and achieved so many "firsts" in this field. In 1910 the first airship to be used for passenger

Opposite, this is actually a 30 ft. long model made for a recent film, "Zeppelin". Right, newest airship is Goodyears' "Europe", just completed at Cardington, Beds.

services, the German *Deutschland*, made a journey of 300 miles, for example.

In the U.S.A. all this had not gone unnoticed and Walter Wellman, a newspaper owner, enthused over airships, planning to fly over the North Pole in one. His experiment to do it failed, due to a guide rope breaking and destroying the airship's vertical equilibrium. It was taken in tow by a Norwegian ship but wrecked in a gale after being insecurely anchored! Wellman in 1910 altered another of his airships, the *America*, in an attempt to cross the Atlantic. As an added precaution a lifeboat was slung beneath the airship! It was needed. The airship, after narrowly missing a schooner, crashed into the sea southwest of Bermuda and floated, although the six man crew and Wellman had by now scrambled into the lifeboat and cast off. They were rescued by a passing cargo steamer which had been attracted to the area by sighting what seemed to the ship's crew to be the biggest ever dead whale glinting in the light, on the sea's surface.

All this effort of individuals culminated in the airships being used for military purposes during the First World War, but not particularly successfully on either side, in view of the rapid development of fighter aircraft by the warring nations. After the War enough faith, however, still remained in airships as a means of travel to build some more examples.

One of the British airships of this time was the R34, which took off from East Lothian, Scotland, on 2nd July, 1919, and crossed the Atlantic in 59 hours, the first transatlantic flight by airship, leaving New York on 9th July and arriving back in Norfolk on the 13th. Later it struck high ground and was a total wreck. Following the R34's successful flight £¾ million was spent on three more airships. The R35 broke up while being inflated, the R36 blew up and the R37 was abandoned before construction was finished. All were more or less carbon copies of German airships captured or surrendered as war reparations. But the R38 was based on a British wartime design of 1918 that had been stopped by the end of the War. It was to be longer than the R34 and more luxurious and if successful was to be bought by the USA as a long-range passenger airship at a cost of 2½ million dollars. It was duly built at Cardington, Bedfordshire, but during tests various faults were found. These were supposedly cured, but during a trial flight in August, 1921, the R38 broke her back over Spurn Head and crashed in flames, with 44 of the 49 aboard being killed. The R39 already under construction was abandoned when the British Government decided to cease work on airships. But it changed its mind and decided to build two more, the R100 and R101. The former was built by private enterprise on a shoestring at Howden, Yorkshire, using duralumin girders. It had 14 huge gasbags within the 700 foot long hull, filled with hydrogen, and carried 50 passengers. The R101 was built, with stainless steel girders, by State enterprise, the Royal Airship Works, at Cardington, Bedfordshire, where the large hangar had to be enlarged to accommodate it. When it flew on trials it was found to be too heavy, deficient in gross lift and underpowered and could only carry 35 tons. As the airship programme stood or fell by the R100 and R101's failure or success, the R101 was modified, cut in two and a new bay inserted, making it 777 feet long. Against sensible advice and to flaunt Britain's aeronautical progress in the face of Germany it was decided to send the R101 on a proving flight to India, the R100 in the meantime having been tested and found successful in all ways. The R101 however, crashed at Beauvais, France, en route to India on 5th October, 1930, five million cubic feet of blazing hydrogen turning it white hot in seconds. Eight men escaped the crash, but two died shortly afterwards. Six lived to tell the tale, forty-six didn't. The R100, although a success, was broken up.

Probably the world's most successful airship was the German *Graf Zeppelin*, which flew from 1928 to 1937, 700 feet long, 100 feet wide, having a volume of 3,710,000 cubic feet, giving it a lift of 107 tons. It had a payload of 15 tons, approximately 20 passengers and 26,400 lbs of mail and freight, that could be carried for 6,250 miles at 70 m.p.h. It visited Britain, crossed to South America several times and circumnavigated the globe. The German *Hindenburg* was one of the largest airships ever built, held 6¾ million cubic feet of gas and carried 72 passengers in luxurious comfort. For a while it successfully carried passengers across the Atlantic but on 6th May, 1937, while approaching the mooring mast at New Jersey, it caught fire and was completely destroyed, thirty-three out of ninety-seven people aboard being killed.

Other events in airship history are equally tragic. The Americans built several airships. The U.S *Shenandoah* set out to fly from Lakehurst to Detroit in calm weather, but although considered the strongest rigid airship ever built, it broke up in the air, killing her commander and thirteen crew. The U.S. *Akron*, filled with non-inflammable helium gas, crashed in 1933 at New Jersey, killing 74 of the 77 people on board. The French *Dixmude* vanished while over the Mediterranean with 53 officers and men aboard.

The nett result of these disasters was that enthusiasm for airships waned rapidly in favour of other variations of aircraft. During the Second World War, though, non-rigid airships called "blimps" were used for coastal patrol work by the U.S. Navy.

Whether airships will ever come back into vogue as common forms of passenger air travel remains to be seen, but people who did fly on airships are still adamant that due to the spaciousness of their interiors, including restaurants, a ballroom, luxurious sleeping cabins, and above all the lack of noise, they were the most comfortable way to travel.

Infra-Red TV Patrol

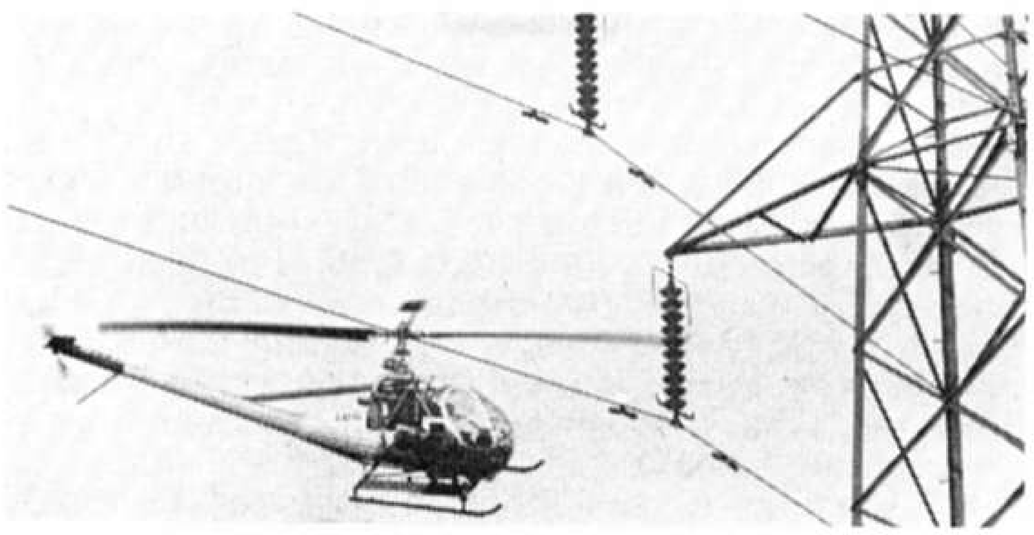
A thermographic closed-circuit trouble-spotting TV system

By Richard Lee

AERIAL photography, even aerial TV, has been filling commercial needs for some years now. The progress of science is much like a series of stepping-stones, one development opening up possibilities for new uses of other techniques.

So it is with the new service run by management Aviation Ltd. and the Rank Precision Industries who are using an aerial infra-red TV technique to carry out a wide range of survey, exploration and rescue operations.

Infra-red *photography* is a fairly recent development and has been much used by high-flying survey planes to take weather pictures and to search for mineral deposits. The pictures yielded by this method show areas of light and dark according to the temperature of the parts of the subject being photographed. Often the parts



of a subject have similar heat areas to their actual shape, so that one obtains a picture of the subject that is quite recognisable. But the important feature is that the density of the colouring may reveal scientific information. Crops infected by disease have a lower temperature than healthy plants, and so the spread of disease can be spotted by camera from the air—even before the plants appear sick to the farmer on the ground!

Now, by relating infra-red photography with the benefits of TV scanning, Rank's have produced a thermographic closed-circuit TV system which can be built into a helicopter.

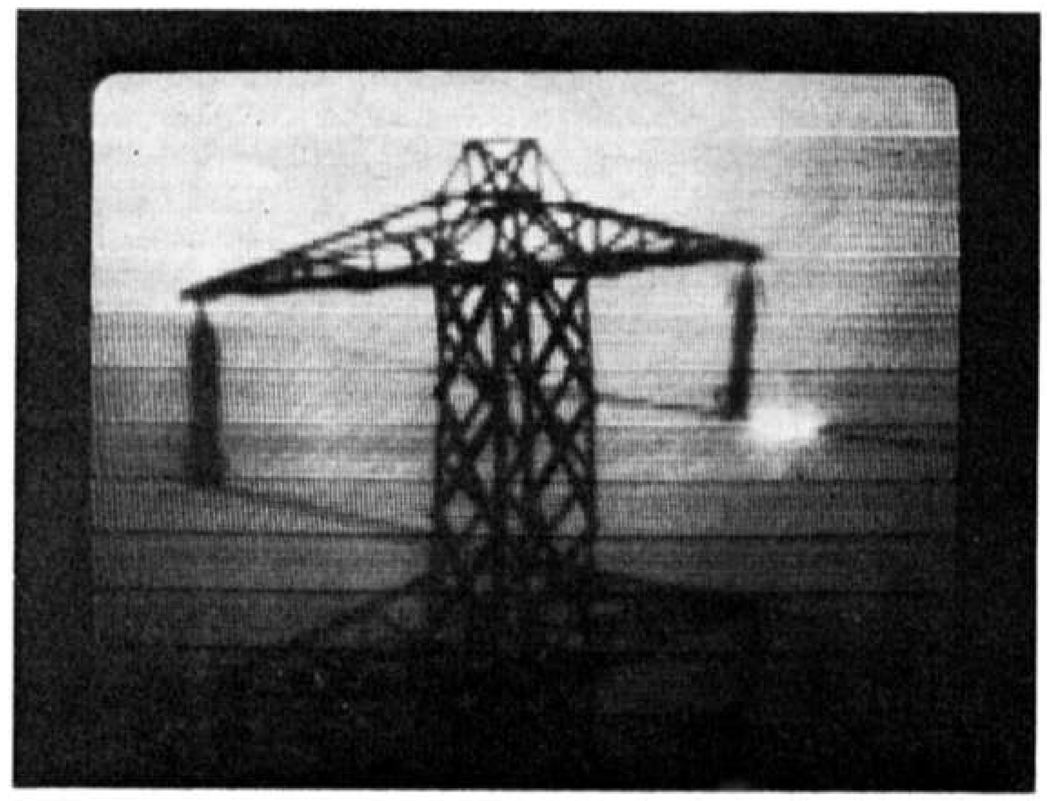
One important job which this chopper patrol can do easily is to check the insulators on the high tension power lines of our national electric grid system. High voltage current is constantly surging along these cables, and is insulated from the metal pylon frames by the long bobbin-shaped porcelain insulators which hang down and support the cables. Should one of these insulators develop a flaw and short-circuit the current to earth,

Top left, the Rank thermographic TV team take off on another "flying eye" assignment in their Hiller 12E helicopter.

Above, the equipment in the 'copter. Camera in foreground uses infra-red rays to detect surface temperature changes; results show on TV screen, here being adjusted.

A trial and demonstration run using a light bulb clipped to the cable to simulate a "hot spot".

The white spot on the TV screen indicates the hot spot in this laboratory simulation of how the system works.



then the power supply to one area will fail as the circuit-breakers (huge fuses) blow and it may be some time before an emergency repair team can get an insulator installed and restore the current.

Before an insulator breaks down, however, it will develop a hairline crack which causes a small leak of electricity to run through it. Normally this would not be detectable. But any such flaw will cause the insulator to get warm—and this is where the infra-red chopper team come in. Flying along power lines at up to 96 m.p.h., the pilot's TV man keeps his camera trained on the insulators and watches his monitor screen in the cockpit. When he spots an insulator showing up lighter in colour than the others he knows that it is warmer than the others—and the reason is that its insulation is breaking down. He records the insulator in question and the Board's service team can schedule replacements without costly emergency action or without anybody suffering a local power cut.

There are many more dramatic applications of the infra-red TV patrol, though. Leaks in underground gas and oil pipelines can be spotted because the leaking substance seeping into the surrounding soil creates a temperature change in the ground which can be spotted – even 1/5th of a degree C being detectable.

Missing persons can be searched for at night or in fog. Children lost on moors show up as white blobs against a dark background. Forests can be covered on a fire patrol that locates outbreaks while they are still controllable. Sources of pollution in our rivers, crop disease in our fields—all these are jobs which the chopper patrol can do today with its infra-red eyesight!

...and Electricity Pylons

themselves, discussed by D. Gunston

THEY straddle the land of Britain like metallic monsters from another planet linked by skyborne life-lines. Lovers of natural beauty shudder at them. Rural conservationists hate their presence almost everywhere.

They do undeniably disfigure the landscape, yet we have come to accept their skeletal silhouettes as part of progress. For they ceaselessly carry a vital burden of life-giving power, warmth and comfort which we know only too well we cannot do without.

Electric pylons. We know them as pylons, but the nation's electricity authority, in its lofty jargon, calls them "transmission towers".

There are now nearly 54,000 of these steel structures and they carry 10,600 miles of current bearing cable lines. These figures have grown steadily in recent years, but gradually, now, the increase will slacken off as the national grid power scheme for the seventies takes place.

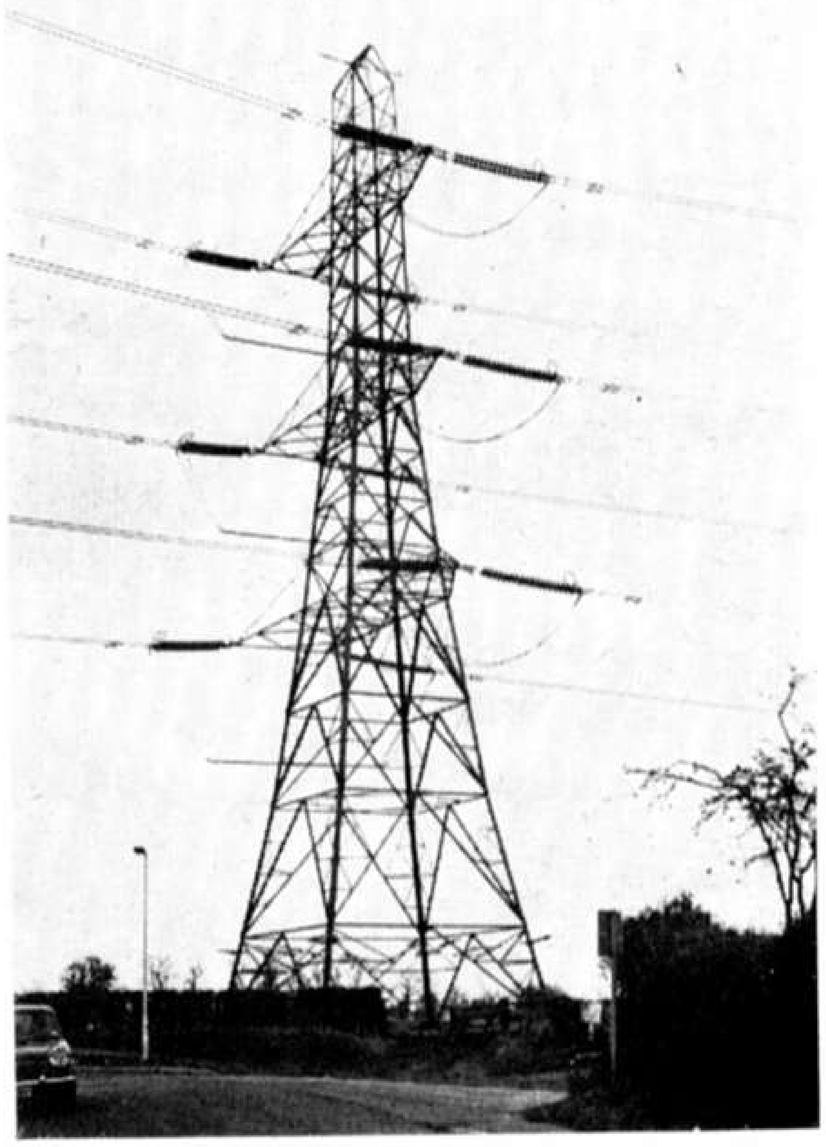
Above all—and this is usually overlooked by those who grumble at the whole concept of carrying electricity across the land on overhead wires—they are by nature temporary erections which could swiftly be removed if an efficient substitute method of power transmission could be found.

Pylons scar and spoil the land and the views it offers, but mercifully they do not obliterate in the way that past mining operations have done.

As for running power cables underground instead of slinging them up in the air, as many preservationists suggest, technically this is extremely difficult—and costly. The latest official figures for the average cost per mile installed are £1,030,000 for underground and £72,000 for above ground, or about 15 times as much for the buried wires.

Part of the unsightliness of today's pylons is due to their size. The standard pre-war type pylon stood 86 ft. tall, but present-day ones reach almost 140 ft. The former were in scale with the landscape with its building, trees, hills, etc., whereas the bigger ones are unavoidably out of scale.

Each pylon is built Meccano-fashion of galvanised, rolled steel angle sections, assembled on the site into a scientifically accurate square-based pyramid, or more exactly, an Eiffel Tower-shape. This is clamped on to foundation legs bolted to its pyramid-shaped concrete footing. Movement, sinkage or collapse are extremely rare and the whole thing is light but very strong indeed, and stands up well to gale, frost, snow and ice.



This pylon, at Round Bush, feeds to or from the huge switching station at Aldenham, Herts.

Normally the span of cable between pylons is 1,000 or 1,200 feet, but proof of what can be achieved is the 5,310 ft. span across the River Severn alongside the new road bridge, held aloft on two towers each 488 ft. tall.

What makes the overhead pylon system relatively so cheap is that it used the cheapest form of insulation of all—air. Each cable hanging from its tower is bare steel-cored, aluminium wire, impregnated internally with grease to fight corrosion.

It carries no external insulation, and in clean country areas may last as long as 35 years before it needs replacement. At least as thick as a broomstick, it is strong without being unduly heavy, so that the unavoidable sag between each pylon never reaches lower than the usual minimum of 100–150 ft. ground clearance.

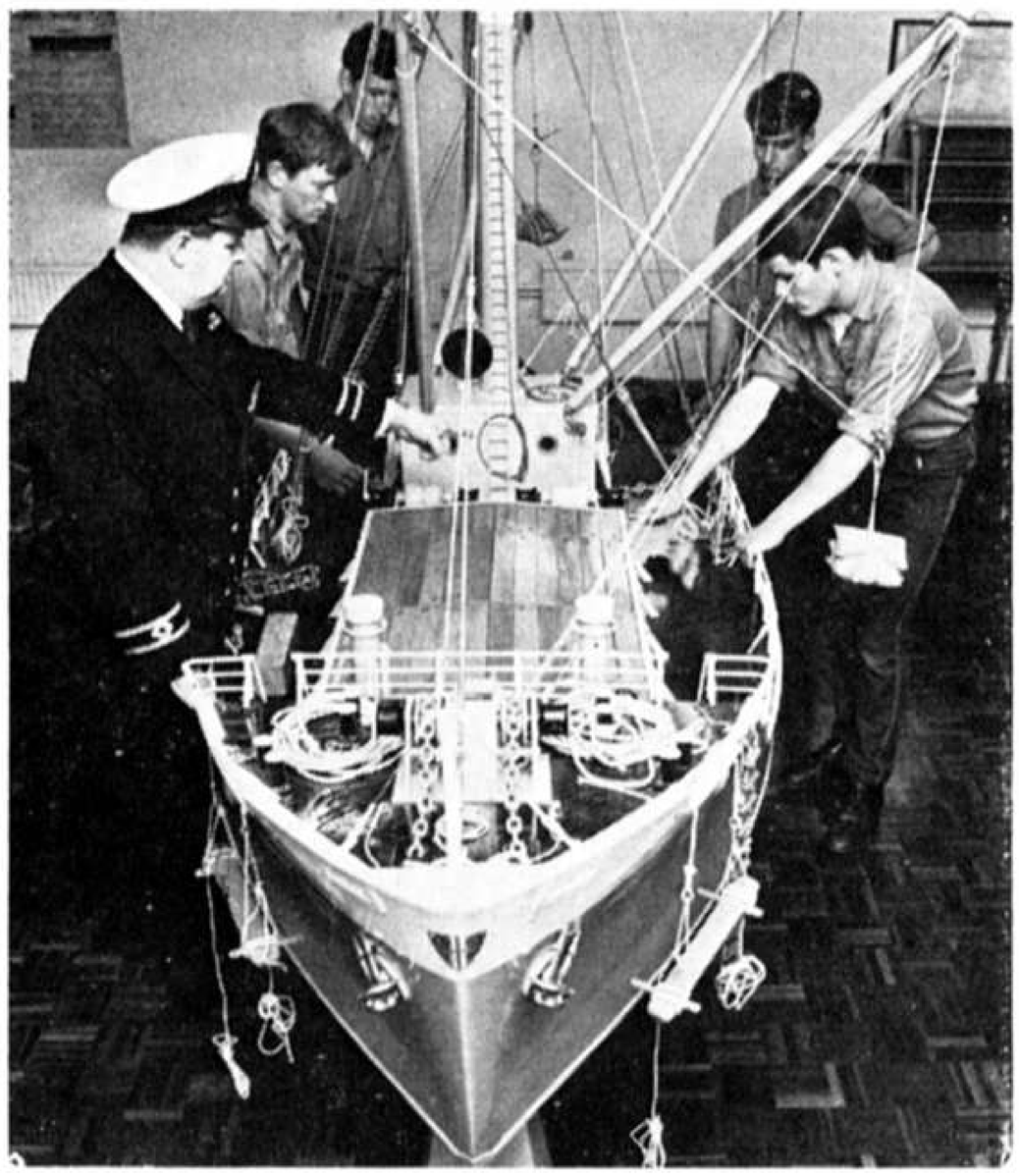
For a long time electricity in Britain has been transmitted across counties at a pressure of 132,000 volts (your domestic supply, for comparison is 240 volts). Now, however, most pylons carry current at 275,000 volts, while the main super-grid system operates at an incredible 400,000 volts.

Now electricity at this voltage is like a ferociously-raging beast, trying its utmost to leap from its wires into the ground, or anything that will carry it nearby. This means that when the live cables are hung from their pylon arms they must be heavily insulated by a huge string of circular insulators at least 12 ft. long. Anything shorter and the current would leap into the steel framework of the pylon and be lost—as well as electrocuting any person or animal touching the structure at ground level.

The dinner-plate insulators have to be made of the very finest dense porcelain or toughened glass without even the minutest flaw or pore through which that mighty current could seep groundwards.

According to the power men, pylons upset only one-fifth of an acre in every mile of their route. And when their blue-grey galvanised steel colour weathers into dull matt grey they do not look so unsightly. At any rate, crows, kestrels, rooks and mistle-thrushes have accepted them, for they have all nested on them!

Whether we like them or not, pylons are here to stay—for the present. We simply cannot do without them. But teams of top experts have been working for years to find a sensible alternative, or to cheapen underground cables to an economic level. So far they have not come up with anything really effective. Maybe pylons, when one knows and understands them, are not so bad after all.



School for the Sea

Where Merchant Navy entrants train in either seamanship or catering

By R. Wiggan

ONE WAY of starting a career at sea in days past used to be for a boy to hang around the docks, hoping a master would take him on as a cabin boy. The hopeful youngster was not too worried about the kind of ship in which he got a job, or of what kind of work he was set to do, as long as he went to sea.

It was all very romantic, but it was a rough and ready way of embarking on a seagoing career. Today all that has changed. Shipping companies have recognized methods of entry and training to crew the ships in what is a major growth industry.

One institution providing excellent grounding for a life at sea is the National Sea Training School on the south shore of the Thames Estuary at Gravesend, Kent. It is recognized as the biggest and most up-to-date Merchant Navy ratings' training establishment in the world.

The school, built and equipped at a cost of almost £1,000,000 to replace two older schools, provides accommodation for more than 500 deck and catering trainees in the 16 to 17 years age group. The majority of boys entering the Merchant Navy in this group, in the seamanship and catering grades, do so through the school. The boys live and work under seagoing discipline under the command of the captain superintendent, who is a master mariner. A staff of 78—many of them former pupils at the school—give instruction.

This "school of the sea" gives a comprehensive introduction to the basic seamanship and catering skills on which the boys' future success depends. There is special provision for boys who have had vocational training before entry.

Some boys see themselves as real "seadogs", striding the deck or bridge, while others prefer to specialise in the art of catering for the "inner man". There is scope for both types.

There are at present three courses. One is a 14-week course for prospective deck boys, while prospective catering boys can undertake a 10-week course. There is also a 10-week course for prospective catering boys specialising in cookery with the eventual object of obtaining their ship's cook-certificate.

Safety at sea is, of course, very important, and the first four weeks of each course provide intensive instruction in this. The training covers lifeboat drill and handling, liferaft, life-saving appliances, fire-fighting, elementary first aid, survival techniques and accident prevention and swimming instruction.

Nothing is neglected to make certain that the boys learn as much as possible in the time available. Deck boys are instructed in basic seamanship covering all the normal duties of the deck rating, including steering, signalling, ropework, deep-sea soundings, rigging and handling cargo-working gear, hatch work, mooring and general ship maintenance. Closer to the real thing is the supplementing of classroom work by river training in the school's own boats, and on the bridge, a fully-equipped navigational platform on the top "deck" of the school, 80 feet above the river.

A primary induction into marine engineering topics is included in the course. These are dealt with simply and

Lower away! Boys in training at the National Sea Training School.

mainly for appreciation value rather than specialised training. It is especially useful to those who may later serve in general purpose ships.

Board of Trade examiners conduct examinations in the school for the Board of Trade certificate of efficiency as lifeboatman and the certificate of qualification as efficient deck hand. The certificates are not issued at the school, but to successful candidates—without further training—when they have completed the necessary sea service and reach the age of 18. There is provision for candidates who complete the courses successfully, but fail the examinations, to make further attempts at one of the National Sea Training Trust's adult day schools.

The age when a cook in a dirty apron cooked up some mysterious, barely eatable meal in an equally dirty galley is past. Great importance is attached to the preparation of food on board ships, and not only the passenger vessels. Boys taking catering are trained in the preparation, laying and serving of meals, cabin hygiene and duties in public rooms and pantries, as well as receiving instruction in menus and wines. What they learn in the classroom is put to good use by undertaking many of the catering and domestic duties of the school.

But the training does not end there. Instruction is also given in food values, simple nutrition, simple calculations, geography geared to commodities, food hygiene and the use of books. Boy cooks receive instruction in basic cookery, both theory and practice. The programme includes instruction in practical bulk cooking. The syllabus is an introduction to Part One of the Ship's Cook's Certificate course.

Intensive though the courses are, it is not all work. Boys are encouraged to join a hobby club. Clubs have been established to cater for enthusiasts in model-making, camping, canoeing, map reading and music. Outdoor and indoor games are played, in addition to the operation of the Duke of Edinburgh Award Scheme. Voluntary evening classes are held in such subjects as mathematics, English, art, photography, economic geography and current affairs and carpentry. The purpose of all this is to help build character and to give the boys interests which, it is hoped, will enable them to live a full life while sailing the world's oceans.

Special day classes in mathematics—geared to navigation—and English are offered to deck boys who show aptitude in these subjects. Boys who show the necessary potential, at the end of the course, are encouraged to enrol for a scheme under which they can train to become navigating officers. This scheme lasts four years and includes two periods of residential training—each lasting 16 to 20 weeks—at a nautical college. It also includes study at sea by correspondence course. About 20 shipping companies have offered to sponsor young men on the course.

Evening classes in catering calculations and English are provided for catering boys, who, on completion of their courses, are encouraged to enrol for a correspondence course jointly administered by tutors of the North-West Kent College of Technology and the Seafarers Education Service. The courses are designed to help those whose ambition it is to become catering officers, chief stewards and higher grade cooks.

Training over, boys return home and register with their nearest British Shipping Federation Office as bona-fide seamen. They can expect to be given their first seagoing job shortly afterwards. Preference for a particular company or type of ship is always taken into account.

Once at sea, how a boy progresses depends on himself. As a deck rating a boy, having qualified as an efficient deck hand, can rise to petty officer. When he has completed four year's qualifying service at sea, he may sit for the examination leading to the Board of Trade certificate of competency for second mate. Many boys from the National Sea Training School have gained promotion to officer rank and in due course have been given command of a vessel.

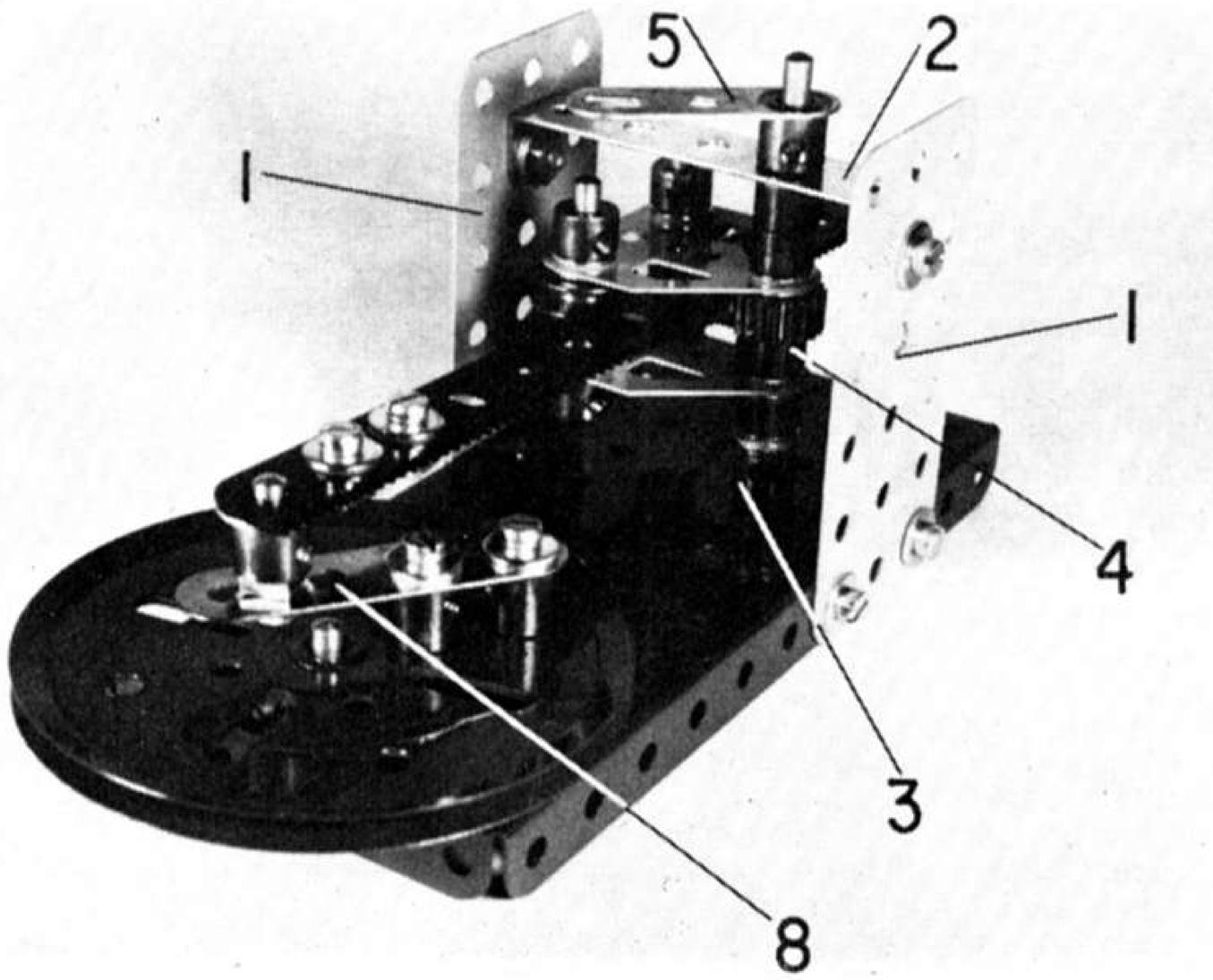
First job at sea for a catering boy may be chiefly on either galley or saloon work. If he is ambitious and has a special flair, he can work and study with the aim of rising to the rank of a fully qualified chef or chief steward.

What qualifications do you require to join the "gateway" to the sea? You must have a first class character and a good school reference and report. You must be of smart appearance. Needed, too, are good references from shore employers for the period between leaving school and being accepted for training. Certain physical standards apply, and if you want to enter the deck department you must have normal form and colour vision.

Training is free, but you have to pay for the uniform and working clothes which are provided at the school and which average £22. This kit can be used at sea.

Application can be made in writing or in person to the British Shipping Federation at any of their numerous offices. The London address is British Shipping Federation, Ltd., Shipping Federation House, 146–150 Minories, EC3N 1ND.

Opposite page, boys receive instruction in readiness for when they "cast off".
Right, boys work a winch at the sea training school.



AMONG THE MODEL BUILDERS

With 'Spanner'

THERE are times, I am sure, when contributors to the Meccano section of the M.M. must think of me with violence in their hearts. They all go to the trouble of submitting material for publication; they have it accepted, then—nothing! Month after month they buy the Magazine and month after month they anxiously search its pages, only to find no mention of their masterpiece. I can well imagine their feelings!

I can also understand those feelings, but it doesn't do to give up hope. Don't forget that these articles are usually written at least two months before the Magazine is published and remember that, at any one time, we already have material in hand waiting to be used. We always try to take things in due order and so, between the two, there can be a pretty big delay.

One of the many contributors who can confirm a big delay is Mr. D. C. W. Fairclough of Prescot, Lancs., the builder of our first offering this month. He submitted it a year ago!

The mechanism in question is a Variable Angle Actuator which Mr. Fairclough designed for use in a programmed crane where he required a mechanism that had a wide range of continuously variable angular movement. Although designed for a crane, it does of course have many other uses and, in fact, Mr. Fairclough understands that the type of rack-and-pinion system incorporated is sometimes employed in washing machines to produce the familiar agitator action.

In the demonstration unit illustrated, a framework is provided by a $5\frac{1}{2} \times 2\frac{1}{2}$ in. Flanged Plate to the side flanges of which two $3 \times 1\frac{1}{2}$ in. Flat Plates 1 are bolted, these Plates being braced by a $2\frac{1}{2} \times \frac{1}{2}$ in. Double Angle Strip 2. Mounted in this Double Angle Strip and in a Rod Socket 3, fixed in the Flanged Plate, is a 3 in. Rod on which are carried, in order, a Collar, a Flat Trunnion, a $\frac{1}{2}$ in. Pinion 4, another Flat Trunnion, two Collars and a Crank 5, this last part being fixed on the end of the Rod above the Double Angle Strip. The Rod passes through the apex holes of the Flat Trunnions and note that packing Washers are added, as required, to ensure that everything fits snugly, but without binding.

Journalled in the corner base holes of the Flat Trunnions are two $1\frac{1}{2}$ in. Rods, each held in place by Collars and carrying a $\frac{1}{2}$ in. Pulley with boss 6 between the Flat Trunnions, the latter free to turn on the Rod. Again, packing Washers are used as required.

Now fixed in the end row centre hole of the Flanged Plate is a Threaded Pin on which a 3 in. Pulley 7 is journalled. Secured to the face of the Pulley by two Threaded Bosses is a 2 in. Slotted Strip 8, arranged with its slotted hole over the centre bore of the Pulley. A second Threaded Pin is locked in the slot, a Crank being mounted, free, on the Pin as shown. Bolted to the arm of the Crane is a $6\frac{1}{2}$ in. Rack Strip 9, the smooth edge of which locates in the grooves of Pulleys 6 with the teeth meshing with Pinion 4.

In operation, it is Crank 5 which provides the angular movement when the 3 in. Pulley is rotated. Adjustment of the position of the Threaded Pin in Slotted Strip 8 will vary the amount of throw at the Crank and it will be found that the range of operation is between 0 and 200 degrees. This range can be further altered by mounting the Threaded Pin directly on the 3 in. Pulley in one of its four slots. As Mr. Fairclough says, when summing up, "Provided that all parts in the unit are correctly spaced, operation is very smooth, and a wide variation of angular movement is easily obtained."

PARTS REQUIRED

1—16b	9—37	1—55a	1—110a
2—18a	1—37b	7—59	2—115
1—19b	36—38	2—62	2—126a
2—23a	1—48a	2—64	1—19
1—26	1—52	2—73	

Multi-purpose Gear Differential

(*see page* 303 *for photo*)

For our second offering we have a fully-operating Differential designed by Mr. G. Relins of Milverton, Leamington Spa, Warwickshire. There is nothing unique in a Meccano differential, of course, but this particular example is the first ever mechanism of its type I have seen using the comparatively new Multi-purpose Gear introduced to the Meccano system in 1970. The unit is easy to make, works remarkably well and is undoubtedly a credit to its designer.

As regards construction, two $2\frac{1}{2} \times \frac{1}{2}$ in. Double Angle Strips are bolted between an 8-hole Bush Wheel 1 and a 2 in. Pulley 2, the bosses of the Bush Wheel and Pulley pointing inwards. Journalled, free, in these bosses are the two half-shafts—in our case supplied by $2\frac{1}{2}$ in. Rods—a Multi-purpose Gear 3 being fixed, boss inwards, on the inner end of each shaft. A loose Collar on the shaft spaces the Gear from its respective Bush Wheel or Pulley. In mesh with Gears 3 are two more Multi-purpose Gears 4 carried, boss inwards, on a 2 in. Rod journalled in the centre holes of the Double Angle Strips. One of these Gears is fixed on the Rod, while the other is loose, being held in place by a Collar 5. Both Gears are spaced from their respective Double Angle Strips by three Washers in each case. Drive is taken to Pulley Wheel 2.

As Mr. Relins points out, the mechanism is suitable for use in any model vehicle which drives on $2\frac{1}{2}$ in. Road Wheels, or 2 in. or 3 in. Pulleys with Motor Tyres. Also, the drive Pulley 2 could be replaced by a 2 in. Sprocket Wheel for chain drive, although, in this case, the spacing Collar on the half-shaft would need to be replaced by three spacing Washers because of the increased size of the Sprocket boss.

PARTS REQUIRED

2—16a	1—24	4—37b	3—59
1—17	4—27f	6—38	
1—20a	4—37a	2—48a	

New Zealand News

Before moving on, I have a bit of news to relate from New Zealand's Christchurch Meccano Club, kindly supplied to me by Club President, Bob Boundy, 53 Greendale Avenue, Avonhead, Christchurch 4. Bob tells me that last December 17 the Club held a highly successful Social Evening which not only included a very impressive display of Meccano models, but also featured a prize-giving ceremony, supper and dancing to music supplied—live—by a local dance band. Relatives and friends of Club members attended in addition to the members themselves and I am delighted to report that a good time was had by all.

On February 4 this year, the Club held its Annual General Meeting and this, I am told, was also a very lively affair. A number of parents attended with the result that the Club committee now has two new adult members to assist in organisation. At the meeting it was decided that the Junior Club associated with the Christchurch M.C., would be joined to the Senior Club to form one large organsiation which, Bob says, "should be extra good"! Members will certainly meet in comfort as the Club is now situated in a brand new hall complete with heating and kitchen facilities. Luxury accommodation, gentlemen!

Hungarian Expert

Moving now from New Zealand to Hungary in Eastern Europe, we find an internationally-known Meccano enthusiast in the person of Mr. Andreas Konkoly of Budapest. Mr. Konkoly is one of those dedicated modellers whose unique and fascinating inventions have not only earned him world-wide recognition among the Meccano fraternity, but which have also won two gold medals for him at International Fairs on the Continent.

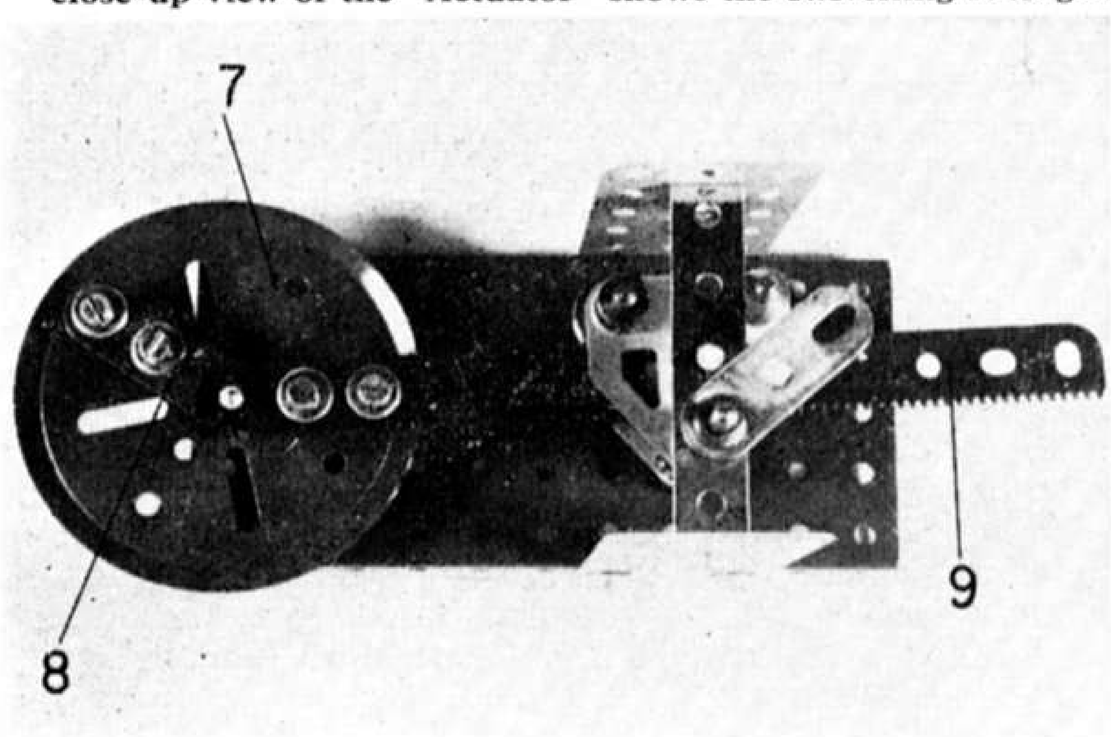
We have featured examples of Mr. Konkoly's work in Meccano Magazine in the past and, in fact, his very latest offering—an utterly intriguing "Meccano Sailor"—appears on page 291 of this issue. By way of a change, therefore, I would like to give here a brief outline of Mr. Konkoly's history, this being of interest to me and, I am sure, to the many readers who are familiar with his work.

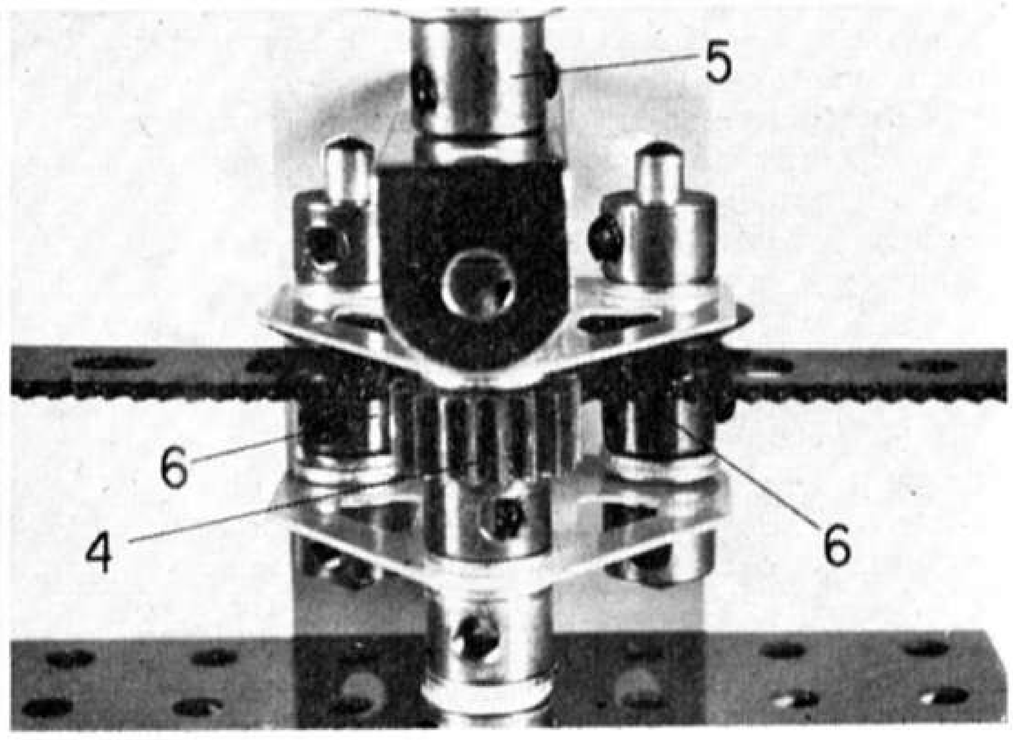
Andreas Konkoly was born in Budapest in 1918, the son of a bank director father and a school mistress mother. He first became interested in model-building at the age of 10, after receiving a small German-made construction set as a Christmas present, and his interest grew with the years. So, also, did his collection, but for more than two decades his experience was limited to Continental systems only. It was not until 1952 that he obtained his first Meccano Set—a pre-war No. 4 Outfit—but from then on he was "hooked". Over the next four years he built the No. 4 Set up into a No. 10 Set and, by 1957 he had started on the course which has now made him famous as a builder of really clever and "different" models of all sizes as well as compact, high-capacity mechanisms. Indeed, compactness is a feature for which Andreas strives in all his model-building activities.

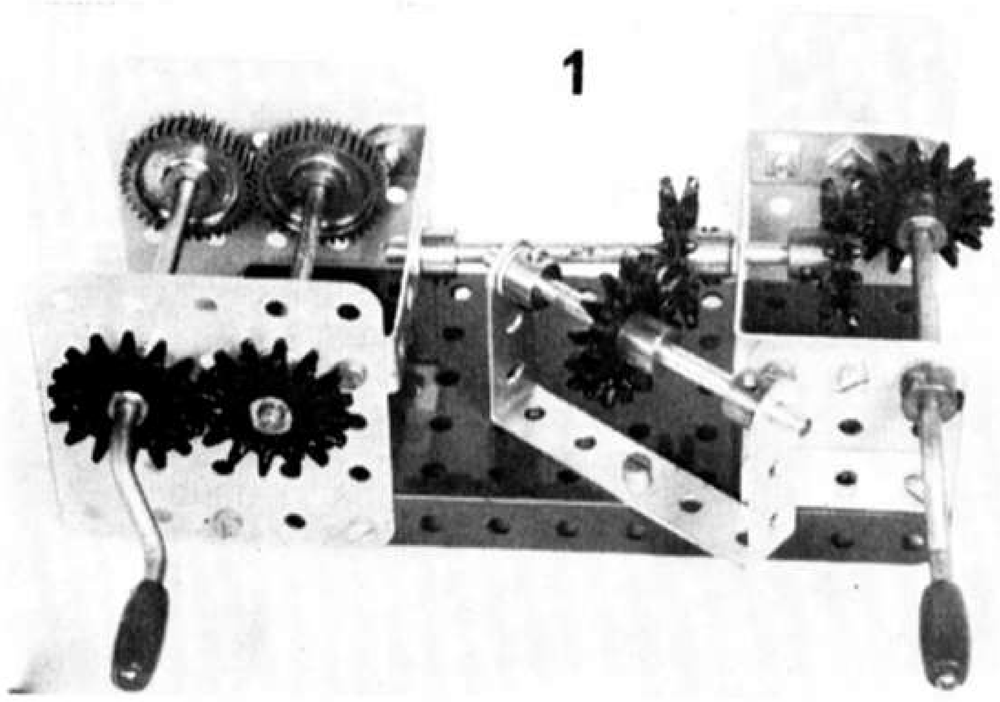
Public recognition for his work first occurred in 1958 when a 3-speed and reverse gearbox he had designed appeared in Meccano Magazine. The following year he had an unusual "Weather Prophet" model published and was also successful in two separate model-building competitions. Since then, we have featured examples of his skill at fairly regular intervals in the M.M., one model which I personally remember very well being a Walking Horse and Chariot which was described in a 1965 issue. In fact, Mr. Konkoly him-

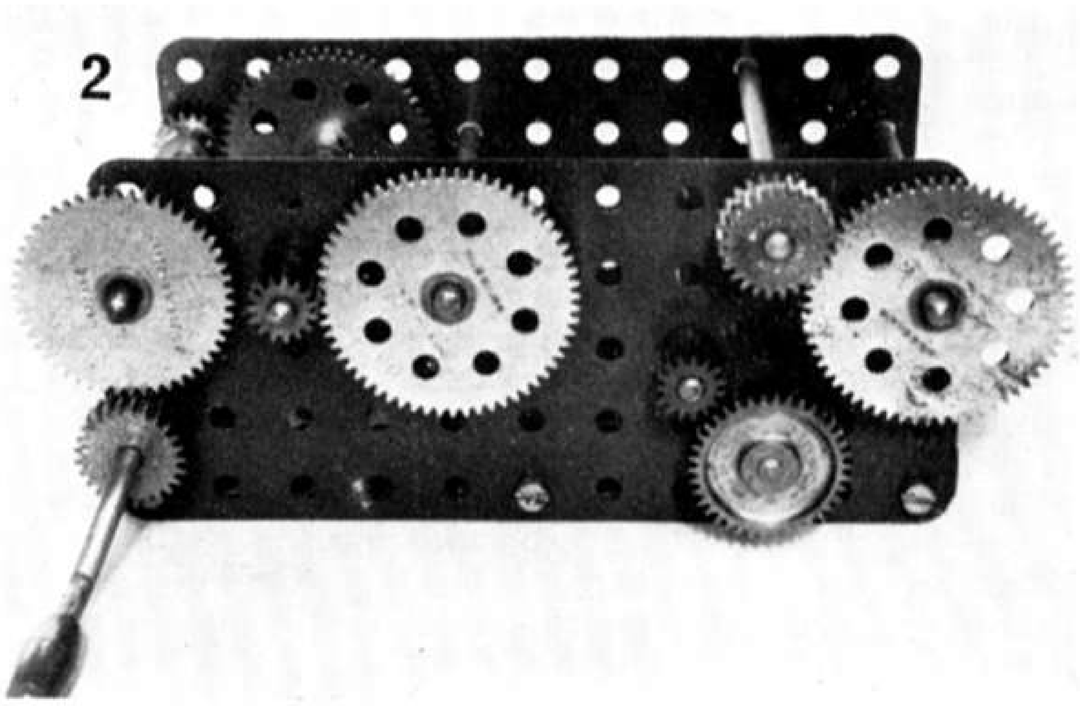
(*continued on page* 306)

Opposite page, full credit for this Variable Angle Actuator mechanism goes to Mr. D. C. W. Fairclough of Prescot, Lancs. Below left, a top view of Mr. Fairclough's mechanism showing the layout of parts with respect to the base. Right, this close-up view of the "Actuator" shows the swivelling rack guide, with one side removed to show the spacing of parts.









MECCANO PARTS AND HOW TO USE THEM

Part 6 — Basic Gear Trains

By B. N. Love

BEFORE continuing with this part, the reader's attention is drawn to an error in the table of Part 4, on page 202 of the April, 1972 Meccano Magazine. The 1½ × 1½ in. Flat Plate is listed as Part No. 76 but should read Part No. 74.

Basic Gear Trains

Most Meccano modellers would agree that their first sense of real engineering comes when they are fitting up the gear trains in their models. Until a few years ago, it was necessary for the enthusias to have an Outfit well up the list in order to have a versatile range of gears at his disposal, but with the introduction of Part No. 27f, Multi-purpose Gear Wheel, the younger modeller will find all the versatility he could wish for in any Meccano Outfit from 3X upwards. Fig. 1 shows just three applications of the new plastic gear wheel. Looking at the left-hand end of the model, a pair of 27f are mounted on the same shafts as a pair of 1 in. brass Gear Wheels. Although the 1 in. Gears have 38 teeth and the plastic gears have only 14, the rotation of the shafts remains in a 1 : 1 ratio. It is instructive to try this arrangement if only to convince the advanced modeller that he can frequently, without loss of mechanical efficiency, substitute the cheaper plastic gears for the more expensive brass ones when he wants such a ratio at 1 in. centre spacing.

A glance at the right hand end of the rig in Fig. 1 shows how the angle of drive may be varied—virtually through any angle from 0 deg. to 360 deg.—a remarkable achievement of design. At 0 deg. meshing, the two gears would be face to face and would then act as a positive clutch mechanism. Incidentally, the groove form in the plastic gear provides a deep-throated pulley wheel which will take a rubber Driving Band or a hoisting cord. When the Multi-purpose Gear Wheel is used for an angular drive as shown, care must be taken in meshing the teeth with sufficient clearance to give a smooth drive. So long as the gears are adjusted on their shafts so that they engage each other with the same overlap of teeth without binding, they will provide a smooth and quiet drive which requires no lubrication of the teeth. The principal limitation of the plastic gear, however, is that it will give a simple 1:1 ratio. This means that one revolution of the crank handle will cause the second shaft to revolve once, in the opposite direction. At a pinch, the Multi-purpose Gear can be mounted as a driving pinion for a complete circle of large Toothed Quadrants (more about those in a later part of the series). When adjusted to mesh with the external teeth, an exact ratio of 12:1 is achieved which may well be of interest to clock-makers!

Fig. 2 shows the more conventional range of gears in the Meccano system. The left-hand grouping shows a complete chain of gears starting with the 25-teeth Pinion, Part No. 25, on the Crank Handle. This meshes with a No. 27 Gear Wheel having 50 teeth, so two turns of the Crank Handle are required for one turn of the 50-teeth gear. The gear ratio thus obtained is therefore 2 : 1. The chain continues by means of a No. 26, 19-teeth Pinion meshing with a No. 27a, 57-teeth Gear Wheel. Three turns of the Pinion are required for one turn of the Gear Wheel, hence a 3 : 1 ratio. These last two gears are shown at the rear of the framework of Fig. 2. Finally, a No. 26c, 15-teeth Pinion meshes with a No. 27d, 60-teeth Gear Wheel giving a 4:1 ratio.

How many turns of the Crank Handle at the left are required for one turn of the 60-teeth Gear? Adding the ratios 2:1 plus 3:1 plus 4:1 would give 9:1—but this would be wrong as a count of turns would quickly show! The true ratio is obtained by *multiplying*, (2 × 3 × 4); answer, 24:1.

All the gears discussed so far are designed to mesh at 1 in. centre spacing, but unorthodox meshing can be achieved by spacing any pair of gears at critical meshing distance. Two examples of this are shown at the right hand end of Fig. 2. A No. 25 will mesh with a 27d when placed two holes along and one hole down as shown. The No. 26c will mesh with the 31 (1 in. Gear Wheel) when spaced at two holes diagonally, again, as shown. It is interesting to try other parts in the system for their varied hole spacing to see what other unorthodox meshings can be achieved. Advanced constructors make use of this feature in some of their planetary gear-boxes which require some rather peculiar gear ratios.

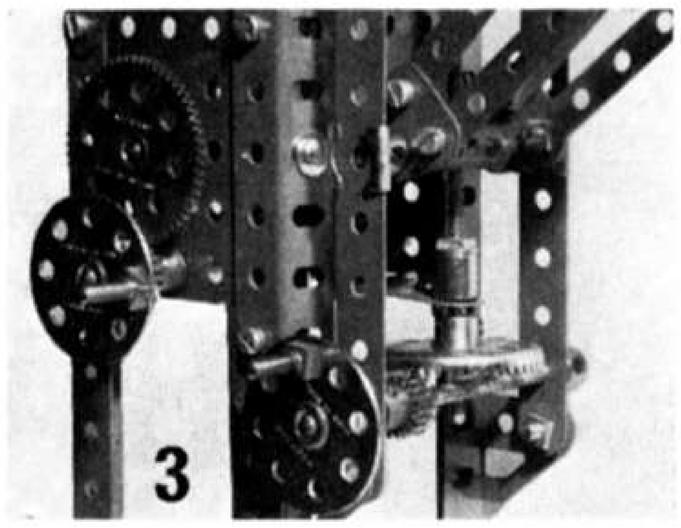
For normal running, thin Gear wheels should be set to run in the central portion of the wider face of the Pinions unless the model is to run for long periods. There would then be a tendency for the Gear Wheel to wear a groove in the Pinion face. This can be prevented by changing the position of the Gear wheel laterally across the pinion face, or by using two thin gear wheels back-to-back to

provide additional contact area. Always test Axle Rods for straightness before setting up gear trains and use the best you can find. Set up the axles with Collars and Washers to take the lateral play out of the shafts and be sure that they are running true before locking the gears to the Axle Rods.

Gears may be mounted inside or outside of the framework forming gearbox journals, as shown in Fig. 3. Here we see a 3:1 gear reduction to a winding shaft of a model crane. A further type of Meccano gearing is also illustrated in this model and it is known as contrate gearing. The Pinion is mounted on the hand wheel shaft and it meshes with a Contrate Gear to give a change of direction (90 deg.) and a gear reduction ratio. Other right-angle drives are illustrated in the remaining figures and they are well worth a little consideration.

Meccano does not claim to be a high-precision system, although surprising accuracy may be achieved by careful design and construction of a Meccano model. Indeed, the somewhat generous tolerance in hole and axle size is to help the youngster to make a working model without recourse to precision alignment. However, the even greater tolerance permitted by slotted Meccano parts can be put to good use by the modeller in adjusting his shafts for smooth running. the demonstration models in Figs 4, 5 and 6 use a similar module for setting up shaft journals. In each case a pair of 3½ in. Angle Girders is joined by a pair of 2½ in. Angle Girders made rigid by "sandwiching" 2½ in. Flat Girders at each end. Flat Trunnions are mounted as shown, using the slotted holes of the end Girders.

Consider Fig. 4 which shows a simple Bevel Gear Drive. To ensure correct alignment of shafts, a Channel Bearing, Part No. 160, is used as a fixed journal for the driven shaft. The driving shaft is mounted in the Trunnions which are then carefully lined up so that, when the driven shaft is pulled through the Channel Bearing, it makes perfect register with the driving shaft. A final check should then be made to see that both shafts are at right angles. They may then be set up with Collars and Washers after sliding the two ⅞ in. Bevel Gears into place. Again, mutual meshing of the Bevels is essential for smooth running and they should be adjusted on their shafts accordingly. This is very good practice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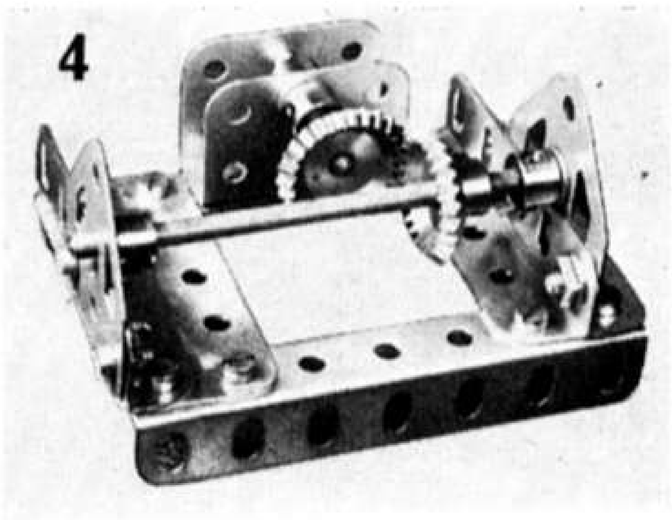
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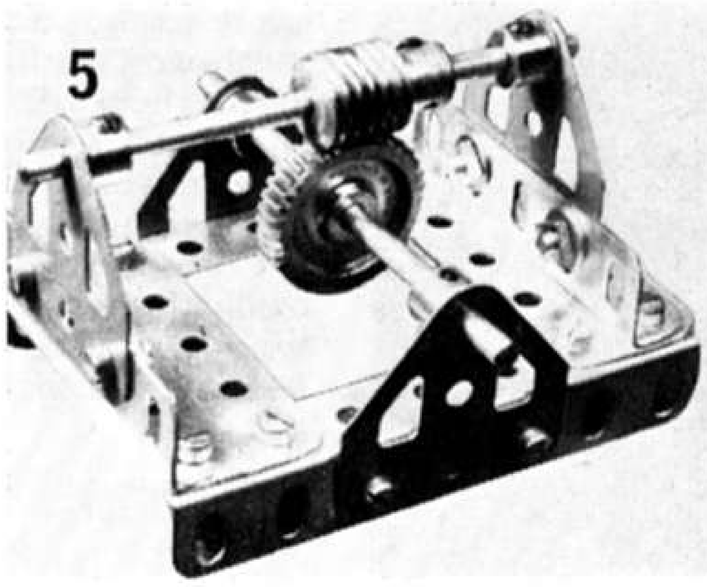
for the novice and for the modeller who experiences difficulty in getting his gears to run smoothly. It is quite possible that one or both Bevels may run with a slight wobble causing a binding at a critical point. If this happens, first try unmeshing the Bevels and rotating one half a turn before carefully setting up again. If the wobble is still pronounced, try double Grub Screws in the Bevel Gear bosses, or simply transfer the Grub Screw to the opposite hole. This will often do the trick.

The same principles of setting up apply to Fig. 5, showing a Worm drive. Critical spacing this time is required to ensure a correct depth of the Worm spiral into the 1 in. Gear teeth. Strictly speaking, because the Gear teeth are parallel to its axis and the worm spiral is not, the shafts should be at a greater angle than 90 deg. although a satsifactory drive is usually obtained at standard spacing in the three planes. Fig. 6 shows the Helical Gears, Parts No. 211a and 211b, which require the most careful setting up. When properly aligned they give a smooth right-angle drive where one shaft passes over the top of the other. The Worm Gear moves one tooth of the gear with which it meshes at each turn of the Worm, therefore the gear ratio of a worm drive is the easiest to calculate. It is only necessary to know the number of teeth on the gear being driven by the Worm, and so the gear ratio illustrated in Fig. 5 is 38 : 1, the 1 in. Gear having 38 teeth.

Meccano Worm drives cannot be reverse driven, i.e. from the Gear back to the Worm, but this has the advantage of providing an automatic brake in any mechanism. Helical drives, on the other hand, can be driven by either shaft, but location of one Helical Gear over another is critical. Shafts must be at right angles and at the correct meshing height above each other. The centre line through the gear face of one Helical must coincide with the shaft axis of the other, and vice versa. Any misalignment will cause the Helical Gears to bind, or to fail to mesh. Once set up properly, however, they perform admirably.

Much of the advice on setting up Meccano gear trains is self-evident to the experienced constructor, but the grinding of overloaded or badly meshed gear wheels still occurs in adult models which are incorrectly adjusted. Given a fair chance, standard Meccano gears will do all that the reasonable and careful builder wants of them—and much more besides in many instances. When accuracies of ratios to 12 places of decimals are achieved and loads of 1 cwt. or more can be raised by standard gearing there is little to complain about in a system which must compete in costs and quality with all of the various available constructional hobbies.

In the next part of this series we will be considering the effect of linking various gear trains together to produce some of the well-known engineering mechanisms.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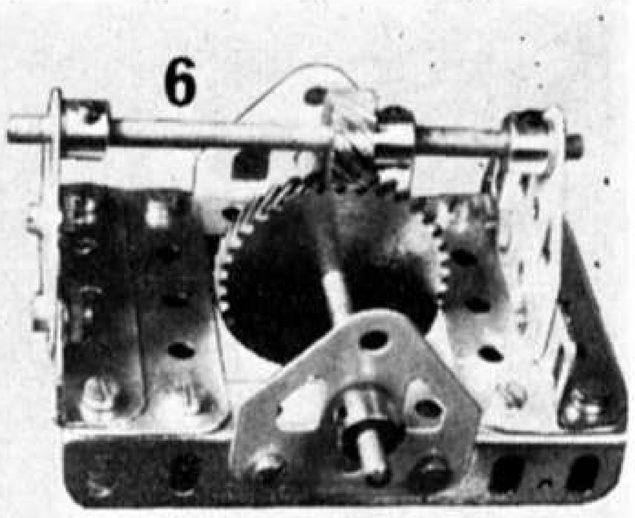
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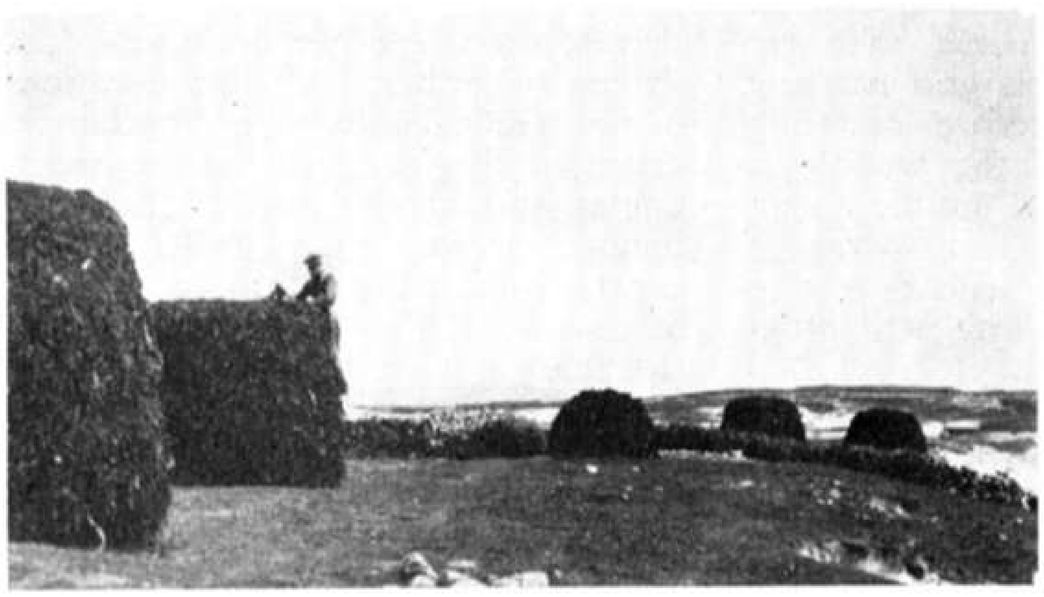


SEASHORE HARVEST

BY E. R. YARHAM, F.R.G.S.

Few people have any idea of the extent to which seaweed is used. Future use will be of immense importance to us all.

IT IS NOT generally realized that at least a million tons of seaweed are harvested every year from the shores and inshore waters of countries as far apart as the British Islands and Korea, the United States and Australia, Denmark and New Zealand, Canada and South Africa, Ireland and Japan. They are processed by the chemical, pharmaceutical, textile, food and fertilizer industries.

Yet the ocean's literally gigantic resources in seaweeds remain for the most part unexploited. For another little known fact is that seaweeds are the most plentiful species of the plant world. In the Arctic alone there are 250 species; there are 300 on the shores of South Africa; a further 900 species are found in the Caribbean; and no fewer than 1200 thrive in Australasian seas. In these islands Scottish crofters have long used seaweed as a fertilizer and, as an example of its abundance, four million tons are cast up annually along Scotland's shores alone.

Seaweeds are not only the most abundant of the world's vegetation, but they number among them the largest of all plant life. Many seaweeds exceed in size anything that flourishes on land, even the giant gums and ashes of Australia and the redwoods of the western United States. The *Quest*, ship of Sir Ernest Shackleton, the Antarctic explorer, on his last expedition, found enormous marine forests in the South Atlantic.

The official report of the voyage says that off the shores of South Georgia the bottom was rocky with several reefs. To quote: "All were fortunately marked by kelp, large forms of seaweed, the great safeguard and aid to navigation around the island, except on the south, south-west and south coasts, where icebergs tear much of the kelp off. It frequently reaches the surface in 60 fathoms and even deeper water." There is evidence that individual plants grow to a thousand feet in length and weigh hundreds of tons.

Corroboration of the value of seaweed in assisting navigation came quite recently in another report, this time of a naval hovercraft unit's trials in the Falkland Islands, which are extremely rich in seaweeds. The

Top, soups, jellies, custard powders, toothpaste, medicines are only a few of the uses of seaweed-derived alginates (*C.O.I. photo*). **Photos 2 and 3 show stacking and inspecting kelp after gathering it (bottom).** *Irish Tourist Association pictures*

hovercraft was used inland, over stone runs, bogs and streams, and at sea between the 200 islands. Weather in the Roaring Forties produces strong gusty winds and short, steep seas, and the navy found the extensive kelp beds around the islands of great assistance in permitting fast running.

Seaweeds are growing more important industrially every year, and an ambitious plan to use Falkland Islands seaweeds to make alginates which would earn up to £90 m. a year in British re-exports, was put forward some little time back by a Scottish company, the world's second largest manufacturer. Alginates—chemicals extracted from dried seaweed—have many applications. They are used in food industries to stabilize ice-cream, in cosmetics, in textiles, for motor car tyres, and for medical dressings. The Falklands represent possibly the world's largest untapped source of raw material for alginate production.

The industrial importance of seaweed was emphasized during an International Seaweed Symposium which met at Edinburgh. It was attended by delegates from every maritime country, China and Soviet Russia excepted. One encouraging outcome of the conference was the grasp of the need to husband even the world's abundant reserves of seaweed—and of protecting them from the ruinous effects of pollution, a menace sadly worsening. Channel Island authorities now strictly ration the cutting of "vraic" for fertilizers; Zanzibar controls collection by licence and the imposition of closed periods; and Japanese biologists have been experimenting with artificial seeding of the spores in order to encourage spread of the plants.

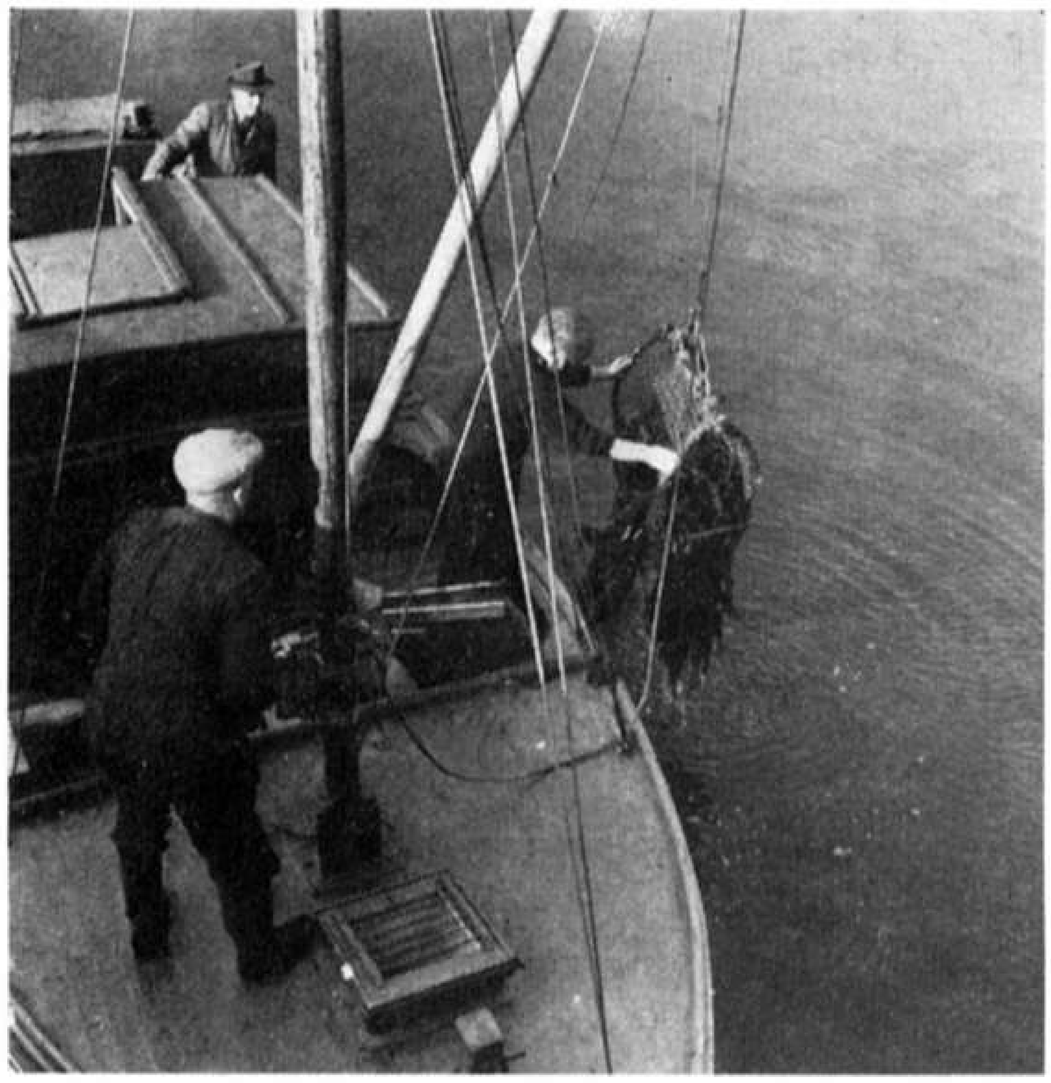
Few lay people, however, have much idea as to what has been going on. Most of us have a vague idea that iodine is or was extracted from seaweed. Nearly all of us have at some time half seriously used seaweed as a barometer, or remarked upon its peculiar effluvium when washed ashore or stacked as fertilizer. And there ends our knowledge of seaweeds as an economic factor. In reality they are entering more and more into the lives of all of us.

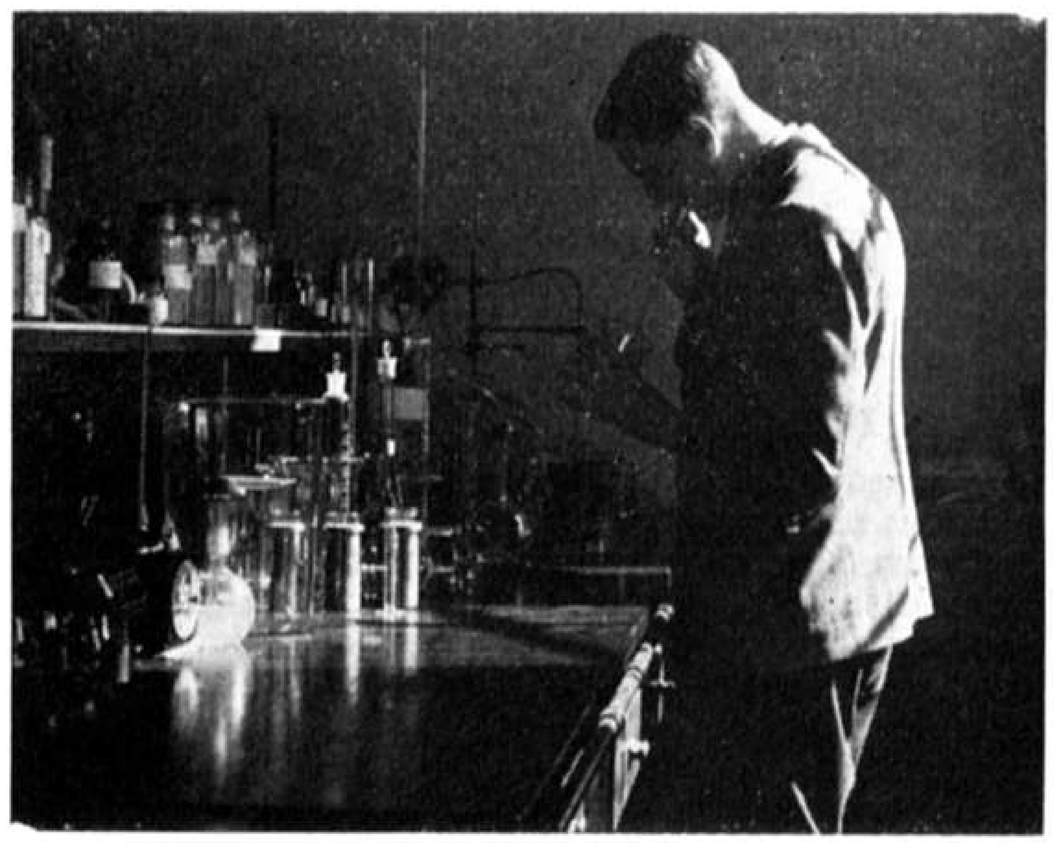
It was World War I that sparked off progress in the scientific knowledge of seaweeds. The one most heard of then was carrageen, which is one of the most widely used and most valuable of all species. It is known as Dorset weed along parts of the English coast. Carrageen was once credited with extraordinary curative properties, was a fashionable remedy for tuberculosis, and sold for as much as half-a-crown a pound. It certainly seems to possess some virtue in the treatment of pulmonary and bronchial complaints. A preparation of it was given to victims of gas during the war named, and it was incorporated in jellies for enteric patients whom it benefited remarkably.

The last war, which began in 1939, forced concentrated attention upon the potentialities of seaweeds. Hostilities made it imperative to investigate the possibilities of exploiting American and British seaweeds because when Japan joined the Axis Powers supplies of agar-agar from there were cut off. This gelatin-like complex carbohydrate is derived from seaweeds and is used widely by the food industries and medicine and almost universally for bacterial and fungal cultures.

These days seaweeds are not only being converted into human and cattle foods; they are playing an

continued on page 283





Scottish Seaweed Research Association boats from Oban and Kirkwall cut and collect weed from the sea-bed at over one ton per hour. Centre, an Association official makes a chemical analysis, and, bottom, a botanist plots and checks littoral weed. *(C.O.I. photos)*

Playboy of the ocean

Mimic, clown, echo-locator, talker — the dolphin is perhaps the most remarkable animal with which we share the world.

BY E. V. MALONE

THE thrill of riding on a dolphin was the experience of a 13-year-old girl called Jill Baker one day in the summer of 1955 at the quiet beach of Opononi, 150 miles north of Auckland in North Island, New Zealand. She was the first to get a ride on Opo, a a lovely bottle-nosed male dolphin, but she was certainly not the only child, because Opo became the favourite playmate of scores of boys and girls on this once secluded beach which was turned overnight into a popular seaside resort.

He also played ball with them and became so tame that he would allow himself to be lifted out of the water and be photographed. In fact, there was nothing he enjoyed more than having his back scratched. Too much handling, unfortunately, probably led to his death in that it removed the protective slime from his skin, and it was a sorry day for young and grown-ups alike when his dead body was washed up on the rocks nearby.

Another member of this species, a Risso's dolphin, which also hit the headlines in New Zealand's history, was Pelorus Jack who, in 1888, began the self-appointed task of acting as pilot to ships entering a particularly treacherous channel in Cook Strait, located between the two great islands of this nation in the antipodes. For many years sailors were accustomed to looking for the guiding fin of his blue-white 16 ft. body to appear, until a passenger aboard the *Rotura* shot at and wounded him, temporarily interrupting his career. So the Parliament of New Zealand introduced an Order in Council in 1904 rendering it a grave offence to interfere with the beloved finned celebrity. Although after a time he resumed his duties, he was to approach too near a passing ship travelling at a good speed and having been sucked into her side and thence to the stern with its dangerous threshing propellers, received a deep gash in his side which proved fatal.

These two illustrations show distinctly that dolphins are man-orientated—they seem to want to be near mankind and actually go out of their way for our company. This was also the case in ancient times, as witness what Plutarch, the Greek philospoher wrote: "He is the only creature who loves man for his own sake. Some land animals avoid man altogether, and the tame ones such as dogs and horses are tame because he feeds them. To the dolphins alone, nature has given what the best philosophers seek: friendship for no advantage".

Despite his marine existence, the dolphin is a mammal of the same order as the whale, known as *cetacea*. More than 20 kinds have been identified in the fresh and salt waters throughout the world and a vast amount is known of his nature and behaviour, thanks to modern research-work. Most important fact of his make-up is that he is biologically closer to man than any other sea-creature, which is confirmed by the vestiges of pelvic bones buried within the musculature of his body and the jointed fingers contained within the framework of his flipper. On his face he bears an eternal smile which is frozen by the curvature of his mouth.

It is a few weeks after birth that his teeth appear, 44 in each jaw, but at birth he can see, hear and recognise his mother's call. Every baby dolphin has a "nanny" who swims near his mother and himself and helps to rear the baby and protect him from sharks. If a shark does happen to attack the trio, the two grown-ups whistle to summon help and after the party has encircled the intruder, strike him with powerful thrusts of their heads.

An adult dolphin has a fair turn of speed, clocking as much as 30 m.p.h. Research into his fleetness shows that it is in some measure due to the very smooth skin which lies on top of the blubber, being resilent matter which allows the whole surface of his body to undulate according to water turbulence. Thereby it can reduce friction by as much as 90 per cent.

Dolphins navigate by the use of sonar in a similar way to bats using radar. Dr. W. Kellogg of Florida State University, who recently investigated this interesting aspect of the dolphin's life, was convinced that their sound perception was far superior to man-made sonar which cannot tell the difference between steel and wooden ships or submarines and whales. In his own words: "Dolphin echo location doesn't merely sense an echo. This animal has the ability to interpret, evaluate and identify that echo." In one of this experiments in which he used hydrophones Dr. Kellogg dropped a ball bearing into the end of a 70 ft. deep pool farthest from several dolphins. Emitting queer clicking noises, they took merely 20 seconds to locate it.

It is not difficult to understand why Pelorus Jack honoured only certain ships by his pilotage. Attracted by their engines, he would make a bee-line for steamers (from which whales generally flee) and ignored yachts (which whales usually attack). But not all steamers did he treat alike; big newcomers he looked at askance, but other ships he knew and streaked to like a vast globe of silver to meet and lead them.

Another facet of the dolphin's life is the special study of scientist John Lilly who works at the Communications Research Institute of St. Thomas in the Virgin Islands, W. Indies. His two-fold aim is to decipher the mammal's language and, if possible, to teach it ours, for the dolphin is a natural mimic; during the war they confused the operations of American submarines by imitating certain sounds—those of engines, ringing of bells, bird-like calls and the creaking of a rusty door-hinge among others. When Dr. Lilly wired up dolphins' tanks to record their private language, he could decipher words that were falsetto repetitions of his own voice. Rather amusingly, when he snapped back at one that made irritating noises at him, it mimicked his voice so well that his wife broke out laughing, whereupon it gave a perfect imitation of her laugh into the bargain.

If the weight and contents of a dolphin's brain are anything to go by, then he may be more intelligent than human beings. Dr. Lilly has discovered that on an average its brain weighs 3.7 lbs compared with 3.1 for a 11 stone man, that the number of cells in every c.c. is the same as in man's and that it is highly developed. Some leading U.S. biologists believe that he has a higher potential I.Q. than man but is so perfectly adapted to his environment that it was never necessary for him to develop it. The mind staggers, indeed, at the consequences if this ever did happen, since for one thing he might be the first species whom we could talk to and understand.

An American author, Mr. J. D. Scott, who has studied the ways of dolphins for over 20 years, writes that they have the keenest auditory senses of any animal and their eyes are capable of 'ranging' just like a human being's. During the 30 years' life-span it dozes only occasionally, partially submerged, with its eyes closed for as little as 30 seconds or for a maximum of 5 minutes. However, it can stay underwater for 6 minutes and on surfacing breathes through its single blow-hole which closes on contact with water and which it can vibrate like a human lip. It is the blow-hole and the sacs leading to it that produce the 'voice'.

Not the least remarkable trait of the dolphin's character is the skill with which he herds fish for food, for which reason he was dubbed the "sea-going cowboy". What a Florida fisherman once saw admirably confirms this sobriquet. After 10 dolphins had surrounded a school of mullet, they herded it to a shallow part of the sea. Here each one in turn darted in to partake a meal of mullet and return to fill his gap in the line, an example of perfect co-ordination equal to any army unit!

The ocean does not hold any creature as playful as the dolphin, reaching its apex in the case of Opo. In marine exhibitions they are seen performing tricks from playing basketball and blowing horns to leaping through paper targets and snatching objects from their trainer's mouth. It is this endless sense of fun which biologists say is responsible when he happens to do something really outstanding, such as the wartime incident related by Dr. George Llano in his book, *Airmen against the Sea*, when four airman in a rubber raft were pushed towards the nearest island by a dolphin, but as the island was in Japanese hands they drove their would-be rescuer away. A Florida woman, nevertheless, gives the credit to a dolphin for pushing her ashore when she was in danger of drowning, a view shared by an eyewitness of the near tragedy. Whether he is conscious or not of his good deeds, the dolphin is doubtless a pelagic playboy and should entertain millions yet unborn by his clever antics.

SEASHORE HARVEST

continued from page 281

enormous part in producing all manner of vital chemicals, in the making of plastics, and "corrective reducing agents", in less flowery language, "slimmers". Studies at the Scottish Seaweed Research Institute have shown that extracts from seaweed are beneficial in treating peptic and gastric ulcers. This is only one possibility arising from investigations—which are still in their infancy—into obtaining new drugs from seaweeds.

As aids to surgery they are in increasing demand for dusting powders, penicillin salts, surgical gauzes, a wax essential to successful operations on the skull, a material used in the filling of badly torn tooth sockets, and first aid dressings. Seaweeds now provide such diverse commodities as tooth brushes, chicken foods, and fire-proof curtains. In some countries they are recognized as essential fattening agents for essential food fishes.

One of the most remarkable of all seaweeds, carrageen, has been mentioned. It is commonly known as Irish moss and at one time was widely used for food in Ireland and Scotland, and still is to some degree. It is a short, tough weed, somewhat resembling parsley, and grows as a thick carpet on flat rocks near the lower tidal limits. The colour varies according to the district, and it is sometimes red, purple, chocolate brown, or yellow.

The weed is gathered from the shore or from a boat when on a large scale, using a long-handled rake with thin, slightly curved teeth. Afterwards the moss is washed in sea water and spread on the shore to bleach in the sun. This washing process is repeated several times at intervals of a day or so. When the washing is completed the weed is boiled in milk to make a pleasant and satisfying blancmange. There is a demand for this species from the commercial manufacturers of table jellies and other gelatinous products.

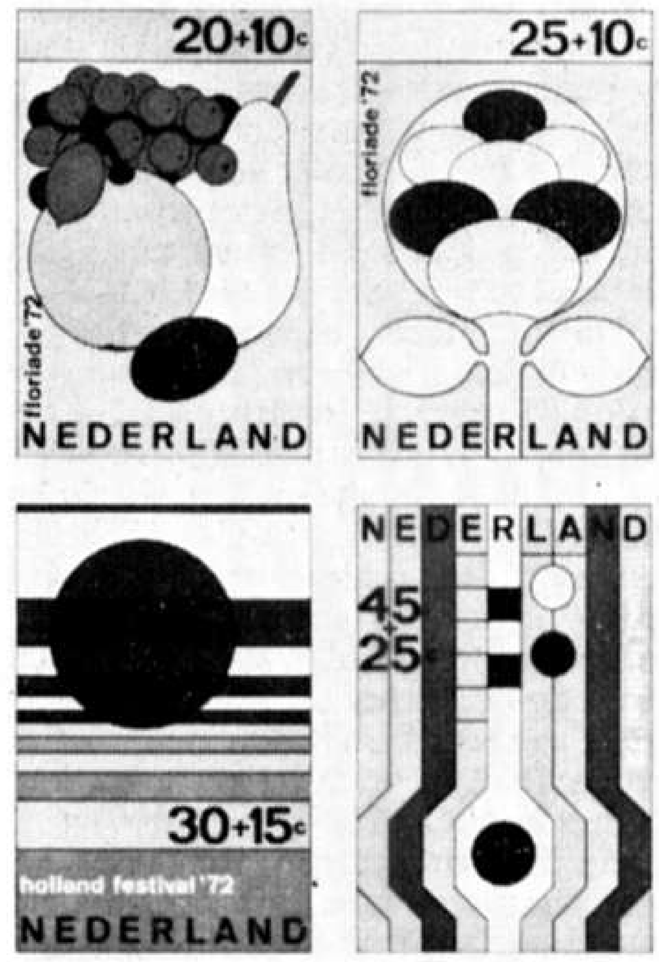
The uses of carrageen are astonishing. In the food processing industry it is used by the makers of milk chocolate, minute breakfasts, sherbet, ice-cream, pie fillings, confectionery, beer, desserts, salad dressings, fruit syrups, flavourings, icings, jellied poultry and fish soups. In other industries it is utilized in insect sprays, water-base paints, inks, cloth-sizing, paper sizing, thread-sizing, shoe stain, shampoos, ointments, emulsions, tablets, finishing leather, graining leather, cosmetics and dental impressions, and some printing processes.

In Japan, Korea, China, Hawaii and in the Old World in the western parts of the British Islands, seaweeds have long been used for food. And if an experimental seaweed banquet prepared in a Wisconsin, U.S.A., town is anything to go by, its inherent properties are greater than most of us realize. At that meal nothing but dehydrated seaweed was served—seaweed fried, seaweed purée, seaweed roast, seaweed devilled, and in many other guises.

Scientists have suggested that seaweeds could play a big part in future space menus. It has been established that they can be successfully grown in rockets!

Stamps
By
JAMES A.
MACKAY

Festivals on Stamps



STAMPS with a festive theme seem to be getting more and more popular. Christmas stamps immediately spring to mind, since they have been around for quite a long time. Austria and Cuba were among the earliest countries to release special Christmas stamps, but Australia, New Zealand, Great Britain, Canada and many other Commonwealth countries have been issuing them regularly since the early 1960s.

With the great popularity of Christmas stamps it was inevitable that some countries should begin issuing Easter stamps, especially since the custom of sending greetings cards at this time of year is gaining ground. Guyana and St. Lucia started the ball (or Easter egg?) rolling in 1968, but the following year there were 22 stamps from six different countries. Since then the Easter theme has remained fairly constant and, as yet, there are not too many previous issues for the new collector to catch up on.

Among this year's special Easter stamps was an attractive set of four from the West Indian island of Montserrat. Two stamps reproduced Bellini's "Agony in the Garden" while the other two depicted motifs from Coventry Cathedral, and these will be of particular interest to collectors in the Midlands. The Turks and Caicos Islands chose works by Rembrandt for their three stamps. St. Christopher-Nevis chose the Crucifixion painting by Massys, now in the National Gallery in London, for its set of four stamps.

The best of this year's Easter stamps, however, came from the Cook Islands. The three stamps, in denominations of 5, 10 and 30c, were printed together in a miniature sheet so that they reproduced a page from the psalter of Robert de Lisle, now in the British Museum. The illuminated manuscript features the crucifixion of Christ. This is the second occasion on which the Cook Islands have made use of this manuscript. The Christmas stamps of 1970 reproduced details of the birth of Christ from another page of the de Lisle Psalter.

Strangely enough Easter stamps have not caught on to any extent outside the Commonwealth. The only other country which issues them is Surinam (Dutch Guiana) which released a set of five stamps on March 29, featuring the Paschal Lamb, the Crown of Thorns and other subjects symbolic of the Passion of Jesus Christ.

Ever since independence was attained in 1948 Israel has produced stamps every August or September in honour of the Jewish New Year. As a rule these stamps have had a religious flavour, featuring ceremonial objects, excerpts from the Torah (Mosaic Law), biblical hemes and views of Old Jerusalem. This year, however, a set of three stamps was also released, in March, to celebrate the Feast of the Passover, which coincides roughly with the Christian Easter Festival. It was on the eve of His arrest and subsequent trial, that Christ and His Disciples celebrated the Feast of the Passover which Jews have held for thousands of years as a thanksgiving for the safe deliverance of the Children of Israel after their sojourn in Egypt. In Hebrew the feast is known as Pesah and it is from this that the French word Pasche and the Spanish word Pascua meaning Easter, are derived.

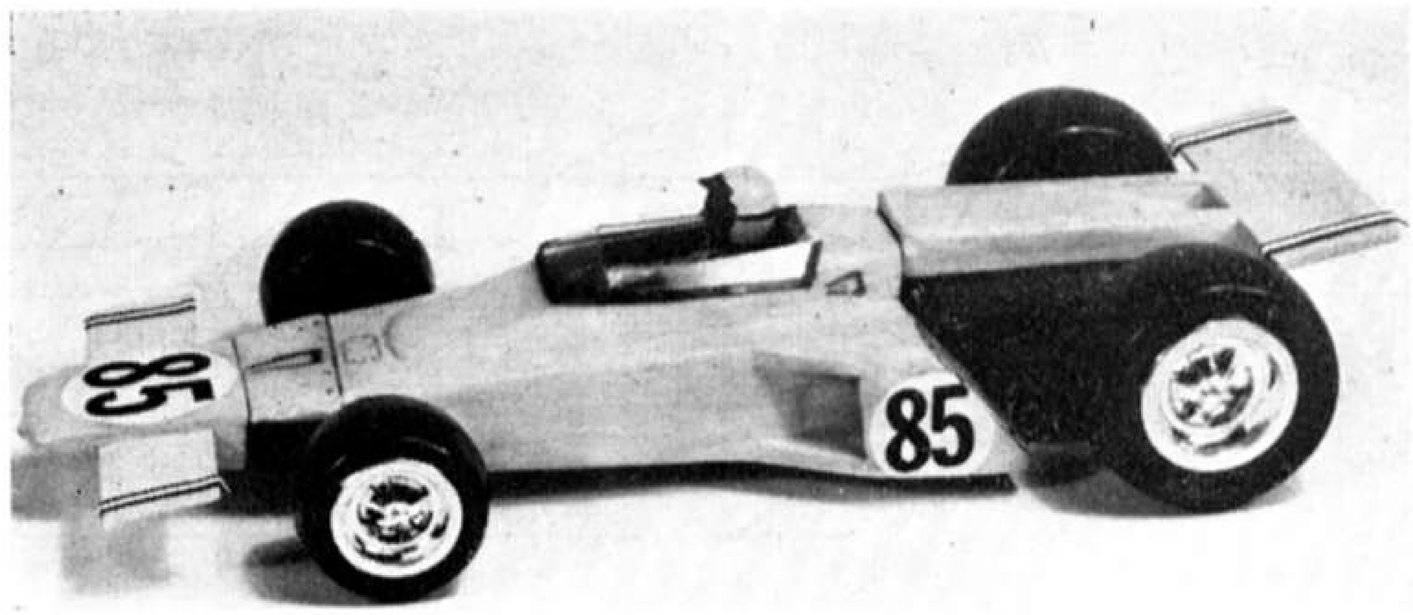
The three stamps were designed by D. Ben Dov and printed by photolithography by Lewin-Epstein. The stamps were released in sheets of fifteen, the bottom row of five stamps having decorative tabs attached, with suitable quotations from the Old Testament in Hebrew and English. The subjects of the stamps are in the style of medieval woodcuts. The 18a stamp shows the Jews preparing to depart from Egypt, where they had been enslaved by the Pharaoh. The tab quotes Exodus 34, 18: 'For in the month Abib you came out from Egypt'. The 45a stamp shows the baking of the unleavened bread, with a suitable quotation, from Exodus 12, 15: 'Seven days you shall eat unleavened bread'. The 95a denomination shows a family sitting down to the Passover Feast, with a quotation from Numbers 9, 12: '. . . according to all the statute for the Passover they shall keep it.'

In contrast with these religious festivals are the annual events honoured on a set of four stamps issued by the Netherlands on April 11. Two of them refer to the Floriade while the other two commemorate the Holland Festival. Both are internationally famous and are great tourist attractions. The Floriade is a gigantic flower festival, but also includes plants, shrubs and horticultural produce. Two stamps feature fruit and a stylised flower respectively. The Holland Festival is a cultural event embracing performances of music, drama and dancing, and is the highlight of the summer season.

Most people seldom give a postage stamp a second glance, and probably never pause to think how the designer evolved the particular treatment of the stamps. The Dutch series is the work of Dick Elffers, one of the leading graphic designers in Europe today. His counterpart in Britain, David Gentleman, has just produced an interesting book entitled *Design in Miniature* (Studio Vista, £2.25) in which he discusses the problems which face the designer and the various ways in which they can be overcome. Although primarily of interest to philatelists, this book covers all kinds of miniature design work, from cigarette cards and matchbox labels to trade cards, coins and banknotes. David Gentleman has now added to his talents as a stamp designer and book illustrator that of an author.

A "scratch-built" Indianapolis racer which will give you hours of fun

By Stephen Archibald



McLAREN M16 RUBBER POWERED CAR

THE McLaren M16 is typical of today's design in racing cars. Of course when building it as a working model it has to be greatly simplified, as all the framework, suspension and engine detail would be rather impractical and would be too complicated to explain in an article of this size.

Bodywork construction

The first stage of construction is the main bodywork and radiator assembly, using $\frac{1}{16}$ in. balsa for the top and bottom, and for the radiator sides, and $\frac{1}{8}$ in. for the sides, remembering to cut out the space for the front axle assembly. Next, the nose is built up using three layers of $\frac{1}{8}$ in. balsa in the bread and butter method. This can then be sanded to shape and the front aerofoils made from card, stuck on using epoxy resin. A block of balsa cemented to the back should be carved down to fit in the hole at the front of the previous assembly. The hook was made from a paper clip positioned through the middle of the nose and bent round under at the other end. This stops it slipping out when the rubber band is wound up. The cowling is constructed in the same way, using another three layers of $\frac{1}{8}$ in. balsa. The windscreen is cut from clear acetate. The engine cover is, again, quite straightforward and shouldn't present any problems.

Painting

The bodywork can now be sanded, doped and painted. The choice of colour is of course up to the individual; ours was painted fluorescent orange. The actual M16's that raced at the 1971 Indianapolis 500 miles race were number 66 dark blue, number 85 and 86 orange.

Wheels

What to use as wheels and still keep the cost down presented us with a problem until strolling through Woolworths I discovered some little toy cars that had exactly the right size wheels. The price was a mere 12p. If these particular cars cannot be obtained in your area there are others that have roughly the right sized wheels.

Front axle

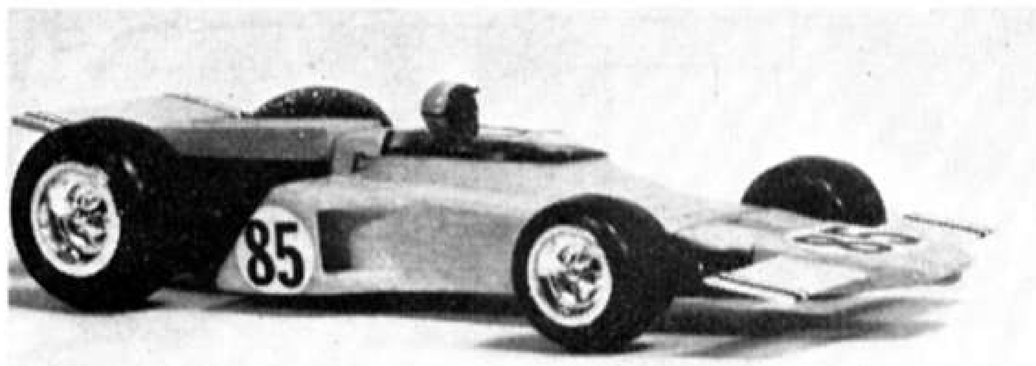
The front axle mounting is from a $\frac{3}{8}$ in. wide strip of tinplate, bent round as shown with holes, the correct size for the axles, drilled in the uprights. This assembly is then glued with epoxy resin into position.

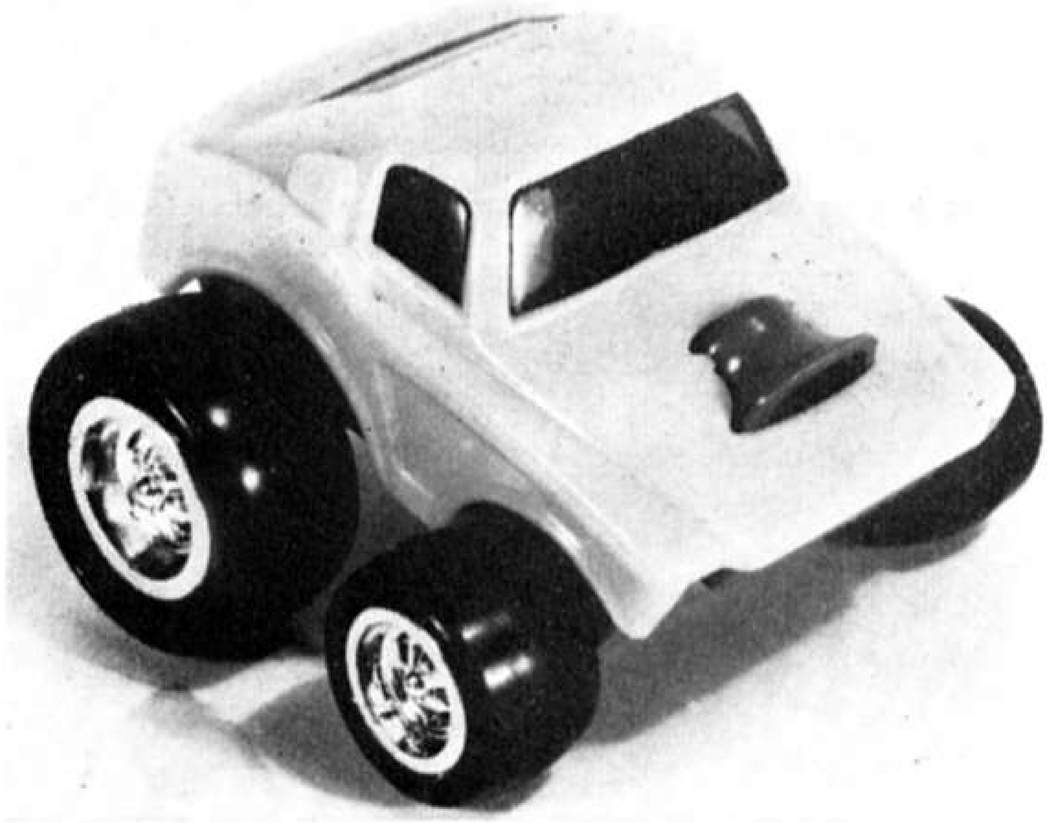
Rear axle

The gearbox is again from tinplate bent along the dotted line to fit in the gearbox housing, which is simply a floor of $\frac{1}{16}$ in. balsa and $\frac{1}{8}$ in. for each side. The contrate gears are from an old slot racing car, but these can be obtained from model shops. The hook is again a straightened out paper clip bent to shape.

Finishing

The radiators can either be cut straight out of the magazine or drawn on to stiff paper or card and stuck either side on each of the side air scoops. If you do use the suggested wheels you will find that a short length cut from an old rubber glove finger and stretched over each rear wheel will stop the wheels from slipping. The size of rubber band used for the main power should be about $\frac{3}{16}$ in. wide and roughly 4 in., or over, in length.

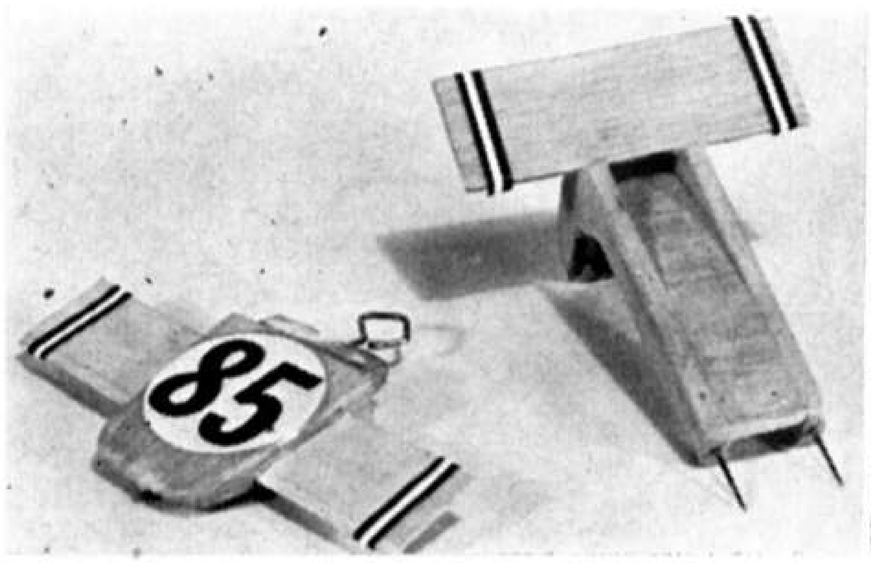




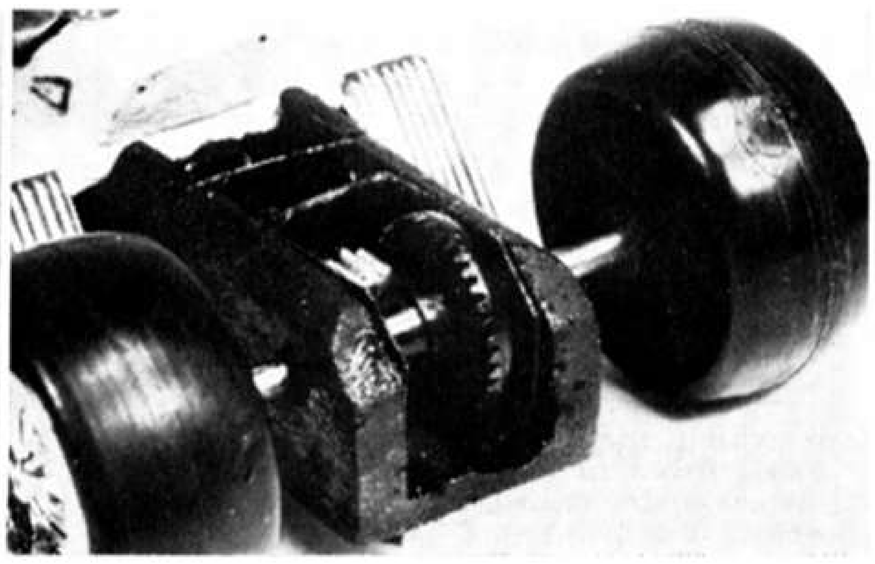
Right, the toy car from which the wheels were taken. Above right, the same wheels fitted to the McLaren. The driver figure is from a 1/24 scale slot racing car, and these should be available from your local model shop.

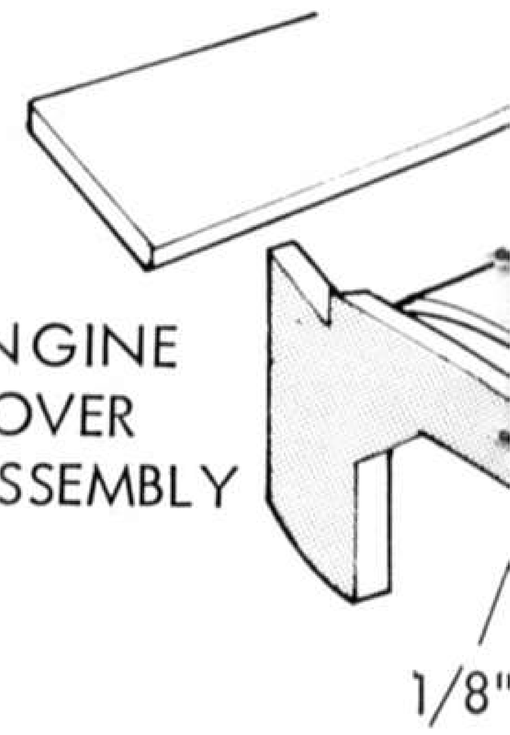
McLAREN M16 "INDIANAPOLIS"

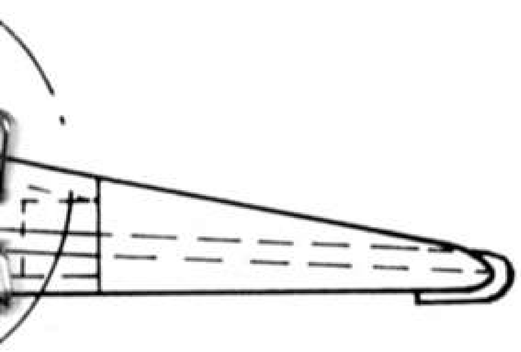
The nose is left unstuck so the rubber band can be changed if a breakage should occur. The engine cover can be secured by two pins fixed to it.

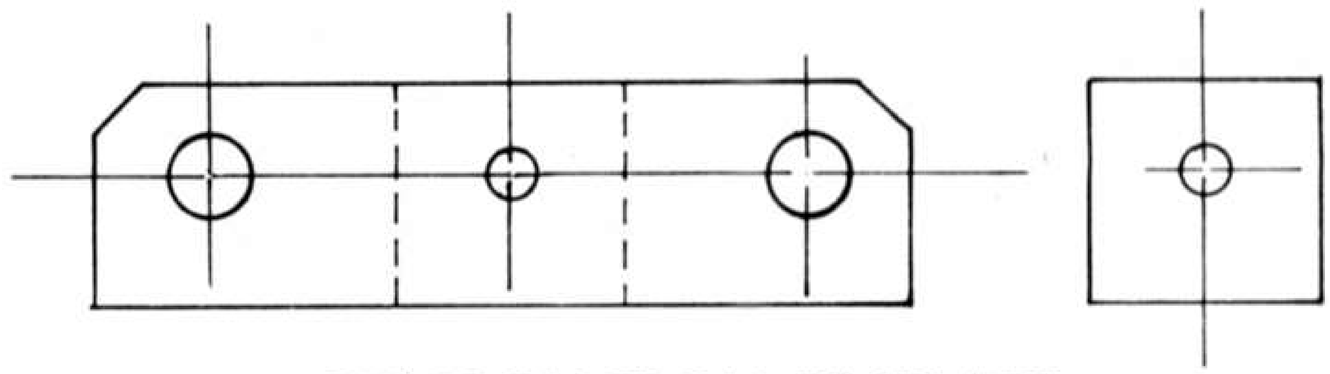


The smaller the gear used on the axle, the faster and longer it will run.



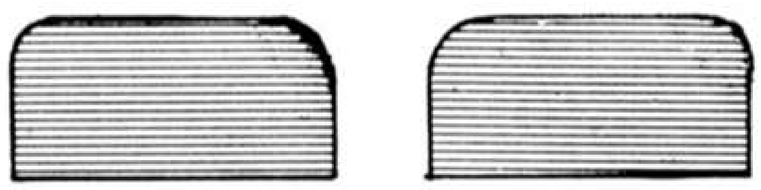




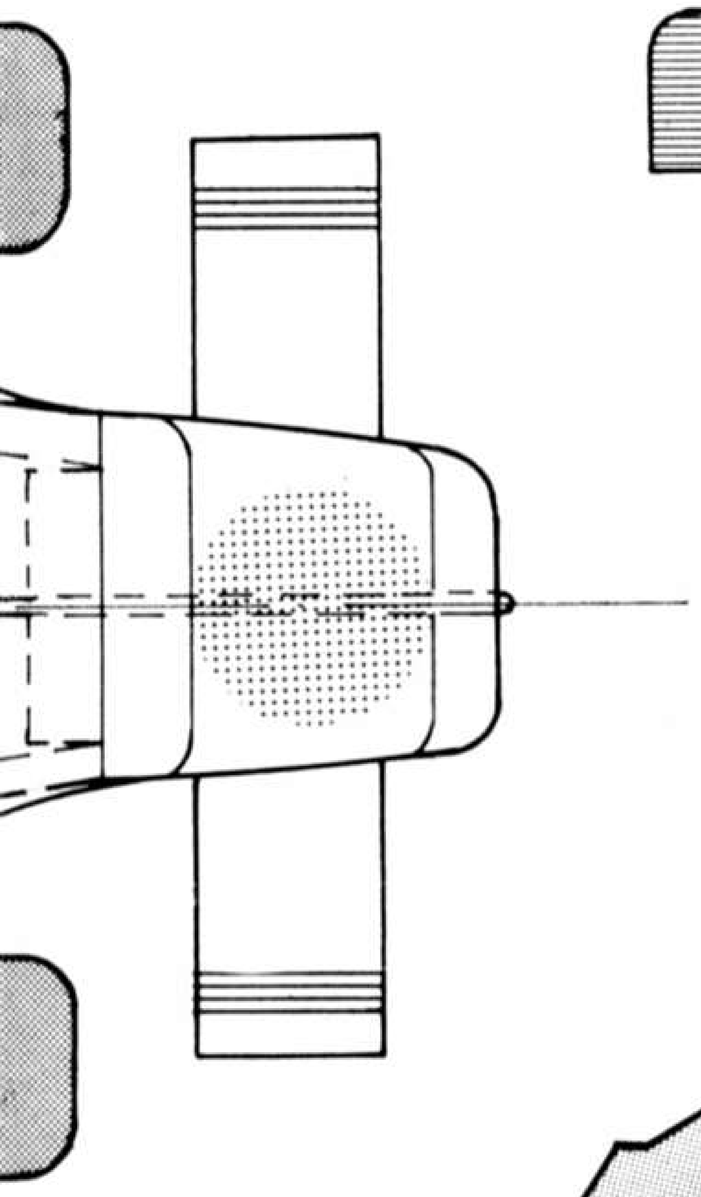


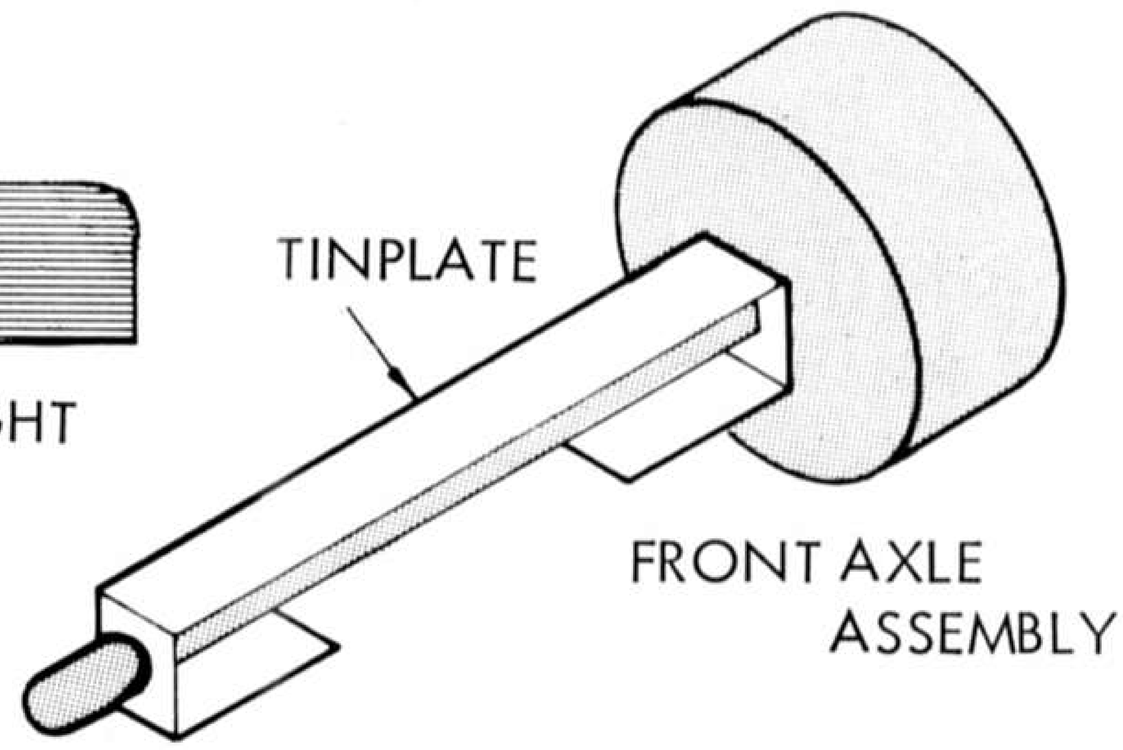
GEARBOX FROM TINPLATE

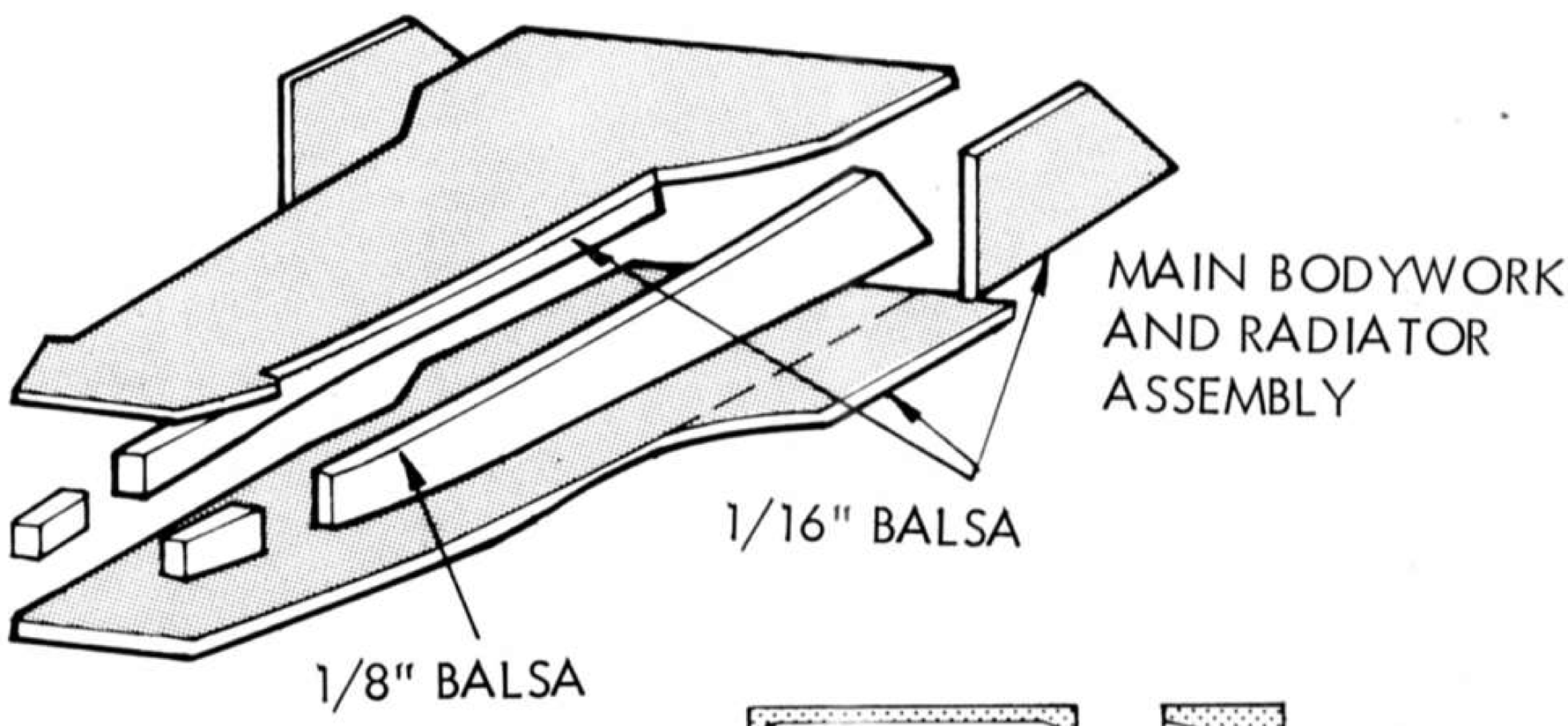
RADIATORS

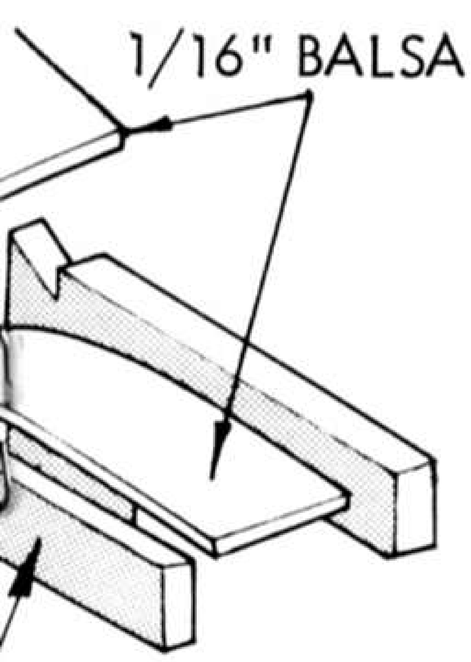


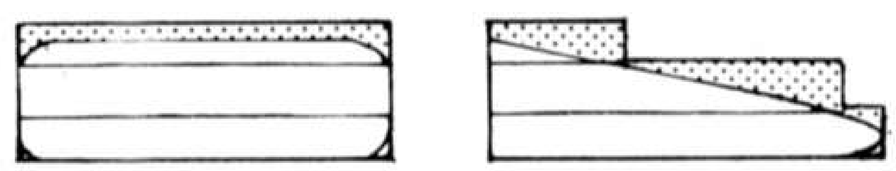
LEFT RIGHT



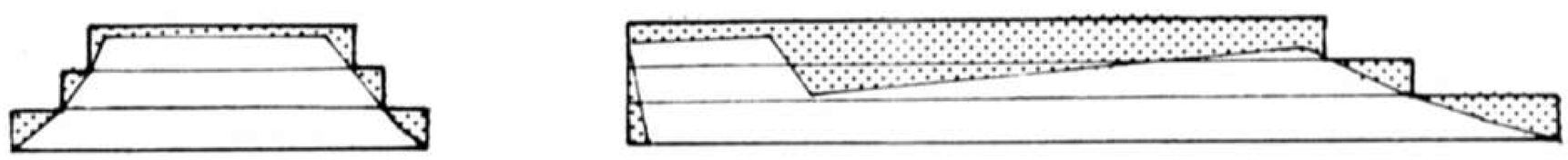




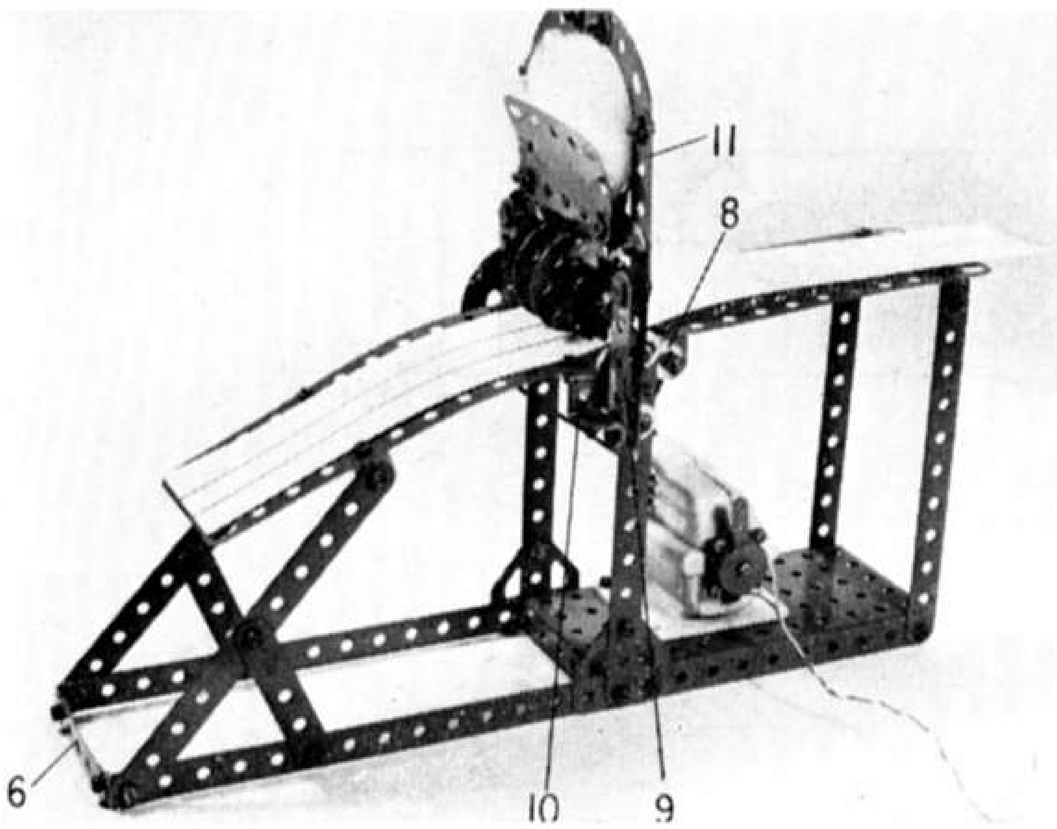


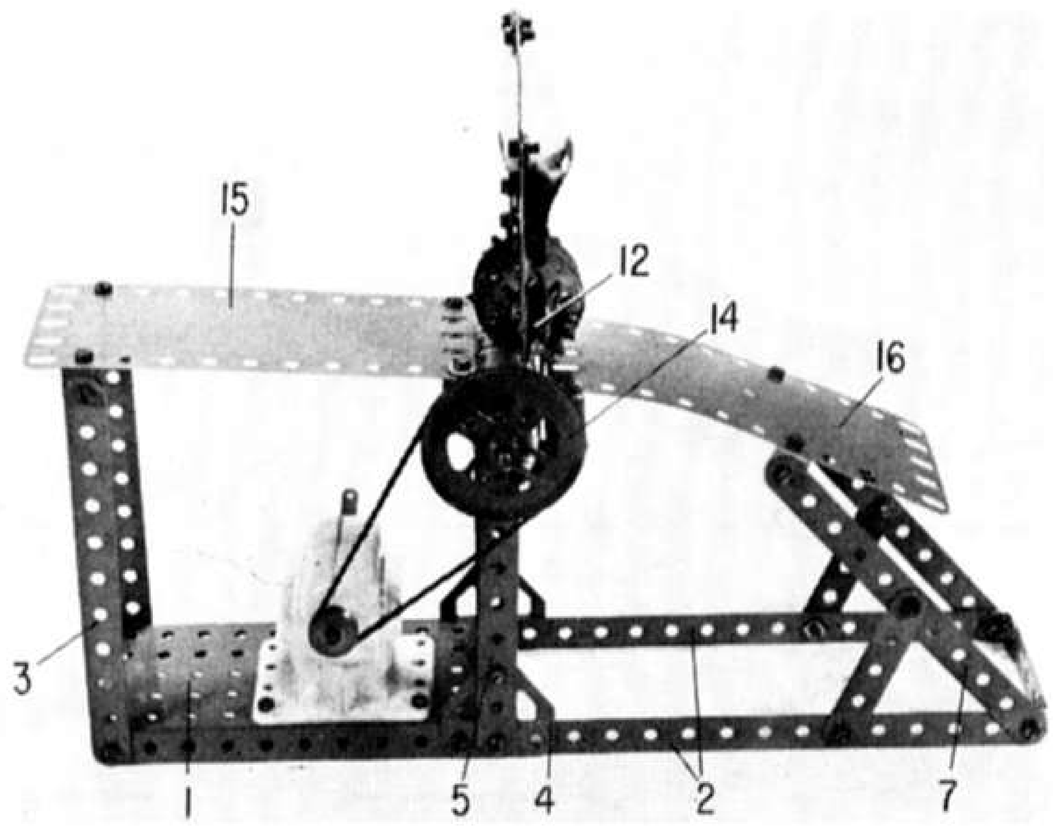


CONSTRUCTION OF NOSE



CONSTRUCTION OF COWLING



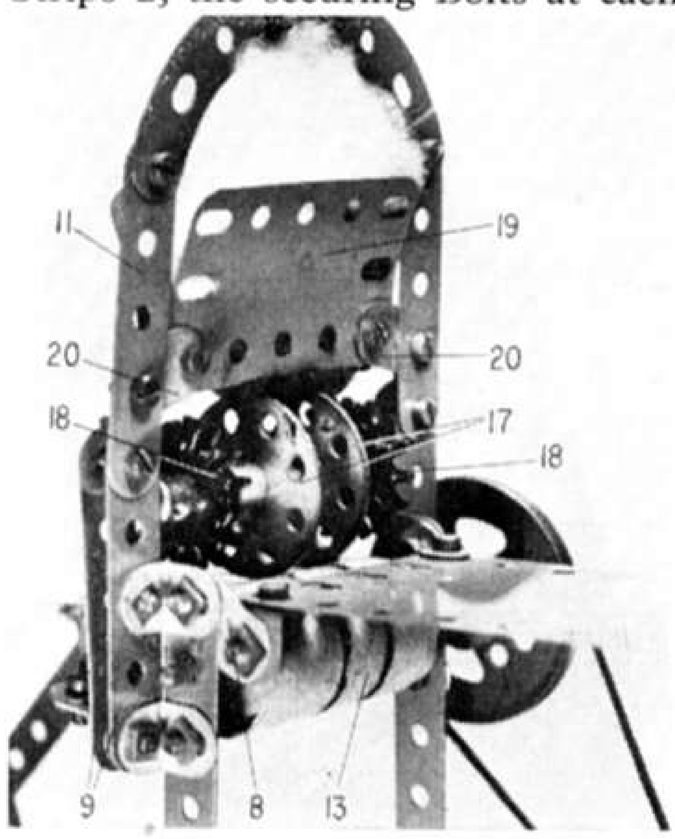


BUILD A SIMPLE RULING MACHINE

A novel model from a No. 4M set, says 'Spanner'

I'VE said it many times before and, no doubt, I'll say it many times again in the future, but "working" Meccano models are generally more interesting than "static" constructions. Of course, I give this primarily as my own opinion, but I think most Meccano modellers would agree with my sentiments, even though we are all pleased to see, admire and build any well-produced model, no matter how static it might be. With this conviction in mind, therefore, I have no qualms about presenting the hardly attractive, but nonetheless novel Line-Ruling Machine illustrated here. Simple to build, it does work and can be produced from a No. 4M Meccano Set.

A framework is built up from a 5½ × 2½ in. Flanged Plate 1, the side flanges of which are extended fourteen holes by two 12½ in. Strips 2, the securing Bolts at each side also holding in place a 5½ in. Strip 3 and a Flat Trunnion 4, the latter overlaid by a 5½ in. Strip 5. The ends of Strips 2 are connected by a 2½ in. Strip 6, attached by Angle Brackets, the side securing Bolts in this case also holding in place two diagonally-positioned 5½ in. Strips 7, each braced by a 2½ in. Strip bolted between the centre hole of Strip 7 and the sixth hole of Strip 2. The upper ends of Strips 3 are connected by a 2½ × ½ in. Double Angle Strip.



Turning our attention to Strips 5 in the centre of the framework, a Fishplate 8 and an Angle Bracket are secured to each of these through its top hole, a second Angle Bracket also being attached through the third hole of each Strip. Secured by a ⅜ in. Bolt to the latter Angle Bracket are two 2½ in. Strips 9 and another Angle Bracket, to which is bolted a ½ in. Reversed Angle Bracket 10. Strips 9 are spaced from each other by three Washers on the shank of the Bolt. The nearest Strip, only is bolted to the upper Angle Bracket.

This same "nearest" Strip is next extended upwards by another 2½ in. Strip 11, using a ⅜ in. Bolt for fixing purposes. Note, however, that the Bolt not only passes through these Strips, but also through the upper hole of second Strip 9. A Spring Clip 12, bend inwards, is clipped onto the shank of the Bolt, between the Strips, and the fixing Nut is added outside the second Strip. The Spring Clip obviously serves as a spacer between Strips 9, ensuring that sufficient room exists between the Strips to receive the lining mechanism Rod which will later be carried between them on the "floating "principle. The upper ends of Strips 11 at each side are connected by two 2½ in. Stepped Curved Strips.

Journalled in the second holes of Strips 5 is a built-up powered roller 13, produced from, in order, two 1 in. Pulleys with boss, three Washers, a ½ in. Pulley without boss, a 1 in. Pulley without boss and another 1 in. Pulley with boss, all fixed on a 4 in. Rod. The bosses of the first two Pulleys point outwards, while that of the last points inwards, the result being that all point the same way. A length of 2 in. wide gummed brown paper is then tightly wrapped round and, at the same time, stuck to the Pulleys to provide the roller face. It will be found that this built-up roller is perfectly adequate for requirements, provided that enough gummed paper is used to result in a thick and firm surface. The 4 in. Rod is held in place by a Spring Clip, on the Rod between the roller and one Strip 5, while a 2 in. Pulley 14 is fixed on the end of the Rod, with two ¾ in. Washers spacing the Pulley from nearby Strips 9. This Pulley is connected by a 10 in. light Driving Band to a ½ in. Pulley fixed on the output shaft of a 4½ volt Reversible Motor bolted to Plate 1 in the position shown.

Fishplates 8, which are angled downwards somewhat, are now connected by a 2½ × ½ in. Double Angle Strip. Bolted to this Double Angle Strip and to the Double Angle Strip joining Strips 3 is a 5½ × 2½ in. Flexible Plate 15, serving as the paper lead-in guide, while another similar Plate 16 is bolted to Reversed Angle Brackets 10. This Plate is curved down and attached to Strips 7 by Angle

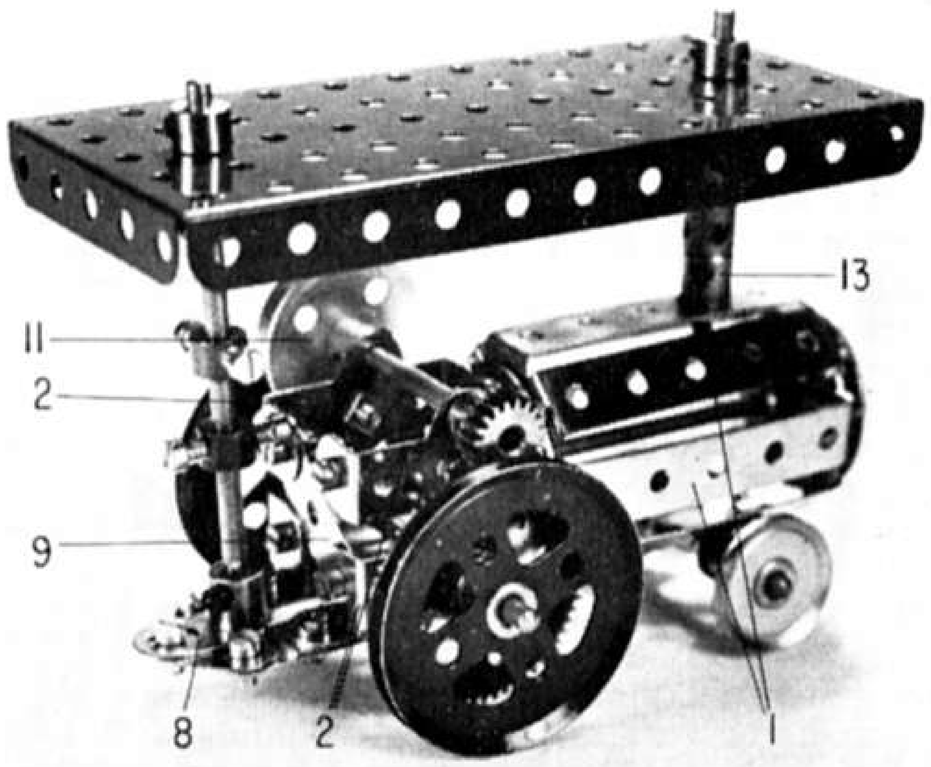
Brackets to provide the exit guide.

The lining mechanism is next built up quite simply from a 3½ in. Rod, on which two 8-hole Bush Wheels 17 are fixed. The rims of these Wheels act as the line rollers, and so their positions on the Rod depend on the required positions of the lines to be drawn, although it is advisable for them to coincide with two of the 1 in. Pulleys included in roller 13. The Rod is then located in the gaps between Strips 9 at each side, where it is held in place by two Multi-purpose Gears 18. These Gears in effect serve as Collars to prevent lateral movement of the Rod, but the required vertical movement—to allow for the paper—is still permitted in the slots.

Finally we have the ink pad for the rollers and this consists of nothing more complicated than ordinary cotton wool held between two 2½ × 1½ in. Flexible Plates 19, spaced from each other by Spring Clips on ¾ in. Bolts. These Bolts also fix the Plates to two Fishplates 20 which are in turn bolted to Strips 11, as shown. The cotton wool must project below the holder sufficiently far, not only to make contact with the rollers (Bush Wheels 17), but also to exert a gentle down-pressure on them in order to keep them in firm contact with the paper being ruled. To obtain the best results, the ink pad should be impregnated with a dense ink, rather than ordinary fountain pen ink, but whatever is used, the new model will still give plenty of fun and that's the important thing!

PARTS REQUIRED

2—1	4—22	2—38d	2—188
6—2	1—22a	2—48a	2—192
9—5	1—23	1—52	Piece of Cotton Wool
4—10	9—27f	2—90a	Length of 2 in. Brown
10—12	5—35	6—111c	Gummed Paper.
1—15b	52—37a	2—125	1—4½ volt
1—16	46—37b	2—126a	Reversible Motor.
1—20a	10—38	1—186a	



SMALL & SIMPLE

'Spanner' describes three easy-to-build models from readers

IT IS true to say, I think, that "simplicity" models hold a fascination for most Meccano enthusiasts. I am certainly enchanted by them and I know I am not alone in this. I do not think, however, that our fascination is purely the result of personal sentimental feelings. There is something more to it than that. To my mind, if a simple little model, although it uses only comparatively few components, captures the atmosphere or movement of its subject, then that model confirms the skill of its builder. As we all know, more skill is often required to build a decent model with a few parts than with an unlimited supply of parts.

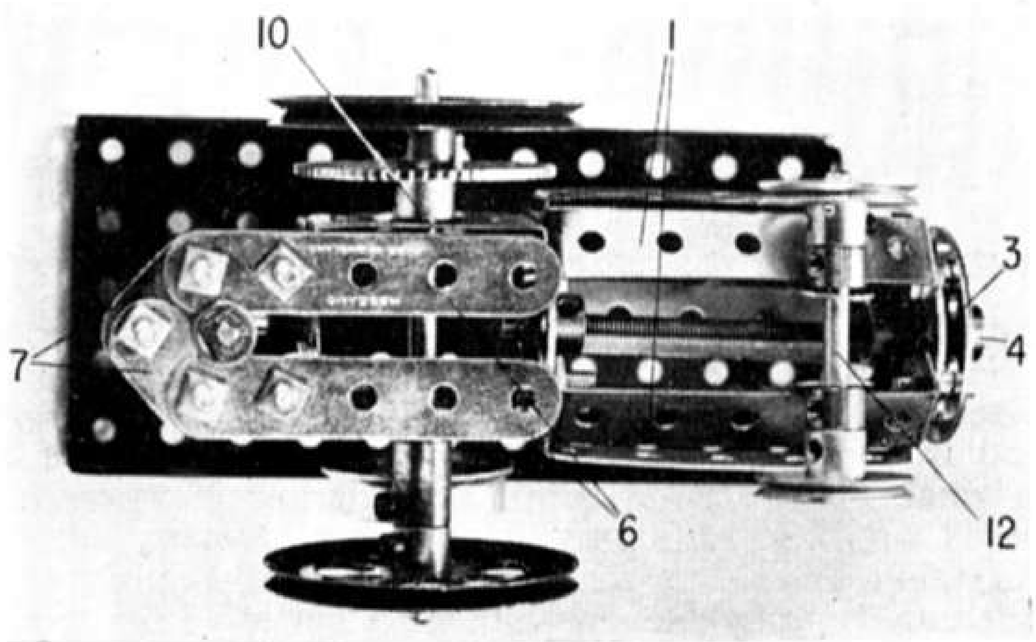
Having made my point (I hope!) I would now like to deal with the matter in hand. Featured here are three "simplicity" models, small in stature, but captivating when built. Two are the productions of adult modellers whose work has been featured in these pages in the past; the third, a Traction Engine, comes from 10-year-old Paul Bourbousson, one of the hard-working members of Hertfordshire's Stevenage Meccano Club.

Traction Engine

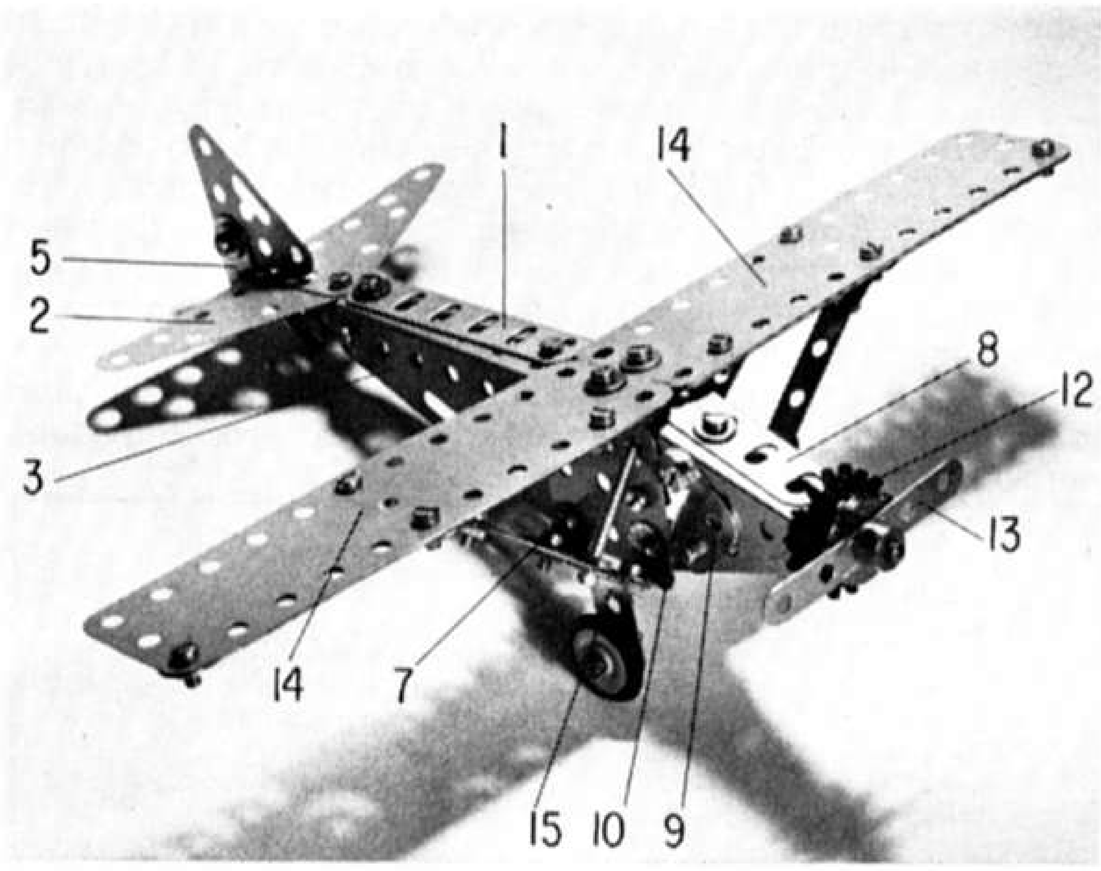
Dealing first with the Traction Engine, the model illustrated is actually a re-built version of Paul's original, incorporating a few unimportant alterations to take advantage of some more suitable parts which Paul did not possess. The boiler consists quite simply of two 8-hole Bush Wheels connected together by seven 2½ × ½ in. Double Angle Strips 1. Note that the Bolts fixing four of the Double Angle Strips to the rearmost Bush Wheel also fix four 1½ × ½ in. Double Angle Strips 2 to the other side of the Bush Wheel in the positions shown. Locked in the bosses of the Bush Wheels is a 3 in. Screwed Rod, on the projecting forward end of which a 6-hole Wheel Disc 3 is held by a Washer and a Collar 4. Two Bolts in the threaded bores of this Collar represent the smokebox door handle.

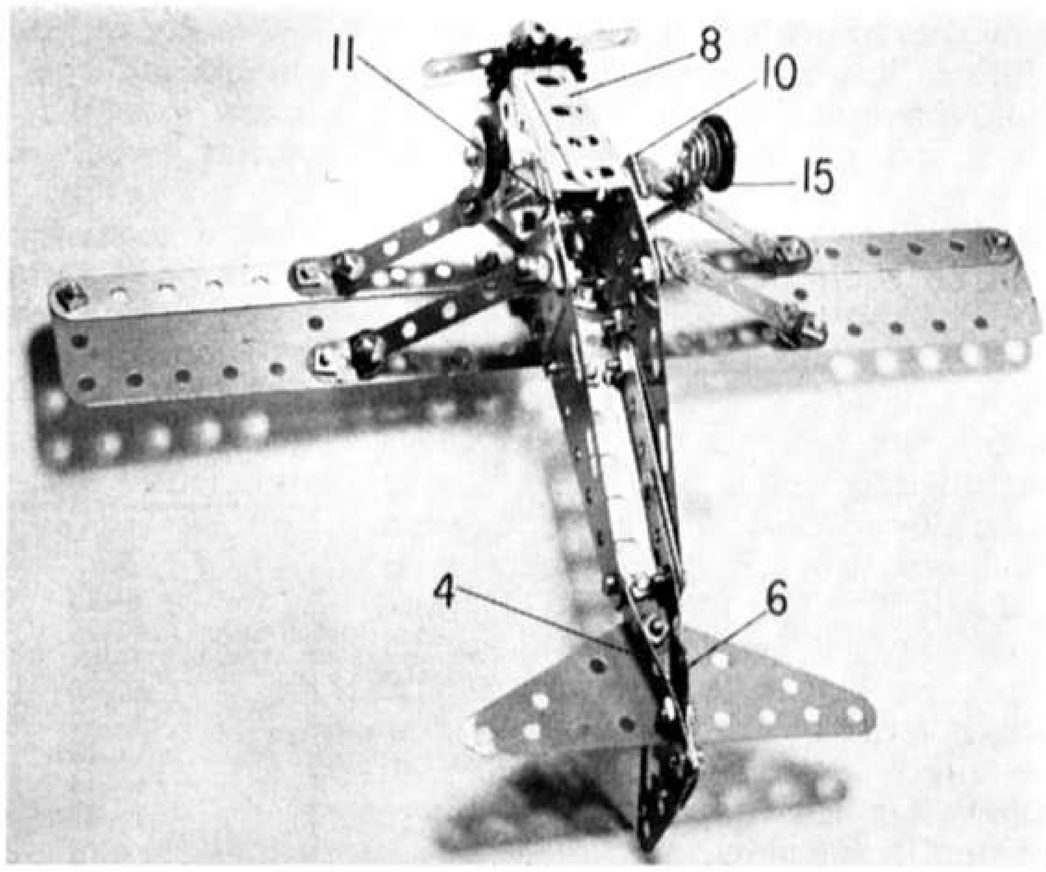
Now secured by Angle Brackets to the lower pair of Double Angle Strips 2 are two 2½ in. Strips 6, the rear ends of these Strips being connected by two Fishplates 7, angled as shown and tightly bolted together. The securing Bolt also fixes a forward-pointing third Fishplate 8 in place by its slotted hole, the circular hole in this Fishplate later serving as the lower securing point for the canopy. The rear lugs of Double Angle Strips 2 are connected by two diagonal 1½ in. Strips 9, as shown.

Journalled in the centre holes of lower Double Angle Strips 2 is a 3 in. Rod serving as the rear axle and held in place by a Collar and a 60-teeth Gear Wheel 10. Two spacing Collars are added to one end of the Rod (opposite side to the Gear) then 2 in. Pulleys are secured in place to act as road wheels. In mesh with Gear



Above, this little Traction Engine is the brain-child of 10-year-old Paul Bourbousson of Hertfordshire. An excellent model, considering Paul's age.
Right, an underside view showing the layout of the chassis.





Left, a good view of the "Spirit of St. Louis"—an extremely life-like model designed and built by Mr. Roger Le Rolland of Stoke-on-Trent, Staffs. Right, an underside view of the aircraft clearly showing the arrangement of the wings, tailplane and landing gear.

Wheel 10 is a ½ in. Pinion on a 2 in. Rod journalled in two Fishplates bolted through their slotted holes to the centre of upper Double Angle Strips 2. A 1⅛ in. Flanged Wheel 11, fixed on the opposite end of the Rod, represents the flywheel. Note that full use must be made of the slotted holes in the Fishplates to bring the Pinion into mesh with the Gear Wheel.

The front wheels are 1 in. Pulleys fixed on another 2 in. Rod 12 journalled in Obtuse Angle Brackets bolted to the two lowest Double Angle Strips 1. Spacing Collars are added to the Rod, to prevent excessive sideways movement.

In the case of the chimney, a Rod Socket 13, carrying a 2 in. Rod, is secured in the second hole of top Double Angle Strip 1. Mounted on the Rod are a Coupling, a Collar and three Washers, followed by the canopy—a 5½ × 2½ in. Flanged Plate—the last held in place by a second Collar above the canopy. The rear canopy support is a 3 in. Rod held in another Rod Socket fixed in Fishplate 8, the canopy resting on a ¾ in. Pinion fixed on the Rod. A Collar above the canopy holds it in place, two more Collars, each fitted with two Bolts, being fixed down the Rod to provide embellishment.

That completes the model, and, considering the age of the builder, an excellent piece of work it is, too. Well done Paul!

PARTS REQUIRED

2—5	3—17	1—25	4—48
2—6a	1—20	1—26	7—48a
5—10	2—20a	1—27d	1—52a
2—12	2—22	29—37a	9—59
2—12c	2—24a	33—37b	1—63
2—16	1—24b	4—38	1—80c
			2—179

Spirit of St. Louis

Paul Bourbousson's Traction Engine, of course, is a "freelance" model, i.e. it is made to Paul's own design and is not a direct reproduction of an actual real-life original. Our second simplicity offering, however, is based on a real-life original which did exist, and a very famous one at that—"Spirit of St. Louis", the celebrated aeroplane in which Charles Lindbergh made the first ever non-stop solo crossing of the Atlantic Ocean.

The most amazing thing about this model is that, although it genuinely is a small, uncomplicated construction, it really looks just like the real thing. In fact, it captures the atmosphere of the original so well that I think the word "masterpiece" is not an unreasonable description! If this, by implication, makes the builder a "master", then a master is Mr. Roger Le Rolland of Stoke-on-Trent, Staffs., to whom full credit for the model is due.

Construction is not difficult. The fuselage consists of a 3 in. "U" section girder 1, built up from two 3 in. Angle Girders bolted together through their slotted holes, with the rear securing Bolt holding a Fishplate in position. Secured to the free end of this Fishplate is the tailplane 2, supplied by two 2½ × 1½ in. Triangular Flexible Plates, arranged as shown. Bolted to each side flange of girder 1 is a 3½ × 1½ in. Triangular Flexible Plate 3, the rear securing Bolt in this case also holding a 3½ in. Narrow Strip 4 in place, the Strip projecting four holes rearward. Strips 4 at each side are bent inwards and bolted together through their two end holes, the end securing Bolt also holding two Fishplates 5 in position, pointing vertically upward, and the second Bolt also holding another Fishplate 6, this one pointing diagonally downwards to serve as the tail skid. Bolted between Fishplates 5 is a 1½ in. Corner Bracket representing the fin.

Triangular Plate 3 at each side is extended forward by a 1½ × 1½ in. Flat Plate 7, the lower fixing Bolt holding an Angle Bracket in place. This Bracket is bent to an acute angle to later provide the lower anchoring point for the rear wing-stay. Bolted to the forward corners of the Flat Plate are two 2 in. "U" Section girders 8, these being angled together to form the nose of the aircraft and connected by a 1 in. Corner Bracket 9 at each side. Note that the Bolt fixing the lower girder to the Plate also holds a Hinge 10 in position.

Now fixed inside the fuselage, on two ⅜ in. Bolts inserted in the front row centre holes of Plates 7 at each side, is a Coupling 11, the Bolts entering the longitudinal bore of the Coupling. Secured in the centre transverse bore of the Coupling is a 3 in. Rod which projects forward through the nose of the aircraft. A Multi-purpose Gear 12, boss inwards, is fixed towards the

front of the Rod, as shown, to represent the original's radial engine (an excellent idea!), then this is followed by five ¾ in. Washers, a 2½ in. Narrow Strip 13 and a Collar. The Strip obviously serves as the propeller.

Finally, we have the wings and undercarriage. Each wing consists of a 5½ × 1½ in. Flexible Plate 14, underlaid along its leading edge by a 5½ in. Strip and attached to the fuselage by an Angle Bracket bolted through the top centre hole of appropriate Flat Plate 7. Wing-stays provided by two 2½ in. Narrow Strips, are attached to the underside of each wing by Obtuse Angle Brackets the lower ends of the stays being bolted to Hinge 10 and the nearby bent Angle Bracket, already mentioned. Bolted by its short lug through the second hole of each forward stay is a 1 × ½ in. Angle Bracket 15 which is opened out to form an obtuse angle so that the long lug is vertical. Note that the Bracket is secured to the stay by a 1⅛ in. Bolt, the long shank of the Bolt thus representing an additional stay. Locked by Nuts in the lowest hole of Angle Bracket 15 is a ½ in. Bolt on which a ½ in. Pulley without boss is mounted to serve as the undercarriage. For added realism, here, Mr. Le Rolland fitted Dinky Toy tyres to the Pulleys, but these, of course, are not vital necessities.

PARTS REQUIRED

2—2	4—12c	5—38	1—133
2—9c	1—16b	5—38d	2—133a
4—9e	2—23	1—59	2—189
4—10	1—27f	1—63	2—221
4—12	37—37a	2—74	2—224
2—12b	35—37b	2—111d	5—235
		2—114	2—235b

Meccano Sailor

Credit for our final model goes to Mr. Andreas Konkoly of Budapest, Hungary who can always be relied upon to come up with something outstanding and "different". A brief outline of Mr. Konkoly's history is given in "Among the Model-builders" in this issue, but, here, we are interested in his model—and this is nothing if not outstandingly different. It's a fantastic working presentation which he has titled the "Meccano Sailor" because it gives the impression of a sailor nipping down the rigging of a ship with great agility; a marvellous little thing which, although it might not be a true simplicity reproduction of something in real life, will utterly delight all who see it!

It consists quite simply of a 12½ × 2½ in. Strip Plate 1 attached to two 12½ in. Angle Girders 2 by twenty-five ¾ in. Bolts arranged in alternate holes, as shown. The Girders are bolted to the lugs of a 2½ × ½ in. Double Angle Strip which is in turn fixed to a 5½ × 2½ in. Flanged Plate 3. The Girders are angled backwards slightly and are braced by two 5½ in. Strips 4 bolted between the eighth holes of the Girders and the end holes in the side flanges of the Plate.

The "sailor" himself is built up from two ½ in. Pulleys without boss 5 bolted, along with two 2 in. Slotted Strips 6 representing the arms, to one end of an electrical Insulating Spacer. Attached to the other end of the Spacer is a Single Bent Strip 7, representing the legs. If any of these parts are not available, a simplified sailor can be built up from a 3½ in. Narrow Strip, to the centre of which an Angle Bracket is attached by a Long Threaded Pin, the Bracket thus representing the head and the shank of the Pin, the legs.

In operation, the sailor is located by his "arms" obliquely on the two top-most Bolts. Immediately he is released, he will slide down the Bolts moving from side to side until he reaches the bottom. It's marvellous!

For added enjoyment, a good suggestion is to build two identical models and then to hold competition races between the two. You'll find it great fun.

PARTS REQUIRED

FRAME

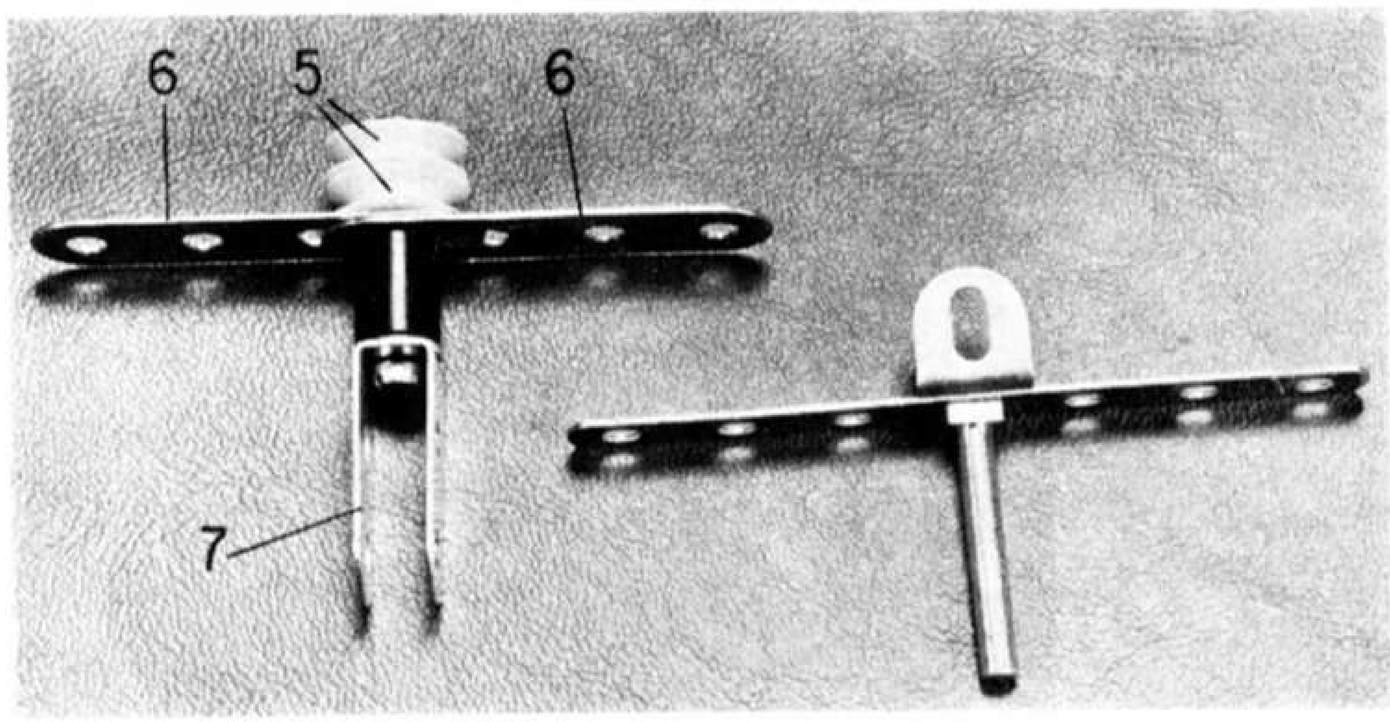
2—2	32—37a	1—48a	24—111
2—8	8—37b	1—52a	1—197

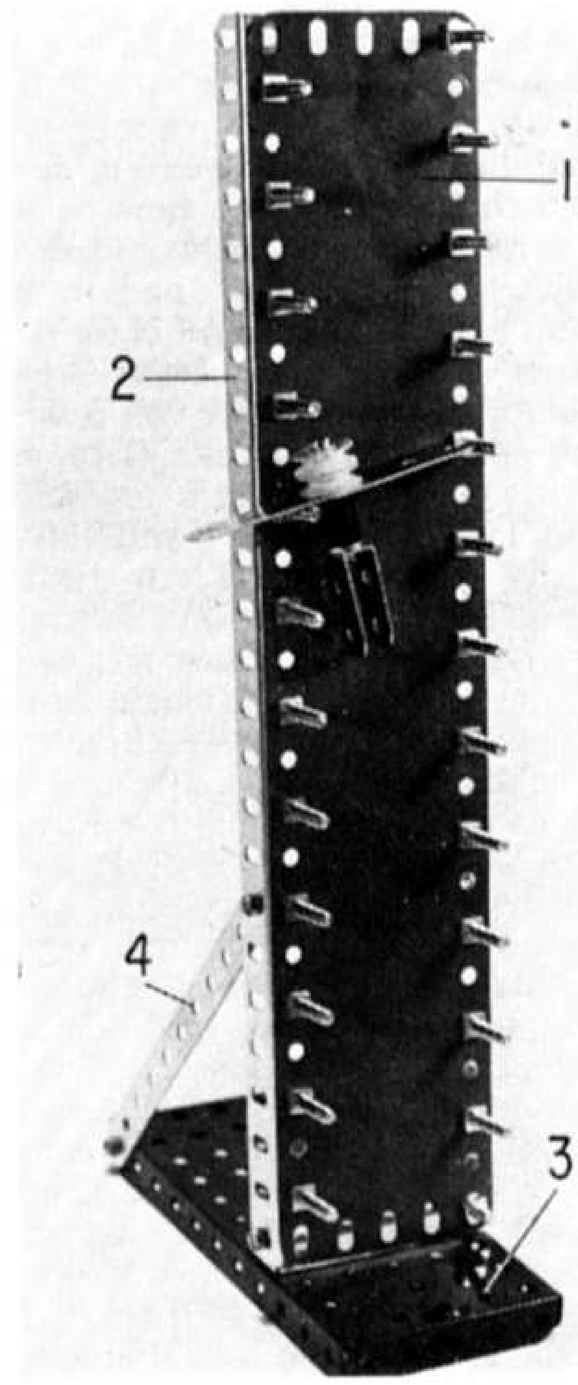
1st SAILOR

2—23	1—38	2—55a	1—111
			1—564

SIMPLE SAILOR

1—12	1—115a	1—235b





Right, seen here is the highly amusing "Meccano Sailor"—another brain-wave from Mr. Andreas Konkoly of Budapest, Hungary. Below, the two "sailors" described for use with Mr. Konkoly's model. Left is the recommended figure and on the right is a simple alternative.

The Flying Saucers of AWACS

No stories of the air war of 1939–45 are more exciting than those of No. 100 Group of the Royal Air Force. Formed on November 8, 1943, with twelve squadrons flying six different types of aircraft, its task was to confuse and destroy the German air and ground defences so that Bomber Command's massive night offensive could bring the enemy to his knees.

Each night, aircraft like the big four-engined Stirlings of No. 199 Squadron would fly to precise positions just clear of enemy territory and begin orbiting endlessly. On board each aircraft a battery of electronic jammers, code-named *Mandrel*, transmitted signals which so 'cluttered' the screens of German early-warning radars that the RAF bomber force could slip through undetected.

Mixed in with the main-force bombers were more aircraft of 100 Group, fitted with devices known as *Jostle* and *Piperack*. These, respectively, blotted out

AIR NEWS

By John W. R. Taylor

with a bagpipe-like warble the messages with which German ground controllers tried to guide *Luftwaffe* night fighters towards their prey, and cluttered up the radar screens in the cockpits of the enemy aircraft. Simultaneously, up to three separate formations of 100 Group aircraft, each ten or twenty strong, set out on feint attacks to draw the opposition away from the hundreds of bombers in the main attack force. They did this by dumping overboard huge clouds of metal foil, known as *window*, which produced so many 'blips' on German radar screens that the enemy could not distinguish the main threat from the feints.

Hundreds of bombers, and thousands of RAF aircrew, were saved by these highly-secret operations in the "radio war" that was waged in 1943–45. It was dangerous work, especially for the "ferrets" of No. 192 Squadron which had to venture out night after night through hostile skies, listening for signals that might indicate the use of some new or more efficient enemy radio or radar system that would be immune to jamming. Sometimes the "ferrets" had to allow German night fighters to detect them and close in for a "kill", hoping to gather all the information they needed and break away before a burst of fire could destroy them.

Such operations still take place, and you may remember a story in *Air News* a few months ago about the Russian Tu-16 ("Badger") and Tu-95 ("Bear") bombers which fly frequently off our East coast, probing the secrets of Britain's radio and radar.

Many of these activities are covered by the initials ECM, standing for electronic countermeasures. The purpose of ECM aircraft is still to confuse the enemy by jamming his defence systems and to destroy his ability to make war by protecting friendly attack forces.

An offshoot of ECM is a class of aircraft which the Americans identify by the initials AWACS, meaning airborne warning and control system. The Russians already have such an aircraft in service, based on the Tu-114 four-turboprop airliner and known by the NATO code-name "Moss". The photograph on this page shows the prototype of America's counterpart to "Moss". Also evolved from a commercial airliner, the Boeing 707-320B, it has the official USAF designation EC–137D and flew for the first time on February 9 this year.

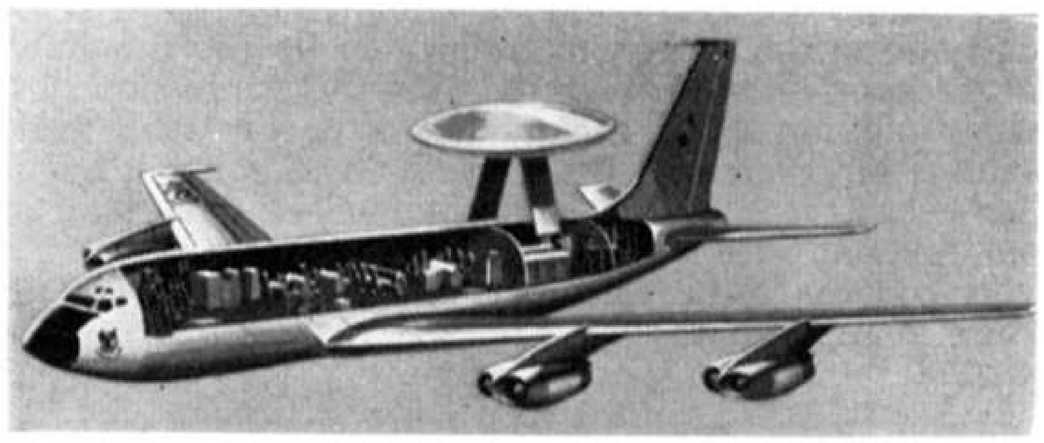
Like "Moss" the EC-137D is distinguished by a huge "saucer" radome carried above its fuselage. When

operated at a height of anything from 20,000 to 40,000 ft., the rotating radar scanner inside this saucer can detect incoming enemy aircraft, far beyond the range of ground radars, even if they are flying only a few feet above the ground. This takes care of the AW (airborne warning) part of the AWACS task.

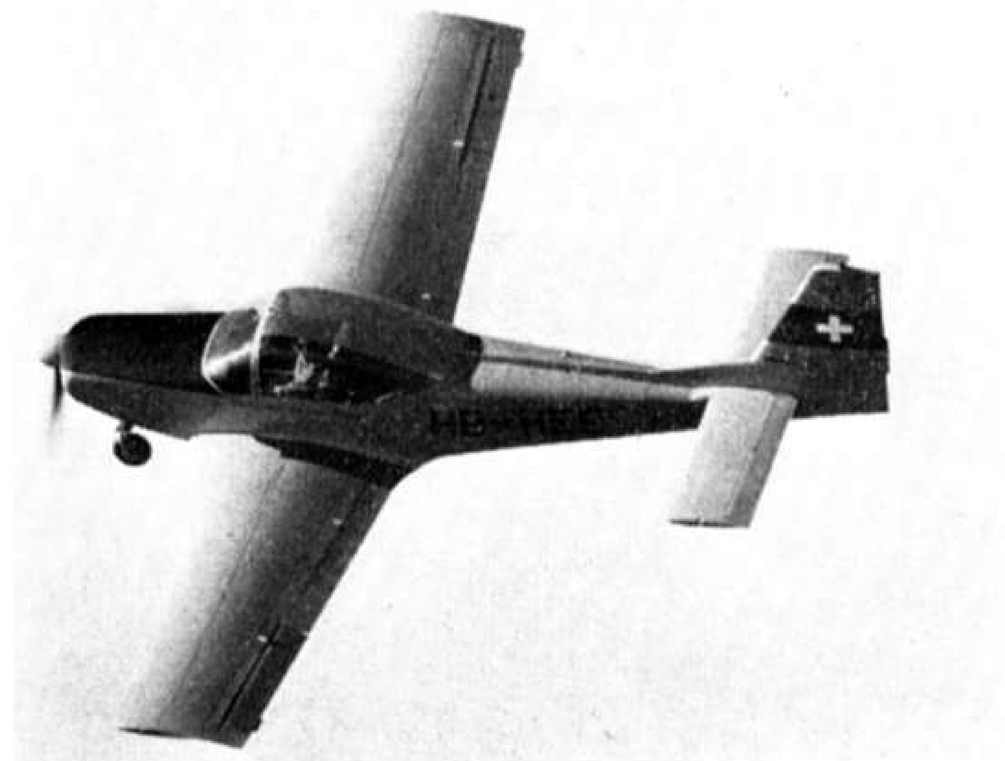
Having located and fixed the position, course and speed of the enemy aircraft, the EC-137D is then able to direct supersonic, missile-armed interceptor fighters towards the raiders, to shoot them down. This is the CS (control system) function.

Two EC-137Ds have been built initially, to flight test prototype radars built in competition by the Hughes Aircraft Company and Westinghouse Electric Corporation. By the end of 1972 the USAF is expected to decide which radar gives the best results. The other components of the complete AWACS installation will then be designed, tested and fitted to the winning aircraft, which is intended to prove its full capabilities by the end of 1974. If all goes well, 42 production AWACS aircraft will then be ordered.

Each will be powered by eight 9,000 lb. thrust General Electric TF34 turbofan engines, in pairs in underwing pods, in place of the four 19,000 lb. Pratt & Whitney JT3Ds of the prototypes, and will carry a crew of seventeen. The cabin, from the flight deck



Top, first prototype EC-137D. Above, a cut-away showing the spacious interior. Auxiliary power unit, power distribution centre, and remote electronics are in lower forward cargo compartment (not shown). Below, first prototype on test with Boeing's Sabre (the only civilian-registered example) monitoring.



Comparison between the first prototype AS202 Bravo (top) and the first production machine.

rearward, will accommodate a crew rest area, data processing, communications and other equipment, multi-purpose systems consoles and the mission commander's operations room, monitoring and test check-out stations, and the radar bay and sleeping quarters.

Apart from all the other assets of such an aircraft, it is of course much more difficult to pinpoint and knock out than any radar site or control centre on the ground.

Bravo

Any company that tries to compete with Cessna, Piper and Beech in the lightplane market faces an almost impossible challenge. One of the few that has achieved any success since the war is SIAI-Marchetti of Italy, whose four-seat S.205, five-seat S.208 and six-seat, twin-engined S.210 benefit by utilising a high proportion of common airframe components.

To complete its "family" of light aircraft SIAI-Marchetti designed a neat little two-seat trainer designated S.A.202 Bravo. The "A" in its designation signified that the Italian company had brought in Flug- & Fahrzeugwerke AG (FFA) of Switzerland as a partner in the project, to avoid overstretching its own resources.

The original intention was to build the SA.202 Bravo in Italy and exactly the same aeroplane in Switzerland as the AS.202. Thus, the first prototype to fly, on March 7, 1969, was the Swiss-assembled HB-HEA, known as an AS.202/15 because it had a 150 h.p. Lycoming O-320-E2A engine. It was followed

on May 7 by an Italian-built SA.202/10 with a 115 h.p. Lycoming O-235-C2A engine, and then by two more Swiss aircraft.

By this time, there had been a worldwide slow-down in sales of lightplanes and SIAI-Marchetti decided to let FFA handle all production of the Bravo. Flight testing had revealed a need for certain design changes. In particular, the tail-fin and rudder did not appear to provide as much positive effect as they should on a modern trainer. So FFA moved back the fin from in front of the tailplane to the trailing-edge, broadened the base of the rudder and added a larger dorsal fin. The result is shown in the photograph of HB-HEE, the first production Bravo, on this page.

The first 50 aircraft will all be AS.202/15s, with 150 h.p. engine, fixed tricycle undercarriage and optional third seat. Span is 32 ft. 0 in., length 24 ft. 7¼ in. and loaded weight 2,200 lb. Maximum speed is 131 m.p.h. and range 575 miles at 126 m.p.h.

The Rallye Minerva 220 glider tug with no fewer than four sailplanes in tow.

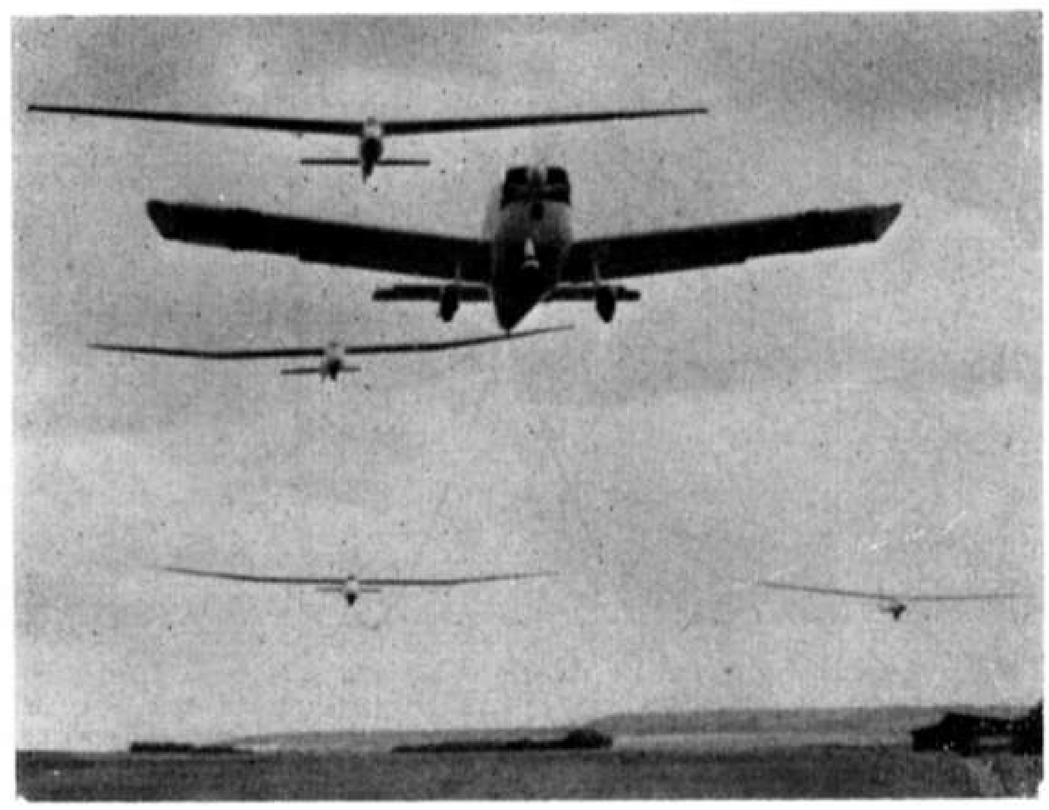
A Four-legged DC-10

On February 28 this year the first Series 20 long-range version of the McDonnell Douglas DC-10 tri-jet airliner made its maiden flight from Long Beach Municipal Airport, California. The take-off is shown in the photograph on this page, and at first glance the prototype looks little different from the DC-10 Series

Take-off for maiden flight of the long-range version of the McDonnel Douglas DC10. It has 141,000 lb. of thrus available.

10s which have been in service since last summer But count the wheels . . .!

Unlike the short-range model, the Series 20 has its normal tricycle undercarriage supplemented by a fourth, twin-wheel unit mounted on the fuselage centre-line between the four-wheel bogie main units. Its wing span is also increased by 6 ft. to 161 ft. 4 in. and its loaded weight by more than a quarter, to 555,000 lb.



It will seat the same number of passengers as the Series 10, with standard accommodation for 255 or 270 persons and a maximum of 345 seats in economy class configuration. The 44,000 lb. thrust General Electric CF6-6D turbofans of the short-range model are replaced by 47,000 lb. Pratt & Whitney JT9D-15s, which will give the Series 20 a range of nearly 6,000 miles with a full passenger load.

Some Tug!

A high proportion of the 1,775 Rallye aircraft marketed by Socata, Aérospatiale's lightplane division, are used throughout the world for glider-towing. This is quite a normal duty for such aircraft, now that unpowered flight has become so popular, but the Rallye is in a class by itself in terms of multiple towing, which helps keep down launching costs for sailplane enthusiasts.

Baby of the Rallye range is the three/four-seat MS 880B Rallye Club 100, powered by a 100 h.p. Rolls-Royce/Continental O-200-A engine. Most powerful is the four-seat MS 894A Rallye Minerva 220, with a 220 h.p. Franklin 6A-350-C1. The more powerful the engine, the more the aircraft can tow off the ground. This is well illustrated in the picture on the previous page, which shows a Minerva 220 taking off with no fewer than four sailplanes in tow.

Two magnificent heraldic dragons on the Victoria Embankment mark the westerly riverside boundary of the City of London. Bottom, the Embankment Gardens—flowers, lawns, exhibitions, and visitors where once was only mud, slime, and filth.

The Embankment and Hygiene

A strange connection? Edyth Harper explains how lack of one led to the other

IT ALL began with the introduction of the Water-Closet! One hundred years ago, at midday on July 13th 1870, the Victoria Embankment was lined by Coldstream and Grenadier guardsmen, whilst thousands of citizens watched the Royal procession as Prince Edward, with Princess Louise, formally opened the Victoria Embankment.

This magnificent thoroughfare must be one of the finest riverside drives in the country—indeed it has been suggested that it is supreme in Europe—but it is probably forgotten that it might not have been built at this time, or in its present form, had it not been for the introduction of the water closet, the abolition of cess-pools, and a smell which nearly drove Parliament from Westminster to Hampton Court!

At one time there were numerous streams and rivers running through London, carrying the rainwater from the streets into the River Thames. The less pleasant sewage was consumed by cess-pools, not very hygienic by modern standards but the system at least succeeded in keeping the river relatively clean.

Around the 1830's two apparently unrelated 'improvements' combined to create a major problem for the Authorities. Firstly, the removal of the old London Bridge increased tidal flow upstream, exposing a wide area of foreshore at low water. Secondly, social amenities were being improved by the introduction of water closets in houses and commercial buildings. This was very desirable, but the cesspools could not cope with the additional water so as an obvious alternative the sewage was piped into the Thames. The result was inevitable, but had not been anticipated. The tide failed to clear the sewage and behind the Temple, the Strand, Whitehall and around Westminster, foul stinking mud was revealed at low water. The situation worsened after 1847 when cess-pools were completely abolished in the Capital and it became a legal requirement that every house in London be fitted with a water closet.

Cholera epidemics occurred in 1848 and again in 1853. At high and low water London's river was no better than an open sewer. Drainage ceased as the tide

The memorial to Sir Joseph Bazalgette set in the Embankment wall near Hungerford Bridge.

rose above the level of some of the outlet pipes and at such times a back-flow was created, depositing sewage in the streets and in riverside houses.

This was the era sometimes described as the 'big stink'. During the summer of 1859 it is reported that more than £17,000 of public money was spent in a vain attempt to sweeten the water. Fifty tons of carbolic was used, plus more than 4,000 tons of chalk lime and nearly 500 tons of chloride of lime. It was at this time that conditions in and around the Houses of Parliament became so unpleasant that a move to Hampton Court was seriously contemplated.

But the problem was not being ignored. Four years earlier the Metropolitan Board of Works had been formed for the express purpose of designing a sewage system for London. They appointed Joseph Bazalgette as Chief Engineer, as astute and skilled man whose name is little known today. He produced a master plan, basically simple, but revolutionary in its time. He planned to intercept the sewage which had previously entered the north bank of the Thames, at three levels. At river level a main channel would run parallel to the river, eastwards to the lower reaches and to an outfall situated at Barking. The question was where to arrange the interception. He was faced with two alternatives—either a subterranean location sixty feet below the Strand, or a position just behind the riverside buildings where the mud flats were revealed at low water.

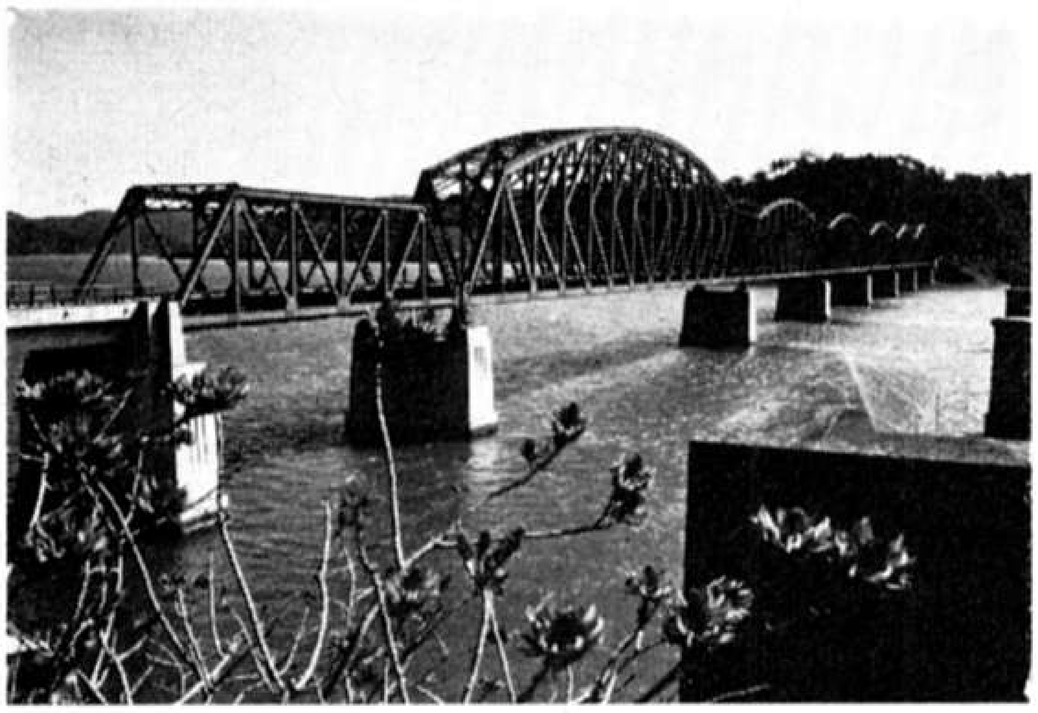
In examining these alternatives, Bazalgette took advantage of the contents of an official recommendation published—but no doubt shelved—in 1840. This advocated the construction of a river wall from Vauxhall to Blackfriars in order to restrict the river and improve navigation facilities.

He proposed that this wall be built, that the drainage channels be sited on the reclaimed land and that the area between the riverside buildings and the wall be earth-filled, with the surface used to create gardens, a continuous riverside walk, and a wide spacious thoroughfare for the conveyance of wheeled vehicles, thus relieving the traffic flow which was creating a problem of its own by choking Whitehall and the Strand. Despite the magnitude of the task and the high anticipated cost, Bazalgette's plan won official approval. An authorising Act of Parliament was passed in 1862 and work started in February 1864.

It was one of the greatest engineering achievements of the period. Nearly forty acres of land had to be reclaimed from the river, the retaining wall was sunk to a depth of 32 feet below high water level and a million cubic yards of earth filling was necessary, with huge quantities of granite brought from Cornwall Dartmoor, Lundy, Ireland and France. It cost over £1,250,000 plus the compulsory purchase of some properties.

The Embankment is known to millions. Citizens and visitors see this thoroughfare without recognising it as a massive monument to an almost unknown engineer, His only named memorial is relatively insignificant set into the parapet opposite the end of Northumberland Avenue—not so very far away from the York House River Gate, still on its original site but now standing high and dry in Embankment Gardens behind Charing Cross underground station. Upon reflection, he would probably have preferred this water gate—or possibly the Queen Mary Steps a little westwards—to have been used as his memorial. They are a long way from the river and provide ample proof of the magnitude of the task for which Sir Joseph Bazalgette was subsequently, and deservedly, knighted.

Stretching from Blackfriars to Westminster, the Victoria Embankment is over 1¼ miles long and incorporates such famous features as Cleopatra's Needle and Scott's ship *Discovery*. It has a charm of its own at night; note the quaint dolphin pattern lamp standards and Big Ben's tower in the background.



THE DESIGN AND CONSTRUCTION OF BRIDGES

by Terence Wise

PART FIVE — TRUSSES

IN APRIL'S article (The Steel Arch) it was pointed out that it was the rapid expansion of railways all over the world which led to a demand for many new bridges, and also influenced the development of bridge design. These new bridges were required to carry heavy loads at speeds never before achieved by Man and these factors led the engineers to adopt the strong and proven method of truss construction first used in Roman times.

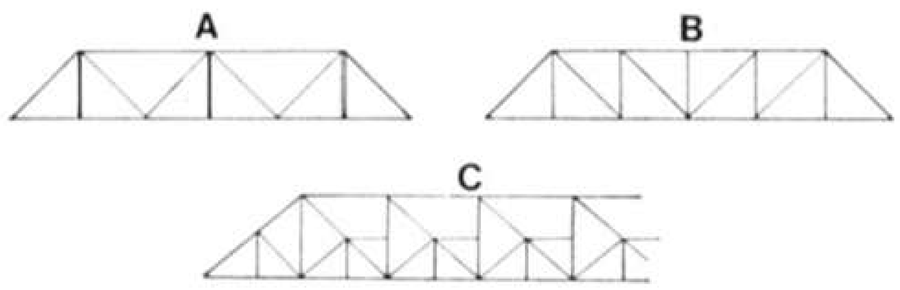
To begin with these truss bridges were built entirely in timber but, because of the industrial revolution in Europe, the cheapness of cast iron—and later of wrought iron and steel—soon led engineers to abandon the timber truss. By 1846 James Warren had introduced a cast iron truss design in Britain which has remained in constant use right up to the present day. The principle is shown in Fig. 1a. In 1962 Warren trusses of steel were used to replace Brunel's original railway bridge at Chepstow, building on the original piers. These trusses were machine welded in the adjoining shipyard of the Fairfield Company and assembled on the site with high strength bolts, without interfering with the train services running above. Brunel himself was famous also for the many timber truss bridges he built for the Great Western Railway. He continued to use timber here for some years after the introduction of iron trusses, but this was an exception to the rule.

However, in other countries where cast iron was costly or not so readily available, but where timber was abundant and cheap, places such as Russia and America, then timber continued to be used. In America, especially, a great number of timber trestle and truss bridges were built for the pioneer railways. By 1840 many variations of the truss had been designed in America, but in that year William Howe patented a truss using timber diagonals with vertical tension rods of iron, and so signalled the end of the exclusive use of timber. One famous bridge using the Howe truss design was that at Havre de Grace, 36 miles north east of Baltimore, over the Susquehanna River. This was built by Nicholas Powers between 1845 and 1850. This combination of materials was soon developed, with the iron rods taking the tensile stresses and the timber employed to its best natural advantage as the compression member. Then an economical cast iron truss, patented by Thomas Pratt in 1844, began to come to the fore, and his design has continued to be used for medium sized spans right up to today. (Fig. 1B). In 1847 the Whipple truss was introduced and by 1850 iron trusses were widely used in America as well as Europe and when wrought iron became comparatively cheap this too was widely used. Fig. 1C shows a third form of truss used today when the older designs are unsuitable. This type of sub-divided truss is used for the larger spans. Fig. 2 illustrates a typical trestle and truss iron bridge of about 1870, built by the American engineer Henry Meiggs in Peru. This particular bridge is called the 'Bridge of the Little Hell' and unites two tunnels in the railway from Callao to Oraya, a 137 mile track with 65 tunnels and 67 bridges.

In Fig. 3 are shown four types of portal used to stiffen truss bridges against wind pressures.

Most iron truss bridges were functional rather than elegant at this time, but the method could lend itself to beauty and one example of the principle used gracefully was the double bow girder bridge on the Hamburg and Harburg Railway over the Elbe, completed in 1872. Fig. 4 shows the design for the entrance piers, Fig. 5 the construction of one of the main spans. The bridge carried two railway lines, with two footways outside

FIG 1



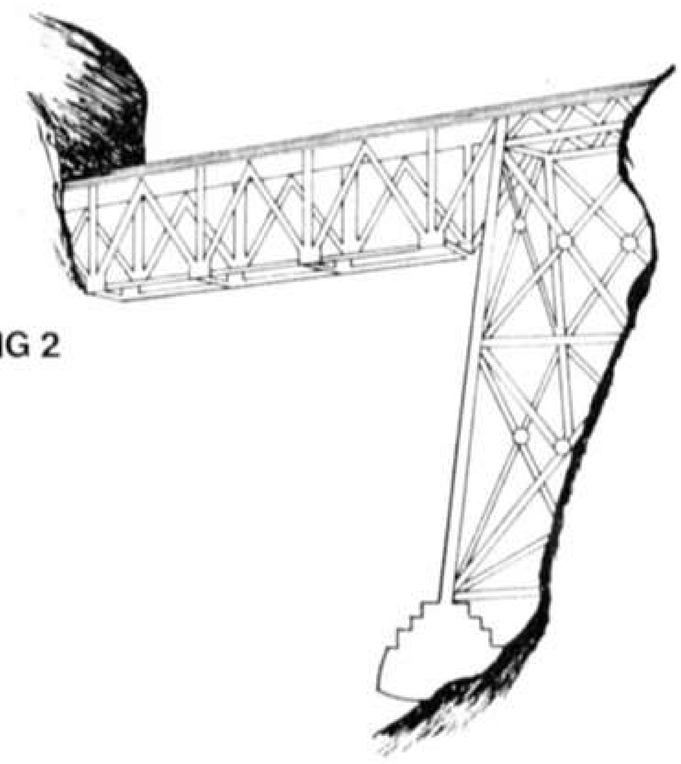


FIG 2

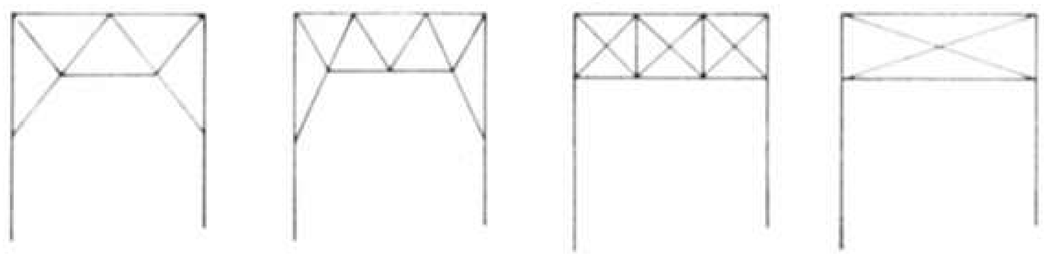


FIG 3

FIG 4

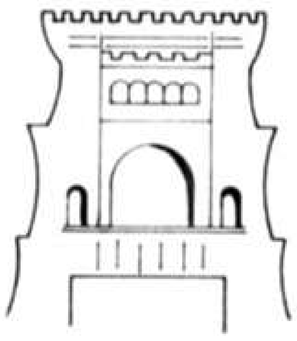
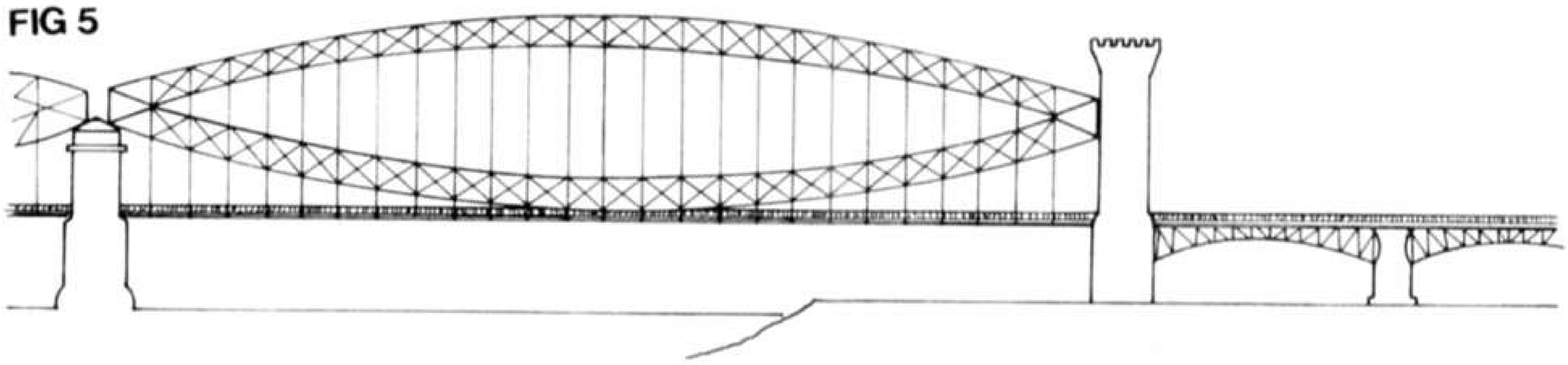


FIG 5



of them. At first an arch design was chosen for this bridge, but the low level that would have resulted was ruled out because of the river traffic. Suspension was then considered but also discarded because of the thick piers which would have been necessary—again an interference with navigation. Finally the arch and suspension design illustrated here was chosen, dividing the weight of the hanging deck between the two bows by means of vertical iron tie rods, and uniting the two curves of the bows at the points of support so that the horizontal pressure acting on them in opposite directions would cancel each other out. By this method the piers received only a vertical load and could therefore be kept reasonably slim. The bridge had three spans of 346 ft. and four of 78 ft. Into the two bows for each truss went 420 tons of wrought iron, 155 tons being used for the roadway and horizontal bracing. The approximate cost for each truss was £150,000.

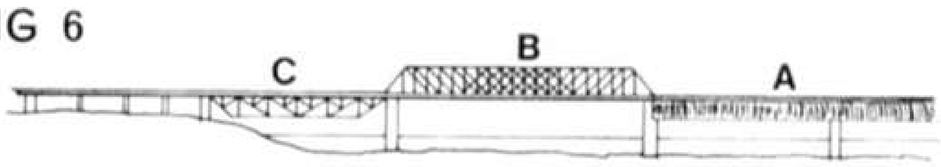
Another example of the truss bridge at this time is the Monongahela Bridge of 1874, carrying the Pennsylvania Railroad to Pittsburgh. (Fig. 6). This was a bridge of eleven spans, with a total length of 1,622 ft. exclusive of the approaches. It was at first erected entirely in timber (as marked A) except for the one span over the channel (B) which was of iron on a Linville and Piper truss design 260 ft. in length. The east span (C) was replaced in the early 1870s with a wrought iron triangulated truss of Pettit's design. This new span had a length of 182 ft., being made up of two trusses. There were six main panels in each truss and twelve sub panels. The length of the main panels was 30 ft. 4 in. and the height of the truss 22 ft. 10 in.

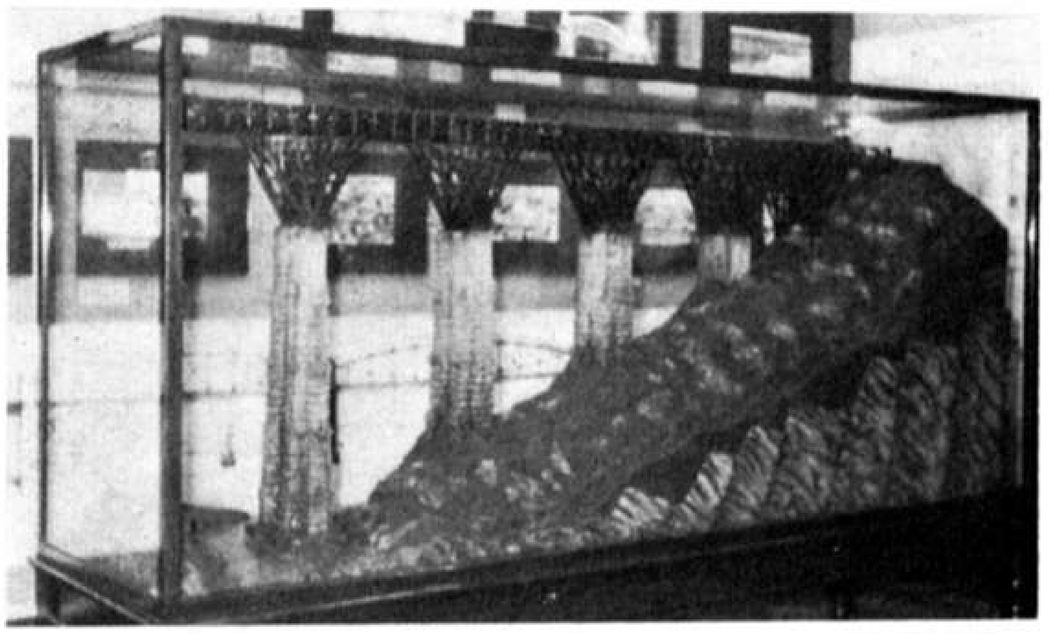
The steel truss soon superseded the lattice girder for long spans and the Hawkesbury bridge in New South Wales, discussed in last month's article on girders, is built in steel on the Whipple truss design. For this bridge the trusses are 416 ft. long, 25 ft. 6 in. wide and 58 in. high. The main girders are 40 ft. long. Each truss is divided into thirteen panels of 31 ft. 6in. each, cross girders 4 ft. 11 in. in depth are fixed between the main girders, and four rows of longitudinal girders three feet deep are fixed to these to carry the double railway lines. Between these bearers and the rails are fixed timber transoms across the bridge on 16 in. centres. Some large truss bridges have also been built in Britain, notably the Selby road bridge in Yorkshire with a span of 256 ft.

A continuous truss design was used for the Lachine bridge over the St. Lawrence, built in 1888 by C. Shaler Smith. The bridge had two side spans of 269 ft each and two centre spans of 408 ft. each. This was replaced in 1910 but until the time of its demolition it was the only example of a continuous truss bridge in America. The Metropolis bridge over the Ohio River, completed in 1917 with a 720 ft. span, was followed in the same year by the Sciotville bridge, again over the Ohio, with two spans of 755 ft. This established a new world record for span length and at the same time firmly established the continuous truss design in American bridge building. Later the Dubuque bridge over the Mississippi was built with a central truss span of 845 ft. This had a tied arch outline and a suspended roadway, utilising the artistic form introduced into Britain in 1853 by Brunel with his great bridge over the Tamar at Saltash. A newer form of truss bridge was the Wichert semi-continuous design, developed

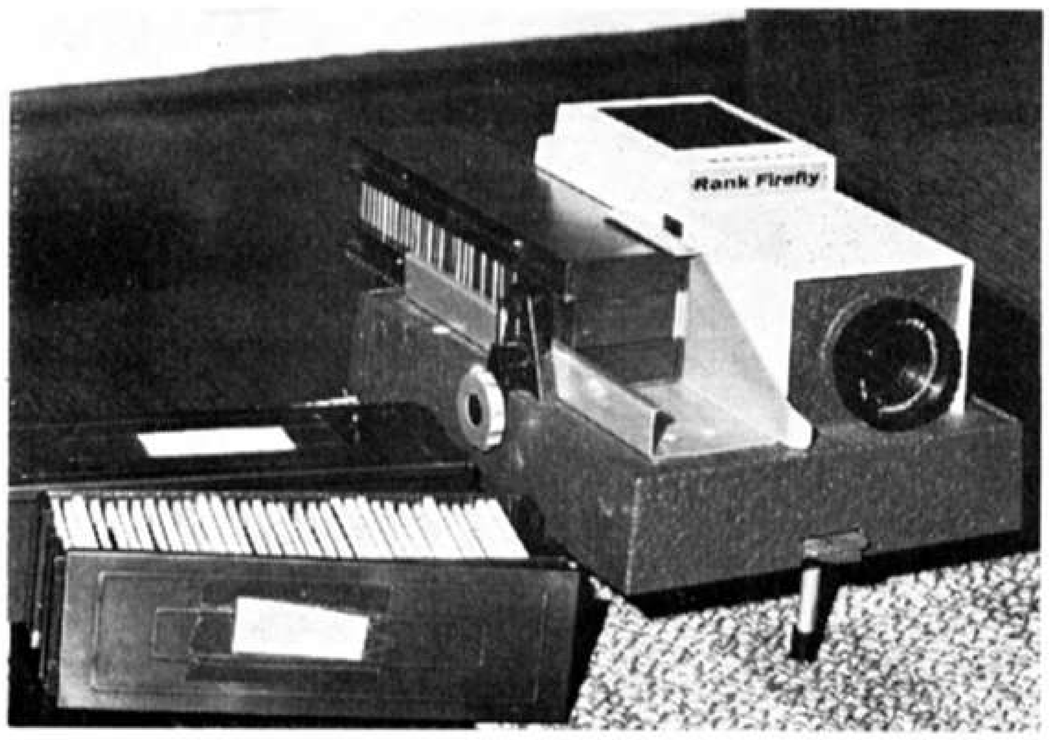
continued on page 299

FIG 6





Heading picture shows the Hawkesbury River Bridge, N.S.W. Piers to the right are remains of the previous bridge.
Right, top to bottom, the railway bridge at Chepstow, converted in 1962, model of Brunel's Ponsanooth Viaduct on the Falmouth branch, typical of the timber bridges built in great numbers by this engineer for the G.W.R. (the model is in the Swindon Railway Museum), and, lastly, seen on the A48 between Gloucester and South Wales, surely one of the last surviving wooden railway bridges, nowadays used only by quarry trains.



PHOTOGRAPHY IS EASY
PART 7
SCENES IN COLOUR

by

PETER WILKES

TODAY, colour is all around us. Television, Cinema, the magazines we read, all are experiencing the revolution of colour. This is as it should be, for the world we live in is dominated by one great factor—the factor of colour. And the colour revolution is daily making greater and greater inroads into photography, for more and more people are expecting from their camera, not prints which turn our colourful world into shades of black and white, but results which record the everyday scene in the glory of its original colour.

Yet, when the beginner takes the first, faltering steps into the world of colour photography, he often finds himself trapped in a maze of bewilderment as words such as Reversal, Negative Colour, Degrees Kelvin and Colour Temperature are hurled at him by those more experienced in this branch of photography, and those whose work he not only admires but aims himself to equal or even surpass.

Often this bewilderment starts as soon as he walks into the dealer's shop, for colour films differ greatly from black and white, and the type chosen depends not only on the end product required, but the lighting conditions under which that film is to be used.

Basically colour films can be divided into two types. COLOUR NEGATIVE films give, as their name implies, a negative from which a COLOUR PRINT can be made, and REVERSAL films, after processing, give a positive of the original scene, that can only be viewed by transmitted light.

One great advantage of colour films is that, through the offices of the Processing Laboratories, each, to a certain extent, can overlap the other. Colour prints can be made from transparencies and, in turn, transparencies can result from colour negatives.

The type of film that one uses is a purely personal matter. If the prime aim is for prints that can be shown from hand to hand or mounted in an album for inspection at any time, with possibly the occasional transparency required from some particularly rewarding shot, then Colour Negative film stock is the medium to use, for a falling off of quality in the transfer process from negative to transparency and vice versa is inevitable.

If, on the other hand, to you, the true glory of colour is in the transparency projected onto a screen, so that the final result is breathtaking colour that stands out in size and quality, then Reversal stock will be the obvious choice, with any particularly interesting transparencies that you may require for passing among friends, converted for you by the laboratory experts. There is little doubt that, for the normal camera user, the true glory of colour is to be seen through the projected slide and for this reason, among amateur photographers, Reversal stock takes pride of place.

To many newcomers to colour photography, the fact that a different type of film is required for different lighting conditions not only causes confusion for them, but often convinces them that this branch of photography is for the expert alone. Nothing, however, could be further from the truth.

Everyone knows that if they enter a room lit by electric light during daylight hours, the first impression on going from daylight to artificial light is that the latter has a yellow hue. Soon, however, because of the adaptability of the human eye, the yellow effect disappears as the eye accustoms itself to this new illumination, and we accept artificial light as "normal" light, our eye ignoring the fact that "white light", as we refer to daylight, can change in hue according to the conditions under which we view it. A colour film, on the other hand, registers colours as they actually are, without

Above, the true glory of colour, in the belief of many enthusiasts, comes only from a transparency projected in all its magnificence on to a screen. Many projectors use magazines that provide storage space for the slides and, with an index and label, give an assured and professional touch to a "slide show"

Left, Exposure, in colour work, for perfect results, is the critical factor and no method can give more accurate results than the incident light meter method of exposure determination.

Left, although the transparency, the final product of the Reversal film, can be viewed on a small hand viewer, they do not offer the convenience of the colour print for casual inspection.

Far right, colour negative material offers the advantage that, with colour prints, they can be either mounted in an album or retained to be handed round among friends and acquaintances

making allowances for the variations in hue that these different conditions can give to "white light". To provide correction for the various types of light to which colour film is exposed, the "colour temperature" of the light is taken into account.

An ordinary domestic coal fire gives a fitting example of "colour temperature". The coal, if such a fire is examined, will be seen, when burning slowly, to be dark red in colour, while, as the temperature increases, the dark red gives way to bright red, and then yellow, indicating that as the temperature rises, the amount of blue in the light emitted increases as compared with the amount of red.

These facts, noticed by scientists, have made it possible to grade light according to its colour temperature, which is expressed in the terms degrees "Kelvin". Hence colour films are manufactured to give true results between certain degrees Kelvin, and providing the maker's instructions are adhered to, the "Colour Balance" of the film will give results that the human eye accepts as true.

This colour balance applies, as far as the amateur photographer is concerned to Reversal stock only, as any faults in the colour rendering of Negative films can be corrected by the laboratory at the printing stage.

Reversal films are available in Daylight type or Artificial light type.

The Daylight films, the type that most photographers use in their cameras, are, as the name implies, colour correct under outdoor conditions, also when used indoors with electronic flash and blue coated flashbulbs, both of which have a colour temperature that is within the scope of the film.

Daylight type film, however, if used without any correction facilities, in artificial lighting conditions, or with the type of photo-flood bulb used by many amateur photographers for portraits and other indoor photography, would give false hues in the final transparency so, for this reason, the makers of films provide some colour balanced for just such conditions and sold as "Artificial light" films.

It often happens that you have one type of film in the camera and wish to take the odd exposure of a subject for which it is not colour corrected. Here we turn to the maker's instructions with that particular film and under the heading of colour balance, will be found details of the filters that the maker supplies to be put over the lens of the camera, in just the same way as filters are used in black and white photography, to correct the film for the conditions under which you wish to use it.

There is another type of correction that can be applied to Daylight films used outdoors in areas where there is an excess of ultra violet radiation, such as by the sea, at high altitudes etc, and that is an ultra violet absorbing filter. Colour films, as well as being sensitive to light, are sensitive to ultra violet radiation, which records as blue on the film. Suitable filters are sold by all photographic dealers and, being colourless in appearance, do not require any increase in exposure.

Exposure, in colour photography, is the critical factor and particularly so with Reversal films, where the latitude is no more than half a stop either side of the "correct exposure". Under-exposure will result in a dark image while over-exposure will give a light image, the absolute reverse to the effects that under and over exposure give with black and white photography.

Because of this critical exposure factor in reversal colour, the use of the incident light meter has long been standard practice among professionals to whom perfection of results is of prime importance.

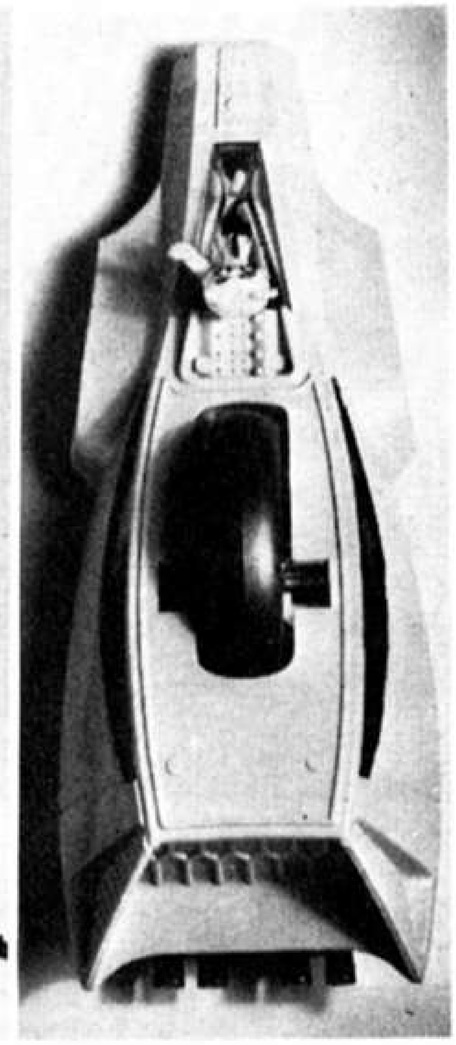
Without doubt colour photography can open an entirely new world for the camera owner, and if due consideration is given to the requirements of the end product, and the correct film chosen, care taken with exposure and, if conditions require it, the ultra violet radiation filter used over the camera lens, success is assured, with results that will bring admiration from both friends and other amateur photographers.

BRIDGES

continued from page 297

just before the Second World War, where the trusses are linked together over their common piers by members which form an open square. An example of this design is the Pittsburg-Homestead bridge of 1937 over the Monongahela River. It has ten semi-continuous arched trusses, the two greatest spans being 533 ft. 6 in. each.

In more recent years the joints between members have been welded instead of riveted and this had not only simplified construction but also saved weight, yet the great spans of almost 900 ft. achieved in America with this type of design are not really economical and for the large span bridges other designs are preferred nowadays. (It has been estimated that once a truss span exceeds about 300 ft. it is no longer economically competitive with other bridge designs.)



Something completely out of the ordinary is the new Dinky Toy Pink Panther Car, Sales No. 354. It is driven by a powerful flywheel motor, started by a special pull-through toothed strap. The vertical shot shows the position of the motor in relation to the rest of the body.

Dinky Toy News *by Chris Jelley*

MILESTONE

New release makes Dinky Toys history

EVERY now and again, something really different happens in the life of any manufacturing company and Meccano (1971) Ltd. are no exception. As I write this, a model has just been released under the Dinky Toy label which marks a prominent milestone in Dinky Toy History—No. 354 Pink Panther Car from television's "Pink Panther" show.

The Pink Panther show is a cartoon series—featuring a pink panther!—which has built up a big following among young viewers the world over, and the Car is a way-out, futuristic "jetmobile" which appears in the introduction to the programme. Needless to say, the Dinky, with some modelling licence, reproduces this car.

What, you may ask, is particularly significant about this? After all, Dinky have produced plenty of television character merchandise models before now. Why should this specific example be such a milestone? Well, the simple reason for my statement—and my enthusiasm—is that the Pink Panther Car is the first ever model made by Meccano to be powered by a flywheel motor and, when I say "ever made by Meccano", I mean in the whole history of the Company. Dinky Toys have only been made since 1934, but the Company have been making other products since 1908! Never in all that time have they produced anything with a flywheel motor.

I know that a few of the older, serious Dinky Toy collectors will not regard the inclusion of such a motor in a Dinky Toy with enthusiasm. They will argue, with some reason, that Dinky Toys have traditionally been small-scale die-cast quality productions that have appealed, not only as toys, but also as true models and part of that appeal has been that they did *not* have, or need, a motor. Such collectors may feel that, instead of a milestone, the new Dinky marks a retrograde step on a downhill road to the realm of "just another indifferent product".

To these people I say, "Not so! Your fears are understandable, but completely unfounded." The Pink Panther Car is not a typical Dinky, but an exciting "special" designed exclusively for motorised operation. It is something completely outside the normal range of Dinky Toys, intended purely and simply as a "toy", in every sense of the word. As a toy, it is marvellous and, believe it or not, it is the very flywheel motor which makes it marvellous.

The reason for this statement becomes obvious from a study of the toy. The motor itself provides built-in propulsion, which of course is appealing on its own, but it is the method of activating the motor which really clinches it. Most flywheel motor-driven models are "revved-up" by holding them in the hand and running them along a flat surface a few times before releasing them. This works reasonably well, but is cumbersome and generally does not result in the maximum possible performance. The Dinky model, on the other hand, is "started" by a special toothed rack strip which is engaged with a gear in the motor and simply pulled out, once. The harder the pull, the higher the revs and I can tell you from experience that some pretty phenomenal motor speeds can be achieved! The model is of course held in the hand while the starter is pulled, but, once the motor is running, it is placed on the ground to immediately go streaking away at high speed over a very long distance.

The actual drive system used is different from the average and, as such, should be considered. Most other flywheel models have the motor hidden inside the model, with the drive usually being taken to two conventional roadwheels. In the Dinky, the flywheel and driving wheel are one and the same thing! The large flywheel is cast in metal to provide the necessary weight and is fitted with an even larger hard-wearing P.V.C. tyre to provide grip. The whole thing projects above and below the body like a giant roller and it is this that drives the model forward. I had this wheel in mind when I mentioned modeller's licence earlier, but I honestly believe that, if anything, it adds to the appeal rather than detracts from it.

Of course, the principle behind this particular method of propulsion is not unique to Dinky Toys. A similar principle has been used elsewhere, but the Pink Panther is the first ever model to be fitted with low-friction Speedwheels in addition to the large flywheel, thus producing maximum performance. In fact, the high performance of the model has been the result of extensive

development work, one stage of which involved the production of an all-metal version, just like a normal Dinky Toy. When this was done, however, it was felt that a heavy metal toy hurtling around the floor constituted a positive danger—not only to furniture, but also to feet and legs! The ideal material eventually proved to be a strong, light plastic which greatly improved the speed and running distance of the model to result in the finest toy of its type I have seen.

A special safety feature is provided by a soft P.V.C.-tipped nose, which helps to prevent possible damage resulting from a high speed-impact, and the last touch of appeal is given by a moulded Pink Panther figure, gaily waving from the wedge-shaped cockpit.

To get the most fun from the model—and avoid parental censure–it is inadvisable to play with it in the home. (Unless you live in a palace, you won't have enough room!) It obviously requires a large and fairly level surface on which to run and, as I cannot advocate using it in the street, I would recommend a school playground, gym or assembly hall as the ideal operating area, the last two with permission, of course. It is specially great for racing, so you could organise your own race meetings with your friends. You will find that, skilfully used, the Pink Panther will beat anything else on the Market!

Armoured Scout Car

As if to reassure collectors that traditional Dinky Toys will continue unabated, Meccano have released with the Pink Panther a new model very much within accepted tradition—No. 680 Ferret Scout Car. This, I know, will receive wide acclaim from all quarters of the collecting hobby, there having been a large and continuous demand for an increase in the Dinky military series ever since the military range began to be cut back some years ago. It is worth mentioning here, by the way, that, contrary to many peoples' belief, the military range has been reduced simply because the manufacturing tools and dies for the older models have worn out—not as a result of any deliberate policy. At the time, replacement models could not be made as production facilities were in constant use for other models.

To my mind, one of the beauties of military Dinky Toys has been their simplicity. Instead of being action-packed "gimmicky" models, the accent has been on strength and realism; not many working features, but strong, solid castings incorporating a wealth of outline body detail. Gimmicks are marvellous in their proper places, but I have never really thought that the military vehicles needed them.

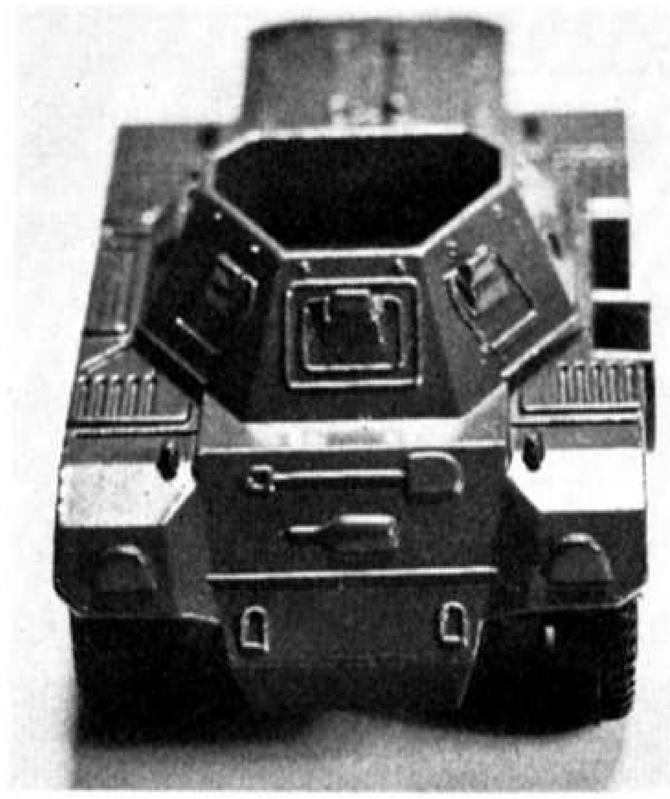
I am pleased to report that the policy of simplicity has been retained with the Ferret. The Model consists of a body casting with two axles, four road wheels and a fifth removable spare wheel carried on the centre nearside of the body. Hardly complicated, this, but the amount of detail in the casting is a joy to behold! All the important body features of the original are represented—along with most of the unimportant ones, as well: gratings, hatch covers, view ports, periscopes, head and tail lamps, they are all shown. In fact detail even runs to a representation of a shovel on the body front panel!

This brings me to a point which a reader may be able to clarify for me. Beneath the shovel is the outline of what appears to be a bottle, although I am not sure it is not. It may be a fire extinguisher, but, as I have been unable to identify it positively, I am hoping that one of you military experts will put me straight. If anybody can do so, please don't hesitate to drop me a line.

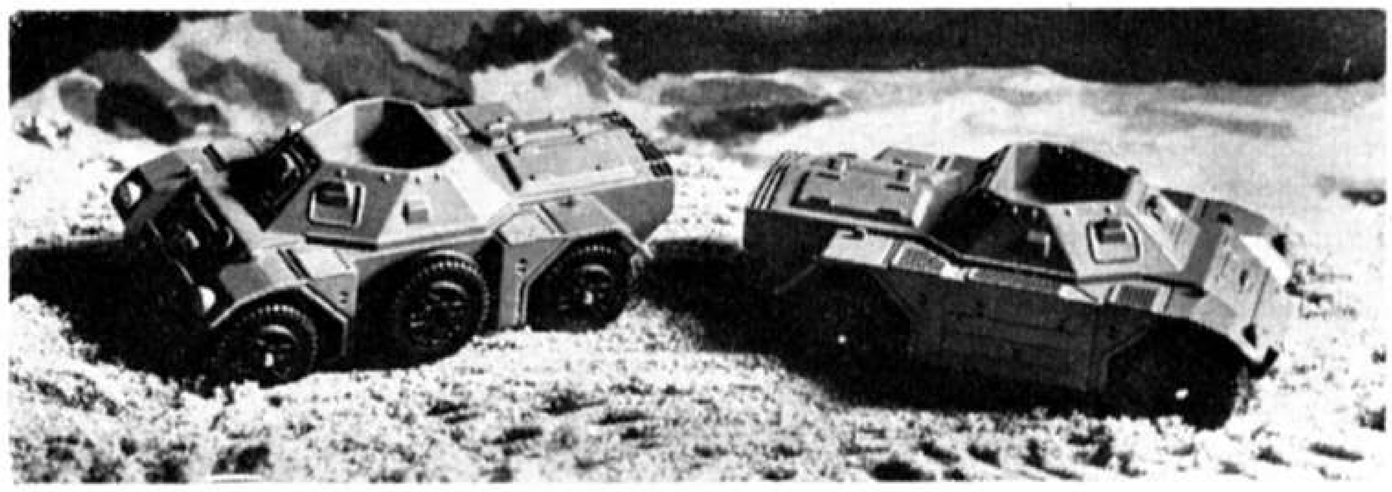
As is to be expected, the model is finished in the well-known military colour of olive green—the standard Army colour in Britain. On my review sample the paint used is semi-gloss, which I understand is the type being used on all the models in the first production runs. In due course, however, a completely matt finish will be used, so it is quite possible that these semi-gloss originals will be rare collectors' items in a few years time—a snippet of information worth bearing in mind. With an overall length of just over 3 inches, the model is compatible with many of the earlier Dinky military models, as well as with the numerous plastic kit military equipment which sells in such large quantities.

A few final words now about the real Ferret Scout Car which is manufactured by the Daimler Co. Ltd. of Coventry. Normally carrying a crew of two—Driver/Signaller and Commander / Gunner — it is powered by a 4,255 c.c. 6-cylinder petrol engine developing 116 b.h.p. at 3,300 r.p.m. Maximum road speed is 58 m.p.h. and the car will average 25 m.p.h. across country, using fuel at the rate of 5 m.p.g. in the latter case. It will climb anything up to 24 deg. gradients and is capable of negotiating vertical obstacles up to 16 inches high, or crossing trenches up to 4 ft. wide. Without any special preparation, it will safely "wade" through 3 ft. deep water and, with special preparation, it can operate in water up to 5 ft. deep. It will even tilt sideways to an angle of 50 deg. without toppling over, therefore it qualifies as an extremely agile vehicle, ideal for its scouting role.

One last and very important point relating to the models is that the accent on casting detail instead of gimmicks has enabled it to be produced at a remarkably low price—it retails in the U.K. at only 29p!

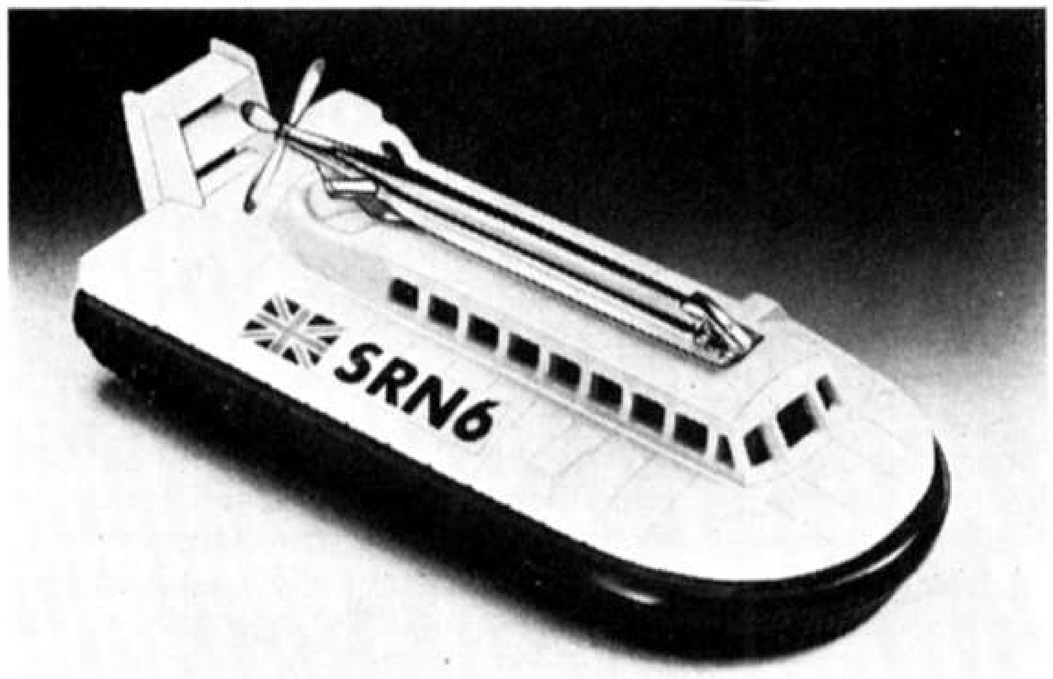


A close-up frontal view of the Ferret showing the shovel and "mystery bottle" referred to in the article. Can anybody identify it?



A long-awaited new addition to the famous series of Dinky Toy military vehicles is the Ferret Scout Car, No. 680

HAVE YOU SEEN?



New MATCHBOX vehicles

Sprayed in a glowing metallic orange with a yellow racing sticker and purple tinted windscreen is the new "MATCHBOX" No. 7, the "Hairy Hustler". Adorning the roof of the model is a chrome air scoop. Through the windscreen can be seen the detail of the interior, which includes a low profile single seat and the steering wheel. No. 72, the S.R.N.6 Hovercraft is finished in two body colours; the upper body and cabin area is sprayed in white and the skirt is in black. The model has a large red aero-fin, situated above the cabin. The model runs on Superfast wheels concealed behind the skirt. Both these models retail at 16p each.

The latest additions to the fast growing range of Speed Kings are the K-31, Bertone Runabout and K-32 Shovel Nose. The Bertone Runabout has a sloping body line and is finished in a fashionable orange with a lime green underbody. Inside the car there are two deep contoured seats, a steering wheel and gear lever. Situated behind the driving compartment is the engine which is revealed after raising the boot. For any child wishing to connect this car to a trailer a towing hook is located at the rear of the car. The Shovel Nose has an elongated and tapered bonnet, to decrease wind resistance with the radiator situated underneath. To enter the car the whole cockpit roof can be lifted, from there the detail of the interior can be seen. Two deep luxury seats accommodate the passengers and there are numerous dials and switches on the central console. These two models are 45p each.

Zoomy Balloonies

Another new item for "MATCHBOX" are some rather weird balloon powered racers called "Zoomy Balloonies". The balloon is blown up then fitted to the top of the toy. The air passing through the chassis and out the back, through a piece of rubber tubing flattened at one end, causes the creature to move along making a terrible rasping noise as it does so. The plastic bodyshell is finished in fluorescent colours making them look even more gruesome. The idea is very clever and should be a favourite with the kids in the 5–10 year old bracket. There are 12 different designs: Spida Bita, Terrible Toad, Mean Motha, Mean Manta, Rat Racer, Fly'n Fang, Nose Job, Bat Cat, Webbed Wonder, Bo-Evil, Blood Shot and Hot Foot all retailing at 25p each.

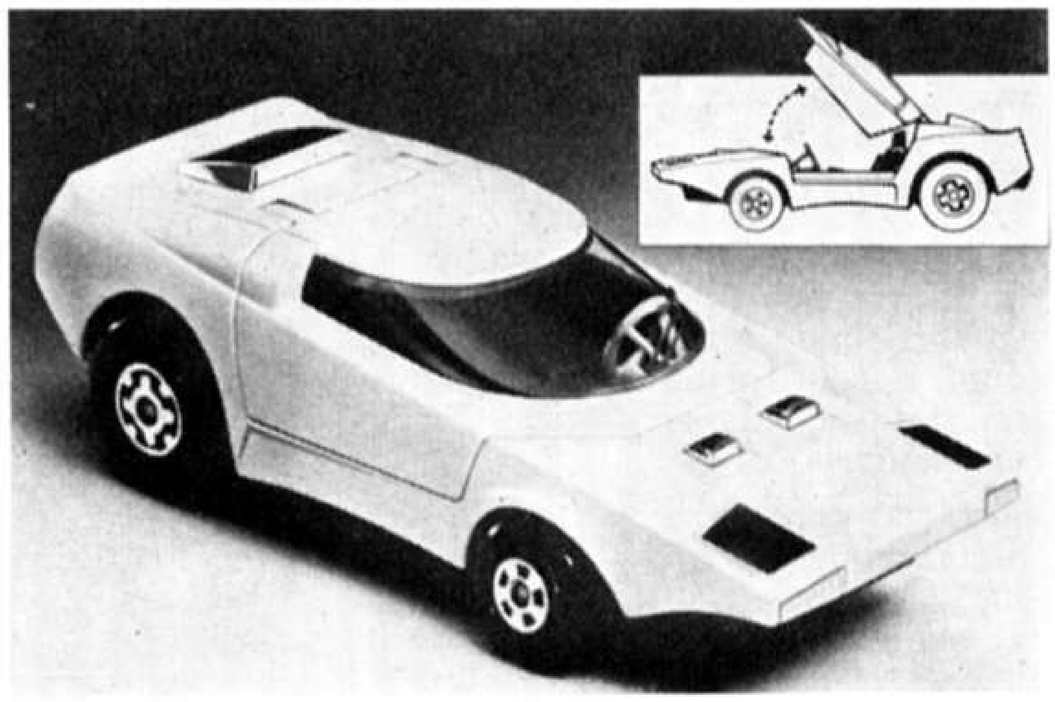
Glue Stick

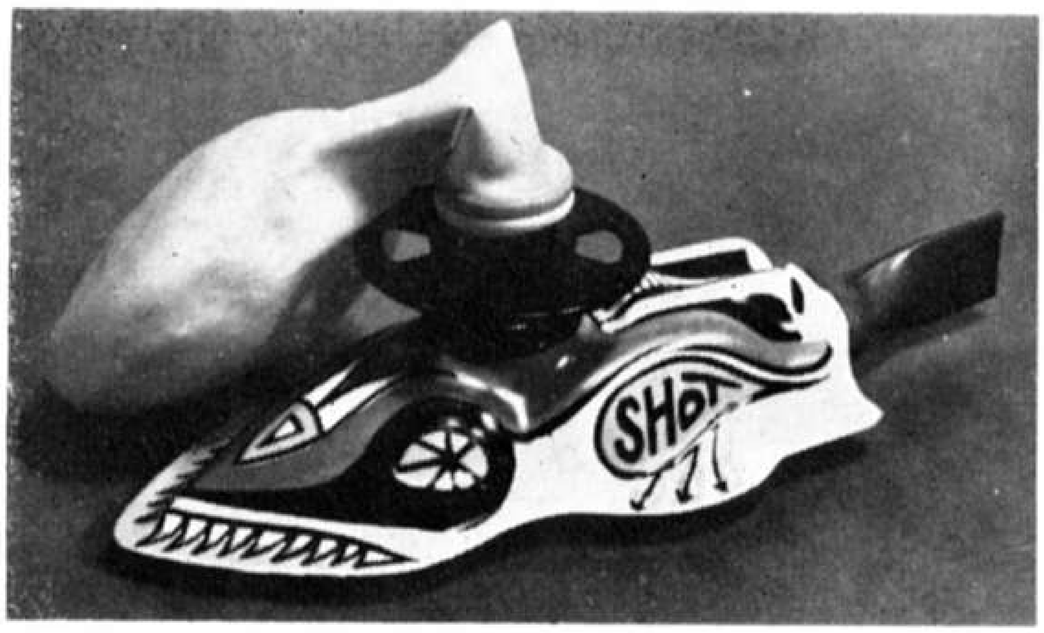
Sellotape Products new "Sellostic" is a water soluble adhesive stick contained in a lipstick type holder. When opened, the top fits on to the base of the container, and the base is then twisted to allow the adhesive stick to protrude. "Sellostic" is held and used like a crayon, so children can use it easily without getting into a sticky mess. An added aid is that the holder is squared and does not roll off the desk or table top.

The glue is non-toxic, has no unpleasant smell and is non-inflammable. Because it is water based it does not stain clothing and it is easily removed with water or by normal washing. Children will find "Sellostic" very easy to use when making up scrap and projects books, making cardboard models, paper flowers etc. The adhesive stick retails at a very reasonable price of 17 p

Wall Plaques

John Crawley Limited of Turvey, Bedfordshire, have 10 new wall plaques of World War II aircraft. The plaques, measuring $6\frac{1}{2}$ in. × $13\frac{1}{4}$ in., have the aircraft profile lines embossed in gold deposit against a matt black background and the colours are filled in. The subjects available are, Vickers Supermarine Spitfire Mk.





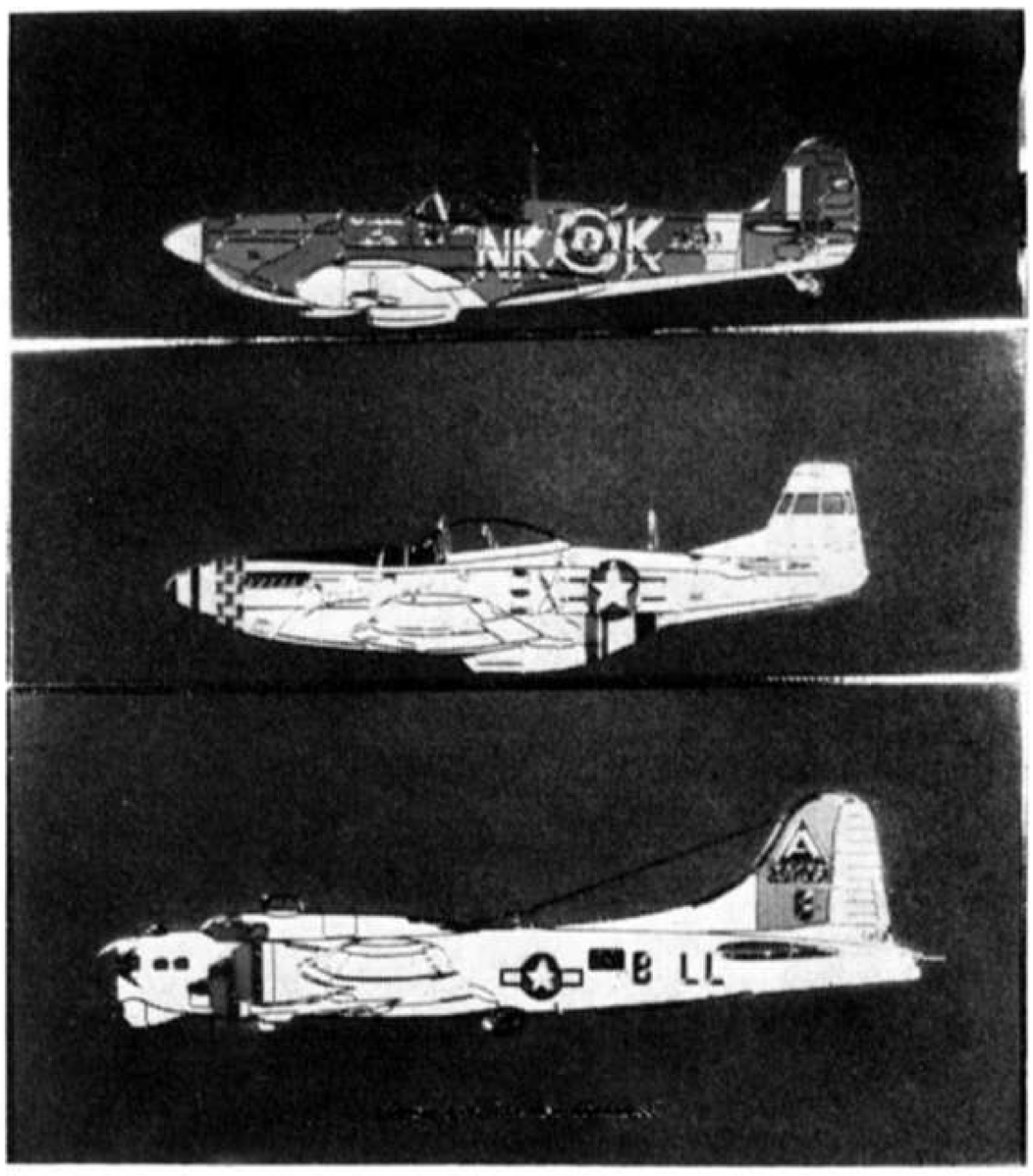
11A, Hawker Hurricane Mk. 1, De Havilland Mosquito Mk. IV, Avro Lancaster Mk. 1, Messerschmitt Bf109F, Junkers Ju88 A4, North American P51D Mustang, Boeing B-17 Flying Fortress, Junkers Ju 87 "Stuka" and Focke Wulf Fw 190. Price, in a gold-finished gift box with acetate window, is 95p each. A very colourful and attractive wall decoration.

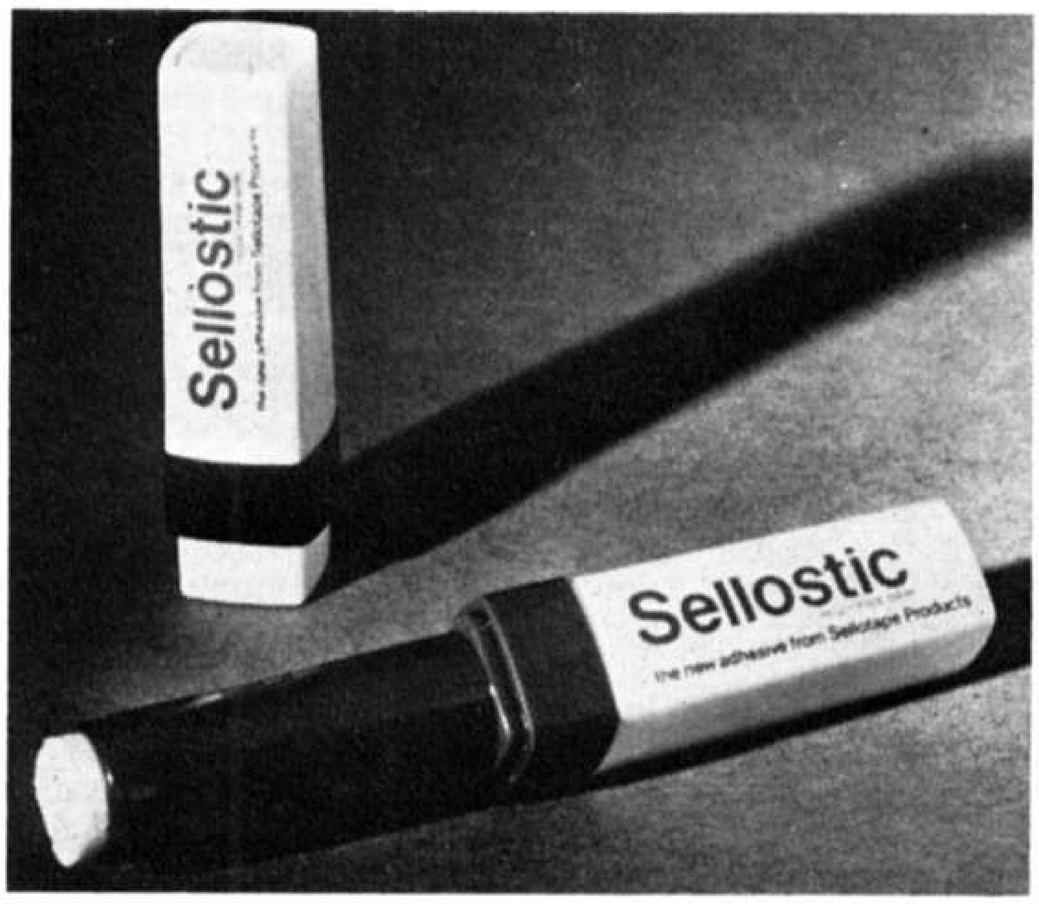
New Books

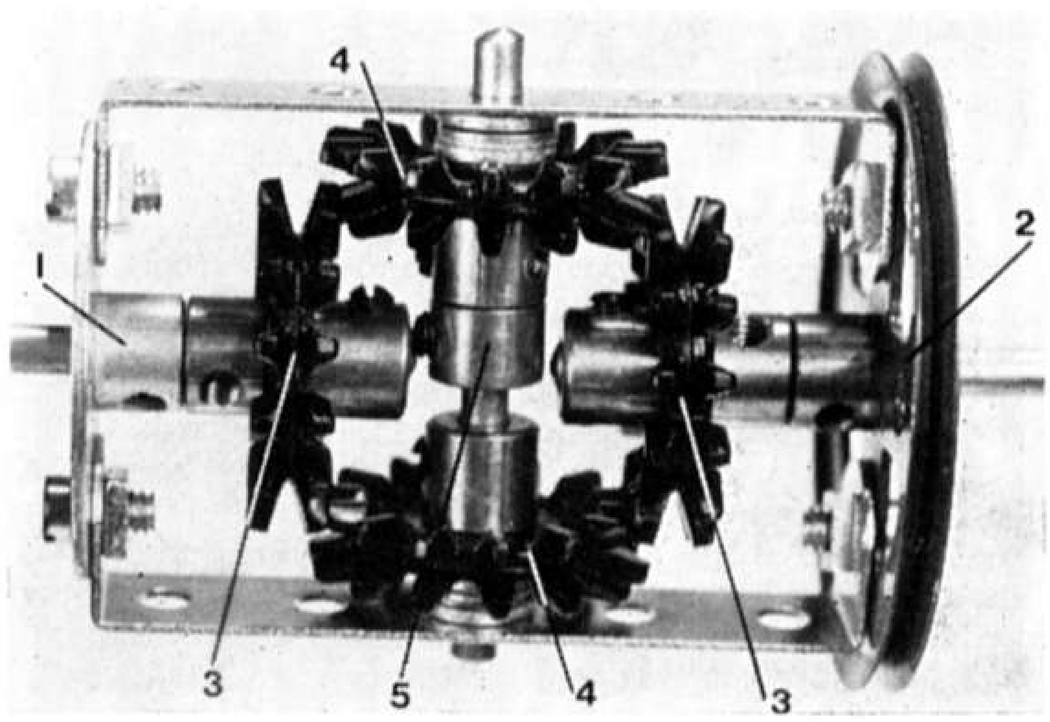
In the book line this month we have two new books published by David & Charles. "Ransome's Steam Engines", by A. Beaumont, opens by introducing steam and its tenuous expansion and progression towards industrial and agricultural use. Following this is a chapter about the steam fitters, which takes the form of a tribute to the men who built these juggernauts. The book also includes a transcript of an old Ransomes, Sims and Jefferies catalogue, displaying various engines and steam driven devices, mainly for agricultural usage. However, moving on from there the rest of the book is devoted to traction engines—their history, construction and purpose, finally winding up with stationary engines. The book retails at £3.25 and is fully illustrated with drawings or plates on each page.

The second book, "Railways since 1939" by H. C. Casserly, essentially consists of two parts, some 70 pages of photographs, all of excellent quality, and about 40 odd pages of writing covering the war years, the immediate post-war years, followed by nationalization and modernisation (including the Beeching era) then the rail tours which covered the years between 1950 and 1960. From there the author goes into the extent of preservation that exists in this country today. The book winds up by covering the present and future status of the railways, their uses and costs etc. Overall this is a comprehensive book and for an enthusiast it is well worth £3.25, if only for the superb photographs that it contains.

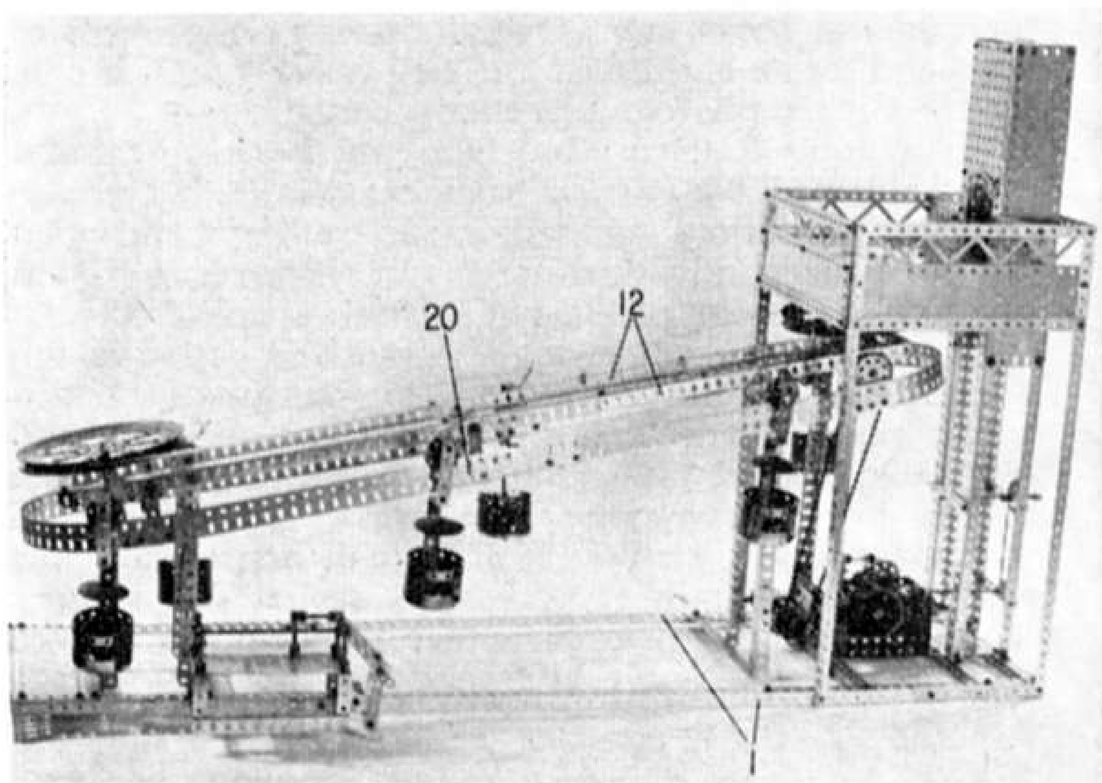
"How to go Railway Modelling", by Norman Simons and published by Patrick Stephens Limited, contains chapters on various types of model railways and what might best suit individual needs and resources as well as practical chapters on layout planning and building, electrical wiring, track laying, locomotives, carriages and wagons, scenery and operating. The informative text is well supported with more than 100 line drawings and over 100 photographs. It also explains the organisation of the hobby, the clubs, the press, the commercial manufacturing, distributing and retail houses, and the accepted model railway standards, scales, and gauges. This book is certain to encourage the beginner as well as offer many valuable hints and tips for the experts. Retail price is £2.60.

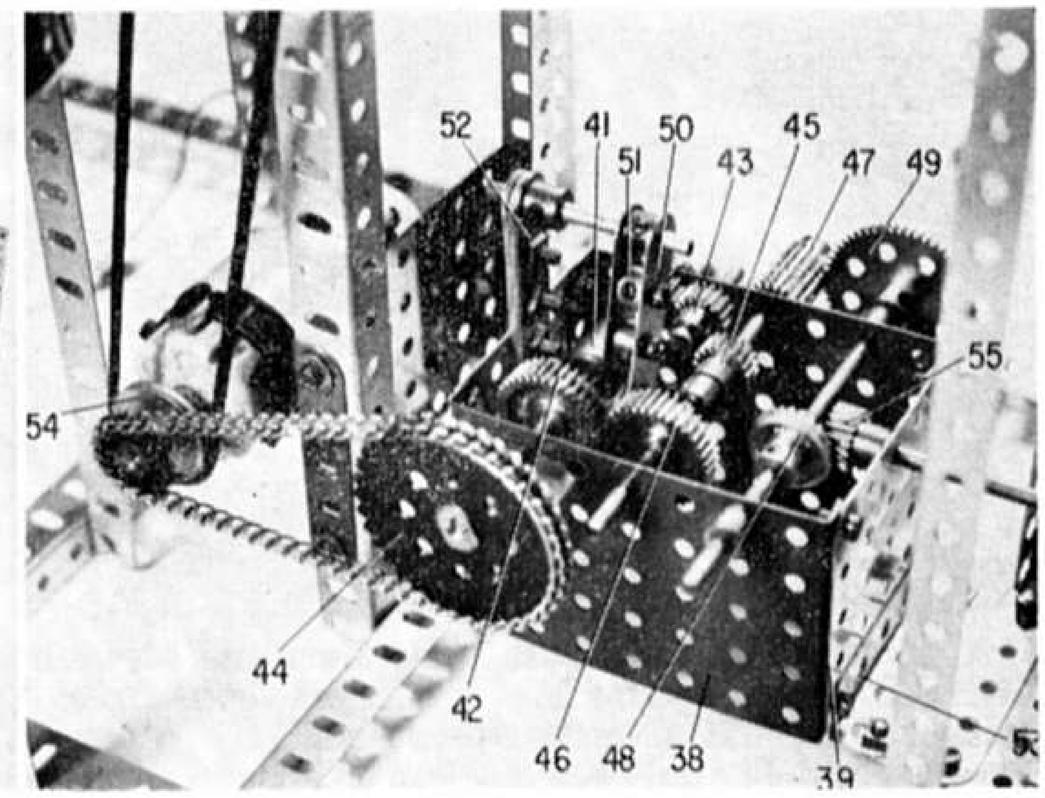






The differential in this photograph is that designed by Mr. G. Relins and descibed on page 277. It may seem strange to have the picture on this page, but this is just one of the odd side effects of the "go-slow" on the railways; the whole story is too complicated to go into here!





CHAIRLIFT

An impressive continual-running display model described in two parts by 'Spanner'.

PART ONE — BASE, TOWERS, TRACK, AND LIFT

SCATTERED throughout the world are numerous modellers who make an invaluable contribution towards the Meccano hobby by building either for exhibitions, or for display in local dealers' windows. Needless to say, these modellers are always looking for suitable display models to build and so I am particularly pleased to feature here the Automatic Chairlift illustrated in the accompanying photographs. This is ideal for display and, in fact, it was designed for that very purpose by Mr. Harold Taylor of Huddersfield—the man to whom Meccano Magazine has been indebted for most of our models for longer than I can remember.

To be effective, a display model obviously requires movement and yet, at the same time, it needs to be sufficiently simple in operation to stand up to continuous running for long periods at a time. In ths case ample movement is present, supplied by six chairs, or "cupolas", moving non-stop up and down an inclined rail, together with a lift at the end of the model which automatically ascends and descends in its shaft, and the fact that the actual model illustrated was displayed for several weeks in a Huddersfield store is sufficient proof that it will run continuously. It therefore qualifies as an ideal Meccano demonstration unit.

Although a large model, construction is not particularly complex. A long rectangular base is built up from two 39½ in. compound angle girders 1 connected at the ends by 9½ in. Angle Girders 2, each compound girder consisting of a 5½ in., a 24½ in. and a 12½ in. Angle Girder, bolted together. Counting from one end, the compound girders are further connected through their fifth, fifteenth, and twenty-third holes by additional 9½ in. Angle Girders, numbered 3, 4 and 5 respectively, while counting from the other end, the seventh and fifteenth holes are joined by 9½ in. Girders 6 and 7.

Before going any further with the main framework, the chairlift supports and runners should be built. Two vertical 12½ in. Angle Girders 8, each extended one hole upwards by a 1½ in. Angle Girder, are bolted through the seventh and thirteenth holes of Angle Girder 4, two more 12½ in. Angle Girders 9 being bolted through the corresponding holes of Girder 5. At the other end of the model, the corresponding holes of Girder 7 receive two 8 in. compound angle girders 10 (each built up from a 5½ in. and a 4½ in. Angle Girder), while two 7½ in. Angle Girders 11 are bolted to Girder 6. Now secured to the upper ends of these vertical Girders are two 32½ in. compound angle girders 12, each compound girder projecting four holes past Girder 8 and three holes past Girder 11. Note that the Girder 8 securing Bolt also helps to hold a 1½ in. Corner Bracket 13 in position. The compound girders themselves are each built up from a 24½ in. and a 12½ in. Angle Girder and are joined together a little below centre by a 3½ in. Strip 14

Turning to Corner Bracket 13, the upper two Bolts fixing this to compound girder 12 also fix a 1 in. Corner Bracket 15 in position as shown, the free hole in this Bracket serving as a bearing for a 5 in. Rod held in place by a Collar and a 1½ in. Pulley 16. Mounted on the centre of this Rod is a Worm Gear which meshes with a ½ in. Pinion on a 3½ in. Rod 17, held by Collars in the centre hole of a 3½ × ½ in. Double Angle Strip, bolted between the lower corners of Corner Brackets 13, and in two 3½ in. Strips bolted one on top of the other between compound girders 12. Note that the Double Angle Strip is angled to lie parallel with the 3½ in. Strips, thus ensuring that the Rod is at right-angles to compound girders 12. A 6 in. Pulley 18 is fixed on the upper end of the Rod.

At the lower end of the assembly another 6 in. Pulley 19 is fixed on a 3½ in. Rod held by Collars in two more 3½ in. Strips, bolted between the fourth holes of girders 12, and in a 3½ × ½ in. Double Angle Strip bolted between the third holes down of Angle Girders 11. A tight loop of very stout cord or string is then passed round this Pulley and Pulley 18.

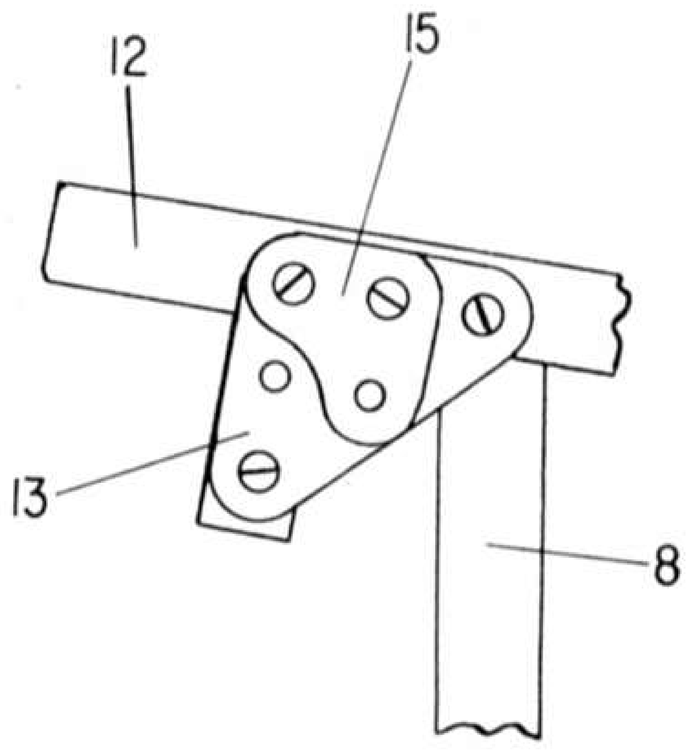
The actual rail 20 on which the cars run is built up from a selection of suitable Flat Girders, bolted together and shaped as shown.

It is of course an "endless" rail, with a circumference of 79 inches, and is attached to compound girders 12 by six $1\frac{1}{2} \times \frac{1}{2}$ in. Double Angle Strips (three at each side), each bolted to a 2 in. Strip 21 secured to one or other compound girder 12.

Now bolted to compound angle girders 1 through their end and nineteenth holes are four vertical $18\frac{1}{2}$ in. Angle Girders 22, connected together to form a square at the top by four $9\frac{1}{2}$ in. Strips 23, the securing Bolts along three sides also holding a $9\frac{1}{2}$ in. Braced Girder in place. Note that the front Strip and Braced Girder is not bolted direct to respective Angle Girders 22, but to two 4 in. compound strips 24, attached to the Angle Girders by Angle Brackets. The Braced Girder is extended downwards by a $9\frac{1}{2} \times 2\frac{1}{2}$ in. Strip Plate 25, the lower edge of which is overlaid by a $9\frac{1}{2}$ in. Strip and bolted to a $9\frac{1}{2}$ in. Angle Girder also attached to Girders 22 by Angle Brackets. Further similar Strip Plates are bolted between side Girders 22, the lower edges of these also being overlaid by $9\frac{1}{2}$ in. Strips. In addition, a $9\frac{1}{2}$ in. Angle Girder 26 is bolted between each pair of side Girders, through their fourth holes down, these Girders at each side being connected through their sixth holes by another $9\frac{1}{2}$ in. Angle Girder 27. Three $9\frac{1}{2} \times 2\frac{1}{2}$ in. Strip Plates are also bolted between the Girders, as shown, to form a floor area.

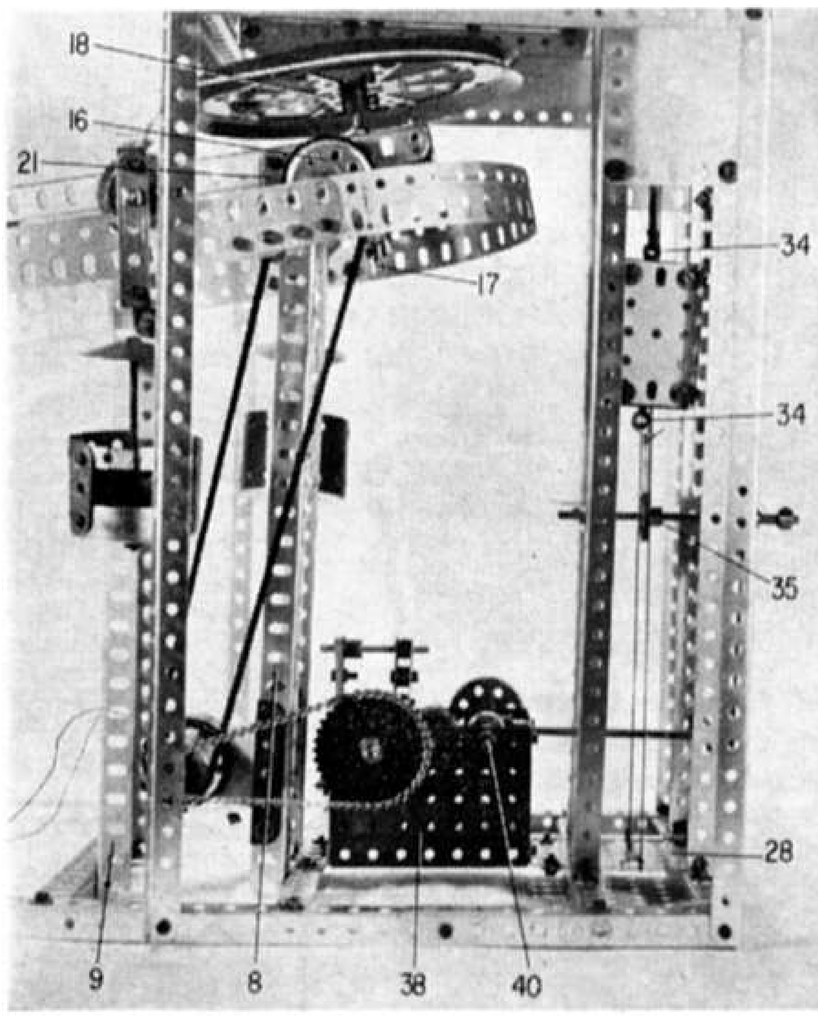
Turning to the base, a $2\frac{1}{2} \times 2\frac{1}{2}$ in. Flat Plate 28, extended one hole inwards by a $2\frac{1}{2}$ in. Flat Girder, is bolted to the centres of Angle Girders 3 and 2. Also secured to these Girders by Angle Brackets are four $24\frac{1}{2}$ in. Angle Girders 29 serving as the lift shaft. These Girders are connected at the top by a $3\frac{1}{2} \times 2\frac{1}{2}$ in. Flanged Plate, while a $5\frac{1}{2} \times 3\frac{1}{2}$ in. Flat Plate 30 is bolted to the front pair of Girders and a $12\frac{1}{2} \times 2\frac{1}{2}$ in. Strip Plate 31 to each side pair of Girders. In addition, each front Girder is connected to nearby Strip 23 by a $3\frac{1}{2}$ in. Flat Girder 32, to which a $3 \times 1\frac{1}{2}$ in. Flat Plate is bolted to provide a safety barrier. A 3 in. Stepped Curved Strip is bolted to the lower edge of Plate 30 to serve as a door arch, the securing bolt also holding a $1 \times \frac{1}{2}$ in. Reversed Angle Bracket in place to serve as a lift "stop".

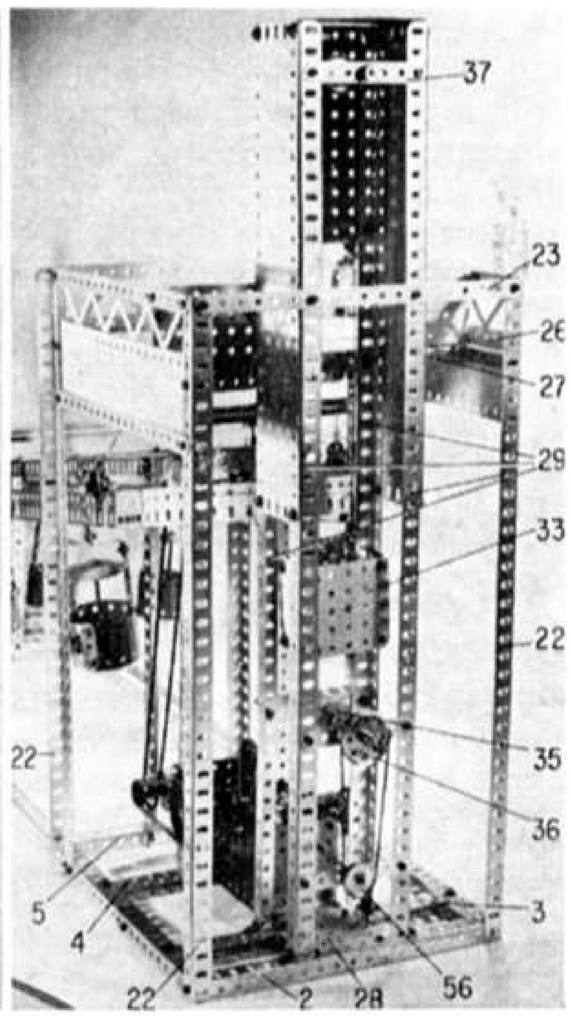
The lift itself consists quite simply of two $2\frac{1}{2} \times 1\frac{1}{2}$ in. Flanged Plates connected together by two $2\frac{1}{2} \times 1\frac{1}{2}$ in. Flexible Plates, with the remaining space being enclosed by two $2\frac{1}{2} \times 2\frac{1}{2}$ in. Flat Plates 33, one at each side. Before finally enclosing the space, however, two Handrail Supports 34 are secured, one through the second row centre hole of each Flanged Plate. A length of Cord is tied to the lower of these and is taken down and around a 1 in. Pulley 35 on a $5\frac{1}{2}$ in. Rod journalled in a $3\frac{1}{2}$ in. Angle Girder, bolted between the thirteenth holes of inner Girders 29, and in a $3\frac{1}{2}$ in. Strip bolted between outer Girders 29. The Rod is held in place by a Collar inside the Strip and a 1 in. Pulley fitted with a Rubber Ring outside the Strip. Free on the Rod, but held in contact with the Rubber Ring by a Compression Spring held by a Collar, is a $1\frac{1}{2}$ in. Pulley 36, this arrangement serving as an efficient friction clutch.



The Cord is now taken up and threaded through the appropriate holes in the Flanged Plates of the lift, then continued upwards and over another 1 in. Pulley on a 3 in. Rod held by Collars in Plate 30 and in a $3\frac{1}{2}$ in. Strip 37, bolted to rear Girders 29. From there, it is taken down and finally tied to a $2\frac{1}{2}$ in. Driving Band attached to upper Handrail Support 34. The Cord, of course, must be pretty taut to prevent it slipping on the 1 in. Pulleys. Guide rails for the lift are provided by tight lengths of Cord running between Flat Plate 28 and the Flanged Plate at the top of the shaft, the Cords passing through the centre end holes of the Flanged Plates in the lift.

The drive system, cupolas, etc., and further photographs will appear in Part Two in the next issue.





Opposite page, left, this Automatic Chairlift makes an excellent model for display at Exhibitions, or in dealers' windows.

Opposite page, right, the automatic reversing gearbox which controls lift movement.

Top of this page, a diagram (not to scale) showing the top mount for the upper chairlift drive pulley.

Right, a side view of the taller tower showing the upper end of the chairlift rail and the position of the automatic reversing gearbox.

Far right, a rear view of the taller tower showing the assembly of the lift shaft.

GLOBE-TROTTER CONTEST

MODELLERS! Don't forget the current Meccano Globe-Trotter Competition. You still have a chance to win a trip for two to almost anywhere in the world, or maybe one of the 50 runners-up prizes of a No. 5 Meccano Set, or the equivalent in Meccano Parts! Time is advancing, though, so if you haven't already started, now is the time to get down to some serious model-building.

The Competition is open to any U.K. resident aged 16, or under. All you have to do is think of somewhere in the world you would like to visit, then build a model associated with that place out of Meccano. Anything appropriate will do such as the Brooklyn Bridge for New York, the famous Viennese Big Wheel for Vienna, a Hydrofoil for the Caribbean or Baltic, and so on. The only stipulation is that the chosen place must be on or near a B.O.A.C. air route as the winner will be flown out there in style on a B.O.A.C. Earthshrinker Jet—staying in luxury accommodation with all expenses paid!

The model itself must be built out of Meccano parts, although non-Meccano "incidental extras" may be used provided they represent only minor constructional features which cannot otherwise be reproduced using standard Meccano parts. No limit—maximum or minimum—is placed on the number of parts which may be used, or the number of entries submitted, but judging will be based on realism, inventiveness and ingenuity so that a small well-built model will stand just as much chance of success as a giant complicated structure.

HOW TO ENTER

Having built the model, send a photograph (or photographs) of it, together with an official Entry Form and brief description, to Globe-Trotter Competition, Meccano (1971) Ltd., Binns Road, Liverpool L13 1DA. Under no circumstances may the actual model be sent, although it should be available for inspection in the event of the builder winning a prize. Where more than one entry is submitted, each individual entry must be accompanied by a separate Entry Form.

Entry Forms are available from Meccano dealers only, and, *before a Form is supplied, entrants must have purchased or had purchased for them, Meccano goods to a minimum value of* 39*p*. The Form must be stamped or signed by the dealer concerned to confirm that the purchase has been made. Full conditions for entry are printed on the Entry Form and all competitors automatically agree to abide by these conditions when they enter the contest.

CLOSING DATE

The Competition closes on 30th June, 1972.

AMONG THE MODEL BUILDERS (*Continued from page* 277)

self said of this model only recently, "Although I later built bigger, or more attractive, or perhaps better models, I nevertheless consider this model the chief work of my Meccano activities". It took him two years to perfect, but I remember that the result was well worth the effort.

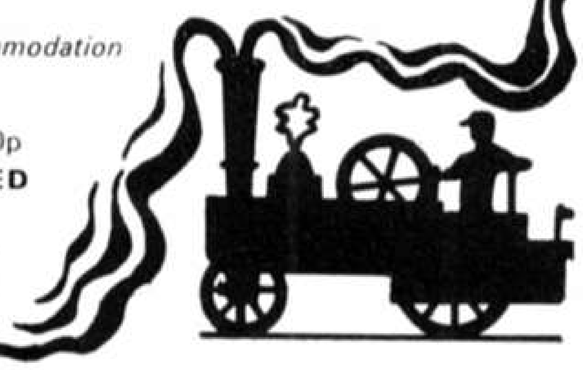
As many readers will know, one of Mr. Konkoly's specialities is in the realm of mechanical designing machines—Meccanographs and the like. At least two examples have been featured in the M.M. and, of these, one was displayed on the Meccano Stand at a Toy Fair in Milan, Italy, while the other, a Spiralograph, was shown on the Meccano Magazine Stand at the 1967 Daily Mail Boys and Girls Exhibition held at Olympia, London. In the 1965–67 period Mr. Konkoly developed three other designing machines, a "Robotgraph" for world-wide industrial use, a "Polydesigner" as a teaching aid for schools, or for tracing out patterns, and a "Minigraph" which traced out toys. Of these, the Robotgraph received a large Gold Medal at the 1969 International Fair in Vienna, while the Minigraph, appropriately, received a small Gold Medal at the Invention Pavilion of the 1971 International Fair in Brussels, where all three models were exhibited.

In the course of his hobby, Mr. Konkoly has done a great deal to publicise Meccano and Meccano Magazine, the exhibition displays accounting for only part of it. At home in Hungary, for example, he has appeared on television a number of times, demonstrating many different models and mechanisms, and both he and his models have often been reported in Hungarian newspapaers and magazines.

Needless to say Andreas spends a good deal of his spare time model-building and he is at this moment working on plans for several typically unusual constructions—including a Meccano Snake! (This I must see!) Andreas likes to keep abreast of news and events in the Meccano world, of course, and it is clear that he is familiar with the work of fellow enthusiasts around the globe. In fact, in the biographical notes he sent me, he paid tribute to many modellers in several countries, by name, and although this is not the place to list them, I can say that I fully agree with him.

One final word of praise must go to Mrs. Konkoly who, since her wedding in 1949, could be forgiven for thinking that she had married a Meccano Set! The fact that Andreas has managed to produce so much means that he builds with her blessing!

NATIONAL TOWN & COUNTRY
Festival
National Agricultural Centre
Kenilworth
Warwickshire
Saturday & Sunday 26 - 27 August 1972 12 noon - 6 pm
An exciting new event planned to be held at the home of the Royal Show
Steam Rally · Model Exhibition · Vintage Tractors · Motor Cycles · Cars, etc., Aircraft · Radio Display · Town & Country · Farming Demonstration Units and many other features.
Excellent facilities · covered accommodation
Toilets · Free car parking
Special arrangements for coaches
Admission Adults 40p Children 20p
* VARIOUS MODELS REQUIRED FOR THIS EXHIBITION
Application forms and other details from:-
D. Kempton, 2 Manor Farm Road,
Tredington, Shipston-upon-Stour



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OUR STOCKS ARE NOW *GIGANTIC*
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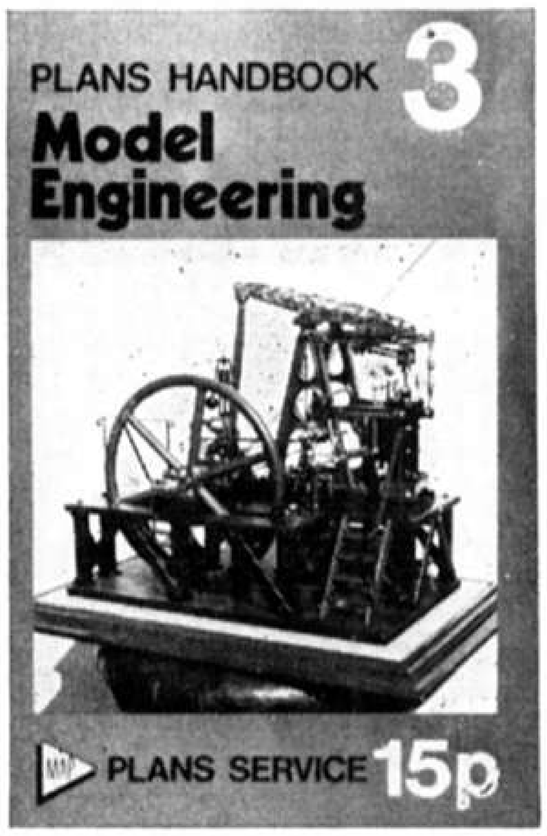

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MAY ISSUE

A review by Cesare Milani on the very latest Historex kit for the Scots Grey and a review of the commercially available figure subjects on the market in the "Marlborough's Wars" period are just two of the many exciting features and articles of interest in the May 1972 issue of *Military Modelling*. In addition are "The Napoleonic Wargame" in which Charles Grant describes his rules for hand-to-hand combat amongst infantry, the Alvis Straussler Armoured Car of the R.A.F. and the final instalment of "Medieval Heraldry" which concludes with a look at flags, their meaning and design. Plus of course, regular favourites like "The Funnies", "Uniforms and Colours of the British Army", more scratchbuilt field guns and books reviewed.

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Everyone likes to produce a well finished model, but the final appearance depends largely on the woodwork underneath. Trevor Faulkner gives much useful advice on "building a little better" which will aid your standard of construction.

John O'Donnell continues his discourse on flapped wing power duration models, Peter Chinn reviews the Enya 19 glow engine, while other articles include making a control line handle providing a third line control system. All these interesting features, plus regular items, mean that the June issue is not to be missed—on sale May 19th.

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