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AUGUST 1972

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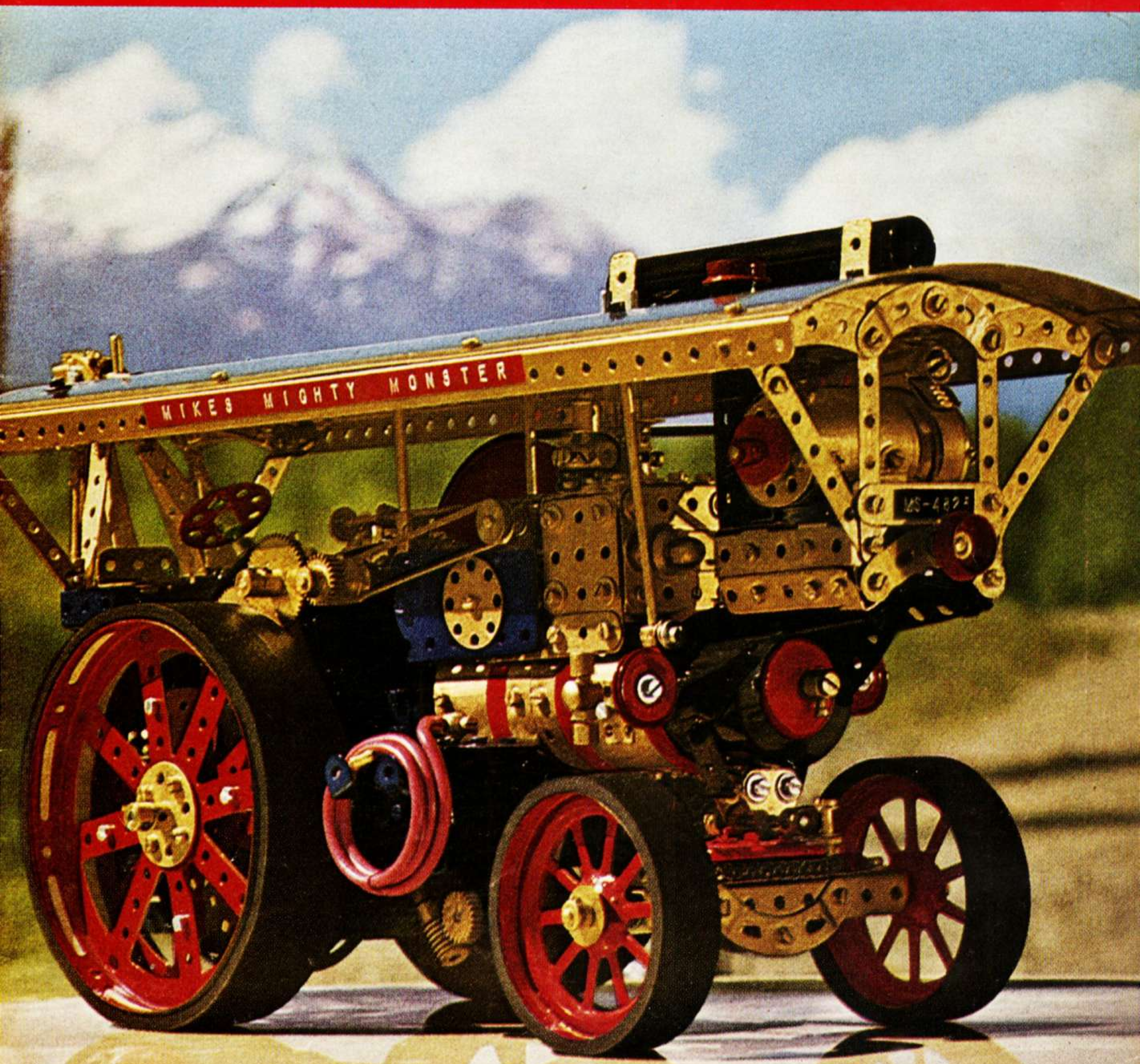

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MECCANO® Magazine

AUGUST 1972 VOLUME 57 NUMBER 8

Meccano Magazine, founded 1916

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MAP **HOBBY MAGAZINE**

ABC
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FRONT COVER

A clever traction engine by M. A. Stoodley of Palmerston North, New Zealand, basically following that published in August 1970 M.M. but with extras copied from full-size engines. Length is 20 in. and weight 18 lb., drive by a 3v motor in the dynamo case belt-driving the flywheel; has working governor, brakes, steering, and winch.

NEXT MONTH

Radio-controlled land yachts, the proposed Morecambe Bay barrage, Koala bears, and full-size plans for another model are among features in preparation for the next issue.

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MODEL & ALLIED PUBLICATIONS LTD.
13-35 BRIDGE STREET, HEMEL HEMPSTEAD, HERTFORDSHIRE

it's the simple ideas that win!

Right from the start model makers of all ages have risen to the challenge of the Bic Model making competition. The simple but imaginative racing cycle shown below, entered by David Smith of Clifton, Bristol, won first prize in the first quarter of the competition.

Instead of throwing away those used Bic Crystals, model makers have fused them, glued them, bent them and submitted a fascinating assortment of models of all shapes and sizes. Why don't you join in the fun ?

Because Bic Crystals write first time every time, there are far more sold in the U.K. than any other ballpen. In fact, each year a Bic Crystal is sold for every man, woman and child in the country plus a few million more.

This is why you will probably find more than you expect in your own home. In offices and factories you should find them by the hundred.

All you have to do . . .
. . . is start collecting medium or fine used Bic Crystal ballpens now, complete a model and enter the competition.

There are cash prizes for the best models produced every three months both senior and junior. Finally, the supreme modeller at the end of the year will be awarded a further cash prize of £250 and the handsome Bic Championship Trophy.

If you have a creative flair and a little imagination – prove it!

BIC
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model making competition

BiC

Regd. Trade Mark

Model Making Competition

Start collecting your pens now but—
one word of warning—

make sure they are genuine Bic Crystal Medium or Fine Point ballpens carrying the Bic Registered Trade Mark because only these are eligible

RULES

1 The participants of the Bic Model Making Competition will be judged on their originality and technical model-making expertise.

2 The competition will be divided into two parts:
Junior: Participants, either sex, under the age of 16 at time of entry. Within this group no heat or flame technique for moulding may be used, but any other form of adhesion may be utilized.
Senior: Participants, either sex, over 16. Within this group, any form of adhesion is accepted. Heat to bend or shape the pens may be used.

3 Entries for the competition must be accompanied by the official entry form below.

4 Any number of BIC Ballpen barrels may be used. All models must be constructed utilising any part of BIC Crystal Fine (Yellow) and Medium (Transparent) ballpens.

5 BIC Crystal barrels may be cut to shape or size, but each barrel must clearly show the Registered trade name BIC (as imprinted on the barrel). Where models are moulded by heat, there must be at least 10 parts where the BIC Registered trade mark is clearly shown.

6 Accessories other than BIC parts may be used *only* to make the model functional or to infer final design, i.e., wheels, transfers, cotton, string, paper, etc.

PRIZES

7 Prizes will be awarded to competitors who, in the opinion of the panel of judges, produce the most creative, unusual or skilful entry for each quarterly competition.

8 **Quarterly prizes will be awarded as follows:**
Senior section—first prize £25.
second prize £15.
third prize £10.
10 consolation prizes of £5 each.
Junior section—first prize £15.
second prize £10.
third prize £5.
10 consolation prizes of £2 each.

9 Models winning any of the three prizes in either Junior or Senior levels of any of the quarterly competitions will automatically be entered in the BIC National Championship Competition and the individual competitor whose model is selected by the judges to be of greatest merit will receive an additional cash prize of £250 together with the 1972 BIC Model-Making Trophy.

10 **Entrants should send their models to:**
The BIC Model-Making Competition,
c/o Montague House, 23 Woodside Road,
Amersham, Bucks.
Should a model be considered delicate for conventional postage, then a photograph (colour or black and white) may be despatched beforehand. This will be used for preliminary judgement. Entry forms should be clearly attached to each model or photograph entered.

11 No responsibility can be taken for the damage in transportation of any model received. Judges will, however, take into account such unfortunate circumstances and the model will still be eligible for participation within the contest.

12 Should participants require a model returned, then return postage must be included by way of enclosing the appropriate stamps.

RESULTS

13 The 1972 competition will be held during 3-monthly periods and results will be announced during August 1972, November 1972, February 1973.

14 Participants should ensure that their models are despatched to arrive by 1st June (for August judging), 1st September (for November judging) and 1st December (for February judging).

15 Any model received after this date will not be eligible for the relevant Quarter but will qualify for the next Quarter's competition.

16 Any prize winning model will become the property of Biro-Bic Ltd., and may be used in any way they think fit.

17 Employees, relatives or direct associates of Biro-Bic Ltd., Model and Allied Publications Ltd., as well as their advertising agents will not be eligible for this competition.

18 The decision of the Judges is final and no correspondence can be entered into in relation to prizes awarded or decisions made.

I understand and abide by the Rules

Name .....
(BLOCK LETTERS PLEASE)

Address .....

.....

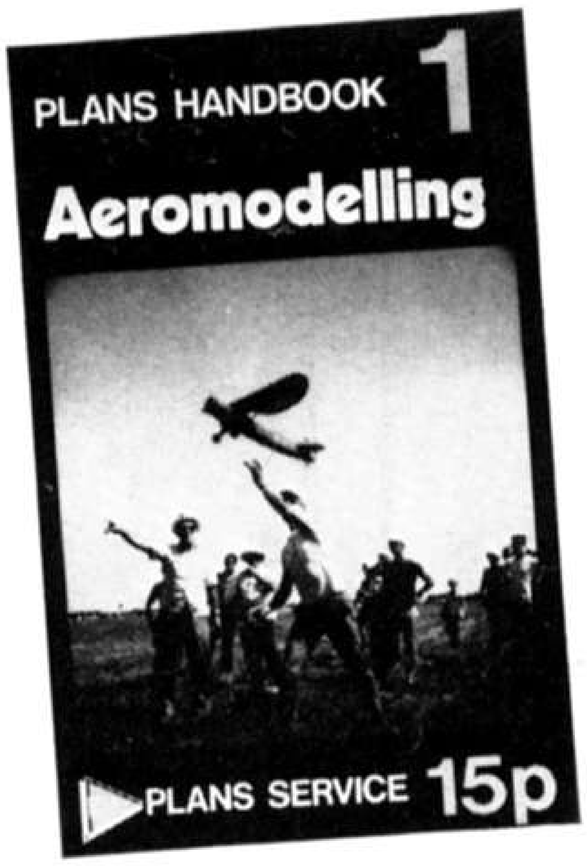
..... Age .....

WHERE DID YOU COLLECT YOUR BIC PENS? .....

.....

MM 3

PLANS HANDBOOKS



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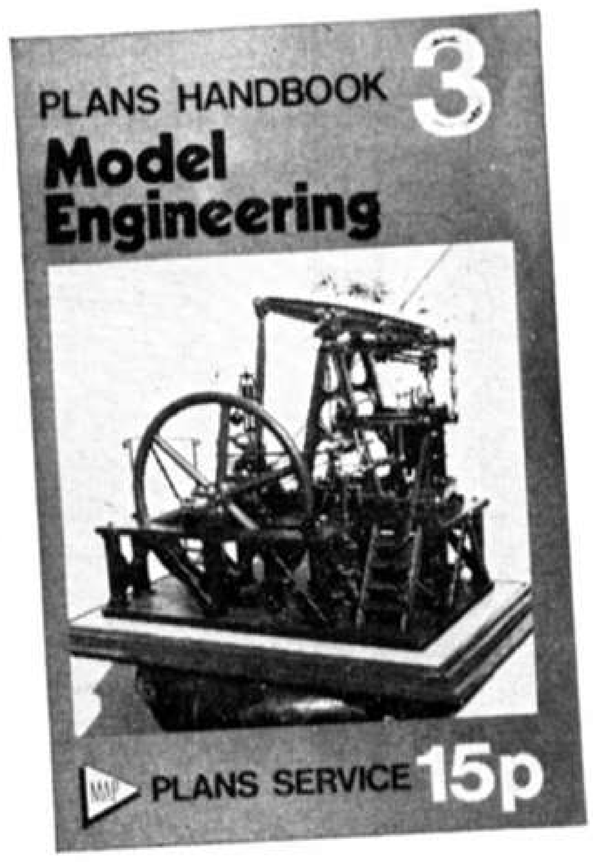
Aeromodelling

128 pages featuring hundreds of working model aircraft, illustrated almost entirely by photographic reproductions of the actual models, plus span, brief description and graded for ease of construction. Also selected engine list with tabulated data; index to illustrated plans X List of vintage unorthodox novel plans, many other classifications, useful articles, order forms Also good selection of trade advertisements.

Model Boats & Cars

96 pages of plans of scale and semiscale ships, tugs, lifeboats, submarines, paddle steamers, period ships, racing yachts, hovercraft, cabin cruisers, mostly illustrated, fully described, and classed for ease of building. Working model cars and usual vehicles are included and a large range of scale car drawings, racing cars ancient and modern. Index of drawings; useful articles on building; waterline plans; trade advertisements.



Model Engineering

96 pages of working model drawings for steam locomotives, traction engines steam engines, petrol engines, workshop equipment from LBSC, Westbury, Evans, Maskelyne, Bradley, Hughes. Plus useful model engineering information, screwcutting tables, standard threads, letter and number drills, wire and sheet metal gauges, miscellaneous information.

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96 pages of radio controlled models are described. There are 128 R/C aircraft all illustrated, including S/C Sports Models and Trainers, Galloping Ghost Models, Competition Aerobatic Models, Multi-Sport and Trainers, Pylon Racers, S/C and M/C Scale Gliders and Soarers. 87 model boats suitable for radio control, plus do-it-yourself R/C systems. Many useful instruction features, like the R/C 'Goof-ups'—an introductory feature for beginners. Fully illustrated current F.A.I. aerobatic schedule.

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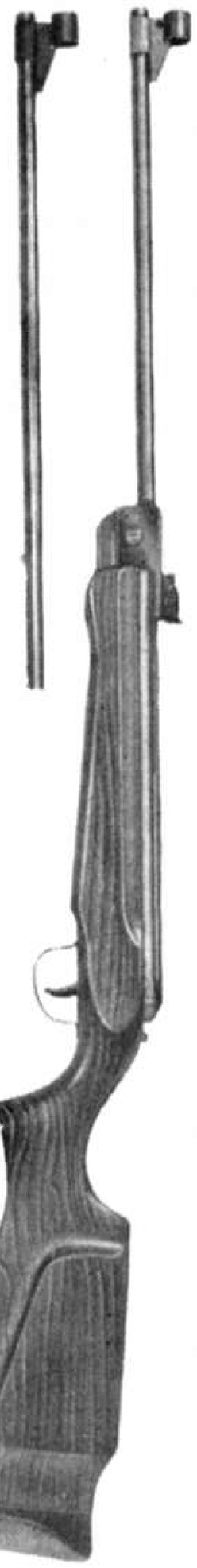

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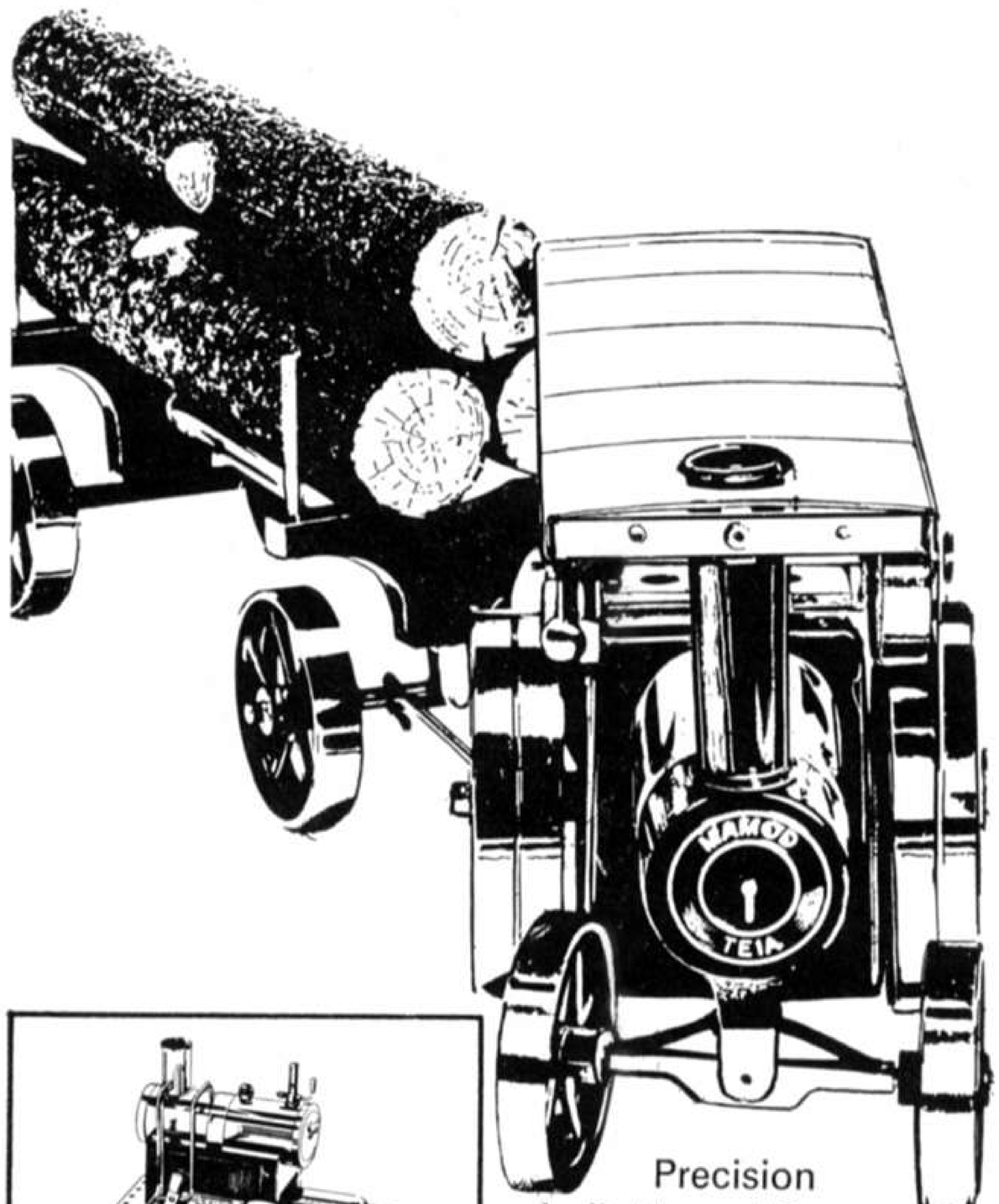

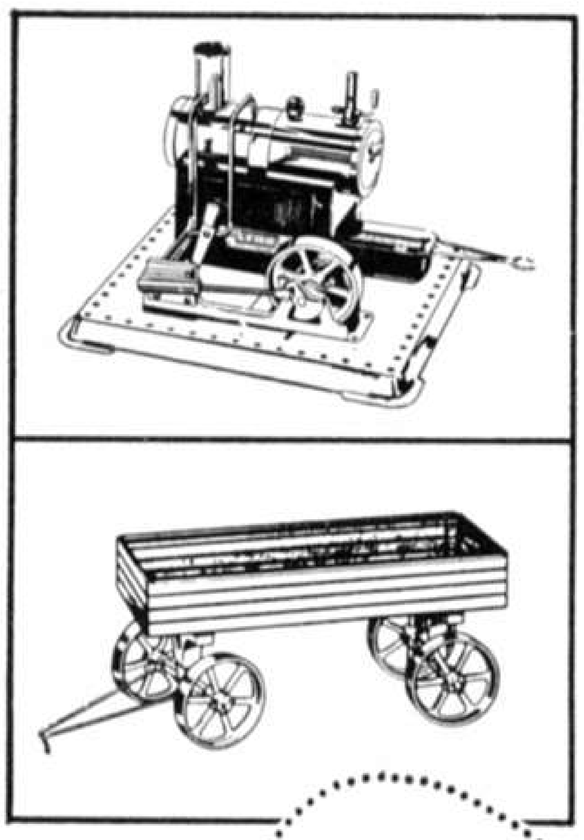

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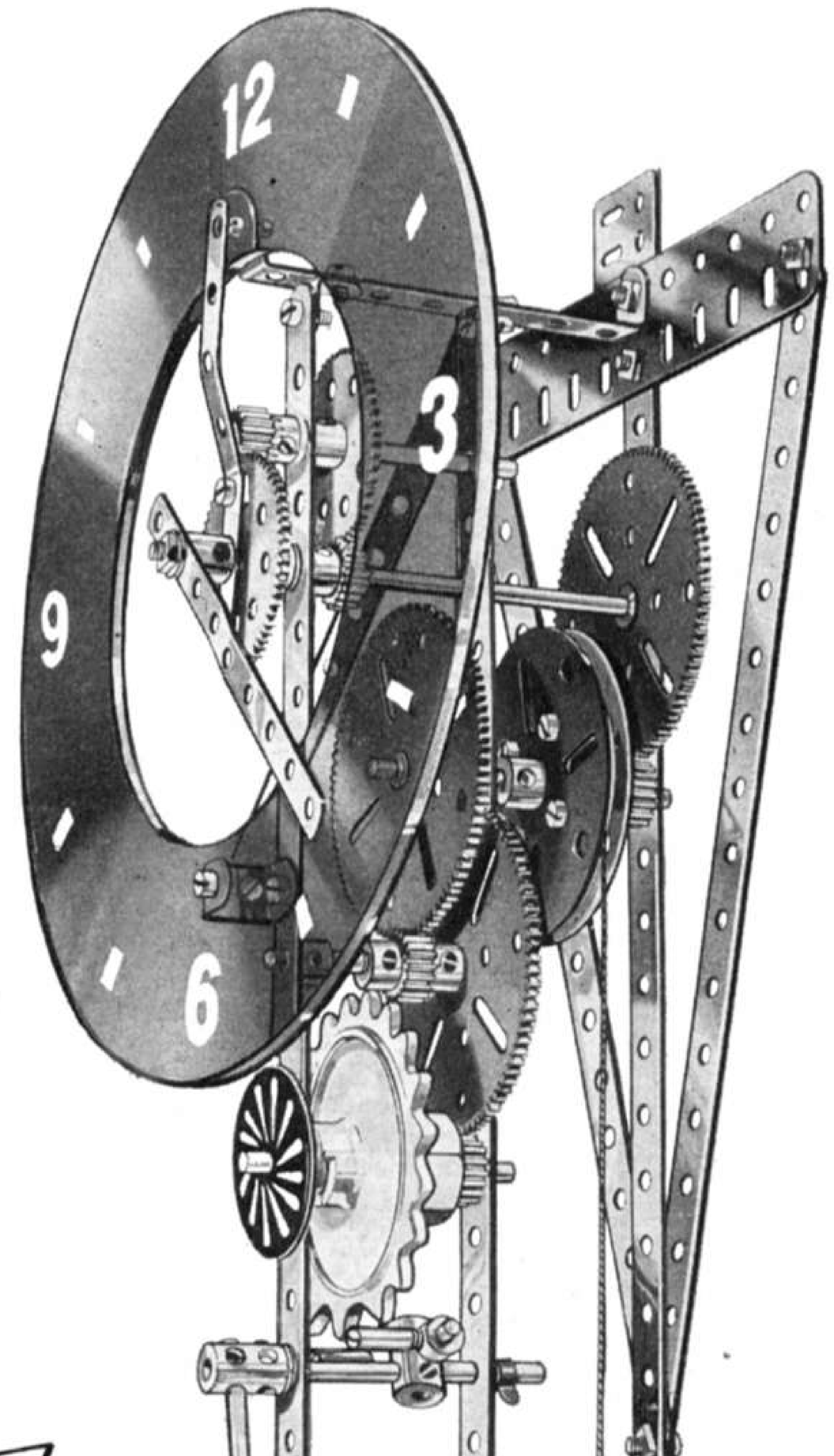

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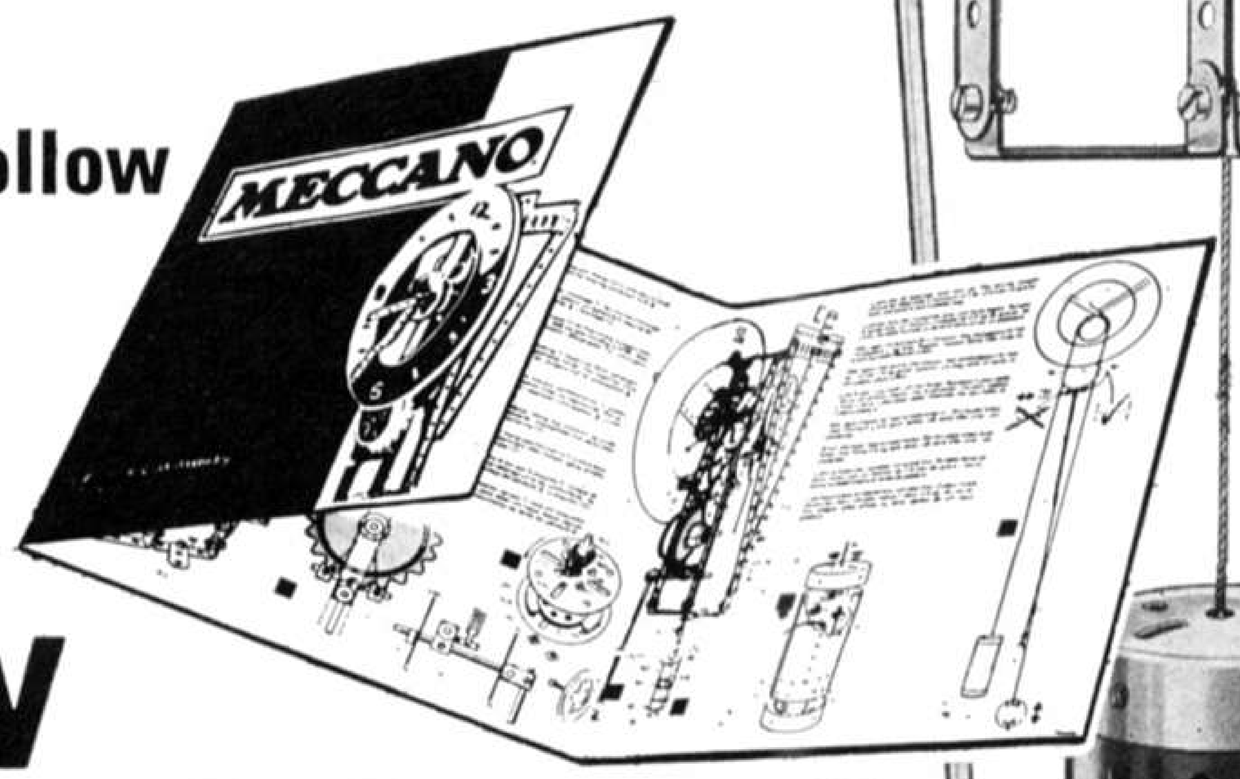

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RUSSIAN AIRCRAFT

Undoubtedly the most ambitious work undertaken by the Harleyford research team, this book traces the origins of Russian Air Power through both World Wars to the modern day. Masses of rare photographs are liberally sprinkled throughout the text. Captions are given in Russian as well as English. There is also a section on airships. 50 aircraft are illustrated by 1/72nd scale 3-view tone paintings, some of the drawings are in 1/144 to fit the pages. Types range from the DUX type II right through to the MIKOYAN STOL, which has flown, since publication of the book. Compiled and written by Heinz Nowarrà and Geoff Duval, with drawings by W. F. Hepworth.

288 *pages, 70 pages of 1/72 half-tone drawings. Over 600 photographs. One colour plate.* **£5.25**

SOPWITH
by Bruce Robertson

The fascinating story of Thomas Octave Murdoch Sopwith and his famous aircraft, one of which, the Sopwith 'Camel' will perhaps be the most remembered of all W.W.I aircraft.

The book traces the development of the Sopwith Aviation Company through its long and successful history.

Text was compiled and written by noted historian Bruce Robertson, with drawings by Peter G. Cooksley. Mr. Robertson produced the book with the closest co-operation of T.O.M. himself. The majority of the photographs are from private files and have never been seen before. Drawings are well detailed, and there are six pages of intimate details of the renowned 'Camel'.

As well as the drawings there is a type-by-type review of all Sopwith types, and a section on surviving Sopwiths and replicas. No self-respecting enthusiast can afford to be without this invaluable book.

244 *pages, 28 three-view 1/72nd scale drawings. Over 400 photographs. Two colour plates.* **£4**

LANCASTER
by Bruce Robertson

Essentially the 'Lancaster Story' rather than just Lancaster, for the Lancaster evolved from the Manchester and the Mark IV and V Lancaster became the Lincoln B.1 and B.2. Thus, both the unfortunate history of the Manchester and the post-war history of successful Lincolns qualify for coverage. Since the York transport used Lancaster wings and undercarriages and the Shackleton evolved from the Lincoln, these and the Lancastrian transports are covered in the text and with photographs and drawings.

A type-by-type review gives the specification details of the series from issue of the Manchester tender in 1937 to the Shackleton. Apart from all the marks the various modifications are covered, including the famous 'Aries' and 'Thor' and the subsequent jet-engine test beds.

The fate of all 7,374 Lancasters is presented with serials, squadron numbers, service histories and final fates.

216 *pages, 362 photographs, 28 pages drawings, 24 pages 1/144 scale tone paintings, colour plate.* **£3.50**

F-W 190
by Heinz J. Nowarrà

Early days and experiments of Heinrich Focke, Georg Wulf and FW190 designer Kurt Tank from the background to this detailed account of one of Nazi Germany's best aircraft.

Throughout the book the history of all the FW190 and Ta152 V-series experimental aircraft can be traced, together with all the operational versions and a number of other interesting projects—the 'Mistel', Glide-bomb and 'Doppleriter'.

Action, both on the Eastern front and over the rest of Europe, is vividly described and supported by translations of extracts from combat reports of several German 'ace' pilots, including reports of action against women pilots.

Supporting the narrative are schedules of complete Luftwaffe battle orders, right up to the final breakdown in 1945.

The accuracy and detail of this book could only have been achieved with access to the Focke-Wulf organisation's official files and reports.

216 *pages, 360 photographs, 12 pages drawings, 24 pages 1/72 scale tone paintings, 6 pages in colour.* **£3.50**

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Lancaster Flying

The company which owned the last flying Avro Lancaster has unfortunately gone into liquidation and while the aircraft still, of course, exists, it has been sold. This has thrown something of a spanner in the works for the Revell "Dambusters" competition, since flights in the Lancaster were to be prizes. However, an alternative which will probably appeal more has been arranged. A party of approximately 12 will be flown from Luton Airport to R.A.F. Valley, in Anglesey, by BEA JetRanger helicopter and Britten-Norman Islander. They will see a Red Arrows film, have lunch, visit interesting parts of the station including the Airmanship Hall (a museum), the control tower, Gnat servicing, etc., and then each try a training "flight" in the Gnat simulator. There will be in addition three £50 cash prizes and each winner will be given a £56 Polaroid camera which will enable a permanent record of an exciting day to be made. Sounds a very worthwhile prize list to us!

New Railway Stamp

The last remaining steam line actually operated by British Rail is the Vale of Rheidol Narrow Gauge Railway near Aberystwyth, and since July 1970 railway letter stamps and various first day covers have been issued. These have proved extremely popular with collectors all over the world. On decimalisation last year two of the stamps were surcharged 5p and 10p, the latter replaced later in the year by a new 10p stamp. Now stocks of the 5p surcharge are on the point of running out, and from July 5 a new 5p stamp will come into use. It shows a map of the Aberystwyth area and the route of the railway.

Although this issue of M.M. will not appear till a couple of days after the introduction of the new stamp, collectors can obtain examples and, with luck, any remaining first-day covers, from British Rail, L.M.R. R.P. Department, Machynlleth Station, Montgomeryshire, SY20 8PL.

That Expedition

In case readers missed it in the national newspapers, the British Trans-Americas Expedition finally made it to Tierra del Fuego, a total distance of nearly 18,000 miles from Anchorage in Alaska, passing through 15 different countries. After the Darien Gap the expedition members spent ten days getting their breath back and servicing and cleaning their two Range Rovers. The trip from Bogota south took less than a month; in one four-day spell they covered no less than 2,375 miles, quite a contrast to the Gap, where four days normally saw 12 miles covered!

Technician of the Year

A very bright idea to increase what is generally a high standard of servicing etc. for Austin Morris cars is the "Technician of the Year" competition organised by the manufacturers. Participants receive ten monthly information bulletins to which are coupled series of questions which induce research. Top students from each region produce six finalists, who face a written paper, practical tests, and an interview. Some 3,000 entrants for the 1972 competition saw Graham Sharpe of Henlys (Derngate) Ltd. of Northampton take the title and £200 worth of goods, but quite a number of other entrants qualify for certification as "Accredited Technician" and this must be good for them, their employers, and of course owners of Austin Morris cars. The course for the N.T. of 1973 is already on its way.

War Posters

The Imperial War Museum is running a major exhibition of war posters from May 18th to Sept. 24th. including some rarities and original sketches. One well-known one featured on the "Lend to defend the right to be free" theme, is that produced by Tom Purvis showing his son building with a Meccano set. Meccano certainly has a habit of popping up in unexpected places!

Safety Features

Two British Leyland cars with many safety features were exhibited at the Transpo 72 exhibition at Dulles Airport, Washington. As an example, an MGB GT had side impact protection (rigid foam in doors, box structure etc., raised sills, pegged doors) graded braking lights (a warning lamp when the accelerator is released, normal brake lights, and flashing hazard lights in heavy braking—they remain on), airbag restraint, pro-pedestrian bumper (experimental padded device to lessen damage to pedestrians), alcohol screening (you

(*continued on page* 383)

Pilot being winched into helicopter which has been receiving a continuous automatic signal from the Sarbe V distress beacon which he is holding in his right hand (see page 377).

THE ROAD RESEARCH LABORATORY

You've heard of it. Now Trevor Holloway gives a detailed survey of its work.

EVERY year Britain spends about £300 million on building new roads and maintaining existing ones. The provision of street lighting, car parks, snow clearing and general administration adds another £100 million to the bill. That's not all—an average of 400,000 people are killed or injured in road accidents and cost the taxpayer around £250 million annually, bringing the total to about £650 million.

If we add the cost of delays due to traffic congestion—estimated at £750 million—we find that as a nation we are spending £1,400 million directly and indirectly on our roads every year.

Approximately half of all the research done in Britain into road and road traffic problems is carried out by the Road Research Laboratory at a cost of only about

£3½ million annually. It is money well spent, for the Laboratory has done much to cut road-making costs, besides making a valuable contribution to road safety matters in general.

The Laboratory was first established as a small experimental station at Harmondsworth, Middlesex, in 1930, but a few years ago moved to its present 250 acre site at Crowthorne, in Berkshire. The staff has been increased to over 900, about half of whom are scientists. The Laboratory is now part of the Department of the Environment.

Research at Crowthorne has four main aims: first, to find ways of improving the techniques of road-building and maintenance and, if possible, doing this more economically; secondly, to investigate ways of improving traffic flow; thirdly, to find ways of preventing accidents and minimising the effects of those that do take place; and fourthly, to examine the broader aspects of transportation as it affects our daily lives.

The Laboratory has five Divisions: Design, Construction, Traffic, Safety, and Transportation, which are in turn divided into Sections.

One of the Laboratory's special features is its research track, used primarily for research on traffic and safety problems—especially those of vehicle behaviour—and in many ways it is quite unique.

It is three miles long and shaped like a figure "8", with one of the loops larger than the other. At the point where the loops join there is a large paved central area, 300 yards in diameter, which is used for traffic experiments. Beneath a section of the large loop there is an underground laboratory with a special glass panel let into the surface of the track above.

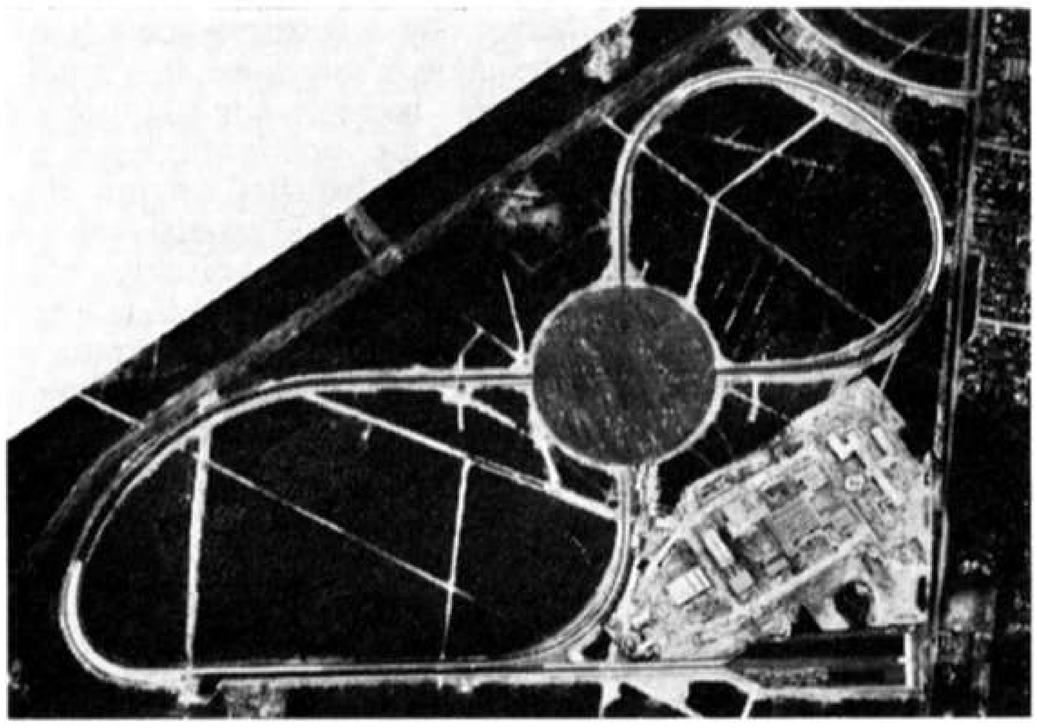
Top left, the R.R.L. Headquarters. Centre left, computing a road in a tropical country. Bottom left, testing the performance of soil compaction. Above, part of a six-mile experimental concrete road on the Grantham By-pass. *(Photos courtesy of Road Research Lab.)*

This allows photographic studies to be made of the contact areas of tyres as vehicles are driven over it. Research of this kind helps to extend our knowledge of the behaviour of tyres at the critical point of contact with the road surface and the way in which this affects the skidding resistance of the surfaces.

The track is also equipped for experiments on the guidance and control of vehicles. Buried about 1½ inches below the surface of one lane of the track is a continuous length of cable which, when energized, provides a guide path that can be followed by vehicles fitted with suitable sensing devices. Such a system would be of particular value in providing guidance to drivers in fog.

Altogether the Laboratory buildings have a total floor area of 335,000 square feet, i.e. nearly eight acres. There are over 200 individual laboratories, varying in size and equipment. Some provide general laboratory services, whilst others are equipped with fume cupboards, climatic control, or designed as pilot-scale laboratories for work with vehicles and plant.

One of the most interesting of the large-scale testing buildings is the Structures Laboratory, designed for the testing of large-scale structural members. The floor of the test hall is 12 ft. thick and is in effect a perforated test bed so that testing apparatus can be installed below the floor and the laboratory itself can be kept uncluttered by complicated test rigs. The floor serves as a test bed for mounting beam structures up to 100 ft. long and for large slab structures. By means of a battery of jacks, a test load of up to 3,000 tons can be applied.

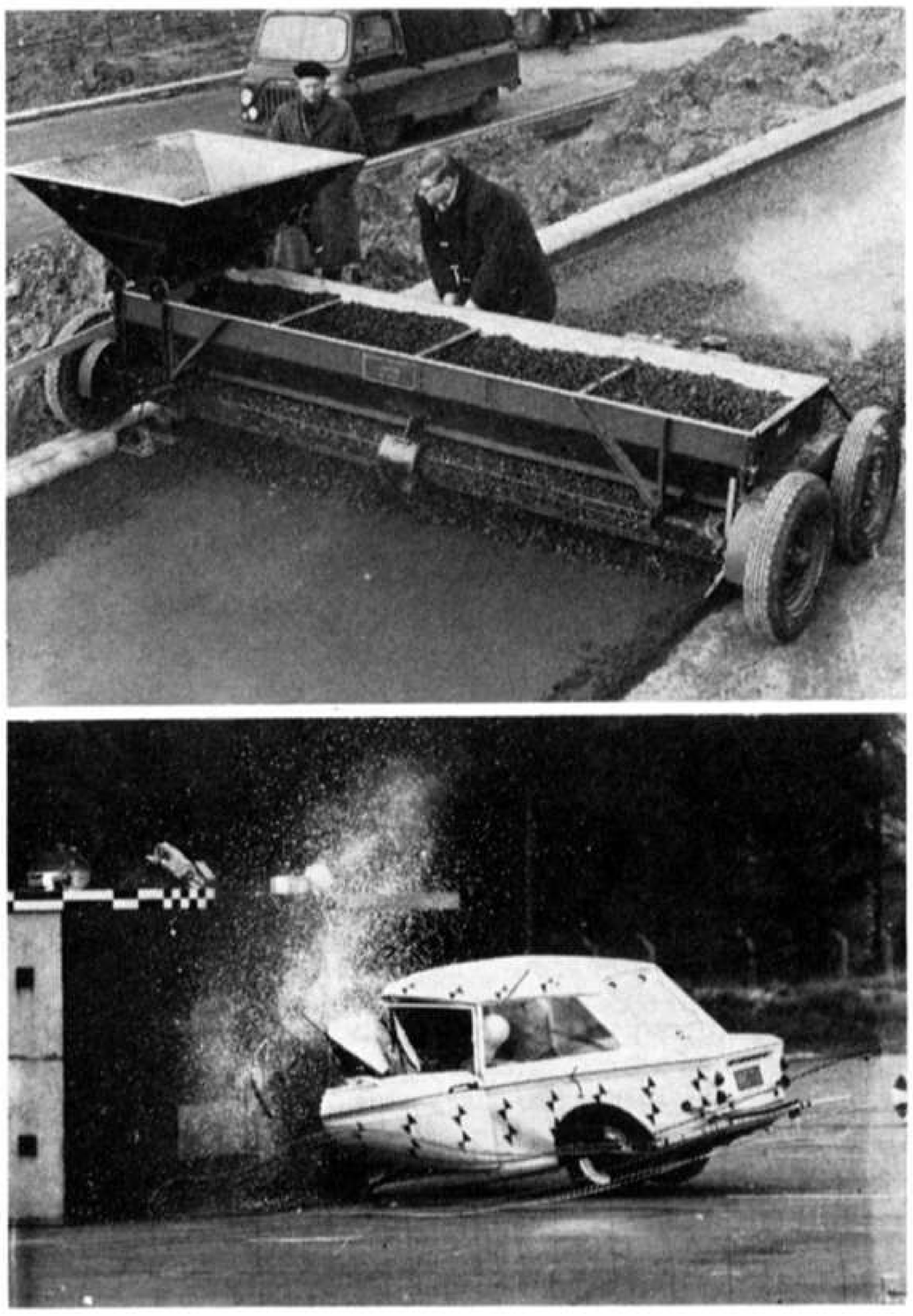


The Design Division always has a very heavy programme of research in hand. Its Bridge Section studies the design and construction of road bridges, the strength and durability of components, problems of movement, maintenance and so on. The Section carried out vital investigations during the designing and construction of the Severn and Forth road bridges. There is also a Tunnels Section which investigates and advises on design, construction, plant and maintenance.

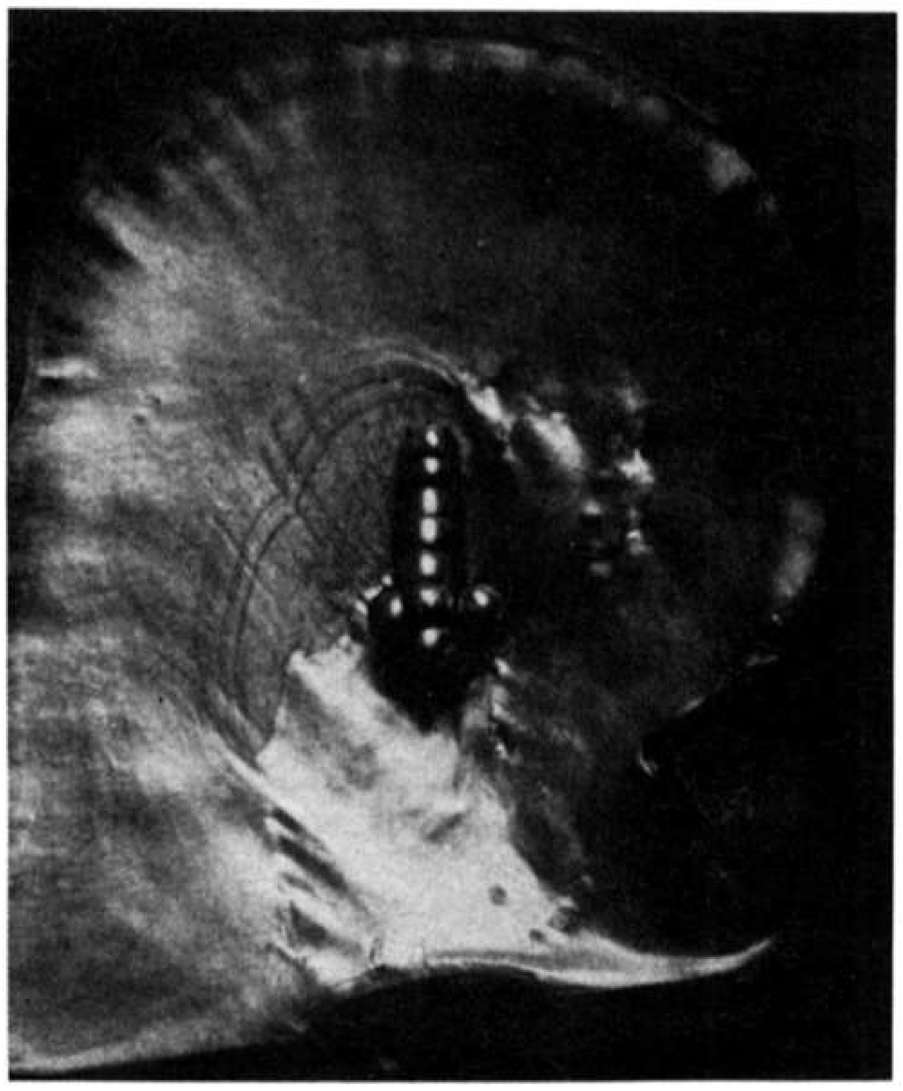
The Construction Division's programme of research includes studies into the various problems of cuttings, embankments, the bearing and draining properties of soils, settlement of foundations and so on.

The study of different kinds of road-making materials. such as road-stone, cement, bitumen, tar and their mixtures, has always been a priority of this Division. There is nothing to equal actual-use tests, and to this end many miles of experimental roadway have been laid and continuously observed over a number of years to ascertain wearing and skid-resisting qualities. For example,

(*continued on page* 409)



Top, a machine designed by the R.R.L. for spreading coated chippings. Centre, crash testing—a saloon car at the moment of impact with a massive concrete block. Left, an aerial photograph showing the Research Track. Below, the specially designed breakaway street light. *(Photos courtesy of R.R.L.)*



Treasure from the Deep

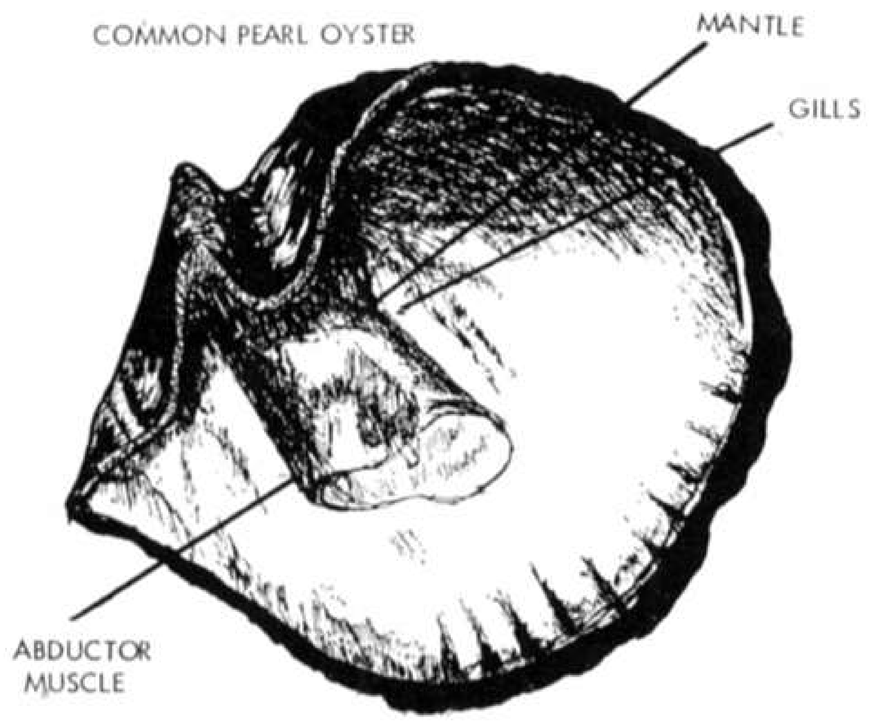
By Cleland Bean

FOR centuries men had risked their lives in dangerous waters to search among the oyster beds for hidden gems. These were the dark-skinned pearl divers of Ceylon, India, Japan, the Persian Gulf, California, Tahiti and Western Australia.

Long before the aqua-lung had been invented many of them fell as prey to sharks, octopuses and other large fish, while numerous men commonly died early in life from sheer exhaustion. Even today there are still native pearl divers who can stay below water for ninety seconds or more at depths ranging from 30 to 50 feet. Such men will descend to the seabed with their nostrils firmly secured by clips, and equipped with nothing more than anchoring stones and network collecting bags attached to life-lines.

The marvellous way in which oysters can wrap layers of mother-of-pearl around stray sand grains or grit particles that accidentally enter their shells makes them as valuable now as they were to princes and sultans in ancient times. On the old caravan routes merchants were willing to exchange many lesser treasures for just one rare pearl specimen of exquisite beauty.

Once it was discovered that an oyster naturally takes from three to five years to create a reasonably sized pearl



men were prompted to set up oyster farms for buyers across the world. But one young Japanese observer by the name of Kokichi Mikimoto took this idea further when he began to think about ways of producing pearls in greater numbers.

He reasoned that if oysters use sand grains or rock particles for making their valuable gems it ought to be possible to induce more of them to act as pearl producers by inserting ready made objects into their shells. This first rate idea came to 20-year-old Kokichi Mikimoto in 1893, and he found that a smooth, round bead produced the best results.

His initial experiments laid the foundation of Japan's cultured pearl industry which today depends on almost 4,000 pearl farms where there are some 216 million oysters. Nowadays Japan produces 400 million cultured pearls annually, but even under these favourable conditions the pearl of great price still remains the aim of the oyster farmer.

Although there are many cultured oysters only 60 per cent of these will produce worth-while pearls, with one in twenty being specimens of first class quality. Oysters vary in their capacity for making mother-of-pearl, and some shellfish will form distorted or discoloured gems.

Ten years ago Tetsuo Miyauchi, a research worker of the Fisheries School of the Mie Prefecture in Japan, discovered that when oysters were seeded quite a number of them did not produce pearls because of bacterial infections which they absorbed from the surrounding water. But eventually he partly solved this problem by dipping the oysters into a suitable antibiotic solution before replacing them in the river estuary.

His technique made a remarkable improvement regarding the quality and number of the pearls produced, As a result high quality pearls had increased by thirty per cent. Efforts at making better gems are continually being made by scientists at the Ministry of Agriculture and Forestry's Fisheries Agency Pearl Research Laboratory at Kashikojima on Ago Bay.

A sizeable proportion of Japan's pearl oysters come from the Ago Bay region, but other protected bays along favourable shorelines add to the output. In these places the oysters are usually kept in wire mesh cages which hang from rafts.

Like Japan the United States is also a centre for cultured pearls, and both countries have done much to develop better pearl-producing techniques. At times the one has aided the other, and in fact it was the commercial oyster species of Japan which became one of the most important molluscs of the Pacific north west. This strain had been introduced into the waters of the state of Washington in 1902 where it obtained a firm hold and flourished.

Whether they investigate the life history of oysters in hatcheries or on the seabed, biologists realise that much remains to be discovered about the production of first rate gems. These molluscs can be affected by fine degrees of temperature, food supply levels, water salinity, disease organisms and ocean predators.

Heading picture, the Western Australian "Southern Cross" Pearl found off the coast near Cossack in 1874 and valued, then, at £10,000. Top right, a pearl oyster laid open showing at A a double pearl and at B a small commensal crab. (*Photos courtesy of the Ulster Museum*)

Spawning patterns are obviously important here for the breeding of good stocks which will remain resistant to disease, and in this respect the common British oyster is being investigated by scientists at the Conway oyster hatchery station. Here it has been discovered that oysters produce larvae which will survive to the stage of young oysters only once every five or six years on average.

Another discovery relates to the way in which the larvae or spat will tend to occupy places where earlier spat formations have rested. Tests indicate that a type of chemical substance is given off which attracts the larva to others of its kind. Such observations would obviously be useful to coastal oyster farmers who may wish to set up or increase their local breeding stocks.

The pearl producers in Japan and the United States welcome this new knowledge for they are not yet able to breed oyster colonies which remain completely free from disease, ocean predators or retarded growth rates. Water temperature too dictates survival patterns, and the oysters will die at once if water heat drops below 0 °C.

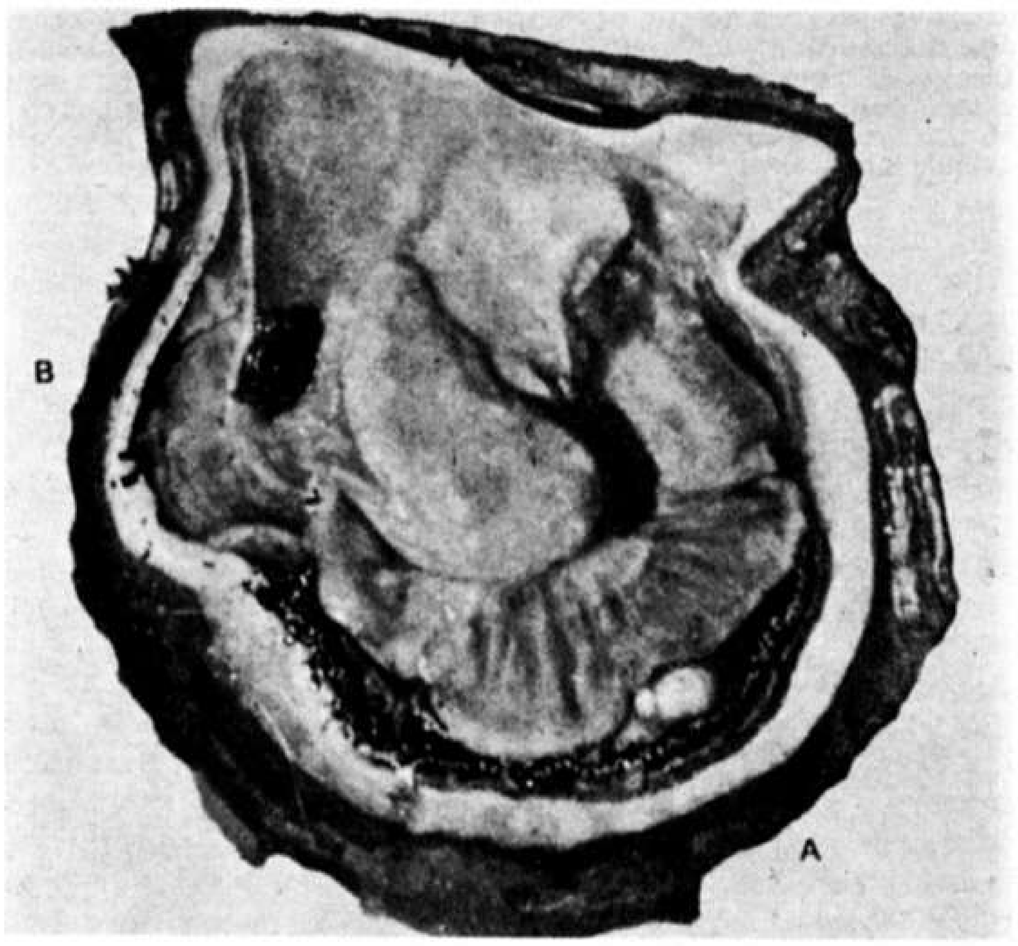
Each year many oysters are killed by parasites or trematodes which are released at the mouths of rivers from certain fish species. Later the eggs of these parasites develop into free-swimming organisms which then attack the oysters, while at the same time using them as their hosts.

Usually 20 to 30 per cent of the oysters affected by this parasite will be killed. But scientists at the Japanese Pearl Research Laboratory have been able to cut their losses by the simple act of advising the pearl farmers to move the oyster rafts further up river from the sea.

Oyster cultivators in Japan were among the first people to adopt the floating raft system, and this method prevented attacks from shell-boring sea snails. But the Americans developed an even better technique, known as the Blount system, which gives the oysters a 90 per cent survival rate against predators.

The Blount system originated in Rhode Island where it involved the use of 10-gauge lengths of wire strings measuring about a yard in length. These are suspended from a raft with each string holding seven scallop shells which form suitable resting places for the growth of oyster spat.

The fact that the pearl oyster is a very delicate creature means that it must be protected from a host of enemies including starfish. At times the latter can reach plague proportions to kill off entire oyster beds. Oyster drills or whelk tingles, shore crabs, sting winkles,



marine worms, fungus species, internal parasites and the octopus are all potential killers on the sea floor.

Although the Japanese have managed to eliminate most of these attackers by keeping their stocks suspended in wire cages above the seabed, changes in tide flows can also affect the oysters to cause ill effects. Because of such variations close watch is kept on current strength within the Ago Bay region. Good tidal currents are necessary for bringing rich food supplies to the oysters, and the shellfish also require plenty of mineral salts for the production of first class pearls.

In specially constructed coastal farms research workers have been able to add nourishing mixtures to the sea water so that faster growth rates may be maintained. At present one major factor which the oyster farmers must guard against is sea pollution; neglect here could mean the overnight destruction of valuable stocks, with millions of pounds being lost.

Apart from pearls the Japanese oyster industry also uses the mother-of-pearl shell linings for making buttons, brooches, dressing table accessories, pottery work, paint mixtures, buckles and decorative insets for items of furniture. A versatile mollusc indeed, and one which has been well chosen from Neptune's treasure chest.

MINIATURE SURVIVAL BEACON

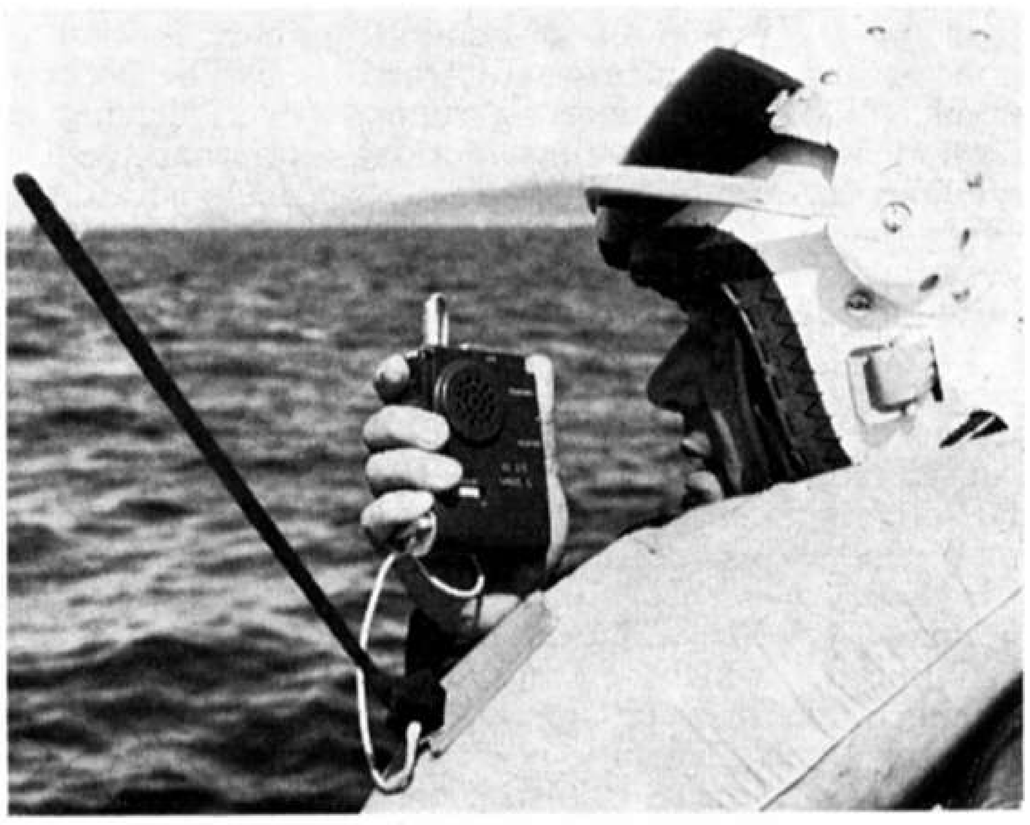
A neat little device reported by Trevor Holloway

SARBE V, an advanced military aviation search and rescue beacon by Burndept Electronics of Erith, Kent, has been undergoing exhaustive sea trials by military authorities in many countries.

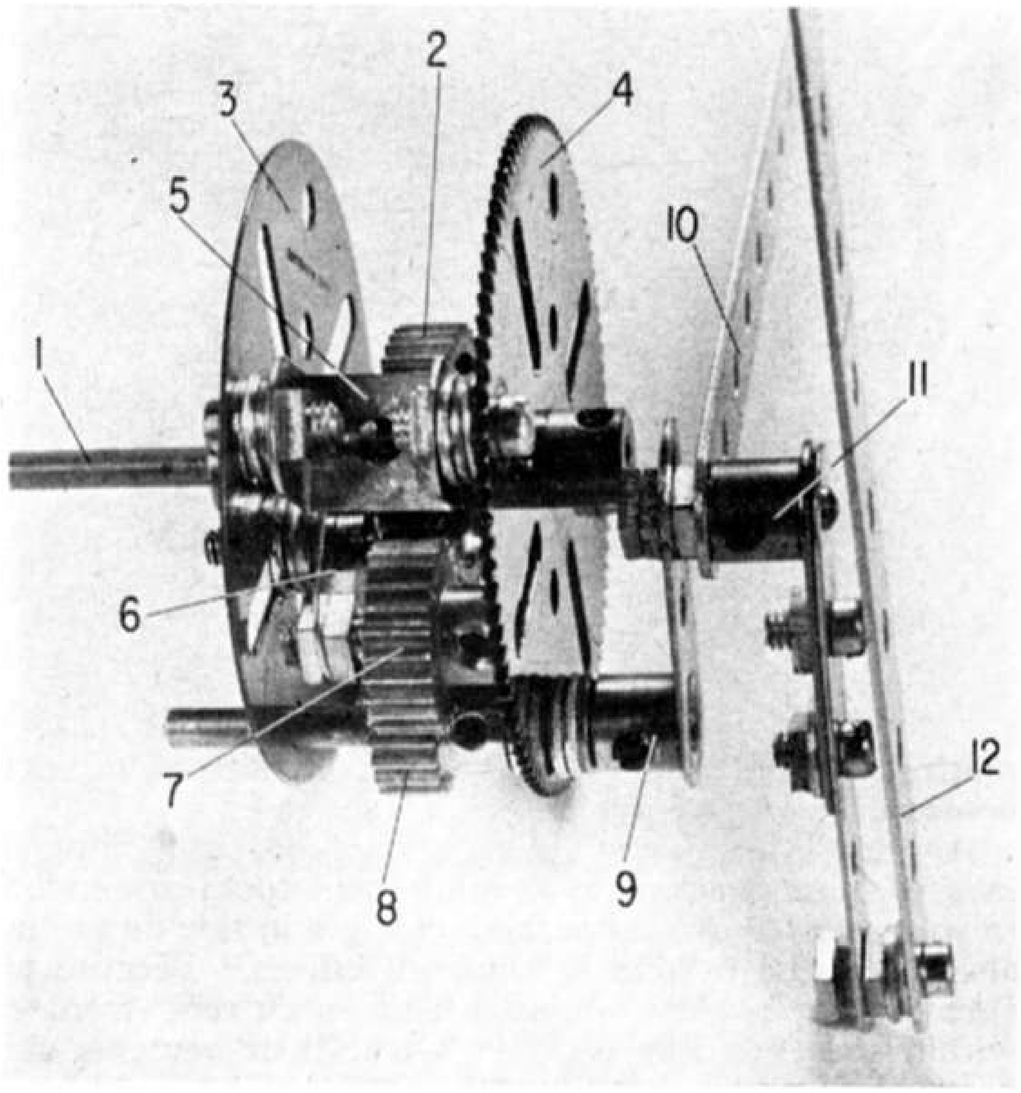
This miniaturised device can transmit a distress signal on the appropriate freqeuncy for up to 24 hours at 0 deg. C. It is activated automatically during ejection from the aircraft, and a patented aerial system enables transmission to start during parachute descent.

For sea survival, the system is attached to the aircrew life jacket, while on land the aerial can be attached to the beacon, which then becomes a one-piece hand-held unit. The beacon also has two-way speech facilities and incorporates a built-in test system.

The equipment is very light and compact, weighing only 18.3 ounces and measuring $4\frac{1}{2}$ in. × 3 in. × $1\frac{1}{8}$ in. The battery is integral with the beacon unit.



Below, working on the planetary gear principle, this interesting mechanism designed by Mr. Colin Spence of Edinburgh, converts rotary motion into linear motion. Right, young Alan Maslen of Bowdon, Cheshire, puts the finishing touches to the weight-driven clock built from the new No. 1 Meccano Clock Kit.



Among the Model-Builders with 'Spanner'

Planetary Motion-Converter

The title "Motion-Converter" has a good mechanical ring to it. It conjures up mental pictures of a sophisticated piece of complex machinery whirring merrily away as it performs all sorts of intricate tasks; a kind of engineering masterpiece, you could imagine. In fact, of course, a Motion-Converter need be nothing so exotic—and usually isn't! More often than not it is something perfectly simple in both principle and operation—witness that most common of all motion-converters, the straightforward crank. This, by converting rotary motion into reciprocating motion, qualifies as a motion-converter in every sense, yet it could not be described as complex by any stretch of the imagination.

Having said this, however, I would now like to look at a rotary-to-reciprocating converter which is considerably more complex—and far more interesting—than the common crank. Illustrated on this page, we have a rather unique unit, designed by Mr. Colin Spence of Edinburgh, which performs its intended job in a fascinating way, working on a planetary gear principle. Mr. Spence himself gives the best explanation of the mechanism.

"When a small wheel is rolled round the inside of a large one," he says, "Any chosen spot on the circumference of the small wheel may be expected to follow an irregular, curly path. However, if the diameter of the smaller wheel is exactly half that of the larger one, the path traced is a straight line. Thus, by rolling a gear wheel within a ring having twice as many teeth, rotary motion can be converted into linear motion.

"The Meccano Gear Ring, however, having an odd number of internal teeth, cannot be used to demonstrate this fact, but the same effect can be obtained by rotating a small gear round one of twice the diameter. These two gears should not mesh with each other directly, but each with a third, intermediate gear to maintain the correct direction of rotation."

The mechanism illustrated was built from Mr. Spence's original specifications and I can confirm that it works exactly as claimed. An axle 1, rigidly held in a suitable support, is fitted with a 1 in. Gear Wheel 2, secured near one end. Free to rotate on the axle is a "cage" constructed from a Face Plate 3 and a 2½ in. Gear Wheel 4 connected together by two Double Brackets 5 with additional spacing being provided by three Washers on the shank of each securing ⅜ in. Bolt. Fixed to the Face Plate inside the cage, but spaced from it by four Washers, is a Fishplate 6, the securing Bolt passing through the slotted hole in the Fishplate and one slotted hole in the Face Plate. A Threaded Pin, on which a ¾ in. Pinion 7 is free to revolve, is fixed in the circular hole in the Fishplate.

Journalled in corresponding outer holes in the Face Plate and 2½ in. Gear is a smaller Rod, on which a ½ in. Pinion 8 is mounted inside the cage and a built-up two-throw crank outside the cage on the end of the Rod. Fishplate 6 is then adjusted so that Pinion 7 meshes with both Pinion 8 and Gear Wheel 2. The two-throw crank, spaced from Gear Wheel 4 by three Washers, is built up from a Crank 9, to the arm of which a Threaded Pin is fixed. Free on this Pin is a pushrod 10 (a suitable Strip), while another Crank 11 is secured on the Pin. The arm of this second Crank is extended two holes by an overlying 2½ in. Strip, to the end of which a second

pushrod 12 is pivotally connected. The mechanism is driven by a suitable Pinion meshing with Gear Wheel 4.

"When the 2½ in. Gear is rotated one way," writes Mr. Spence, "The centre of the crankshaft is carried in a circle of 1 in. radius in that direction, but the crankshaft rotates about its own axis in the opposite direction at the same speed. The result is that one crankpin moves in a straight line of 4 in. to and fro, while the other works similarly at 90 deg. to it—a most fascinating movement to watch! The crankpins can be connected directly to the piston rods of a 90 deg. V-twin engine, or pump, with a 4 in. stroke without using connecting rods as there is no angularity to compensate for. The number and angular settings of the crank webs can be varied to suit requirements."

An intriguing mechanism, Mr. Spence!

PARTS REQUIRED

PARTS LIST

*2—1	*1—15a	1—27c	24—38
1—5	1—17	1—31	2—62
1—10	1—25	13—37a	1—109
2—11	1—26	2—37b	1—111a
*Dependent on the model with which the mechanism is used.			5—111c
			2—115

Variable Speed Mechanism

Moving on to a different subject, now, Mr. E. R. W. Schoolar of Rusthall, Tunbridge Wells, Kent has supplied me with details of the accompanying Variable Speed Mechanism which he built after seeing a similar mechanism in the April 1971 issue of Meccano Magazine. The original unit was built by Mr. Colin Hoare of Beaconsfield, Quebec, Canada, but, as Mr. Hoare himself pointed out at the time, it had the disadvantage of requiring a large amount of space to operate. By employing a rather ingenious differential link, Mr. Schoolar has managed to produce a considerably more compact unit, although, as he rightly points out, "On my model, the total output direction is opposite to that of the input shaft." I know Mr. Hoare will be the first to congratulate Mr. Schoolar on his improvement.

As regards construction, two 2 in. Strips 1 and two Corner Gussets 2 are bolted, one each to each side flange of a 5½ × 2½ in. Flanged Plate, the upper end of each Strip and Gusset being connected by a 5½ in. Strip 3. Journalled in Strips 3 is the input shaft, supplied by a 3½ in. Rod and held in place by a ¾ in. Sprocket Wheel 4 and a 1 in. Sprocket Wheel 5. A Triple-throw Eccentric 6 is mounted on the Rod, as shown.

A differential is next built up from two 8-hole Bush Wheels 7, connected together by two 1½ × ½ in. Double Angle Strips, the securing Bolts at one side fixing a 2 in. Strip 8 across the face of one Bush Wheel to project one hole outwards. Journalled free in the bosses of the Bush Wheels and in Strips 3 are the half-shafts—1½ in. Rods—each carrying a ½ in. Pinion 9 fixed on the inside end and spaced from the Bush Wheel by a Washer.

In constant mesh with the Pinions are two ¾ in. Contrate Wheels, one fixed and one loose on a 2 in. Rod journalled in the centre holes of the Double Angle Strip. Again, a Washer spaces each Contrate from the nearby Double Angle Strip, but note that each Bush Wheel is spaced from nearby Strip 3 by two Washers. A ¾ in. Sprocket Wheel 10 is fixed on the outside end of one half-shaft, while a 1 in. Sprocket is fixed on the outside end of the other half-shaft, the latter Sprocket being connected by Chain to Sprocket Wheel 5. The arm of Eccentric 6 is then finally lock-nutted to the protruding end of Strip 8 to complete the mechanism. Input drive is taken to Sprocket 4, with Sprocket 10 providing the output take-off point.

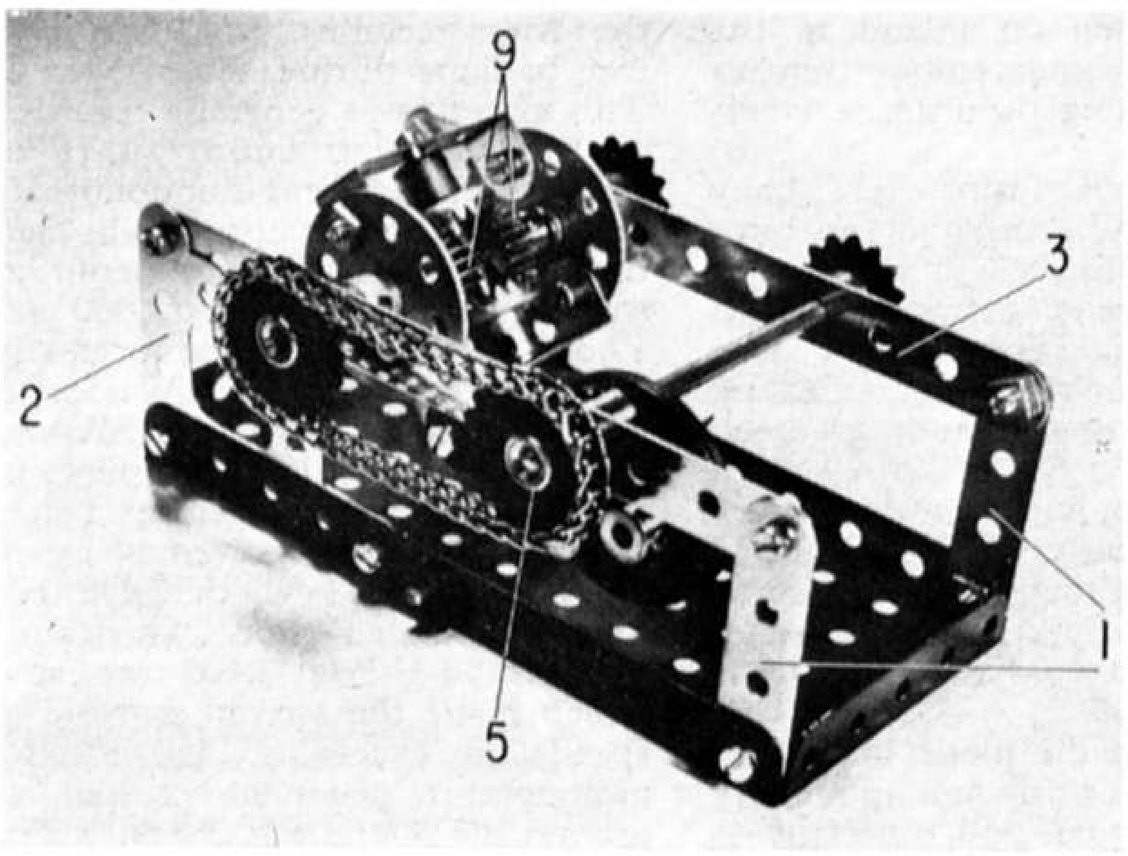
During operation, the Eccentric moves the differential backwards and forwards which alternately speeds up and slows down the output shaft. The amount of variation may be adjusted by using different throws of the Eccentric and by replacing the 1 in. Sprockets with those of other diameters.

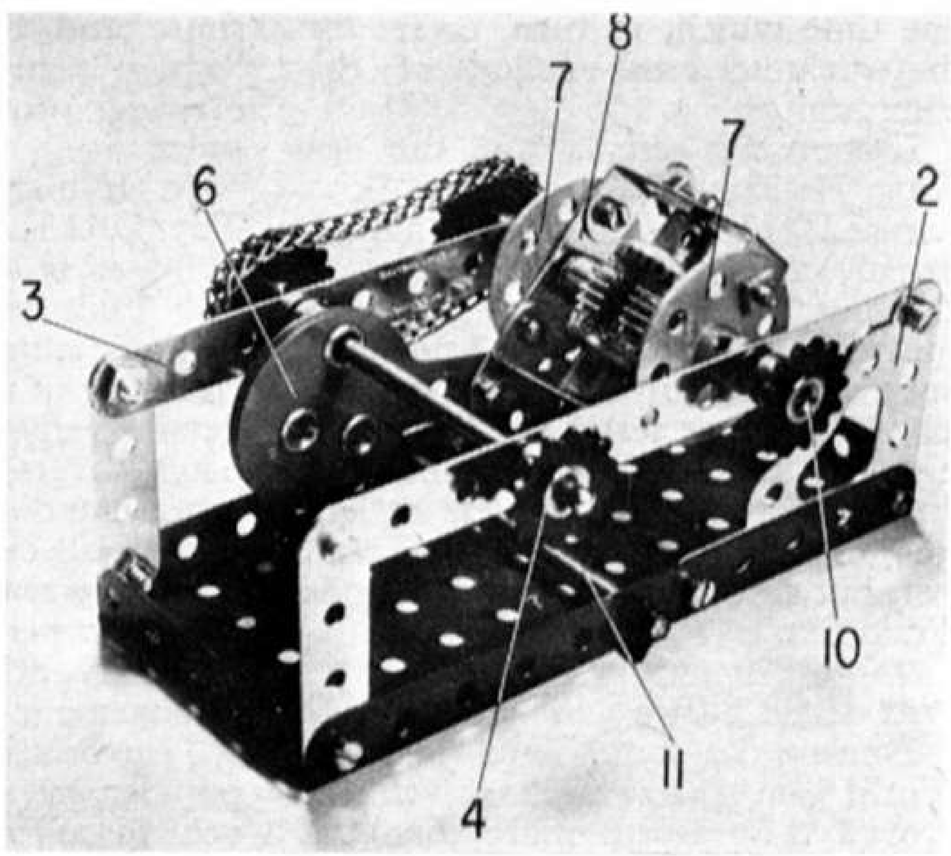
On the subject of the Eccentric, Mr. Schoolar gives a final word of advice. "If the 1 in. throw is used," he says, "It is advisable to fit a 6 in. Driving Band over an axle (11) secured by Spring Clips in the Flanged Plate, pass it through a hole in one of the differential Double Angle Strips, then take it back and on to the axle again. If this precaution is not taken, the Eccentric arm will be able to rise and the result will be a variable and *unpredictable* drive!"

PARTS REQUIRED

2—2	2—18a	16—37a	1—94
3—6	2—24	15—37b	2—96
1—16	2—26	8—38	2—96a
(1—16b)	2—29	2—48	2—108
1—17	(2—35)	1—52	1—130
			(1—186a)

Two opposing views of a Variable Speed Mechanism designed by Mr. E. R. W. Schoolar of Rusthall, Tunbridge Wells, Kent.





Meccano Clock Kit

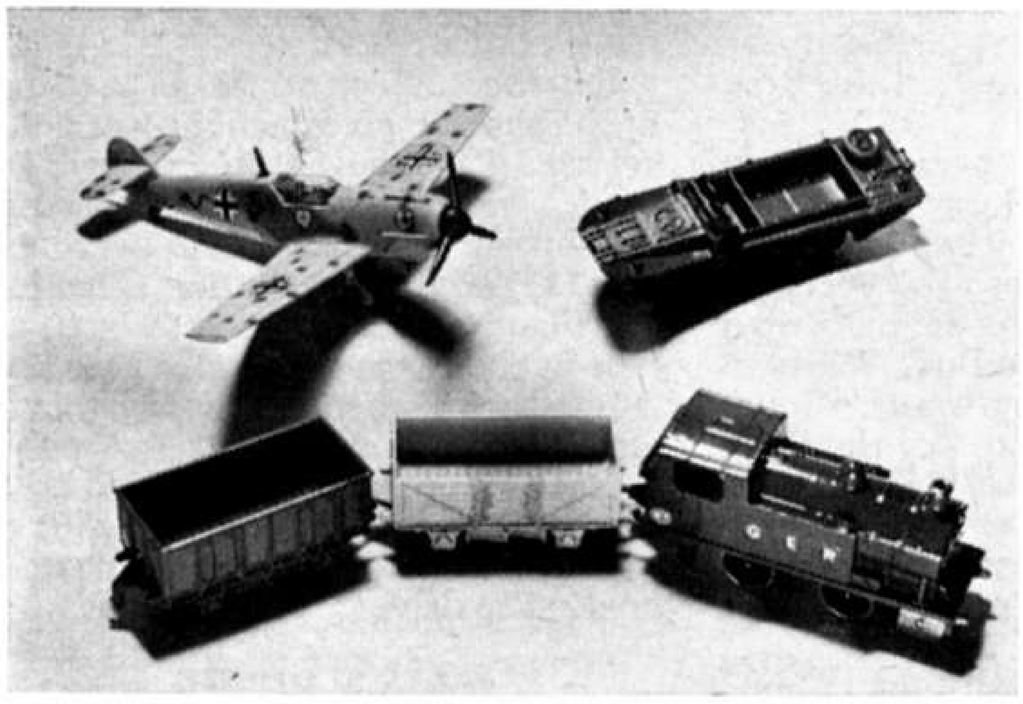
Thanks to a number of advertisements in recent issues, regular M.M.

readers will be aware of the very latest products from Meccano (1971) Limited—the Meccano Clock Kits, pre-production samples of which were shown for the first time at the Brighton Toy Fair earlier this year. Two Kits are planned, the basic No. 1 Kit and the more advanced No. 2 Kit with a built-in hourly chiming device. I am pleased to report that the No. 1 Kit is now in full production and should be readily available by the time this magazine appears.

The Kit contains all the components needed to build up into a real, working wall clock—weight-driven and keeping accurate time (if correctly adjusted, of course). It makes a comprehensive timepiece, complete with a blue-tinted circular clock face and an attention-drawing revolving disc arrangement which gives the impression of coloured droplets "exploding" outwards as it revolves. Full assembly plans are supplied and—most important—you don't need to be a Meccano expert to build it. Anyone with average do-it-yourself ability can successfully complete it.

The assembly components consist almost entirely of standard Meccano parts, although one or two Plastic Meccano parts are used, together with some special components—Pallet Pins, clock face, numbers, "exploding" discs, pendulum rods, etc. Of these, the Pallet Pin is the most interesting from a Meccano point of view, being best described as a "headless" Pivot Bolt with a slot for a screwdriver being cut in the end of the shank. I use this purely as a description, however, because the Pin *is* a new part (No. 251) and is not actually made from the existing Pivot Bolt. When built, the Clock is a genuine timepiece which keeps good time and it's the sort of thing which one would not normally dismantle. If it should be dismantled, though, the parts could always be added to existing Meccano collections—after all, they are mainly standard! (I like the assembled Clock, myself).

The No. 2 Kit will not be available until later, but I will report on it as soon as it is released.



DINKY TOY NEWS

THE TERRIFIC TRIO

By Mike Peddie

ONE of Meccano's primary aims is to please the public, and to satisfy public demand. With their Dinky Toys they try—with undoubted success—to please as many people as possible by bringing out new and different models at very regular intervals. This results of course in a remarkably wide range of Dinky Toys on the market at any one time which, in turn, caters for the greatest cross-section of the community.

Last month, apart from the Sea King Helicopter Kit, Dinky Toys released only one new model, namely the Duple Viceroy Luxury Coach. This month by way of contrast they have released not one, not even two, but three new models, all of which are terrific in their own right—a D.U.K.W. Amphibian (a "must" for military vehicle collectors), a Messerschmitt Bf 109E, and last, but certainly not least, a Goods Train Set.

War-time Fame

During the long, hard years of World War 2, few military vehicles proved their worth more than the D.U.K.W. Amphibian (pronounced "duck" incidentally). Its amazing versatility proved legendary and it probably came second only to the famous Jeep for world renown. As the pronunciation of its name suggests, the D.U.K.W. is as much at home on water as it is on land and, during the war, it was frequently used to carry troops from ship to shore and then on inland to the "action", any intervening stretches of water proving no obstacle whatsoever.

In miniature form, the Dinky Toy D.U.K.W., although not amphibious, is an excellent representation built round a finely detailed casting which captures the true character of the real thing. Casting detail really is outstanding—seats, hatch-covers, tools, a spare wheel representation, and even deck riveting are all clearly visible. Finished in olive green, the model runs on no less than six Speedwheels fitted in the correct two-front/four-rear arrangement.

I can foresee this model being very popular, particularly among military vehicle collectors, and especially as it is a "traditional" die-cast Dinky with no unwieldy features. Marketed under Sales No. 681, the D.U.K.W. Amphibian is excellent value at the amazingly low recommended U.K. Retail Price of 32p.

German Fighter

Continuing with the military theme, Dinky's second "offering", the Messerschmitt Bf 109E, also rose to fame during World War 2. This aircraft was generally regarded as the German counterpart of Britain's Spitfire, and it undoubtedly proved roughly equal to it—in fact, the Messerschmitt was superior in some respects. Between 12,000 and 17,000 ft. there was little to choose between them, but at altitudes of 20,000 ft. and above, the Messerschmitt was considered by pilots of the day to be a somewhat better aircraft. It was powered by a Daimler-Benz, 12 cylinder inverted-vee liquid-cooled engine, which produced 1150 H.P. at 2,400 revs., and which made the aircraft capable of speeds in excess of 350 m.p.h., although it generally cruised at around the 300 m.p.h. mark.

In miniature, the ME 109 makes a superb Dinky and is a fitting opponent for the existing Dinky Toy Spitfire Mk. 2. A detailed, well proportioned die-cast model in every respect, it succeeds in capturing the true character of the real thing, as I am sure collectors will agree as soon as they see it.

To greatly increase its "play-value" and, in fact, its overall authenticity, it is fitted with a retractable under-carriage and a revolving propeller, which is driven by a small "flick-start" battery-operated electric motor, housed in the fuselage. The correct way to start the motor is to flick the propeller in an anti-clockwise direction but I personally found that, if you flick the propeller sharply in a clockwise direction, it tends to simulate the "whiplash" of a starting propeller and is extremely fascinating to watch.

The Luftwaffe had many different units, all of which had their own particular markings and, for this model, Dinky have chosen markings similar to those of the 1/JG 27 Unit that was based in Libya, in 1941. The topsides are finished in the desert camouflage colours of sandy stone with matt olive mottling, and the undersides are finished in sky blue. This camouflage was extremely effective as, from above, it blended with the scrub-covered desert and, from below, it was difficult to see against the blue of the sky.

To complete the model, which incidentally carries Dinky Toy No. 726, it is supplied with three alternative sets of squadron marking transfers for self-mounting.

Break-through

Dinky Toy's third and final "offering" this month is a Goods Train Set which marks a complete breakthrough in die-cast toys by being both a train set, and a genuine Dinky Toy. The Set consists of an 0-4-0 tank locomotive, a goods wagon and a mineral wagon, all of which are produced in die-cast metal for strength and which are joined together by a simple coupling arrangement that is unique to this model. Fitted with low-friction Speedwheels, it is designed primarily for push-along operation on the floor, but it has been built to OO-scale and will also run on any OO-gauge model railway track. It is intended as a toy, however, although enterprising model railway enthusiasts will no doubt be able to fit a motorised chassis to the loco.

Although not based on any specific prototype, the locomotive is representative of a typical tank locomotive from the steam period of British railway history and, when coupled with the wagons, plays the part admirably. On seeing the model for the first time, the striking feature is the bright paintwork, the finish of which can only be described as impeccable. The loco is finished in the deep blue colouring of the old Great Eastern Railway Company and carries yellow GER identification letters on labels mounted on the sides. The goods wagon is finished in yellow, while the mineral wagon is red, and together they make an extremely colourful set.

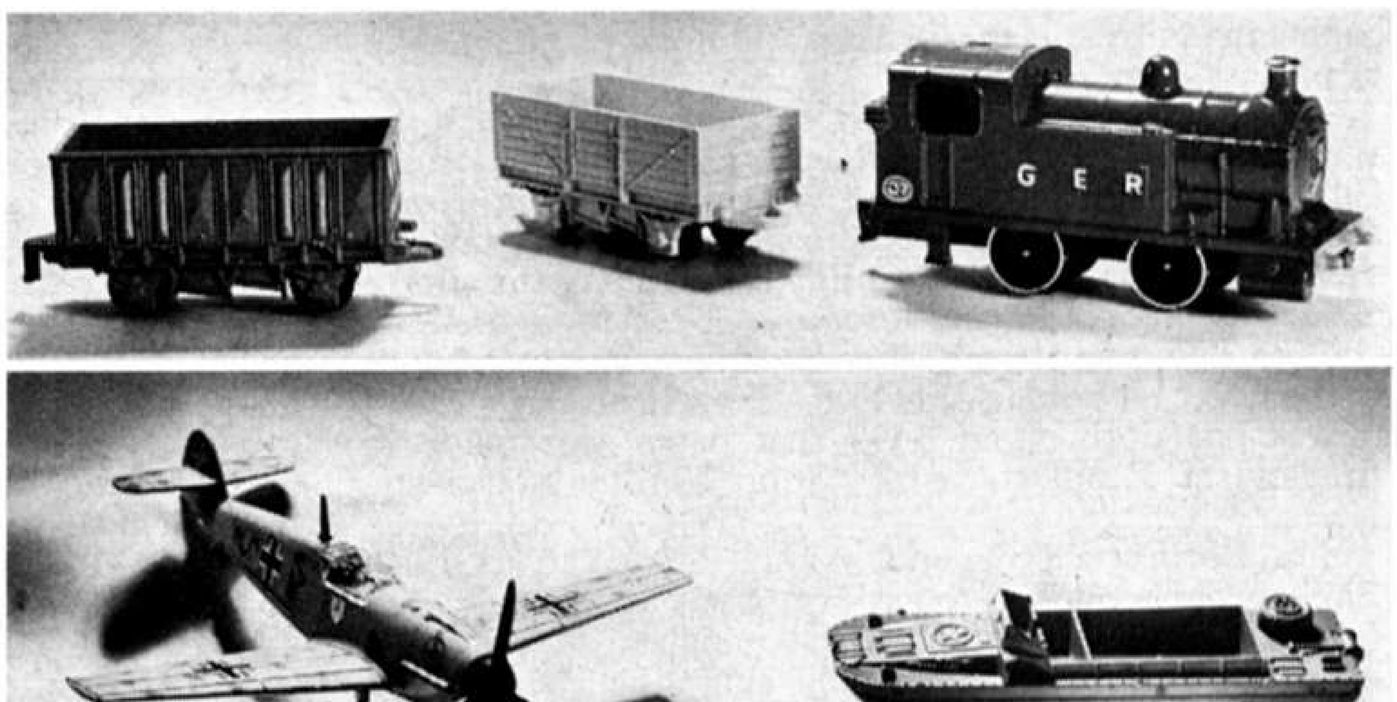
All three units of the Set are very well detailed, right down to the suspension; even underside detail has been included to complete a colourful goods train which I feel justified in describing as "immaculate". Marketed as Dinky Toy No. 784, Goods Train Set, it sells at a Recommended U.K. Retail Price of 99p.

Transfer News

Moving away from new Dinky Toys, I have some final and rather more specialist news for serious model and kit enthusiasts. The serious collector when expanding his collection invariably branches out with self-repainted models in addition to models carrying the finishes and liveries applied by the manufacturer. Having repainted, however, the collector is often unable to successfully round off the new finish with correct transfer markings, particularly in the case of model buses and aircraft. Hand painted markings, no matter how well done, nearly always look as if they have been hand painted and generally compare unfavourably to professional transfers. Serious collectors, therefore, might well be interested in an excellent range of bus, aircraft and railway transfers produced by Mabex Products, 31 Pevensey Road, Eastbourne, Sussex which are ideal for many Dinky Toy and other models.

The range of Mabex bus transfers is undoubtedly the most comprehensive, offering a very wide choice of real fleet names—modern and historic—together with a fair number of fictional fleet names, as well as vehicle accessory items, destination screens, advertisements, registration numbers, etc. Less comprehensive, but equally interesting are the aircraft transfers which have been produced with the immediate pre- and post-war range of Dinky Toy aircraft especially in mind. These include R.A.F., German, Japanese and Russian markings as well as three separate Service titles—"Royal Air Force Air Support Command", "Royal Navy" and "Army". Two different-coloured Swastikas and Czech roundels are also available to the larger 1/72nd scale. Among the railway transfers are a number of titles—"British Rail", etc.—and a particularly interesting series of railway wagon chalked town names, i.e. the sort of thing you see chalked on wagons in railway stations and goods yards so that the loaders know where the wagon is going and can therefore ensure they put the right things in the right wagons.

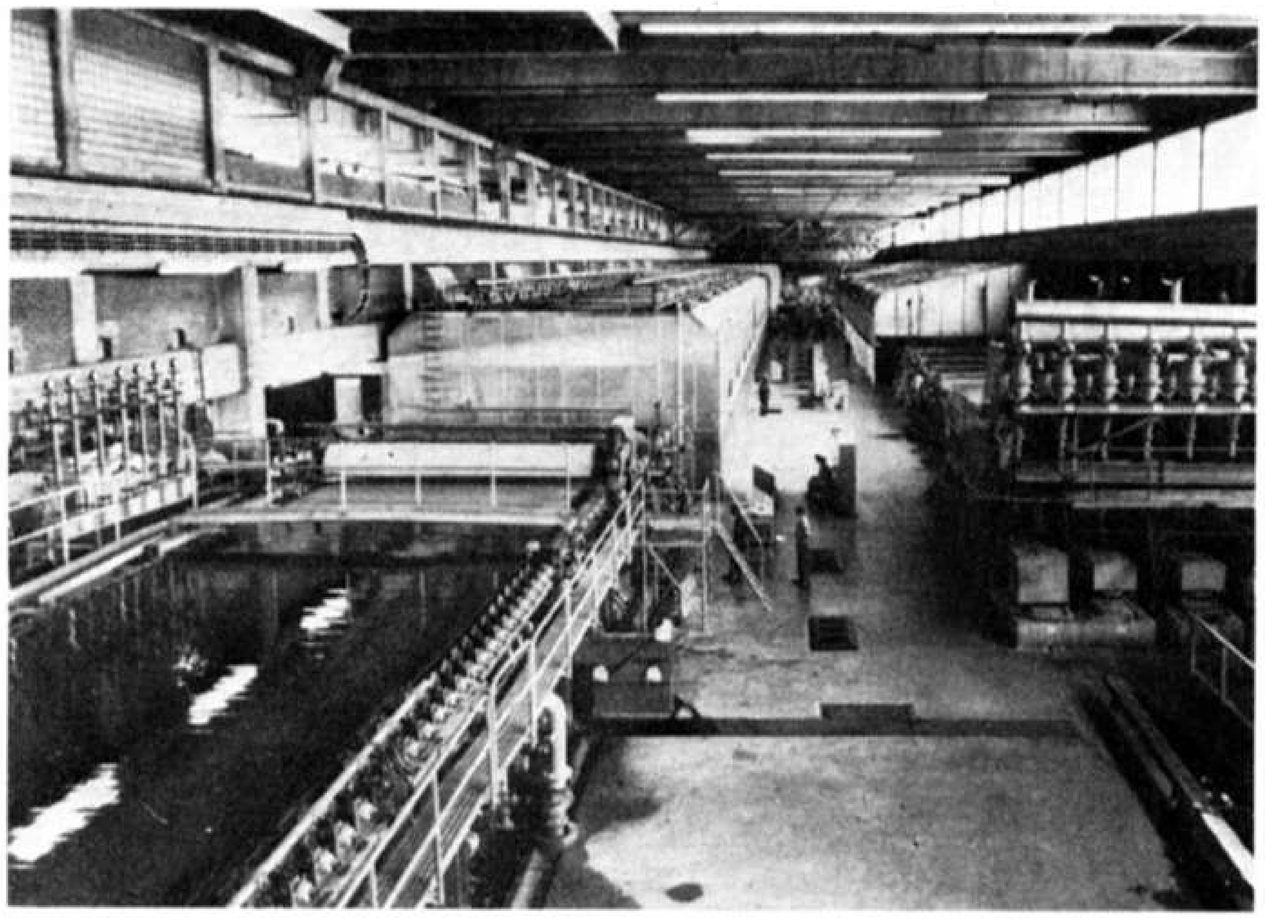
Details of Mabex transfers can be obtained from Mabex Products upon request, enclosing a stamp for a reply.



Opposite page, trains and boats and planes . . . ! The latest three models from Dinky Toys. Top left, No. 726 Messerschmitt Bf 109E, top right, No. 681 D.U.K.W. Amphibian and bottom, No. 784 Goods Train Set.
Pictured above right is the dual-purpose Goods Train Set—a breakthrough in die-cast toys, and on the right, friend and foe—Dinky style! The D.U.K.W. Amphibian is seen here alongside the Messerschmitt Bf 109E.

Lloyd's Register and

Paper Making



Paper making machine at the Tugela Mill of South African Pulp and Paper Industries Ltd., for which Lloyd's Register Industrial Services has inspected continuous wood pulp digester equipment.

THE paper this article is printed on is a remarkable substance. It can be made soft enough to serve as a tissue handkerchief or strong enough to support the weight of a motor car.

Paper is usually described as an aqueous deposit of vegetable fibres in the form of a sheet or web, and the raw material used in paper making is vegetable cellulose fibre which, in theory, can be produced from almost any vegetable growth. In practice, wood pulp, esparto grass, and rags are the materials most used today in Britain for paper making. In eastern countries, bamboo, mulberry, and the stalk of the sugar cane are utilised.

Before the invention of paper people used to write upon stone, wood, bone, silk, bamboo strips, papyrus, parchment, and anything else handy. So the world owes a debt to those damnably clever Chinese who invented paper in AD 105.

The inventor, Tsai Lun, was an engineer at the Court of the Empress and the system he used was to stamp or beat in a mortar the fibres from hemp rags, ropes, fishing nets and other domestic articles, in water. The beaten pulp was spread on a piece of loosely woven cloth through which the water drained and left a web of fibres which, when semi-dry, could be peeled off and dried in the sun. A later method used by the Chinese was to spread the beaten pulp on a flexible mould made of fine strips of bamboo laid together and tied in position by silk threads. Some of the early Chinese papers made by this method are still in an excellent state of preservation.

The craft of paper making took centuries to reach the West by way of Samarkand where, in AD 751, some Chinese paper makers were captured by the Arabs during a war with China. The secrets of paper making then spread, via Baghdad, to Egypt and along the shores of the Mediterranean to Morocco. The Moors took the craft to Spain and established a paper making industry in Toledo. It spread slowly to the rest of Europe and it was not until about 1495 that paper was made in England at a mill started by John Tate at Stevenage, Herts.

The Portals, a Huguenot family, helped to establish English paper making on a firm basis when they took refuge here and started to make paper at a mill in Hampshire in 1716. This mill subsequently obtained the exclusive contract for making banknote paper for the Bank of England. The same firm is still supplying the Bank of England with paper.

Up until the 19th century all paper was made by hand with each sheet of paper being made individually, but in 1803 the Foundrinier brothers developed a method of producing paper continuously on a reel which, although not a success in the early stages, soon superseded the hand methods.

As the speed and size of paper making machines increased, the raw materials, which were then flax, hemp and cotton, proved insufficient to keep pace with the demand and new sources of raw materials were sought. Thomas Routledge introduced esparto grass into the process in 1852 but it was not until 1866 that wood was used.

In that year B. C. Tilghman patented the sulphite process for making wood pulp from softwood. Others carried on his work and put the sulphite treatment of wood on a proper commercial basis to give paper makers a cheap and seemingly inexhaustible supply of raw material. Today, wood pulp is the chief raw material used for paper making all over the world.

The sulphite process was first used in the United States and it consists of treating wood chips with sulphurous acid in water and heating them in a closed vessel or boiler under pressure. The process dissolves all the non-fibrous matter and leaves a fibrous product suitable for paper making. These vessels are called digesters and are in fact huge pressure cookers weighing up to 340 tons and may be 62 metres in height. The weight of a digester with its charge of wood chips and final product may be up to 2,000 tons.

After the digester process the pulp is then subjected to further processes of washing, leaching, and refining before it goes into the papermaking machine to emerge as the finished product. The modern paper making machine is perhaps the largest single unit of machinery in operation today. In many cases it may be twenty feet wide by 100 yards long and may cost over a million pounds.

This is a far cry from the cottage industry type approach of the past, and paper making today has the same technological problems as any other science-based industry. Much of the complex plant and equipment is made abroad and it is vital for safety, efficiency and cost effectiveness that the material is manufactured to the exact design of the purchaser and to the relevant British Standard or other codes specified. This means that some reputable independent technical inspection

organisation must be available to survey the equipment right through manufacture and sometimes during installation at the paper mill.

Lloyd's Register Industrial Services carries out the technical inspection of many items of industrial plant and equipment and is becoming increasingly involved in the inspection of continuous wood pulp digesters for installation at paper mills all over the world. Inspection contracts have been carried out for plant of this nature destined for the Piet Retief Pulp and Paper Mill in South Africa and for the AREUCO mill in Chile. Current inspection contracts are being carried out for the Tugela Mill of South African Pulp and Paper Industries Ltd., New Zealand Forest Products and for the Tasman Pulp and Paper Mill.

The plant being inspected for the Tugela Mill is a good example of the complex nature of the hardware now being used in modern papermaking mills. It is described as a KAMYR Continuous Cooking Unit. AB KAMYR is a group representing three leading Scandinavian manufacturers of pulp and paper mill equipment (AB Karlstads Mek. Verkstad of Karlstad, Sweden; A/S Myrens Verksted of Oslo, Norway and O/Y Karhula Bruk of Karhula, Finland).

This KAMYR digester employs the neutral sulphite semi-chemical process in which the cooking liquor comprises a mix of sodium sulphite and sodium carbonate which is used for partial digestion of hardwood chips.

The wood logs intended for the process must first be prepared by removing the bark and reducing the logs to small chips about 12 to 15 mm. long.

These are then ready to be fed into the digester system from a hopper, the output of which is controlled by a rotating feeder with variable speed drive. The chips are then passed into a pre-steaming vessel where they are retained for a few minutes only and heated by low pressure steam at a temperature of between 105 deg. and 120 deg.

A high pressure feeder instantaneously submerges the chips in the cooking liquor under full cooking pressure (but below the cooking temperature) and sluices them to an inclined separator from which they enter the top of the digester column. The liquor is recirculated back to the high pressure feeder.

The stream of impregnated chips leaving the top separator is directly heated with steam admitted to the top of the digester and controlled by means of a temperature recorder-controller.

The digester column is 42 m. high, 3.616 m. in diameter and 19 mm. thick at the base.

The column of chips moves slowly down the digester where the cooking temperature of 170°C. is maintained by indirect heating through a strainer girdle in two separate halves. A pump circulates the liquor through a steam heated heat exchanger and horizontally across the digester as the chip column moves down past it.

Near the bottom of the column the chips enter a diffusion washing zone where they are cooled to washing temperature by radial displacement circulation. Cooling of the chips at the discharge end improves the physical properties of the resulting pulp. The washed and partially digested chips are passed through defibering machines which mechanically disintegrate them into a fibrous mass. This material is passed on for final washing and dewatering ready for the papermaking process. The spent cooking liquor and wash liquor are discharged from the digester to the chemical recovery plant.

The digester is designed to B.S. 1515 for a working pressure of 147 p.s.i.g. at a temperature of 180°C. and the digester shell parts which come into contact with the liquor, chips and vapour are made from stainless clad steel. Central pipes, the strainer girdle, bed plates and pin supports are all made in stainless steel to resist corrosion. The digester shell is delivered in sections to the site to facilitate transport and erection.

The various parts for this installation for Tugela in South Africa were made in Sweden, Finland, and Norway. Surveyors from Lloyd's Register offices at Vasteras, Stockholm, Gothenburg, Helsinki, Oslo and Kristinehamn attended to the shop inspection of factory made items, and surveyors from the Durban office will provide site installation inspection services.

The inspection of complex plant like this one for Tugela involved the appraisal of manufacturers' working drawings and their proposals for welding, fabrication, heat treatment, non-destructive examination, prototype testing and final pressure and leak testing.

At the fabricators, the proposed welding procedures were examined and the results of the procedure tests assessed to ensure compliance with the specification requirements. Welders were tested for their ability to carry out the approved procedures in a satisfactory manner and fabrication then commenced, using materials which had been inspected by surveyors at the place of origin. Inspection was carried out at every stage of construction including the supervision of all non-destructive testing.

On arrival at the Tugela site, the equipment will be installed under the supervision of a Lloyd's Register site surveyor. Welding procedures will be proven and welders will be tested and passed as qualified to perform their duties before commencing work on the equipment. Non-destructive examinations will be supervised as work proceeds up to the final stage of site pressure and leak testing. Finally, certificates covering all aspects of site inspection will be issued.

This is one of many special projects inspected each year by Lloyd's Register Industrial Services. Others include road bridges, desalination plants, hyperbaric medical chambers, irrigation equipment and prestressed concrete beams. Plant and equipment for nuclear and conventional power stations, oil refineries and chemical factories all over the world are also inspected under the terms of any recognised code of specification as agreed between the client, manufacturer and Lloyd's Register.

EDITOR'S DESK (*continued from page 373*)

can't start up unless you're sober), passive seat belts, anti-lock brakes, hydraulic anti-roll suspension, head-up display for speed and station keeping (two lines projected on windscreen, varying according to speed—if the space between the lines is narrower than the car in front, you're too close), a periscope rear mirror, and total mobility tyres (a burst at up to 100 m.p.h. does not affect stability, and you can drive as far as 100 miles at up to 50 m.p.h. with a puncture).

A Triumph 2.5 PI had several of these features plus self-levelling headlamps with washers and wipers, an all-automatic high intensity beam to augment dipped headlamps, adjusting itself to conditions, an automatic dipping mirror, a monitoring system (giving warnings on brakes, brakefluid, oil pressure and level, light bulb failure, and coolant and screenwash levels) and a dual level rear light system. Cars could get more complicated!

Design and Construction of BRIDGES

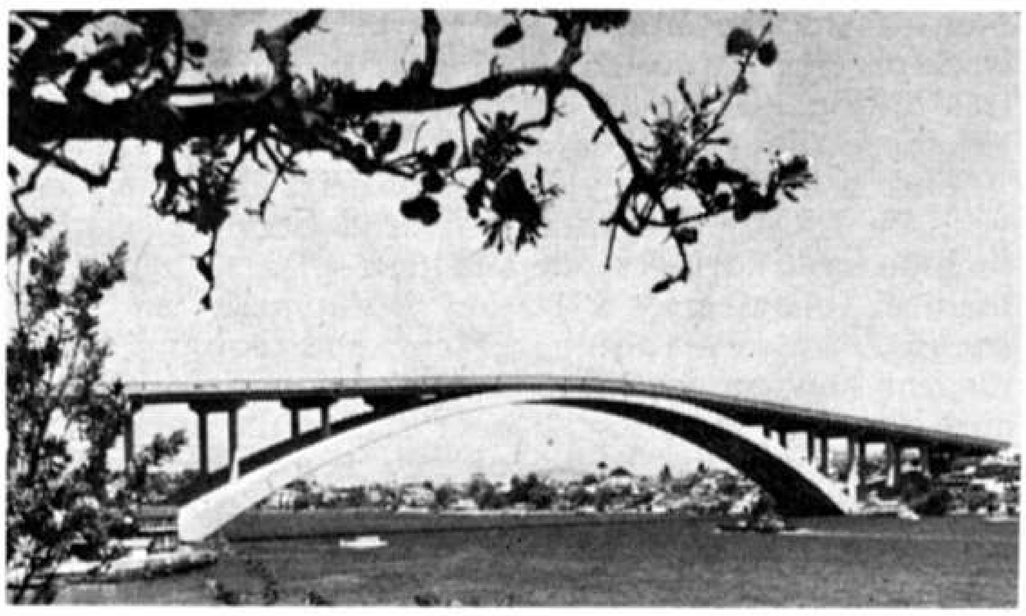
BY TERENCE WISE

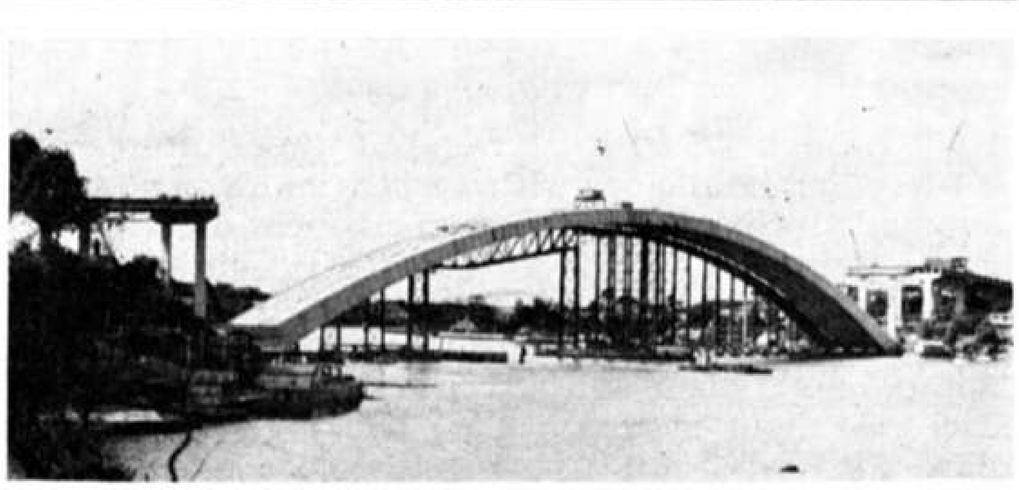
Part Seven — the Cantilever

THE wide spans of 20th century bridges usually combine all types of construction and materials, including the cantilever principle, which is after all only a sophistication of the projecting beam method—one of the earliest forms of bridge known to Man. So although the heyday of the great cantilever bridges has now passed, in favour of the graceful concrete structures we see everywhere, it should be remembered that this form of construction is far from dead. The modern Waterloo bridge in London, for example, is not just a concrete shape but is in essence several girder bridges giving the appearance of arches.

This century has also seen some great steel cantilever bridges, such as the Montreal Harbour bridge over the St. Lawrence River, begun in 1926 and finished in 1930. The bridge cost 12 million dollars to build, has four lanes for traffic, two footways for pedestrians, clearance above the river of 163 feet, and, including the approaches, exceeds two miles in length.

Rivalling this is the Carquinez Straits bridge in California, 25 miles north of San Francisco, begun in 1923 and finished four years later. One of the largest steel girder cantilevers in the world, this bridge has two cantilever spans of 1100 feet, a central tower span of 150 feet, two anchor arms from the shores of 500 feet, and at the southern end a steel viaduct approach 1132 feet long, making an overall length of 4482 feet. Silicone steel was used as the main material for the towers, the trusses of the suspended spans, the cantilever arms and the anchor arms. This has an ultimate strength of 80,000 to 95,000 pounds and 45,000 pounds minimum yield point. The main tension members for the major trusses, and some of the tension members of the viaduct trusses, were built from heat-treated carbon steel eye bars, with a minimum elastic limit of 50,000 pounds and a minimum ultimate resistance of 80,000 pounds per square inch. Longitudinal expansion is allowed for at the shore ends of each anchor arm, and each suspended span is fixed at the central tower cantilever arm with expansion allowed for at the shore ends. (Expansion of the 1100 foot spans is 11 inches). To allow for the possibility of earthquakes shock, six hydraulic buffers are provided at the expansion joints between suspended and shore cantilever arms, and also between the main structure and the viaduct. The bridge has a 30 foot roadway and two footways, built from reinforced concrete slabs. Another notable point is the depth of the foundations for the piers—built in 90 feet of water to 132 feet below water level.





Another sphere in which the cantilever has remained active is the multi-span bridges, especially in America where many miles of water are being crossed. One such is the Oakland Bay bridge which unites San Francisco with Oakland across a gap of over eight miles. Opened in 1936, this bridge is one of the greatest combination bridges ever built, with a double deck throughout. The western half of the bridge consists of two suspension bridges, 2300 feet long, with towers 440 feet high, anchored into a huge concrete monument in the centre, at Yerba Buena Island. The bridge then continues over a 1400 foot cantilever span of five through truss spans and 14 deck truss spans before connecting with a viaduct from the Oakland shore. The 51 piers of this bridge, which cost £15 million to build, go deeper below water than any substructure built up to that date—some being as far as 237 feet below low tide level.

The Lower Chesapeake Bay bridge-tunnel, a multi-span bridge 18 miles long, crossing a stretch of water so wide as to look like the open sea, is the greatest multi-span bridge in the world. It consists of a series of low level trestle roads, two tunnels which go beneath the main shipping channels, and two high level bridges over the secondary channels. Four "islands" had to be built in the bay in order to link the trestle and tunnel

Top, the Albert Bridge in London, built 1873 and employing the cable cantilever technique. Left, the graceful Gladesville Bridge over the Parramatta River, linking the suburbs of Gladesville and Drummoyne with Sydney. Believed to be the world's longest of its type, it is 1,901 feet 6 inches long, including a four-ribbed concrete arch with a span of 1,000 feet, rising 120 feet above high water level. The lower picture shows this bridge during construction in 1963. Work began in 1959, and the bridge was designed to relieve the pressure on the Sydney Bridge. *(Aust. Info Service.)*

sections. The bridge replaced a ferry system which had been in service for 80 years, and cut the crossing time from 1½ hours to twenty minutes!

An unusual modern variant of the cantilever principle is the cable cantilever. The George Street bridge in Newport, Monmouthshire, completed in 1964, is an example of this method. Here the gap between abutments is 1770 feet and the main river span of 500 feet is supported from hollow reinforced concrete towers by steel wire ropes, passing over rollers inside the towers and anchored at the shore ends to the concrete approach viaducts. The towers are 165 feet above high water level. The bridge carries a 48 foot roadway with two nine foot footways, as well as the water, electrical and telephone services.

Concrete

Prior to the use of reinforced and prestressed concrete the longest arch span for a concrete bridge was the 280 feet centre span of the Rocky River bridge in Cleveland, Ohio, completed in 1910. The Swiss engineer Robert Maillard was the pioneer of reinforced concrete bridges at the beginning of this century and by the end of the First World War his work had led to reinforced concrete largely replacing steel, stone and brick for small to medium bridges. Primarily this is because of economy—spans of up to about 40 feet can be fabricated off site in the form of reinforced concrete girders, and quickly lowered into position across the abutments, the bridge deck then being laid on the beams in the form of reinforced concrete slabs.

Reinforced concrete members can be designed to take either tensile or compressive forces and it was Monsieur Freyssinet, a French engineer, who first used "prestressed" concrete for his bridge at Plougastel over the Elorn in Brittany, thus making use of the compressive strength of concrete. The principle had been known since the mid 19th century but engineers had not previously discovered a satisfactory method of anchoring the tensioned wires, nor had an economic and reliable high tensile wire become available until the 20th century. Freyssinet's Plougastel bridge had a double deck, the lower one for a railway line, and three arches with a total span of 613 feet. It was completed by 1931.

It is some indication of Freyssinet's achievement that even now his bridge over the Elorn still ranks as the fourth largest concrete bridge, after the Gladesville Bridge in Australia, the Sando bridge over the Angerman River in Sweden, built in the early Forties with a span of 866 feet, and the Elsa railway bridge in Spain, again early Forties and with a span of 690 feet. The first prestressed concrete bridge to be completed in America was a small bridge in Tennessee in 1950, and it was to be several more years before any bridges of decent size were built in this manner in the States.

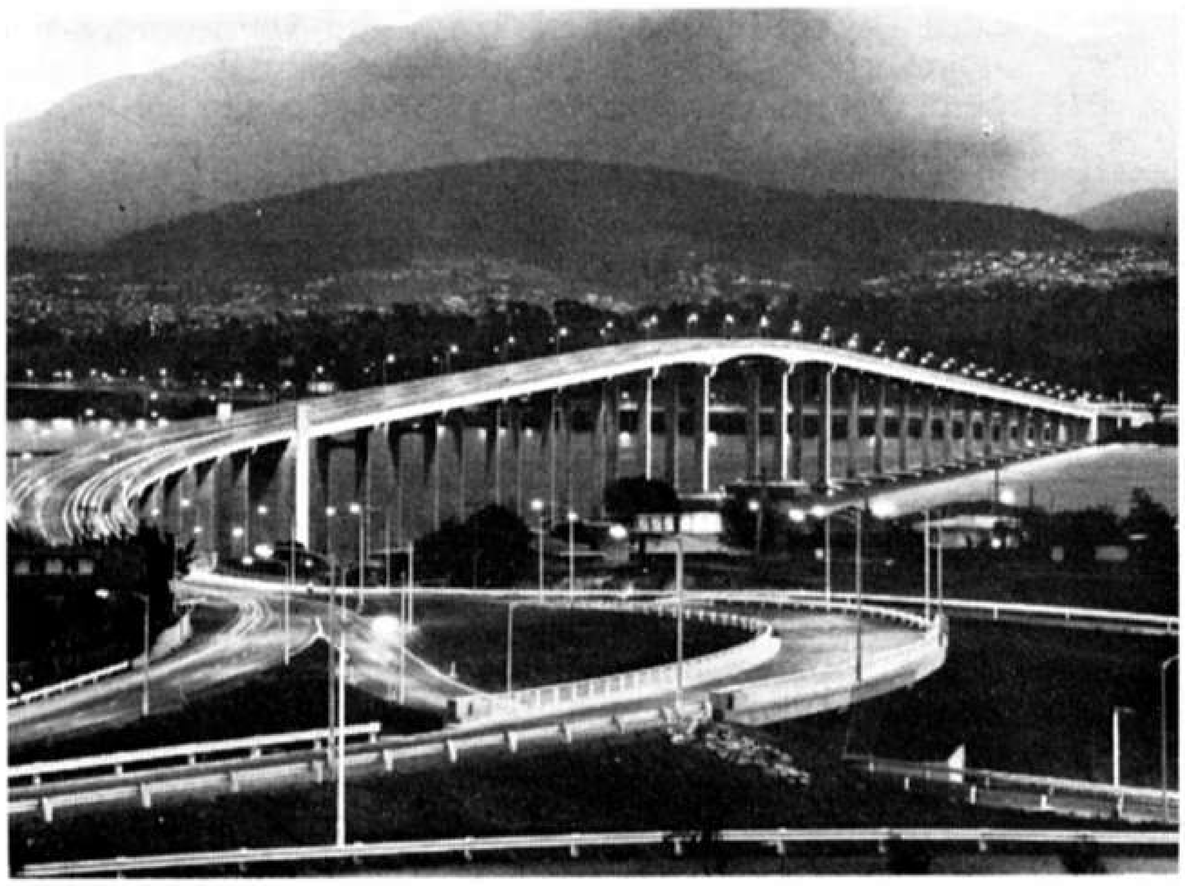
In England the largest prestressed concrete span of the Sixties was that over the Medway near Rochester for the M2 motorway, with an overall length of 3272 feet 6 inches. Of flexible cantilever construction, this bridge was remarkable for achieving a new record in size for a prestressed concrete bridge of the cantilever type. The deck is 113 feet 6 inches wide, and there is a centre span of 500 feet, 116 feet above the river. The piers taper from ten to six feet at the top, and are solid to just above water level, after which they are hollow boxes with 18 inch walls. They rest on foundations of chalk inside steel cofferdams and it was estimated that the downward pressure on the foundations would be 20,000 tons.

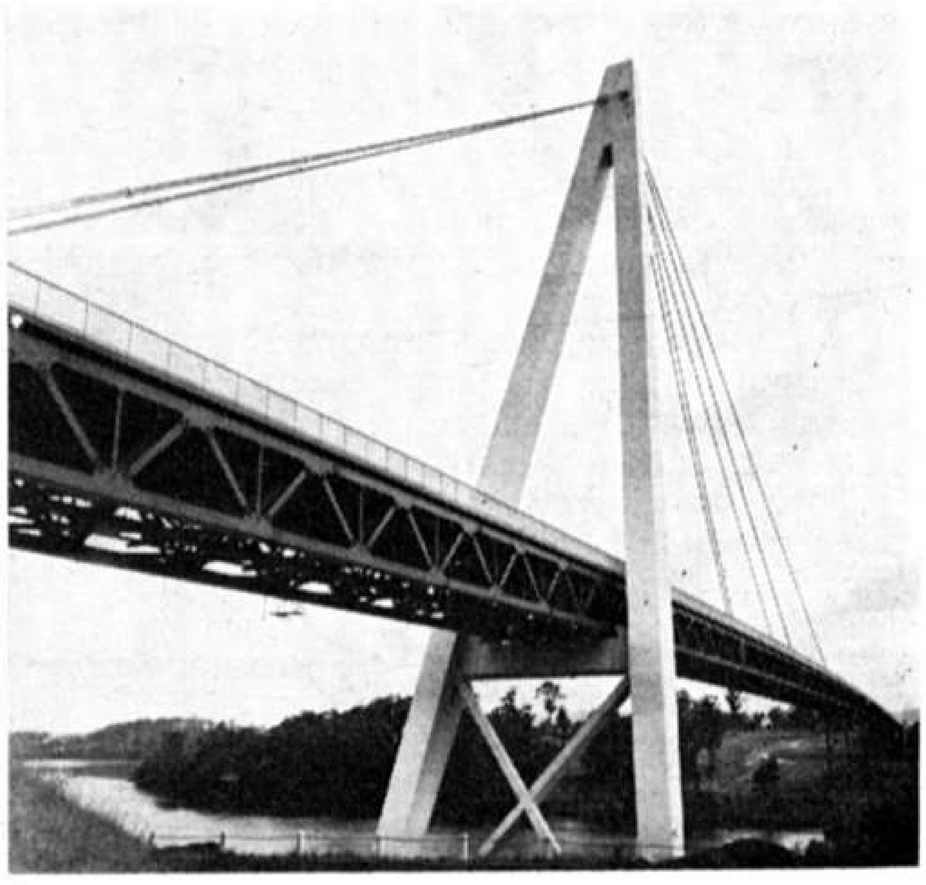
The anchor arms and main cantilevers were built outwards from the tops of the piers in ten foot sections, with working platforms slung from the structure itself. These were moved outwards as the concrete set. When the anchor arms reached 312 feet they came to rest on piers and linked up with the side spans, which are clear of the water at low tide. The main cantilever arms were built out to 200 feet and the central gap closed with 100 foot prefabricated prestressed beams weighing 135 tons.

The viaducts are basically prestressed beams supported on port and lintel frames, with the lintels projecting to form short cantilevers. The beams were made on the banks of the Medway. The west viaduct has a total length of 1350 feet in eleven spans: the east viaduct 797 feet in seven spans.

118,000 tons of concrete were used in the construction of this bridge, and over 6,000 tons of mild steel reinforcement. Another 187 miles of 1¼ in. Macalloy bar was used in the superstructure. Total cost was £2.3 millions. Until the Gladesville bridge was built, the bridge over the Medway had the longest pre-stressed concrete cantilever span in the world.

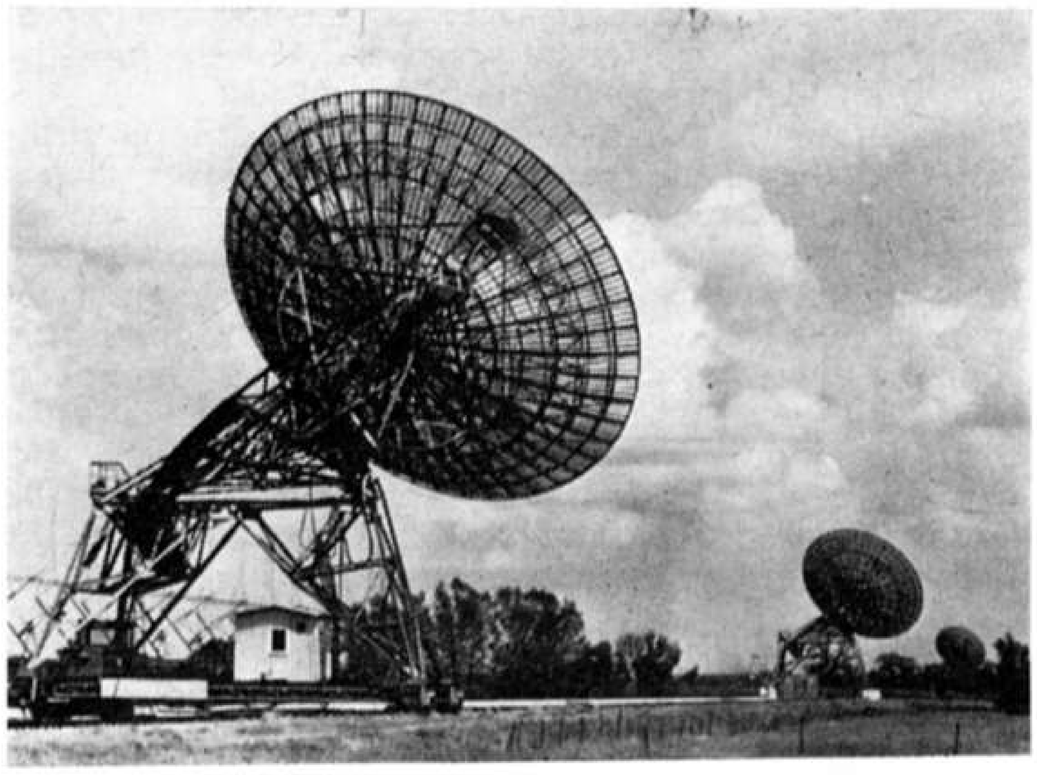
Below, left, the Tasman Bridge crossing the Derwent River in Hobart, Tasmania. One of the world's longest prestressed concrete bridges, it was completed in 1964 with a length of about 1100 feet. *(Aust. Info Service).* **Below, right, the Batman Bridge, Tasmania, spanning a 225 yard stretch of the Tamar River with a cable cantilever.** *(Aust. Info. Service.)*





Inventions and Discoveries

C. A. Rigby briefly outlines some of the important inventions and developments which affect our everyday life.



Top, the three 60 ft. dish aerials of the Science Research Council's radio telescope at Cambridge. Two are in fixed positions, but the near one in the picture can be moved along a 2,500 ft. track (Mullard R.A.O. picture). Right, self-propelled oil recovery vessel picks up oil film from water on moving belts, transfers it to cargo tanks on board (*B.P. photo*)

THROUGHOUT history, inventions and discoveries have brought about many changes in living standards. Centuries ago, for example, Archimedes discovered the principles of specific gravity and the lever. He also invented an important drill, named after him. One of the simplest 'breakthroughs' in the means of transport and travel was the invention of the wheel. Though considered at first of minor importance, wheels are still necessary in all vehicles for land travel, including railway trains. They are also used in clocks and most other machines.

Various other inventions and discoveries long ago have also helped to speed up the developments of today. As will be seen after some study of the subject, both inventions and discoveries can be listed broadly under various headings as 1—Transport and Travel by Land, Sea and Air, including Roadmaking; 2—Communication by Electric Telegraph, Submarine Cables and now Telecommunication, also Telex, by Radio and Broadcasting, Radar, and by Printed Books, Magazines and Newspapers; 3—Electric Lighting, Heating and Power, etc.

Means of travel and transport have always been important. After the stage-coach came the railways with the invention of the steam locomotive by Trevithick in 1804, though it was not till 1829 that George Stephenson demonstrated its practicality for passenger hauling. After 1965, the biggest change in railway history took place with the adoption in Britain of Electric and Diesel traction at higher speeds of from 60–90 m.p.h. Electricity as the motive power is generated in the locomotive by a diesel generator. One of the fastest regular services of today is that from Tokyo to Osaka, in Japan, where electric 'bullet trains' maintain a speed of 125 m.p.h.

With its universal use by all classes, the automobile or motor car has become one of the miracles of present-day engineering and applied science combined. Among the many developments since the Industrial Revolution, no other machine has brought so many benefits. After the invention in 1801 of the steam road carriage by Trevithick, Gottlieb Daimler with Dr. Otto of Cologne perfected the Otto petrol gas engine in 1884. With this invention a new trend was given to the design of self-propelled vehicles. Later, the oil-using form of the internal combustion engine, with automatic ignition caused by the high temperature arising from compressive action upon the air in the cylinder, came into use, five years before the first of Dr. Diesel's own units was operating. This was made by Ackroyd Stuart.

Ships have always been used for long sea voyages and with the invention of the steamship and iron and later steel construction ('Great Eastern' by Brunel in 1859 was a breakthrough in this field), came bigger ships and liners. By 1914, the oil-using or diesel marine engine was beginning to be used. Another development for short distance sea travel was the Hovercraft, invented by Sir Christopher Cockerell in 1956. Employing the 'cushion of air' principle, the world's first Hovercraft, the SRN 1, crossed the English Channel. Since then various other services have commenced.

Another new type of vessel is the Hydrofoil which first came into service in Italy in 1952. The HS-Victoria, which skims over the water at 37 knots, can do the trip between Seattle and Victoria on the Pacific Coast of America in 90 minutes. By the ordinary ferry service it takes from 4½ to 5 hours. Automatic

controls for the surface piercing foils on each side of this vessel keep its stern within 6 inches of a set altitude in calm water. Vertical acceleration of ± 0.15 g in a state 4 sea is obtained, including winds of 20 knots and waves of maximum height 4 to 8 ft.

Since the invention of the aeroplane, there have been many major developments in air travel. The first practical heavier-than-air machine built by Wilbur and Orville Wright in America attained a maximum distance of 825 ft. In 1909, Bleriot flew the English Channel in a mono-plane with a 25 h.p. motor. Many different types of propeller-driven monoplanes and biplanes followed, and World War I brought marked developments in aeronautics. Piston engines which have compression, combustion and expansion taking place in a single organ had reached the limit of metallurgical development. The quest for bigger and better aircraft, however, demanded greater power units to compete with technical developments. For many years, the principle of jet propulsion was known. In 1867, Sir Isaac Newton formulated his third law of motion, stating that action and reaction are equal and opposite in direction.

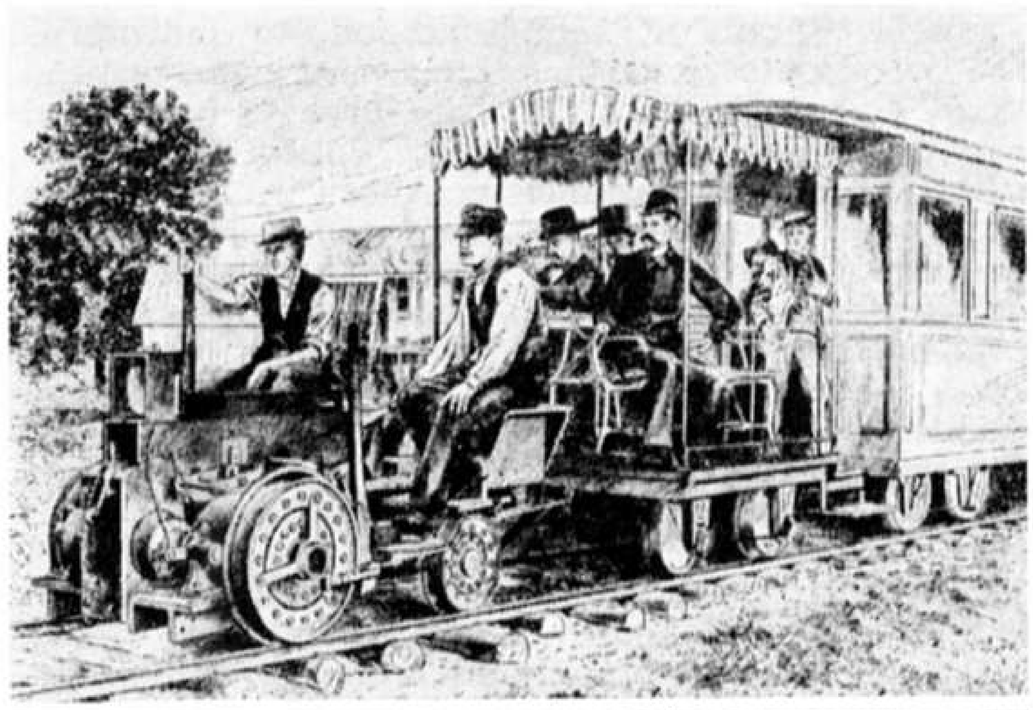
Frank Whittle, a young RAF officer, began experimenting, and after much work developed what is normally recognised as the first practical jet engine.* Little notice of it was taken at first, but in 1941, the Gloster Aircraft Company developed a prototype which made its first flight. In 1945, after further developments, the Gloster 'Meteor' was built to the Whittle design. Two years before this a gas turbine engine proved successful. Newton's law of motion is used in aircraft jet engines where the incoming air is compressed, heated, greatly accelerated by the turbine, and ejected as a high-speed jet forcing the aircraft to move forward.

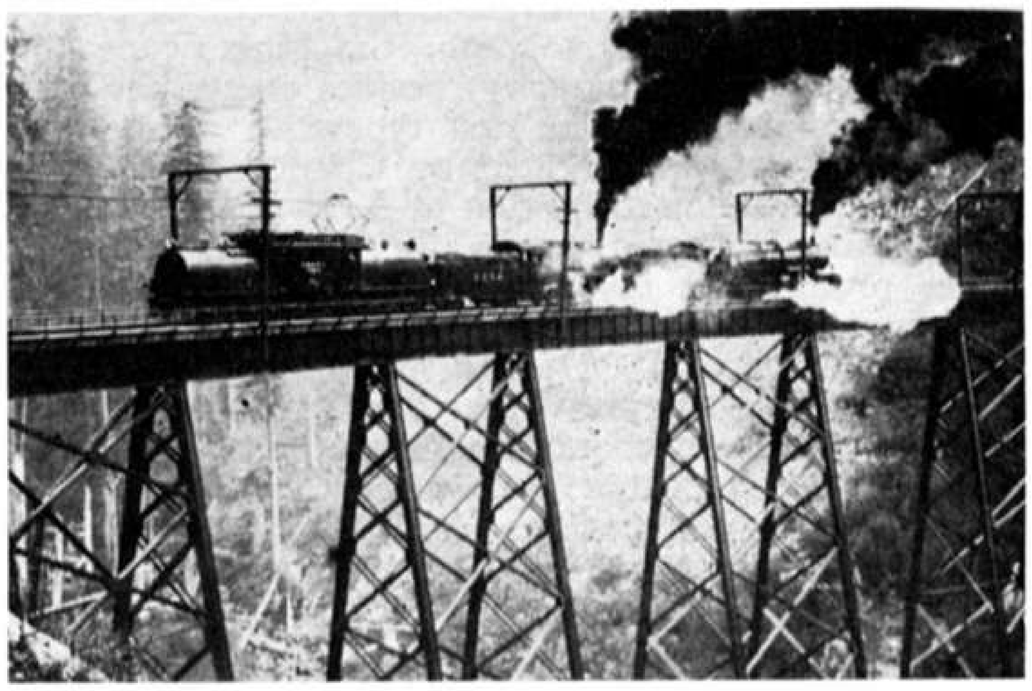
The pure jet engine or turbo-jet consists of a combustion space in which fuel is mixed with compressed air, and burnt, an air compressor, a turbine wheel and a pipe through which the products of combustion are ejected. Besides turbo-jets are turbo-props which deliver very little actual jet thrust.

In the sphere of communication, the first practical electric telegraph was produced in 1837, when Cooke and Wheatstone invented the needle telegraph, and Morse in America produced his electro-magnetic telegraph. By 1849, this was the principal means of sending messages via land by wires supported by telegraph posts spaced at intervals between the sending and receiving ends. The next wonderful development was that of the submarine cable which in time was used for the transmission and reception of messages between Britain and other countries, including U.S.A. In 1956, the first Transatlantic telephone cable linked America with the U.K. The wireless telephone uses electromagnetic radiation for transmission. Another development, relatively lately, is 'Telex' which is used chiefly for business calls.

Marconi's development of wireless telegraphy by Hertzian waves was one of the greatest discoveries of the century. After succeeding with transmission and reception across the Atlantic in 1901, he began developing the system further, and in 1909, he was awarded the Nobel prize for physics. He also experimented with short-waves later, a development which led to the 'Beam System' of radio. Since then radio has proved of immense benefit not only on land and sea and in the air, but also in space.

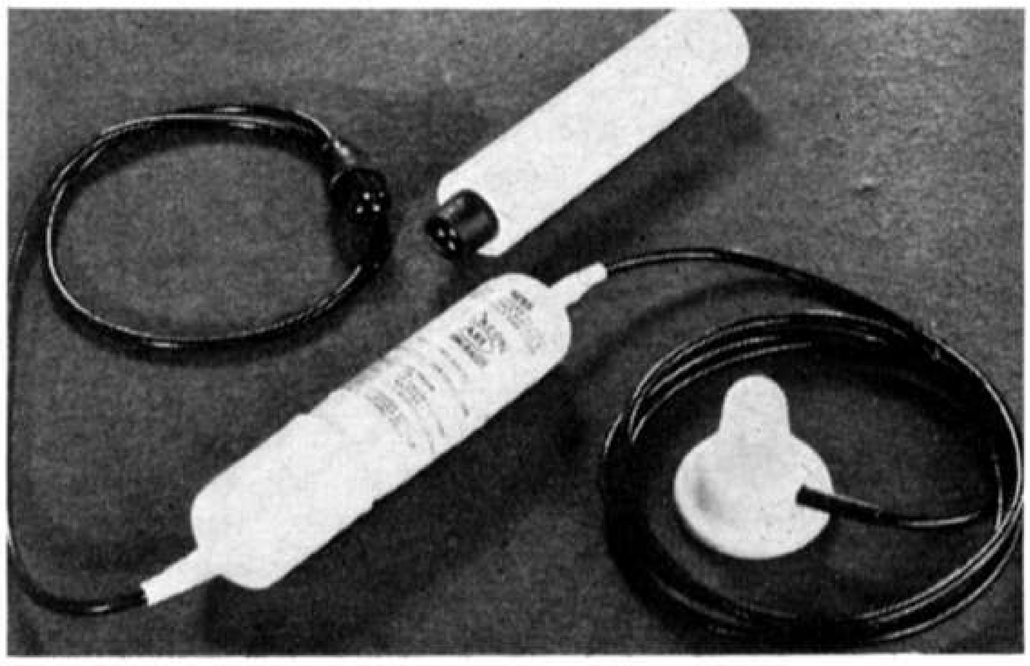
Jet flights were made in Germany in 1939, but development was given a very low priority.—Ed.





Top, artist's impression of America's first electric locomotive, built by Thomas Edison. Above, trial of strength—one Chicago, Milwaukee and St. Paul electric locomotive wins a tug-of-war with two powerful steam locomotives (*Pictures General Electric Co., U.S.A.*)

Below, an Argosy Freighter in flight, typical of the matter-of-fact movement of goods by air (*B.E.A.*). **Bottom, this distress beacon for marine, mountain, or desert survival weighs 3½ lb. but its flashes can be seen as far as ten miles at night** (*A.E.I. Ltd*)



Another means of communication, to individuals directly, of course, is via the printed word in newspapers, books, and magazines. All these have to be printed by special machines. In Britain, William Caxton set up his press near Westminster Abbey in 1476. The first improved machine for speed and cheapness was that invented by Konig in 1811. In this particular machine the paper was applied to the forme by means of a revolving cylinder which held the paper in its passage across the type. This introduction of the impression cylinder proved a much quicker way of printing. Since that time there has been a stream of inventions and developments of new processes and machining for better and faster printing.

More than 1,000 patents were granted to Thomas A. Edison, a well-known American inventor, (1847–1931). He not only brought out a number of improvements in telegraphy but invented the electric or incandescent lamp, the phonograph, the kinetoscope (or forerunner of cinematography) besides one of the first electric locomotives. The first typewriter to be put to practical use was invented by Charles Thurber in 1843. It was followed by that of A. E. Beach in 1856 for printing embossed letters for the blind. Later, Sholes produced a machine which was embodied in the American Remington of 1874. Many other types of machine followed. During 1827, John Walker, a chemist of Stockton-on-Tees sold what he called 'Friction matches', about the development of which there is an article in this magazine.

Inventions and discoveries, both big and small, are now in great demand. Space projects and electronics have produced their share. Not long ago, as an example, the Americans were seeking a material harder than steel. A British inventor discovered how to make this and it was soon sold.

Perhaps the most famous scientist of early times was Leonardo Da Vinci of Italy (1452–1519) who discovered the laws of optics, gravitation, friction, heat, and light, and foresaw invention of the helicopter and the parachute. Certain writers have also added to scientific knowledge. Jules Verne of France, wrote "Five Weeks in a Balloon", "Twenty Thousand Leagues under the Sea", "Around the World in 80 Days", also "From the Earth to the Moon". (1870–1873) H. G. Wells, a British writer wrote: "The Time Machine", "The War of the Worlds", "The First Men in the Moon", and certain short stories. Both these authors showed remarkable foresight and undoubtedly caused scientists to think about the possibilities of their ideas.

As readers will readily appreciate—*MECCANO* means: "A SET OF MINIATURE PARTS FROM WHICH ENGINEERING *MODELS* CAN BE CONSTRUCTED". (Concise Oxford Dictionary). All kinds of Models have been constructed, including Fair-ground Engine, Eiffel Tower, Optical Telescope, etc. Usually, inventions or discoveries come from those interested in certain trades or professions, or subjects as Chemistry, Physics, General Science, and Electronics etc. Another important point about this work is that a *drawing* of a *MODEL* is essential, showing all parts in proper perspective as Plan, End Elevation, Side Elevation etc. Books on this subject covering Machine Drawing, and Workshop Drawing are available from various publishers.

A Working Model Rowing Boat

A simple electric-powered rowing skiff which draws a crowd wherever it appears.

By Philip Connolly

This full-size plan originally appeared ten years ago in 'Model Maker' and we have had many requests to reprint it.

PERHAPS one of the most amusing model boats to watch on the water is a working rowing boat. This little 10 in. model will run off 1½ v. and with 3 v. battery the man really does work hard.

The motor used is a Kako 01 bolted to the front seat with two cells from a Bijou battery under the rear seat. These can be disguised by covering them with boxes and the people in the boat. The motor draws a current of under ½ amp and this should give quite a long running time. Miniature accumulators such as Deacs could be used if they are available, and would give a still longer run.

As the heart of the boat is the motor and gearbox, the construction of this will be described first. The gears needed are a 40 : 1 worm and pinion set, a 10 tooth and a 30 tooth pinion. These are all nylon gears made by Ripmax. The worm gear can be fixed to the motor shaft by tinning the shaft with solder, and pushing the gear on while the shaft is still hot. Alternatively epoxy resin or any impact glue could be used. Cut out the two halves of the gearbox and drill the holes in the motor baseplate 8 B.A. clearance size. The centres for the $\frac{3}{32}$ in. holes are shown with crosses. These should be drilled as accurately as possible to prevent the gears from binding. Bend both parts of the gearbox along the dotted lines to give the shapes shown in the sketches. Fit the gears on $\frac{3}{32}$ in. brass shafting into the gearbox. Solder or bolt the two parts of the gearbox together making sure that when the motor is held on the baseplate the worm gear engages the pinion. This is not very critical as the baseplate can be bent or the motor packed up with washers to obtain the best alignment.

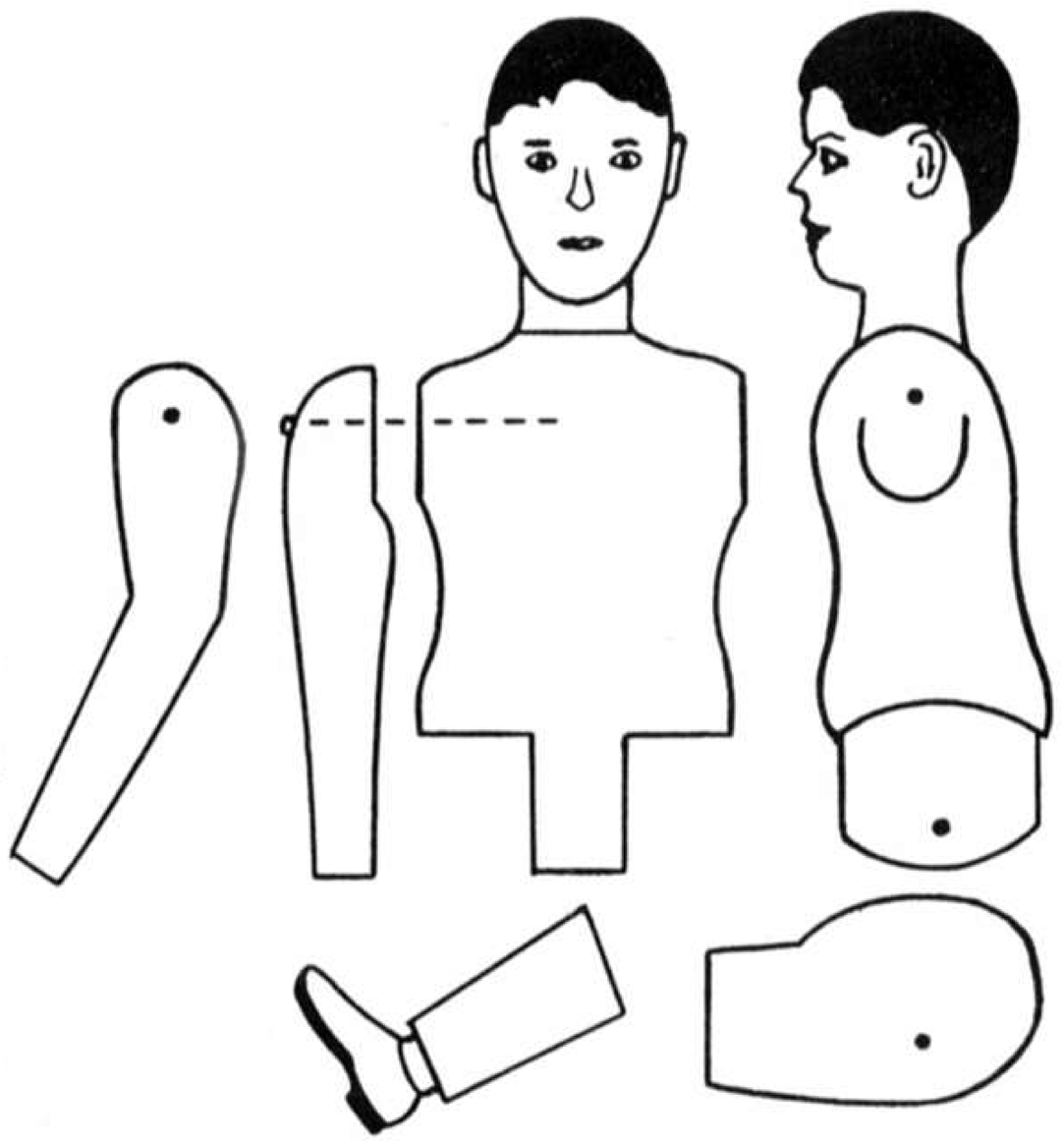
The shaft with the 30 tooth gear has cranks soldered on either side of the gearbox. These are made from tinplate and 8 B.A. bolts.

Hull Construction

The model is built almost completely from $\frac{1}{16}$ in. balsa. Cut out the keel, deck pieces and bulkheads and glue them together inverted on a building board. B1 and B4 should be packed up $\frac{3}{32}$ in. and B2 and B3 $\frac{3}{16}$ in. above the board. This is to give the correct sheer. As the bulkheads have to be cut away almost completely, it helps to cut along most of the dotted line shown on each bulkhead before assembly. Glue the keel support in at the bow and cut out the two bottom skins. Fit these on together using a rubber band over them at the bow as well as pins to hold them in place. When thoroughly dry remove the model from the board, and cut out two side skins. These are almost as shown on the side view of the boat. They may be given a curve by steaming, or, if the wood is soft, by rolling a piece of $\frac{1}{2}$ in.–1 in. dowel over one side of them. Fit the side skins and sand the hull down gently. It should now be tissue covered with lightweight Modelspan, doping this on with aircraft dope. Now remove the centres of the bulkheads.

Bolt the motor and gearbox to the front seat, which is best made from $\frac{3}{32}$ in. balsa as this is slightly more rigid. The rear seat and footrest can be made from $\frac{1}{16}$ in. balsa. Paint the inside of the boat and glue two seats into the hull together with the gearbox and motor.

The oars are made from $\frac{1}{8}$ in. dowel with $\frac{1}{32}$ in. ply blades. The size of the blades could possibly be increased, if the gearbox is well made, and this would increase performance considerably. The rowlocks are shown in the sketch. Two pieces of $\frac{1}{8}$ in. sq. hardwood or $\frac{1}{8}$ in. dowel are needed for each rowlock. Drill a $\frac{1}{32}$ in. hole in each piece to take the T-shaped bearer. A $\frac{1}{32}$ in. hole also has to be drilled in each oar in the same plane as the blades. The position of this hole is shown approximately on the plan, but its exact position should be marked from the particular model. The screw eyes on the end of each oar slide over the two 8 B.A. bolts, and the hole for the T-piece should be positioned such that the screw eye neither slides off the bolt or binds against the other end. The T-shaped bearers can be made from $\frac{1}{32}$ in. brass or steel split pins. Push the pins through the holes in the oars, separate the ends and bend them as shown on the plan. An alternative method is to use a dressmaking pin, and solder a second pin to it to form the T-shape. The head of the pin is again used to stop the oar coming off. The $\frac{1}{8}$ in. sq. rowlocks fit into two holes cut in the deckpiece.

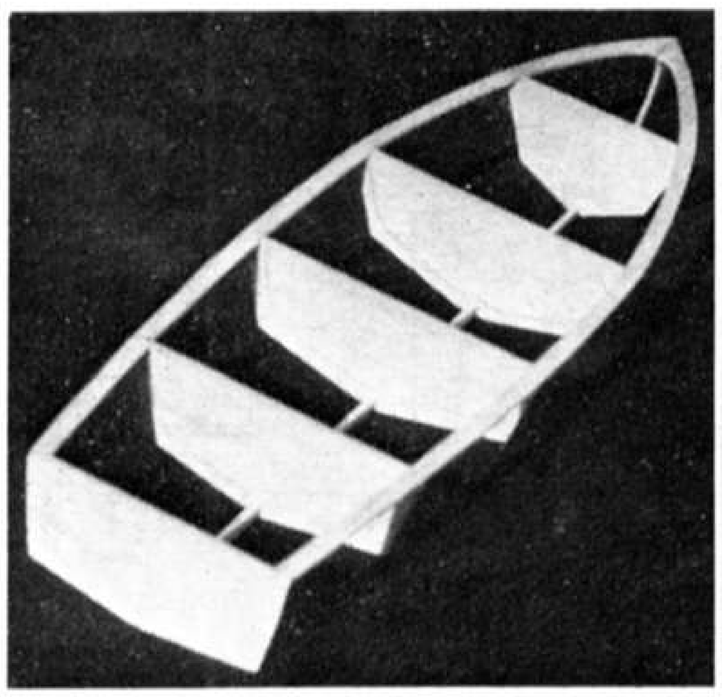


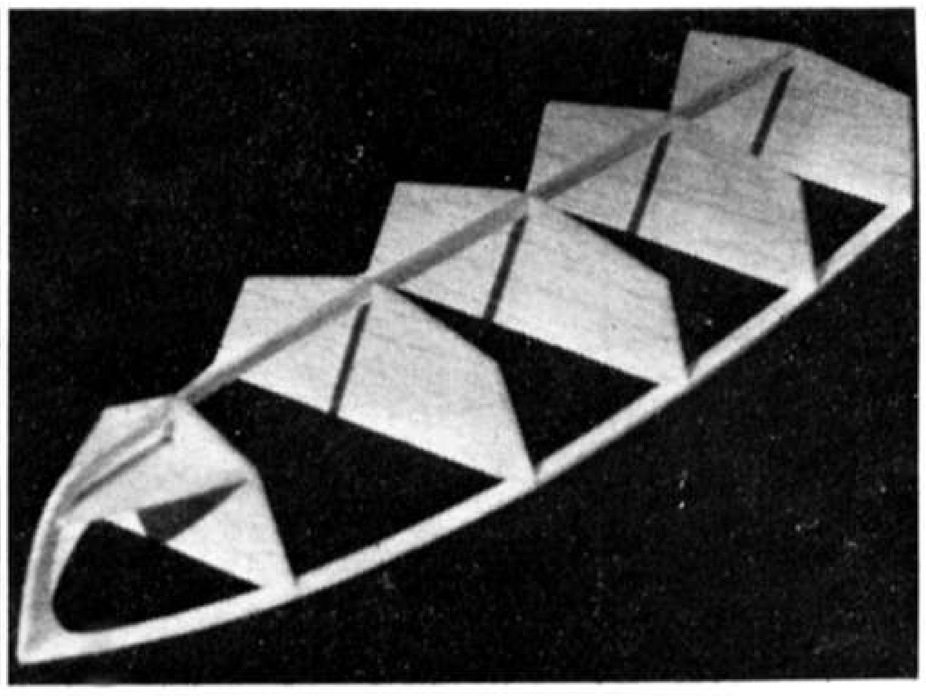
Figures

The approximate shape of the oarsman is shown in the diagram. Carve the head on the end of a block of balsa $\frac{3}{4}$ in. sq., being careful not to make it too small. The body is also carved from block balsa and hinges at the thighs. Glue the thighs to the front seat, making sure that the body is free to pivot about the pin. The feet are glued to the $\frac{1}{16}$ in. balsa footrest and rest against the edge of the gearbox. The arms pivot at the shoulders, again using pins, and are loosely tied to the ends of the oars with thread. Paint the figure, making sure no paint is allowed to stick the joints. The girl in the back seat was made from a little doll, but she could be made in the same way as the oarsman. Her legs and dress cover the batteries under the rear seat.

A box under the forward seat hides the front of the electric motor. The switch consists of a pin on one of the motor leads. This is pushed between the cardboard case of the battery and the battery itself to make contact, the other wiring all being soldered in place.

In conclusion, make the gearbox and the joints free, and you will have a boat which although not fast is interesting to watch, especially in the neighbourhood of other moored models.





ALL WOOD IS 1/16" BALSA UNLESS OTHERWISE STATED

1/8" SQ.

1/8" DO

B1

B2

B3

KEEL SUPPORT

CUT KEEL TO DOTTED LINES

CUT TWO DECK PIECES TO THESE LINES

1/32" PLY BLADES

OARS - 2

APPROX. SHAPE OF BOTTOM SKINS

KAKO OI. BASEPLATE

GEARBOX FROM TINPLATE. BEND ALONG DOTTED LINES

8 B.A. BOLT. SOLDER TO TINPLATE ARM

FULL 0·5"

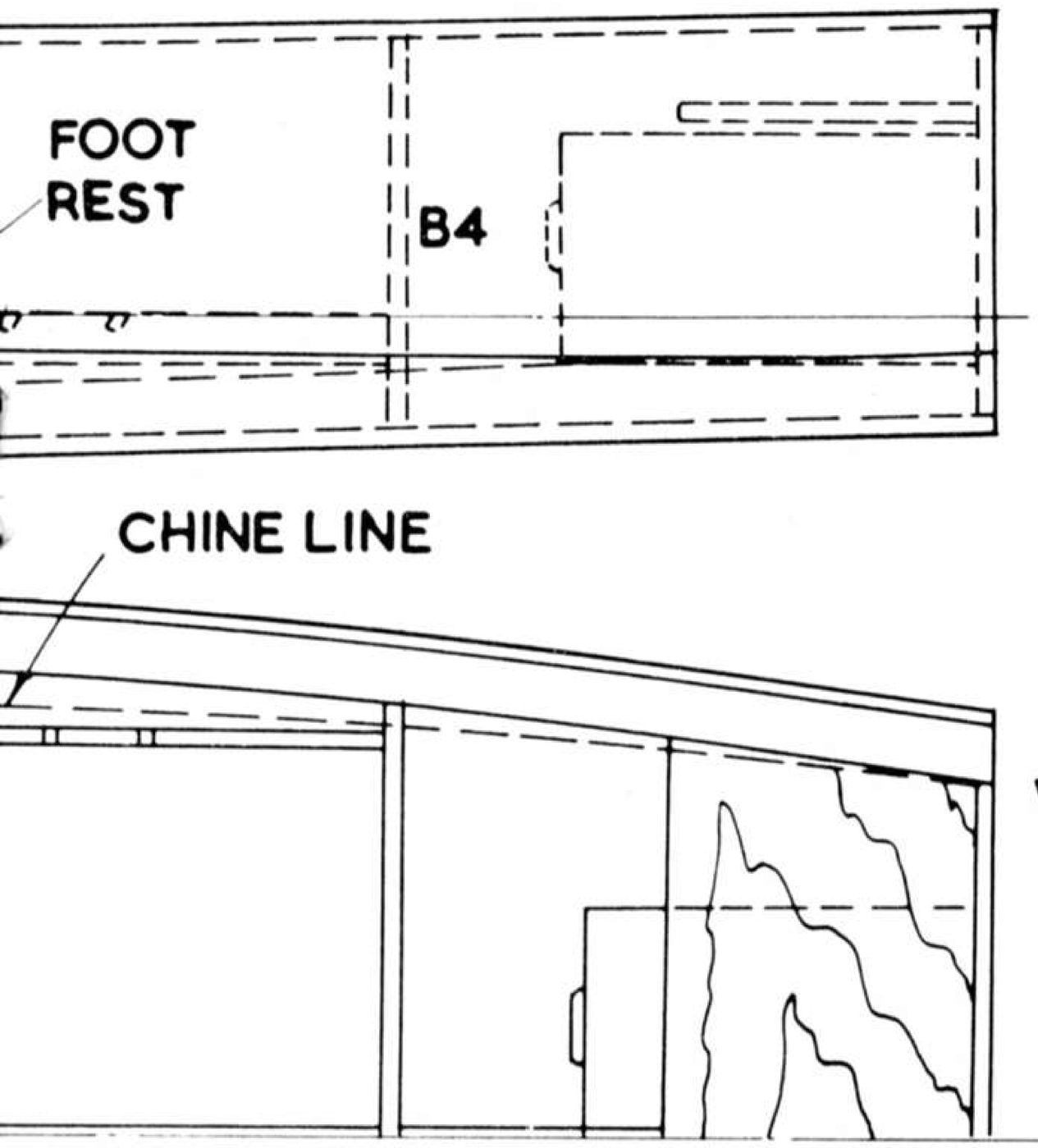
SOLDER OR BOLT TWO HALVES OF GEARBOX TOGETHER (8 OR 10 B.A.)

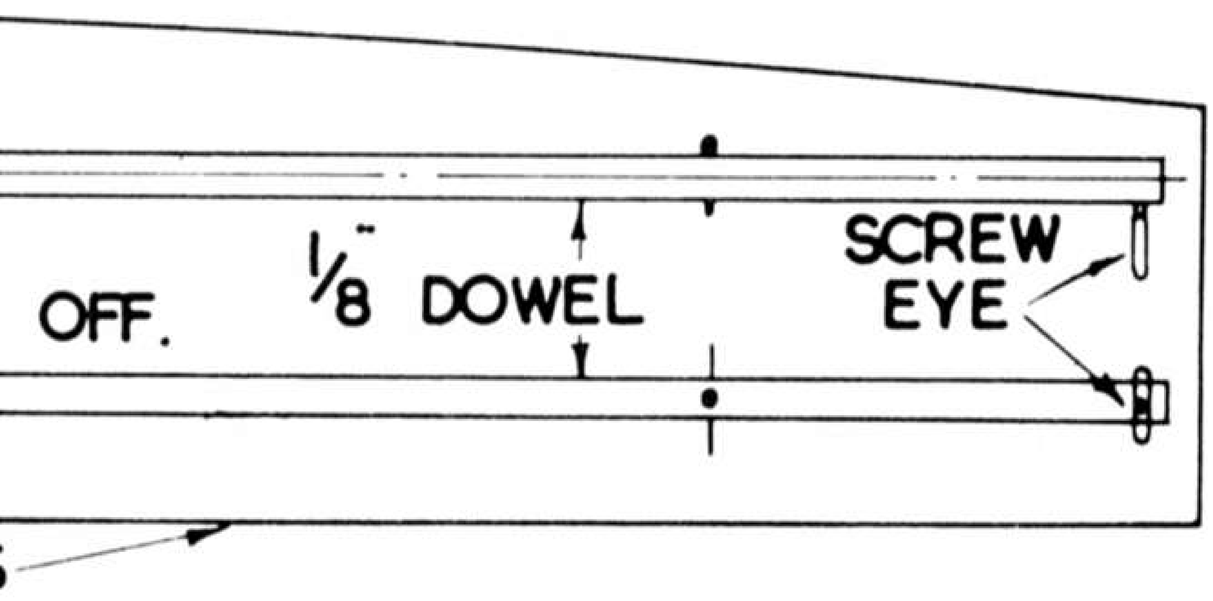
40 : 1 WORM S

ALL GEARS

CENTRES FOR 3/32" HOLES. USE 3/32" BRASS FOR AXLES

HARDWOOD OR
OWEL





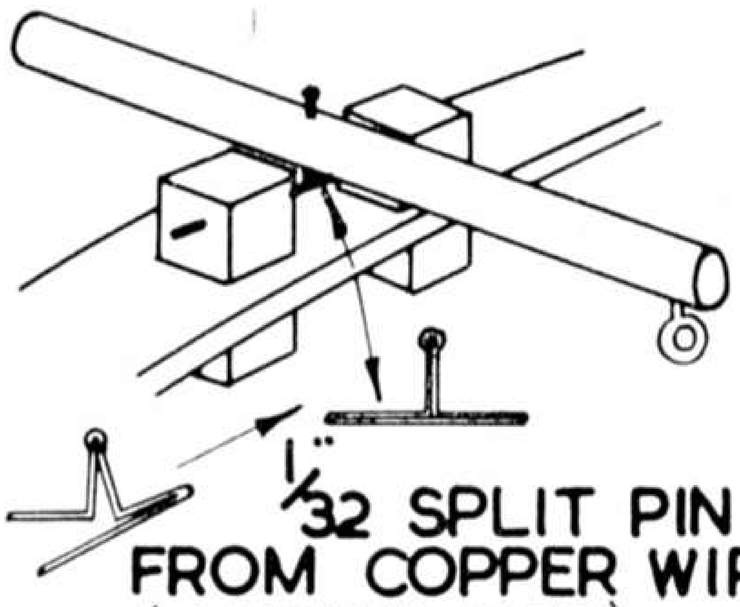
30 TOOTH GEAR

3/8" - 1/2"

D TOOTH GEAR

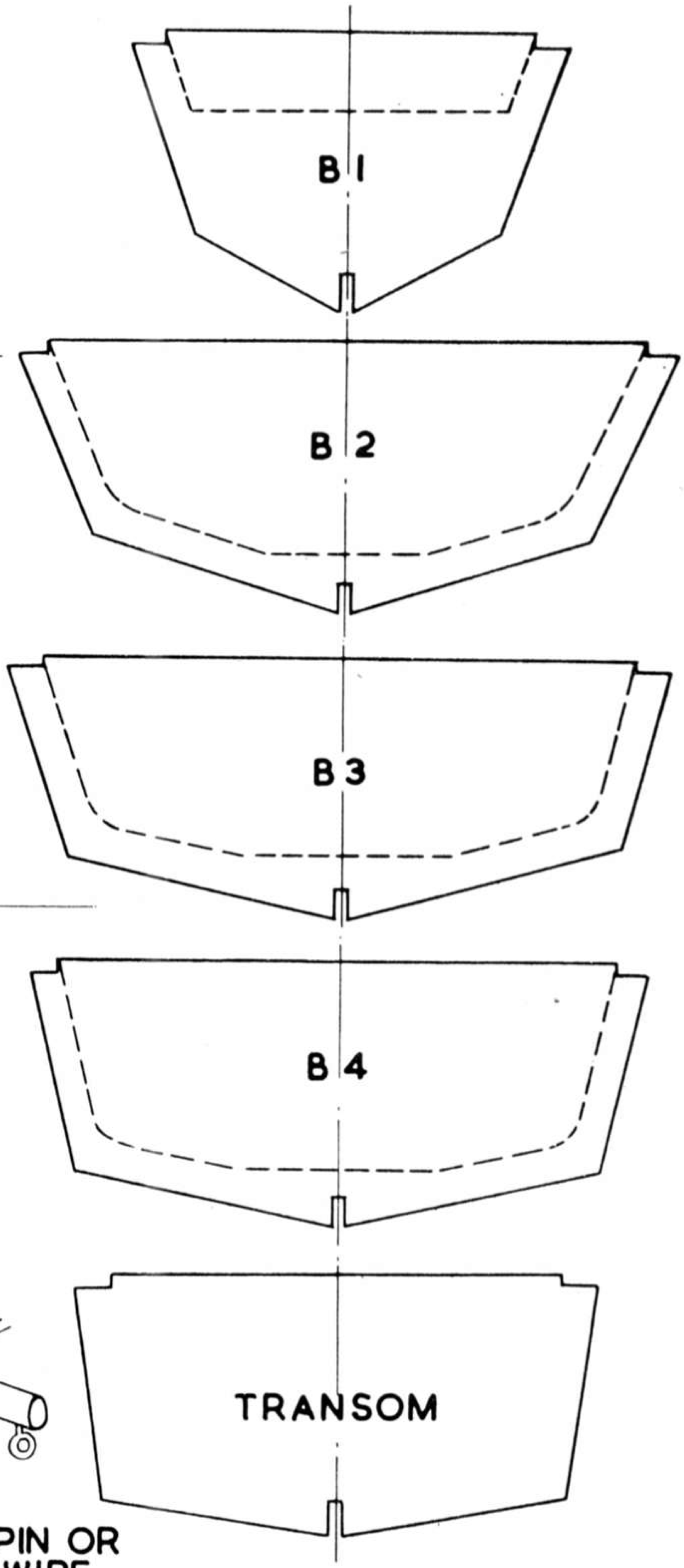
SET

S ARE RIPMAX
NYLON



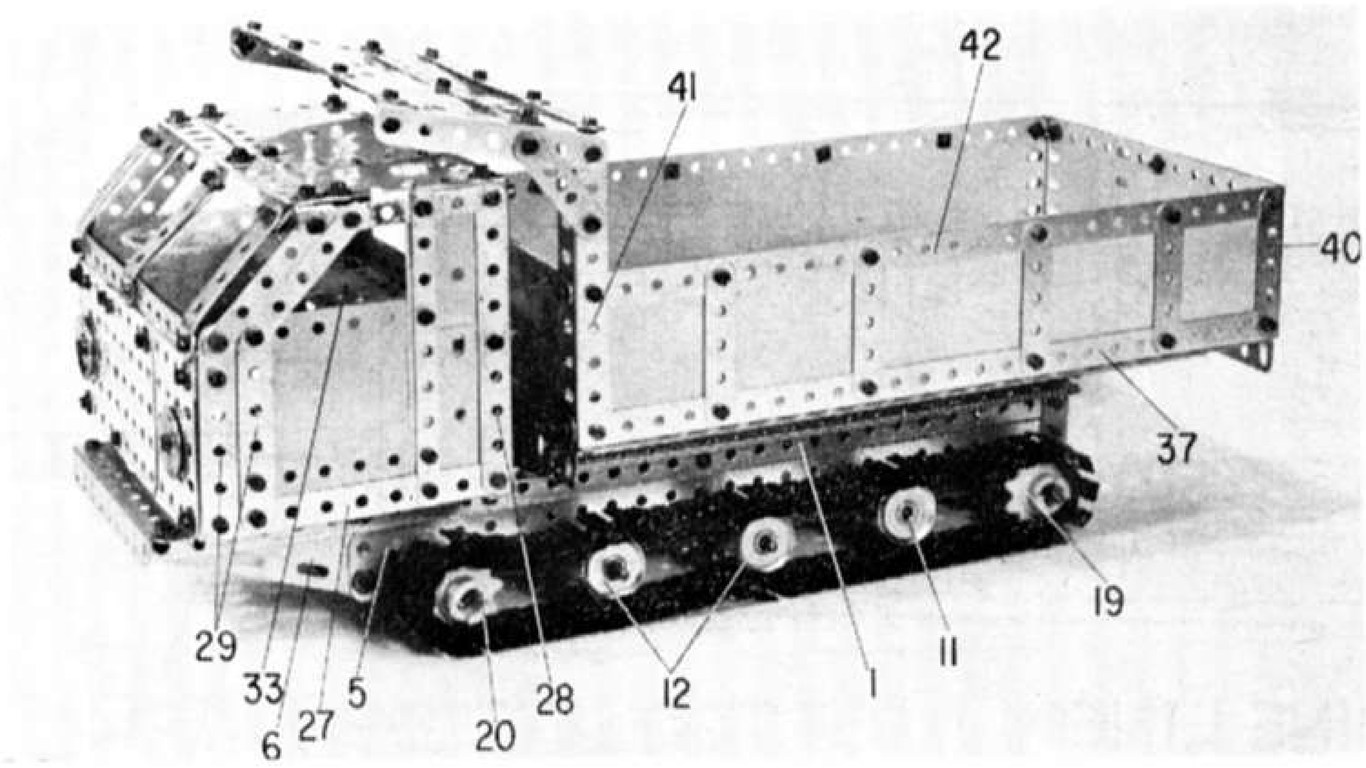
1/32 SPLIT PIN OR
FROM COPPER WIRE
(ACTUAL SIZE)

NOTE SCREW EYE WHICH
ENGAGES ON
CRANK



CUT ALONG DOTTED
LINES ON BULKHEADS
ONCE HULL HAS BEEN
TISSUE COVERED

A caterpillar-track cross-country vehicle based on the full-size Flextrac-Nodwell FN110



Making use of the Meccano Caterpillar Track Pack, this ruggedly appealing model follows the layout of the Flextrac Nodwell type FN110 vehicle, which can take almost any surface in its stride.

Tracked for Tough Terrain

SAYS 'SPANNER' OF THIS ADVANCED MODEL

SLEEK, intricate and streamlined models are very appealing in their place, and I am among the first to appreciate them, but now and again I really do like to see a big, chunky, "monster". Some people might regard such models as ugly, yet I often think they have their own particular beauty—in an aura of brute strength and power!

Featured here is a model which undoubtedly falls into the latter category. Tracked for tough terrain, it is based on a Flextrac-Nodwell type FN110—a rugged cross-country vehicle designed to carry loads over the worst kind of ground from rocky wastelands to muddy swamps, or treacherous ice-fields. The real thing, in fact, will climb gradients in excess of 60 degrees and can manage a 30 degree side-tilt without any trouble. It can be fitted with various tracks to meet "any conditions" and already has an impressive record of operational successes in many countries behind it to prove its capabilities.

From the Meccano modeller's point of view it is an ideal vehicle, not only because its rugged shape lends itself perfectly to reproduction in Meccano, but also because its tracked characteristic offers an excellent opportunity for using Meccano Caterpillar Track Pack. Needless to say, this is what our model-builder has done—with very realistic results. The model runs well and also incorporates working steering, controlled by a steering wheel instead of the more usual lever-steering found on most tracked vehicles. We do not know the system used on the real FN110, by the way, but the average tracked vehicle is steered by braking one or other track, while allowing the non-braked track to drive the vehicle round. Our system relies on a simple but effective gearing system, as will be seen.

Chassis

The chassis is built up from two 15½ in. compound angle girders 1, each consisting of a 12½ in. and a 4½ in. Angle Girder. These compound girders are connected together at their forward ends by a 4½ in. Angle Girder and, at their rear ends, by a 3½ × 2 in. Double Angle Strip 2, each securing Bolt in the la ter case also holding a 1½ in. Strip 3 in position. Bolted between Strips 3 at each side are two further 3½ × ½ in. Double Angle Strips 4, the securing Bolts also fixing a 12½ in. Flat Girder 5 in place. The forward ends of Girders 5 are connected by another 3½ × ½ in. Double Angle Strip, each securing Bolt in this case helping to hold in place a 3½ × 1½ in. Triangular Flexible Plate 6 which is also bolted to compound girder 1. Counting from the rear end, Flat Girders 5 are further connected through their sixth, ninth, fourteenth and sixteenth holes by four more 3½ × ½ in. Double Angle Strips, arranged as shown and numbered 7, 8, 9 and 10 respectively. Note that the Bolts fixing Double Angle Strips 7 and 8 in place also fix a Double Bent Strip to the outside of each Flat Girder, while the Bolts securing Double Angle Strip 9 help to fix a strengthening 1½ in. Strip between the insides of the Flat Girder and compound girder 1 at each side. Held by Collars in the Double Bent Strip and the Flat Girder is a free-turning 2 in. Rod carrying a 1 in. Pulley 11 which will serve as an "idler" wheel for the tracks. Further idlers are provided by additional 1 in. Pulleys 12, fixed on two 6 in. Rods journalled in Flat Girders 5.

Now bolted to Double Angle Strips 9 and 10 is a Motor-with-Gearbox, output shaft rearwards and set in the 60:1 ratio. A 1½ in. Strip 13 is added to the shaft, followed by a ¾ × ¾ in. Pinion. This Pinion is in constant mesh with a 50-teeth Gear Wheel 14 fixed on a 6½ in. Rod, free to slide in the centre holes of Double Angle Strips 7 and 8 and lower Double Angle Strip 4, as well as in the lower hole in Strip 13. Stops to prevent the Rod sliding so much that Gear 14 disengages with the ¾ × ¾ in. Pinion are supplied by two Collars, one fixed on the rear end of the rod and the other between Double

Angle Strips 7 and 8. Also fixed on the Rod in the position shown is ½ × ¾ in. Pinion 15.

Two 3½ in. Rods are next held by Collars in lower Double Angle Strip 4 and Double Angle Strip 7 one each side of the 6½ in. Rod. Two ½ in. Pinions 16 and 17 are secured one on each of these Rods, care being taken with their positioning. They should be staggered in relation to each other so that with the 6½ in. Rod in its forward position, Pinion 15 meshes only with Pinion 16. As the Rod moves rearward to the centre position, however, Pinion 15, remaining in mesh with Pinion 16, should also mesh with Pinion 17. As the Rod moves further back to its rear position, Pinion 15 should disengage Pinion 16 and mesh only with Pinion 17. Pinions 16 and 17 each mesh with a ¾ in. Contrate Wheel fixed on a 2½ in. Rod journalled in the bosses of two Double Arm Cranks 18 bolted one to the inside and one to the outside of Flat Girder 5. Packing Washers are added as necessary. Mounted on the Rod is a Coupling on which a Plastic Meccano 10-teeth Sprocket Wheel 19 from the Track Pack, is secured. A similar Sprocket 20 is fixed on another Coupling mounted on a 2 in. Rod journalled in one Double Arm Crank bolted towards the opposite end of Flat Girder 5 and held in place by a Collar.

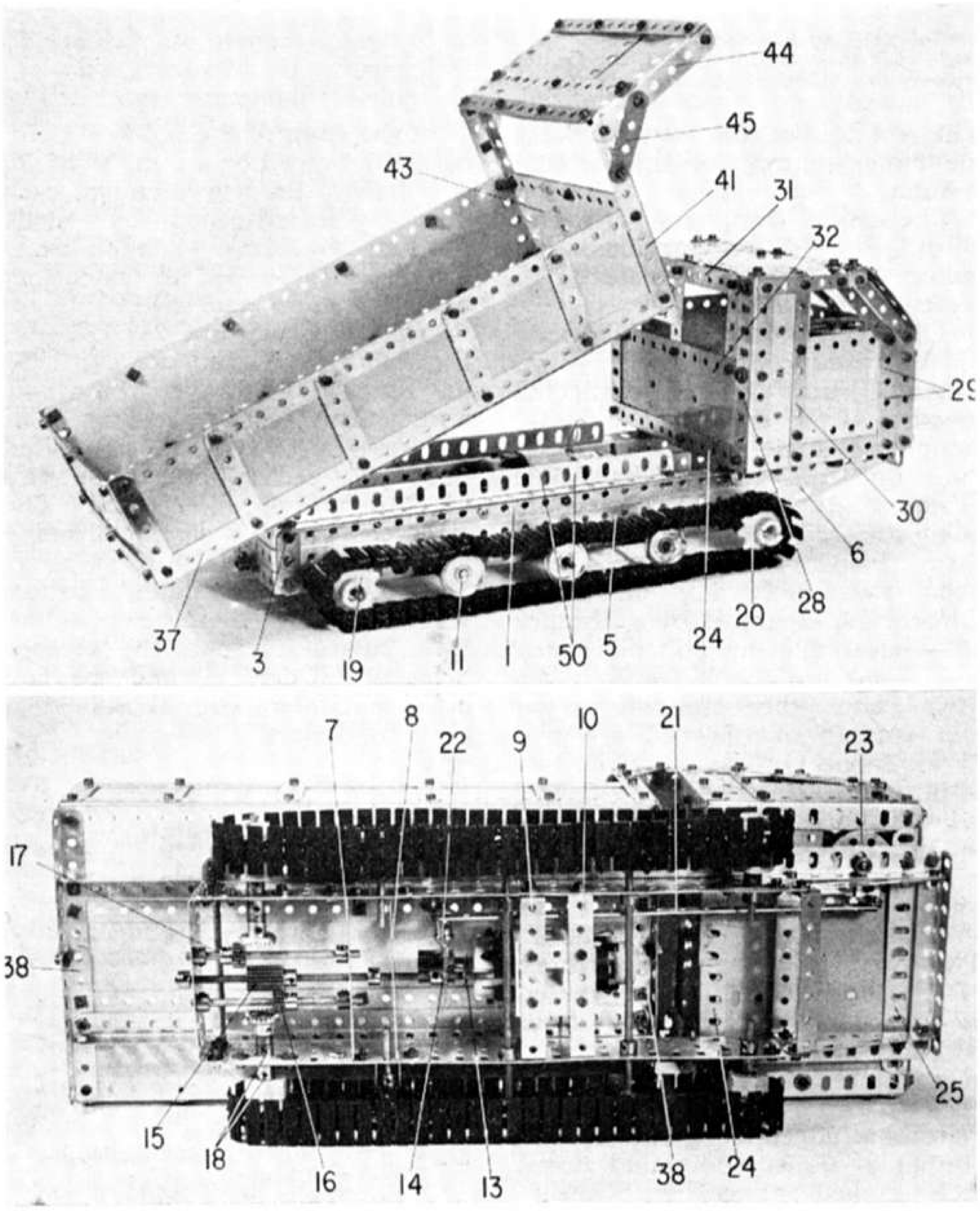
Lengths of caterpillar track will of course be carried on the Plastic Meccano Sprockets but before fitting them it is advisable to complete the steering linkage. Turning freely on a Pivot Bolt locked in the tenth hole of compound girder 1 is a Crank to the lower end of the arm of which a 9½ in. Strip 21 is pivotally attached by a ½ in. Bolt. Fixed on the shank of this Bolt is an End Bearing 22, the arms of which locate over the face of Gear Wheel 14, but note that the arms must not grip the Gear, or hinder its turning movement in any way. The forward end of Strip 21 is lock-nutted to an Angle Bracket which is in turn lock-nutted to an 8-hole Bush Wheel 23 fixed on the steering column. This column is supplied by a 3½ in. Rod journalled in the fourth hole of compound girder 1 and—later—in a journal mounted inside the cab. When the steering wheel is turned, it causes End Bearing 22 to act on Gear 14 moving it and its supporting Rod backwards or forwards which, of course, controls the meshing of Pinions 15, 16 and 17. This, in turn, causes the model to steer in the chosen direction.

The two crawler tracks can be positioned as soon as the control linkage has been completed. Each track consists of 63 Track Links, which is just right to ensure sufficient slack for easy running without being so loose that the track is easily "thrown".

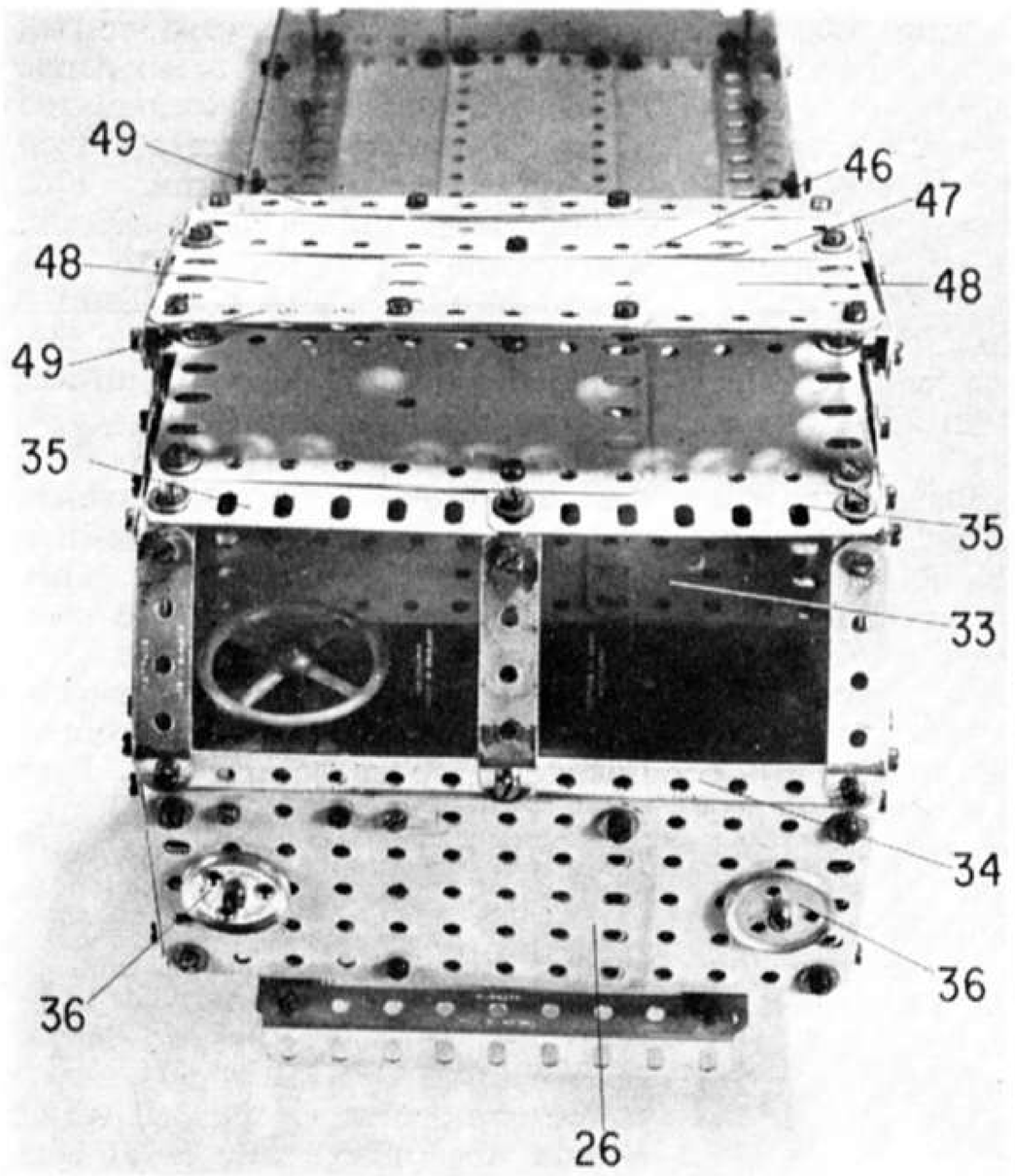
Cab

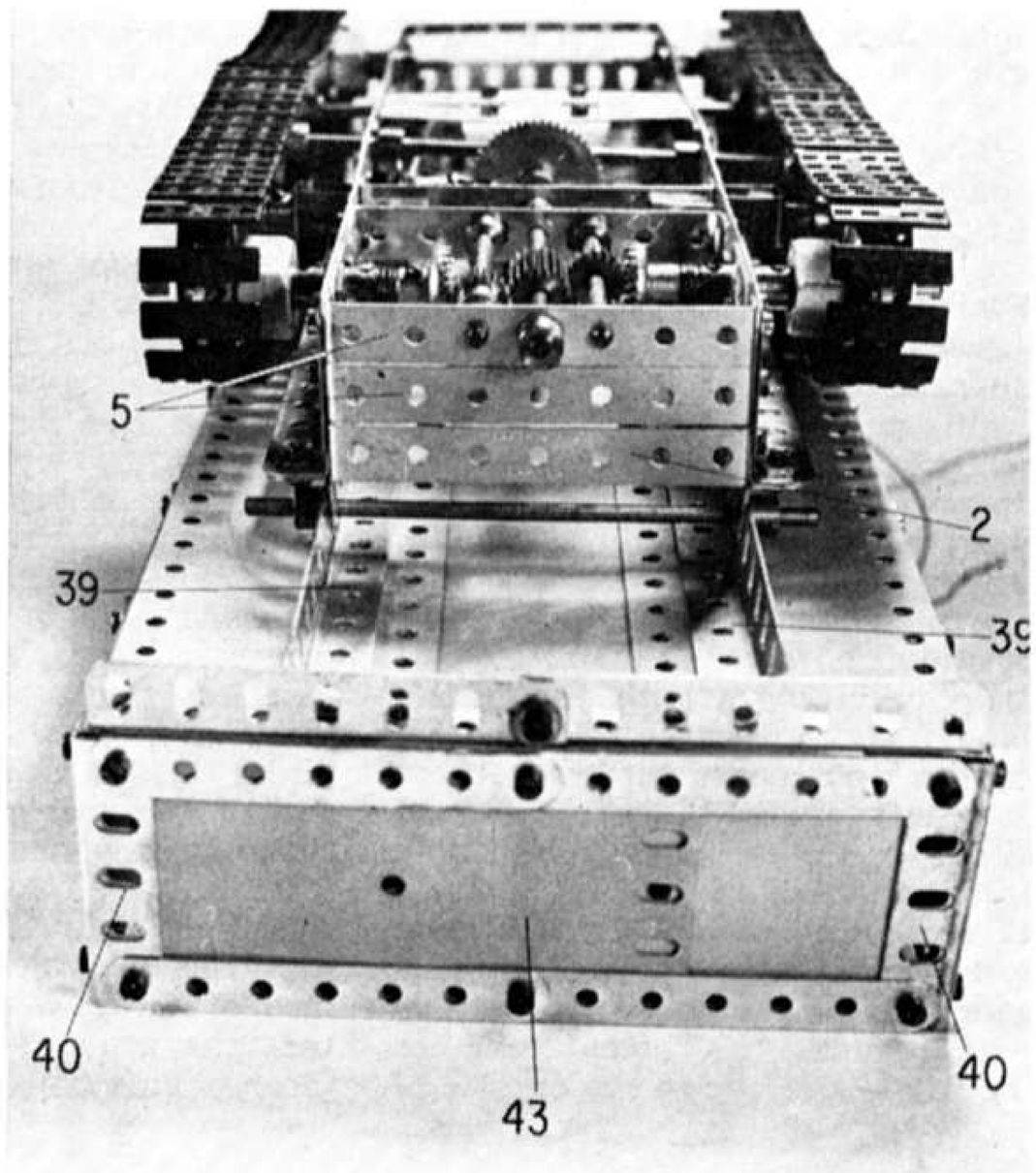
We come next to the cab which should not present any great constructional difficulties. A 6½ in. compound angle girder 24 (built up from one 4½ in. and one 3½ in. Angle Girder) and a 5½ in. Angle Girder 25 are attached to compound girders 1, being spaced from the girders by two Washers and a Nut on each securing ½ in. Bolt. A 6½ × 2½ in. compound flat plate 26 built up from two 4½ × 2½ in. Flat Plates and edged by 2½ in. Angle Girders is bolted to the vertical flange of Girder 25. The lower end of each 2½ in. Girder is then connected to the end of compound girder 24 by a 4½ in. Angle Girder 27, a rear vertical corner post being provided by another 4½ in. Angle Girder 28. Two 3 in. Strips 29, extended upwards and rearwards by 2½ in. Narrow Strips, are bolted to the forward end of Girder 27, the upper ends of the Narrow Strips being connected to the top of Girder 28 by a 3 in. Narrow Strip. The end securing Bolts also hold two Angle Brackets in place. A 4½ in. Narrow Strip 30 is bolted between the 3 in. Narrow Strip and Angle Girder 27, then the cab side is completed by a 4½ × 2½ in. and two 2½ × 1½ in. Flexible Plates arranged as shown to leave a gap for the side window.

At the back of the cab, a 2½ in.



Top, a general three-quarter rear view of the model, with the load body in the raised position. Left, an underside view of the model showing the drive to the tracks.





Left, a high frontal view of the cab, in close-up. Right, in this close-up underside rear view of the model, the Double Angle Strip connections between the sides of the chassis are clearly shown.

Flat Girder is bolted to the upper half of each Girder 28, these Flat Girders being connected at the top by a 5½ in. Strip 31 and, at the bottom, by a 5½ in. Angle Girder, the securing Bolts in the latter case helping to fix a 6½ × 2½ in. compound flexible plate 32 between Angle Girders 28. The centre of the Angle Girder is connected to the centre of Strip 31 by a 2½ in. Strip, while a 5½ × 1½ in. Flexible Plate 33, extended two holes by a 2½ × 1½ in. Flexible Plate is bolted to the horizontal flange of the Girder to represent the seat.

A 6½ in. compound strip 34, built up from two 3½ in. Strips, is attached by Fishplates to compound plate 26, at the same time fixing in position two 3½ × 2½ in. Transparent Plastic Plates overlaid by three 2½ in. Strips to serve as the windscreen. The Strips and Plates are carefully bent to the required shape, then the roof is added, this consisting of two 4½ × 2½ in. Flexible Plates, overlapped five holes, and two 3½ in. Flat Girders 35. The roof as a whole is attached to the sides by the earlier-mentioned Angle Brackets with the windscreen being secured to Flat Girders 35, by Angle Brackets.

A Trunnion is bolted to the inside top edge of compound plate 26, the apex of this Trunnion being extended one hole by a 1½ in. Strip. The end hole of this Strip provides the upper journal for the steering column.

The cab is completed with two 1 in. Pulleys without boss 36, bolted to the front of plate 26 to serve as headlamps.

This leaves only the load body to be produced. Two 12½ in. Angle Girders 37 are connected together at the ends by two 6½ in. compound angle girders 38 (each built up from two 3½ in. Angle Girders), the intervening space being enclosed by three 12½ × 2½ in. Strip Plates forming the lorry bed. Two more 12½ in. Angle Girders 39, separated by a distance of five clear holes, are bolted between compound girders 38 beneath the Strip Plates, then attached to the rear corners of the bed are two 2½ in. Angle Girders 40, while two 4½ in. Angle Girders 41 are attached to the forward corners. Bolted to Girders 37, 40 and 41 at each side is another 12½ × 2½ in. Strip Plate, serving as the body side and edged along the top by a 12½ in. Strip 42. This Strip is connected to Girder 37 by four 2½ in. Strips spaced as shown. The back and front are both enclosed by a 6½ × 2½ in. compound flexible Plate 43, built up from two 4½ × 2½ in. Flexible Plates and edged along the top and bottom by 6½ in. compound strips, each supplied by two 3½ in. Strips.

At the front of the body a 3½ in. Strip 44, braced by a 2 in. Strip 45, is bolted to the upper end of each Girder 41. Attached by Angle Brackets to Strips 44 is an overhanging 6½ × 3½ in. extension, built up from one 5½ × 1½ in Flexible Plate 46, one 2½ × 1½ in. Flexible Plate 47 and two 4½ × 2½ in. Flexible Plates 48, the whole arrangement being edged at front and rear by two 6½ in. compound Strip 49, each supplied by two overlapping 4½ in. Strips. The completed body is finally pivotally attached to two 9½ in. Angle Girders 50—bolted to compound girders 1 in the chassis—by means of a 5 in. Rod passed through the seventh holes of Girders 39 and the end holes of Girders 50. It is held in place by Collars.

PARTS REQUIRED

1—1a	3—12c	2—29	5—111a
1—2a	1—14	211—37a	1—126
4—2a	2—14a	191—37b	1—147b
10—3	1—15	60—38	1—166
4—4	1—15b	2—45	1—185
12—5	2—16	9—48b	6—188
2—6	2—16a	2—53a	2—189
6—6a	4—17	19—59	2—190a
6—8	6—22	1—62	13—191
2—8a	2—22a	6—22b	2—193b
2—9	1—24	4—63	5—197
10—9a	1—25b	10—69c	2—224
5—9b	2—26	2—103b	4—235
4—9d	1—26b	4—103d	2—235a
9—12	1—27	2—103f	2—235d

4—10-teeth Sprockets (Plastic Part No. P1)
126—Track Links
1—3-12 volt Motor-with-gearbox.

Photographed in Fig. 3 is a simple practice assembly to show the principles of sprocket drive, shaft adjustment, etc.

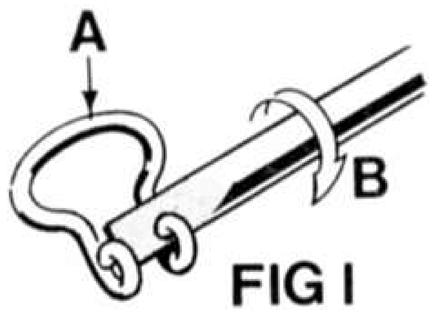


FIG 1

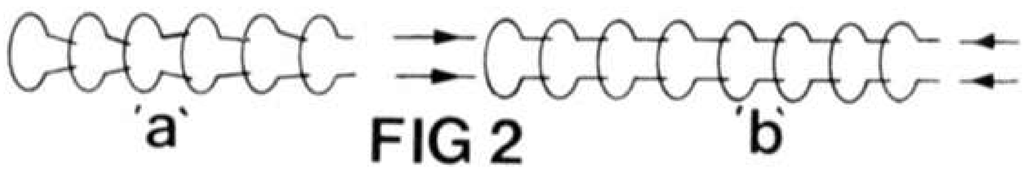


FIG 2

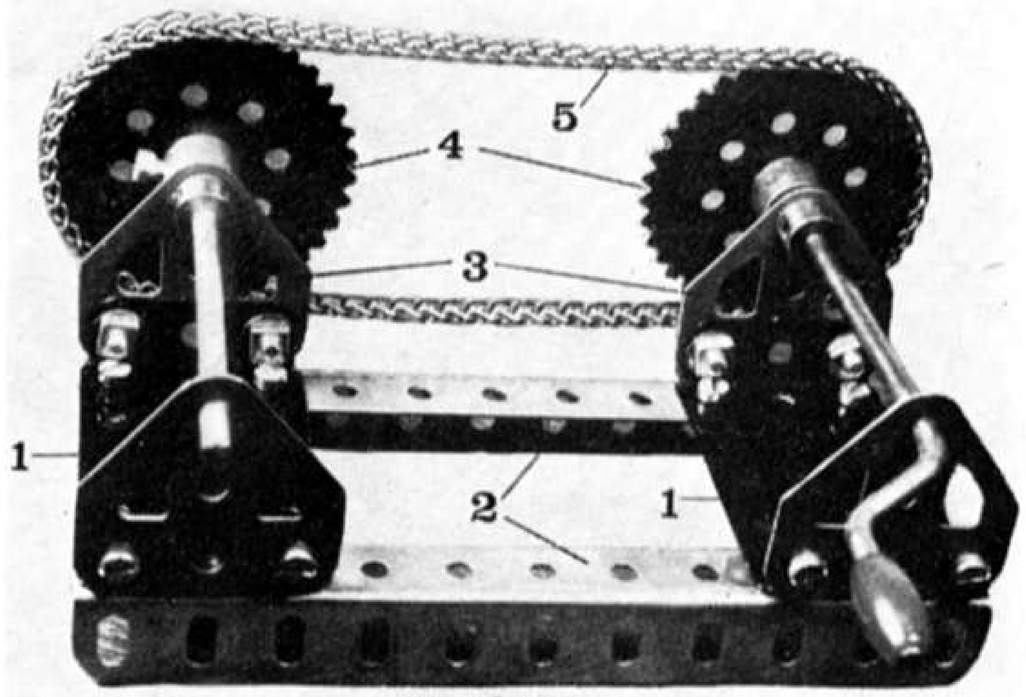


FIG 3

Meccano Parts and How to Use Them

PART 8 BY B. N. LOVE

SPROCKET CHAIN AND SPROCKET DRIVES

THERE are many occasions in mechanics where a chain drive is the most acceptable method of passing on a drive from one shaft to another. This may be occasioned by a wide spacing between shafts which would make gear drives, with their extended shafting, too cumbersome or too expensive, or by high speed requirements where low noise and wear are important. Roller chain, which every boy knows as the type used on his bicycle, is also very successfully used in high speed motor car engines for operating the cam shaft which opens and closes the engine valves many times per second. Chain is also capable of transmitting very high torque via sprocket wheels which are relatively simple to produce and do not require the same degree of precision as is required in spur gears when it comes to forming the teeth.

Meccano Sprocket Chain (Part No. 94) is of the simple link type but, when properly applied, it will serve in the same way as roller chain, enabling models to be motivated with great realism. The machine in the Binns Road Factory which produces Meccano Sprocket Chain is fascinating to watch. It is a comparatively small, table-top machine which is fed from a large spool of bright steel wire. This is drawn into the machine which cuts off enough wire to make one chain link and then puts in the rather complicated bends and the two loops required to hitch one link to the next. It actually performs this hitching operation also, forming a continuous chain by closing the loops of one link on to the ring portion of the next. The operator has a pre-set length of 40 in. (1 metre approx.) marked on the bench and, as the Chain comes from the machine, it is measured against the standard and cut with wire nippers as required. Literally miles of Sprocket Chain are used by the Model Room at Binns Road and they normally have it supplied to them from the factory below on wooden reels like small cable drums. In this case, the machine is allowed to make an unbroken length until the drum is filled up.

Most serious constructors have Sprocket Chain in their Meccano collection, often in various lengths and sometimes in peculiar condition! It is so easy to take Sprocket Chain for granted, but it needs looking after like any other Meccano part and an inspection of well-used Chain often reveals some surprising shapes. The first part of Fig. 2 shows the common faults encountered when links have suffered at the hands of heavy-handed enthusiasts, or indifferent tools.

If Sprocket Chain is in good condition it should appear as a continuous parallel arrangement as shown in part B of Fig. 2. In fact, by holding up the Chain, and stretching it at eye-level, a full length should look like a neat run of miniature railway line with no kinks or twists in it. If you have lengths like this, keep them for long-reach jobs. On the other hand, short lengths which are distorted should not be thrown away as they will make quite satisfactory chain slings for crane hoists, or lashings for heavy-duty lorry loads.

There is a simple way of opening the links at any point in a length of Sprocket Chain and this is shown in Fig. 1. A slim-bladed electrician's screwdriver is used to prise open the loops, one at a time, by keeping the back of the link flat on a table with pressure at point A and by rotating the screwdriver in the direction indicated. It is only necessary to open the loop sufficiently to accept the ring portion of the next link. When closing the loops, a small pair of thin-nosed pliers is the most suitable tool, but, again, they must be used with care so that, on closing the loop, it is not crushed out of shape in any direction or made too tight to give adequate freedom of movement in the adjacent link.

Fig. 3 shows a simple rig on which the novice may exercise his skill in producing a Sprocket Chain drive. Construction is very simple and almost self-evident from the illustration. Two 5½ in. Angle Girders 2 are secured at either end by 2½ × 1½ in. Flanged Plates 1 to provide a rigid base. Four Flat Trunnions 3 are mounted on the flanges to form bearings for the Crank Handle at one end and a 3½ in. Axle Rod at the other. The 2 in. Sprocket Wheels 4 are attached to the outer ends of the two shafts and held in place with Set Screws. Two Collars hold the shafts in place. Taking a length of Sprocket Chain longer than required, a full loop of chain is passed half way round both Sprocket Wheels, then the Sprocket Wheels are allowed to turn until a join is indicated by the position of one end

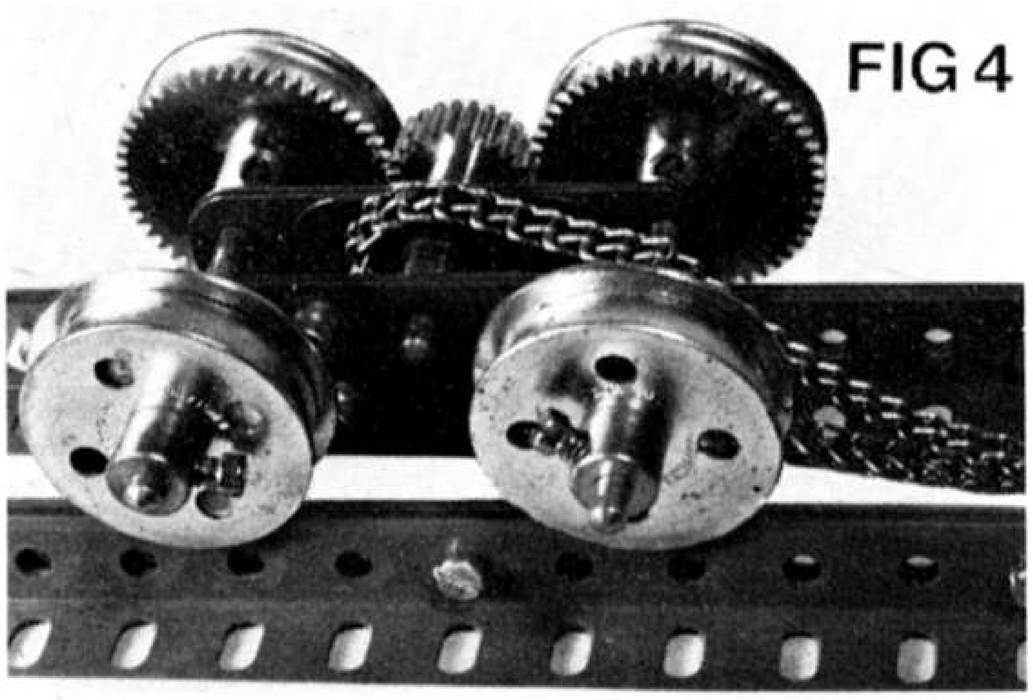


FIG 4

A bogey (shown upside down) from a dragline machine showing use of slack chain drive.

of the Chain lying on, say, the right-hand Sprocket. Note carefully where the break should be made in the length of Chain and then proceed to open the correct link carefully. Don't be the least bit surprised, if, when you offer the Chain up again, you are one link short or one link over. (This can happen with the most advanced modellers!) However, when you are satisfied that the Chain is a reasonable fit—and certainly not a tight one—you may well find that it is just a bit too slack.

On the rig shown in Fig. 3 it is a simple matter to "stretch" the distance between the shafts because the Flat Trunnions 3 are mounted on the slotted holes of the two Flanged Plates and, by careful adjustment of the Nuts and Bolts, the position of the Sprocket Wheels can be adjusted to take up any slack. Care should be taken not to twist the two shafts out of parallel alignment with each other, adjusting all four Trunnions if necessary. This is a point worth noting so that, when the enthusiast designs his own models, some means of lateral adjustment of the shafts should be built in, if possible.

There are many occasions in modelling in Meccano where standard spacing is unavoidable for shafts and this does not always tie up with optimum spacing for Sprocket drives. There are ways round this problem, however. First, if you have an assortment of Chain, try them out—you may find one length a better fit than the other as lengths of Sprocket Chain vary after use owing to natural elongation wear. Secondly, if the fit is loose but the drive is satisfactory, leave it alone. In extreme cases, a slack Chain should be taken up by means of a "jockey" sprocket which is a third Sprocket Wheel mounted on a sprung arm to bear against the slack portion of the chain. Well-experienced constructors can sometimes do the trick by putting a light squeeze on a number of adjacent links to shorten their loops fractionally, but this requires skill if a jammed and distorted Chain is to be avoided.

Sprocket drives retain the advantage of gears in providing fixed ratios. In the rig of Fig. 3 a 1 : 1 ratio is shown. This ratio would be the same if both wheels are the same size so why not use the smallest Sprocket Wheels at each end? These would be $\frac{3}{4}$ in. dia. and there would be no objection to this so long as heavy drive is not required where slipping could well occur. The larger Sprockets reduce the slip possibilities on heavier drives.

A word of warning here on gear ratios via Meccano Sprocket Wheels: count the teeth! A $1\frac{1}{2}$ in. Sprocket Wheel driving a 3 in. Sprocket Wheel gives a reduction ratio of 2 : 1, as expected, but a 1 in. Sprocket driving a 3 in . Sprocket does *not* give a 3 : 1 ratio as might be expected. This is because the teeth ratio is 18 for the 1 in. Sprocket and 56 for the 3 in. Sprocket which is not a 3 : 1 arrangement. The $\frac{3}{4}$ in. Sprocket, 14 teeth, does give proper ratios with the $1\frac{1}{2}$ in. Sprocket, 28 teeth (2 : 1) and with the 3 in. Sprocket, 56 teeth (4 : 1). The rig in Fig. 3 will demonstrate all this by attaching the range of Sprockets mentioned and will provide good practice in handling Sprocket Chain.

There are occasions, as has been mentioned earlier in the series, when a chain drive is deliberately attached with a slack loop and Fig. 4 shows such an application to the travelling bogey of a dragline subject to unsteady levels when running over undulating track. For clarity, this particular bogey is shown mounted upside down so that the drive arrangements are clear.

Fig. 5 shows just how compact a Meccano Chain drive can be. This shows a travelling bogey from a dockside crane in which all wheels are driven. For this purpose, $\frac{3}{4}$ in. Sprocket Wheels are adequate, the drive being spread over a total of 12 wheels when the crane is in motion. This is a case where the spacing for all wheels is identical and the lengths of Chain can be trimmed to the same length and preferably fitted to the small Sprocket Wheels *before* sliding them in place on their Axle Rods. This avoids a common, but not good practice of forcing the Chain on with the wheels in position which invariably stretches the Chain and stretched chain can be disastrous on such short runs. Whether or not one closes the final link in the Chain is a matter of personal choice. The link should be closed on an exhibition or demonstration model, of course, but the open end is frequently left in case early adjustments are required. The Chain will still give a satisfactory drive, even if the last link does not have its loops fully closed.

Finally, a word on storing Sprocket Chain: drop it into the bottom of your cabinet in a heap and you are asking for trouble! You can expect a tangled, dirty mess on trying to retrieve it later. Either wind it on to a stiff card or wooden reel and put it into a plastic bag (a dry one, or your Chain will rust—*don't* blow into the bag to open it!), or hang your Chain in selected lengths from hooks inside your Meccano storage cupboard if you are lucky enough to have one. Be very sparing on oil with Sprocket Chain. The slightest overdose will guarantee a chain looking like a hairy caterpillar in no time! Look after your Sprocket Chain and it will serve you well.

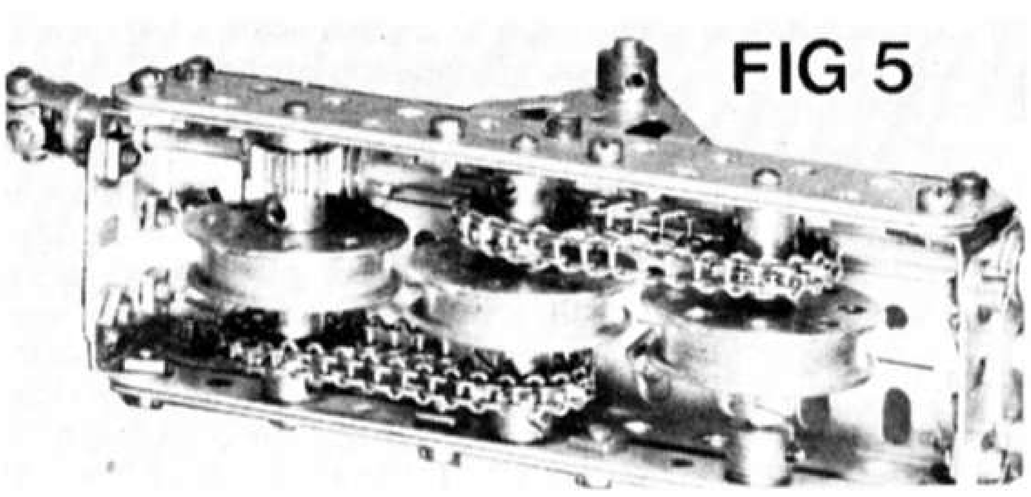


FIG 5

Another bogey, this time from a crane, which demonstrates compactness of sprocket drive.

STAMPS . . . by James A. Mackay

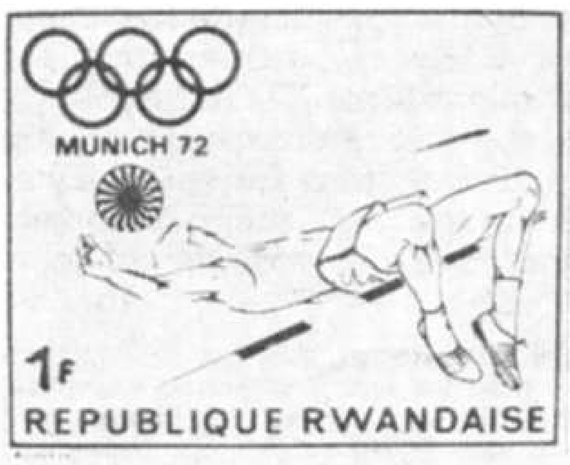
Olympic Games Stamps

ON the 26th of this month the Twentieth Olympiad will open at Munich in Germany and some 12,000 athletes and sportsmen from every part of the globe will compete for the coveted medals in this famous four-yearly event. A special Olympic village has been created at Oberwiesenfeld, 2½ miles from the actual Olympic Games venue in Munich. Some idea of the scope of the preparations for this event can be obtained from the miniature sheet issued by West Germany on July 5. The sheet takes the form of an aerial view of Munich and the surrounding district and four of these landmarks are, in fact, postage stamps, separated from the surrounding picture only by their perforations. At the right of the picture is a 70 pfennig stamp featuring the television tower, an impressive landmark standing almost 900 feet high. From the revolving platform on the top of the tower one gets a splendid panorama of the city and the Olympic stadia. On the far left of the picture, on a 30 pf stamp, is the impressive main stadium, with seating for 80,000 spectators. Beyond that (and shown on a 25 pf stamp) is the velodrome and sports halls for indoor events. In the middle of the picture (on a 40 pf stamp) are the gigantic tent-like structures which enclose the other venues, so that the uncertainties of the weather will not interfere with the smooth running of the Sports. The German authorities have laid on special rail and underground services, facilities for 4,000 journalists and television crewmen, and a host of fringe activities and events for the entertainment of the thousands of visitors expected for the Games. The German miniature sheet bears a small premium in aid of the Foundation for the Promotion of the Olympic Games.

It is 36 years since Germany was last the venue of the Olympic Games. On that occasion a set of three stamps was released for the Winter Games, at Garmisch Partenkirchen, and a set of six stamps for the Summer Games held in Berlin. The huge Olympic stadium in West Berlin, a show-piece of the Third Reich, is still one of the outstanding attractions in a city full of architectural masterpieces. The Berlin stadium has appeared on stamps of West Berlin in recent years.

Ever since the Olympic festival was revived in 1896 by Baron Pierre de Coubertin the host country has usually issued stamps to mark the occasion. The first of the modern Games was staged in Athens, and Greece issued a set of twelve stamps featuring athletes from ancient Greek art, and views of Athens. No stamps were released for the 1900 Olympics in Paris or the 1904 Games in St. Louis, United States, but Greece again produced a set in 1906 for the Athenian Games, a semi-Olympic event which was never repeated in subsequent years. No stamps for the Olympic Games were issued again until 1920 when the sixth Games was held in Antwerp. Belgium released a set of three for the event. France issued four stamps for the 1924 Olympics held at Colombes near Paris and subsequently Uruguay issued three stamps to celebrate victory in the football event. In 1928 the Netherlands released eight stamps for the Amsterdam Olympics and Portugal also issued stamps in honour of the occasion. The 1932 Games held at Los Angeles had two stamps issued by the United States, plus a third for the Winter Olympics at Lake Placid.

It was not until 1948 that the Games could be resumed after the Second World War and then Britain issued four stamps and an aerogramme for the London Games. Special stamps, stationery and postmarks have been produced for each of the subsequent events, not only by the host country, but by an increasing number of the participant countries as well. Another feature of Olympic philately is the tendency of the host country to release sets of stamps as a form of advance publicity. This began in 1954 when Australia issued a 2s stamp to promote the 1956 Melbourne Olympics. Nowadays these advance issues tend to appear almost as soon as the next host is announced, while the Games are hardly over for another four years. West Germany's first series appeared in 1968 and portrayed famous personalities connected with the history of the modern Olympics. The second series (1969) had designs symbolising



various events, and the third series (1970) featured prominent buildings in Munich, venue of the Games. The fourth series (1971) publicised the Winter Olympic Games at Sapporo, Japan.

Attractive sports stamps for the Twentieth Olympiad have already been released by several countries. An unusual set of eight was issued by Rwanda last October, featuring various athletic events. Other African countries which have announced Olympic stamps include Gambia, Lesotho, Malawi and East Africa (Kenya, Uganda and Tanzania). East Germany issued a set of six in May. By using a curious lined treatment the artist has conveyed an impression of speed and action. The same impression has been created, in the United States set, by repeating the motifs and overlapping them in different colours. Czechoslovakia's designers have tackled the action theme more subtly, using circular or curvilinear backgrounds to sharply outlined figures of a cyclist, diver, canoist and gymnast. By the time the Games are over there will no doubt be many other stamps honouring the occasion, not to mention advance publicity stamps for the *next* Games.

Strike a Light!

There's more in a box of matches than you might think, says John Ruffels

Photos by courtesy of Messrs. Bryant and May

FIRE is as old as the earth, but the problem of producing an instant and safe flame has only relatively recently been solved. A box of matches seems such a simple thing that we take it for granted, and yet manufacturing a single match is such a complicated technical process that man has had to wait a very long time to be able to "strike a light". The match as we know it is little more than a hundred years old.

Primitive man could produce fire by making sparks fly from a piece of flint on to dried leaves and grass. The tinder-box of the Middle Ages was just an extension of this method and the principle of fire-from-flint was generally used well into the nineteenth century.

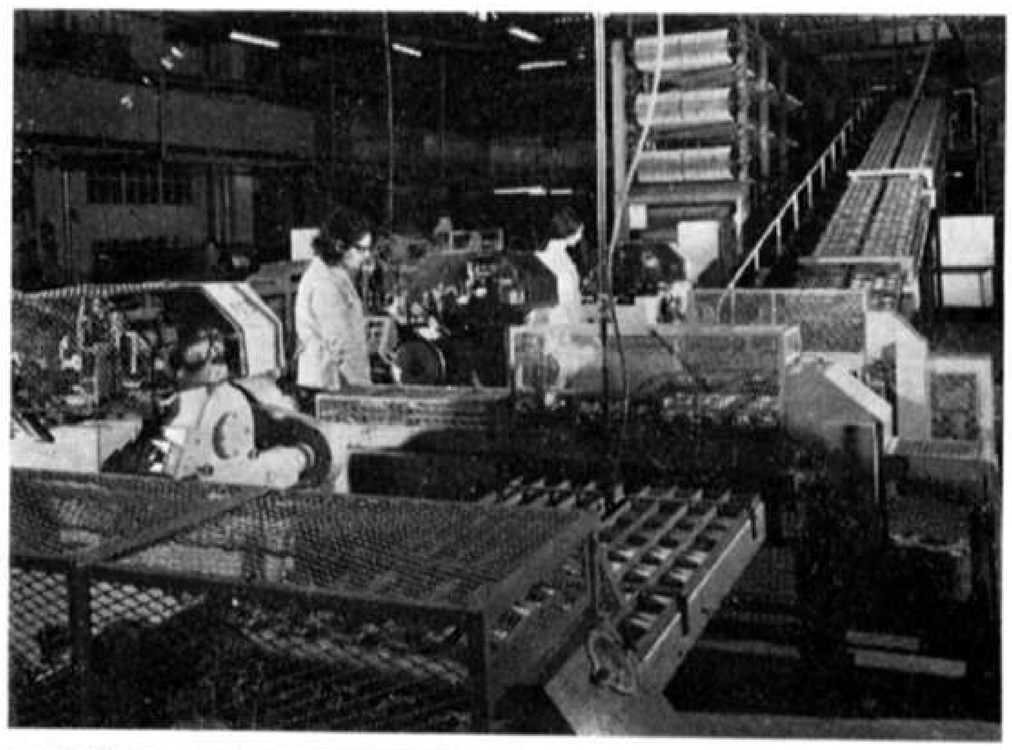
The earliest attempt to produce a match came in 1805 when a Frenchman called Chancel invented the "fire-stick". His idea was to dip a wooden splint coated with chemicals into a bottle containing asbestos threads saturated with sulphuric acid. By a chemical reaction he could produce an instant flame, but it was a clumsy arrangement and a dangerous one.

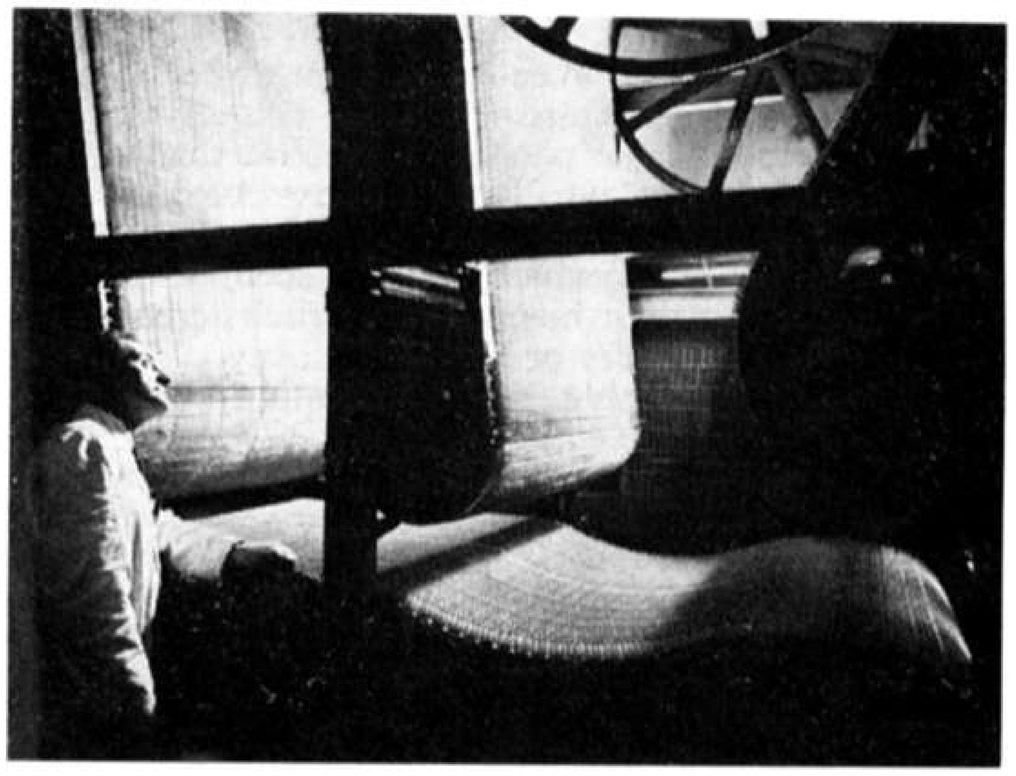
The first real breakthrough came in 1827 when John Walker, a chemist from Stockton-on-Tees, invented the friction match. It was an accidental discovery. Walker noticed that a stick he had used to stir a mixture of potash was left with a hard blob deposited on one end. He rubbed it across a stone floor and it burst into flames. Walker saw the potential of his discovery and began to manufacture his "friction lights" to sell at one shilling per hundred. But they were still a very long way from the modern match. Each flat, wide stick was three inches long and had to be rubbed inside a piece of folded sandpaper.

The next step was to use phosphorus on the head of the stick and later on boxes; these matches were called "lucifers" and were introduced first in France in 1831. Unlike Walker's friction lights, they could be relied upon to produce a flame nearly every time. In fact, they worked too well for comfort. If the box was knocked or left in the sun, it would ignite spontaneously, and the phosphorus gave off dangerous fumes. Nevertheless, lucifers had a long run and the next breakthrough came when these "strike-anywhere" matches

Top, eight-year-old poplars at one of Bryant and May's forestry estates. The trees take 20 years to reach maturity for match-making. Left, poplar logs on the way to the saw-mill; up to 15 logs a time are handled by the one-man transporter.

Right, this group of machines makes inner boxes from reels of cardboard and automatically conveys them to the match-making machines. Below, a "carpet" of freshly-dipped match heads is inspected as it travels through part of the machinery.





were joined in 1855 by a Swedish invention, the safety match. This was a great improvement since the chemicals on the head of a safety match would only ignite when they were struck against a special surface.

But there was still one more problem to overcome before the modern match emerged. The white or yellow phosphorus which was universally used was found to be deadly. Workers in match factories frequently suffered from a disease which they called "Phossy jaw" that caused their bones to waste. In 1864 another Swedish chemist discovered red phosphorus, which could still be used to make matches but was quite harmless to health, though it was another fifty years before white phosphorus was completely outlawed.

Today we strike something like seventeen million matches every day. Ninety-five per cent of British matches are made by the British Match Corporation which includes the famous Bryant and May Company that was founded 120 years ago. The company now manufactures matches in places as far apart as New Zealand and Brazil, and its three factories in Britain alone produce 40,000 million matches every year.

A recent survey showed that when you buy a box of matches you get good value for money, since a box usually contains more than the average contents stated on the outside label. In fact, one third of the price of a box of matches is tax. The first attempt to tax matches was made in 1871, but a protest march by three thousand workers in the industry forced the Government to change its mind. The Chancellor tried again in 1916 and since then £35 million has flowed into the Exchequer from the match tax.

The wood used to make the best matches is poplar; it is hard enough not to bend, but soft enough not to snap. Bryant and May consume 20,000 tons of timber in Britain each year. Sweden provides some of it in log form, and ready cut match sticks come from Canada. By 1982 Bryant and May hope to be using wood from their own poplar plantations in East Anglia and the Welsh border.

When the timber arrives at the saw mills the bark is stripped and the logs sawn into two feet long "billets". Machines then peel veneers from the billets and chop them into match sticks at the rate of a thousand sticks per chop.

The raw matches are then impregnated with ammonium phosphate. This substance ensures that when the flame is blown out, the match will not continue to smoulder. The match sticks then go through a long process of cleaning and polishing, and then to the match making machines.

Here, two million sticks at a time are slotted automatically into holes and soaked in paraffin wax. The wax will allow the stick to burn after the chemicals on the head have been used up. Next comes the most important part, the application of the match head.

The exact balance of chemicals used is the secret of a good match. The head of the strike-anywhere match contains potassium chlorate and phosphorus sesquisulphide. The safety match has potassium chlorate and sulphur. The mixture on the strike-anywhere match will ignite when rubbed on any rough surface, but the chemicals on the safety match will only produce a flame if they are struck against the side of the box. The potassium chlorate provides oxygen to feed the flame in both matches. These basic chemicals are just part of the match head which also contains zinc oxide, glass and plaster of Paris. These additions enable the match head to burn steadily without exploding on ignition. All the ingredients are bound to the stick with glue and the head is coloured with a dye.

The completed matches, 14 million from Bryant and May each day, are then dried and packed into boxes. The striking surface on the box contains powdered glass, red phosphorus and glue. When the match is struck, the heat of friction converts the safe red phosphorus to white which ignites the match head.

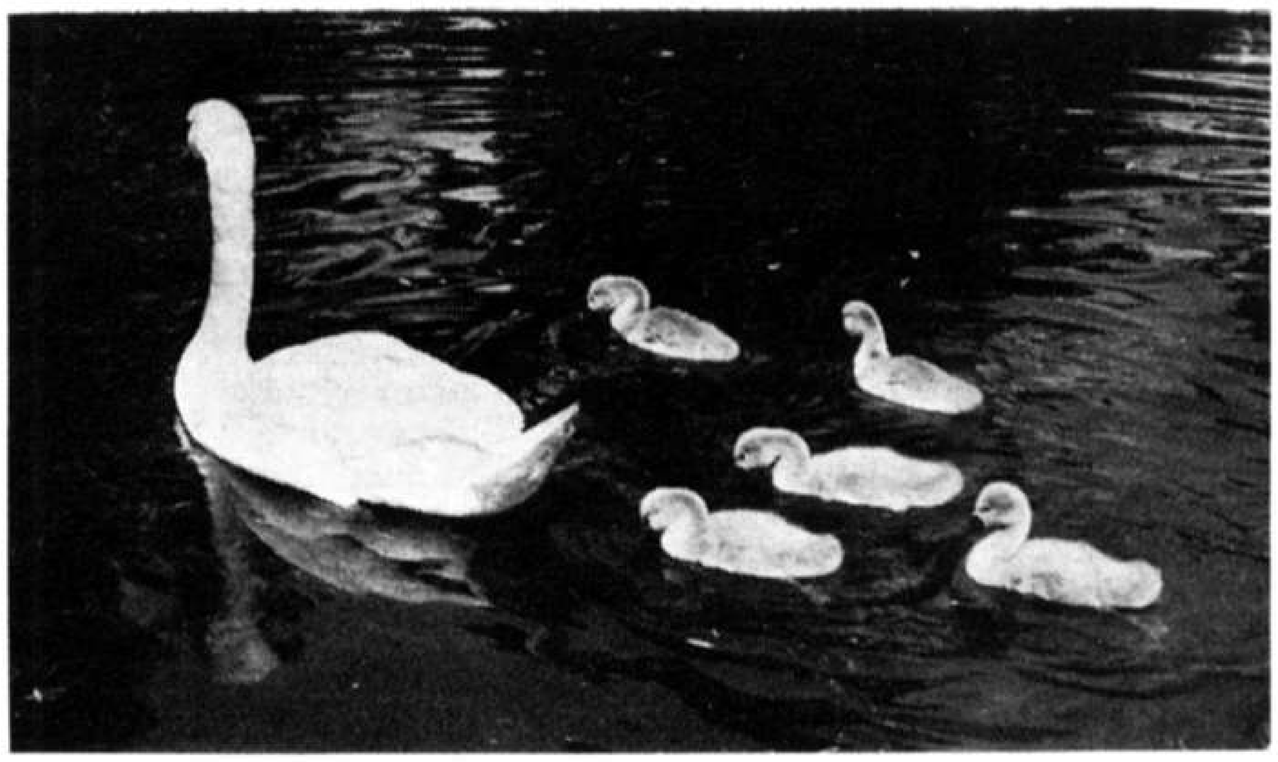
One fifth of the matches produced in this country are safety matches and they sell mostly in the South of England, while people in the North and Midlands prefer strike-anywhere matches.

This leads to the production of regional brands which is a boon to phillumenists—collectors of match box labels. Phillumenists have their own association, The British Match Box Label and Booklet Society, with over three thousand members. The rarest collector's item is the first printed match box label produced by Samuel Jones in 1829. There is only one known copy, now in the Bryant and May Museum of Fire-Making Appliances in the London Science Museum.

Next time you have to strike a light, remember that it's not so easy as it's all made to seem. The Chinese found this out a few years ago. When the Chinese Communist Government tried to establish a match manufacturing industry, it failed miserably since one match in ten refused to light. A national campaign was started called "The Struggle For The Purpose of Reducing The Number of Useless Matches".

But that's something we need never worry about, thanks to the inventiveness and advanced technology of the British match makers.

The Mute Swan

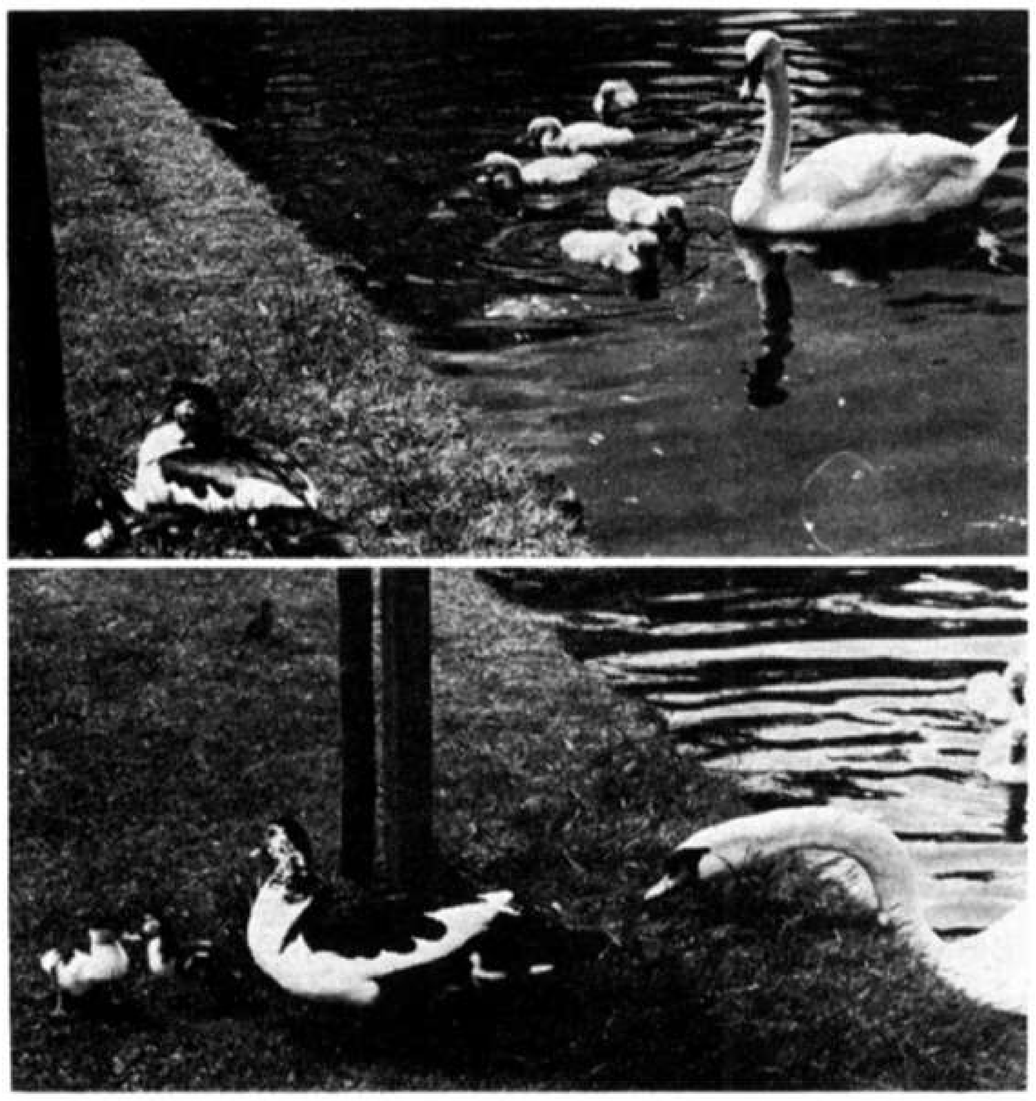


Britain's largest native birds live as long as humans

By Richard Lee

IT is a fair bet that even the biggest duffer at natural history can recognise a swan! For all this, however, surprisingly few people have more than a superficial knowledge of our largest native bird. Perhaps this is due to the complete poetry of motion of these graceful water-birds which can be seen on any park lake going about their business with such serene dignity as not to invite inquiry or arouse curiosity.

They are, for all that, most interesting birds in their habits. Most people know that the terms "cob", "pen" and "cygnet" apply to the male, female and young respectively. At the age of four years swans mate for life and share their parental duties with great devotion. Their marital lives are exemplary by any standard. The pen usually lays her large pale-blue eggs in May, from three to nine in number. These are incubated for almost six weeks and both parents take turns in this task—the sitting bird will never leave the nest unguarded or allow the eggs to cool until relieved by the other. This fact sometimes leads to a double tragedy—for if one partner is killed or injured whilst out feeding, the other parent will remain on the eggs, waiting in vain to be relieved. If the eggs do not hatch in time, the surviving parent remains on the nest incubating until starvation supervenes.



The young cygnets are covered in a grey down on hatching. After a day or two they will enter the water to feed, at the start, from regurgitated food from their parents—a few drops at a time—with frequent beak-touchings.

Soon, however, they become weaned on to plant life and water organisms that can be found near the surface. Sometimes they will climb on to their parents' backs for a "pick-a-back" trip down the river or canal. As they grow stronger, the family makes a charming sight on excursions, with the young cygnets in a convoy streaming out "in line astern".

The first plumage of the cygnets is quite brown and their "childhood" period of growing and education under parental control is usually seven months. These are busy days for the cob and pen who have to teach them how to feed and clean themselves and how to understand their own "language" in this time. Both parents are ever on the alert for the low piping call of any cygnet lost or in distress, and will rush to aid with great concern and if necessary will put on a display of aggression that would deter all but the most intrepid of intruders!

There is a slight difference in the behaviour of swans which inhabit stretches of salt-water and those which live on fresh-water reaches. This is related to the way they use their territories. Fresh-water swans are territorially possessive birds by nature and will drive off their young from their "home waters" when they become adolescent at about 8 months of age, and when their plumage is mottling to a near-white appearance. Some of the offspring accept the situation that they cannot stay—for the stretch of water which their parents own will have a weed growth only enough to support the two mature birds through the winter. But there are usually one or two obstinate youngsters who have to be taught this lesson forcefully. The cob turns aggressive towards the laggards and with each successive day becomes distinctly more unpleasant towards them, chasing and nipping them. Sometimes he resorts to giving them sessions of what can only be described as "downright good hidings"!

Salt-water swans are more ready to accept a communal life, however, and do not hold individual territories in the same way as their fresh-water cousins. It should be emphasised that there is no difference of species between them. On the Thames and other rivers it is a common sight to see a dozen or more swans living

A swan and her cygnets photographed just outside MM's office door. Note the pen's aggression in driving away the Chinese duck and her ducklings. These cygnets are about three weeks old.

together as a small herd—where the waters go down to an estuary and a tidal flow causes different types of soft weed, on which the swans mainly feed, to be in abundance. The food supply is all-important, for these swans cannot rely on being fed bread as happens in parks. Important plants in their diet are certain seaweeds such as *Zostera Marina* and *Zastera Nana*.

There are huge colonies or "herds" of salt-water swans which inhabit the sheltered waters behind the Chesil Bank on the South Coast where numbers have been recorded in excess of 1,000 birds in a single herd or swannery. These swans nest in colonies amongst the reeds of the salt-water mud-flats. Again they pair for life.

Swans, like Geese (with which they have been known to hy-breed), will live easily to forty years of age; many survive longer and exceptions aie known to have lived for a century. A large cob may attain a weight of 40 lb. and they were often considered to be good eating in earlier days. A report of an early Lord Mayor's Banquet mentions, with mouth-watering intentions, that no fewer than 100 swans were on the menu! Swans are popularly feared to be dangerous when provoked but this arises from their successful "bluff" in aggression. Injury from a swan is very rare and once held by the neck, behind the head, they become very submissive and may be carried under the other arm with ease. The Mute Swan, which this article is about, is protected by law from being taken or killed under a maximum penalty of £5. Other species, Bewick's Swan and the Whooper Swan, are specially protected under a £25 penalty.

Two into One will Go!

Peter Wilkes describes multiple exposure technique in Part Ten of his series "Photography is Easy"

DOUBLE exposure is no stranger to the majority of camera users, for there can be few who, at one time or another, have not experienced that "sinking" feeling as they gaze at two perfect portraits of two different people—perfect, that is, except for the fact that, due to the photographer forgetting to wind on his film, both appear on the same print.

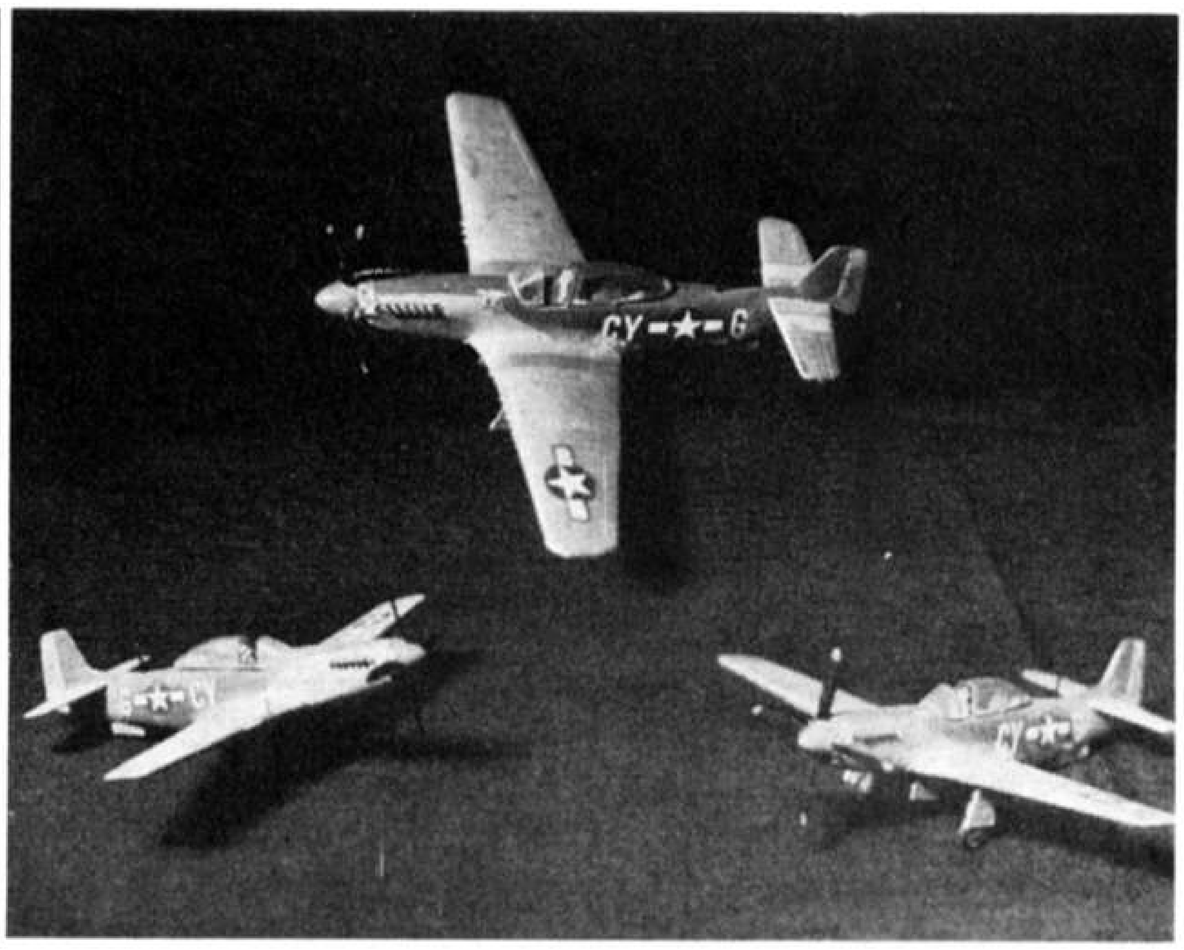
Yet, as frustrating as double exposure can be when carried out accidentally, under controlled conditions it is a technique much used in the field of advertising and display photography, and not only provides a satisfying field for the amateur to experiment in, but guarantees to mystify and amaze less knowledgeable friends.

By virtue of its requirements, the technique of creative multi-exposure is usually confined to indoor work but, by the very simplicity of the material used, it renders itself admirably suitable to the needs of the beginner who, after mastering the basic techniques of the hobby, feels the need to branch out into fields new.

Controlled multi-exposure, as the illustrations that accompany this article show, consists of using the technique to produce a final print which either shows one person from a variety of angles, or adds to the print those which, by conventional methods, would be impossible to include.

Of particular benefit to the beginner is the fact that, unlike many other facets of photography, this technique is often more easily carried out with the less expensive camera, due to the fact that with the more elaborate models the manufacturers' steps to ensure that accidental

Left, the effect of a treble exposure using only the simplest of equipment. The lighting was provided by one photoflood in a small reflector but with a "snoot" fitted over the reflector. Right, variation on a theme. Another treble exposure with the same equipment.



Left, the beginning. If the negative of this print is imagined, it will be realised that all except the figure is absolutely clear. Hence, any "second exposure" will not be affected by the first. Right, to model makers the system can provide a multitude of results not possible with conventional photography.

double exposure does not take place can prevent deliberate multi-exposure from being carried out.

With cameras which have a front cocking shutter, no difficulty is experienced, and even with many of the models which automatically cock the shutter as the film is wound on, the film movement can be "overridden" by pressing down the film release button as the wind-on lever is moved.

The essential requirement for controlled multi-exposure photography is a pure black background, for without this the images will be superimposed, in the final print, in a manner similar to that accidental double exposure that comes from forgetting to wind on the film. This, however, need not be expensive and, in my own case, consists of sheets of black crepe paper pinned to the picture rail in the room that I use for such work.

Although many experts will insist that a focusing spotlight is an essential, as it is imperative that no light falls on the background, being of that impoverished band of photographers who are, of necessity, bound to improvise, I have found that an ordinary reflector with a photoflood bulb and a "snoot"—a tube about 12 in. long made of brown paper or similar and fitted over the end of the reflector—will give results equal in every respect to those obtained under professional studio conditions.

The only technical factor that must be borne in mind is that of exposure, for, with normal exposure given to the first shot, an increase of approximately a quarter of a stop must be applied to the next and each subsequent exposure made on that same piece of film.

Although, when one gets engrossed in the fascinations of this new outlet for your photographic talents, it is tempting to guess the positions of the various figures and shoot off sufficient film to allow for error, a far more controlled approach can be made, and a guarantee of success attained, if the outlines of the respective figures are drawn on to the camera focusing screen with a chinagraph pencil which, when the work is finished, can be easily wiped off with no damage to the screen itself.

Failing this, a piece of paper, lined into squares, can be kept at the side of the camera and the outlines drawn on that in the same relation to that which they have on the viewing or focusing screen of the camera being used.

A further necessary item, particularly if a number of "small heads" are intended to feature in the final print, is a piece of black cloth to drape over the sitters' shoulders, to eliminate any clothing that may cut across the other images.

Although it has been stressed that a black background is an absolute essential, it is not only black paper or black material that can be used, for the background can be produced photographically if the first exposure depicts the sitter in silhouette.

In this case a white background is the essential, and this can be anything from a sheet hung on a wall to a projector screen.

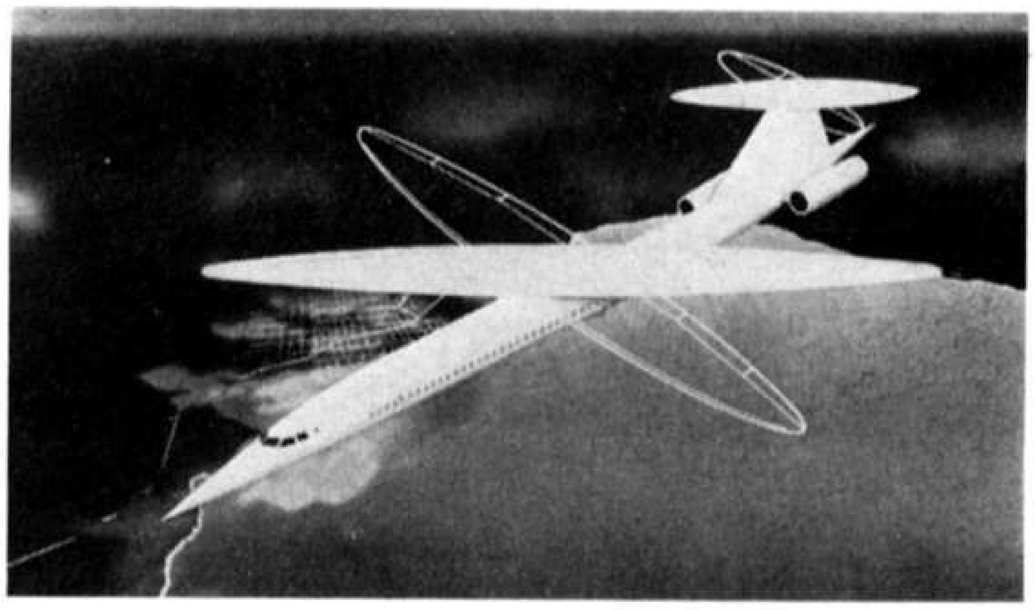
If the person being photographed is turned sideways and the camera adjusted until the outline of the face and head nearly fills the viewfinder, and the lighting set up so that it shines only on the white background, a silhouette will result providing the exposure given is based on the background illumination.

Then, if this temporary white background gives way to the original black, a most charming and representative portrait can be made showing, within the silhouetted outline of the subject, the head and face either in single or double exposure.

Although people are the natural subjects for multi-exposure technique, they are far from the only ones for, in the case of the model builder, providing the film is not moved on, the stages in the construction of a model can be shown from the rough beginnings, through intermediate steps to the final result in all its glory.

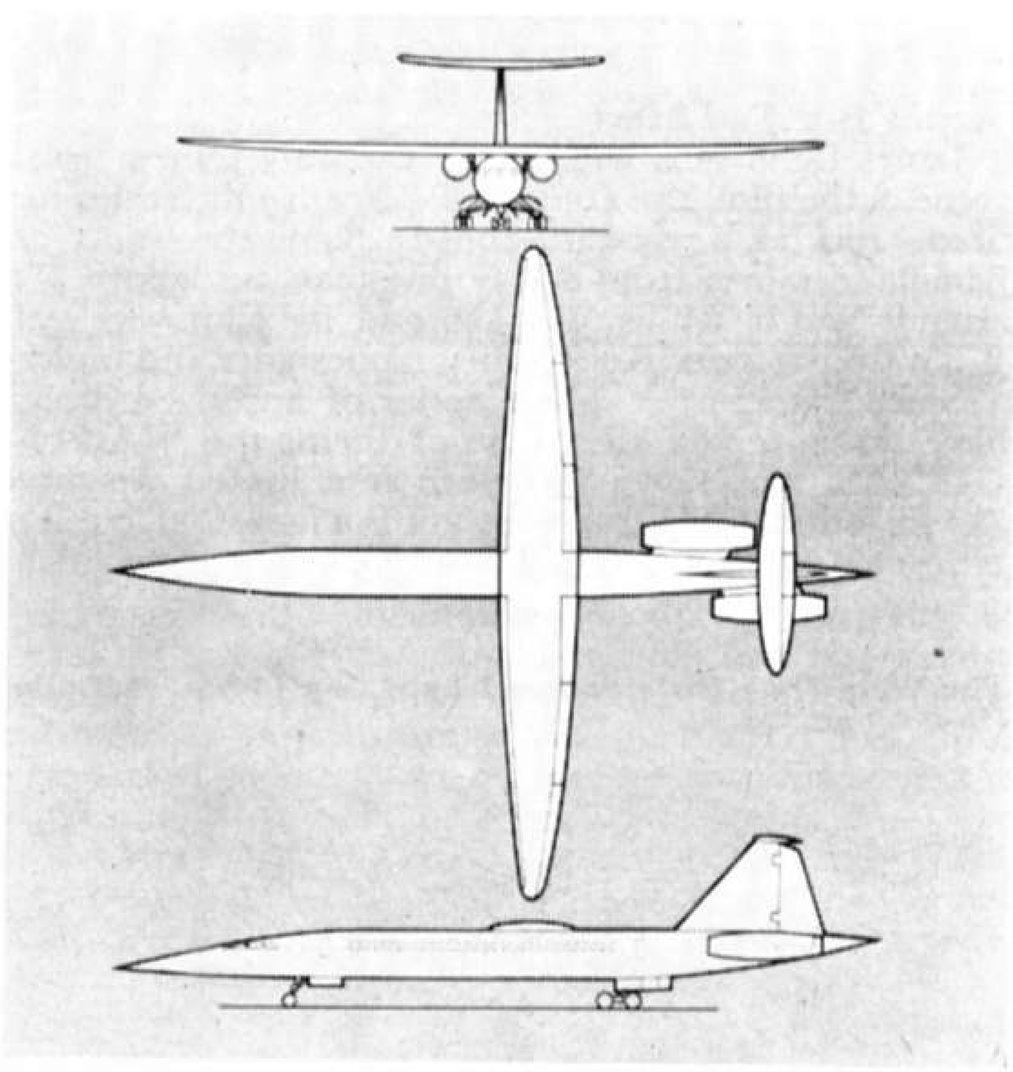
Remember, when you start your experiments, a black background is an essential, and any light that falls on the subject must be shaded so that none strays on to that background, as even the smallest amount can give a tone other than the pure black which on the resultant negatives, comes out as clear film.

So forget those early failures when "two heads" represented disappointment, and turn to this both useful and creative technique and not only improve your own photographic skill but astound those less knowledgeable with this example of "camera magic".

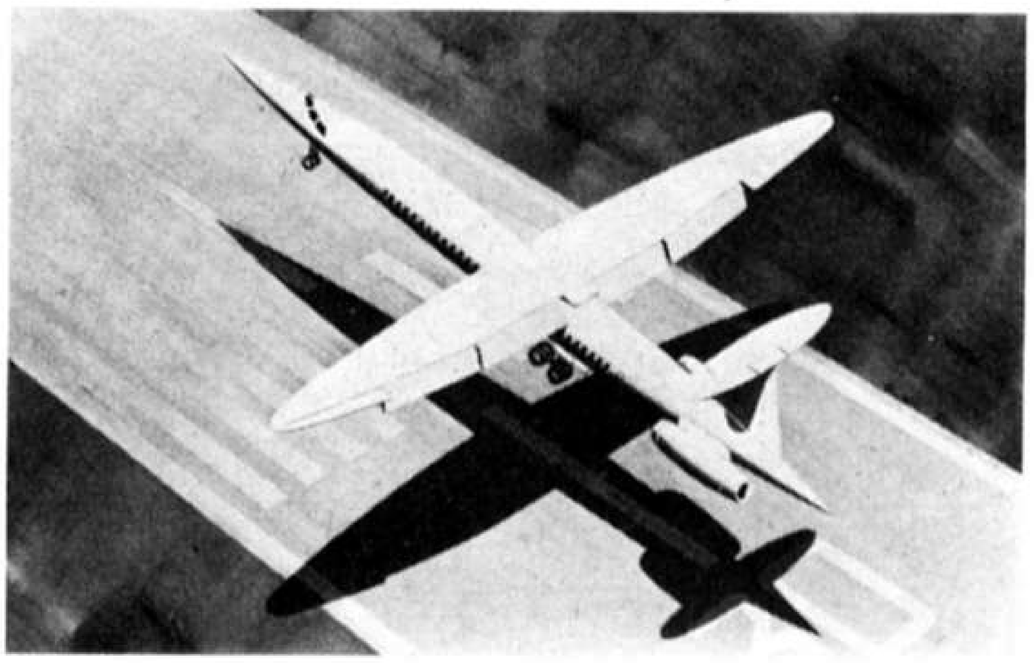


Air News

By John W. R. Taylor



At the top is an artist's impression showing what happens to the new design swing-wing aircraft in flight. Centre drawing shows the narrow wing and staggered engines and below, artist's view of the plane during take off.



Next the Pivot-Wing

The Germans built and flew the first jet aircraft on August 27, 1939. A few years later their designers discovered that they could take better advantage of the higher power and speed offered by turbojet engines if they fitted their aircraft with swept wings.

Most modern jets have sweptback or delta wings, and we tend to forget that those wartime German designers were just as interested in wings that swept *forward.* Junkers built their Ju 287 four-jet heavy bomber prototype with wings of this kind. Nearly twenty years later when Hamburger Flugzeugbau began work on Germany's first business jet, the HFB 320 Hansa, they resurrected the idea. Not only did 15 degrees of forward sweep give the same aerodynamic advantages as sweepback, it meant that the wing spars passed through the fuselage behind the passenger cabin, causing no obstruction, and the wings did not spoil the view downward from the cabin.

The Hansa tends to look a little odd, as if the wings have been put on back to front. But the latest design for a supersonic airliner being studied at NASA's Ames Research Center, Mountain View, California, is even more startling.

Most people in aviation will admit that, in theory, variable-geometry in the form of "swing-wings" offers advantages over even the best swept wings. When in the forward, fully-extended position, swing-wings have the same high-lift, slow-speed take-off and landing characteristics as an unswept wing. When fully swept they have all the high-speed advantages of ordinary swept or delta wings.

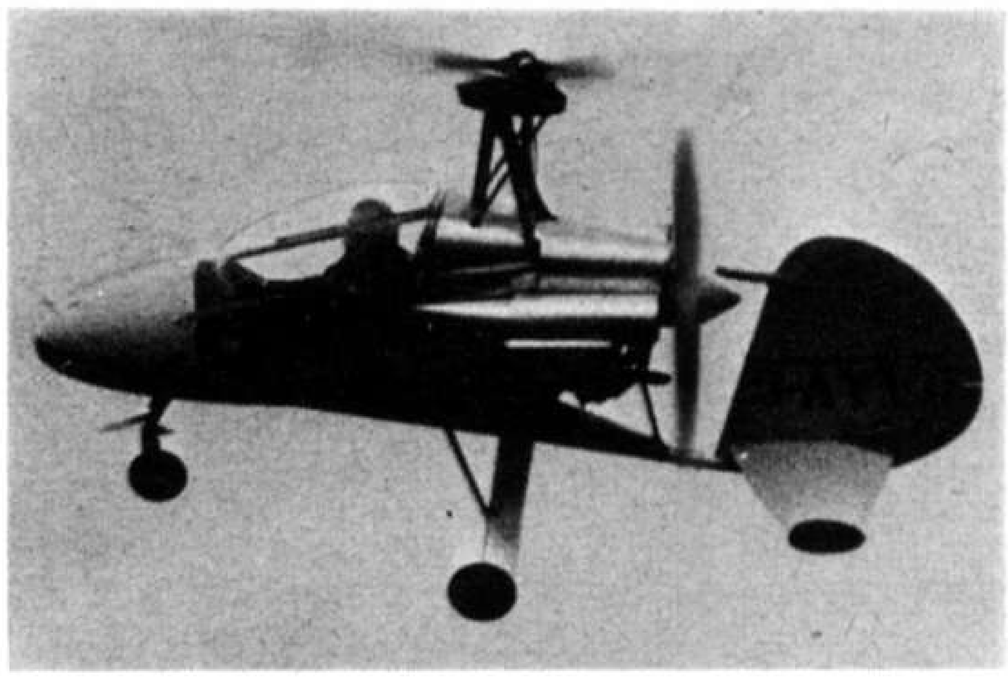
Unfortunately the mechanism needed to swing the wings to and fro creates weight and structural problems. Added to all the other problems presented by an aeroplane that changes its shape in flight, they have prevented any of the swing-wing types built so far from proving entirely successful in daily service.

Boeing tried to design a swing-wing for their Model 2707 supersonic airliner. It did not work out, and eventually the whole project was cancelled, leaving America without a competitor for the Anglo-French Concorde. Since that time, NASA has been studying the possibility of developing a supersonic airliner that would be faster than present-day subsonic types like the Boeing 747 but slower, and less noisy, than the Concorde.

The ideal speed for such an aircraft might be around 925 m.p.h. (Mach 1.4). Although 500 m.p.h. slower than the maximum cruising speed of the Concorde, this is still fast enough to make swing-wings worthwhile, if they could be made to work. Bearing in mind that sweepforward is as efficient as sweepback, Dr. R. T. Jones of Ames Research Center suggested that the answer might be to use a simple one-piece wing that pivoted in the middle, rather than two individual wings that pivoted backward.

An aircraft built to Dr. Jones' ideas would have its port wing swept back and its starboard wing swept forward in cruising flight, which would look even more odd than the Hansa. There is, however, no reason why this should not be acceptable, and wind tunnel tests with a model of such an aircraft have given promising results.

As shown in the drawings on this page, the aircraft would have a pivoting tailplane as well as pivoting wings. In addition, the starboard engine, mounted on the rear fuselage, would be forward of the port engine. In other respects the design would be conventional, and the airframe could be built from aluminium alloys, like the



Above is the Willis WA-116-T used for the loaded-to-empty weight record flight and right is the latest WA-120 in flight.

Concorde, rather than the special heat-resistant metals that would have been essential in the 1,800 m.p.h. Boeing 2707.

Dr. Jones believes that the limited speed of his projected supersonic airliner, coupled with use of the slewed-wing, would make it possible to fit only two turbofan engines of fairly modest power. This would cut both fuel consumption and noise.

James Bond's Latest

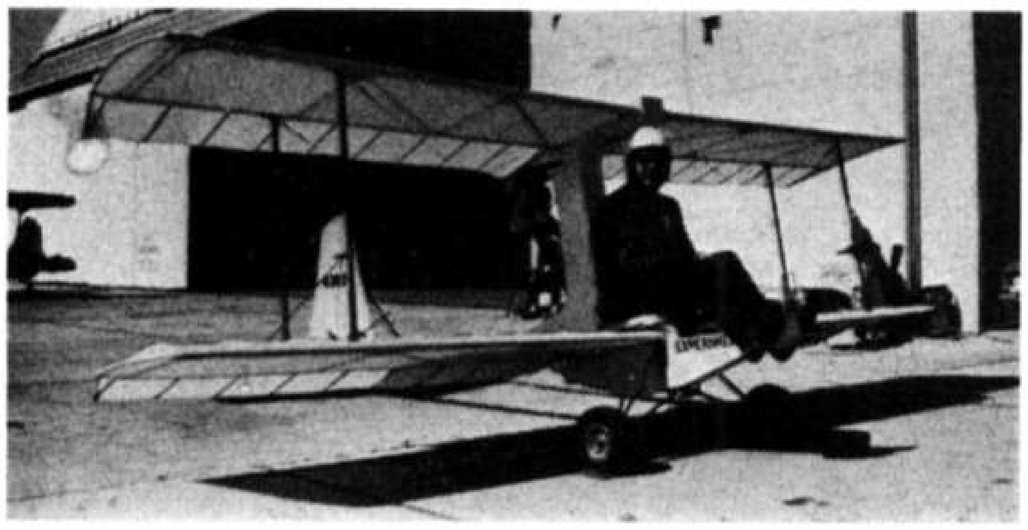
James Bond fans will almost certainly remember the scene in the film *You Only Live Twice* in which their hero fired rockets, rearward-aimed flame-throwers and parachute mines from a tiny one-man autogyro. The aircraft was a Wallis WA-116 and its pilot was really Wing Commander Ken Wallis, its designer and builder.

Since that time, a whole series of improved designs have taken to the air. One of them, the WA-116-T G-AXAS, was flown last year at a loaded weight of 753 lb. although its empty weight is a mere 240 lb. This ratio of 3.14 : 1 between loaded and empty weight has probably never been exceeded by any other aeroplane or rotating-wing aircraft. Like the world speed record of 111 m.p.h. set up earlier, it is a good measure of the efficiency of these little single-seaters.

Most exciting member of the "family" is undoubtedly the WA-120 G-AYVO, illustrated here. The superb craftsmanship of all the Wallis designs has been combined with a smoothly streamlined new cockpit enclosure, blending neatly into the cowling over the 130 h.p. Rolls-Royce/Continental O-240 engine. The result is a high-speed, long-range version which would delight any speed-loving youngster or his father.

Unfortunately, for very good reasons, these fast, sporty little aircraft are built at present only to special order, for use by Wing Commander Wallis and other selected pilots. But a new type, designated WA-121, is under development which might prove suitable for less experienced owners. Two of the prototypes will have 100 h.p. Wallis-McCulloch and 120 h.p. Meteor engines. The third, with a 60 h.p. Franklin, should be the smallest and lightest Wallis autogyro to date, with a good cross-country range.

The Wing Ding III is powered by a tiny 14 h.p. McCullock Go-Kart engine.



Whing Ding the Second

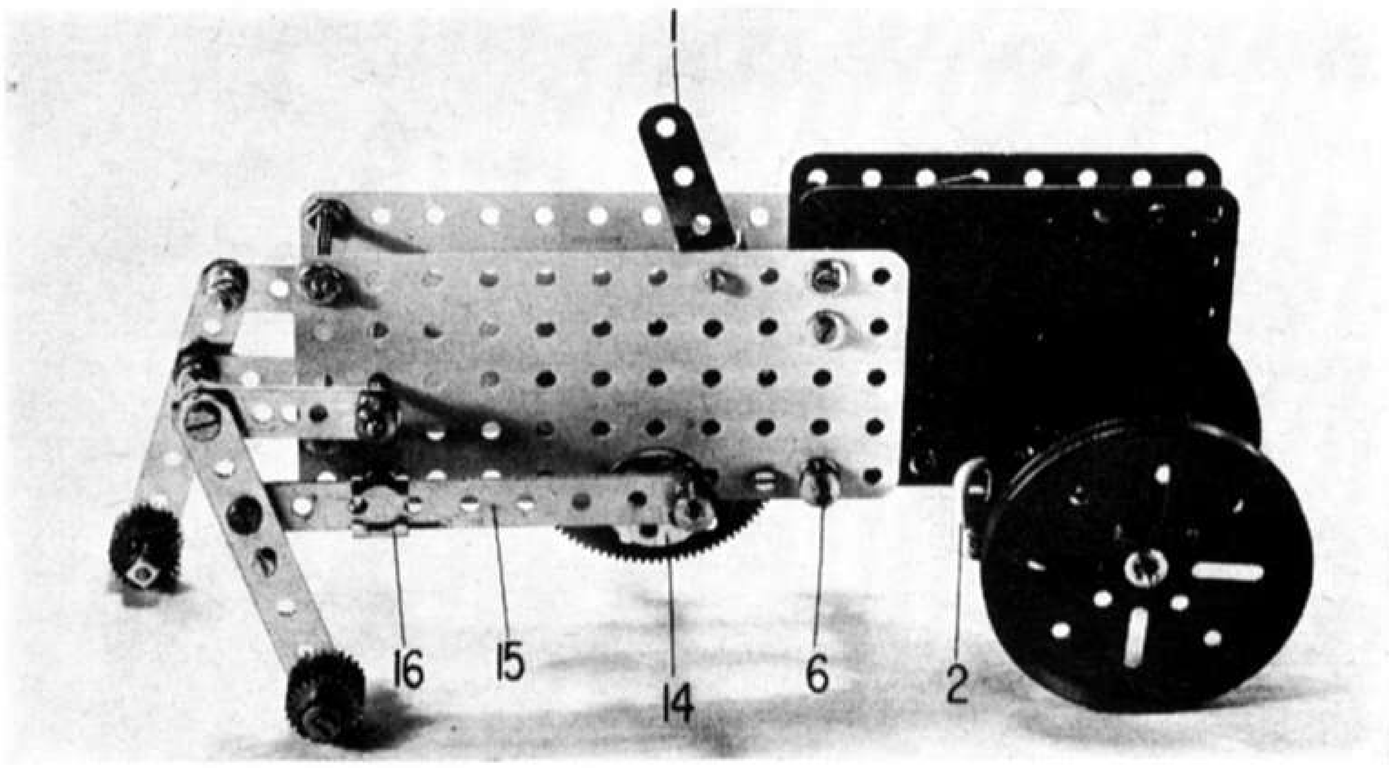
While on the subject of baby aircraft, you might like to know something about the latest from America. Known as the Whing Ding II, it is intended as a "minimum aeroplane" for amateur construction, in much the same class as the Aerosport Rail described in the July *Air News*.

Designer of Whing Ding II is Mr. R. W. Hovey of Saugus, California, who claims that it is simple enough for anyone to build at home in less than six months, for under £250. Like the Rail it has a stick "fuselage", built in this case as a mahogany plywood box structure and filled with plastic foam to stiffen it. The fabric-covered wings are each built around two wooden spars and light alloy tube ribs. Instead of being fitted with ailerons, they are warped, or twisted, by control wires, like the Wright biplane and other early aeroplanes. The tail control surfaces comprise an all-moving tailplane and a rudder attached to the fin by a cloth hinge; they are carried on an aluminium-tube tailboom.

The tailwheel undercarriage uses Go-Kart main wheels, and Whing Ding II is powered by a 14 h.p. McCulloch Go-Kart engine, driving a 4 ft. diameter pusher propeller. Only half a gallon of fuel is carried, but this is sufficient for a range of 20 miles at the normal cruising speed of 40 m.p.h. If this sounds slow, try it from the very air-conditioned seat at the front of Whing Ding II and find out how quickly you will change your mind!

Whoever heard of a WALKING TRACTOR?

— asks 'Spanner'



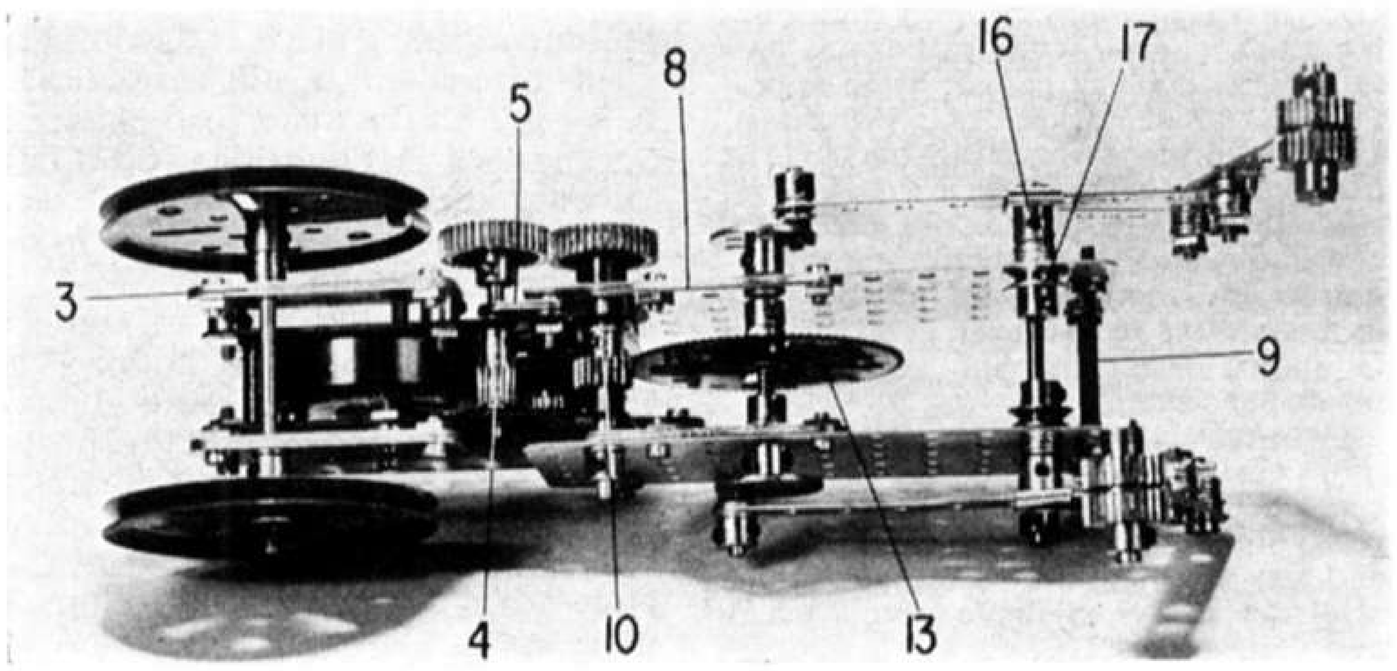
MANY and various are the models which I have seen since my first days of association with the Meccano hobby—big and small, complex and simple, common and unusual—but few, if any, can compare for sheer appealing "oddness" with the Walking Tractor (whoever heard of a "Walking Tractor"?) featured here! Built round a No. 1 Clockwork Motor, it goes whirring and stamping along with a weird marching gait that has captured the hearts of all of us in the office—all, that is, except for our hard-working but delicate secretary who tells us it reminds her of a "big, creepy-crawly cockroach"!

Creepy-crawlies aside, though, full credit for the model illustrated goes to Mr. H. J. Halliday of South East London, who supplied us with all the constructional details. Mr. Halliday, however, disclaims credit for the original idea as the model is actually based on a construction which appeared in a pre-war No. 7 Instructions Manual. Considerable modifications have of course been made, not least of which is the substitution of the No. 1 Clockwork for a long obsolete-electric motor, plus a greatly improved drive and gearing system.

Construction of the modified model is relatively simple. To begin with, a 3 in. Strip 1 is lock-nutted to the outside of the No. 1 Clockwork Motor's reversing lever, then a 2½ in. Flat Girder 2 is secured to each sideplate of the Motor in the position shown, but is spaced from the sideplate by a Collar on each of the two securing ½ in. Bolts. Note that, on the winding side, these securing Bolts pass through the end elongated holes of the Girder, while, on the other side, they pass through the end and fourth elongated holes of the Girder so as not to foul the reversing lever. Three 2½ in. Strips 3, one on top of the other, are bolted along the inside lower edge of each Flat Girder to provide extended bearing surfaces.

Next, and most important, the output shaft of the Motor is removed, along with the long-faced, 13-teeth final drive Pinion 4 it carries. This is achieved by simply loosening the Pinion's Grub Screw and sliding out the shaft which, in turn, enables the Pinion to be withdrawn. Once out, three Fishplates 5, one on top of the other, are bolted through their elongated holes to the outside of the non-winding sideplate of the Motor in such a position that the circular holes of the Fishplates coincide with the output shaft hole of the Motor. A 2 in. Rod 6, replacing the standard output shaft, is then mounted in the sideplates, this protruding at least three-quarters of an inch through the Fishplates and of course being fitted with Motor Pinion 4.

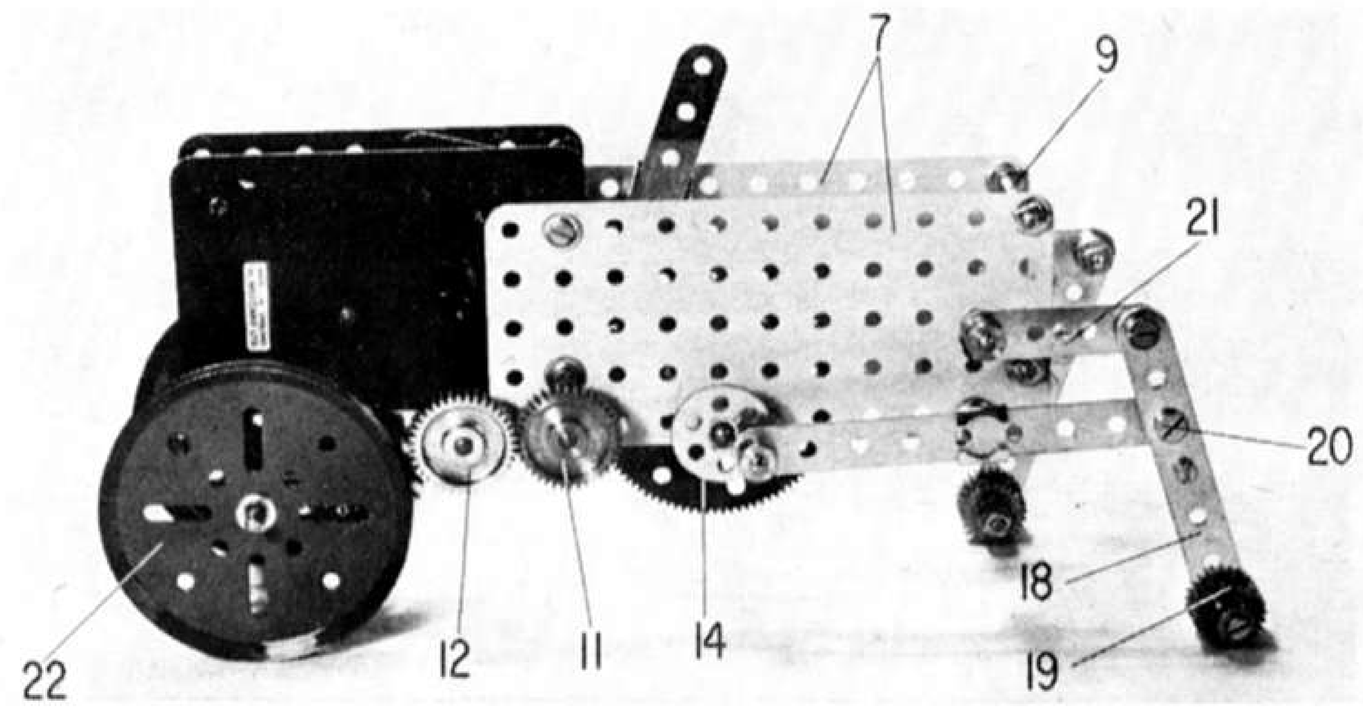
The Motor sideplates are now extended nine holes by two 5½ × 2½ in. Flat Plates 7, fixed in the positions shown, but spaced from the sideplates, as with the earlier-mentioned Flat Girders, by a Collar on the shank of each securing Bolt. These Bolts should be positioned one hole in from the ends of the Flat Plates—in the first and fourth holes down on the winding side of the Motor and the first and second holes down on its other side. Again as with the Flat Girders, three 2½ in. Strips 8 are secured along the inside lower edge of each Flat Plate to provide extended bearings. The outer ends of the Plates at each side are then rigidly connected together by Nuts and Washers on two 2 in. Screwed Rods 9 which pass through the end row first and fourth holes down of the Plates. Care must be taken to ensure that the Plates are arranged perfectly parallel to each other and to the Motor sideplates. A Double Bracket is bolted to the inside upper edge of one of the Flat Plates in the position shown, this acting as a guide for Strip 1, bolted to the Motor reversing lever.



Drive System

With Flat Plates 7 carefully lined up, a 2½ in. Rod, carrying a ½ in.

Heading shows clearly this utterly captivating Walking Tractor model designed by Mr. H. J. Halliday of South East London from an original idea featured in a pre-war Manual. Left, an underside view showing the inner gear arrangement.



The completed Tractor viewed from the opposite side.

Pinion 10 between the sideplates, is journalled in the lower corner holes of the Motor sideplates and in the corresponding holes of Plates 7, being held in place by the Pinion and a 1 in. Gear Wheel 11 fixed outside Plate 7. Both the Pinion and Gear are each spaced from the nearby plate by a Washer. The Gear meshes with a similar 1 in. Gear 12 on Rod 6, while the Pinion meshes with a 2½ in. Gear Wheel 13, fixed on another 2½ in. Rod journalled in the appropriate lower holes of Plates 7 (and Strips 8) and held in place by Collars and Washers inside the Plates. The Rod should project an equal distance each side.

Mounted on each projecting end of the Rod is an electrical 1 in. Bush Wheel 14 (Part No. 518), in one hole of which a Threaded Pin is carried. Note that the Threaded Pin in the Bush Wheel at one side is diametrically opposed at 180 deg. to the Pin in the other Bush Wheel. Free to turn on each Pin is a 4½ in. Strip 15, between two Washers, held in place by a Collar, with the Pin passing through the end hole in the Strip. The Strip slides in a Slide Piece 16, fixed on a 1 in. Rod journalled in the second row bottom hole of Plate 7 and held in place by the Slide Piece and a ½ in. Pulley with boss 17, the latter inside the Plate with its face bearing against the Plate. The Slide Piece is spaced from the Plate by four Washers. The whole assembly must be as "steady" as possible, while still allowing the 1 in. Rod to revolve with a minimum of friction.

Each of the model's two "legs" is next produced from two 3½ in. Strips 18, one on top of the other and bolted together through their centre holes. Two ¾ in. Pinions 19, bosses outwards, are tightly fixed by a 1⅛ in. Bolt to the lower ends of the Strips to form the feet, then the Strips are *pivotally* attached to the end of Strip 15 by a Pivot Bolt 20, suitably packed with Washers, which passes through the end hole of Strip 15 and the third holes down of the leg Strips. Pivotally attached by a similar Pivot Bolt to the upper end of the leg is a 2 in. Strip 21, held by Collars on a 3 in. Rod journalled in the second row centre holes of Flat Plates 7. Note that Strips 21 and the legs must pivot freely, yet without excessive side-play.

Finally, a 3½ in. Rod is journalled in the second-from-end circular holes of Flat Girders 2, where it is held in place by Collars. A 3 in. Pulley 22 is secured on each end of this Rod and, after lubricating all bearings and ensuring all moving parts are free-running, the model is completed.

Once built, the Walking Tractor cannot fail to bring hours of entertainment to one and all, but a notable way to increase the fun for youngsters (of any age!) is to build two or more examples and to race them against each other. Bearing in mind that Mr. Halliday's model achieved walks of forty feet or more, such racing could be extremely competitive.

PARTS REQUIRED

2—2a	2—16a	1—27c	2—81
4—3	1—16b	2—31	2—103f
1—4	1—17	43—37a	8—111a
12—5	2—18b	11—37b	2—111c
2—6	2—19b	71—38	2—111d
3—10	2—23a	2—50	2—115
1—11	4—25	20—59	4—147b
1—16	1—26	2—70	2—518
			1—No. 1 Clockwork Motor

Meccano Constructors' Guide

"Meccano Constructors' Guide" by B. N. Love is a welcome addition to bound Meccano literature. Published by M.A.P. in March, the book is in handy pocket size with paper back binding.

The contents take the reader from the basics to the advanced stages of model building and its twelve chapters cover a wide range of topics which are of general interest to the Meccano enthusiast. Essential mechanisms and methods of construction are illustrated with excellent prints by the author throughout the 144 pages. Although the book is an edited edition of a series of twelve monthly articles which appeared in the 1970 volume of Meccano Magazine, the compact assembly in the bound edition of Meccano Constructors' Guide puts the wealth of knowledge at the fingertips of the modeller in concise form.

With a readership in mind from boyhood to retirement, the author has presented his book in easy style to appeal to the whole range of enthusiasts. Having more space available in the book, the general arrangement of script and illustrations makes for excellent continuity and the author's fine photographs are reproduced to full page size in many cases so that even greater detail is shown than that of the original magazine series.

Attractively presented with a 21 cm × 15 cm page format, the coloured cover depicts an automatic gantry crane receiving final adjustments from a father and son combination. The book retails at £1.25 and is available from M.A.P. and their agencies.

HOLY TRINITY (*from opposite page*)

meeting that a "good time was had by all" was once again true.

The next meeting will be held on 5th August and I have made a provisional booking of the Church Hall, Hildenborough, for that date. This hall is considerably larger than our present meeting place and will cost £7 to hire which is still very cheap. It is right on the main road between Sevenoaks and Tonbridge and it has its own car park alongside; exact directions for arrival will be circulated nearer the date.

Should anybody wish to contact me at any time, my address is 58 Leigh Road, Hildenborough, Kent. Tel: Hildenborough 3340.

TONY HOMDEN

(Mr. Homden would be pleased to hear from anybody interested in the Holy Trinity Meccano Club—'Spanner'.)

HOLY TRINITY MECCANO CLUB

A report on the fourth meeting

'SPANNER' writes: Reprinted below is a report on the fourth meeting of the Holy Trinity Meccano Club which has been supplied to us by the new Club Secretary, Mr. Tony Homden. It will be seen that the report begins with a message of farewell from the retiring Secretary, Mr. Peter Matthews, who is emigrating abroad, and I would therefore like to take this excellent opportunity of wishing Mr. Matthews "Bon voyage" and a successful "new life" on behalf of both Meccano Magazine and Meccano (1971) Ltd. Mr. Matthews has done a great deal of good for the Meccano hobby, not only founding the H.T.M.C., but also originating and building up his Meccano Museum—that utterly unique collection of Meccano literature, equipment and "lore" which we have mentioned in the M.M. in the past. Good luck in South Africa, Peter!

Report on the Fourth Meeting of the Holy Trinity Meccano Club

On Saturday 15th April, the fourth meeting of the Holy Trinity Meccano Club took place in the Scout Hut, Hurstpierpoint, Sussex. The occasion was marred for me by the knowledge that this would be the last time that I would be addressing the Club as its Secretary, as I will soon be leaving England to take up a new life in South Africa.

One of the things that I am looking forward to on my arrival in Cape Town is attending a meeting of the Cape Peninsular Meccano Club and establishing contact with enthusiasts in my new home. My intention of course, when settled in Johannesburg, is to establish a club there and to give Meccano Exhibitions once again.

The entire Meccano Museum will be travelling with me to Johannesburg . . . and will be rehoused, I hope in a much larger building than at present.

As a result of a vote taken at the meeting, it was decided that Tony Homden would become the new Secretary and the remainder of this report is written by him.

Goodbye to you all and happy modelling.

PETER MATTHEWS

All of us I know, join in wishing Peter every success in his new venture and, to use the old saying, our loss is somebody else's gain; in this case, South African Meccano enthusiasts who I know are already looking forward to his move.

My thanks go to all members who have entrusted the Club's future to me and I will do my best to repay that trust by working to expand and improve it even further for the benefit of all members.

The meeting went extremely well with twenty-five subscribing members and a number of guests being present. Three new members who brought with them models of high standard were welcomed.

The afternoon began with members working all round the hall, setting up models and sorting out an electrician's nightmare of cables and plugs, in order to give everyone who needed it, a power supply. Amid cries of "mine's working", "mine's dead", and "who turned the power off", order gradually emerged and even your new Secretary who was on the furthest end of the supply was connected up. (I mean of course, his model and not the Secretary!)

After a short business discussion, the feature begun at the last meeting of members giving talks and demonstrations of their models, was reintroduced and six members were persuaded to enter the spotlight.

The first victim was Phil Bradley who showed a superb Foden Steam Lorry as used for heavy haulage work in the pre-war years. All of Phil's skill and care was apparent in this model which conveyed beautifully the spirit of the prototype. A novel feature was the rear wheels design which were shod with flexible Plastic Plates which had been first bolted to the rim and then gently "cooked" in an oven to soften them, after which they were cooled and then the bolts removed.

This procedure removed the tendency of the Plates to spring flat when unbolted and all that remained to do to produce a smooth obstruction-free wheel rim was to wrap a layer of black adhesive tape around it to hold the plates in place. Not many people would consider putting their Meccano in an oven to cook and it demonstrates that techniques of construction are still being developed some seventy years after the hobby began.

Next on the rostrum was Geoff Bennet with an improved version of that old Supermodel favourite, the twin-cylinder Motor Cycle Engine. Using standard parts, Geoff had constructed a distributor which ran from the engine and caused light bulbs mounted in dummy spark plugs to flash at the correct time in the "firing" stroke.

Stuart Day showed another improved model, this time, of a Ransome Scrap-yard Crane, which appeared in the Meccano Magazine some years ago. The model performed all the functions of the prototype and was equipped with both lifting hooks and a fully operational grab. This was operated by a wire running inside a length of Spring Cord forming a very satisfactory "Bowden cable".

Michael Martin demonstrated a very ingenious Tower Crane which featured an extending counterbalanced jib which was modelled on a prototype operating near his home in Ilford. This crane was one of several at the meeting and showed that cranes really are one of the fundamental Meccano models.

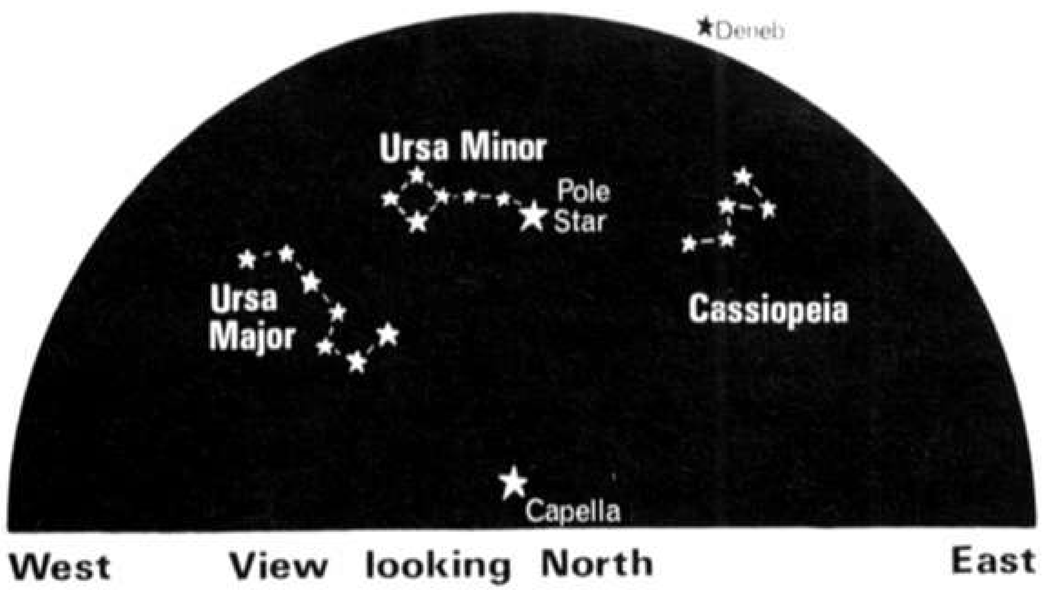
From Henley-on-Thames, Mike Nicholls brought along and demonstrated a Watts Steam Engine which showed clearly to even the most uninitiated, the operation of Watts famous "sun and planet" motion which defeated the patent on the crank held by a rival inventor. The model also showed the "parallel link" which enabled the piston rod to operate the great overhead beam without the use of an accurately machined crosshead slide which was beyond the crude mechanics of those days.

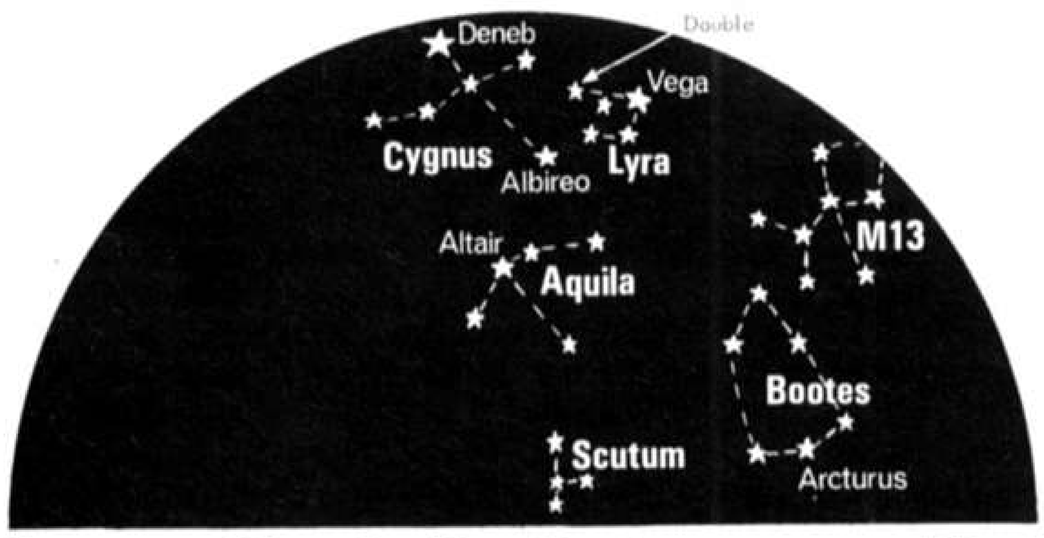
Next, Geoff Wright intrigued us with a Meccano Slot machine which dispensed packets of Pocket Meccano after the correct price of 39p was inserted. This model sorted the coins out and added them up as they were put in the slot and as soon as the correct total in any combination of "silver" or bronze coins was reached, a Pocket Meccano Set could be obtained by pulling out the drawer.

The last speaker was the writer who showed a 15 in. Naval Gun Turret.

Tea was then served and our thanks go to our lady helpers, Anne Matthews, Margret Ta Bois and Diane Gamble, who provided much-needed refreshments in the form of sandwiches and cakes. After tea, members circulated around the hall examining models, swapping ideas and telling each other about plans for models as yet unbuilt. The meeting finally broke up at 8 p.m. and I think it fair to say that the remark of Peter Matthews which preceded the report on our third

(*continued opposite*)





There's lots to see in the

Summer Sky

R. A. Westwood mentions some of the special features visible in the sky during August

MOST people imagine that the Summer is the worst time for looking at the stars, and it is easy to see why: in the evenings the sky is too light, indeed in June and July the nights are not dark enough to see the stars properly at all. However, by August, the sky is dark in the late evening, and as August is the month of holidays, and the need to get up early is not so great, why not spend an hour or two on a late summer evening looking at the stars?

High overhead, in the place occupied by Capella in the winter, is the bright blue-white star, Vega, the brightest star of the constellation Lyra, the lyre. The rest of the group, which is very small, forms a sort of 'squashed box' trailing below. There is also one star to the west of Vega. If you examine it with a pair of binoculars, you will see that it is double. This is very easy to see, and some very acute-sighted people can see the star double without optical aid, but not me, I'm afraid!

Looking to the east, we find another bright star, Deneb, in the constellation of Cygnus the swan. Deneb marks the tail feathers, the neck points toward the horizon and the wings east and west. Cygnus is often called the Northern Cross, because of the obvious shape it forms in the sky.

On a very clear, dark, moonless night take a pair of binoculars, and holding them very steadily, gaze at the stars of Cygnus and then sweep slowly from Deneb to the horizon, for this is one of the richest areas of sky visible from these latitudes; stars crowd on our vision in uncountable numbers, forming a very impressive sight.

Before leaving Cygnus, mention must be made of the lowest star in the cross, Albireo. If you have one of the 60 mm. Japanese telescopes currently on the market, try looking at Albireo, for it is one of the finest doubles visible with a small telescope. One of the components is bluish-green and the other golden-yellow. There are other pairs of similarly coloured stars, but in my opinion at least, Albireo is the most attractive.

Another bright star, visible in the south on summer evenings, is Altair, the leading star of Aquila, the Eagle. Deneb, Vega, and Altair form a large triangle called, appropriately enough, 'the summer triangle'. Aquila and its neighbouring group, Scutum, the Shield, offer yet another attractive star field for the owner of a simple pair of binoculars or field glasses.

High in the sky, to the west of Lyra, is the large constellation of Hercules, the hero. He is much less prominent in the sky than he is in legend. Even the brightest star is only of the third magnitude, and the group has no obvious pattern, except the 'flowerpot' shape at the centre.

However, Hercules has one claim to fame. The brightest globular cluster visible in the northern hemisphere is located in the "flowerpot". Globular clusters are vast spherical swarms of stars which form a "halo" around the centre of our galaxy. They are very remote; the Hercules cluster is 22,500 light-years away, and this is one of the nearer ones!

The Hercules cluster is known to astronomers by the designation "M13". This is because it was listed as the thirteenth object in a catalogue of such clusters and nebulae compiled by the eighteenth century astronomer Messier, a Frenchman who spent his time looking for comets with a small telescope, like many amateurs today. Messier found that these clusters looked so much like the comets he was searching for, that he kept mistaking them, so he compiled a list, which was eventually published. It is ironical that Messier is remembered more for his catalogue than his many comet discoveries!

M13 is easily seen with binoculars as a faint misty patch. In my small astronomical telescope it is a beautiful sight, when the sky is clear and dark.

Looking still further west, the kite shape of Bootes, the herdsman, will be seen, dominated by the beautiful orange light of the bright star Arcturus.

Over to the east, the "W" of Cassiopeia is climbing to the high overhead position it occupies in the autumn and winter, showing that the starry skies are never still.

If you can, try to see some of these "sky sights" this summer holiday. I'm sure you will enjoy the experience!

THE ROAD RESEARCH LABORATORY (*continued from page* 375)

the Colnbrook By-pass has been used as a site for many experimental thin surfacings. Over 1,000 short sections of different compositions have been tested under actual traffic and climatic conditions.

At the present time an experiment is being carried out on a six-mile stretch of the Grantham By-pass to study the behaviour of different types of continuously reinforced concrete slabs.

How many accidents have been prevented, or how many lives have been saved as a result of research by the Laboratory's Safety Division will never be known, but the total must be very considerable. Incidentally, the Division has a complete set of casualty statistics dating back to 1956.

During recent years the Safety Division has carried out hundreds of on-the-spot accident investigations. A team consisting of three or four, including a physicist, an engineer and a photographer, proceeds to the scene of an accident immediately a report is received from the police. A series of photographs is taken of damage to vehicles or other objects, and notes are made of road features and any other relevant evidence. A great deal of valuable data has been gathered and made available to motor manufacturers, the police and other authorities.

Exhaustive tests have been made into the design and fitting of safety belts and of different kinds of safety fence and crash barrier. It has also pioneered a special type of lightweight lighting column that breaks off at the base on impact, thereby lessening the risk of serious accident. Machines have been developed for measuring the skidding resistance of road materials and road surfaces. It is estimated that this research has reduced skidding accidents to the extent of saving £3 million a year.

The Laboratory also stage-manages its own "accidents" by sending cars crashing at speed into massive concrete blocks. A "post-mortem" is then carried out on the wreckage and careful note taken of all effects of the impact.

By means of its Tropical Section the Laboratory has rendered valuable aid to developing countries in tropical regions. Such countries, when planning their road and traffic programmes, often lack the specialised knowledge and experience necessary to obtain the desired results. RRL research teams make tours of up to three years duration studying specific problems on the spot, working in close collaboration with the staff of local administrations.

It is estimated that the present number of vehicles on the roads of Britain (about 15 million) will reach around 36 million by the end of the century. It is obvious that as our road and traffic problems increase, the work of the Road Research Laboratory will become progressively more important.

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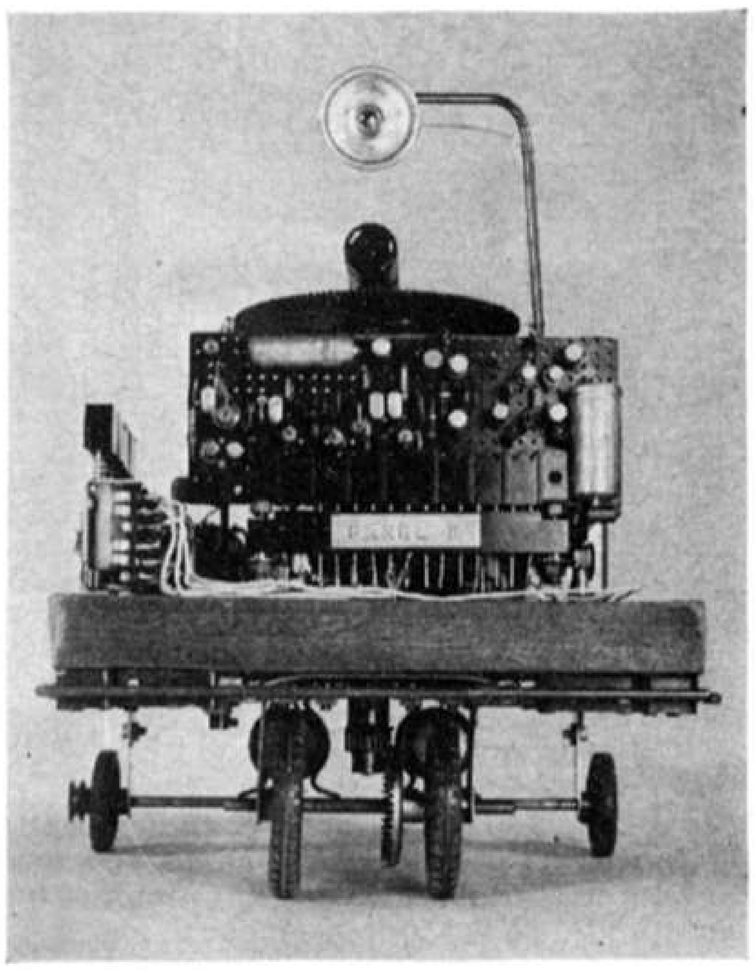

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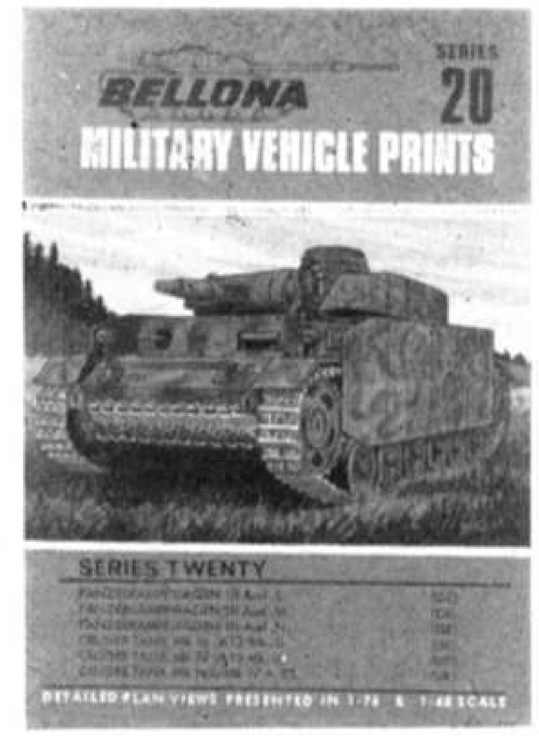

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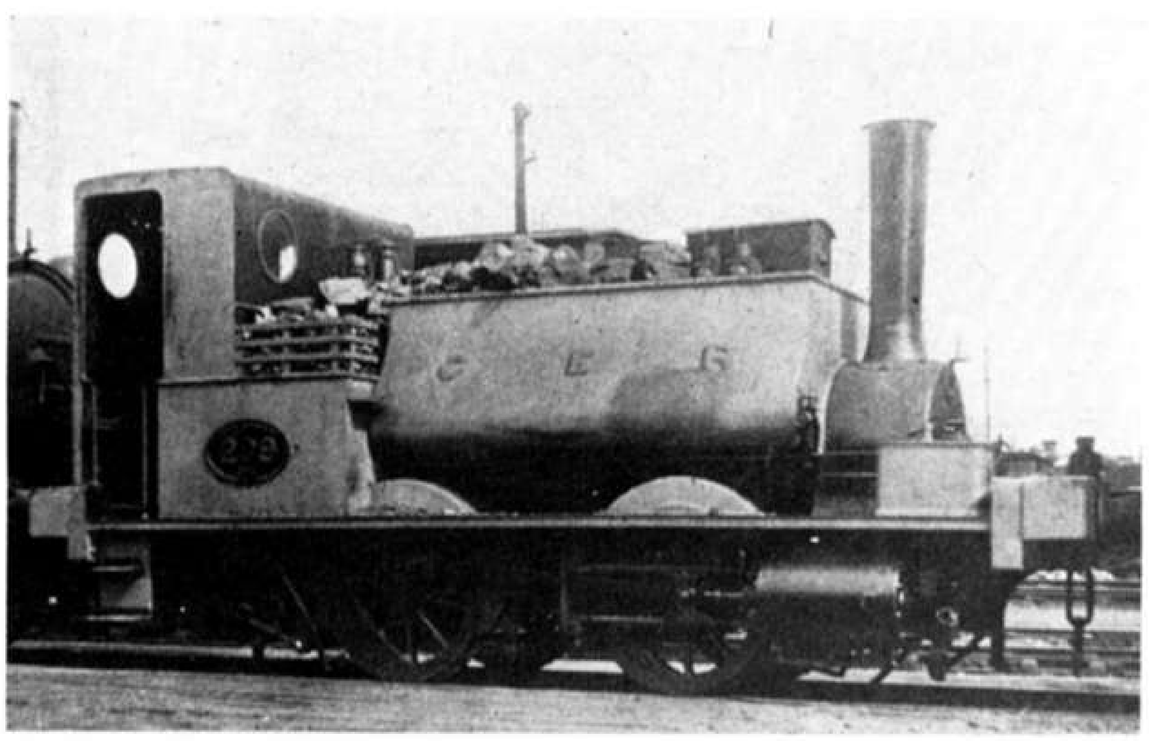

Popular "Portrait of a Locomotive" series is continued with the story on the Great Eastern Railway's diminutive locomotive known as the "Coffee Pot", complete with scale drawings showing the locomotive in many of its guises and detailed tone sketches.

The increasing interest in modelling diesel locomotives is catered for with notes by one of the country's best modellers. Mike Cole's diesels are well known in the northern clubs.

The batch production of narrow gauge wagons is this month's subject of the regular series "Production Methods for Modellers".

Model Railways

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The MODEL RAILWAY EXHIBITION comes at the traditional beginning of the model railway season and we shall be once again taking Central Hall, Westminster, over the Bank Holiday period to promote an exhibition devoted to the smaller gauge of Model Railways. This strikes a new note in that it is at the beginning of the modelling season rather than the end. It lasts for nine days, which includes two Saturdays and a Bank Holiday Monday so that we feel there should be a great opportunity not only for enthusiasts to visit us, but for many in London, perhaps on holiday, who would not otherwise have had the opportunity.

NEW STYLE

In our first exhibition last Summer we introduced some changes in the traditional presentation. These proved so very successful and popular that we are continuing this presentation. The trade stands will be placed in the usual manner round the edge of the hall, but instead of having high walls screening off the central layouts these will be presented in what we can only call an open-plan form. We hope this will do more than justice to the trade displays and also enable some comparison to be made between one layout and another.

TRADE STANDS

A number of proprietary exhibition layouts (of international calibre) will be on display. The model railway trade will be in strength offering a wide range of goods. Firms and manufacturers whose goods will be on sale and on display already include: Beatties of London; Chuffs; A. A. Hales Ltd; Studiolith; Traction Engine Enterprises; Plaistow Pictorial; M. & R. (Model Railways) Ltd.

GRAND LAYOUT COMPETITION

We are offering prizes of:
First Prize £50: Second Prize £30: Third Prize £20: for the best club *and* for the best individual layout, £200 in all! The layouts displayed will be limited to 200 sq. ft. which gives a maximum size of about 16 × 12 ft. Gauges eligible will be O gauge and smaller gauges.

How to enter is simple—a club or an individual has only to drop us a line and send a photograph of the layout; if possible a rough sketch/plan and a note of dimensions and special features. We will visit layouts which seem likely to be of interest and make our choice from them. A great deal depends on how well you describe your layout in the first place so while not asking for modesty we do ask for accuracy.

A condition of winning this competition is, that the first three layouts shall be available for display at our exhibition. We would be responsible for collecting the layouts and returning them after the exhibition and keeping them insured during that period. If the layout owner wishes, and is able, to demonstrate his layout during the exhibition, expenses will be paid for this purpose. Alternatively, we shall be happy to provide reasonably skilled club operatives who would operate the layout.

OTHER COMPETITIONS

STATIC DISPLAY MODELS: O GAUGE & SMALLER

£50 in prizes which will be divided into prize units of £10 first prize, £7 second prize, £5 third prize and miscellaneous additional awards to a total of a further £28.

BEST LOCOMOTIVE—

Models may be entirely scratch-built; built from kits; partly kit and modified. Amount of "own work" will be considered in judging. Junior prizes awarded in addition of three or more junior entries in a class, plus "Best Junior" prize.

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Goods, passenger, private traders, special purpose.

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Platforms, complete station unit, etc.

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Points, crossover, single and more elaborate work.

SOUVENIR HANDBOOK & GUIDE—

MODEL RAILWAYS comes out on August 11th and will contain a special Exhibition Souvenir Handbook and Guide Supplement and provide a grand enlarged number.

ADMISSION—

Hours of Opening—The exhibition will be open on the 24th August 1972 at 10 a.m. and will continue through daily to 9 p.m. except Sundays, when it will be closed, and will finish on Saturday, September 2nd at 7 p.m.

It will be open on the two Saturdays and the Bank Holiday Monday all day.

Prices of Admission—Price of admission at the door will be 30p adult, 15p child. A child is regarded as anyone still at school. Children under 5 who have not started school and are accompanied will not be charged.

Reduced admission charges for prebooking as under—Single and small number pre-booking tickets available from these offices. Adult 25p, child 12½p. Parties of more than 10: adult 20p, child 10p. Teachers i/c parties free—one per 10 in party.

A combined family ticket can also be bought in advance.

Enquiries to Exhibition Organiser, Model & Allied Publications Ltd., 13/35 Bridge Street, Hemel Hempstead, Herts.

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The British National Championships, by tradition the biggest sporting and social event of the aeromodelling year, was for the first time divided into two separate meetings, and the full story of 'what happened' appears in the August issue of **Aero Modeller.**

Two free, full-size plans are provided. One is for a rubber-powered scale model of the *Spinks Akromaster*, while the other, *Snoopy*, is a most unusual craft, being a flex-wing, tow-line glider. Featuring wings made from polythene sheet and with very simple construction, this unusual project may be built with an absolute minimum of time and materials.

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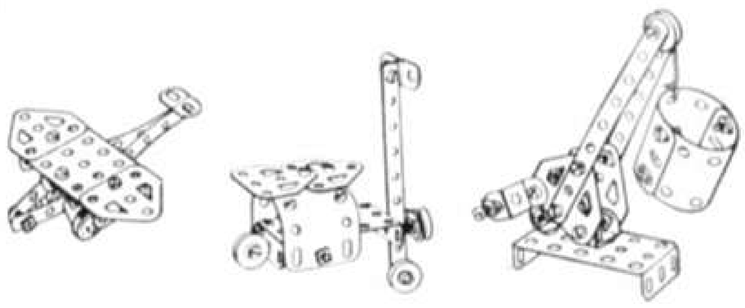

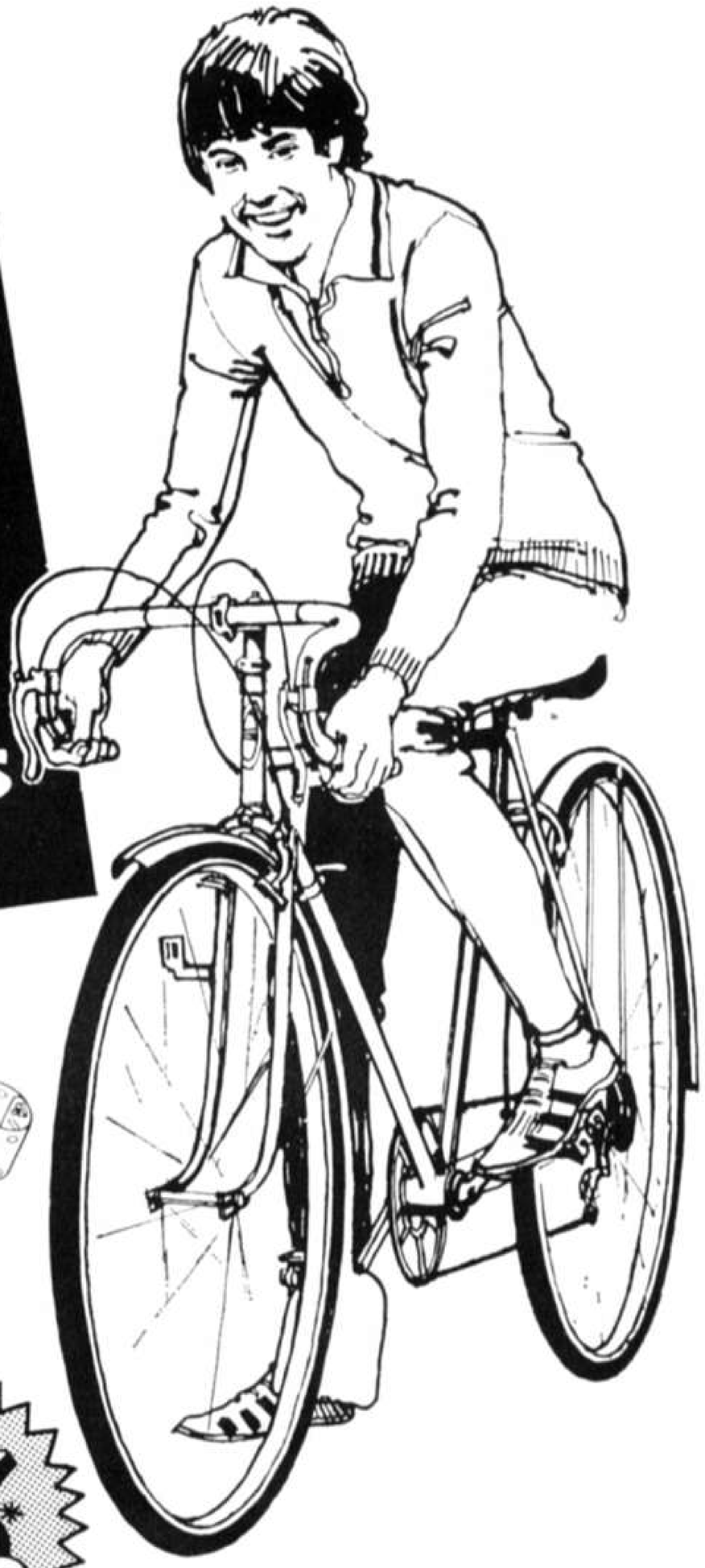

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