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SEPTEMBER 1968

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MAP HOBBY MAGAZINE

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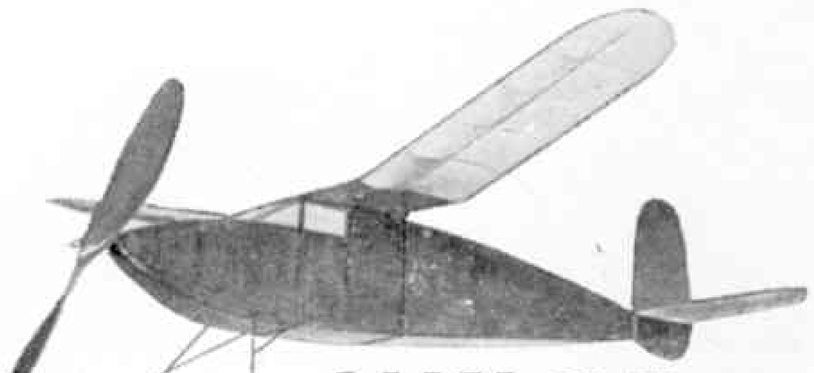

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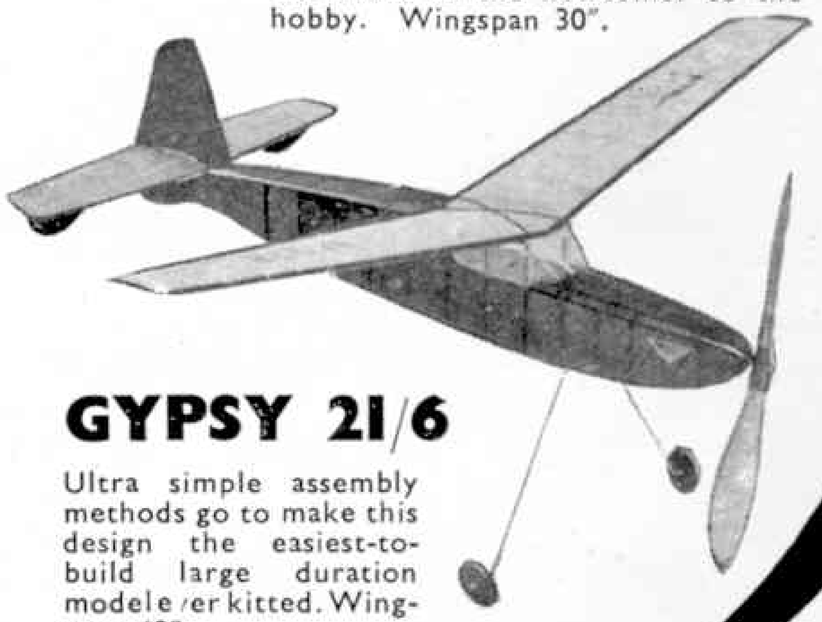

GYPSY 21/6

Ultra simple assembly methods go to make this design the easiest-to-build large duration model ever kitted. Wingspan 40".

MECCANO® Magazine

SEPTEMBER 1968 VOLUME 53 NUMBER 9

Meccano Magazine, founded 1916.

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MAP **HOBBY MAGAZINE**

FRONT COVER

This pretty little model is a scale free flight Nieuport 17 by Bruno Markiewicz of Detroit, U.S.A. It won the Open Free Flight Scale at the 1964 U.S.A. National Model Flying Championships. See the British National Championships in this issue.

NEXT MONTH

Next month's magazine will feature a Tri-ang Hornby layout cover with a special four page feature "Building a OO Gauge Layout on a Tight Budget", we know this feature will be a great help to many readers. The Full size plane is for a scale conversion slide rule, of all balsa construction. Watch out for part two of the Supermodel feature and many new Meccano models to build. A.B.C. of Model Railways, Great Engineers and all the other regulars will be included as usual together with Militaria and Battle.

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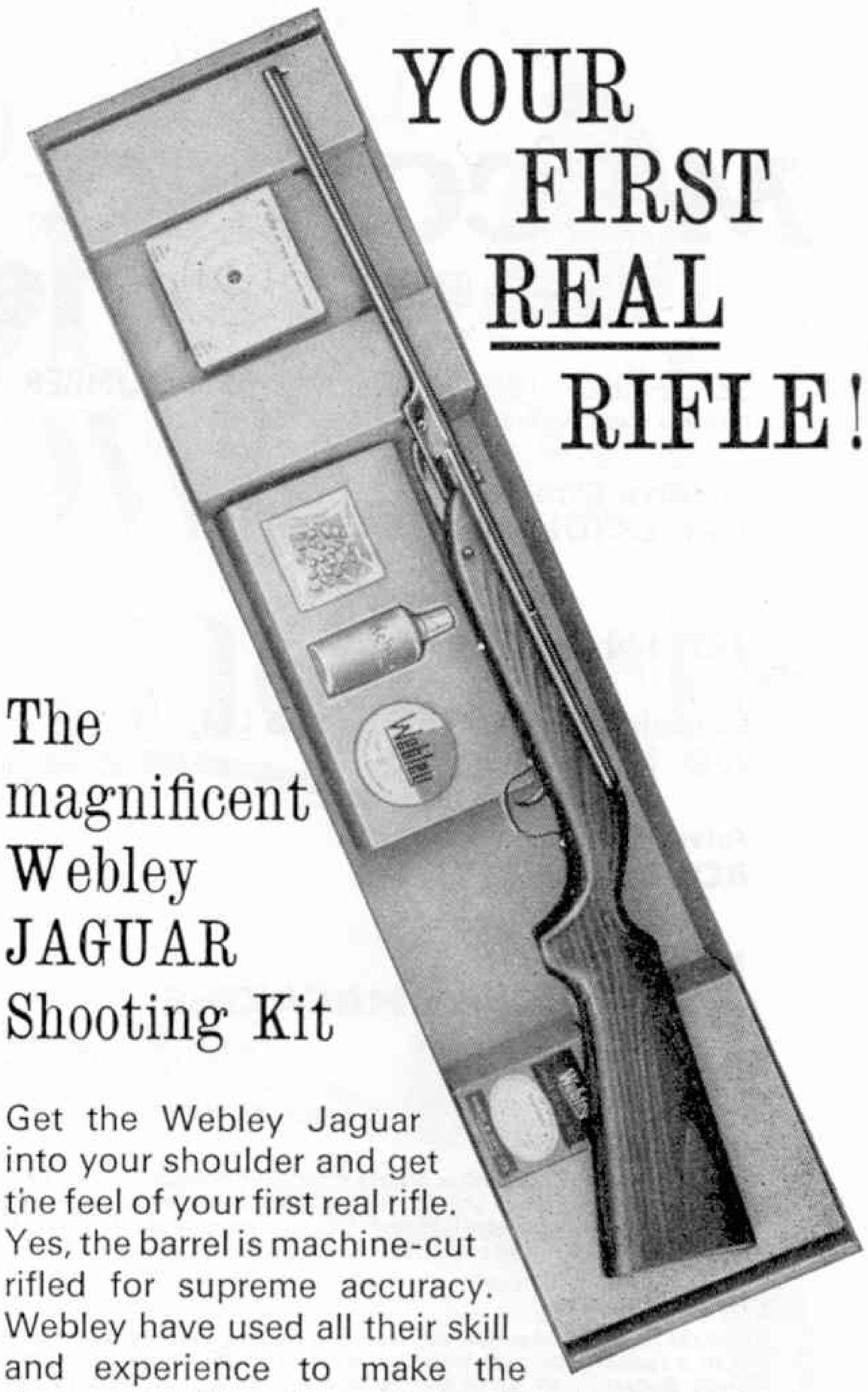

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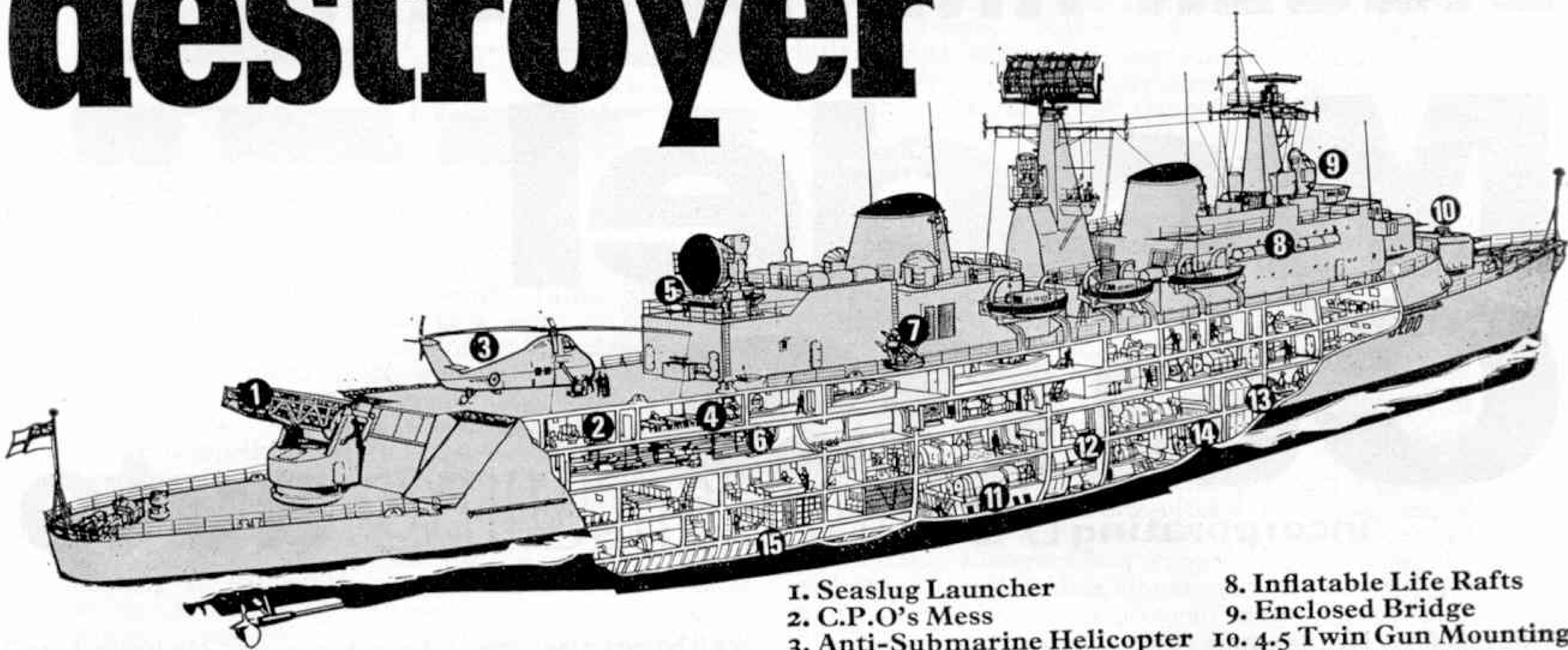
The missile-age destroyer



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With this first, big, new-look *Model Cars* now incorporating " Miniature Auto," we can at last offer the model car enthusiast all that's best in reading—every month, under one single cover! Here's how. Firstly, *Model Cars* will have more pages than ever (but still at the regular price of 2s. 6d.!) Secondly, we're going to retain all the articles, features, etc., which you enjoyed most—so you won't miss any old favourites. And thirdly? Well, more pages will mean more room to really cater for all tastes in models, and provide something of interest for everyone.

And we do mean everyone. Collectors and die cast enthusiasts will have their own regular pages every month and space will be devoted to " chopping " and plastics. More room to move gives us a chance to go deeper into details like painting and finishing, display of models, restoration, and all the interesting " side-lines " often overlooked. Slot racers can expect bigger and better articles on top cars, scratchbuilders will get the very best in designs and ideas—remember, we'll have a choice now of all the best authors in the model car field. There'll be more reports on meetings and Trade coverage will be more comprehensive than ever. In fact, quite simply, we'll be providing everything you like to read most—and more! As we said, we'll be retaining some of the most popular " Miniature Auto " features mainly on the die cast side and giving this developing angle of the hobby, a fair share of room in *Model Cars*.

If you've enjoyed reading " Miniature Auto " and *Model Cars* in the past as separate titles, we think you're going to be thrilled to bits with this first bigger October issue of *Model Cars*. Just check this top reading line up: For a start, there'll be a free 32-page booklet on slot motors with every number, giving specs of all the mills plus tuning, building and maintenance articles. Scale plans will be for the F1 Matra and the Brabham BT24 with complete specifications and superb photographs; there'll be features for slot racers on motor winding, and for scratch-builders will be a winning endurance car in 1/32nd scale. There'll be more in our highly popular "Workout" series and further offerings from Laurie Cranshaw, more for beginners, Gadget Special and Racing Review. All our regular favourities will be there, too—Pit Chatter, Readers Write, Club News and Trend of the Trade. In addition will be a corner for collectors and plenty of race reports with car specs plus, of course, Racing U.S.A. from *Model Cars*' U.S. Correspondent, Bob Rule. And much more . . . you *know* you can't afford to miss it!

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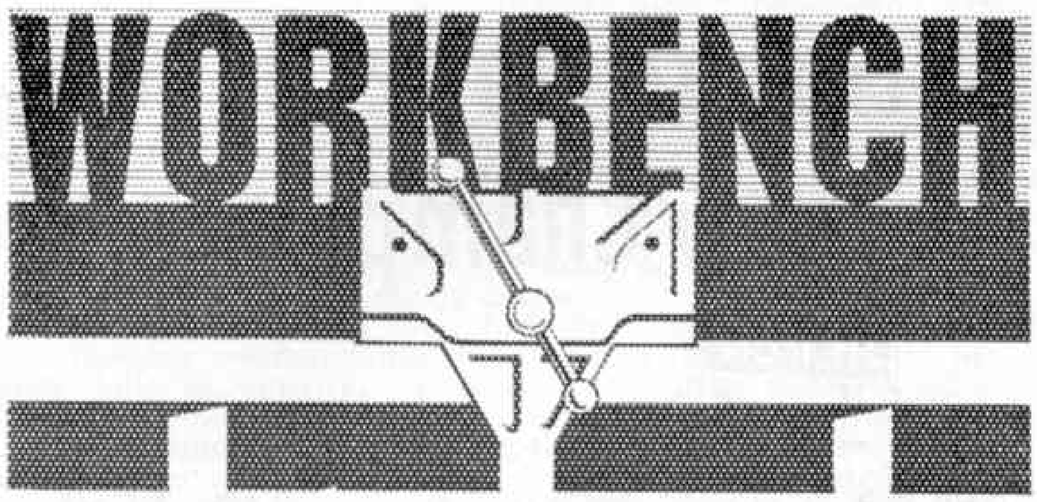


A Day with the " Red Arrows "

A contest for non-flying scale modellers, with a magnificent prize list is announced by the Central Flying School, Royal Air Force, Little Rissington. Cash awards and Trophies to a value of more than £150 will be distributed to winners in 4 classifications. In addition, major prize winners will be given the wonderful opportunity of having a day with the famous " Red Arrows " aerobatic demonstration team.

The competitions are for non-flying scale models of aircraft which have served with the Central Flying School and have to be entered in either 1/24th or 1/72nd scale according to class. Entry fee is 5/-, and on registration, the entrant will be supplied with a drawing to guide his modelling plus such references as may be available. CFS reserves the right to restrict entries to no more than twenty of each aircraft, but the list spans 50 years of flying so that the choice is extremely broad. Types range from the Farman Shorthorn to the Percival Provost.

Class 1 is for 1/24th scale fixed wing. Class 2 for 1/24th rotary wing types. Class 3 for grouped models in aerobatic formation to 1/72nd scale and Class 4 is for juniors under 16, working to 1/72nd scale. Plastics are not barred, but must, of course, be modified and coloured to CFS markings.

Class winners will be expected to loan their models for exhibition in the CFS Museum and outstanding runners-up are invited to display their entries in the permanent exhibition at Little Rissington. Further details of this fine contest are available from Flt. Lt. A. J. Gunn, Competition Secretary, Central Flying School, Royal Air Force, Little Rissington, Cheltenham, Glos.

The 1968 National Wargames Convention

The Convention will take place this year in London, under the auspices of the London Wargames Section. It will be held on the last weekend in September, at the Rembrandt Hotel, Brompton Road, London S.W.7, opposite the Victoria and Albert Museum, and will last two full days. Due to the small space available, the number of people that may attend (including advertisers and visitors), will be limited to two hundred. Space will be available for individuals to exhibit their figures, terrain or accessories. There will be no charge for this, but exhibits must be painted and labelled. Prizes for the best painted figures and the best conversions on display, will be awarded. For more details, write to the Secretary, London Wargames Section, 90 Burrage Road, Plumstead, London S.E.18.

Festival of Great Britain Fair

Served in the peaceful surroundings of a typically British Public House, you will be able to have a meal or drink, listening to the sound of the Town Crier outside. Not so far away, you will be able to watch a potter at work, relaxing in the security provided by a good old British " bobby ". A peaceful scene from a little country village, you might think. Not at all, for in the street outside, the pulsating life of New York City marks the end of any tranquillity the visitors may think he has found.

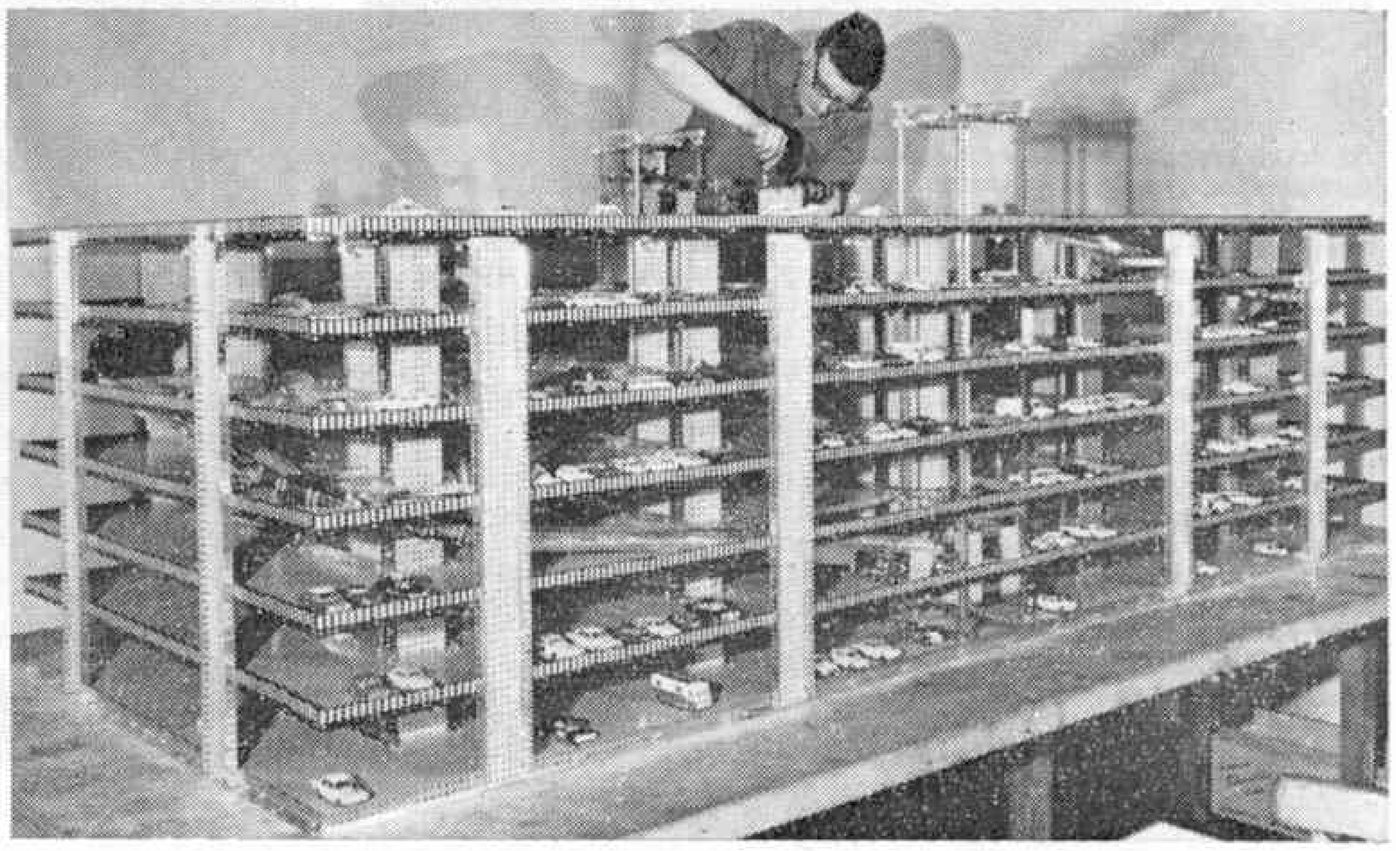
The pub, the bobby and the potter, are all just part of a Festival of Great Britain Fair, open for 3 weeks from September 3rd, in the very heart of New York City itself—a Fair, for which British Manufacturers and industry are preparing, by shipping goods and produce representative of this country.

Organised by Macy's, owners of a chain of stores throughout America and Canada, the Fair will be held in no less than twelve stores, including one in downtown New York, and representative displays of life in England, Scotland, Wales and Ireland will show the visitor all he wants to know about this country. An important part of the Festival will be a Toy Fair, which will have as its centre-piece a 12 ft. long model of a British multi-storey car park. This was constructed by Meccano, Liverpool and shipped to New York; the park is capable of holding almost 1,000 cars and is fully automatic with operating lifts and ramps, along which six Dinky Toy cars will travel automatically.

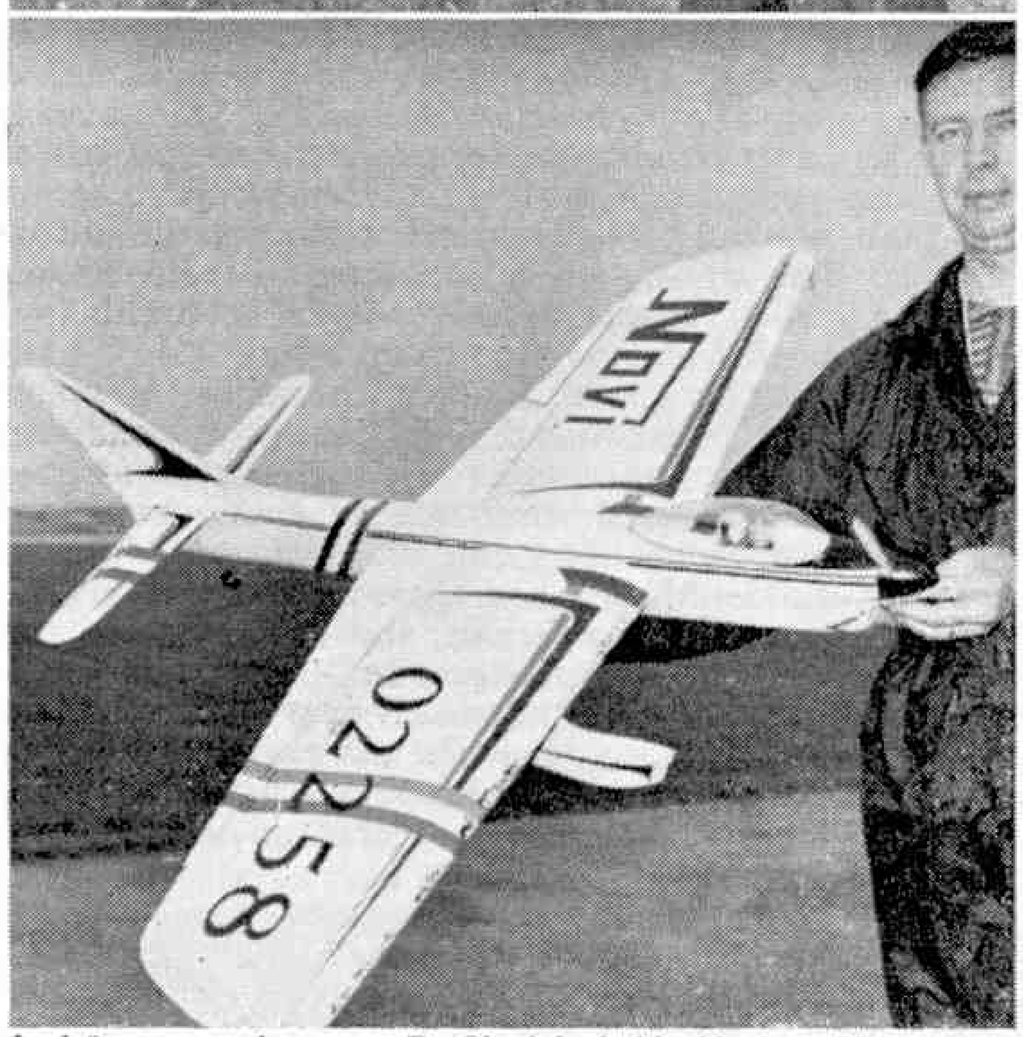
Twenty-eight year old model-builder Pat Lewis, of Barkfield Road, Formby and a team of three other helpers, spent three months in building the model, which has over 20,000 Meccano parts, and 120 bulbs. Weighing almost half a ton, the model was designed and built without any plans and with only the aid of sketches. Pat, who has been interested in the Meccano system for about twenty years, made his hobby his job, when he joined Meccano nine months ago.

Having already built another enormous Meccano model for the International Toy Fair at Nuremburg, Pat says, " I enjoy the challenge that this type of project provides, although this sort of thing is a very different proposition to the type of model most amateurs build. Models like these have to work continuously for very long periods, and this takes concentration and very careful construction."

Although he has built practically every type of model over the years, Pat says that the car park, " Presented many difficulties of a special kind, in synchronising the movement of the six cars that operate in the lifts and along the ramps."



National Model Flying Championships

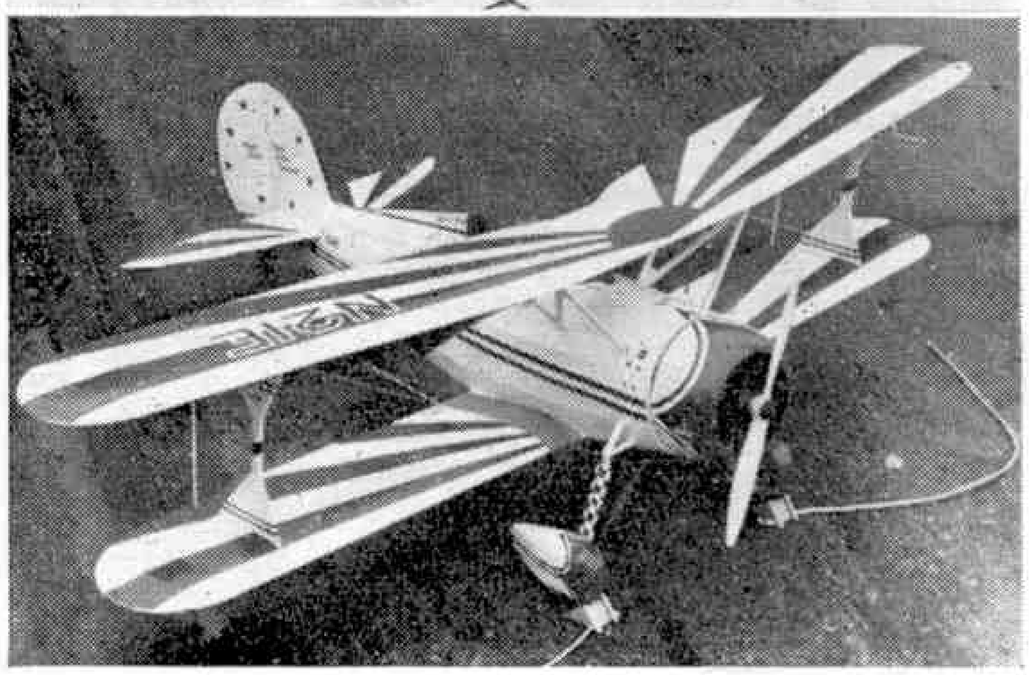


June 2/3rd at H.M.S. Heron, Somerset.

THIS YEAR'S National Model Flying Championships held at R.N.A.S. Yeovilton (H.M.S. Heron) over the Whitsun weekend, was, as ever, the highlight of the aeromodelling year. The three classes, Radio Control, Free Flight and Control Line attracted some 2,000 campers and the influx of cars was tremendous. This great occasion was organised and run by the Society of Model Aeronautical Engineers.

As well as the modelling bonanza, spectators and competitors alike were able to visit the Fleet Air Arm Museum and get a first-hand glimpse of the Royal Navy's F4K Phantoms, as described in last month's Meccano Magazine. Early arrivals had an Air Show of their own, as Sea Vixens of 892 Squadron flew out to another base.

Reflecting the modern trend of affluence, the Radio Control events attracted the largest crowds. Twenty-three scale, Radio Control models were on the flight line and these large 5-6 foot wingspan models presented a really exciting show of aerobatics and scale manoeuvres, with several spectacular crashes, proving that it is not as easy as it looks. One of the most outstanding models was a huge 73 inch wingspan S.E.5a W.W.1. biplane. Weighing nearly 11 lbs. it was beautifully made and intricately detailed; it also reproduced the floating flight of the full-size aircraft very convincingly. Another scale masterpiece, was a detailed replica of Sheila Scott's record breaking Piper Commanche, this included thousands of rivets on the surface with a fine replica of Sheila Scott in the detailed cockpit. The winning model was a Percival Provost entered for the second

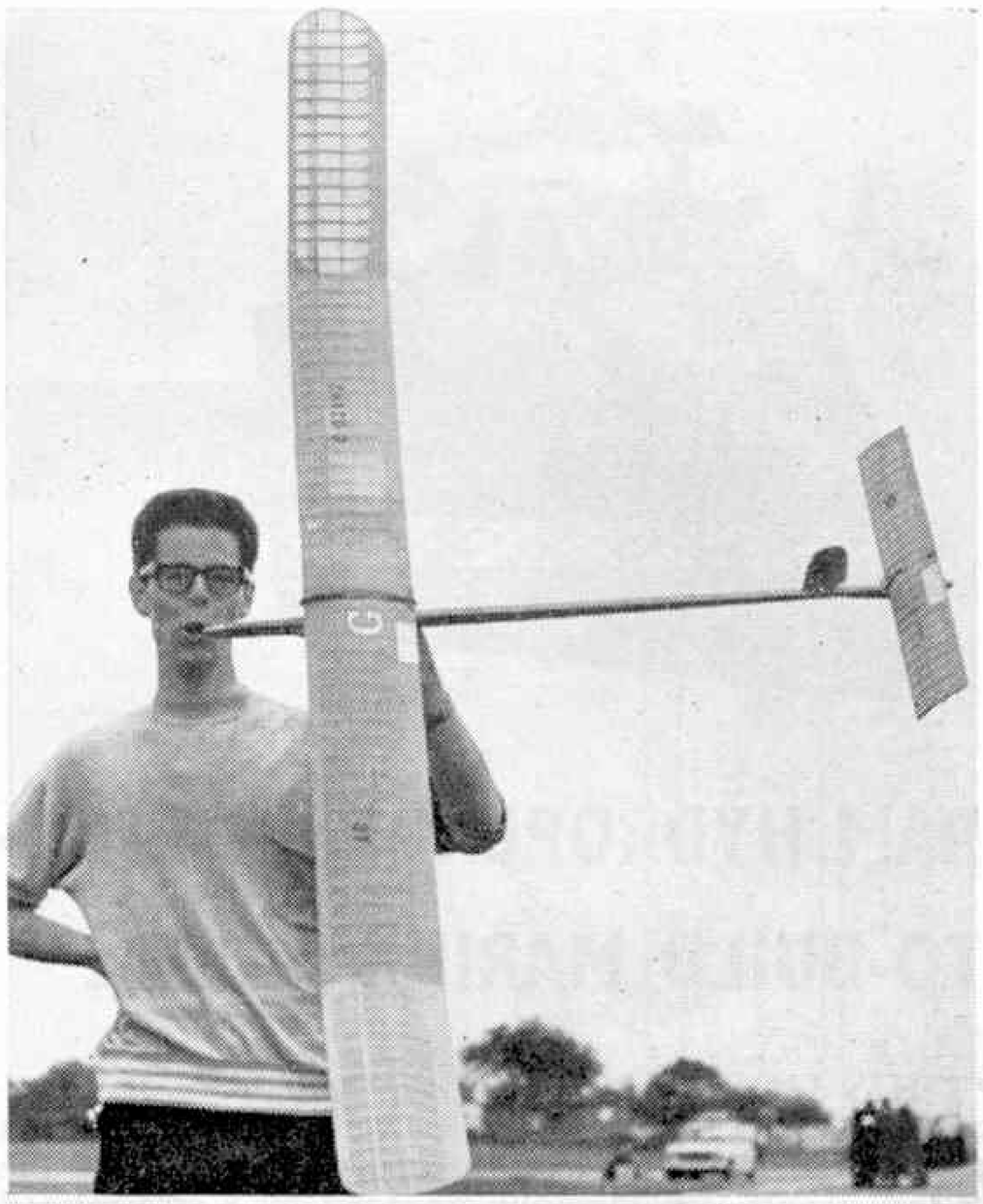


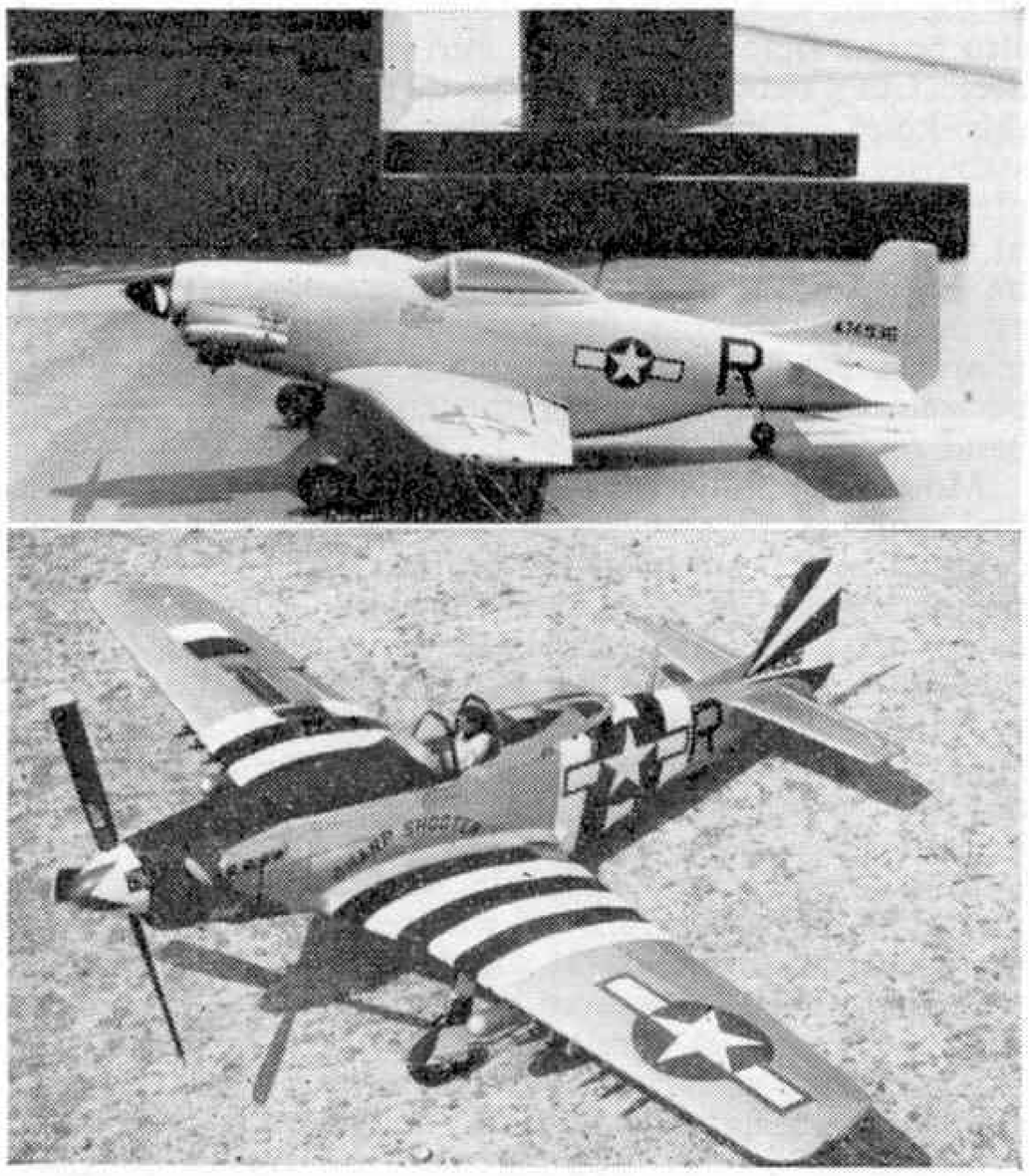
At left, top to bottom. B. Sinclair holds his free flight power model that won the International class event. Called "Faital" it is built from plans published in Aeromodeller magazine and powered by a Super Tigre 2.5cc glow plug engine. This functional model has an astonishing rate of climb during its 10 second engine run, so the diagonal braces between the wing ribs are put in to prevent warps and flexing at high speed. Next, we have a control line stunt flyer, C. L. Elliot of Wolverhampton with his "Novi" model built from plans published in an American magazine. Powered by an O.S. 35S engine from Japan it has a 54 inch wingspan and is finished in cream with black lining. At right, top, a semi scale multi radio control "Ju87D Stuka" entered in the Radio Control Scale event. Unfortunately, this model by K. Evans of Kinver, placed last in this event, but standards are very high indeed in Radio Control Scale. At right, bottom, a really superb Control Line Scale "Great Lakes Special" by Clive Hall of Cambridge. This has all the cockpit controls working together with all the moving flying surfaces. Powered by a Merco glow plug engine it flew very well. Even the fuselage is scale with sheet alloy panels used as covering, hence its 4¾ lb. weight.

year. A brilliant display of aerobatics and a really scale-like take-off and landing, separated this from the other models. Radio Control aerobatics, although frightfully competitive for the top few places, could have proved rather a bore to the spectators as every model tried to fly the same schedule of manoeuvers, but fortunately the organisers mixed some scale flights in. Pylon racing, with small semi-scale, midget racer Radio models, flown together round a triangular course, proved highly successful; these little models touched 100 m.p.h. and provided a really interesting spectacle, as they over-took and passed each other on the racing course.

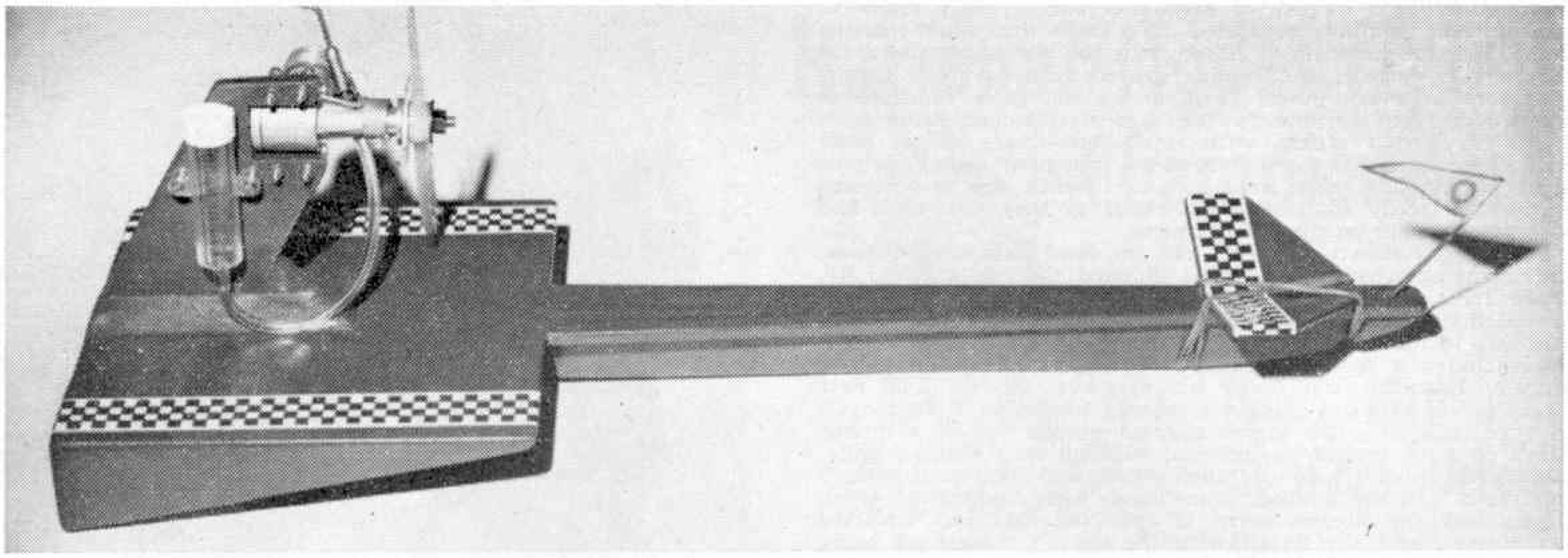
Free Flight events, as ever, had the most individual entries, and changing weather conditions dictated the best time to fly, hence lulls in activity. A special event for tailless models proved that these weirdies can perform, and some most unusual features, including rotating wing-tips were used. Free Flight also included a special women's event, and the second placer, Jennifer Edwards, was flying her first ever model. The Free Flight power event saw engines ranging from Cox T.D. 0.049's to 5 cc. Eta 29's, the larger engined models having a terrific climb on a 10 second engine run, with up to 3 minutes glide, but several models had too much power and were seen to loop and crash into the ground, immediately after launching. Open Glider was the biggest event of the Nationals and attracted 123 entries, and the fly-off with the top 17 models all being launched together to decide the eventual winner, was quite something to see.

Control Line events were quite interesting, and in Speed, a 2.5 cc. powered model flying on one Control Line, recorded 142.5 m.p.h. with a special tuned length exhaust pipe fitted to the engine to act as a supercharger. For the Juniors, Mouse Racing for small Cox 0.049 engines, proved very fast, the winning model flying at an incredible 80 m.p.h. Compared with the larger Rat Racing event, Mouse Racing provides a very cheap but safe sport with rewarding speeds gained from careful preparation. The Combat event, where models try and chop off each other's streamer, had at least one model released by its pilot to eventually disappear overhead into the high cloud, with the engine still going strong. The Oliver Tiger 2.5 cc. diesel engine still reigns supreme, as does the flying wing model configuration. The three other Control Line racing events were interesting to watch, with Rat Race the most spectacular, as four models all doing about 120 m.p.h., are flown *at the same time in the same circle.* Control Line Stunt was rather low on entries this year, with the large 5-6 cc. aerobatic models performing very quietly with their silencers fitted. Last, but not least, was a new event, Carrier Deck. As the Championships were held at a Naval Air Station, a semi-scale Navy Carrier Deck was laid down on the concrete, complete with arrestor wires. Scale or semi-scale Control Line Navy models had to take off from the carrier deck, demonstrate both high and low speed flight then come into land on the deck, by engaging their arrestor hook on the carrier deck's arrestor wires. Some models pulled themselves in half !





At left, top, the winning control line Navy Carrier model. This "Mustang" was built from a Top Flite kit by Mick Reeves, imported into this country by Ripmax. It is powered by a Merco 35 glow plug engine, and it has three control lines. Two of the lines operate the conventional elevator whilst the third adjusts the engine's throttle for slow or fast speed running. It also has a large flap under the wing that is lowered when the arrestor hook comes down to engage in the landing wires, set across the carrier's deck. Below this, is another "Mustang" model by Mr. Ingram of Exeter, but built from a Sterling kit. This was entered in control line scale and the photo shows the model after it had been extensivly repaired after an unintentional prang. This model was powered by an Oliver Tiger diesel engine. Above top, the winning glider flown in the International class event. Steven Bowles of Norwich built this huge model to his own design, note the tiny tailplane and very short nose, both current contest model practice. Below this, we have the ladies' winner Mary Day, who won the Woman's event with this Open class rubber model. The intricate structure hides a huge 4½ ounce rubber motor.



RAM HYDROPLANE AN EASY-TO-BUILD MARINE MODEL

THIS MODEL represents the very latest thoughts in full size offshore powerboat racer design where a planing hull forms only part of the craft, the overall length considerably extended by a streamlined ram which *pushes* its way through the water. It is no "mad inventor's" idea. It has been developed by Sonny Levi, designer of some of the most successful full size high speed power boats and a past winner of the Cowes-Torquay race.

The basic idea is to stop the craft becoming airborne when travelling at high speed through rough water. Also, by increasing the effective length of the boat the rate at which it is caused to pitch in waves is reduced, making for a smoother ride. The ram hydroplane, therefore, combines the advantages of a longer hull but with much less wetted area to cause drag; and the additional stabilisation provided by most of the length (i.e. the ram) travelling through, rather than jumping out, of the water.

High speed models are even more prone to jump out of the water, or even flip, in quite a mild popple —so the ram idea is well worth investigating. It is also much cheaper and quicker to build models instead of full size boats to try out new principles. Our model, therefore, is very much an experimental one, but it could lead to something quite new in high speed design layout. We have made it very simple, so that it is quick and easy to build—and adopted airscrew drive because this is by far the simplest way of obtaining high speed performance with a model boat. Any spare .049 glow plug motor will do, or a 0.5 to 0.8 c.c. diesel. The model is designed for tractor propulsion, which means that you can use a standard model aircraft 5 in. diameter propeller on the engine rather than a special 'pusher' type.

The plan is reproduced here one half actual size so you need to scale it up twice (reproduced) size. Full size printed plans are available from **Meccano Magazine, 13-35, Bridge St., Hemel Hempstead, Herts.; price 2/6d.**

Start by selecting a length of really hard 1 in. × $\frac{1}{4}$ in. balsa for the ram. Cut this to 17 in. long and then notch $\frac{3}{16}$ in. deep on one edge for a length of 5.8 in. in from one end. Cut two 6 in. lengths of 3 in. a $\frac{3}{16}$ in. sheet balsa, cement together to make a 6 in. square and trim to 5.8 in. wide. Cement this onto the notch cut in the ram, as shown on the plan.

Cut the four triangular formers from $\frac{1}{4}$ in. sheet and cement under the $\frac{3}{16}$ in. sheet panel—two close up against the ram and the other two on the ends of the sheet. Cut the two back pieces, chamfer off the bottom edges and cement in place. Finally cover the bottom of the planing part of the hull with four 3 in. square panels of $\frac{1}{16}$ in. sheet.

Now cut two stiffener pieces from $\frac{3}{16}$ in. sheet to cement along the top edge of the ram, as shown. Cut the motor mount from $\frac{1}{4}$ in. ply, shaping the cut-out to suit the motor you are using. Cut a slot in the top of the $\frac{3}{16}$ in. sheet to take the motor mount, cement in place, add the $\frac{1}{4}$ in. sheet fillet and the two $\frac{1}{4}$ in. square fillet blocks each side. Carve and sand these down to a triangular section when set.

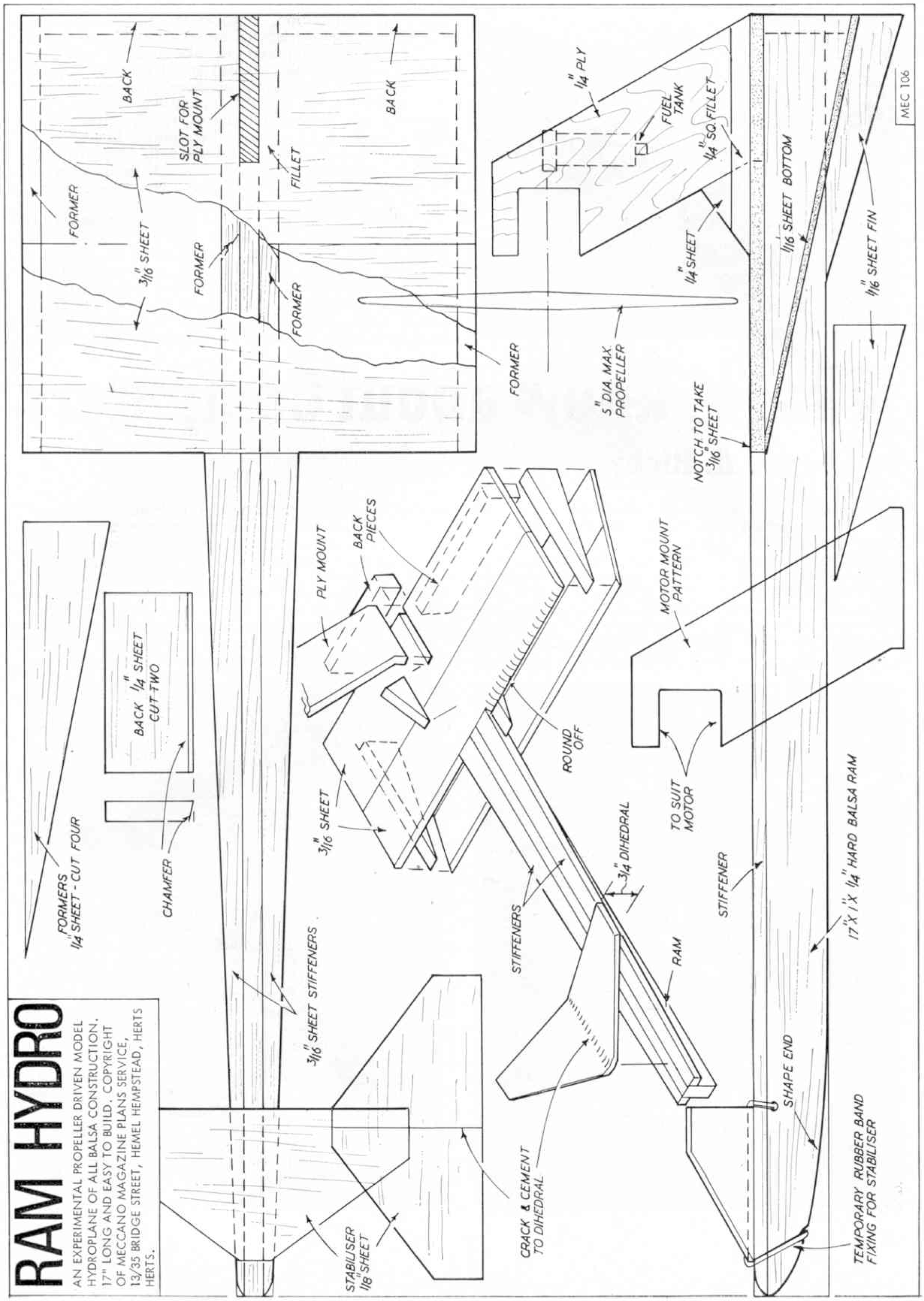
The next part to make is the stabiliser. This is cut from hard $\frac{1}{8}$ in. sheet to the shape shown. Sawcut partially through the centre, crack bend to $\frac{3}{4}$ in. dihedral at each tip and cement over the centre thoroughly. When set, flatten off the bottom by sanding so that the dihedralled stabiliser will sit squarely on the front of the ram.

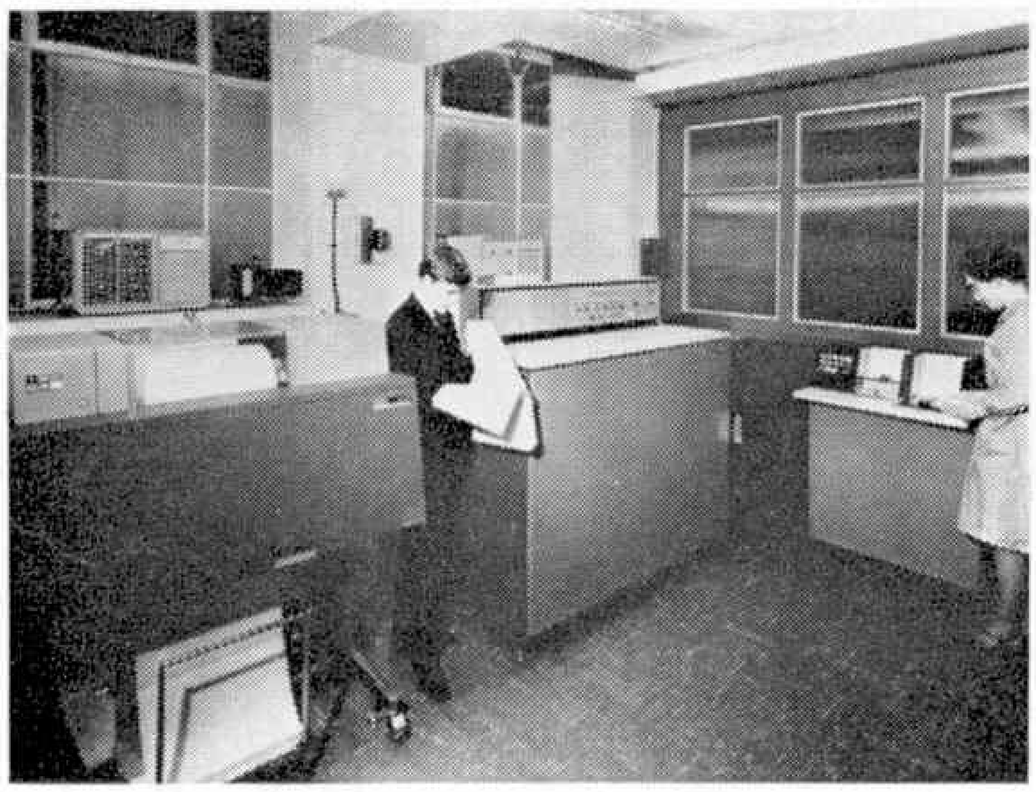
The front of the ram should be carved and sanded to the rounded shape shown. Cut a nick in the bottom of the ram just behind the front of the stabiliser, and also bore a hole through the ram just behind the stabiliser. Cut a rubber band and re-tie after passing through this hole. This band can then be looped over the stabiliser and under the ram to hold the stabiliser in place. The idea of temporary rubber band mounting in this manner is to enable small pieces of packing to be inserted under the front or rear of the stabiliser, as necessary to trim the model. Once a satisfactory trim has been achieved the packing and stabiliser can be cemented in place permanently and the rubber band removed.

Mount the motor in place with bolts. A small plastic fuel tank can be screwed to the side of the ply mount, coupled to the spraybar of the motor with a length of plastic tube. Check over all the joints on the sponson to see that they are watertight and finally cut and fit the $\frac{1}{16}$ in. sheet fin which is cemented to the bottom of the ram. You are then ready to start your first trial runs. This is purely an experimental model so you do not need to bother about painting it, unless you particularly wish to do so.

Do not expect perfect results straight away. You will probably find that the ram will tend to dig in as the model drives forward. If so, put some packing under the front of the stabiliser to tilt it up and try again. Ideally the model should run with the stabiliser just skimming the surface, and the amount of adjustment of stabiliser setting will depend almost entirely on the power of the motor. You may find it necessary to move the stabiliser position farther aft increase its area, or even try a longer ram.

With this model you are trying something quite new. Don't be afraid to experiment and make further design changes. You could be pioneering a revolution in high speed model power boat design!


RAM HYDRO
AN EXPERIMENTAL PROPELLER DRIVEN MODEL HYDROPLANE OF ALL BALSA CONSTRUCTION. 17" LONG AND EASY TO BUILD. COPYRIGHT OF MECCANO MAGAZINE PLANS SERVICE, 13/35 BRIDGE STREET, HEMEL HEMPSTEAD, HERTS HERTS.
MEC 106
BACK
SLOT FOR PLY MOUNT
FILLET
BACK
FORMER
3/16" SHEET
FORMER
FORMER
FORMER
1/4" PLY
FUEL TANK
1/4" SQ. FILLET
1/4" SHEET
5" DIA. MAX. PROPELLER
1/16" SHEET BOTTOM
1/16" SHEET FIN
NOTCH TO TAKE 3/16" SHEET
BACK 1/4" SHEET CUT TWO
FORMERS 1/4" SHEET - CUT FOUR
CHAMFER
PLY MOUNT
BACK PIECES
3/16" SHEET
ROUND OFF
MOTOR MOUNT PATTERN
TO SUIT MOTOR
3/16" SHEET STIFFENERS
STIFFENERS
3/4" DIHEDRAL
STIFFENER
RAM
17"X 1/X 1/4" HARD BALSA RAM
SHAPE END
CRACK & CEMENT TO DIHEDRAL
STABILISER 1/8" SHEET
TEMPORARY RUBBER BAND FIXING FOR STABILISER



What to know about Computers

by Charles A. Rigby

PERHAPS ONE of the most important discoveries of this century was the invention of the radio valve in 1904 by Sir J. A. Fleming. Perfected later on by Dr. De Forest who first introduced the 'triode valve' or what is commonly known as the electron tube, not only did this make radio what it is today, but it also led to an even bigger technological 'break-through.' This was the invention of the electronic calculating machine or computer. Now this revolutionary invention is opening up a new world based upon the electronic speed of computation, a world so different with the drudgery of clerical labour entirely eliminated.

The modern computer can take liberties with time never before possible. It can speed up processes 10, 100, and even 1,000 times or more, thus compressing into a matter of seconds, operations which might normally take weeks. Of course, speed of calculation does not matter very much where only a few numbers are concerned, but when dealing with vast quantities of data or figures, the speed at which these sums can be done is of utmost importance. No wonder that it is now at the disposal of the scientist, and engineer, the technologist, the banker, and so many other trades and professions where data is so vast in quantity that ordinary desk work is out of the question.

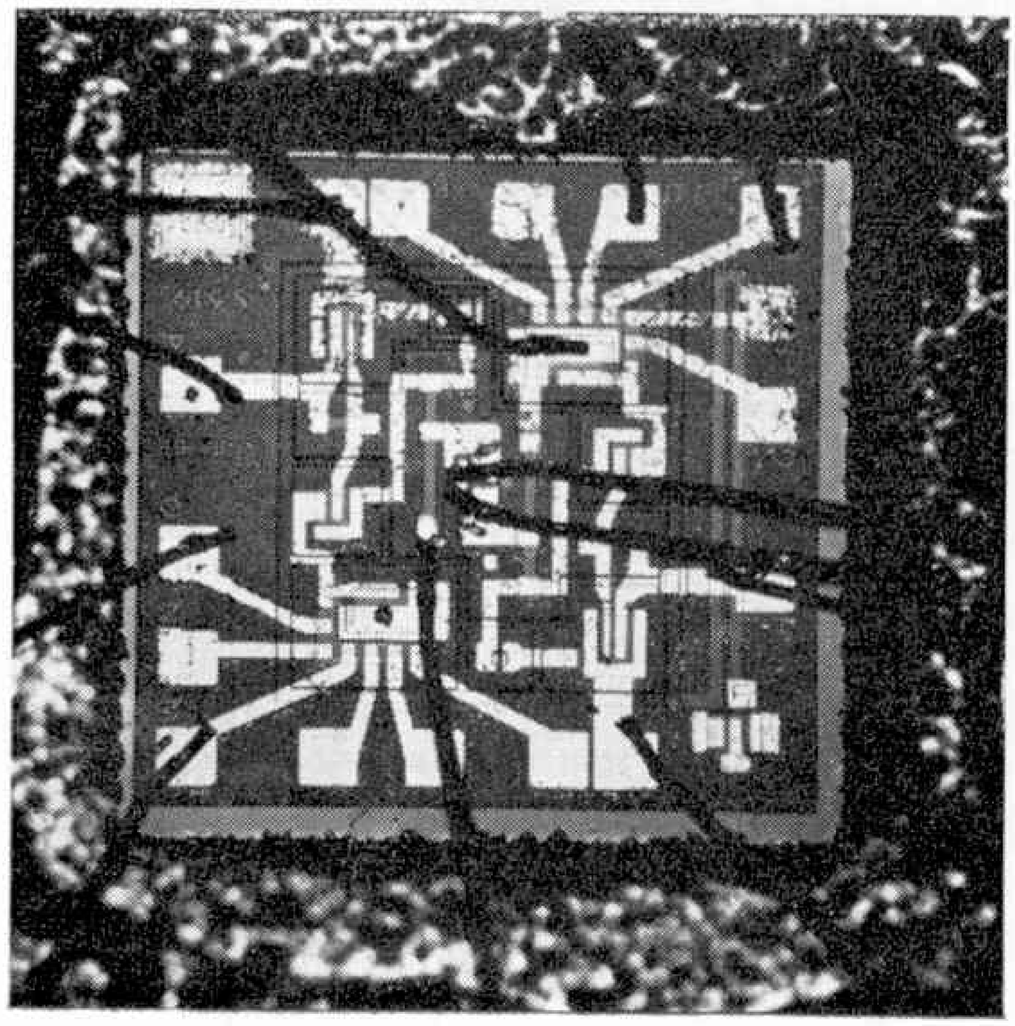
Earlier machines for calculating or counting are of great interest as they show that man has had this in mind for a long time. It was the Scottish mathematician, John Napier (1550-1617) the discoverer of logarithms, who published an account of an ingenious method of calculating by means of 'rods' or 'bones.' He also introduced the comma or stop between the integral or decimal part of a number. In 1642, Blaise Pascal designed and made the first calculating machine to help his father collect taxes. His machine consisted of a series of wheels numbered nought to nine, and interconnected so that complete rotation of one wheel caused the following wheel to rotate by one division.

Then in 1671, the German philosopher Leibnitz succeeded in mechanising multiplication by a process of repeated additions. Over 30 years later, Giovanni Poleni, a Venetian mathematician, published his collected studies in the volume "Miscellanea" in which there was a detailed description of the design and operation of a calculating machine. More than a century was to pass before calculating machines were in production for in 1820, the French financier, Thomas de Colmar developed a mechanized computing machine not based on previous attempts.

In 1875, F. S. Baldwin began producing machines on a commercial basis. Actually none of these machines were really automatic except perhaps for the carrying-over mechanism. The first step towards complete automation of the calculation process was taken by the Frenchman Falcon who in 1728 discovered the principle of the punched card and used it to make some phases of weaving automatic. Charles Babbage, a professor at Cambridge, first combined the two principles, punched card and rotating wheel for automatic carrying forward. In 1850, Parmalee invented the first calculating machine to be operated by a keyboard and in 1855, Dr. E. Felt produced his Macaroni box, a calculating device based on the old to and fro motion of a planing machine.

In 1887, a young French inventor, Leon Bollee made a few machines capable of doing multiplication directly and not by means of repeated additions. A year later, calculating machines made by W. S. Burroughs, Heinitz and Hahamann were marketed as commercial propositions. Several types of machines with punched card systems were later invented. The final step towards fully automatic calculation was the develop-

Above, the first IBM 360/20 computer to be installed in the Midlands is now working in the Birmingham Offices of Tubes Ltd. This computer is available for the six local factories. Photo: Tubes Ltd. Below, the Microner II is a microelectronics component used in the English Electric System 4, made by Marconi, in their works at Chelmsford. Photo: Marconi Ltd.

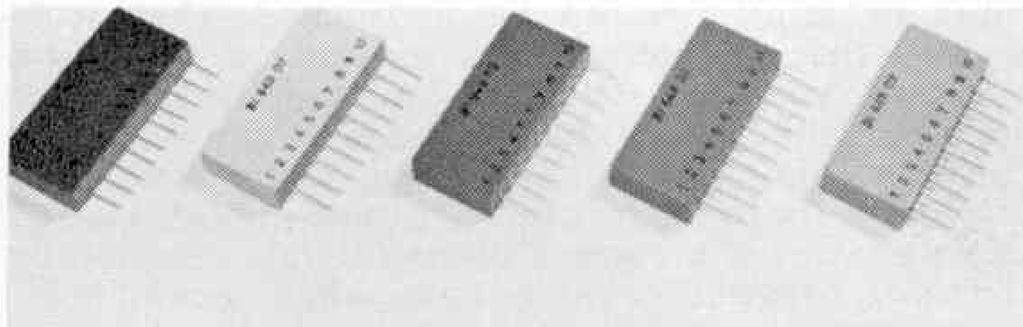


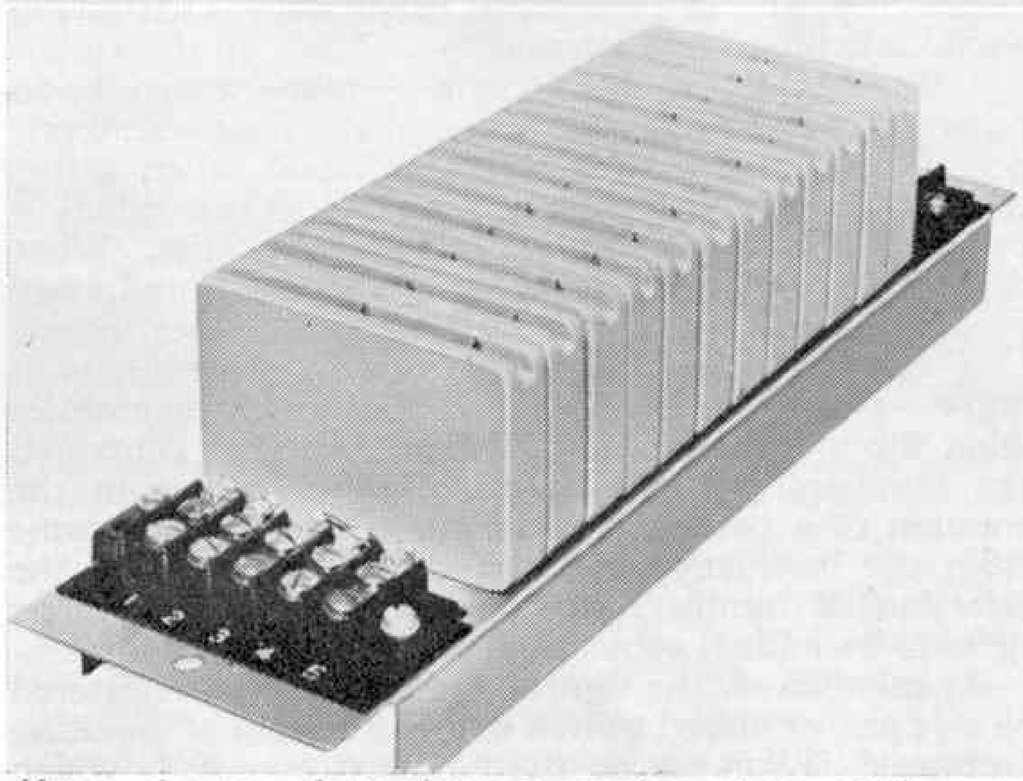
ment and introduction of electronic calculating machines in 1944. In that year, the first large electronic computer, 'ENIAC', was built in America. It had 18,000 electronic valves and a 'memory' which was capable of storing data and also instructional information, to connect operational sequences.

There are many things to learn about computers as there are now so many different kinds, but perhaps the essential points to keep in mind will help you to understand them better. Digital computers operate on numbers which are represented by separate pulses of electricity, while analogue machines operate on continuously variable currents and voltages, which represent the quantities. As many know, computer engineers build these rather complicated machines, each make having special applications and uses, logical design giving a maximum of computing capacity for a minimum of size. The earliest machines, of course, made use of electron tubes and were much larger than those of today which make use of transistors, smaller components, and simplified methods of wiring and circuitry with the introduction of micro-electronics.

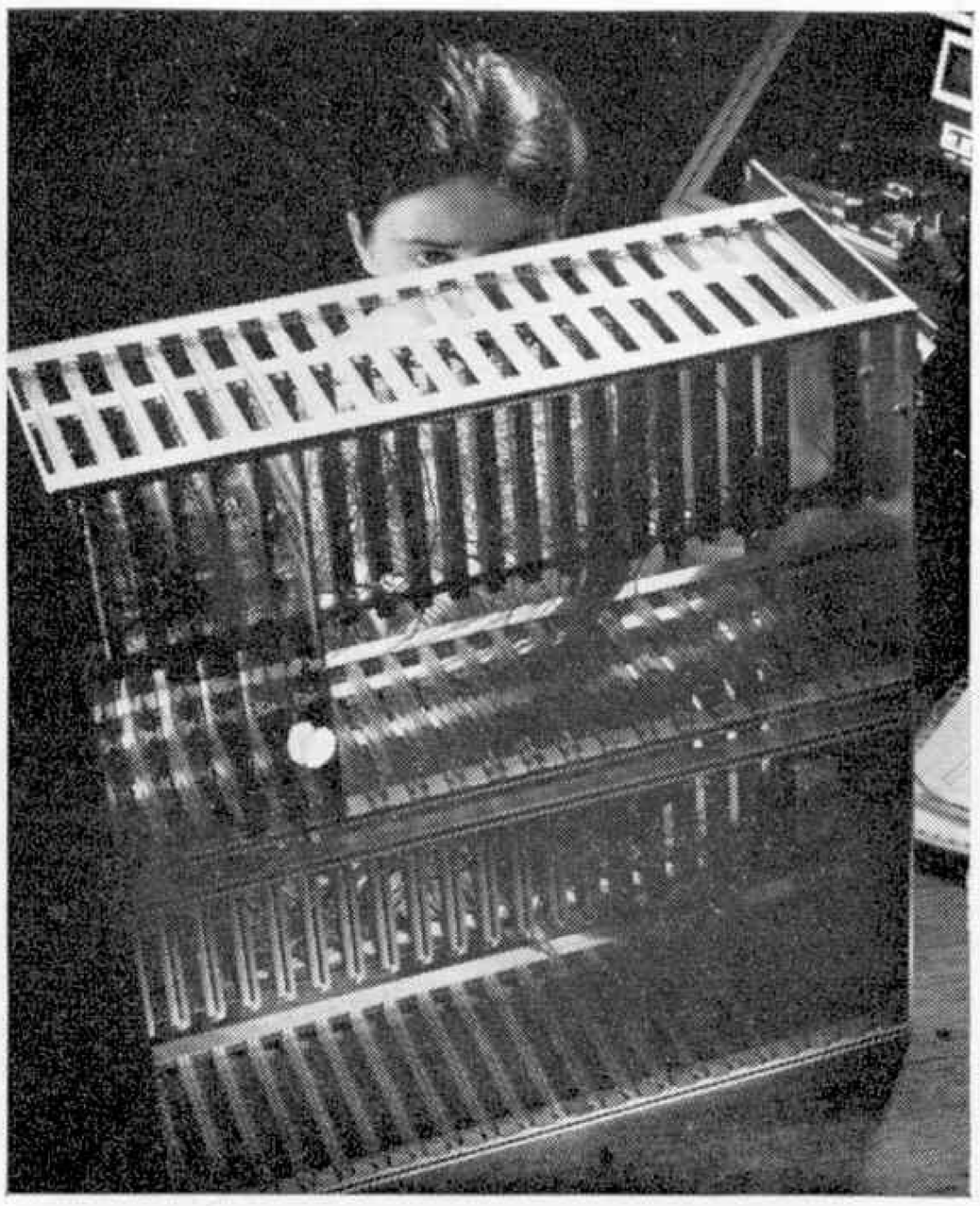
The modern computer, as Argus 100, is as yet a strange mass of wires and other components such as thermocouples, transducers, decimal switches, decimal displays, paper tape reader, magnetic drums, magnetic tape, knobs and controls, working accumulators, and other necessities. Essentially, the electron tubes or transistors are used specially for the task of pulse processing. But, it is the wire which helps most in the magic of calculation, since every number which the machine deals with is transmitted along some of it inside, and how this is done is mentioned later.

Besides 'ENIAC' built in 1944, 'OMIBAC' with 3,300 valves was built in 1949. This digital computer dealt directly with the digits of the original problem, as contrasted with the analogue computer which translates the problem into analogous terms. 'OMIPAC' had two 'memory' devices. The advantages of using





Above, the top photo shows a number of Combi-Elements. These plug in units which are really circuits on their own are now widely used. Photo: Mullard Ltd. Above, another type of plug together system is the Norbit. 12 are shown mounted on a single channel. With these, firms build their own control systems without the services of skilled electronic engineers. Photo: Mullard Ltd. Below left, a Myriad II microelectronic on-line computer that can analysis and store vital information. After analysis, information can be punched out on paper tape, or printed out on a tele-typewriter. Photo: Marconi Ltd. Below, a view of the Myriad computer in production, showing the logic unit. The operator is checking the wiring which links the printed boards carrying the actual circuitry. This computer is designed primarily for air traffic, road traffic and defence applications. Photo: Marconi Ltd.



tubes or transistors can be understood when it is realized that these can handle as many as 5,000,000 alternate choices in a second. All these electrical devices are essentially two-position machines ideally suited for handling a simple system of counting. The alternatives of 1 and 0, for example, can be registered as an open or closed switch, as a current flowing in one direction or the other, as a plus or minus charge on a piece of magnetized tape and in a variety of other ways, each giving a choice between two alternatives.

'OMIBAC' could remember more than 1,000 separate instructions and more than 1,000 numbers, producing this stored away information when called upon to do so. Its 'memory' came from fast-spinning cylinders coated with a black magnetic material. What 'OMIBAC's' 'memory' consisted of was stored away in the form of magnetic impressions on these cylinders. One cylinder contained instructions in a certain code known as the *BINARY SYSTEM* which determines what the machine does and when. Another contained the numbers it could be called upon to use in the solution of a particular problem. Orders which came from the instruction cylinder controlled not only the selection of numbers but also whether the numbers were to be added, subtracted, multiplied or divided.

As mentioned, the figures 1 and 0 can be registered as an open or closed switch and the system of counting employed is known as the 'Binary System', which disregards two, three, four, five, six, seven, eight and nine. The symbols 1 and 0 merely signify presence or reverse from right to left. Where the symbol 1 occurs its value is determined by its relative position from the right. Then all the symbol 1 values are added to find the decimal equivalent. Thus, 100 is written: 1100100.

Similarly, the representation of other decimal numbers in the Binary System gives:

64	32	16	8	4	2	1
1	1	0	0	1	0	0

1 = 1	6 = 110	11 = 1011
2 = 10	7 = 111	12 = 1100
3 = 11	8 = 1000	13 = 1101
4 = 100	9 = 1001	14 = 1110
5 = 101	10 = 1010	15 = 1111

Although the computer operates in Binary, it is not necessary to learn binary arithmetic because quite automatically it will translate decimals, sterling, feet and inches, etc. into binary arithmetic for its own internal use and then will convert its binary answers back into the kind of units required.

The pulse processing carried out by an electronic tube or transistor is a replica of the simple binary arithmetic rules given below as it so happens they naturally operate in this way. In this system where 0's and 1's are used, only three rules are observed. These are: 0 + 0 = 0; 1 + 0 = 1; and 1 + 1 = 0 and carry 1. By making special connections in the wire or circuits in a particular part of the computer, the processes of subtracting, multiplying or dividing instead of adding are made possible. Which circuit is to be used at any one moment is controlled by four switches, one for addition, one for subtraction, one for multiplication and one for division. These are electronic switches made of an assembly of valves or transistors, and the important point is that they are not moved by hand, but by a pulse in a wire connected to them. What they do is to cause the two numbers which flow into this particular part to pass through either the adding, subtracting, multiplying or dividing circuit, and the required job is done.

Four types of devices are used for memory storage, namely, magnetic tape; magnetic drum or disc; magnetic core, or punched cards. However, computers are no more accurate than the facts which are fed into them. To analyse and define problems in suitable terms is a highly specialized type of work called PROGRAMMING requiring experts who know how to deal with computers to get the maximum results. These are only some of the elementary facts about them.

In an amazing way, these wonderful machines working like Robots are transforming this world of ours, and helping man to get on with the job.

AIR FORCE ONE —THE FLYING WHITE HOUSE

by Robert Carr

AIR FORCE One is the callsign given to any United States Air Force aeroplane in which the American President travels. Usually however, Air Force One is Boeing VC-137C:26000. Responsibility for the care and maintenance of The Flying White House lies with the USAF Military Airlift Command's crack 89th Military Airlift (Special Missions) Wing stationed at Andrews Air Force Base on the outskirts of Washington D.C. In addition to responding to presidential travel needs, the wing also flies the Vice President, the various department secretaries, diplomatic envoys and foreign heads of state who are official guests of the United States Government. To carry out this mission the 89th. Wing operates a variety of aircraft, ranging from four Boeing VC-137s (a military variant of the 707 civil jetliner), to smaller twin-turboprop powered Convair C-131s.

Air Force One is backed by a team of professional and specialist personnel, roughly broken down into three groups: flying, maintenance and security. The aeroplane is commanded by Lt. Col. James Cross, who is also the President's military aide. Alternative commanders Major Paul Thornhill and Major Donald L. Short complete the front-seat crew. The remainder of the flying crew are: Lt. Col. C. W. Rogers (navigator), Warrant Officer John McLane (chief flight engineer) and Master Sergeant William Justus (radio operator). Six sergeants act as stewards. The crew represents a total of 95,000 hours flying experience, and this is reflected in the fact that the 89th. Wing has *never* had an accident.

Safety encompasses far more than aircrew training—it begins with basic maintenance. Leading a team of twenty-three maintenance men is Chief Master Sergeant Murray Orvin, a 27-year Air Force veteran. Explaining that Air Force One always receives special care, Orvin said: "We keep the big bird hangared, both for maintenance and security reasons. For one thing, it's much easier for the mechanics to work in a warm

One of the four Boeing VC-137's (a military variant of the Boeing 707 civil airliner), operated by the 89th Wing. This aircraft is guarded day and night and seldom washed. To keep it in top trim it is constantly wax polished, the better surface finish adding several m.p.h. to its top speed, as well as making it very impressive as it gleams on the runway of a foreign country.

hangar. It also protects the finish of the aircraft. Air Force One is seldom washed, but is constantly waxed. The wax finish not only keeps it clean and shiny, but also increases airspeed."

Another part of the supporting team is the security force. Responsibility for anything and everything in which the Presidents flies rests with Chief Master Sergeant C. E. McCreedy Junior. " We not only guard the aircraft around the clock, but our own men fly whenever the President is aboard," McCreedy explained. Air Police guard the hangar housing Air Force One, and a roped off security perimeter. " No. 26000 is so big that one man can't see around it," McCreedy said. In addition all fuel is clinically analysed twice a day for contaminants—particularly water. Once the fuel has been analysed and approved, the refuelling trucks' tanks are sealed, and a 24-hour guard is mounted over them in the fuel storage area. The trucks are ready to go at a moment's notice.

The wing's reputation as an elite unit is warranted, since every man is handpicked. The levels of skill are equally high in all positions. The flight steward must be the composite of a skilled chef, personal valet, customs specialist and airborne diplomat. On any given flight, he may be responsible for the comfort and safety of a king, a president, or a statesman. Many of the stewards are gourmet chefs, having trained under some of the finest hotel maestros in the USA. Recalling a recent mission that involved the Israeli prime minister and his party, one steward noted that because of the strict Jewish dietary laws, most of the food had to be prepared on the ground before the flight. " We've got almost everything imaginable aboard our special mission aeroplanes," he explained, " but kosher kitchens, we haven't got. . . ." What the 89th. Wing does have in good measure is experience. Their motto appropriately enough is " Experto Crede "—" Trust One Who Has Had Experience."

An aerial conference aboard a VC-137. President Johnson talks with aides during the flight from Washington to Hawaii. Clockwise, from left: General Maxwell Taylor, special White House consultant; General Earle Wheeler, chairman of the Joint Chiefs of Staff; Defence Secretary Robert McNamara; Ambassador Averell Harriman; William Moyers, White House press secretary; Secretary of State Dean Rusk; U. Alexis Johnson, Deputy Under Secretary of State, and Jack Valenti.

BATTLE

by Charles Grant

Part V—Artillery Range

BEFORE PLUNGING into the technicalities of artillery fire, may I remind the reader of the ground scale we have already established? It is very important in this connection, particularly when we discuss gun range in relation to the capabilities of armour-piercing shot and its effect on the target, whether this be armoured or 'soft skinned'. The scale was of course based on the concept that an infantryman can advance 100 yards in one minute, and, as his game-move on the battlegame table occupies this interval of time, it will represent 100 yards. We made this distance 3 in., the idea in mind being to have easily compared speeds for all moving objects—100 yards per minute being 3 m.p.h. Thus the game move in inches of any vehicle represents its speed in miles per hour.

With this point disposed of, we go on to consider heavier weapons than those already dealt with, to wit, the enormous variety of artillery pieces which, for simplicity, we shall try to reduce to a more limited selection.

First, let us look at long range fire with high explosive shell, to get an idea of what its function was, how it was employed tactically, and what was its range. Roughly speaking, field guns could be used in two ways, with the target either quite out of sight of the gunners, or in actual visibility, whether that was unaided or with binoculars. I don't suppose that firing "over open sights" with H.E. shell was all that common in our chosen period—World War II—this meaning that the gun commander had a direct personal view of the target and was able to lay down fire thereon, making the necessary corrections from his own observation. Far more often gunfire was directed by a forward observer, either airborne or perched on some vantage point whence he had a good view of the enemy and was in touch with his guns by field telephone or by radio. Basically, he would see the enemy at a particular point, note that position with reference to a map, radio back for a 'shoot' on that spot, and then correct it until the shells were falling on the point desired. The Forward Observer's job was somewhat fraught, for it was the urgent concern of the enemy to silence him, by shooting him down were he in an aircraft, or eliminating him by ground attack. In such cases, without the benefit of the Forward Observer, the guns were virtually useless, for long range work at least.

An alternative was for artillery to fire on pre-determined targets on ranges calculated in advance from maps or on previously obtained reconnaissance information—all this without the assistance of a Forward Observer. This of course precluded observation of any results and tactically would be a defensive measure. An advancing army would have less knowledge of topographical detail than one which having retreated through a certain area would have been able to determine ranges with accuracy and to pick out the most advantageous areas to saturate with fire. This was the true function of artillery—in this role—to fire patterns of shot on an area, in fact to 'plaster' it with shells over a period, to the considerable discomfiture of whatever might be therein. One can think of a road junction which, having fallen into enemy hands, might be worth attention. If no Forward Observer were available to report casualties, accurate fire at irregular intervals would snarl up traffic if not necessarily destroying it.

Modern artillery, including that of World War II, has a pretty prodigious range and although we are not going to consider at the moment the really large calibre types we are still faced with a small problem. If we take three fairly typical guns of our period—the British 25-pounder gun-howitzer, the German 105 mm. field howitzer and the Russian 76.2 mm. field gun, we find that their maximum effective ranges are slightly different, but average out at about 12,000 yards (this being an approximation). A quick calculation will show that this amounts in terms of our battlegame scale to a somewhat terrifying 30 feet! It goes without saying that even the most fortunate of players do not have a table allowing artillery to be in position thereon and still fire at its maximum range of 30 feet. My own is 9 ft. by 7 ft., or, to scale, 3,600 yards by 2,700 yards, while the largest I know of is 12 ft. by 8 ft. By this token we see that field guns in 'Battle' will be able to cover the entire table and in fact need not be actually in position on it. They can be assumed to be just off the table with their fire being directed by a Forward Observer who must of course be on the table and in visual range of the target. Not that there is any reason for the guns not being on the table. They could be well in the rear with their firing properly controlled from a forward position.

We rule then that field artillery fire of the kind we have described has unlimited range when controlled fire is operating, with the target seen by the observer—this will normally be a fairly substantial distance, this chap being certainly equipped with powerful field glasses. Even so, it will not be the same in a fog as it would be in bright sunshine, but this question is bound up with the weather and will be considered separately.

The other type of artillery fire to be looked into is that when armour-piercing shells are used, usually against armoured fighting vehicles. This is not a matter of deluging an area with H.E. but of picking out a target object and of hitting it directly with one's fire. This is almost always a matter of direct fire, the difficulties of guiding an armour piercing shell onto a target that is out of sight being readily apparent. Tanks, naturally, could be called upon to fire H.E. shell in a conventional artillery role.

The first point about anti-tank firing is that the range is enormously less than when H.E. is used, for two reasons. It is almost invariably direct firing, with the range thereof necessarily being within existing visibility and, second, there is a limit to the range at which even armour-piercing shell will be effective against a heavily protected tank, for instance. In the

hope that by so doing we shall make things relatively simple we shall take the best conditions of visibility and use this as a base for an optimum of 'hit probability' which can be scaled down as circumstances dictate.

When we speak of maximum A.P. range we don't mean the greatest distance the shell will travel, but that at which it can penetrate and possibly destroy. We shall later find that penetration is affected by the thickness of armour and the angle at which the shell strikes, but of this more later. Maximum A.P. range will be based on penetration of a given thickness of armour, taking the angle of strike as being the best possible in every case.

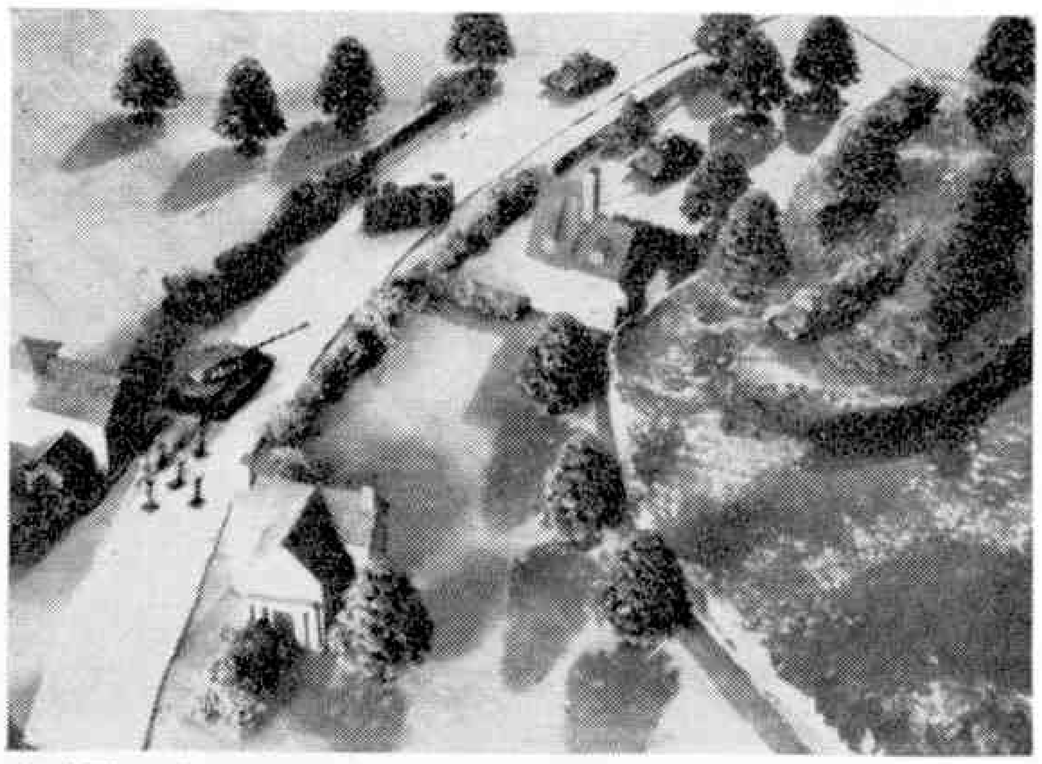
Just for a change, we shall begin with the big fellows, instead of with the small ones, the first of the former to come to mind being the celebrated German "Eighty-eight"—the 88 mm. PAK. This gun—in the anti-tank role—probably did more damage than any other in the service of the combatants in World War II and was truly a terrific weapon, its power making it capable of knocking out practically anything that came against it at a range of over a mile. Given the requisite visibility we can say that its greatest effective range was 2000 yards. A quick conversion and we get a 'Battle' table range of 60 in. This again is a pretty terrific range for a table which might not be of the largest, but after all, this does imply unimpeded visibility, and certainly in fighting which simulates the conditions of Western Europe particularly, terrain irregularity, woods and so on will ensure that it is a pretty uncommon thing for an 88 mm. to get a shot at an enemy at this range—indeed it will say little for the latter's tactical skill if it *does* happen. Add to all this the fact that the first shot does not always strike home and before a second can be got off, an uncooperative enemy will doubtless have made himself scarce with some alacrity.

Maximum range for the '88' then is 60 in. and this will also do for the next "Big 'un"—the British 17-pounder anti-tank gun. This was also extremely powerful although, like the previous gun, its length and general size made it a fairly awkward thing to manoeuvre when it was used as a towed piece in close country, like the Normandy 'bocage' for example.

Coming down the scale a little we find that the Germans had two guns of 75 mm. calibre, a 'short' and a 'long', this referring to the length of their respective barrels. The latter was an excellent gun, with a range of 1500 yards, while its shorter brother's was but 1000 yards—these figures converting to 45 in. and 30 in. respectively. The British 6-pounder and German 50 mm. A.T. guns are next for assessment and their range can be equated to that of the 'short' 75 mm, although their penetrative power will be seen to be quite a bit less. The American 76 mm. as fitted to later Shermans was also a good gun—maximum range 1500 yards—or 45 in. As for the Russians, they had the weapons mounted in the two varieties of T.34 tank—76 mm. and 85 mm. The former's 'Battle' range we can take as being 45 in., the latter's 60 in.—pretty deadly again. The Russians had also a 57 mm. gun—range similar to that of the German 50 mm.—30 in.

I realise that there are very many others that could be mentioned but those instanced are really enough to be going on with, although finally, I should say that normal field guns could be used in the anti-tank role at a pinch, if equipped with A.P. shell, the British 25-pounder having a range as such of 1000 yards—30 in.

Let us conclude with a recapitulation of the ranges we have set down above.

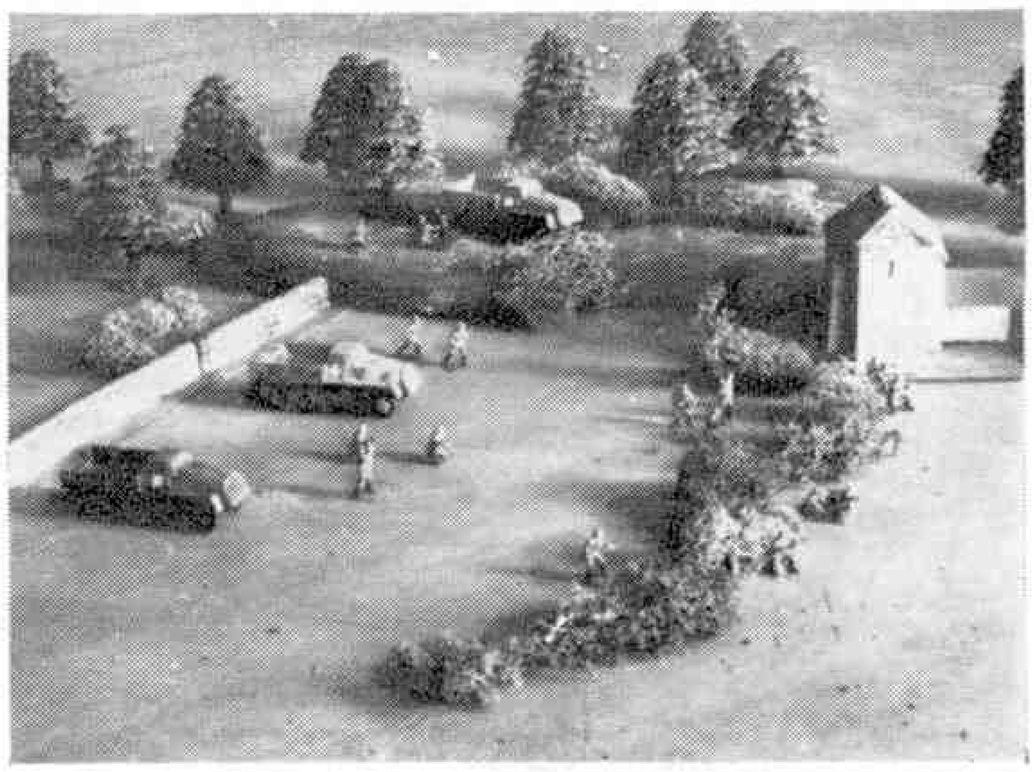


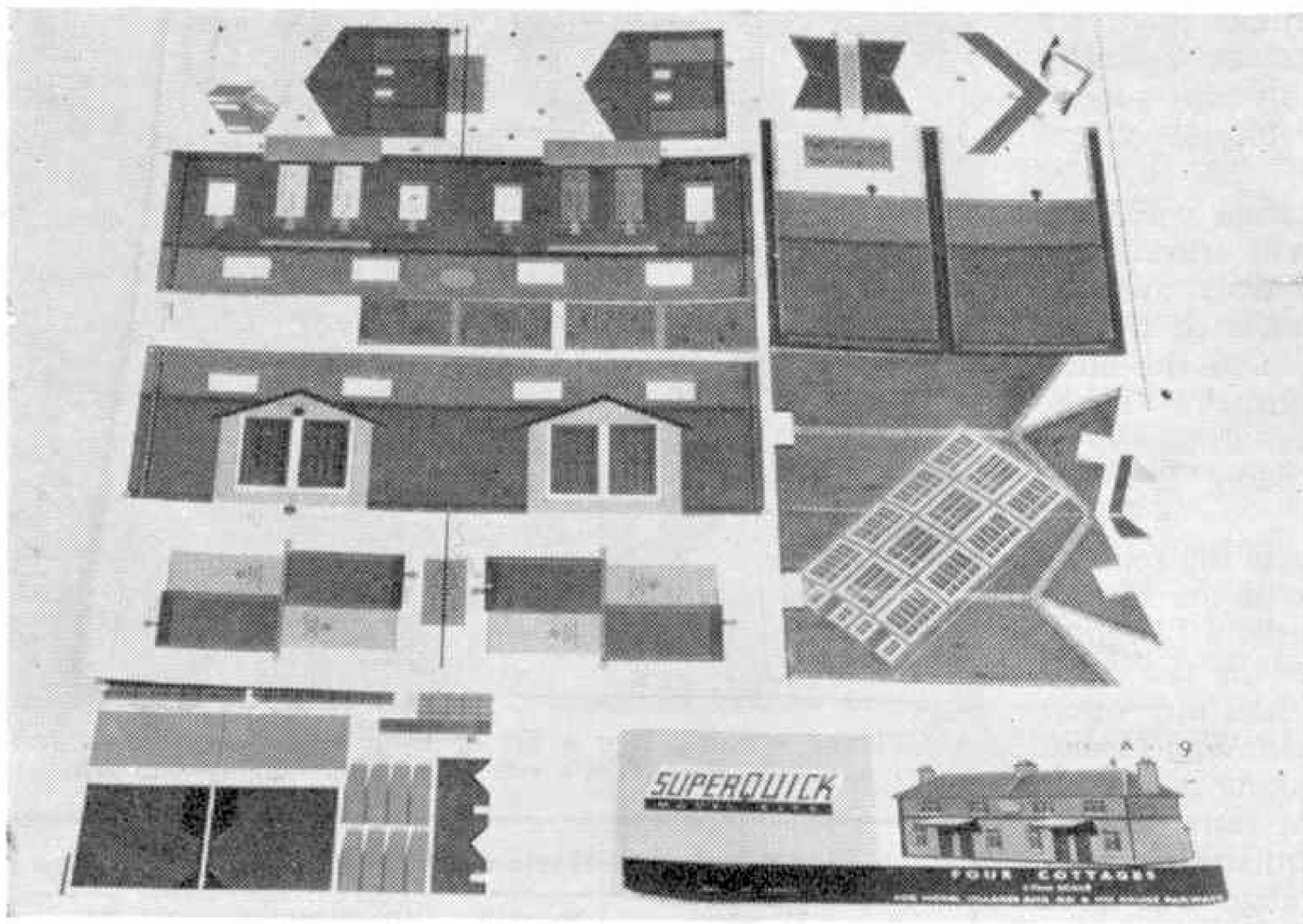
A 'Tiger' running into a bit of trouble—a careful look and no less than four T.34's can be seen lurking in ambush.

	Weapon	Nationality	H.E. range	A.P. range
Field guns	25 pdr.	British	unlimited	30"
	105 mm. fld. howitzer	German	unlimited	—
	76.2 field gun	Russian	unlimited	

	Weapon	Nationality	A.P. range
Anti-tank guns	88 mm.	German	60"
	17 pdr. A.T. gun	British	60"
	75 mm. (long)	German	45"
	75 mm. (short)	German	30"
	76 mm.	U.S.A.	45"
	76 mm.	Russian	45"
	85 mm.	Russian	60"
	50 mm.	German	30"
	6 pdr.	British	30"
	57 mm.	Russian	30"

After deployment from half-tracks, infantry deploying into position sheltered by a high hedge.





TRACKSIDE CONSTRUCTION

Building a Superquick Locomotive Shed in 00 gauge

At left, the contents of a "Superquick" kit. This one is a block of four cottages and not the Locomotive Shed reviewed in this feature. At right, the completed shed with a single track and Continental locomotive. Note the realism of the tiny bricks.

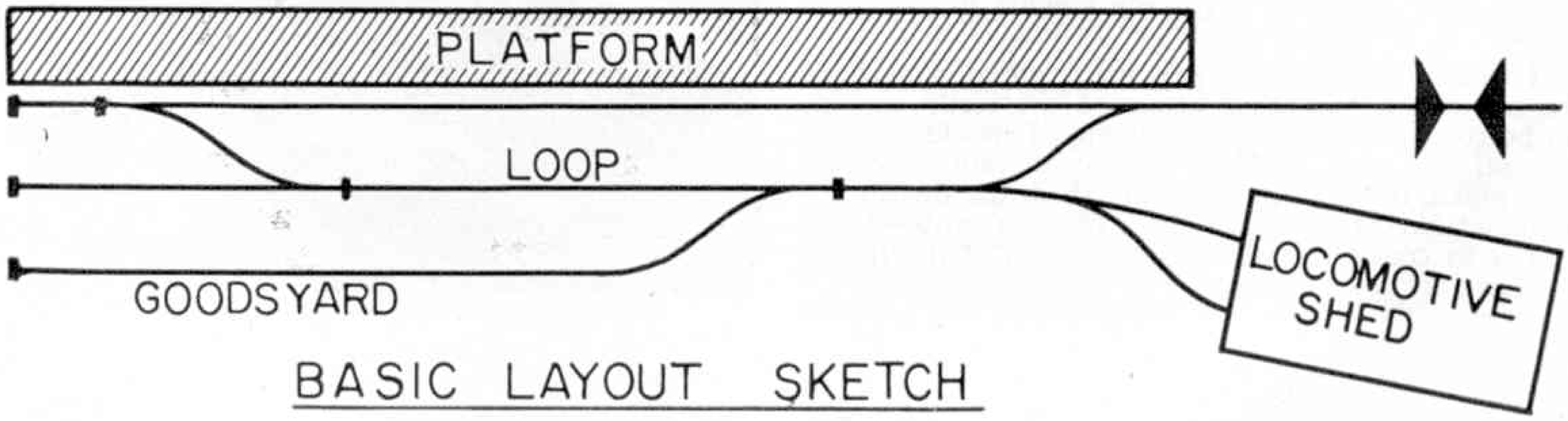
LOCOMOTIVES, LIKE all machinery from motor cars to aeroplanes, need constant and regular maintenance and servicing if they are to provide trouble-free running. Steam locomotives, although by no means efficient in the modern sense of the term, had the advantage of being robust and simply constructed and would run (at least after a style) when almost completely worn out. Even steamers, however, needed regular attention, and after every turn of duty, there were many rather unpleasant tasks for the shed staff. Tubes had to be cleaned out, tenders coaled, ashes dropped and new fires lit, and all these operations required premises of a more or less specialised sort.

No model railway which operates "steam" locomotives can really call itself complete if it has no facilities at all for the servicing and stabling of its engines. Obviously, few enthusiasts have room on their layouts for a locomotive works like Crewe or Swindon, or even a main line type "running shed" like Old Oak Common or Camden. There were, though, in the heyday of steam power, many small locomotive depots which are ideal subjects for the modeller. Such depots were often situated at smallish country termini, and were provided for the use of locomotives working in a particular small area. This system meant that small branch line engines did not have to make a daily journey to the nearest large depot for general running maintenance like coaling, watering and lubricating. It is one of these minor or "sub sheds" as they were called, which has provided the inspiration for our model this month.

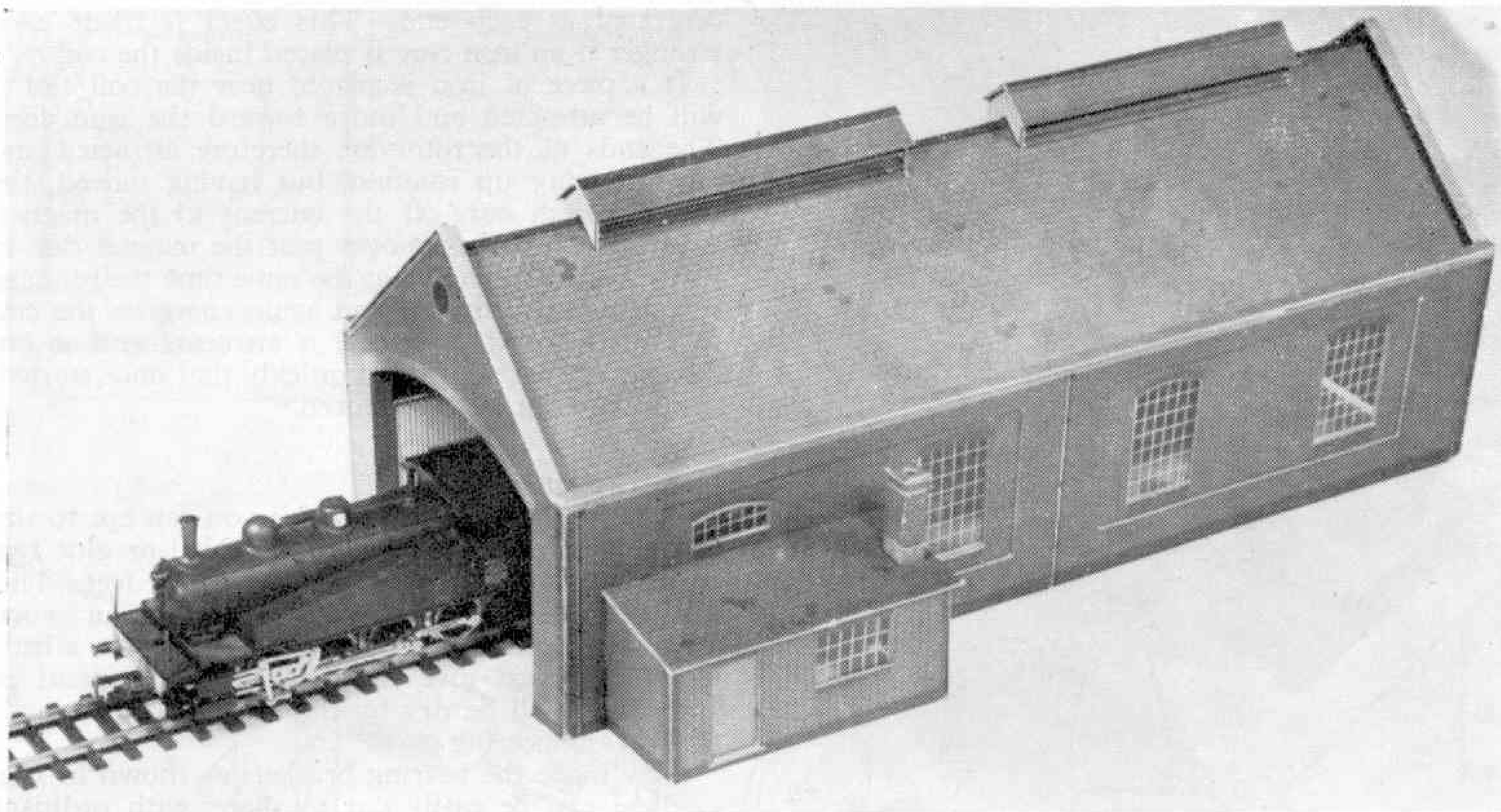
The basis of the model is a very nice kit from the **"Superquick"** range—the two-road locomotive shed (code A5). For those of you who are not familiar with these kits, some description of them is called for. All the parts of the Superquick kits are printed in colour on very stout card: every part is die-cut, and can almost be pushed out of its surround without the aid of a knife, although it is really much better to use a modelling knife, just to cut through the small uncut pieces of card which hold the various parts in place. The colour printing is to a very high standard, with beautiful modulations in the colour of the bricks; in this particular kit, there are even some sooty marks to be seen over the entrance to the shed ! Transparent material is provided for windows, with the glazing bars printed on.

Although the instructions provided with the kit are very simple, do not be tempted to ignore them and go off on your own, as you could get into trouble. Each wall, for example, has an inner and outer face (both with brick finish) and the window material is trapped between the two pieces. This gives the windows (which thus appear to be recessed from both sides) a most realistic appearance, but imagine your embarrassment if you had stuck both parts together before inserting the windows—we nearly did this. Read the instructions! Incidentally, assembly is simplified if you leave the various parts attached to the main card until you need them, as their reference numbers, referred to in the instructions, do not appear on the parts themselves.

Assembly is really very easy. We used Uhu as an adhesive as it dries clear, and is easily obtainable from Woolworth's. As you can see from the photographs, the windows along the sides of the building are recessed into brickwork panels. This was a common method of giving large, free-standing brick walls in industrial buildings a degree of strength (the extra layer of bricks acts as a sort of buttress) and has precisely the same effect upon the model. The inner and outer wall faces, together with the superimposed brick "panelling"



BASIC LAYOUT SKETCH



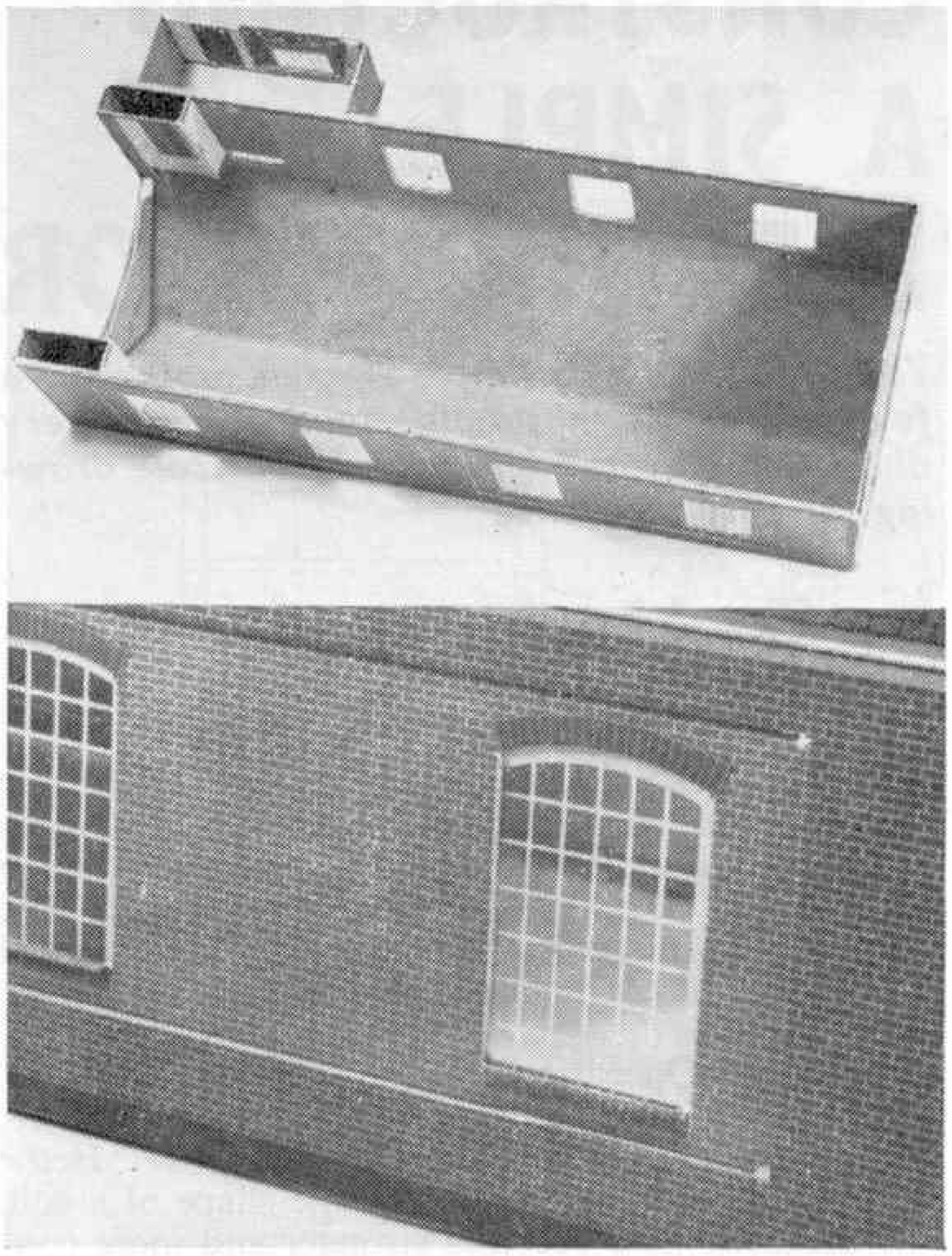
combine to give the wall triple thickness. This means that the completed structure is very strong indeed, particularly when the roof has been fitted. The two little wooden-built offices just inside the main door are an attractive and typical feature of this sort of shed, and also do double duty by strengthening the entrance end of the shed as a whole. The brick " lean-to " is, no doubt, the shedmaster's office.

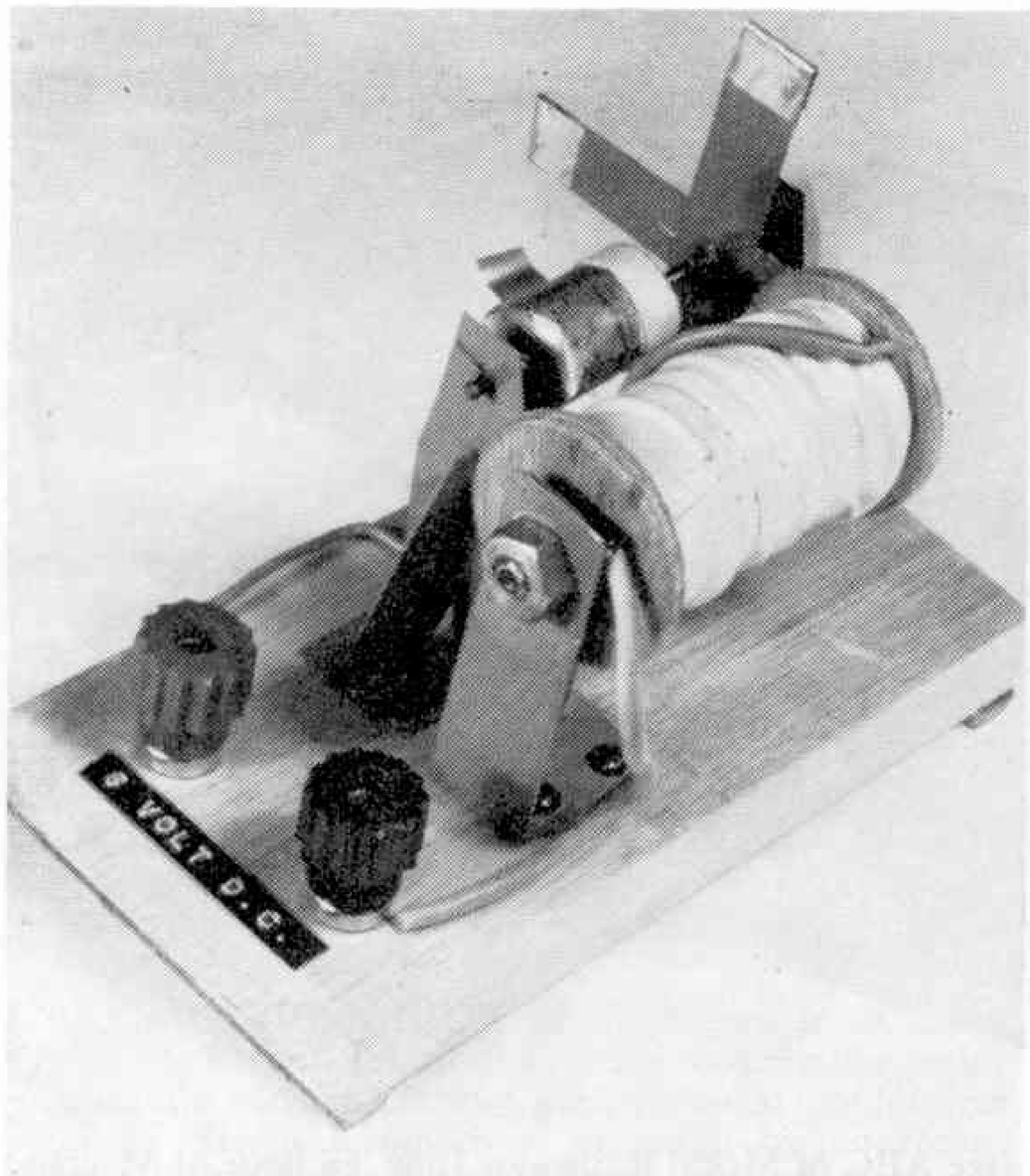
There is room inside the shed for two tracks (railway men always call them " roads " in this context) so the building's capacity is either four fairly small tank locomotives, or two main line express tender engines. The latter would be rather unusual occupants of a shed this size, but stranger things have happened.

Coaling and watering facilities are provided outside the shed. Sometimes there is an impressive water tank on a brick plinth, which would be quite easy to model, but as our shed is only a very small one, we would use a simple water crane, from the Airfix " Trackside Accessories " pack. Coaling facilities at small depots like this often take the form of a big heap, perhaps retained by a low fence of old sleepers. It sounds crude (engine bunkers and tenders were replenished by hand, using baskets full of coal) but that's the way it was often done. It is important to remember, when modelling a locomotive depot, that the whole business was an exceedingly messy one. Engines standing outside the shed dropped oil and grease, which mixed with the inevitable coal dust to form a glutinous mess which usually hid the sleepers from view completely. This is quite easy to represent in model form; probably the best way is to cover in the sleepers with card strips, almost up to the rail tops, and then paint the lot matt black with touches of browny-yellow. Make sure that you have left room for the flanges of the locomotive wheels to pass through between the card " decking " and the rail.

Another important point to consider is the location of the depot on the layout. In the sketch, we have shown how the shed could be incorporated into the layout of a small country terminus. Note that when the locomotive has been released from the train, it backs over the " release " crossover on to the run-round loop (see ABC of Model Railways, June '68 issue of Meccano Magazine). Once on the loop, it can either regain the opposite end of the train to take it out again, or if it needs coal or water, can proceed straight into the shed *without any further reversing movements.*

The inside of the Locomotive Shed reveals the simplicity of this kit. Note the little offices by the entrance, these box structures add considerable strength to the model. Below, the first class pre-painted plastic windows supplied with the kit.





The completed motor, ready to run when connected to a 4½ or 6 volt battery. Note the generally simple construction and the adhesive tape on the coil windings to hold them in place. By relating the wiring diagram to the completed model, you can orientate the wiring.

CONSTRUCTING A SIMPLE ELECTRIC MOTOR

You can build this simple electric motor for a few shillings with simple hand tools. Every dimension is stated on the reduced scale drawing for easy reference

by D. Horler

BUILDING SMALL electric motors can be very interesting and exciting, indeed you will be re-exploring ground covered many years ago by men like Faraday, Oersted, Davenport and others. The materials are not expensive, can be easily obtained and the results are models that work.

Principle of Operation

When an electric current flows through a wire, a magnetic field is set up around the wire. If the wire is insulated and wound in the shape of a coil, the magnetic field becomes stronger and more concentrated at each end. This effect is made even stronger if an iron core is placed inside the coil.

If a piece of iron is placed near the coil end it will be attracted and move toward the iron core. The ends of the rotor are therefore attracted and move, setting up rotation, but having moved, the rotary switch cuts off the current to the magnet. The rotor end then moves past the magnet due to its flywheel action, and at the same time the rotatary switch has also moved and again energises the coil so that the next rotor end is attracted and so on. This action takes place so quickly that once started, continual rotation is produced.

Construction

Begin with the baseplate, this you can cut to size from any piece of wood, Fig. 1. Nail or glue two pieces of plywood underneath to act as feet. This will prevent a scratched table should your wood screws for holding the components down, be a little too long. Next give the base a coat of paint or varnish, it will be dry by the time you have made the real engineering parts.

Now make the bearing brackets as shown in Fig. 2, these can be easily cut to shape with ordinary domestic scissors from a cocoa tin or any tin of the unprinted type—it's easier to solder ! As the tin-plate is likely to be thin, stiffeners are soldered in to prevent vibration—engineers use this idea and the plates are called gussets. When you have cut out, bent to shape and soldered in the gussets, place them both together and file up the edges. Now drill the bearing hole through the two brackets, and you can be sure they are in line. You must solder a contact brush of brass or copper foil or shim on one of the brackets to make sure the current from the battery has an easy path. Your first batch is now off the production line, paint these and put aside to dry.

You now make the coil support Fig. 3 and the Brush bracket Fig. 4 in a similar way. The coil or magnet suport is made of double thickness metal, the only reason is to prevent the magnet vibrating due to its overhang and weight. Don't forget to solder on the brass shim before painting.

The Rotating Parts

Cut out the 'windmill' rotor and drill the centre hole, bend over the ends of each rotor arm. This is to stiffen up the blades and to give a flywheel action. See details in Fig. 5. Make the shaft from an old knitting needle or a cycle spoke, but clean up with emery paper as you have to solder this. The rotary switch is made from dowel and brass shim, the brass spider can be stuck down to the wood dowel with Evostik and the ends bound with plastic tape.

The rotor and the rotary switch is then soldered on the shaft. You must position this correctly, the rotary switch contact arms must be positioned so that they are between the rotor blades. You must

Text continued on page 486

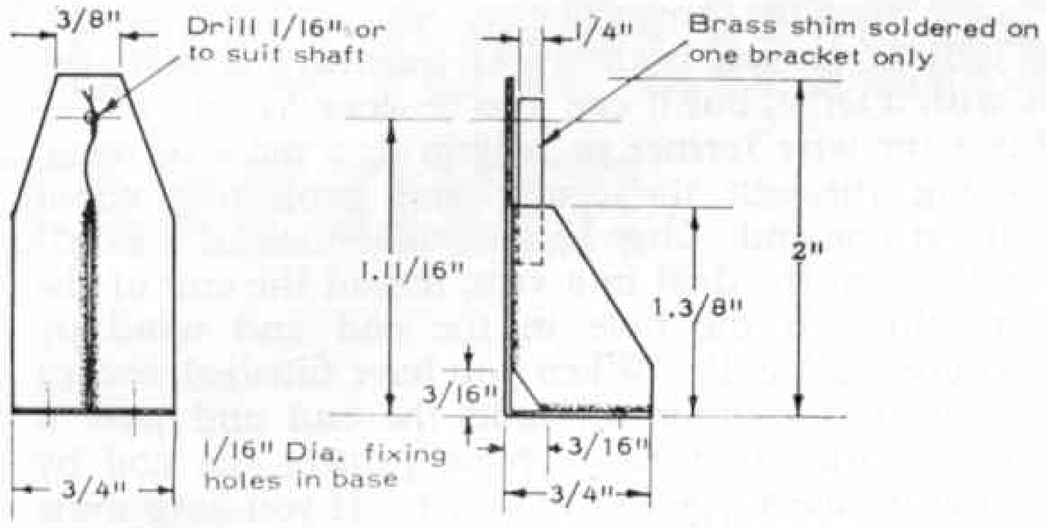


FIG. 2. BEARING BRACKETS - 2 off
Material - Tin plate

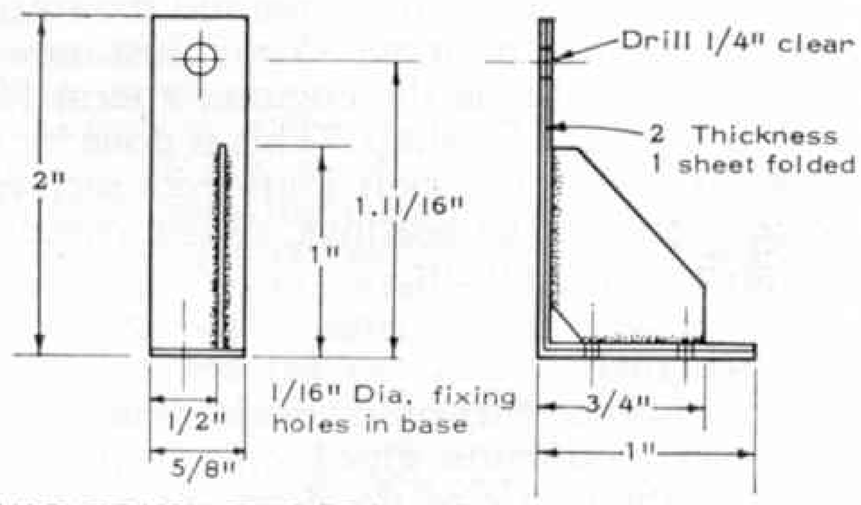


FIG. 3. MAGNET MOUNTING BRACKET
Material - Tin plate

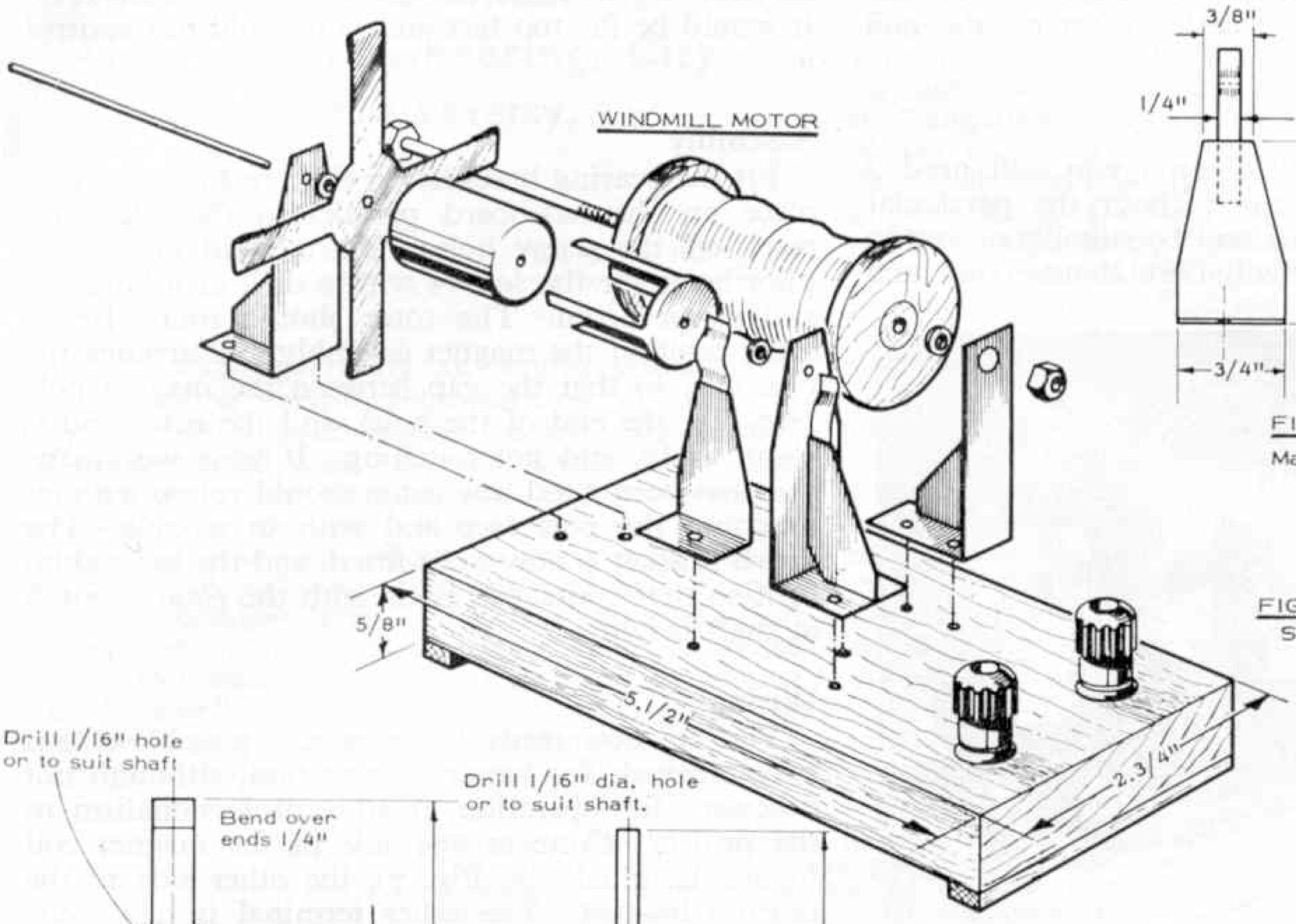


FIG. 1. EXPLODED VIEW
Showing Construction

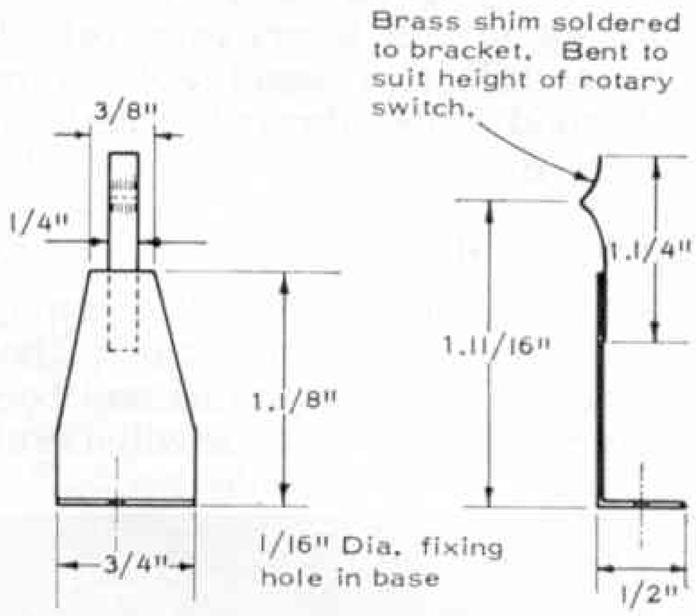
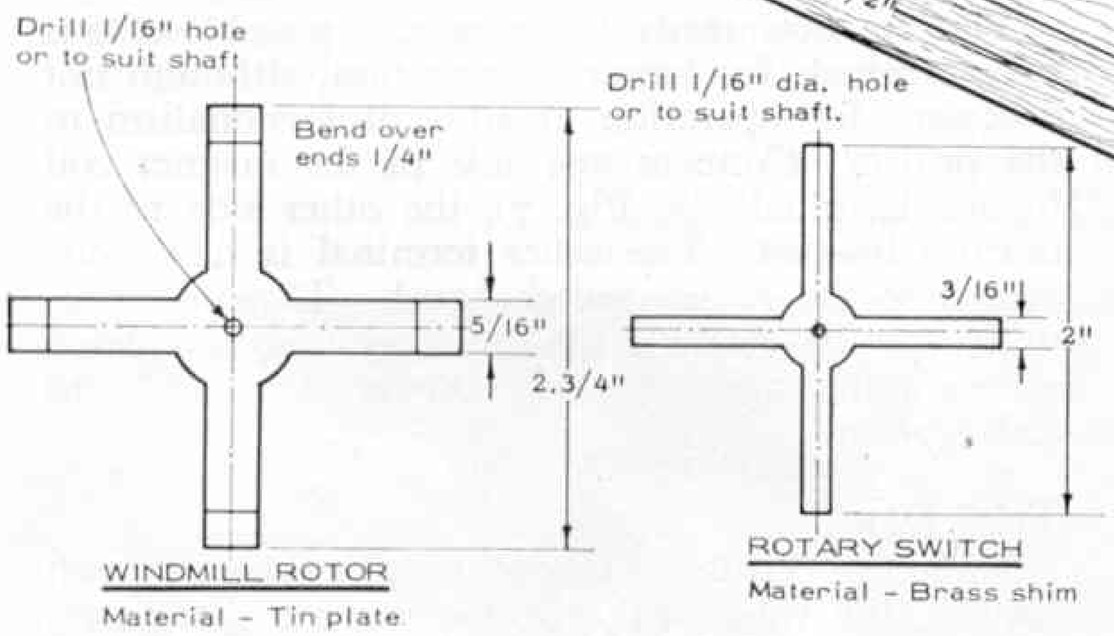


FIG. 4. BRUSH BRACKET
Material - Tin plate



WINDMILL ROTOR
Material - Tin plate

ROTARY SWITCH
Material - Brass shim

FIG. 5. ROTATING MEMBERS

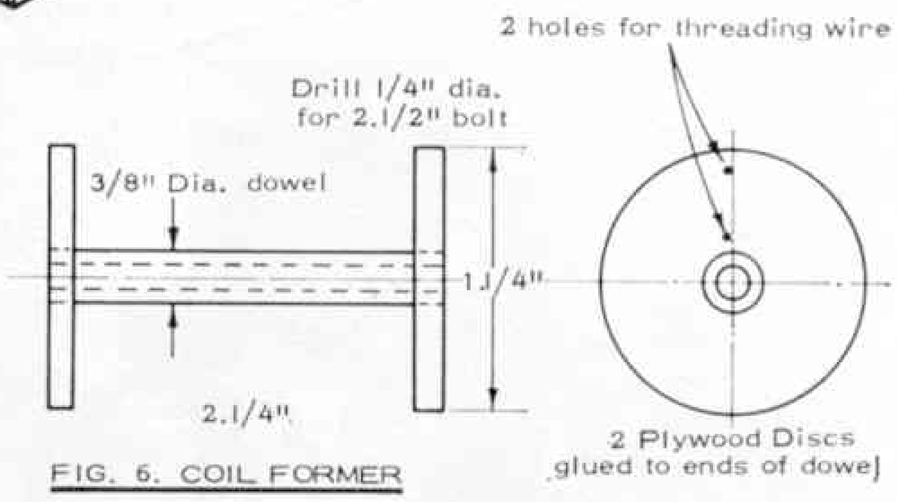
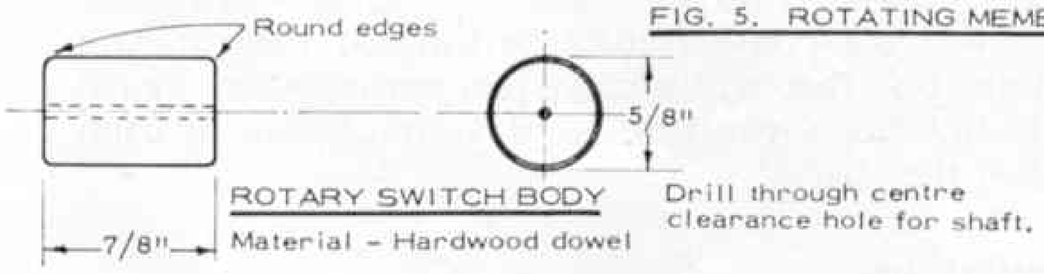
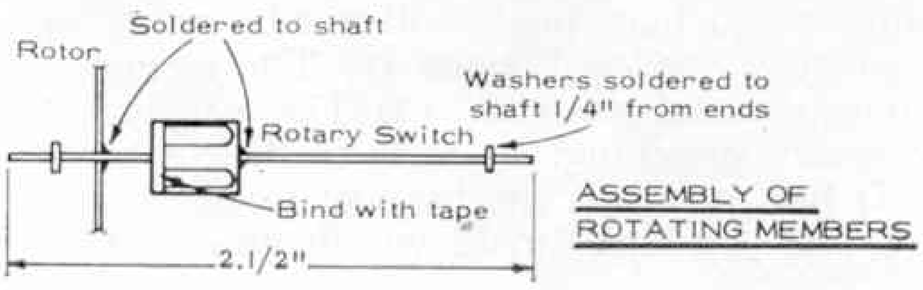


FIG. 6. COIL FORMER
Material - Plywood and dowel



ROTARY SWITCH BODY
Material - Hardwood dowel



ASSEMBLY OF ROTATING MEMBERS

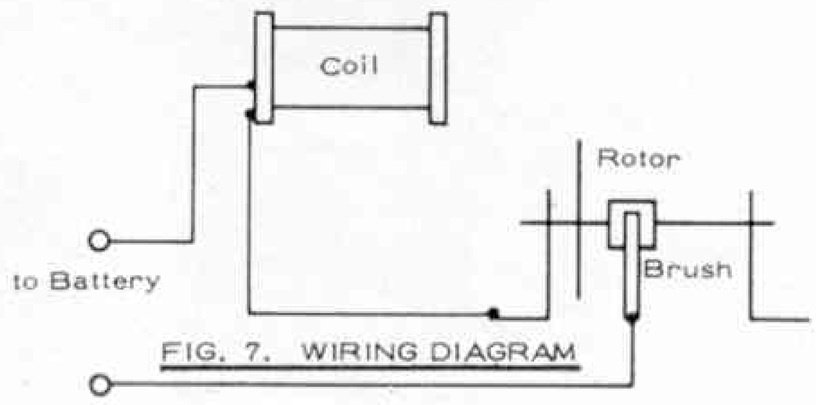


FIG. 7. WIRING DIAGRAM

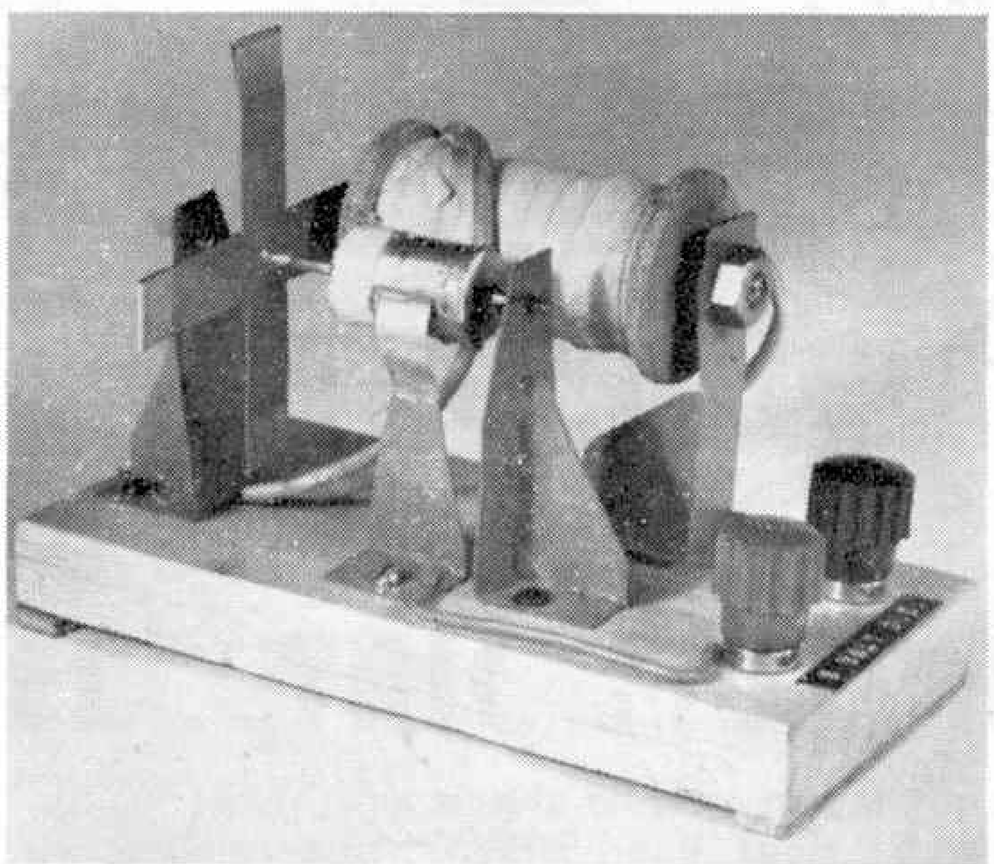
make sure you solder the rotor and the rotary switch exactly in this position. You must now prevent 'end float'—this is the engineer's term for end to end movement of a shaft. This is done by soldering two washers on the shaft ¼ in. from each end, these serve as end thrust bearings. When completed, you are now ready to paint.

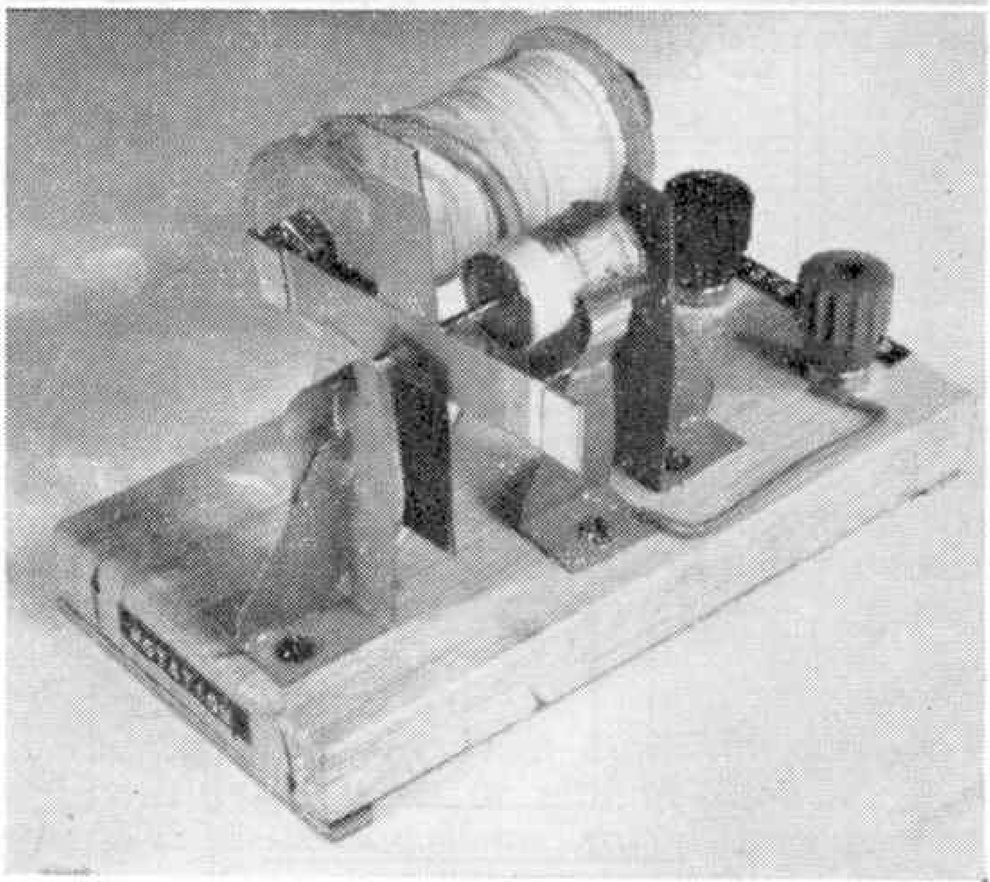
The Magnet

The magnet former is made from wood dowel with plywood ends glued on. A hole is drilled through the centre of the dowel to receive the ¼ in. diameter bolt, that serves as the magnet core. Don't worry if you can't find a dowel, use paper by building up several layers interspersed with glue. You must drill two small holes through one of the plywood ends, through which to thread the coil wire. Fig. 6.

Winding the Coil

Use 24 gauge enamelled wire, you will need 4 ozs., don't worry too much about the particular gauge, anything near this will be suitable or cotton covered will do. This will cost about 3/6d. and many surplus government stores have stocks. Winding the coil is the most tedious, the best way is with a lathe, but it can also be done as follows:—Fix your wire former or bobbin to a piece of metal passing through the centre and projecting about 1 in. at one end. Grip this in the chuck of a hand-drill, fasten the drill in a vice, thread the end of the wire through the hole in the end and wind by turning the handle. When you have finished, except for the last foot or so, hold the end and pass it through the other hole. Now protect the coil by taping up the surface of the turns. If you have some sleeving handy, this will protect the ends. It is a simple matter now to bolt the former with a ¼ in. bolt to the support bracket. You must not, on any account, try to wind the coil with an electric drill. It would be far too fast and you could not control it.





Assembly

Fit the bearing brackets on each end of the shaft, place on the baseboard parallel to the edge and mark off the screw holes. You should now make pilot holes for the screws with a drill or a bradawl, and screw down. The rotor should rotate freely. Next position the magnet assembly and arrange the positions so that the gap between the magnet pole face, (i.e. the end of the bolt), and the rotor end is about $\frac{1}{16}$ in. and not touching. If your workmanship has been good, the rotor should rotate without touching the pole face and without wobble. The brush bracket is now to be fitted, and the brass shim bent so that contact is made with the rotary switch at shaft height.

Wiring

You are now ready for wiring, if possible obtain two terminals for battery connection, although not necessary for operation, it adds professionalism to the project. Connect one side of the magnet coil to one terminal (see Fig. 7), the other side to the bearing bracket. The other terminal is now connected to the rotary switch brush. These connections can be easily made by loosening the wood screws and slipping the wire between the baseboard and bracket.

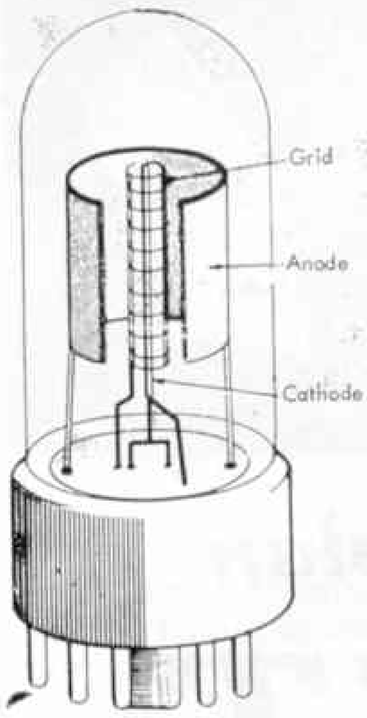
Trial Run

Now for results! Connect up a 4½ or 6 volt battery, the rotor will jerk and remain stationary. Don't despair! Give it a flick and it will rotate. You will see considerable sparking at the rotating switch, but this will almost disappear as the brush beds in. Soon you will need your oil can at each end of the shaft.

Limitations

The motor you have made will not be powerful enough to drive models because (1) The magnetic circuit is crude and wasteful. (2) The elementary form of rotary switching. (3) The inefficient rotor system. It has, however, the basis of electrical engineering, and you have 'made wheels go round'!

FLUID AMPLIFIERS TAKE OVER



by R. S. Neave
Department of Mechanical Engineering, City University, London.

At left, Fig. 1. This is the triode, the simplest form of electronic amplifier.

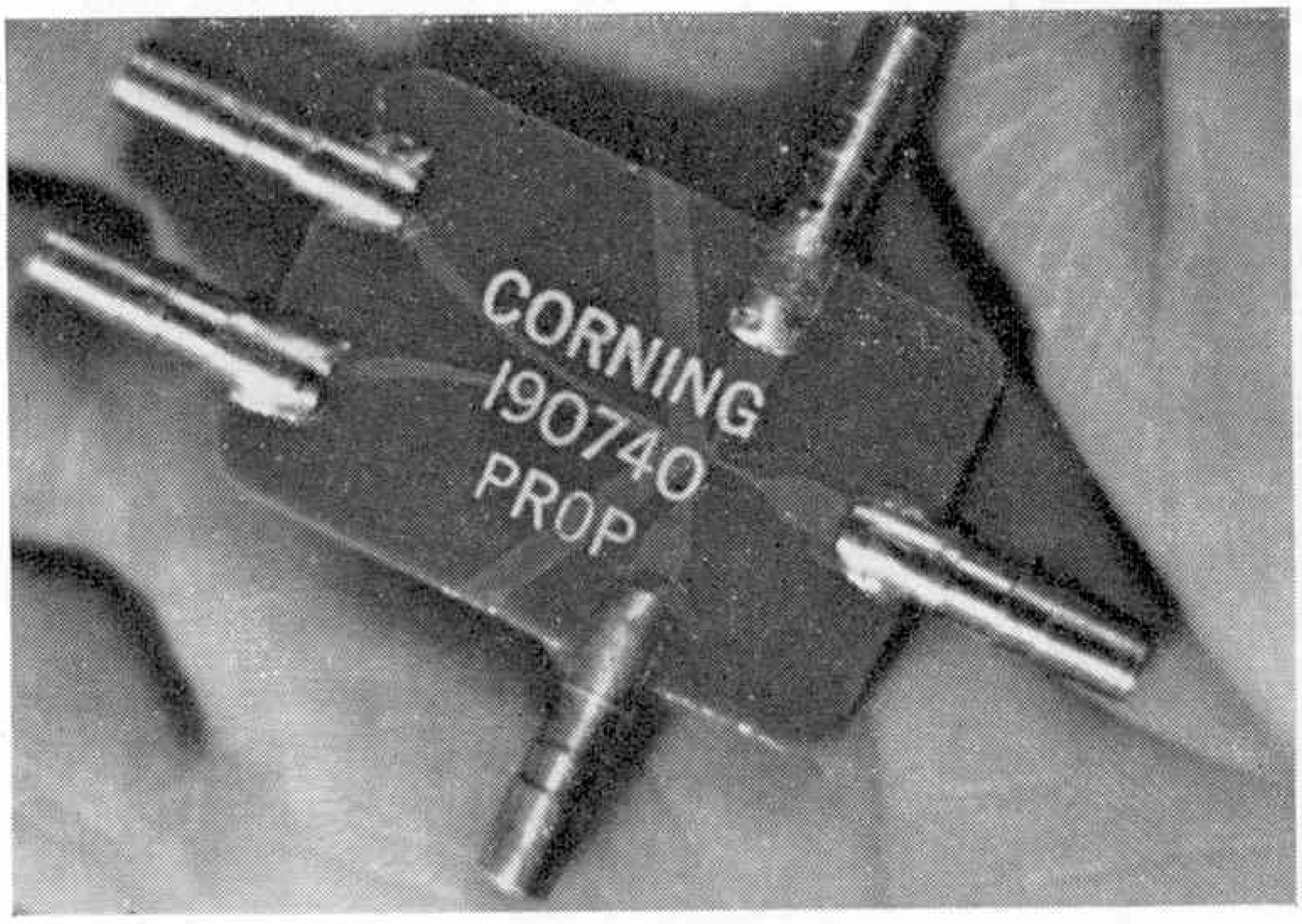
TEN YEARS ago nearly all control systems were electrical or electro-mechanical ones. A vast technology had built itself around the transistor because this device offered some very real advantages of cost, size and power consumption over the thermionic or radio valve. In the last few years however the transistor's dominance has decreased because it doesn't perform at all well under conditions of high temperature and radiation levels. Nowadays control systems are required to operate inside space vehicles, guided missiles and near to nuclear reactors and so another type of " amplifier " has been evolved to carry out the functions that transistors would have performed.

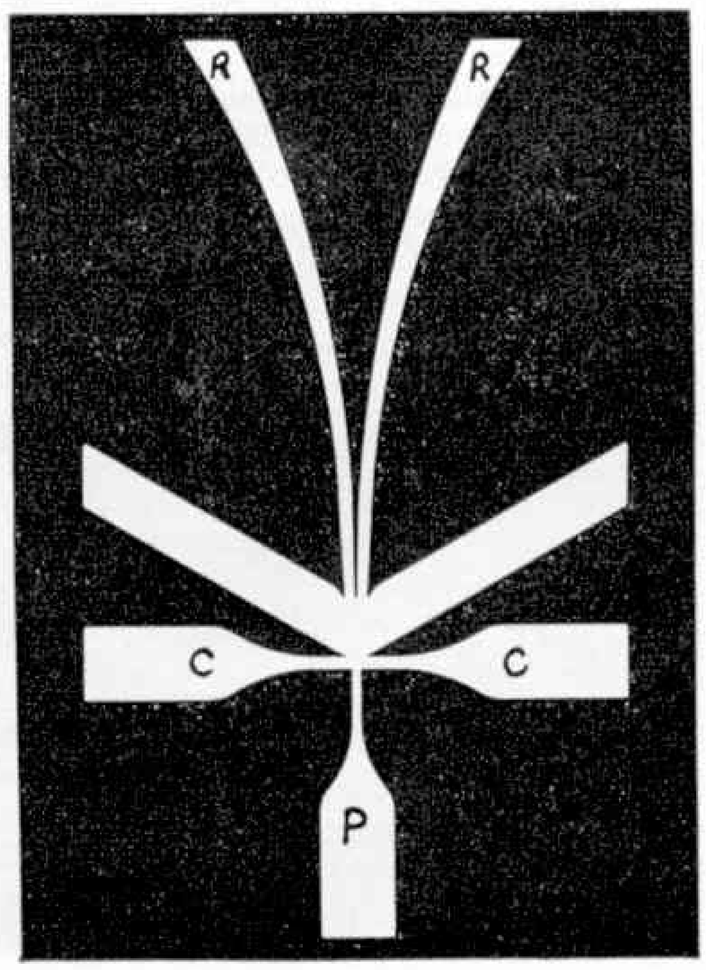
This new device is called a fluid amplifier because it uses a stream of fluid instead of a stream of electrons to produce controlling operations. There are several forms of these, of which the simplest is shown in Fig. 2, and the channels in which the fluid flows are shown diagrammatically in Fig. 3. A continuous jet of gas or liquid is shot from the main nozzle marked 'P' towards the central splitter vane downstream and then divides equally into the receiver channels 'R' each side of the splitter. The difference of flow rates or pressure levels between the two channels is therefore zero, but if a small jet of fluid called the control jet is ejected from one of the nozzles marked 'C' the main jet will be forced more into one receiver channel than the other. This causes an increase in the pressure and flow rate in the channel now receiving the majority of the jet and a decrease in the other, so causing a difference between the two which is roughly proportional to the control input which caused the main jet deflection; hence the term " proportional amplifier." This difference is usually about ten times as large as the signal which caused it so the device is definitely an " amplifier ". Like other amplifiers, if the output of one is used as the control jet input of the next, the " gain " will be 10 × 10 or one hundred. This process has so far been taken to the fifth order of repetition, thus giving t gain of one hundred thousand. The two channels in Fig. 3 which are unmarked are to alow any surplus fluid not admitted by the receiver channels to escape.

A useful analogy between fluid amplifiers and electronic ones is obtained from considering the working principles of both. Referring to Figs. 1 and 3, the main jet replaces the cathode, the control jets the grid coil, and the receivers the anode (or " plate ").

The uses to which fiuid amplifiers can be put are many, because of the number of applications in which control systems are important. However, these have one distinct disadvantage compared with the transistor which is that they are much slower in action, producing changes in perhaps 10^{-3} seconds compared with 10^{-9} seconds for a transistor. They are, however, more reliable than transistors and so have found use in systems not requiring extremely fast reaction times.

Below left, Fig. 2. A Corning fluid amplifier of average size. The ducting inside can be seen through the plastic material of which it is made. Right, Fig. 3. A silhouette of a proportional fluid amplifier, see text for key figure explanation.





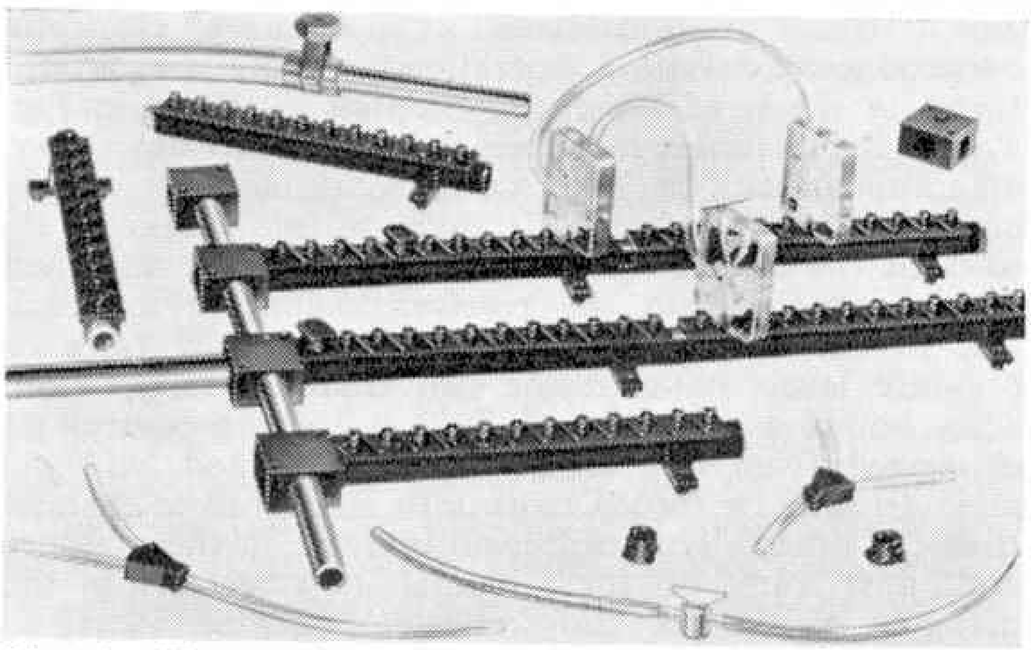


Fig. 4. The manifold method of connecting fluid amplifiers together. Each hole of the manifold is a source of air under pressure. *Photo: Plessey Company Ltd.*

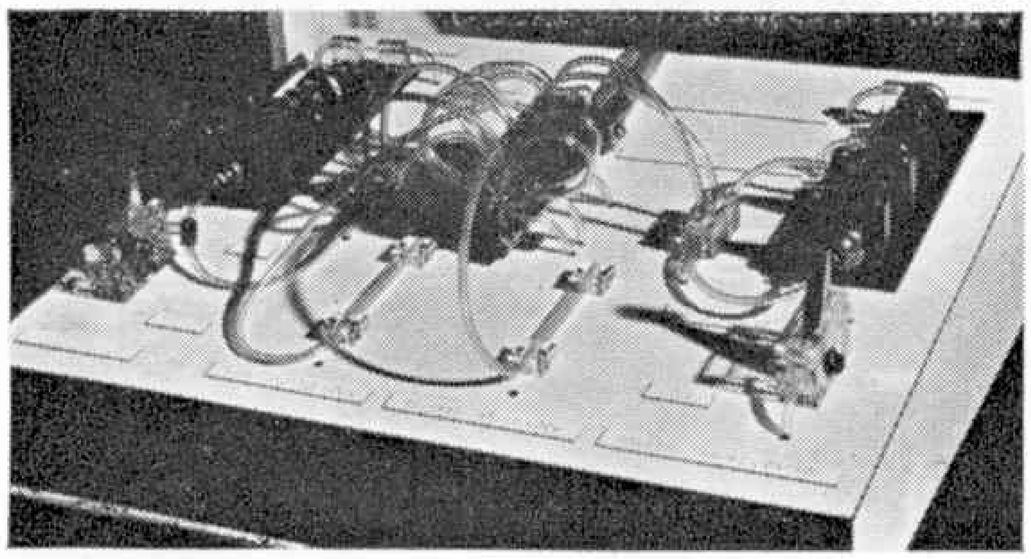
A recent American investigation showed that fluid amplifiers are six times more reliable than transistors in normal usage, 540 times more reliable when subjected to extreme vibrations encountered in guided missiles and 600 times when in the vicinity of a nuclear reactor.

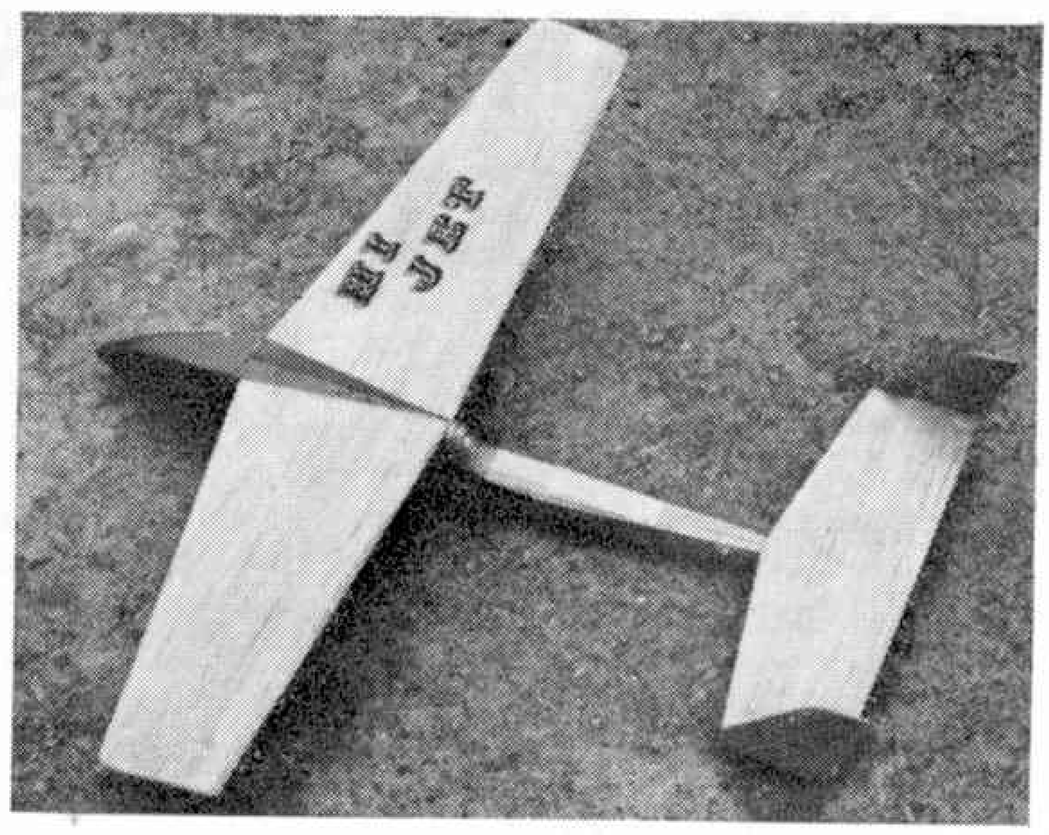
The range of power outputs possible with fluid amplifiers is much larger than that with transistors and is limited only by size considerations. At the lower end of the scale, it is found impossible accurately to mass-produce devices with nozzles smaller than about 0.01 inches. If air is then passed through at sonic speed, a power output of about a fifth of a watt is produced. With sufficient care in design, these very small devices can be packed into control systems at a density of five hundred per cubiv inch. At the other extreme, devices for controlling sewage disposal have been built with nozzles three feet in diameter and nozzles twice this size are planned.

One application of small amplifiers is the system shown in Fig. 5 for controlling the thrust reversal of jet engines. The devices can be seen just above the centre of the picture. Other applications have included the steering of rockets by deflecting their exhaust jet instead of the combustion chamber, a French device for controlling the speed of jet engines ,a "heart pump" to replace the beating action of the heart and which once operated continuously for about seven months without a hitch, and many devices for checking products on production lines, rejecting them if of incorrect size.

The possible total sales of these amplifiers in the years ahead are very large indeed. A recent estimate puts the figure at 150 million dollars a year in 1970 and nearly four times that figure in 1975 so these small pneumatic and hydraulic devices are becoming very big business.

Fig. 5. A fluid amplifier control system for a jet engine thrust reversal control. *Photo: Plessey Company Ltd.*





Your full size plan

HI-JET

A simple all sheet jet model that really does fly "Hi" on its Jetex 35 motor

by W. I. Barrett

HI-JET is a 14 in. wingspan model designed for use with the Jetex Atom 35 motor. Construction is simple, and the complete model can be made from one sheet of $\frac{1}{16}$ in. balsa, 3 in. wide by 36 in. long. It is essential to use the lightest grade available—ask your local model shop to select a lightweight sheet for you.

Start by tracing the outlines of all the various pieces on the plan and transferring these to the sheet of balsa. Cut out the pieces accurately with a razor blade or modelling knife.

Pick out the upper rear fuselage decking, F7, and cement to its underside the stiffener F5. Add the two formers F4 and F6, ensuring that F4 is correctly positioned vertically with reference to the fuselage side. When the assembly is dry, it can be cemented to one of the fuselage side pieces, and the remaining formers (F1, F2, F3 and F8) added. Before the formers are completely set, cement on the other fuselage side and hold the assembly together with rubber bands. See that the fuselage is equally curved along both sides. Put the fuselage on one side to dry.

Now take the wing and carefully sand it to the section shown on the plan. This section is basically a rounded leading edge, with the top surface of the wing tapering down towards the trailing edge. When the wing has been finally sanded smooth, cut and separate the two halves. Apply cement to both cut edges, rub into the grain and allow to dry. Then apply more cement, and bring the two halves together as shown on

the plan, supporting one wing at an angle to the other (the dihedral angle).

While the wings are drying, sand smooth the tailplane and fins, again rounding the leading edges and tapering the trailing edges, this time symmetrically. Cement the fins to the tailplane tips.

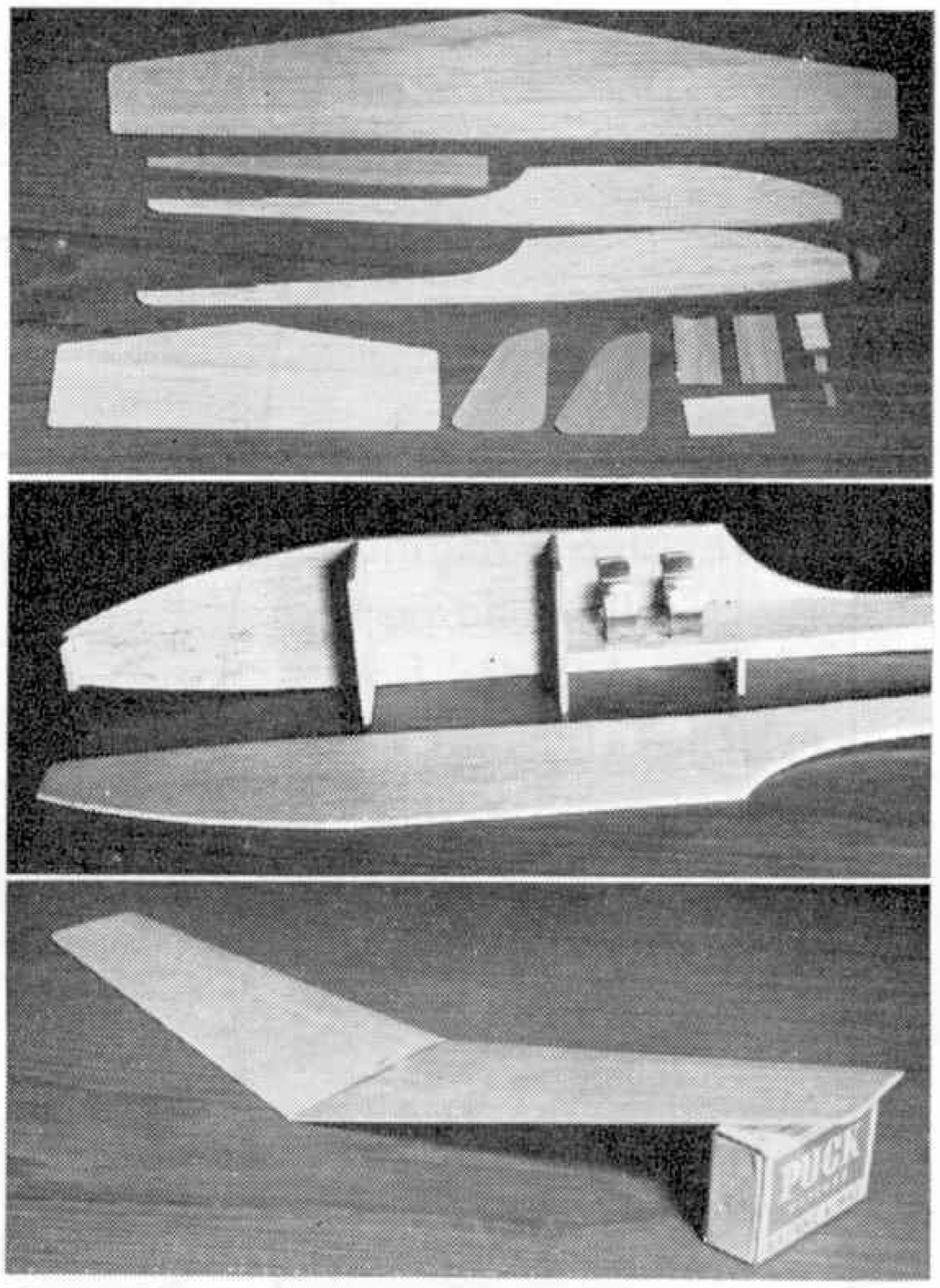
Back to the fuselage again, this time to screw in the Jetex motor clip, using the screws supplied with the outfit. With the motor in place, the fuselage sides may tend to spread a little, so leave the motor in position when the wings are added. Cement them firmly in position, making sure they are square with the fuselage, and are not twisted along their span. When satisfied, add the tail unit, again checking for squareness with the fuselage and wings.

With the flying surfaces securely in place, use scrap pieces of $\frac{1}{16}$ in. sheet to cover the top and bottom of the fuselage. The upper nose covering can have the grain running across the width of the fuselage for ease of bending. Blend in this sheeting with the wing root leading edge. Add the nose, made from either a scrap piece of block or built up from several laminations of $\frac{1}{16}$ in. sheet. When dry, sand the fuselage smooth, rounding the corners and streamlining the nose block.

The whole model can now be given a coat of cellulose sanding sealer and rubbed down when dry. Any colour dope for decoration should only be added to the nose—remember, colour dope adds considerably to the weight.

With the model complete, and an empty motor in the clip, the balance should be checked. Support the model by the finger tips under the wing at about half chord (i.e. half way back at the wing centre). The model should balance level. If not, cut a small door in the decking over the nose and add Plasticine for weight until the model is balanced correctly. Total weight should be under 1 oz. Temporarily secure the door in position, and test glide the model. This should be done on a calm day over grass. If the model dives rapidly, remove some nose weight. If the model lifts its nose, stalls and then dives to the ground, add some more nose weight. When you have achieved a long steady glide, cement the hatch back in place. Any tendency for the model to turn sharply one way or another can be corrected by gently twisting the wings. The wing on the outside of the turn should be twisted so that the trailing edge at the tip is slightly raised. The twist can be held in the wing permanently by gentle application of heat.

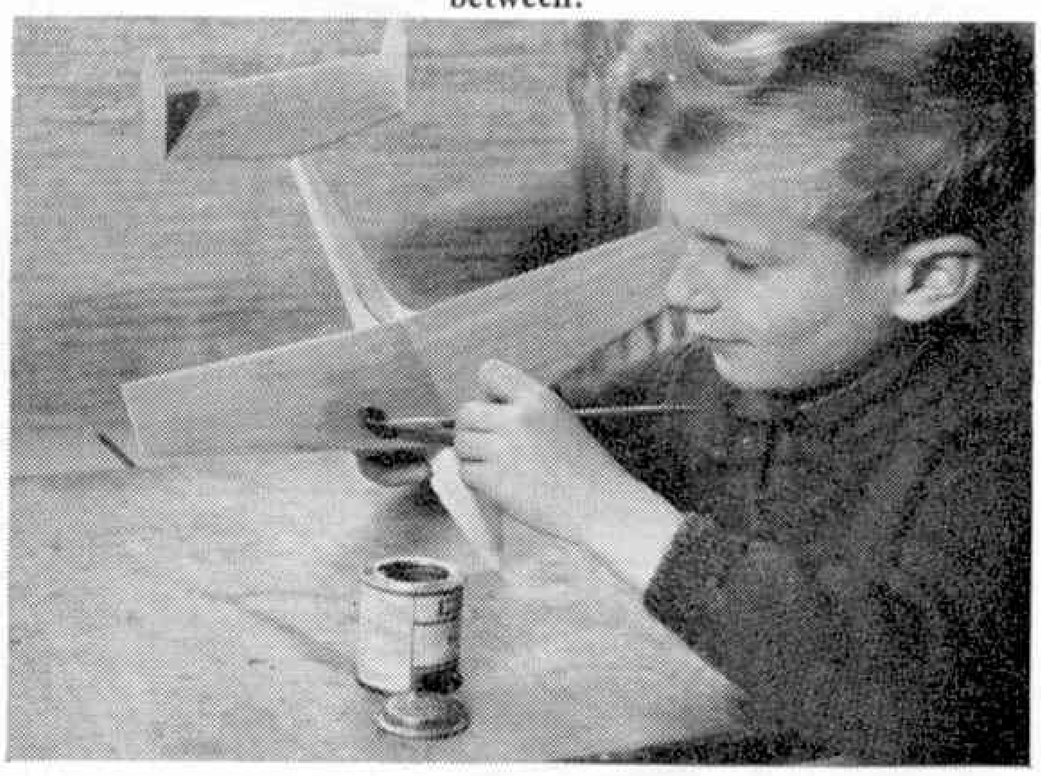
The designer's son shows the right angle for launching Hi-Jet. Wait until the Jetex unit has built up full thrust then give a smooth upward launch. Follow the launch through to make sure it is smooth.

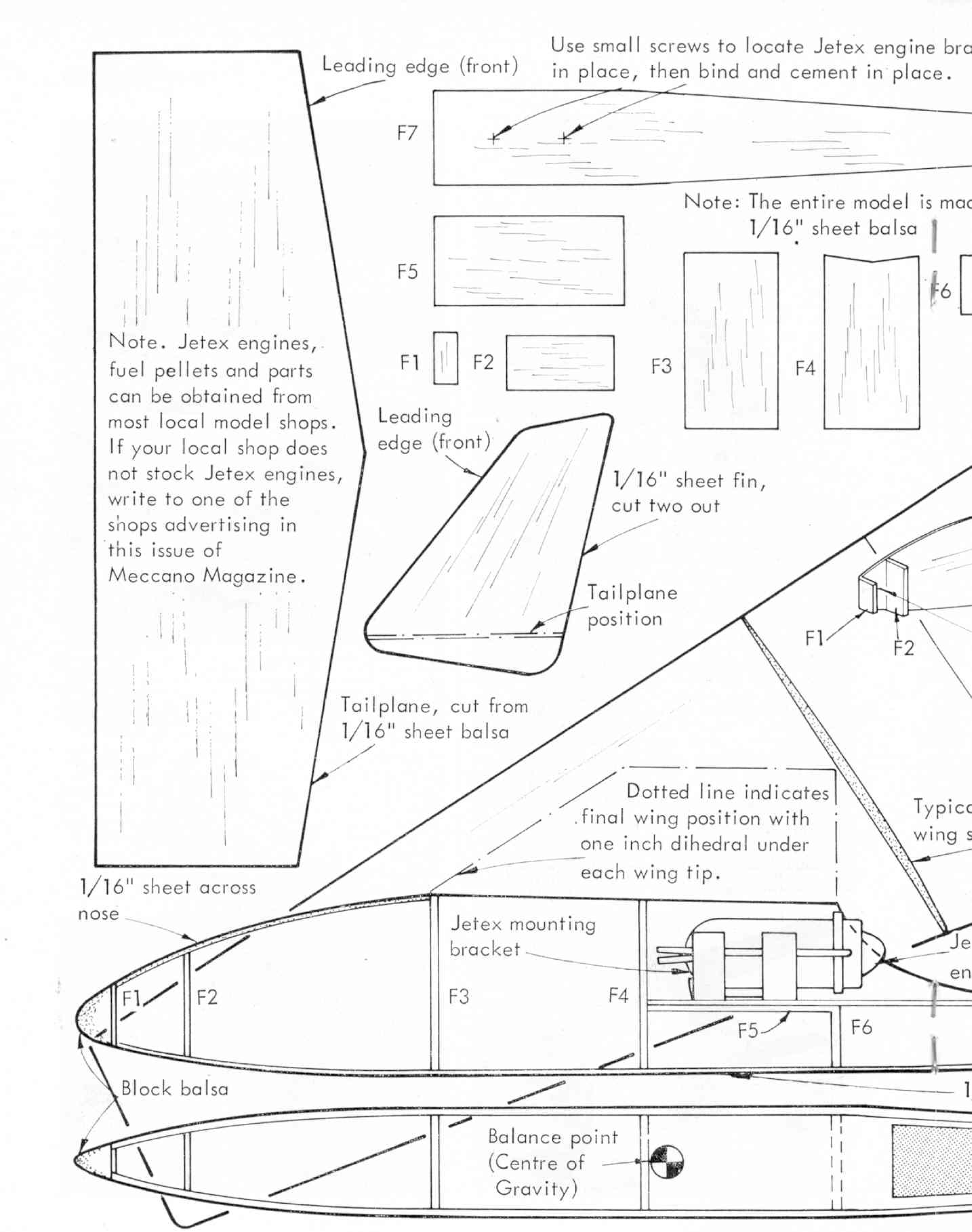


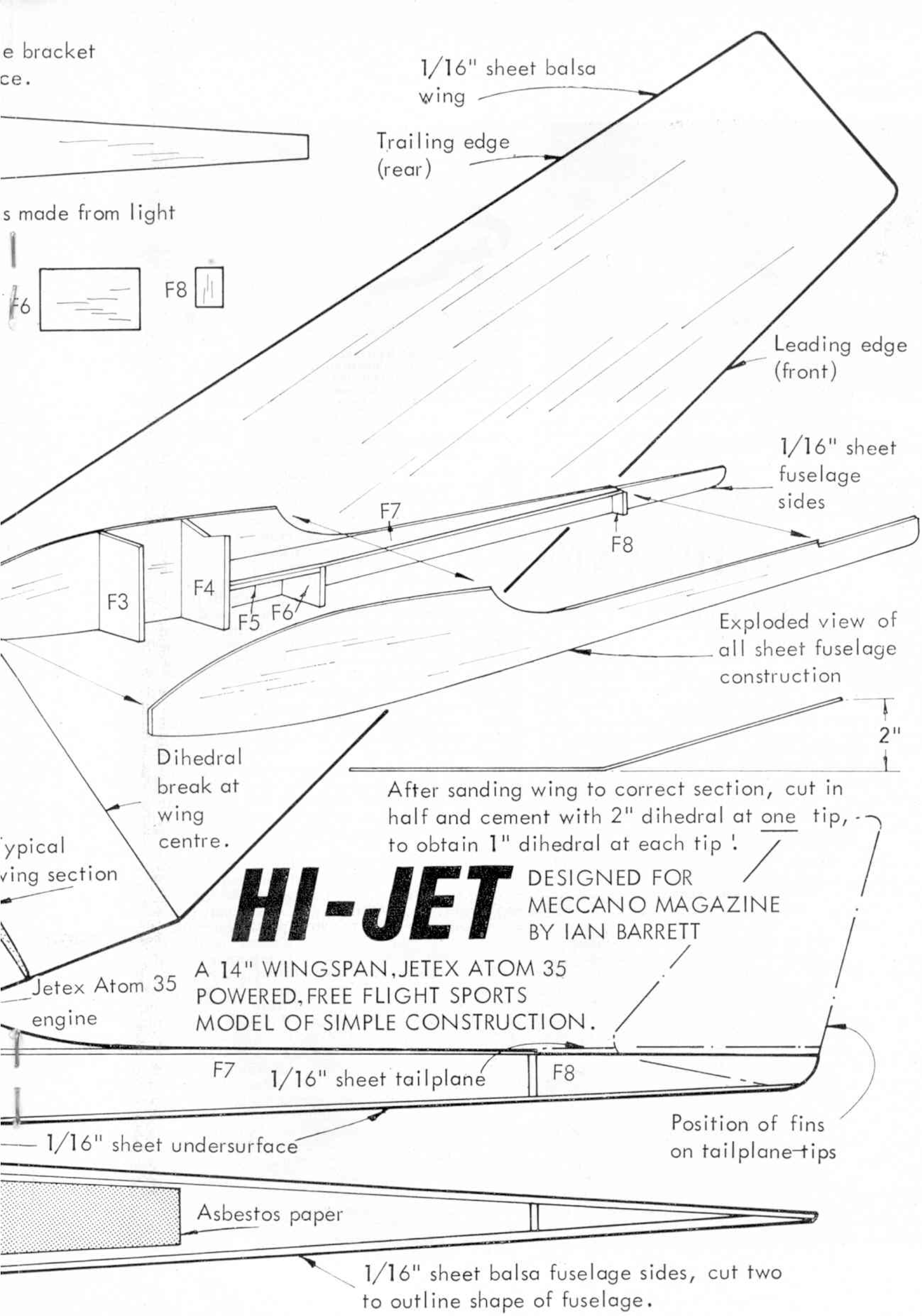
Above. Top, the component parts of Hi-Jet. Cut them all from lightweight 1/16 in. sheet balsa, note the proper grain direction (shown on the plan) as this factor adds considerably to the model's strength. Centre, the two 1/16 in. sheet fuselage sides with formers F3-F6 in place. Note the Jetex Atom 35 mounting clip. Next, the sheet wing being propped up 2 inches under one tip. This is to give 1 inch dihedral under each wingtip when the wing is glued to the fuselage.

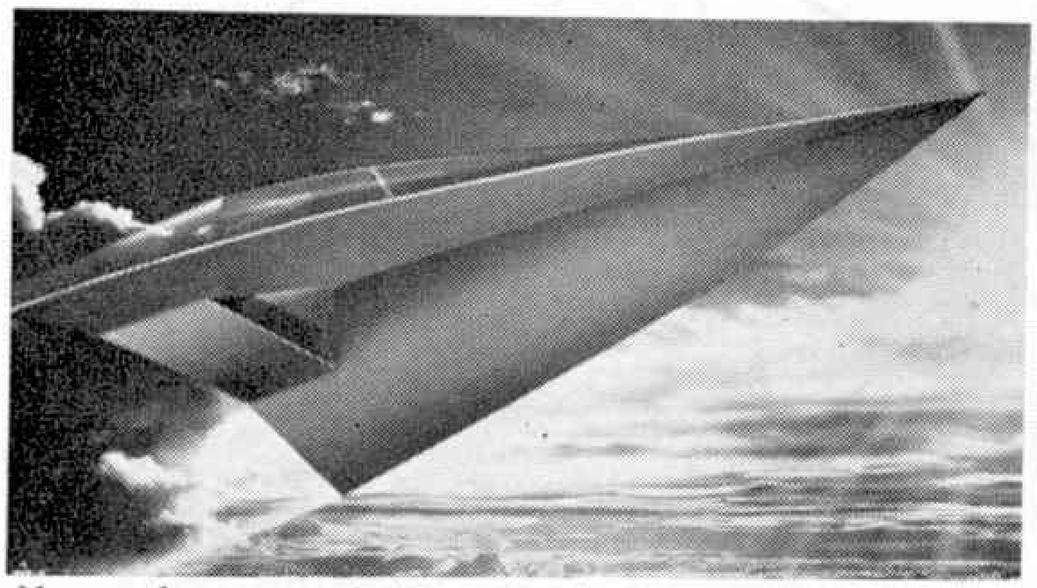
Now try some power flights. Make sure that the Jetex unit is parallel to the fuselage centre line before lighting. Allow the thrust to build up, then launch into wind. Any signs of the model spiralling can be corrected by the method outlined above. Should the turns persist, check that the fins are correctly aligned with the fuselage.

Dope your model sparingly as unthinned dope adds a lot of weight to an all sheet model like Hi-Jet. It is better to apply two thinned coats of dope than one really thick one, sanding between.




Leading edge (front)
Use small screws to locate Jetex engine bra
in place, then bind and cement in place.
F7
Note: The entire model is mad
1/16" sheet balsa
F5
F6
F1
F2
F3
F4
Note. Jetex engines, fuel pellets and parts can be obtained from most local model shops. If your local shop does not stock Jetex engines, write to one of the shops advertising in this issue of Meccano Magazine.
Leading edge (front)
1/16" sheet fin, cut two out
Tailplane position
F1
F2
Tailplane, cut from 1/16" sheet balsa
Dotted line indicates final wing position with one inch dihedral under each wing tip.
Typica
wing s
1/16" sheet across nose
Jetex mounting bracket
Je
en
F1
F2
F3
F4
F5
F6
Block balsa
1
Balance point (Centre of Gravity)


e bracket
ce.
s made from light
F6
F8
1/16" sheet balsa wing
Trailing edge (rear)
Leading edge (front)
1/16" sheet fuselage sides
F7
F8
F3
F4
F5
F6
Exploded view of all sheet fuselage construction
2"
Dihedral break at wing centre.
ypical ing section
After sanding wing to correct section, cut in half and cement with 2" dihedral at one tip, to obtain 1" dihedral at each tip !
HI-JET
DESIGNED FOR MECCANO MAGAZINE BY IAN BARRETT
A 14" WINGSPAN, JETEX ATOM 35 POWERED, FREE FLIGHT SPORTS MODEL OF SIMPLE CONSTRUCTION.
Jetex Atom 35 engine
F7
1/16" sheet tailplane
F8
1/16" sheet undersurface
Position of fins on tailplane tips
Asbestos paper
1/16" sheet balsa fuselage sides, cut two to outline shape of fuselage.



Above, the proposed 'Caret' wing layout sketched by an artist in B.O.A.C. markings, looks very much like the paper dart we have all folded at some time or another. The Laboratory boys tell us that a double 'Caret' forming an inverted W is the thing for 5,000 m.p.h. flight with external fuel burning ram-jet engines.

The Sikorsky S-64 Skycrane carrying an experimental bus type pod in the first demonstration of the Skylounge proposal, currently understudy for the Los Angeles Dept. of Airports. By cutting down the city centre to airport time lapse one can shorten some journeys by as much as doubling the aircraft's speed.

After the Concorde . . .

CARETS AND CONVERTIPLANES

by John W. R. Taylor

ONE OF the most frustrating things about flying is that by the time an aeroplane gets into service it is usually out of date. Take the Concorde: it has not yet flown, but already designers are testing models of aeroplanes that will, one day, fly more than three times as fast as this first supersonic airliner.

Over in the United States, the North American X-15 has already travelled at 4,250 m.p.h., which is about three times the Concorde's highest cruising speed. There is, of course, a big difference between hitting such a speed for a few seconds in a single-seat rocket-powered research aeroplane, which does not even take off under its own power, and cruising for hours at over 4,000 m.p.h. in an airliner. But the Concorde itself would have seemed equally fantastic 21 years ago when only one aeroplane—the single-seat rocket-powered X-1—had succeeded in flying at supersonic speed, at great risk to its pilot.

If we take a look at what has happened to the speed of transatlantic airliners in the last two decades, an interesting fact comes to light. The best airliner of 1948 was probably the Constellation, which cruised at around 300 m.p.h. By 1958, the advent of the jet-powered Boeing 707 almost doubled cruising speeds over the Atlantic. Now, after another ten years, the Concorde promises to more than double the 707's speed. We may not reach 2,800 m.p.h. with an airliner by 1978; but 4,000 m.p.h. by 1988 is by no means beyond our reach.

The biggest problem might not be to build an airliner capable of such an immense speed, but to do so at a price that the airlines could afford to pay. A Concorde is still comparatively cheap at a mere £8 million or so. The American B-58 Hustler bomber, built of materials like metal honeycomb sandwich and stainless steel, has an airframe that cost more than its weight in pure gold, and this could easily be true of any future 4,000 m.p.h. airliner.

Few passengers would be willing or able to pay two or three times the normal fare just to cut an hour or so off the time that the Concorde will take to fly between London and New York. That is why many people believe it would be far better to concentrate first on reducing the overall city-centre to city-centre times than simply to increase cruising speed in flight. It is easy to see why. If we halved the time taken to get from the centre of London to Heathrow, through Customs and into the aircraft—and then did the same in New York— the saving would be about the same as if we doubled the Concorde's cruising speed !

The Los Angeles Department of Airports has been working on this possibility and one result is the Skylounge. In its present form, this consists of a comfortable 23-seat mobile lounge which can be towed behind a variety of different vehicles. The idea is to tow it round town, picking up passengers; then drive it to a waiting Sikorsky S-64 Skycrane helicopter which would whisk it over a 250-mile range at 100 m.p.h.

It would be easy to improve on this basic idea. As a start, there is no reason why the Skylounge should not travel to the airport under its own power, at high speed on a monorail or as an underground railway coach, with the end of the line under a waiting helicopter.

Stage two might see the helicopter replaced with a faster type of vertical take-off and landing (VTOL) aircraft. In Britain, Westland have already produced a design for a short-range VTOL transport that would carry 80 people at up to 380 m.p.h.—nearly four times the speed of the Skycrane. Known as the WE-02 convertiplane, it would be a tilting-rotor aircraft, as opposed to the more complex tilt-wing layout.

The WE-02 would be powered by two pairs of coupled engines, each pair driving a large-diameter rotor-prop of special design. With the power plants tilted upward, as shown in the illustration on page 493 the rotor-props would operate as helicopter rotors during take-off and landing, and would be tilted forward and down, through 90 degrees, to function as propellers for high-speed cruising flight. The transmission would be cross-coupled, so that in the unlikely event of failure of one, or even both engines on one side, the remaining pair would drive both rotor-props to maintain safe flight.

Initially, Westland are developing a smaller aircraft on the same lines, known as the WE-01. This will be able to carry six people at 285 m.p.h. and it is hoped to have it in the air by 1971. The WE-02 could then follow in 1975 if air forces or airlines were farsighted

At right, the Westland WE-02 tilting-rotor aircraft. This short haul aircraft will be able to take off vertically and fly to its destination conventionally then swing its engines round to land like a helicopter. Westland are currently developing a smaller aircraft on this principle to carry six passengers.

enough to appreciate the great potential of such a " go-anywhere " machine.

Within ten years, therefore, there is no reason why we should not be able to speed out from city centre to airport on a 100 m.p.h. monorail, a hundred feet above the traffic jams on the roads below, and then catch a 380 m.p.h. VTOL airbus to any place within a few hundred miles' range. Overall journey time on a route like London-to-Paris could easily be halved.

Long before then, the Concorde will half flying time on longer routes, while big 400/500-seat " jumbo jets " like the Boeing 747 will offer lower-than-ever fares for those who are prepared to fly below the speed of sound.

Some people are afraid of such big and fast aircraft; but experience has shown that safety has improved steadily in recent years, in pace with increased size and speed. Much of the credit for this must go to the world's highly-efficient air traffic control systems, and to the wonderful electronic devices which enable an aircraft to be flown automatically, to by-pass storms that might prove unpleasant or dangerous, and even to land under complete automatic control.

Before many years, aircraft will be under automatic control from the moment they begin their take-off run until their engines stop after landing. Fog and bad weather will no longer cause delay and danger, and the possibility of human error will be almost eliminated. Even " near misses " will be averted by devices that will detect any aircraft on a collision course and start a gentle turn to avoid any risk of accident.

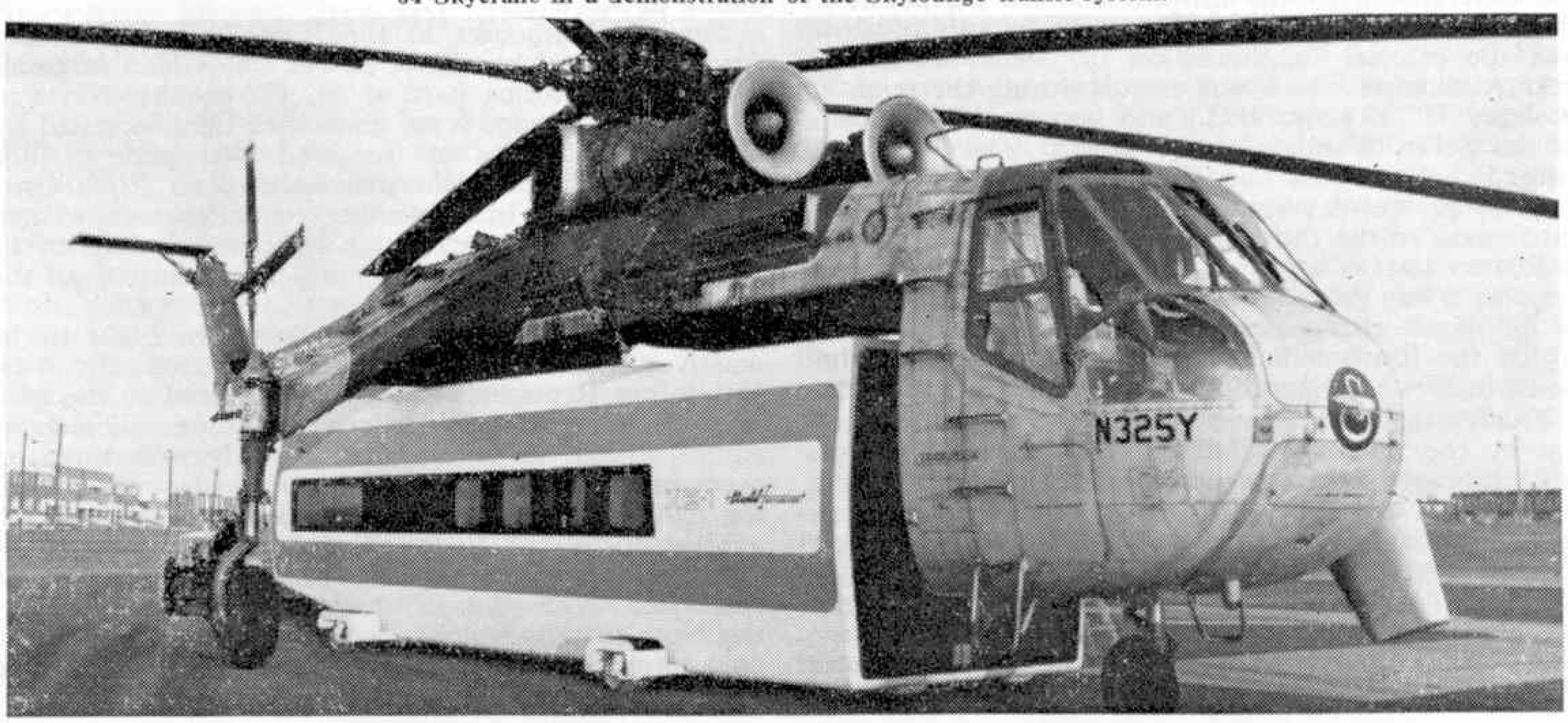
Vertical take-off will probably become practicable for big, fast airliners by the use of tiny, inexpensive jet engines that will plug into vertical sockets in the fuselage and wings, rather like electric light bulbs. Such engines are already within sight, for Rolls-Royce's little RB.162 lift-jet, used in several prototype VTOL fighters and transport aircraft, gives sixteen pounds of thrust for every one pound of its own weight, and is made largely of plastics.

The prospect of a VTOL Concorde, able to take off and land automatically in all weathers, without any need for long runways, is tremendously exciting. But, as already mentioned, the airliner of the 1990's may well make even the Concorde seem slow. They will look very different from anything we are accustomed to seeing today. The first new term we shall have to learn is " caret ", as the hypersonic transport (HST) designs now being studied in British wind-tunnels have what are called " caret " shapes.

A typical simple " caret " is illustrated (rather prematurally in B.O.A.C. insignia !) on page 492. As can be seen, it is very like a schoolboy's paper dart. A more likely design for a future airliner is, in fact, a double-caret, consisting of two such shapes put together to form a sort of inverted W-wing in front view. Wind tunnel tests at the Royal Aircraft Establishment and National Physical Laboratory have shown that this offers great possibilities for flight at around eight times the speed of sound—say 5,000 m.p.h.

Such aircraft will be powered by ramjet engines, without any moving parts. They may even burn their fuel *outside* the engines rather than inside during cruising flight. The idea of riding in an airliner half-enveloped in burning fuel may not seem very attractive; but neither did the possibility of flying faster than sound twenty years ago. Both may be regarded as everyday routine by the end of our 20th century.

Below, a Budd built Skylounge is picked up by the Sikorsky S 64 Skycrane in a demonstration of the Skylounge transit system.



LIGHTHOUSES & LIGHTSHIPS on Stamps

by J. A. Mackay

IN NOVEMBER Australia is issuing a 5 cents stamp to mark the 150th anniversary of the first lighthouse erected in that country, the Macquarie Light on the Outer South Head at the entrance to Sydney Harbour. This is the first time that a lighthouse has been featured on an Australian stamp, all the more surprising when it is realised that neighbouring New Zealand has had many stamps in this theme. In fact, the first stamps ever to depict a lighthouse were released by New Zealand as long ago as 1891. In that year the Life Insurance Department (a Government organisation) received the privilege of issuing stamps for use on its own correspondence. The first set, in denominations ranging from ½d. to 1s., featured a lighthouse with the words STATE SECURITY illuminated in the beams of the light. The monogram of Queen Victoria was included in the original design but the stamps were re-issued in 1905 with the letters "VR" omitted. This set lasted, with minor variations, for more than forty years. Then, in 1947, an attractive pictorial series was produced, featuring various lighthouses round the coasts of New Zealand. These range from Cape Brett in the North Island to Cape Campbell in the South Island.

The 3d. stamp in this series, however, depicted the famous Eddystone Lighthouse which lies about fourteen miles off Plymouth. The Eddystone Lighthouse is a good example of what is technically known as a wave-swept station since it is built on a rock continually lashed by the sea. The first lighthouse on this site was made of wood and was erected between 1695 and 1698 by Henry Winstanley. During the great gale of November 20th 1703 this edifice was swept away and the occupants, including Winstanley himself were drowned. A second tower, also of timber, was erected in 1706-9 and was destroyed by fire in 1775. The third tower, built by John Smeaton in 1756-9, was constructed of masonry blocks dove-tailed together for greater strength. This structure proved to be more durable and remained in use till 1877 when, on account of the undermining of the rock on which it stood, it had to be replaced by the present lighthouse. This was built by Sir James Douglass and completed in 1882. The upper part of Smeaton's tower was removed and re-erected at Plymouth Hoe where it may be seen to this day.

The earliest lighthouses, of which records exist, were the towers built by the Libyans and the Egyptians in the seventh century B.C. The most famous of them was the colossal lighthouse on the island of Pharos near Alexandria which was erected during the reign of Ptolemy II (283-247 B.C.) and was regarded as one of the Seven Wonders of the World. The tower was alleged to have been 600 feet high, a fantastic height even by present-day standards. It was destroyed by an earthquake in the thirteenth century but its ruins were visible as late as 1350. Although no trace of it now remains it has given its name to *pharology*, the science of lighthouse engineering, and to the Pharos of Dover, which the Romans built in 43 A.D., the first lighthouse in Western Europe.

During the Middle Ages lighthouses fell into disuse but by the middle of the sixteenth century, as trade and shipping began to increase, the idea of lighting beacon fires to guide navigation and warn sailors of reefs and dangerous rocks was revived. The earliest of these lights were known as bascules and consisted merely of braziers for wood or coal fires erected on top of poles. An ancient bascule light was featured on the 30 ϕ stamp issued by Denmark in 1960 to mark the 400th anniversary of the Danish Service.

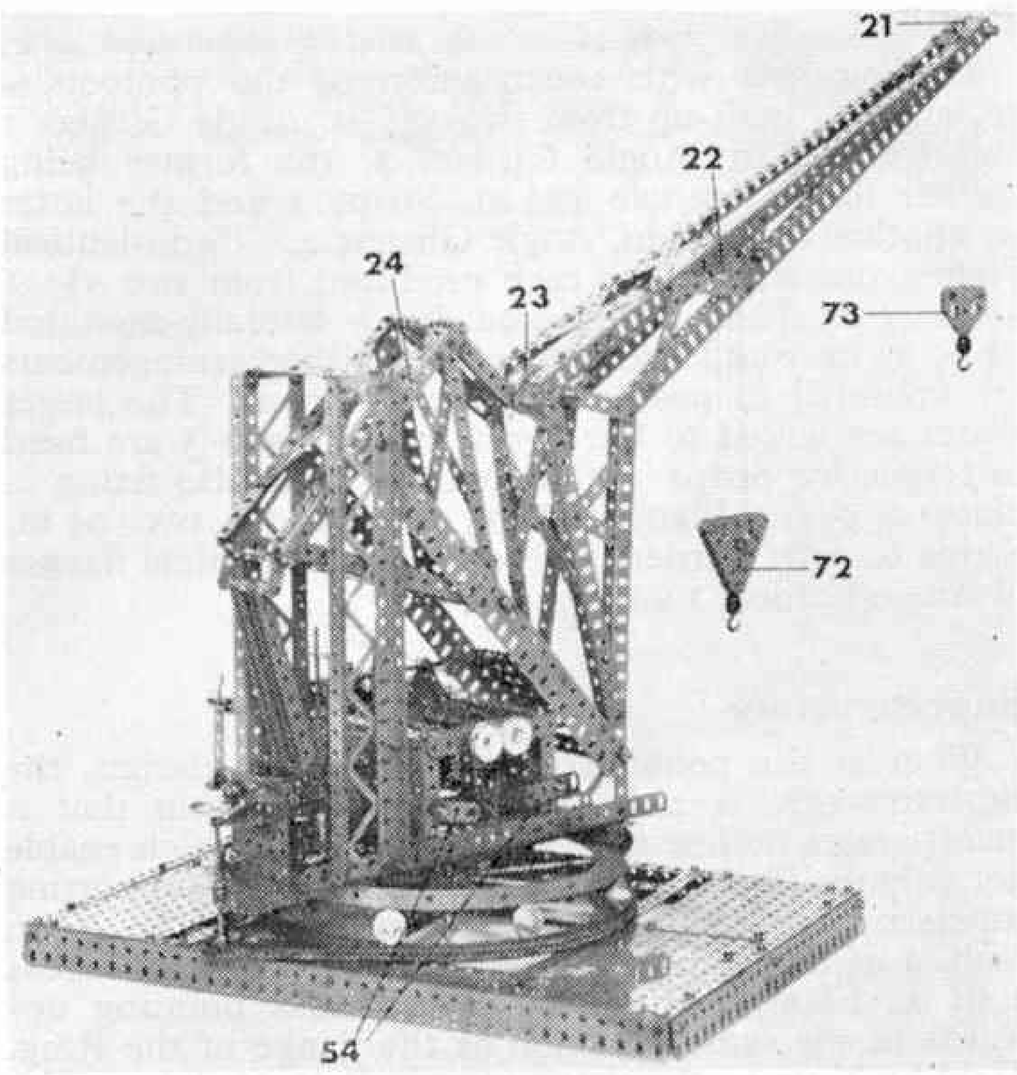
At a later stage fairly substantial towers were erected on headlands and illumination was provided by hoisting a brazier of coals from a crane-like device. A good example of this type was shown on a Finnish stamp of 1946 to commemorate the 250th anniversary of the Pilotage Institution. By contrast is the fine modern lighthouse at Porkkala, depicted on a stamp released by Finland in 1956.

Other examples of modern lighthouses include the Kijkduin at Den Helder, shown on a Dutch charity stamp of 1933.

Several lighthouses in the West Indies have been featured on stamps. That on the tiny island of Sombrero, which forms part of St. Christopher-Nevis in the Leeward group, is an unmanned light mounted on an openwork frame of iron and steel girders. The original Sombrero Light was featured on the 8 cents stamp of 1957. In September 1960, however, a hurricane severely damaged this light and it had to be replaced by a new structure, which is featured on the current ½c stamp, issued in 1963.

In contrast with the modest Sombrero Light is the massive Columbus Lighthouse erected by the Dominican Republic as a fitting memorial to the man who discovered the West Indies in 1492. This huge edifice, in the shape of a cross, has been featured on numerous stamps of Dominica and also on one of the Cuban stamps of 1944 commemorating the 450th anniversary of the discovery of America.

Lightships, moored over reefs and dangerous shoals date from 1732 when a small vessel was anchored at the Nore to warn shipping. The only lightship shown on a stamp is the *Elbe I*, featured on a German Winter charity stamp of 1937.



First featured in the March 1925 issue of Meccano Magazine and subsequently described in pre-war Super Model Leaflet No. 28, this giant Pontoon Crane has been re-built for today's readers.

NEW 40-YEAR OLD MODEL

by Spanner

A giant Pontoon Crane rebuilt from the March 1925 issue of Meccano Magazine for advanced model builders.

MECCANO MAGAZINE has been published now for more than half a century, during which time literally thousands of new Meccano models of all shapes and sizes have been featured. Meccano, itself, has been on the market even longer—some 60 years—and so, as Meccano is a life-long hobby for many people, there are innumerable adult enthusiasts throughout the world who have seen or possibly even built lots of the models we have presented in the past.

Because of this we have always been a bit wary about giving a second showing of some of the old models for the benefit of newer readers, but we have recently been rather surprised by the large number of requests we have had from the same adult readers asking us to reproduce some of the old advanced models not only for the benefit of newer readers, but also because they would like to see them again, themselves. In response to these requests, therefore, our model-builder has delved 43 years back into our history and come up with this Pontoon Crane, originally featured in the March 1925 issue of the M.M. It was also described in No. 28 of the famous series of pre-war Super Model Leaflets but, despite its age, it can still be built with standard Meccano parts included in the current system, although our builder has made one or two modifications.

Owing to circumstances, it will be necessary for me to re-write the actual building instructions, but before doing so, I think it would be interesting to reprint, word for word, the introduction to the original article. I found it interesting as well as informative and I hope you will do so too.

"Elsewhere in these pages," it says (referring to the 1925 magazine, not this one), "Mention is made of 'Crane Lighter No. 4,' the immense Pontoon Crane belonging to the British Admiralty, which was illustrated and described in the "Meccano Magazine" for September 1921. This crane has been carefully copied in the accompanying model, and the result must undoubtedly be considered as yet another splendid Meccano achievement.

Before proceeding with our description of the model it would be of service perhaps to recall the chief characteristics of 'Crane Lighter No. 4.' The crane is mounted on a pontoon 242 ft. in length and 86½ ft. in breadth. It is capable of lifting its load of 250 tons to a height of 77½ ft. above the level of the sea, and has a reach of 100 ft. radius. The base of the crane rotates and rests upon rollers, which have a path of 50 ft. in diameter.

A large working area

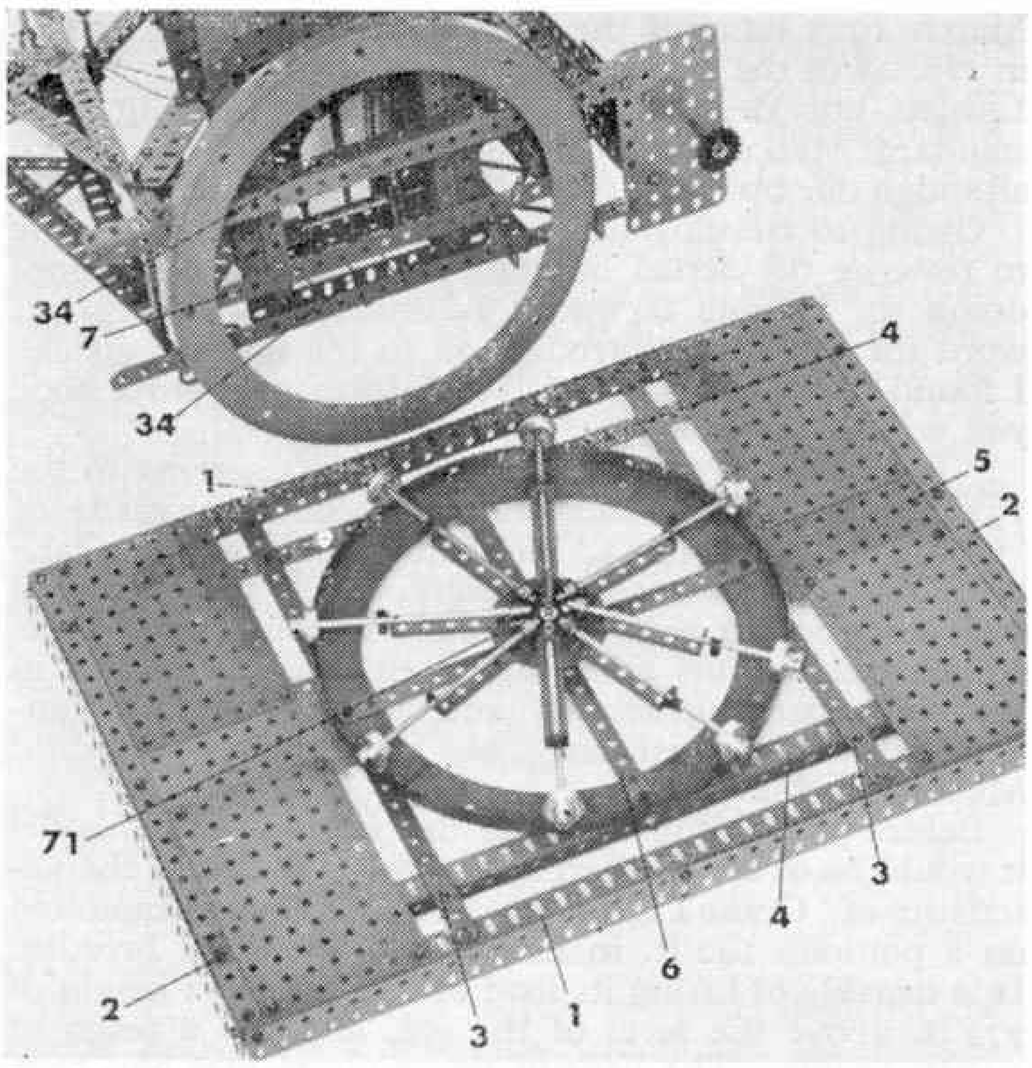
By raising or lowering the jib the reach of the crane is altered thus enabling loads to be picked up from the deck of the pontoon at, say, a reach of 50 ft. swung round and lowered into place at a reach of 100 ft. The crane, as erect as possible, picks up its load and swings round in line with the place where the load is to be dropped. The jib is then lowered, extending the reach of the load as it hangs, until it is immediately over the spot where it is finally deposited.

Hauling is accomplished by steel ropes, the maximum effort being made with the jib inclined at an angle of 40 or 45 degrees to the horizontal. When a heavy load is on, both steam and hydrulic brakes control the movements with wonderful precision.

The Meccano model

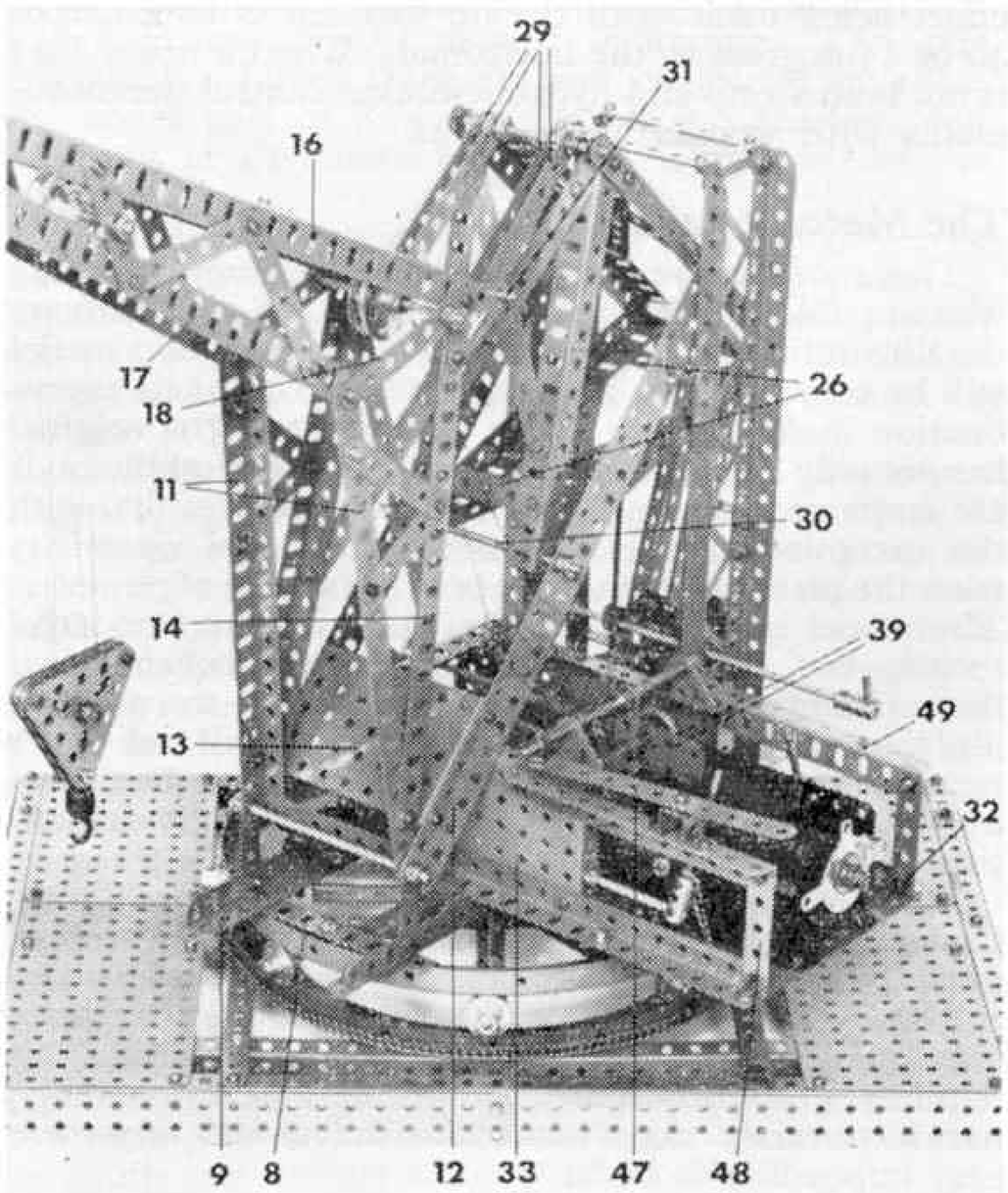
Those of our readers of sufficiently long standing who are able to turn up "M.M." No. 20 and compare the illustration on page 6 with our new Meccano model will be struck by the accuracy and realism of its reproduction in Meccano. Every movement of the original has not only been carefully copied, but identical methods are employed to bring about the required results, with the exception that in the Meccano model electricity takes the place of steam engines as the source of power... The model is complete in every detail—the wonderful rocking-bar, giving great leverage and movement at the expenditure of the minimum of effort—the graceful jib, with its two pulley blocks; the wheel and roller race, to minimise friction, and the screw mechanism—by which the jib is raised or lowered—perfectly demonstrated by the Meccano Threaded Rods."

All these comments apply equally to our re-built Crane although I must mention that, whereas the original model employed two Motors, one to drive the hooks and the other the slewing movement, our model uses only one E15R Motor to drive all movements. This requires a slightly more-complicated gear assembly, but it certainly does not make the model anywhere near impossible to build.



In this view of the model the superstructure has been removed from the pontoon to show construction of the pontoon and roller race, both of which are easily built.

A close-up view of the general superstructure. Pay particular attention to the method of joining the jib to the body.



Pontoon

Dealing first with construction of the pontoon, a rectangle is built-up from two 18½ in. Angle Girders 1 and two 12½ in. Angle Girders 2, the former being further joined by two 12½ in. Strips 3 and the latter by another two 18½ in. Angle Girders 4. Two identical Plate arrangements are each produced from two 5½ × 3½ in. Flat Plates connected by a laterally-mounted 4½ × 2½ in. Flat Plate 5, then the finished arrangements are mounted in position on the pontoon. The larger Plates are bolted to Girders 1, while Plates 5 are fixed to respective Strips 3, the securing Bolts also fixing in place a 9⅞ in. Flanged Ring crossed by two 9½ in. Strips 6. Flat Girders are bolted to the vertical flanges of Angle Girders 1 and 2.

Superstructure

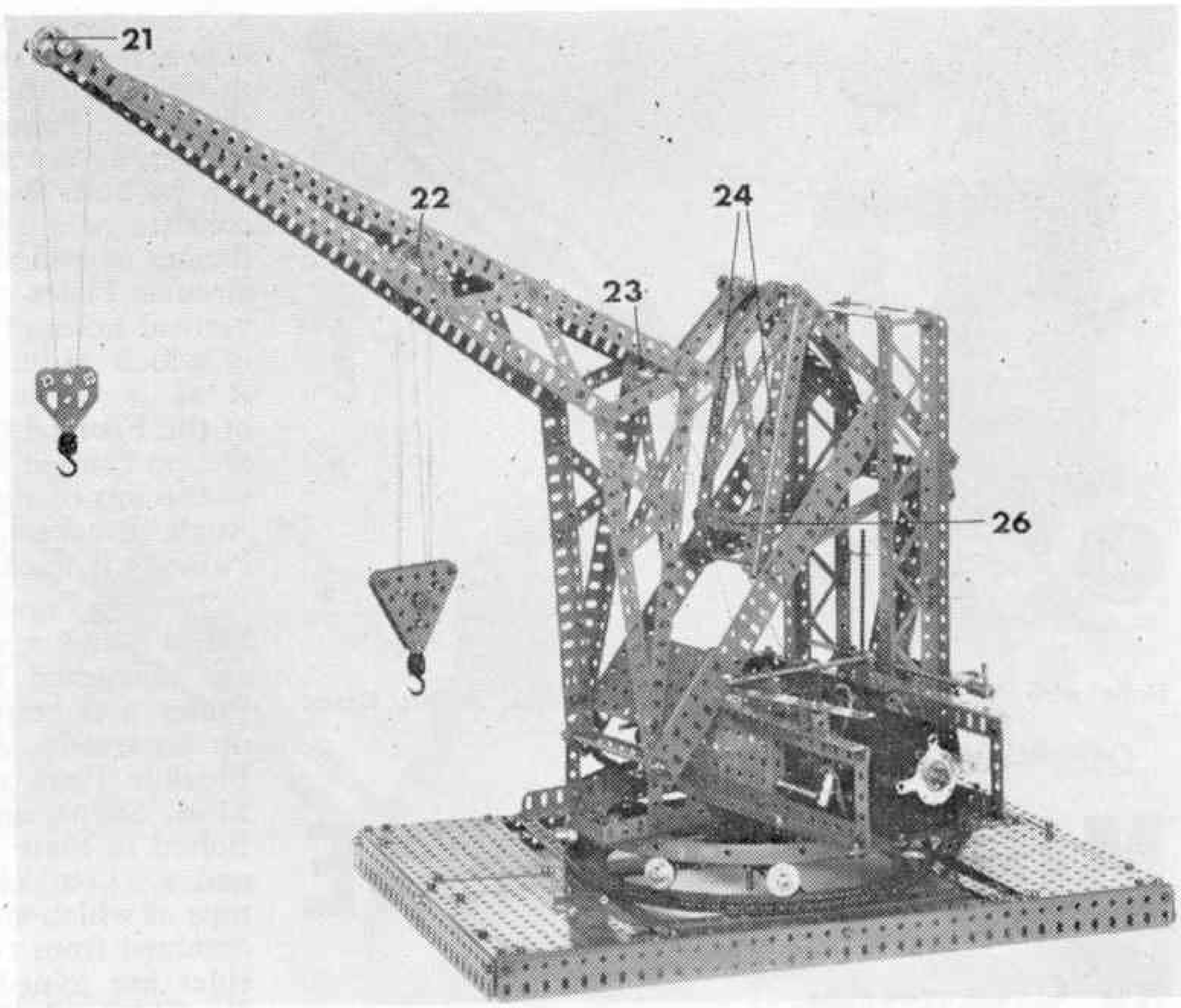
Whereas the pontoon is very simple in design, the superstructure is rather more complicated in that it incorporates no less than six hinge points which enable not only the jib, but also a large section of its supporting superstructure to vary its operating angle. To begin with, a 9½ in. Strip 7 is fixed by two ½ in. Bolts across a 9⅞ in. Flanged Ring, the Bolt shanks pointing upwards in the same direction as the flange of the Ring. Held by Nuts on the shank of each Bolt, at right-angles to the Strip, is a 4½ in. Angle Girder 8 which cuts across a section of the Ring, its horizontal flange clamped tight against the vertical flange of the Ring. Bolted to Girders 8 are two 12½ in. Angle Girders 9, separated by a distance of five clear holes.

Now fixed to each Girder 9, through the third and sixth holes are two further 12½ in. Angle Girders 10 joined by a 12½ in. Braced Girder. The upper ends of Girders 10 are, in turn, joined by two 3½ × ½ in. Double Angle Strips to which a 3½ in. Braced Girder is bolted. Also fixed nearer the opposite ends of Girders 9 are two Corner Gussets in which a 4 in. Rod is held by Collars. Mounted on this Rod are two 9½ in. Angle Girders 11, connected by a 3½ in. Strip, and two 12½ in. Flat Girders 12, the other ends of which are bolted to inside Girders 10. Flat Girders 12 are themselves connected by a 3½ × 2½ in. Flanged Plate 13, as shown.

A further 9½ in. Angle Girder 14 is bolted to each Girder 11 through its third hole, the two Girders being held apart further up by a 2½ in. Strip and a 3 in. Strip 15, arranged as shown. Girders 11 are joined by two crossed 5½ in. Strips. Two 18½ in. Angle Girders 16 and 17 are next attached one to the top of Girder 11 and the other to the top of Girder 14, the securing Bolts fixing a 3½ in. Strip 18 between the Girders and at the same time helping to fix a 1½ in. Corner Bracket 19 to the top of Girder 14. Girders 16 and 17 are bolted together at one end, bracing Strips being added further back as shown. Girders 16 at each side are joined by two crossed 3½ in. and two crossed 4½ in. Strips 20, while a 1½ in. Strip is bolted through the third holes from the ends of Girders 17. A 2 in. Rod, carrying a 1 in. loose Pulley 21, is held by Collars in the end holes of these Girders, while similarly held in two of the jib bracing Strips, is a 3 in. Rod carrying two 1 in. loose Pulleys mounted between two 8-hole Bush Wheels 22. An identical Pulley/Bush Wheel arrangement 23 is mounted on a 3½ in. Rod held by Collars in Strips 18.

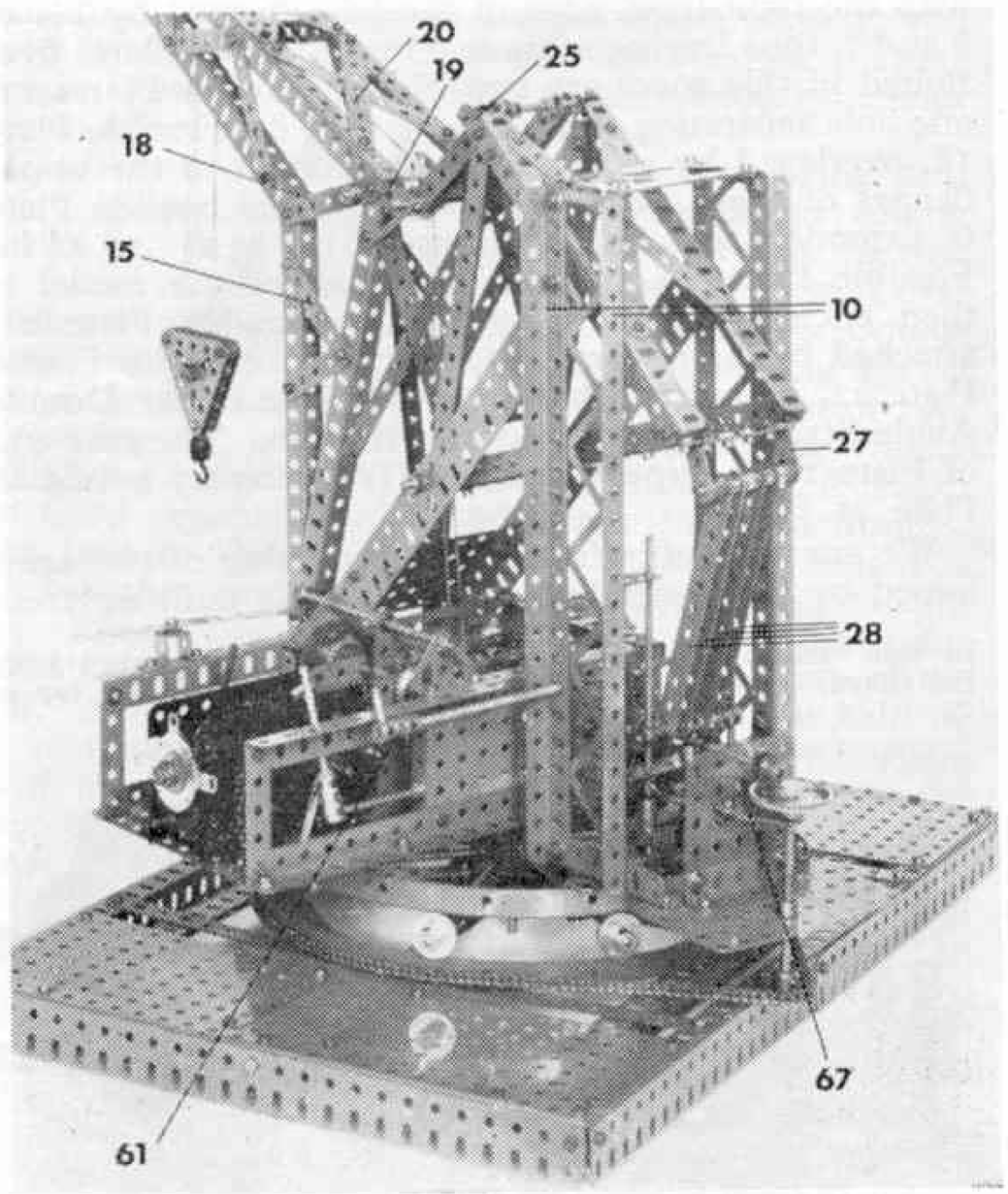
At this stage, two triangular constructions 24 are each built up from three 7½ in. Angle Girders, one of which is extended one hole by a 1½ in. Strip 25. The triangles are then joined by crossed 5½ in. Strips down each side and by an additional 3 in. Strip 26 in two cases. A further 3 in. Strip is bolted to the ends of one pair

The magnificent re-built version of the giant Pontoon Crane which was first featured in the March 1925 issue of Meccano Magazine.



Below, a rear view of the general superstructure showing the relation of the main and secondary gearboxes to each other.

of Girders and to this are fixed two 1 × 1 in. Angle Brackets 27, in the free lugs of which a 2½ in. Rod is journalled. Mounted on this Rod, in order, are four Washers, a Collar, a 5½ in. Strip, a second Collar then a second 5½ in. Strip followed by two more Washers, a further Collar, two further Washers and a third 5½ in. Strip. A fourth Collar and Strip are added, then a final Collar and four last Washers. The Strips, numbered 28 in the accompanying illustrations, must be free to turn on the Rod.



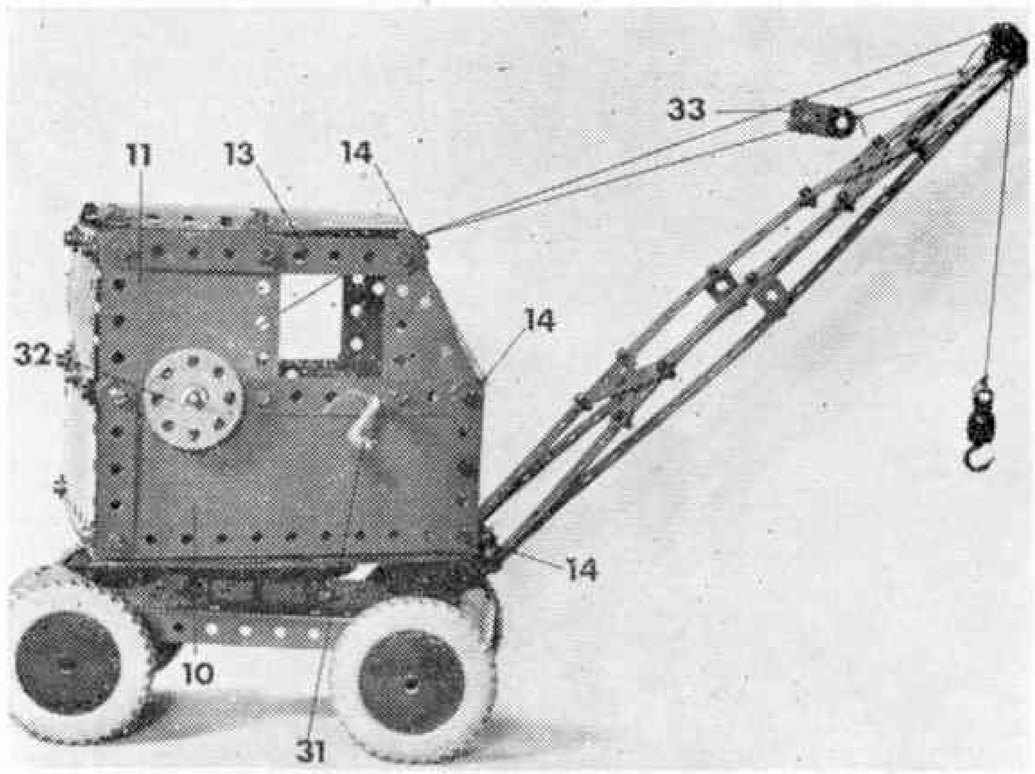
Held by Spring Clips in Strips 25 is a 3½ in. Rod on which four 3½ in. Strips 29, arranged in pairs, are held by Collars. The Strips in each pair are themselves separated by a Collar and, like Strips 28, they must be free to move on the Rod.

The completed triangular box is now positioned in the model, a 4½ in. Rod 30 being passed through the unused corners of the triangles and through the centre holes in Flat Girders 12 to be held by Collars. Strips 29 are then held by Collars on a 3½ in. Rod 31 journalled in Corner Brackets 19, and this should leave Strips 28 dangling at the rear, to be secured later.

Next month's Meccano Magazine concludes the Pontoon Crane. The Motor, Gear, Pulley Blocks and Roller Race assembly are described together with operating instructions.

PARTS REQUIRED:

2—1	2—15a	242—37a	3—76
3—1a	7—16	218—37b	1—94
13—2	4—16a	80—38	1—95a
2—2a	1—16b	1—40	1—96
11—3	2—17	1—45	1—96a
7—4	1—18a	8—48a	1—97
6—5	2—18b	4—48b	2—99
3—6a	8—20b	1—48c	4—103a
6—7a	2—22	2—52	4—103b
8—8	7—22a	5—52a	2—108
10—8a	1—23	1—53	1—109
6—8b	4—24	1—53a	2—111
2—9	6—26	2—57c	4—111a
5—9a	1—26a	62—59	3—111c
1—9d	1—26b	4—62	2—126
1—9f	4—27a	3—63	3—126a
4—12a	2—28	3—63d	2—133
1—13	4—30	2—70	2—167b
3—13a	3—31	1—72	2—173
12—15	10—35	2—73	1—E15R Motor



Built with Meccano Outfit No. 4, this simple Mobile Crane is fitted with full working features.

MOBILE CRANE

by Spanner

A realistic working model built with parts contained in Meccano Outfit No. 4.

PERHAPS MOST frequently featured in Meccano Magazine over the years have been models based on cranes of one sort or another. Some years ago I might have thought that this frequency would bore or even upset readers, but experience has shown that a regular supply of cranes is necessary. This, I have discovered, is because cranes make excellent subjects for Meccano models and, as such, are highly popular with almost everybody. For those who do not share the same tastes, however, and who understandably tend to be disturbed by their frequent appearances, I should point out that not everybody owns a similar-sized Outfit. As we must cater for as many as possible, it means that we must present a good variety of the same type of model, but ranging in size from small to large.

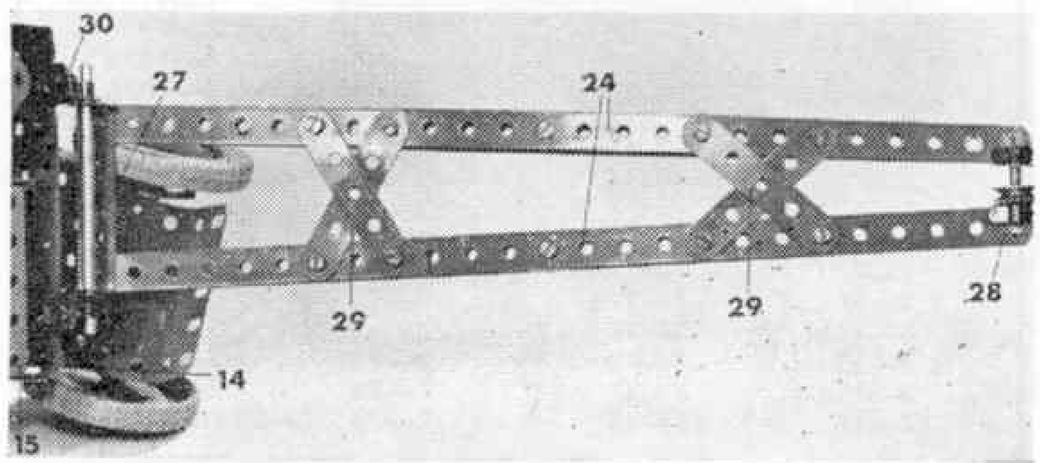
Having explained all this, I can now pass onto the model featured here. Even if you had not seen the accompanying pictures, you will have guessed from the above that it is a crane, the photographs showing it to be one of the mobile sort. Not to be confused with the giant Pontoon Crane described elsewhere, it is, in fact, a very good example of a Mobile Crane which can be built from Meccano Outfit No. 4. The chassis consists of a $5\frac{1}{2} \times 2\frac{1}{2}$ in. Flanged Plate, to the side flanges of which two Flat Trunnions 1 and two Semi-circular Plates 2 are bolted. Journalled in the centre vertical holes of these are two $3\frac{1}{2}$ in. Rods on the ends of which $2\frac{1}{2}$ in. Road Wheels are mounted, as shown. A $2\frac{1}{2} \times 1\frac{1}{2}$ in. Flexible Plate 3, attached to the top of the Flanged Plate, projects at one end while a "U" section Curved Plate 4 projects at the other. Also bolted to the top of the Flanged Plate are two $\frac{1}{2}$ in. Reversed Angle Brackets, to the upper lugs of which a 3 in. Pulley 5 is fixed.

Turning, now, to the body, two $4\frac{1}{2} \times 2\frac{1}{2}$ in. Flat Plates 6 and 7, a distance of one hole separating them, are connected by two $5\frac{1}{2}$ in. Strips 8, then a 3 in. Pulley 9 is bolted beneath them. A cab is next built up separately, each side consisting of a $5\frac{1}{2} \times 2\frac{1}{2}$ in. Flexible Plate 10, one edged by two $5\frac{1}{2}$ in. and two $2\frac{1}{2}$ in. Strips, and the other just by two $5\frac{1}{2}$ in. Strips. Bolted to Plate 10 are a $2\frac{1}{2} \times 2\frac{1}{2}$ in. Flexible Plate 11 and a $2\frac{1}{2} \times 1\frac{1}{2}$ in. Triangular Flexible Plate 12, the tops of which are joined by a $4\frac{1}{2}$ in. compound strip 13, obtained from two $2\frac{1}{2}$ in. Strips. When completed the sides are joined, at the front by three $2\frac{1}{2} \times 2\frac{1}{2}$ in. Double Angle Strips 14 and a $2\frac{1}{2} \times 1\frac{1}{2}$ in. Flanged Plate 15, and at the rear corners by a further two $2\frac{1}{2} \times \frac{1}{2}$ in. Double Angle Strips. The roof consists of a $2\frac{1}{2} \times 2\frac{1}{2}$ in. Plastic Plate and a $2\frac{1}{2} \times 2\frac{1}{2}$ in. Curved Plate 16 attached to the sides by Obtuse Angle Brackets, while the windscreen is a $2\frac{1}{2} \times 2\frac{1}{2}$ in. Transparent Plastic Plate bolted to upper Double Angle Strip 14.

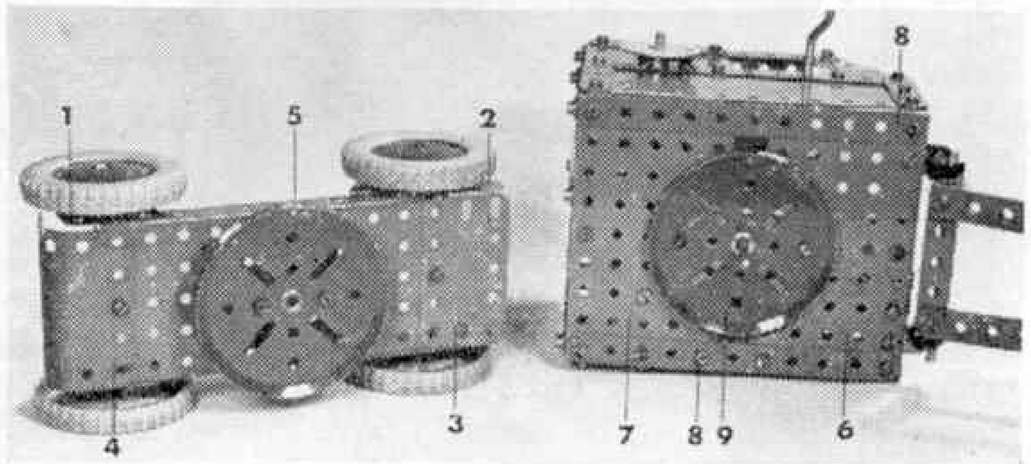
At this stage, the cab is attached to Flat Plates 6 and 7 by Bolts passed through lower Double Angle Strip 14 and the corresponding Double Angle Strip at the rear. Note that the right-hand side of the cab coincides with the right-hand edge of the base formed by Plates 6 and 7, thus leaving some two inches of the Plates free. Bolted in this space are two Flanged Sector Plates 17, one hole separating them. A $5\frac{1}{2} \times 1\frac{1}{2}$ in. Flexible Plate 18, overlayed by a Trunnion 19 is fixed to the upper flanges of these Sector Plates, while the outside Plate is extended two holes rearwards by a $2\frac{1}{2} \times 1\frac{1}{2}$ in. Flexible Plate 20. The entire back of the model is then enclosed by a $4\frac{1}{2} \times 2\frac{1}{2}$ in. Flexible Plate 21, attached by Angle Brackets, and a $2\frac{1}{2} \times 2\frac{1}{2}$ in. Plastic Plate 22, bolted to Plate 21 and to the upper Double Angle Strip joining the sides of the cab. The rear end of Plate 18 is trapped under a Trunnion 23 bolted to Plate 21.

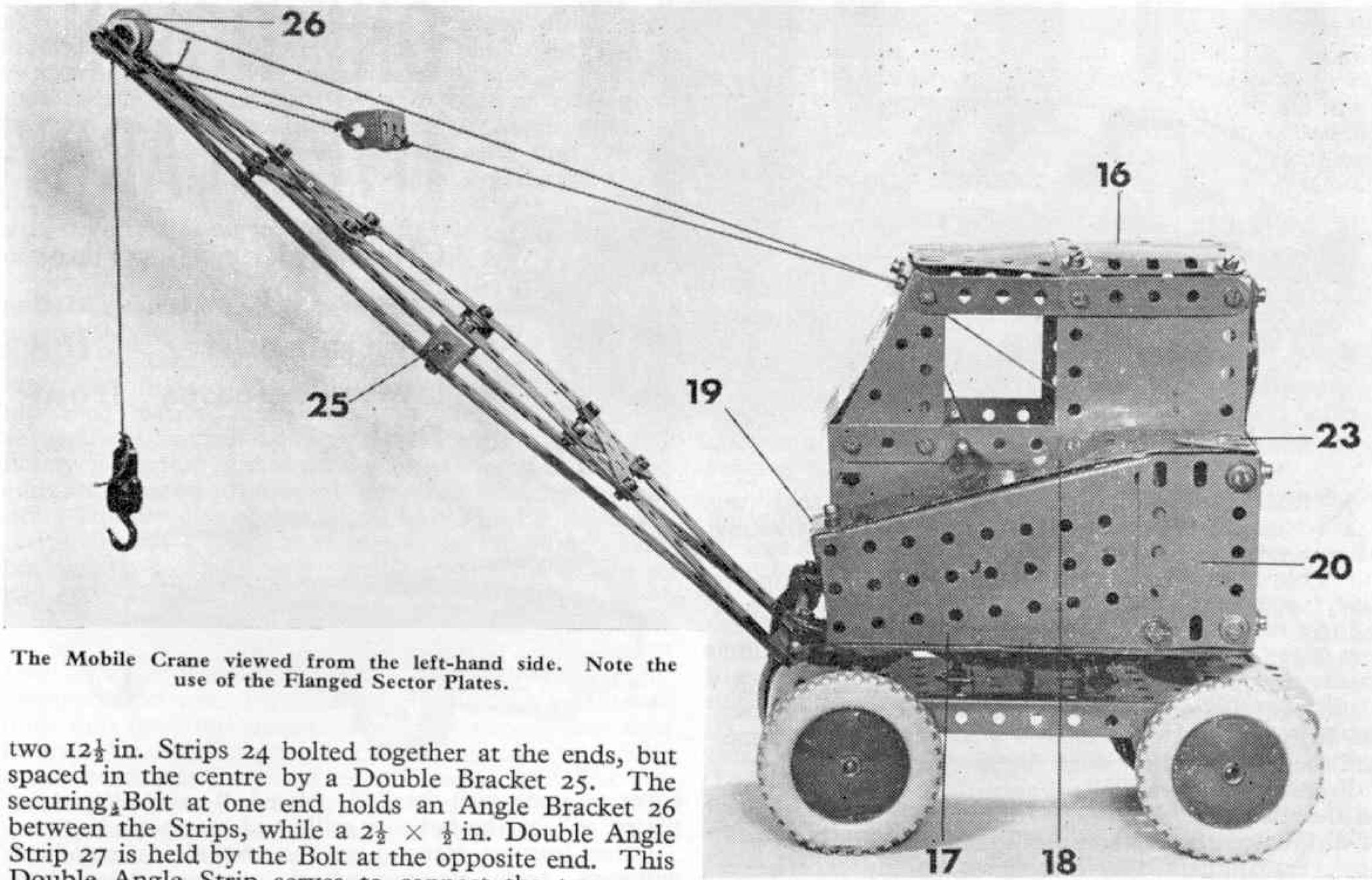
We are now left with the jib, consisting of two arms joined by cross-members. Each arm is built up from

A close-up view of the jib, from which the operating Cord has been removed.



In this view of the model, the body has been removed from the chassis to show the underside of the former and the top of the latter.





The Mobile Crane viewed from the left-hand side. Note the use of the Flanged Sector Plates.

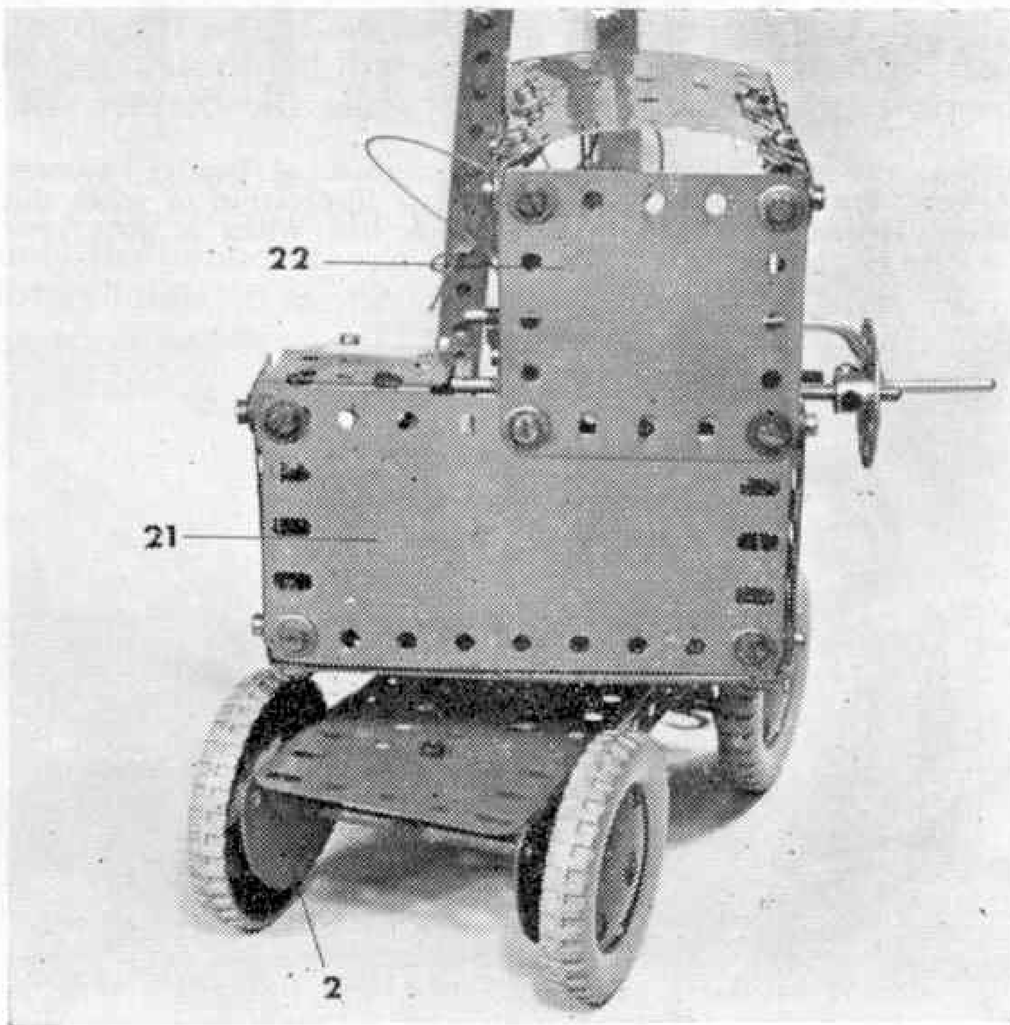
two 12½ in. Strips 24 bolted together at the ends, but spaced in the centre by a Double Bracket 25. The securing Bolt at one end holds an Angle Bracket 26 between the Strips, while a 2½ × ½ in. Double Angle Strip 27 is held by the Bolt at the opposite end. This Double Angle Strip serves to connect the two arms which are also connected at the opposite end by a 1 in. Rod carrying a ½ in. loose Pulley 28 and held by Spring Clips in Angle Brackets 26. The cross-members are supplied by two sets of two 2½ in. Strips 29, bolted as shown between upper Strips 24, then the finished jib is pivotally connected to the body by a 3½ in. Rod, passed through the lugs of Double Angle Strip 27 and held by Spring Clips in Angle Brackets 30. These Angle Brackets are bolted to upward-bent Fishplates which are in turn bolted to Plates 6 and 7.

Two control rods are now added, both being held by a Spring Clip in the upper 5½ in. Strips edging Plates 10. A 3½ in. Crank Handle 31 serves as the first of these, carrying the Hook Cord which is passed over Pulley 28 and threaded through a hole in upper Double Angle Strip 14 to be tied to a Cord Anchoring Spring fixed on the Crank Handle. The other control rod, operating the jib itself, is a 4½ in. Rod on one end of which an 8-hole Bush Wheel 32 is mounted. A length of Cord attached to the Rod is also threaded through the hole in Double Angle Strip 14, after which it is tied to the centre of a 1½ × ½ in. Double Angle Strip 33. Short equal lengths of Cord tied to the lugs of this Double Angle Strip are connected to the arms of the jib. A stop for the Rod is supplied by a Bolt held by a Nut in Plates 10. The shank of the Bolt engages with a hole in the face of Bush Wheel 32, therefore the securing Spring Clip on the Rod should be so positioned that it allows the Rod to be slid in its bearings.

Finally, the completed cab and jib assembly is attached to the chassis by a 1½ in. Rod 34 held tight in the boss of Pulley 9. The Rod is passed, free, through the boss of Pulley 5 and the baseplate, being held in position by a 1 in. Pulley fixed on the Rod beneath the Plate.

PARTS REQUIRED:

4—1	1—18b	6—48a	4—187
6—2	2—19b	1—51	2—188
2—3	1—19g	1—52	1—189
8—5	1—22	2—53a	2—190
2—10	1—23	2—54	1—191
2—11	1—24	1—57c	2—192
8—12	6—35	6—111c	1—193a
4—12c	88—37a	2—125	2—194a
1—15b	81—37b	2—126	1—199
3—16	14—38	2—126a	1—200
1—18a	1—48	1—176	2—214
			2—221



A rear view of the model showing the layout of Plates 21 and 22.

ONE DOWN FIVE to CARRY

Chris Jelley describes a new G.T. model and car transporter — the latest releases from Dinky.

"NAME BRITAIN'S top high-performance car manufacturers," said Meccano's Marketing Manager to me recently.

"That's easy," I replied smugly, thinking of sports cars, "Aston Martin, Jaguar, Austin Healey, M.G. and Lotus!"

"What about Jensen?" he asked.

"Jensen," I said, "They're not British, are they?"

"Oh yes they are," he said—and he was right. Jensen are British, but I wonder how many readers, like me, had the idea that they were based overseas.

From time to time I have seen the occasional Jensen on the road and have long admired them as being cars of distinction, power and sleek good-looks. They are, however, comparatively rare sights, in my experience, and it is perhaps this rarity which made me think they were foreign. Whether this is the true reason or not, though, I was delighted to learn that they were British, and I was even more delighted to learn that Meccano are to produce a Dinky Toy version of the fabulous Jensen FF—the last word from the Jensen stable.

I say "are to produce," here, because at the time of writing the model has not gone into full production. By the time you read this, however, it should be on general sale, and, having already seen some test castings, I can assure you that it will be a first-rate Dinky, reproducing exactly all the visual lines of the real car. Action features will include opening doors and bonnet, steering, 4-wheel suspension and tipping backs to the front seats. Incorporated in the doors will be detailed panel inserts representing upholstery, while the bonnet will cover a very well-detailed, plated "engine." Also plated will be the radiator-grille and bumpers.

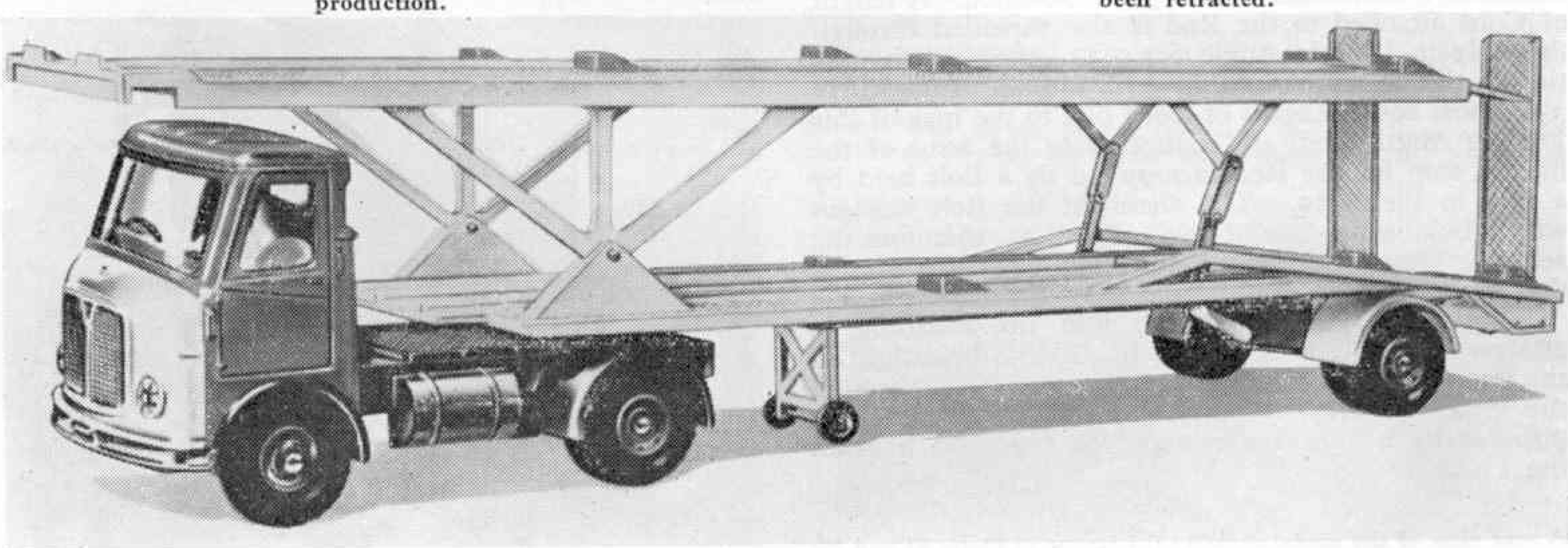
Above, the real-life Jensen FF—a mixture of beauty, power, performance and safety, and an artist's impression of what the Dinky Jensen FF, No. 188 will look like when it goes into production.

Other features planned are the now almost standard windows, seats, steering wheel, number plates, and jewelled headlamps. The number plates themselves will be the new-style items as first fitted to the Dinky E-type Jaguar 2 + 2, namely black lettering on a white background at the front and black lettering on a vivid yellow background at the rear. Finish for the model as a whole has not been finalised as I write this, but you may be sure it will be well up to Dinky Toy standard. When you buy the model, don't forget its Sales No. 188!

Sleek beauty

In real life, the Jensen F.F. is a picture of sleek beauty and a credit to its manufacturers, Jensen Motors Ltd., of West Bromwich, Staffs. If you are a fast car fancier, you'll love this one. You only have to look

Dinky Toy No. 947 A.E.C. Hoyner Car Transporter shown here unloaded, but ready for travelling once the bogey wheels have been retracted.



at it to know, instinctively, that it's packed with power and the facts would prove you right. Under the bonnet is a massive Chrysler V-8 engine of 6,276 c.c. capacity that develops a maximum power output of 325 b.h.p. at 4,600 r.p.m. to give the car a top speed in excess of 130 m.p.h. A 3-speed automatic transmission system is fitted as standard, but the thing which really sets the F.F. apart from all other cars of its type is the fact that the drive is taken, not just to the rear wheels and not just to the front wheels, but to all four wheels!

Yes, the Jensen F.F. is fitted with the revolutionary new Ferguson Formula 4-wheel drive unit (which presumably accounts for the letters "F.F." in the title of the car). This is a complete break-through in high performance motoring, and makes for greatly increased traction, control and thus safety at fast speeds, as well as improving road performance generally. Safety is further increased by power-assisted steering and an aviation developed anti-skid braking system using Dunlop disc brakes on all four wheels. In short, therefore, the F.F. is a tremendously powerful, fast, but safe car, comfortable to drive in and a dream to look at.

Talking of looks, incidentally, the F.F. is very similar in external appearance to its sister car, the Jensen Interceptor. As far as I can see, in fact, the only obvious differences between the two are the air-intakes built into the front wings. There are two at each side in the F.F., and only one in the Interceptor. The major mechanical differences, of course, are that the Interceptor is not fitted with 4-wheel drive and also usually incorporates a manual gearbox, although automatic transmission is available.

Car transporter

Moving on now, we come to the other new Dinky release, No. 974 A.E.C. Hoyner Car Transporter. This is an articulated model consisting of a double-decked car-carrying trailer coupled to a detachable A.E.C. tractor unit, the trailer being based on a widely-used piece of equipment produced by Hoyner Ltd., of Danbury, Essex. Before describing the trailer, however, I would like to quickly cover the tractor which is, in truth, the existing Dinky Unit. As you may know its features include windows, seats, steering wheel and jewelled headlamps, plus a special de-coupling device actuated by pressing an imitation fuel tank built onto the side of the chassis. This is an extremely useful device as it removes all possibility of the trailer becoming accidentally detached from the tractor, yet it allows them to be easily disconnected at will.

Turning to the trailer, we have a model that works just like the real thing with drop-down loading ramps, lowering top deck and retractable bogey wheels, the last to enable the transporter to be loaded when the tractor is uncoupled. The top deck is raised and lowered by imitation hydraulic rams controlled by a little lever beneath the bottom deck. When loaded the cars are held in place by removable chocks which clip on to the platform beds against the wheels, thus preventing the cars from rolling about.

The correct method of loading the transporter is fairly obvious. First of all the loading ramps are lifted to free them and are dropped down to ground level, then the upper deck is lowered until its rear end rests on the lower deck, its front end angled upwards. Any chocks in position are removed and a car is run up the ramps right to the front end of the deck. Chocks are fitted to hold it in place, then the sequence is repeated until the upper deck is full. Now, the deck is raised to its travelling position and the whole operation again carried out with the lower deck. Using small Dinky Toys such as the Ford Escort or the Mini Minor, the upper deck will hold three models and the lower, two, but, with larger models such as the Ford Zodiac, the capacities are two and two, respectively.

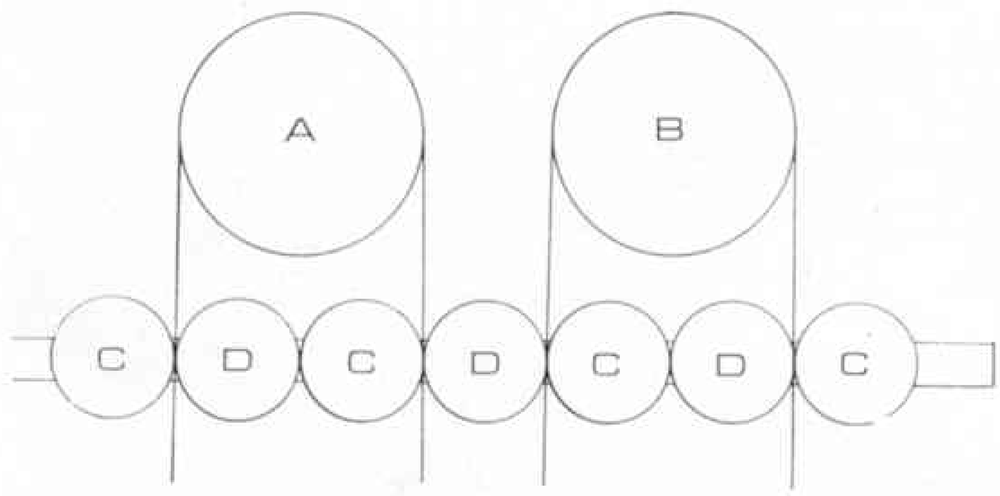
On the model I have, colour finish for the trailer is two-toned with yellow upper deck and orange lower deck and ramps, while the cab is blue with yellow chassis and cream interior. Although not shown in the accompanying illustration, both the tractor and trailer carry "Silcock & Colling Ltd." transfers, this company being one of the largest car delivery firms in the country. All in all, the model is highly realistic and really packed with play-value. You'll have "loads" of fun with it!

Among the Model Builders

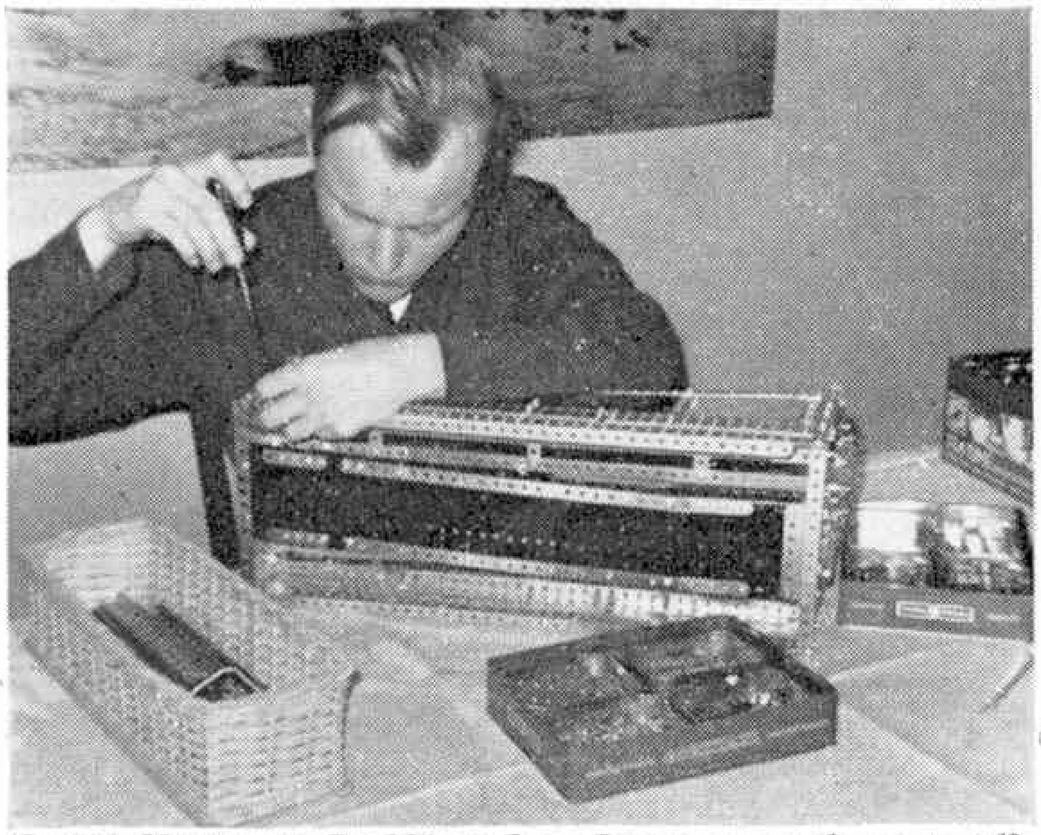
with Spanner—still on clocks

CLOCKS SEEM to be something of a habit with me these days! In the last two issues of Meccano Magazine clocks or parts of clocks have been featured in one guise or another, yet I make no apology for kicking off this month with yet another hint for clock builders—this time of the grandfather variety (the clocks, not the builders!). The idea comes from Edward Barklay of Willowdale, Ontario, Canada, who recently wrote to me. "I have found", he said, "That when one builds a model Grandfather Clock a slight swing of the weight is very likely to throw the Chain off the main drive Sprocket. This is even more prone to happen when the clock is of the self-winding type with a heavy weight. The mechanism I have designed (see accompanying diagram) although childishly simple, eliminates all possibility of the Chain jumping off the Sprocket."

"In operation the teeth of the 1½ in. Sprockets just press on the rim of the Bush Wheels, allowing the Chain to pass freely between the two parts, turning only the Sprocket. Any unwanted movement is therefore eliminated at the Bush Wheel and 1½ in. Sprocket,



A mechanism designed by Edward Barklay of Willowdale, Ontario, Canada, to eliminate all possibility of the Sprocket Chain jumping off the drive Sprockets in a weight-driven clock. Key: A—main drive 3 in. Sprocket; B—rewind drive 3 in. Sprocket; C—1½ in. Sprockets; D—Bush Wheels.



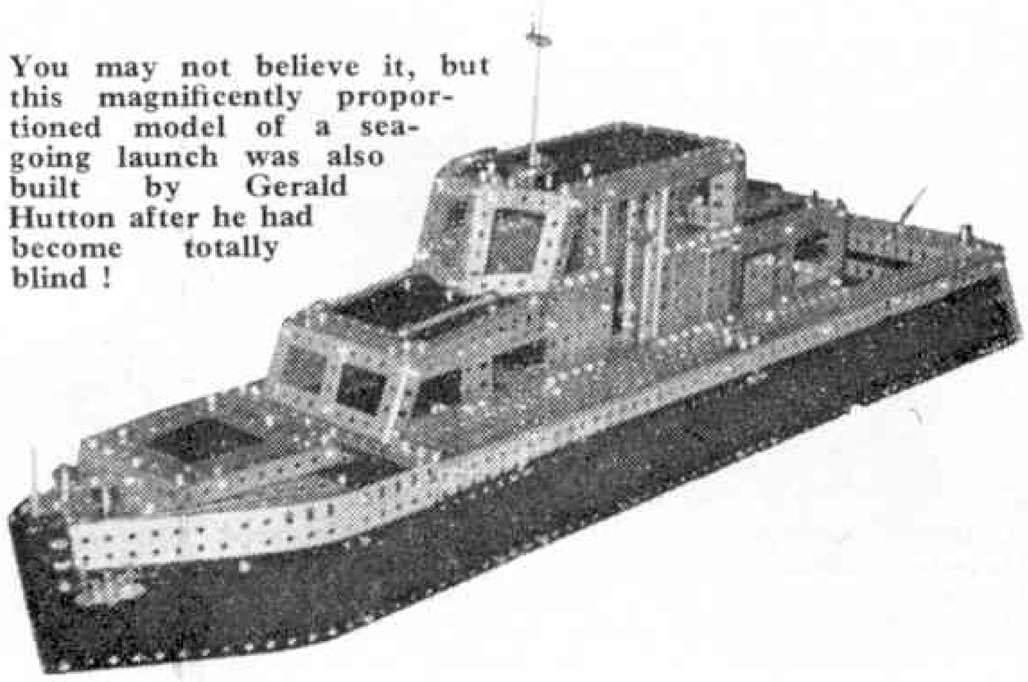
Gerald Hutton of Bexhill-on-Sea, Sussex at work on a self-designed model of a combined shed and greenhouse. See "A builder with a difference."

thus leaving the section of Chain between the main Sprocket and the smaller Sprocket and Bush Wheel exactly in line."

Edward's idea is not just a design he has worked out in theory without putting it to practical use, as is sometimes the case, for he goes on to say, "I have the mechanism fitted into a large astronomical clock and it works perfectly even though I am still constructing various parts of the clock." ("The proof of the pudding is in the eating", as the old proverb says!)

Robot modifications

To pass onto a different subject, the majority of Meccano builders produce models from the standard instructions books before they branch out into designing their own constructions. Undoubtedly, one of the most popular "manual models" with more advanced builders is the Robot featured in Leaflet No. 9.7 in the series of Special Model Leaflets for Outfit 9, but, while this model is not particularly difficult to build, it can be a bit tricky to operate successfully. Mind you, Meccano Limited's original model worked very well indeed, but Meccano have never claimed that their models could not be improved upon, and the Robot is no exception. In fact, Mr. D. Higginson of Stevenage, Hertfordshire, has sent me some details of three modifications he has made to this particular model to improve both its operation and appearance. Only a few extra parts are needed.



You may not believe it, but this magnificently proportioned model of a sea-going launch was also built by Gerald Hutton after he had become totally blind!

The first alteration is to the ratchet-type brake mechanism at the rear of each foot preventing the foot from moving backwards when the opposite foot moves forwards. The existing ½ in. Pinion 26 on the rear axle is replaced by a Ratchet Wheel spaced from one side of the foot by a Washer. A Pawl with boss is then mounted free on a ¾ in. Bolt, locked by Nuts in the rear end hole of the same side, the Pawl engaging with the Ratchet Wheel. In other words, the existing built-up pawl-and-ratchet arrangement is replaced by the much more positive "proper" arrangement. A very simple idea, which, as Mr. Higginson puts it, ". . . is solid and really locks the feet when the model is in motion. I found that the method shown in the leaflet slipped and the model tended to fall."

He goes on to say that, "The second improvement is to strengthen the drive to the legs by replacing the two 1½ in. Sprocket Wheels (96) with 1½ in. Sprockets (95a) to which Bush Wheels are bolted. A Bush Wheel is also bolted to the 2 in. Sprocket (95) driving the Rod carrying the upper 1½ in. Sprocket." These Bush Wheels, of course, serve as extra bosses for the Sprockets, thus minimising the danger of the Sprockets slipping on the Rods when fitted with Grub Screws. Note, incidentally, that the Set Screw in the boss of the lower 1½ in. Sprocket must be replaced by a Grub Screw, part 69c, as the head of the Set Screw strikes against the adjacent 5½ × ½ in. Double Angle Strips.

Both the above ideas have been to improve the operation of the Robot, but Mr. Higginson's third and final suggestion is an improvement to its appearance. It consists of nothing more than giving it illuminated eyes which is achieved quite simply by substituting Elektrikit Lamp Holders, with lamps, for the existing 1 in. Pulleys. The Holders are wired in series and connected direct to the terminals of the driving Motor.

The extra parts required to effect all three alterations are as follows:

3—24	2—111	2—539
4—69c	2—147a	2—540
2—95a	2—148	1—558

A builder with a difference

Featured on this page is an illustration showing Gerald Hutton of Bexhill-on-Sea, Sussex, working on a model of a combined shed and greenhouse he has since built. On the face of it you might think that there is nothing unusual about this, and there wouldn't be—except that Gerald has been totally blind for the past two years! Now you know the situation, take another look at the photographs and I think you will agree that the detail and dimensions of the models shown are really amazing under the circumstances.

It turns out that Gerald was a keen Meccano enthusiast for something like 18 years until his sight began to fail him. He thought at the time that his model-building days were over as, indeed, they probably would have been if he had not gone to the Blind Rehabilitation Centre in Torquay. There, much to his surprise—and ours, as well—he again came into contact with Meccano, certain parts being used to help in the work of the Centre. Gerald stresses, incidentally, that the Centre is not a training school in that members do not go straight onto work when they leave. It is, he points out, purely a rehabilitation centre where blind people are taught self-confidence and are shown that they can become ordinary, hard-working members of society. This is where Meccano comes in handy.

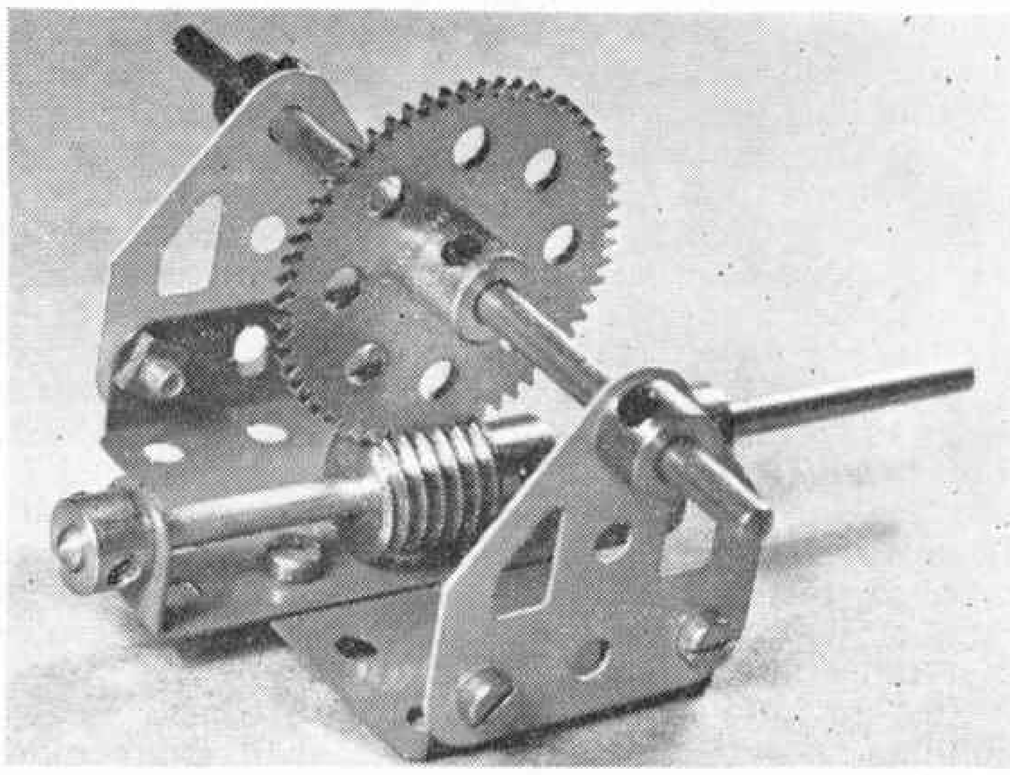
Mind you, members do not build models in the accepted sense, but are given patterns constructed from various Strips, Plates and Girders which they must

copy. " I believe the whole idea of the exercise ", says Gerald, " Is to find out how we can work out the shapes of a pattern, and then copy it ". It is done, he goes on to say, " More or less on the same lines as the assembly line in a factory," and he adds that " I must admit all this is a jolly good idea to see how patient one is when confronted with the various patterns."

The " Meccano Section " is only a small part of the excellent work done down at the Blind Rehabilitation Centre in Torquay, but it was sufficient to show Gerald Hutton that he could still enjoy his old hobby. The accompanying pictures prove how successful he has been and, in addition to the models shown, he has built numerous others from the old-style Instructions Manuals containing written building instructions. How does he do it ?—By copying the instructions in Braille and working out mental illustrations to go with them. That's genuine skill !

DRIVE ON

Spanner looks at the methods and linkages used in the driving of Meccano models



The Meccano Worm Gear No. 32 has a rating of 1, therefore, when it is meshed with a Gear, you immediately have a ratio as high as the number of teeth on the Gear. Here, we see a Worm meshing with a 57-teeth Gear to result in a 57 : 1 ratio.

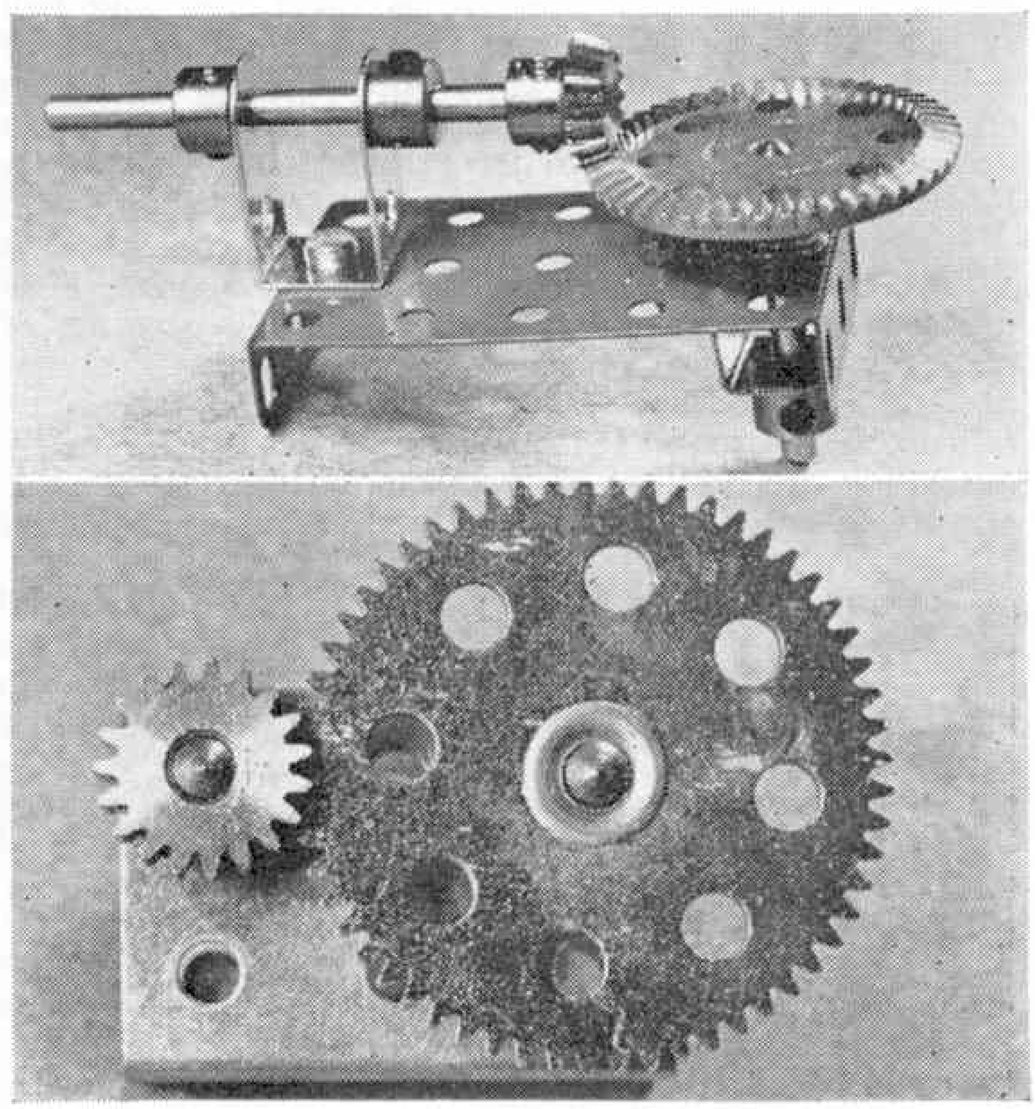
WHENEVER I feature working models in the M.M. I describe, almost in passing, how they are driven: X is connected to Y; this Pinion meshes with that Gear, and so on—stark building instructions, all, without any theory to explain why it is done. This is as it should be in constructional articles, but it's worth pausing here to take a general look at the various methods of driving or, more correctly, the various methods of transmitting drive in Meccano models. " Transmitting " is the operative word because, as far as Meccano is concerned, there are only two actual drive sources—manual and motor.

For the purposes of this article, the drive source is not important. What we are interested in is how the drive is taken from the source to the point where it is applied, and what happens to the power on the way. Generally speaking there are four basic types of drive—direct, belt, chain and gear. Of these, the last three are closely related to the final output power as well as the speed of the drive system, as we shall see.

Direct drive

First, however, let us look at the direct drive system which is certainly the most simple in operation, at the same time being the most limited in use. Direct drive is where the output shaft of the drive source, or an extension of the output shaft, serves also as the final drive for the operation being carried out. Assume, for example, that you have a simple crane in which the hook cord winding drum is provided by a Rod coupled direct to the output shaft of a Motor. This is direct drive as also are the manual winding operations in the Mobile Crane featured on page 498 of this issue. Here,

Below, top, a positive method of obtaining a right-angled drive is to use bevel gearing. Here we have a Meccano Bevel Gear 30a (16-teeth) meshing with Gear 30c (48-teeth) to give such a drive and, at the same time, a gear ratio of 3 : 1. Next, a gear ratio of 3 : 1 obtained by meshing a ½ in. Pinion (19-teeth) No. 26 with a 57-teeth Gear, No. 27a. These are two of the most frequently used gears in the Meccano system.



the power source is the operator, the final output shaft being the Crank Handle or jib control Rod, as the case may be. The drive is therefore direct from the operator to the Rod or Handle.

Belt drive

If direct drive is limited in use, however, perhaps the most frequently used drive method—particularly in smaller models—is the belt system. This, one of the oldest forms of drive transmission, is where a Pulley on the output shaft of the power source is connected to another Pulley on a second shaft by an "endless" belt, usually represented in Meccano models by a rubber Driving Band or a length of Cord with its ends joined. Immediately a minimum of two Pulleys have been introduced into the system it becomes possible to vary its final output power and speed by using Pulleys of different diameters. Imagine for instance, that the power source is a Meccano Motor and a ½ in. Pulley, Part No. 23a, on its output shaft is connected to, a 2 in. Pulley, No. 20a, on the final shaft of the system. The circumference of the 2 in. Pulley is four times greater than the circumference of the ½ in. Pulley, therefore the ½ in. Pulley will need to revolve four times in order to turn the 2 in. Pulley through one revolution. This results in a step-down reduction ratio of 4 : 1 between the Motor output shaft and the final drive shaft. If, on the other hand, the positions of the Pulleys were reversed, then the resulting effect would be a step-up ratio of 1 : 4 causing the final drive shaft to revolve four times faster than the output shaft of the Motor. A step-up ratio is fairly unusual in Meccano model-building, however, for reasons we shall study more closely when we look at gear drives.

Chain drive

While a belt drive is suitable for small or at least uncomplicated models, it has the disadvantage of possible "slip" between the belt and the Pulleys. Consequently it cannot be fully relied on to give a positive and accurate drive when the ratio to be produced is of critical importance—and this is where chain drive is invaluable. Meccano Sprocket Wheels and Chain serve the same purpose as the Pulley and belt system with the one important difference that, if mounted correctly, there is no slip between the Chain and the Sprockets. It therefore follows that the Sprocket on one Rod can be used to drive the Sprocket on another Rod at a definite rate.

Included in the Meccano system are five Sprocket Wheels, numbered 95, 95a, 95b, 96 and 96a, all of different diameters and all with a different quantity of teeth ranging from 56 down to 14. By using a combination of Sprocket sizes suitable step-up or step-down ratios can be obtained, the particular ratio being determined by the number of teeth on the Sprockets. For example, Part No. 96, with 18 teeth, connected to Part No. 95, with 36 teeth, would give a ratio of 2 : 1.

Turning to the Sprocket Chain, itself, this is numbered 94 and is supplied in 40 in. lengths with six links to the inch. When the required length for a particular job has been measured off, it can be easily separated by gently prising open the ends of one of the links with the blade of a screwdriver until the adjacent link can be slipped out. After rejoining, the ends of the opened link are carefully bent back again, care being taken to ensure that they do not grip the next link too tightly. The Chain should be passed around the Sprockets with the turned-over ends of the links facing outwards away from the Sprockets, as this will result in smoother running. Note that, in place, the chain must not be completely taut, but should have a very small amount of "play" in it to keep friction to a minimum.

Gear drive

We come now to gearing which is by far the most interesting and accurate method of transmitting drive in Meccano. First, however, let us take a look at the basic types of gears in general use today, of which there are five—spur, contrate, bevel, helical and worm. Of these, perhaps the most common are spur gears, used to transmit drive from one shaft to another running parallel to it. The Meccano range of spur gears includes Pinions numbered 25, 25a, 25b, 26, 26a, 26b, and 26c, plus Gear Wheels 27, 27a, 27b, 27c, 27d and 31. Remember though, that as far as working-out ratios is concerned, Pinions 25, 25a and 25b can really only be counted as one gear, all having a similar diameter and number of teeth. In fact, the only difference between them is their width or "face", the same thing applying to Pinions 26, 26a and 26b.

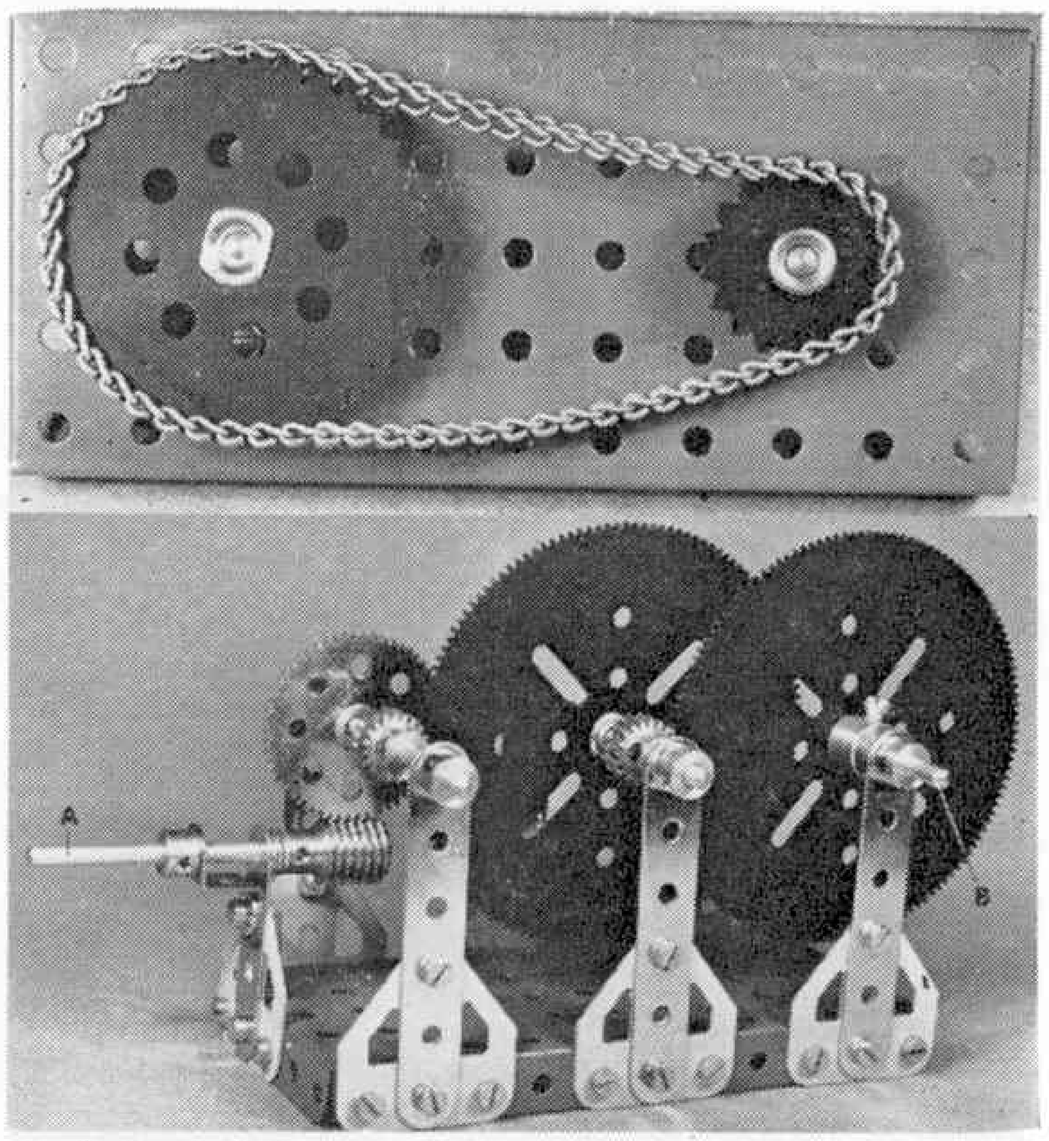
Bevel gears (represented in Meccano by Parts 30, 30a and 30c), contrate gears (represented by Parts 28 and 29), helical gears (Parts 211a and 211b) and worm gears (Part 32) all serve a similar purpose in that they are used to drive shafts positioned at right-angles to each other. Here the similarity ends, however. A Contrate is usually meshed with a Pinion, whereas Bevel Gears, like Helical Gears, can only be used together. Alternatively, a Contrate will mesh with a Pinion and a pair of Bevels with each other only when the Rods on which they are mounted are at right-angles to each other in the same plane. Helical Gears, on the other hand, will only mesh when the supporting Rods pass one at right-angles to the other in a different plane, this also applying to the Worm which will mesh both with Pinions and Gear Wheels.

Differences aside, it is gearing which really makes it possible to accurately increase or decrease the final output speed of a mechanism. If, say, a ½ in. Pinion with 19 teeth on one shaft is meshed with a 57-teeth Gear on a second shaft, a 3 : 1 reduction ratio will result, the second shaft revolving at one-third the speed of the first shaft. If the positions of the gears are reversed a step-up ratio of 1 : 3 results causing the second shaft to revolve three times as fast as the first shaft. As with Sprocket and Chain drive the ratio of any two meshing spur, bevel, contrate or helical gears is discovered by dividing the number of teeth on the smaller gear into the number of teeth on the larger.

If, in the above example, the speed reduction was insufficient for the job on hand, a second stage could be added. Suppose, in addition to the Gear, another ½ in. Pinion was mounted on the second shaft and meshed with a second 57-teeth Gear on a third Rod. A further 3 : 1 reduction would result between the second and third shafts therefore the overall reduction between the first and third shafts would be 9 : 1, a figure obtained by multiplying the two 3 : 1 ratios together. If a similar third stage were added, the overall ratio would be 27 : 1, thus: $3 \times 3 \times 3 = 27$. This type of arrangement employing more than a single stage (two gears) is known as a compound gear train.

So far we have been looking at gears in relation to speed but it is a matter of mechanical fact that a gear train also has a direct effect on power, the increase or decrease in power being inversely proportional to the increase or decrease in speed. To give an example, if a 3 : 1 reduction-ratio gear train, such as our first example above, was coupled to a Motor, the speed of the second shaft would be one-third that of the Motor

At right, top. An example of chain drive using Meccano Sprocket Wheels 95 (36 teeth) and 96 (18 teeth) connected by Sprocket Chain 94. A ratio of 2 : 1 results. Next, an example of a 3-stage compound gear train which gives the enormous reduction ratio of 2793 : 1 between the input shaft A and the output shaft B. The input shaft must revolve 2,793 times to turn the output shaft once, but the power at the output shaft is 2,793 times greater than at the input shaft.



output shaft, but the power output of the second shaft would be three times greater than the Motor shaft. In mechanical terms, for a reduction ratio of 3 : 1, the power ratio is 1 : 3 and this direct reversal always applies, no matter what the ratio.

By the same token, of course, if a step-up ratio of 1 : 3 is coupled to a Motor, the power ratio will be 3 : 1, meaning that the power output of the second shaft will be one-third that of the Motor shaft. For this reason, step-up ratios are rarely used in Meccano model-building, where the object of gearing is almost always to obtain increased power by "stepping-down." In many cases, in fact, the amount of reduction required is so great that, if ordinary Pinions and Gears were used, a multi-stage gearbox would be necessary—and this is where the Meccano Worm Gear comes in handy! This has a rating of 1, therefore, when it is meshed with a Gear, you immediately have a reduction ratio as high as the number of teeth on the Gear. If meshed with the popular 57-teeth Gear, for instance, the resulting ratio is 57 : 1 and with this sort of figure to start with you can soon increase the ratio enormously in very few stages.

Let us take an imaginary case starting with 57 : 1 and including only two more additional stages using a ½ in. × 19-teeth Pinion meshing with a 3½ in. × 133-teeth Gear Wheel in each case. The ratio between each Pinion and Gear is 133 divided by 19 giving 7 : 1. To find the combined ratio of the three stages we multiply the three separate ratios together, thus: 57 × 7 × 7. The final ratio, therefore is a staggering 2793 : 1! If you coupled the gear train to a Motor, the final shaft would turn very slowly, but just imagine the tremendous power it would have!

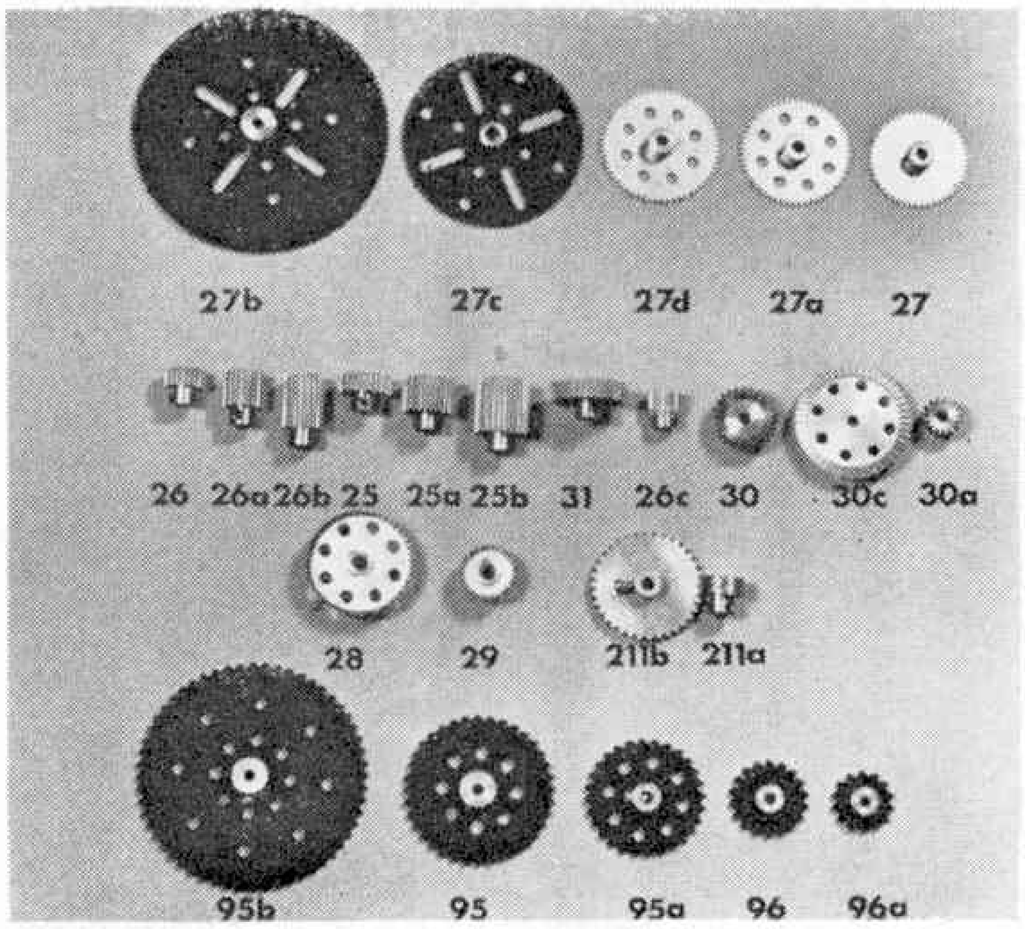
A few words now on things to look out for when fitting gearing to Meccano models. The most frequently used items in the range are the standard Pinions, numbered 25 to 26c, and the standard Gear Wheels, 27 to 27d. These of course have different diameters whereas the holes in Meccano Strips and Plates, etc., are spaced regularly every half-inch. Consequently some parts when mounted in line will not mesh with others. The rule, therefore, is that *Pinions and Gears will only mesh if the combined diameters of any two Parts add up to the round inch or half-inch.* For example, a ¾ in. Pinion will mesh with a 1¼ in. Gear because their combined diameters add up to a round 2 in., but the same Pinion will not mesh with a 1½ in. Gear because the sum of their diameters is 2¼ in. In the same way, a ½ in. Pinion 26 will engage with a 2½ in. Gear 27c, but not with a 1¼ in. Gear 27. Note that the 7/16th in. Pinion No. 26c will mesh only with the 60-teeth Gear No. 27d, and vice versa.

Finally, all Meccano gears, excluding the Worm, are reversible meaning that they can be used either as the driving or the driven gear. The Worm, however, cannot be driven by another gear and therefore *must always be used as the driver in any gear mechanism.*

MECCANO GEARS AND SPROCKETS

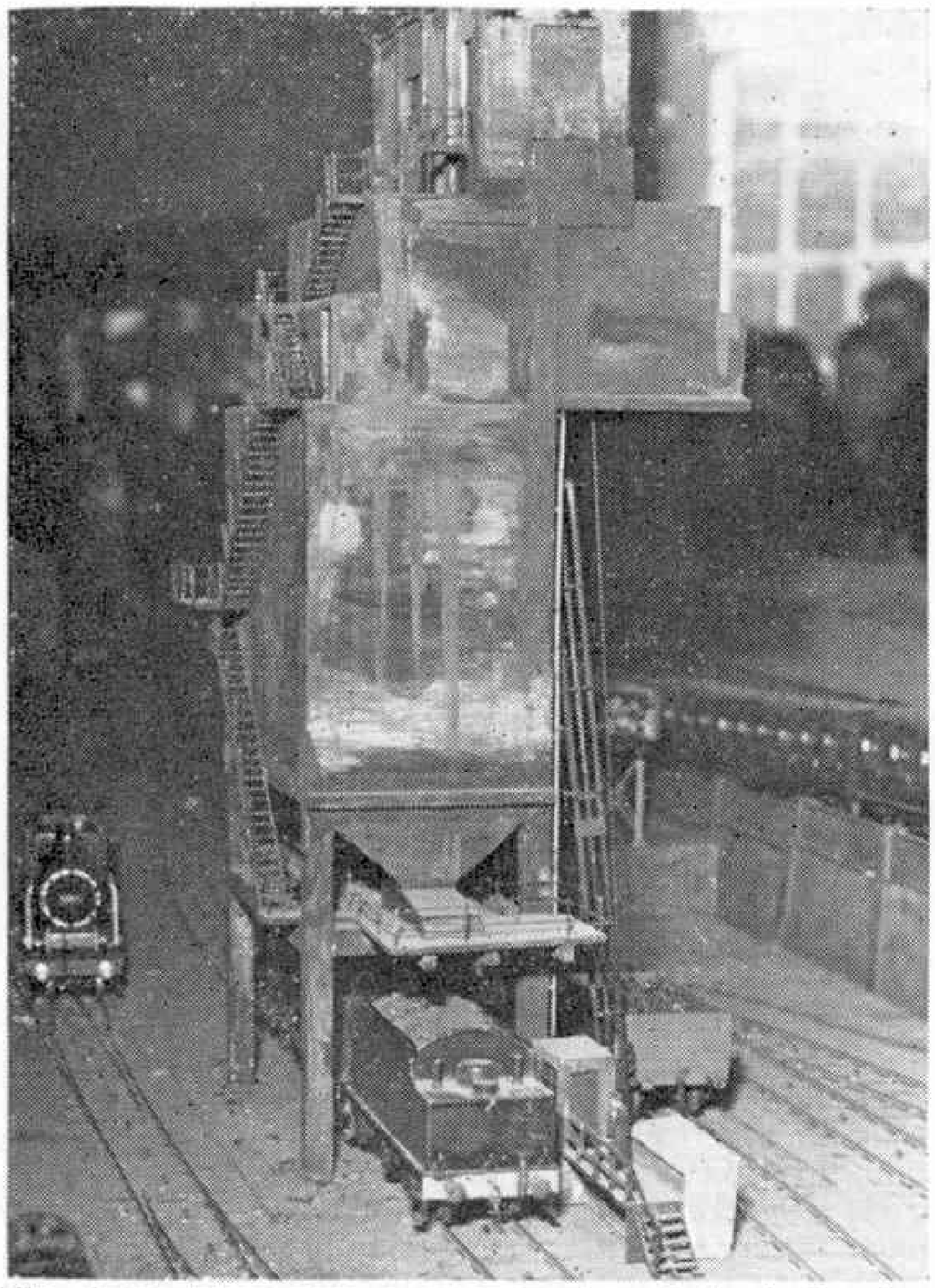
Part No.	Description
25	¾" diam. Pinion, ¼" face, 25 teeth
25a	¾" ,, ,, ½" ,, 25 ,,
25b	¾" ,, ,, ¾" ,, 25 ,,
26	½" ,, ,, ¼" ,, 19 ,,
26a	½" ,, ,, ½" ,, 19 ,,
26b	½" ,, ,, ¾" ,, 19 ,,
26c	7/16" ,, ,, ¼" ,, 15 ,,
27	1¼" diam. Gear Wheel, 50 teeth
27a	1½" ,, ,, ,, 57 ,,
27b	3½" ,, ,, ,, 133 ,,
27c	2½" ,, ,, ,, 95 ,,
27d	1½" ,, ,, ,, 60 ,,
28	1½" diam. Contrate Wheel, 50 teeth
29	¾" ,, ,, ,, 25 ,,
30	⅞" diam. Bevel Gear, 26 teeth
30a	½" ,, ,, ,, 16 ,,
30c	1½" ,, ,, ,, 48 ,,
31	1" ,, Gear Wheel, ¼" face, 38 teeth
32	½" diam. Worm Gear
95	2" diam. Sprocket, Wheel, 36 teeth
95a	1½" ,, ,, ,, 28 ,,
95b	3" ,, ,, ,, 56 ,,
96	1" ,, ,, ,, 18 ,,
96a	¾" ,, ,, ,, 14 ,,
211a	½" ,, Helical Gear
211b	1½" ,, ,, ,,

The Gears, Pinions and Sprocket Wheels contained in the Meccano system excluding No. 32 Worm Gear. See the list above for descriptions of the parts.



A.B.C. of Model Railways

LINESIDE FIXTURES FOR YOUR LAYOUT—BRING IT TO LIFE



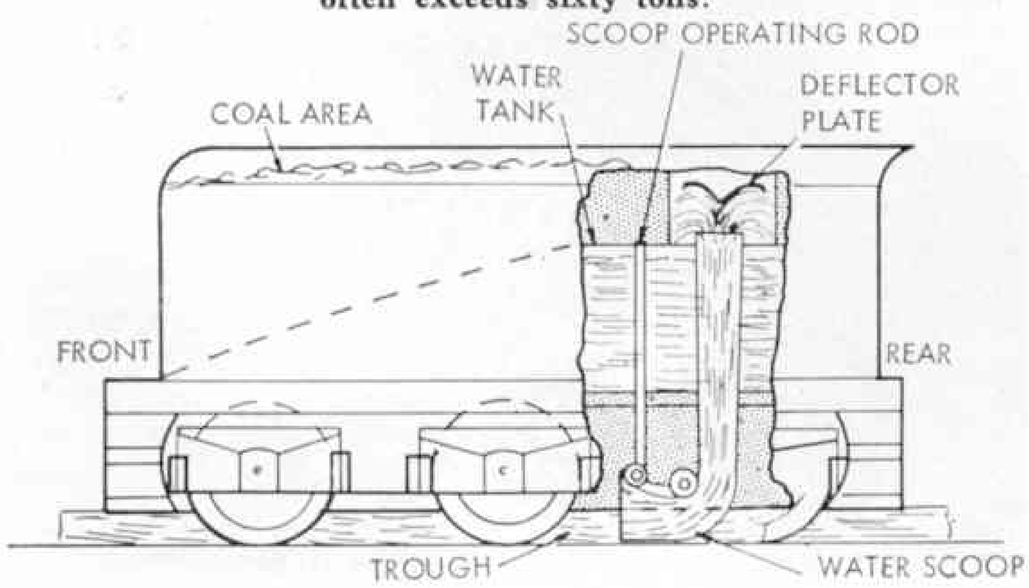
A true to scale Gauge "O" coal bunker on the West Lancashire layout. This model, built by R. C. Chown really works! The coal wagons are lifted up and the coal is then tipped into the waiting tender.

LAST MONTH, we looked at some of the interesting features which can be seen along the lineside and which, in model form, can be add a great deal of interest to a model railway layout. In this article, we shall take a look at some more details of much the same type.

Our first picture shows a large and complicated piece of railway equipment to be found at large motive power depots, but only very rarely seen in model form. It is a gigantic automtic coaling hopper, and the model illustrated stands on the layout of the West Lancashire O gauge group. These huge structures were built of concrete, and were able to replenish locomotive tenders with coal very quickly and entirely automatically. In the picture, the locomotive tender is in position below the tower; behind the tower can be seen a loaded coal wagon. When the controls in the small hut at the base of the structure are operated, the wagon is hoisted bodily to the top (the rails of the lift can be seen in the picture) where the wagon is turned over and its contents shot down the hopper into the waiting tender. The model in the picture actually works, but most people would be content with a non-working model, which would be quite easy to build in the usual balsa and card manner.

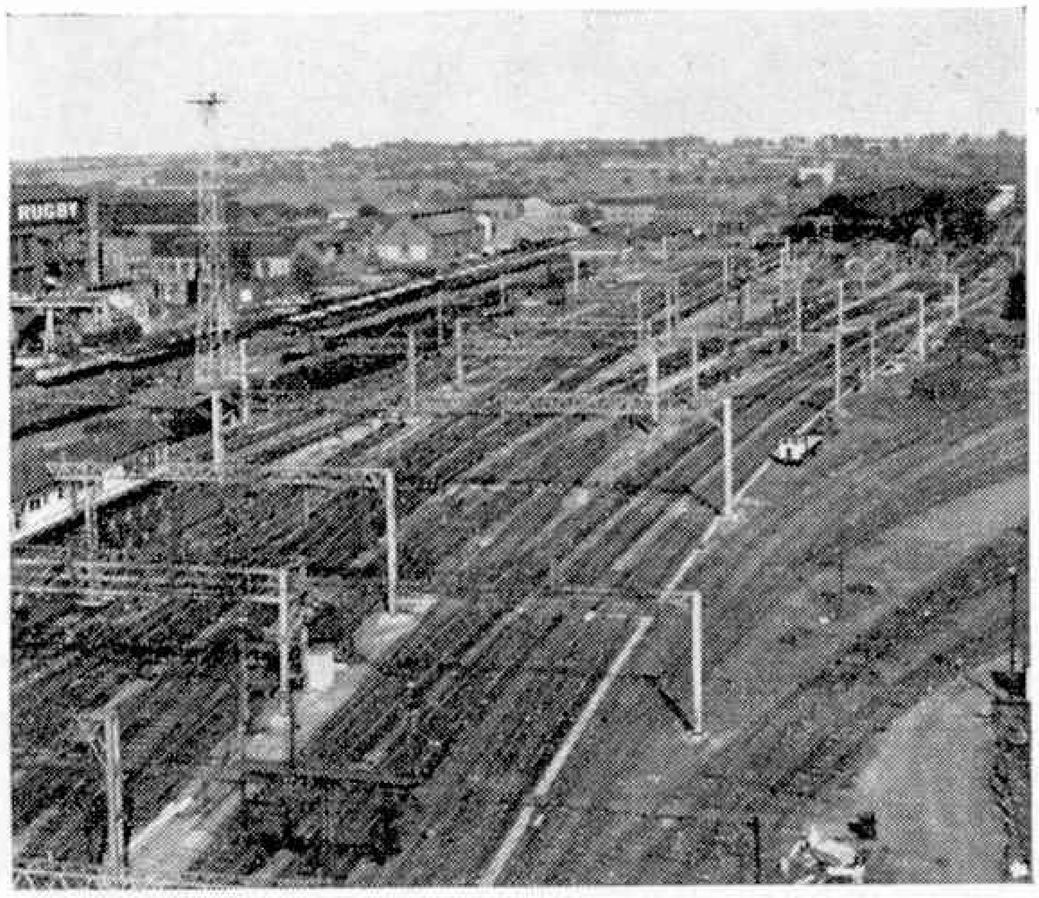
Our next photograph is an aerial one, of the junction just north of Rugby station on the London Midland region. This was taken during the installation of the overhead catenary equipment for the new 25,000 volt electric services, but there are all sorts of things in the picture which are of interest to us as railway modellers. In the mid distance on the right-hand side of the picture can be seen some coal staithes. These are really only huge fences made from old sleepers, used to retain heaps of coal which has been unloaded from railway wagons and await shipment by road to consumers.

The sketch below gives a cut-away view of the inside of a typical locomotive tender, fitted with water-pickup apparatus. This system was used by all the pre-Nationalisation railway companies except the Southern Railway (the Southern had no main line non-stop runs long enough to justify water troughs, although its express locomotives generally had large, high capacity tenders to compensate for their absence). As can be seen from the sketch, water is provided in a long shallow trough between the running rails of the track. When the locomotive reaches the troughs, the fireman lowers the scoop beneath the tender, by means of a controlling wheel on the tender front, and the water in the trough is forced up the vertical pipe by means of the sheer velocity of the train. As the water spurts out of the top of the pipe, it hits the specially shaped deflector plate which diverts it into the water tank inside the tender "body". The dotted line on the sketch indicates the limits of the water tank itself; the area above it is for coal. The reasons for the sloping floor to the coal space are to enable the fireman to shovel the coal from footplate level, and also to ensure that the coal works its way to the front of the tender, where it is needed. Needless to say, the water stored in the tender is fed into the locomotive boiler when needed, where it eventually becomes steam. Flexible pipes between engine and tender carry the water, which is virtually "sucked" along by a steam "injector", the workings of which will form the basis of a future article. The average main line steam locomotive tender carries about nine tons of coal, and no less than 4,000 gallons of water—the all-up weight of the tender often exceeds sixty tons.



WATER PICK-UP GEAR TENDER

BICC overhead equipment erected at the busy junction area just north of Rugby Station. The 100 foot floodlighting tower on the left is one of five supplied and erected by BICC. This photograph was taken prior to the replacement of the old signals and signal boxes by modern equipment.



Such staithes can be seen in many goods yards, although they are now fast disappearing in favour of highly mechanised centralised depots. No coal yard can be considered complete without the coal merchant's lorry, which can be seen in the picture just below the staithes themselves.

From the traditional coal yard, to the bang up-to-date. On the left of the picture is a 100 ft. tall floodlighting tower, which serves to illuminate the marshalling yard after dark, and enables operations to be carried out round the clock. Towers like this are becoming a common sight at modern yards, and would add a great deal of authenticity to a modern layout, especially if actual illumination could be arranged with miniature bulbs at the top of the tower. Has anyone tried it ? At the bottom right-hand corner of the picture can be seen the old-fashioned small lamp standards which are the forunners of the modern floodlight towers.

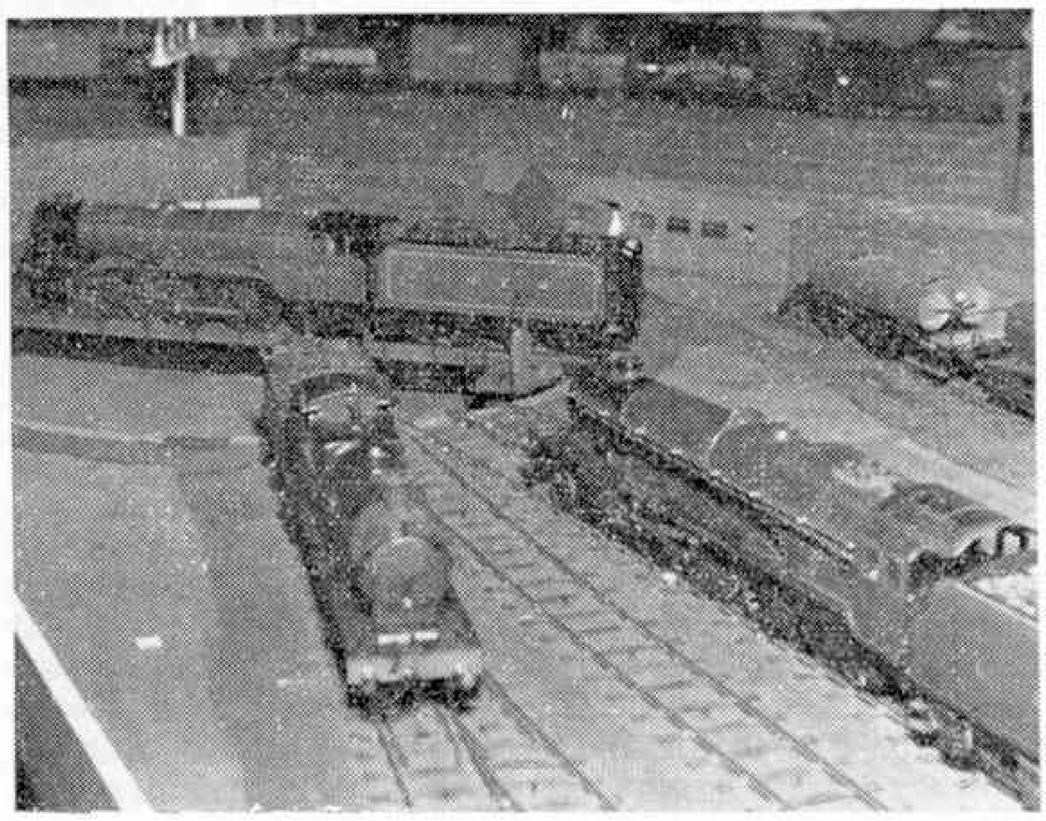
The third picture shows a shed scene on the layout of the West Lancashire O gauge Group. L.N.E.R. Pacific No. 4472 is being turned on the turntable, and the scene in general is most realistic. Just behind No. 4472's tender is an old coach body, minus its underframe, which is being used as a hut. The railways found that this was a most economical way of providing small buildings of this type, and a lot of very interesting old coaches and vans have survived for many years because of this habit. The railway modeller can take advantage of this by using old and discarded coaches for scenic effect in goods and locomotive yards. Incidentally, the coach body in the picture looks very much like an old steam railcar which was once operated by the Kent and East Sussex Railway. Does anyone know for sure ?

Here's another problem. Last month, when talking about the various " signposts " to be seen along the trackside, we described the warning board for water troughs. We have *never* seen water troughs on a model railway, and would like to hear from anyone who has tried it. Obviously they could not be made to actually work in a small scale, but there does not seem to be any reason why non-working ones should be difficult to build, on two-rail layouts at any rate. For those of you who do not know how these troughs worked, the diagram of a locomotive tender, showing the pick-up scoop should make things clear.

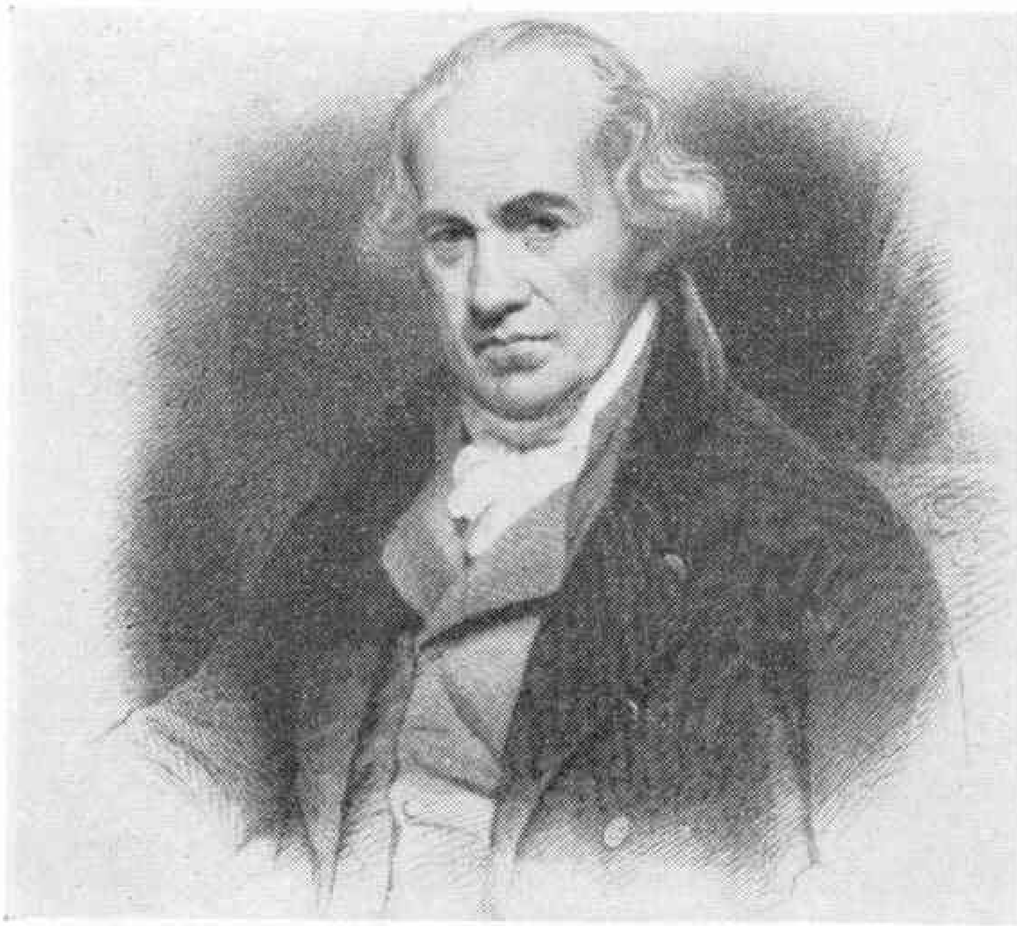
Not all railway " signposts " are entirely for the benefit of the railway crews themselves; some are intended for passengers, like the huge signs which say " LONDON 17 MILES " or " EUSTON 300 YARDS ". Then there are the huge train indicators at main line termini like Waterloo and Victoria, with their scores of little enamel nameplates and polished wood surrounds. Such an indicator would make an interesting " static " model, although it would look out of place on anything but a large multi-platform station.

Station nameboards are also of interest. If your layout is " with it " enough to represent present day practice, your nameboards will have to have black letters on a white background. Have you noticed that all modern railway nameboards and notices have the words spelt in " upper and lower case " letters ? That means that both capital and small letters are used, instead of all capitals. Thus the nameboard which used to read HEMEL HEMPSTEAD now says Hemel Hempstead. This is standard modern practice, which can be seen on most official signs on Motorways etc, and there is sound thinking behind the idea. Small or " lower case " letters vary in size and shape more than do capitals, and so words composd of them are easier to read in a hurry—quite important if you want to read the name of a station through which you are passing at eighty miles an hour. Older railway nameboards were always spelt in capitals, and during the Victorian and Edwardian eras some were very ornate indeed, with separate cast iron or wooden letters fixed to a board which was often painted in the passenger livery of the railway concerned.

Other notice boards which are worth looking for are those old " warnings to trespassers ". These are usually cast iron, and so have lasted very many years, and a lot of them still have the names of the old pre-grouping companies cast on them, like " South Eastern and Chatham Railway ", " London and North Western Railway " etc. etc. Similar warnings, also usually in cast iron, are those to be found guarding the approaches to road bridges and giving details of the maximum weights allowed for vehicles using the bridge. Some of the terms used on these boards sound quite picturesque these days—" Heavy Locomotives ", " Light Locomotives " etc. Plenty of these old notices survive to this day—there is probably one near your home.



An operating Gauge " O " turntable by the West Lancashire group. Note the old coach " shed " in the background and the detail on those locomotives.



GREAT ENGINEERS No. 8.

JAMES WATT

JAMES WATT was born in the Clyde estuary town of Greenock and his father was a carpenter, undertaker, ship-chandler and general merchant.

As a boy James was introduced to all of the tools of carpentry, thus gaining valuable experience at an early age. He also had a small forge in which he made metal models. He attended a local Grammar School, and then trained, in the manufacture of mathematical instruments but without a proper apprenticeship. At the age of 18 he was sent to Glasgow and worked for a self-assumed optician, who was actually a mechanic, selling and repairing spectacles, musical and drawing instruments. There was little prospect for him in this shop, so he arranged to go to London. Not having had a proper apprenticeship he was obliged to take a post with an instrument maker upon payment of a premium, the agreement lasting twelve months with no payment for his services. He was, of course, obliged to rely upon his father for financial assistance, but he was never a strong lad and the frugal conditions soon affected his health and after the agreed period of training he returned to Greenock.

At the age of twenty he returned to Glasgow, the intention being to set up business as a maker of instruments. But the local guilds were not helpful because of his un-orthodox apprenticeship. Eventually he was able to set up a workshop within the precincts of the University and was privileged to call himself "Mathematical Instrument Maker to the University". The friends he made here had a lasting influence upon his subsequent career.

At this time the steam engine existed. Indeed, Thomas Newcomen's engine of 1712 had a piston and cylinder, employing steam at atmospheric pressure. In 1763 Watt was given a model Newcomen engine to repair and this set his feet on the path that he trod for many years. The subject of steam power developed strongly within him and he would liked to have spent considerable time in experimenting, but the need to earn a living prevented this. Watt took employment, in addition to his workshop duties, upon the surveying of canals and land. His ideas were delayed because of this and it was not until 1769 that he took out his first patent. Then came into the picture Dr. Roebuck, a founder of the Carron Ironworks, bringing with him the facilities to make an experimental engine embodying Watt's patent. Further, Watt made contact with Matthew Boulton, a forward-looking manufacturer of Soho, Birmingham who displayed considerable interest in Watt's engine. He thought it would get him over his troubles in driving his machinery. Meanwhile the Doctor became involved in financial difficulties and Boulton took over Roebuck's share in the Watt patent.

The partnership between Boulton and Watt allowed for the former to meet expenses and keep accounts, and the latter to 'make drawings, give directions, and make surveys'. The first engine made under this agreement was supplied to John Wilkinson's ironworks at Broseley in 1776.

The Cornish mine owners became keenly interested, and in 1777 an order was obtained from the Ting-tang mine near St. Day, and during the next decade Cornwall became the main area for Boulton and Watt's activities. An engine was installed at Wheal Busy mine, near Chasewater, and Watt was particularly 'puffed up' about its performance . . . "the noise seems to convey great ideas of its power to the ignorant . . ." Payment for these engines was based upon the cost of one-third of the coal saved in comparison with that used by a Newcomen engine doing the same work. By the end of 1780 some forty engines had been built, more than half of them being for Cornish customers.

It seems odd that Watt, the master inventor, by now considered he had achieved his ambition and was ready to 'rest on his laurels'. He was forty-six and at the very height of his powers, yet he was in no hurry to follow up new applications for his engine. William Murdock, another engineer set to achieve fame, was working for the partners at this time and he was experimenting with a steam carriage. Watt took a dim view of this and wrote to Boulton: "I am extremely sorry that W.M. still busys himself with the Stm. Carriage . . .". Further, Watt did not seem to be in any haste to produce a rotative motion to his engine which hitherto was limited to a reciprocatory motion. But Boulton was of different material. He saw the wide-open fields available for an engine capable of turning machinery of every description—the pumping in Cornwall would not last for ever. He urged Watt accordingly. The many problems were not easy to overcome. The top and bottom dead-points (the end of the strokes) were overcome by the flywheel. Then Pickard's patent of the crank made it necessary to use a sun-and-planet motion. Some say Watt was the inventor, others that it was an invention of Murdock.

It would be difficult to enumerate, or to evaluate, here all of Watt's subsidiary inventions embodied in his steam engine. There was his favourite the parallel-motion, the governor for speed control and the indicator to slow pressure, to mention but three. It was Watt who established the unit of horsepower.

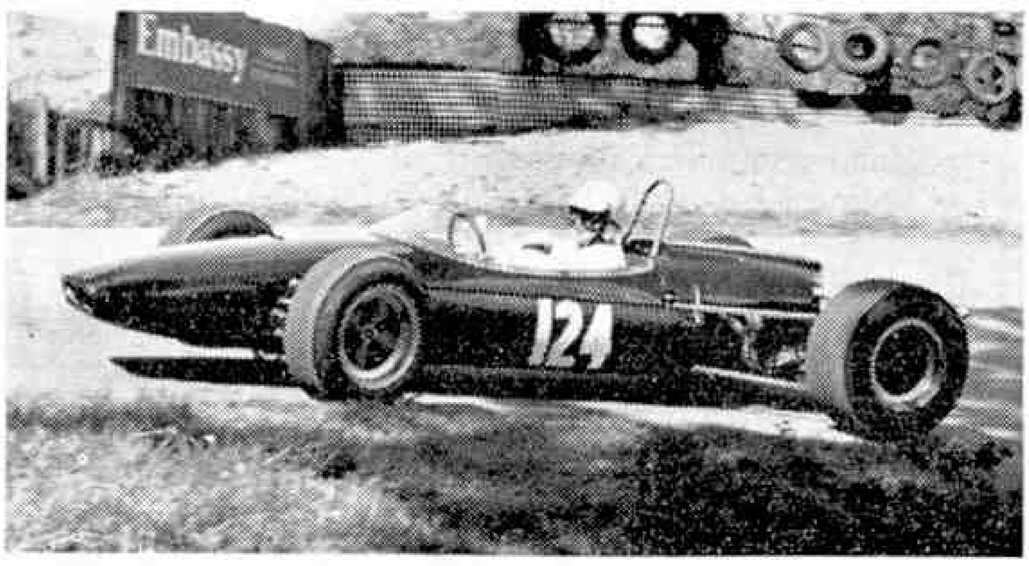
As Watt grew old he grew rather weary of the steam engine and found contentment in more simple things like gardening and reading. He moved to Handsworth, about twenty minutes' walk from Soho, where he bought 40 acres of land and built a modest mansion. Here he lived out his life. But he could not give up inventing entirely, now his hobby. He developed a copying machine and experimented with metals and chemicals. Here, too, he died after a short illness. Now he lies in Handsworth Church and is close to his 'most affectionate and steady friend' Matthew Boulton. What could be better ?

" The Start ". Note the traffic lights and the starter clock. A photo-electric beam operates across the starting line for precise timing of the cars.

PRESCOTT HILL CLIMB

by Edward G. Hodgkins

Peter Blankstone in a Brabham B.T.18 Cosworth Ford, takes the hairpin bend.



DEEP IN the heart of the Cotswolds, about eight miles from Cheltenham, lies the quiet, sleepy village of Gotherington. Very little ever happens in this pretty little place but five times a year the inhabitants are rudely awakened and sent scurrying off the streets by the roar of traffic. This is not just ordinary weekend joy-riding traffic either, but more like race traffic. Racing cars on trailers, high powered sports cars, vintage racing cars and the usual following of spectators normally associated with a motor race meeting. But there isn't a motor racing circuit within fifty miles of Gotherington, so where on earth are they all going to up there in the hills ! The locals know from bitter experience that these noisy, evil smelling towns people from all over Britain are heading for Prescott House, a mile or so away. This is the headquarters of the Bugatti Owners' Club and the Ferrari Owners' Club, with a mile-long drive which is a racing driver's dream. The drive climbs steeply from the road and possesses one 180° right hand bend—very tight,—one left-hand hairpin—even tighter,—and a very difficult ' S ' bend.

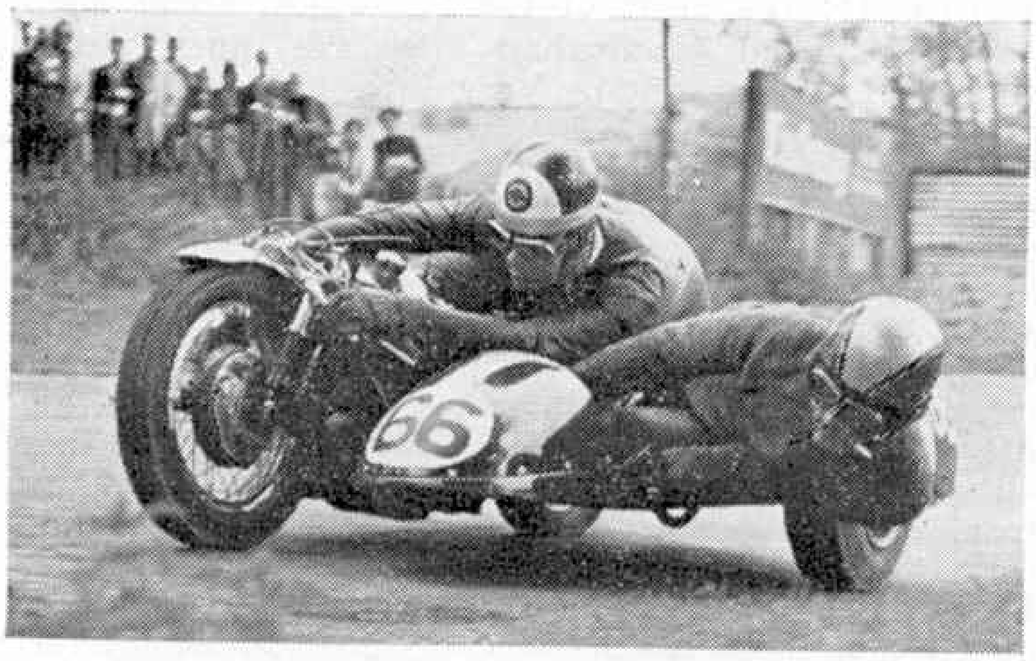
This glorious site is used five times each Summer for hill-climb events organised by the two host clubs. Two National Open Meetings, two closed Meetings for members only and one restricted Meeting take place each year, under the competition rules of the Royal Automobile Club and Auto Cycle Union. The actual course is taken over 1127 yards and the sole aim of the competitors is to reach the top in the shortest possible time from a standing start.

I had the pleasure of attending the first of the 1968 open events in May. This was the Wills Trophy Meeting, sponsored by W.D. & H.O. Wills, with 154 cars and motor cycle combinations taking part in a thrilling display of driving skill. The first thing that struck me on my arrival on the Saturday was the way the event was equipped. The start was marked by a photo-electric beam across the track which started a timing mechanism as soon as the car broke the beam. Another similar device at the finish stopped the clock and the time of each competitor was immediately known. Next, a stop-go " traffic light " was installed beside the starting line and operated from the timing hut. As soon as the track was clear for the next competitor, he was given the green light. The starting line was always attended by two officials, one to wave the driver up to the line so that the front wheels are within a few inches of the light beam, the other to place a chock behind one of the rear wheels to prevent the car from rolling back down the hill.

The track itself was attended by dozens of Marshals, all equipped with a red flag which was waved whenever an obstruction was ahead (such as a stalled, blown-up or crashed competitor—a frequent occurrence !). The Marshalling points were all provided with a direct telephone line to the start. All these precautions are necessary when it is considered that some of the cars may be travelling at 80 m.p.h. or more in places and with spectators only a few yards away, accidents must not happen.

Finally, the usual Bar Tent, Ice Cream vans, public address sytsem, first aid, conveniences, break-down trucks, car-parks, etc., were all provided. The programmes were free, as was admission on the Saturday, which was the practice day. On the Sunday, the charges were 10/- for a public enclosure pass, and 20/- for a paddock pass. Car parking again was free.

The competitors were split up into classes for groups such as:—sports cars up to 1000 ccs; Ferraris only;



On the left-hand hairpin, Mick Ferrant and passenger Pete Dade lean over to keep the balance. The machine is a 499 cc. Vincent Special.

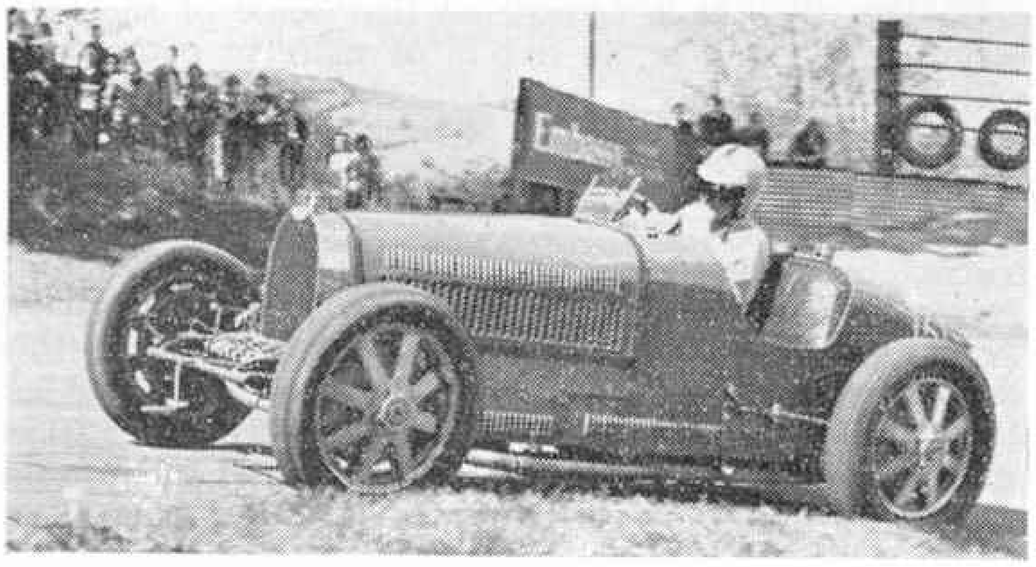
Bugattis only; Racing cars up to 1100 ccs; Racing cars 1101-2000 ccs; Racing cars 2001 ccs and over; Motor Cycle Sidecars; etc. There were 12 classes in all with prizes awarded in every class. Each competitor on the Sunday had several runs up the hill, his fastest time being taken as the result. The cars attacked the slope one at a time at approximately 30 second intervals, and so, provided no one in front had spun-off or broken down, every competitor would have a clear run from start to finish.

For the spectator, the event provided a great deal of interest and variety. The start would consist of anything from the sedate purring away of a vintage Bentley saloon—adequately silenced—to the deafening roar of a 7.2 litre Cooper 81B Chrysler racing car leaving inches of rubber up the track as it disappeared in a cloud of smoke. The two hairpins and the "Esses" lead to many a spin-off, particularly after a shower of rain. Several clutches were burnt out, a prop-shaft broke and one combination came to grief when the passenger's crash helmet went under the sidecar wheel!

The fastest time of the day was clocked by Peter Lawson in his 2070 cc, four-wheeled drive B.R.M. No. 140 who completed the course in 47.34 seconds, just outside the course record of 47.31 seconds. The fastest lady was Mrs. A. Mickel in a 3528 cc Lotus 21 Buick with 53.35 seconds. After taking classification handicaps into account, the Wills Trophy was won by Michael MacDowell in an 'E' type Jaguar with a time of 52.56 seconds.

Altogether, everyone had a great weekend with plenty of atmosphere and excitement. Many spectators, like myself, took the Gotherington Lanes home a great deal faster than they did on the way to Prescott.

Not only modern cars go in for hill climbs! Here we see F. E. Walls' 2261 cc. type 35B Bugatti of 1926 vintage in action.



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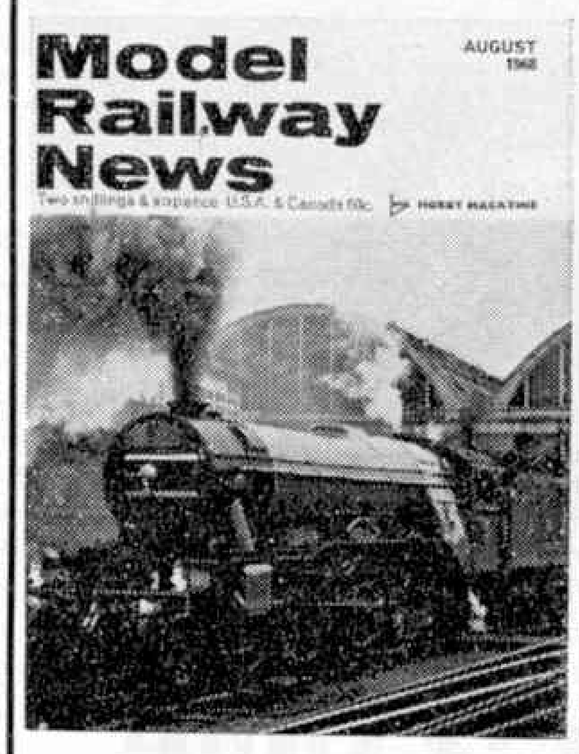

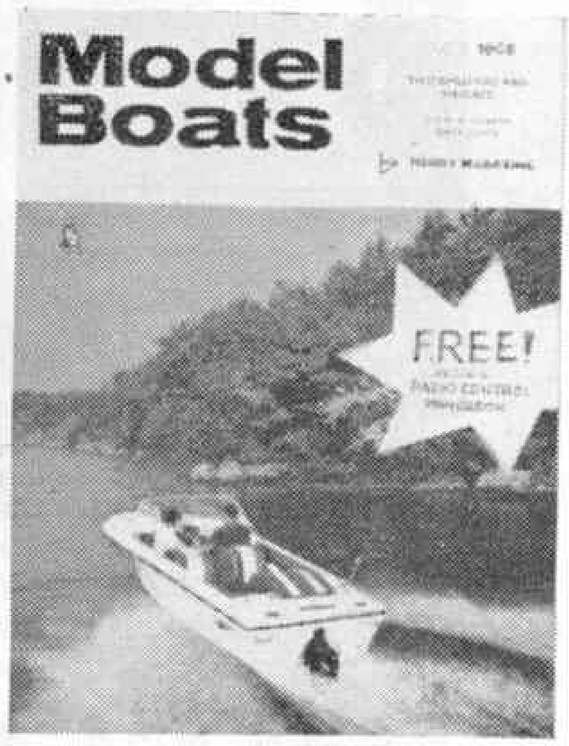

The August issue of Model Railway News contains a variety of articles to suit all tastes. Those with a liking for the ultra-small scales can read G. Dover's description of a L.M.S. Fairburn tank in N gauge. Further up the scale David Jenkinson and his team continue the story of their Johnson Belpaire 4-4-0 in 4 mm. scale. In O gauge Dennis Allenden shows us how he constructed his unusual model of 'St. Jean d'Angeley' a French 2-4-2 engine of a bygone era. This article, which will be in two parts, is well illustrated with photographs and step-by-step assembly diagrams. G. Newey has restored the O gauge Bowman steam locomotive, a once popular commercial model beloved by our fathers.

2nd FRIDAY MONTHLY 2/6

August issue has a free booklet—Model Boats Radio Control Handbook—included with every issue. This answers many of the questions asked by the not-so-expert radio enthusiast. Regular contents include Topcat, 30 in. power boat, and Try-One, 36 in. trimaran, for readers to build, descriptions of a steam-powered trawler and a 9 ft 9 in steam yacht, an explanation of tuned pipes and fitting out a glass fibre hull, drawings of an Iranian frigate, a xebec, a famous liner, and a Dutch aircraft carrier, reports on regattas, readers' letters, paddle steamers, customs and pilot cutters—a real mixture of interest to all.

4th FRIDAY MONTHLY 2/6

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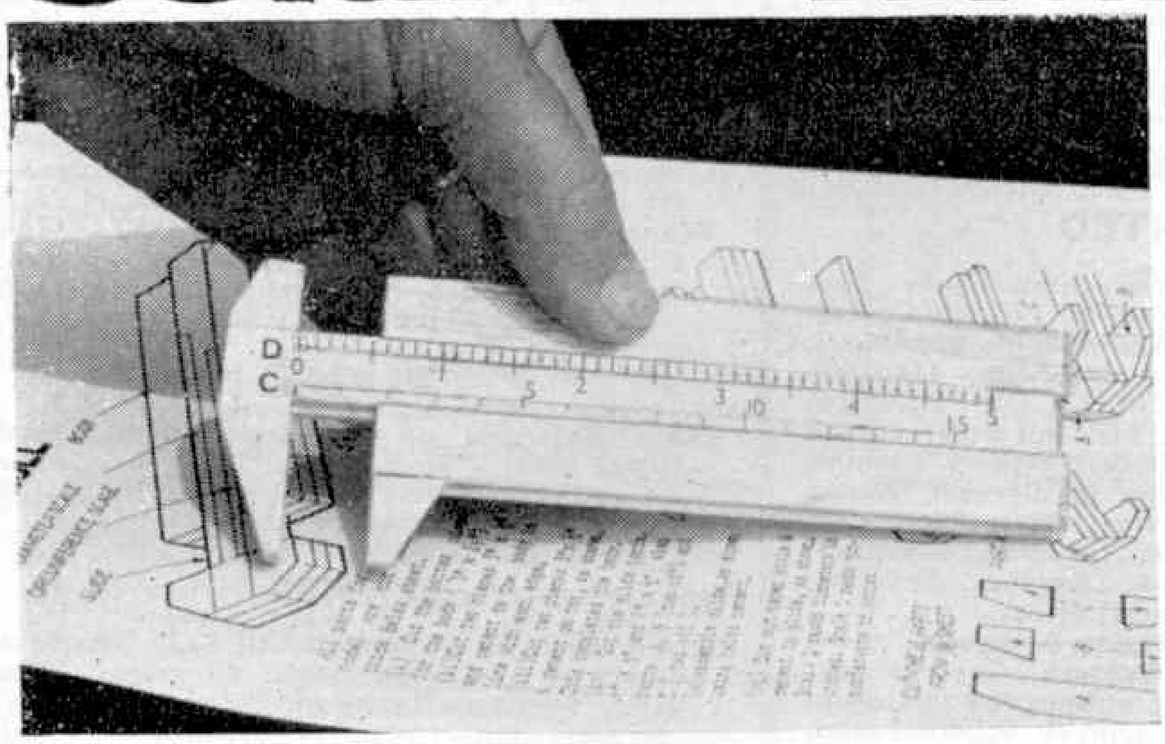

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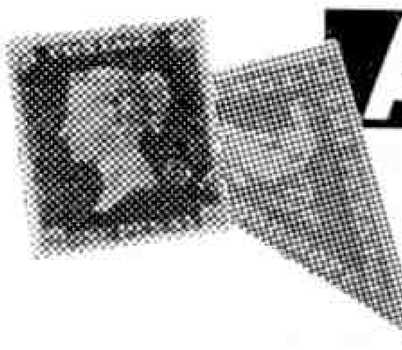

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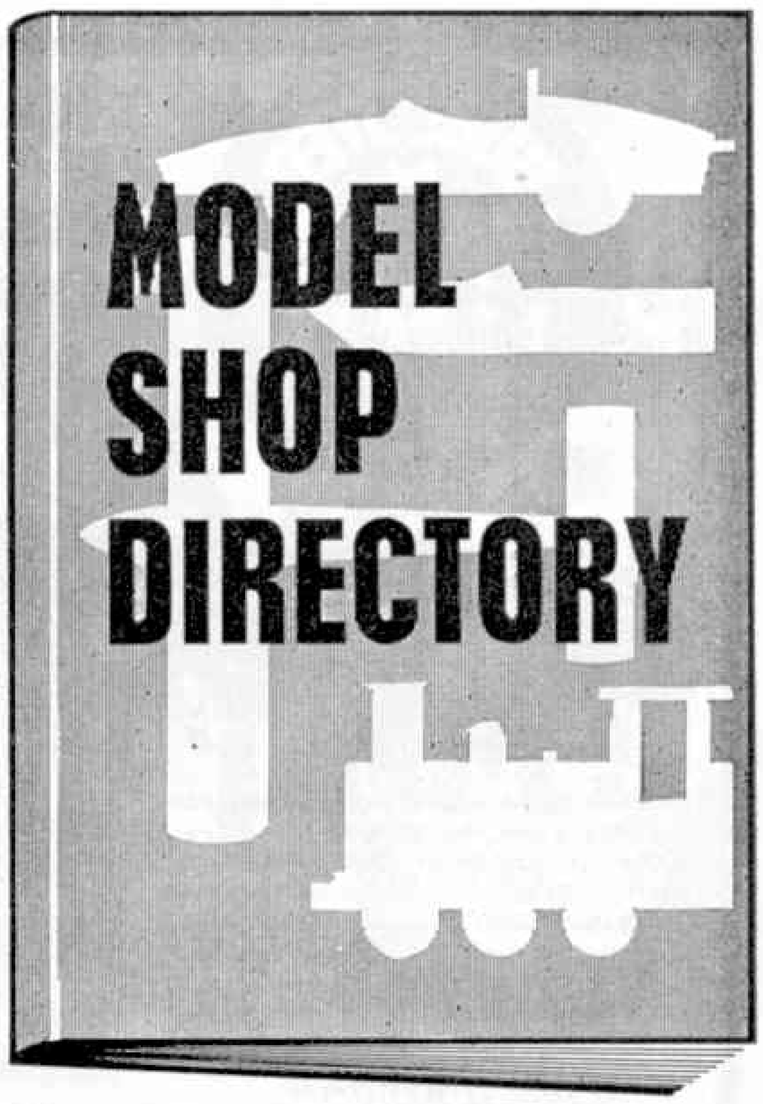

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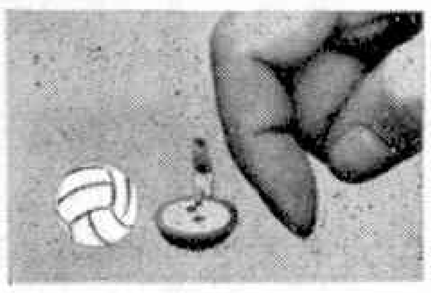

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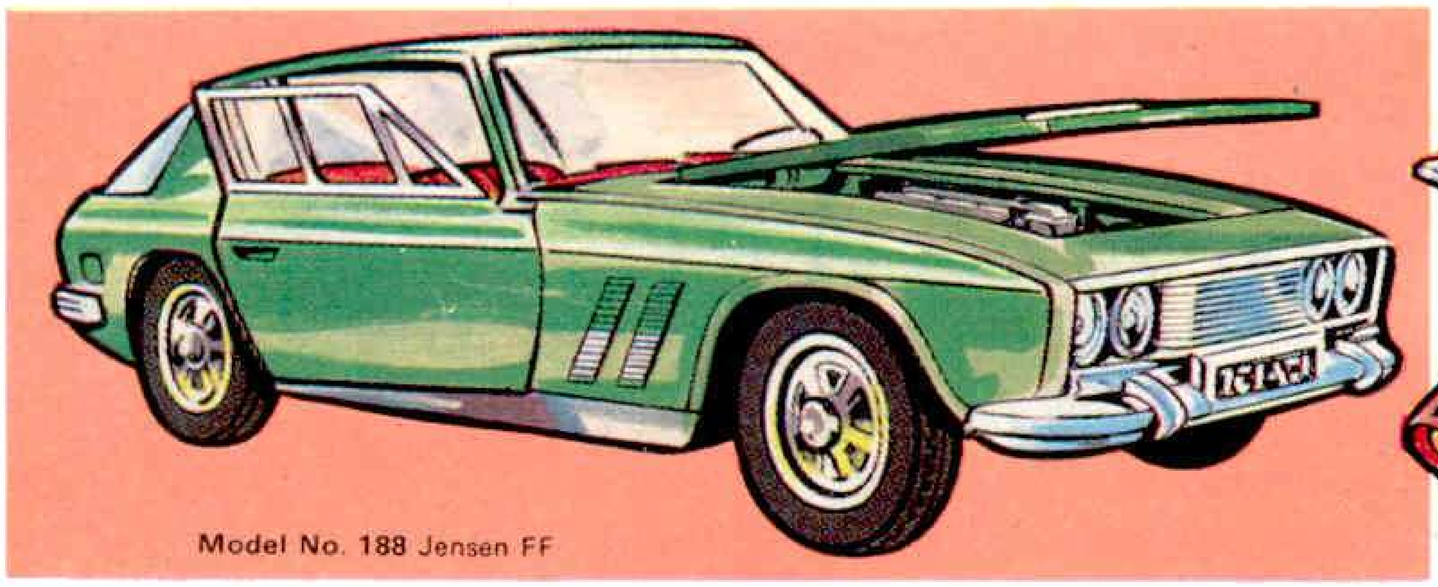

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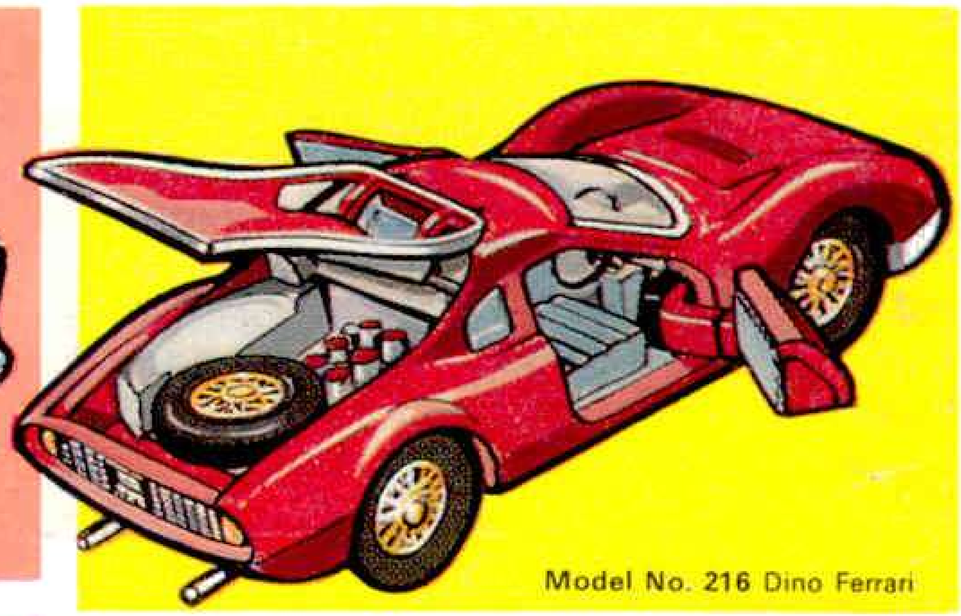

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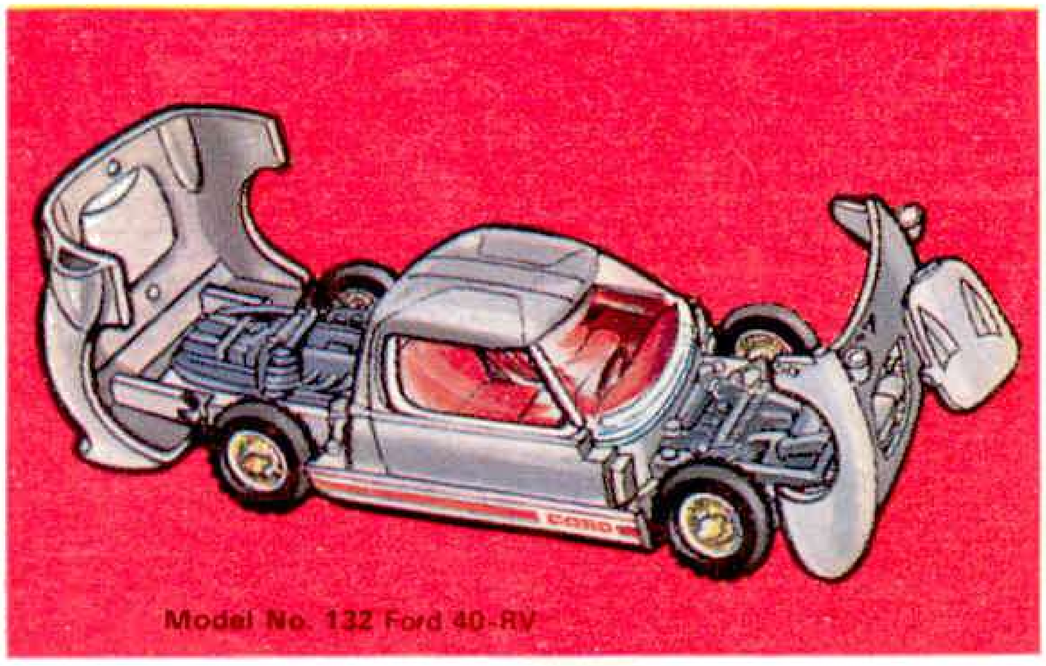

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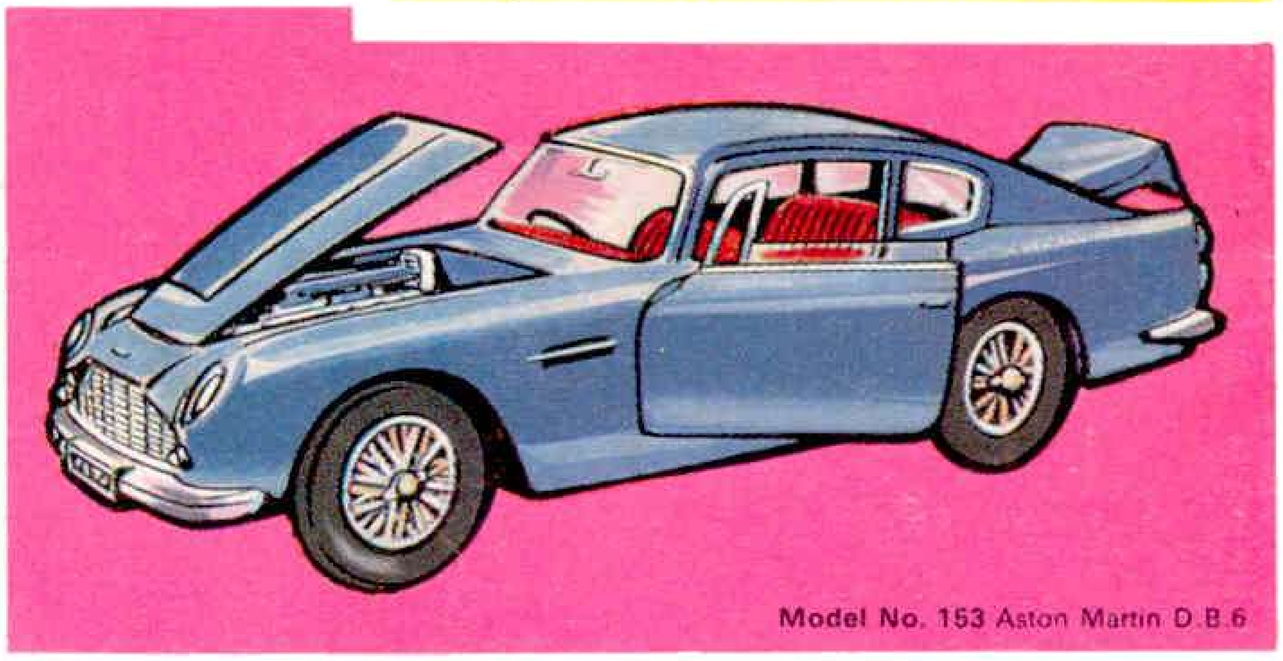

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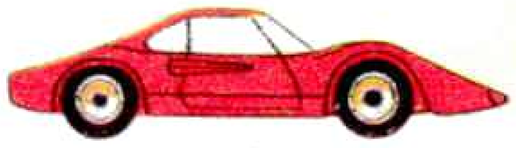

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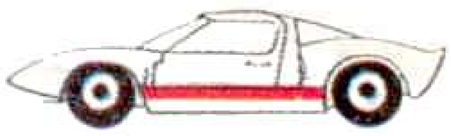

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