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JULY 1971

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MECCANO® Magazine

JULY 1971 VOLUME 56 NUMBER 7

Meccano Magazine, founded 1916.

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FRONT COVER

Scch—woof! Artist's impression of U.F.O. Interceptors and their lunar base. This recent missile-firing Dinky Toy (No. 351) has proved extremely popular, especially in those areas where I.T.V. has already shown the "U.F.O." series.

NEXT MONTH

A simple tram from a Meccano No. 4 Set, the Eiffel Tower, camels, and another plan for a fine working model are among the interesting mixture scheduled for our August issue.

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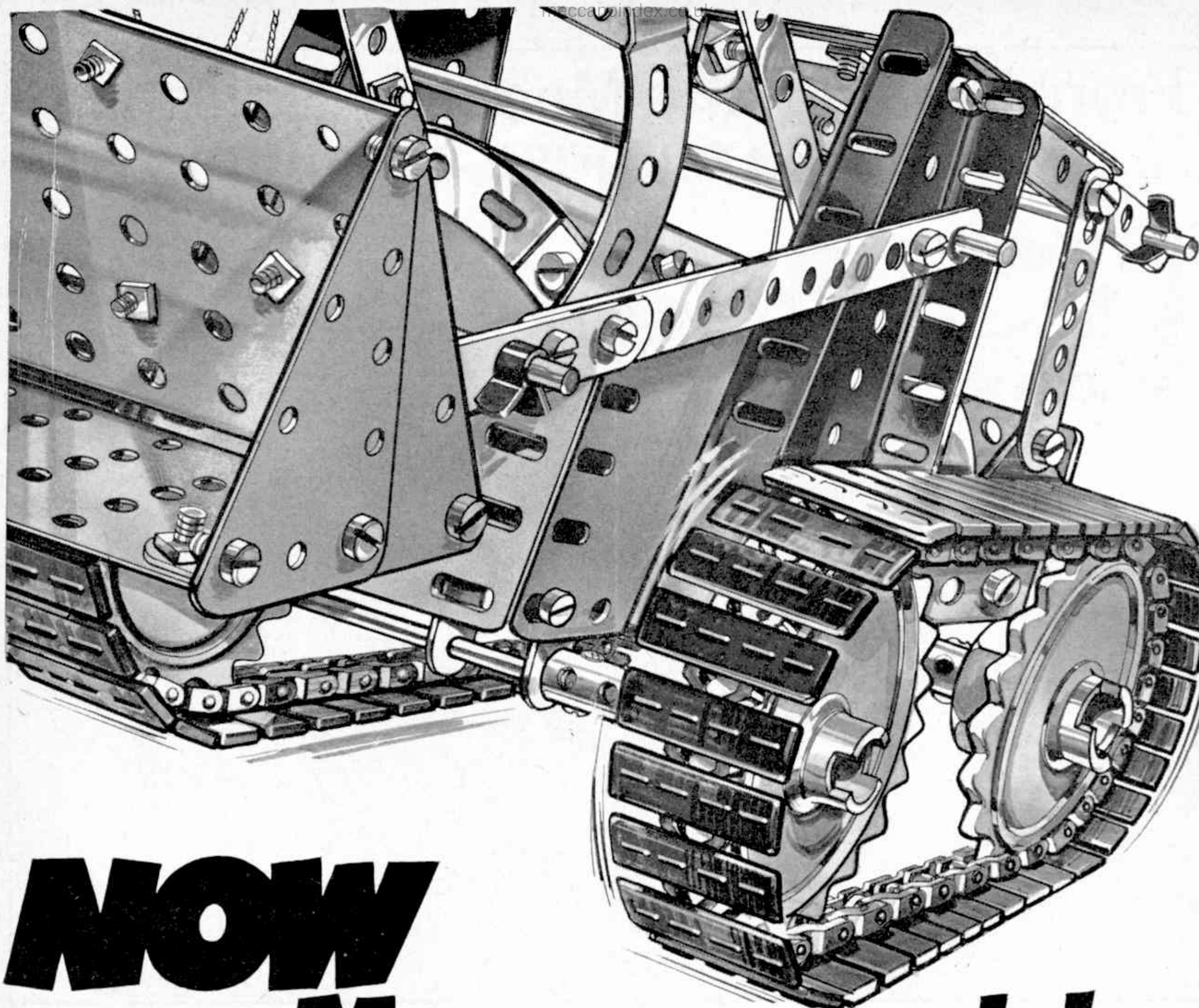

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But in practice this never happens because in the time between the designs the phase relationship of the two cranks that drive the pen linkages changes, and a special mechanism changes the amplitude of their motion. So in fact all the designs drawn by the machines are different, and it is impossible to tell in advance what they will be like. Beat that for originality!

No matter how simple or complicated they are, we should like you to write about any models you've made which you think would be of interest to other Meccano enthusiasts around the world. Please send photographs and descriptions to Meccano Tri-ang Limited, Binns Road, Liverpool L13 1DA.

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ON THE EDITOR'S DESK

In this issue, rather more space than usual is devoted to one article, that on "Hydroponics." We believe that this rapidly expanding method of growing high quality food will in future years do much to reduce the number of people in under-developed countries suffering from starvation, and that it will also contribute to the better standard of living of advanced countries. So much land everywhere is unsuitable for economic crop-growing and can support only a few sheep or cattle, yet hydroponic farms can be built anywhere. In the British Isles, Wales, Scotland, the Yorkshire Moors, and many other under-developed areas could all be made into really productive farming regions, while overseas there is no limit to the possibilities.

In our view, just about all readers of this journal will have their lives touched by hydroponics. We thought that individuals and schools would like to learn about it and perhaps conduct some simple experiments, hence our extended coverage of the subject.

Plastic Meccano

As firm believers in the value of constructional toys, we have always been in favour of Meccano in its plastic form. New developments in this direction are discussed on page 330; the photograph on this page shows the completely new parts now introduced, which, with the caterpillar track, broaden the scope of this creative hobby enormously.

Meccano Exhibition

Readers in the South of England who missed the excellent exhibition of modern and historic Meccano equipment displayed at Hurstpierpoint, near Brighton, last August will have another change this July to see much of the rare material that was on show—and a great deal more besides. Mr. Peter Matthews, the organiser of the last Exhibition, will be holding another, larger Show at Hurstpierpoint on the afternoon of July 3rd at the St. Lawrence Fair Recreation Ground, Hurstpierpoint, aided by members of the Holy Trinity Meccano Club.

Spanner, who visited the 1970 Exhibition, was tremendously impressed with it and strongly recommends everyone interested in Meccano to visit the 1971 Show, where they will find every stage of Meccano's 70-year history authentically illustrated by literature and models built with period equipment. Everything from the first "Mechanics Made Easy" to the very latest electronic construction will be there for all to see, so make a point of being in Hurstpierpoint on July 3rd. The Exhibition opens at 2 p.m.

Former Editor

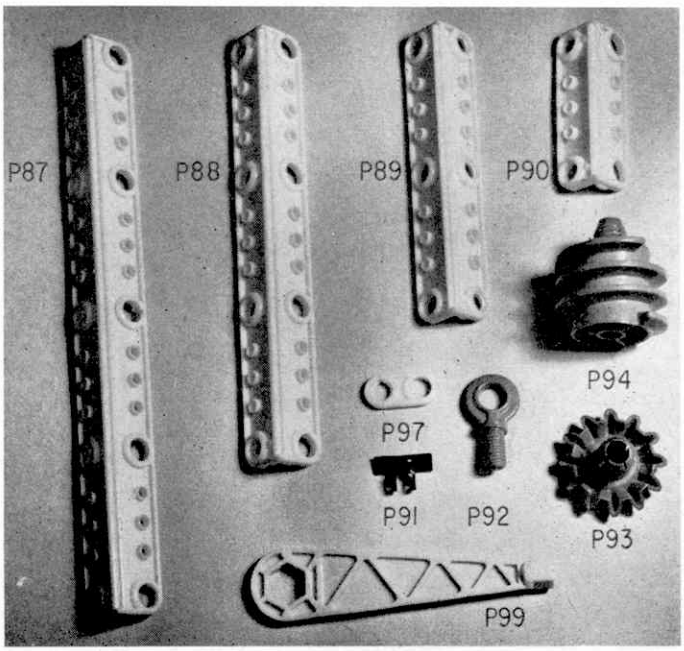
It was with deep and sincere regret that we learnt of the death in April of Mr. Ellison Hawks of Southport, Lancs., a former Editor of this Magazine and author of no less than 70 science and motoring handbooks. He was aged 82.

Mr. Hawks joined the staff of Meccano Ltd. in 1921 as Advertising Manager, a position which also included the Editorship of "Meccano Magazine." During his time in the editorial chair he greatly increased the circulation and quality of the Magazine, building it up into the finest boy's paper ever published. He was also an enthusiastic administrator of the Meccano Guild and Hornby Railway Company, doing much to further the enjoyment to be obtained from these two hobbies.

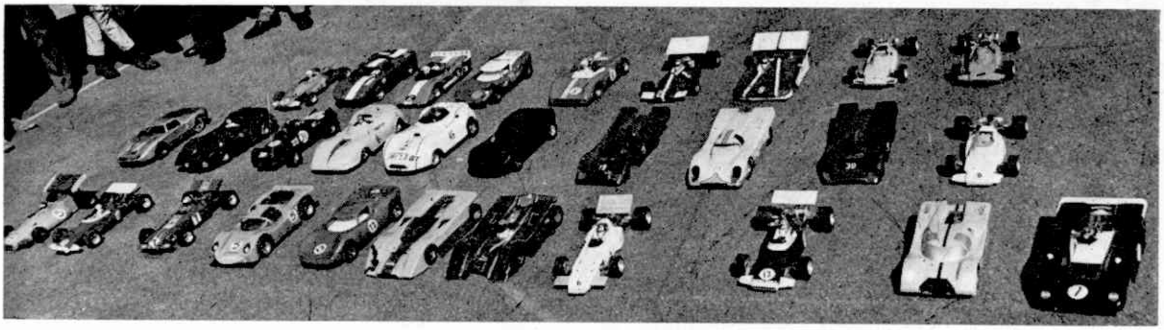
After leaving Meccano in 1935, Mr. Hawks became General Editor of the Amalgamated Press, publishers of periodicals such as "Dog Owner," and also formed Real Photographs Ltd., suppliers of railway, aeroplane and ship illustrations.

Mr. Hawks is survived by two daughters and a son and we, the present staff of "Meccano Magazine," as well as his old colleagues at Meccano, would like to offer our sincere condolences to them in their bereavement. Mr. Hawks will continue to be remembered by all who knew him.

We also very much regret to report the death of John Edwards, Chief Designer of Airfix Products Ltd. since 1956, at the very early age of 38. John was a quiet and most likeable man and an extremely clever one. His search for perfection is evident in the kits for which he was responsible, which are enjoyed by millions all over the world. He will be sadly missed.



Sample of all the new parts now included in the Plastic Meccano system: P87 5-hole Girder, P88 4-hole Girder, P89 3-hole Girder, P90 2-hole Girder, P91 Caterpillar Track, P92 Ring Bolt, P93 Bevel Gear, P94 Worm Gear, P97 Fishplate, P99 Hexagonal Key and Ring Spanner.



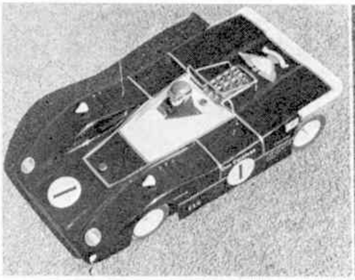
FIRST-EVER BRITISH R/C CAR RACES

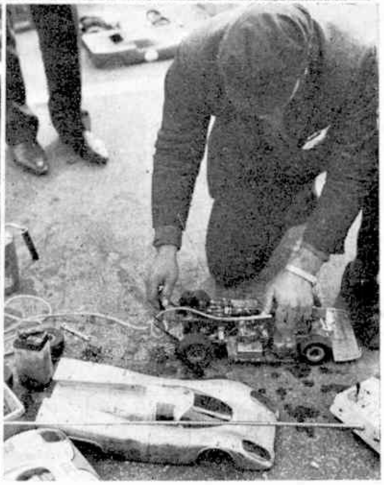
Crowds of spectators got their first taste of the thrills of radio-control car racing at the meeting organised by our sister magazines *Model Cars* and *Radio Control Models* at Berkhamsted over Easter. Some 40 cars arrived, all to 1/8 scale, and there was some exciting running round a 440 yard course marked out with yellow tapes and polythene bottles. Naturally, with so new a hobby, there was much to be learned, and participants learned more during this two-day meeting than they could have found out in a whole season of solo running. Reliability must be the watchword—that and front suspensions able to take collisions with other models as well as immovable objects !

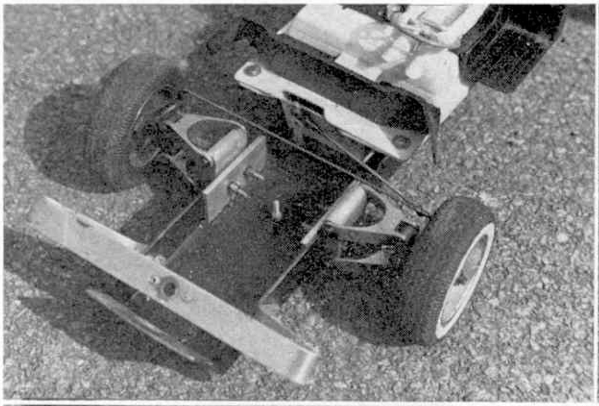
At the moment these little cars are fairly expensive —around the £80-£100 mark—but development will bring the prices down. Chief cost is the radio, though this can be used in other models such as power boats, yachts, aircraft, etc. At Meccano Magazine we are already working on a simple approach to a competitive car, but of this more in due course. It is certainly a lot of fun.

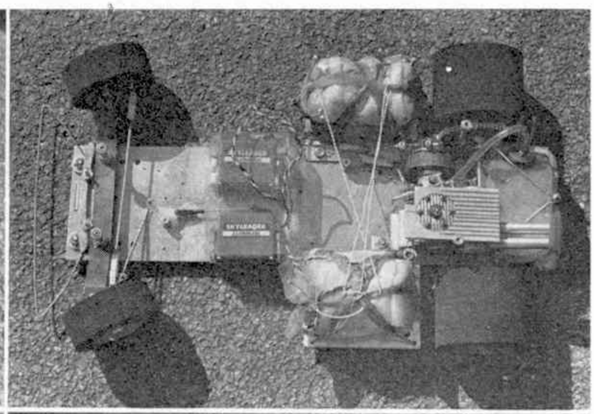
Picture above shows thirty of the cars which ran. Top row below, left to right, gear " box " and R/C clutch projecting from the back in true F1 style; smart McLaren 8A by Don Careless from Portsmouth, and a Mardave Matra of " Ecurie M.A.P." Bottom row, Tom Littler of Mainstream in smart orange coveralls, using an electric starter (rubber drum turns engine flywheel by friction, can also be done with an upside-down bicycle); Portsmouth's Fred Body making adjustments to another neat Matra; and Keith Plested with a Heath Spectre, a popular kit car.

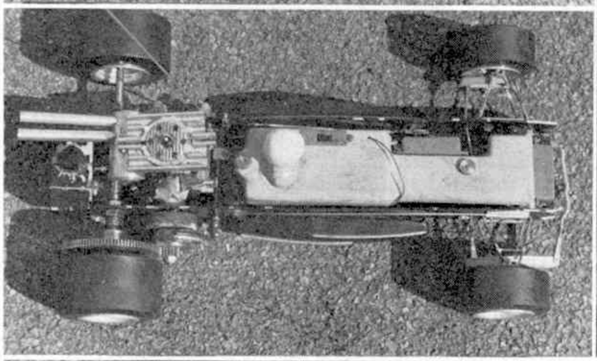
Opposite page, left hand column, top to bottom, scale-type front suspension on prototype of Mainstream's Ford G.T.40; complete Mardave Matra by Aeromodeller Editor Peter Richardson with body off—note spur gear drive, neatly enclosed radio, and motor heat sink; double belt drive and motor laid flat to use chassis as heat sink; and a nicely painted Dynamic Porsche by Ben Cooper. Right-hand column, much more room is obvious in sports car layout—note receiver and batteries mounted on outboard chassis pans; sandwich box and soap box protect radio in this highly-engineered belt drive model; another F1 car with plastic bottle fuel tank and large size cylinder head heat sink; the internals of Cooper's Porsche which uses a Humbrol thinners tin as a silencer expansion chamber.

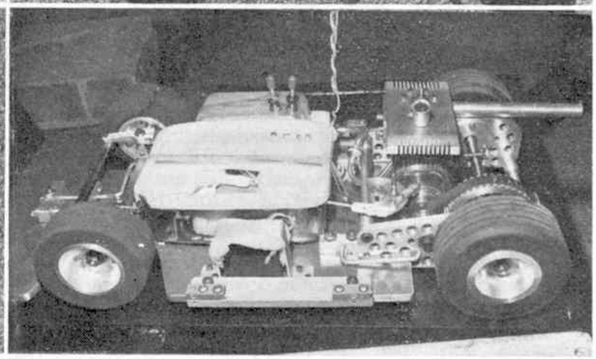


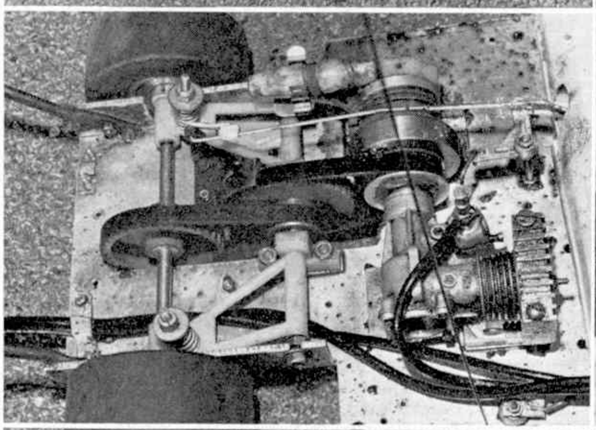


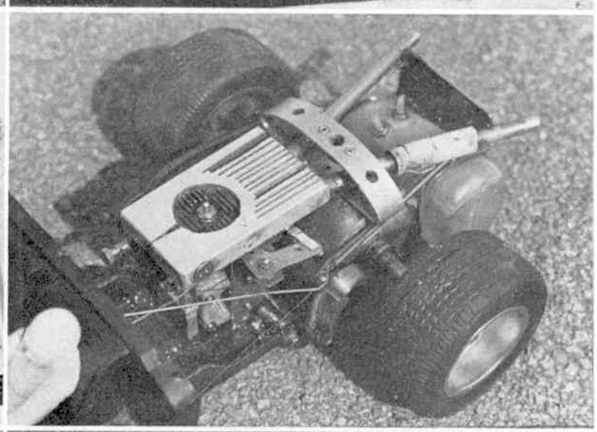


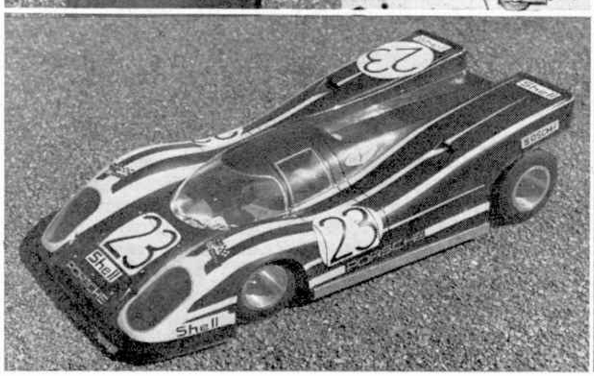








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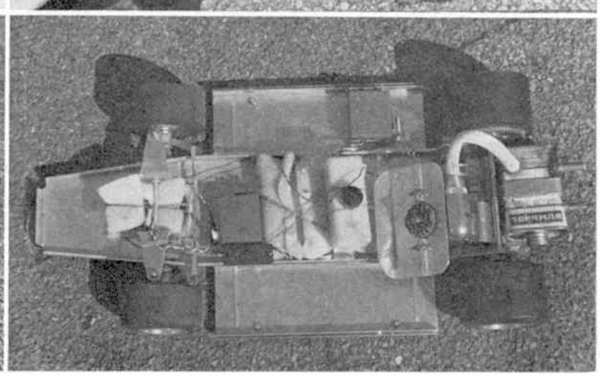
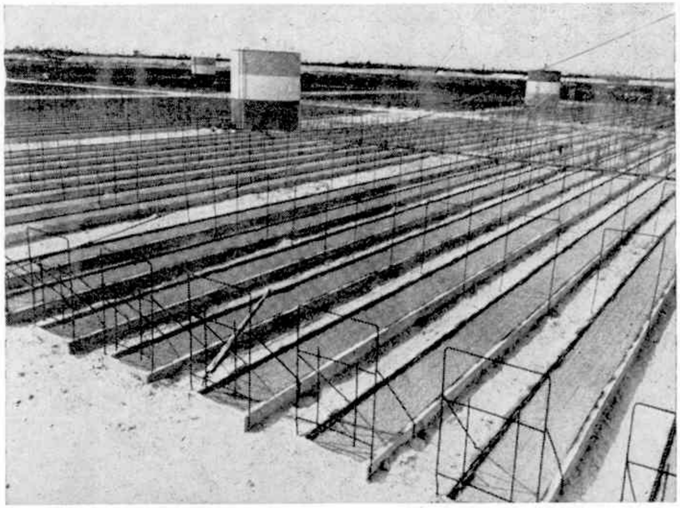


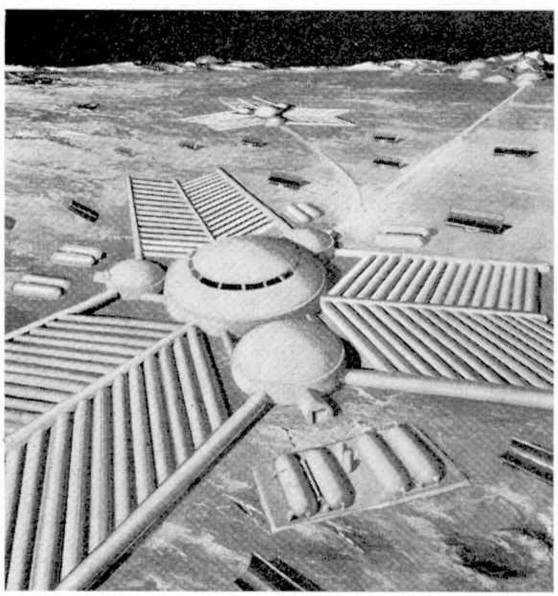
HYDROPONICS



J. Sholto Douglas, B.Sc., Dip. Agri., Dip. Econ., is a consulting member of the International Working Group on Soilless Culture. Here he explains the basics of this tremendously important method of food production.

HAVE you ever seen or read about soilless farms and gardens where plants grow in hydroponics without any need of earth and manures ? If so, then you will certainly remember how very different this modern scientific system of cultivation is from the familiar and often rather old-fashioned ways of digging and ploughing the ground that man has been using for thousands of years. Not only different, but also much more efficient and easier, for hydroponics gives bigger harvests of vegetables, grains and fruits and greater numbers of flowers in shorter periods of time, without any hard manual work, than do ordinary gardening and farming methods. This is why soilless crop growing is spreading so rapidly throughout the world today.

The term hydroponics means literally "water-working" and is derived from two Greek words, *hydor* (water) and *ponos* (work). Plants grown without soil obtain their nourishment from properly balanced mixtures of fertiliser chemicals and water, called nutrient solutions, which are applied to the crops at regular intervals. Their roots are supported in beds of aggregate, usually formed from stones, sand or similar inert materials and sometimes on wire mesh trays placed over tanks of solution. There are several methods of hydroponics in use at present, but they all conform to the same basic principles.

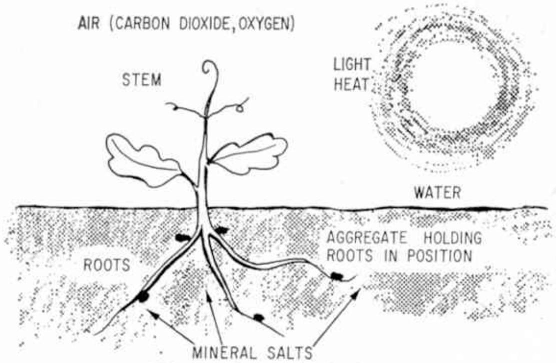


Hydroponics is exceptionally valuable for growing crops in places where normal gardening or farming with soil would be impossible. This applies particularly to deserts and barren regions like the Sahara or Siberia, as well as the dry arid countries of the Middle East. In Antarctica, too, the system has produced excellent results. Industrialised lands where there is a shortage of space for agricultural activities have also found hydroponics helpful. In the United States and Europe many commercial growers and amateur gardeners now employ soilless methods to raise greenstuff and flowers inside towns and cities or in large glasshouses. Because of its high output, low cost and virtually automatic operation, hydroponics offers numerous advantages in all these kinds of places.

During World War II (1939-45) soilless farm and garden units were built at many military and air force bases, to supply troops with fresh vegetables every day. This helped to maintain the health and morale of fighting men. The experience gained at the time later assisted the further development of hydroponics for peaceful purposes. One particularly interesting aspect of modern plant growing without soil is its value in the exploration of space. Before long, we may expect to see colonies established for human settlement on the Moon and Mars, as well as possibly on other planets. Plans now exist for constructing hydroponic units in these places to supply astronauts and settlers with regular quantities of fresh greenfood.

To understand just how plants thrive in hydroponics, let us take a short lesson in botany. If you look at any vegetable or flower growing in a garden or farm field you will see that it consists of two main parts—the stem and foilage above ground, and the roots fixed in the earth. This division illustrates how plants live and from where their food comes. While the leaves are in contact with the air and absorbing light and carbon dioxide, the

Heading picture show a newly-constructed hydroponic farm in Florida. On the left, design for a hydroponic lunar farm. Such installations will be the only possible way of producing fresh food in Moon or planetary colonies. (*Drawing by R. A. Smith*)



What a plant needs to grow.
Here we can see how hydroponics supplies all the needs for good plant growth, without using any soil. Nature gives us light, air, and water—or we can provide them ourselves—while instead of the earth employed in ordinary farming and gardening, we substitute an aggregate to hold the roots in place and add fertiliser salts to give the plants food. Heat can come from the sunshine or else from common artificial methods of supplying warmth, like electricity, gas or oil heating systems.

roots are engaged in drawing up water and important mineral salts from the soil. Additionally, both parts benefit from the stimulating heat of the sun. So we know that plants require light, air, water, heat and mineral salts in order to grow.

In ordinary gardening and farming, Nature and man's good husbandry may supply the plant's general needs. But often there are times when something is missing. Finding good soil is frequently a serious problem, especially in deserts and waste lands or inside towns and cities. Again, the soil can be deficient in mineral salts and even when manures are applied there will be imbalances in the quantities of essential plant food which cause bad growth of crops. Water utilised for soil irrigation can soak away and be lost in evaporation. The tasks of digging and ploughing are laborious and costly.

In hydroponics, the place of the soil is taken by aggregate beds or tanks. These cannot wear out or become eroded. The plants receive their nourishment from the carefully prepared solutions, containing all vital mineral salts, that are applied regularly. So crops are assured of maximum care and the uncertainties of ordinary gardening and farming are eliminated.

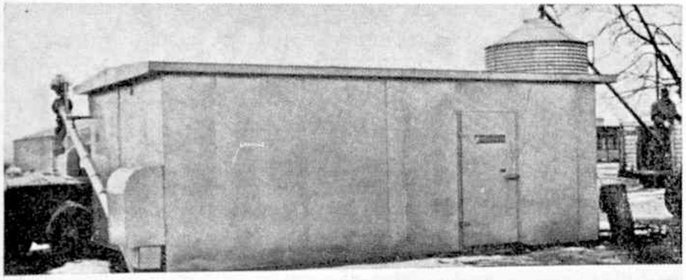
Although a new system, soilless growth of plants is based upon a long history of scientific investigations and experiments. During the Middle Ages, people thought that crops were nourished by water. As one ancient manuscript put it ". . . for the nourishment of vegetables the water is almost all in all . . . the earth only keeps the plant upright." In 1699, however, John Woodward, a Fellow of the Royal Society, published *Thoughts and Experiments on Vegetation*, in which he asserted that earth and not water is the matter that constitutes vegetables. Not until 1804 did a clearer idea of the facts emerge when Nicolas de Saussure found that plants needed nitrates and mineral substances for healthy growth. By the middle of the nineteenth century, Jean Boussingault has introduced controlled methods of raising seedlings in sand, quartz and charcoal, to which solutions of known chemical composition were added. In 1860, Julius von Sachs published in Germany the first standard mixture of fertiliser salts for laboratory work in plant growth.

The value of these early discoveries was not fully understood for many years. Finally, in 1929, William F. Gericke, a professor of the University of California, devised a large scale installation for growing plants without using soil, based on the work of the European pioneers. Calling the system "hydroponics," Dr. Gericke began to draw attention to its practical advantages. Soon, the interest of other scientists was aroused and hydroponic test units were set up in many countries. Today there are few lands where soilless cultivation is unknown and numerous scientific institutions are now engaged in the further development of the science. Hand in hand with research has gone the extension of practical soilless farming and gardening, both for commercial purposes and as an interesting hobby for home gardeners.

Interesting new developments during the past year or two include the enlargement of the hydroponic farms at at Moscow and Kiev in Russia. These are chiefly hothouse units, producing vegetables and fruits for town dwellers. Several oil companies in north Africa and the Middle East operate big installations which turn out thousands of tons of crops like tomatoes, lettuces and cucumbers for consumption by workers living in these desert regions. In the United States and Canada there are many hydroponic flower, fruit and vegetable gardens, especially in Florida, California, Colorado, the Middle West and the eastern seaboard States, while in Mexico, Puerto Rico and the Dutch Antilles soilless cultivation is well established. The Spanish government sponsored the use of hydroponics in the Canary Islands and growers there now export hundreds of tons of tomatoes annually from soilless units to the British market.

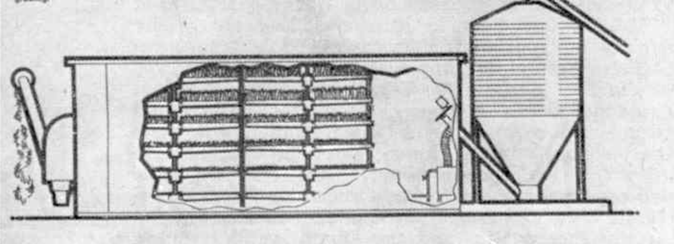
Other places where you can see hydroponic farms and gardens working are Kuwait, on the Persian Gulf, Japan, India, South Africa, Australia, the Netherlands, where the government pays for a hydroponic advisory department, France and Germany, Italy, Sweden, Poland, and many more areas. In England, several commercial firms produce tomatoes and salads without soil. The University of Reading in Berkshire carried out trials in soilless cultivation as long ago as the 1940's.

Right, a fine show of cauliflowers and beetroot in a hydroponic garden in Calcutta.



Left, this "grass factory," little bigger than the average dining room, can produce one ton of fresh fodder every day. Seed hopper is on right and auger for delivery of forage or sprouted grain on left.

This hydroponic "grass factory" is designed for the production of fresh fodder or sprouted grains all the year round. The seed hopper is on the right and the extractive auger, which delivers the material ready for feeding to livestock, on the left. The trays can be seen in the cut away part of the diagram with forage and sprouted seeds growing.



Recently, in addition to vegetable and flower growing, successful results have been secured with the production of green forage for dairy cows. Hydroponic units of special design have been made that can speed up the growth of grass so that from the sowing of seed to harvesting takes only six days. The value of the process during harsh winter months when there is no outside grazing is very great for farmers. These installations have become known as soilless grass factories.

Formerly, hydroponics was rather a complicated system to use and special equipment was necessary. This tended to discourage ordinary growers and amateur gardeners from taking up soilless culture. Recently, however, very simple methods have been developed that can be operated without difficulty by any person following a few straightforward rules. Procedures have been standardised as more knowledge of how plants respond to hydroponic conditions has become available. At the end of this article one or two experiments have been suggested, so that you can try out the simple technique for yourself.

Inside a large mushroom farm. The crop grows in troughs in soilless substrate.

Despite its advantages soilless plant growing needs proper care and the rules must be followed. Good results cannot be obtained if the work is not done well. Because hydroponics operates on scientific principles it is necessary to check each task exactly. But where the right efforts are made, growers will benefit. Higher yields, better quality produce, much saving of time and labour, quicker maturity of plants combined with reduction in space used, no hard manual jobs, lower costs, improved control of crops, no weeding and absence of dirt and smells are just a few of the advantages of soilless cultivation. Returns are consistent, year after year. The system can of course be employed in places where ordinary gardening and farming would be impossible. To be able to produce vast amounts of foodstuffs for the hungry regions of the world by means of hydroponics is a very important factor in raising living standards of the poorer nations.

Plants grown without soil are provided with all the necessary nutrients to enable them to attain full size and quality. This also means that they will supply the people who eat them with plenty of vitamins and minerals. The mixtures of fertilizers and water that make up the hydroponic crop solution contain vital elements like nitrogen, potassium, phosphorus, calcium, magnesium, manganese, iron, and boron—all of which are converted by the plants into food for human beings and animals. Naturally, the better the growing conditions the more palatable and nutritious will be the vegetables and fruits that are produced. This is why hydroponic greenstuff is so well liked, with its superior taste and flavour. Trials have shown that bread baked from soilless cultured wheat is of higher quality, while it is possible to add extra calcium for babies or more iron for invalids to hydroponic tomatoes and other produce.

The balanced nutrient solutions used in hydroponics account largely for the big harvests. Tomatoes yield crops of up to 200 tons per acre three times a year, lettuces mature twenty-five per cent quicker than soil raised salads, and potatoes and root vegetables do equally well. Flowers, including roses, carnations and chrysanthemums, together with many other types, produce fine blooms. Mushrooms, too, can be cultivated in special soilless composts. To meet particular needs it is also quite practicable to grow algae in plastic tubes, employing hydroponic nutrient solutions. Algae may be processed into acceptable human and animal food, useful in times of famine.

To encourage the development of hydroponics on a world basis and to facilitate the exchange of information between countries. the International Working-Group on Soilless Culture (I.W.O.S.C.) was established in 1956. The chief secretariat is located at the Centre for Plant Physiological Research, P.O. Box 52, Wageningen, The Netherlands. I.W.O.S.C. distributes literature on hydroponics, arranges periodic conferences and maintains a register of consultants in different lands.

Experiments

To make simple hydroponic units at school or in the home is very easy. Here are two experiments that you can carry out. Not only will they demonstrate how plants grow without soil but they will also provide useful aids to learning about botany and nature study.

A.

1. Obtain a light wooden tray or box of the kind used for packing fruit. Greengrocers will be able to give you one. This will measure up to two feet in length by one to one-and-a-half feet wide and be about six inches deep. Place the box on a table or similar stand. Then take some polythene sheeting, or opened bags of this material, like those employed for wrapping various large goods. Line the box or tray carefully with the water-proof plastic, turning it up at the sides and ends and fixing it with drawing pins to the top edges of the box. Now, using a gimlet, make small holes half an inch from the bottom of the box, two in each side, and two at one end only. Put two small stones or a strip of thin wood under the other end so as to raise it about three quarters of an inch. Finally, put little plugs in each of the holes you made. These will pass through both wood and plastic.

Your hydroponic container or bed is now ready, awaiting filling. Sometimes these devices are also termed troughs or tanks.

Alternatively, you can make a frame of the same dimensions using Meccano parts (girders and strips) and line it with polythene to form a watertight " basin." Pierce the plastic with a sharp pencil point or skewer to make the necessary holes, as you would with the wooden box, and staple some stiff cloth or strips of bicycle repair patches around them to stop any tearing. Then plug the holes as already instructed.

2. Next, collect some small stones or gravel not over a ¼ inch grade. This means that the diameters will not exceed this size. At the same time obtain some clean sand. Mix together well three parts of the small stones with two parts of the sand, measuring the amounts by volume, i.e., use a tin or cup to get the correct quantities —do not weigh them as stones and sand are different in density. The mixture of stones and sand is called the *aggregate*. Fill the hydroponic bed or trough you have made with enough aggregate to come up to within a quarter of an inch of the top, smoothing it over carefully, so that it is quite level. Instead of stones and gravel you can use cinders that have been soaked in water and well washed, or vermiculite. The latter may be obtained from garden stores. But always see that you make the aggregate from a mixture of three parts of the coarser material and two parts of sand.

3. The hydroponic container with its aggregate will now be complete. Using a jug or can or a piece of piping, run water unto it. Allow as much water as will thoroughly dampen the aggregate, so that it feels like a wet sponge that has just been lightly wrung out. Do not overwater or leave too dry and ensure the aggregate is moist in all parts.

4. The next job is to sow seeds or plant young seedlings. To begin with, try easy-to-grow crops like lettuces or tomatoes or some annual garden flowers. Take about a dozen good seeds of the plants you prefer and sow them by pushing them gently down into the moist aggregate with a small stick. Do not bury them more than half an inch deep. A hydroponic bed of the size mentioned already will have enough space for six or eight plants. So put the seeds two together at equally distant intervals, with three groups of two each down one side of the container and the same number along the other side. See that they are covered by the aggregate and not left exposed to the light. When the seeds have germinated after a week or so and are growing strongly, pull out any weaker ones, to allow the strong plants in each group to develop by themselves. The object of sowing seeds in pairs is because sometimes a seed may fail to grow well, due to a defect in itself, and it saves time to have a second one ready to take its place. At the same time, if necessary you can always move a seedling a few inches either way to get equal spaces between the number you decide to leave in the bed.

A Simple Hydroponic Trough

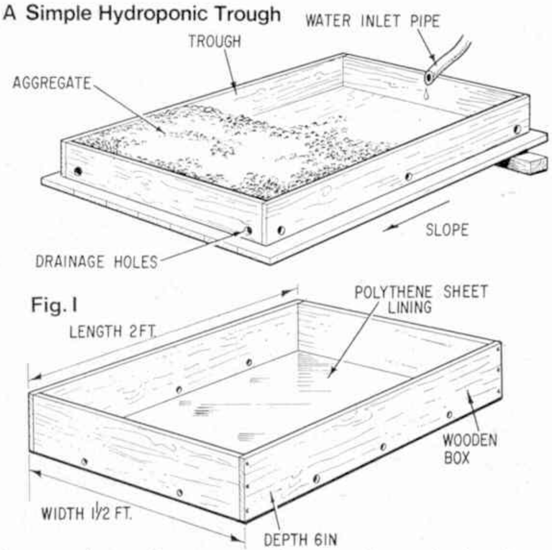


Fig. 1

If you wish to use young seedlings, bought from a shop, be sure to wash their roots carefully before planting them in the hydroponic container. This can be done by holding them under a slowly running tap. Make small holes in the aggregate at equal intervals, drop in the seedlings, taking care that their roots are not turned up, and gently rake back the stones and sand or other mixture around them. The stems should be firm and steady and not left to wobble about.

5. All is now ready for the final stage—applying the *nutrients*. These are the mixtures of fertilizer chemicals which supply the plants with food. To prepare them you require a weighing scale. The fertilizer salts may

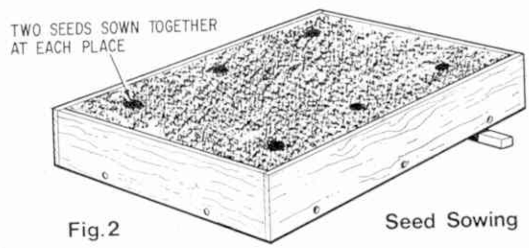


Fig. 2 Seed Sowing

Sow at equally distant intervals, with three groups of two seeds down one side of the trough and the same number along the other side. Later, as the young plants grow, remove the weaker seedling in each group, leaving only the strong one to develop.

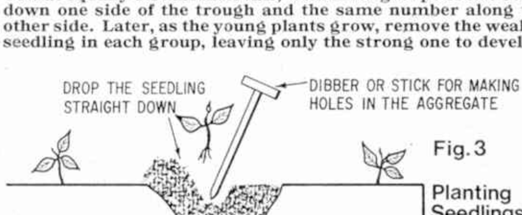


Fig. 3 Planting Seedlings

After washing off any dirt on the roots of the seedlings that you are going to plant, make holes in the aggregate and drop in the young plants, taking care that their roots are not turned up and lie properly. Then gently rake back the aggregate around the stems, seeing that they stand firmly.

A fuchsia growing in a pot without soil.

be in your school laboratory or can be obtained from chemists' shops, garden stores or places like Woolworths.

Weigh out on the scale the following quantities of fertilizer chemicals:

Chemical	*Amount* in Ozs.	*OR* in grammes.
Sulphate of Ammonia	5	142
Superphosphate	3½	99
Sulphate of Potash	2½	71
Sulphate of Magnesia	1½	42

When you have done this, mix all the chemical salts together thoroughly. Then take as much Sulphate of Iron as will cover the nail of your little finger and add this to the mixture, stirring it all up carefully.

This is the nutrient mixture, also called the *formula.* It should be stored in a dry box or bottle and not allowed to get damp before application.

To use the formula, allow not more than ½ oz. or some 14 grammes of the complete mixture to each 2 square feet of the surface area of the hydroponic container every week. For a bed or trough of the size suggested for this experiment (about 2 feet long by 1 to 1½ feet wide) 15 grammes of the nutrient mixture weekly will do very well.

So now, having prepared the nutrients, take 15 grammes of the formula and sprinkle it evenly all over the surface of the aggregate in the container. This must be done just after sowing or planting of seedlings. Then pour water gently from a jug or can on to the dry salts lying on the aggregate to wash them down amongst the roots and the stones and sand. Or else spray them carefully with water from a sprinkler fitted on a pipe or a piece of rubber tubing. What happens is that the dry chemical fertilizer mixture is dissolved by the water and forms the *nutrient solution* which supplies the plants' roots or germinating seeds with food.

Do this every week, as plants grow. Use the same rate of application each time.

General care: Looking after a hydroponic unit is straightforward. See that the aggregate in your trough or bed is always properly moist. If it becomes too wet and there is excess water standing in the container, pull out the plugs from the holes in the sides and end. This opens the holes for draining. Replace the plugs after about an hour. Doing this from time to time also assists air to circulate through the aggregate. Always remember to apply the nutrient mixture regularly every week, keeping the day for sprinkling and watering them in the same. By correct applications every seven days good growth will be assured, In between, if the aggregate looks a bit dry, add more water. Make sure that it is continuously moist just like a damp sponge. The water spreads through the bed by capillary attraction.

Keep troughs or containers clean and tidy. When plants are ready for harvesting or cutting flowers, pick the vegetables, fruits or blooms. Then you can take out the old roots, rake the aggregate over and sow or plant a new lot. It is also a good plan to pour a little extra water over the aggregate in the bed after opening the drainage holes, every three months, to flush it through and freshen it up. Then plug up the holes again for more plant growing.

B.

1. Take some suitable container, such as an old sink, a plastic plant growing trough, a glass fish tank, or some other watertight trough, of not less than six inches depth. Even bowls and basins will do. If the container you choose is made of galvanised iron then you must paint it inside with a good quality paint or varnish, but not tar. Otherwise, most waterproof materials are satisfactory. Here again, you can of course, use a framework of Meccano parts, with a stout polythene bag lining that will hold water.

2. On the top of the container place a wire mesh frame. You can use ½ inch gauge wire netting to make this, with rigid supports at the ends and sides so that it cannot sag. The frame can be hooked onto the top of the container or fitted with small legs to hold it in position.

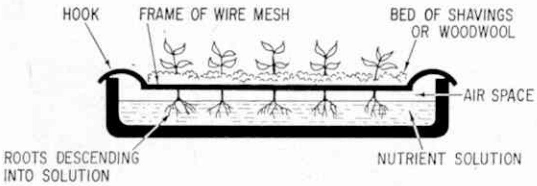
3. Now obtain some shavings from a carpentry shop or some wood wool. Coarse peat moss is also satisfactory. Place the material carefully on top of the wire mesh, making a bed which can be used for seed sowing or planting. This bed should be fairly loose and level. A good thickness to aim for is about two inches.

4. The next job is to fill the container with nutrient solution. Prepare this by mixing up the following formula:

	Chemical	*Grammes.*
KNO_3	Potassium nitrate	1.00
$Ca_3(PO_4)_2$	Calcium phosphate	0.50
$MgSO_4$	Magnesium sulphate	0.50
$CaSO_4$	Calcium sulphate	0.50
$NaCl$	Sodium chloride	0.25
$FeSO_4$	Ferrous sulphate	0.01

This mixture was employed by Julius von Sachs in 1860 for soilless cultivation. It is known as Sach's solution, after it has been mixed with water.

Dissolve the above quantities of nutrients in one litre of distilled water. You will probably find that one litre of solution will not be enough to supply your hydroponic tank or container, so you can multiply the quantities of the chemicals by any figure you want, keeping the relative proportions constant, to prepare larger amounts



Experiment B. How to arrange the container.

up to any number of litres. The chemical salts will no doubt be available in school laboratories or can be obtained at any good chemist's shop. Distilled water is common in laboratories or may be bought at garages.

Pour as much nutrient solution into the hydroponic container as will fill it just up to the base of the wire mesh frame. To avoid any overflowing of the liquid it is best to let the frame down an inch or two below the rim of the tank or basin. By supporting it on legs or with hooks this can easily be done.

5. After the tank or container has been filled with the solution, moisten the bed of shavings or wood wool with ordinary water and sow the seeds or plant small seedlings carefully in it at suitable intervals. The bed has to be kept damp constantly—if it is allowed to dry out the plants will die.

6. In due course, the roots of the young plants will descend through the wire mesh supporting the bed into the nutrient solution in the tank below. When this happens, lower the level of the solution an inch or so to give an air space. The roots will go on growing downwards. You can let the solution height fall continuously until no more than two or three inches remain of the liquid. As long as a good proportion of the roots stay in contact with the solution satisfactory growth will occur.

7. It is necessary to see that the solution in these kinds of hydroponic containers is well aerated. At intervals of two or three days, blow air into the liquid with a rubber tube either with the mouth or by means of a bicycle pump. Every fortnight add fresh solution as necessary to see that sufficient is present. Growing plants use up the nutrient solution quite rapidly.

8. When making such hydroponic tanks or containers it is just as well to leave small gaps between the edges of the wire mesh frame and the tops of the containers. This allows for additional air to enter and permits the solution to be poured in easily as well as making inspection of the level simple.

If glass containers are used cover them with black paper or cloth. The roots must always be kept in the dark.

Hydroponic units can be made of one or many troughs or containers. The beds can be large or small. But it is best to start with one small container; as you learn to operate this you can gradually expand. Usually, troughs are arranged in rows, with space for moving between them. In large scale units there may be complete automation of the work and in fact some installations now use computers to control the application of the nutrient formulae, with mechanised plant and harvesting.

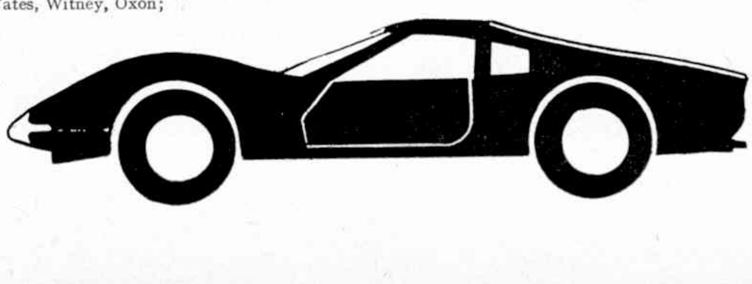
Hydroponic lettuces in the Canary Islands—with, apparently, a lecture in progress.

CAR OUTLINE COMPETITION

Last month's vehicle was, of course, Dinky Toy No. 308, Leyland 384 Tractor. The first 50 correct identifications out of the sack were:—

Peter Alcock, Luton, Beds; Tony Baldwin, Devon; J. G. Ball, Stockport, Cheshire; David Biggs, Boreham Wood, Herts; Paul Burgess, Wilts; Nicolas Burrows, Crewe, Cheshire; David Buss, Ingatestone, Essex; Nigel Cole, Suffolk; K. R. Cowley, Sheffield; Neill Cudlip, Redruth, Cornwall; G. Davey, Sussex; A. Davies, Farnborough, Hants; Nigel Dixon, Folkestone, Kent; Graham Dowle, Sidmouth, Devon; A. J. Drake, Cambridge; David Dungworth, Yorkshire; Giles and Aidan Favell, Birmingham B17 8NR. C. Gadd, Holmes Chapel, Cheshire; P. Gibbs, Bournemouth, Hants; Michael Guest, Axminster, Devon; N. C. Hart, Consett, Co. Durham; R. Hellier, Crewkerne, Somerset; Robin Hoad, Hastings; B. Jarman, Billinghurst, Sussex; Stephen Lambley, Loughborough, Leicestershire; Ian Lunn, Sheffield S2 3DX; L. P. Mills, Virginia Water, Surrey; T. J. Moore, Crowborough, Sussex; David Newcombe, Tavistock, Devon; Mathew North, London SE3 8RW; Trevor Parkinson, Lancs; Nigel Peat, Aldershot, Hants; M. Prior, Malvern, Worcs; Peter Raby, Chesterfield, Derbyshire; A. Sartain, Melksham, Wiltshire; Kevin Saunders, Southampton, Hants; Raymond Smietana, Hornchurch, Essex; Colin Smith, Wokingham, Berks; Andrew Spencer, Coventry; J. H. Stainsby, Stamford, Lincs; Michael Straw, Southend-on-Sea; S. J. Taylor, Wells, Somerset; J. Tibbitts, Seascale, Cumberland; J. Tomkins, Defford, Worcs; Michael Tully, Blaydon-upon-Tyne, Co. Durham; Michael Vincent, Brighton, Sussex; Ian Watts, Aylesbury, Bucks; Peter N. Wiltshire, Wilts; William Yates, Witney, Oxon;

Now here is this month's. Write what it is on the coupon or on a card—don't forget your name and address—and there will be 50 of them sent to the winners.



COMPETITION ENTRY FORM

The vehicle illustrated is.......................

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Name............................ Age......

Address.......................................

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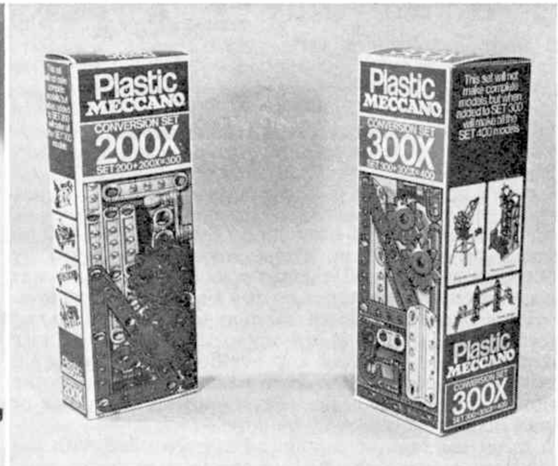


'71 SPECIAL

PLASTIC MECCANO SYSTEM GREATLY EXTENDED, SAYS 'SPANNER'

Plastic Meccano, the "Junior" version of the famous metal Meccano miniature engineering system, is acknowledged by Meccano Tri-ang Limited as being their most successful new product since the introduction of Dinky Toys 35 years ago. Like the metal system, Plastic Meccano consists of a comprehensive range of interchangeable (although much larger) components, all of which are based on sound engineering principles, and it has the added advantage of being designed for use with many of the metal Meccano parts. As a result, it has the same "timeless" potential as traditional Meccano, which means that it will be just as "modern" to the youngsters of 50 years time as it is to those of today.

No timeless model-building system could remain completely modern, however, without periodic extension and expansion. Metal Meccano has been revised regularly in its 70 years history, and the time has now come for the first major improvements to the Plastic Meccano system. The system, in fact, has been significantly extended to improve its scope with a new range of Sets, several interesting new parts, new instructions literature and an entirely new and stronger packaging system.

NEW SETS AND PACKAGING

Looking first at the Sets situation, until now the range has consisted of four main Outfits, A, B, C and Workbox, the latter being intended mainly for use in schools. Under the revision, Sets A, B and C have been withdrawn and replaced by four new Main Sets, numbered 100, 200, 300 and 400. Set 100 is equivalent to the old A Set, but Sets 200, 300 and 400 are quite new, although they are, of course, made up of standard Plastic Meccano parts. The 400 Set also contains all but one of the new parts, to be described later.

In addition to the main Sets, two Conversion Sets have also been introduced, the 200X and the 300X, the former converting the 200 Main Set into the 300 Main Set and the latter converting the 300 Set into the 400 Set. Like metal Meccano, of course, it must be remembered that the Conversion Sets are intended purely for conversion—to be *added* to the appropriate Main Set—and are not designed to be used for model-building on their own.

The Workbox, being intended mainly for group work in schools, is a special, large Set, housed in a strong wooden box which is itself drilled with standard-spaced holes to enable it to be used as a base for suitable models. Under the revision, the wooden box remains, but its contents have been widely readjusted to incorporate a number of the new parts. The existing Gears, Sprockets and Nuts and Bolts Accessory Sets, on the other hand, continue un-

Left, Second of the main Sets in the new Plastic Meccano range is the 200 Set, seen here with the Lunar Module, one of the many interesting models that can be built with the Set. Pictures above, left, containing a selection of all the new parts introduced to the Plastic Meccano system this year is the 400 Set, the largest main outfit in the range, and right, in addition to the main Sets, the new Plastic Meccano system includes two Conversion Sets, the 200X and the 300X. Each of these Sets is designed purely to convert its appropriate main Set into the next larger main Set and is not intended to be used by itself for modelling purposes.

Smallest of the new Plastic Meccano Sets, the 100 Set, equivalent in content to the old A Set

changed because of their already-proved appeal.

All the new Main and Conversion Sets are packed in entirely new and colourful boxes which, except for the 100 Set, have broken away from the original " envelope " design to return to the more practical " lidded " design. The parts themselves are carried inside the boxes in shaped recesses in vacuum-formed plastic trays. The trays not only separate the different parts to prevent everything becoming hopelessly mixed up together, but the shaped recesses make re-packing the parts after use extremely easy as it is usually possible to tell at a glance which parts go where. I think I speak for everyone with any experience of Plastic Meccano when I say that the new boxes are a considerable improvement over the old.

NEW PARTS

This brings us to the new parts which have been added to the system and it is here that some of the most interesting advances have been made. The new additions are as follows:

Part No.	*Description*
P87	5-hole Angle Girder
P88	4-hole Angle Girder
P89	3-hole Angle Girder
P90	2-hole Angle Girder
P91	Caterpillar Track
P92	Eye Bolt.
P93	Bevel Gear
P94	Worm Gear
P97	Fishplate
P99	Hexagon Key and Ring Spanner

Of all these parts, the most important from a purely constructional point of view are the four Angle Girders. One of the set-backs of Plastic Meccano in the past has been that the inherent flexibility of the Strips sometimes resulted in larger constructions being rather unstable and the new Angle Girders, being perfectly rigid, overcome this problem admirably. The Eye Bolt, on the other hand, is more of an " extra " with valuable although less-essential uses as a cord guide, part of a vehicle coupling, a side-lamp representation, and so on. The Bevel Gear, of course, when meshed with another similar Bevel, will give a positive right-angled drive at a ratio of 1 : 1, while the Worm Gear, when meshed with one of the existing Gear Wheels, will also give a right-angled drive, but with a reduction ratio equivalent to the number of teeth on the Gear Wheel. If, for example, the Worm is meshed with a 12-teeth Gear, the resulting ratio will be 12 : 1. Please note, however, that the Worm is non-reversible which means that the drive must be transmitted from the Worm to the Gear Wheel. The Gear Wheel will not drive the Worm.

Smallest yet one of the most useful of the new parts is the Fishplate. With a length equivalent to the width of two Strips side by side and with two holes, one threaded and one smooth, it has many uses, from locking two Strips or other suitable parts together to providing raised bearings for an Axle. The Hexagon Key and Ring Spanner is a new assembly tool produced in addition to the existing open-ended Spanner. At one end is a hexagonal ring socket designed to fit over a Nut or the head of a Bolt, while at the other end is a hexagonal key, designed to fit into the recessed head of a Bolt. Both ends give a greatly improved grip over the existing tool, allowing more purchase to be applied, therefore care should be taken to ensure that the Bolts are not over-tightened, with resulting damage to the Bolt threads.

Of the new parts described, samples of all of them are contained in the 400 Set, with the 5-hole Girder, the Fishplate and the new Spanner being included in the 300 Set and the Spanner only in the 200 Set. All the Angle Girders are contained in the Workbox.

CATERPILLAR TRACK

The only new part not contained in any of the standard Sets is the Caterpillar Track, this being omitted because its tremendous value, both to Plastic Meccano and metal Meccano modellers, has warranted the introduction of its own accessory pack. The Track comes in the form

The Plastic Meccano 300 Set is one of the larger of the new outfits and includes a useful selection of Gear Wheels.

of separate track links, 1 in. wide, which clip together like the existing Chain Links to result in complete lengths of realistic and effective "crawler" track. Like the Chain Links, the completed tracks are designed to run on the existing Plastic Meccano Sprocket Wheels, and a length of Track wrapped around a Plastic Meccano Road Wheel also makes an excellent tractor wheel.

This, you may think, is fine for the Plastic Meccano system, but you may wonder how a Plastic Meccano caterpillar track can affect the long-felt need of the more advanced metal Meccano system for such a track. The answer is simple. Accepting that, at 1 in. width, the size of the links is compatible with the scale of most metal-built models, the only thing preventing the Plastic track from being used with metal Meccano is the fact that the Plastic Sprockets designed to take the Track will not fit on metal Meccano Rods. What is required, therefore, is an adaptor to increase the size of the metal Rod so as to receive the Plastic Sprocket—and the metal Meccano system already has the perfect adaptor in the shape of the standard Coupling, Part No. 63. The outside diameter of the Coupling is almost exactly that of a Plastic Meccano Axle, therefore the problem is solved! Thus, the Caterpillar Track is a valuable new part for both the Plastic and metal Meccano systems.

TRACK PACK

As already mentioned, the Caterpillar Track is marketed in a new accessory set, known officially as the "Track Pack." The Pack includes four 10-teeth and four 20-teeth Sprockets, with Collet Nuts, as well as 125 individual track links which make up almost 47 inches of track—sufficient for most models. In addition, the track links will be available separately as, indeed, are all Plastic Meccano parts, so no modeller should be forced to buy a complete Pack for the sake of a few extra track links. The Pack, however, does not contain any metal Couplings for adapting purposes, the reason being that their inclusion would increase the price of the Pack noticeably, thus penalising the many Plastic Meccano customers who do not require the Couplings. In any case, most metal Meccano modellers will already own sufficient Couplings for their needs or, if not, they will be able to purchase them separately.

As a matter of interest, the dual metal/Plastic Meccano capability of the Track Pack is made crystal clear by the Pack's box design: two of its sides carry Plastic Meccano colours and lettering, while the other two sides are finished in the deep blue, with white lettering, of the standard metal Meccano boxes!

Of particular interest to all Meccano modellers is the new Caterpillar Track Pack. Containing a selection of drive Sprockets and sufficient Track Links to make up almost 47 inches of track, it can be used with both Plastic Meccano and metal Meccano models. Its dual use is clear from the box, two sides of which carry the Plastic Meccano design and two the metal Meccano design.

COLOUR IMPROVEMENTS

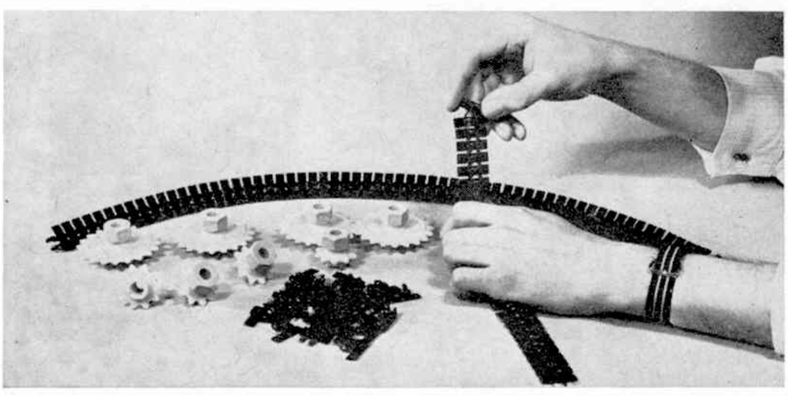
Besides the introduction of new parts to the Plastic Meccano system, there have been a few colour changes made to existing components. The three parts originally black are now blue, namely the Base, the Handle and Knob and the open-ended Spanner, the Hank of Cord also being changed to blue, from green. Although few, these changes are a vast improvement, brightening up the whole appearance of completed models.

NEW INSTRUCTION LEAFLETS

With the revision of the Plastic Meccano system have come new, full-colour plans for suggested models to build from the various main Sets. Under the old system, you may remember, there was only one single Leaflet giving plans for all three Sets A, B and C. Under the new system there are separate Leaflets for both the 100 and 200 Sets, with a book-type Manual (as opposed to a Leaflet) for the 300 and 400 Sets, combined.

An added improvement over the old Leaflet lies in the fact that each of the new publications features a complete contents list of all the Main and Conversion Sets, together with separate illustrations of all the parts, identified by their part numbers. This is obviously invaluable when ordering extra parts and, of course, lets owners of a particular Set know precisely what components should be contained in it. It has also made it possible for one or two of the parts to be identified with their part numbers on some of the plans, where necessary, to simplify construction. The plans themselves, particularly in the larger 200/300 Manual, are generally clearer and better-detailed than in the original Leaflet.

All in all, therefore, the 1971 Plastic Meccano system is bigger, better and more versatile than ever before. It has changed somewhat, but all the changes are improvements and so we can look forward to a youngster's modelling system with plenty of popular years ahead of it.



The new Caterpillar Track Links clip together very easily in the same way as the existing Sprocket Chain Links. The completed track is designed to be driven by existing Plastic Meccano Sprockets, eight of which are included in the Track Pack, four 10-teeth and four 20-teeth.

DESPITE modernisation in most other industries today, the craft of bell founding has been almost unchanged through the centuries and much of the work is still done by the same methods as it was five hundred years ago. Machinery is used but the majority of the founding of a bell is by hand.

Bells were used in India and China as early as 4000 B.C. These were either saucer-shaped or "crotal shaped," the latter similar to those on a baby's harness with several holes and a ball rolling loose inside. The present-day bells evolved from the saucer-shape. Early examples were fitted with a handle, like handbells, for summoning people to church, festivities or meetings, but as bells grew in size and weight, loops or "ears" were cast on the head to support them and they were struck with hammers. The bell design from these became larger in shape and during hundreds of years various shapes and thicknesses of metal were tried until about the 12th or 13th century a shape was developed almost the same as those made now.

The Church was the first important user of bells in this country, being in general use in church buildings and monasteries by the 7th century. It is believed they were first installed in churches, to summon worshippers to services, on the orders of Paulinus, Bishop of Nola, in Campania, in 400 A.D. From Campania's name was derived "campanile" for bell tower and "campanology" for the art of bell ringing.

The first skilled bell-founders were monks in various monasteries, but gradually other young men were trained in the craft and eventually it passed into their hands. Few of these very early made bells survive, only about eighty being known in English churches earlier than

CLEAR AS A BELL

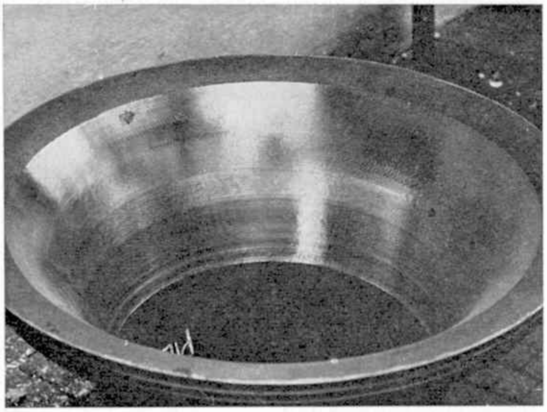
Bells and bell-founding discussed by A. P. Major

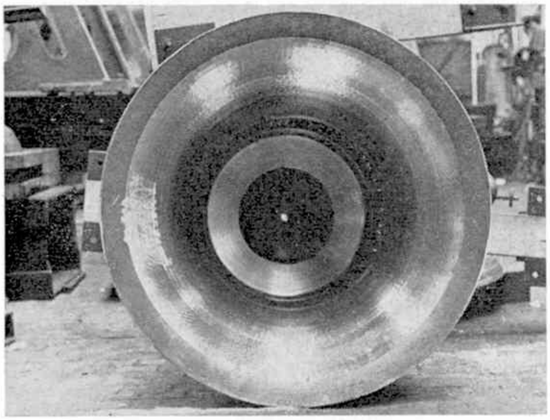
1300 A.D. This is partly due to the fact that on the dissolution of the monasteries and religious houses on Henry VIII's orders, hundreds of ancient bells were melted down. Another reason is that in cases where they did survive they were re-cast in later periods and the bell-founder either re-stamped them with a new date, so that in fact some bells may be much older than their date, or some old bells bear no date, founder's name or inscription at all. It was not until the 16th century that it became general practice to record all these details on a bell. One of the earliest dated bells known is at Claughton, Lancaster, bearing an initial cross and the date 1296 in Roman figures.

It was the custom for the sets of massive abbey and cathedral and smaller church bells to be cast close to the site of the building, especially if the church was still under construction, choosing a site for the furnace and equipment in a field near the building close to a plentiful supply of wood fuel, so avoiding the difficulty of transporting heavy bells over the primitive, often muddy, roads. The first commercial bell-foundry to be erected on a permanent site was in Leicester by Johannes de Stafford in 1360.

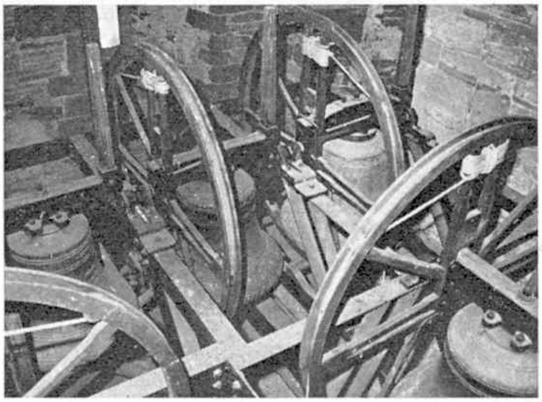
Even though their product can last up to 250 years before it needs any attention, the bell-founding industry is working flat out to meet orders. A reason for this is that there are only two bell-making firms in Britain, one being at Loughborough, Leicestershire, the other at Whitechapel, London. Another reason is that neither firm has sacrificed quality for mass-production quantity and because of this British bells are renowned throughout

Top picture shows a bell being carefully drilled at Taylors, Loughborough. Right, the inner core mould being built up of loam on a basis of bricks using a metal gauge.





the world. Example of both bell-founding firms hang in Singapore cathedral, Seoul cathedral, Korea, the Peace Tower and Niagara Falls, Canada, Sydney Post Office, Australia, and Harvard University, U.S.A. As well as order from abroad there is a steady flow of work for cathedrals and churches in this country, either to produce new bells or repair, recast or re-tune old ones. Those which are cracked have to be re-cast but the older ones are too valuable from a historic point of view to melt down and where possible they are re-tuned and turned so that the clapper will strike a new place. Prices for a new bell range from about £100 for a single unadorned bell to over £2,000 for an average set of bells in a parish church. The largest bell in Britain, " Great Paul " at St. Paul's Cathedral, cast in 1881, weighing 16 tons, 14 cwt., 2 qrs, and 19 lbs., with a diameter of 9 feet 6½ inches, was cast at Loughborough. One of the most famous bells cast at the Whitechapel foundry is " Big Ben," cast in 1858, weighing 13 tons, 10 cwt., 3 qtrs, 15 lbs, which chimes from the clock tower of the Houses of Parliament.



Top left, the rings in a bell—the rifling made during tuning, seen complete at left. Bottom, the raised inscription being formed in the mould by tapping brass letters in the soft cope. Above, the belfry at Bosbury, Herefordshire.

A bell begins its existence in the bell-founder's drawing office where each new bell is individually designed, taking into consideration the purpose of the bell, how frequently it is to be used, the structure of the building to house it, etc. From sectional drawings patterns are made for the two moulds for the inside and outside of the bell. These patterns or gauges are made from strips of metal cut to represent a section taken from the crown or top to the lip of the bell. The mould which shapes the inside of the bell is called the " core " and the outside shape mould is the " cope." These moulds are made by hand in the foundry, the " core " being built up on a foundation of bricks and " loam "—London yellow clay, sometimes mixed with horsehair to bind it—the patterns or gauges being used to smooth the inside and outside to a bell shape. While the " cope " is still soft and before becoming too dry the required lettering or decorative pattern is inscribed on it by carefully using brass letters and designs to tap these into it with a hammer. The two moulds are next separately baked, smoothed with graphite, then clamped together to form a single bell-shaped mould. Into the space between the two moulds the molten metal, an alloy of tin and copper, is poured. When the bell is cool and removed from the mould it is a dirty black

(*continued on page* 340)

The Royal Family on Stamps

By James A. Mackay

IN view of the fact that about a third of the stamp-issuing countries in the world today belong to the British Commonwealth it is hardly surprising that the British reigning monarch easily tops the list of the persons most often portrayed on stamps. The all-time record, of course, was established by Queen Victoria, most of whose long reign coincided with the first sixty years of adhesive postage stamps, at a time when it was very much the rule for the sovereign to be the subject of stamp design. Until 1952 it was invariable practice for the monarch's portrait to appear on the stamps not only of the colonies and protectorates, but also on the definitive issues of the dominions. Only the pictorial designs in certain sets of Canada, Australia, South Africa and New Zealand provided exceptions to this, but they often compensated for this by using a wider variety of royal portraits on other occasions.

More difficult, but by no means impossible, is a collection of stamps devoted to portraits of members of the royal family other than the reigning sovereign. In this category come stamps portraying historic kings and queens of Britain, or living members of the royal family other than the Queen. The earliest examples of the first emanated from Canada which, in 1851, portrayed Prince Albert the Prince Consort on the 6d. denomination. This idea was swiftly adopted by New Brunswick and Newfoundland, both of which portrayed the Prince of Wales (later King Edward VII) as a boy in Highland costume. Newfoundland went on to develop this theme to a far greater degree than any other Commonwealth country. As well as portraying the Prince Consort and the Prince of Wales, Newfoundland produced a whole portrait gallery of the Royal Family in 1897, at the time of Victoria's Diamond Jubilee. Among those portrayed were the Duke and Duchess of York (later King George V and Queen Mary), Queen Alexandra as Princess of Wales, and the infant Prince Edward (now the Duke of Windsor).

In 1911 Newfoundland celebrated the coronation of King George V by portraying all the royal children, from the Princess Royal (Princess Mary) and the Prince of Wales in the uniform of a naval cadet, to the little Prince John who died in childhood. Subsequent definitive sets from Newfoundland portrayed the Prince of Wales and even Princess (now Queen) Elizabeth at the age of six. Later portraits of Princess Elizabeth showed her at the ages of 11 and 21 respectively.

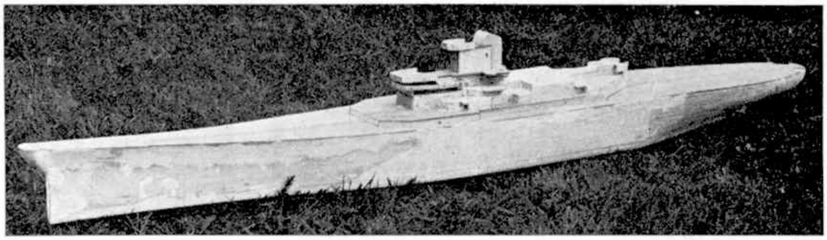
Princess Elizabeth and Princess Margaret were portrayed side by side on the stamps of several countries—Canada (1939), New Zealand (1944), South Africa and Southern Rhodesia (1947) and individually, on stamps of New Zealand (1943) and Northern Rhodesia (1947). The entire royal family was featured on the 2d stamp in New Zealand's Victory series if 1946 and the 1s value in the sets issued by Basutoland, Bechuanaland and Swaziland to mark the Royal Visit to South Africa in 1947. Both Australia and Canada issued stamps to mark the wedding of Princess Elizabeth in 1948.

Neither of these portrayed Prince Philip, though Canada portrayed the Duke and Duchess of Edinburgh (as they were then known) on a stamp of 1951. Prince Philip was subsequently portrayed alongside the Queen on stamps of Australia and New Zealand in 1953-4 and Canada (1957). The Prince first appeared on a stamp without the Queen in 1959 when he visited Ghana. Subsequently he was portrayed on stamps of Ecuador and Paraguay to mark his visits to the countries in 1962. Incidentally the Queen has been portrayed on stamps of Ethiopia, Persia and Brazil in honour of her state visits. Prince Philip's most recent visit was to the Pacific islands and this event has resulted in an attractive series of stamps released by the Cook Islands. The stamps depict various incidents in the Prince's life, from his wedding in November 1947 to his visit to Rarotonga earlier this year. Other stamps in this series feature two of his best-known pastimes—yachting and polo-playing.

One of the Cook Islands stamps shows the Prince of Wales and Princess Anne as young children. Both of them have also appeared on New Zealand Health stamps (1950, 1952) while more recently Prince Andrew has also been depicted (1963). Prince Andrew as a baby was shown on the £1 stamp of St. Helena (1961-65), but so far Prince Edward has not appeared on any stamps.

Historic members of the royal family recorded philatelically include Prince Alfred, first Duke of Edinburgh (Tristan de Cunha, 1967), George III (Mauritius, 1961), William IV (Cayman Islands, 1932) and Charles I (Barbados, 1927 and 1939). Newfoundland portrayed Henry VII (1897), James I (1910) and Elizabeth I (1933) on stamps commemorating important anniversaries in the development of the colony. Since February 1970, however, the West Indian island of Barbuda has embarked on a lengthy series portraying British kings and queens from William the Conqueror (1066-87) to the present day. Two stamps are being released each month, all of 35 c denomination. When complete this series will provide collectors with a full-length portrait gallery of British monarchs from the Norman Dynasty onwards. Historic sovereigns connected with the bailiwick are portrayed on the current definitive series of Guernsey, their profiles being based on contemporary coins. In addition to the rulers portrayed on the Barbudan set Guernsey has gone slightly farther back in time, to include King Edward the Confessor on the old ½d value.

The Sterling U.S.S. Missouri built by one of TV's top comics



Dick Emery's Review

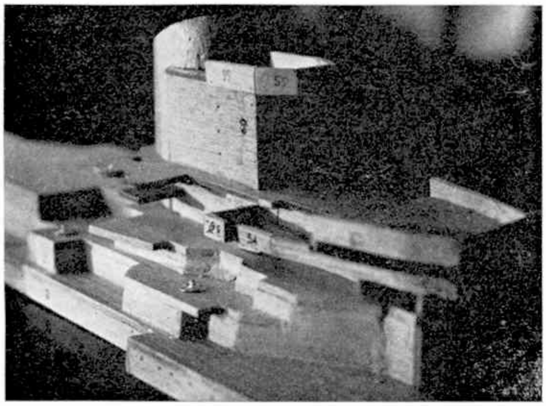
After building and reviewing so many plastic kits in my last column I felt the need to find a single model which would take all my attention. My latest television series has taken even more time than the last and, therefore, what I was seeking was a single kit, which like a good thick novel, I could turn to whenever I had free time.

What I have chosen is not quite my usual thing and because it involves more work I will spend this issue describing its basic construction and in a further issue, the finer details and painting.

The kit, from Ripmax, is the Sterling replica of the USS Battleship *Missouri* in wood, and it costs £15. I have had a little experience with Billing Boats and for some months I have seen the whole page Ripmax advertisements in other MAP publications. The battleship appealed to me greatly and boasted an overall length of 55½ inches, which is quite a challenge.

It arrived in a box only 28 inches by 8 and its contents looked most unlike a replica of America's biggest World War II Battleship. It's just a heap of balsa and plywood bits, partly shaped or stamped out in sheets. The fittings are tiny and also need a good deal of work. However, the drawings and instructions are good and the whole box of "firewood" represents the most exciting challenge.

To start with, you lay out and glue a floor of 7 pieces of preshaped balsa. The outer edges are slotted and into these go preshaped and numbered uprights, and across those, cross members; at the bow the individual side members become solid one-piece uprights.



Once this is complete and three interlocking, preshaped planks of balsa have been laid along the outer edges of the cross members, the model really begins to take on the shape of a vessel.

The next stage involves turning the boat over and laying numbered balsa pieces into a long narrow diamond shape, thus forming a stepped effect on the underside. Now the gap between the sides of the boat and the raised area is filled with four preshaped balsa blocks providing the hull shape.

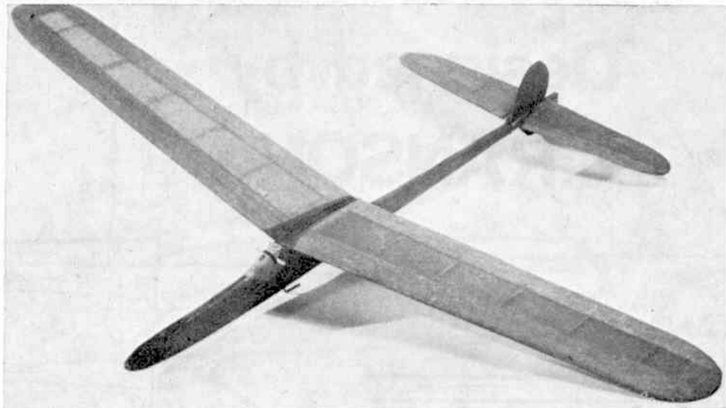
Next come the balsa side skins to the vessel. These are shaped and have areas towards the stern and parts of the bow left for filling with balsa planking. This appears necessary with the more complex curves. The part-shaped bow and stern blocks go into place and five plywood deck pieces go into place on top. This completes the basic hull and before moving onto the superstructure, I should say each step requires sanding, gluing, pinning, and much patience.

The basis of the superstructure is a series of plywood decks with balsa walls containing as many as 32 tiny irregular sections per deck. After sanding and some wood filler it looks good. Occasionally, however, the numbers are completely wrong on the stamped out sheets and you have to work on sight from the instruction drawings.

Finally you reach a point where three deck levels are solidly glued together, forming a platform onto which you gradually build the forward detailed structure. This involves four more levels of decks and smaller uprights. Into this area too goes the forward funnel.

At this point the major construction work nears an end. The instruction book suggests that all is put on one side whilst attention is focused on the details like turrets, guns, conning assemblies, radar, etc., and it is at this stage I will continue next time. It's the detail which will make or spoil such a model and with instructions like 'bind thread round 80 pins to form 40mm guns,' the report should test, at the very least, my patience. It will also concern itself with the painting and finishing off of this big scale kit.

MINIMOD



Full-size plans for a tough, high performance 25 in. wing-span glider

By LEN RANSON

MINIMOD is exactly what its name implies: a true model aircraft in miniature, both in appearance and style of construction. The idea behind its design was to present a model that even the rawest beginner could produce, but yet not look too typically a beginners' model. In fact, I personally do not believe in beginners' models as such; any model design, in my opinion, should be capable of a performance of interest to the experienced modeller just as much as to the beginner, and here *Minimod* is every bit up to model club standard, giving a fast, soaring type of flight which everyone will admire, even the expert. It should be good to look at, too, if built and finished correctly, with its sleek, modern sailplane lines and realistic flight pattern.

You can construct *Minimod* in a few evenings, using only the very basic tools: a balsa knife and a few grades of fine glasspaper, plus, of course, model pins and drawing pins. You will, however, need some sort of building board, and here any flat piece of softwood, not less than 30 in. × 6 in. in size, will suffice. A piece of floorboard will do admirably, although it is advised that you buy this rather than prise it up from the living room floor. And, I almost forgot, you will need some grease-proof paper.

Regarding materials, the sheet balsa is perhaps a bit expensive, particularly the thick stuff, but the durability of this type of construction over that of strip balsa and tissue is well worth the extra outlay, Moreover, the tough sheeting makes *Minimod* an ideal rough weather model, allowing it to be thrown about without mishap. See, though, that the sheet is soft. Not pappy soft, but definitely the lighter balsa wood grade. Here your model shop should help. Most balsa sold is now graded into soft and harder categories, and you should not have too much trouble in getting the type of wood you require. Hard balsa will make for tough carving and disastrously over-weight your model.

As you can see, the fuselage is a three ply lamination: two pieces of $\frac{1}{8}$ in. sheet sandwiching a centrepiece of $\frac{3}{16}$ in. sheet. The difficulty is to shape these as per plan. One way is to take a tracing on greaseproof paper, cutting this out and lightly pasting on to the sheet balsa. The shape can then be readily cut with a sharp balsa knife. Do not forget the ballast well in the centre piece, nor the cut outs for wing and tail platforms and the towhook slot. The towhook assembly, that is, the 18 s.w.g. wire looped and bent as shown held between two slivers of plywood, must be cemented in before assembling the fuselage. Prepare the fuselage sections by smearing a thin layer of cement over each of the facings. Allow to dry, repeat the process, press the sections together and hold firm with a light cellotape binding. Leave to set for at least 24 hours, then carve and sand to shape. Do ensure that you pare down to the right dimensions; nothing looks worse than a lumpy half finished fuselage.

Now cut out the sheet wing sections, preferably using a steel edged rule. Shape these roughly to the aerofoil shape indicated on plan before pinning down. When you have constructed the two wing halves slightly cant back the dihedral break ends to ensure a good V fit and cement the two halves together. This is best done by pinning down one wing half and propping up the other with a $3\frac{1}{2}$ in. support at the tip. When thoroughly set, sand down smoothly to the aerofoil shape, finishing off with the finer grade of paper. Again ensure against lumpiness, particularly at the tips and along the trailing edge. The tailplane is similarly constructed, but without dihedral.

The fin is cut from $\frac{1}{16}$ in. sheet. The edges should be sanded round.

Having completed the various components they should be given a coat of dope, and when thoroughly dry lightly sanded to a satin finish.

The model is covered in Modelspan tissue, using a model tissue paste as an adhesive (I use thick Polycell). The paste should not be spread on too thickly, nor over the whole of the balsa areas. Paste along edges only, pulling the tissue with an even tension. Allow a slight overlap when trimming off, and paste this smoothly down. Lightly water spray the components, though not the fin sections as this may cause warpage. Leave to dry for at least 24 hours.

You can now cement the fin sections to the tailplane and fuselage. You will notice that the upper fin needs to be shaped to fit the tailplane section.

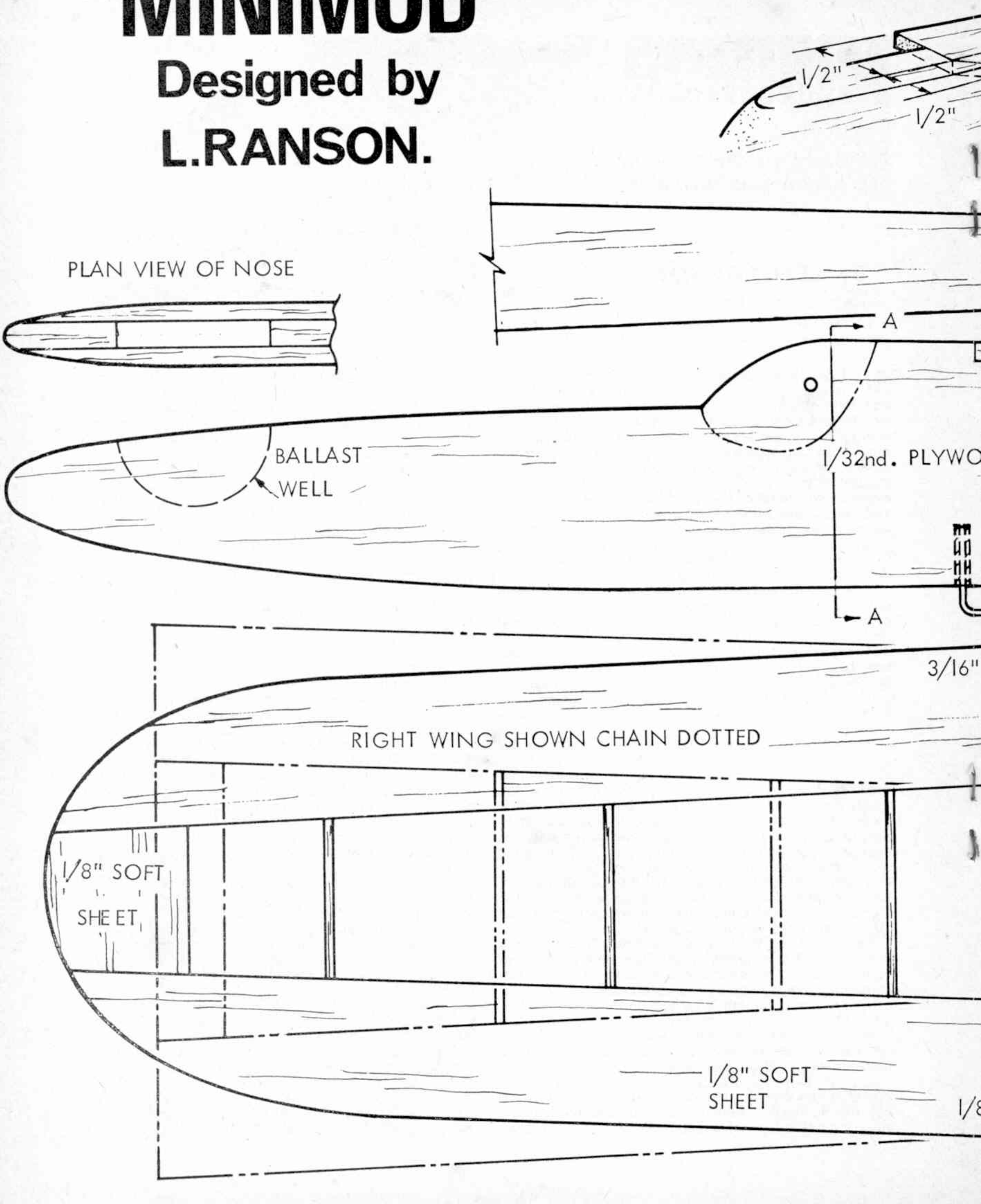
Give the whole model a coat of dope, and an extra coat to the fuselage if required. For a high finish use banana oil or even fuel proofer, though apply same sparingly. The cabin can be denoted by two layers of a lighter coloured paper.

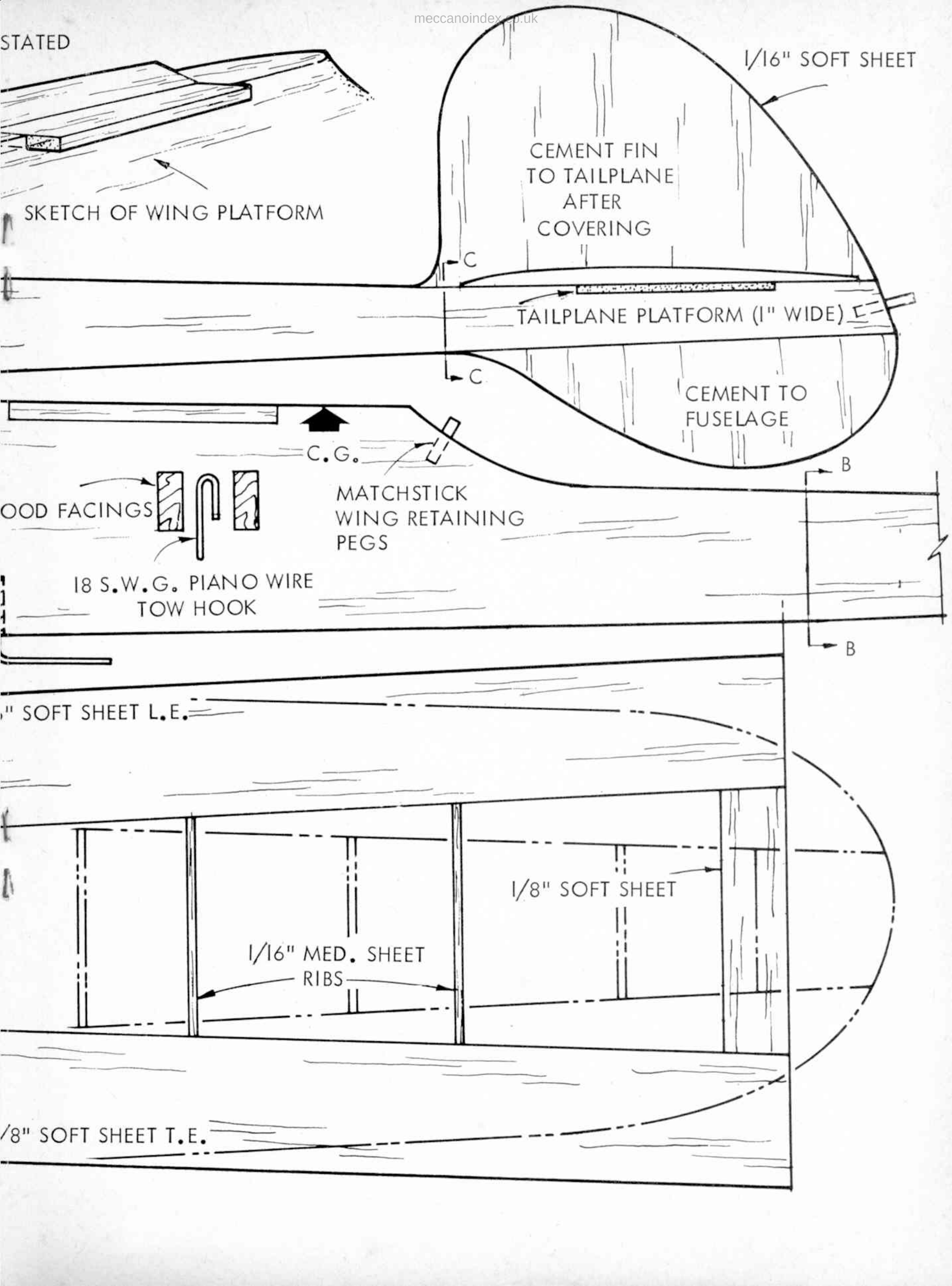
Ensure that the wing is a good fit on the platform, which should be vee-ed to take the wing dihedral. Next, pierce the fuselage where shown to take the matchstick retaining pegs. Fill the forward ballast well with lead shot or lead scrapings, using Plasticine to seal it in. Use not one, but two, rubber bands to hold the wing on to the retaining pegs—same for tailplane. It is important that the surfaces are attached firmly, without wobble, particularly as the model tows up fast. Do not

MINIMOD

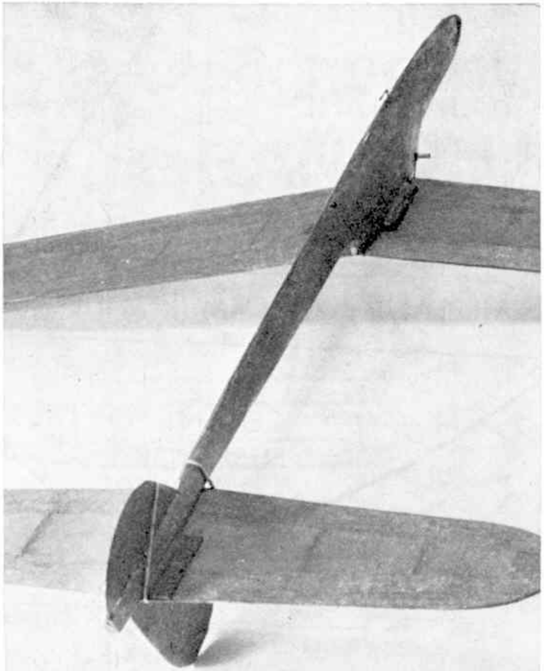
Designed by L.RANSON.

ALL WOODS BALSA UNLESS OTHERWISE ST





STATED
SKETCH OF WING PLATFORM
1/16" SOFT SHEET
CEMENT FIN TO TAILPLANE AFTER COVERING
C
C
TAILPLANE PLATFORM (1" WIDE)
CEMENT TO FUSELAGE
C.G.
MATCHSTICK WING RETAINING PEGS
OOD FACINGS
18 S.W.G. PIANO WIRE TOW HOOK
B
B
" SOFT SHEET L.E.
1/8" SOFT SHEET
1/16" MED. SHEET RIBS
/8" SOFT SHEET T.E.



overtension, though, as in the event of a mishap, the wing should spring off.

With the model assembled and balanced at the point given on the plan, try a hand launch over a soft patch of grass. If all is correct it should travel quite a few yards from a gentle, shoulder height throw. However, it might well dive in, and if it does this and you are satisfied that it is not due to faulty launching, remove some of the nose lead and try again. On the other hand it may rear up into a stall. It may do this anyway, if the weather is windy or your throwing too energetic, but if it persists in doing this from the gentlest of launches then more nose weight is indicated. Again if the model veers to the right or left you should correct this tendency by bending the rear part of the upper fin.

The towing line is a length of terylene or nylon about a hundred feet long, and this can be obtained from a model or angling shop. The launching ring can be a curtain ring, about ½ in. diameter, or bent from paino wire, and is securely tied to the end of the line. Attach a drogue of tissue paper about a foot back from the ring—it's easier to find that way. Use only about twenty feet or so of line for your initial flights. Get your helper to hold the model level into wind, head high, and run forward with you until sufficient airspeed is obtained for the line to take it up. The amount of run of both tower and helper will depend on the strength of the wind. Do not carry out initial tests in anything but a slight breeze.

You will find the model will tend to pull up very quickly on the line and swoop off quite suddenly. The amount of control you achieve over the model is a matter of practice. It is, of course, very unlikely that the model will be in correct trim. It might well stall, or go into a spiral dive. This is where the robustness of *Minimod* pays off. The sort of crash which would severely damage the balsa and tissue type of model will leave *Minimod* unscathed. Even so, test fly your model over fairly high grass, and see that there are no people standing just down wind.

Once you get the hang of flying *Minimod* you should have many interesting flights.

Materials

1 sheet of Soft $\frac{3}{16}$ in. × 4 in. × 36 in. Sheet Balsa.
1 sheet of Soft $\frac{1}{8}$ in. × 3 in. × 36 in. Sheet Balsa.
1 Strip $\frac{3}{16}$ in. × $\frac{1}{16}$ in. medium balsa.
1 short length $\frac{1}{8}$ in. × $\frac{1}{16}$ in. balsa.
Scrap of $\frac{1}{16}$ in. sheet balsa (for fin sections and tail-plane platform).
Slivers of 1/32 in. plywood.
Short piece of 18 s.w.g. piano wire.
2 sheets of Modelspan tissue (variously coloured).
1 tube of cement, medium.
1 tube of tissue paste.

CLEAR AS A BELL

(*continued from page 334*)

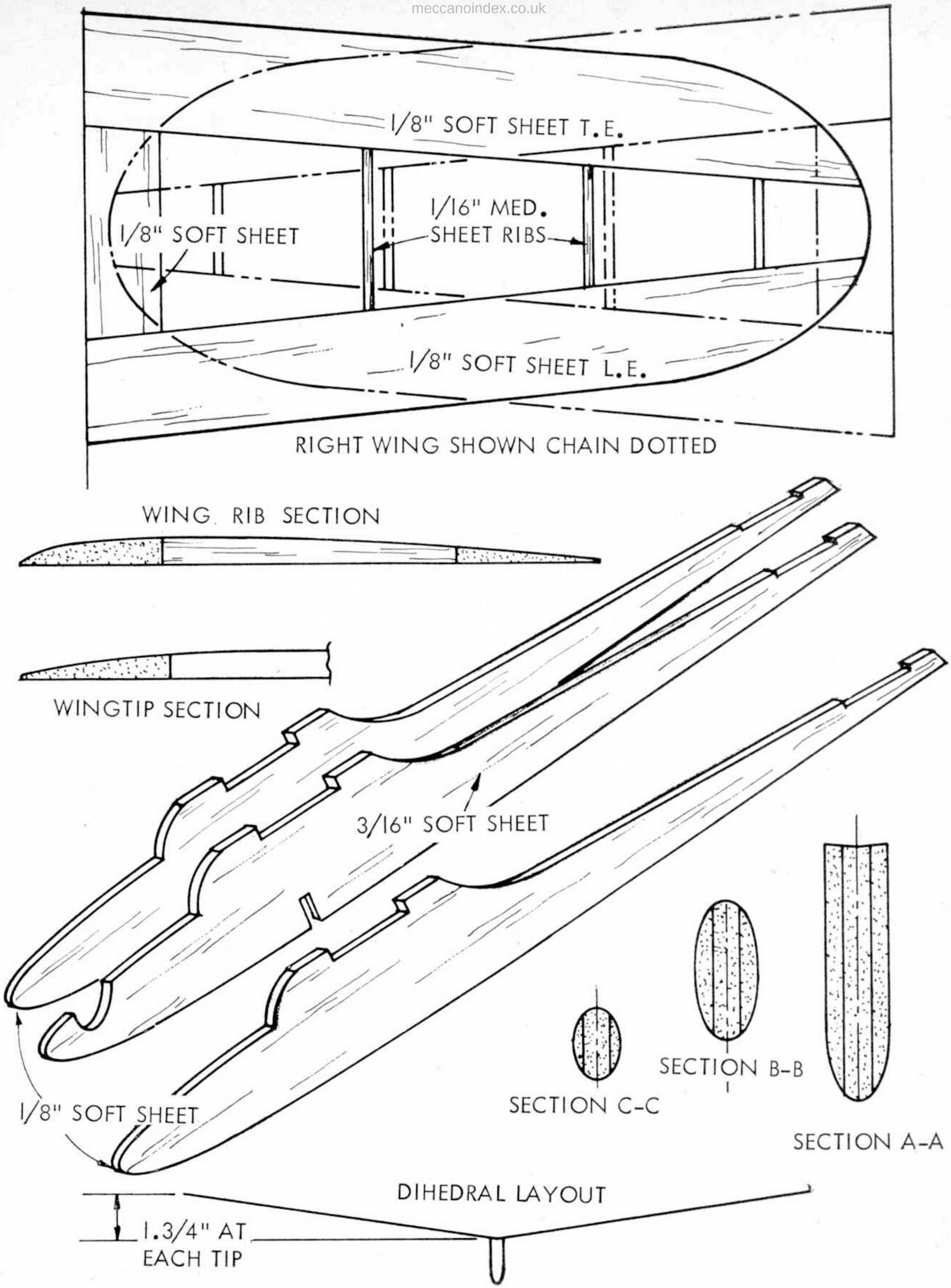
colour and has to be cleaned, then set up ready for tuning.

The quality of a bell's tone depends on the shape, size, thickness and material of the metal and experience is the main guide as there is very little written as textbook on the subject. To the expert a bell has five distinct notes—the strike note, the hum, which is an octave lower, the nominal, which is an octave higher, the tierce, a third above the strike, and the quint which is a fifth above the strike. A bell is always cast slightly sharper than the note required so that it can be gradually flattened to the correct note by turning metal from the inside using a large vertical lathe to do so. By removing metal from different areas inside the bell each of these notes is at its correct position in the musical scale. This is a task that requires true craftsmanship and experience, involving hands, ears and eyes, working together. If a mistake is made it cannot be rectified. Incidentally, the bell metal is so valuable that a special machine is used in the foundry to separate the fragments of metal from other sweepings.

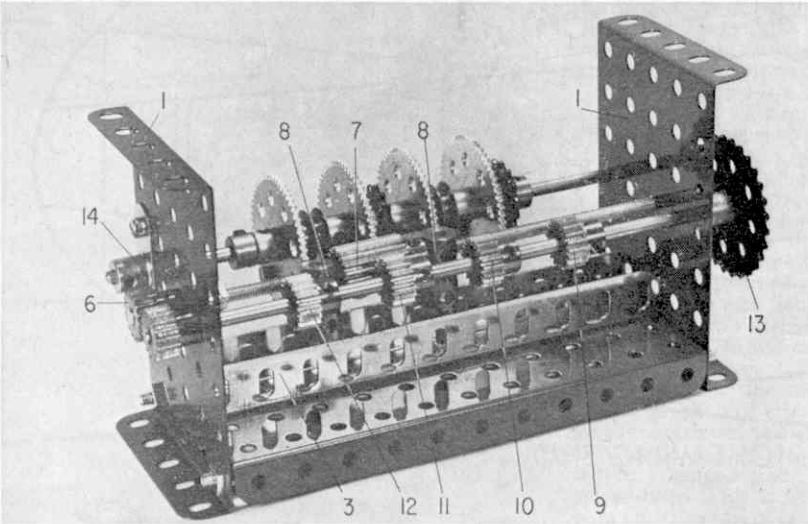
When a new " ring " or set of bells is being tuned they are placed in a semi-circle and the tuner walks by, hitting each one in turn with a wooden mallet to ensure that they make a pleasant harmony. During testing the room is filled with their deep, sonorous sounds. After tuning each bell is lagged with material to protect it during transportation, particularly the lip from chipping which would affect the sound of the bell.

The hanging of the bell is also very important because it can affect the ringing sound and the safety of the tower so the bell-foundries employ specialists to do the job. The bell foundries have metal-working and carpentry departments where specialists make the various parts of the bell frame, even the keyboards for carillons. A wheelwright makes the bell wheel over which the bell ropes run, the spokes being of oak, and the rim of elm. Another expert sets the ball bearings in the wooden guides for the ropes. The " striker " and other metal parts are also made at the bell foundry, with the girders which support the frame in the belfry.

Automation, however, is creeping into the act of bell ringing itself. In its simplest form this consists of an outfit that will stop or start a bell ringing at the push of a button, while it is possible now to obtain a time switch which can be set to ring a bell at the appropriate time for the services during the whole of a week.



1/8" SOFT SHEET T.E.
1/16" MED.
SHEET RIBS
1/8" SOFT SHEET
1/8" SOFT SHEET L.E.
RIGHT WING SHOWN CHAIN DOTTED
WING. RIB SECTION
WINGTIP SECTION
3/16" SOFT SHEET
1/8" SOFT SHEET
SECTION C–C
SECTION B–B
SECTION A–A
DIHEDRAL LAYOUT
1.3/4" AT
EACH TIP



Among the Model-Builders

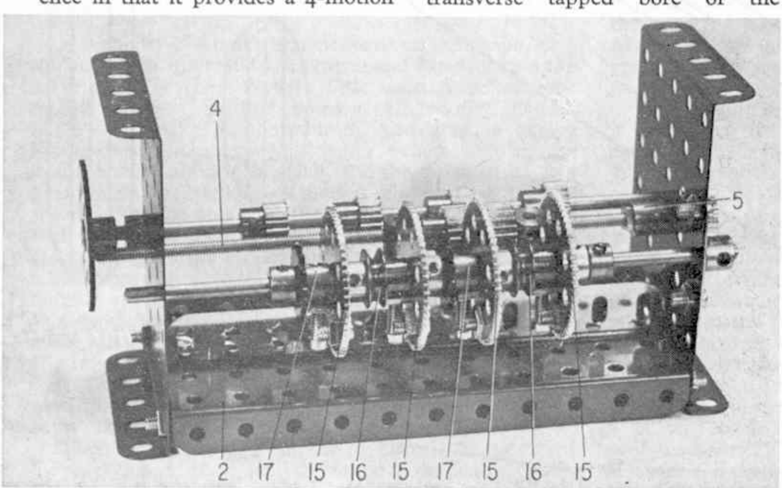
with 'Spanner'

Intermittent Motion Mechanism

Of all the many types of advanced Meccano models which are built for display purposes, those which create the most interest—and give the greatest satisfaction to the builder—are the fully-automatic type, the models which, after being started up, perform their sequence of movements entirely on their own, without any outside control.

To produce automatic movement in models, special mechanisms must often be incorporated and one of the most frequently-used of these special mechanisms is the Intermittent Motion Unit which, instead of providing constant, non-stop movement, provides an "intermittent" movement at regular intervals. Our first offering this month is such a mechanism, but one with a difference in that it provides a 4-motion intermittent drive instead of only a single-motion drive. Full credit for its design goes to Mr. Robert Clark of Newcastle-on-Tyne, Northumberland.

As far as construction is concerned, two 3½ × 2½ in. Flanged Plates 1 are bolted one to each end of a 5½ × 2½ in. Flanged Plate 2, a centrally-positioned 5½ in. channel girder 3 (built up from two 5½ in. Angle Girders) being bolted to the top of the latter Plate. Journalled in the centre hole of one Plate 1 is a 6 in. Screwed Rod 4, one end of which is locked by a Nut in an Adaptor for Screwed Rod 5, journalled in the centre hole of the other Plate 1 and held in place by a ½ in. Pinion 6. Mounted loose on the Screwed Rod is a ½ × ¾ in. Pinion 7, positioned between two Couplings 8, the Rod passing through one end transverse tapped bore of the Couplings. Held in the lower end of the longitudinal bore of each Coupling is a 1 in. Rod which locates between the flanges of channel girder 3 to prevent the couplings revolving in the Screwed Rod.



In mesh with Pinion 6 is another ½ in. Pinion on a 6½ in. Rod journalled in Plates 1, this Rod also carrying four further ½ in. Pinions 9, 10, 11 and 12 (evenly spaced along the Rod, as shown) as well as a collar and a 1½ in. Sprocket Wheel 13. Another 6½ in. Rod is mounted in Plates 1, this Rod being prevented from turning by being held in the boss of a Double Arm Crank 14 bolted to the outside of one of the Plates. Carried loose on the Rod are four 57-teeth Gears 15, each Gear followed by either a ½ in. Pulley with boss 16 or a ¾ in. Sprocket Wheel 17, these also loose on the Rod. A ½ in. Bolt is locked by a Nut in the boss of each Pulley or Sprocket, the shank of the Bolt engaging with an ordinary Bolt fixed by a Nut in the face of the corresponding Gear Wheel. As one or other of the Gears revolves, the Bolts engage, thus causing the adjacent Pulley or Sprocket to revolve with it. The whole Gear and Pulley-or-Sprocket arrangement is held in place on the Rod by two Collars.

In operation, drive is taken to Sprocket Wheel 12, this drive also being passed to Screwed Rod 4 via Pinion 6. As the Screwed Rod

Top, a 4-motion Intermittent Drive Mechanism designed by Mr. Robert Clark of Newcastle-on-Tyne, Northumberland. Left, another view of Mr. Clark's Intermittent Drive Mechanism showing the output Gear Wheels with their alternative output Pulleys and Sprockets.

revolves, Couplings 8, with Pinion 7, move along it, causing Pinion 7 to mesh, in turn, with Pinions 9, 10, 11 and 12 and corresponding Gear Wheel 15 as it progresses along the Screwed Rod. Thus an intermittent drive is transmitted to each Gear Wheel 15 in turn. The drive to the required movements is, of course, taken from Gear Wheels 15, the adjacent Pulleys and Sprockets providing alternative drive points if the Gears are unsuitable for the requirements of the particular model.

In his original instructions for the Mechanism, Mr. Clark stresses that the unit illustrated is only a demonstration model and that the close proximity of the Gears can prove awkward when they are linked to different outlets. "I suggest," he says, "That Socket Couplings be used if the unit is built to a larger scale. The 1½ in. Sprocket input drive is, of course, optional." For continuous working under operational conditions, a reversing mechanism would need to be incorporated either in the mechanism itself, or in the input drive linkage, to reverse the direction of rotation of the Screwed Rod at the end of the long-faced Pinion's travel.

PARTS REQUIRED

2—9	1—26b	1—52	1—79a
2—14	4—27a	1—53	1—95a
2—18b	12—37a	3—59	2—96
2—23a	17—37b	1—62b	4—111a
6—26	1—38	2—63	1—173a

Meccanograph crown head

On a different subject, you will remember that, in the April M.M., we featured one of a pair of Meccanograph attachments designed by Mr. H. J. Halliday of London. Lack of space prevented us from featuring both mechanisms at that time, but we are pleased to rectify the situation, now, with the Crown Head illustrated in the accompanying diagrams. When fitted to the driven rod, actuating the pen arm of a Meccanograph, it will considerably increase the number of patterns it is possible to produce.

A 1½ in. Bevel Gear 1 is first secured on a Long Threaded Pin fixed in the centre tapped bore of a Coupling 2, then two Angle Brackets are bolted in diametrically opposite positions to the face of an 8-hole Bush Wheel 3, the securing ⅜ in. Bolts passing through the elongated holes of the Angle Brackets and into the longitudinal bores of two Threaded Couplings 4 which take the place of the securing Nuts. The Angle Brackets should be extended outwards to the limit of their elgonated holes. Five more Threaded Couplings are fixed to the face of the Bush Wheel, four of them spaced from the Bush Wheel by Nuts on the shanks of the securing ⅜ in. Bolts (see diagram 2). Note that all the Couplings should be arranged so that one of the transverse tapped bores is directly in line with its opposite number.

A Set Screw is next fixed by a Nut 5 in the circular hole of each Angle Bracket, with a Washer between the Nut and Bracket and the Nut tightened to lie diagonally to the edges of the Bracket. The Bush Wheel is then mounted loose on the Long Threaded Pin, Nuts 5 being adjusted so that the lowest corner of each engages simultaneously with the teeth of Bevel Gear 1. A short length of Compression Spring (about three or four coils) is added to the Threaded Pin, to hold the unit in engagement, and is held in place by a Rod Socket 6, leaving sufficient freeway to allow the Bush Wheel to be raised and rotated on its axis. Another Threaded Coupling is then secured to the face of the Bush Wheel through its remaining hole, using an ordinary Bolt which can be tightened through one of the holes in the face of the Bevel Gear. This last Threaded Coupling was omitted earlier, incidentally, to allow access to the Rod Socket securing screw.

When incorporated in a Meccanograph, Mr. Halliday's Crown Head is mounted on the driven Rod of the model by one end Transverse bore of Coupling 2, and so is eccentrically mounted. As the Bush Wheel moves round its axis, each Threaded Coupling assumes a slightly wider, or narrower radius in relation to the driven Rod.

The short Axle Rods usually acting as cams against the pen arm can be dropped freely into any pattern in the Threaded Couplings, but, if secured tightly by Grub Screws, other forms of cams can be devised, such as a Double Arm Crank fixed to one of the Rods and also carrying one or two Threaded Pins. Another example could be an Adaptor for Screwed Rod fitted by its shank into one of the Threaded Couplings, its larger end further increasing the amount of throw obtained. An Adaptor for Screwed Rod can also be fitted to Rod Socket 6 to give a further short-radius-throw cam that can be combined with others round the perimeter of the Bush Wheel to make up a minimum number of nine possible cams. These cams, however, can be

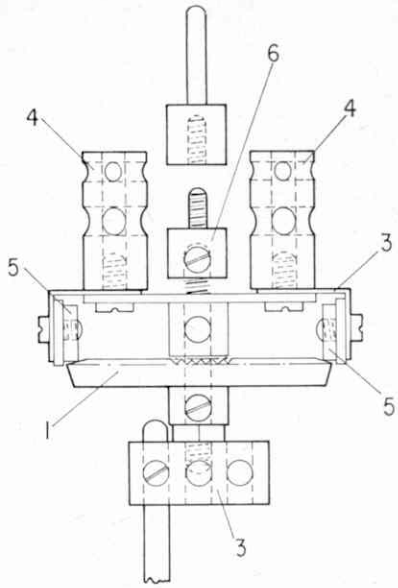


Diagram 1. A Crown Head for a Meccanograph designed by Mr. H. J. Halliday of London. The Adaptor for Screwed Rod A can be added to serve as an extra short-radius-throw cam, as described in the article.

infinitely varied to give the unit tremendous versatility.

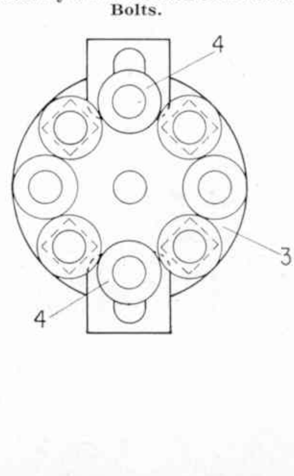
PARTS REQUIRED

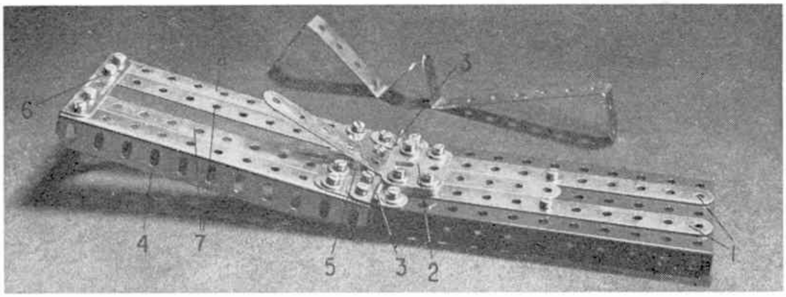
2—12	6—37a	8—63c	1—115a
1—24	1—37b	2—69	1—120b
1—30c	2—38	7—111c	1—179

Bending Jig

To close with, this month, I have a small item which came to me from the head of Meccano's Model-building Department and which I think may be of interest to many readers. In the course of their work

Diagram 2. The Bush Wheel assembly used in the Crown Head, as seen from above. Note that four of the Threaded Couplings are spaced from the Bush Wheels by a Nut on each of the securing Bolts.





A simple, yet highly effective Jig for bending Meccano Strips, designed by the Head of Meccano Tri-ang Limited's Model-building Department. The original is used for non-modelling purposes.

in the Model Room, the staff frequently have to build display pieces—not necessarily Meccano displays—in which they often use bent Meccano Strips for brackets. They are not alone in this, of course, as a lot of people use Meccano for non-modelling purposes, but, because of the large number of such brackets used in his Department, the Head of the Model Room has developed a simple, yet efficient jig for bending Strips cleanly and in the right place—between two holes, as opposed to across a hole. It can be used to produce ordinary angle brackets, reversed angle brackets and even double angle strips.

The simplicity of the Jig's design is evident from the accompanying photograph. Produced in two sections, one section consists of a 5½ × 2½ in. Flanged Plate, to the top of which two 5½ in. Strips 1 are bolted, a distance of one hole separating them. Bolted to one end of the Strips, as shown, are four 1½ in. Flat Girders 2, placed one on top of another for strength, and these should be arranged so that a standard Strip will just fit beneath them when slid along the channel between Strips 1. The whole assembly is connected by two Hinges 3 to the other section of the Jig which is built up from two 5½ in. Angle Girders 4 connected together at one end by a 2½ in. Angle Girder, overlaid by a 2½ in. Flat Girder 5 and, at the other end, by a 2½ in. Angle Girder 6, only. Angle Girder 6 is connected to Flat Girder 5 and the other 2½ in. Angle Girder by two 5½ in. Strips 7, with a half-inch space between them. This space is necessary when producing reversed angle brackets as one of the lugs of the bracket must project through it.

To use the Jig, a suitable Strip is slid down the channel between Strips 1 and under Flat Girders 2 until the point where the bend is to be made is in line with the inside end of the Flanged Plate. The exact position can be determined by lining up the two nearest holes in the Strip with the holes in Flat Girders 2. With the Strips in position, the desired bend is achieved by simply hinging up the section of the Jig containing Girders 4. For reversed angle brackets and double angle strips, the first bend should be made, then the action repeated as required.

PARTS REQUIRED

4—2	20—37a	1—52	2—114
2—9	20—37b	1—103f	
2—9d	10—38	4—103h	

DINKY TOY NEWS (*from opposite*)
eye-slit headlamps, producing an impression of graceful power. The rear engine cover and roll bar creates a cowl-like effect, easily seen from the side view, this impression being further accentuated by the blunt, sturdy rear of this action-packed car.

Dinky Toys have captured all the lines of the original and incorporated some special features of their own to add to its play-value. An opening rear engine cover, with a transparent centre panel similar to the original's, is decorated with a black sporty stripe on each side, and it hinges back to reveal a plated engine complete with a stubby exhaust pipe projecting rearwards. The nylon moulded Speedwheels also used on the Ferrari give it increased speed while a black moulded interior adds to its attractiveness. External finish is in fluorescent light red, with white baseplate and black and white engine cover.

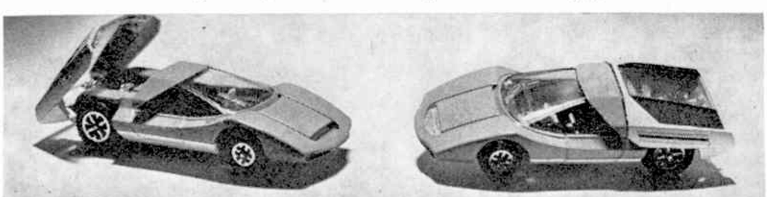
Produced, like the Ferrari, to a scale of 1 : 43, the Fiat Abarth 2000 is marketed under Sales No. 202, and should attract a lot of attention from sports car enthusiasts and general collectors alike.

FIRE CHIEF'S RANGE ROVER

Another recent Dinky Toy announcement from Meccano Tri-ang will be of particular interest to collectors of model fire-fighting equipment. A new Fire Chief's Car is being introduced in the form of a specially-finished Range Rover, enamelled in a flamboyant red gloss with bright-plated baseplate and radiator-grille, and equipped with an imitation blue light on the roof and fire service labels, with Brigade crest, on the side doors. Identified by Sales No. 195, this model will make a very handsome partner for the other fire-fighting appliances in the range, being, after all, based on an ideal vehicle for the job—a big, powerful, 4-wheel-drive estate car as much at home across country as on paved roadways. What could be better ?

As with the standard Dinky Range Rover, introduced at the end of last year, the new Fire Chief's Car is fitted with Speedwheels, opening bonnet covering a detailed engine, opening doors and an opening two-part tailgate. Windows are of course included as well as a steering wheel and full seating, the backs of the front seats hinging forwards. This year's number plates are carried at front and rear.

Most people have a keen interest in a well-equipped Fire Brigade and I honestly feel that no model Brigade would be complete without this new Dinky.

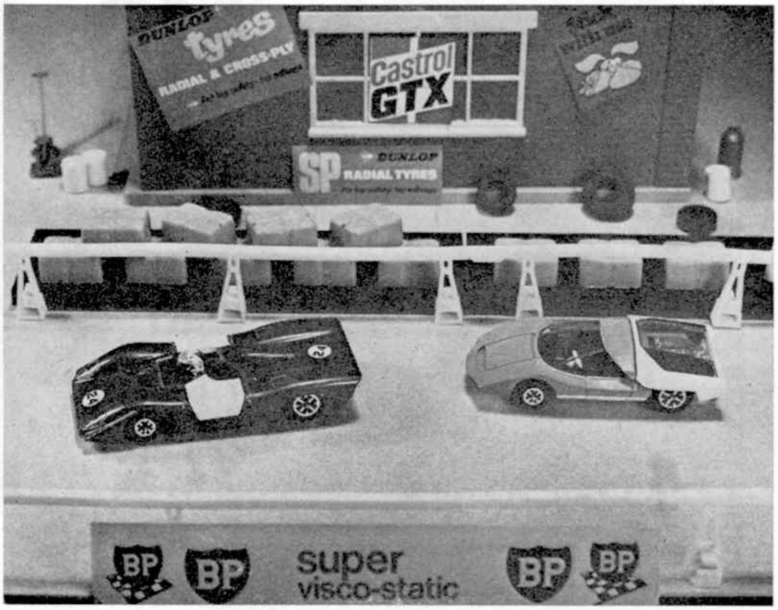


Opposite, top, the two new Dinky Toy sports cars in a simulated racing sequence, with the Fiat Abarth hot on the heels of the Ferrari 312P. Bottom, left, anticipating real-life trends is Dinky Toy No. 195 Fire Chief's car and, right, the Ferrari 312P showing the unique forward-hinged doors. Left, the sleek and attractive shape of the Fiat Abarth 2000 is well captured in Dinky Toy No. 202.

DINKY TOY NEWS

Sports Cars Italian

by FRANK LOMAX



The evolution of the racing sports car undoubtedly owes a great deal to the Italian motor industry. In fact, it is probably true to say that it owes a great deal to one particular Italian motor manufacturer—Ferrari Automobile of Modena. Throughout racing history Ferrari have certainly managed to occupy a prominent place among the world leaders, producing machines which have approached engineering perfection, and they are still in the forefront today. The ultra-modern Ferrari 312P, for instance, is a fine example of their design skill and it is this powerful vehicle which Meccano Tri-ang Ltd. have chosen for a new addition to their Dinky Toys range.

The long, low, rectangular body has the basic wedge-shape so common among modern racing cars, with the long bonnet sloping down to the front air-intake slit. The slightly bulbous front wings, carrying oval headlamp inserts, also include small aerofoil sections which serve to force the nose down, thus improving road-holding.

From the side, this beautiful car has an undulating shape with two gentle " waves " over the large rear and smaller front wheels. Positioned just behind the cockpit is a roll-bar and a raised carburettor air-intake in a streamlined housing, while, at the rear, the direction indicators, brake and rear lamps are sheltered by an extended body sweep-back which further increases the impression of power.

Dinky action features have of course been added to increase realism and play value, the most distinctive being opening doors which hinge upwards and forwards just like the real thing. The black moulded two-seat interior is fitted with a white steering wheel protected by a small windscreen and positioned to the left of this is a streamlined racing mirror. Competition numbers at front and rear increase the air of speed and performance.

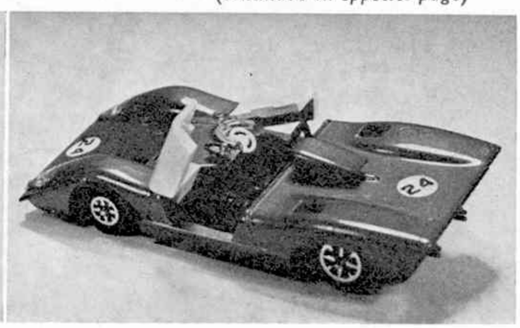
To match the high-speed characteristics of the original car, Dinky Toys have fitted, for the first time, the special one-piece " Speedwheels " made from high-density Polyethylene which are now becoming generally accepted by model manufacturers for use on today's die-casts. The wheels greatly increase the velocity at which a model will travel on flat surfaces and the fact that they are moulded in Polyethylene not only permits much more realistic chrome-work to be included, but also enables stronger, non-flexible axles to be used, thus improving straight-running. All in all, therefore, the Ferrari 312P, Sales No. 204, should make an excellent addition to any model racing stable.

SPORTY FIAT

Parked majestically outside the London Hilton Hotel, gleaming on a sun-drenched Mediterranean harbour front, or speeding along a winding snow-covered mountain road, the sleek Fiat Abarth 2000—another dream-like Italian sports car—still retains its impression of lithe beauty, no matter what the surroundings, and this is a quality which Meccano Tri-ang Ltd., have managed to retain in their recently released model of this high performance car.

Aerodynamically designed to ensure minimum wind resistance and maximum speed, the long, low, wedge-shaped body has exciting, sweeping lines which make it a real eye-catcher. The gentle, sloping front, incorporating an expansive windscreen, tapers to the

(*continued on opposite page*)



AIR NEWS

BY JOHN W. R. TAYLOR

Marshall White's Home-built Fighter

Back in 1969 Marshall White of Anaheim, California, decided to design and build his own sportsplane. As he works for a company that manufactures space-age satellites, it may seem surprising that he turned the clock back more than half a century and based his aeroplane on German fighter designs of the 1914-18 War. However, the result is one of the most beautiful and exciting " home-builts " in the world, and dozens of other amateur constructor-pilots are already working on similar aircraft, made from Mr. White's plans.

The prototype is named, appropriately, Der Jager D.IX. *Jager* is German for " fighter " and reflects the fact that the wings of the little single-seater are based on those of the Albatros D.Va, and the tail unit on that of the Fokker D.VII—types flown by many of the top German aces of the first World War. Two dummy machine-guns are mounted above the fuselage forward of the cockpit, and the " bomb " between the main undercarriage legs is so designed that it can be used to trail coloured smoke during aerobatic displays. The undercarriage is, incidentally, similar to that of the Focke-Wulf Stosser trainer of the 'thirties—a different era but still German.

Such parentage for a modern American lightplane is by no means surprising. There is tremendous interest on the other side of the Atlantic in anything connected with the air fighting of 1914-18, and aces like Germany's " Red Baron," Manfred von Richthofen, are viewed in much the same light as mediaeval knights in shining armour. Replicas of Fokker Monoplanes and Triplanes, and Sopwith Pups and Camels, are flying or under construction by the dozen. Marshall White's Der Jager D-IX is not in quite the same category, inheriting only the outline shapes of the first World War fighters, but this has enabled it to combine " vintage " lines with a thoroughly modern performance.

Construction is similar to that of the old Fokkers, with a welded steel-tube fuselage and tail unit, and wooden wings, all fabric-covered, but Der Jager is much smaller, with a span of only 20 ft., length of 17 ft. and maximum take-off weight of 888 lb. Its 115 h.p. Lycoming O-235-C1 engine compares with the 110 h.p. Oberursel of the 1917 Fokker Triplane, which had a top speed of 103 m.p.h., but Der Jager can fly at 145 m.p.h. Even the Fokker D.VII of 1918, with a 160 h.p. Mercedes engine, could manage only 117 m.p.h.

Marshall White built four other aeroplanes before Der Jager D.IX, which flew for the first time on September 7, 1969. None of them achieved such immediate success, for he is now kept busy supplying not only sets of plans but kits of materials and some of the more difficult-to-construct parts in finished form. It may not be many years before whole squadrons of these little biplanes are available to recall the swirling aerial dog-fights of aviation's first big war.

Dassault's Baby Airbus

An airliner able to carry up to 155 passengers is hardly one's normal idea of a " baby." Nonetheless, Dassault's new Mercure is small by airbus standards and this may be its biggest attraction, as airlines are finding it impossible to fill such giants as the Boeing 747. Only a quarter of the seats were occupied when BOAC operated its first regular 747 service to the USA in April, and when one American airline executive suggested that more passengers might be attracted if

Pictures above and right show the second prototype Bulldog Series 100 in Swedish Air Force markings. Left, the attractive Marshall White home-built " Der Jager DIX ".

Left, some baby at 100ft. wingspan! The Dassault Mercure could well prove a smash hit. Below, 4-seat Piper Cherokee with examples of glass fibre and thermoplastic components including a hopper, engine cowlings, various fairings, wing tip, spinner, spats, nose cones, etc. Even the girl has plastic sunglasses and shoes! The Cherokee contains more than 90 plastic parts.

his 747s were fitted with a 17-seat lounge, a journalist replied that he always thought of the 747 as being a 17-seat lounge, as there had been only 16 passengers on board last time he travelled in one.

At the time this *Air News* is being written, the prototype Mercure was being prepared for its first flight. The photograph on this page shows it leaving the factory in which it was built, on April 5. Engine runs were planned to begin in mid-April, followed by the start of test flying a few days before the opening of the Paris Air Show on May 27, so that the aircraft could be demonstrated before hundreds of thousands of visitors from all over the world.

Design-wise the Mercure is absolutely straightforward, with its wings swept back at a modest 25 degrees and two Pratt & Whitney JT8D turbofan engines in underwing pods. These are 15,000 lb. thrust JT8D-11s in the prototype, but production Mercures will have JT8D-15s, rated at 15,500 lb., and a maximum take-off weight of 114,650 lb. Wing span is 100 ft. 3 in., and overall length 111 ft. 6 in.

In its production form, the Mercure is intended to cruise at up to 575 m.p.h. and to operate over a 620-mile stage length with a typical load of 134 passengers. Airlines will welcome the fact that its engines are basically similar to those fitted in existing airliners like the Boeing 727 and 737 and McDonnell Douglas DC-9. People living around airports will welcome Dassault's assurance that anti-noise treatment of the engine pods and the use of special exhaust noise suppressors will make the Mercure much quieter than present aircraft.

Plastic Planes

When we travel by air, most of us like the feel of a nice "solid" metal aeroplane around us. However, at least two lightplane manufacturers are already producing four-seaters built almost entirely of special plastics, while even the more conventionally-minded companies are using such materials more and more in secondary structures.

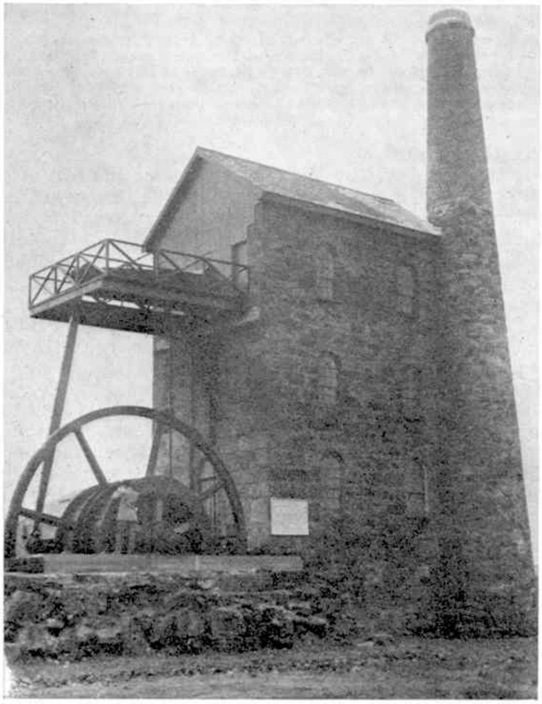
Piper Aircraft Corporation, for example, builds aeroplanes which are all-metal, structurally speaking, yet each of its 18 current models contains at least 90 non-metallic components, mainly of thermoplastics and glass-fibre. Largest of more than 200 glass-fibre components produced by the company are wingtips, propeller spinners, engine cowlings, wheel fairings, rudder and tailplane tips, tail and nose cones, passenger and luggage compartment doors, bulkheads, engine nacelle fairings and the big chemical hopper carried by the Pawnee agricultural aircraft. Smallest plastic part is the electric trim button mounted on the pilot's controls. Other thermoplastic items include interior trim, panel knobs and switches, hatshelves, air vents and cable guides. The entire instrument panel and the windows are also made from plastics.

In many cases glass-fibre can be substituted for non-structural aluminium parts without any loss of strength or durability. Compound curves can be formed more easily with such materials; it would, in fact, be almost impossible to produce some intricately-shaped aircraft parts from metal. What is more, plastic and glass-fibre parts can be produced easily in a variety of colours, with the pigment mixed in before they are moulded.

Swedish Bulldog

The sight of the second prototype Bulldog Series 100 military trainer flying in Swedish Air Force markings should gladden the heart of all those who regretted the collapse of the Beagle company last year. When Scottish Aviation announced that they had taken over the Bulldog programme, there was no guarantee that foreign customers would transfer their existing orders for the type. The Zambian Air Force did not, preferring to buy eight Italian SF.260Ms "off the shelf." The

(*continued on page* 355)



CORNISH BEAM ENGINES

A brief survey of these monsters of the steam era, a few of which can still be seen in preservation

By Richard Angove

SUMMER tourists traversing the undulating, mist-enshrouded moorlands of Cornwall are intrigued by the number of derelict chimneys and engine-houses standing, like gaunt sentinels, along the hilly backbone of the Duchy. These are the remains of Cornwall's long mining and engineering heritage, when not only most of the World's copper and tin, but much of the engineering equipment needed for its recovery, was shipped from neighbouring harbours.

Once scenes of export activity, they are now backwaters of leisure where children explore the decayed jetties and the only commercial activity is that of a few small fishing craft.

From the middle ages, when the quantity of metals recovered from alluvial deposits by the traditional washing or 'streaming' methods began to diminish, miners were forced to excavate.

This led to the inevitable ingress of water, the elimination of which, from earliest times, has been a challenge to their ingenuity.

Shallow workings could be drained by 'adits' or horizontal tunnels which emerged at lower levels; these were satisfactory and also afforded a degree of ventilation to shallow shafts dug into gently sloping hillsides, but as depths increased the need for some mechanical means of water removal become evident.

Endless chains carrying swabs were probably among the earliest innovations. These were later enclosed in crude wooden pipes, and small buckets replaced the swabs which, later still, were propelled by horses.

The first dramatic engineering break-through was by Thomas Savery, who, working on principles tried out by the Naples engineer Giovanni Battista della Porta in the early 17th century, ejected steam into a cylinder and condensed it by applying water. The resultant vacuum was used to raise the water; by operating two cylinders Savery was able to maintain a continuous stream and he patented the idea.

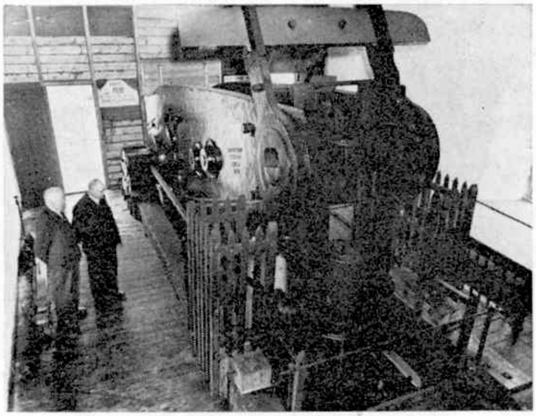
Coincident with these experiments, Thomas Newcomen, working on similar lines, produced an improved pump which, by an arrangement of rods actuated in conjunction with a rocking beam, manipulated valves to admit steam and water appropriate to the movements; the device thus became self-acting and the first of its kind. Because the initiating power was that of the atmosphere it was known as an 'Atmospheric Engine.'

James Watt, then an instrument technician at Glasgow University, had a model of one of these machines sent to him for repair, and so intrigued was he by the novelty of its operation that he developed the basic principles and subsequently produced, in conjunction with a colleague, Matthew Boulton, the first really practical rotative steam engine.

Looms, mills and factories in the Midlands and north of England were, until this time, mostly operated

Top, the East Pool winding engine which ceased work in 1921 lifted ore and miners from a depth of 1300 feet. Left, Trevithick's cottage at Camborne. Trevithick was one of the greatest engineers of his day.

The top chamber of the East Pool pumping engine, showing the 52 ton beam. Taken on the day of closure, at the left of the picture stands Mr. Tregonning Hooper, Hon. Sec. of the Cornish Engine Preservation Society (now the Trevithick Society). Nearest the beam is Mr. William Jelbert who helped to build this great machine 62 years before this date (26.10.54).



by water-wheels, which necessitated their location near rivers or other reliable water sources. The introduction of steam as a prime mover changed this. Factories could now be more conveniently located and industrial cities developed near collieries, ports, and other more economically desirable sites. Steam engines thus automatically increased country-wide coal consumption and a great boom in coal mining accompanied their introduction into every branch of social and commercial life, resulting in the great industrial revolution to which steam was probably the biggest single contributory factor.

Readers may recall some of the technical battles of the period between Boulton and Watt and the Cornish engineer Richard Trevithick and others. Development was complicated by much legal debate involving patents and claims concerning coal consumption and other aspects of engine performance.

Consequently Watt is generally credited with the 'Invention of the Steam Engine' and sometimes even known as the 'Father of the Steam Engine.'

However, Trevithick, who advocated the use of steam at a higher pressure, contributed substantially to the practicability of more compact and powerful engines which we think of when considering engines in more general terms. His early locomotives and experimental traction engines could not have been developed on the lines they were had steam at higher pressure not been used.

So, as a direct result of the work of Watt, Trevithick and others, by the start of the 19th century many of these 'beam' engines as they were now universally known, were to be seen operating pumping, crushing, winding and other machinery in mines and factories all over the world.

Made at various foundries and engineering works, many of which were situated in Cornwall, some remained in service until the 1930s and 40s and a few as late as the 50s. When, at the turn of the century, the discovery of more economically recoverable sources elsewhere led to the run-down of Cornish metal mining, many of the engines were transferred to the then-expanding china clay industry which did much to alleviate the hardship caused by tin's diminished role in Cornwall's economy. Some of the engines now preserved have been saved by the help of the English China Clays group of companies.

One of the earliest and most important of the builders of these huge engines was the firm of Harvey & Co., of Hayle, in the far west of the county. One of their biggest was a compound machine with cylinders weighing over 20 tons. Another Harvey engine is preserved in Holland where a museum has been established in the engine-house surrounding it.

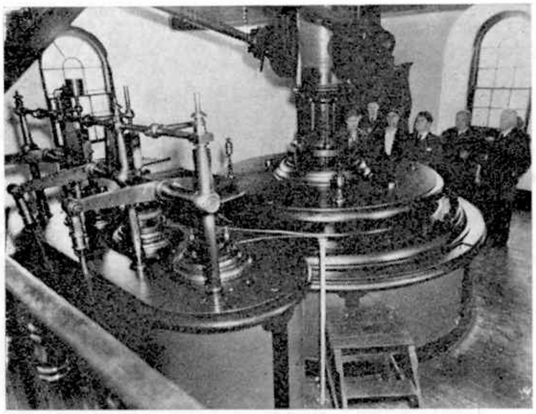
The Netherlands have, of course, always had problems of water encroachment and these engines have always been to the forefront in water-handling work. Pumping establishments everywhere used them; some of the most notable Harvey engines kept the Severn Tunnel dry for over 80 years. This involved maintaining a continuous service, sometimes pumping 30 million gallons every 24 hours.

Messrs Holman Bros. Ltd., of Camborne, who still produce mining machinery at their extensive plant there, also built these impressive monsters in their hey-day and have one on public display at their engineering college museum.

A fine Boulton and Watt rotative model built in 1797 can be seen and is sometimes operated in the Science Museum at South Kensington where, of course, there is a wealth of material on every aspect of this fascinating subject.

This particular exhibit has an impressive 12 foot diameter flywheel, 19.25 inch diameter cylinder with a four foot stroke, and 'sun and planet' movement for converting the lateral movement to rotary motion. This interesting feature was evolved by Watt to avoid using a crank which was, at the time, protected by a patent held by another engineer. At both Camborne and the Science Museums movement is achieved by compressed air or electricity; no steam is used in preserved engines.

Several others, thanks to the National Trust and the Trevithick Society, are preserved in Cornwall, and fine models too numerous to itemise exist all over the world. In Cornwall the most accessible examples are adjoining the A30 Trunk Road at Camborne. One there worked winding men and ore from depths of nearly 1,300 feet until 1921. Built in 1887, this was Holman's last rotative beam engine. Nearby, a pumping version built by Harveys in 1892 which has a 90 inch cylinder and 10 foot stroke was erected at this present site in 1924 and worked until 1954. (See illustrations.)



Taken a few minutes before the engine ceased working in 1954, this view in the East Pool's middle chamber shows the 90in. cylinder. *Photos by permission of the Trevithick Society and National Trust.*

THE MURDER DOCTORS

Medical science can often establish the fact of a crime and provide essential information from which the police can act

By Peter Wilkes

DESPITE the glamour given to murder by writers of detective fiction who, for our enjoyment, successfully produce an 'Ace sleuth' capable of solving the most intricate cases by their own brilliant deductions, the crime, in real life, is always sordid and, on many occasions, to those engaged on the side of law and order, means plodding routine work by a team of experts of whom the 'murder doctor' is an essential part.

Indeed, without the 'murder doctor' or, to give him his full title, the forensic pathologist, often there would be no murder to investigate, for the police are not always presented with a body in such circumstances that even a raw probationary constable could immediately shout "murder."

Sometimes such enquiries are started from nothing more than the findings of a few bones, and it is in these cases that the true value of the forensic pathologist is revealed. Sometimes his deductions can astonish the most experienced detective, himself an expert in interpreting facts and arriving at a true conclusion.

Sir Sydney Smith was a famous 'murder doctor' who, on more than one occasion, came up with a theory that, when proved true, left the detectives with little to do but question suspects indicated by the doctor himself.

However, even he excelled himself when, after being presented with just three bones by the police, with a request to inform them if they were animal or human, gave them such a picture that, at first, they must have doubted his findings.

Sir Sydney told the astonished detectives that the bones were indeed human, and furthermore were the remains of a girl in her mid twenties who had died some 12 weeks earlier. He reported that she had, in life, a pronounced limp, had been married and had at least one child, and that she had met her death as a result of gunshot wounds. He was even able to tell them that her killer had been seated in front of the victim and at a distance of about 3 yards, when the shotgun had been discharged.

The explanation, when given by the eminent doctor, recalled the famous saying by the equally famous Sherlock Holmes, "Elementary, my dear Watson, elementary." The bones found by the police had proved to be the complete human pelvis, and from this Dr. Smith was able to determine, with ease, the sex of the victim, the fact that she had borne a child and also, from the size of one of the hip bones, that she had suffered from that pronounced limp.

Shot recovered from the bones showed the type of weapon that had caused the fatal wound and, by working out the spread of the pellets, he could give the distance that the assailant had been from the girl, and surmise that such person has been seated in front of her.

Police enquiries proved him completely correct, but no charge of murder followed. The shooting, according to the killer, had happened when the gun has accidentally discharged and, in a panic, he had destroyed the body. The evidence of Dr. Smith, as to the presumed position of victim and killer, proved the man's innocence of murder.

Such a case could be called the classic example of pathology, for not only did the expert start the police enquiry, but the absolute impartiality of his evidence confirmed the accused's story and hence, possibly, saved him from execution.

Medical Jurisprudence is not a new subject, for since the early part of the nineteenth century it has been taught at both Edinburgh and Glasgow Universities and in 1834 a Professor of Medical Jurisprudence was appointed at Guy's Hospital.

1910, however, brought the forensic pathologist to the attention of the public, after the arrest and conviction of Dr. Hawley Harvey Crippen for the murder, by poison, of his wife. The case for the prosecution saw the beginning of the public career of one of the most famous Home Office Pathologists, Dr. Bernard Spilsbury. It was his evidence, of the results of an examination of the body of Mrs. Crippen and details of the poison he had traced in it, that convinced the jury that, without doubt, the man standing before them in the dock was a murderer.

Today no case of a suspicious death occurs without a pathologist being called in at the start of the investigation. It is on them that the police rely for information as to how the victim died, the time of death, whether the death was murder or suicide, and what type of instrument was used.

Often the answers to the questions are straightforward and, in obvious cases, the detective himself can gather, by an examination of the scene, all he wants

Heading picture, above, even something as ordinary as the family portrait can be brought into use by the medical specialists. To establish identity, in the case of a murder where the physical identification is impossible, the "Murder Doctor" can superimpose a negative of the skull on one taken from the ordinary family portrait like this one.

From Headquarters like this the murder hunts are started after senior detectives, stationed at force's headquarters, have received reports from the "Murder Doctors."

to know except for the time that the victim has been dead.

This question, often vital to both prosecution and defence, depends upon a condition of stiffening of the corpse, or rigor mortis, setting in. It has been established by the doctors over the years that rigor mortis depends upon a number of determinable factors including the conditions at the scene of the crime and, in particular, the temperature.

Doctors know that rigor mortis sets in as the body cools and, after affecting the whole of the body, passes off in the same manner as its onset.

Today determination of the time of death by a forensic expert is rarely challenged in court for defending council know of the certainty of the expert's evidence.

Accident or murder ?—how often this question arises, for many murderers try to hide the true way the deceased came by his death, and the only person who can answer the question as raised by the police is the forensic pathologist.

His methods are many. Sir Sydney Smith tells of how, when a farmer's body was found in a field clutching his own shotgun and his wife and son insisted he had gone pigeon shooting at night, a murder conviction followed.

By a minute examination, at the place where the farmer had been found, and before anyone had moved the body, he was able to prove that the unfortunate man had come to his death at some other place and the body dragged to the spot where it was found.

By carefully checking the clothing against the wounds, bloodstains were found on it in positions that would have been impossible if the victim had been standing at the time of the alleged accident, and fallen only after he had been fatally injured. In this case the murderer made an elementary mistake. When Sir Sydney and a medical colleague removed the man's hat, they found that, despite extensive injuries to the head, the inside of the cap was without any bloodstains, conclusive proof that it had been put on after death and the factor that made the medical experts certain that the killing was a case of murder.

Often the police are confused between suicide and murder and it is only by forensic pathology that the truth can be revealed.

This is particularly true in the case of death by drowning. To the uninitiated it is impossible to tell if the victim came to his death by deliberately entering the water, or if, more ominously, the word murder should be used.

Deceit in cases of drowning is impossible. When a person drowns, death is caused by asphyxia and some small amount of water enters the lungs and stomach, which is not so if a body is put in the water. Also, and very important to the forensic expert, anyone who is drowning will use an inbuilt urge to live, no matter how strong the intention to take one's own life may be, and such action causes the victim to grasp with their hands and clutch, as if in one last pathetic attempt to survive, even water for support. For this reason the hands are one of the first things examined by the expert.

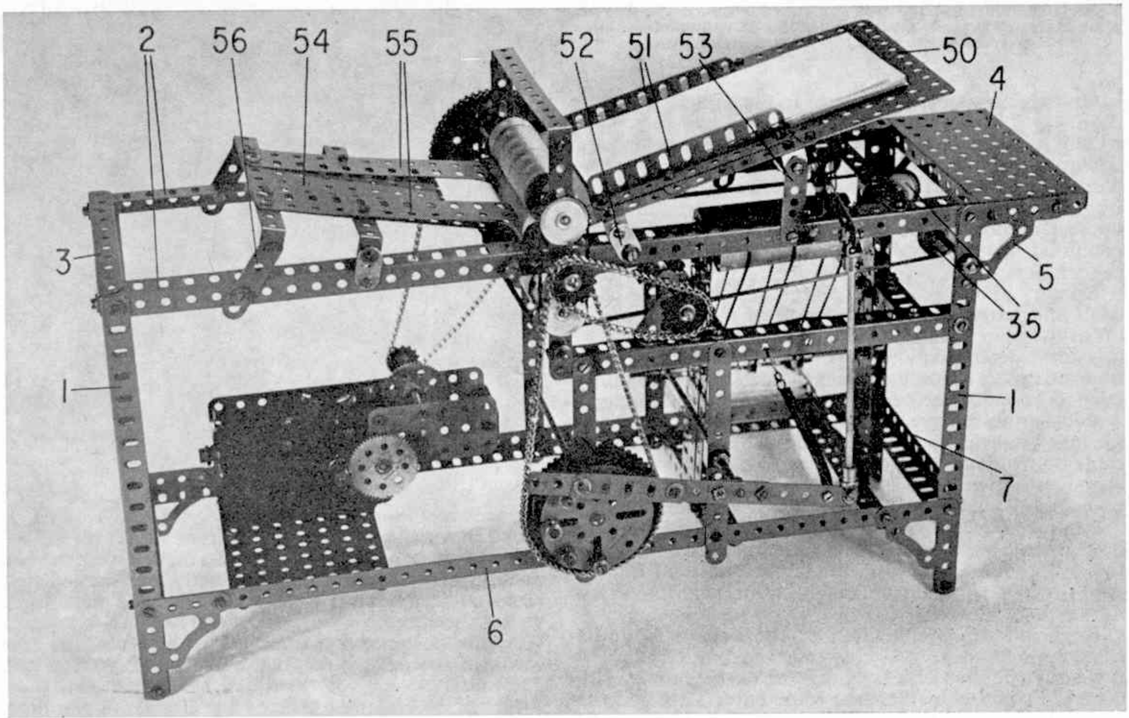
What could possibly be called a classic case when the police were uncertain between suicide and murder happened in Surrey. The body of John Mudie was found in a shallow trench with a rope round his neck—to every intent a case of suicide. So certain were the first medical men to arrive that the body was immediately removed to the mortuary, and no trained pathologist visited the scene.

At the post mortem examination however, the true worth of the pathologist in the fight against crime was made clear.

Dr. Eric Gardener, assisted by Dr. Keith Simpson, both eminent legal-medical experts, performed the examination and they had no doubt of the cause of death. Suicide was out of the question. John Mudie had been manually strangled and the body later taken to the place where it was found. Another murderer later stood facing judge and jury because of the ability of these often forgotten men who play such a vital part in the fight against that most terrible of crimes—Murder.

When we realise that full extent of their knowledge and ability and their often uncanny predictions, it is not hard to realise that it was one of these men, more often than not forgotten by the writers of the fictional detective stories, who gave us the most famous detective of fiction and one who most illustrated the way the mind of the 'murder doctor' must work; through Sherlock Holmes we can salute them.

The "Murder Doctors" are unique in the structure of forensic science because they work independent of Home Office Laboratories. Behind the frontage of many hospitals, familiar scenes in towns and cities, the "Murder Doctors" work.



Paper-Folding Machine

'Spanner' describes an intriguing model for experienced builders

By their very nature, working Meccano models invariably prove more appealing than static models. This does not mean of course that static models require less skill to build, or are less realistic when completed, but it does mean that a good model becomes more interesting if it incorporates movement. If the movement itself is not just representative, but actually enables the model to reproduce the real work of the original, then the model is truly ideal.

Qualifying as " ideal " under this definition, therefore, is the Meccano model illustrated in the accompanying photographs. Produced as a Paper-Folding Machine, it is fully working in that it will take a flat piece of paper, fold it in half and then fold it in half again, finally depositing it in a small collection tray built on to the side of the model. I cannot say that the model would be exactly suitable for folding your own letters or circulars to send out to correspondents, but it is undoubtedly fascinating to watch, as well as to operate.

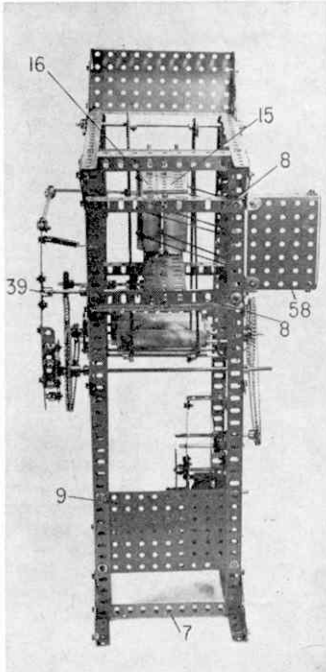
Used in the model are five Wood Rollers, which should be specially covered to improve the operation of the finished Machine and it is advisable to prepare these Rollers before starting assembly of the model, proper. The face of one of the Rollers is covered by a sheet of glasspaper, glued into position, while the four remaining Rollers are covered with strong, brown paper, also glued into place. Two of the latter Rollers also have 1 in. Gear Wheels, mounted one in each end of the Rollers, boss inwards, these Gear Wheels also serving as the anchoring points when the Rollers are mounted on their respective Rods in the model.

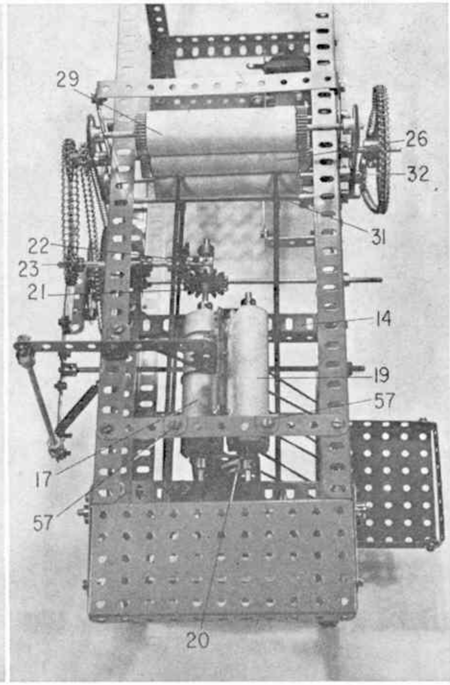
Main framework

In building the main framework, four uprights are provided by 9½ in. Angle Girders 1, these being connected at the top by two 18½ in. Angle Girders 2, a 5½ in. Angle Girder 3 and a 5½ × 2½ in. Flanged Plate 4, the Flanged Plate being secured to the Girders by two Corner Gussets 5. Girders 1 are further connected, through their fifth holes up, by two more 18½ in. Angle Girders 6 and two 5½ in. Angle Girders 7, Girders 6 themselves being joined by two additional 5½ in. Angle Girders 8 and a 5½ × 3½ in. Flat Plate 9.

Now bolted to each Girder 6 through its twelfth and eighteenth holes are two 5½ in. Strips 10 and 11, both these Strips projecting one hole below the Girder. The upper ends of the Strips are connected together and to nearest Girder 1 by a 9½ in. Angle Girder 12, to the free end of which a 5½ in. Perforated Slotted Strip 13 is fixed. These Slotted Strips at each side project half their length above Girders 2, their upper ends being connected by a 5½ × ½ in. Double Angle Strip. Girders 12 at each side, on the other hand, are connected by two 5½ in. Angle Girders 14, positioned above Girders 8, each Girder 12 then being attached to respective Girder 8 by a 7 in. compound flat girder 15, built up from one 5½ in. and one 3½ in. Flat Girder, and a 7 in. compound strip 16 built up from one 5½ and one 3½ in. Strip. Both the flat girder and strip project a distance of three holes abov- Girder 12, and note that the elone gated holes in the flat girder are positioned farthest from the strip.

Qualifying as a true working model, this Paper-folding Machine will actually fold a flat piece of paper into four quarters. Power is supplied by a Meccano E15R Motor. Right, an underside view of the model showing the layout of the lower framework. Far right, in this view of the model, the paper guides have been removed to show the positions of the second-fold Rollers.





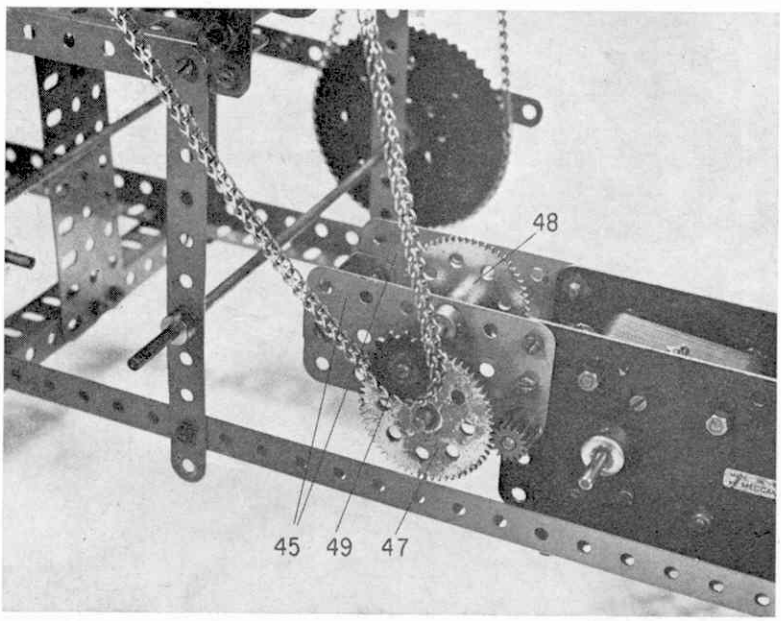
Held by Collars in the upper end holes of compound strips 16 is a 6½ in. Rod on which one of the plain paper-covered Wood Rollers 17 is fixed. This Roller is connected by three 10 in. Light Driving Bands to three ½ in. Pulleys on another 6½ in. Rod 18, journalled in Angle Brackets bolted to Strip 10 and nearby Angle Girder 1. The glasspaper-covered Roller 19 is mounted on a 5 in. Rod journalled in the upper end elongated holes of compound flat girders 15, this being tensioned against Roller 17 by two 2½ in. Driving Bands, each attached to a Fishplate 20 mounted on one or the other end of the 5 in. Rod, the other end of the Driving Band being looped over a ⅜ in. Bolt held by a Nut in respective Girder 14.

Now mounted on the protruding inside end of the Rod carrying Roller 17 is a Multi-purpose Gear 21, a Coupling 22 and a Collar, the Rod passing through one end transverse bore of the Coupling. The Gear and Collar are fixed on the Rod, while the Coupling is free, but prevented from sliding on the Rod by the other two parts. The longitudinal bore of the Coupling serves as one of the bearings for a 3½ in. Rod 23, the other bearing for which is provided by a 1½ in. Strip bolted to a Trunnion 24 which is in turn bolted to nearby Girder 2. Fixed on the inside end of the Rod is a Multi-purpose Gear which meshes with Gear 21, while a 1 in. Sprocket Wheel 25 is fixed on the outside end of the Rod.

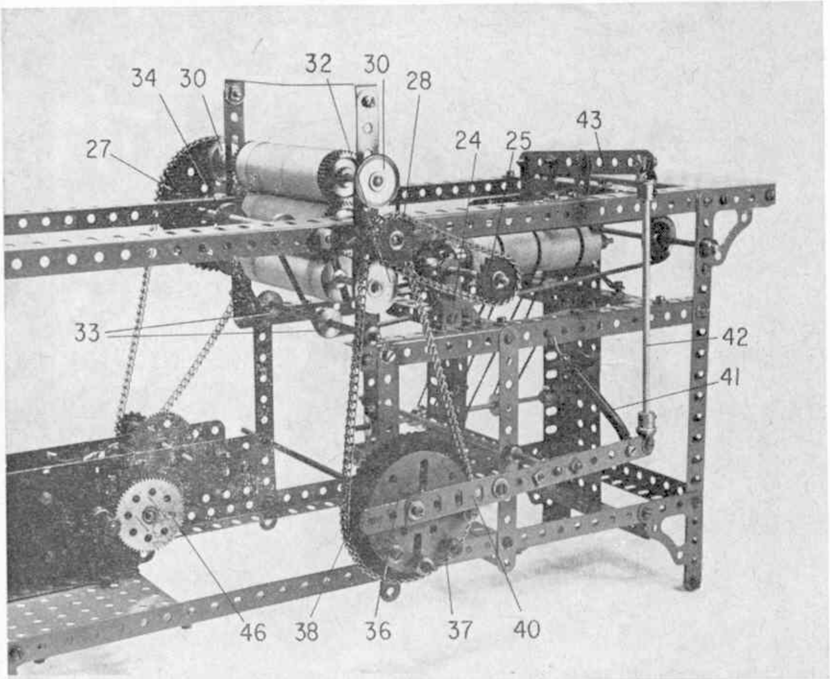
Journalled in the centre holes of Slotted Strips 13 and in Girders 2 is an 8 in. Rod, held in place by Collars, this Rod carrying one of the Rollers (26) incorporating the 1 in. Gears. Fixed on one end of the Rod, as shown, is a 3 in. Sprocket Wheel 27, while on the other end of the Rod are mounted a ¾ in. Sprocket Wheel and a 1 in. Sprocket Wheel 28. Sprocket Wheel 28 is connected by Chain to Sprocket Wheel 25. Journalled in the slotted holes in Slotted Strips 13, above Roller 26, is a 6½ in. Rod carrying the other Roller with 1 in. Gears 29 and held in place by two 1 in. fixed Pulleys 30. The Gears included with the Roller, of course, mesh with the Gears included with Roller 26.

The final Roller 31 is mounted on another 6½ in. Rod held by 1 in. Pulleys 32 in the lower slotted holes of Strips 13. Pulleys 30 and 32 at each side are connected by a 6 in. Driving Band which not only provides drive to the lower Roller, but also tensions the upper and lower Rollers against Roller 26.

Also mounted in Slotted Strips 13, two holes below Roller 31, is another 6½ in. Rod carrying two ½ in. loose Pulleys 33. Diagonally above these, on a further 6½ in. Rod journalled in Angle Girders 2, are two ½ in. fixed Pulleys 34, while two 1 in. fixed Pulleys 35 are mounted on yet another 6½ in. Rod journalled in



The gearbox which is built onto the Motor to reduce its speed, while increasing its torque, or power.



A close-up view of the model showing the drive to the Rollers and the built-up cam controlling the second-fold pressure lever.

the third holes from the top of opposite end Girders 1. Two 20 in. Driving Bands are then passed between Rollers 26 and 31 and around Pulleys 33, 34 and 35 to provide an endless belt which carries the paper from the first-fold Rollers to the second-fold Rollers already described.

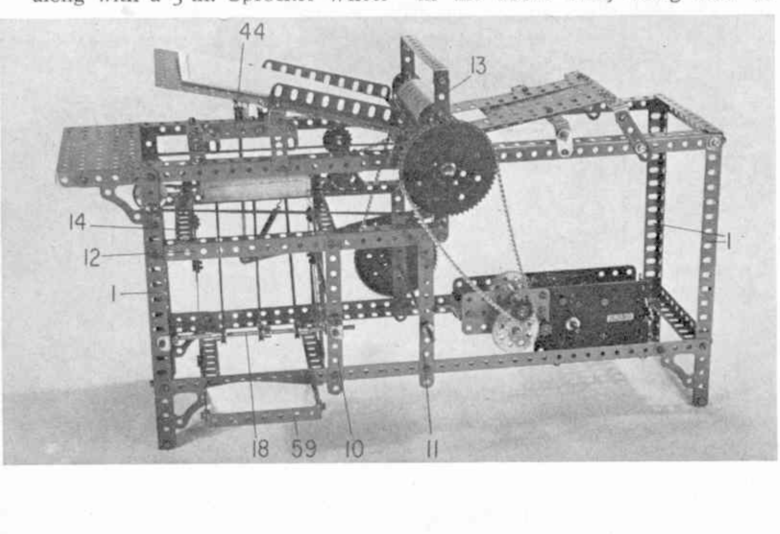
A special cam is next built up from a Face Plate 36, in adjacent outside holes of which four ½ in. Bolts are locked by Nuts, a Collar 37 being mounted on the shank of each Bolt. The Collars should revolve freely on the Bolts. When completed, the cam is mounted, along with a 3 in. Sprocket Wheel 38, on an 11½ in. Rod journalled in the fifth holes from the lower ends of Strips 11. Sprocket Wheel 38 is connected by Chain to the ¾ in. Sprocket Wheel on the Rod carrying Roller 26.

Journalled in the sixth holes from the lower ends of Strips 10 is another 11½ in. Rod, on one end of which a Double Arm Crank 39 is fixed. Bolted to the arm of this Crank is a 7½ in. Strip to which, in turn, a 2½ in. Angle Girder 40 is bolted, the end hole of the Girder coinciding with the third hole of the Strip. The spare flange of the Angle Girder makes contact with Collars 27 in the above cam, being held in contact by the action of a Tension Spring 41 bolted through the second hole from the opposite end of the Strip, its other end being attached to nearby Girder 12 by a Wire Hook.

Lock-nutted through the end hole of the 7½ in. Strip is an End Bearing, in the boss of which a 5 in. Rod 42 is fixed. Mounted on the upper end of this Rod is another End Bearing, the lugs of which are pivotally attached to one end of a 4½ in. Strip 43, lock-nutted at its centre to a 1 × 1 in. Angle Bracket bolted to nearby Girder 2. A 1½ in. Corner Bracket is secured to the free end of the Strip, a 3 in. Strip 44 being attached at right angles to the lower corner of this Bracket by a 1 × ½ in. Angle Bracket. Two Fishplates are bolted, one to each end of Strip 44 and the whole arrangement should be so constructed that, when the Strip is pivoted down, the Fishplates engage in the slot between Rollers 17 and 19.

Motor and Gearing

Power for the model is supplied by an E15R Electric Motor bolted to one Angle Girder 6 and to Flat Plate 9. Before fitting the Motor, however, it is advisable first to add a reduction gear train to reduce the output speed. Two 3 × 1½ in. Flat Plates 45, connected by a 1½ × ½ in. Double Angle Strip, are bolted one to each sideplate of the Motor, the securing Bolts using the respective upper two end holes of the Flat Plates and sideplates. Journalled in the lower corner holes of the Flat Plates and in the centre sideplate holes is a 2½ in. Rod held in place by a 7/16 in. Pinion and a 60-teeth Gear Wheel 46. This Gear Wheel meshes with a 7/16 in. Pinion fixed on the Motor output shaft, while the first Pinion meshes with another 60-teeth Gear Wheel 47 fixed on another 2½ in. Rod journalled in Flat Plates 45. Also fixed on this latter Rod, inside the Plates, is a ½ in. Pinion which meshes with a 57-teeth Gear Wheel 48 on a 3 in. Rod held by a Collar in the Flat Plates vertically above it. Gear 48, by the way, is spaced from the Flat Plate by two Washers. Mounted on the end of the 3 in. Rod is a ¾ in. Sprocket Wheel 39 which is connected by Chain to Sprocket Wheel 27.



The uncomplicated nature of the Paper-folding Machine is evident from this general view of the model. Care, however, must be taken in adjusting the machine.

Paper Guides

At this stage the guides for the paper can be built up and added to the model. The feed-in guide consists of an $8\frac{1}{2} \times 5\frac{1}{2}$ in. compound flat plate 50, built up from one $5\frac{1}{2} \times 2\frac{1}{2}$ in. and two $5\frac{1}{2} \times 3\frac{1}{2}$ in. Flat Plates, bolted together. Bolted to this compound plate, in the positions shown, are two $4\frac{1}{2}$ in. Angle Girders 51, then the plate is secured to Girders 2 by two Fishplates 52 and two 2 in. Strips 53, all attached to the plate by Angle Brackets. Note that the forward edge of the plate is positioned close to, but not quite touching, the central Rollers.

The other guide is supplied by another $5\frac{1}{2} \times 3\frac{1}{2}$ in. Flat Plate 54, to which two $5\frac{1}{2} \times \frac{1}{2}$ in. Double Angle Strips are bolted through the end and fifth holes of the Plate, the securing Bolts also fixing two $5\frac{1}{2}$ in. Flat Girders 55 in position. The Flat Girders are spaced from the Plate by a Washer on the shank of each Bolt securing the inner Double Angle Strip to the Plate and note also that the free ends of the Girders are curved up slightly to allow easy access of the paper to be folded. The completed guide is attached to Angle Girders 2 on the opposite side of the central rollers from the first guide by two Fishplates and two 2 in. Slotted Strips 56, the former bolted to the inner Double Angle Strip and the latter to the outer Double Angle Strip.

In operation, a sheet of paper, approximately $7 \times 3\frac{1}{2}$ in. in size, is fed down the first guide, between Rollers 26 and 29 and into the second guide. There, the paper travels along under Flat Girders 5 until it meets the first set of Bolts which prevent it going any farther. However, the Rollers are still feeding paper through and so the paper starts to "bulge," this bulge being caught by the 20 in. Driving Bands passed round Pulleys 33, 34 and 35 and fed back between Rollers 26 and 31 to fold the paper in two. The folded paper then continues along the "belt" provided by the Driving Bands until positioned over the remaining set of Rollers, being prevented from travelling farther by two stops provided by two $1 \times \frac{1}{2}$ in. Angle Brackets 57, bolted to a $5\frac{1}{2}$ in. Strip fixed between the fourth holes of Angle Girders 2. In due sequence, Strip 44, with its two Fishplates, drops down and pushes the paper between Rollers 17 and 19 to give it its second and final fold. The paper continues down the 10 in. Driving Band and is collected in a tray, supplied by a $3\frac{1}{2} \times 2\frac{1}{2}$ in. Flanged Plate 58, attached by Angle Brackets to appropriate Angle Girder 6. A $3\frac{1}{2} \times \frac{1}{2}$ in. Double Angle Strip 59 is bolted between the flanges of the Plate, as shown.

Obviously adjustments to the machine will be required before it will operate successfully, but, once everything is right, it will prove fascinating. The position of the first fold in the paper, incidentally, can be varied by fixing two Bolts in Flat Plate 54 to provide alternative stops for the paper. Also, the second-fold action may be improved by increasing the tension of Tension Spring 41, perhaps by using a second Spring as well as the first. The paper used with the model should be fairly thin and flexible.

PARTS REQUIRED

1—1b	6—14	1—48	2—96a
7—2	3—15	1—48b	2—103
1—2a	2—16	3—48d	2—103d
2—3	2—16a	1—52	5—106
1—4	6—22	3—52a	6—108
2—6	2—23	1—53	1—109
1—6a	5—23a	2—55	4—111a
4—7a	1—26	2—55a	5—111c
6—8a	2—26c	1—57d	1—126
7—9	1—27a	23—59	1—133
2—9a	2—27d	1—62b	2—166
1—9d	2—27f	1—63d	2—186
8—10	4—31	1—70	2—186a
6—12	257—37a	2—73	2—186b
1—12a	243—37b	1—94	2—186e
3—12b	45—38	2—95b	1 E15R
3—13a	1—43	2 96	Motor

AIR NEWS (*continued from page 347*)

Swedish Air Force, on the other hand, made it clear that the Bulldog was the aeroplane it wanted and let its order for 58 stand, with an option on 45 more later. The Kenya Air Force also confirmed that it still wanted the five Bulldogs it had ordered.

While getting production under way, Scottish Aviation pressed on as fast as possible with flight testing of the original prototype. To prove its versatility, the aircraft was given a thorough testing on skis from snow-covered areas of Sweden. Early in 1971 it was joined by the second prototype (G-AXIG) and deliveries to Sweden are expected to begin during the summer of this year.

Powered by a 200 h.p. Lycoming 10-360-A1C engine, the Bulldog has a top speed of 162 m.p.h. in level flight, can reach 241 m.p.h. in a dive and is fully aerobatic. The big canopy over the two side-by-side seats can be jettisoned in an emergency.

How many Bulldogs will be built eventually is anyone's guess, but many hundreds of aircraft in this category are needed by air forces throughout the world, to give their pupil pilots initial training before putting them on to jet basic trainers like the Jet Provost and Aermacchi M.B.326. The R.A.F., as a start, would dearly like to replace its veteran Chipmunks with Bulldogs, and this would not appear to be too expensive as the five Kenyan aircraft are to cost £20,000 each, complete with a very full set of navigation/communications electronics and spares.

Photo at right is of the four-shilling Heller plastic Lunar Module kit, built and photographed by M.A.P. Staff members R. Rimell and R. Simpson. Lunar light effect was achieved by using a single spotlight for the picture.

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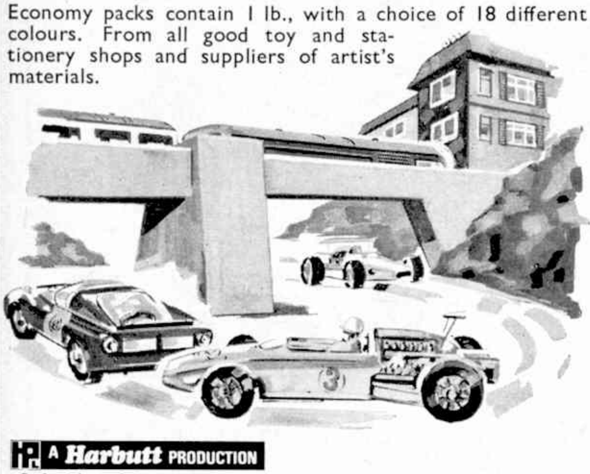

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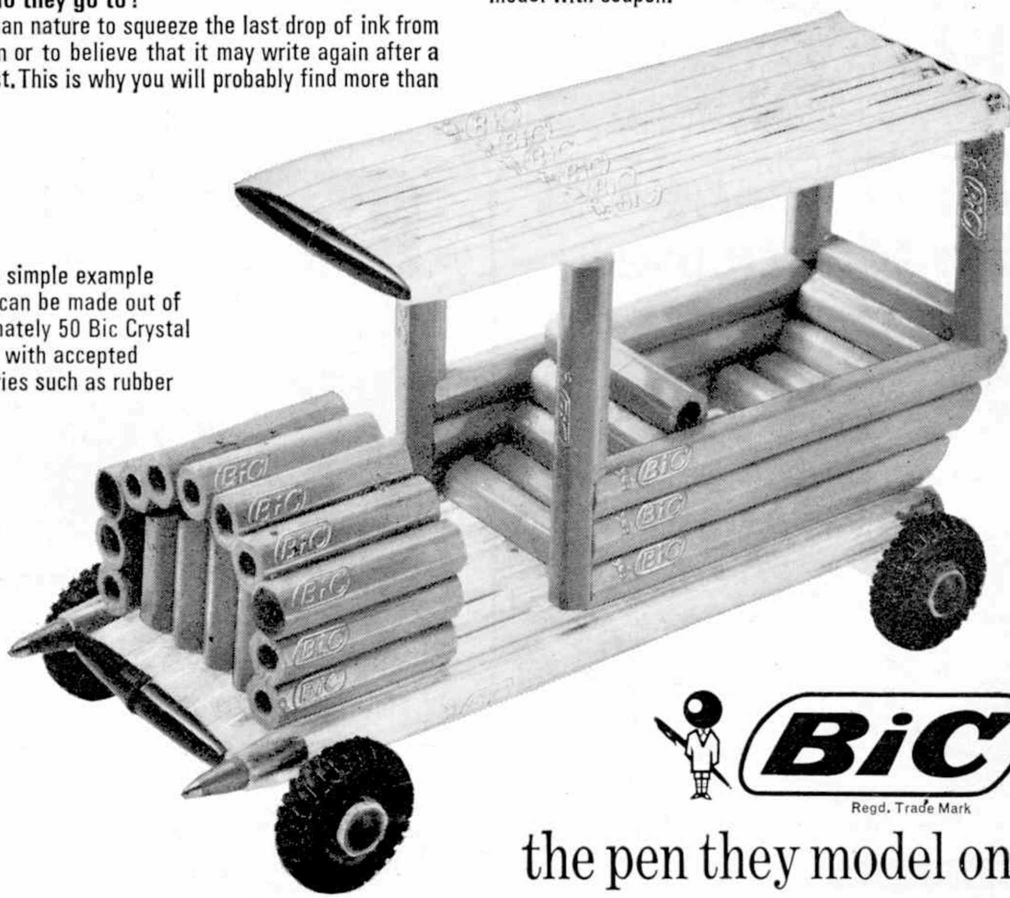

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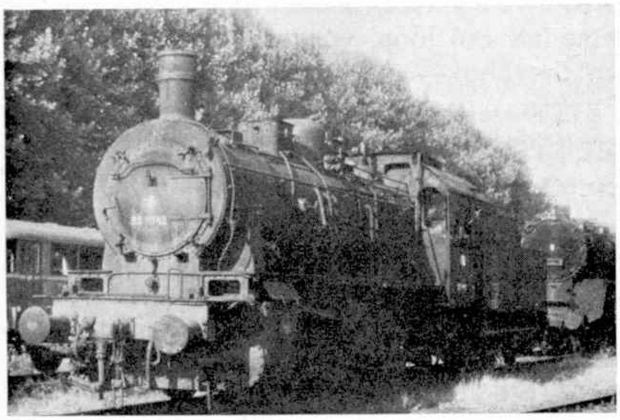

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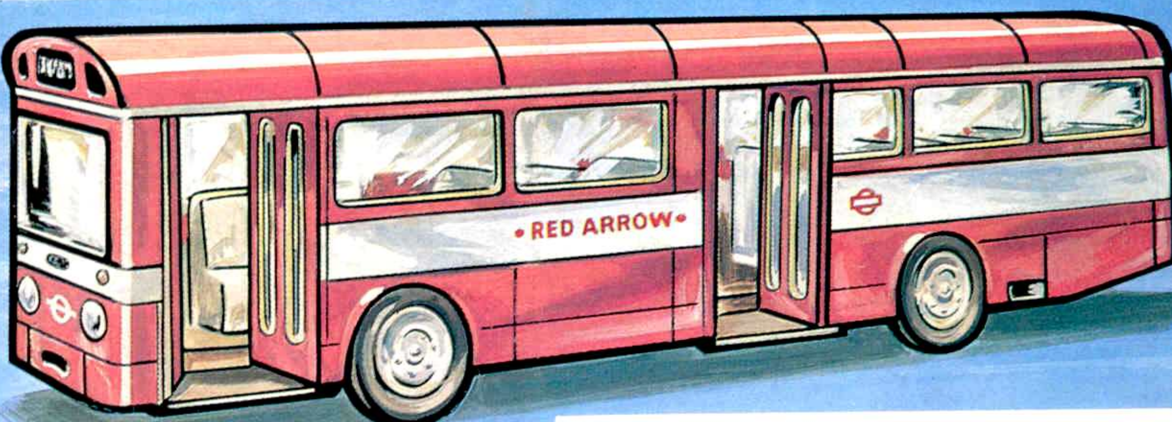

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