MECCANO® Magazine

JUNE 1969

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MAP HOBBY MAGAZINE

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MECCANO® Magazine

JUNE 1969 VOLUME 54 NUMBER 6

Meccano Magazine, founded 1916.

Editorial Director
D. J. LAIDLAW-DICKSON

Editor
DAVE ROTHWELL

Consulting Editor for Meccano Ltd.
J. D. McHARD

Advertisement Manager
ROLAND SUTTON

MAP **HOBBY MAGAZINE**

FRONT COVER

This beautiful relic of the past, finished in crimson and yellow, is a Wallis and Stevens Showman's Steam Traction Engine. The "Golden Queen", photographed by Stephen Goodger, and is shown here at a recent rally.

NEXT MONTH

Main feature of the July issue of Meccano magazine is the commencement of a series on the construction of an 'N' gauge railway layout. The series covers all the problems involved, and should provide a useful asset to those wanting to construct a complete layout of their own, but lack some of the knowledge needed.

A growing number of schools these days are teaching pupils to drive and maintain motor cars and Arthur Gaunt describes the efforts of the Blackwell Secondary Modern School in Harrow in conjunction with the Automobile Association on how they started a course for tomorrow's motorists.

For Meccano followers, more competition models, a simple commuter car for juniors, and for advanced modellers a modern diesel type road roller.

All the usual favourites are included, stamps, Great Engineers, Battle and Transport Topics, etc.

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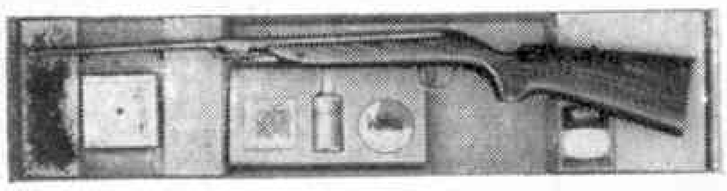

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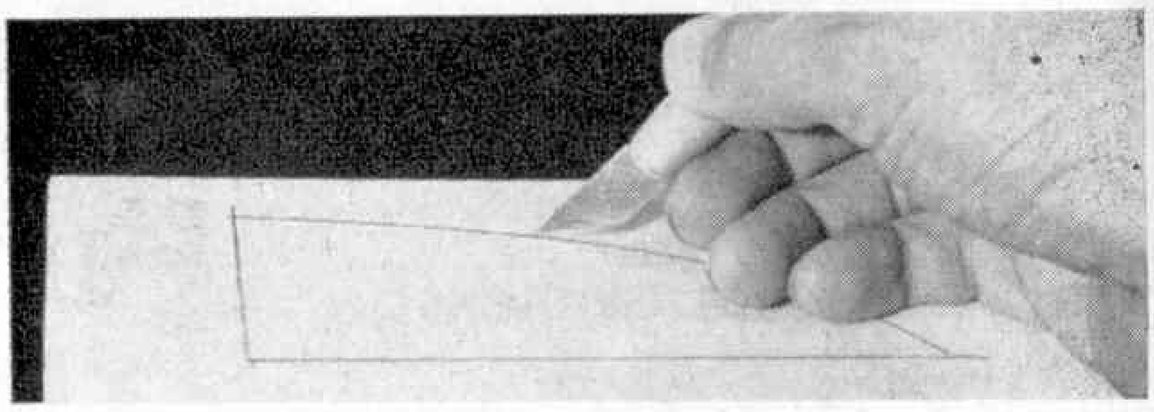

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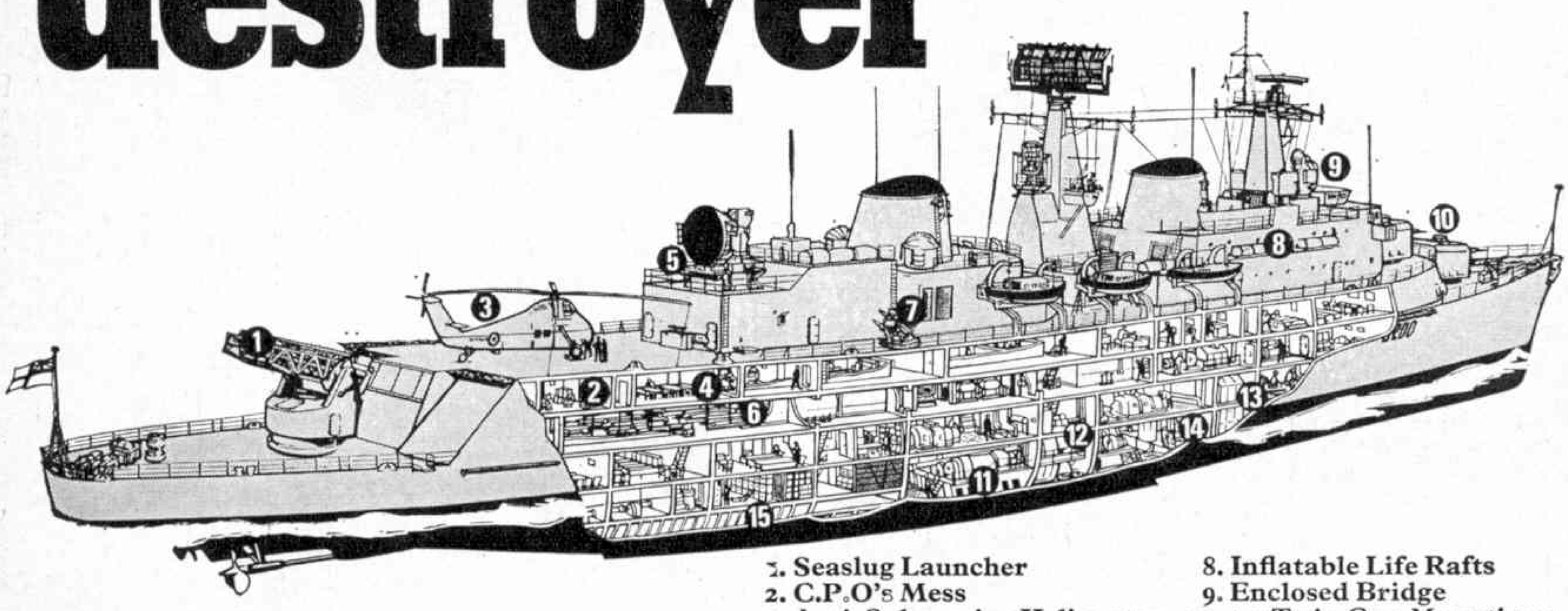

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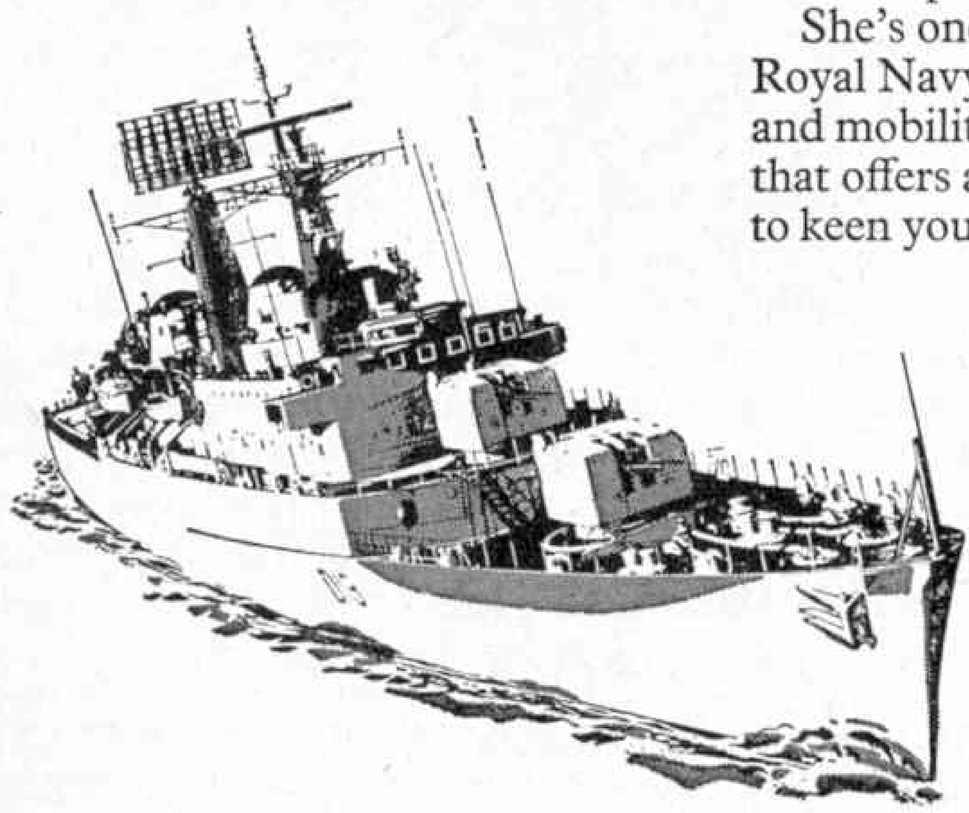

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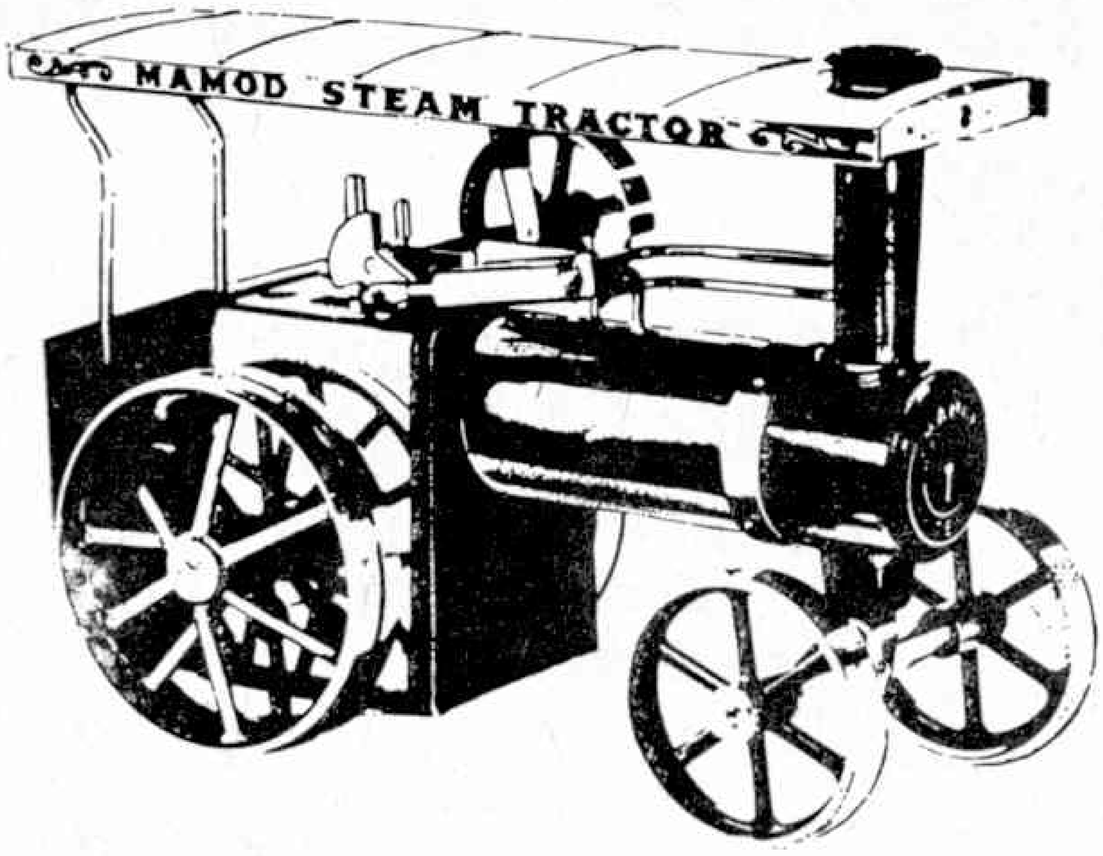

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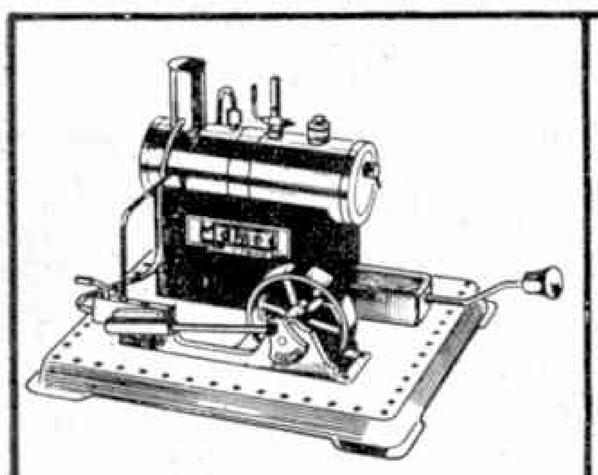

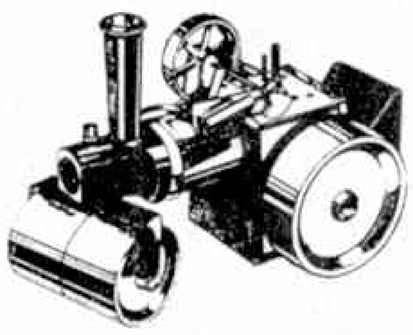

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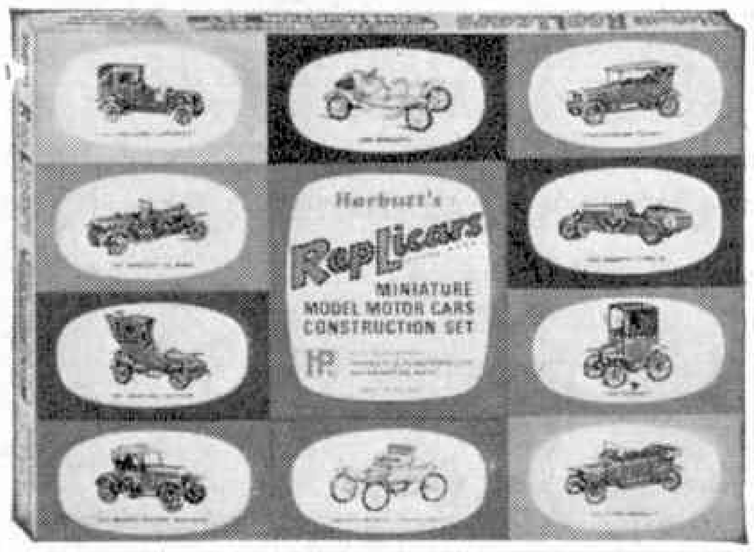

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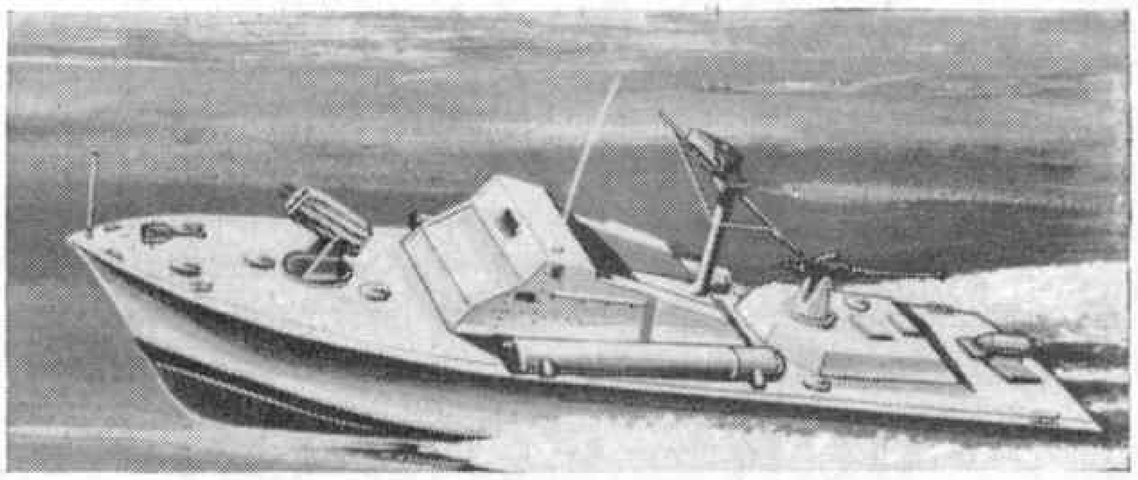

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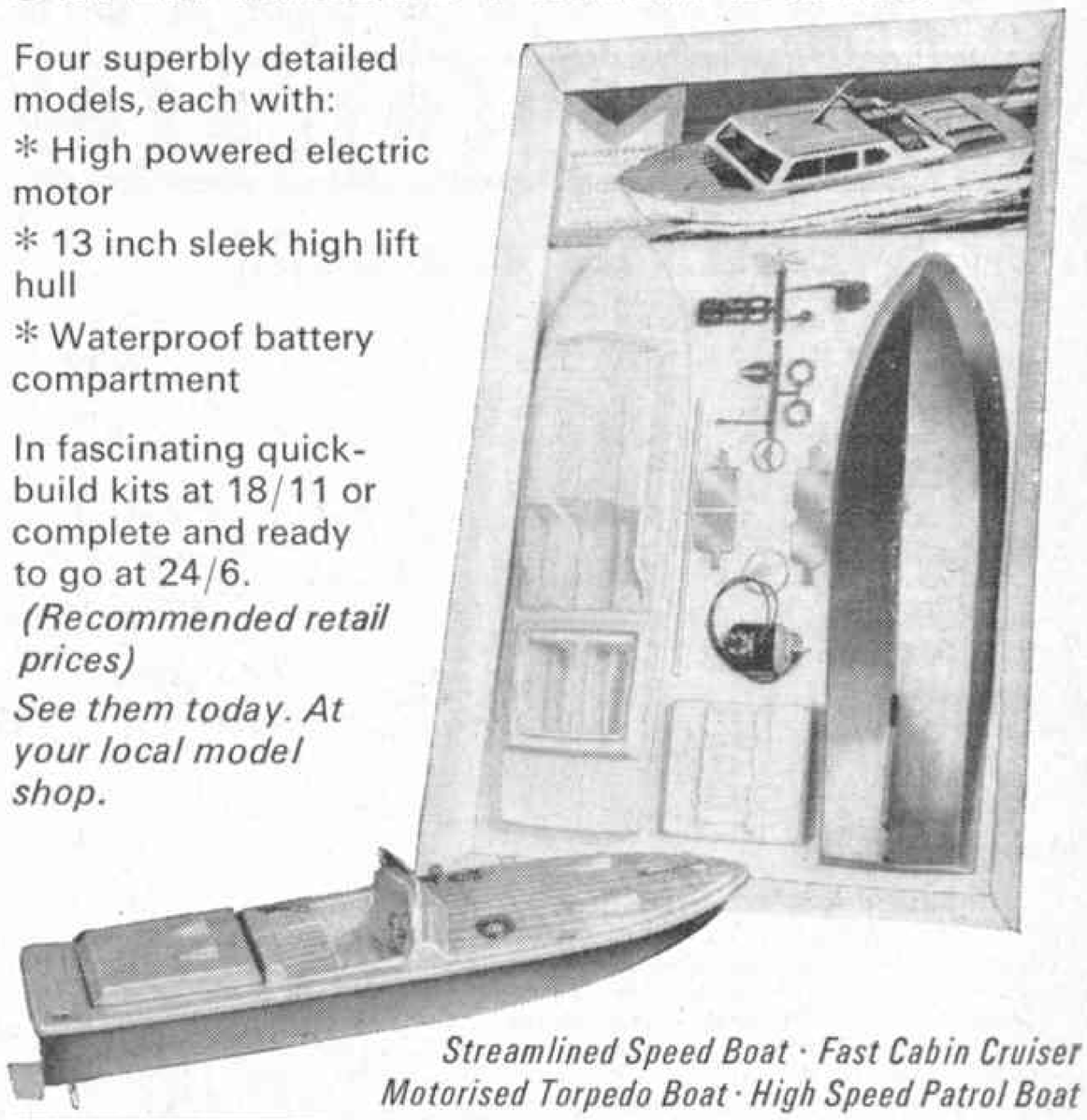

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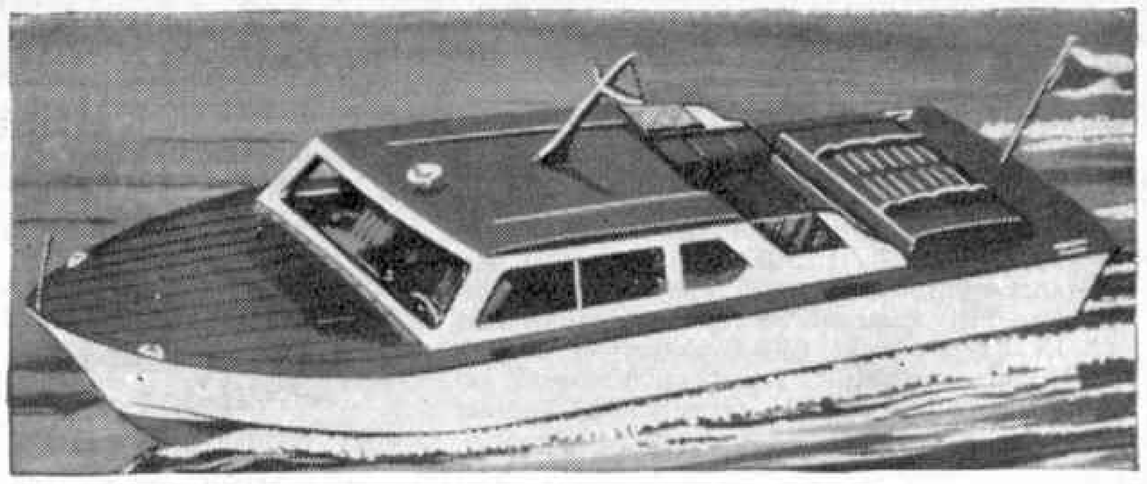

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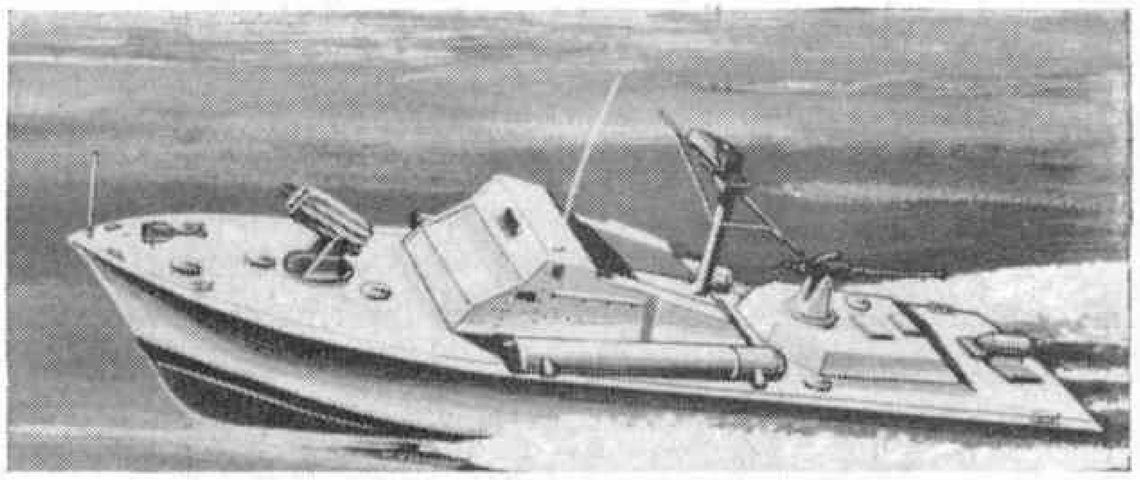

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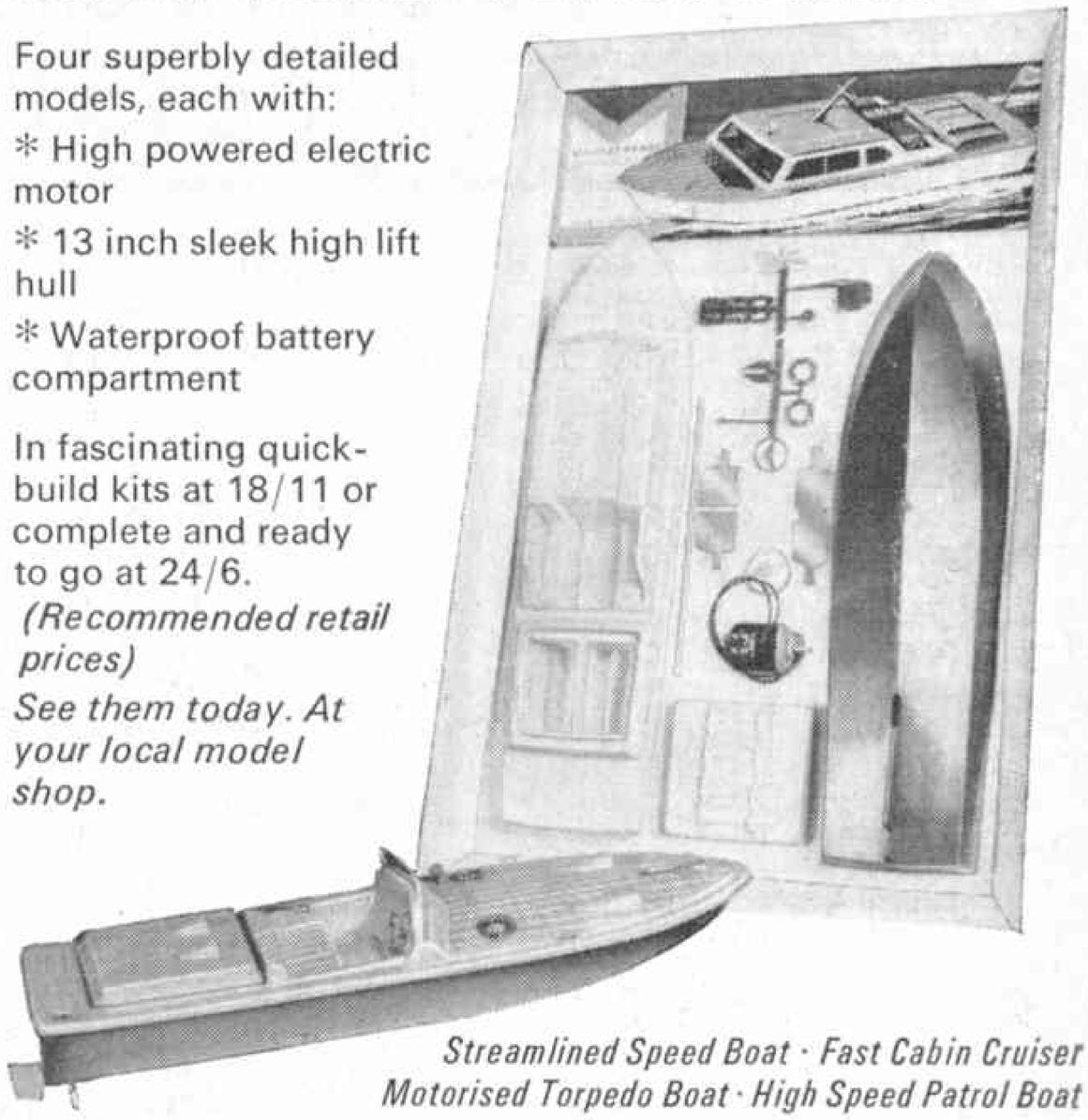

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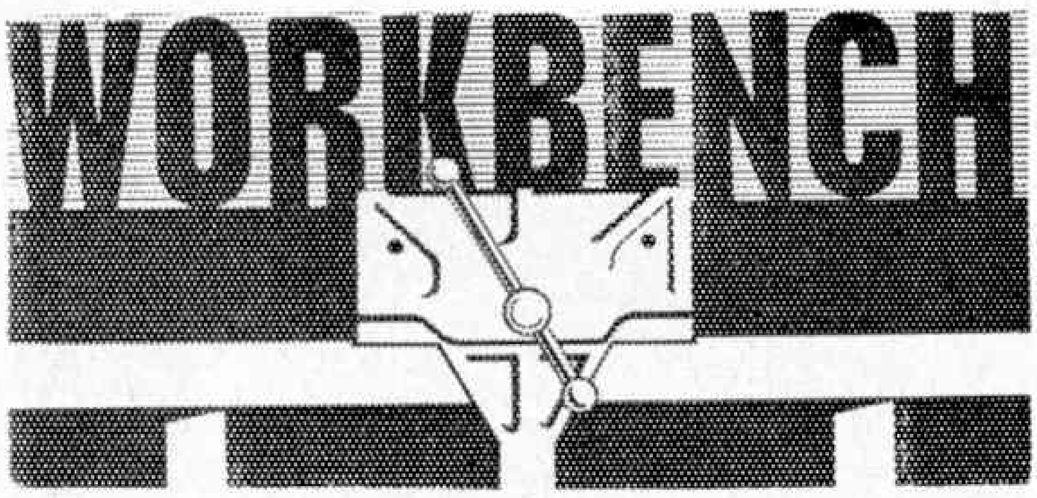


Photography Competition

WITH SUMMER almost upon us, we decided that it was about time that we held a competition; many readers have in fact been urging us to do this for some time, and consequently for the last couple of weeks we've been trying to decide upon a suitable type of competition to run, and what exactly we should give as prizes. The final choice was that it should be a photographic competition, and should run throughout the summer, prizes to be awarded every month for what, in the opinion of the Editor are the best photographs submitted. The best photograph received during the whole competition will win the reader by whom it was taken £5.5.0 as well as the prize of the month. Complete details of the competition are listed below.

The competition will run from 1st June until 31st October 1969, and will be divided into two groups:

Group 1. Any photograph of an outdoor activity, i.e. Scouts, Canoeing, Rock Climbing, Hiking, etc.

Group 2. Any photograph taken of any subject on National Trust property. Photographs submitted should be in black and white, *not* colour and should have enclosed details of where the photograph was taken, what the photograph is of and your name and address. Envelopes containing entries should be clearly marked "Photographic Comp." and addressed to *Meccano Magazine*, 13/35 Bridge Street, Hemel Hempstead, Herts. The winning photographs of the month will be printed on this page, 1st prize for the winners of each group being £2.2.0, runners up receiving 10/6d.

The closing date for entries each month will be the 10th, entries received after that date will automatically be carried forward into the next month's group.

We will undertake to return all photographs submitted providing they are accompanied by a stamped, self addressed envelope.

There is no limit to the number of entries sent in by any one person but each submission must be accompanied by the small coupon to be found in the bottom right-hand corner inside the back cover, so dust off your cameras, and let's see some really first-class snaps!

Win a Diamond !

Still on the subject of competitions, Hatton Garden diamond merchants are co-operating with the Royal Sovereign group of companies in a "diamond-a-day" prize scheme to launch a new adhesive brand-named "Dia-Mend."

Nation-wide sales of the new product—a special formula all-purpose clear fixative in tubes—will begin on May 1, and for every working day between then and the end of October diamonds, each worth at least £50, will go to the winners of a crossword and slogan competition open to buyers of the adhesive. With each individual pack is enclosed an entry form bearing a crossword puzzle and its clues and the first few words of a slogan. Each week the entries with correct crossword solutions will be judged on the merit of the accompanying slogans. The senders of the five best slogans will each receive a brilliant-cut unmounted diamond.

Mr. Alan Nelson, Royal Sovereign's group sales manager, said that in the initial stages of working out details of the "diamond-a-day" scheme he encountered unexpected difficulties among the diamond merchants of Hatton Garden.

"At first, they just would not take me seriously," he said. "It took me a long time to convince them that I wanted to make a contract for the supply of brilliant-cut unmounted diamonds, of uniform size and value—around £50—at the rate of one every working day for at least six months. Now the merchants who have undertaken to supply us are so interested in the scheme that they have offered to provide, free, a consulting service to winners seeking advice on how best to use their diamonds—in a ring, a brooch or tiepin, for example".

Birmingham's 'Beat the Clock' Competition

Forming the centre-piece of Meccano's display at this year's Boys and Girls Exhibition in the Bingley Hall, Birmingham, were two impressive models built by Meccano Limited. One of the models, a replica of London's G.P.O. Tower, was complete with miniature revolving restaurant, and stood a total of 14 ft. high. It was, however, dwarfed by its companion model of New York's Empire State Building, which towered nearly 30 ft. high altogether. Both models were built in rough proportion to each other and for added effect, the Empire State model was illuminated by hundreds of coloured lamps. Like the G.P.O. Tower model, it was built entirely from Meccano parts and a team of five model-builders worked for over a month to assemble the 100,000 Meccano parts needed to build the model, which because of its size had to be built in twelve sections, and assembled outside Meccano's workshops in Liverpool.

Another feature of the show was the 'Beat the Meccano Clock' competition on the Meccano stand, planned to be run at half hourly intervals throughout the show. Six competitors at a time tried their hand at duplicating a Meccano model truck, and the competition was aimed at finding the quickest time that this can be done in. The winner of every 'heat' won a small Meccano set, and the competitor to set up the record won a large Meccano outfit. No one left the stand empty-handed, however, for every competitor received a free copy of *Meccano Magazine*.

A similar competition was organised at the 'New Year Show' in London when over 1,000 children entered. A record time of 7 min. was achieved on that occasion, and a Meccano spokesman said recently, "We were amazed at the response from the public, indeed so popular was the competition, that at times queues began to form, and some youngsters entered their names hours in advance to ensure a place."

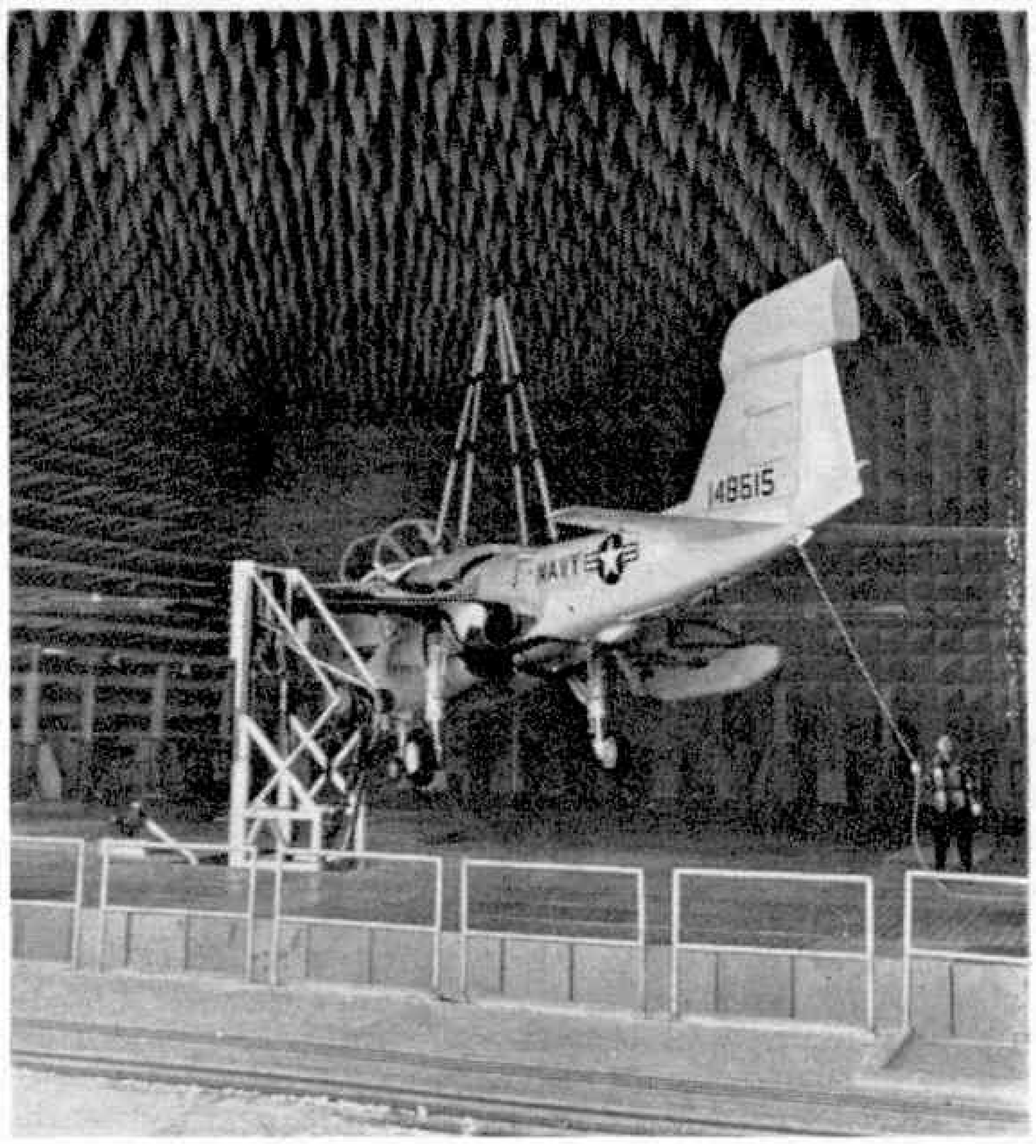
Correction

On page 37 of the January issue of *Meccano Magazine* in the "Meccano Electric Pendulum Clock" article by L. R. Dougal, we said that Ratchet Wheel 20 should be mounted on Rod 19 with its boss outward. Alf Hindmarsh of Lincoln, who has since built the model, points out that the Ratchet should in fact, be mounted with its boss *inward*. Our thanks go to Alf for spotting this error.

AIR NEWS

by

John W. R. Taylor



This Fighter Will Have Everything

One of the most important and exciting aircraft of the 'seventies will be the Grumman F-14A two-seat carrier-based fighter, ordered recently for the U. S.Navy. Although small and lightweight by modern standards, it is intended to replace a variety of existing fighters and light attack aircraft and to hold its own against the best combat types that Russia will have in the next ten years.

Inevitably, it packs a lot into a small space. In fact, it seems to have everything—even two of everything! There are swing-wings, like those of the American F-111; small triangular foreplanes in front of the wings, as on Sweden's Viggen; two engines in square-section underwing ducts similar to those of the Concorde; and even two slightly-canted fins and rudders reminiscent of those of the Soviet MiG-23.

There are good reasons for all of these features. For example, the swing-wing will enable the F-14A to take off and land fairly slowly, and be easy to handle at low speeds, with the wings in the fully-forward position, and yet offer all the advantages of a swept-wing design in high-speed flight. The foreplanes will help to keep the aircraft on an even keel while the angle of sweep of the wings is changing; the twin fins will assist stability and help to give the F-14A a high rate-of-roll in action.

In its initial form the F-14A will have two well-proven Pratt & Whitney TF30-P-12 turbofan engines, each rated at about 20,000 lb. of thrust with reheat. They will enable it to fly at more than twice the speed of sound (over 1,320 m.p.h. at high altitude) but are so economical on fuel that the F-14A will be able to escort strike aircraft on long-range missions without needing to refuel in flight.

To get the aircraft flying and into service as quickly as possible, Grumman are fitting it with main undercarriage units similar to those on its A-6A Intruder attack 'plane, an already-perfected Hughes AN/AWG-9 weapon control system, and British Martin-Baker ejection seats for the pilot and missile control officer. Armament will include an M-61 six-barrel 20-mm. cannon in the port side of the nose, plus bombs or Sparrow air-to-air missiles under the fuselage, or Phoenix air-to-air missiles under the fuselage and engine ducts, and four Sidewinders, carried on each side of the pylons for long-range fuel tanks.

Main tasks of the F-14A will be to escort U.S. Navy

Above: A Grumman EA-6B suspended in the new anechoic chamber. Here it will be tested to make sure that all the electrical equipment is working properly. Left: Germany's HFB 320 Hansa. Note the peculiar back-to-front type wings.

Right: A model of the Grumman F-14A two-seater fighter. Read " This Fighter Will Have Everything " to learn more about this amazing plane.

strike aircraft, to defend the U.S. fleet against attack by enemy aircraft or surface or air-launched missiles, and to attack ground targets in support of friendly troops. It is expected to fly for the first time in early 1971 and to become operational two years later. The present contract also covers development of an improved F-148 version, with more powerful engines, and includes an option on the purchase of 463 production aircraft. More than 1,200 F-14s are expected to enter service with the U.S. Navy eventually.

No Ghosts at Grumman

Another item of news from Grumman is that they have succeeded in getting rid of ghosts that have been haunting electronics engineers for many years. These particular ghosts are not of the see-through spirit type. In fact, you will have seen them yourself in the form of double images that sometimes spoil the picture on home TV sets. They result from reflection of the TV signals from buildings, a passing aircraft or other solid object, and are even more of a worry to engineers who want to test the efficiency and reliability of new electronic or radar equipment.

That is why the U.S. Navy awarded Grumman a £1½ million contract to build a test chamber in which complete aircraft could be placed and their electronic equipment tested without any false signals of this kind. It was quite a problem. Sound-proofing is easy; but how do you lay " ghosts " caused by reflections off buildings, and snow, rain, cold and heat which can upset the accuracy of test devices ?

The answer is Grummans' new anechoic (anti-echo) chamber, built inside an outer hangar and lined with steel-plywood-steel sandwich pyramids two feet square and six feet high. Every face of the chamber is covered, with a total of 7,300 pyramids facing inwards, so that the result looks rather like a mediaeval torture chamber of the " Iron Maiden " type. Not only do the walls, floor, ceiling and 37-ton sliding door keep out all radio frequency interference from outside; they also absorb and convert into heat the energy radiated by the aircraft equipment under test.

First machine put into the anechoic chamber was Grumman's new EA-68 Intruder four-seat electronic warfare aircraft, which is festooned with aerials, blisters and pods to identify, locate and jam enemy radio and radar equipment. Slung from the ceiling by non-metallic cables, it was able to prove the effectiveness of all its " black boxes " without even flying.

A Real " Chopper "

Helicopters are often referred to as " choppers ", but they are not supposed to be used as tree-trimmers. That did not stop Lt. Michael Smith of the U.S. Army when he saw a helicopter crash-land in a forest in Vietnam.

The occupants of the downed helicopter were not badly hurt, but enemy guerillas were near and already opening fire on them. Smith decided to fly his UH-1 Iroquois to the rescue of his friends. Unfortunately, the only half-clear space anywhere in the vicinity was dotted with small trees about two inches in diameter.

He hovered over this hole in the forest and then gradually lost height, so that his rotor blades cut off the tops of the trees. In this way, he got down to within 12 feet of the ground, from where his crew chief and gunner were able to lean out over the skids and grab the hands of the men below, to help them aboard.

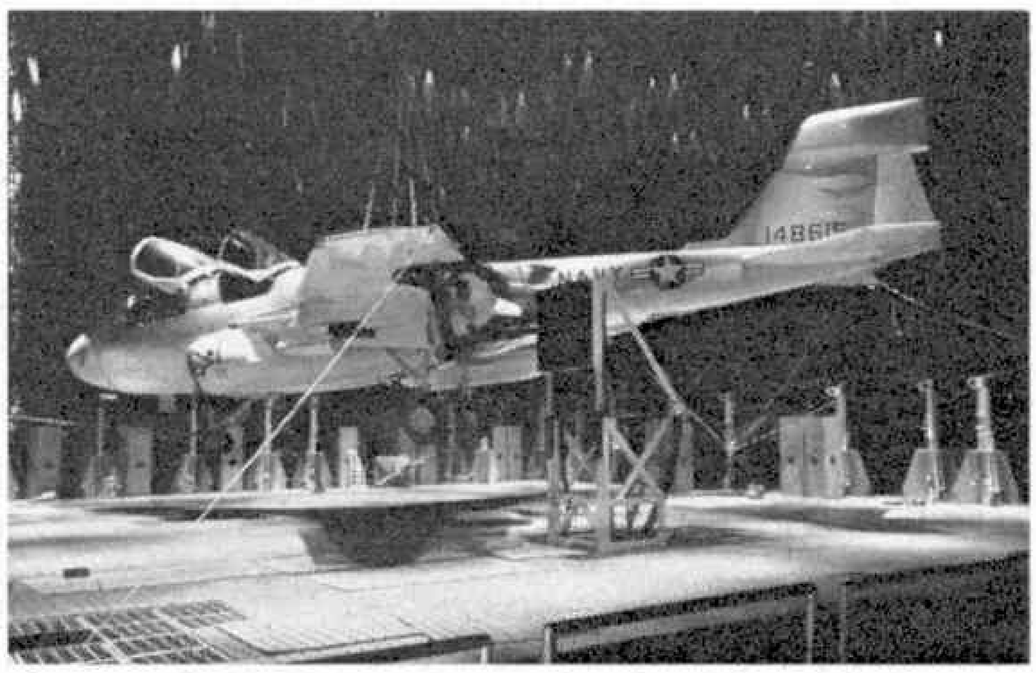
Back at base, the Iroquois had to be grounded while new rotor blades were fitted. Smith was awarded the Distinguished Flying Cross for his courageous and skilful exploit. Asked what was the worst moment of the operation he said it was when he upset a hornets' nest and was far more worried about the attacking insects than the bullets of the Viet Cong.

Back-to-Front Business Jet

Germany's little HFB 320 Hansa presents few spotting problems, as its wings appear to be put on back to front. In fact, sweptforward wings have many advantages compared with straight wings, not least being that the spars can be taken through the fuselage without lessening the cabin space and that passengers have a much better view of the ground in flight, being ahead of the wings.

The Hansa was designed originally as a seven-seat business jet, offering a high standard of comfort and cruising speed of up to 513 m.p.h. Several other versions are now available, including an 11/12-seat feeder-liner, a cargo transport with a payload of 1½ tons, a quick-change version which can be switched from passenger to cargo operation in 30 minutes, and a flying and navigation trainer for airline and military pilots.

First company to put the 12-seater into scheduled service is Golden West Airlines, which operates 16 flights a day between the Californian cities of Santa Barbara, Burbank and Palm Springs. Three of the training Hansas are used by the Dutch National Flying School.



Right: Another view of the Grumman EA-6B suspended in the anechoic testing chamber.

THE MANLY FERRIES OF SYDNEY

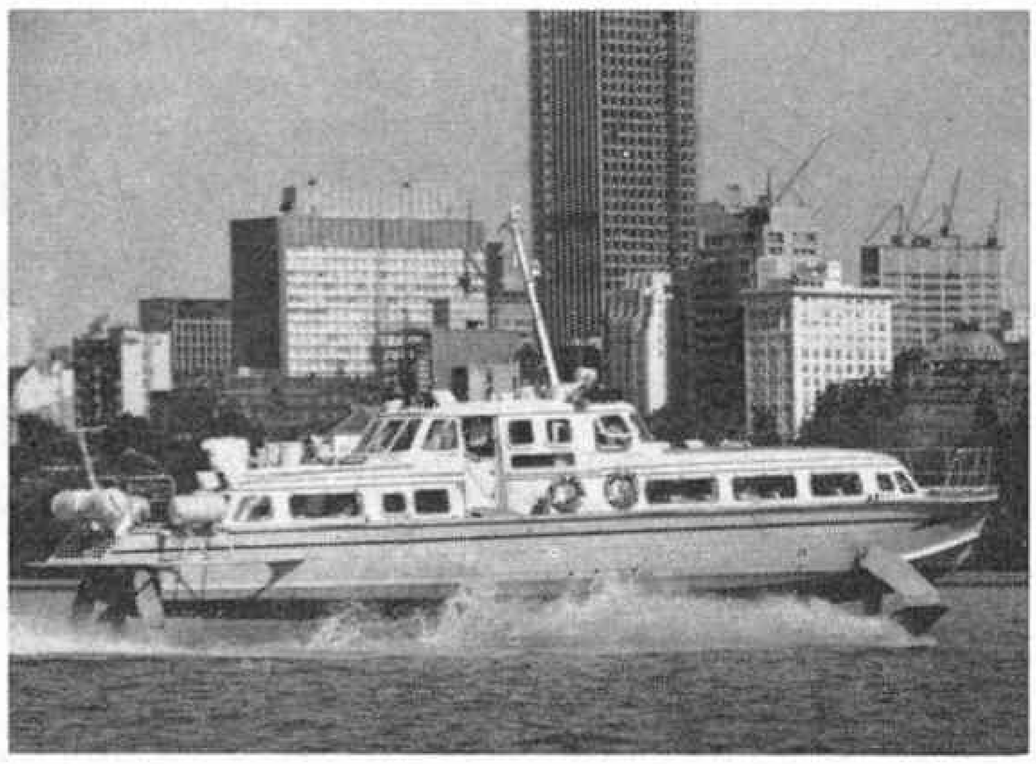
by Susanne Twiston-Davies

One of the Japanese Hydrofoils now in service is seen here at its mooring.

HOW WOULD you like to go to school or work by boat every day? This is what very many people enjoy doing in Sydney, Australia. Sydney has a huge harbour with hundreds of little bays and inlets, and, as people like to live by the sea, most of these bays have been turned into pleasant residential areas. The winding coast roads, however, although they are attractive, mean that residents in these areas must make a very long car or train ride to the centre of the City where the schools and offices are situated; so the Australians have overcome this problem by the use of ferries. These boats ply between Circular Quay in Sydney Harbour and the ocean suburb of Manly—situated between the harbour and the open Pacific—and they call at various other little bays on the way. The name of the company running this service is "The Port Jackson and Manly Steamship Company Ltd." Port Jackson was the original settlement founded by Captain Arthur Phillip when he "took over" from the Aborigines in the name of England in 1788. Later, the huge city of Sydney was to grow up from this tiny settlement.

The very first ferry to operate in Sydney Harbour was built in 1847. The settlers had lost little time in making themselves more mobile, for this was only 77 years after Captain Cook discovered Australia! The ferry was a 23-ton wooden paddle steamer called *The Brothers*, and carried 50 passengers. Seven years later, the *Nora Creina* was built, and she was vastly superior, an *iron* paddle steamer used to make excursions around the harbour, as well as on the normal ferrying duties. With her huge round paddle wheels, she must have resembled those pictures one sees of the Mississippi river-boats.

Seen here approaching 40 knots, the Hydrofoil makes an impressive sight.



Every few years, more boats were built (mostly from shaped iron imported from Scotland), and gradually they increased in size and power. In 1859 came the *Clommel*—a giant of 598 tons! Another, smaller ferry of the same period—the *Breadalbane*—sank in Black Wattle Bay, and now lies buried ignominiously under a timber yard.

These boats and their crews seem to have been extremely hard-worked; the majority of them doubled as tugs or cargo-boats as well as ferries during the week, and turned into excursion boats up and down the coastline at weekends. One ferry, the *Brightside* continued her usefulness even after being scrapped in 1909, for her hull went into the building of a lighter, and her engines were used to run a saw-mill!

The *Fairlight*, built in Glasgow in 1878, came out to Sydney under sail and steam; this must have been quite a journey for a ship of only 315 tons. She was 171 ft. in length, just 66 ft. longer than Captain Cook's *Endeavour*, and there was great excitement in Scotland at so small a ship making this journey to the other end of the world.

The thirty-first ferry boat to be built was the *Bellubera*. She was once almost destroyed by fire, and then rebuilt on more modern lines. She is still in service, and so are the *Baragoola*, the *Dee Why*, the *North Head* and the *South Steyne*.

As a visitor to Australia, I made the "commuter trip" from Sydney to Manly and back in April of this year—just to see what it was like. I went on the *South Steyne*, and was interested to learn that she is the biggest and fastest ferry in the world. She has four boilers with coal and oil burning equipment, has a displacement of 1203 tons, and can carry 1,781 passengers. She was built at Leith in Scotland in 1938 and came to Sydney under her own steam in sixty-four days. The story goes that, during this journey, the ship ran into bad weather and had to heave-to for the storm to blow itself out. A liner passed close by going in the opposite direction, and a very queasy Australian passenger (who was suffering from the after-effects of a party the previous night) sent for the ship's doctor and said he must be very ill indeed, for he had just had the hallucination of seeing a Manly ferry through his cabin porthole!

I enjoyed my trip on the *South Steyne*, which was quite the best way to see the magnificent harbour. We had a wonderful view of Sydney Harbour Bridge ("Our Bridge", as it is affectionately called), and of the controversial Opera House, still in the course of construction—its very modern outline of full sails representing the Australian craze for yachting which is a harbour feature in summer-time. There were ocean liners, flying-boats and yachts to look at, and for a while I lay back idly in the sunshine admiring the ever-changing view. Then I went off to explore the

boat herself: she is old-fashioned in appearance, as you can see from the photograph, but she is very up-to-date below decks, with a radio telephone, public address system, a cocktail lounge and a cafeteria, where commuters can breakfast on their way to work if they wish—the height of luxury!

As we approached Circular Quay on the return journey from Manly, I saw what at first glance appeared to be Sydney Harbour's answer to Loch Ness—a large monster which sped menacingly towards us. It turned out to be a hydrofoil (the very first in Australia) which also operates as a Manly ferry. Her official designation is *Supramar PT20 Type Hydrofoil Vessel "Manly"*, and she is a 33-tonner capable of taking seventy-two passengers. The accommodation is very luxurious, with aircraft-type foam seats and large observation windows. The vessel's crew consists of the Master, an engineer, and one or two deckhands. This hydrofoil was built in 1964 by the Hitachi Shipbuilding and Engineering Co. Ltd. in Japan, and she has a twelve-cylinder Mercedes Benz diesel engine fitted with Brown Bovari VTR200 exhaust pressure chargers and intercoolers. In case of need she can fall back on an auxiliary Yanmar NT65K diesel engine driving an emergency bilg pump and battery charging generator. It was interesting to see this vessel cruising through the water at about 15 knots after leaving the quayside, and then, as she gathered speed, rising suddenly on to her steel foils which brought the bows out of the water and enabled the boat to reach her maximum speed of 40 knots—all very quietly, for the passengers feel neither noise nor vibration as they tear through the water. The vessel is easy to manoeuvre, and can be stopped very quickly in emergency; and a safety device on the front hydrofoil enables the foil to retract immediately if it hits anything floating in the water—a useful asset in a harbour which is so full of activity.

The hydrofoil is, of course, quicker than the other ferries, and does the journey to Manly in only fifteen minutes. She also makes trips beyond the headland, out into the Pacific. These trips are termed by her Owners as "zestful excursions", but I am told by those who have been on them that the "zest" of a hydrofoil combating the heavy Pacific swell is only for those with very strong stomachs!

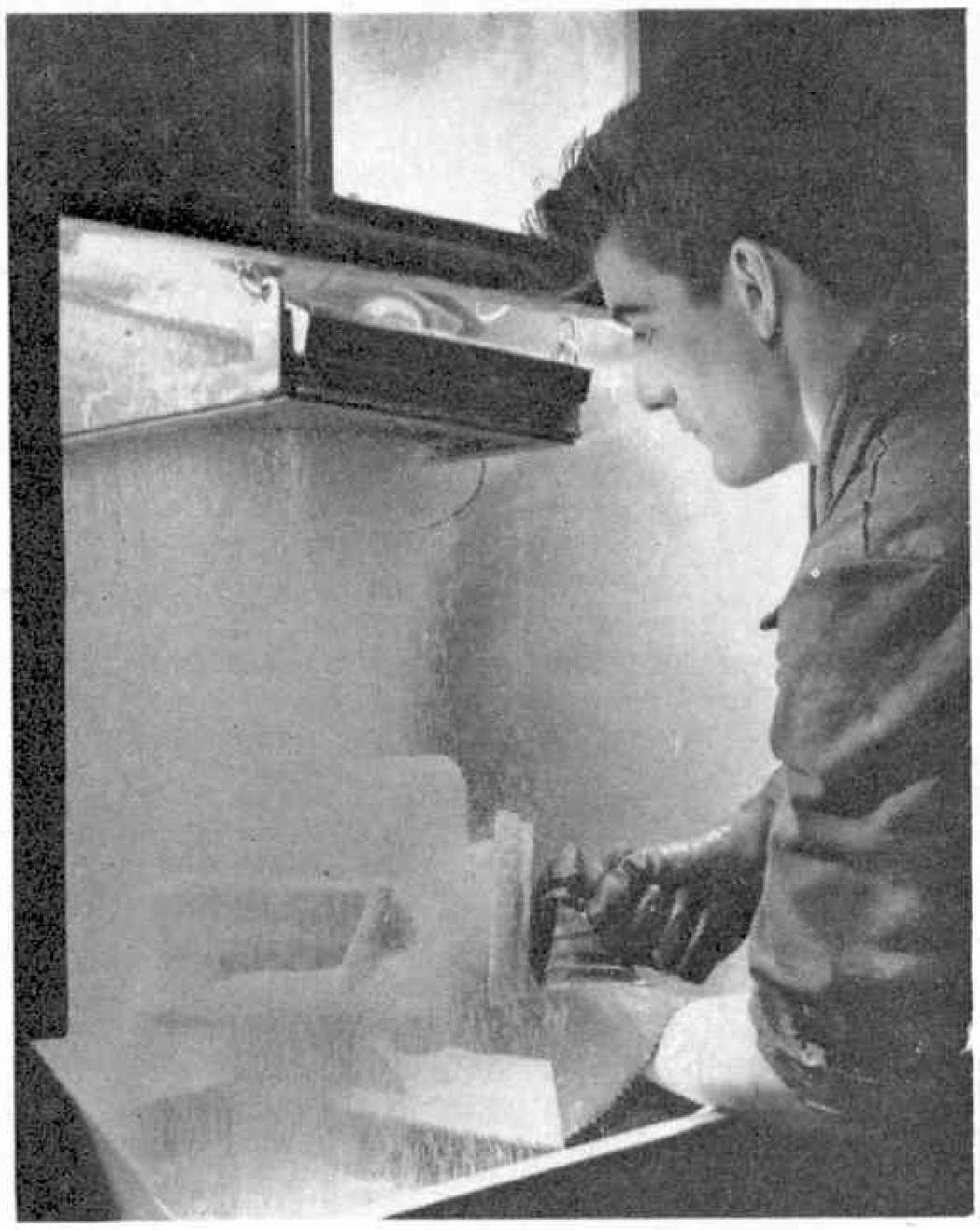
All the boats run sight-seeing excursions to such places as Broken Bay and the Hawkesbury River, and a commentator points out spots with odd names like Hole in the Wall, Coal and Candle Creek, The Duckhole, Whale Beach, Lion Island, and describes events of historical interest which have occurred along the course which the boat is taking. Some excursions include a coach ride; you leave the boat at a certain rendezvous and the coach takes you to a wild-life sanctuary where you can see button-nosed Koala bears peeping shyly from behind the branches of the eucalyptus trees, whilst brilliant-coloured parakeets flash screeching above your head; with luck, you may even see that odd-shaped bird, the kookaburra, whose weird call has earned him the name of "laughing jackass". Or you can start off by coach for a tour of the suburbs of Sydney, then out through the hills and past extensive citrus orchards until you come to Berowra Waters, where the coach drives onto a river ferry to take you across to the Ku-ring-gai Chase reserve; after visiting the Koala Sanctuary you can board a boat which takes you speeding eighteen miles down Cowan Waters, and you eventually finish up at Sydney's famous Palm Beach.

But my own opinion was that the ferry rides through exciting Sydney Harbour were the most fun, and I envied a friend of mine who, living near one of the ferry "halts", would time his dash to the quay in the mornings by starting his corn flakes when the ferry was first sighted, and finishing his bacon and eggs one minute before it was time to go aboard. Fifteen minutes later, he was sitting at his office desk—and what commuter could ask for more than to have a luxurious cruise through a beautiful harbour and to enjoy a quarter of an hour of brilliant Australian sunshine before starting the day's work?

Top: The South Steyne, largest and fastest displacement Ferry in the world today.

Centre: One of the Manly Ferries passing in front of the world famous Sydney Harbour Bridge.

Right: One of the more conventional ferries, it does however, bear a strong resemblance to the Hydrofoil types.



The Lost Wax Process

by

Charles A. Rigby

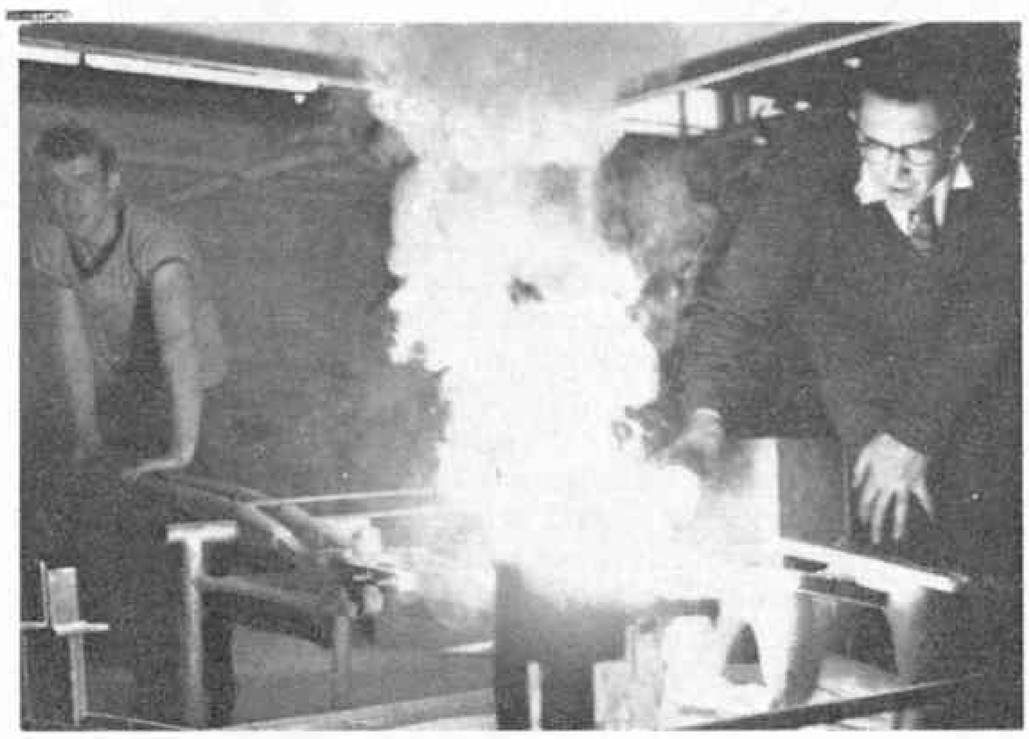
IT IS with the industrial process of investment casting now used in the production of precision-made jet engine components that the name of Benvenuto Cellini is linked. While this technique of casting was introduced into Britain from the United States in 1941, it is by no means new, since Theophilus in the 11th century, and Cellini (1500-1571) both wrote detailed accounts about the process. In 1565 the latter began writing his important treatises on goldsmith's work and sculpture, called the " Trattato dell Oreficeria " and the " Trattato della Sculptura ", which were translated into English in 1577.

It was because of his skill and art in metal working that Benvenuto Cellini really became famous, and whatever he turned out attracted much public attention. He linked Greek mythology with most of his sculptural work such as a model of Mars for a projected fountain at Fontainebleau in France, and a bronze Perseus rescuing Andromeda now in the Loggia de Lanzi. Also, in 1543, he modelled and cast a large bronze lunette of the Nymph of Fontainebleau for the entrance to the king's palace, which is now in the Louvre.

Born in 1500, he was first apprenticed as a metal worker in the studio of Andrea de Sando Marcone, a goldsmith in Florence. Always more or less unsettled, after living for a time in one town he would move to another. First he moved to Sienna and then returned to Florence. Then in 1527, he went to Rome, and returned again to Florence. Moving back to Rome in 1529, he was appointed ' Maestro del Stampe ' at the Papal Mint and between 1530-1531 he made a celebrated clasp for a cape for Clement VII. Like so many of his precious metals this was later melted down but its design is recorded in three 18th century drawings in the British Museum. The only survivors of the many works he prepared for the Pope are two medals in 1534. He also made a number of coins for Alessandro de Medici in Florence.

Twice he visited France, first in 1536, and later in 1540, he arrived at Fontainebleau carrying with him an unfinished salt cellar which he completed in gold for the king in 1543. This, Cellini's fully authenticated work in precious metal (now in a Vienna Museum) is the supreme example of Rennaissance goldsmith's work. It was on this second visit to France that much of his sculptural work was done. He died in 1571.

Investment casting has been in use for several centuries as a method of producing metal figures from patterns fashioned by artists from clay or wax. It has also been employed by dental mechanics to make artificial dentures. While there are variations in the technique according to the type and size of objects to be fashioned, the technique here described is used in

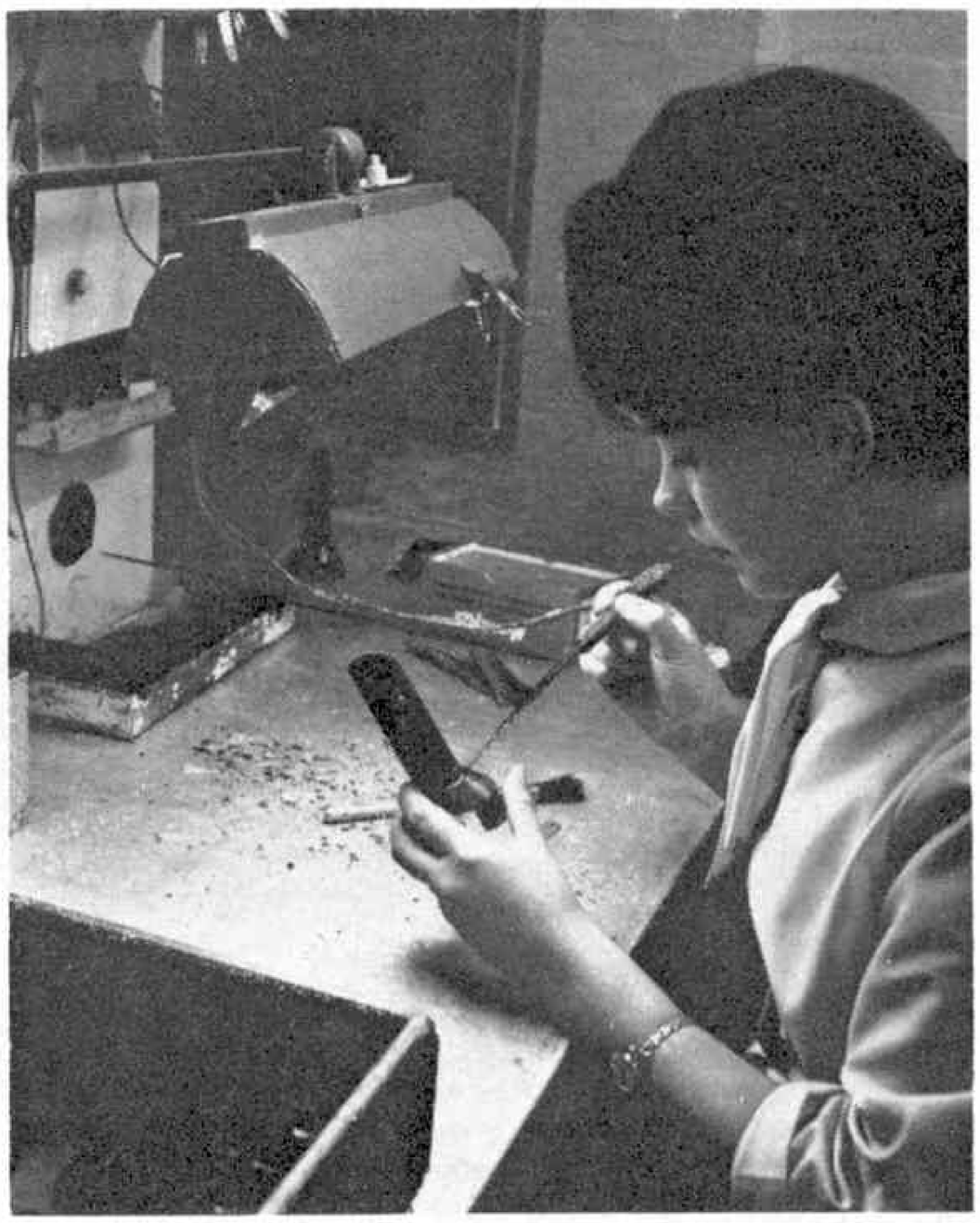


the manufacture of jet engine parts. Briefly, investment casting is a method by which a reliable wax pattern produced for each individual component is used to make up the final mould for casting the finished product. This has led to the popular definition " The lost wax process ", about which this metal worker gave details in his books.

Engineers and metallurgists have long sought methods by which components of intricate shape and dimensions can be cast with sufficient accuracy to require virtually no further machining. Among such components are turbine stator segments, turbine motor blades, com-

Above: Covering the coated pattern with hot sand to melt the wax. This leaves a shell of refractory material.
Above right: Preheating the moulds before filling. *Photos. courtesy of Bristol Siddley Engines Ltd.*

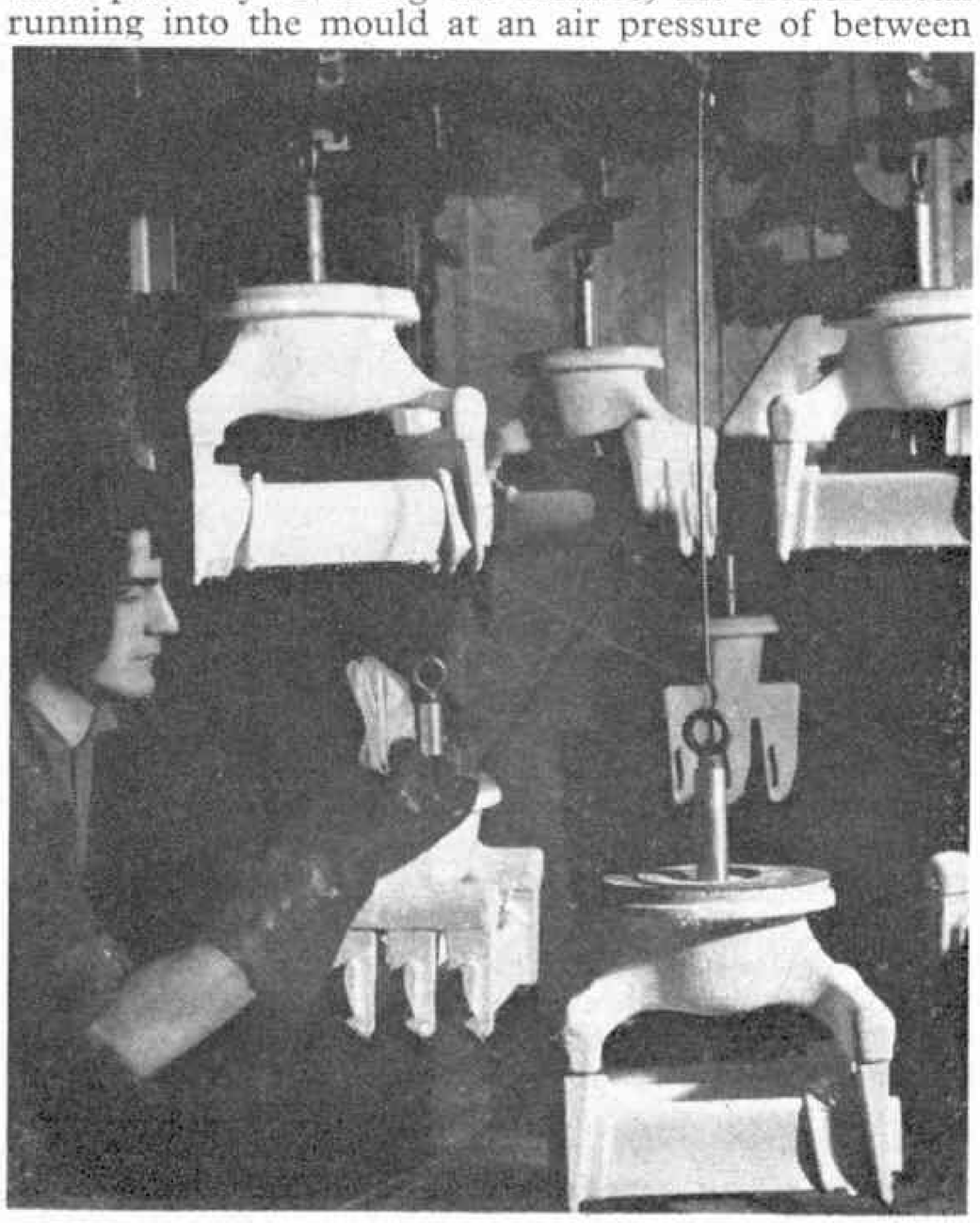
Right: Welding the test-piece and wax pattern together. Below: Covering the pattern with Alumina. *Photos. courtesy of Bristol Siddley Engines Ltd.*



pressor stator blades, combustion chamber swirlers, and exhaust pipe elbows. Accuracy, of course, is important, and the investment casting process used for many of the more complicated high temperature gas turbine components, is capable of attaining an accuracy of within ±.005 in. which would otherwise only be obtained by very costly and wasteful machining methods since this would prove difficult with components made of high nickel alloys.

The process takes place in a number of stages, numbered for reference, as follows: 1—First, the manufacture of a steel die from which the wax pattern is obtained, 2—Injection of the steel die with wax, 3—Excess wax at the joins of the die section are cleared or 'dressed off' after the pattern has cooled, and welding of the pattern onto a heavy wax runner to which a test piece is also attached. If the pattern is small a series of them may be joined to the same riser, and the welding carried out by an electrically-heated knife, 4—Final production of the mould, the pattern being dipped into a bath containing a fine alumina compound in water, and is then covered with stucco of coarse grade alumina, to bond subsequent coatings, and allowed to dry. This procedure is repeated several times until the outside of the pattern is coated to a total thickness of about ¼ in. Between coatings, the pattern is passed through a drying chamber so that each layer is dried hard before the next coating is applied.

5—The wax pattern is then removed by covering the mould with hot loose sand which causes the wax to melt and run out, leaving a shell of refractory material which is next heated in an oven for about two hours at a temperature of 1,050°C, 6—While this is being fired, a weighed quantity of metal is placed in an electric arc furnace and melted, 7—Pouring out of the metal takes place by inverting the furnace, the molten metal running into the mould at an air pressure of between



5-10 lb./sq. in. 8—The moulds are then broken open, each component given an identifying number, and then heat-treated to remove stresses set up during cooling, 9—The test pieces are then removed for laboratory analysis, and the castings are cut away from the runners and immersed in an acid solution to remove all traces of refractory material, 10—The components are then blasted with fine sand and visually inspected, followed by a full dimensional check, X-ray examination, and inspection for any 'cracks' etc.

The steel die, is in effect a mould of the finished component. Its design has to allow for several important factors. First, it must be easy to assemble, since in any production process time saving is important. In addition, the different coefficient of contraction of the wax pattern and the material from which the component is to be cast must be considered. The die will have an injection hole for filling, but risers, if present at all, will be merely shallow channels between the joint faces.

When the die is injected with wax it is placed on the table of a vertical wax injection machine and the table is raised until the injection hole presses against the injection nozzle. Liquid wax then enters the die at a pressure of about 40 lb./sq. in., and a temperature of about 70°C. This machine consists, chiefly, of a heated tank containing the wax in which an open ended cylinder is immersed leading to the injection nozzle. A piston forces the wax through the nozzle and into the die. The wax is usually permitted to set for approximately two minutes before the die is opened and the pattern removed.

Several kinds of wax are used, a typical one having a composition of about 60% paraffin wax, 25% flexoresin and 15% carnauba wax. While wax is undoubtedly the most suitable compound from which patterns can

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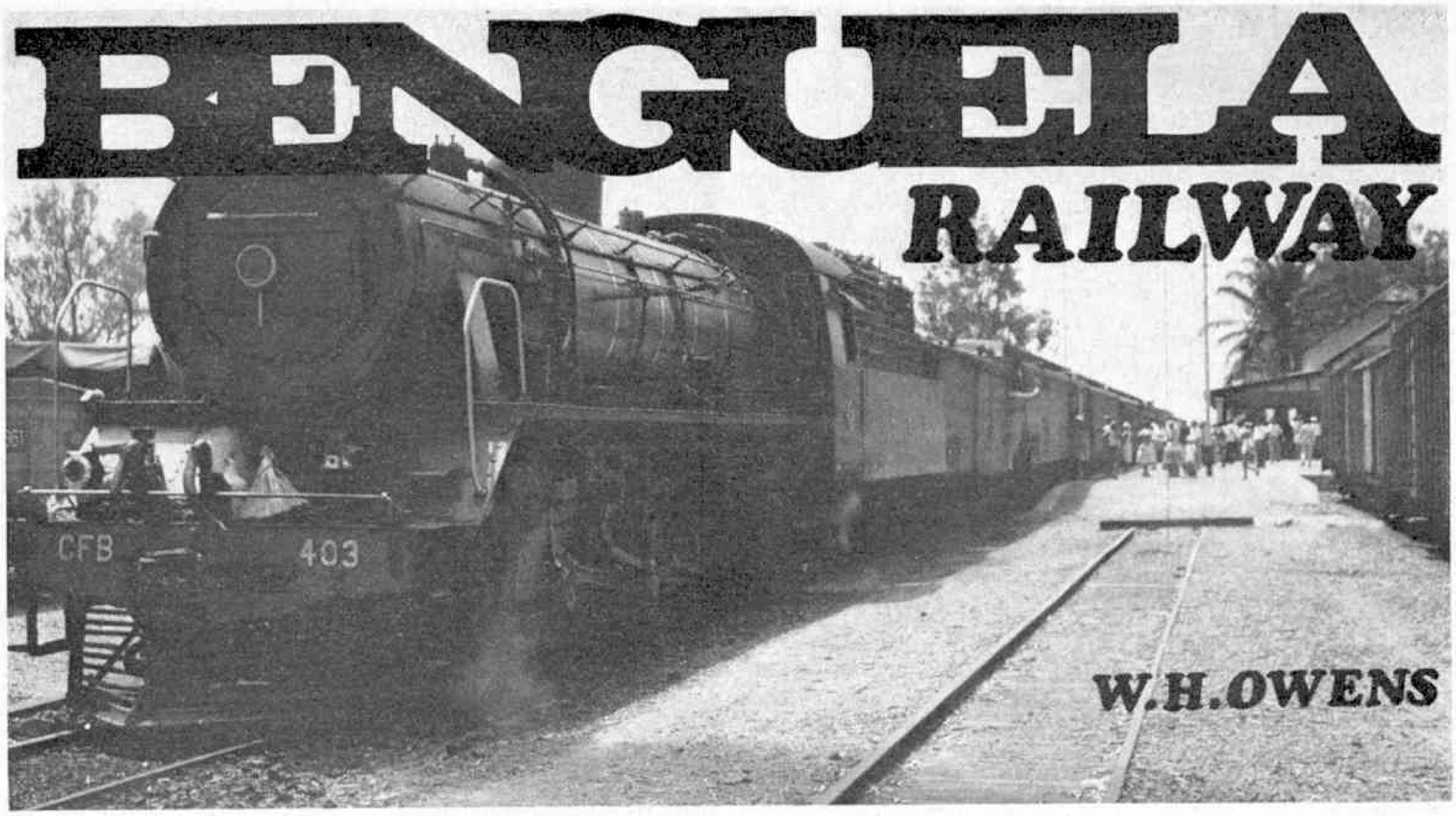
BENGUELA RAILWAY



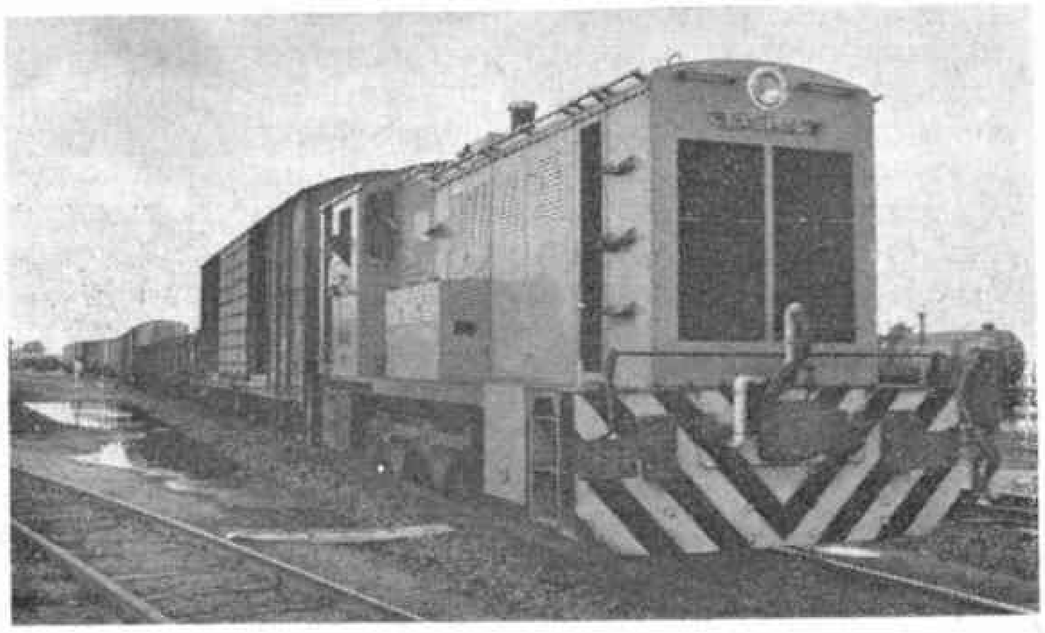
ONLY ONE seaport along the 6,000-mile coastline of West Africa is directly linked to the rail systems in the heart of that great continent. The port of Lobito in Angola is important as the Atlantic terminal of the Benguela Railway, an Anglo-Portuguese concern which runs for 840 miles across that province to link up with the interior railways of the Congo Republic and Zambia.

As the shortest route to Central Africa, the Benguela Railway has played a tremendous part in the development of one of the richest mineral areas in the world. Without the direct outlet to the Atlantic Ocean, all goods from Europe and North and South America to Central Africa, and vice versa, would have to be carried an additional 2,000 miles by sea around the Cape, and then taken on by rail from Lourenco Marques or Beira.

Every day through freight trains, hauled by powerful British-built locomotives, leave the Lobito quaysides bound for the distant Congolese border. From the opposite direction come trains loaded with copper and other African minerals for which there is an increasing world demand, and agricultural products from the Angolan hinterland. Regular passenger services, with restaurant and sleeping cars, also operate over the length of the line to connect with the interior railway services.

Our heading photograph shows a Beyer-Garratt Class II locomotive used for passenger trains working over the easier section of the line between Nova Lisboa and the congo frontier.

Below: One of the fleet of North British Diesel shunting locomotives at work in sidings.



Like most African railways, the Benguela is single track, of 3ft. 6 in. gauge, with frequent loops enabling trains to pass each other. During recent years wooden sleepers have been steadily replaced by steel, and the track is now stone ballasted throughout.

The most difficult working stretches of the line are on the coastal escarpment. From Benguela station (the second after Lobito) there is a steep climb through barren mountainous country to almost 3,000 feet in 37 miles. This followed by a sharp descent to 1,770 feet only 16 miles further on. Then the line begins its long climb on to the Angolan central plateau, reaching its highest point (6,082 ft.) near Vila Verde, 240 miles from Lobito.

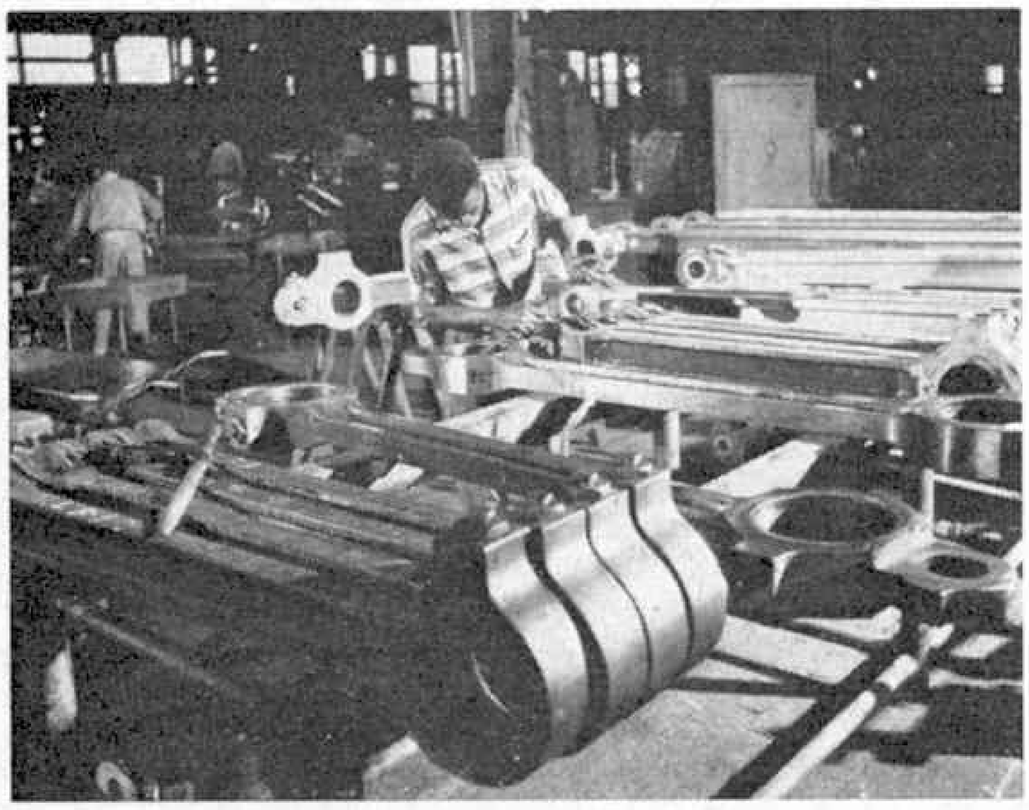
For working heavy traffic efficiently over such a difficult route powerful locomotives are required which, however, do not exceed the axle load permitted by the weight of the rails. The Beyer-Garratt articulated locomotive meets these conditions and is used extensively on the Benguela line. The locomotives, with wheel arrangement of 4-8-2 2-8-4, weigh 175 tons in working order and have an axle load of 13 tons. The latest types in service are the Class 10C and Class 10D, the latter being equipped for oil burning, and both have a tractive effort of 52,340 lb. at 85 per cent boiler pressure. They can haul 400-500 ton trains over the steepest part of the line.

Since there is no coal in Angola, wood has to be used as alternative fuel for the steam locomotives. They consume more than half a million tons of logs every year. To ensure a continuous supply the railway company laid down vast plantations of softwood eucalyptus trees. These stretch for mile after mile along the line beyond Cubal, 123 miles from Lobito, where the wood-burning locomotives take over from the oil-fired ones. The railway has its own forestry service employing over 4,000 men, whose job it is to maintain the woodlands,

plant new trees, cut mature logs into small fire billets and stack them conveniently beside the track for locomotive crews to take aboard as required.

Several other types of locomotives are used on the railway, notably the Beyer-Garratt Class II type. These have a coupled wheel diameter of 4ft. 6in. and a tractive effort of 35,100 lb. at 85 per cent boiler pressure. They are used for passenger train working over the relatively easy part of the line between Nova Lisboa, 265 miles from Lobito, and the Congo frontier at Dilolo. In addition, a small modern fleet of North British Diesel hydraulic locomotives is used for local shunting duties at Lobito and Nova Lisboa, the inland railway headquarters where the main railway workshops are situated.

The long mileages and steep gradients which have to be worked on the Benguela line impose heavy strain on locomotives and rolling stock. These are maintained and repaired—often completely rebuilt—at the large Nova Lisboa works where more than 1,000 skilled Africans and Europeans work side by side. Modern plant in great variety has been installed here over the years, and the power to drive it is supplied from a nearby hydro-electric plant constructed by the railway company. This also supplies electricity to the African bush town, which today has nearly 70,000 inhabitants



Inside the workshops at Nova Lisboa where finishing touches are made to a connecting rod.

and many other industries besides the railway engineering works.

Rolling stock in use includes first and second class passenger coaches, which have compartments that can be converted into sleeping berths on night trains. Freight wagons, mainly of 40 tons capacity, are of bogie type and fitted with vacuum brakes. They include high-sided, low-sided and also covered wagons. Open well wagons are used for transporting heavy and awkward loads up to about 50 tons, and refrigerated wagons are operated for perishable goods.

One of the stations on the line between Lobito and Nova Lisboa is named Robert Williams, after the Scotsman who founded the Benguela Railway. Williams, who went pioneering in Southern Africa towards the end of the last century, discovered the rich copper mines of what is now Zambia and the Katanga province of the Congo. Having done so, he realised that the mineral wealth could not be exploited unless a direct outlet for it to the coast was established. The shortest route lay to the west across Angola, much of which was then almost inaccessible.

Considerable difficulties were soon encountered,

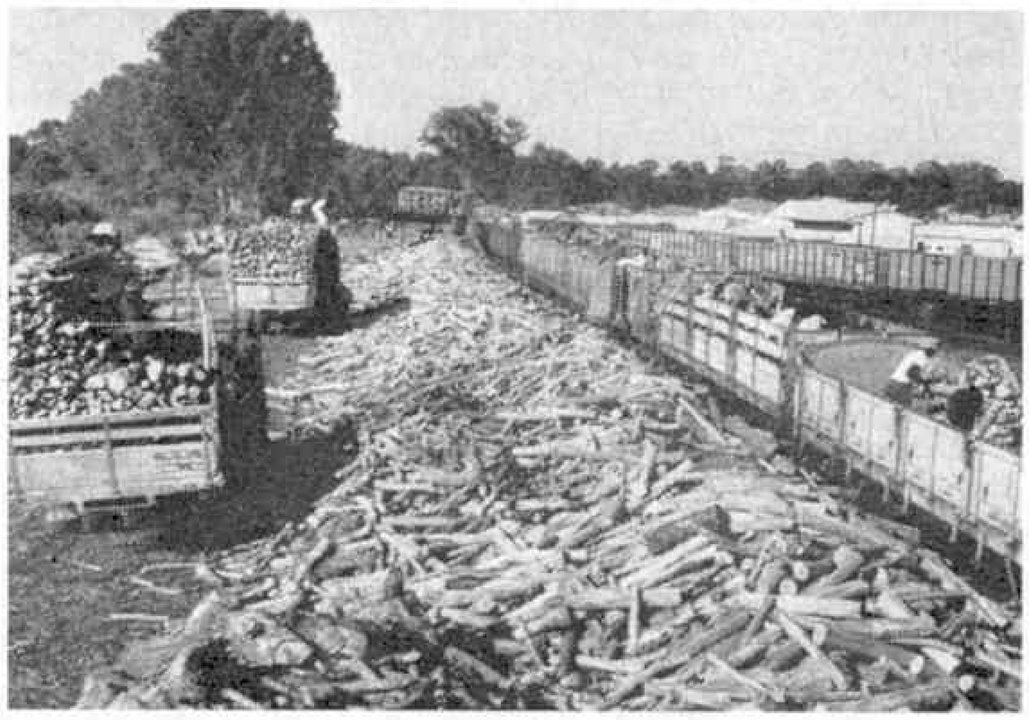
A freight train of mineral ore from Katanga, crosses the Commander Machado Bridge on route for the coast.

however, because of the rugged and extremely remote country through which so much of the track had to be laid. Hundreds of miles of virgin bush had to be cleared to make way for it. Construction was further delayed by the First World War which brought all operations to a standstill. So the line from Lobito to the Congolese frontier was not complete until 1928, a quarter of a century after it was begun.

The cost of the railway had been originally estimated at about £2,750,000. But by the time it was opened a further £10,000,000 had been spent. In 1931 the connecting link built by the former Belgian Congo Railways reached the Angolan border, and the through line from the copper mining areas of Central Africa which had been Robert Williams' plan at last was achieved.

Six years ago, in 1962, the first branch line on the Benguela Railway was opened. This runs from Robert Williams station to Cuima, a distance of nearly 50 miles. As a result of this rail extension the rich iron ore mines at Cuima are directly linked with the coast, eliminating the costly delays in transferring ore shipments from road trucks to the railway at Robert Williams. This new branch line is destined to play a key part in the future development of a promising region of Angola, which country as a whole has derived enormous benefit from the forty-year-old railway.

Eucalyptus forests provide the fuel for the locomotive, since there is no coal in Angola.



Two aerial views of a model of the proposed SEA CITY. The top photograph shows it by day, and the lower, by night.

SEA CITY

A possible solution to the rising population problem

described by T. Holloway

FIRST THE problem. According to a United Nations report, the present world population figure of around 4,000 million may double itself within the next fifty years. By that time many countries will be desperately short of land for building purposes. Sir Hugh Wilson, President of the Royal Institute of British Architects, predicts that within the next hundred years Britain will require a new town of 50,000 people every seven days, and the world as a whole one every seven *hours*.

Architects and scientists in a number of countries have put forward a variety of suggestions for coping with the situation, but it is the revolutionary plan for building a city on the sea advocated by a British firm of glass manufacturers that has aroused the greatest interest throughout the world.

The Glass Age Development Committee, established by the Lancashire firm of Pilkington Brothers, argued that as the sea represents three-quarters of the earth's surface, the obvious answer to the shortage of land is to build out at sea. They accordingly appointed a highly qualified team of architects and engineers to explore the problems and prepare a feasibility study. The result of their researches provides the blue-print for an off-shore sea city capable of accommodating a population of 30,000.

Sea City is no mere science-fiction idea, for although such a city may not be needed for another fifty years, it *could* be built today with present materials and techniques.

The site chosen for this blueprint sea city is in shallow waters of the North Sea, about fifteen miles off the Norfolk coast close to abundant supplies of undersea natural gas for providing heat and power.

Shoal water, with depths of only 30 ft. to 40 ft. covers nearly 10 per cent of the sea-bed, providing many suitable sites around the world for sea city development. For example, suitable sites off American shores include the Gulf of Mexico and around the island of Martha's Vineyard off the south coast of Massachusetts; and extensive areas of shallow water between Rio de Janeiro and the River Plate.

As may be seen in the illustrations, Sea City would for the most part be built on a forest of piles, but many open-space areas and public buildings, such as schools, would be built on islands of floating pontoons.

Apart from the harbour entrance, the city is enclosed by a high wall, and beyond this is a unique type of breakwater. These two features deserve special mention, for upon their efficiency depends the safety and comfort of the city's inhabitants.

In section, the 180 ft. high city wall resembles a letter S leaning slightly backwards. Its design was arrived at after extensive wind-tunnel tests proved that such a curved surface would deflect the wind upwards and over the city. Even with a gale force wind blowing, the inhabitants would experience no discomfort.

The North Sea can be very bad-tempered at times, so a very efficient breakwater was considered necessary to maintain a comparatively calm 'moat' of water around the wall. After exhaustive research, the planners decided on a design for an ingenious type of floating breakwater consisting of hundreds of cylindrical coated-fabric bags 90 per cent full of fresh water, each bag being about 100 ft. long and 6 ft. diameter. The bags would be allowed to float awash, anchored fore and aft in groups of three by flexible cables.

This type of breakwater would effectively 'damp' the waves because, when struck by an oncoming wave, a secondary wave is generated inside each bag. This secondary wave rebounds against the end of the bag to meet the following sea.

In bad weather, a curtain of compressed air bubbles from an undersea pipeline would rise to the surface across the harbour entrance to break up the waves still further and to maintain calm water within the city itself.

The city is designed as a vast amphitheatre rising to sixteen storeys, built around a large lagoon which would be artificially heated by waste industrial cooling water.

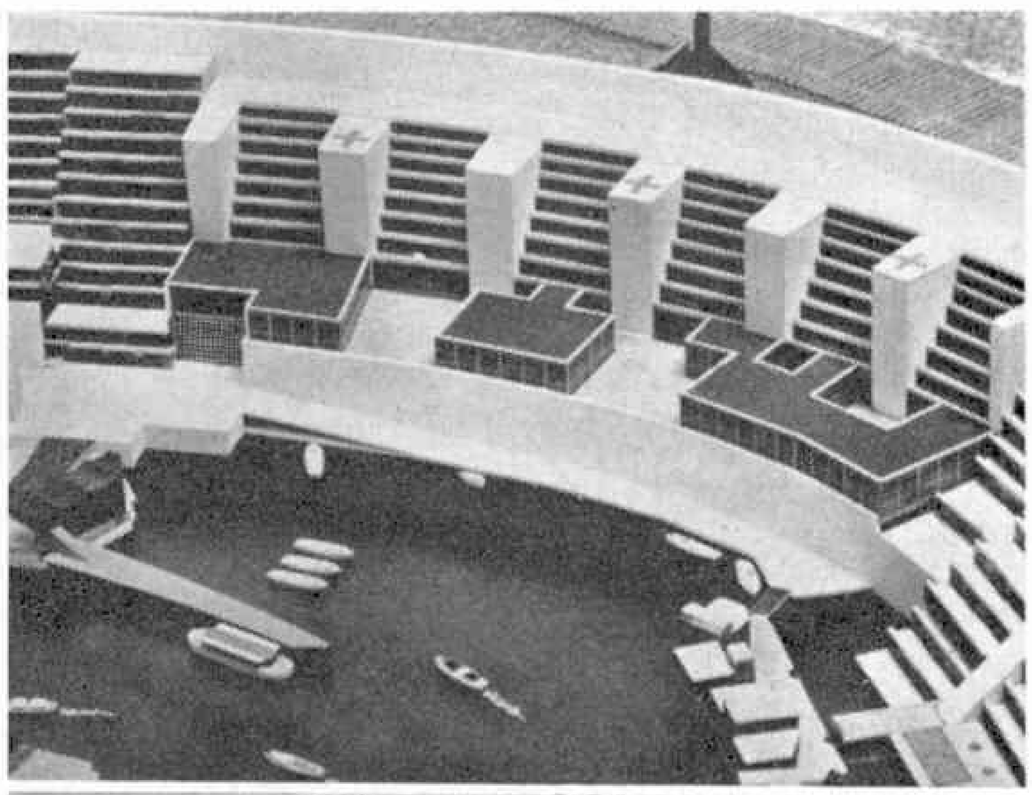
An interesting feature of Sea City is that all types of industrial combustion engines would be banned in order to eliminate the nuisance of noise and air pollution. There would be no cars, buses, motor cycles or

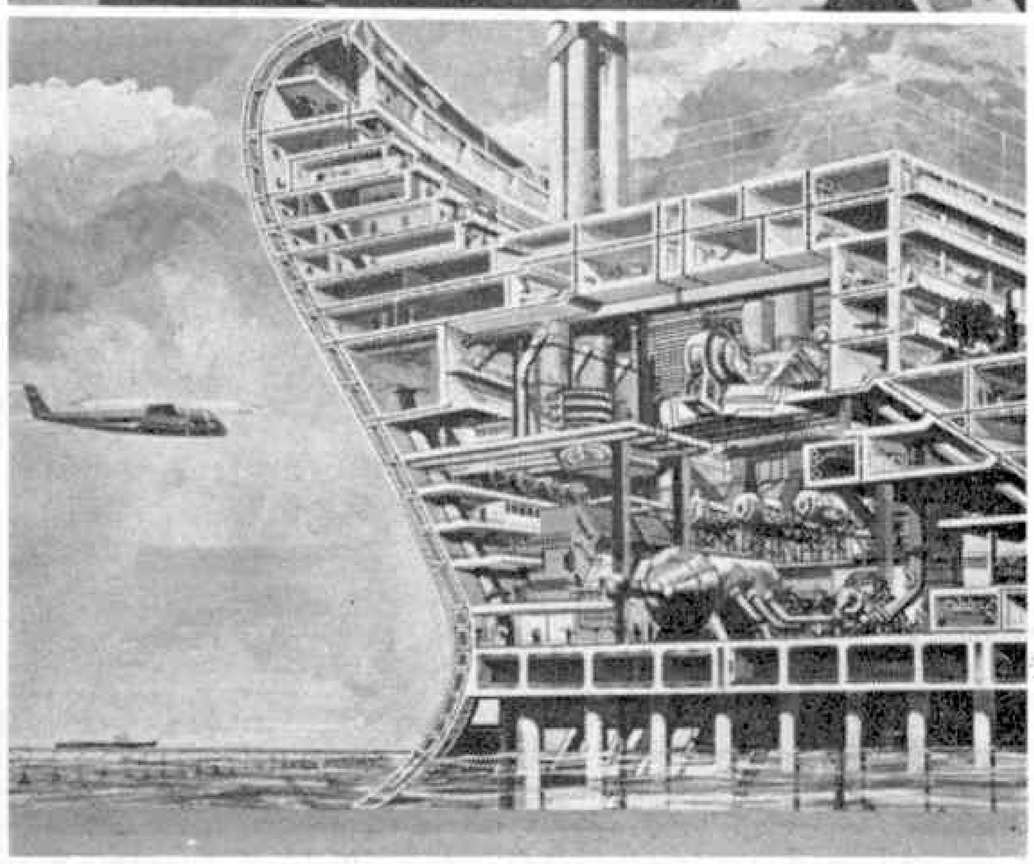
commercial vans. Transport within the city would be mainly by electrically-powered craft, using a comprehensive network of waterways. Goods arriving at the harbour entrance would be delivered by conveyor belt running the whole way round the inside of the wall. The maximum possible use would also be made of pneumatic tube delivery.

The whole city is woven with pedestrian routes and all islands are connected by bridges. Flats, shops, gardens and other amenities would be well served by escalators, travelators and covered walkways.

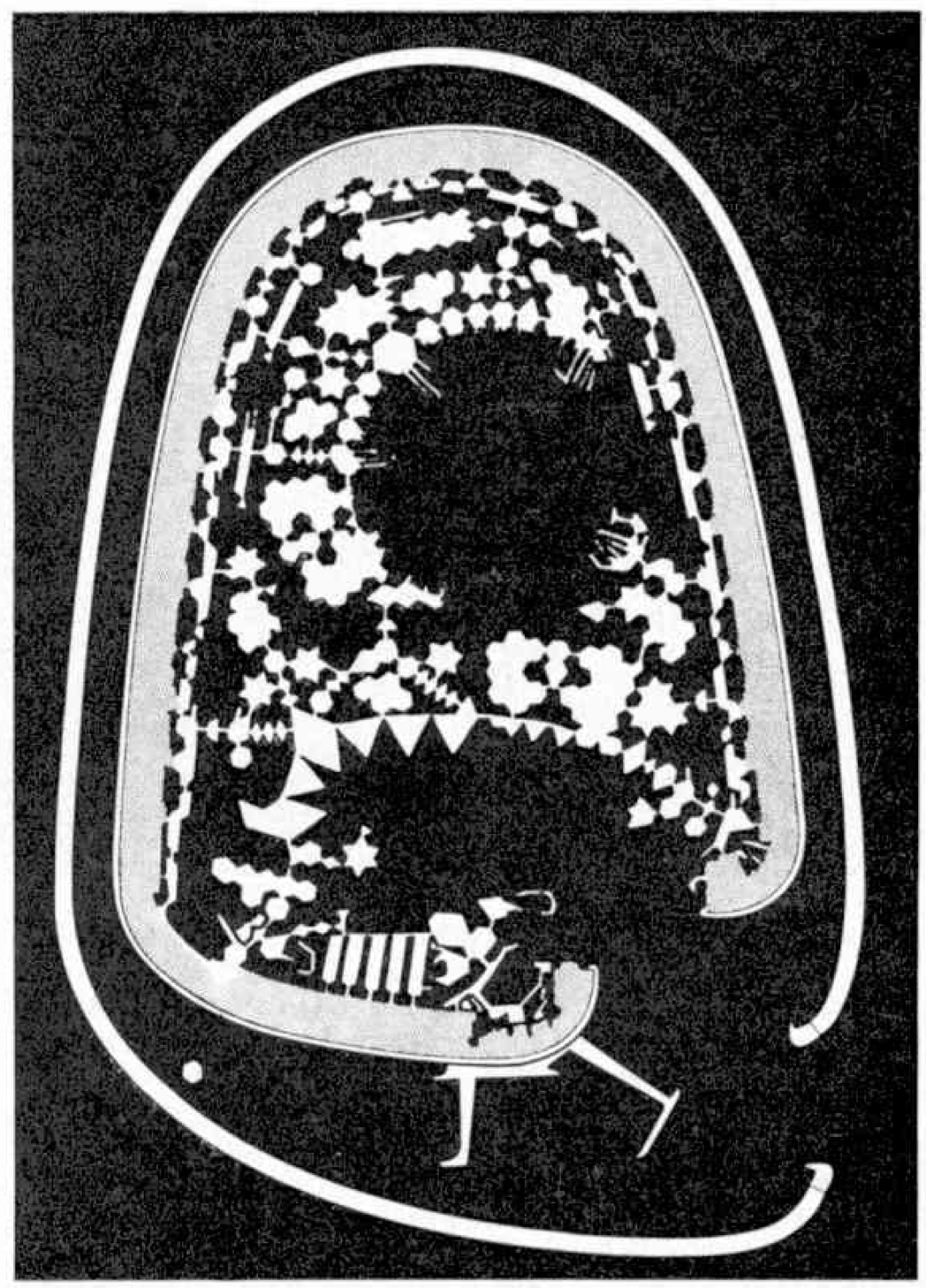
Don't imagine that life in Sea City would be as cramped or restricted as life on, say, an off-shore drilling rig. Despite its isolation, Sea City will lack few of the attractions of a city ashore. There will be grass tennis courts and bowling greens, netball courts, libraries, community centres, theatres and cinemas, and numerous public gardens with flowers and shrubs chosen to flourish in the city's artificially-warmed climate. The planners have even made provision for a full-sized football pitch on the roof of the power station!

The heated central lagoon would be reserved for sailing, swimming, water-skiing and skin-diving—all during a season lengthened by the warm climate provided by the heated water of the lagoon.





Top photograph shows an aerial view of the City's 200 bed hospital. Lower photograph shows a section through the wall showing the power-house.



Architectural sketch Plan of SEA CITY. The white band around the perimeter indicates the breakwater.

It is intended that the city should be industrially self-supporting and there are a number of industries ideally suited to such a sea-based community—particularly so when ample supplies of natural gas are available, as in the North Sea.

One of the most important industries would be large-scale fish farming. The industrial area in the terraced wall is well suited to such an enterprise. Cheap fuel could be used to maintain correct temperatures and air-conditioning; there would be an abundance of fresh sea water to house the fish; and plenty of process waste matter would be available for food. Large stocks of plaice, trout, salmon, eels, shrimps, prawns, clams, etc., could be quickly built up, to be marketed fresh, canned or processed.

There is also great scope for large-scale breeding of ornamental fish, some species of which fetch good prices.

To supply its fresh water needs, Sea City would have its own desalination plant associated with the power station. Fresh water is a commodity already in short supply in several parts of Britain, and it is foreseen that Sea City could earn considerable revenue by exporting fresh water to the mainland by pipeline.

It is probable, too, that associated with the desalination plant would be processes for recovering not only salt from the brine concentrate, but profitably marketable trace elements such as magnesium, bromime, rubidium, nickel and cobalt.

As a large number of Sea City residents would be

Continued on page 301

TRACTION ENGINES

BY JOHN HAINING

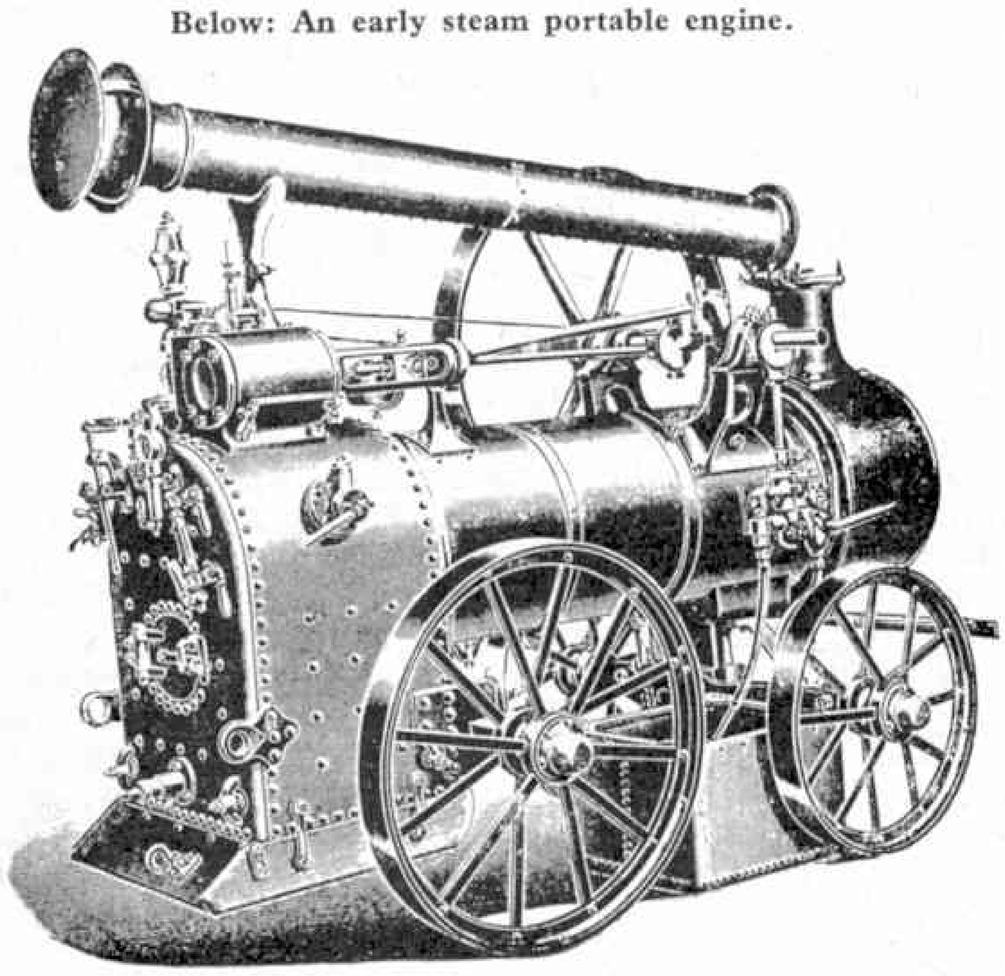
QUITE EARLY in the 19th century, when the steam engine was already firmly established on the railways it was also introduced as a cheap and compact form of power for use in agriculture, driving the various machines then coming into use on farms.

These engines were called "portable engines" and although the earliest designs included some unusual features, the type of engine which quickly found favour was a simple locomotive boiler upon which was mounted a single cylinder driving a crankshaft and large flywheel, the whole machine being mounted on four iron wheels to enable it to be moved from place to place by a pair of horses or even a team when required.

These engines proved so useful that their use quickly spread, and in an age when the electric motor and internal-combustion engine were as yet unheard of they provided the only form of power, other than the water-wheel and windmill, available in the countryside. One of these early portable engines is illustrated in Fig. 1. The tall chimney is made to hinge-down on to a rest, and the cylinder is mounted above the firebox, with the crankshaft behind the chimney supported in cast-iron brackets. Shafts were attached below the smokebox to the front axle for the horses. The steam engine had already been applied to road vehicles in the form of the steam coach, and although a number of these vehicles were built in various forms, their use never became really widespread owing to their rather frail construction, and unpopularity with a large section of the public; consequently a number of engineers turned their inventive minds to adapting the trusted and reliable portable engine to becoming a self-moving engine, capable of propelling itself along and hauling a load behind it, and thus was born the traction engine.

Above: One of a pair of big Fowler compound Ploughing Engines at work with a "turning cultivator". Note the cable wound on a drum beneath the boiler. The cable from the second engine is visible in the foreground.

Below: An early steam portable engine.



These early traction engines retained many features of the portable, for quite a long time; in fact, many of the earliest traction engines were virtually portables with the addition of a chain drive to the rear wheels, and a small platform or footplate for the driver, attached to the back of the boiler. For some time, a few makers retained horse-steerage, so that instead of a steering wheel and chains to the front axle, operated by the driver from the footplate, a horse harnessed between shafts at the front of the engine actually steered the machine. It was thought, at that time, that other horses on the road would not be frightened by the appearance of a noisy, clanking, steam engine if they saw a horse preceding it, quite undisturbed by the engine so close to its tail!

However by the late sixties of last century, the traction engine had assumed most of the appearance of the engines we know today, although several makers stuck to the front-steerage, with the unfortunate steersman sitting in front of the smokebox door, steering by means of a ship's type wheel, for a few years more. The practice of fitting the flywheel on the left, or near side of the crankshaft, also dates from the early days of horse traffic, as in this position it was less likely to frighten oncoming horses.

By this time some of the firms, later to become so famous as builders of engines had become firmly established, and were busily turning out engines and equipment in considerable numbers.

One such firm was Charles Burrell and Sons Ltd., who had a works in the small Norfolk town of Thetford. This firm built several engines on the "Boydell" principle, and these were really the earliest "track-laying" vehicles on record, as the back wheels of the engine had tinged or pivoted flat plates mounted so that each plate in turn lay flat on the ground, the wheel rim running over the plates, which formed in effect, an endless track—in principle like tank tracks of many years later. Engines fitted with these patent Boydell wheels hauled quite heavy loads over long distances, but the plates and pins soon wore out, and the idea was dropped, the firm concentrating on building orthodox traction engines and rollers.

In 1865 the firm of Aveling and Porter, of Rochester, built their first steam roller, the forerunner of many thousands bearing the famous brass horse trademark that found their way to all parts of the world; nearly all firms building traction engines also constructed steam rollers in various sizes and weights and even today a roller may occasionally be seen at work, usually highly polished and kept in fine condition by its driver.

A few rollers were built with vertical boilers, and some unusual types for special work were constructed by firms from time-to-time, but generally the steam roller was built on the same lines as the traction engine, but with heavy cast rolls instead of straked wheels, and small differences in detail.

After much early experimental work, the great engineer John Fowler successfully applied the steam engine to actually plough and cultivate the ground, and in the sixties of last century the famous Steam Plough Works was established at Leeds, to turn out over the next 75 years many thousands of road locomotives, traction engines and ploughing engines, together with a vast variety of implements and other engines of all types.

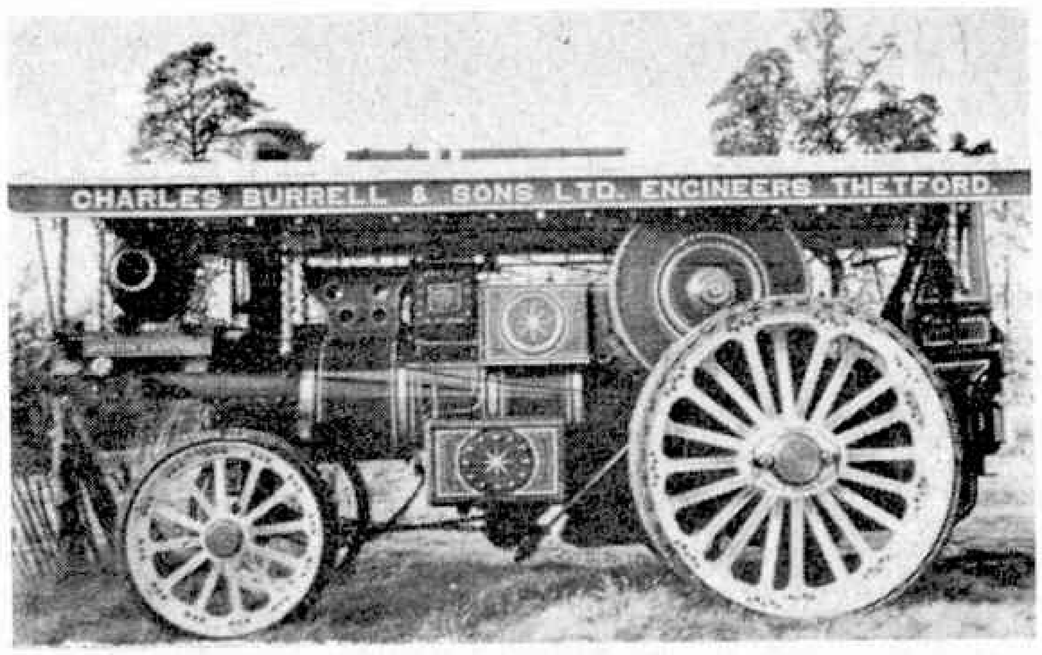
These early ploughing engines were really developed from the traction engine, but whereas the traction engine was designed primarily to *haul* its load, or drive machinery from the flywheel by belt, the ploughing engine was developed especially for the purpose of hauling the implement to and fro across the field by means of a cable wound on a drum beneath the boiler, two engines being employed for this operation, one on each side of the field, with the plough or cultivator travelling between them.

The next major development was the introduction of the principle of compounding to traction engines, in the eighties of last century.

This meant that instead of having just one cylinder, engines were built having two cylinders, side by side, a small one the high-pressure and a larger one the lower pressure cylinder.

When the steam had finished its work in the high pressure cylinder it was exhausted into the low pressure one, where it continued to expand until it was finally exhausted through the blast-pipe into the chimney. This was a very big step forward in traction engine development, as it increased both the power and economy of the engine, and also made for much quieter running as the exhaust of a compound lacked the bark of a single-cylinder engine.

Traction engines built purely for general agricultural work such as threshing remained for the most part single-cylinder engines, but fairground showmen and heavy road haulage firms were quick to seize on the compound engine, and from about 1890 onwards, until the end of the Second World War all the big fairs and most of the really heavy loads of industry were hauled by big compound engines built principally



Burrell Showman's Locomotive *Winston Churchill* **now privately owned.**

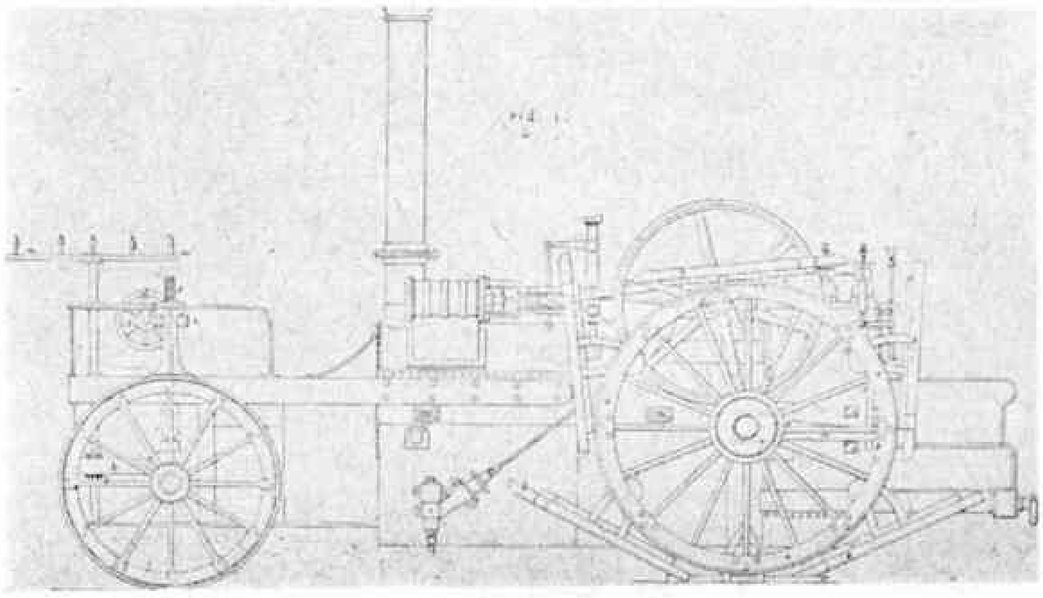
by Fowlers, Fosters, Fodens, Burrell and McLaren.

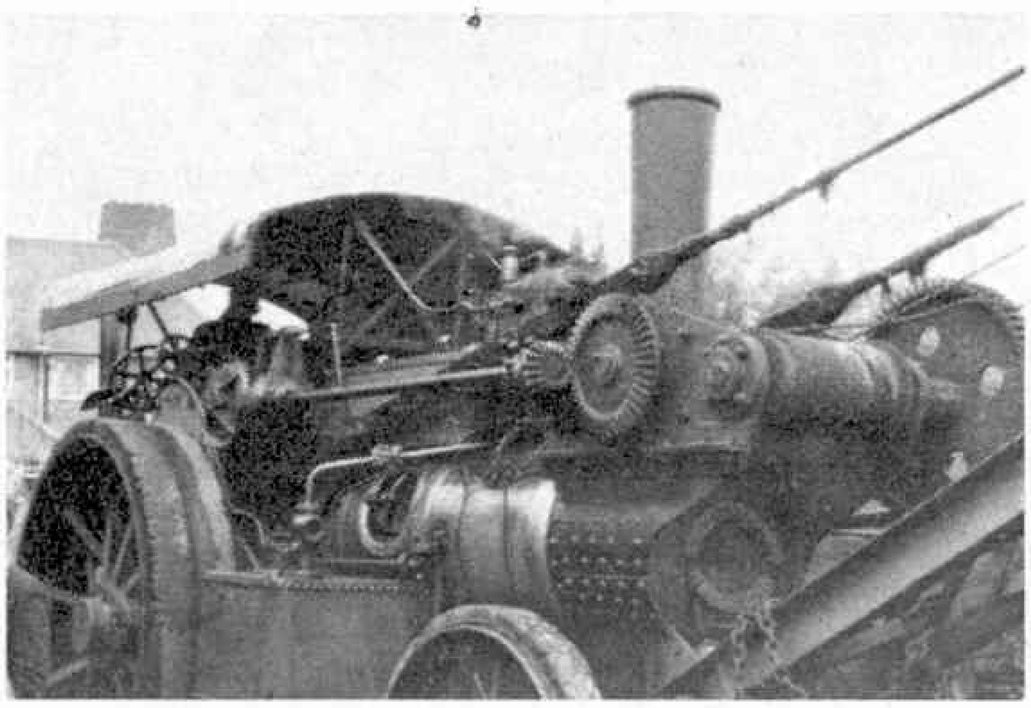
These big engines, the aristocrats of the road, built specially for heavy haulage work, were known as "Road Locomotives" and were always compound engines. They had solid rubber tyres on both front and rear wheels, both front and rear axles fully sprung to absorb road shocks, heavy disc flywheels, three-speed gears, rim brakes on rear wheels, and extra water tanks beneath the boiler.

Showmens road locomotives had full-length "Canopies" or cab-tops, and a big dynamo driven by belt from the flywheel, mounted to an extension of the smokebox for supplying current to fairground machinery; they were painted in distinctive colours with much highly-polished brasswork, while the engines used by heavy road-haulage firms had three-quarter length canopies, and most of them also had electric headlamps driven from a small dynamo. All had a winding-drum mounted on the rear axle, and showmens engines fitted with a built-in lifting crane on the back of the bunker were termed "scenic" engines, as this crane was used for lifting the gondola cars of the "scenic rides".

The average weight of these big engines was 16 tons, and they were rated at 8 or 10 nominal-horse power, although of course they actually developed a great deal more than this figure. A Fowler Super Lion, for example, was designed to haul a load of about 40 tons, although in fact it would pull 120 tons, three times that amount; and when very heavy loads such as huge boilers or industrial machinery were being transported by road it was common practice to use two road locomotives coupled in tandem, that is, one behind the other, to haul the load, with another behind to assist if necessary when ascending or descending steep hills.

Fig. 1—Early Burrell Heavy Haulage and direct traction ploughing engine fitted with Boydell Patent Wheels.





Fowler Crane Engine *Duke of York*, **showing the drive to the crane drum, and the long jib extending out of the photograph.**

Fairground drivers usually worked to a tight time-table, and so were always in a hurry to reach their next destination; consequently a run of 180 to 200 miles in two days, hauling a train of big four-wheeled trailers weighing up to 45 tons was considered quite normal.

Some road locomotives were built with a crane jib extending from the smokebox, with the lifting drum driven from the engine crankshaft by gears and shafting. These crane engines, as they were termed were particularly useful, as they were capable of both lifting and hauling any load, however unwieldy. A particularly fine example is the big 10 H.P. Fowler "Duke of York", now in private ownership, together with a Burrell crane engine of similar type.

The winding-drum on the rear axle of traction engines and road locomotives was a very vital piece of equipment, as it was invaluable when extracting the engine or load from soft ground being particularly useful when loading or unloading the trailers, with their bulky, and unwieldy loads.

From the early days of the century many firms built small road locomotives under 5 tons in weight, and of only 3 or 4 nominal horse-power; these were termed steam tractors, and were built to compete with the internal-combustion engined tractor which was starting to become more widely used in the country-side.

These little engines were very popular with furniture removal firms, timber hauliers, and other users who required a fast, handy, and easily driven engine; particularly popular were the little steam tractors made by Garrett, Marshall, Robey, Foster, and Burrell to name but a few, while the Fowler "Tiger" tractor was a real miniature road-locomotive, mounted on rubber tyres and proportioned most handsomely as were all Fowler products.

Despite the ever increasing competition of the petrol-paraffin and diesel tractor, most threshing contractors contrived to use the trusted and reliable traction engine for all their work until just before the 1939-45 War; in fact many were still using steam until well on into the '50's, but generally speaking the manufacture of nearly all traction and ploughing engines ceased in about 1935 although at least one traction engine was built to special order during the last war.

Steam portable engines and steam rollers continued to be made until well after the War.

Steam ploughing is still carried on in Essex and elsewhere where the heavy land and big fields make this still the best form of cultivation. The ploughing engines in use today are big compound engines of 16 and 18 nominal horse-power, weighing over 20 tons, although one or two very early sets of single-cylinder engines and ploughs are still used occasionally.

A great deal could be written on the subject of steam ploughing alone, but it must suffice here to say no opportunity should be missed of seeing these magnificent great engines and implements at work, as the ploughing engine shows in spectacular fashion, the immense power of steam when applied to the task the engine is designed to do.

One pair of Fowler 18 H.P. class A.A. ploughing engines supplied new with all their implements in 1918, and used every year since on their owner's farm had new piston rings fitted in 1967 for the very first time—a fact which speaks well, for the designers and builders of these fine engines! Despite the great number of engines scrapped during and after the last years of the War, very many engines of all types survive today in the hands of private owners, and at the big Rallies held in the Summer months may be seen in steam and working, lovingly restored to all their original glistening paintwork and polished brass at the hands of their owners.

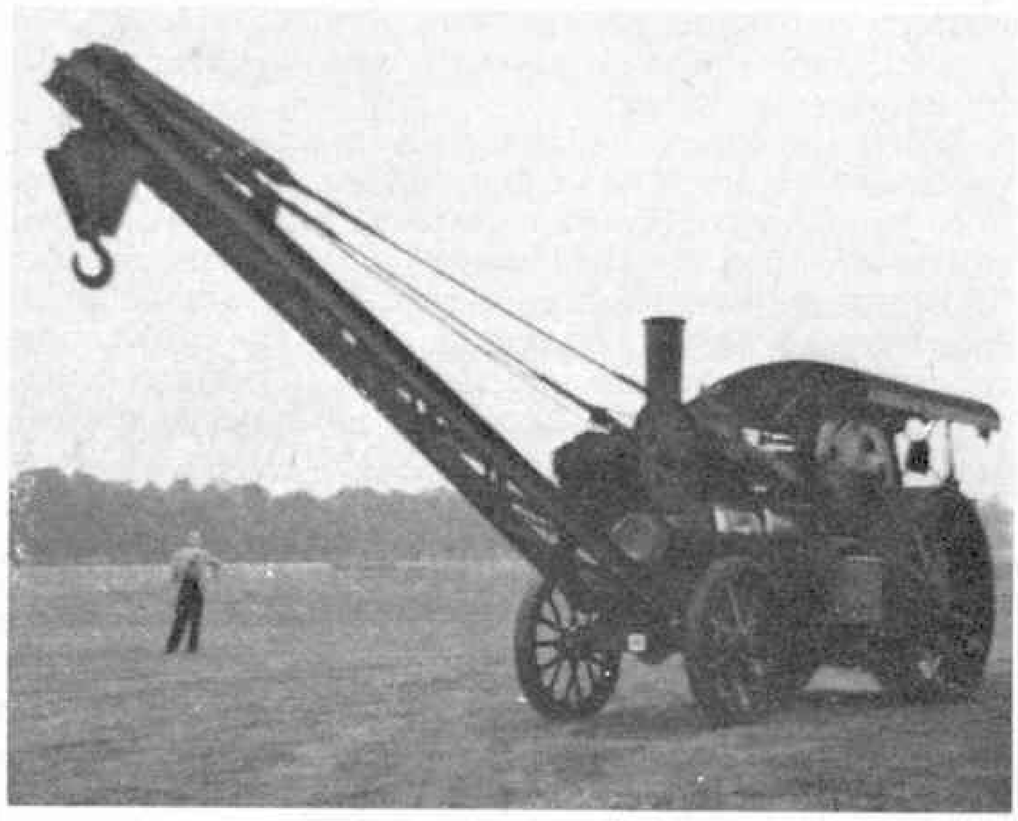
Restoration of an engine which has been left standing in the open for a number of years without any form of protection against rain or frosts, involves a vast amount of heavy work and considerable expenditure of both time and money.

More often than not the smokebox has rusted through and needs cutting-off and renewing and the tubes will require withdrawing and renewing too.

The firebox will need examining and may even need replacement, and certainly all the motion work—that is the valve gear and eccentrics—and the pistons, will require soaking in anti-rust fluid to free all moving parts and allow the crankshaft to be turned in the main bearings.

Very often the bunker or tender will have rusted through where water has been allowed to stand, and will have to have new plates welded in position, and possibly even the chimney has corroded through in places and needs repair or a new one fabricating; when all this work plus overhaul of bearings and other moving parts has been completed, the engine will require thoroughly cleaning and careful painting and lining-out in the authentic makers' colours, but most people will agree that despite the size of the task the sight of the engine in steam for the first time, more than repays all the immense effort involved!

This photograph shows the complete Fowler Crane Engine. *Photographs by Courtesy of B. J. Finch, E. Middleton, D. R. Gray.*



JOSEPH WHITWORTH

by

A. W. Neal

GREAT ENGINEERS—No. 17

ON DECEMBER 20th, 1805, Joseph Whitworth was born at Stockport in Cheshire. His father being a schoolmaster gave him his early education, but when he reached the age of twelve he was sent to a school at Idle, near Leeds.

Two years later he began working in his uncle's cotton mill near Ambergate, Derbyshire, where he learnt much about the business. He soon became skilled with the machinery of the mill and even at this early age, criticised much of its efficiency. Urged by his desire to become an expert in craftsmanship, he ran away from the mill and took employment as a mechanic with Crighton and Co. of Manchester. At the age of 22 he left Crighton and joined the Westminster Bridge Road, London workshops of Henry Maudsley. (see Great Engineers No. 7) Maudsley's passion for perfection must have affected Whitworth a great deal, since it was here that he first realised the importance of precise measurement. He developed, probably with Maudsley's help and encouragement, his well known three plate method of producing plane flat surfaces. In 1840 he wrote a paper on "Plane Metallic Surfaces and the Proper Mode of Preparing Them". It had far reaching effects. Later he moved to the works of Holzapfel, then on to Joseph Clement where he worked on Bubbage's calculating machines.

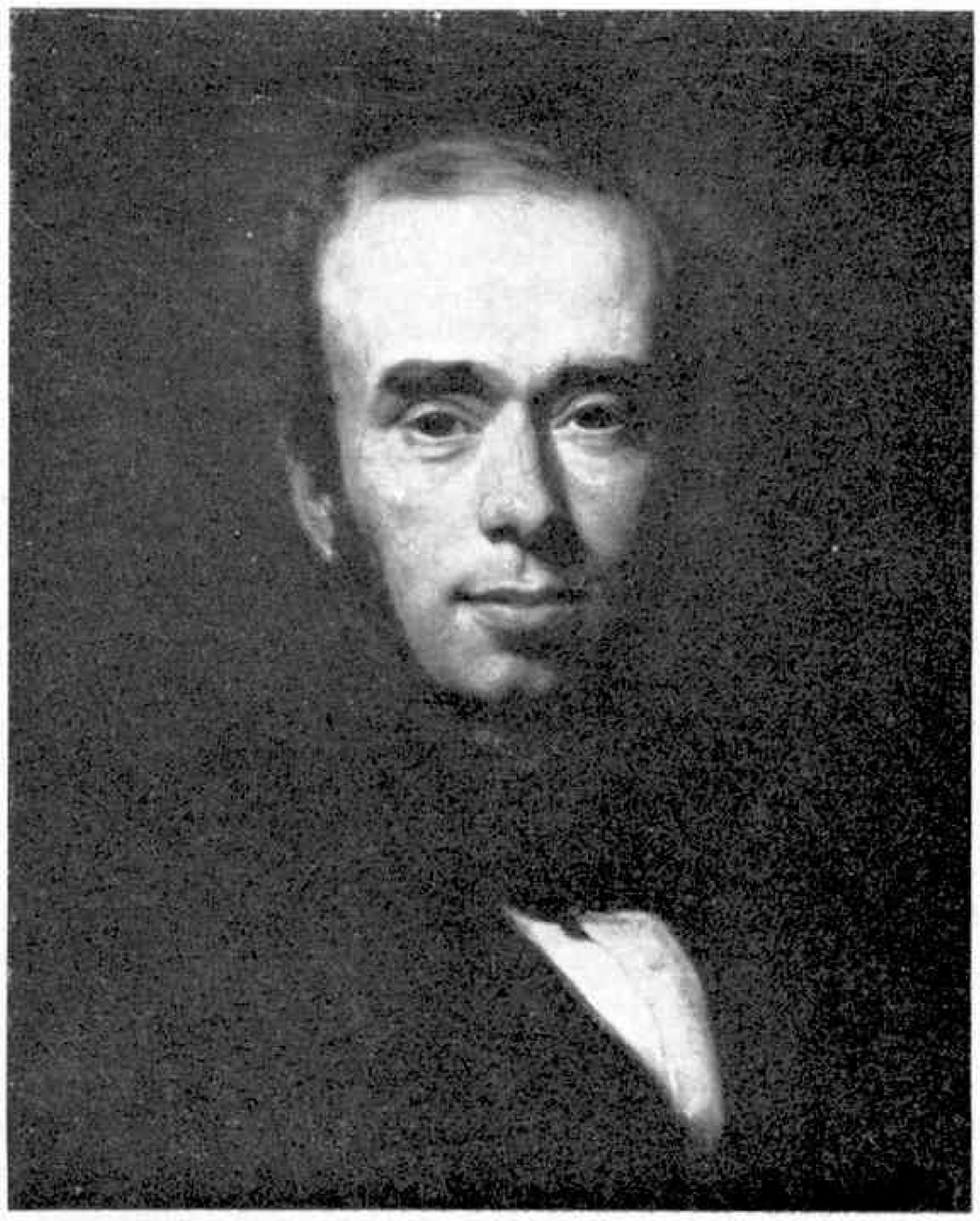
In 1833 he was back in Manchester trading as "Joseph Whitworth Tool Maker from London". So the foundation stone was laid for the works which developed into one of the largest of its type in Britain. About 1834 he made a measuring machine capable of measuring to an accuracy of one ten-thousandth of an inch and in a later version of this he claimed to be able to detect a difference of a millionth of an inch. From this stemmed the standard Yard, Foot and Inch. Whitworth could not help inventing things, and this went on throughout his long life. He advocated a decimal standard of lengths, such lengths facilitating the making of standard gauges and promoting a means for multiple production. His work on screw threads was equally thorough, his "Whitworth" standard threads are world known.

In 1835 Whitworth and John Wild patented a knitting machine, and in 1847 came his horse drawn road sweeper. He also produced some spring wheels for the reduction of wear in vehicles.

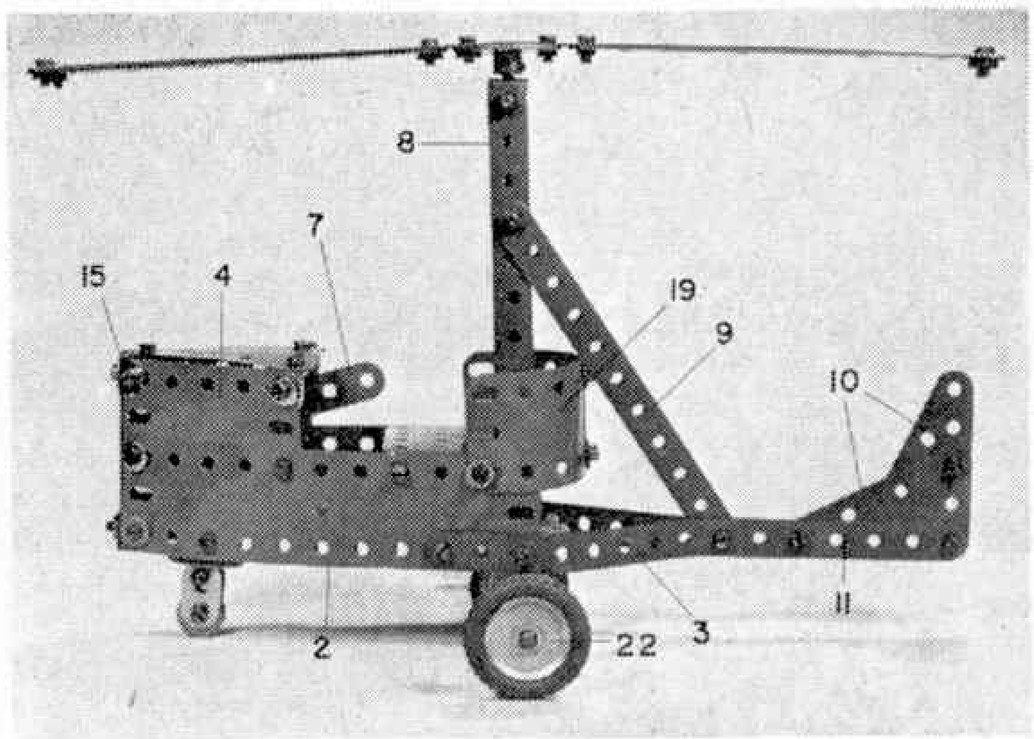
Whitworth was also occupied with the manufacture of steel, and he made advances in this field, all of which was of considerable help with his work on fire arms. His small bore rifle showed improvements in accuracy over the service rifle of the day and his investigations into guns and gunnery including the design of shot, rifling and proving.

He became a fellow of the Royal Society in 1857 and received honorary degrees of LL.D (Dublin) and D.C.L. (Oxon). He was awarded the Albert Medal of the Society of Arts and in 1869 was created a Baronet. Twice he was elected President of the Institution of Mechanical Engineers. France conferred upon him the Legion of Honour in recognition of his work in connection with field guns.

This great pioneer of precision tools, standardisation and the interchangeability of machine parts spoke with a broad Lancashire brogue, and looked as some writer unkindly said "not unlike a baboon". He died in January 1887 at Monte Carlo, and was buried in the churchyard of Darley Dale, Derbyshire.



AUTOGYRO by Spanner



Inspiration for this little autogyro model came from the Wallis Autogyro which appeared in the James Bond film, " You Only Live Twice ". The model is of course only roughly based on the real thing, but the rotor revolves when the model is pushed along.

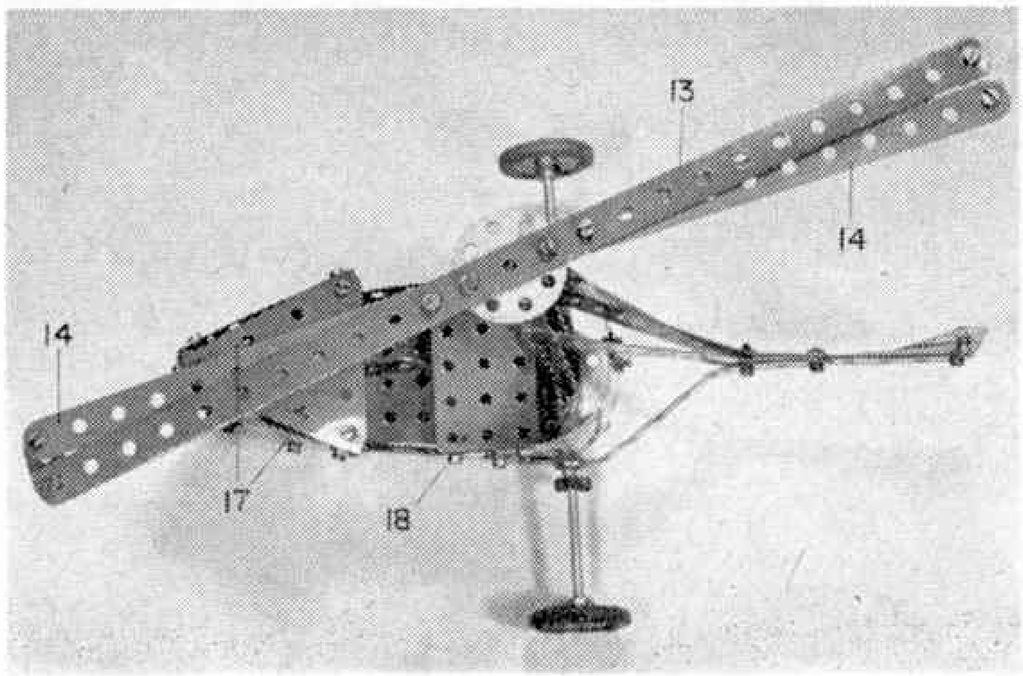
CROSS AN aeroplane with a helicopter and what do you get? Answer—an autogyro.

Most of us know something about both the aeroplane and the helicopter, but the autogyro is something of a mystery to many people, so what exactly is an autogyro? Well, to answer this one, we need to first look at the aeroplane and helicopter. In basic terms, the former, equipped with wings, is driven forward by an engine. As this happens, the passage of air over the aerofoil surfaces of the wing creates " lift " which enables the aircraft to leave the ground and fly. In the case of the helicopter, the wings are replaced by a large revolving rotor driven by the engine. As the rotor blades turn, the air passing over the blades again causes lift to raise the helicopter into the air.

The autogyro is similar to the helicopter in that it does not have any wings to speak of, and is equipped with a set of rotor blades. The rotor, however, is not driven by the engine but is free-running, the engine itself usually powering a separate propeller to drive the machine forward. As the machine moves forward, the action of the air over the rotor blades causes the rotor to revolve which in turn creates lift to get the machine airborne. All this happens very quickly once the craft begins to move, therefore an autogyro needs only a very short take-off run thus giving it a great advantage over a conventional aeroplane.

Autogyros have been brought well and truly into the limelight recently with the star role of the Wallis Autogyro in the James Bond film, " You Only Live Twice ". This marvellous aircraft could be described as the mini version of the autogyro, yet it nonetheless overcame some pretty impressive odds in the film. Our model-builder was so taken with the aircraft that it formed the inspiration for the simple little Meccano model, described here. The model does not of course fly, but it is equipped with a revolving rotor that operates when the model is pushed along.

In this high top-view of the model the simple but effective construction of the rotor is quite obvious.



Construction is extremely easy, the whole model being built up round a Flanged Sector Plate 1, to each flange of which is bolted a $5\frac{1}{2} \times 1\frac{1}{2}$ in. Flexible Plate 2 extended eight holes by a shaped $5\frac{1}{2}$ in. Strip 3. A $2\frac{1}{2} \times 1\frac{1}{2}$ in. Flexible Plate 4 is fixed to Plate 2 in the position shown, then, before anything further is done to the body, the steerable nosewheel is added. The wheel itself consists of a $\frac{1}{2}$ in. Pulley without boss mounted loose between two Fishplates 5 lock-nutted on a $\frac{3}{8}$ in. Bolt. The free ends of the Fishplates are secured by Nuts on Bolts to the boss of a 1 in. Pulley 6 mounted on the lower end of a 2 in. Rod journalled in Flanged Sector Plate 1 and a $\frac{1}{2}$ in. Reversed Angle Bracket bolted to the underside of the Plate. A Spring Clip above the Plate holds the Rod in Position and, mounted above this Spring Clip, is another 1 in. Pulley to the boss of which a Fishplate is fixed. A $2\frac{1}{2}$ in. Strip 7 is bolted to this Fishplate to serve as the " joystick "-type steering handle.

Now fixed to the wide end of Flanged Plate 1 are two Angle Brackets to each of which a $5\frac{1}{2}$ in. Strip 8 is bolted, each Strip 8 in turn being connected by another $5\frac{1}{2}$ in. Strip 9 to Strip 3, the lower securing Bolts helping to fix the fin in place. This fin consists of two $2\frac{1}{2} \times \frac{1}{2}$ in. Triangular Flexible Plates 10, arranged as shown and trapped between two $3\frac{1}{2}$ in. Strips 11. Strips 8 are joined at the top by a Double Bracket which, along with Flanged Plate 1, provides the bearing for a $6\frac{1}{2}$ in. Rod, on the lower end of which an 8-hole Bush Wheel 12 is mounted. Mounted on the upper end of the Rod is the rotor, built-up from an 8-hole Bush Wheel to which one $12\frac{1}{2}$ in. Strip 13 and two $5\frac{1}{2}$ in. Strips 14 are bolted, the ends of Strips 14 being connected to the ends of Strip 13 by Fishplates.

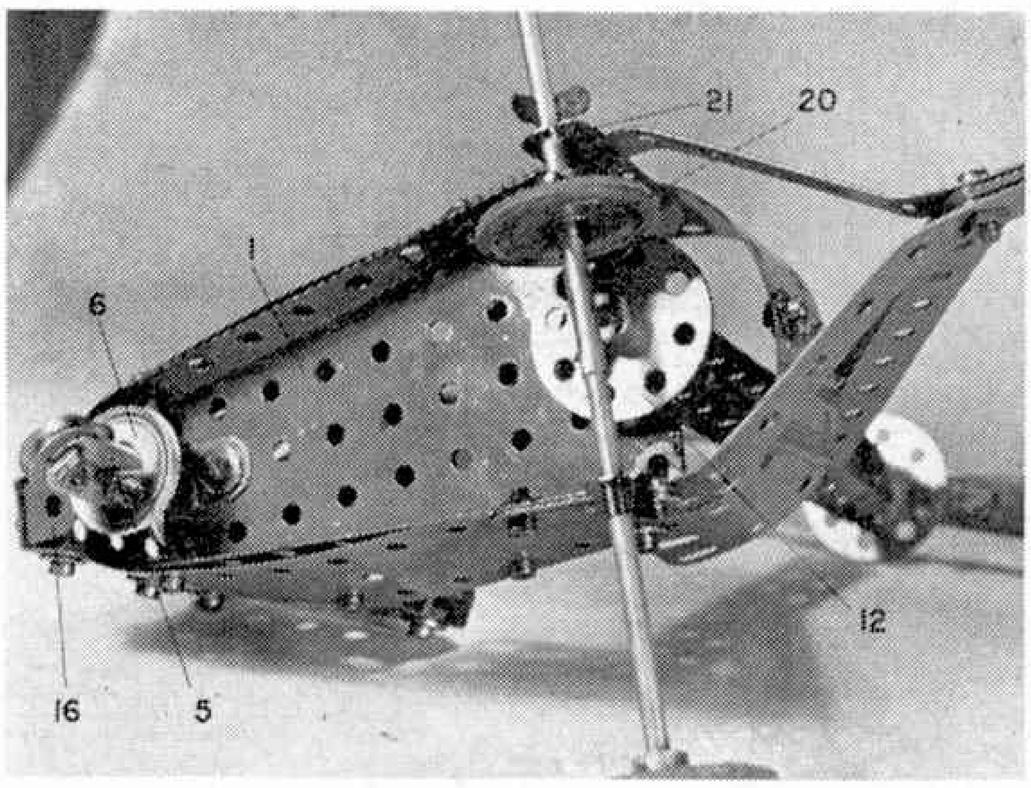
Returning to the body, Plates 2 and 4 at each side are joined, at the bottom, by a $\frac{1}{2} \times \frac{1}{2}$ in. Double Bracket with its lugs bent outwards slightly and, at the top, by two Obtuse Angle Brackets 15 formed into a compound double bracket. A $2\frac{1}{2} \times \frac{1}{2}$ in. Double Angle Strip 16 is bolted to the Double Brackets, its lugs pointing rearwards, then two $2\frac{1}{2} \times 1\frac{1}{2}$ in. Triangular Flexible Plates 17 are bolted to the upper lug, also being attached to Plates 4 by Angle Brackets. A seat is provided by a $2\frac{1}{2} \times 1\frac{1}{2}$ in. Flanged Plate 18 bolted between Flexible Plates 2, the securing Bolts also

holding two curved $2\frac{1}{2} \times 1\frac{1}{2}$ in. Plastic Plates 19 in place.

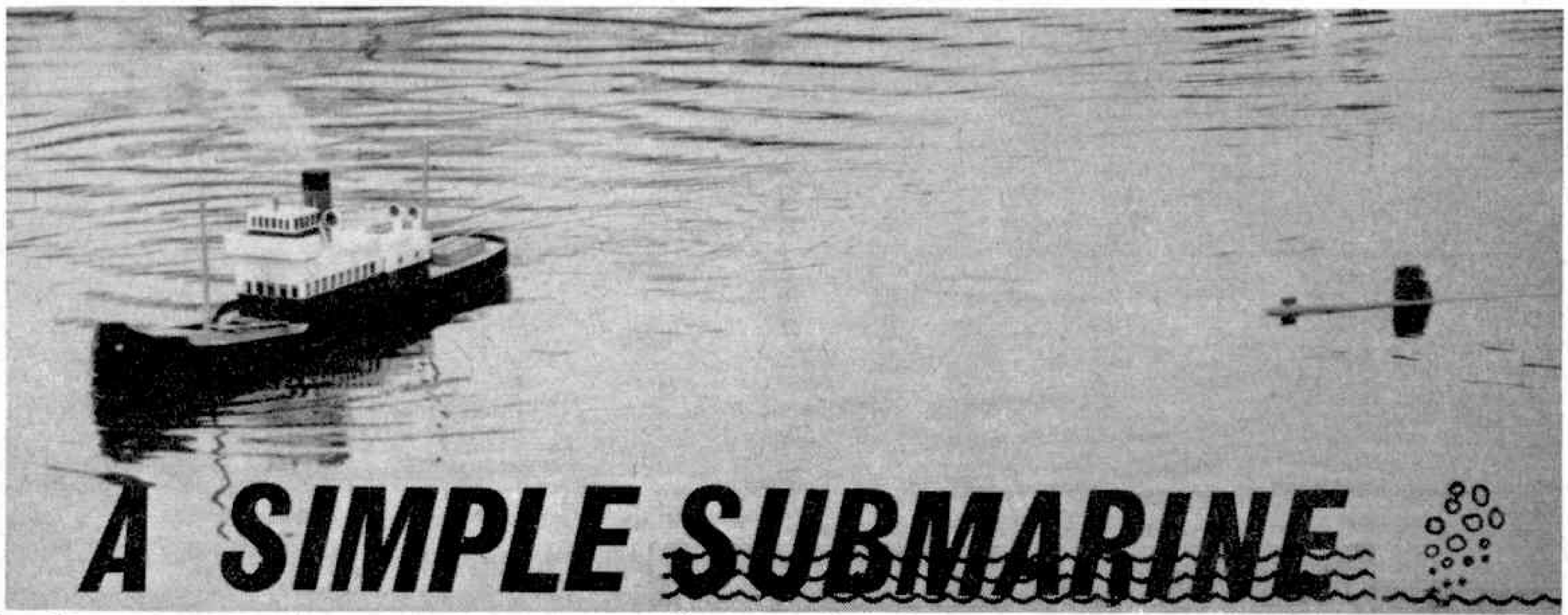
Last of all, the rear axle, supplied by two $3\frac{1}{2}$ in. Rods joined by a Rod Connector, is fitted with a 1 in. fixed Pulley with Rubber Ring 20 and then journalled in Fishplates 21, bolted to Strips 3, where it is held in place by Spring Clips. Pulley with Rubber Ring 20 makes contact with Bush Wheels 12, thus providing a friction drive to the rotor when the model is pushed along on wheels provided by two 1 in. Pulleys 22, fitted with Motor Tyres and mounted on the ends of the rear axle.

PARTS REQUIRED

1—1	2—16	56—37a	2—142c
8—2	1—14	51—37b	1—155
2—3	1—17	14—38	2—188
1—5	4—22	1—48a	2—189
5—10	1—22a	1—51	2—194
2—11	1—23	1—54	1—213
5—12	2—24	3—111c	4—221
3—12a	6—35	1—125	



An underside view of the model showing the nosewheel and friction drive to the rotor. The nosewheel is controlled by a "joystick"-type steering handle.



A SIMPLE SUBMARINE

Designed, constructed and described for readers by Lieut. Comdr. A. Greenhalgh R.N., C.Eng., M.I.Mech.E., A.F.R.Ae.S.

THIS LITTLE model is ideal and exciting for the younger members of the Model Shipbuilding Fraternity; the cost to build it is small and the time required is short.

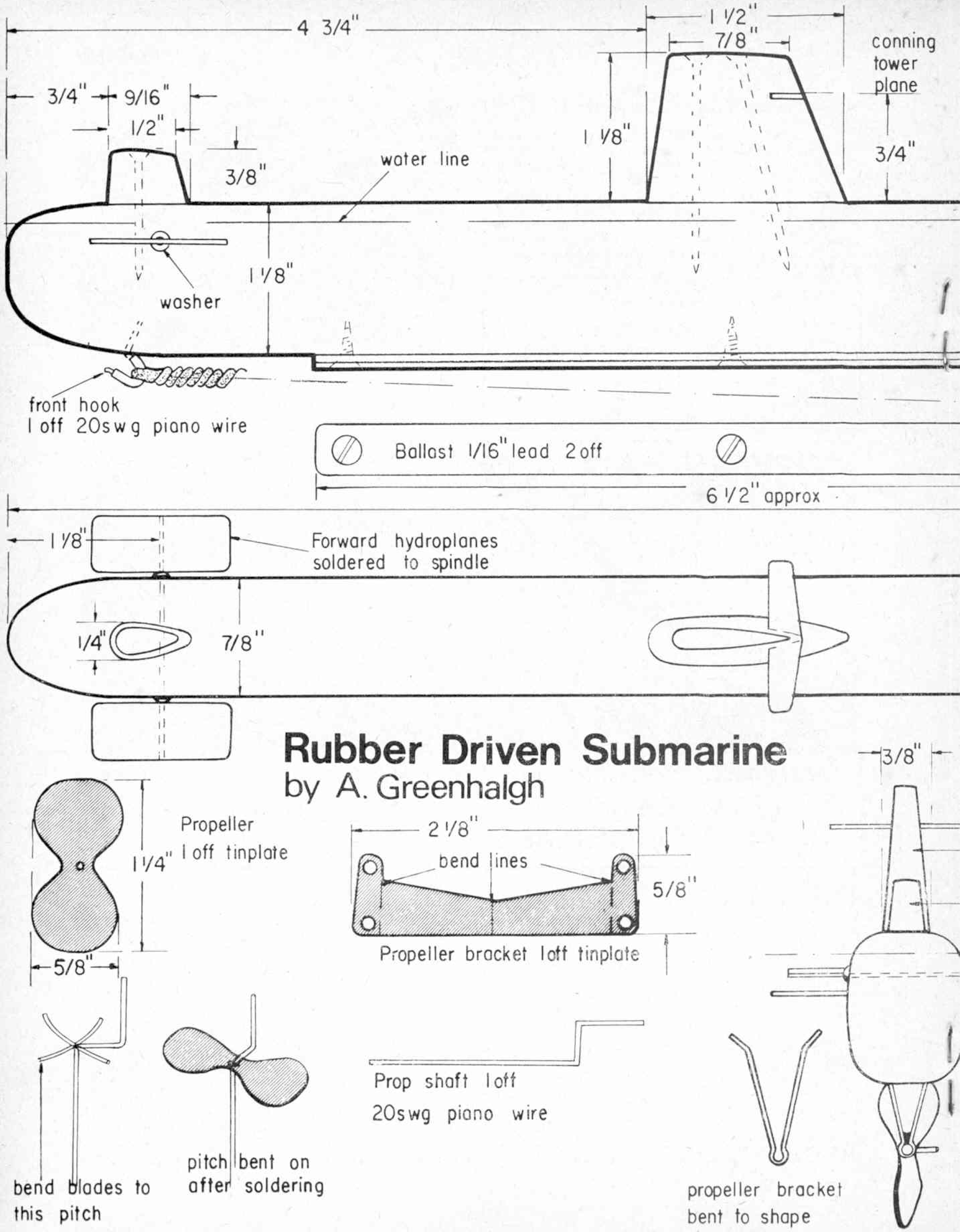
Make the hull from a piece of spruce or similar soft-wood to the dimensions and shape shown on the drawing. The conning tower and dome are made from the same sort of wood as the hull. Balsa wood is not really suitable because it soaks up water very easily, particularly if not properly proofed. Any absorption of water, no matter what wood is used, will seriously affect the trim, and eventually, as the weight increases, the boat will fail to surface.

After carving each component to shape, sandpaper it smooth. The conning tower and dome are now glued and nailed to the hull. It is advisable to drill holes through these items to accommodate the nails and so avoid splitting the wood. Make the conning tower plane from tinplate and cement in place.

The next operation is to drill the hole for the spindle which carries the forward hydroplanes. This is drilled in from each side of the hull using a piece of 20 swg piano wire filed to a sharp point. The holes, of course, should meet at the centre.

The vessel can now be prepared for painting. Punch all nails to below the surface of the wood and fill the holes and any cracks with plastic wood or other suitable filler. When dry, remove the excess filler and rub the vessel down with fine sandpaper. A thin coat of undercoat paint should now be evenly applied. When thoroughly dry, apply a second coat and rub down again. Finish the model with a good quality enamel. The usual colour for a submarine is grey, but there are those who prefer them yellow!!

Let us now turn to the metalwork. The propeller and its bracket, hydroplanes and rudder, are made from the metal of a tin can. Cut a can up and flatten the metal obtained. Mark out the components using templates



Rubber Driven Submarine

by A. Greenhalgh

Hull, Conning tower and dome are made from spruce or similar wood. Balsa is not recommended, but if it is used it should be very well water proofed and heavier ballast is necessary

paint with two coats primer and two of finish

W.L.

1/8" rubber motor

3/8"

bead or cup washer

14"

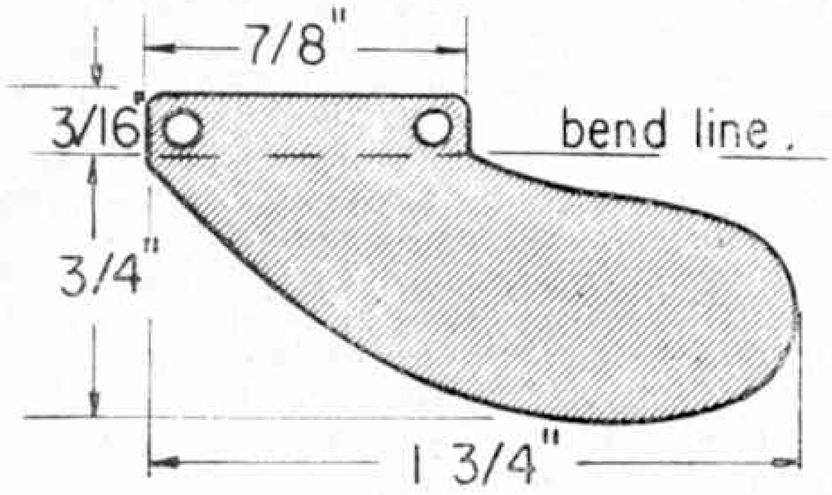
conning tower

dome

W.L

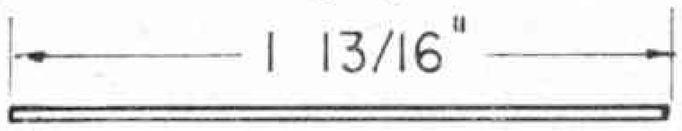
forward hydroplane

aft hydroplane

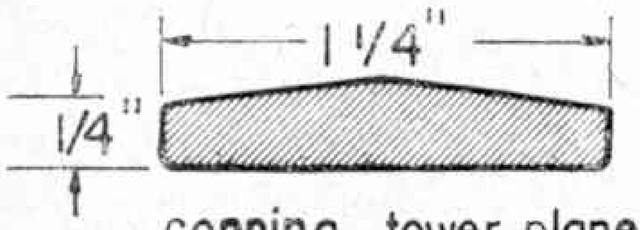


Rudder 1 off tinplate

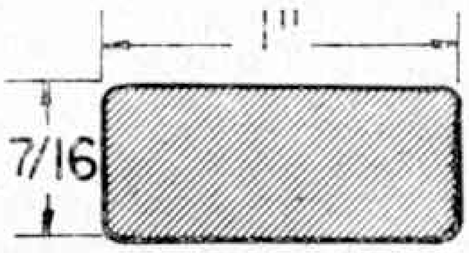
Forward hydroplane spindle
1 off 20 swg piano wire



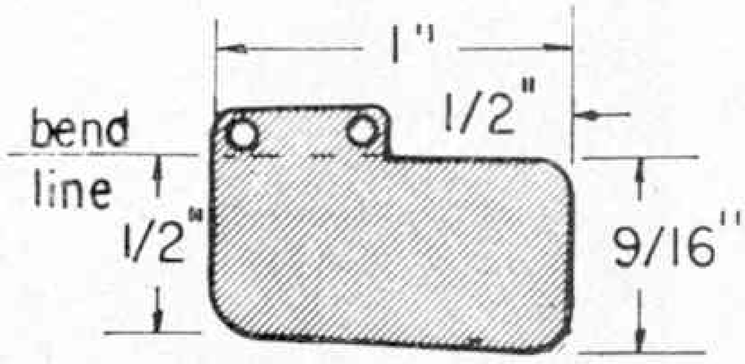
all holes in tinplate 3/32" diam.
screws 1/4" No 1 Rd. head



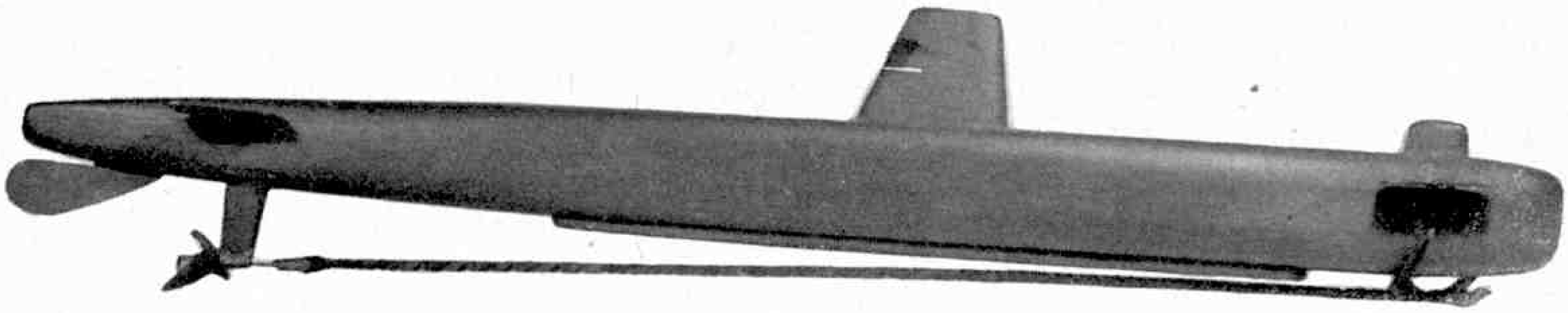
conning tower plane
1 off tinplate



For'd hydroplane
2 off tinplate



Aft. hydroplane
2 off tinplate



Side view of the completed submarine showing its simple yet convincing lines.

made from cardboard to the shapes given in the drawing. Drill all holes and file all sharp edges smooth. Bend the rudder and after hydroplanes to shape and attach them to the hull in the position shown using small wood screws

The propeller bracket requires a little more skill to bend it to the required shape. Take the flat outline shape and scribe a line which divides it across the centre. Bend at this line to an angle of about 90°. Place a piece of 20 swg wire in the "V" so formed and continue to bend until the top edges meet. Squeeze the bracket

The small crank on the end of the propeller shaft makes winding up a simple operation.

together with pliers at a point immediately above the wire so that the bearing hole is formed. Bend the edges of the bracket outwards to the correct angles to fit the hull.

The propeller shaft is made from 20 swg piano wire and is bent to the shape shown in the drawing. The propeller should be soldered to the shaft. Bend the pitch on the propeller as shown. Thread a bead, or two cup washers on the shaft and push into the bearing. The washers or bead act as a thrust race between the propeller and the bearing. A hook is bent in the wire to take the elastic motor. The assembly is now fitted to the hull by the four small woodscrews. The front hook for the elastic is bent from 20 swg wire and fitted as shown.

Make the forward hydroplane spindle from a piece of 20 swg piano wire. Push this through the hole already drilled near the bows. This spindle should be a tight fit in the hole so that the planes do not move when the boat is under way. Fit a small washer at each side as shown on the drawing and solder the hydroplanes to the spindle.

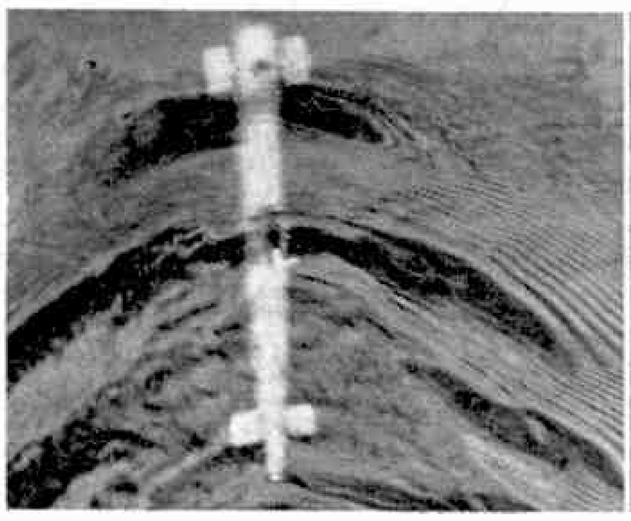
The ballast is made from lead of $\frac{1}{16}$ in. thickness, and is in two pieces. Cut a piece of lead to the dimensions given and screw it to the bottom of the hull in the position shown. Attach a similar piece of lead to the hull with two elastic bands. Now fit the elastic motor which consists of one loop of $\frac{1}{8}$ in. elastic. Place the submarine in water and adjust the weight of the second piece of lead by trimming off, or adding more, until the submarine floats to the correct water-line: as shown on the drawing. This is very important. Remove the elastic motor and ballast, and dry the vessel thoroughly. Attach the ballast permanently and give the whole vessel another coat of enamel paint. When this is dry, the elastic motor is refitted. Rubber tubing fitted over the hooks will prolong the life of the motor; that stripped off lighting flex is ideal.

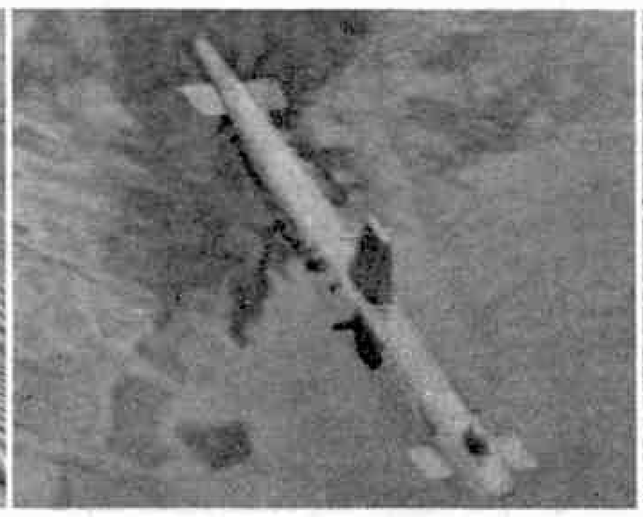
Wind the model up and adjust the forward hydroplanes to an angle of about 30° to the horizontal, forward edges down. Released in the water, the vessel will gather speed and submerge, only surfacing when the motor is expended. The boat will remain on the surface if the forward hydroplanes are moved to an angle of about 10°, forward edges up. Should the model fail to submerge, re-check the water-line, adding ballast as necessary. Ensure that the pitch of the propeller is correct. When the submarine is properly trimmed, it will submerge to a depth of about four feet, a shallower dive is obtained by reducing the angle of the forward hydroplanes. It is safer to operate in a proper boating pool, for in a natural pond the model may well be caught up in weeds.

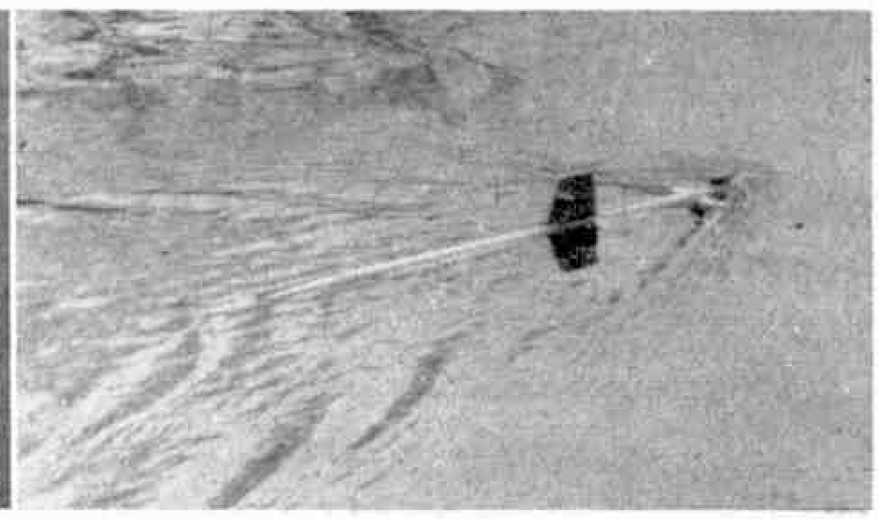
Left: The simple submarine cruising along just beneath the surface.

Centre: Shows the submarine surfaced at the end of a successful run.

Right: With the forward hydrovanes tilted slightly upwards the submarine will cruise on the surface.



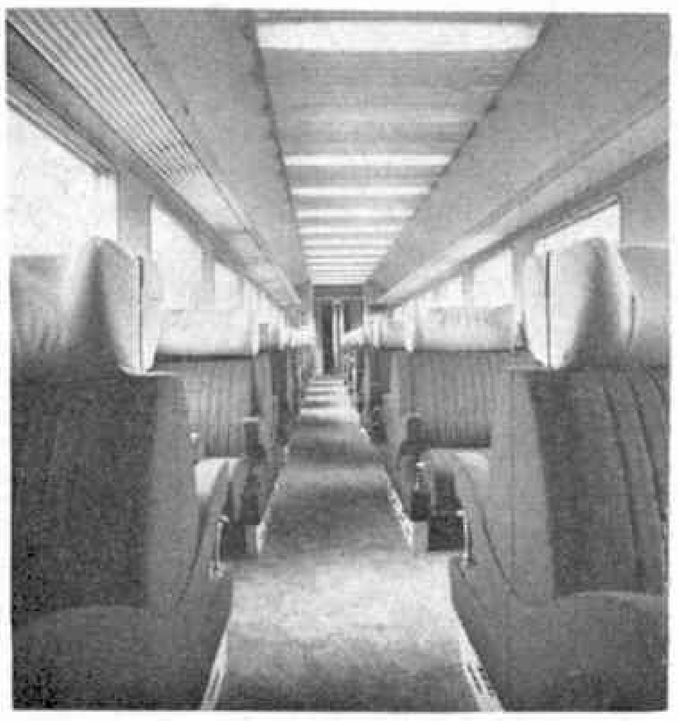




TRANSPORT TOPICS

by Mike Rickett

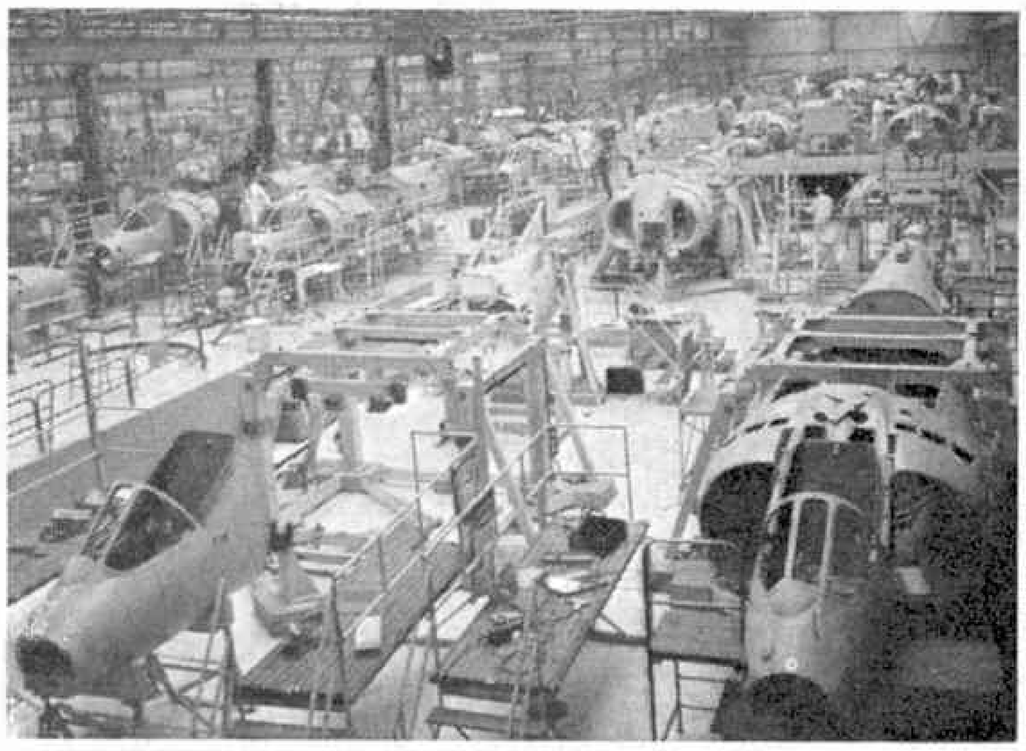
NO MATTER how improved British Rail's latest train services may be, there are still in my opinion, one or two things they could usefully copy from a number of the crack expresses now running on the continent. I recently heard, for example, of the services offered by the S.N.C.F. (French Railways) "Mistral" train, which runs between Paris and Nice, serving several large business and tourist centres along the route. Among the towns served are Dijon, Lyon, Valence, Avignon, Marseille and the most important resorts on the Cote d'Azure. It is, as you have probably guessed, a luxury train that travels at 100 m.p.h., with an average speed between Paris and Lyon of 84 m.p.h. and an average speed for the entire journey of 74 m.p.h. "Mistral" is also the most recent of the 25 Trans-Europe expresses on the European Railways network.



Looking down the central corridor of a carriage of the new Mistral.

Where this train differs most radically from most British main line expresses however is in the standard of comfort offered and also the facilities that are available to the passengers on the train itself. It is, first of all, completely air-conditioned throughout and all doors—made completely of glass—open and close quite automatically. Seats can be adjusted to various angles and these also have adjustable head-rests, and electric push-button venetian blinds.

Another rather pleasing innovation is the meal service, which does not require passengers to move from their seats to a special restaurant car. Instead, meals can be brought directly to your seat, providing the coach is of the central corridor type. Yet another innovation which I feel passengers in this country would appreciate, are the hostesses that welcome passengers aboard and who advise on the various facilities that are available. What more, you might say, could they possibly offer? Well, according to the information that the S.N.C.F. make available, the "Mistral" also has a boutique which sells books, magazines, newspapers, and novelties and there is also a secretarial service available for businessmen who wish to work during their journey. A photo-copying, duplicating and typing service really show that the S.N.C.F. mean business! Finally, there is a salon for hairdressing and manicure, for both men and women. Beat that B.R.!



Part of the immense Harrier production line at the Hawker Siddeley plant.

In order to sample the elegance of these latest S.N.C.F. trains yourself, you do of course first have to travel to France! Certainly one of the most popular ways of doing this is by means of one of the British Rail car-carrying ships. One of the latest and also one of the most luxurious to ply the English channel is the M.V. "Chantilly," part of the "Big Fleet" of car ferries run by British and French Railways. Four drive-on drive-off routes are used between England and France and during the coming season, there will be 9,052 scheduled "Big Fleet" crossings of the channel. On peak Saturdays alone in the Summer there will be a record 27 sailings in 24 hours from Dover, bringing the total number of car spaces on those days to over 10,500.

One ship that can certainly boast of a really chequered career is the old steam yacht "Isabella Baldwin," built in the Barrow yard of Vickers and now under charter to the U.S. Navy in Vietnam. For the second time in her long history she has been sunk and now rests on an even keel in 42 feet of water near Qua Viet. Her two masts were originally 20 feet clear of the water, but the main mast has now been sawn off by the Vietnamese—there being a shortage of wood. Formerly named "Melisande," "Bulimba," and "Monarch," the "Isabella Baldwin" has been under rocket attack three times since she has been in service in Vietnam, and she was sunk for the first time a few years ago in a typhoon which drove her on to the rocks near Hong Kong. On that occasion, she was submerged for eight months before salvage was possible, but her present owner hopes to raise her much sooner this time and has already fitted out a salvage ship for the purpose.

Did you incidentally know that launching ceremonies is a survival from the days—said to be as far back as 2800 BC—when a ritual ceremony was made whenever some large venture was undertaken. Usually, the sacrifice involved the spilling of blood—even human slaves—and this is why some shipyards when launching new ships used a red wine instead of champagne, and indeed this practice is even now occasionally observed.

Talking about launchings, did you hear about the ship that refused to be launched? It happened in the doomed Scottish shipyard of Burntisland in Fife when a Liverpool-owned cargo ship, the last to be built at the yard, defied all attempts to launch her! Embarrassed officials investigated the reasons for this after two attempts to move the 7,333 ton "Helen Miller" had failed. Mr Robert Miller, General Manager of the yard, blamed sticking wooden runners on which the ship should have glided down the slipway, and also the almost freezing temperatures. It is nevertheless very significant that the boat did not want to leave the yard and if I were superstitious . . .

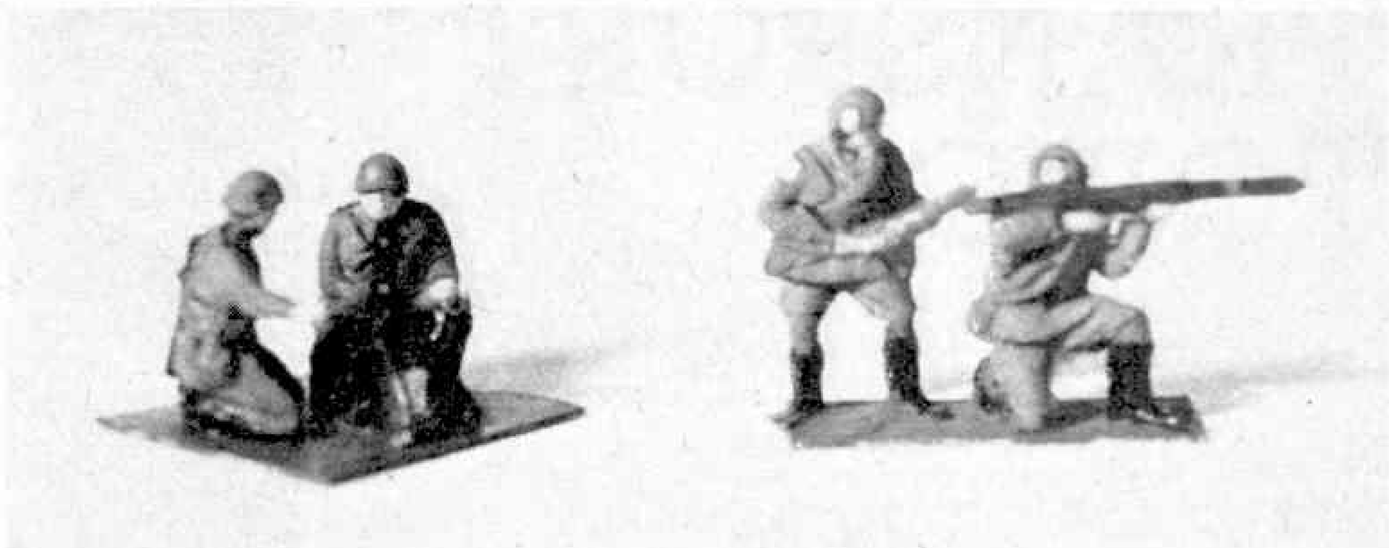
Often mentioned in the national and technical press in recent times is the "Harrier" aircraft built for the R.A.F. by Hawker Siddeley. At the time of writing the planes are nearing completion and will be in service by April. Twelve aircraft have flown and the first two-seat version is due to fly for the first time very shortly. Altogether, 77 single-seat "Harriers" and 13 two-seat aircraft were ordered and the recent trials seem to show that the plane has inherited all the strength and good handling so characteristic of its predecessor, the "Hunter." Designed for ground attack and tactical reconnaissance using either vertical or ultra short take-off and landing, a recent status report on the "Harrier" gave the news that the testing of the plane and its systems for the R.A.F. is nearing completion. The testing has included the firing of 68mm SNEB rockets which the "Harrier" can carry 114 of, and which are capable of penetrating 15 inches of armous plate, and 30mm Aden cannons. Three 1,000 lb HE bombs have been carried and released, navigation systems tested and fuel jettisoning carried out.

All mod-cons! This is the hairdressing salon on the Mistral.

BATTLE

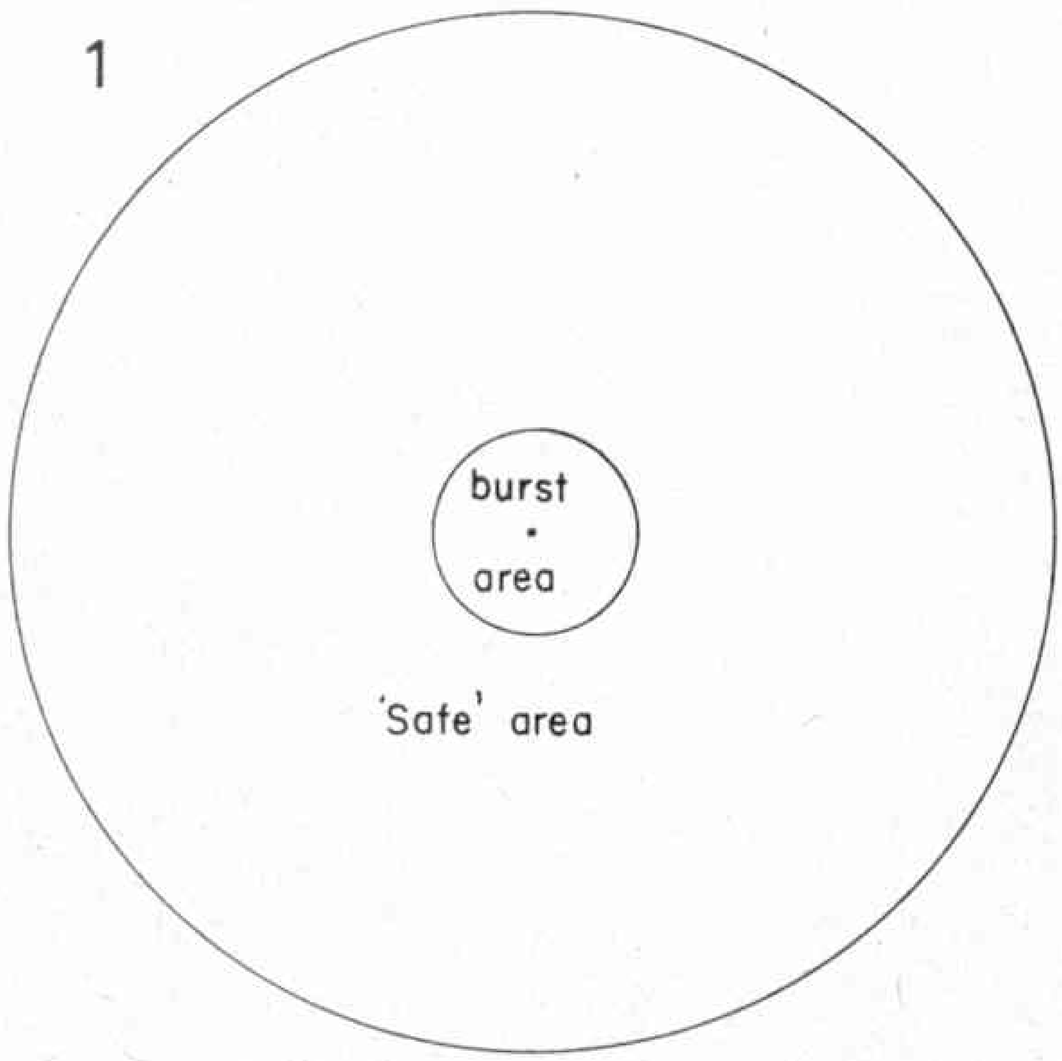
by

Charles Grant



Part XIV – Infantry Weapons – Conclusion

THE TWO last infantry weapons we have to consider are those which involve the delivery of some sort of explosive projectile—the hand grenade and the infantry mortar. The first is obviously of relatively limited range and of doubtful accuracy but for close range fighting, above all in built-up areas, it has a definite and important role to play. It may be recalled that it was given (in Part IV of " Battle ") a range of 2 in., by our scale an equivalent of 66 yards. This is really a very good throw and no mistake, but we have to err on this side rather than on the other, particularly when we have to consider the distance it will burst from the man who throws it in relation to the radius of the actual burst circle. What I mean is this—is the burst going to be so big as to include the spot whence it was thrown ? It would hardly do to have an overlap whereby the man who threw it was caught in the blast of his own grenade ! What then is the lethal area ? Now, the effective burst area of a hand grenade varies pretty widely according to the nature of the surface it exploded on—this will be greater on a hard than on a soft surface, and, of course, the actual explosive effect will be much greater in a very enclosed area if it, for instance, goes off inside a house, having been lobbed through a window maybe. Generally speaking—and allowing for the different capabilities and power of grenades of different national forces—if we take the blast area in the open as being a rough circle of 30 to 35 yards diameter, we shall be hitting a fair average. This, on our wargame table scale, will be 1 in. As to its effectiveness, it would appear that troops within this area would have, at best, only a 50/50 chance of emerging unscathed. So if, having upon a sheet of transparent acetate, inscribed a circle of 1 in. diameter, we place this with its centre upon the point where it is desired our grenade shall burst, dice—one per man—will have to be thrown for any personnel unlucky enough to be covered by the circle. If the die comes down 4, 5 or 6, he has had it, and is forthwith removed as a casualty.



Hand grenade device

In fact, it might be quite handy to construct an easily read grenade device to use in such cases. On the acetate, draw the 1 in. diameter circle to represent the burst area and, with the same centre draw a circle with a 4 in. diameter. This produces what is shown in Diagram One. When your man wants to throw a grenade the device is placed with its centre on the Point of Aim. If the ' grenadier ' in the outer area —i.e. between the 1 in. and 4 in. circles, he is safe from the blast of his own grenade and can left fly then with impunity. On the other hand—if within the 1 in. ring, he'd better think again, and naturally, if outside the 4 in. one, he is out of range of his desired target. This device is quite obviously not a ' must ' but it will be found to expedite matters just a little.

The above refers to grenade throwing in the open, but if it happens that the thrower is on one side of a wall, say, lying prone as he well might be, he need fear nothing from the blast if he simply lobs the grenade over the wall at an enemy on the other side—it will act as a protection from the explosion. It has to be a good solid stone wall, needless to say. It is much the same when it is a question of putting a grenade through the window of a house under attack. The thrower stands beside the window—it is ruled that he must be in actual bodily contact with the building—and the grenade goes through the window. No circle is required, the blast being contained within the walls of the house, and, thus confined, it has a greater effect that had it taken place in the open. Any troops therein will have to be diced for, and 3, 4, 5 or 6 will suffice to put any one of them out of action. This seems pretty deadly, I know, but it must not be overlooked that the grenade man must get up to the house, which in itself may be a very hazardous undertaking, if those within are active with rifle and sub-machine-gun.

As to the number of men to be armed with grenades,

this is largely a matter of personal taste and inclination —I think myself that only a limited proportion should be so equipped. Certainly, if one has figures actually in a grenade throwing attitude, then it would seem logical to use these only, to avoid confusion. Again, all this depends on the wargamer's organisation, and of this rather more later.

So much for the hand grenade, then, and we proceed now to the last infantry weapon we are concerned with at present, and most certainly it is one of the most important. I remember reading—I simply cannot remember where—that the mortar was the most effective anti-personnel weapon to be used in World War II, and it was employed in enormous numbers by both sides and all armies. What we are going to deal with now is the infantry mortar we made reference to in Part IV, and whose maximum range in our game was to be 50 in. (This, I repeat, is the infantry mortar in battalion use, as opposed to the heavy types which are properly to be considered in the category of artillery.) Into our weapon specifications we must bring a new factor, this being minimum range. Obviously, the elevation of one's mortar can be increased to the point where, instead of the range increasing, it actually begins to get less, and this could get to the point where the projectile will fall to earth far too close to the mortar for comfort. This won't do at all, and of course, as the mortar bomb—even of the smaller calibres—has a pretty powerful burst, one must make sure that the explosion does occur at a safe distance from oneself. This minimum range we shall say is 6 in. (or, scaled up—200 yards), and although this might be a trifle overlong, it will suffice for our purpose.

So, with minimum and maximum ranges established as 6 in. and 50 in. respectively, we can carry on. I am aware that the latter may exceed the determined visibility, and the problem might arise as to how the comb could be dropped on a target that is out of sight. Not to worry, for the moment, but let us simply consider the case of the target in full view of the mortar crew—aided vision, I should say—and on which direct fire can therefore be brought.

Now, although World War II mortars were reasonably accurate, they did not have the highly advanced range-finding devices of their present day counterparts. We have then to allow for possible errors in sighting as well as for the inevitable ballistic vagaries of the propellant charge. By the latter I mean that, if a mortar is fired twice in succession with the same elevation, etc., the two bombs will not fall exactly on the same spot—it would be most unlikely, in fact, if they did. All these factors produce four basic types of error—the overshoot, the undershoot and right and left errors. There can be combinations of two, but for the sake of sanity let us stick to the simple four instanced. We have to think up some way—with a dice throw to give the effect of the imponderable resulting from the various errors—to make the irregularity of the fall of a mortar's bombs resemble as nearly as possible what might be thought of as the 'real thing.' I hope no one will object if I suggest that this can best be done by constructing yet another device. This time you can call it a 'Fall of Shot Indicator'—or more simply—the mortar "whatsit". Diagram Two will show what we have to allow for when a mortar lobs its bomb at a target.

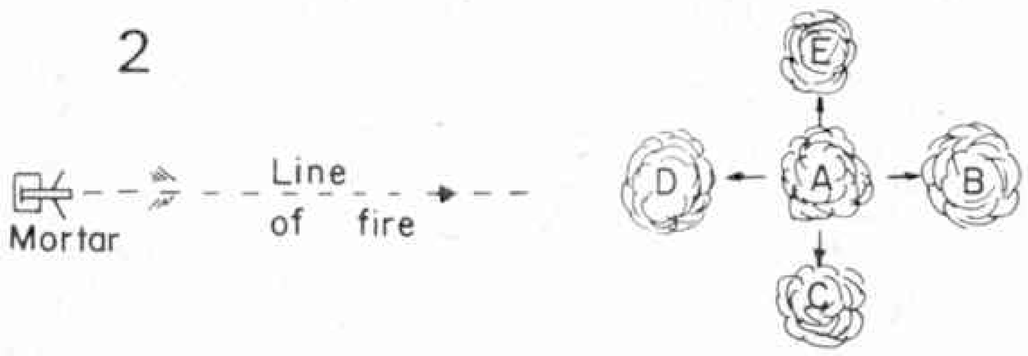
'A' is a direct hit—exactly on the spot aimed at (you can't see what it is because of the burst !), 'B' is the overshoot, 'D' the undershoot, and 'C' and 'E' right and left hand errors respectively. Back now to that other piece of perspex or acetate you have been saving for just this contingency, and upon it with your

Our heading photograph shows Conversions of Airfix Russians —the 120 mm. mortar 'cut down' to infantry mortar size, and two riflemen converted into a rocket-launcher crew. Above: A heavy assault gun converted from a modern German tank destroyer. (A Roco model.)

pair of compasses you prepare to inscribe five circles in the manner you can see in Diagram Three, together with an arrow to indicate the line of fire, but before you are in business, there is an immediate snag—what about the diameter of the circles ? In effect, what is the burst area of the mortar bomb ?

This, as might have been anticipated, varied slightly with different types of mortar, and it may be remembered that, when first treating of this weapon, we instanced three types—the U.S. 60 mm., the German 81 mm., and the British 3 in. As our knowledge and expertise increase, we may—depending on our taste in armies—juggle about with different burst circles for different weapons, but right now it will be very much easier to establish a kind of 'mean.' If we lay it down, then, that the lethal area of the average mortar bomb burst—within which one might say that things were pretty fraught—is a circle of about 60 yards diameter, this should be just about right. Quickly converting this distance to our table scale we arrive at a circle with a diameter of 2 in. (to the nearest inch). This then will be the size of the burst circles in our device or "whatsit", and you will see that a slight overlap is allowed. We don't want the errors to be unrealistically large.

2



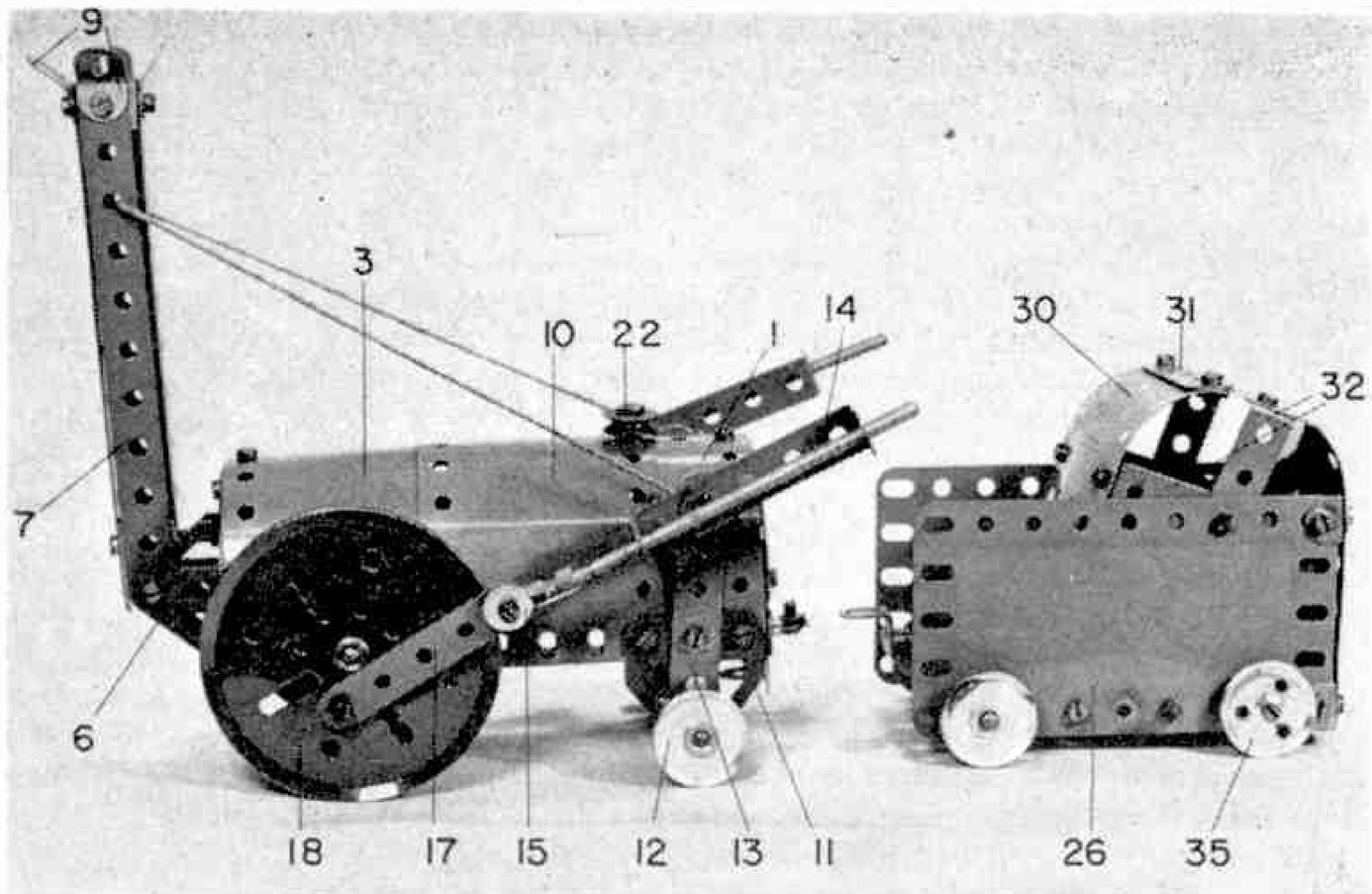
Mortar bomb errors

As to use, it is simple—the player whose mortar is firing specifies his target, and throws one die. This is the 'ranging' shot, from which adjustments are made for correction, sometimes called 'bracketing'—a deliberate overshoot followed by a deliberate undershoot, and by taking an average, hoping to get a direct hit with the next. It is ruled that this has to be done with each new target, and if 5 or 6 are thrown, the target is ranged and the device placed upon it, the arrow in line with the direction of fire. The die is thrown once more. If 5 or 6 come up, it has been a direct hit, and whatever is in the area is a possible casualty. As for the grenade, a 4, 5 or 6 on the next throw 'for effect' is sufficient for the victim to be

continued on page 311

ROCKET FOR FOUR

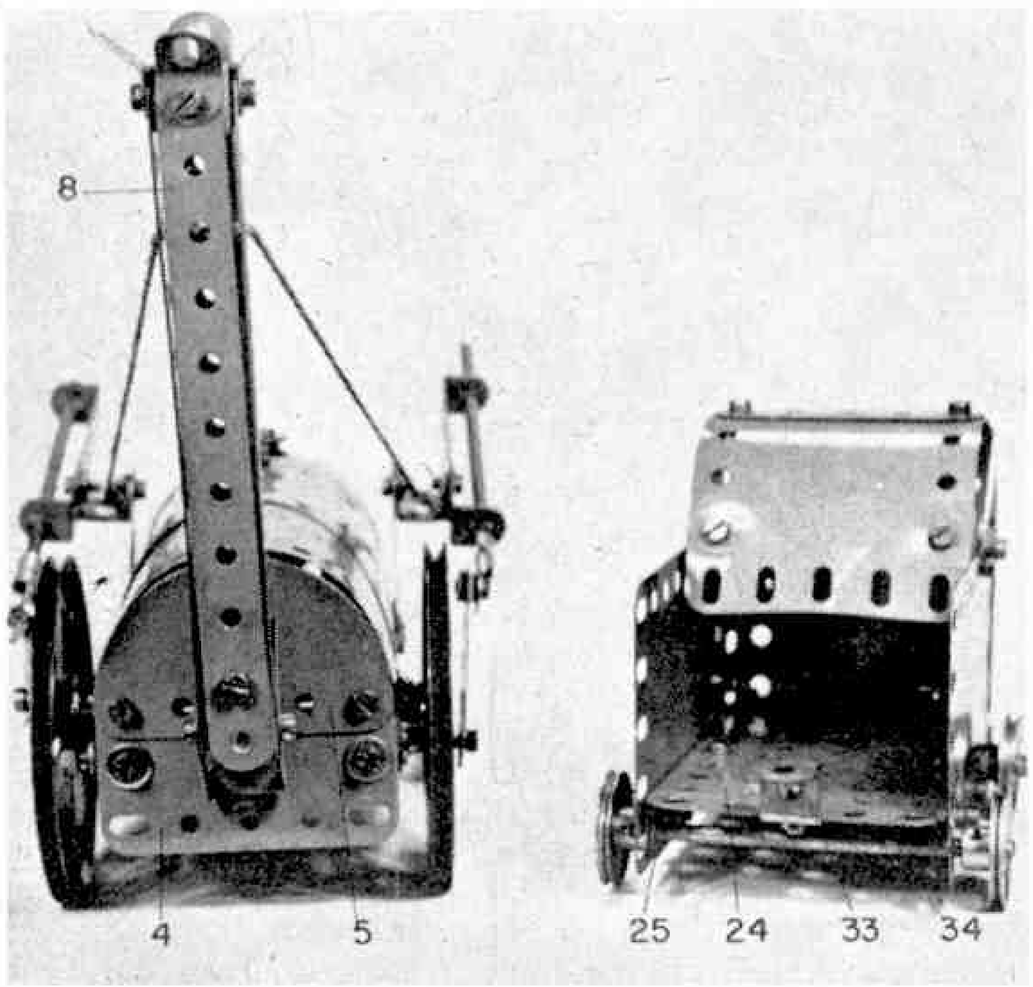
by Spanner



A simple, attractive model using a No. 4 Outfit

IN THESE days of manned space flight, I wouldn't mind betting that mention of the word "rocket" conjures up one picture only in the minds of most people—a long, sleek projectile standing ready on its launching pad, its tapered nose pointing skywards, eager to blast off to the stars. Mention the word "rocket" to a railway enthusiast, however, and his mind will conjure up an entirely different picture—a picture of the first Liverpool and Manchester railway locomotive, namely Stephenson's famous "Rocket."

Illustrated here is a simple Meccano model based on the "Rocket." Built with Outfit No. 4, it is produced in two sections, the main locomotive itself, and the tender, the front section of which also serves as the footplate for the loco. Dealing first with the loco, a 5½ × 1½ in. Flexible Plate 1 is curved to shape and bolted to one end of the side flanges of a 5½ × 2½ in. Flanged Plate 2, a 5½ × 2½ in. Flexible Plate 3 being similarly positioned at the other end of the Flanged Plate. Two 2½ × 1½ in. Flexible Plates 4, each extended by a Semi-circular Plate 5, are bolted one to each end flange of Plate 2, the top of the Semi-circular Plate being attached to the respective Flexible Plate 1 or 3 by an Angle Bracket.



In this picture, the front of both the locomotive and tender are clearly shown. Note the use of the Semi-circular Plate at the front of the locomotive.

Now secured to front Semi-circular Plate 5 are two Trunnions 6, to the apex of each of which a 5½ in. Strip 7 is bolted to form part of the chimney. The rest of the chimney is supplied by two further 5½ in. Strips 8 attached at the top to Strips 7 by Angle Brackets, the securing Bolts also holding four Obtuse Angle Brackets 9 in place. The lower ends of Strips 8 are joined together by a 1 × ½ in. Double Bracket.

The centre of the boiler can now be enclosed by a curved 5½ × 2½ in. Flexible Plate 10 bolted to the side flanges of Plate 2, the rear securing Bolts helping to fix a Flat Trunnion 11 to each side flange. Held by 1 in. Pulleys with boss 12 in the apex holes of these Flat Trunnions is a 3½ in. Rod acting as the rear axle.

Attached to the centre of each Flat Trunnion is a 2½ in. Strip 13, projecting three holes upwards and angled backwards as far as the "play" in the holes will allow. Bolted to the top of this Strip in each case is a Double Bracket, also angled, and to the free lug of which a 2½ × ½ in. Double Angle Strip 14 is fixed. Free to slide in the lugs of this Double Angle Strip is a 4 in. Rod, on the end of which, in one case, a Rod and Strip Connector 15 is mounted, while, in the other case, a right-angled Rod and Strip Connector 16 is used. Rod and Strip Connector 15 is lock-nutted to a 2½ in. Strip 17, the other end of which is mounted loose on a ½ in. Bolt held by Nuts in a 3 in. Pulley 18. A ½ in. Bolt carrying another 2½ in. Strip 19 is held in a similar 3 in. Pulley 20, both the 3 in. Pulleys being mounted on a 3½ in. Rod, journalled in the side flanges of Plate 2 to serve as the front axle. The 2½ in. Strip is lock-nutted to a Fishplate 21 bolted to right-angled Rod and Strip Connector 16.

To complete the locomotive, a ½ in. Pulley 22 is fixed on a ½ in. Bolt secured as shown to the top of the boiler. A coupling point for the tender is supplied by an ordinary Bolt fixed, with its shank pointing upwards, to the horizontal lug of a Reversed Angle Bracket 23, bolted to the lower edge of rear Plate 4. Finally, a

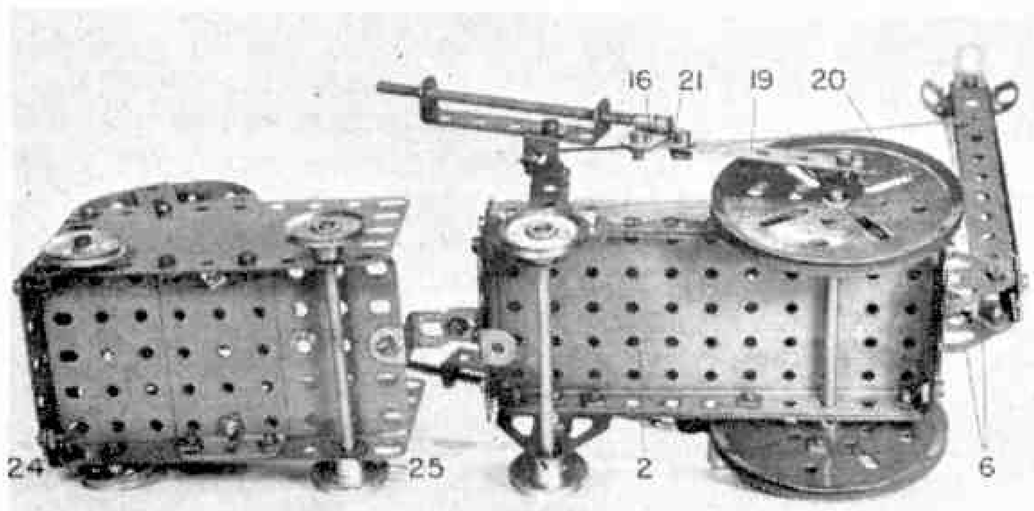
length of Cord is tied to the Double Bracket bolted to one Strip 13 and is threaded through the third holes from the top of the chimney to be tied to the Double Bracket bolted to remaining Strip 13.

PARTS REQUIRED

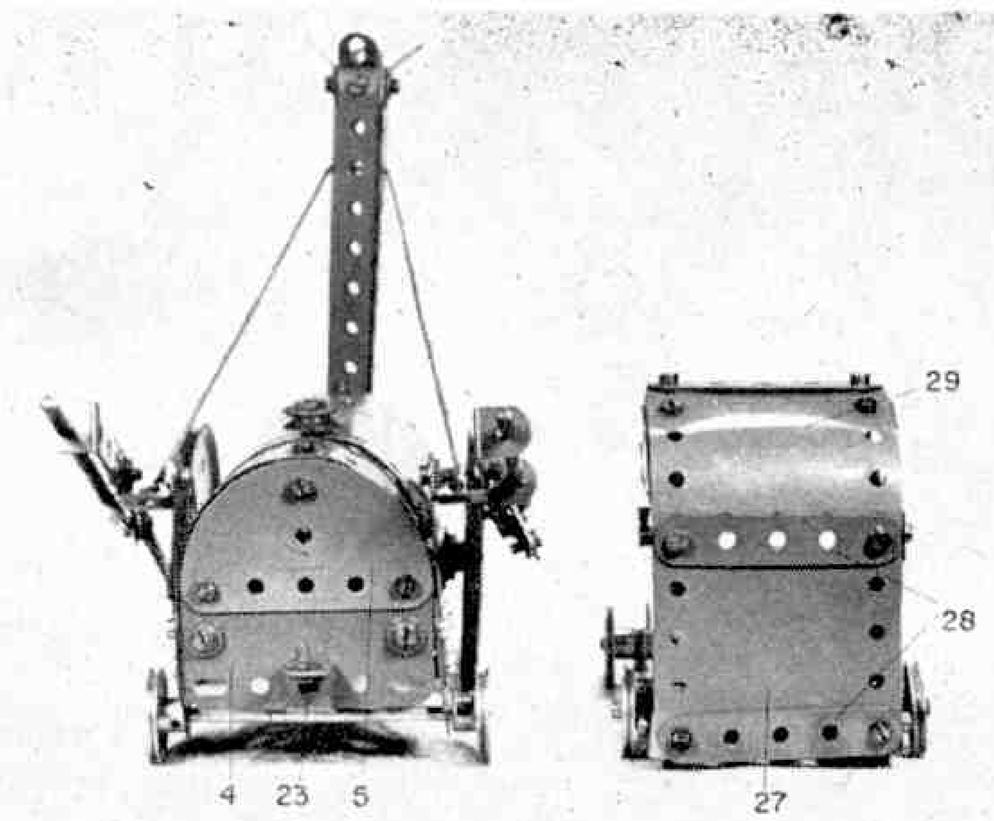
4—2	3—16	1—51	1—189
2—3	2—19b	1—52	1—190
7—5	4—22	1—53a	2—191
1—10	2—22a	5—111a	2—192
2—11	1—23	2—125	2—194a
1—11a	82—37a	2—126	1—212
10—12	66—37b	2—126a	1—212a
4—12c	13—38	2—188	2—214
2—15b	6—48a		

Tender

Coming to the tender, this is really very basic in design, a base being built up from a $4\frac{1}{2} \times 2\frac{1}{2}$ in. Flat Plate 24 bolted to a $2\frac{1}{2} \times 1\frac{1}{2}$ in. Flanged Plate, each flange of which is extended by a $3\frac{1}{2}$ in. Strip 25, the securing Bolts also fixing a $4\frac{1}{2} \times 2\frac{1}{2}$ in. Flexible Plate 26 in place. Plates 26 at each side are connected at the



An underside view of the model showing construction of the bases of the locomotive and tender. Couplings are supplied by Reversed Angle Brackets.



This picture shows the rear of both the locomotive and tender. You will see that a Semi-circular Plate is again used to effectively block off the back of the locomotive.

rear by a $2\frac{1}{2} \times 2\frac{1}{2}$ in. Flexible Plate 27, secured by Angle Brackets and overlayed along the upper and lower edges by $2\frac{1}{2}$ in. Strips 28 at the same time extending the Plate upwards with a $2\frac{1}{2} \times 2\frac{1}{2}$ in. Plastic Plate 29. This Plate is, in turn, extended by another $2\frac{1}{2} \times 2\frac{1}{2}$ in. Plastic Plate 30, the join overlayed by a $2\frac{1}{2}$ in. Strip 31, then the Plastic Plates are curved over and fixed to Flexible Plates 26, as shown, by two crossed $2\frac{1}{2} \times \frac{1}{2}$ in. Double Angle Strips 32 in each case. A coupling is supplied by a $\frac{1}{2}$ in. Reversed Angle Bracket 33 bolted to Flat Plate 24, then, last of all, the wheels are added, those at the front consisting of two 1 in. Pulleys with boss mounted on a $3\frac{1}{2}$ in. Rod 34 journalled in the end holes of Strips 25. The rear wheels, on the other hand, are 1 in. Pulleys without boss 35, loose on $\frac{1}{2}$ in. Bolts held by Nuts in the other end holes of Strips 25.

SEA CITY continued from page 287

boating enthusiasts, the foundations would exist for building up a good export trade, possibly concentrating on fibreglass construction to eliminate the need for large timber storage areas within the city.

The shallow water around the city would facilitate the dredging of sand and gravel, basic building materials for which a profitable market is assured.

It is envisaged that Sea City would have a College of Marine Research, the first stage of a Marine University. It would have ideal facilities with direct access to the sea, underwater laboratories, research vessels and trial grounds. Visitors to the city would be able to enjoy the observation of sea life by strolling along inside glass 'tubes' laid on the sea bed. Another attraction would be a Marine Zoo.

The city would be built mainly of glass and reinforced concrete. Much of the glass would have special heat and light transmission and insulation properties to reduce glare and overheating. In a multitude of colours and tints, the vast expanses of glass would greatly enhance the city's appearance and by night Sea City would become as a sparkling jewel.

The terraced wall provides the majority of the accommodation, housing 21,000 people in flats and maisonettes of one to seven rooms in size, almost all having private terrace gardens. Other residents would have individually designed houses on the pontoon islands. Incidentally, the width and angle of all windows is designed to ensure that every resident can enjoy at least $2\frac{1}{2}$ hours of winter sunshine a day.

Commuting between Sea City and the mainland would be by hovercraft, supplemented by a helicopter service.

The planers are confident that Sea City would very soon assume an added importance by becoming a popular holiday resort—not only during the summer months but also during the winter when the city's artificially mild climate and freedom from icy winds would be greatly appreciated by chilly mainlanders.

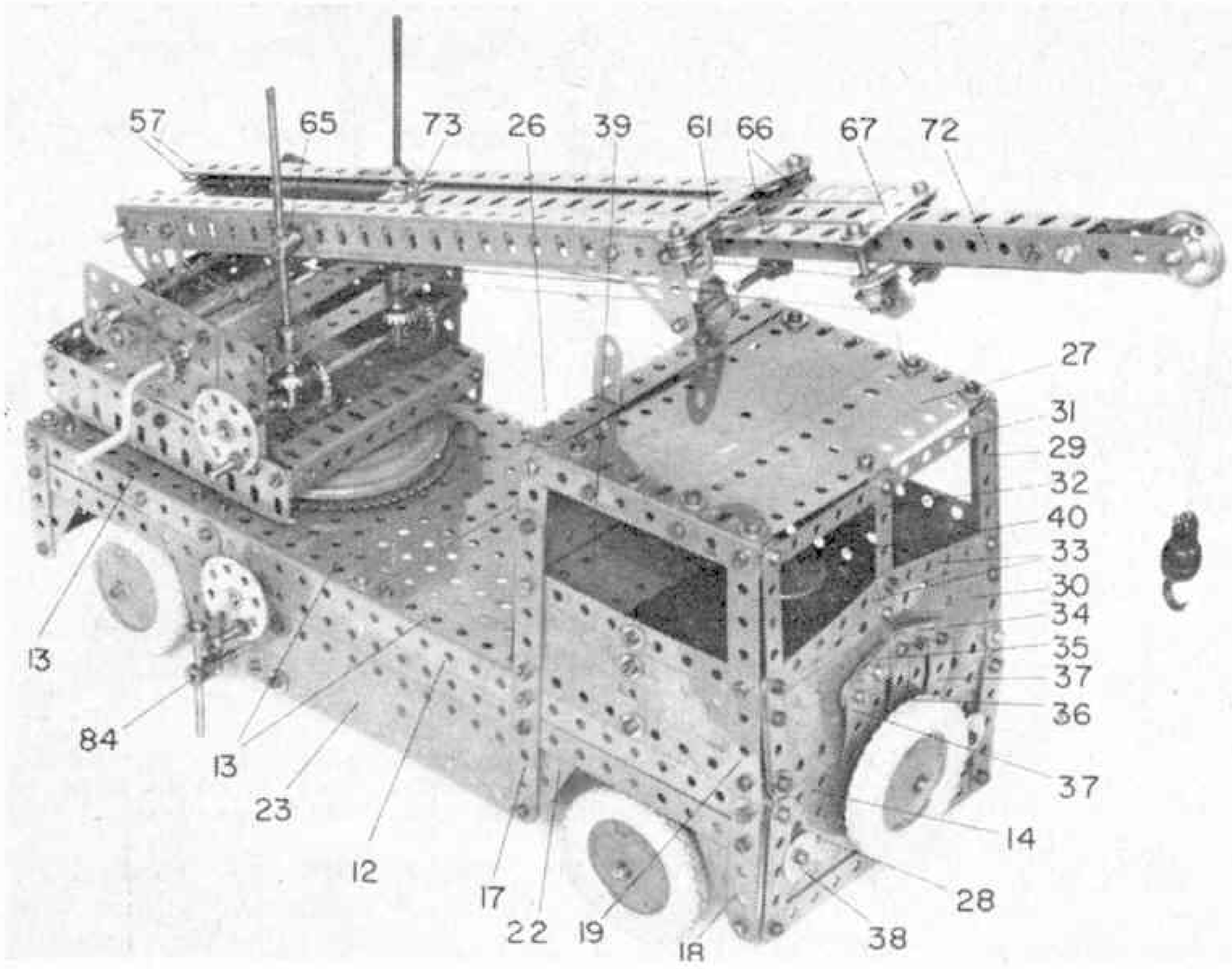
Although it has been hinted that it may be fifty years before sea cities become realistic, there is a possibility the first sea-based community will be established long before then. Indeed, at this moment, a far-sighted plan reminiscent of the Pilkington Sea City project, is being considered for the future development of Toronto.

Early industrial developments are hampering modern plans for the city's downtown area and a revolutionary scheme has been researched for extending the downtown area onto a massive pontoon and raft foundation and creating a floating city on the adjacent waters of Lake Ontario. Although not an open sea project, the basic idea is the same—conserve land by building on water.

People must be housed, but the world dare not sacrifice vast areas of vital agricultural land on which to house them. Sooner or later sea cities will offer the last and only solution to lack of living space.

A PLANT HIRE CRANE

described by Spanner



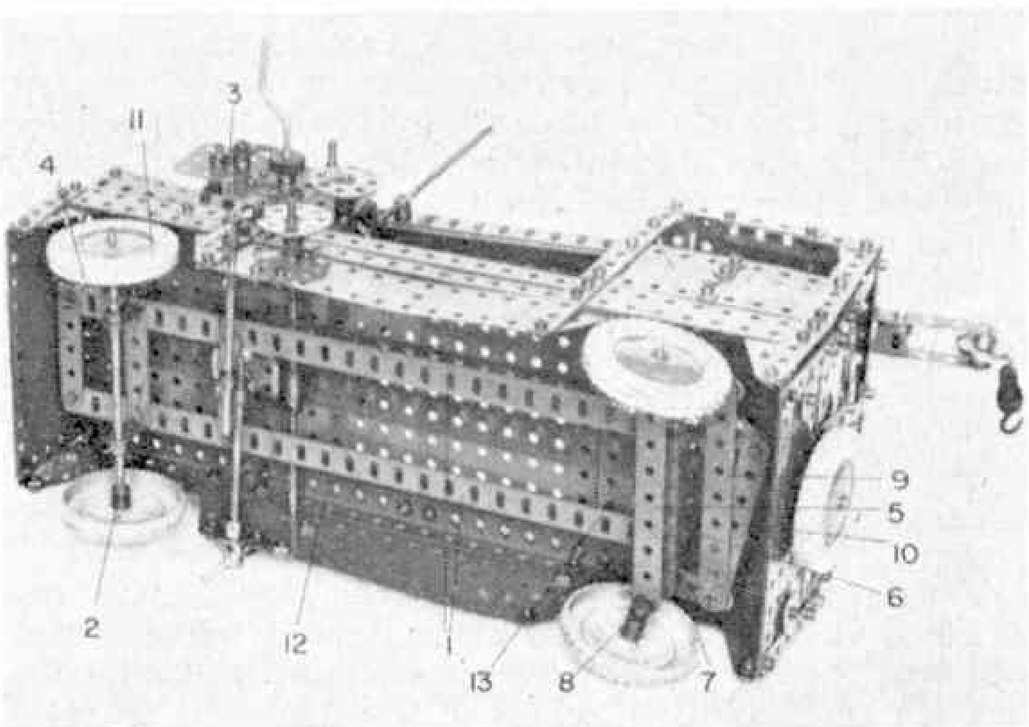
A mobile crane with a difference is this advanced model based on a Coles Hydra Telescopic Truck Crane as manufactured by Coles Cranes Ltd. of Sunderland.

VARIOUS kinds of mobile cranes are in use today, but there is one particular type which is becoming increasingly popular with hire companies, namely the telescopic-jib variety. As the name suggests, these cranes have a jib split into several sections, one section fitting inside the next and designed to be extended or retracted just like a telescope. The Meccano model featured in this article is roughly based on just such a crane, the 12-ton Coles Hydra Telescopic Truck Crane manufactured by Coles Cranes Ltd. of Sunderland. On the model, the hydraulic actions of the original are reproduced by screw jacks and Cord.

Chassis

Beginning construction with the chassis, two 12½ in. Angle Girders 1 are connected at one end by a 2½ in. Strip, through their fourth holes by a 2½ × 1 in. Double Angle Strip 2 and through their eighth holes by another 2½ in. Strip 3. The Bolts securing the end 2½ in. Strip also hold two 1½ × ½ in. Double Angle Strips 4 in place. At their other ends, Girders 1 are joined by a 4½ in. "U"-section girder 5, built up from two 4½ in. Angle Girders, the open end of the "U" pointing forward. The upper arm of the "U" is overlayed by a 4½ in. Strip, while the Bolts securing the girder to Girders 1 again hold two 1½ × ½ in. Double Angle Strips 6 in place.

An underside view of the model showing the layout of the chassis and steering gear.



Journalled in the end holes of "U"-section girder 5 are two 1½ in. Rods, each held in place by a Crank 7 above the girder and by a Collar 8 beneath it, the Collar being spaced from the girder by two Washers. Lock-nutted between the arms of Cranks 7 is a 4½ in. Strip 9, a 3½ in. Strip 10 also being lock-nutted to the left-hand Crank. A Double Arm Crank which, in due course, will take the steering column, is lock-nutted to the end of Strip 10, then a ¾ in. Bolt, on which a free-running 2½ in. Road Wheel is mounted, is screwed tightly into one tapped bore of each Collar 8. Two similar Road Wheels 11 are mounted on the rear axle, supplied by a 6½ in. Rod held by Collars in the lugs of Double Angle Strip 2.

Body and Cab

Coming now to the body, a framework is first built up from two 15 in. compound girders 12 connected by four 5½ × 3½ in. Flat Plates 13 and joined at each end by a 5½ in. Angle Girder 14. Girders 12 each consist of a 12½ in. Angle Girder extended five holes by a 5½ in. Angle Girder. Bolted to rear Angle Girder 14 to form the back of the body is a 5½ × 2½ in. Flexible Plate edged along the sides by 2½ in. Strips and along the bottom by a 5½ in. Strip. Attached to the back by Angle Brackets are two 2½ × 1½ in. Triangular Flexible Plates, one at each side, each overlayed by a 2½ in. Strip 15 bolted, along with the Triangular Plate, to compound girder 12.

Also bolted to compound girder 12 in the positions shown are another 2½ in. Strip 16, a 5½ in. Strip 17 and a further 2½ in. Strip 18, the last extended upwards by a 4½ in. Strip 19, angled rearwards. Secured to Strips 15, 16, 17 and 18 is a 15 in. compound strip 20, built up from a 12½ in. and a 4½ in. Strip, the Bolt securing it to Strip 18 also fixing another 2½ × 1½ in. Triangular Flexible Plate in position, while similar

Triangular Flexible Plates 21 and 22 are held by the Bolts fixing Strips 16 and 17 to the compound strip. The lower ends of Strips 16 and 17 are joined by a 7 × 1½ in. compound flexible plate 23, obtained from one 5½ × 1½ in. and one 2½ × 1½ in. Flexible Plate overlapped two holes.

Strip 17 is now extended two holes upwards by a 3½ in. Angle Girder 24, the top of which is joined to the top of Strip 19 by two 3 in. Angle Girders 25, overlapped four holes. Girders 24 at each side are themselves joined by a 5½ in. Angle Girder 26, the securing Bolts at the same time helping to fix the back of the cab in position, the back being supplied by two 5½ × 2½ in. Flexible Plates overlapped two holes. A 2½ × 1 in. Double Angle Strip is bolted to the top flange of Girder 26, while the cab roof is represented by one 5½ × 2½ in. Flexible Plate and one 5½ × 1½ in. Flexible Plate 27 bolted between Angle Girders 25.

In the case of the cab front, a 5½ × 2½ in. Flat Plate 28, overlayed along its side edges by 2½ in. Strips and along its lower edge by a 5½ in. Strip, is bolted to the back of the vertical flange of front Angle Girder 14. The 2½ in. Strips are extended upwards by 4½ in. Narrow Strips 29 which are in turn connected by a 5½ × 2 in. compound flexible plate 30, obtained from two 5½ × 1½ in. Flexible Plates, and by a 5½ in. Narrow Strip 31, the securing Bolts in the latter case also fixing the cab front to Strips 19 by means of Angle Brackets. The centre of plate 30 is connected to Narrow Strip 31 by a 2½ in. Narrow Strip 32, the upper securing Bolt again holding in place an Angle Bracket which is also bolted to Plate 27. A further two 2½ in. Narrow Strips 33 are bolted between Narrow Strips 29 and Narrow Strip 32.

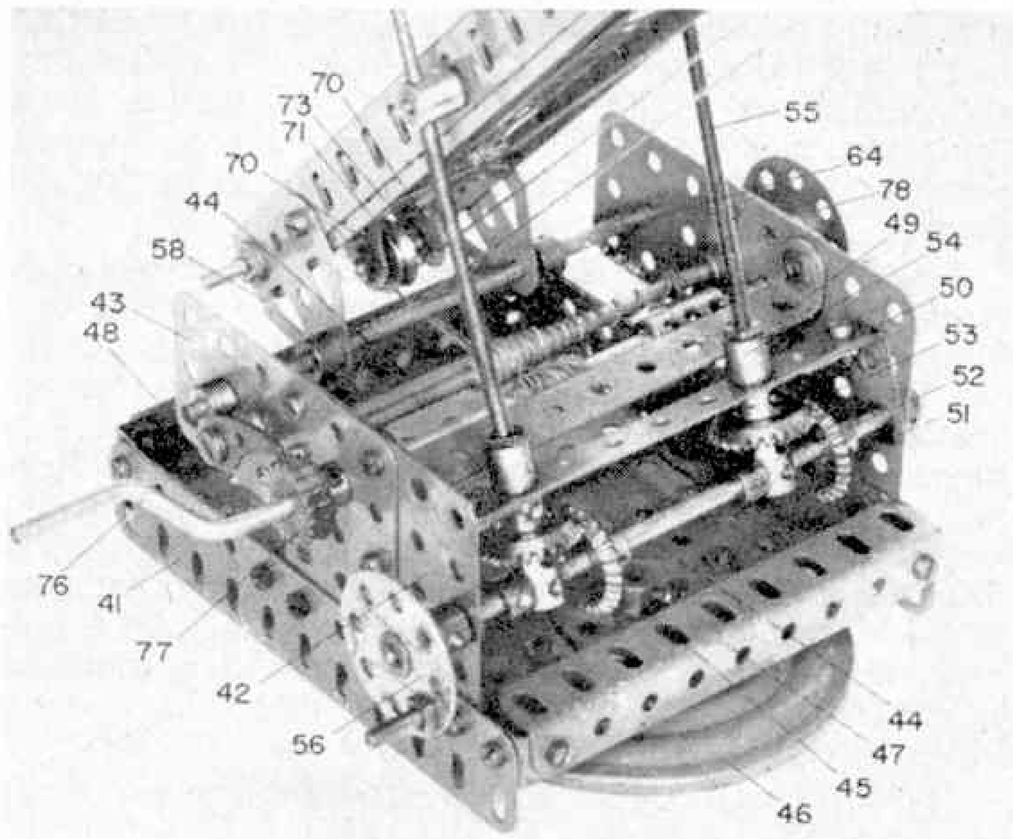
The radiator-grille is built up from three 1½ in. Strips 34, one behind the other and interlocking with three similar Strips 35, all bolted to the front of the cab along with a 2½ in. Narrow Strip 36. Another two 2½ in. Narrow Strips are bolted one each to the centre of Strips 34 and 35 while two 2 in. Strips 37 are secured to the end of the Strips. A 2½ in. Road Wheel, representing the spare wheel, is bolted to Flat Plate 28 immediately below the radiator grille, while two ¾ in. Washers 38 are added to the same Plate to serve as headlamps. Strips 18 are attached to the cab front by Angle Brackets.

Inside the cab, a seat is provided by a 5½ × 1½ in. Flexible Plate 39 attached to Girders 24 by 1 × ½ in. Angle Brackets. Also, a Double Bent Strip is bolted to the top of front Flat Plate 13, this later acting as one of the bearings for the steering column.

Now tightly fixed to the tops of the third and fourth Flat Plates 13 (counting from the front) is a Ball Thrust Race Toothed Disc, after which the body can be secured to the chassis by bolting the free lugs of Double Angle Strips 4 and 6 to respective Flat Plates 13. A 3½ in. Rod representing the steering column, is then journalled in the above-mentioned Double Bent Strip and the Flat Plate to which it is bolted, being fixed in the boss of the Double Arm Crank lock-nutted to Strip 10. Mounted on the upper end of the Rod is an 8-hole Bush Wheel 40, serving as the steering wheel.

Crane Section

Although not especially difficult, the most complicated part of the model is the actual crane section. This is built up on a swivelling base, each side of which consists of two 2½ in. Angle Girders butt-jointed together by a 5½ in. Flat Girder 41 projecting forward one hole, the Bolts fixing it to the front Angle Girder also holding a 2½ × 2½ in. Flat Plate 42 in position. This Plate is, in turn, extended three holes rearward by a 3 × 1½ in.

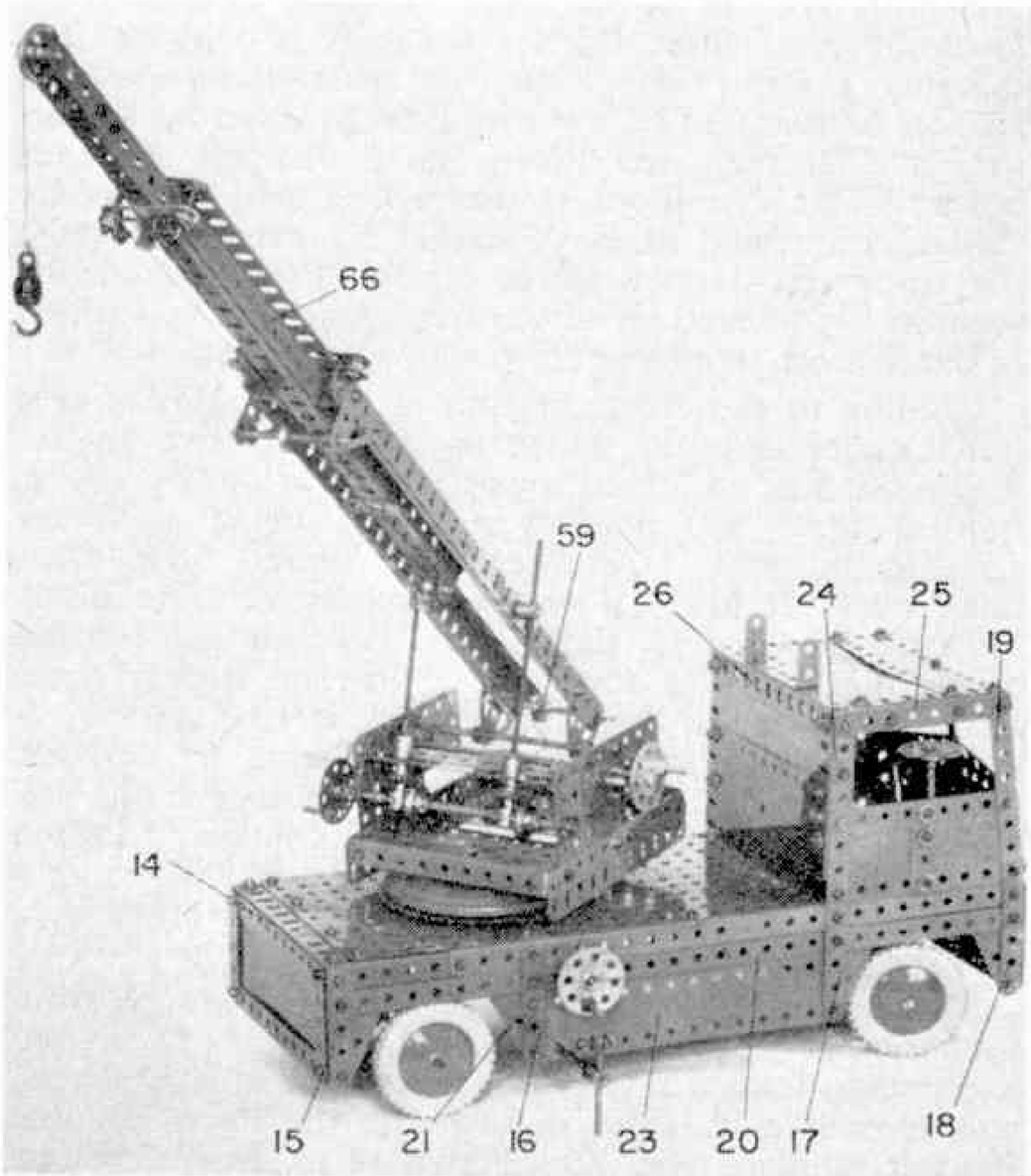


In this close-up view of the crane section base, removed from the model, the construction of the jib-raising gear is clearly shown. Note that the hydraulic rams of the original are replaced by screw jacks on the model.

Flat Plate 43, whereas the lower flanges of the Angle Girders at each side are connected by two 4½ × 2½ in. Flat Plates 44. Bolted to the top of the foremost of these Flat Plates is an 8-hole Bush Wheel 45, the securing Bolts helping to fix a Ball Thrust Race Flanged Disc 46 to the underside of the Plate. The projecting ends of Flat Girders 41 are joined by a 4½ in. Angle Girder 47, secured by Angle Brackets, while, at the rear, they are joined by a 4½ in. Flat Girder 48, also secured by Angle Brackets.

Flat Plates 42 are now joined through their top centre holes by a 4½ × ½ in. Double Angle Strip 49, spaced from each Plate by a Washer. A 4½ × 1 in.

A general view of the model showing the crane section out of the travelling position, with the jib partially extended.



compound double angle strip 50 is then produced from two 1 × 1 in. Angle Brackets bolted to a 4½ in. Strip and is mounted on a 5½ in. Rod held by Collars in the front centre holes of Flat Plates 42. Note that the compound double angle strip is *not* bolted to the Flat Plates.

Also mounted on the 5½ in. Rod are two similar arrangements, each consisting of a ⅞ in. Bevel Gear 51, a Short Coupling 52 and a Collar. The Bevel and Collar are fixed on the Rod, but the Short Coupling must be perfectly free. In mesh with the Bevel is another ⅞ in. Bevel Gear 53, fixed on an Adaptor for Screwed Rods 54, journalled in double angle strip 50 and in the longitudinal bore of Short Coupling 52. Held in the Adaptor is a 4½ in. Screwed Rod 55 which will later act as one of the rams for raising the crane jib. An 8-hole Bush Wheel 56, fitted with a Threaded Pin, is mounted on the end of the 5½ in. Rod in Flat Plates 42, to serve as a handwheel.

The jib, itself, consists of three separate sections, one fitting inside the other. In the case of the lower and largest of these sections, two arms are each built up from two 12½ in. Angle Girders 57, placed one over the other and bolted together through their elongated holes in such a way that their horizontal flanges are separated by a space of about ⅛ in. At their lower ends Girders 57 at each side are connected together by a 3 in. Screwed Rod held in place by Nuts, the Nuts helping to hold two Flat Trunnions 58 in place as shown. Free on the Screwed Rod is a ½ in. Pulley without boss 59.

Fixed through the upper end holes of Girders 57 at each side are a Reversed Angle Bracket 60, on the inside of the Girders, and an Angle Bracket on the outside of the Girders. The Angle Brackets at each side are joined by a 2½ in. Strip 61 spaced from the Brackets by five Washers on each securing ⅜ in. Bolt. Reversed Angle Brackets 60 on the other hand, remain undisturbed, as their inside lugs will later serve as guides for the centre section of the jib. Still on the lower jib section, however, two 1½ in. Corner Brackets 62 are bolted through the second and fourth holes from the upper ends of Girders 57. Held by Collars in the lower holes of these Corner Brackets is a 2½ in. Rod carrying a ½ in. loose Pulley 63, then the completed section is mounted on a 5½ in. Rod 64, held by Collars in Flat Plates 43, the Rod passing through the apex holes of Flat Trunnions 58 where it is held in place by Collars. Screwed Rods 55 should be screwed through the transverse tapped bores of two Rod Sockets 65, secured one to each set of Girders 57, so that movement of handwheel 56 affects the position of the jib.

Coming to the centre section of the jib, this is very much easier to build, consisting simply of two 12½ in. Angle Girders 66 joined together at one end by a 2 in. Slotted Strip 67, two 1⅛ in. Bolts being used for securing purposes. Another 2 in. Slotted Strip 68 is fixed by Nuts lower down the shanks of these Bolts, beneath the Girders, then Angle Brackets are secured to the Bolts further down still. The free lugs of these Brackets are joined by another 1⅛ in. Bolt which carries a ½ in. loose Pulley 69. Slotted Strips 67 and 68, together with the vertical flanges of Girders 66, will later serve as guides for the upper jib section. Bolted to the lower ends of Girders 66 are two 1 in. Corner Brackets 70, the lower corners of which are joined by a ¾ in. Bolt carrying a ½ in. loose Pulley 71.

The upper section of the jib is now produced from yet another two 12½ in. Angle Girders 72 joined together to form a box girder by two Double Brackets, one at each end. The Bolts fixing the lower Double Bracket in place also secure two 1½ in. Strips 73 one above and one below the box girder to act as guides, while the Bolts fixing the upper Double Bracket in place help to secure two 2½ in. Strips 74 to the sides of the girder to extend it a distance of three holes. A free-running 1 in. Pulley without boss 75 is held by Collars on a 1 in. Rod journalled in the end holes of Strips 75.

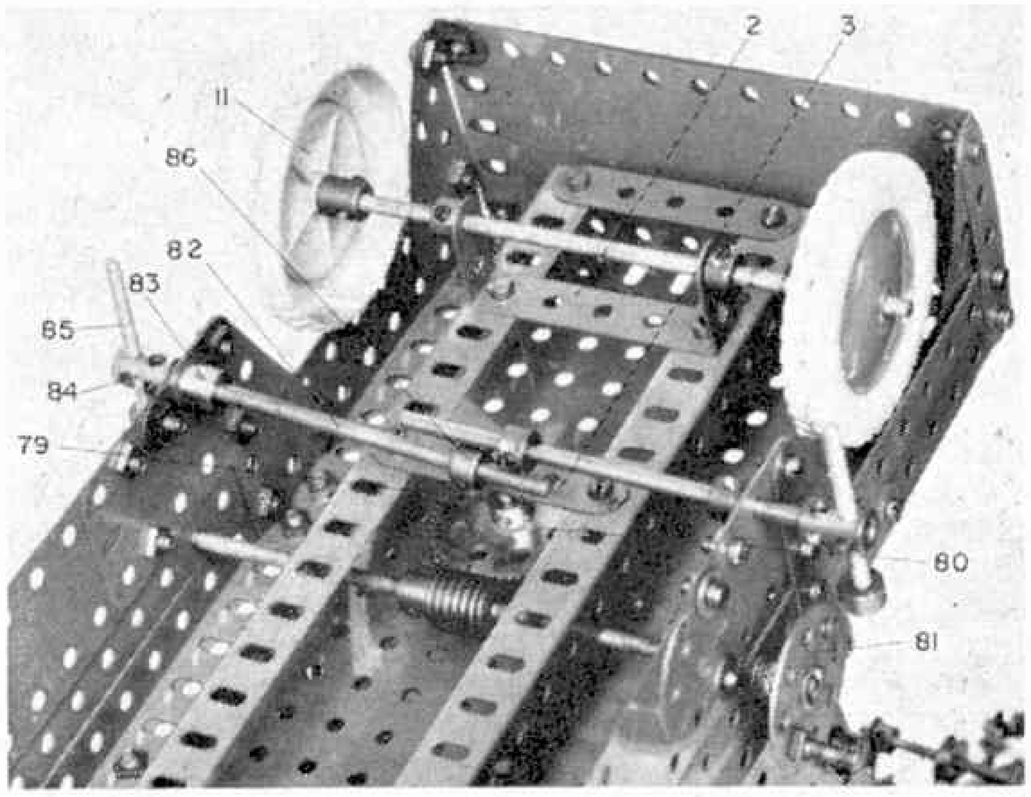
At this stage the three jib sections can be slotted inside each other, temporarily removing the parts that would otherwise prevent this being done, then the operating cords should be fitted. First, a 5 in. Crank Handle 76 carrying a Ratchet Wheel 77 and extended, via a Coupling, by a 1½ in. Rod, is journalled in Flat Plates 42 where it is held in place by a Collar. A good length of Cord is then tied to an Anchoring Spring on the Crank Handle, is taken round Rod 64, brought up and round Pulley 63, taken back and around Pulley 69 and is finally tied to the lower end of the box girder formed by Angle Girders 72. A Pawl mounted on a Pivot Bolt held in appropriate Flat Place 43 engages with Ratchet Wheel 77 to prevent the jib closing up under its own weight when Crank Handle 76 is released. However, when the Pawl is disengaged and the Crank Handle turned in the reverse direction, the weight of the jib should cause it to close up.

In the case of the load hook, a length of Cord is simply tied to a Hook, passed over Pulley 76, taken down the centre of the jib and round the Screwed Rod joining Girders 57, to be secured to a 5½ in. Rod held by Collars in Flat Plates 43, An 8-hole Bush Wheel 78, fitted with a Threaded Pin, is fixed on the end of the Rod to serve as the handwheel.

Next, the finished crane section can be mounted on the body, being held by a 3 in. Rod 79 fixed in the boss of Bush Wheel 45 and projecting through the Ball Race (to which a Ball Cage must of course be added), as well as appropriate Flat Plate 13 and 2½ in. Strip 3. It is secured by a Collar beneath this Strip, while, above the Strip, is fixed a 57-teeth Gear Wheel 80 which meshes with a Worm on a 6½ in. Rod journalled in compound strips 20 and held in place by a Collar and an 8-hole Bush Wheel 81. This Bush Wheel is spaced from Strip 20 by three Washers and is also fitted with a Threaded Pin so as to serve as the handwheel controlling the slewing movement of the crane.

Last of all, two pull-out stabilising rams are each produced from a 4 in. Keyway Rod 82 mounted in the boss of a Double Arm Crank 83 bolted to the inside

The mechanism controlling the slewing movement of the crane is clearly shown in this detail shot of the rear underside of the model.



lower edges of compound flexible plate 23. Fixed on the end of the Rod is a Short Coupling 84, through the end transverse tapped bore of which a 2 in. Screwed Rod 85, carrying a Collar on its upper end, is screwed. The Keyway Rod is prevented from turning in the boss of Crank 83 by a Key Bolt screwed into the upper tapped bore of the boss and reached, when the ram is to be extended, by a screwdriver inserted through a hole in appropriate Flat Plate 13. A Collar 86 fixed to the Rod acts as a stop to prevent the Rod being pulled completely out of its mounting. When operating the crane, by the way, it is important to remember that the stabilising rams must be pulled out and Rods 85 screwed down to the ground otherwise the model is in danger of tipping over when the jib of the crane is swung out to the side.

PARTS REQUIRED

2—1	3—15	2—55a	2—126a
5—2	3—16a	1—57c	2—133
7—2a	2—18a	26—59	2—133a
1—3	2—18b	2—62	1—147
1—4	1—19h	3—62b	1—148
13—5	1—22a	4—63d	1—168
2—6	4—23	2—64	2—173a
8—6a	5—24	2—72	1—176
10—8	4—30	2—73	5—187
3—9	220—37a	2—80b	11—188
5—9a	185—37b	1—80c	5—189
2—9b	80—33	2—81	5—192
4—9c	2—38d	2—103	8—221
4—9d	1—45	1—103c	2—230
2—11	2—46	4—111	2—231
16—12	4—48	8—111c	4—235
2—12a	1—48c	3—111d	2—235a
2—12b	4—52a	1—115	2—235d
2—14	2—53a	2—125	1—235f

DEVON'S MUSEUM OF SAILING CRAFT

by ARTHUR GAUNT

DEVONSHIRE, FOREVER associated with Drake and other Sea Dogs, is today building-up a fascinating collection of sailing ships from various parts of the world. The International Sailing Craft Association, as the supporters of the project have named it, has been founded because the age of sail marked an important stage in the evolution of man, and concerns

A pearling dhow, one of the two presented to the Exeter collection of sailing craft.

an aspect of human history equivalent to the development of steam power and great engineering feats.

You will find this maritime museum at Exeter, where about twenty sailing ships and man-propelled working craft are already being preserved, mostly in working condition.

Until recently the creation and maintenance of such a museum of full-sized working craft would hardly have been possible. A suitable site would have been hard to obtain, most small ports in Britain being in regular use and unavailable for an enterprise of this sort. The problem was heightened by the difference of preserving wood, iron, canvas, and rope.

Science, and the shrinking of coastwise trade, have now largely taken care of these snags. Exeter, geographically an ideal sport for a museum of sailing ships, is no longer economic as a port. Again, with television in nearly every household, and with the gradually increasing amount of leisure time, the scheme can be brought to the notice of a vast number of people with opportunities to make use of it.

Scientific progress has enabled the problem of preservation also to be solved. Synthetic materials, plastic paints, and effective fungicides and insecticides can nowadays help to save or replace many things that would otherwise soon perish.

Exeter City Council have co-operated in establishing the new museum by granting a site in the Quay area. Here the large craft can be kept afloat along the west bank of the River Exe and in the basin nearby. The smaller vessels can be housed in cellars to the west of it, and can be moved to the Quay whenever the weather allows.

The arrangements for the smallest and most fragile craft are to keep them in two warehouses on the east bank.

Among the variety of vessels so far acquired is the ceremonial barge *Venita*, built about the year 1900 for the Duke of Westminster. Another noteworthy acquisition is the steam tug *St. Canute*. She was built in Denmark in 1931 to serve as a firefighter and ice-breaker. Her displacement is 130 tons, and she has a triple expansion coal-fired engine.

But oar-propelled coats are being collected too. These include two Irish currachs—an eight-oared four-man one measuring 26 ft. and a four-oared two-man example measuring 16 ft. The International Sailing Craft Association also possess a lifeboat built in 1886. Trolley-launched, this life-saving craft was oar-propelled for more than 40 years, and was equipped with an engine only shortly before being withdrawn from rescue operations in the 1930's.

A 25 ft. double gun punt, with all its equipment (such as a breach-loading gun), is also being preserved, and there are two coracles representing Britain's most primitive type of craft still in use.

Unusual interest attaches to a 120-ton two-masted dhow giving by the Kuwait Government. She was to have sailed to Britain last year but the closure of the Suez Canal prevented this, and the donors agreed to hold her until the Canal opened again.

The preservation association, however, has been provided with a second dhow. A 52 ft. one has been specially built for the Devon museum by the Ruler of Bahrain.

The steam tug St. Canute, built in Denmark in 1931 for fire-fighting and icebreaking. She is now preserved by the International Sailing Craft Association at Exeter.

The International Sailing Craft Association is indebted to a number of individuals and organisations for its steady growth. The lifeboat already described was presented by the Tyne Lifeboat Society, and the ceremonial barge was given by a rowing club. An Exe fisherman has donated a four-oar open boat to show the type used by salmon fishers, and a 20 ft. East African dug-out craft has come to Devonshire through the generosity of the men of H.M.S. *Gurkha*.

Of exceptional interest is a boat made entirely of reeds. It not only demonstrates the skill of its builders but also illustrates the kind of craft used on Lake Titicaca, 12,000 ft. up in the Andes. A second reed-boat acquired by the Exeter museum was made by natives on the Batina Coast; they used the central stems of palm trees.

The preservation of disappearing types of boats, and the presentation of displays of such vessels, are by no means the only activities which the Devonshire organisation aims to follow. A collection of books, pictures, photographs, records, documents, films, and recordings is being built up.

It is also considered important to preserve the knowledge and skills needed to sail craft with vanishing rigs. So a branch is being formed for sailing members of the Association, who will help to keep these skills alive. The members of this branch will be responsible for taking craft on to the estuary or out to sea, to pass on the technique. Some strange rigs are therefore likely to be seen near Exeter and along the Devon coast in the future !

The museum has been planned to incorporate a maintenance yard with a slipway, so that craft needing repairs will not have to be sent elsewhere.

A further idea is to use this workshop for the construction of replicas of craft which have already vanished. Wherever possible the traditional tools will be used for this job.

Even more exciting is a plan to hire out small dhows, sampans, and dghaisas. Being built as working boats they are cheaper, stronger, and easier to repair than the traditional English skiff. They will thus quickly repay the extra cost of shipping them to this country.

The preservation society is a non-profit-making body, and has been officially recognised as a charitable trust. But to make the museum succeed it will have to appeal to a wider section of the public than merely the yachting community, and although the centre is some distance from the large ones used by yachtsmen, it is at the heart of one of the largest and most popular holiday areas in Europe. Well over 6,000,000 visitors and tourists go to the South-West every year, and the exhibition of boats is only six minutes walk from Exeter Cathedral and the main shopping area.

A further advantage is that the whole site, and all the buildings needed for developing the museum, belong to Exeter City Council. The Council have already made available the buildings required to open the exhibition this summer.

Confidence in the scheme arises from the success of other specialised museums and places of interest in recent years. The National Maritime Museum at Greenwich attracts more than 600,000 visitors a year, and over 275,000 people are drawn to the *Cutty Sark* nearby. About 750,000 inspect the vehicles in the Montague Motor Museum at Beaulieu, Hants., during the same period, and not far from 1,000,000 go to Bristol Zoo.

Big attendance figures are reported from similar exhibitions abroad. A wide variety of maritime museums have been established in the U.S.A., to preserve such typical craft as Mississippi stern-wheelers, whaling ships, four-masted barques, and even a 40,000-ton battleship.

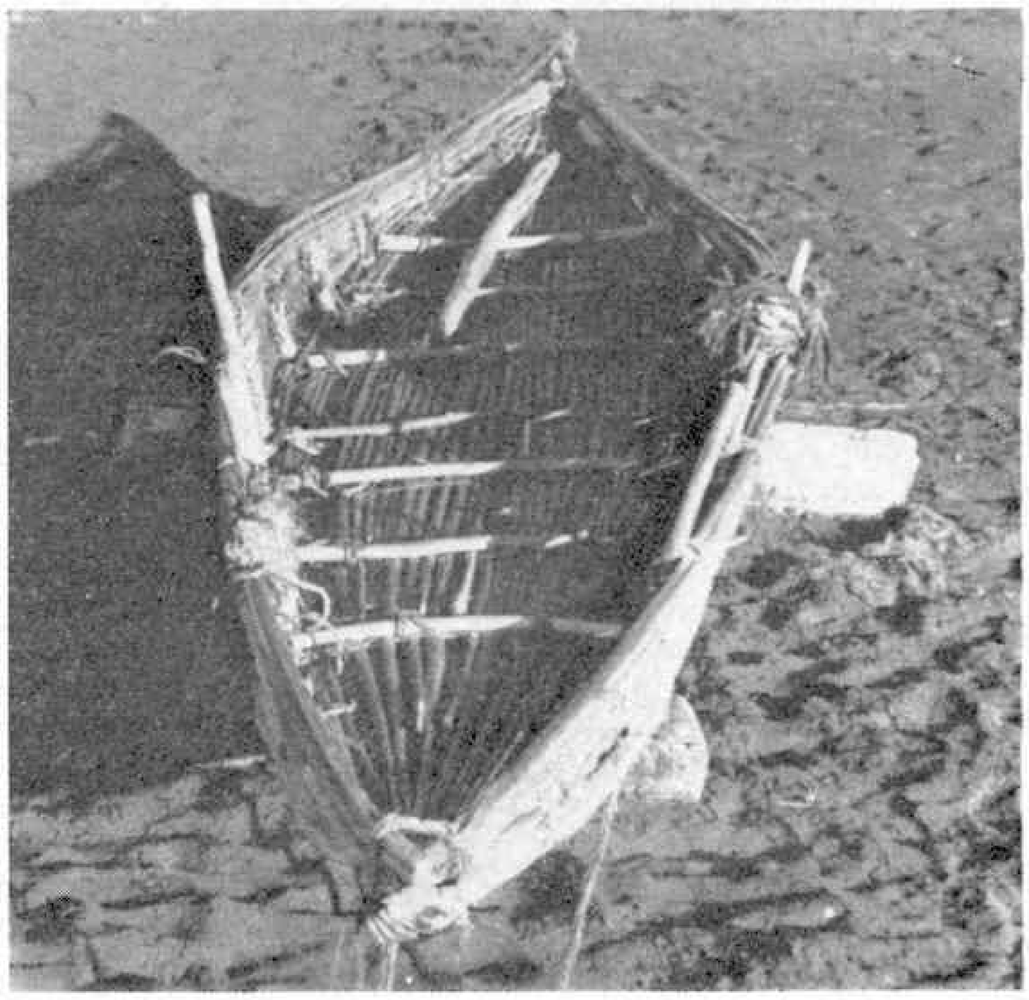
At Mystic, Connecticut, an old whaling port has been reconstructed, and many boats associated with the whalers are preserved there. Europe has a fine collection of Dutch barges at Enkuisen, in Holland, and both Oslo and Bergen have maritime museums.

All these exhibitions are financially sound today, although it is doubtful whether any of them began with as many advantages as those existing at Exeter. The intention and determination of the sponsors of the Devon museum are that it will become self-supporting when fully established, though in its early stages financial aid and help in kind will be necessary.

The promoters believe that a lot of interest could be stimulated, particularly through television programmes, thereby increasing attendances—just as animal programmes have given a big boost to zoos.

To round off, perhaps you can spot something singular about the name given to this scheme. Whether by accident or design, its initials form the word ISCA. And if you know your Roman Conquest history, you'll be aware that Isca was the name given to Exeter in Roman times !

This boat, from the Batina Coast, is one of the two reed-built craft acquired by the Exeter museum.



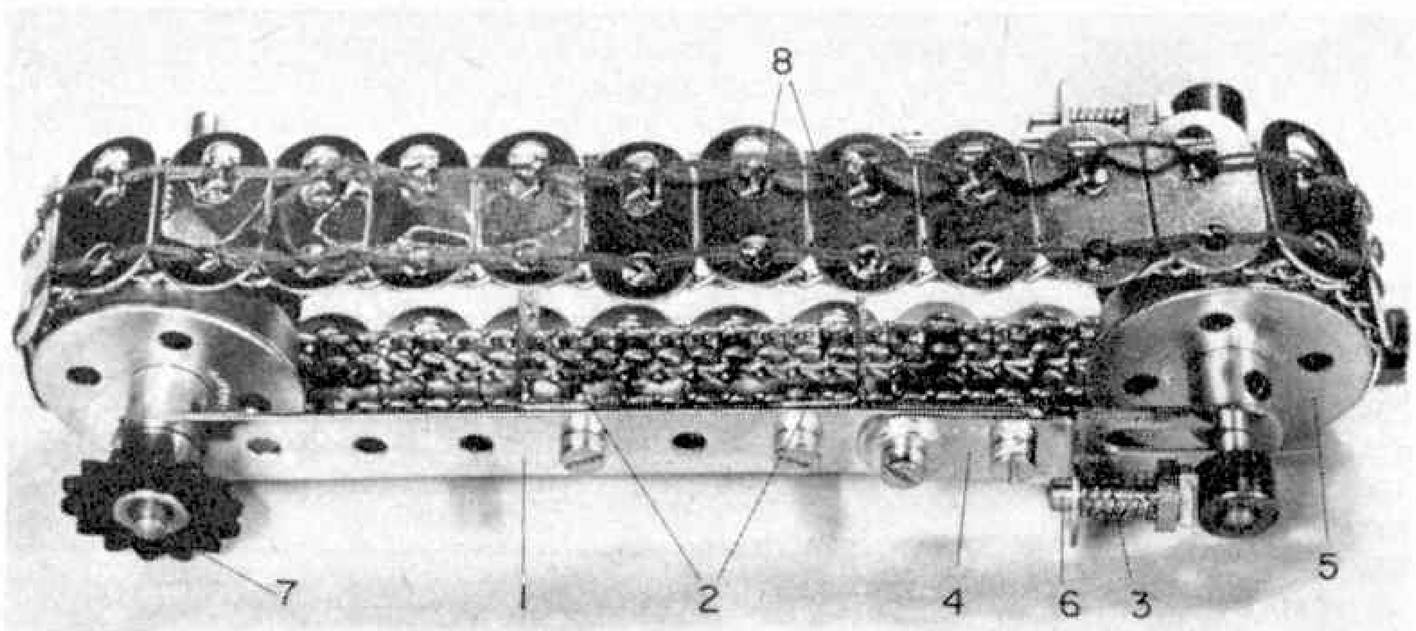
AMONG THE MODEL BUILDERS
with Spanner
TO DO WITH CRAWLER TRACKS

IT HAS never been claimed by Meccano Limited that the Meccano Parts range is 100 per cent complete, but even if the company thought this was so, the idea would soon be dispelled by the number of suggestions for new parts sent in by modellers.

Meccano do receive a lot of ideas for new parts, many of which, on the surface, would make useful additions to the range. When talking about proposed new parts, however, several things must be taken into account, the most important of which are the tooling and production costs of the parts in relation to their potential sales. It must be remembered that all Meccano parts are mass-produced on automated machines which are extremely costly to prepare for a production run. The sales of the parts produced must cover the costs involved, otherwise the resulting loss would not only make the particular parts, themselves, unacceptable from a manufacturing point of view, but would also weaken the range as a whole. This reason alone puts paid to most of the suggestions received, as the majority are either for too complex a part or for a specialised part with very limited appeal—or both ! It's unfortunate, but sadly true.

This, of course, does not alter the fact that such parts do have a definite use, but one of the joys of the Meccano system is that, in most cases, existing standard parts can be built up into constructions which perform the work of the proposed parts, perhaps not as well as would a specially-produced item but usually well enough. A good example of the type of thing I have in mind is a Crawler Track which is something required for a lot of Meccano models. Meccano do not as yet manufacture one and so the only way of obtaining a working example is to build one up from standard parts. Three such examples are described here, the first two being relatively simple ideas taken from past issues of Meccano Magazine and the third being a more-complicated unit designed and built by Pat Lewis of Formby, Lancs.

Example No. 1, taken from the October 1956 M.M., really needs very little description as it consists of nothing more than a series of 2½ in. Flat Girders joined together by Cords. The arrangement of the Cords, though, is interesting. Two lengths are required for each side of the track, one length being formed into a series of loops which are pushed through a row of holes in the Flat Girders. The second length of Cord is then threaded through these loops, after which the two Cords are pulled tight and their ends tied together.

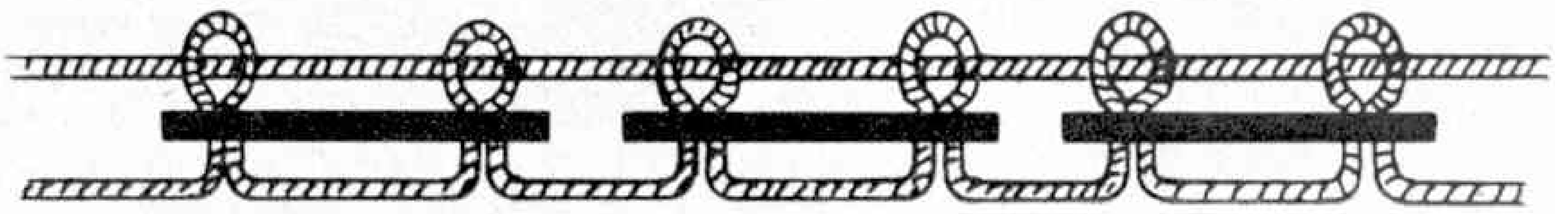


A simple, but effective Crawler Track Unit re-built from the August 1953 issue of Meccano Magazine. Note the built-in tensioning device.

The track illustrated uses 2½ in. Flat Girders, but these particular parts are not essential. Smaller Flat Girders could be used, for instance, or Perforated Strips—2½ in. or 1½ in.—perhaps even Fishplates ! The " chassis " on which the track is mounted would depend on the model being built, but the track, itself, lends itself ideally to friction drive, supplied by a Pulley (or Pulleys) fitted with a Motor Tyre. Grip can be increased by mounting Bolts in the spare holes of the parts used as track plates.

With the second crawler track idea, taken from the August 1953 M.M., a useful if not exactly elaborate " chassis " is included. As can be seen from the accompanying photograph, it consists of two 4½ in. Strips 1, joined by two 1½ × ½ in. Double Angle Strips 2. Each Strip is extended by a 2 in. Slotted Strip 3, slotted hole outwards, the securing Bolts also holding a 1 × ½ in. Angle Bracket 4 in place. Journalled in the slotted holes of Strips 3 is a 2½ in. Rod, carrying two 1⅛ in. Flanged Wheels 5 and held in place by Collars, in one threaded bore of which a Threaded Pin 6 is tightly fixed by a Nut so that it does not foul the 2½ in. Rod. Tension Springs are slipped on to the shanks of these Threaded Pins, which are then engaged

A sketch showing the arrangement of the Cords used in the first Crawler Track idea described above.



in the holes in the short lugs of Angle Brackets 4. Another 2½ in. Rod, also carrying two 1⅛ in. Flanged Wheels, is held by a Collar and a 1 in. Sprocket Wheel 7 in the end holes of Strips 1. The drive would be taken to Sprocket Wheel 7.

The track itself is, if anything, even easier in design than the track in our first unit. It consists simply of a number of Fishplates 8, attached by Cord to two identical lengths of Sprocket Chain. Each length of Cord is passed through a hole in a Fishplate, is threaded round one of the links in the appropriate Chain and is brought back through the same hole in the Fishplate. It is then taken on to the next Fishplate where the procedure is repeated, and so on until the required length of track has been built up. Once completed, the track is passed round the 1⅛ in. Flanged Wheels and its ends joined. The action of the Springs on Threaded Pins 6 hold the track in tension provided the track is made just short enough to partially compress the Springs.

To move on, now, to Mr. Lewis's more complicated unit, this also includes an interesting "chassis", each member of which consists of two 5½ in. Strips 1, placed one on top of the other for strength, extended at each end by two 2 in. Slotted Strips 2, these also placed one on top of the other with their slotted holes inwards. Two 1 in. Triangular Plates 3 are bolted to each chassis member in the positions shown, the members then being connected by two 1½ × ½ in. Double Angle Strips 4.

Journalled in the end holes of one set of Strips 2 is a 2 in. Rod, held in place by two 1½ in. Pulleys 5, fitted with Motor Tyres. Also mounted on the Rod, between the Pulleys, is a Large Fork Piece, the Rod passing through the holes in the lugs of the Fork Piece. Another Large Fork Piece, flanked by a further two 1½ in. Pulleys 6, is similarly mounted on a 2½ in. Rod, journalled in the end holes of remaining Strips 2. Fixed on the Rod, outside the chassis members, is a 1½ in. Sprocket Wheel 7, to which the drive would be taken.

The Large Fork Pieces at each end of the chassis are next connected by a 7 in. compound rod, obtained from two 3½ in. Rods joined by a Coupling 8, the compound rod being tightly fixed in the bosses of the Fork Pieces. Idler wheels are then supplied by four 1 in. Pulleys 9, fitted with Rubber Rings, fixed in pairs on two 2 in. Rods, journalled in Triangular Plates 3.

Last comes the track proper, this being produced from 1½ in. Strips 10, lock-nutted together through their end holes to leave their centre holes free. Fixed to each Strip through this centre hole are two Angle Brackets 11 which together form one track plate. The completed track, of course, runs on Pulleys 5 and 6 which should be sufficiently far apart to enable the lock-nutted Bolts joining Strips 10 to pass between them. Track tension can be adjusted by means of the slotted holes in Strips 2. Please note, by the way, that the Parts List for this and the preceding mechanism apply only to the units as illustrated. They would of course vary if the size of the track were altered.

The Meccanoman's Club

Before closing this month, I would like to mention an organisation which will be of interest to many readers of Meccano Magazine—The Meccanoman's Club.

Actually, the Meccanoman's Club is not a "club" in the sense that it does not have any club rooms or hold any meetings, but it is still an extremely useful organisation because it has, as its founder puts it, ". . . the world's postal services at our command." It is, in fact, a sort of postal club which offers members, at a price, an immensely wide variety of literature from informative and specialist booklets, through photocopies of just about every Meccano publication ever printed as well as previously-unpublished private model-building instructions, right down to lists of "Meccanomen" in most major countries throughout the world. A stereotyped club magazine, "The Meccanoman's Journal," is published quarterly and, having read this regularly, I can vouch that it contains many interesting articles, models and mechanisms, hints, open correspondence, etc. No membership fee for the Club is charged, but the subscription to the Club magazine is 25s. per year. There is no obligation to take the magazine, however, although to my mind it typifies the "fellowship" side of the Club.

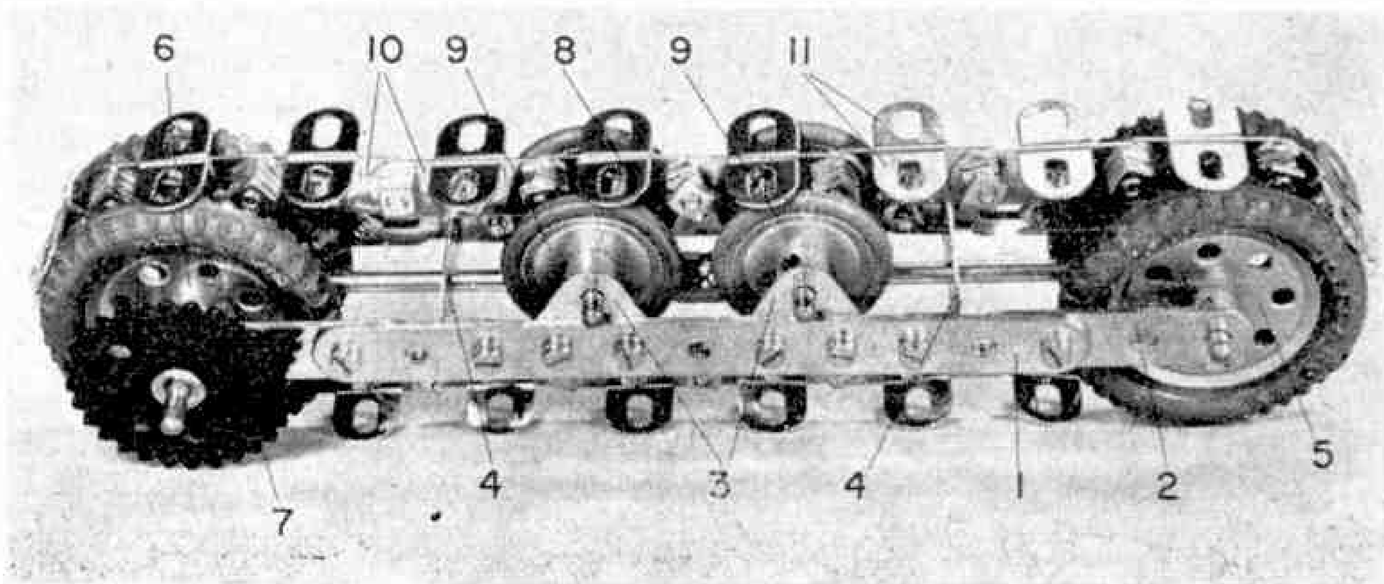
For further information on the Meccanoman's Club please contact The Chief Meccanoman, 248 Woolwich Road, Abbey Wood, London S.E.2, enclosing a stamp or Reply Coupon for return postage.

PARTS REQUIRED
(Lewis Mechanism)

4—2	3—17	2—48	2—116
20—6a	4—21	8—55a	4—142d
40—12	4—22	4—77	4—155
2—16	76—37a	1—63	
1—16a	56—37b	1—95a	

PARTS REQUIRED
(1953 Mechanism)

2—2a	4—20	1—40	1—94
28—10	8—37a	2—48	1—96a
2—12b	8—37b	2—55a	2—115
2—16a	2—38	2—59	2—120b



An inverted view of another Crawler Track Unit, this one designed and built by Mr. Pat Lewis of Formby, Lancs. In operation, the unit is mounted with the idler wheels at ground level.

PANDA PATROL

Chris Jelley looks at the new Dinky Police Escort

OVERWORKED, UNDERSTAFFED, harassed, insulted, threatened, and even beaten—all are words that could be used to describe the police forces of Britain, today. Despite this, however, Britain's police forces are among the best and most successful law-enforcement organisations in the entire world and certainly qualify as the most respected. Why, then, do we hear so many perfectly respectable members of the public running down the police ? The answer, I think, lies in the frequently-heard comment, " You never see a copper, these days."

Most people using this comment really mean that it is becoming more unusual to see the regular policeman steadily patrolling his " beat " on foot, making sure that everything is in order and generally keeping an eye on things. This is true, to a certain extent, although the foot policeman is far from the unusual sight that some people try to make out, but have you ever wondered just how useful this type of patrolling honestly is ? Admittedly, the sight of the " good old bobby " is reassuring to most of us and, being in the open, the officer can check that doors are locked at night, as well as listen for unexpected sounds. Precisely because he is on foot, however, the chances are that he will be able to do very little about it if anything does happen on his beat. Why ? Because criminals these days are mobile and, unless they are actually caught in the act, they can be up and away before the beat policeman arrives at the scene of the crime. A policeman on foot won't be too successful in chasing a gang of criminals in a high-powered car or van !

For years, now, more criminals than enough have managed to evade capture simply because they have been mobile while the policeman on the spot was not. Surely the obvious answer to this state of affairs is to mobilise the policeman and, here, I mean the local beat bobby, not the traffic and crime patrol officers who are already mobile, but who have a much greater area to cover. Yes, give the beat bobby a car and he can patrol his beat quickly and therefore much more often than would otherwise be possible, thus increasing his chances of happening upon a crime, as well as of deterring criminals. Most important of all, however, when something suspicious is reported, he can make the scene fast and, if he should disturb some criminals at work, he can give chase with a good chance of capture.

Of course, all these ideas are not new and are certainly not exclusive to myself. The police, themselves, have had them for a long time and, as you all know, they have already put them into practice with the Panda beat system of police patrolling, first introduced in 1966 by Lancashire County Constabulary. Normally crewed by one policeman in constant touch with his headquarters by means of a pocket two-way radio, " Panda Cars " have proved so successful in crime prevention that they have been adopted by many police forces throughout the country.

Initially, the Anglia was the most requested car for Panda work, but of late, the much newer Ford Escort has been more and more in demand, so much so that I believe it is destined to be the most common Ford Panda on the road. In fact, it will become a far more common sight than the Ford Motor Company imagined in even their wildest dreams—perhaps not in full-size form, but certainly in model form, because Dinky have just released Model No. 270 Ford Panda Police Car, based on the Ford Escort.

In my opinion, this model gives excellent value for money. Despite retailing, at the time of writing (before the budget !), at the very modest price of 8s. 11d., it is packed with all the action features of most much more expensive models. Not only does it have an opening bonnet covering a highly-detailed " engine," but it also has an opening boot and wide-opening doors which give easy access to the interior of the car. Inside, the model is equipped with full interior fittings including a steering wheel and front seats that tip forward just like those fitted to the real-life car. Windows are, of course, included, the windscreen moulding incorporating rear-view mirror and windscreen wiper representations, while prominently displayed at the front and rear of the body are reproductions of the latest-style number plates—black lettering on a white background at the front and black lettering on a yellow background at the rear.

Being modelled on a police Panda Car, the new Dinky is finished in a realistic colour-scheme of lagoon-blue body and contrasting white doors with the word " POLICE " in large blue letters on each door. Mounted on the roof is the typical wedge-shaped " police " sign which is fitted to nearly all police cars to enable the car to be identified from the front and rear when the signs on the doors cannot be seen. The interior moulding of the model is red.

The heading picture shows the Dinky Panda with all its authentic features in operation.

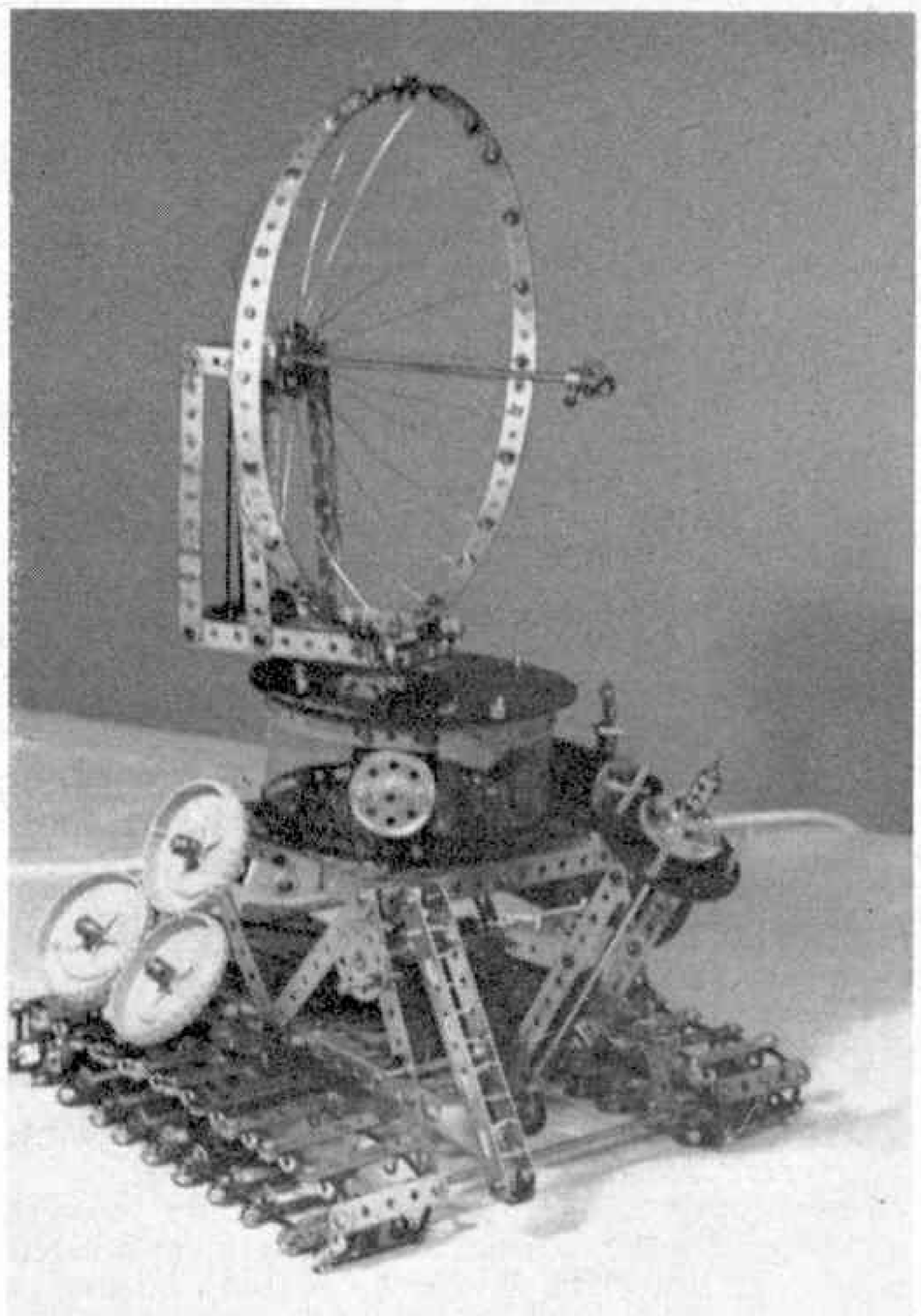
Right: You can see from these two views how realistic the new Dinky looks.

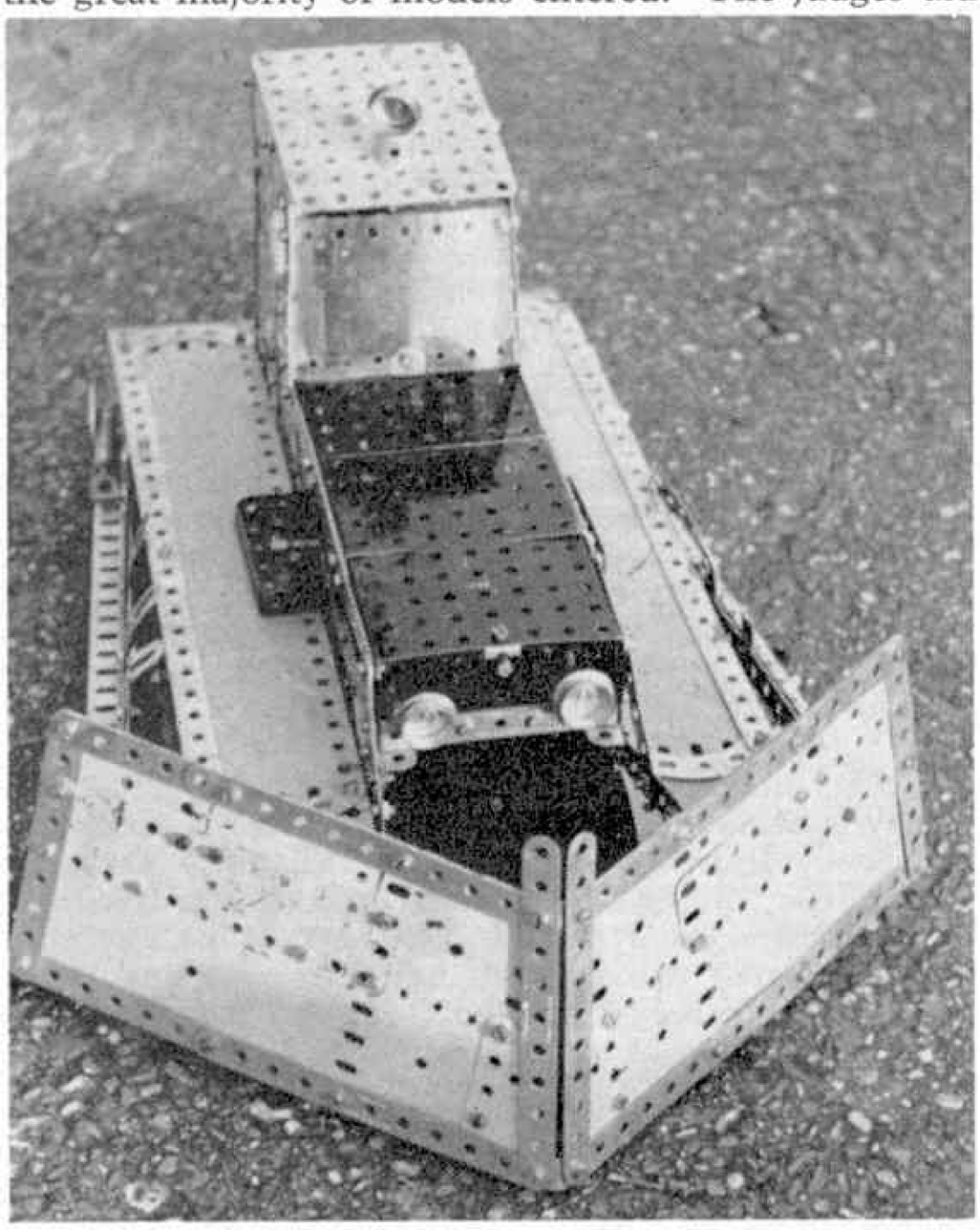
MECCANO CONTEST WINNERS

by Spanner

ENTHUSIASTS THE world over have for some time now been anxiously awaiting the results of our last Meccano Model-building Competition which closed at the beginning of February. Well, the mammoth task of judging the hundreds of entries in the contest was actually completed in March (when this issue of the M.M. was prepared) and all winners were notified by post shortly afterwards. For the interest of unsuccessful entrants, however, we give below a list of the winners, together with some illustrations of winning models, but, first, we would like to make a few general comments on the Contest.

To begin with, the number of entries received was most encouraging, as also was the building standard of the great majority of models entered. The judges did remark, though, that a small, but noticeable group of contestants in both Sections fell into the trap of sacrificing strength and realism to size. This unfortunately kept them out of the winning ranks, because, as we warned when announcing the contest, large, rickety structures invariably take second place to smaller, but stronger, well-built models.





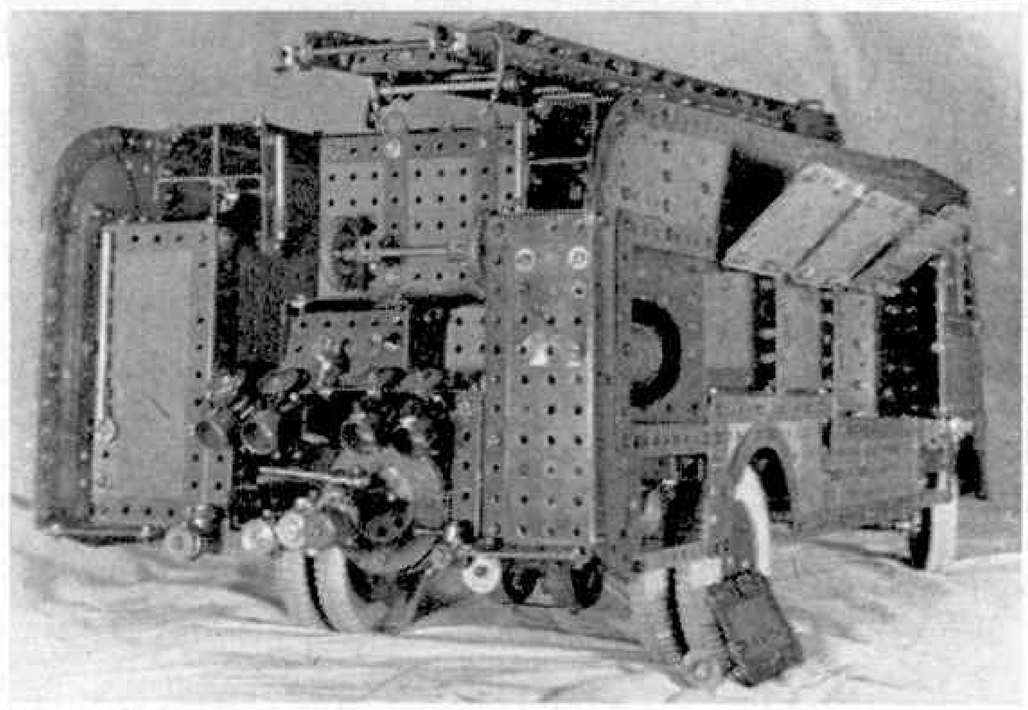
Heading photograph: With a tradition of more than 60 years behind it Meccano is still the system of tomorrow, as is realised by Peter Miller of Points Claire, Quebec Province, Canada. This model of a Moon Exploration Vehicle won him first prize in Section A !

Above: Although not built very often, Snow-Ploughs make good subjects for Meccano models. Martin McGorie of Bodle Street Green, Nr. Hailsham, Sussex, built this example with Outfit 7 plus an Elektrikit—and gained second prize in Section A with it.

Also, it was surprising how many people did not mark their entries correctly, following the instructions given in the Competition announcement. We asked for the name, address and appropriate Section letter to be written on the back of *each* photograph and/or drawing entered, yet this was not done in quite a number of cases. Admittedly, it is only a small point, not sufficiently great to cause disqualification, but it does give the judges a bad impression. Entries without the Section letter or any indication of the competitor's age, by the way, were automatically placed in Section B to avoid the danger of older competitors' entries being judged in the younger Section, thus reducing the chances of younger competitors.

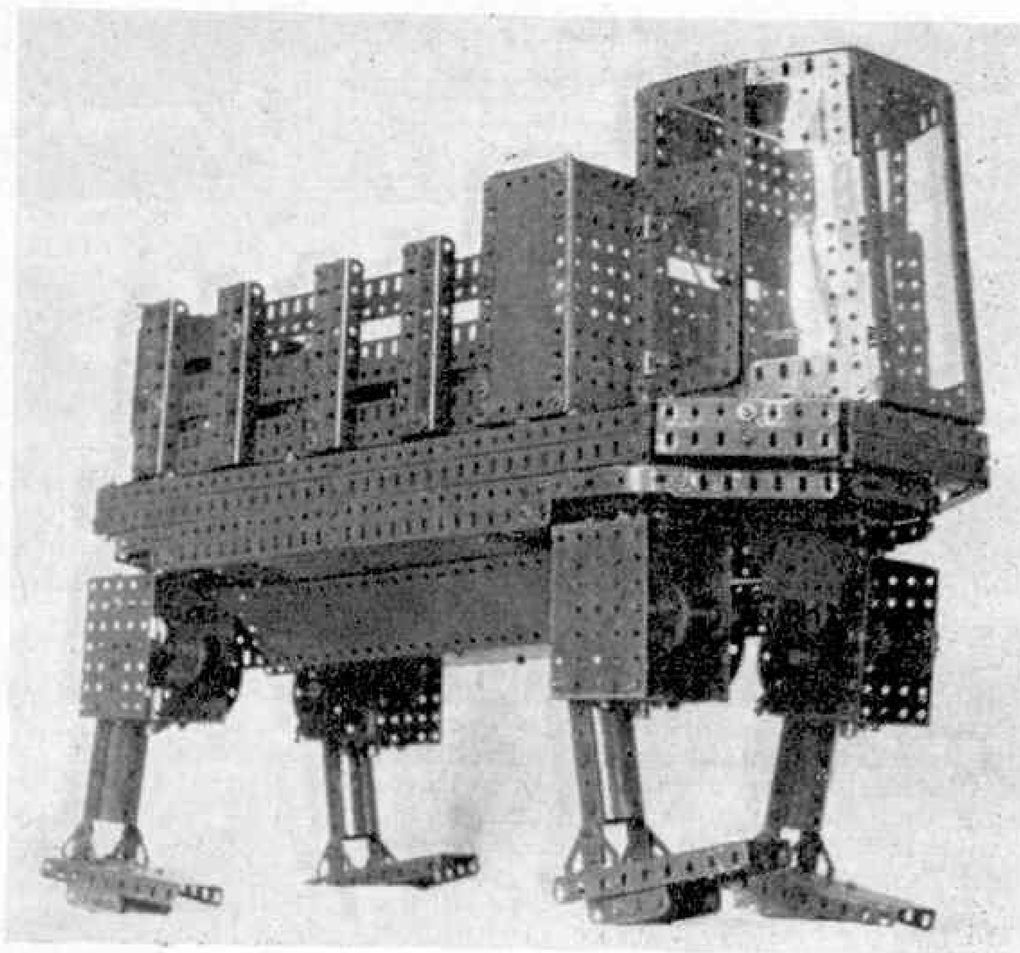
Talking of age, the judges of this latest Contest were particularly impressed by the number of first-class models entered by very young children. Peter Jones of East Grinstead, for example, was only five years old, yet his model netted him a prize in Section A ! In fact, the youngsters seem to have the right idea, generally, judging by the number of uncomplicated, but well-designed and built models entered.

Mind you, a well-built advanced model epitomises the versatility of the Meccano system, and this is where the majority of Section B competitors came into their own. By and large, the models entered in this Section were magnificent and covered every conceivable subject. The judges had an extremely difficult time choosing the thirteen winners and wish to say that those finally chosen were, in their opinjon, the best of a whole host of models that were well up to prize-winning standard. We hope that this will be of some consolation to unsuccessful entrants and wish them better luck in future contests.



Top: This picture shows S. J. Kennedy of Christchurch, New Zealand with a half-life size model of a Violinist which netted him third prize in Section B. Although the model does not actually " play ", it saws away with its bow, moves its fingers, winks and taps its foot !

Above: First Prize in Section B went to G. R. Illingworth of Birmingham for this superb model of an Auxiliary Fire Service Self-propelled Fire Pump based on a Bedford 7-ton chassis. The detailed features shown in this view are only a few of the many incorporated in the model.



Originality of subject was one of the many things taken into account by the judges of the Model-building contest. This model of a U.S. Army Walking Truck was original enough to help H. W. Henry of Strood, Kent, towards a £1.1.0d. prize in Section B.

PRIZE-WINNERS

SECTION A: 1st. P. Miller, P. Quebec, Canada; 2nd. M. McCrorie, Hailsham, Sussex; 3rd. P. Spiers, Walsall, Staffs.

Consolation prizes: R. Thorne, Wells, Somerset; I. Miller, Canada; P. Berry, Bury St. Edmunds, Suffolk; P. Spencer, Romford, Essex; A. Grimshaw, Kettering, Northants; G. Leech, Auckland, New Zealand; M. C. S. Cannell, London N.W.7; R. Rahman, New Delhi-11, India; J. Turton, Romsey, Hants; P. Jones, East Grinstead, Sussex.

SECTION B: 1st. G. R. Illingworth, Birmingham 26; 2nd. C. A. Burnett, Victoria, Australia; 3rd. S. J. Kennedy, Christchurch, New Zealand.

Consolation prizes: J. C. Palmer, Droitwich, Worcs; A. Farina, Milan, Italy; H. Groen, Holland; S. Jones, Chester; I. Potts, Hartlepool, Co. Durham; L. S. Gelernter, London W.14; E. Amirault, Sask., Canada; J. van Dyk, Apeldoorn, Nederland; H. W. Henry, Rochester, Kent; B. R. Kuss, Queensland, Australia.

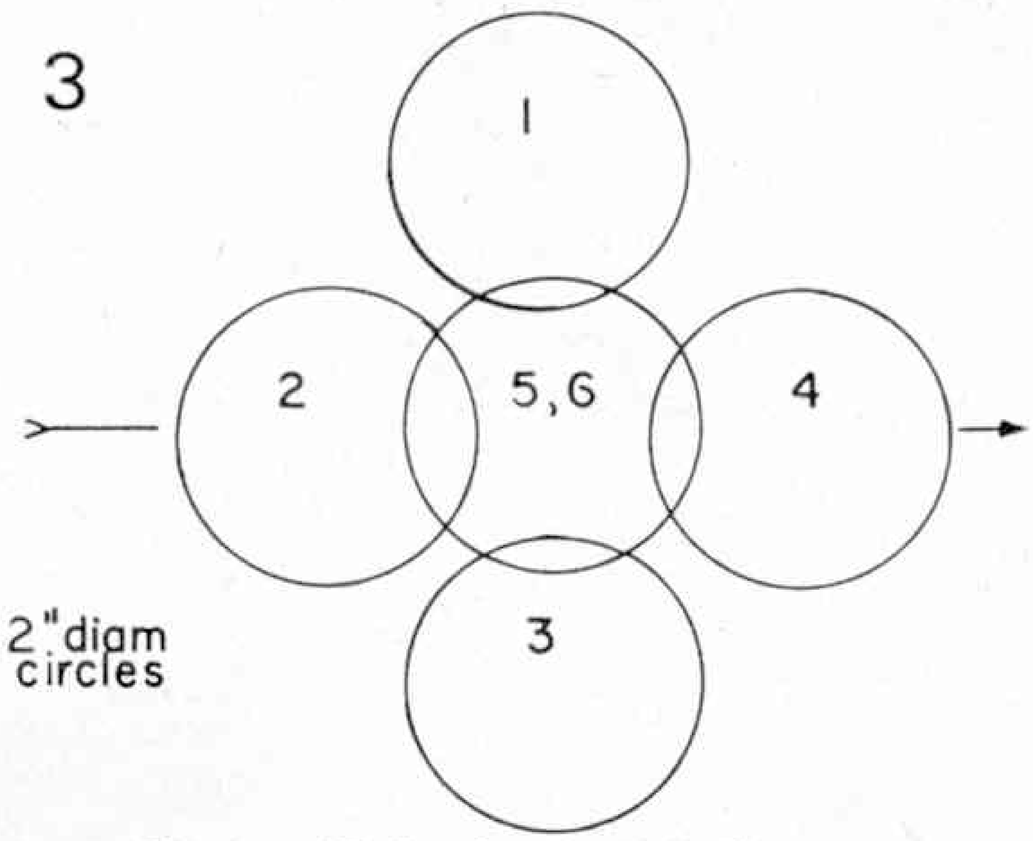
BATTLE continued from page 299

removed and returned to the box or shelf whence he came.

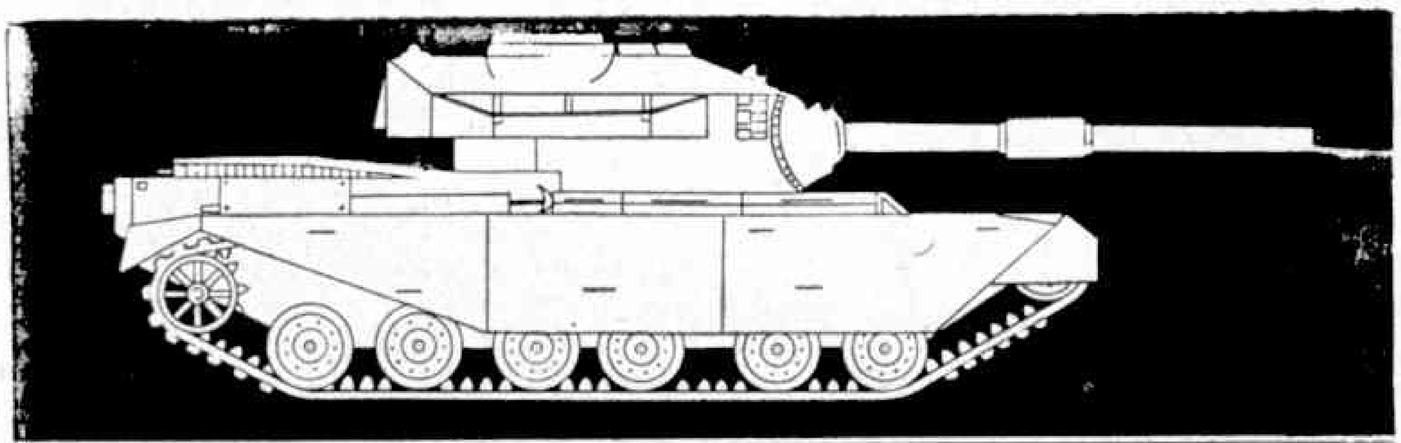
If 1, 2, 3, 4 or 5 are thrown when determining where the mortar bomb landed, although this may be a miss in terms of the intended target, there still might be something to throw for—transport or support troops, and with personnel, 4, 5 or 6 ensure a casualty.

If the 'ranging' shot is unsuccessful—i.e. if a 5 or a 6 is not thrown, this has to be repeated on the next game move or until in fact the range has been established.

Once again, I say that this process refers to firing at targets in direct sight of the mortar crew. Firing under radio control is to come, and one final point has to be thought of—the composition of the mortar crew. Two men should be enough, and again the player can decide whether, if one is knocked out, his place can be taken by an ordinary infantryman. The move of the mortar and crew is as for the heavy machine gun and its attendants—it *cannot* be shifted and fired in the same move. Even an infantry mortar required a fair bit of lugging around and setting up for action.



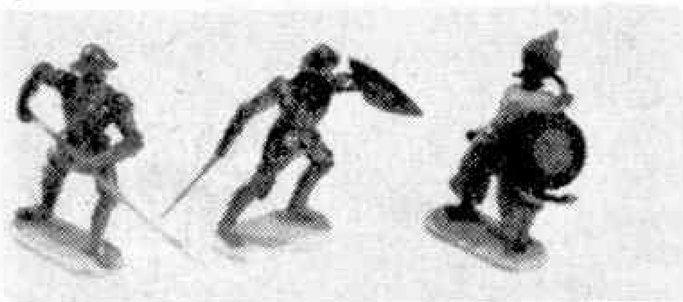
Mortar 'Fall-of-shot' indicator

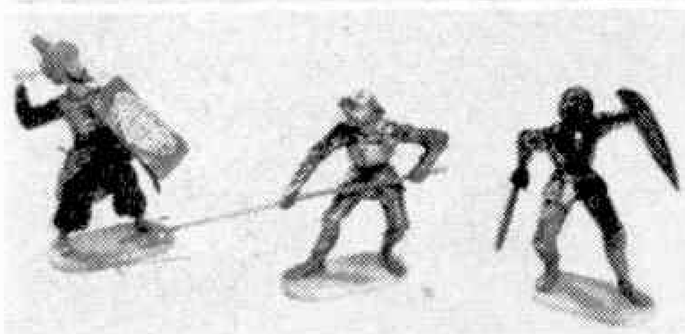


MILITARIA

A REVIEW BY CHARLES GRANT

ALTHOUGH THEY have been about for a considerable number of years it is rather surprising that ELASTOLIN model soldiers are not better known in this country than they are. Produced in Germany they are as good as anything that can be obtained in the plastic miniature line. Years ago, there was a display case showing a large selection of pre-1939 German Army types in the old Royal United Service Institution Museum in Whitehall (now unfortunately taken over by some government department) and, if memory serves me correctly, those were ELASTOLIN, although not of present day plastic material. To-day, of course, they are of very hard plastic, come in two sizes—40 mm. and a much larger type, 65 mm. at least, I should say. They are in rather a limited range of periods, comprising mainly 'ancient' types, plus extremely well modelled cowboys and Indians—not that I complain about the first category, needless to say. The firm—O. & M. Hausser of Neustadt-bei-Coburg—also puts out a well illustrated catalogue.





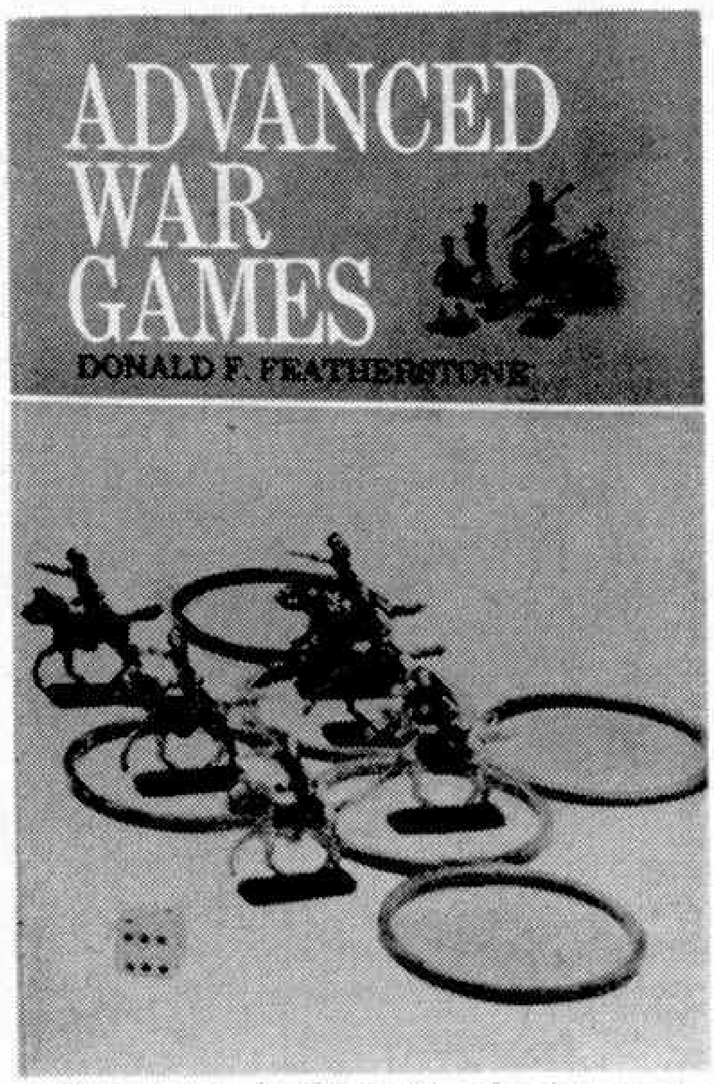
A small selection of mediaeval 40 mm. plastic figures by Elastolin.

Included are numbers of buildings to go with the figures—some of them, notably various types of castles, being really fabulous and mouth-watering items, together with an impresive selection of mediaeval siege weapons and early cannon. As I said, you don't see these figures about very much, but they are obtainable at some big London stores—Hamleys, of Regent Street, and Harrods, Knightsbridge, and they are well worth adding to any collection of model soldiers. The 40 mm. types are around 4/- each, the larger being considerably more. This may sound expensive, but they are first rate models, and for something a little different, I can recommend them.

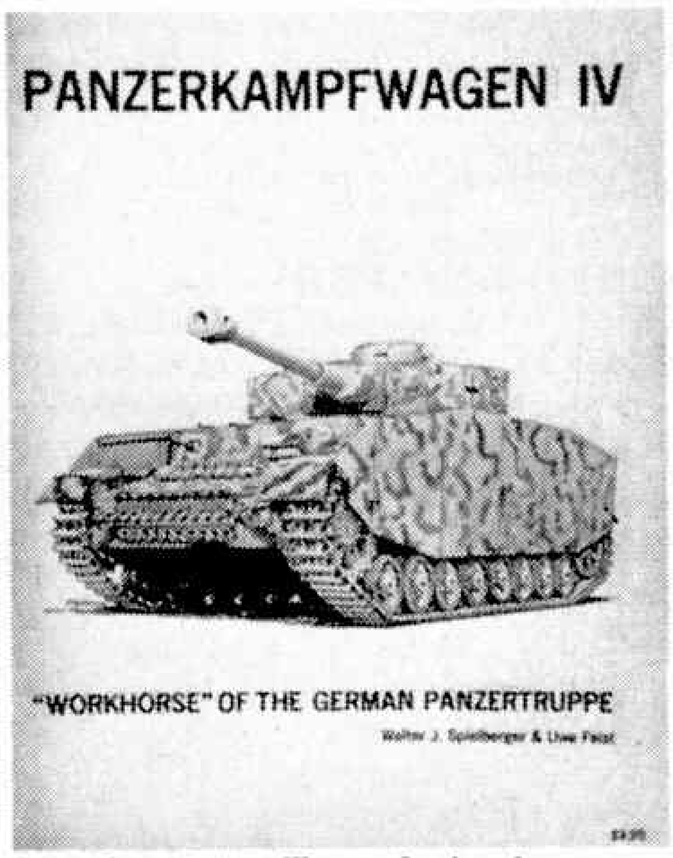
Two excellent illustrated works come from the indefatigable partnership of Walter Spielberger and Uwe Feist (U.K. Agents—Bellona Publications, Badgers Mead, Hawthorn Hill, Bracknell, Berks.).

These are PANZERKAMPFWAGEN IV, described as the 'workhorse' of the German armoured forces, and PANZERKAMPFWAGEN VI, which deals with Tiger tanks I and II, plus the 'King-tiger'. Both are really for the model-maker rather than the wargamer, as they are devoted more to the production history of the different models of the tanks in question rather than to details of their performance or their battle history. Even so, they can be browsed through with profit by anyone with the slightest interest in things military, and they are invaluable for the modeller who wants to add the realistic bits and pieces that always seem to be hung on tanks, spare lengths of track and similar impedimenta. They show, not only the production variants but the most interesting photographs of the tanks they deal with in the most varied conditions of active service. For my own part, I tend to go for the coloured drawings—they are most attractive. Incidentally, one of the line drawings in the "Tiger" volume depicts an idea some German 'boffin' had of using two Tiger chassis to transport a 24 cm. calibre field-gun! The caption says "Only blueprints give evidence of this undertaking". I should think so, too. The price of the books is 34/- each—I think they're worth it.

The latest selection of PAINT-YOUR-OWN POSTCARDS (Rene North, 53 Blackheath Park, London S.E.3) is a wide one, ranging from a set on Polish

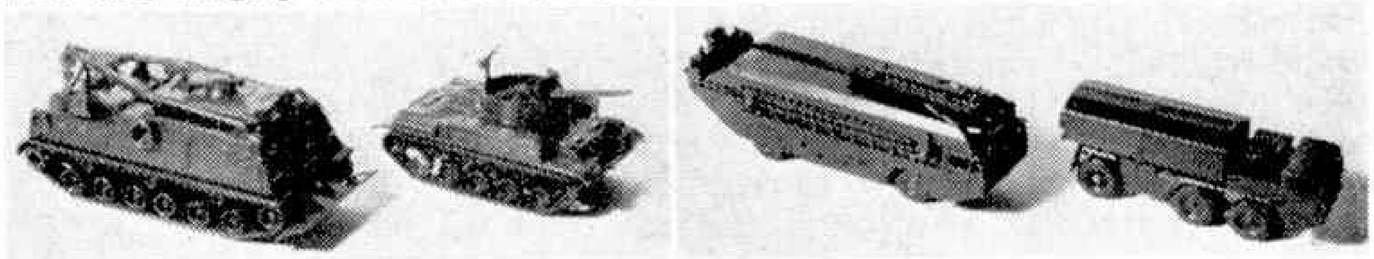


"Chasseurs à Cheval" of 1810-12 to Russian Artillery of 1914, taking in a most useful series on the Royal Scots Greys in the years 1807-15. These cards, which come in sets of eight and cost 6/6 are a most inexpensive way of collecting information on the uniforms one fancies. They are accompanied by colouring instructions and a good coloured illustration can be quite easily produced. From time to time, the uniforms of a complete unit are dealt with, in this series, as well as the Scots Greys, the French 17th Light Infantry being represented.



Opposite page: Two of the latest examples of Rene North's "Paint Your Own Cards." Six cavalrymen of the Napoleonic times.

Below: Four of the splendid Minitanks models—greatly detailed and most realistic.



Set 86 Polish Chasseurs à Cheval 1810-12
No. 2 Trumpeter 1st. Regt.

Some of the recent MINITANKS (U.K. distributors—Model Hobby Products Ltd., Mebro Works, Cuckoo Lane, London N.9) may already be known to enthusiasts but they merit a little re-appraisal nevertheless. I'm thinking chiefly of the larger types, some of which are quite remarkable for the working detail which has been put into them. Probably the most notable is No. 222—the huge, amphibious bridging truck dubbed the "Alligator" and used by U.S. and N.A.T.O. forces. This is probably MINITANKS' best effort, and it has a wealth of movable parts, pontoon and bridge sections and so on, plus even a lifebelt for emergency use. Second only to the "Alligator" is No. 232—the Armoured Recovery Vehicle—but I'm partial myself to the 10-ton FAUN gun carrier (No. 229). It has a tremendously solid and purposeful look about it, and I should think it would be of great use to the wargamer in many a desperate engagement. The most expensive is the "Alligator", retailing at 7/8, but this is not too much, considering its complexity. One small criticism I would make, and this refers to the more complicated models only. I feel that, to avoid accidents, rather more could be given in the way of a description of the model—the tiny moving parts, hinges, and so on, can be easily broken by unenlightened handling. Something like a small sheet of instructions would be a good thing. This, of course, is not required for the simpler vehicles, naturally.

ADVANCED WAR GAMES by Donald F. Featherstone (Stanley Paul and Co. Ltd.—42/-) is an unsatisfactory book. To a considerable extent it appears to be an anthology of the favourite ideas of a number of different wargamers, and some of them—the ideas, I mean—are of an extremely abstruse character. The general impression left by the volume is of an advocacy of complexity for its own sake. I confess that I found it pretty heavy going to read, and the inevitable comparison with the recent CHARGE—HOW TO PLAY WAR-GAMES by Young and Lawford does not redound greatly to the credit of the present book. The photographs are not terribly well chosen, and there is page after page of complicated tables, diagrams, zodiacal-like circles and goodness knows what else. This sort of stuff is likely to frighten off all but the most fanatical wargamer, and certainly any beginner might well wonder what he's getting himself into and no mistake. Nor do I think it will really appeal to the chap who has been wargaming for years and, with a well-tried setup, sticks to it, and doesn't want to know. In a book of this nature much more historical background should be introduced to justify the dicta laid down for rules, and one of the rare mentions of a date of military significance—the Battle of Quebec—gives it as 1749 instead of ten years later. Not my cup of tea, I'm afraid.

HUMBROL Authentic Military Colours—Kits No. 21 and 10—Combat Uniforms and Military Vehicles—are as good as those I have mentioned previously, and the colours are of great use to the wargamer who favours the modern period, whichever army he prefers. A word of warning, though—Authentic Colours are advertised as 'quick drying' and this is no exaggeration at all. They dry almost as quickly as you apply them. The best thing to do, to avoid waste and to prevent deterioration to the contents of the tinlets is to put a small quantity on a spare lid—or any palette sort of thing—and seal the tin up right speedily. This is important, particularly if you are the sort of painter who likes to surround himself with a shoal of open tins—all of them hardening away before your eyes because you haven't put the lids on after use.

From BELLONA PUBLICATIONS LTD., (Badgers Mead, Hawthorn Hill, Bracknell, Berks.), comes a booklet which could be of great use to the military enthusiast on holiday this summer in this country. This is A GUIDE TO MILITARY MUSEUMS by T. Wise, and it deals succinctly with literally dozens of regimental and other military museums in every part of Great Britain, including big ones like the National Army Museum, Camberley, the Imperial War Museum, London and the Scottish United Service Museum in Edinburgh Castle, together with a host of smaller and lesser known ones. This little book is the obvious product of much labour and research and is well worth its cost of 5/-. You'll need it if you want to check on the local military museum at your holiday spot—it includes times of opening, what the museum has, and so on. Most useful, indeed.

Set 89 The Royal Scots Greys 1815
No. 6 Sergeant

The range of military transfers produced by the ALMARK PUBLISHING CO., (104-106 Watling Avenue, Edgware, Middlesex) is a formidable and exhaustive one. It's simply not possible to list them all, but everything for the battlegamer in the modern period is here, whichever of the powers he favours for his armoured units—Britain, Germany and the U.S. particularly. Emphasis is on the first, of course, but one can always 'borrow' some favourite device and incorporate it in one's own army ensignia. Apart from swastikas—I never knew they came in such variety—you have all sorts of aircraft roundels, army divisional signs, Afrika Korps palms and just plain groups of letters and numbers. For the chap who is not too handy at painting numbers and such like on his vehicles and tanks—like me, for instance—Almark transfer sheets are of the greatest benefit. At 3/- per sheet they can be recommended.

Among the many attractive items in the latest book list from K. G. WYNN (42 Esher Drive, Littlehampton, Sussex) is one—it is an advance announcement, actually—of a new range of postcards, in full colour, of British uniforms from 1660 to 1900, all reproductions of oil paintings by Charles C. Stadden. Mr. Stadden is, of course, widely known as one of the foremost creators of model soldiers ("Norman Newton" figures) and I know his art work is also of the highest class in this line. The new series—of which details are promised in Mr. Wynn's next list—should be worth seeing.

LOST WAX continued from page 283

be made, it has serious drawbacks in that it is fragile and continues to shrink and distort after removal from the die. It is this property which governs the final accuracy of the component. Of the methods used to overcome distortion, the most successful practice is to make up a plaster receiver die of the same form as the original die, and to place the pattern in this while it cools. The wax in the heavier sections of the die then tends to cool more slowly than in the thinner sections. To offset this, pieces of wax are inserted into the die when it is being assembled to ensure that the amount of hot wax entering each section is roughly equal. The hot wax fuses with the inserts which then form an integral part of the pattern.

As mentioned, a large variety of complicated components for use in jet engines can be most economically produced by this method of casting. Benvenuto Cellini conjured up visions by casting even large objects in metal resembling some of the Greek Gods. Little did he think that his method would prove so helpful centuries later, in the jet aeroplane age.

SCOUTS ON STAMPS

by James A. Mackay

ONE OF the most popular themes in stamp collecting is that devoted to Scouting. The earliest stamps in this theme go back a surprisingly long way—in fact they appeared several years before the Movement was founded! During the siege of Mafeking in the Boer War, Colonel Baden-Powell organised the boys of the beleaguered town into a cadet force whose "sergeant major" was Warner Goodyear. Part of the boys' duties consisted of carrying the mail so it was appropriate that the penny stamp produced during the siege should depict young Goodyear on a bicycle. The 3d stamp portrayed the garrison commander, Colonel (later Lord) Baden-Powell himself. Stamp collectors regard these two stamps as the forerunners in a collection of Scout stamps. It is interesting to note that among the earliest stamps in this theme were two produced by the Boy Scouts of Czechoslovakia in 1918 when they organised the country's first postal service.

Although many stamps have been issued for Scouting in the past sixty years most of them are connected with Jamborees. The first of these international events was staged in the Old Deer Park at Richmond in July 1920. Scouts of 26 nations took part but there was no philatelic commemoration. The second Jamboree, held at Copenhagen in 1924, fared little better, though a souvenir postcard was produced on that occasion.

Five years elapsed before the third Jamboree was held, to commemorate the Movement's coming-of-age in 1929. Appropriately, it was held in England, birthplace of scouting. A total of 50,000 Scouts took part at Arrowe Park, near Birkenhead and 42 countries were represented. Because of the large numbers of Scouts housed in and around Arrowe Park, the G.P.O. laid on postal facilities which included a special postmark, now eagerly sought after by collectors.

Hungary, the host to the fourth Jamboree in 1933, produced the first Jamboree stamps. Although only 9,000 Scouts from 40 countries took part a set of five stamps, depicting the White Stag of Hungary, was released. Four years later the venue for the fifth Jamboree was Vogelenzang near Haarlem in the Netherlands. Some 28,000 Scouts from 53 countries took part in this, the last Jamboree before the war and the last in which Baden-Powell took part. The Netherlands issued three stamps featuring the Scout badge, flags and a drum, and a statue of Hermes respectively. For the first time a country which was the host issued stamps to celebrate the Jamboree; the Dutch East Indies produced two stamps showing the Jamboree emblem.

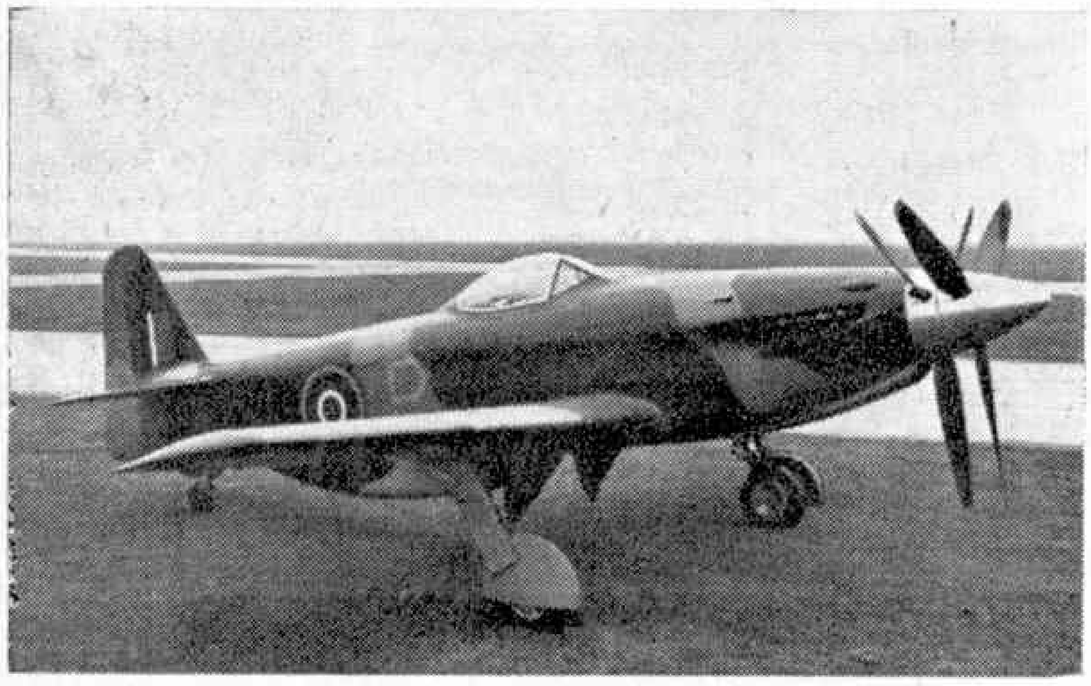
The sixth Jamboree was not held till 1947, on account of the war, but 40,000 Scouts from 70 countries participated in the Jamboree de la Paix at Moisson. France issued a 5frs. stamp showing the Jamboree emblem, a fleur-de-lis and carrick-bend knot. In 1951 Austria was the venue for the seventh Jamboree. An attractive 1s. stamp marked the occasion. This stamp is technically interesting since three different processes were combined in its production—recess for the frame, photogravure for the fleur-de-lis emblem and typography for the shield and background.

The first world Jamboree to be held outside Europe was staged at Niagara-on-the-Lake, Canada in 1955. A 5c. stamp showing the Scout badge linking the hemispheres was issued on this occasion. The normal four-yearly cycle was broken to celebrate the golden jubilee of the Movement and the centenary of B-P's birth. Seventeen countries, from Bahrain to the United Kingdom. The latter released a set of three stamps featuring a rolling hitch encircling the Queen's portrait and the Scout badge (2½d), swallows in flight, symbolising scouts coming from all parts of the globe (4d), and a compass encircling the globe (1s 3d).

The Jubilee Jamboree had departed from the normal sequence so the tenth Jamboree was held in 1959 as scheduled, Makiling Park in Manila, Philippines being the venue. The host coutry issued a set of five stamps while Indonesia released a set of six. The eleventh Jamboree was held at Marathon in 1963. Greece issued five stamps for the occasion. One stamp portrayed Lord Baden-Powell while another reproduced a watercolour painting by him, entitled "Athens at Dawn". Cyprus, Nigeria, the Maldive Islands and Dubai were among the other countries which issued stamps for the event. The twelfth Jamboree was held in August 1967 at Farragut State Park, Idaho and was attended by Scouts from about a hundred countries. The United States issued a 6c. postcard but no adhesive stamps. This deficiency was, however, amply made up by stamps from many other countries ranging from Bhutan (in the Himalayas, to Dahomey (in equatorial Africa).

Apart from the great world Jamborees there are numerous other meetings of a more localised nature and many of these have had stamps issued in their honour. The most recent of these was the Fifth National Boy Scout Jamboree held at Christchurch, New Zealand to mark the diamond jubilee of Scouting in that country. The Cook Islands sent a contingent to the Jamboree, held in January and also issued a handsome set of six stamps showing various Scout activities. The top value, 30c. portrayed Lord Baden-Powell against a view of Rarotonga which he visited in 1935.

AEROMODELLER



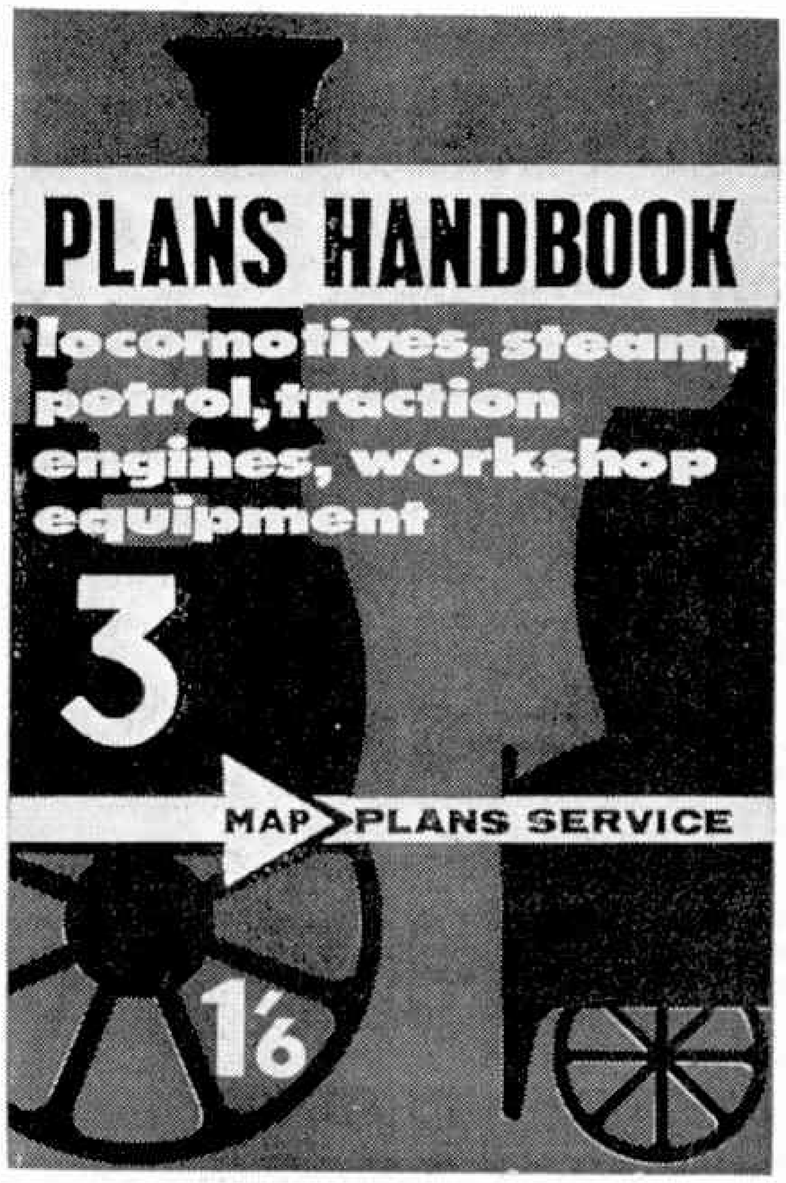
Full size plans for a novice's rubber driven model, scale design of the Blackburn B2 lightplane, plans for a contest winning 'combat' control-liner plus scale drawings of the sleek Martin-Baker M.B.5 (pictured above) are part of May *Aeromodeller*, out 18th April. Special features include Air-to-Air photography of radio controlled models, the French Winter Cup international event, and ever popular Gadget review. In fact all the usual features added makes this yet another great issue not to be missed.

3rd FRIDAY Monthly 2/6

SHIPS of London River

This book is a collection of 50 photographs of a variety of vessels regularly seen on the Thames. The range of craft covered varies from barges and launches to liners and large cargo ships, and each photograph is accompanied by a caption giving a brief description of the particular ship.

The popularity of other similar books in our range covering photographs of traction engines, locomotives, etc. suggests that ship-lovers will welcome a book of this type. 60 pages, size 7¼ in. x 4¾ in., wire stitched with card cover. **5/-**



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Sale. M.M.'s, most issues 1942-1960. Good condition. Offers for any or all to—J. Kernahan, 10 Regwood Street, Glasgow, S.1. R

A Complete Range of obsolete (except 167) and new Meccano parts and motors. Current items at about half list price. Also M.M.'s from 1930 to date in varying condition in any quantity. Will accept certain items of H/D 2-rail rolling stock instead of cash if required. Send list of requirements and/or offers, to—D. N. Mackay, 8 Linton Terrace, Burghmuir, Perth, Scotland. R

Obsolete Dinky Toys. S.A.E. for wants. Also two volumes "Wonders of World Engineering" now obsolete. Offers wanted.—J. Wyndham, 41 Sunnyside, Stanstead, Essex. R

Gauge O mostly Hornby; pre-war, post-war, interesting stock, accessories, plenty track. All cheap to clear. Send S.A.E.—38, Minster Road, Oxford. R

Die-cast Latest from Dugu, Norev, (Moyen Age), also Tekno, Gama, Rio, Mercury. Edil, Wiking, soon Politoys (E) and others, also obsolete Dinky, Corgi, Spot-on etc. S.A.E.—T. I. Jeffrey, Pitmullen House, Nr. St. Andrews, Fife, Scotland. R

M.M.'s 1948 Bound, 1949 June missing, 1950, 1951 complete, 1952 August missing. Good condition.—Telephone 051-342-3300. R

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Large Selection of Meccano spare parts, motors for sale. Also large Elektrikit. Send S.A.E. for list.—Campbell, 9 Marmion Street, Tamworth, Staffs. R

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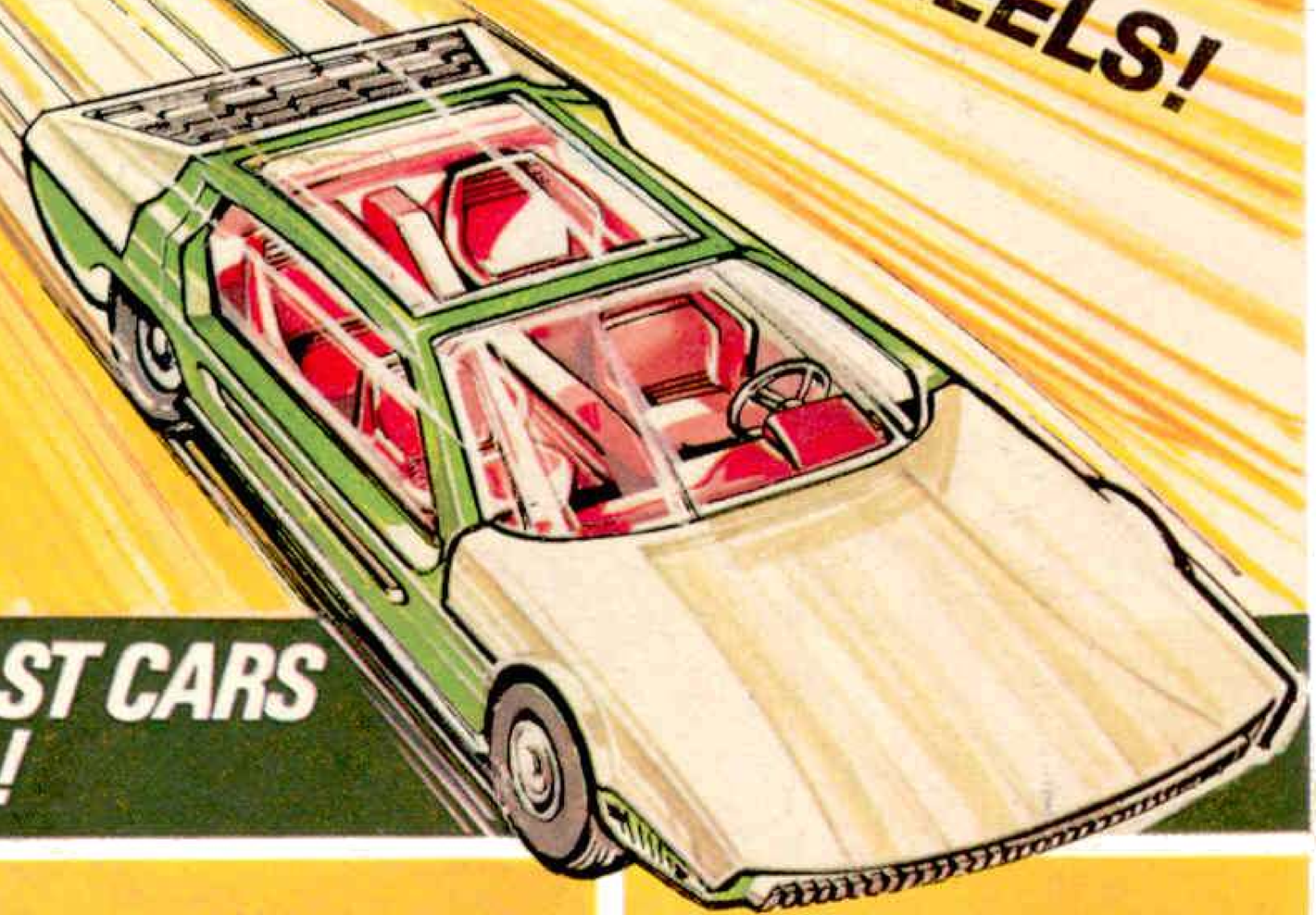

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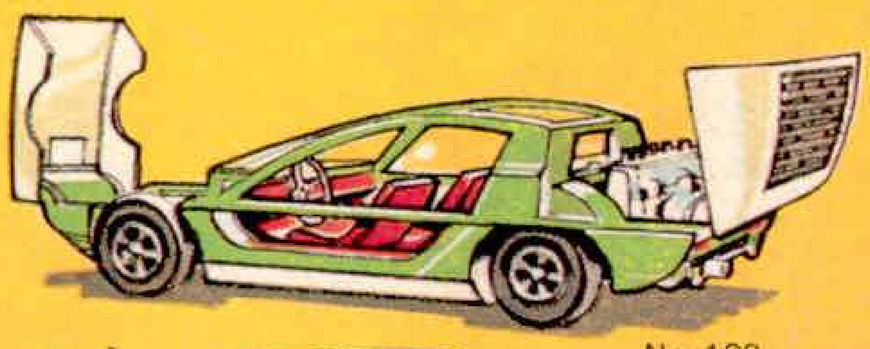

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