BOMBING BY AIRCRAFT

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PRACTICAL MECHANICS

NOVEMBER 1940

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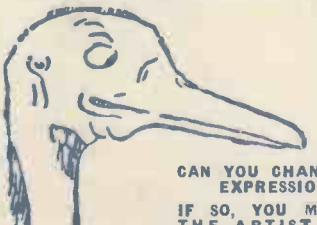

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PRACTICAL MECHANICS

Owing to the paper shortage "The Cyclist" is temporarily incorporated

Editor : F. J. CAMM

VOL. VIII. NOVEMBER, 1940. No. 86

The Falling Bomb

THERE has been considerable discussion in the newspapers concerning bombs and shells. Most of these arguments evince a complete lack of knowledge of first principles. For example, it is stated that if you hear the whine of a falling bomb, then you are comparatively safe from a direct hit, whilst another argument revolves round the question as to how far must an aeroplane be from its target before it releases a bomb or bombs. In the case of the falling bomb, may I inform my readers that they are by no means safe from a direct hit if they hear its whine. It is quite possible for you to hear the bomb which hits you, and it is certainly possible for you to hear a shell which hits you. The argument seems to be that as the speed of sound is about 770 miles per hour at sea level, a shell fired from a gun cannot be heard because it travels at a much higher speed than that of sound; but a shell is in no different category to a bomb, for its velocity will have considerably fallen by the time it lands, and it is even possible for its speed to be much less than that of a bomb dropped from an aeroplane. A bomb released from an aeroplane has an initial velocity equal to that of the aeroplane, but from the moment it is released it is subject to the acceleration to earth due to gravity, which, of course, is 32.2 ft. per second per second. Its speed in a horizontal direction is therefore gradually dropping, and thus the aeroplane which released the bomb would pass over the target before the bomb hit it. Some of the newspaper articles have affected to give figures indicating how far from its target an aeroplane would have to release its bomb from an altitude of, say, 10,000 ft. and 20,000 ft. when flying at 200 miles per hour. These calculations pre-suppose that the aeroplane would be flying on a horizontal keel, and thus the calculations are not only meaningless, but grossly inaccurate, for a pilot could put his aeroplane into a shallow dive, a steep dive, and could even release the bomb whilst climbing, in order to ensure that from a given distance his bomb reaches the target.

FAIR COMMENT
By the Editor

Seeking a New Job

THERE seems to be a common belief that those engaged in reserved occupations may not leave their present employment in order to find another job. This is not so, for there is no law or regulation which prevents a man from changing his employment. There is, however, the recent regulation which insists that employers must only engage staff through the local employment exchanges; therefore, applications for jobs can only be made through employment exchanges. Employers naturally are raising objections to staff changes when the Government is pressing them to accelerate output, but equally a man engaged on work which does not employ his abilities to the best advantage is entitled to seek and to take another job. In any case, the employer has no power to retain a workman against his will. If a man is engaged, say, on drilling, when he is capable of tool-making, he is entitled to seek a job as a toolmaker for drilling is unskilled work and the country is more in need of toolmakers.

Inventions

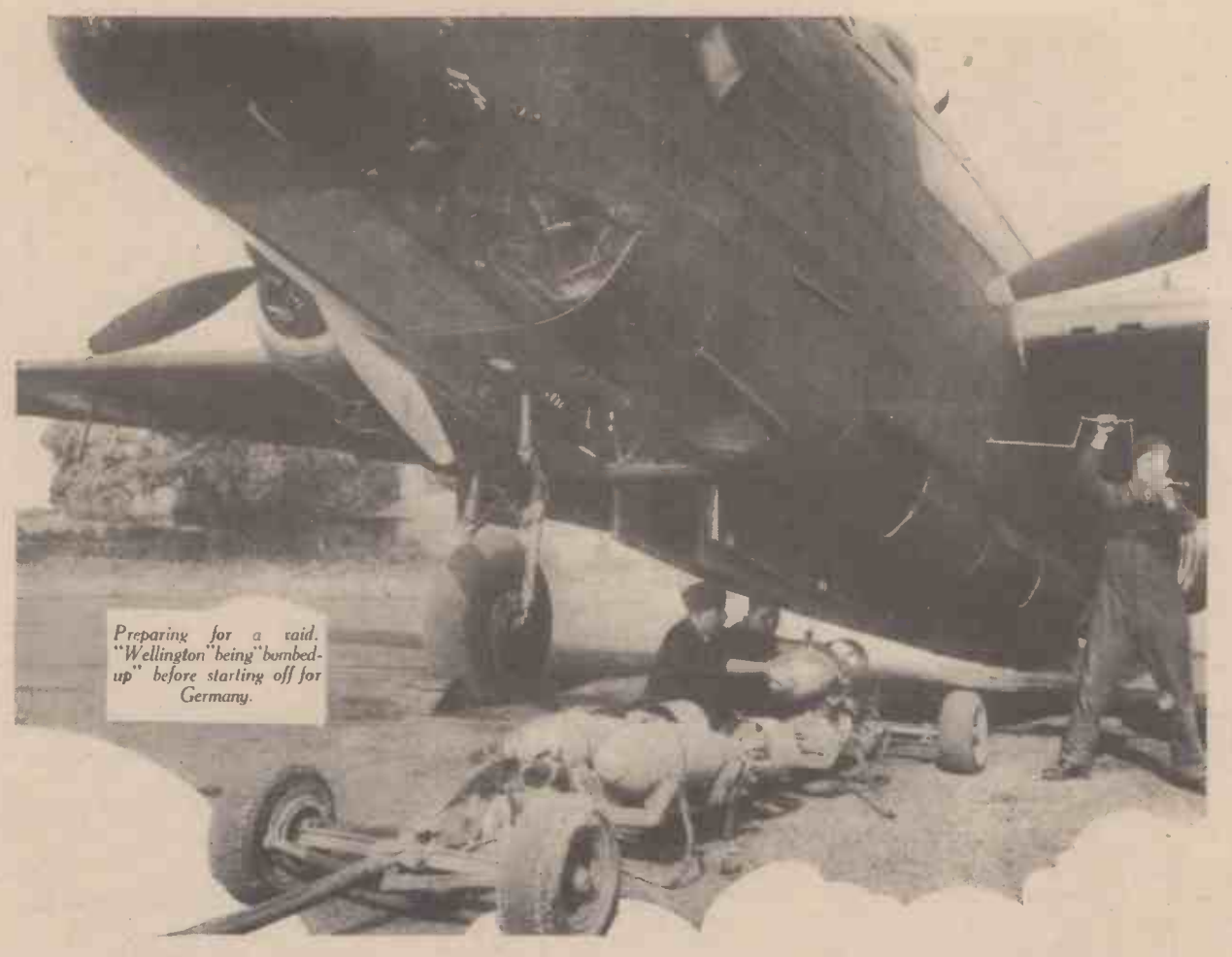
LAST month I made the suggestion that the Government should form a Ministry of Ideas and Inventions, which would act as a clearing house to investigate ideas and inventions to further our war effort, to aid our export drive, and to help industry when peace returns. In America, of course, there is the Mellon Institute, which was formed in 1913 and has carried out investigation work for the inventor and put, through practical experiment, over 400 inventions right that started in commerce wrong. They now work in a building which is larger than Buckingham Palace. Canada has just formed an Inventions Board to deal with the growing volume of inventions and suggestions intended to further Canada's war effort. The establishment of this board by the Canadian Government provides a means whereby ideas and inventions submitted by citizens of Canada and abroad can be carefully examined and promising proposals submitted to the proper authorities. In this country the inventor is left to the tortuous and discouraging system of writing to various Government departments who take months to investigate the matter. The Government should immediately form the ministry we have suggested.

A New Book

THERE has recently been published from the offices of this journal an important new book entitled "Gears and Gear Cutting." It deals with types, cutting methods and terms, bevel gears, worm gears, gear generation, gear-wheel forms, epicyclic gear trains, methods of mounting, measuring gears, hobs, end mills, generating cutters, the load capacity of gears, the efficiency of gears, and useful formulæ relating to gears. The book is well indexed, contains over 100 illustrations in half-tone and line, and costs 5s., by post 5s. 6d., from the Book Department, George Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2.

Recent Publications

OTHER books recently issued from this office are the "Radio Engineers' Vest Pocket Book," 3s. 6d., by post 3s. 10d.; "Diesel Vehicles: Maintenance, Operation and Repair," 5s., by post 5s. 6d.; "The Superhet Manual," 5s., by post 5s. 6d.; "The Short-Wave Manual," 5s., by post 5s. 6d.; "Watches: Adjustment and Repair," 6s., by post 6s. 6d.; "Motor Car Principles and Practice," 3s. 6d., by post 4s.; "The Engineers' Manual," 5s., by post 5s. 6d.; "Dictionary of Metals and Alloys," 5s., by post 5s. 6d.; and the new edition of "Workshop Calculations, Tables and Formulæ," 3s. 6d., by post 3s. 10d.



Preparing for a raid. "Wellington" being "bombed-up" before starting off for Germany.

Bombing by Aircraft

The Technique of Bombing and Types of Bombing Planes Used by the R.A.F. and other Countries

NIGHTLY, bombing 'planes of the R.A.F. attack Nazi Germany through her dockyards, munition works and oil dumps which they bomb with unfailing accuracy. Oxygen apparatus now makes it possible for bombing airmen to fly at a great height whilst over enemy territory and the danger of being hit by A.A. fire is considerably minimised. Before considering the actual bombing, let us study the machines which carry out the work. Firstly there is the Vickers "Wellington" long-range bomber which was originally fitted with two 980 h.p. Bristol "Pegasus" engines, but now these machines have been given an even finer performance with new-type engines. Two liquid-cooled Rolls-Royce "Merlins"—the type fitted in the famous Hurricane and Spitfire fighters—replace the radial air-cooled types previously fitted. Whilst the improved performance figures are secret the several hundred extra horsepower may be assumed to add considerably to the former speed of around 260 m.p.h. It is heavily armed against attack by fighter aircraft.

Another popular type is the U.S.A. Lockheed Hudson bomber which has been flown across the Atlantic for use by the R.A.F. This machine has a top speed of about 260 m.p.h. and a ceiling of 28,000 ft. Three Browning guns are carried, one fitted in the nose and the other two in the tail.

Bomber Types

Other types of machine used extensively by the R.A.F. are the Handley-Page "Harrow" heavy bomber with a top speed of 190 m.p.h., the Handley-Page "Hampden" medium bomber with a top speed of 265 m.p.h., and the Armstrong-Whitworth "Whitley" bomber with a top speed of 215 m.p.h.

Next comes the celebrated Bristol "Blenheim," of which there are three types. The Bristol "Blenheim" Mark I medium bomber, fitted with two 840 h.p. Bristol "Mercury" engines and capable of a top speed of 280 m.p.h.; the Bristol "Blenheim" Mark IV long-range fighter bomber, which has a maximum speed of 295 m.p.h. and is powered with two 900 h.p. Bristol "Mercury" engines, and the Bristol "Beaufort," which is a modern successor to the "Blenheim." It is powered with two 1,065 h.p. Bristol "Taurus" engines, has a larger wing-span than the "Blenheim" I and carries a crew of three. This machine was designed as a reconnaissance bomber and torpedo dropper. The "Blenheims" are used as intercepter fighters as well as bombers.

"Battleships" of the Air

A number of new bombing 'planes will shortly be coming into service with the R.A.F. which will provide a first-class shock for the Germans. Although they are on the secret list, it is learned that they are twice as powerful in nearly every respect to those already in use. They are surprisingly fast despite their huge size, and a pilot who has handled one stated that they can be heeled over on one wing tip in the air with almost the ease of a Hurricane fighter. They will be called Britain's "battleships of the air" and they are almost impregnable to ordinary defence fire. Whilst on the subject of new bombers, America has been carrying out tests on the Wright Field at Dayton, Ohio, with new giant four-engined stratosphere bombers which are said to be almost immune from present anti-aircraft defences. Although details are withheld by the United

States War Department, it is known that these bombers are designed to fly eight to ten miles above the earth in the stratosphere.

The normal effective range of anti-aircraft guns is said by United States military experts to be about 15,000 ft., because the shell must be timed to explode within a small radius of the target for it to be effective. These stratosphere bombers, army officials declare, will be able to destroy targets with deadly accuracy, even from the higher ranges, because of the secret gyroscope bomb sight. The new bombers will be equipped with super-charged air cabins which will enable the crews to stand the thinner air without wearing cumbersome individual oxygen masks. One of these bombers has been known to reach a height of 36,000 ft. which is an official record for four-engined craft.

The " Briefing Room "

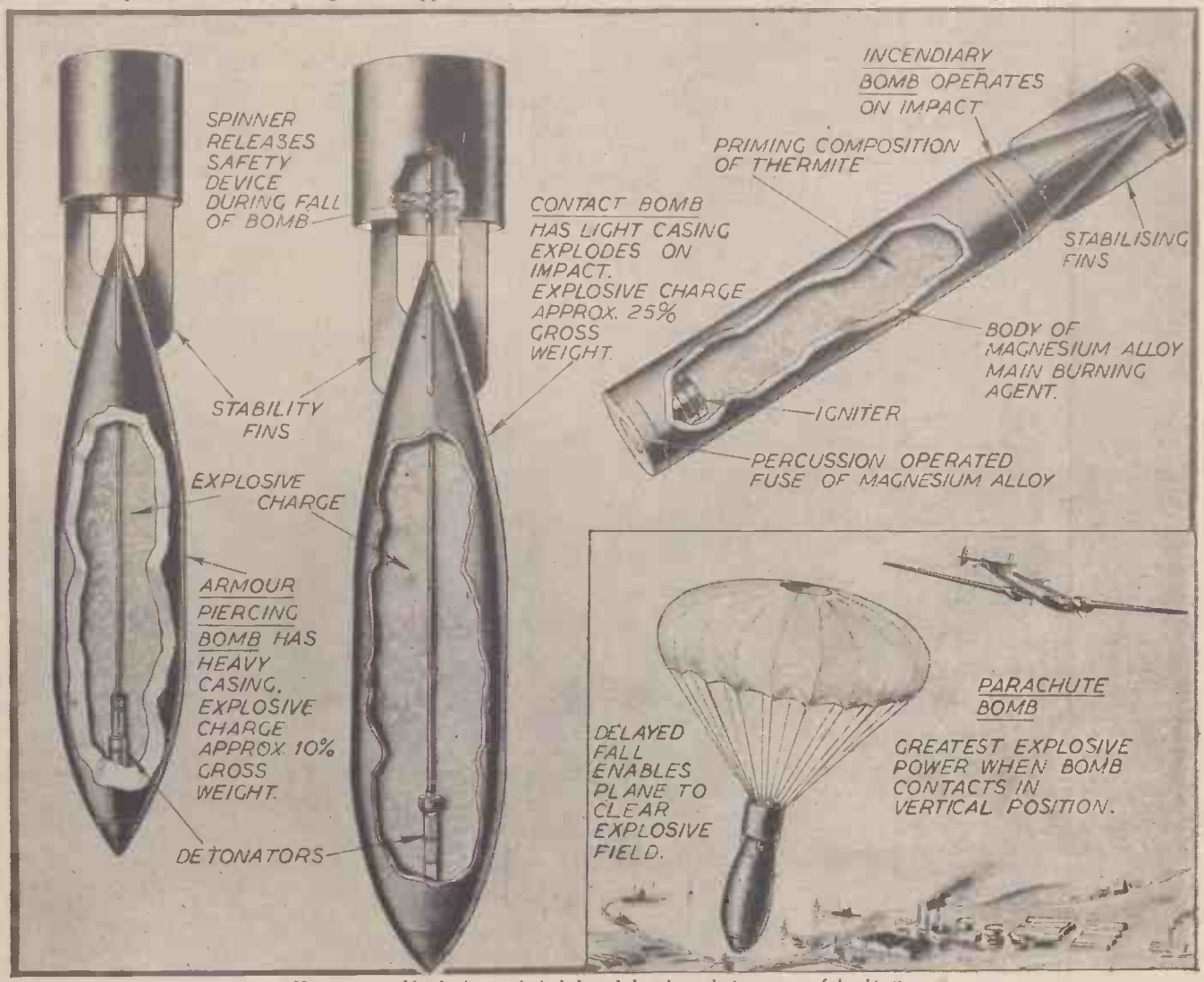
Before starting out to bomb an objective the pilots and navigators of the 'planes taking part in the raid visit the " briefing room " which is part of every bomber command aerodrome. Here they sit in rows, whilst in front of them are a table and chair. On the wall behind the table is a screen, and at the far end of the room is a magic lantern. As soon as the crews have taken their places the Intelligence Officer mounts the platform and explains in great detail the object of the forthcoming raid. Then the room is darkened, and slides are thrown upon the screen, details of the pictures being pointed out by the Intelligence Officer. Photographs may show an oil refinery, an enemy aerodrome, a hydrogenation plant, a section of the Kiel Canal or an enemy warship. All the men pay the utmost attention to what is being said, for the difference between success and failure may hang upon what they are being told. Each pilot and navigator has already been supplied with a photograph of his target, and on this he writes notes which may help him later. At the end of the briefing the Intelligence Officer asks for questions. Some he can answer personally. Others concern the practical side of the operation and are answered by the Station Commander, who has taken his place at the back of the room. Many points are discussed, including positions of balloon barrages which might interfere with the success of the operation. Thus, when the crews set out on their raid they do so with their natural confidence reinforced by the precise and expert knowledge that has been placed at their disposal.

Over the Objective

Once the 'plane is over its objective, the man at the bomb sights comes into action. On this man's calculations depends the success of the raid. Lying full length on the floor of the 'plane he adjusts his sighting apparatus and watches the objective come slowly into position through the safety-glass window below him. He is in constant communication with the pilot, and the pilot follows his directions implicitly. Various factors must then be calculated such as the height and speed of the 'plane, wind, etc., and as soon as the target comes into the sights a button is pressed and the bomb or bombs released. A bombing 'plane can carry nearly a ton of bombs and these are distributed under the wings or on either side of the fuselage. A bomb falling from a 'plane gathers terrific momentum as it descends, and a bomb of average size falling from a height of 12,000 ft. would be travelling at a speed of 700 m.p.h. when it hit the ground.

There are various methods of releasing bombs, and if the target covers a considerable area, the 'planes fly over it in formation and on a given signal from the leader release their bombs. This is known as " pattern bombing." Or again, they may fly one behind the other and release their bombs as each one passes over the objective. We now come to dive-bombing and in this case the pilot of the aircraft " aims " his machine at the target and releases his bombs as he pulls out of the dive. Medium bombers are generally used for this last form of attack.

As will be seen from the illustrations accompanying this article, there are different types of bombs used depending largely on the importance of the objective. Incendiary or fire bombs for targets such as oil dumps,



Various types of bomb, the use of which depends largely on the importance of the objective.

etc., and the very large bombs are generally used for important military objectives.

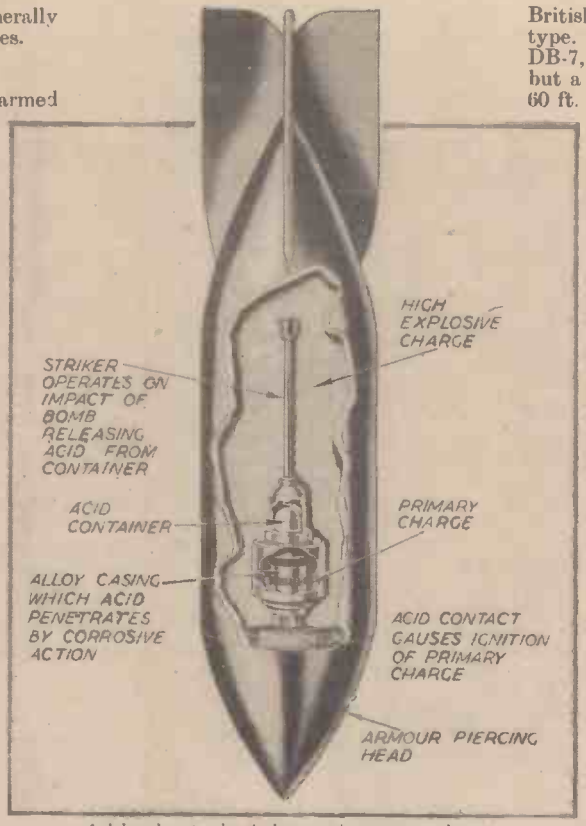
Defending the Bomber

All our bombing 'planes are heavily armed against attack from enemy fighter aircraft which generally attack the bomber from the rear. Thus it is the tail gunner's job to keep an unceasing watch over the entire area within his view to the rear of the aircraft, and to report any incident such as anti-aircraft fire from the ground and to take immediate action to deal with any hostile aircraft. When the tail gunner enters the rear turret at the beginning of a raid, first he puts his parachute handy, locks the turret doors and prepares for action. He then rotates his turret to see that it is moving freely, sees to his guns and sights, his lighting system and spare bulbs, and checks his reserve ammunition. He plugs in his intercommunication set and speaks to the captain; then, having seen that all is well, he settles down to keep watch, marking each section of the sky to right and left, above and below, just as if it were a sector of the countryside.

Once clear of the English coast he asks permission to fire a short burst to try his guns. Soon the aircraft will be over enemy territory where enemy fighters may be met, though in point of fact they seldom trouble the bombers at night.

But the big moment, the moment for which all the rear-gunner's training has prepared him and in which the rest of the crew will depend upon him—comes when an attacking aircraft approaches within range of his powerful Browning guns. If the bomber is flying alone the rear gunner will have to deal with the attack himself if it is made from the stern. But when a number of bombers are flying in formation any attackers would have to meet their concentrated fire. In any case the rear gunner is, and always must be, ready for immediate action. The accompanying table shows how famous British types compare in armament with similar Nazi types.

British Bombers.	*German Bombers.*
Handley-Page Hampden, 2 forward guns, 4 rear guns.	Dornier 17, 2 fixed guns, 2 moveable guns.
Armstrong-Whitworth Whitley, 1 forward gun, 4 rear guns.	Heinkel 111, 3 movable guns.
Vickers Wellington, 1 forward gun, 4 rear guns.	Junkers 88, 3 gun positions.



A delayed action bomb showing the timing mechanism.

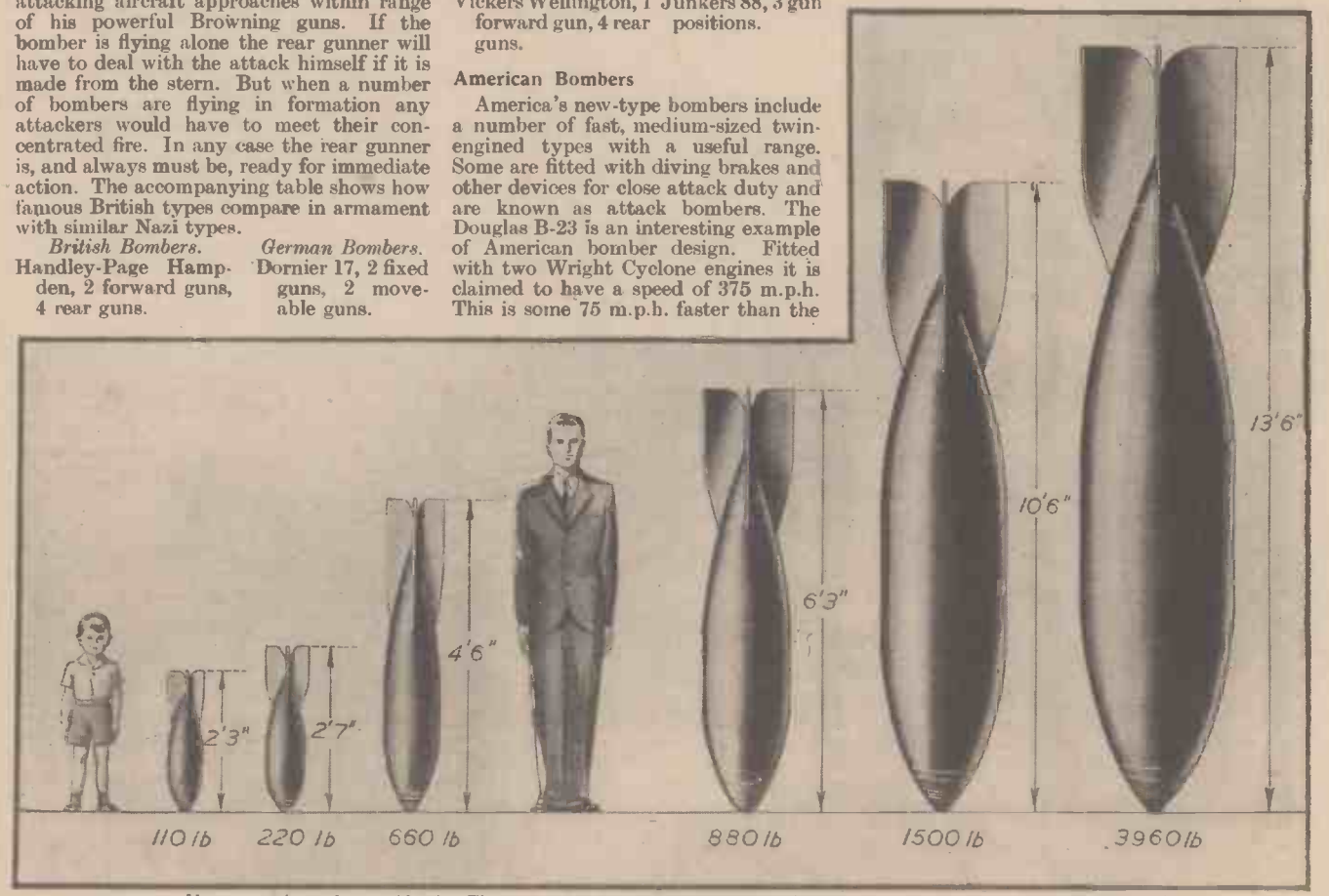
American Bombers

America's new-type bombers include a number of fast, medium-sized twin-engined types with a useful range. Some are fitted with diving brakes and other devices for close attack duty and are known as attack bombers. The Douglas B-23 is an interesting example of American bomber design. Fitted with two Wright Cyclone engines it is claimed to have a speed of 375 m.p.h. This is some 75 m.p.h. faster than the British Blenheim, a somewhat comparable type. An earlier type of Douglas, the DB-7, has much the same characteristics but a lower performance. Its wing span of 60 ft. is about midway between that of the Bristol Blenheim and the Handley-Page "Hampden." Another good U.S.A. bomber is the Glenn-Martin 167-W which was used by the French Air Force. Not so fast as the new Douglas—315 m.p.h. is about the maximum it can do—it is nevertheless a generally useful type, being designed not only for bombing, but also for fighting, reconnaissance and ground-attack work.

A new American bomber which will soon be flying with the R.A.F. is the Boston bomber. It has a tricycle undercarriage and will be the first machine of this type to go into service with the R.A.F. It has a wheel in the nose instead of the tail and the usual main landing wheels in the nacelles of the engines. The Boston requires only a short run to take off as it is permanently in the take-off position when at rest.

New German Bomber

As shown in the table on this page the most popular types of Nazi bombers are the Dorniers, Heinkels and Junkers. They have now produced new four-engined bombers which are believed to be Junkers 89's. They are rather cumbersome, however, weighing 22½ tons, and their speed of 200 m.p.h. is rather poor. It is doubtful whether these machines will be very successful as their petrol or oil consumption is very heavy, and their operational advantages are not very



Various weights and sizes of bombs. Their size can be judged by comparison with the man and boy who are of average height.

marked. A new advanced type of long-range twin-engined dive-bomber is also being made by the Henschel Co. These machines have been designed to carry only one bomb, weighing about a ton, their policy being apparently one of chancing all on one direct hit.

Yet another new German raider which has lately made a fleeting appearance over Britain is a large, black, four-engined heavy bomber which bears a strong resemblance to the pre-war Folke-Wulf "Condor." Designed as a 26-seat civil air liner the "Condor" is a low-wing cantilever monoplane with a wing-span of 108 ft. and only a single rudder. The civil version of the "Condor" had four B.M.W. radial engines of about 720 h.p. each, giving it a maximum speed of nearly 230 m.p.h. It had a "ceiling" of roughly 22,000 ft., and with special fuel tanks the extreme range was just under 1,000 miles. Its carrying load, all in. was 4½ tons.

Italian Bombers

Italy's best-known bombers are of the three-engined type. The Savoia-Marchetti 79 and 81 are examples, the SM.79, powered with engines of the Bristol "Pegasus" type, being the more successful. This aircraft, with a wing span of about 66 ft. and a top speed of 270 m.p.h., is roughly comparable in size and speed with the British twin-engined Hampden. Newer are the twin-engined Savoia-Marchetti 85 and 86, and the Fiat BR.20. The last-named machine has a speed of about 260 m.p.h., and besides carrying a useful load mounts four guns. Most of Italy's bombers are more lightly armed.

Putting the sting in the tail of the bomber

A General Purpose Electro-Magnet

A Magnet Weighing One Ton

A powerful electro-magnet for magnetising magnets

THE introduction of new materials for more powerful permanent magnets has greatly increased the difficulty of magnetising magnets made from them. Electro-magnets have been used as magnetisers for many years, but some of the recent alloys resist magnetisation so stubbornly that a more powerful general purpose electro-magnet than was available was needed in the laboratories to magnetise them.

The Coils

To fill this need a very efficient electro-magnet has been built. It has two coils, each fifteen inches in diameter, which are mounted facing one another close together on large horizontal cores. Heavy soft iron end plates resting on an even heavier iron base plate are bolted to the ends of the cores to complete the magnetic circuit. The entire magnet weighs about one ton. To permit varying the air gap between the pole faces, one core with its coil and pole-piece assembly can be adjusted by a jack-screw which maintains the air gap within close limits although the force of attraction between the poles of the magnetiser may be thousands of pounds for short gaps. In addition, the coils may be slid independently on skid plates to entirely cover the air gap. Cap screws which extend through slots in the base of the coils are used to anchor them securely in any desired position.

Magnetising Bars

The coils, which have 4,500 turns each, are designed for a 120-volt circuit. They consume about 700 watts when connected in series and 2,800 watts in parallel. The series connection provides 50,000 ampere turns for continuous operation without requiring forced cooling and as much as 100,000 amperes turns can be obtained with the coils in parallel. By utilising the full capabilities of the magnetiser it is possible to thoroughly magnetise bars of the hardest commercial magnet-steel ten inches long and 3½ inches in diameter.

The cores are made of Permendur which is the best magnetic material known for high flux densities. They are tipped with pole-pieces held in place by large soft iron bolts which extend through the end plates and the centres of the cores. This makes it easy to change pole tips. Normally two sets are used; one has 45-degree conical tips for producing highly concentrated magnetic fields; the other has the upper surface planed off flat for magnetising horseshoe magnets and similar devices.

Magnetic Flux

Since the total magnetic flux produced is about 1,500,000 maxwells, it was necessary to protect the magnetiser coils from insulation breakdown which might result from the high voltages induced when a rapid change in this flux occurs. Threefold protection is provided to cover all possible contingencies. Lightning protectors, which operate if the voltage exceeds about 500 volts, are connected permanently across each coil. Surge voltages are smoothed by connecting across the input to the magnetiser coils a large varistor whose resistance decreases rapidly as the voltage increases. Finally the current through the magnetiser is controlled by a variable series-resistance which permits changing the current only in small amounts at a time. A dash-pot arrangement has been provided to limit the speed at which the resistance-control handle may be moved.

The new magnetiser has been in daily use since its installation. Its high power and flexibility combine to make it a valuable addition to the working tools of the Bell laboratories. *Reproduced from "Bell Laboratories Record."*

The Story of the Lifeboat

Lightship and Lighthouse

Safeguards of the Seas

THE purpose of the "traffic lights" of the ocean roads is to facilitate peaceful navigation and prevent loss of life. The natural adjunct to lighthouses and lightships (and buoys) is the lifeboat, whose purpose is to save shipwrecked persons. These have gained added interest in the public eye by reason of unholy attentions paid to them by Nazi airmen.

Except in outward form there is slight resemblance between the modern lighthouse and, say, the first that was set up on the Eddystone rocks. A dozen or so tallow candles provided its illumination. The present structure (the fourth to be erected there) cost £60,000, and its main light, 133 feet above the sea is visible at a distance of 17½ miles; another light shows 40 feet below the main one. The manner in which any lighthouse shows its flashes is distinctive from all others, so that it may easily be recognised. Its main part, therefore, is the lantern. These differ in make but agree in having an arrangement of lenses and prisms whereby the light of the lamp instead of being diffused, is concentrated into extremely powerful beams—four, if the lantern has that number of panels.

One of the most interesting lighthouses around our coast. It was one of the first to be lighted by electricity, and its beam has the stupendous power of seven million candles. The double siren shown on the right can be heard far out to sea in foggy weather. Note the screens and guards to keep sea-birds off the glasses

Reserve Lantern

In recent types two electric lamps occupy the centre of the lantern, one being in reserve. If the lamp which is in action suddenly fails the reserve automatically replaces it. The heavy lantern revolves with its lenses and prisms, around the stationary lamp at fixed intervals, smoothness and ease of motion being assured by reason of the fact that the hollow base of the lantern floats on mercury in a trough. The turning is done by an electric motor served by a petrol engine and dynamo; a second generating set is in reserve in case of breakdown. Sound-waves increase the usefulness of some lighthouses, especially during fog; a siren or diaphone actuated by compressed air is used in conjunction with the light-flash. The time lapse, counted in seconds, between flash and sound tells an observer out at sea the distance the lighthouse is from him—the light-flash being practically instantaneous whilst sound travels through air at about 1,100 feet per second.

An underwater sound-signal may be substituted for siren or diaphone, a bell or oscillator suspended in the water sending out vibrations that can be picked up by any vessel within reasonable distance and equipped with the necessary underwater telephone or other pick-up. The velocity of sound in water is nearly a mile a second; therefore, if five seconds elapse between the light-flash and receipt of the underwater sound the vessel's navigator knows the lighthouse is approximately five miles distant. Some lighthouses are equipped with radio-telephony, which enables them to pick up messages from vessels in distress.

Lighthouses

Lamps of unattended lighthouses automatically light up when visibility falls to a certain point, and extinguish themselves when the light has regained a definite strength. These are visited for overhaul

A typical lightship They are anchored where the erection of a lighthouse is impossible

once every three months. A radio beacon sometimes takes the place of a flashing light, automatically transmitting morse signals which enable a navigator who may be shrouded in dense fog to determine his position relative to the wireless lighthouse.

The modern lightship, anchored where the erection of any kind of lighthouse is impossible, is equipped with lantern, diaphone fog signal, submarine oscillator, wireless, and has its own distinctive morse sign. Two of the most famous lightships mark the treacherous Goodwin Sands and the Thames-mouth Nore Sand; their hardy crews have seen rather more than their share of war-time activity. Lightships, lighthouses and buoys (the latter each anchored in its own spot and telling its own story automatically by light or bell or whistle) around the English and Welsh coasts are the responsibility, mainly, of Trinity House.

Lifeboats

Lifeboats have been improved to a similar extent, those carried by some big vessels being equipped with a safety device to facilitate launching. This consists of two or more semi-circular steel skates or narrow plates clamped to that side of the lifeboat which is nearer the ship's side; the skate extends upwards from the lifeboat's keel, and shock absorbers separate the skate from the boat. This device enables the lifeboat, when being lowered, to slide smoothly down the ship's side however acutely the big vessel may be canted over (in the opposite direction). As soon as the lifeboat, with its full complement, is launched the clamping screws are undone and the skates pulled inboard or allowed to sink. The world's largest liner, the *Queen Elizabeth*, gross tonnage 85,000, with 14 decks and accommodation for 2,326 passengers and a crew of 1,235, has motor lifeboats, any one of which will accommodate more passengers than the first of the Cunard ships, the *Britannia*, ever carried on any one voyage.

The lifeboats which operate around the 5,000 miles of coast of Great Britain and Ireland are provided and maintained by the Royal National Lifeboat Institution, a charitable society solely dependent on voluntary contributions. The R.N.L.I. has more than 130 motor lifeboats, with petrol or diesel engines, and twin or single screws. The largest, and the most powerful in the world, has two engines each of 375 h.p. and a speed of 17-18 knots; she is 64 feet by 14 feet and was built specially to guard the safety of crew and passengers of 'planes flying across the Straits of Dover. She bears the name *Sir William Hillary*, who was founder of the R.N.L.I.

Steam Lifeboats

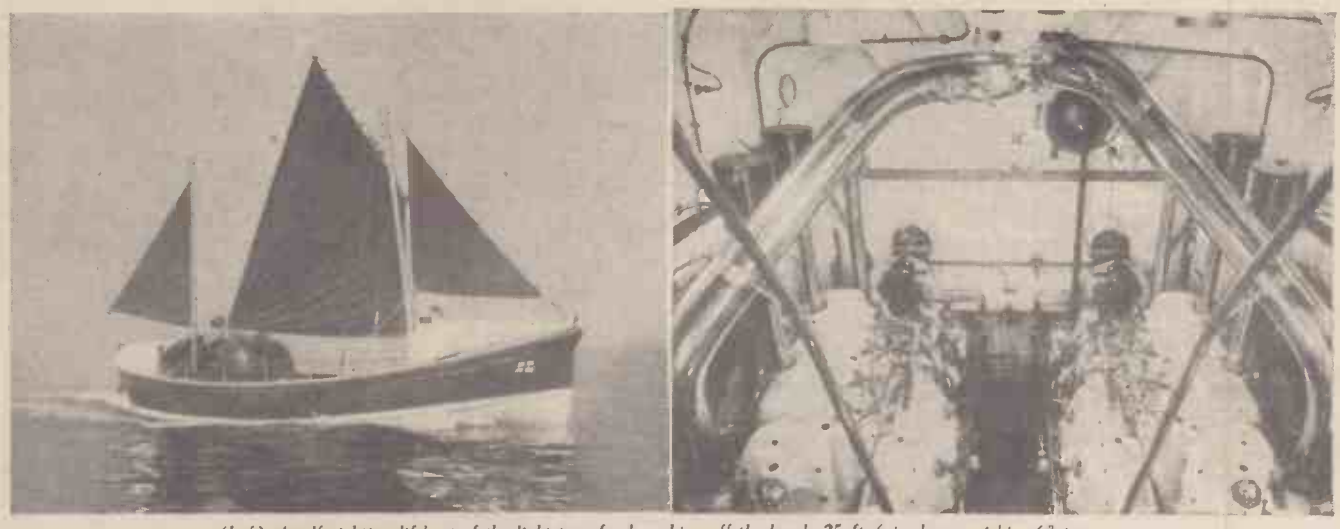
Steam lifeboats appeared in 1890, the first at Harwich. Propulsion was by water drawn in through an opening in the boat's bottom at the rate of a ton a second by a powerful pump and discharged at the sides. It had a speed of 9 knots. Only a few went into service, and the last was withdrawn in 1928. A lifeboat was first equipped with a petrol engine in 1904, this being supplementary to sails and oars. The experiment resulted, five years later, in a lifeboat specially designed for petrol engine propulsion. In 1923 the first twin-screw boat appeared, but not until 12 years later was the first powered lifeboat without any sailing gear put into service.

Apart from the outsize *Sir William Hillary*, power ranges now between 12 h.p. petrol engines and twin 40 h.p. diesel engines. Machinery continues in operation even when the engine-room is flooded, and in all cases is controlled from the deck. In the self-righting boats a mercury type capsizing switch automatically cuts off the fuel supply and stops the engine when the boat assumes a tilt of about 60 degrees; the engine is restarted again without difficulty when the boat is right way up again and it is seen that none of the crew have been pitched out. This type, after having turned completely over, will right itself and get rid of all water in 25 seconds. The other type, which cannot self-right, is provided with greater buoyancy, stability and speed. Danger of total flooding is reduced by water-tight compartments, and buoyancy is increased by air-cases ranging in number between 70 and 160. These would keep the boat afloat in the unlikely event of all the water-tight compartments being smashed open. As fast as water is shipped, in normal circumstances, it is discharged through one-way valves in the sides above the water-tight deck; a boat filled to the thwarts will empty herself in 12 seconds.

The use of wireless for intercommunication between lifeboat and shore-station, is at present restricted, for technical reasons, to boats with cabins. These have radiotelephony, with the exception of one which has wireless telegraphy. Portable and submersible searchlights and masthead signalling lamps with portable morsing switch are carried by electrically equipped boats. In some, an oil-tank is located in the bows, from which the wave-subduing liquid can be sprayed; and a line-throwing gun with a range of 100 yards can be fired from a tripod or from the shoulder. Fire-control apparatus is also carried.

Launching Methods

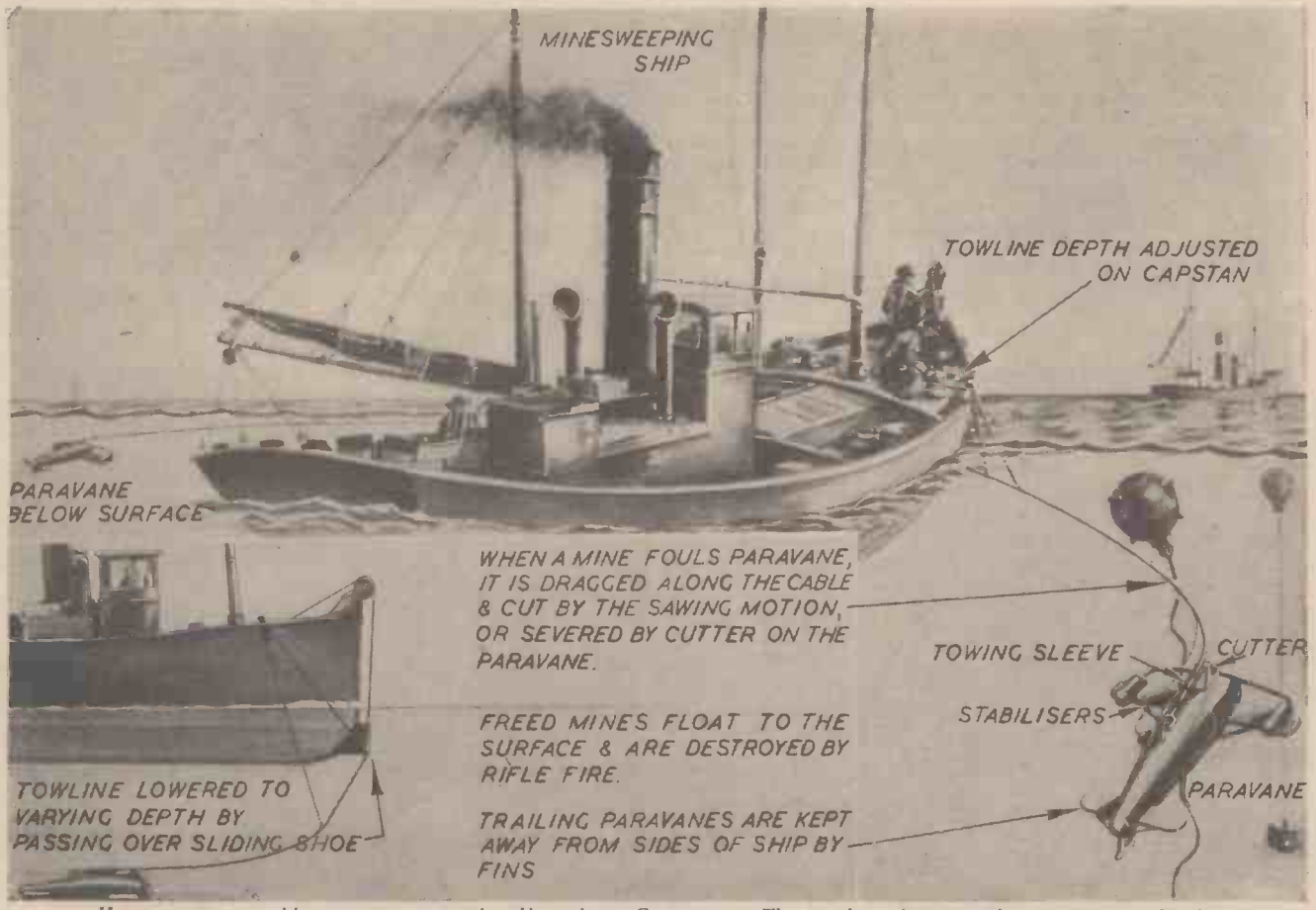
Launching methods are largely determined by the nature of the shore from which the lifeboat operates. If a special slipway is used the boat slides down by its own weight. To enable it to be hauled up again after use, the boat is furnished with chains which pass through holes in the keel, forward and aft. Hauling cable is attached to these chains and power is supplied by a winch at the top of the slipway. For launching from a beach, portable rollers are sometimes used, the lifeboat being pushed along and into the water with long poles. A wheeled carriage hauled by a motor-tractor may be used to transport the boat to the launching site; the tractor is then removed and the launch effected by man-hauling on ropes which, attached to hooks on either side of the boat's sternpost, pass through sheaves at the fore-end of the wheeled carriage and then back to shore. Where damage is likely to occur to propellers through contact with shingle or rock they are protected with shrouds.



(Left) A self-righting lifeboat of the light type for launching off the beach, 35 ft. 6 in. long, weighing 6¾ tons and driven by one 35 h.p. engine. (Right) Two 40 h.p. diesel engines in the engine room of a lifeboat.

Lifeboat Construction

Construction is of wood. Steel has been tried, but experience proved that wood will take severe punishment under which necessarily thin steel plates would collapse. Steel is, however, used for bulkheads in the larger boats. About 8 tons of carefully selected and worked timber go into a 46-foot cabin lifeboat of the Watson type, which weighs 18 tons without the crew. The total is accounted for as follows: 12 cwt. of British oak, for the stem and stern; 1 ton 8 cwt. of Canadian rock elm for the framework; 5 tons of Honduras mahogany for deck and planking (or skin); 6 cwt. of Burma teak for the keel; 14 cwt. of Canadian white deal or Columbian red cedar for the air-cases. To get those finished quantities 19½ tons of wood in the rough have to be handled. Costs are high, varying from £3,700 for a 32-foot surf motor lifeboat to £11,000 for a 51-foot cabin motor type. Engines range between £400 for a 12-h.p. petrol to £1,300 for a 40-h.p. diesel engine.



How paravanes are used by minesweepers to cut the cables anchoring German mines. They are also used to protect the sweeper from accidentaliy hitting a mine.

Safeguarding the Minesweeper

The Use of Paravanes in Minesweeping

THE risk run by a minesweeper when operating in a minefield is considerable, and in order to minimise the danger of the trawler striking a mine, special types of sweep are used. Although there are various methods of sweeping, only one is dealt with in this article and that is high-speed sweeping.

With high-speed sweeping the sweeper is protected to a very considerable extent, as the sweep is towed from the bows instead of the stern which is usual with other types of sweep. It consists of paravanes towed on either side of the trawler, at the end of a specially strong, light wire sweep, or "towing wire." The paravane is made of metal, is buoyant and is similar in shape to a torpedo. Running at right angles to its length is a metal plane which is weighted at one end and is made buoyant at the other. The paravane is inclined to one side by means of this metal plane, so that when it is pulled through the water, it tends to run away from the ship that is towing it.

Inside the Paravane

A hydrostatic valve is incorporated inside the body of the paravane which in turn controls a horizontal rudder, and this keeps the paravane at any required depth below the surface of the sea. Over the stem of the sweeper is fitted a "towing shoe" and through this passes the inner end of the towing wire. When the paravanes are not in use, the "towing shoe" is raised out of water, and is lowered to the lowest part of the stem when the paravanes are running clear of the sweeper. If it is desired to take in the paravanes the "shoe" is raised again, to enable the towing wire to be caught in a snatch-hook attached to the wire which is used for hauling in and hoisting the paravane.

If desired, the "point of tow" of the paravanes may be attached to "paravane chains" as an alternative to the "towing shoe." The "chains" pass through special holes in the forefoot of the sweeper, and they can be hove up and down by means of a capstan.

Paravane Davits

The paravanes are carried on special "paravane davits" when not in use, or they can be stowed on special slips. They are kept constantly ready for use, however, in time of war, with their towing wires

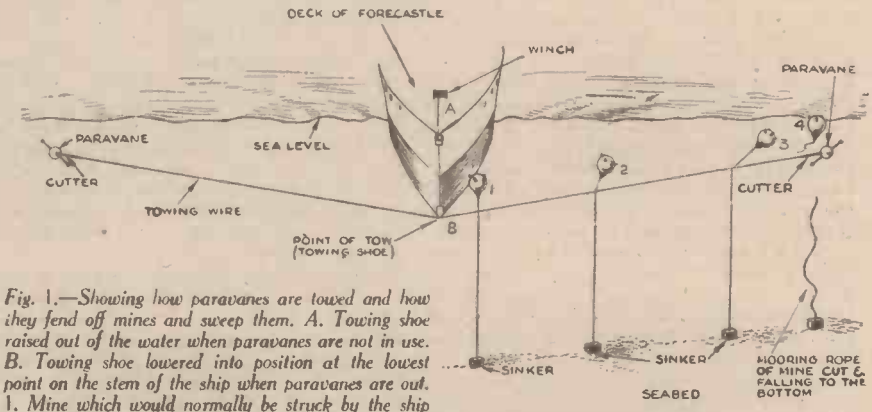


Fig. 1.—Showing how paravanes are towed and how they fend off mines and sweep them. A. Towing shoe raised out of the water when paravanes are not in use. B. Towing shoe lowered into position at the lowest point on the stem of the ship when paravanes are out. 1. Mine which would normally be struck by the ship and exploded is fended off the swell of her bows by the paravane towing wire which fouls its mooring rope 2. Mooring rope of the mine slides along the paravane towing wire. 3. The mine being drawn away from the ship. 4. Mooring rope of the mine slides into the cutter on the paravane and is cut. The mine then rises to the surface and is destroyed.

attached to the point of tow, coiled up and secured on the forecastle.

When required for sweeping purposes, they are lowered almost into the water and then slipped, after which they dive and run out at an angle away from the sweeper. As soon as it is seen that they are running correctly, the point of tow is lowered and all is then ready for sweeping. Fig. 1 shows how the sweeping is effected. Unless by bad luck, the mine comes in direct contact with the stem of the sweeper, in which case it blows the latter to pieces, it is washed to one side by the bow wave and its mooring rope is caught by the paravane towing wire or sweep. As the sweeper moves forwards with the paravane towing wires inclining slightly backwards, the mooring rope of the mine slides along the latter until it passes into the jaws of the cutter on the paravane and is severed. The mine is thus released from its sinker, after having been carried well clear of the sweeper, and floats up to the surface, where it can be riddled with bullet holes until it sinks.

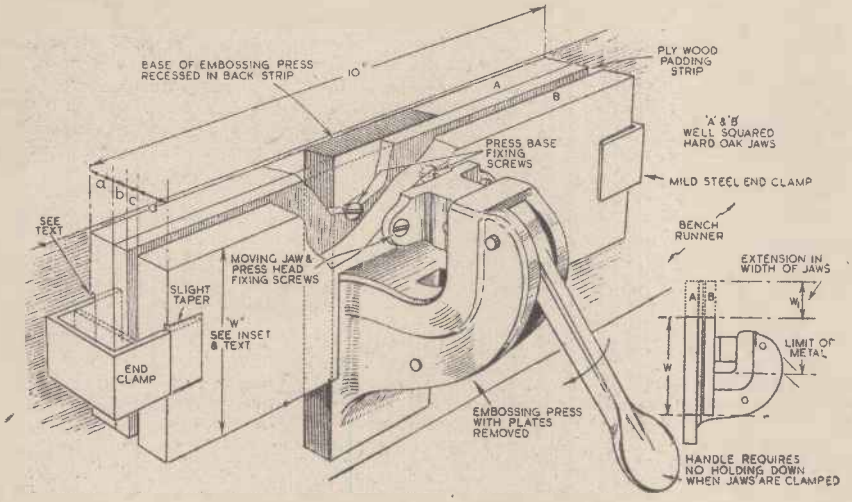
Cannot Be Mined

Paravanes can be, and are used by all classes of ships as a safety device against mines, and as such are extremely effective. Unless the mine comes into contact with the ship (which is very improbable), or the after part of the ship, in turning, passes through water which has not been swept by the paravane towing wire (which is only slightly less improbable), a ship towing paravanes cannot be mined. A fully descriptive article on other types of mine-sweeping, by Commander Edgar P. Young, R.N., appeared in our issue dated June, 1940.

A Novel Bending Tool

Constructional Details of a Simple Press for Bending Sheet Copper and Aluminium

A VERY necessary tool for the home constructor is a bending vice, that will provide clean flexures for the more pliable metals—copper, aluminium, brass and certain soft steel of reasonably light gauge. The simple bending vice, shown in the accompanying illustration, will be found particularly useful for the purpose, especially where an ordinary wood workers' vice is not available.



General arrangement of a simple bending vice.

Both jaws "A" and "B" are of well-seasoned oak, the intermediate strip, which was necessary to bring the width up to the desired limit of the movement, being of good quality plywood. This "padding" strip as it is called here, also serves the purpose of reinforcing the fixture of the press base to the bench, since after fixing down the base and each section of "A" as mentioned, the extra screws necessary for the padding strip should be long enough to pass right through the jaw to the bench runner.

When deciding upon a suitable method of construction, it was found that an old embossing press provided the desired pressure. When obtaining one of these embossers from a second-hand dealer, and after a preliminary examination, it was found that the removal of the name plate fixing screws was all that was required in the way of alteration.

With both plates removed it was then noted that the maximum movement of the press head was 3/16 in., thus by allowing 1/8 in. gap between the proposed wooden jaws "c" the correct thickness of both jaws and the intermediate padding strip "a," "b" and "d" could soon be determined. It is not intended that gauges above 16 S.W.G. be handled by this vice, so 1/8 in. is ample for adjusting the metal along the bending lines.

Oak Jaws

To provide a flush mounting, the base of the press is recessed as depicted, consequently the jaw "A" is made up with two pieces of oak, carefully planed, these pieces being positioned on the bench runner with the vice in the most convenient place, then screwed down with three well countersunk screws to each side.

The jaw "B" is fitted after the assembly just described, as the holes in the press head through which the fixing screws pass, are in direct line, and can be conveniently used—at least in this particular case—for inserting a screwdriver to fix the padding strip and base screws; this will be clear on referring to the illustration.

The inset diagram shows how an extension "W1" may be made in the width "W" if deeper bending is required to that depicted by the limits in the illustration, the pattern of the particular press casting determining the limit to the edge of the metal.

By cutting away the jaw "B" to bridge the press as depicted, a greater degree of rigidity is given to the ends of this jaw, whilst at the same time, the "U" clamps about to be mentioned afford a better purchase; a plain strip of wood is not, after considering this point, advisable.

Side Clamps

Owing to the slight "give" which may be apparent at the ends of the jaws after clamping the metal, two "U" clamps are provided to ensure a more even distribution of pressure for acute bends, and the method adopted is clearly defined. Fairly heavy gauge mild steel is used for each clamp with the edges slightly rounded to facilitate fitment over the tapered edges of the jaw.

It will be noticed that these "U" pieces slide into slots provided between the jaw and the bench, thus when the metal to be bent is positioned, it only remains for the end clamps to be tapped over the jaw, after pressing down the handle.

If it is desired that the handle of the press be kept down under pressure in addition to the end clamps, a simple method is to attach a strong spring to the bench, a suitable hook being provided which will conveniently slip over the thin part of the handle; this consideration, however, is not included in the illustration, as the essential features only are dealt with in regard to the adaptation of the embossing press.

Hobbies Handbook for 1941

WE have just received a copy of Hobbies handbook for 1941, which is packed full of useful reading matter for the handyman and home craftsman. It describes dozens of ways in which you can spend your spare time profitably. A design chart priced at 1s. 6d. is given away free with the handbook. The handbook tells you how to make all kinds of models in wood—battleships, model planes, guns, bridges, railway stations, etc., or practical pieces of work such as cigarette boxes, table lamps, furniture, with large complete pattern sheets for all necessary parts. As well as containing numerous instructive articles on woodwork, a complete range of fretwork tools and wood are listed. The Handbook costs 6d.

"Glossary of Aeronautical Terms." By Douglas H. Wilson. Price 3s. 6d.. 112 pages. 236 illustrations. Published by Geo. Newnes, Ltd., Tower House, Strand, W.C.2.

A handy dictionary of terms based on the nomenclature adopted by the British Standards Institution and recognised by the leading authorities. The book is well illustrated and includes identification silhouettes of German and Italian aircraft.

Showing ten parachutes being released simultaneously at the re-opening of the popular parachute jump at the New York World's Fair. More than half a million persons experienced the thrill of the 250-ft. drop last season.

THE MONTH OF SCIENCE

Miniature Barrage Balloons

AN inventor claims that it is now possible to have barrage balloons at negligible cost. His idea is to coat a very thin wire with chromium crystals so that it will cut into steel. One metre of hydrogen will be capable of holding up 1,000 ft. of the wire, and calculations have shown that its tensile strength is such that it will easily stand up to an aeroplane travelling at 200 m.p.h. In this way the barrage balloon can be reduced considerably in size and the barrage can be extended indefinitely at small cost.

This Castor Oil Is Nice

JAPAN is now using a castor oil that fizzes. The oil, which is quite pleasant to drink, has citric acid and bicarbonate of soda added to it. When the concoction is mixed with water and stirred, it effervesces, thus masking the taste of the castor oil.

World's Biggest Aeroplane

THE largest aeroplane in the world is now nearing completion at the Douglas Aircraft works, America. It is a four-engined American bomber with a 210-ft. wing span, and its 8,000-h.p. engines will give it a range of 7,000 miles.

"Heavy Water"

"HEAVY water," a curious liquid which was produced a few years ago from "heavy" hydrogen, is still the subject of numerous experiments. Its chief drawback, however, is that it is very costly to manufacture and works out at 6d. a drop.

A Use for Bubbles

AMERICA'S oil industry has found a use for bubbles. They are being made to order by a new process to prevent formation of a destructive sulphuric acid mist in refineries. Two Chicago engineers, D. W. Bransky and F. F. Diwoky, told an American Petroleum Institute meeting at Fort Worth, Texas, recently, that manufacture is abolishing the need for expensive electrical equipment in refineries, as well as reducing corrosion.

A "green acid"—a sulphuric acid product—is bubbled through water, said the engineers, forming large quantities of foam, which absorbs the sulphuric acid mists.

Spin-Proof

AMERICAN aircraft factories are now producing a new light aeroplane which is of unusual design. Crack American pilot found that when putting the plane through its paces it was impossible to put it into a tail spin owing to its phenomenal "air-worthiness." The machine is fitted with super-safety landing gear and extra-simplified controls. It is called the Ercoupe, and will, in the opinion of the U.S. Civil Aeronautics Authority, greatly speed up the "education" of novice pilots and help to eliminate many private flying fatalities.

Great Engineering Feat

FOUR huge water wheels, which were installed in 1832 for driving the mill machinery, are still in daily use at the linen works of James Finlay & Co., Ltd., Perthshire. It was considered a great engineering feat when the water wheels were installed, and they have given continuous service for more than one hundred years without need for any repairs. Each wheel is 36 ft. in diameter and develops 75 h.p. at two revolutions a minute, the source of power being taken from the water from the River Teith.

"All-Purpose" Gun

TWO of the latest weapons of war produced in the United States are the "all-purpose" gun and the Garand rifle. The feature of the "all-purpose" gun is that it can fire anything from tear gas and parachute flare shells to 1-lb. fragmentation bombs. The Garand rifle is considered one of the finest infantry rifles in the world and is capable of firing 30 shots a minute.

New Incendiary Weapon

ACCORDING to the daily papers, the R.A.F. are using a form of incendiary weapon which can be described as a self-igniting leaf. It is designed to set fire, for example, to military stores standing in the open, to an arsenal or ammunition factory, to a dump of engineers' stores in the field, and other similar objectives. Our planes drop them on objectives during the night and when the rays of the sun fall on them they are ignited. The accusation made by the Germans that the leaves cause poisoning is false. The leaf is not poisonous, but if handled, it would cause burns just as every other incendiary bomb would do.

Shop Lighting

SHOPKEEPERS hope that they will be allowed to use a new modified form of display window lighting this winter. Lighting engineers have been trying to perfect a simple new device. It will be an improved version of the device used last winter.

Powerful New Tank

A NEW British tank which is now in use will be one of the most formidable we have yet put into the field against the enemy. It combines speed with the maximum of armour, and armament capable of piercing the protective shields of any vehicle which the enemy has yet put into the field. The successful combination of these qualities is the result of years of experiment.

New Secret Defence

SIR ARCHIBALD SINCLAIR, the Air Minister, recently referred to a new secret defence against bombers. He said: "We are working hard at the solution of the problem of dealing with enemy night bombers and are making progress." The system, which was not in use when war began, has succeeded in bringing down bombers in certain circumstances; for instance, in the defence of small sites. It is not possible to hint at the nature of the device, but it can be said that it is simple and not costly to manufacture or use. It does not need a large number of men to operate it. It is neither a balloon, a gun, nor a ray. When the device is developed, the defence of London will be enormously strengthened.

A Pilotless Plane

ACCORDING to an American inventor, Dr. Lee de Foresri, a pilotless "television torpedo" plane may be completed within a year. He states that the plane could be made from inexpensive plastics and would require no armour, as it would be a robot machine. The flight could be directed by radio from a mother ship ten miles or more away.

Television cameras could be placed in the nose of the plane, and a television transmitter could send pictures of the terrain below to a ground base or to the mother ship, where operators would be able to manœuvre the plane. The army authorities who are at present testing the plane, say that it could also act as a robot bomber. It is estimated that the plane would cost between £250 and £300.

Bomb-proof Tunnels

A SUGGESTION has been made as to whether, in the opinion of competent engineers, deep bomb-proof tunnels could be dug in London for the whole population of 6,000,000 for a total cost of £120,000,000; that such tunnels could be used after the war for relief of traffic congestion: and whether, in view of the Government's

IN THE WORLD OF INVENTION

declared opinion that the war will last three years, the Home Secretary will give the necessary instructions for this work to be put in hand forthwith.

500 *m.p.h. Fighter*

A NEW twin-engined interceptor plane, the Lockheed P38, has successfully undergone tests at Burbank, California. The plane flew down the coast at 350 m.p.h., with its engines only opened out to half throttle, and it is expected that the aeroplane will be able to attain a speed of 500 m.p.h. It lands and takes off at 100 m.p.h., and can climb 4,000 ft. in one minute. The machine is armed with a 36-millimetre cannon in the nose, and is equipped with numerous machine-guns.

Mobile Garages

CANADIAN divisions in the field are now being equipped with mobile garages which are outfitted as efficiently and completely as any modern city garage. They are converted motor transport lorries, and each one is fitted with its own electrical plant, to operate electric grinders, drills, refacers, lathes, brake servicing equipment, and other tools. Lubrication, battery service and overhauling facilities, including the boring of cylinders, the fitting of pistons, valve grinding and welding are provided in this modern garage on wheels. All tools required have been specially designed with a view to portability and are part of each lorry unit.

Air Conditioners

A DEVICE that is becoming rather popular in America is an air-conditioning unit. This is a self-contained device made to fit on a window-sill or table and provides de-humidified, fresh filtered air in summer and fresh filtered air (warm) and ventilation in winter.

New Type of Organ

THE photo-electric cell has a wide variety of applications. It can be used for burglar alarms, shop-window lighting, operation of electric signs, timing of races, etc. This little device has now been adapted in a new type of electric organ. The organ has been devised based on the use of "synthetic" wave forms imprinted on rotating discs, which interrupt light beams in photo-cell circuits for each wave form. An almost illimitable range of tones is, therefore, made available.

Laboratory Coal and Oil

ACCORDING to Dr. Ernest Berl, Research Professor at the Carnegie Institute of Technology, coal and oil can be made in one hour in a laboratory. Dr. Berl told the American Chemical Society in Detroit that he had discovered a process whereby coals, asphalts, and oils, having exactly the same properties as their natural counterparts, could be made from grass, leaves, seaweed, wood, cornstalks, and other materials containing carbohydrates.

The substance is placed under pressure with limestone and similar materials and heated, the professor said, and the transformation was completed in about an hour.

Self-sealing Petrol Tanks

SOMEWHERE in England is a testing ground where technical experts of the Air Ministry study the progress made in German aviation. As Nazi planes are shot down in this country, they are carefully studied by these experts, who look for any outstanding feature in their design. Of great interest is the German self-sealing petrol tank. Although they are very heavy, weighing 4½ lbs. per square foot of tank wall, they are extremely effective. The walls of the tank are built up of several layers. The outside covering of the tank consists of a thick coating of vulcanised rubber, followed by a layer of thin treated rubber, then a layer of leather, a covering of thick pure rubber, and finally an inner wall of fibre. The whole is held firm by a criss-cross of internal fibre stiffeners. When the tank is punctured, the petrol melts the thick pure rubber and seals the hole.

Automatic S O S

ANOTHER interesting "find" in one of the shot-down Nazi planes is a complete radio transmitter mounted in a waterproof metal container. The container holds a small transmitter, the necessary batteries and a motor which automatically "keys" the morse signal, S O S, S O S . . . when the transmitter is switched on.

The transmitter can be used in conjunction with a form of "umbrella" aerial fitted on a long, thin mast, or with a kite aerial, the line for which is carried on a reel inside the container.

It is presumed that this transmitter is intended for use in the rubber dinghy used by pilots who have had to leave their machines when over the sea. This transmitter does not appear to be a regular part of the equipment of the Nazi planes, but is probably carried only when an important Nazi official is being flown.

Probing Nazi Radio Secrets

IT is evident that the radio technicians associated with the R.A.F. do not take anything for granted when examining and testing the equipment of shot-down German planes. At a certain experimental establishment there is a very large dossier containing complete specification of the radio equipment. Not only does this give complete specifications, test data and circuit diagrams, but also valve curves and the most minute detail of every part of the equipment.

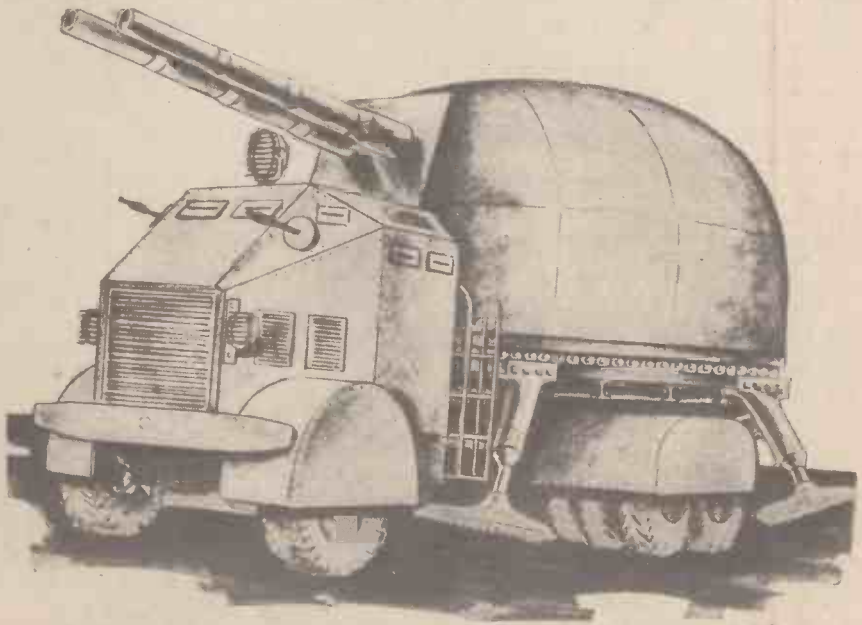
Standardised Valves

AN interesting fact concerning the standard receiving equipment fitted to most of the German planes is that H.F. pentode valves are used exclusively; every valve in the set is interchangeable with any of the others. The valves have side contact bases and top cap; they are fitted in an inverted position and are held firmly in place. To withdraw them a small knob is screwed into a tapped hole in the plastic-material base. The valves are very small and bear some resemblance to "acorns," although being somewhat larger.

An "Invasion" Boat

THE Chris-Craft Corporation in Algonac, Michigan, announce that a new spoon-shaped 30-ft. boat, built specially for landing troops from battleships, has been delivered to the United States Navy.

The vessel carries a maximum load of 35 men and can be taken into water only six inches deep to effect a landing. When the boat leaves the shore, two flipper appendages are lowered into the water and the propellers thrown into reverse. The backwash from the propellers strikes the flippers and lifts the craft off the bottom.



An American "war truck." These armoured cars are equipped with two 6-in. anti-tank guns and powerful machine-guns. The guns are in a 360-degree moveable turret. The arms that look like vacuum cleaners can be lowered to the ground to take up gun recoil. The trucks have undergone extensive tests and are powered by a marine diesel engine. They have been drawn at speeds up to 65 m.p.h. by their 12 rear wheels

Using the Multi-Purpose Tool

Further Details Regarding the Use of the Juneero Tool which was described in Last Month's Issue

A SCREW cutting die is included in each Juneero Set to enable you to cut threads on the rod. Place the clamp plate in position as shown in the illustration—this acts as a vice to hold the rod to be threaded—next insert the rod to be threaded and tighten up the nut so that the rod is held in a tight grip. Insert the die on the end of the rod, hold the die perfectly square and rotate it slowly in a clockwise direction. It will gradually feed itself on the rod.

Before commencing to cut the thread drip a little lubricating oil on the end of the rod that is to have the screw cut on it. This will lubricate the die, causing it to cut more freely and to last longer. After rotating the die three or four complete turns in a clockwise direction, twist it in the opposite direction for a quarter to half a turn to break up the chips of metal that are being cut off the rod. The screwing die should be cleaned after use by blowing the chips out of the holes.

Bending strip. To open jaws of bending die, pull lever right down towards the front. Insert strip in required position, then raise lever until correct angle is obtained

Bending and Forming

At the back of the Juneero tool is the bending die for bending strip, and below it is a small hole which is used to effect sharp bends in the rod. The rod to be bent is pushed through the hole until the edge of the hole comes opposite the part of the rod that it is intended to bend. This can be marked on the rod or located by the gauge bar. The rod is bent by pulling it in the requisite direction with the fingers.

Cutting rod. Insert rod in sleeve as shown just above the bending die. Raise lever as if operating the bending die

The illustration in the first column shows the method of bending the strip. Here again the position of the bend may be marked on the strip or located by the gauge bar. Before bending it is desirable to smear a little oil on both sides of the strip in the region of the bend. This lubricates it and facilitates the bending operation. To bend the strip press the handle right down towards the front of the tool, i.e., the side remote from the bending die. This opens the jaws to their full extent. Insert the strip and pull the handle up to bend the metal. The handle should not be jerked up sharply but pulled with an even steady motion. Make sure to insert the metal as far as it will go into the jaws of the tool. Sight the strip along the gauge bar to ensure that it is parallel with the bar and that it is truly at right angles with the strip.

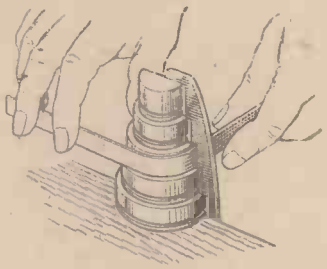
When imitating wrought ironwork the decorative effects of the old smiths can be obtained by cutting the ends of the strip in the form of spear points and up-setting a rib along the point by the aid of the bending die.

The Curve and Scroll Tool

The Juneero Patent Curve and Scroll Tool enables accurate curves and scrolls to be bent from rod or flat strip. The tool which is shown in the sketch provides for five diameters. This is invaluable when making certain objects, such as clips for the repair of water hose, which must be made to a definite size. The tool is quite simple to use. Just feed the end of the strip or rod into the guide plate as shown, and hold it with the fingers of one hand. With the other hand, force it round the circular face of the tool. If it is required to form more than a semi-circle, first form a half circle, and then feed as much of the formed portion as necessary through the guide plate. Continue forming the rest of the curve with the fingers as before. After a little practice you will be able to form circles, arcs, scrolls, etc., in an expert manner.

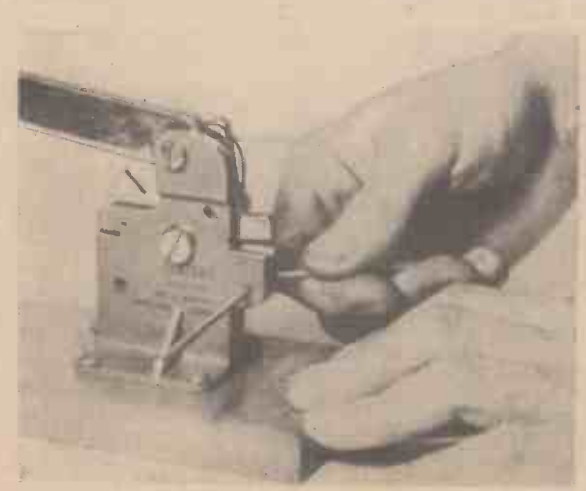
Important

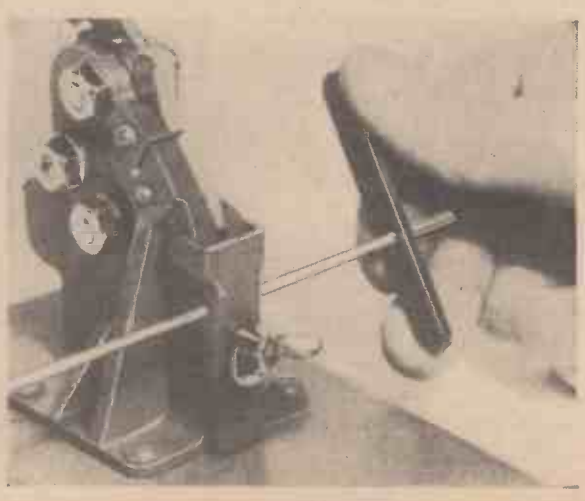
On no account should metal strip or rod other than that supplied with the Juneero set be cut, bent or punched on the Juneero tool. If metal that is thicker, of a harder temper, or otherwise unsuitable is used, the tool may be irreparably damaged.



The Juneero Patent Curve and Scroll Tool

Four holes are drilled at the corners of the wooden base on which the tool is mounted. These enable it to be screwed or bolted firmly on to the work bench and it is recommended that this is done.



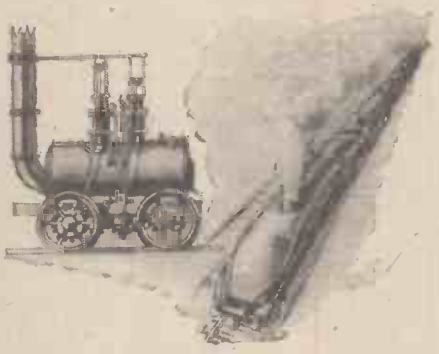


(Left) Bending rod. Insert the rod in the hole below the bending die, to the position where angle is required, grip firmly in the right hand and bend round as shown. (Right) The method of threading rod

The Fascination and Problems of Speed

What will be the ultimate Speed reached by Man?

Road transport ancient and modern



Stephenson's "Rocket" compared with a modern streamlined train

THE man who set the first log rolling started the craze for mechanical speed. From the rough log the smooth roller developed, and from that the wheel. No name or date or country is attached to the inventor of the wheel, but whoever he was he let loose a chain of consequences of which he could not be expected to have the foggiest notion. Taking only one use of the wheel—the facilitation of travel—its slow but steady development enabled mankind to reach speeds which pleased him exceedingly. With horse and wheeled vehicle of one kind or another he increased his rate of progression over the ground to round about 10 miles per hour. A sail enabled him to do the same for himself on the water. For several hundreds of years that remained his maximum. Then he learned how to dispense with the horse—and his sail—and harness horse-power to his needs. Stephenson's famous locomotive, the "Rocket," did 35 m.p.h., and the world (or that part of it which was interested) was astonished.

In July of this year an English test-pilot took his aeroplane into a power dive at 600 m.p.h.

Speed of Sound

That's getting rather close to the speed of sound, which is nearly 770 m.p.h. If and when an aeroplane manages to exceed that speed it will outrace the noise of its engines and, incidentally, involve itself with many interesting new constructional problems, and others connected with Time and Space. As we extend our incursions into the realms of really high speed the question as to whether there is any limit to it—so far as concerns man—assumes still greater fascination.

Is there a limit? The speed of an aeroplane, racing car or cycle, or anything else is necessarily relevant to some other body or thing. The quickest speed of which we have knowledge is that of light, which is 186,000 miles per second—one-seventh of a second to encircle the Earth; and that is identical with the speed of wireless waves and of radiant heat. Look up at the stars on a cloudless night (there are plenty of opportunities in the blackout!) and you will see approximately 3,000 of them out of a probable total of about thirty thousand million. Suddenly there may shoot across your vision a meteor (misnamed "shooting star"). Millions of these penetrate the Earth's atmosphere in the course of every 24 hours, and mostly they are composed of iron-nickel alloy. But the point about them here is their speed, which is the relatively low one (astronomically speaking) of about 50 miles per second.

Light Waves

The outer stars of the Milky Way are moving at the rate of 150 miles per second, and the light-waves which come to us from some of the more distant nebula, started on their journey through space before human life appeared on the Earth, the era of gigantic reptiles. Those nebula are 40,000,000 parsecs from us. One parsec equals 19,150,000,000,000 miles, or 3.26 light-years; a light-year (0.3069 parsec) is the distance which light travels in a year, that is, 5,880,000,000,000 miles. Speeds and distances of that order are difficult to grasp; it is easier to visualise their meaning if we convert them into terms of, say, railway travel. A train travelling without interruption at 60 m.p.h. would (if such a journey were possible) encircle the world in something under 20 days; the journey from Earth to the Sun would occupy 177 years; to the nearest star, 40,000,000 years.

Compared with the time taken to complete those suppositious journeys the train's speed of 60 m.p.h. seems trivial. The same speed would get you from London to Brighton in an hour—which at once makes it seem rather considerable. It's all a matter of comparison. Which brings us to a seeming paradox: that an object can be both at rest and in motion. A fixed object on the Earth's surface—a house—is not moving relative to the ground it stands on. But relative to the sun it is moving all the time at tremendous speed! The same thing can be said, of course, about a stationary car or train—which is really moving at approximately 1,000 m.p.h., the speed at which the Earth rotates or spins.

Danger Aspect of Speed

For practical purposes the speed of any land vehicle is measured relative to the ground, a ship or boat relative to the water, and an aeroplane relative to the air; when we wish to refer to the speed of an aircraft relative to the Earth's surface we speak of its "ground speed." Very high speeds, short rapid turns, or rapid flattening-out from a dive sometimes produces a "black-out," or momentary failure of the pilot's vision. At what speed the "black-out" would become fatal has yet to be demonstrated. In touching on the danger-aspect of speed it is as well to remember that in the early days of railways, doctors positively and solemnly declared that the human constitution could not with-

stand a speed in excess of about 20 m.p.h.

The swiftest aeroplane's flight is but a crawl in comparison with the movements of the heavenly bodies, a challenge which aircraft and aero-engine designers have always before them. They are working for the day when the airman will not exactly meet himself coming back but will hear the approaching roar of his own aeroplane some time after he has grounded !

There is only one product of man's hands which has greater speed than an aeroplane, and that is a bullet from a rifle (or shell from a gun); its speed may be as great as 3,000 feet per second. The firing of a gun of any description demonstrates the slowness of sound in comparison with light. You see the flash an appreciable time before the sound reaches your ears—as also you see a cricket ball in flight before you hear the click of the impact between the ball and the bat. Sound is at a disadvantage when travelling through air, as far as its rate of progress is concerned. Its speed is much greater through wood and through water, and 14 times greater through steel. It is interesting to note how comparative speeds of sound were first determined. Two groups of scientists stationed themselves 61,047 feet apart, one group at Montlhery, the other at Villejuif, France, each with two cannons and a chronometer. Each group fired its guns at ten-minute intervals and with the chronometers recorded the time which elapsed between the sight of each flash opposite and arrival of its sound. The light was registered with practically no time-lapse, whereas the sound took a little over 54 seconds to arrive (1,100 feet travelled per second.)

Sound Through Water

To determine the speed of sound through water, two experimenters took up station, each in a boat, 44,237 feet apart, on Lake Geneva. Their apparatus was cumbersome, but they got a result. One boat was equipped with a bell and striker which was lowered into the water, and some magnesium powder. The magnesium was lighted with a match, the same movement causing the striker to hit the submerged bell. Thus light and sound originated at the same instant. The reception of these was recorded by the experimenter in the other boat, with the aid of a chronometer, and a speaking-trumpet fitted with a sheet of metal over the large opening which was just below the surface of the water. Time taken for the sound of the submerged bell to impinge on the metal sheet and so travel to the recorder's ear was 9½ seconds. From which the two experimenters deduced that sound travels through water at the rate of 4,706 feet per second.

Actually the stopwatch and eye method is out of date now for timing where very high speeds have to be recorded, as when cars are racing over a measured mile, an error in timing amounting to only a fraction of a second, giving an exaggerated error when the speed comes to be worked out in miles per hour. The cine-camera is employed now in conjunction with the stop watch, this method also being employed with racing aeroplanes, 'plane and stopwatch being photographed simultaneously. The electrical timing of a racing car is accomplished by means of a contact strip at each end of the course, the car as it passes over these strips (one at the start, the other at the end, of the measured mile) causing electric currents to register themselves on ribbons of paper which are kept moving by clockwork motor. This device gives the time taken to cover the mile to within one four-hundredth of a second.

Time—Space—Speed

The fascination which these hold over the imagination of mankind has given us many works of imaginative fiction, the most notable of these being Jules Verne's "Round the World in 80 Days," and H. G. Wells' "Time Machine." We have still to catch up on Wells' experimenter who devised a means of projecting himself into Time—travelling forward into history still to be made. But Verne's imaginative race around the world has been handsomely eclipsed in reality—by Howard Hughes and four companions who in 1938 (July 10-14) flew the round trip in 3 days 19 hours and 8 minutes. Soon even that will be bettered, when stratosphere machines cleave the thin air of the upper levels at speeds almost frightening and incredible.

First Use of Parachutes

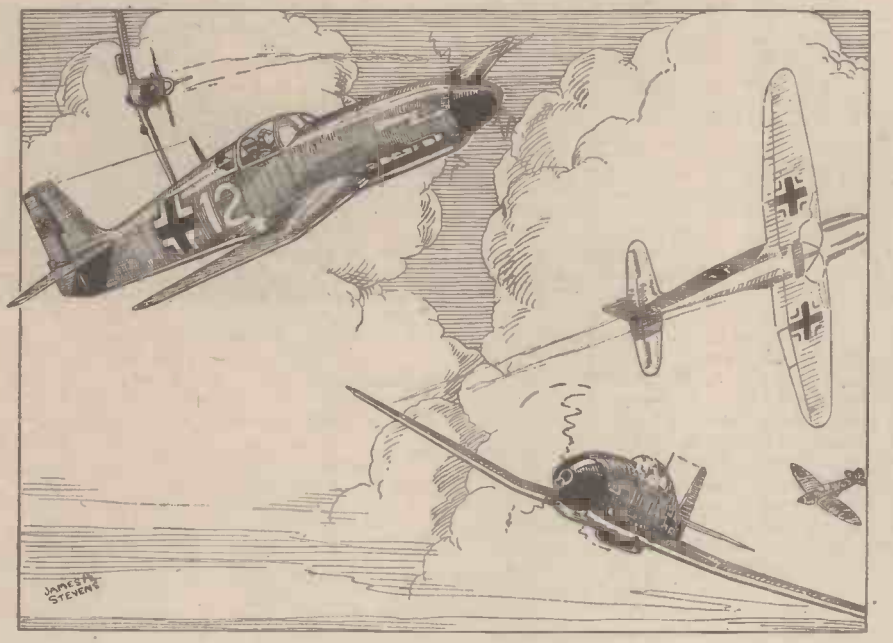
THERE are now so many remarkable escapes by parachute that one sometimes forgets that the last war was over before parachute jumping had passed beyond the experimental stage. For well over a century previously inventors had been toying with the idea of leaping to safety from a great height. As far back as 1783 the Frenchman, Lenormand, jumped from the tower of Montpellier Observatory wearing an apparatus of his own invention. The aim in this case was to find a means of escape from burning buildings.

The idea of jumping from balloons was developed about the same time by another Frenchman. Blanchard, who in 1785 successfully released a dog in a basket from a balloon. In 1793, he himself jumped, sustaining some injury in landing. The modern use of parachutes was developed in America, the first jump from an aeroplane being made two years before the Great War at St. Louis, Missouri, by Captain Berry. During the three years 1914-17 parachutes were out of the picture. Then German pilots began to "bale out" with the attached type of parachute which is stowed in the aircraft.

The earliest British report in which the enemy use of a parachute is mentioned appears to be one dated August 12, 1918. A patrol of four British aircraft under Captain C. H. R. Lagesse saw four Fokker biplanes east of Bailleul at 14,000 feet. All four enemy aircraft were destroyed. One burst into flames at 1,500 feet. The pilot pulled the aircraft up in a right-hand stall and jumped out. After a drop of 200 feet a parachute opened and the pilot landed. After the war the "seat pack" type of parachute was developed in the United States Army Air Service, and has since become universal.

Carving in Steel

AN engineer of Bognor Regis, Mr. H. Wiles, is, as far as is known, the first man to prove that it is possible to carve in steel. That he has been successful is proved by the fact that he has already carved five busts, and is now at work on a model three feet square. The only tools he uses are a small chisel and hammer and a burnisher for polishing the faces of his busts.



SCALE MODEL AIRCRAFT No. 7

The Heinkel HE 113

By J. H. Stevens, A.R.Ae.S.

The Latest and Fastest German Single-Seater Fighter

THE Heinkel He 113 is the production version (embodying all the latest modifications) of the three-year-old He 112 single-seater fighter. The He 112, which was produced rather later than the original of the now well-known Messerschmitt Me 109, was a very typical Heinkel design with a graceful fuselage and elliptical inverted gull wings. The original machine was, even for 1937, comparatively low-powered, with a Junkers Jumo 210 Ea engine of only 650 h.p.; yet it had a good performance and carried quite heavy armament.

The alterations made in developing the He 112 to He 113 are of some technical interest. A small batch on the lines of the prototype was built and tried out on the *Luftwaffe's* testing ground—the Spanish Civil War. The results there, by comparison with the Me 109, which had by then been fitted with a 1,000 h.p. engine, pointed to the need for more power. The machine was taken in hand and the nose was enlarged to take either the Daimler Benz DB-600 or DB-601 engines of 1,000 and 1,150 h.p. respectively. The extra weight was compensated by moving the retractable radiator back almost under the pilot's seat. The undercarriage legs were arranged to fold inwards instead of outwards. The protruding streamlined cockpit cover was faired back to the fin with built-on light-alloy panelling. The fin and rudder were enlarged to compensate for the extra torque of the more powerful engine and the resulting aeroplane was very like the present type. This machine was stripped, fitted with a specially "hotted-up" engine (which, incidentally, was thrown on the scrap heap after the one flight), and used to set up a world's speed record of 464 m.p.h. in April, 1939—this record being raised 5 m.p.h by the Messerschmitt Me 113 R three weeks later. For propaganda purposes both record breakers were publicised as standard fighters. In actual fact the original He 112 had a maximum speed of 300 m.p.h., while the present He 113 is thought to do about 400 m.p.h.

Simplicity of Production

In order to simplify production, the service version of the He 112, the He 113, was further modified and given a tapered wing, which corresponds as nearly as possible with the original elliptical plan form. The engine is understood now to be the new 1,500 h.p. DB-603.

The armament has had to be reduced because of the heavier engine and, instead of two shell-guns in the wing, two synchronised machine-guns in the fuselage and recessed racks for six 22-lb. bombs under each plane, there is only one shell-gun, mounted on the engine and firing through the airscrew shaft, and two synchronised heavy-bore machine-guns accommodated in the wing roots.

As may be seen from the illustrations, the He 113 is a very clean machine, with fuselage lines not unlike those of our own Spitfire. It is fortunate that the elliptical wing has been discarded, as the similarity was then too striking for comfort! The main plane is notable for the fact that the main spar is placed nearly halfway aft from the leading edge in order to allow room for the undercarriage, otherwise it is of fairly normal stressed-skin construction. The ailerons are fitted with mass balances and large trimming tabs—probably with servo control. The flaps are unusual, because the inner sections are of the plain type (so popular with Axis designers), and the outer ones are of the more usual split variety. The pronounced inverted gull wing is a common Heinkel characteristic.

A Powerful Engine

The fuselage is of normal construction, with a sliding cover for the pilot's cockpit. The nose represents the neatest cowling yet made for any of the rather bulky Daimler Benz engines. That used on the He 113 is a development of the 1,150 h.p. DB-601 liquid-cooled unit of 1,150 h.p., the modified 1,500 h.p. DB-603.

These modern German inverted engines are larger than the British Rolls Royce Merlin and do not permit such a good nose shape. Rearward-facing exhaust stubs are fitted, but not the thrust-giving ejectors used on British machines.

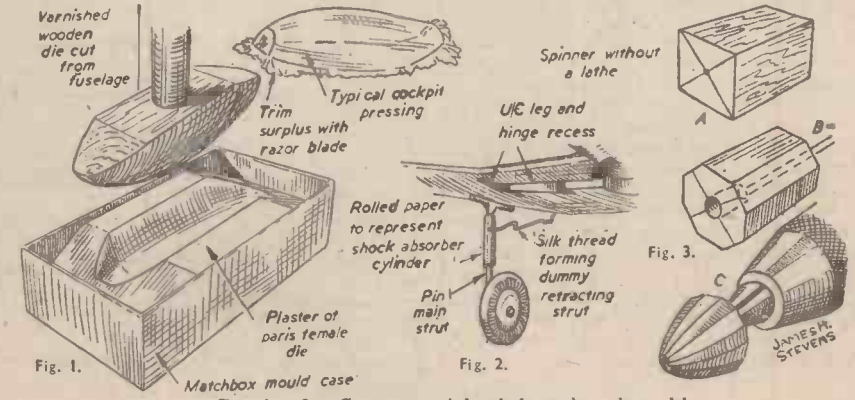
The tail unit has been finished off in a somewhat "square-cut" style, also, apparently, with a view to helping production. The inset controls, servo tabs, and balance hinges are worth noting.

The undercarriage legs hinge inwards and the whole wheel aperture is closed by fairings on the struts and small plates hinged beneath the fuselage.

Making the Model

The first question to be settled when making a model is the scale to be used and, as this has already been dealt with at length in other articles of this series, little need be said about it here.* One word to new

* *See particularly "The Boulton Paul Defiant," "Practical Mechanics," August, 1940, pp. 481-2.*



Figs. 1 to 3. Constructional details for making the model

modellers, which might not be out of place, is, take care in the choice of a scale and, once it has been decided upon, stick to it, as the chance of being able to make direct comparisons, model to model, adds greatly to their interest.

If a collection is intended, the solid model, i.e. carved from blocks and planks of wood, as opposed to being built up with framework and covering, is by far the best. For this type of model the best material is fairly soft and, if possible, close-grained wood. In these days it may be necessary to make do with deal or pine, but in these the grain is fairly open, and the tendency when glasspapering is for it to become slightly furrowed. The best materials include American whitewood (or bass), beech, birch, satin walnut (in fretwood form for the main planes), plane, boxwood, or holly—the two latter being rather more rare, but very good. The tail surfaces on a small-scale model are very conveniently made from the red fibre which is used for making washers. As it has no grain and is very tough, this material is easy to shape and there is no risk of splitting.

The Transparent Cockpit Cover

When the fuselage is carved from the chosen block of wood, the cockpit section should be shaped with the rest. Once shaped, it should be carefully cut off intact with a fretsaw. It is then mounted on a stick, varnished, and used for the male die for producing the transparent cover. The material for this cover is thin cellophane or celluloid—the stoutest available commercial wrapping would be best. A female die is produced by making a plaster-of-paris cast of the male tool.

The tools and material are prepared for action by being heated : the former in an oven, or by *gently* heating it by a fire, and the latter by " cooking " in very hot water. Gloves are advisable in doing this work, as every part is hot. When ready, the tools are put in a convenient working position, the cellophane removed from the water (in which it should have been suspended by a piece of string), dried on a cloth, laid across the mould and the die pressed quickly and firmly in place. The first attempt may not be a success; the most likely cause of failure being too rapid cooling of the material. Though an excessive surplus of cellophane, with consequent wrinkling may also be a contributory cause.

The Retractable Undercarriage

The undercarriage of the He 113 is very simple and can be made from brass wire of a gauge appropriate to the scale being used (large pins will be found very useful, as the heads serve to retain the wheels more neatly than can be done with wire). A cross shaft of wire is soldered to the top of each leg in order to act as a hinge (see Fig. 2), which is let into a slot in the undersurface of the wing and packed with plastic wood Care should be taken that the leg rises correctly into its slot before final fitting. The shrinkage of the plastic wood when it dries should give ample clearance on the hinge: if it does not it can soon be worked free.

For a small-scale model, i.e. 1/72 or less, the little retracting strut presents a tricky problem, and it is suggested that the simplest way is to glue a silk thread that will be taut when the leg is down. The small fairing plates under the fuselage can be used as catches to hold the legs up. The main fairing plates are perfectly satisfactory if made of stiff paper which, once it is painted, is amply strong.

The retractable tail wheel is made in a similar way, but is, of course, even more delicate to model. For the small fairing plates, and those of the main wheels, tiny cloth (silk or fine cotton ribbon) hinges will be found quite satisfactory.

Making the Airscrew

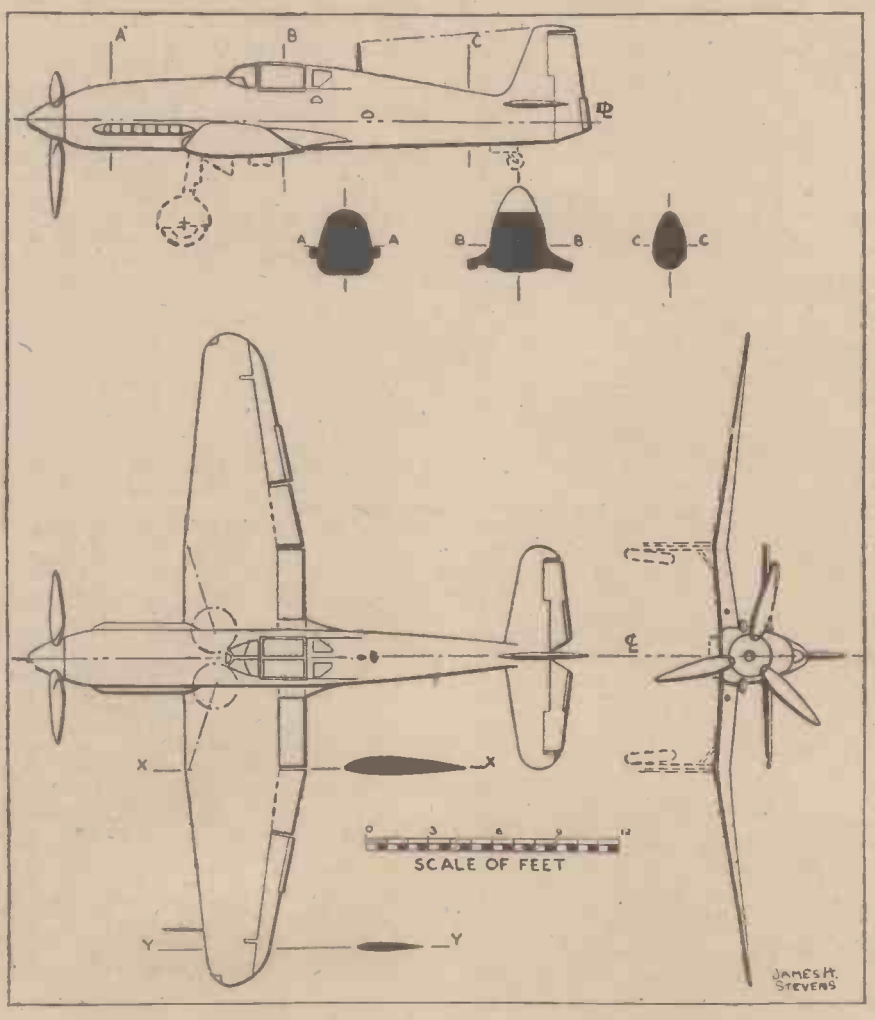
Quite good cast model airscrews can be bought at model dealers, many of them for 1/72nd scale, but it is quite a simple matter to make one for this model. If a lathe is available, the spinner should be turned up from wood or metal, according to choice. However good one's eye, it is impossible to make an absolutely symmetrical spinner by hand, and the following method is recommended for those not fortunate enough to possess a lathe—or a friend with one : Obtain a piece of close-grained hardwood and square it up to the outside dimensions of the spinner, draw diagonals on the end, mark a circle from the centre so found, and drill a hole carefully down the centre of the block. (At this stage the radial positioning of the three blades should be clearly marked on the rear end of the spinner block.) Next drill a hole the size of the shell-gun bore in one end to a depth of about one-quarter the length of the spinner. and glue a pin firmly in the main hole (Fig. 3). Now carve the block down to an octagon and finally a 16-sided figure, then carve it to its correct pointed shape, always continuing the 16 facets. Finally, mount the spinner by its pin in the chuck of a hand brace itself gripped in a vice (it must be very close up and firm or the pin will bend and all the careful work go for naught), and finish off by rounding with a file and then fine glasspaper. This improvised lathe works quite well for light finishing work, but is not up to rough shaping. The blade root positions should be located and carefully drilled while still held in the drill chuck.

The airscrew blades are simply filed from fibre and glued into the holes in the spinner.

Colour Scheme

The He 113 is simple enough to paint—at least as long as the present colour scheme is retained. The main colouring is a very dark shade of green (darker than olive green and bluer in tone) with very pale blue or light stone-colour undersurfaces. The German black cross, heavily outlined in white, and the outline itself edged with black, is carried on the sides of the fuselage and on both surfaces of the wing. A small black, white-outlined swastika is painted on the rudder. The airscrew blades and the exhaust pipe are black. The interior of the cockpit is light grey. The first squadron of which illustrations have appeared has as a distinguishing marking a conventionalised lightning streak on the engine cowling. Individual machine numbers (it is believed, from 1 to 12) are painted in white on the sides of the fuselage. The illustrations show the exact location of all these details.

SIDE, PLAN AND FRONT VIEW OF THE HEINKEL HE 113



A Magnetic Tape Recorder-Producer

Auditory Perspective and Magnetic Tune Recording

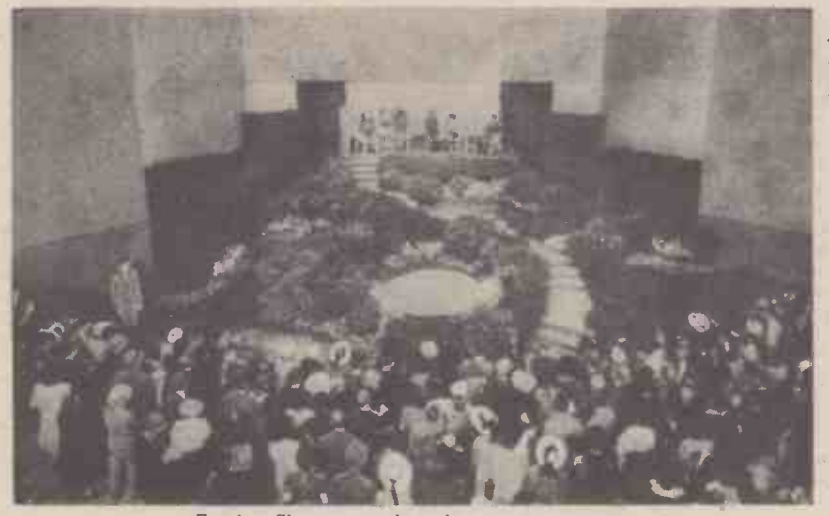


Fig. 1.—Showing an audition demonstration in progress.

IN the fundamental plan for the Bell System Exhibit at the New York World's Fair, participation by the audience was considered essential. To apply this to a demonstration of auditory perspective and magnetic tape recording—two important contributions of the Bell Laboratories—it was decided to hold successive interviews with members of the audience and reproduce them from tape recordings. That the platform might not be empty during the reproductions, the interlocutor and his group were replaced by lay figures. Electrical and mechanical arrangements for this involved considerable ingenuity, both in the planning stage and as construction proceeded.

Design Problems

Technical requirements for the audition exhibit were dictated by considerations of good showmanship and presented a number of design problems. For example, no microphones, loudspeakers, control or other equipment should be visible from the audience area; no screen or glass should separate the talkers on the platform from the audience; the conversation, normally carried on at rather small volume, must be projected with sufficient level to be easily understood at any point in the audience area in spite of normal audience noise. A two-channel stereophonic system was selected with a view toward maximum naturalness rather than emphasising localisation of the sound source. A standard theatre system of two-element loudspeakers was installed above the upper corners of the proscenium opening on each side, and hidden by motion-picture screening. The tiny openings in the screen were invisible from a distance but presented little obstruction to the sound from the loudspeakers. The microphones were located just back of the loudspeakers near the ceiling of the platform area, out of sight of the audience. Each microphone was placed in a large box-like baffle made of layers of muslin stretched on a frame-work. The baffles were highly directional, which serves two purposes, first, to provide satisfactory sound pick-up at a distance of twelve to eighteen feet, and, second, to make them relatively insensitive to sounds entering the platform space from the audience area. In spite of the excellent acoustic design of the auditorium, both as to shape and to the acoustic treatment, some small part of the sound projected by the loudspeakers found its way through the opening of the proscenium arch into the platform space. This space also required careful design to prevent the reflection of stray sound toward the sensitive region of the microphones while presenting the maximum direct sound from the talkers. It is readily seen that this system is novel in several respects as a pure public address system in addition to its reproduction of speech.

Fig. 2.—One of the magnetic tape recorders.

Making a Recording

Each performance began with the selection of a group of five people who were ushered into an anteroom where, with an interlocutor, they decided on the subject of conversation. As soon as the platform was vacated, it was moved into the wings, and the group took their places on the chairs. When the previous demonstration had been completed, the platform was rolled back into view of the audience, and the interview began. Visible to the interlocutor but to no one else was a large voltmeter connected to a potentiometer driven by the recorder; thus the pointer indicated elapsed time. When about two minutes had passed, the interview was concluded, and the party walked down a path to take seats on a bench. Meanwhile attendants (Fig. 3) had set up lay figures on a second platform which came into view as the first one was withdrawn. The interview was then played back to the audience and to the particular group which had made the recording.

Two identical recording-producing channels were used to give auditory perspective; one of these is shown in Fig. 5. From the microphone the sound signals were transmitted through amplifiers to a "baffle equaliser," which corrected the response characteristics of the microphone-and-baffle combination. Next to that was the dialogue equaliser, used because the speech level projected to the audience was considerably higher than that produced on the platform by the talkers. Its higher loss at the low end overcame the guttural sound of speech at high level.

The Horn System

During the recording cycle the horn system was used to reinforce the speech so that after passing through the limiting amplifier the circuit divided two ways, one

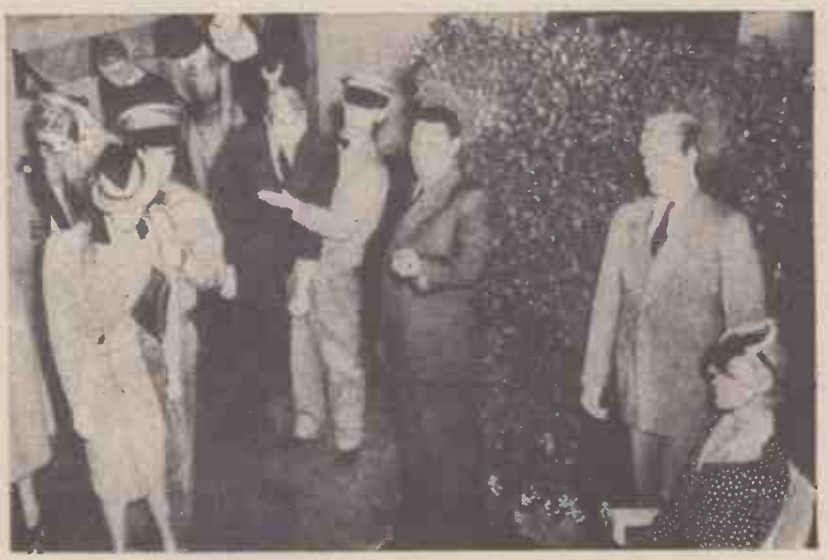


Fig. 3.—Lay figures being placed in position on the platform.

Fig. 4.—The first two panels (from the left) mount amplifiers, channels 1 and 2 respectively; on the right-hand panel are monitory loudspeakers and the announcer's emergency amplifier.

to the public address system and one to the recording machine. The limiting feature in the amplifier prevented overload of the tape under unusual circumstances, such as loud laughter, and was not called into play during the usual recording. The horn equaliser, the characteristic of which is shown, was adjusted so that the combination loudspeakers projected a flat frequency characteristic to 7,000 cycles. The amplifier, dividing network and loudspeakers were characteristic of a good theatre installation. At any time that recording or reproducing was not actually taking place, the horns were disconnected from the circuit and a dummy load placed on the output of the amplifier.

During reproduction of the conversation the relays in the centre of Fig. 5, made contact downward with the result that the signals from the tape went through an amplifier to a reproducer equaliser, the function of which was to compensate for the normal frequency characteristic of tape recording. Signals were then transmitted to another amplifier, volume control, the limiting amplifier (which in this case operates like an ordinary amplifier), and to the loudspeaking system on the stage.

Maintaining Synchronism

In the magnetic-tape recorder-reproducer shown with cover open in Fig. 2, a separate tape was associated with each channel. Synchronism between the channels was maintained by winding the two separate tapes simultaneously from the left-hand reel to the right-hand reel, one tape going through the near recording units and the other tape passing through the far recording unit. This method is simple and no difficulty was experienced in maintaining synchronism of a higher order than is necessary for stereophonic reproduction.

When the interlocutor stopped the recording of the conversation on the platform by pushing a button, the tape drive was stopped by the release of a forward driving clutch. The tape was then rewound at high speed by the operation of the left clutch which connected the nearly empty left-hand reel to the rewind motor. This clutch was finally released by a cam-operated contact before the tape was completely unwound from the right-hand reel. The control relays ensured that the tape could then be driven only in the forward direction, and that the circuit of Fig. 5 was switched for reproducing. A contact, closed when the section of the platform carrying the mannequins was in position in full view of the audience, started the reproducing cycle. The reproduction continued until its elapsed time had been equal to the recording time. The tape then rewound automatically as before. It was necessary to interlock mechanically and electrically all these operations to take place in a definite order to relieve the interlocutors of control sequence and to protect the equipment from control errors.

Three Machines Installed

Since this equipment was in operation for thirteen hours a day and seven days a week, three of the machines were installed, the nominal arrangement being that one was in use, one stand-by and the third available for maintenance and test. The amplifying equipment associated with these machines was mounted on the three relay racks shown in Fig. 4.

During the twenty-nine weeks of the New York World's Fair, about 110,000 persons took part in the auditions, while many times that number enjoyed the demonstrations.

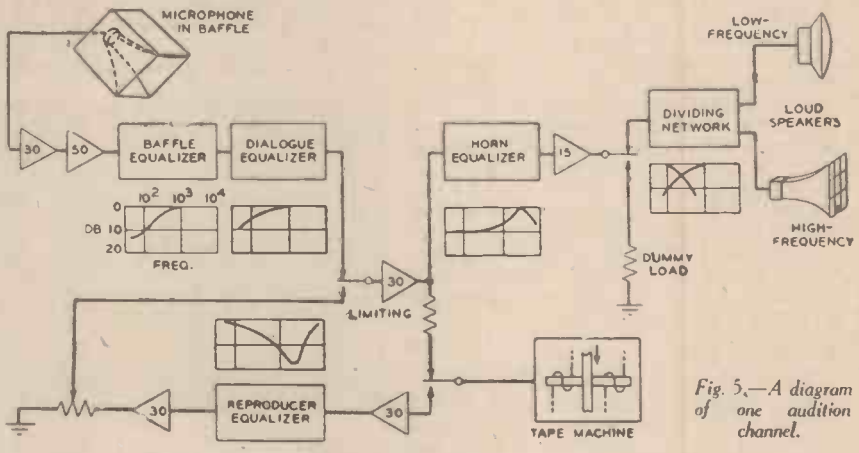


Fig. 5.—A diagram of one audition channel.

Radio Traffic Control

America Solves the Traffic Problem

A NOVEL plan to bring traffic signals into cars in the form of distinctive tones corresponding to the "stop" and "go" lights, may in time make a car-radio a legal requirement on every one of the nation's 30,000,000 cars, according to the men behind the plan in America.

In its present form, this traffic-control system uses the existing car radio tuned to 550 kc., thus making the system immediately available for the 6,000,000 cars now equipped with auto-radios, though eventually a special small set would be employed with fixed tuning to the highway safety-signal frequency.

By the use of this system, the driver, instead of letting his attention wander from the roadway in his search for traffic signals in unfamiliar territory, would hear a pleasant low tone as long as the lights ahead were green. When "red" comes on, in all cars on that section of the roadway an interrupted high note would be heard, like a crossing signal. If desired, relays could be installed which would switch on the car instrument board. Cars thus equipped and operating over a test section of New York City highways, were described over the N.B.C. Blue network recently.

Recorded Messages

The small highway transmitting unit, which may be mounted on a telephone pole or a traffic light stanchion, makes use of a magnetic tape sound recording device by which continuous repetition of a traffic bulletin or a safety message may be broadcast. A distinctive sign placed on the street or highway in advance of a given radio zone calls attention of motorists to the radio system which they are approaching and tells them the frequency to which to tune their set.

Preventing Traffic Jams

By means of this device, traffic can be re-routed to a secondary thoroughfare from crowded highways, preventing jams before cars have a chance to pile up: drivers can be warned of speed limits or of emergency in case of fire or accident; doctors can be paged on the road or pedestrians can be warned of an impending change in traffic lights. The robot can give oral warning of such impending changes to drivers and pedestrians also.

LATE DELIVERY OF "PRACTICAL MECHANICS"

A Message from the Editor

We are doing all we possibly can to ensure that "Practical Mechanics" reaches you regularly every month, but occasionally there may be a delay owing to the dislocation of transport caused by air raids.

If, therefore, "Practical Mechanics" should arrive after the normal day of sale, please help your newsagent by accepting your copy as usual. Under the Government's Paper Control Order he is unable to return unsold copies, and if you refuse to accept he will have to pay for it himself.

Your newsagent is working under difficult conditions these days, and your kind co-operation in this matter will be greatly appreciated by him—and by ourselves.

A NEW SERIES

The Story of Chemical Discovery

No. 4—Scientific Chemistry Begins

ALCHEMY, to all practical intents and purposes, closed its long and tortuous career with the passing of John Baptist van Helmont, the Brussels physician, in 1644. Van Helmont, "the last of the alchemists," had played a certain part in preparing the way for the coming of scientific chemistry. Nevertheless, at heart, van Helmont remained to the end an alchemist and a follower of fanciful theories, an individual who preferred to speculate upon supposedly mystical matters connected with the chemical arts rather than to search actively for strictly logical explanations of the chemical facts which he undoubtedly brought to light.

Honourable Robert Boyle

When van Helmont died, there had just returned to England after a protracted tour on the Continent, a youth of noble family, one Robert Boyle, born in 1627, the 14th child of a certain Baron Youghall, Viscount of Dungarvan and Earl of Cork. Robert had received his education partly at Eton, but for several years he had, in the company of a brother and a French tutor, wandered up and down Europe in a somewhat desultory fashion and with apparently no particular object.

On his return to London, Boyle found that his father had died and that he had inherited certain estates, both in this country and in Ireland. He was, however, not of the temperament to settle down contentedly to an aimless country life. For one thing, his health was bad and, furthermore, he was possessed of studious habits, which made the idea of complete inactivity particularly distasteful to him.

The Honourable Robert Boyle, founder of English Chemistry.

Thus it was in the end that the Honourable Robert Boyle settled down at Oxford in 1654—10 years after van Helmont had died—and in that famous city of learning devoted himself entirely to scientific research.

Boyle spent 14 years in Oxford. Then he went to London and remained there for the rest of his life.

A curious fellow was Boyle. He was pale and emaciated and very delicate constitutionally. Mentally, he was at times subject to fits of something akin to melancholia. As one contemporary puts it: "He had divers sorts of cloaks to put on when he went abroad, according to the temperature of the air, and in this he governed himself by his thermometer." For nearly forty years it is said that he laboured under such a feebleness of body and depression of spirits that it was astonishing how he could read, meditate, perform experiments, and write as he did. Yet, somehow or other, Boyle proved himself to be an indefatigable worker. He left six folio volumes of scientific works, many of them connected with chemistry, and all of which constitute a mine of information concerning the beginnings of scientific research in England.

The "Invisible Society"

Boyle was one of the founders of the Royal Society, which began as the "Philosophical Society," or, as Boyle himself preferred to call it, the "Invisible Society," because it met secretly. During his later life Boyle had much to do with the running of the Royal Society. Yet he would never consent to become its president, for the charter of the Society prescribed the taking of an oath upon accession to that office, and Boyle, being of a very devout and religious disposition, strictly interpreted the injunction of the New Testament not to swear "neither by heaven, nor by earth, nor by any other oath."

A primitive microscope of Robert Hooke's day. It is made of wood and cardboard and is equipped with only a single lens.

Such was the Honourable Robert Boyle, the individual who has ever been said to have "worn the white flower of a blameless life." Such was the man who gave scientific chemistry its first impetus, who disentangled scientific thought from the wrappings and trappings of alchemy and who, in every possible way, proved himself to be one of the earliest pioneers of scientific research, not only in England, but in the entire world.

Boyle has been called the "Father of Chemistry." It is a true title, for although Boyle's actual chemical discoveries were not in any way striking, it was he who first insisted on that which we may call the chemical method of scientific investigation which was to become so enormously fruitful in after years.

"Boyle's Law"

Boyle is known to every schoolboy as the discoverer of that famous law connecting the relations between the pressure of gases and the volumes which they occupy. This law, known afterwards as "Boyle's Law," was first published in 1660, after Boyle had invented and perfected a new form of air pump. Boyle did a good deal of experiment on the subject of atmospheric pressure, and it is to him that we owe the introduction of the term "barometer."

It was Boyle who first drew attention to the darkening of silver salts by light, upon which fact the whole edifice of photography has been reared. He, too, it was who discovered phosphoric acid, wood alcohol, several luminescent substances, and various chemical salts. He was the first maker of phosphorus in England, and he seems to have distinguished between acids and alkaline substances by means of vegetable colour tests.

The Strange Theory of "Phlogiston," or the Principle of Fire

Boyle's great service to chemistry, however, lies in his sweeping away of the fantastical "elements" of the ancients and of the alchemists. Although he did not distinguish the chemical elements as we know them, he introduced the first clear conception of what an element really is. Such a notion he set forth for the first time in a rather remarkable book which he entitled, *The Sceptical Chymist* and which was published in 1661. In *The Sceptical Chymist* Boyle demolishes the old Aristotelian and alchemical theory of elements, producing clear and convincing reasons for so doing.

Elements

"I mean by 'Elements,'" says Boyle in his book, "certain Primitive and Simple or perfectly unmingled bodies which not being made of any other bodies or of one another are the ingredients of which all those called perfectly mixed bodies are immediately compounded, and into which they are ultimately resolved."

In other words, elements are bodies or substances which cannot be resolved into other substances. They have a fundamental "one-ness" throughout, but by combining

together in various proportions they are able to give rise to numerous other compounds.

Boyle had an assistant at the Royal Society, a clever experimenter and an original thinker, albeit a crabbed, ill-tempered morose sort of a fellow who, during his last two or three years of life, sat night and day at a table and never went to bed or undressed himself, so engrossed was he in his scientific studies. Robert Hooke was this man's name. He was born in the Isle of Wight, in 1635, and was originally intended for the Church. But Hooke, like Boyle, was delicate, and after a somewhat erratic career, he ultimately became, in 1662, "Curator of Experiments" to the Royal Society

Robert Hooke

Hooke's work was many-sided, and for that reason we cannot pretend to deal with it in detail here. There is one aspect of it, however, which we must stress. Hooke was probably the first chemical scientist to formulate any reasoned explanation of the phenomenon of combustion.

Hooke's work on combustion is a very important landmark in chemical history. From time immemorial, mankind has naturally been interested in combustion, with its accompaniment of flame and fire. Exactly what flame and fire are, no philosopher before the time of Hooke had ever been able to explain. It is, however, to the credit of Robert Hooke that he arrived at the opinion that the burning of a combustible (or, as he termed it, a "sulphureous") material, as, for example, charcoal, is due to the combination of it with a substance existing in the air. Such a substance, also, said Hooke, exists in saltpetre (potassium nitrate), because charcoal and saltpetre can be made to burn in a vacuum when heated by means of the sun's rays focused by a burning glass.

Hooke published his ideas of combustion in a curious work entitled, *Micrographia*, which dealt mainly with microscopical observations which he had made. It is probably for this reason that they were overlooked, for Hooke's guess at the real nature of combustion was so astonishingly accurate that it is hardly credible that his views should have been for more than a century subsqeuently supplanted by a totally erroneous theory which held the scientific world in its grip until repeated experiment eventually elucidated the real nature of fire and flame and so confirmed the remarkable exactitude of Hooke's original supposition.

John Mayow

John Mayow, a contemporary of Hooke's and a Cornishman by birth, also arrived at similar conclusions independently of the former experimenter. Mayow for a time followed the profession of law, "especially in the summer at Bath," but he was scientifically inclined and he devoted much time to the study of the human body. Mayow showed that the dark venous blood is changed to bright red blood in the lungs by taking up an unknown substance from the inhaled air, which unknown substance he called the "nitro aero" constituent of air. He seems to have realised, like Hooke, that flame and fire result from the combination of the burning substance with some ingredient of the air. Had he lived, John Mayow would undoubtedly have made his name as a pioneer chemist, but he died in 1679 at the early age of 35, having been married a short time previously, and "not altogether to his content," as a contemporary somewhat bluntly puts it.

The early theories of Hooke and Mayow concerning flame and combustion sank into obscurity after the deaths of their authors. In place of them came the German theory of "Phlogiston," which saddled the scientific world for a century before it was finally dispelled and a return was made to the correct theory of the two former English experimenters.

The "Phlogiston" theory of combustion began with one John Joachim Becher, of Speyer, in Germany, who was born in 1635, and who died in 1682. Becher retained the alchemical notion of the metals containing "three principles," the nitrifiable, the mercurial, and the combustible, and he reasoned that during the burning of a substance its combustible principle was expelled, being wafted away into the air via the flame of the burning material.

After Becher came another German chemist, one George Ernest Stahl, who was born at Anspach in 1660, and died in Berlin in 1734. It was Stahl who put on its feet the now famous but long discredited theory of "Phlogiston." Stahl, who was Becher's pupil, took the germ of his "Phlogiston" idea from his master and merely elaborated

Boyle's own representation of his air pump. With the aid of this instrument he formulated "Boyle's Law"

the theme, making it plausible and presentable in the characteristic German fashion.

Combustion

According to Stahl, when a substance burns it emits a mysterious entity which was to be known as *phlogiston*, a word which he derived from the Greek *phlogisteo*, "I set on fire." Phlogiston, therefore, according to Stahl's theory, was a principle which was contained by all combustible bodies. When such substances burned, their phlogiston escaped. Materials which burn readily contain a good deal of phlogiston. Substances which do not contain much phlogiston do not burn easily.

Thus carbon (charcoal) was supposed to be nearly pure phlogiston, whilst metal (such as lead) which, when they were burned (or oxidised) became converted into "calces" (or oxides), were supposed to consist of a mixture of phlogiston and such calces.

Thus :

Metal phlogiston + metal calx (oxide).

Had those early chemists made greater use of the chemical balance the tremendous and century's-duration error of phlogiston might probably never have arisen. Stahl, the originator of the phlogiston theory, and his followers, entirely overlooked the fact that when a substance burns it increases in weight. For example, if a piece of lead be calcined in air, the "lead calx" (lead oxide) which is left is heavier than the original mass of lead. And, in a like manner, if a piece of coal be combusted, the weight of the ash plus the weight of the gaseous products of combustion exceeds the original weight of the coal.

Universal Law

Such a law is a universal one, and it admits of no exception. Since, however, the phlogiston theory laid it down that a mysterious something (called phlogiston) actually escaped from a burning substance, it ought naturally to have followed that the ash or calx, or whatever the product(s) of combustion may have been should have weighed less than the original weight of the combustible material. Instead, however, a few investigators — daring spirits who rebelled against the imposition of the fradulent phlogiston theory—showed conclusively that the combustion products of combustible substance actually weighed more than the original material. Hence, as they said, the phlogiston theory could not be correct.

To all of which statements, George Ernest Stahl, the comfortable and self-satisfied German, replied that "phlogiston is, in addition to being a principle of fire, also a principle of levity."

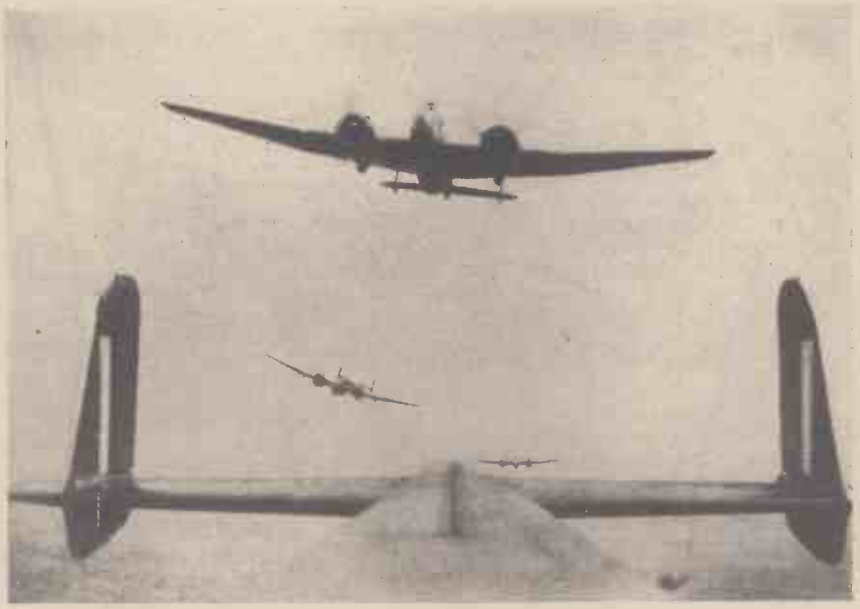
In other words, phlogiston is a sort of essence of lightness. It weighs almost less than nothing. Or, at any rate, its presence in a substance causes that substance to weight actually less than it would do were the phlogiston to be absent from it. Hence by adding phlogiston to a material you gave additional lightness to that material. The *thing* called phlogiston was very different from anything else known. Not only was it the principle of lightness, but it was also all-pervading.

When air was saturated with phlogiston, combustible materials would not burn in it. This supposition explained the fact that combustible materials would not burn in an atmosphere of nitrogen or carbon dioxide. Ordinary air (containing oxygen) was said to contain little phlogiston. Hence when combustible materials burned in it, their constituent phlogiston readily escaped into it.

Strange Theory

And so the strange and ludicrous theory of *phlogiston* went on and had its way. So widespread did it become that nearly all the famous chemical investigators of the 18th century became adherents of it. The renowned Joseph Priestley, a pioneer chemical discoverer, lived and died a confirmed "phlogistonist." When he discovered oxygen, he called it *dephlogisticated air*, because, as he imagined, the oxygen supported combustion so vigorously that it must be almost entirely devoid of phlogiston. Combustible material burning in this gas emits a copious flow of phlogiston into the gas, which latter absorbs the phlogiston eagerly and readily.

Such, in brief, was the now often-referred-to theory of phlogiston. Phlogiston, however, constituted a scientific deception of the 18th century and of most of the chemists of that age. It was a German-imposed theory based upon unwarranted assumptions and with little regard for actual facts. Nevertheless, it had its usefulness in stimulating chemical research and discovery, for, after all, it did at least make some attempt to explain the age-long phenomena of flame and combustion without having recourse to the many ridiculous speculations of the ancients upon such matters.



A flight formation of Handley Page "Hampdens"

Aircraft Recognition

Suggestions for Home Study

By R. A. Saville-Sneath

THE general interest in aircraft recognition needs little explanation. Whether we play an active part in any of the defence services or pursue our normal civilian occupation, in totalitarian warfare all are targets and few escape some concern with the subject.

Wintry conditions may be less favourable to mass attacks, but they provide better cover for lone raiders and for hedge-hopping tactics. Prompt spotting of a hostile plane may enable one to get family or neighbours under cover before the deadly business begins.

Apart from the specially air-minded student, the usual reaction to an array of aircraft silhouettes is one of bewilderment, which increases as many new types are added.

The man in the street, no less than his service colleagues, may, with very little effort, acquire a useful knowledge of the subject. A photographic mind or an abnormally retentive memory is quite unnecessary so long as a few simple rules are observed and a definite method is followed.

Fix a Limited Objective

Avoid the attack of mental indigestion which may follow a hasty attempt to memorise many types, by firmly fixing a modest objective. If you are already able to recognise *six* different British aircraft, make your immediate objective *twelve*. If, however, you are not completely certain of *six*, take that modest figure as your goal.

In selecting the first objective, choose those friendly machines which are most frequently seen in your neighbourhood. Cut out illustrations of them whenever you get the chance and paste these on to cards, first of all removing the name of the machine. Whilst doing so, note carefully the principal structural differences, such as :

1. Whether high, mid, or low WING.
2. The number of ENGINES.
3. TAIL UNIT, whether simple or compound, i.e. single fin and rudder or two or more.
4. Special features and general shape of FUSELAGE.
5. Type of Engine (Radial or In-line) and position of engine nacelle.
6. Type of UNDERCARRIAGE, whether fixed or retractable, etc.

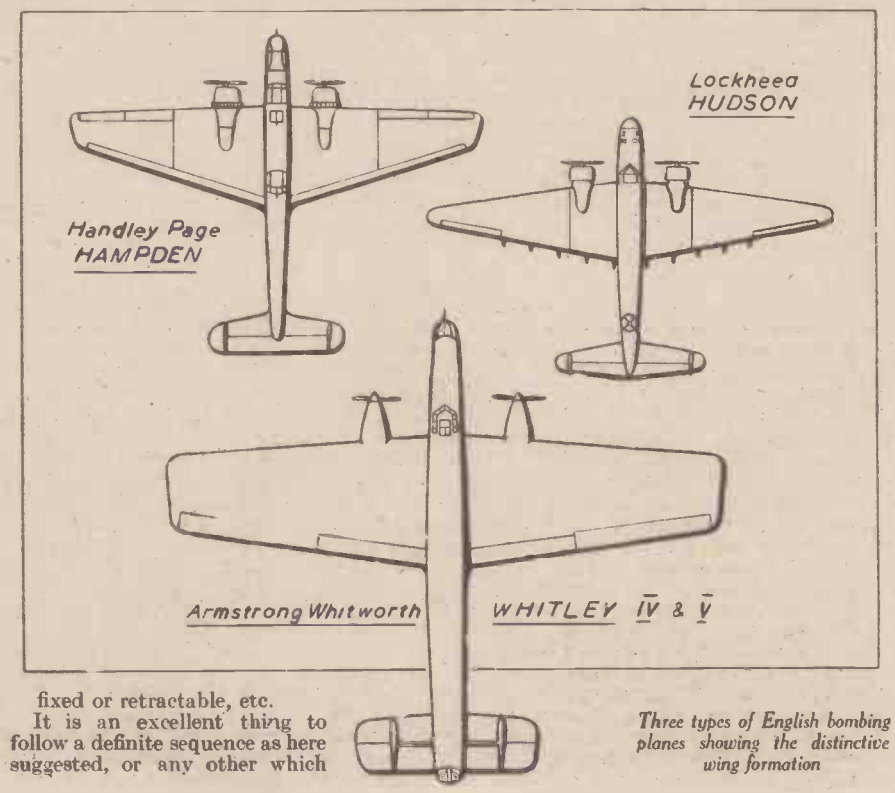
It is an excellent thing to follow a definite sequence as here suggested, or any other which you find convenient, with the object of establishing a simple routine.

After each of the cards has been individually studied, shuffle them together and test your recollection of the points observed by correctly naming each card. You may fail at the first attempt, but reshuffle and try them again until you recognise each one instantly.

Do not fall into the easy trap of remembering the landscape or recognising the pilot's face. Short cuts of this kind will not help you to recognise machines in the air.

When your card test shows you to be name-perfect on your first selected objective, which may, for example, include an Avro Anson, you will on next noticing this machine in the air be surprised to find that you are *really seeing it* for the first time. You will take note of the low wing position; two engines of radial type, with fluted cowling; the large glazed cabin or "conservatory"; the domed gun turret aft, and the unusual shape of the tail plane. As each of these points, noted, in turn, now confirms your own mental picture, your previous vague uncertainty of recognition disappears. As the plane recedes in the distance, you no longer regard it as a meaningless silhouette, but as a friendly shape, which you will have no difficulty in recognising again.

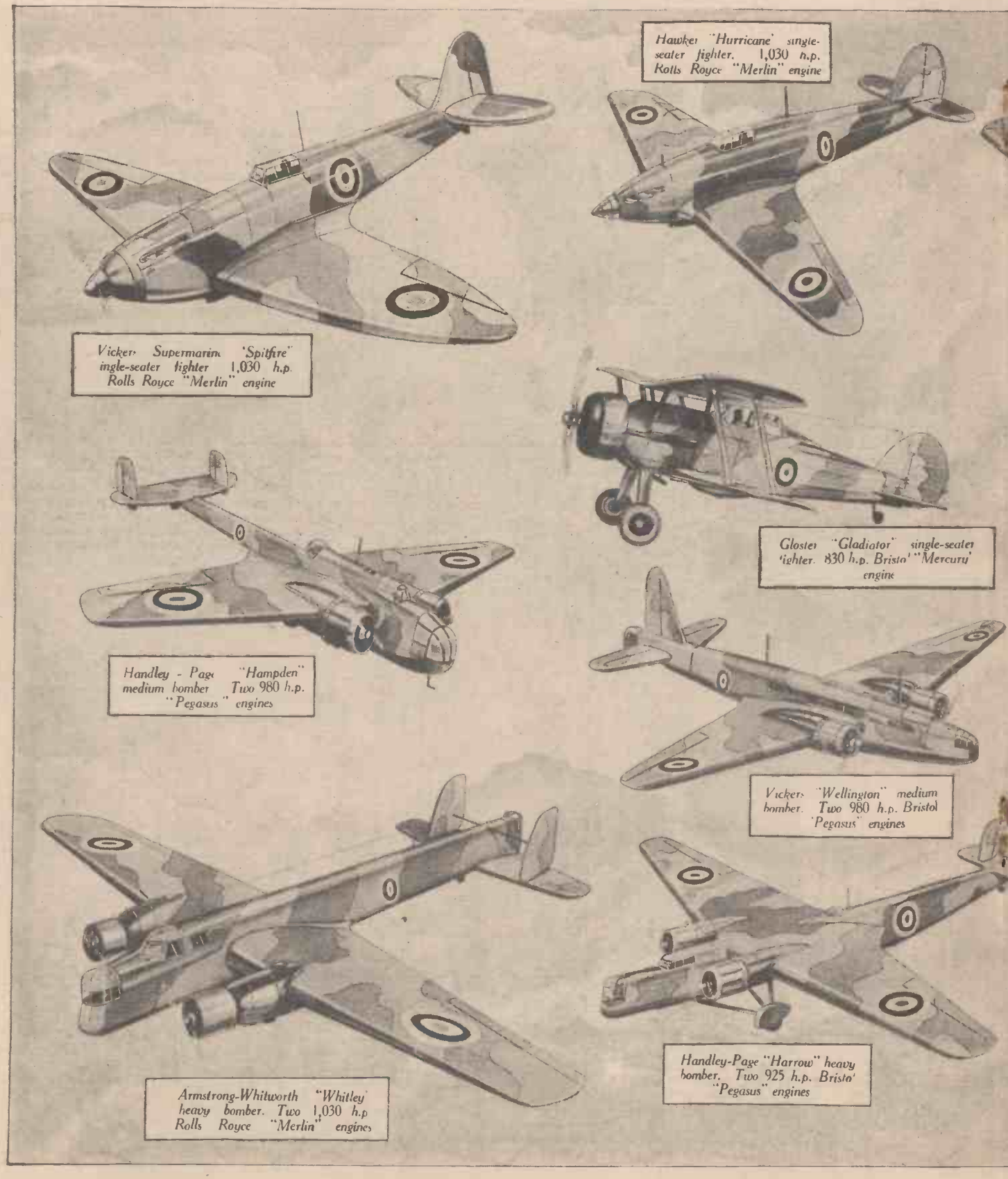
In some cases a slight effort may be required before facility is acquired in recog-



Three types of English bombing planes showing the distinctive wing formation

SOME OF THE MANY INTERESTING TYPES

HOW TO RECOGNISE THESE MACHI



Hawker "Hurricane" single-seater fighter. 1,030 h.p. Rolls Royce "Merlin" engine

Vickers Supermarine "Spitfire" single-seater fighter 1,030 h.p. Rolls Royce "Merlin" engine

Gloster "Gladiator" single-seater fighter. 830 h.p. Bristol "Mercury" engine

Handley - Page "Hampden" medium bomber Two 980 h.p. "Pegasus" engines

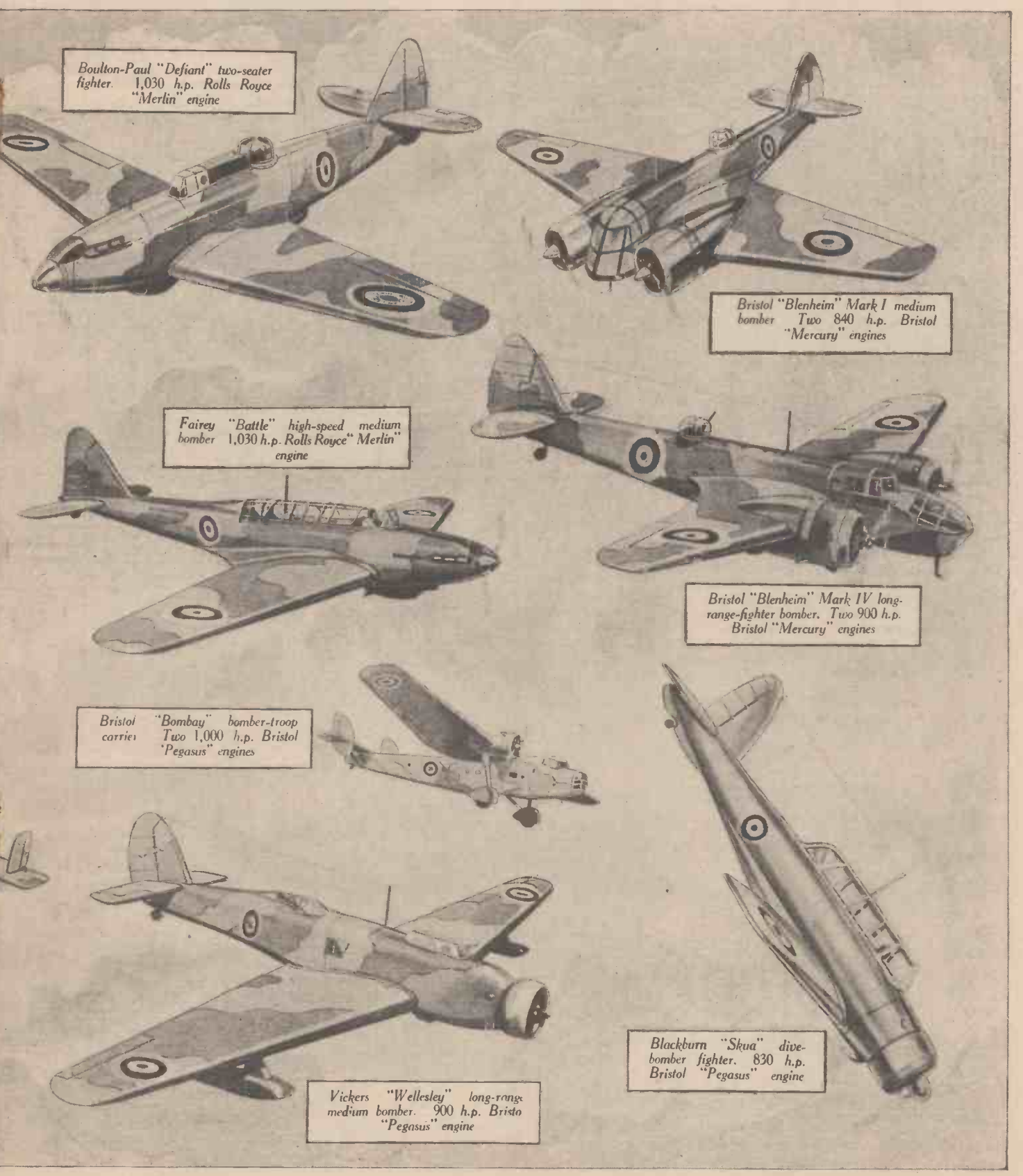
Vickers "Wellington" medium bomber. Two 980 h.p. Bristol "Pegasus" engines

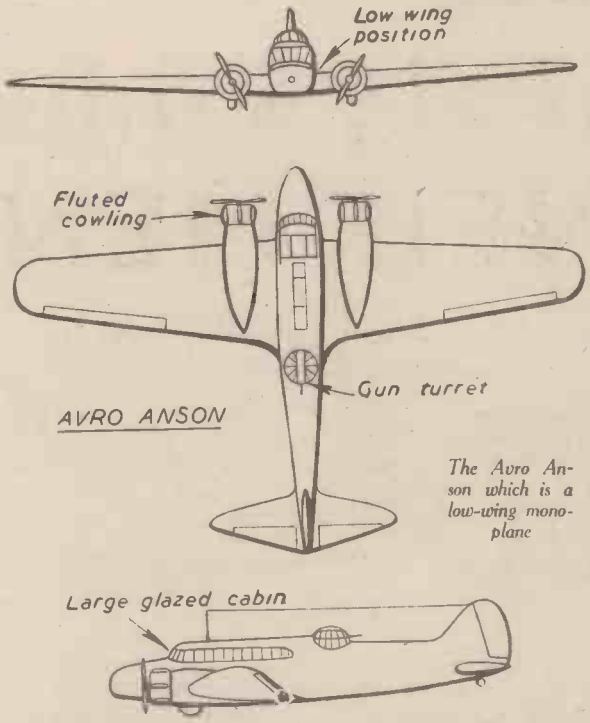
Armstrong-Whitworth "Whitley" heavy bomber. Two 1,030 h.p. Rolls Royce "Merlin" engines

Handley-Page "Harrow" heavy bomber. Two 925 h.p. Bristol "Pegasus" engines

OF AIRCRAFT IN SERVICE WITH THE R.A.F.

NES BY THEIR DISTINCTIVE FEATURES





The Avro Anson which is a low-wing monoplane

nising the first dozen types. As soon as this stage is reached, further progress is easy, as long as the principle of limited objective is followed. One, two, or three new types may be added weekly according to individual aptitude and opportunity.

Know Your Friends First

Just as in daily life we recognise our friends without conscious analysis of their features, so eventually with aircraft features, the final stage is familiarity and effortless recognition. Although you may have made no serious effort to memorise the names and type numbers of hostile planes, your increasing knowledge of friendly types will produce an instinctive sense of caution when unfamiliar characteristics are noted.

About Biplanes

Do not—in the early stages, at least—clutter up your mind by trying to memorise friendly biplanes and other relatively slow training and transport planes. Many of these, although at present doing valuable work, are obsolete or obsolescent types. They may be generally assumed to be friendly. It is true that the German air force includes large numbers of biplanes, but as these are similarly employed for training and communication purposes, it is unlikely that they will be seen in action over Great Britain. If and when that occurs, it will be an unmistakable sign that Goering's reserves have been sorely depleted.

The first 24

The following list of British Service *monoplanes* is suggested as a useful basis for preliminary study :

Albatross	Hurricane
Anson	Lerwick
Battle	Lockheed-Hudson
Blenheim	Lysander
Beaufort	Magister
Bombay	Master
Defiant	Roc
Ensign	Skua
Flamingo	Spitfire
Hampden	Sunderland
Harrow	Wellington
Harvard	Whitley

Choose from these your first 6 or 12 of the types which you most frequently see in the air.

Selection by Structural Features

In some cases it is helpful to choose for preliminary study a group of machines designed to the same general formula. Attention is then more clearly focused upon their individual characteristics.

The 24 named monoplanes provide representatives of four principal structural groups, e.g. :

1. *High Wing.* — Bombay, Ensign, Flamingo, Lysander
2. *Mid Wing* (including low mid wing). — Blenheim, Beaufort, Hampden, Lockheed-Hudson, Wellington, Whitley.
3. *Low Wing.* — Albatross, Anson, Battle, Defiant, Harvard, Hurricane, Magister, Master, Roc, Skua, Spitfire.
4. *Flying Boats.* — Lerwick. Sunderland.

Let us select as a convenient example the mid-wing groups of six machines. The *number of engines* is probably second in order of importance as a recognition feature. It so happens that each of our six chosen types has two engines. In the high-wing group we find examples of one-, two- and four-engined monoplanes, but this usually valuable means of differentiation fails us in the mid-wing group. We must, therefore, pass on to the third important feature, the *tail unit*, which we find provides this clear sub-division :

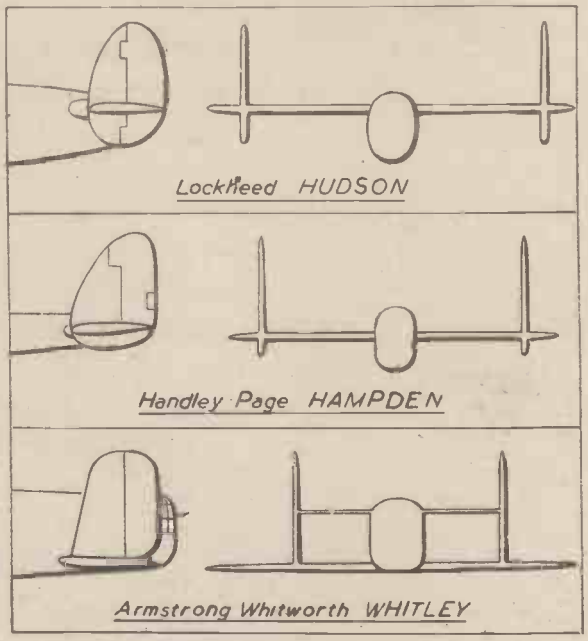
(*a*) SINGLE FIN AND RUDDER.—Blenheim, Beaufort, Wellington.

(*b*) TWIN FIN AND RUDDER.—Hampden, Lockheed-Hudson, Whitley.

Obviously it is an easy matter to distinguish aircraft in sub-division (*a*) from those in sub-division (*b*), but each of the three machines in the respective groups is of similar general structure. Following the suggested routine procedure, we must now compare details of the *fuselage*.

The BEAUFORT has a strong family likeness to the BLENHEIM, from which it was developed. Of the two Blenheim types, the later Mk. IV, or *long-nosed* version, can be readily distinguished from Mk. I, the *short-nosed version*, or Blenheim fighter. The Beaufort most closely resembles the Mk. IV, having a similar long nose. The fuselage is much deeper forward and has a definite step-down or "shoulder" aft. The Beaufort turret mounted at this shoulder, facing aft, is quite different from the gun turret of both Blenheim models.

Within the same group the chief distinguishing points of the WELLINGTON are : unusually high fin and rudder; straight-tapered wings of high aspect ratio; long slab-sided fuselage; position of gun turrets in the nose and tail; tail-plane is noticeably lower on the fuselage than that of the Beaufort and Blenheims.

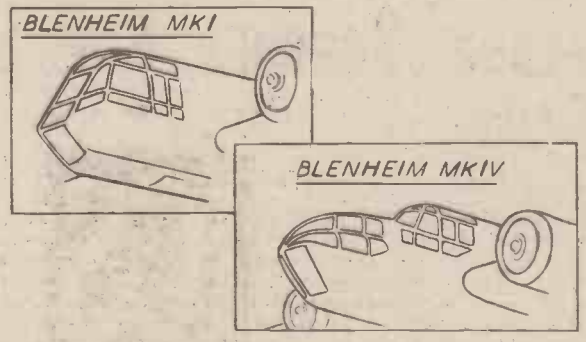


Showing the arrangement of the fins and rudders of three distinctive types of aircraft

Twin Tail Types

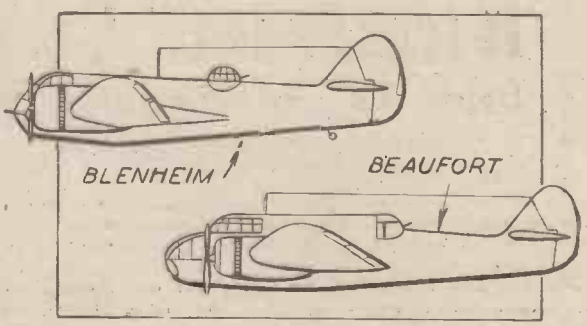
In considering the second group of three, what are the principal points of distinction ?

Type of Engine.—The distinction between in-line liquid-cooled engines and air-cooled engines may appear to be too fine, but in



(*Left*) *Nose details of the Blenheim Mark I and IV*

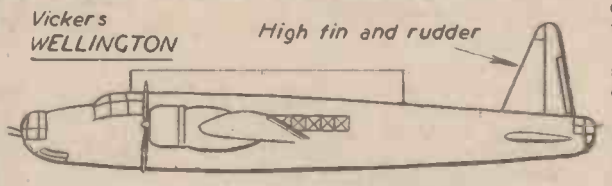
(*Right*) *The Blenheim and Beaufort have a strong family likeness*



practice the characteristic shape of either type can be observed at an appreciable distance. Each of the three machines previously considered is fitted with radial engines. In the present group the Handley Page HAMPDEN has radial engines, but it must not be forgotten that the Hampden has a twin brother known as the Hereford, which is fitted with in-line Napier engines. This point also enables us to differentiate between the Mk. I WHITLEY, with radial engines, and the more powerful Merlin engined Whitley Mks. IV and V.

Considering *fuselage*, the Hampden is narrow and deep forward, sometimes termed "a flying suitcase." The slender after part of the fuselage serves chiefly as a boom, carrying the tail unit. The Whitley fuselage is long, straight, and slab-sided, with nose and tail gun turrets. In contrast, the LOCKHEED-HUDSON fuselage is large, deep, and of good streamline form, as may be expected in a design developed from the well-known Lockheed 14 air liner. There is a domed turret on top of the fuselage, well aft.

Tail Unit.—We have already noted that these three machines have twin fins and rudders, but here the similarity ends. It is our good fortune that each aircraft designer appears to have a preferred shape and arrangement for fins and rudders. The student soon learns to recognise this distinctive "signature." There are, nevertheless, occasions when an aircraft seems to outgrow its designer's stock pattern, so that a machine which starts its career with a single fin and rudder may later develop two or three. Conversely, a new type will take the air with three fins and rudders and subsequently be standardised with two or only one.



The Wellington bomber, which has a high fin and rudder

For these reasons tail units repay particular study, and each of the three under consideration will be found to be quite distinctive.

WING "POINTERS." The following chief points of difference are easily remembered:

Lockheed-Hudson.—Wings fully tapered to tips; upswept from root to tips (dihedral angle). Fowler flaps fitted to trailing edge.

Hampden.—Practically straight leading edge, fully tapered trailing edge. Wings upswept outboard of engines to tips.

Whitley.—Large wing of low aspect ratio; slightly tapered with square tips; upswept outboard of engines.

Undercarriage.—The six machines described are all, without distinction, fitted with retractable undercarriages. Only four of the suggested first 24—the Bombay, Harrow, Lysander, and Magister—have fixed undercarriages. It is helpful to keep this point in mind without placing too much reliance upon it as a means of recognition. Otherwise a temporarily lowered undercarriage is apt to lead one astray.

Concentration upon permanent structural features is essential. When this is combined with an orderly sequence of observation, most of the difficulties which confront the student of this absorbing subject disappear.

Our Busy Inventors

By Dynamo

Rocking Air-raid Shelter

THE latest thing in air-raid shelters will undoubtedly have a certain amount of sway. In other words, it is capable of a swaying motion. Indeed it is nearly related to a rocking-chair. The new shelter has a convex under surface and is so arranged that it will oscillate. The structure is loosely placed in a concave recess on the ground, the recess having a larger radius than the bottom of the shelter.

If a bomb explodes in the vicinity of the shelter, the force of the explosion will naturally cause the structure to rock within the limits of the recess. Consequently, it will, more efficiently than a stationary shelter, resist concussion from a direct hit. It will also considerably reduce the destructive effect caused by blast or splinters. The inventor claims that the shelter would likewise afford protection from earthquakes.

The juvenile occupants of this wobbling refuge will be rocked in the cradle of the shelter.

Long Life for Bristles

A HAIR brush, when not in use, is generally laid on its back and the comb is inserted in the bristles. The constant repetition of this action causes distortion of the bristles, some of which may eventually be broken. This results in a groove or irregular portion to appear, like long grass which has continually been trampled upon.

Prevention of cruelty to hair brushes in this manner is the subject of an application to the British Patent Office. There has been devised a brush with a handle having an elongated slot of depth sufficient to receive and retain a comb. Tapering of the slot ensures a close fit, preventing the comb from falling out. This device will contribute to the longevity of the hair brush. And the comb, assuming that it will always be placed in its receptacle, will invariably be ready to hand.

Puddle Pump

THE hard tennis court tends, in time, more or less to resemble a switchback railway. It develops large dimples which, on wet days, contain puddles. Expeditiously to remove these tiny lakes is the object of a recent invention. The bottom of a bucket is provided with an opening communicating with a pump fitted within the bucket. This pump draws water through the opening and discharges it into the interior of the bucket.

The invention is not only useful in keeping a tennis court dry; it is effective in other places where the removal of water by the usual methods is not possible or convenient. For example, it may be employed for extracting water from the bottom of a tank.

Dummy Collector

THE charming lady who stands at the corner of the street and with a winning smile chinks a money box has an inanimate rival. And an application has been made to patent in our land this dummy appellant for charitable societies. There is a flat-backing sheet bearing or being a representation of a person having relation to the object for which the contributions are invited. For instance, if it were for Dr. Barnardo's Homes, a full-sized curly-headed orphan would be pictorially personified. Attached to the figure is a bag with a restricted opening for the reception of coins. An inturned flap hinders the coins from accidentally making their exit. But I do not find any reference to means for preventing unprincipled folks from surreptitiously abstracting the subscriptions of the generous.

Cute Names

THE Americans display considerable aptness in inventing names for their proprietary articles. The following are some significant current instances gathered from the official gazette of the United States Patent Office.

"Lilac Time" is the name bestowed upon perfume extract, rouge and cold cream.

"Radish Red" is apposite in connection with lipstick.

Explosives are well represented by the term "Tru-Shot."

"Knee-Sense" is appropriate in relation to hosiery.

"Tumble-Togs" is the name applied to children's rompers.

Youngsters' sleeping garments are designated "Snuz-Ease."

"Automatic Memorizer" is the name given to note-books.

New Toe-Tinter

IT is fitting that a lady should devise improved means for tinting the finger and toe nails of the fair.

As is obvious to all but the blind and the colour-blind, many modern damsels cause the nails of their hands and feet to resemble "the roseate hues of early morn." To enable this colouring to be conveniently performed is the object of an invention for which an application to patent in this country has just been made.

The device serves not only to protect the hands and feet against the accidental applying of tint or varnish to parts not intended. But it also provides a comfortable and easily supplied support for holding the toes apart while the tinting is being carried out.

It comprises a member made of sponge or cellular rubber. This contains holes for the reception and separation of the fingers or toes. The nails project beyond the member to permit application of the tint. And there are slits extending from the holes to one edge of the member, so that fingers or toes can be removed without withdrawing them through the holes.

MASTERS OF MECHANICS

Dr. Denis Papin

No. 61.—A Physician Turned Mechanic, Dr. Denis Papin, an Early Steam Power Pioneer

IF any man is deserving of lasting fame in the annals of invention, such an individual is surely the one who first applied to practical ends the fundamental idea of the piston and the cylinder as a means for generating power.

Denis Papin, a French physician of the seventeenth century, goes down in engineering history as the apostle of the piston and cylinder. True it is that he was not the first to conceive this nowadays universal power-generating device. Nevertheless, it was he who first took up the piston and cylinder idea in his search for the secret of steam power, and from his experiments the practicable steam engine directly followed.

Papin had a crowded career, which was not without its romance, its glamour, and its disappointments. Born in the French town of Blois, on August 22nd, 1647, he was educated at the Jesuit school in that town and was subsequently brought up to the profession of a physician, studying medicine both at Paris and at Orleans.

Anaesthetics

When he was about twenty-seven years of age, Papin settled in Paris, practising there as a doctor and gaining a considerable reputation for himself. He wrote, for instance, a *Treatise on Operations Without Pain*, in which work he described the use of various chemicals and drugs for the purpose of deadening pain during surgical operations. Here, therefore, at the very outset of his career, Dr. Papin is deserving of some little fame as a forerunner of the science of anæsthetics. Had he continued his medical career in an uninterrupted fashion, there is little doubt that he would have ended his days as a highly respected Paris physician, wealthy, tranquil, and well self-contented.

But such a state of affairs had not been mapped out for Dr. Denis Papin. There happened at that time to be lecturing in Paris Christian Huygens, the great Dutch experimenter, who had many inventions and discoveries to his credit, among which was a primitive device for exploding a charge of gunpowder in a barrel fitted with an upwards-moving piston and so forcibly driving outwards the loose piston.

Papin became very greatly impressed by Huygens' ideas and experiments. In fact, he became a pupil of Huygens, assisting the latter in many of his experiments and collaborating closely with him in his mechanical work.

Expelled From France

However, Papin's association with Huygens did not last very long. Of a fervent religious nature, he held unpopular opinions, and was, in 1681, expelled from France, along with many other of his countrymen, as a result of a religious persecution which arose at that time. Papin took refuge in London, where he came into personal contact with the celebrated Robert Boyle, with whose experiments he quickly became associated.

During his sojourn in England, Papin took an active part in the running of the then newly founded Royal Society. He was appointed a temporary curator of that Society at a salary of £30 per annum, and with the proviso that he should devise at least one experiment for demonstration at each meeting of that august body.

One of his first inventions of those days —and, perhaps, his nowadays best-known creation—was his famous "Digester," which, to us moderns, is all the more noteworthy because it embodied a very important principle—that of the steam-pressure or "safety" valve.

Papin's original "Digester" was an apparatus for softening bones by boiling them with water in a closed iron vessel under pressure. To obviate the risk of explosion, Papin fitted in the upper portion of his "Digester" a simple type of plunger valve, controlled by a lever from the end of which was suspended a weight. When the internal steam pressure exceeded that of the weight, the valve was raised, thereby allowing the steam to escape. In this guise came the first germ—and application—of the safety valve.

Papin's "Digester" served on one occasion to cook a supper for the members of the Royal Society. John Evelyn, the famous diarist, refers to the invention thus: "The hardest bones of beef itself and mutton were made as soft as cheese, producing an incredible quantity of gravy, and a jelly made of the bones of beef, the best for clearness and good relish and the most delicious that I have ever seen or tasted."

Practical Use of Steam Power

Let us hope that all the early members of the Royal Society who participated of Papin's "Digester"-cooked supper were of the same opinion and were actuated by a like enthusiasm. It would seem, however, that they failed to see anything very remarkable in Papin's creation of the safety valve, nor in the demonstrated fact that water boils at a higher temperature under pressure than it does under normal conditions.

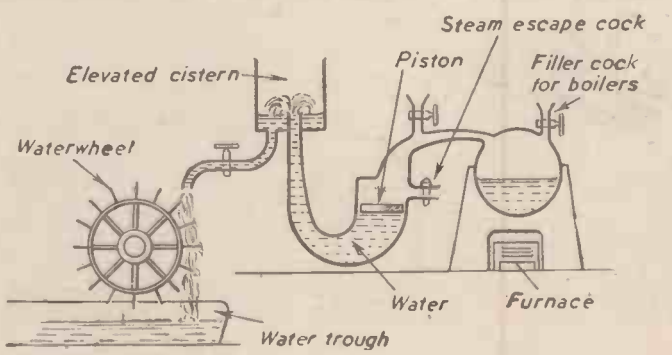
Papin's reputation as an experimenter of some daring and originality had extended to Germany, with the result that he was offered a Professorship of Mathematics at Marburg, which appointment he accepted in 1687, and in which town he remained for many years.

It was at Marburg that Papin made his first experiments on the practical use of steam power. Huygens, we have already seen, had previously attempted to make a crude type of engine by exploding gunpowder in a barrel provided with a movable piston, but Papin went one better by substituting steam for gunpowder.

Papin's original steam engine was of a very simple type. A small amount of water was placed at the bottom of a cylinder, which latter was then heated. The generated steam pushed upwards a crude variety of piston. In the piston rod was a notch, which was engaged by a latch at the top of the cylinder. Thus when this latch was brought into action, the raised piston could be held in its elevated position. With the piston so held, the cylinder was allowed to cool. A vacuum was thereby produced therein and thus, as soon as the piston latch was disengaged, the piston was thrust violently downwards to the bottom of the cylinder by the force of the pressure of the atmosphere on its external side. By attaching a rope to the piston, the rope passing over a pulley, Papin found it possible to raise weights in this crude and decidedly erratic manner.

Raising Water and Coal

Papin's cylinder had a diameter of 2 ft. and a piston stroke of 4 ft. He suggested



Papin's final steam engine by means of which he proposed to obtain motive power. It was unsuccessful

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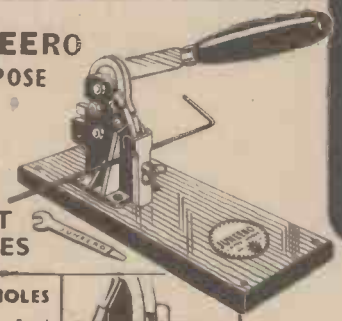

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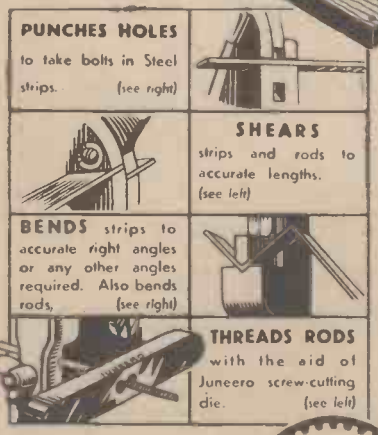

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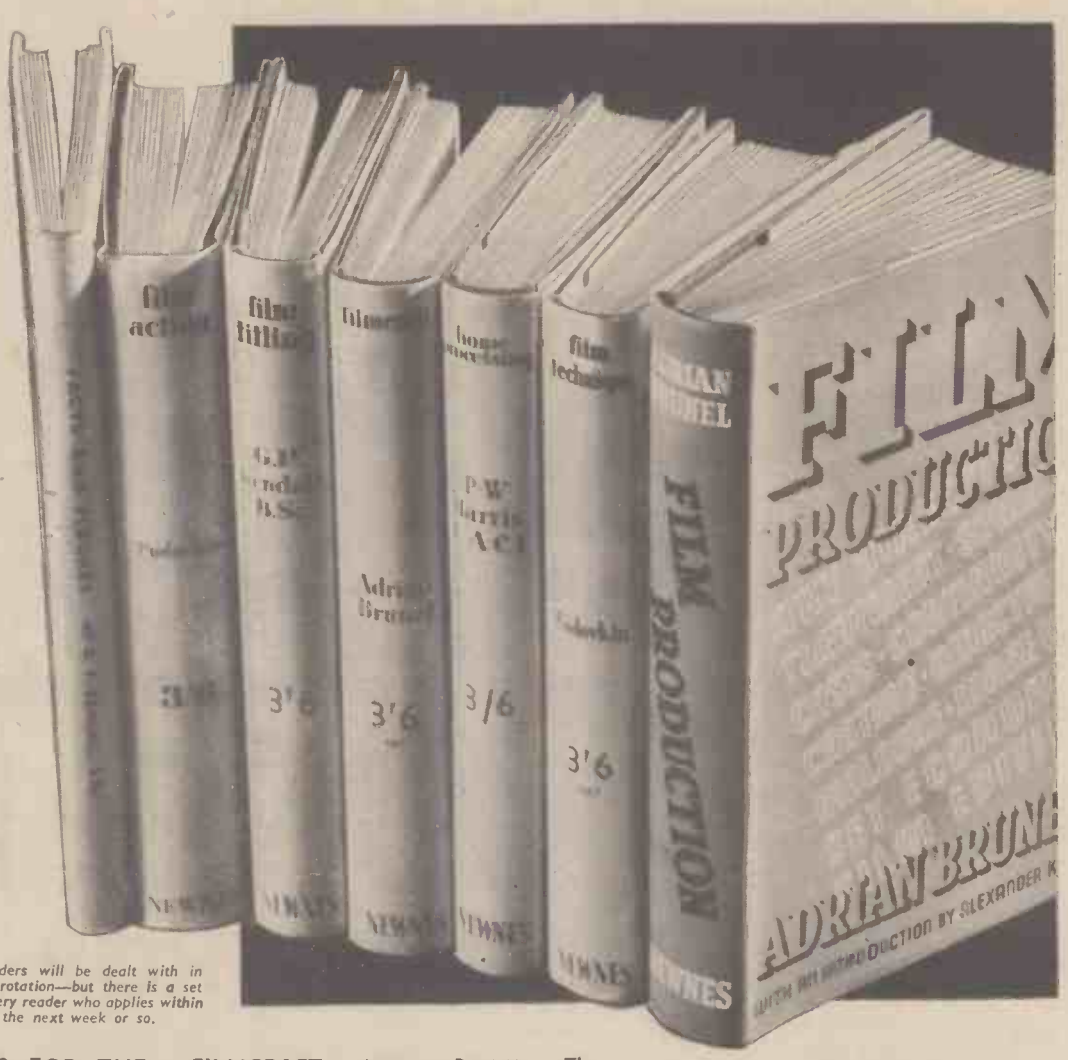

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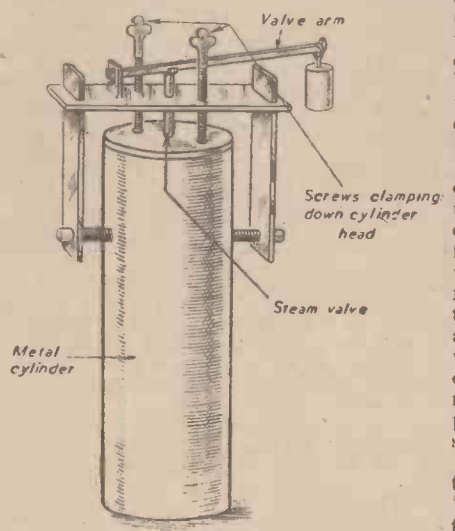
that such an "engine" should be employed for raising water and coal from mines and for driving ships by means of paddles. Also, by way of a faint foreshadowing of modern warfare, he suggested that the engine might be used for "throwing bombs," although he gave no indication of the exact means of so doing.

At a later date (in 1707) Dr. Papin actually seems to have devised a paddle-boat fitted with some sort of crude engine as the one described above. Whether it ever worked even moderately successfully we do not know, but it would appear that the inventor made the necessary arrangements to transport his vessel to London in order that it could be tried out in the smoother reaches of the Thames. The story has it that this remarkable vessel—the progenitor of every steamship of modern times—was seized at Munden, a river town in Prussia, where it was destroyed by a number of boatmen, who had heard vague accounts of its success and the ultimate promise of "sailing without oars" which it held out.

Although, perhaps, this story may be, in some respects, far-fetched, there is doubtless some truth in it, for, in the following year (1708) we have Papin writing rather frantically to some of his old associates at the Royal Society, London, requesting them to advance him sufficient cash

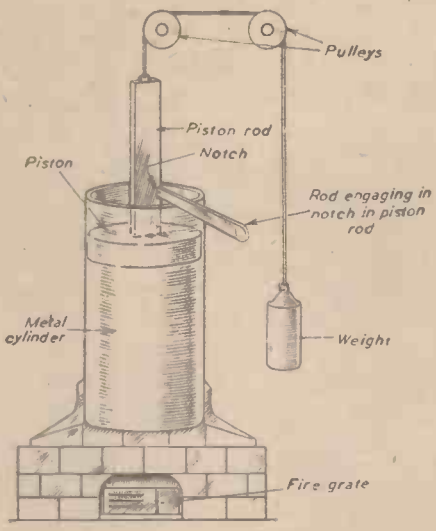


The original "Bone Digester" of Dr. Denis Papin. It embodied the world's first steam safety valve

(approximately £15) in order that he might construct another engine "and fit it so that it might be applied to the rowing of ships." The Royal Society, however, seems not to have acceded to this request.

Not a Great Mechanic

Despite the fact that Denis Papin was a fertile inventor, he was no great mechanic. He lacked the inborn ability to construct devices with his own hands. Always he had to seek the aid of any workmen whom he could find to bring his numerous and ingenious ideas into actual practice. And, of course, throughout his career Papin was faced with the severe difficulties of mechanical construction which were common to all inventors of his time. There were no metal lathes, no precise methods of drilling, grinding, screw-cutting, and machining. Each individual part of a machine had to be made almost inconceivably slowly and, with the utmost labour, by hand, and, often enough, when a number of mechanical parts came to be assembled, they would be found not to fit.



Papin's first steam engine

Thus it was that Papin, whilst being full of ideas, made but little really sound and lasting progress with them. In some respects he was a man born before his time.

Another of Papin's steam engine notions embodied a "displacement chamber" (analogous to a cylinder) containing water, upon the surface of which a piston or diaphram floated. Steam generated in a boiler was made to force the piston downwards and thereby displace the water into an elevated tank, from which it was allowed to flow over a waterwheel.

This design of engine was unsuccessful, despite Papin's many efforts to improve upon it. In some respects, however, this engine represents a step back from Papin's first steam engine, for the operation of the water-wheel engine was obviously even more awkward and laborious than that of the first of Papin's engines. The steam, after forcing the piston or diaphragm downwards, was allowed to escape via a side cock, and subsequently the piston was raised to its original position in the displacement chamber by means of a further supply of water being admitted therein.

It is a curious fact that, after originating the idea of the safety valve with his famous "Digester," Papin never applied the notion to his steam engines.

Papin Returns to England

The above-described "engine" constituted one of the last of Papin's essays in steam power. After the tragic failure of his steam-propelled sailing vessel, he seems to have been thoroughly disheartened. Within a short time, he left Germany and came over to England again. This time, however, he was not received with honour. Rather, he was allowed to languish, and had it not been for the action of certain members of the Royal Society in coming to his aid with small financial help, he would undoubtedly have ended his days in dire poverty. As it was, discouraged by his successive failures to construct a successfully working steam engine and by the prevailing lack of interest in his projects, Papin surely but slowly sank into an almost complete obscurity, from which he never succeeded in raising himself. He is supposed to have died in London in 1712 (some writers give 1714; others 1710), but of his decease there is no clear record.

Of recent years the importance of Papin's work in the evolution of the steam engine has been increasingly realised. The French nowadays claim Denis Papin as the originator of the "atmospheric engine," thereby endeavouring to deny the claims of the British inventor, Thomas Newcomen, to that honour.

A Mechanical Theorist

Papin, at first, as we have seen, a physician, and afterwards a physicist and a mathematician, was a mechanical theorist rather than a practical working mechanic. He had not the gift of mechanical construction. Yet it is certain that it was Papin who first imagined a steam engine having a piston. It was he, also, who first saw that steam could be used to produce a vacuum underneath a piston, which idea our own countryman, Thomas Newcomen, of Dartmouth, subsequently elaborated in his famous "atmospheric engine," the world's first commercially successful steam power producer. And finally, it was Papin, too, who first constructed the steam pressure or "safety" valve, although, strange to say, he subsequently completely dropped the notion of this device.

Steam-power Device

Dr. Denis Papin, therefore, must at least be accorded the honour of creating (or at any rate of conceiving) a steam-power device in which the idea of the piston and cylinder was first put to anything like practical use. But, as we have previously noted, Denis Papin was before his time, and probably for such a reason only he suffered at the end of his life an ignominy and a degree of hardship and disillusionment which would have hardly been possible had he but possessed just that little extra ability which was necessary to push home his notions to their successful conclusion and to apply them in strictly practical fields.

Hopeful Inventors

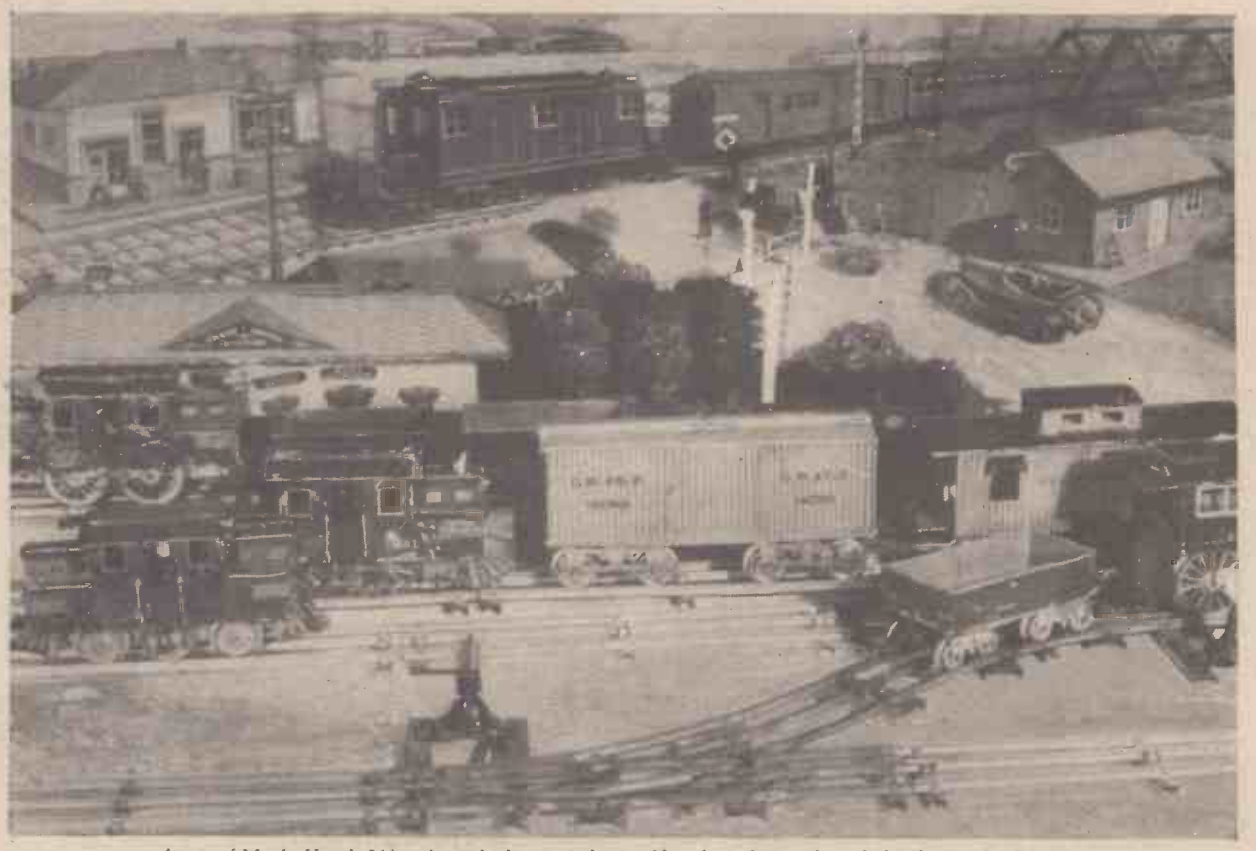
THE INVENTORS OF THE TANK

EVEN in peace-time there is a department at the War Office which is kept constantly busy examining the indeas submitted to them by hopeful inventors, but in time of war, the trickle swells to a flood. Literally hundreds of new inventions—and some that are not so new—are presented to the authorities every week. Perhaps one in a thousand is any good.

After the last war a Commission was set up to make awards to those who had invented or claimed to have invented ideas which helped to win it. There were 1,834 applications, out of which 544 were turned down, 864 were abandoned by the inventors and the remainder were dealt with by the Commission.

Altogether the Commission awarded a total of £1,500,000 for inventions. The most involved case of all was that of the tank, for which there were 85 claimants. The Commission reduced this number to two—Sir William Tritton and Major Wilson—and they received £15,000.

"MOTILUS" PEEPS INTO THE



A view of Mr. L. Hertz's 2⅛-inch standard gauge railway. Note the realistic and simple detail on cars and engines

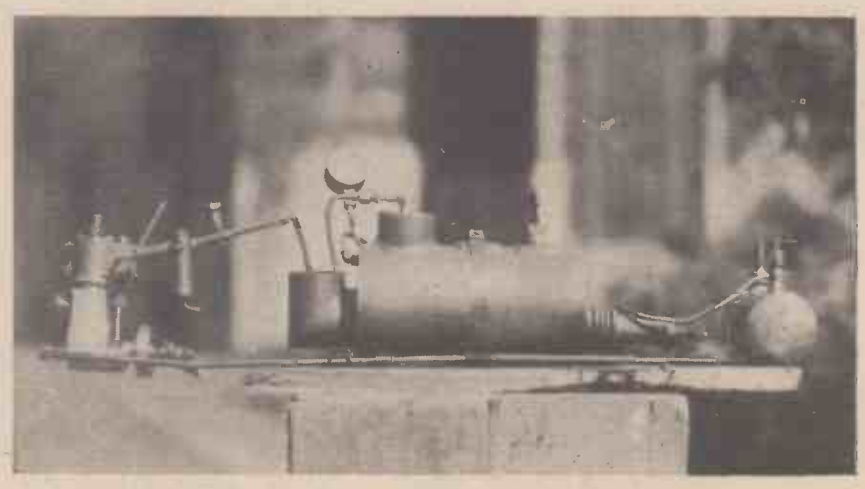
A COUNTRY that is making enormous headway to-day—as far as one can judge from correspondence and magazines and books on the subject—in model railway production, is the U.S.A. Anyone who reads the journals of our friends across the Atlantic will realise the advances that are being made, chiefly, of course, in electrically operated and controlled railways. There is no doubt that the enormous exhibition —the World's Fair at New York last year and again this year—has been instrumental in showing models to the general public who previously had no idea of the scope of the hobby, and has kindled a brighter flame of interest in the hearts of those who were already model minded.

One of my friends in New York, Mr. Louis Hertz, a contributor to many American model journals and editor of the "Model Railroaders' Digest," has recently mailed me a photograph of his 2⅛-in. standard-gauge layout, giving some idea of the realistic scenic effect he has produced. The background is partly painted and partly real, some of the trees, station, etc., being actual units and not painted as are the trains to the back. Mr. Hertz writes that the actual equipment in this picture is of rather early vintage—Lionel 1910, to be exact. He has about the largest layout in the U.S.A., and upwards of 200 locomotives, but when this particular picture was taken it was desired to show some of the old equipment at the same time. He writes that "this layout has now been taken down ready for moving, and when I set it up again I think the trains on the background will best be left off the painted wall!"

A Model Yacht

Even the most casual onlooker will shift his gaze from the world at large to study the lines of a beautiful yacht, and here we are able to show you both the model and the original. All designers should be proud of the yachts they design, but often after they have finished a yacht it passes out of their hands and that is all the impression they have to remind them of their work. But when a model is made, there is a record in tangible form. This model, which is of super-detail finish, has been built for the owner, on the instructions of its designer, Mr. Robert Clark, and is the modern cruising and racing yacht, *Mary Bower*. It is modelled to the scale of ⅜ in. to the foot, with dimensions of 18 in. in length and 4 in. beam. It will be noted that the model shows the standing rigging, but no running rigging or sails. The fittings are all silver plated, with beautifully polished hull and base and the model will be protected by a mahogany show-case and, when mounted under glass, will be a real pleasure to examine as a fine example of the cruising

Model Yacht and Model Power Boats



The power plant of an American model enthusiast's motor boat

MODEL WORLD

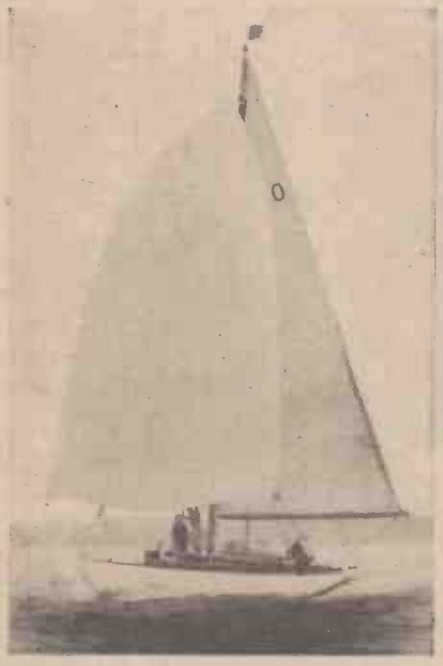
A recent picture of Bassett-Lowke's shop in High Holborn

yacht of to-day.

Model Power Boats

Another friend of mine in the Middle West of America—Minneapolis to wit—has further favoured me with some pictures of his work—this time of model power boats. He writes : "I recently had the idea of fixing up an old concrete fish pool and taking some pictures of my tests on model steam boats. I put the pool into good condition and then began inspecting my models which I had not run through for about ten years ! I found they were not good enough to kick up enough spray in the pool to appear impressive in a picture, so am now in the throes of fixing up their engines.

"My first picture shows the power plant of one of my boats. The engine is a Stuart Turner, which I bought as castings; the boiler is of 'Shelby' seamless steel tube, which I cut to my own ideas and then had welded together. Cross tubes in the flame tube were expanded by a method I worked out myself, but which nevertheless was perfectly satisfactory. The blow lamp was bought ready made, and the frame on which the boiler and engine are mounted was constructed mostly from ¼-in. 'Shelby' tube.

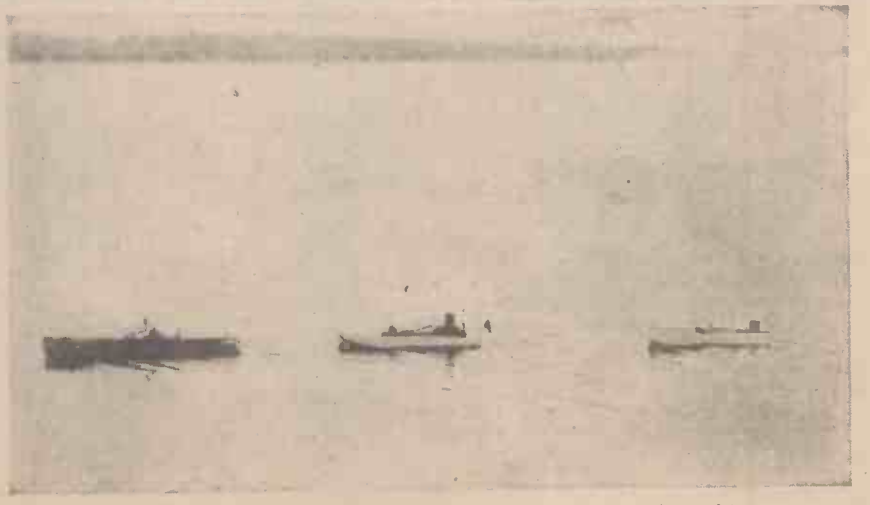


(Left) The "Mary Bower" cruising yacht prototype (Right) a super detail scale model of the "Mary Bower"

"The second picture shows my 'brass boat,' so called because the hull is of that metal, towing two of my very crude earlier models. The shore in the distance is about half a mile away. This boat had one interesting adventure. She was running in a very large circle rather too late in the evening, and the blow-lamp died from want of petrol. By the time I went around the lake, where I could secure one of the row-boats they rent, it was too dark to even dream of finding her. There was not very much wind, but as there was a very small leak in her hull, I feared that she would sink before she drifted to shore. Next morning she was nowhere to be seen and I felt sure she had sunk. I made a 'water telescope' and went out in a boat and looked for her on the bottom, but without success. Then I advertised in the papers, giving my telephone number. Next morning a phone message came through from a woman who told me the boat had been found on the shore across the lake from whence she started and told me exactly where I could find her !"

Model Display

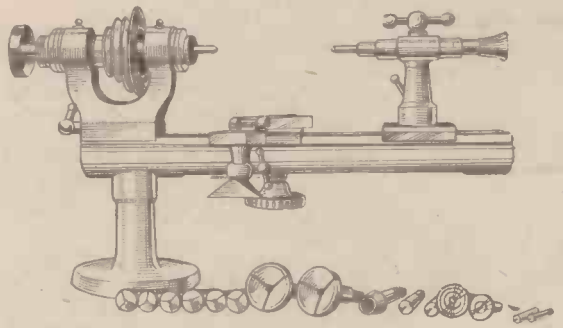
Walking along Holborn the other day, I was pleased to see, despite the aerial bombardment of London, that Messrs. Bassett-Lowke are making an excellent show, even in wartime. They must have had a splendid reserve of their best models in stock before war broke out, to enable them to make such a good display of specialities after over 12 months of war. In addition to their own productions, they were showing the "Studiette" sets of parts and lines, new flying construction kits, including the Spitfire and Hurricane fighters and Wellesley bombers, and the German Messerschmidt fighters. Bassett-Lowke's London shop was first opened in 1909 where the Pearl Insurance offices now stand. Not long afterwards they moved to 112 High Holborn, where they have been for nearly thirty years, the landmark of England's model world. They carried on in business throughout the last war and are hoping to do the same in this with the help of such papers as "Practical Mechanics," which still forms an invaluable link between model makers, who have been scattered for various reasons all over the country, and not forgetting those abroad with whom they still hope to maintain trade.



The "brass boat" of a Minneapolis correspondent towing two other models

Watch Repairing and Adjusting—No. 11

Watchmaker's Tools

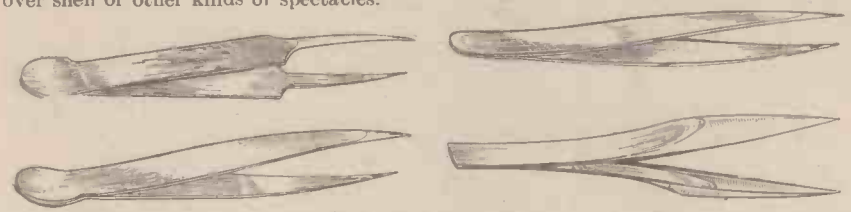


Watchmaker's lathe and some of the split collets and stepped chucks

THE skilled repairer can never have too many tools. A large and varied selection gives confidence and enables any repair to be undertaken.

As a watchmaker's kit can be extensive, I will deal with the smaller bench tools first.

The inability to hold an eyeglass in the traditional manner should be no cause for despair. If the old method of attaching a piece of elastic to the eyeglass does not appeal, one of the modern methods can be used. One method consists of a pair of spectacle frames to which is riveted an independent lens which can be brought into immediate use. To wearers of spectacles this is a boon as the frames can be glazed to personal prescriptions. The latest device consists of a collapsible eyeglass with a monocle type of rim which can be slipped over shell or other kinds of spectacles.



Various patterns of tweezers

Many types of ordinary eyeglass are available. Those suitable for general bench work are made from celluloid, vulcanite or horn. These are light and comfortable but will fracture if constantly dropped. For strength use either rigid or collapsible aluminium. The only disadvantage to this type is that constant use tends to make a black mark on the face. The folding pattern is really only suitable for the pocket. Dual control eyeglasses consisting of two lenses are useful for examining jewel holes and tiny working parts. Mention must be made of the dual eyepiece microscope now proving popular in the detection of escapement faults.

Types of Tweezers

Tweezers are one of the watchmaker's most useful tools, and are made in more than thirty different styles. As well as general purpose tweezers which are made with fine points in a variety of patterns, there are tweezers designed for special purposes. For taking movements apart the points are curved like a bird's beak. As well as extra fine pointed tweezers for hairspring work are a number with hollow jaws for Bregnet hairspring work. For coiling Bregnet springs some jaws are fitted with adjusting screws.

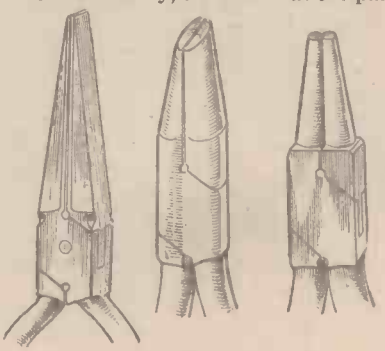
Nipper tweezers for taking off watch hands, cutting hairsprings, etc., are shaped like pocket nail clippers. For straightening pivots the points are flat and wide. Non-magnetic tweezers are made of brass. Probably the most useful of the whole range are those for holding small pieces like pallets and those for removing pressed-in hairspring studs. The latter consists of a lower jaw, forked to embrace the stud and an upper jaw with a small pivot. When depressed the pivot pushed out the stud.

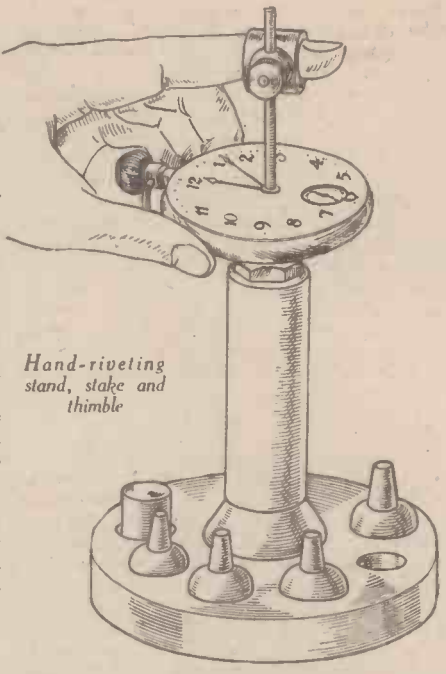
Apart from tweezers, the screwdriver is probably the most used tool. Pocket screwdrivers with interchangeable blades are convenient, but for bench work the fixed blade is best. Some of the best screwdrivers are London made and can be obtained in a range of sizes. The sizes range from 0.75 mm. to 2.75 mm. Although not a screwdriver, the balance screw adjusting tool serves the same purpose. This tool has two jaws which are closed by means of a knurled nut. The ten sizes range from .20 mm. to .80 mm.

Die-jawed tweezers for forming Bregnet hairsprings

Pin-Tongs

Other adjustable tools of similar design are commonly called pin-tongs. Some are single, others double-ended. The single-ended type consist of a brass or wood handle, a four-jaw chuck, and a knurled adjusting nut. Another type is known as the pin vice.





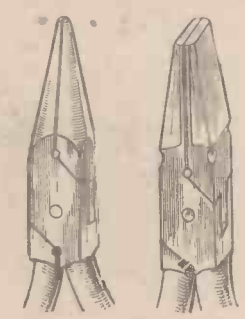
Hand-riveting stand, stake and thimble

This type is a miniature counterpart of the old-fashioned bench vice with iron leg. One model has a hollow handle. This is very convenient as it enables a long piece of wire to be held; thereby saving time in centring short pieces. Other hand tongs are made on the plier principle with a variety of noses. Some are designed for holding watch hands. Hour hands are held in jaws with holes into which the sockets are placed. Minute hands are held in jaws having a fine slit.

Nipper and plier design is even more varied than that of tweezers, for each type can usually be supplied in at least four different lengths. Watchmakers' nippers are made in as top or side cutters.

Pliers and Files

Pliers can be supplied with short and long flat, short and long round, half-round, pointed, brass jaws, parallel and self-adjusting jaws. Others have special jaws for balance trueing, adjusting hairsprings when fixed to balance, hand and collet removing, watch case adjusting and brace-



Various types of pliers. (Left to right) Long nose, half round, round nose, taper nose, wide nose

let fixing. Two kinds of punches are available. One for removing broken screws and one for punching holes in mainsprings. The mainspring punch can be supplied with one punch or from different shaped punches and a barrel hook punch.

A good file is a valuable asset; a good selection of files is even better. Flat files are called pottance and pillar, the only difference being in the width. Made in different lengths and at least half a dozen different cuts, perhaps the most important feature is the safety edge. One edge has no serrations, thus enabling one side of a right-angle to be filed without damage to the other. A set of watchmakers' files, escapement files and needle files is a joy to any repairer. Although their life is short owing to their delicacy the delight in using them is worth an occasional break. In all these files, three quarters of the length is handle. The shapes include flat taper, flat oval, three-square, square, round, half-round and knife-edge. No bench can be said to be complete without a screw-head file, sometimes called a slitting file. This is a thin blade of steel having serrations on the edge only.

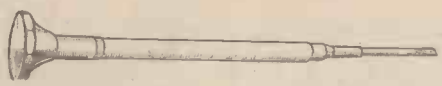
Broaches, the five-sided reamers used by watchmakers, can be bought separately or in assortments. Sizes are gauged on Stubs' wire gauge, from 1 to 80. The smaller sizes are called pivot, pallet, joint and bottoming broaches. Round broaches, which can be obtained in the same sizes, are used for burnishing and hardening the surface of brass holes.

Oil Containers

Oil cups or containers consist of a boxwood stand with a concave cornelian reservoir. Some have two reservoirs, one above the other for different oils. The most up-to-date is a small stand like an inkstand with various containers and reservoirs and a place for oilers which is supplied by a well-known firm of oil manufacturers.

Gauges are essential items of the watchmaker's kit. No accurate replica can be made without a gauge. The most used are probably the two mainspring gauges. The Martin height gauge is a double-sided brass gauge. Notches corresponding to various widths or heights are cut on each edge. Lever sizes on one side and Geneva sizes on the other. The mainspring strength gauge—for gauging the thickness of the spring—consists of two pieces of steel with a tapering space between. A space is provided at the top to enable the mainspring hook to be passed through when gauging a spring.

A pivot gauge which has been described in a previous article is similar to a mainspring height gauge. The micrometer is too well-known to need any description. For measuring balance and other staffs the douzieme or dixieme gauge is used. These gauges are divided into twelfths or tenths of a ligné and are particularly suitable for measuring the overall distance from jewel hole to jewel hole. The two limbs of the



Screwdriver available in various blade widths

Pin vice

Hand vice

gauge have curved jaws at the pivoted end and a pointer and scale at the opposite end.

Pinion Gauge

The pinion gauge which is used to take the height of pinion shoulders, closely resembles the bow pen used by draughtsmen. The two slender jaws are opened or closed by means of a screw. The pinion height gauge is a small screw-operated gauge whose extremities end in two small feet. The feet are extended until they touch the inside of a pair of jewel holes. This measurement is recorded on two fine jaws at the other end of the gauge. The recording feet are slender and curved to enable measurements to be taken in deep set bridges and plates.

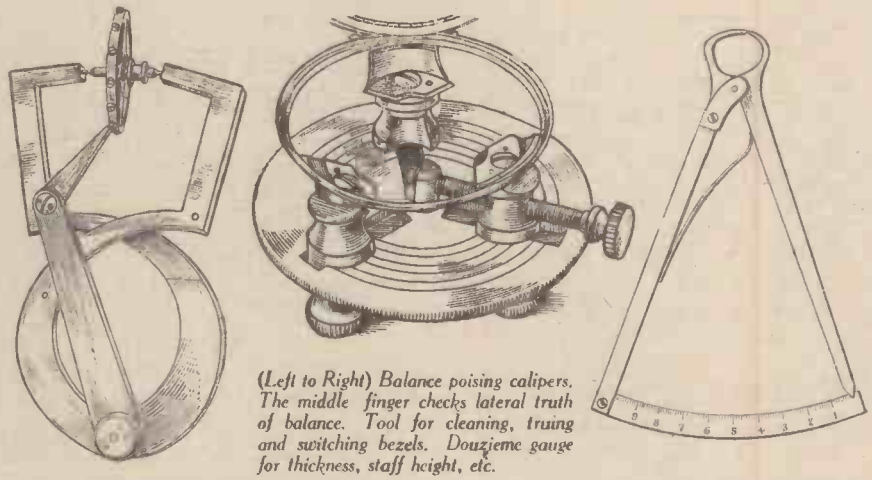
When replacing a broken cylinder use is made of a cylinder height tool. The small tubular gauge has a movable central steel shaft. The upper end of the shaft terminates in a jaw, the lower end of the shaft terminates in a pivot, small enough to enter any jewel hole. Another jaw is attached to the upper end of the gauge. Movement of the steel shaft naturally moves the lower jaw. The distance of the pivot from the nose—which represents the bottom of the cylinder—is therefore registered between the two jaws. When the jaws are closed the pivot is flush with the nose.

Barrel Arbor Gauge

The size of a barrel arbor is designed to be one-third of the inside diameter of the barrel. In order that the exact size may be determined when fitting a new arbor, use should be made of a barrel arbor gauge. The gauge consists of a pair of calipers having inside jaws at one end and outside jaws at the other. The inside jaws of these proportional calipers always open three times the size of the outside jaws.

Calipers

Calipers are usually used for measuring, but several different types are made, a number of which are used for testing the truth of wheels. In some fine holes are drilled on the inside of the jaws, in others jewel holes are fixed. A small movable toucher or feeler is attached to one arm. This feeler is brought near the wheel being tested. Any unevenness will then be readily detected. The plier-shaped caliper is one of the most popular on the market. Spring controlled, the plier is fitted with an adjusting screw, feeler, male and female centres.

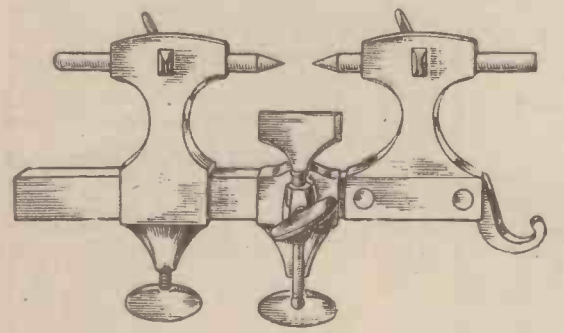


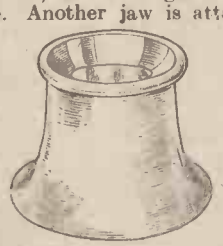
(Left to Right) Balance poising calipers. The middle finger checks lateral truth of balance. Tool for cleaning, truing and switching bezels. Douzieme gauge for thickness, staff height, etc.

Rebushing Bearings

When rebushing a brass bearing, it is essential that its position with regard to the other wheels should be correct. To ensure the correct depth, the wheel whose bearing is to be bushed and the next wheel should be placed in the depthing tool. This tool consists of two sections, pivoted, spring controlled with an adjusting screw. The adjusting screw allows the sections to be opened or closed. Each section or side has two tail stocks with adjustable runners. The inside ends of the runners have female centres and the outside ends male centres. A pair of wheels or a wheel and pallets being tested are placed between the female centres and the depths adjusted. When the depth is correct, one pair of runners is released and the wheels removed.

The male centres are then used to trace the correct position on the watch plate. One centre is placed in the existing bearing, the other centre is brought to the level of the watch plate and a portion of a circle described by slowly revolving the watch plate.





(Left) Swiss pattern bow-operated turns, used for pivoting, etc. (Above) Many types of eyeglass are available. Those suitable for general benchwork are made from celluloid, vulcanite or horn

QUERIES and ENQUIRIES

A stamped addressed envelope, three penny stamps, and the query coupon from the current issue, which appears on page iii of cover, must be enclosed with every letter containing a query. Every query and drawing which is sent must bear the name and address of the reader. Send your queries to the Editor, PRACTICAL MECHANICS, Geo. Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2.

Silver Plating

CAN you give me a formula for a liquid or paste (not using mercury) for silver plating small articles of copper and brass? I should like the result to be permanent if possible.—A. H. (West Ealing, W.13).

THE following is a formula for a silver-plating preparation not containing mercury :

Silver chloride	..	6 oz.
Tartaric acid	..	12 oz.
Common salt	..	6 oz.
Chalk	..	4 oz.

The above ingredients in a thoroughly dry and powdered condition are well mixed together. Sieve the mixture through a fine sieve and store the powder in a perfectly dry amber-glass bottle.

In order to use the preparation, take sufficient powder for the work in hand and mix it with sufficient water to form a sloppy paste. Apply this paste with a perfectly clean rag to the well-cleaned and grease-free metal surface, rubbing vigorously until the desired degree of plating is obtained upon the metal. Afterwards rinse the plated parts with warm water and allow them to dry. It is often advisable to give the plated areas a thin coating of clear lacquer after this treatment.

Preparing Chamois Leather

WHAT is the best method of making chamois leather out of lamb skins?—W. H. (Co. Tyrone).

YOU will, we are afraid, find it a difficult matter to prepare chamois leather from lamb skins, since, in the manufacture of this material, much depends upon practical experience. However, you may go about the job in the following way :

Soak the skins for two or three days in cold water, after which immerse them in a thin cream of lime and water for a further ten days. This treatment will loosen the hairs and enable them to be rubbed out with the aid of a blunt knife. Again rinse the skins in cold water so as to remove all the lime, and finally immerse them in a bath containing egg yolk, flour, common salt, and alum.

The exact proportions of these materials used by chamois leather makers are kept secret, but there is little doubt that if you make up a thin cream of these materials to soak the skins in you will get reasonable results.

The skins are soaked in this bath for anything from a fortnight to three months, after which they are carefully washed in clean water, and air-dried.

If the skins are hard they can be softened by rubbing egg yolk into them and finally washing it out.

Aircraft Spotting

IS it possible to obtain a clear image on an 8 in. by 8 in. ground glass screen through a telescope which is focussed at 17 in., with or without extra lenses? I wish to fit the device in a concrete "pill-box" for aircraft spotting.—J. S. (Wembley).

A TELESCOPE with its internal diaphragms and compound eyepiece would be unsuitable for projecting an expanse of sky on to a screen. The region magnified would be very small and dim. Moreover, even if a plane happened to cross this limited area it would not be perceptible for more than a moment. A better *camera obscura* effect would be obtained by using the object glass alone. This could be done by leaving it in its section of the telescope tube and disconnecting the others; provided that that section does not contain any diaphragms, or that they can be removed. Alternatively, the object glass may be left in its cell and firmly remounted in another short tube (cardboard, fibre or metal) taking care that it is set accurately square. You would have to find some way of supporting this tube in such a manner that it could move in all directions, unless you are satisfied to hold it in your hand or to fix it rigidly in the wall or roof of your "pill box." The screen would have to be attached to the tube by a light frame and placed at a distance from the lens of about its focal length. There should be some slight freedom to slide up and down the tube for focussing purposes. A smooth white paper or cardboard reflecting surface on the inside of the screen would give sharper definition than transmission through the granular texture of ground glass.

In any case much must not be expected from such a make-shift substitute for a proper *camera obscura*, if only for the reason that your telescope object glass is so small. Magnified representations of things need brilliant illumination of the originals, and the relatively feeble radiance of the sky has therefore to be concentrated for satisfactory projection. This entails reduction in the size of the picture, as on the ground glass screen of a stand camera. In fact, such a camera, if of half-plate size would about give you what you require. If you could get hold of a second-hand telescope object glass of two or three inches diameter, you would obtain much better results than with your one-inch lens; moreover, the longer focus would give you a larger image.

Vulcanised Rubber

CAN you recommend any solvents dealing with vulcanised rubber? Processing is no objection, provided the liquid is reasonably cheap and easily handled.—W. L. (Surrey).

IT is not easy for us to answer your query fully because you do not state to what degree your rubber has been vulcanised. Unvulcanised rubber, as, no doubt, you are well aware, is fairly readily soluble in naphtha, carbon bisulphide, ethylene dichloride, sulphur monochloride, whilst petrol and petroleum-naphtha will usually swell out unvulcanised rubber without actually dissolving it.

If, however, your rubber is "dead hard" vulcanised, it will be more or less completely insoluble, although, to a certain extent, it may be softened by prolonged immersion in tricresyl phosphate, dibutyl phthalate, these solvents being employed in the pure state or mixed with an equal bulk of trichlorethylene.

Partially vulcanised rubber can usually be got into solution by soaking and macerating in any of the solvents mentioned in the first paragraph. After solution has taken place, it is a good plan to add to the liquid about 1 per cent. of tricresyl phosphate or dibutyl phthalate to prevent "gelling" of the solution.

All the solvents mentioned above are fairly cheap, particularly when bought in bulk from suppliers such as Messrs. A. Boake, Ronerts & Co., Ltd., Stratford, London, E., but they must be handled with care, since some of them are inflammable whilst others are toxic.

"Acetyl Chlorine"

THERE has recently been a good deal of publicity given in the American and English Press concerning the use of "acetyl chlorine" as a sleeping gas for use in war time. Could you give me any details of the chemical and physical properties of this compound and how it would be used for the above purpose?—A. F. M. (Folkestone).

THERE is no such substance as "acetyl chlorine" and we fear that any reference to this must constitute still another of the many technical inaccuracies of the newspaper Press.

Are you, however, perhaps, thinking of acetyl chloride? This chemical, which has the formula $CH_3.COCl$, is a liquid, made by the action of phosphorus trichloride upon acetic acid. It is colourless and pungent-smelling, fuming in moist air. It is not, however, of much military use, since it is rapidly decomposed by moist air into acetic acid and hydrochloric acid, both of which are easily neutralised. Furthermore

it does not possess lethal or "sleeping" properties.

You may, alternatively, be referring to carbonyl chloride, $COCl_2$, a gas which may be obtained by the direct combination of carbon monoxide and chlorine and which is extremely poisonous and lethal and hence of value in military gas operations. Carbonyl chloride is generally known as "phosgene." It smells like musty hay and when breathed in even moderate concentrations quickly brings on unconsciousness.

We cannot think of any other toxic substances which may be referred to under the name of "acetyl chlorine," but you may take our word that no such material as the latter-named exists.

Resistance for Arc Light

I HAVE an arc lamp movement belonging to a full-size cinema projector, and a variable resistance which I think was used for lowering theatre lights. Can I run this arc with the resistance off the house lighting? The installation is wired for the all-in system and the meter will take 50 amps.—K. O. (Manchester).

WITHOUT knowing the normal current consumption of your arc lamp, and the resistance in ohms and gauge of wire in your dimming resistance, it would be impossible to give a definite reply to your question. As a rough guide, the normal current consumption of your lamp can be estimated by the size of carbons it employs. The normal carbon diameters for varying current values are :—

For 6 amperes, carbon diameter of 8 mm.
" 12 " " " " 10 "
" 24 " " " " 13 "
" 48 " " " " 15 "

As the terminal voltage of a normal A.C. arc is only about 35 to 40 volts under normal burning conditions, the series resistance will have to dissipate something like 200 volts when carrying full current, the required value in ohms being 200 divided by the amperes taken by the arc. Probably a step-down voltage transformer would be found far more economical if the lamp is to be in use much, with just a few ohms in circuit as a steadying or ballast resistance.

Welding Stainless Steel

WHAT precautions should a welder take to avoid inhaling the fumes of chromium when welding stainless steel? Also, is it necessary to take any precautions when welding electrodes containing 8 per cent. or more chromium, and are there any Board of Trade regulations to this effect?—T. B. (Lincs.).

CHROMIUM is not a volatile metal. It boils at a temperature of about 2,200 degrees Centigrade. Hence, when welding stainless and mild steels with electrodes containing chromium, one is not likely to inhale any actual chromium metal vapour. Some of the chromium metal, however, oxidises at the high temperature to which it is subjected during the welding operation, and, owing to a sort of "spluttering" effect, the chromium oxide thus formed passes off into the air in the form of an extremely fine spray. This emanation should not be breathed in any quantity, for all chromium compounds are more or less poisonous.

Short of wearing a simple form of respirator, or even a moistened cloth worn over the mouth and nostrils, there is little one can do to avoid inhaling small traces of chromium fumes when engaged in these jobs. Whenever possible, always carry out the job in the open, or, at least, in well-ventilated surroundings. If the job has to be performed in confined surroundings, wear a damp rag over the mouth and nose. This will act as a satisfactory fume catcher.

If, for any reason or other, you feel that your system has imbibed more chromium fumes than is good for it, take a purgative and several cups of strong tea. Such a precaution will prevent traces of absorbed poison from settling in your system.

There are no special regulations respecting the individual use of chromium-containing alloys in welding. You are probably thinking of the several Regulations designed to protect workers in the chromium-plating industry, which is, of course, a dangerous occupation if the necessary precautions are not taken.

Making Match Heads

CAN you give me a formula for making match heads that will cause as little smoke as possible ?—L. M. (Monteith).

COMMON friction matches can be made by dipping wood chips into a paste made up by grinding together red phosphorus, manganese dioxide and a small amount of potassium chlorate with a thick solution of glue. If required, the manganese dioxide can be omitted from the formula and the quantity of potassium chlorate increased. When dry, matches so prepared will ignite on friction with any rough surface.

Safety matches are prepared by dipping wood chips into a mixture of equal parts of antimony sulphide and potassium chlorate, finely powdered and made into a paste with thick glue solution. Such match heads, after drying, will only ignite when they are rubbed on a surface which is covered with a mixture of red phosphorus (3 parts), powdered glass (1 part) made up into a paste with glue solution.

If the matches so prepared give rise to too much smoke, slightly increase the potassium chlorate content of the various mixture and cut down the proportion of glue.

Making Perfumes

CAN you tell me how I can extract oil of peppermint from the plant? If so, how much oil can be obtained from 1 lb. of peppermint, and what apparatus is necessary? Will the perfumes sold by chemists suffice for the preparation of perfume pastilles ?—F. O. (Royton).

IN order to obtain oil of peppermint, the flowers and leaves of the plant (either fresh or dried) are macerated with a small quantity of water for several days and then distilled. A mixture of water and peppermint oil passes over. The oil is separated from the water and re-distilled.

Only a simple type of still is required for the production of the oil, but unless the task is carried out on a very large scale it is hardly worth attempting, except by way of interest. About 1 lb. of the pure oil is obtained from some 250 to 300 lbs. of the plant.

The perfumes sold by chemists will suffice for the preparation of the perfume pastilles you mention. Avoid, however, the lighter perfumes such as eau de Cologne. It is better to use the heavier perfumes and, if possible, actual essential oils, such as oil of cinnamon, oil of lavender, etc.

Transfer Making

IS it possible to make satisfactory and reliable transfers at home ?—D. H. (Isleworth).

YOU will find it an extremely difficult matter to make satisfactory and reliable transfers at home, and we would advise you to procure such articles from any firm of transfer makers and printers, as, for example. Messrs. J. W. Beresford & Co., Steward Street, Springhill, Birmingham, or The British Transfer Printing Co., Ltd., Quinton Road, Coventry.

Most transfers nowadays comprise thin films of toughened gelatine laid on paper and suitably printed upon. To make them, prepare an approximately 15 per cent. solution of hard gelatine in hot water, and flow this evenly over the surface of thin, well-calendered paper. Next, pass the paper (after the gelatine film) has set through a hardening bath containing one part of formalin in 100 parts of water. Allow the paper to dry, and then print on it. Another sheet of paper is now taken, passed through a sizing bath of gelatine or arrowroot starch and dried. The transfer sheet is wetted and laid down in contact with the sized paper, the printed gelatine surface of the former being pressed into contact with the latter. After a few minutes, the top paper support of the gelatine film can be stripped off, leaving the printed gelatine film adhering to the sized paper support. This is the transfer required. For use, it is wetted, squeezed firmly on the surface to which it is desired to make the transfer and the support paper is then stripped away, leaving the transfer attached to its new and permanent support. Finally, the transfer is varnished over with a thin, clear varnish.

Home-made Toothpaste

I HAVE made what I consider a satisfactory toothpaste by mixing precipitated chalk with a flavouring mixture. Would it be advisable to manufacture it ?—D. M. (Manor Park).

AS far as it goes, your toothpaste is quite good, but, in our opinion, it does not go quite far enough.

It is more or less the general opinion nowadays that a dentifrice made up entirely of chalk is rather too abrasive for the teeth. It would be better, therefore, if, instead of using precipitated chalk entirely, you employed 50 per cent. of chalk and 50 per cent. of light magnesium carbonate. This abrasive mixture should be "diluted" with a substance such as ground orris root, and it should also contain a small percentage of soap and also a small percentage of powdered gum myrrh to act as an astringent for the gums.

There are many difficult formulæ on the above lines, a typical one being the following:—

	Parts
Precipitated chalk 50 per cent. / Light magnesium carbonate 50 per cent.	75
Powdered orris root	15
Powdered gum myrrh	5
Best Castile soap powder	5
	100

The above ingredients may, of course, be varied to suit your individual preference. For instance, if a more "foamy" toothpaste is required, the percentage of soap powder may be increased.

The above toothpaste powder will, of course, have to be flavoured. For this purpose the best flavourings are oil of peppermint and a trace of oil of wintergreen (methyl salicylate). A judicious mixture of these two essential oils freshens up the toothpaste flavour remarkably and leaves a "clean" taste in the mouth.

We do not think that the toothpaste as you make it at present would stand much chance of success on the market, but made on the above lines and suitably flavoured, attractively got up and, of course, advertised, the product would be entirely successful.

THE Cyclist
Editor : F. J. CAMM

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'Phone : Temple Bar 4363

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Comments of the Month

By F. J.C.

The Purchase Tax

THE purchase tax came into operation on October 21, and of course it includes bicycles and certain accessories. A quaint position, however, has arisen. Dealers will not be permitted, it seems at the moment of going to press, to include the purchase tax on stock in hand prior to October 21. Therefore, readers may expect to find in a given district some machines and accessories being sold at the old price and some at the new, for not all dealers carried heavy stocks on October 21. Those associated with the Hire Purchase Trade Association, however, state that it seems fairly certain that the retailer will be allowed to average the prices of his goods within the Prices of Goods Act. as between those purchased after the Purchase Tax came into operation, and those in stock before. It must, moreover, be remembered that the trader is not allowed to make a profit on the Purchase Tax.

The Position of the Hirer

IT also seems clear that where goods are destroyed or damaged by war, the hirer is not liable for the repair of the goods or their replacement if they are lost or destroyed, nor is he liable to continue to pay for them. Moreover, he is not liable for damages or compensation for the loss or damage to the goods.

The New W.R.R.A. "50" Record

CONGRATULATIONS to Mrs. Ann Briercliffe on the remarkable time she made in her successful attack on Marguerite Wilson's 50-mile record. As reported elsewhere, she returned a time of 1h. 59m. 14s., thus beating Marguerite Wilson's time of 2h. 7m. 59s. It will be remembered, that Mrs. Briercliffe held this record for a few hours in July at 2h. 9m. 29s. This is the first time that a woman has beaten 2 hours for a "50." There does not seem immediate possibility that Marguerite Wilson will return to the attack, although it is our view that under the same conditions on the same course as that used by Mrs. Briercliffe, she would have been even faster. The new record is one of which any male time trialist would be proud.

Extraordinary R.R.A. Procedure

WHEN the spacious days of periodicals return, we shall have an interesting story to tell of the extraordinary procedure adopted by the R.R.A. at a special general meeting called by the Editor of this journal. He called upon the committee to show reason why he was not re-appointed as an R.R.A. timekeeper for 1940. Instead of giving the reasons, the chairman read a statement which *dealt with points which were not raised until after the committee's decision* (which was not unanimous) was questioned. Only 18 delegates turned up in addition to the 12 committee members. It appeared obvious from the start of the meeting that the committee intended to have its decision upheld and although the committee must have felt unhappy about its decision, it was enabled, by reason of its 11 votes, plus those of the few supporters of the committee who turned up, to have the decision ratified. It is only right that delegates who did not attend the meeting should know that the chairman refused to disclose the name of the proposer and seconder of the resolution although there were aspects of the matter which the chairman, in his capacity as an impartial guardian of the rights of all, should have allowed to be aired. It has, however, emerged that the committee, unable to find a valid reason to support their decision, had to revert to quibbles which they raised after the appointment had been declined. We know from discussions that some members of the committee and many delegates view the matter with concern. It is observed that the proposer and seconder of the resolution (their names are known to us), sheltering behind the protection conveniently afforded by the chairman, had not the courage to speak in support of their resolution. R.R.A. delegates will agree that it is extraordinary procedure (and this is describing it in charitable terms) for a committee whose decision is challenged, to give as its reason, a statement which was calculated to mislead, and which contained matters *which could not have formed part of their original deliberations*. The special general meeting, therefore, ratified a decision of the committee on evidence which had no part in their original decision, and moreover, upon evidence that had no relation to time-keeping, and for which satisfactory explanations were given, supported by letters from the Auto Cycle Union, Professor A. M. Low, and J. Burden Barnes, O.B.E., and various speakers who testified to the appellant's ability.

The voting (by secret ballot, a show of hands on a decision being refused) was not unanimous—10 in favour, 20 against. Of these latter, 11 were committeemen. and several timekeepers.

America Goes Cycling

IN America there is a great revival of interest in cycling, no doubt as a result of the increase in imports of British machines which make the American imitation motor-cycle type look ridiculous. The Americans are now learning the difference between pushing a weighty dreadnought and pedalling a lithe and lively British machine of low weight. Further evidence of this interest exists in the fact that two new books on cycling have recently appeared in America, and there is a re-issue of the well-known autobiography of Major Taylor, who claims to be the fastest bicycle rider in the world. He was the coloured cyclist who held the world's championship in 1899 and the American championship in 1900.

The other books are "Bicycling as a Hobby," which is written by R. C. Geist, President of the College Cycle Club, and "Bicycle Built for Two," by James and Elizabeth Young.

The Kenora Race

THE 148-mile cycle race held annually in Canada was won this year by a 41-year-old veteran, Julien Sansen. The previous winner was Higgins, who this year finished second, whilst Maurice Pothier was third.

Sansen's time was 6h. 49m.; Higgins, 6h. 49m. 30s.; and Pothier, 6h. 51m.

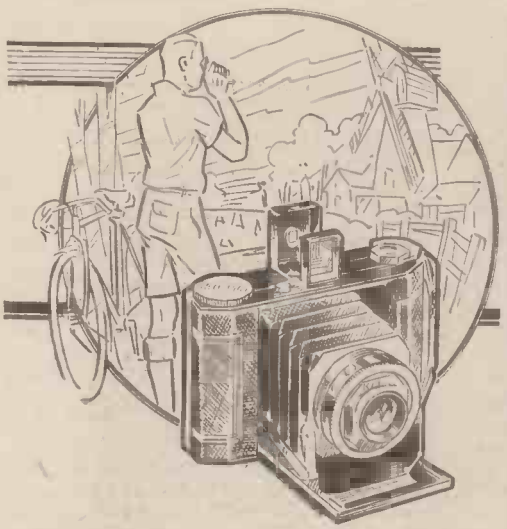
Summer Time

AT the moment of writing it has not been decided to allow summer time to continue throughout the year. Although this step has already been taken in Germany, the conditions over here are not precisely similar. The arguments, however, in favour of allowing summer time to continue through the winter months outweigh the disadvantages.

Munition workers will particularly appreciate it, especially now that usual forms of transport are not always available and the foggy weather will add to the delays. There is little point in munition workers working two or three hours overtime each evening if that time is to be lost by late arrival in the morning due to traffic delays. It is in such circumstances that the bicycle demonstrates its handiness. It is the door-to-door travel link between home and work, as well as the vehicle to transport the owner from war worry to the delights of the country lanes when leisure is available. Bicycles will not be so plentiful during the war, for the materials from which they are made are more urgently needed for war purposes. Dealers' stocks are running low, and there is not too much time, therefore, to select a machine if you want to be independent of traffic problems. The Purchase Tax will increase prices, and we therefore advise all readers who do not at present possess a bicycle to obtain one now. See that it is properly equipped with good brakes, a good headlamp, a good touring bag, and carry a repair outfit, spanners, and spare bulbs if electric lighting is fitted. Select a machine to fit you; the range from which you may make your choice is not so wide as it was in peace-time, but it is important that you should have a machine upon which you can ride comfortably. Spend a little time adjusting the saddle height, the reach and height of the handlebars, and the fore and aft position of the saddle.

Club Socials

MOST clubs have changed the venue of their annual dinners, and many have abandoned the idea of a dinner and are running a Sunday lunch instead. There will not be so many annual prize-givings, for prize-winners have been asked to select their prizes and to take possession of them as soon after the event as possible.



Paragrams

Road Sport

THOSE clubs which carried on road sport during the past few months have every reason to be satisfied with their efforts. Scores of events were held and there were no incidents to bring down official criticism of the sport.

Women's Road Records

INTEREST in the Women's Road Records shows no signs of abatement. Cycle and tricycle records have been beaten and further improvements in the near future are suggested. No attempts have been made this year on R.R.A. records, although the machinery for checking any claim is waiting to be put in motion.

Dispatch Riders Wanted

MANY battalions of the Home Guard still require cyclist dispatch riders and signallers. Among these is the Altrincham Battalion whose headquarters are at the Drill Hall, Hale, Cheshire.

Irish Record

A NEW 100-mile Irish tandem competition record has been set up by T. F. Quinn and E Kirwan (City of Dublin Club) with a time of 3.50.40. This is nearly three minutes faster than the corresponding British record.

An Unpleasant Experience

MR. C. J. COLE, well-known member of the North Road Cycling Club, had recently the unpleasant experience of his house being gutted by an incendiary bomb. To add to his discomfiture he was, at the time, out with other A.R.P. wardens putting out a series of small fires caused by incendiary bombs in nearby woods. The fire in his home burned for two hours before being noticed.

He Won a Dagger

WINNER of the "Major Liles" Trophy as the Best All Round Tricyclist in 1939 and winner of the Tricycle Association Championship in the same year, Gordon E. Thomas, now with the Honourable Artillery Company "somewhere in England," won a one-mile and a ten-mile massed start cycle race confined to members of H.M. Forces. For each event the first prize was a dagger!

Cycling Luncheon

MEMBERS of Southgate Cycling Club will meet in the Salisbury Hotel, Barnet, on Sunday, November 10, for an informal lunch and re-union which will be a substitute for their 48th annual dinner.

A Remarkable Summer

IT is now permissible to give some account of the summer's remarkable record. If you wonder why worn tyres stood up so well remember this—it was the driest August since 1818, the hottest June for 44 years, and the century's worst drought was rivalled! It was the warmest May for 18 years and the brightest since 1929. July provided eight or nine degrees of frost on the nights of the 13th and 27th. For dearth of rain the past summer has not been matched for 19 years!

Released from the Army

HOLDER of the Land's End to John o' Groats unpaced R.R.A. tricycle record (3 days 19 hrs. 56 mins. in 1929), Leslie J. Meyers his been released from the Army to resume his work of National importance as a key-man in an aircraft works.

Scrap Metal

SCRAP metal is needed for use in the manufacture of armaments, yet nobody in authority has yet seriously suggested that the millions of steel studs scattered all over the country in streets and roads should be collected for scrap.

Bicycle Boom

BICYCLES are "booming" and even in military circles their utility is recognised, many cycling units being now formed.

Still Rides an Ordinary

MR. "TOMMY" CHARLETON, president of the Wellam Cycling Club and the well-known North of England rider, still finds great delight in riding an Ordinary. He recently put in a day's ride of 43 miles. "Tommy" is a past-president of the annual Barnard Castle meet.

Sir Alfred Robinson

SIR ALFRED ROBINSON, K.B.E., C.B., deputy secretary to the Ministry of Transport, who is interested in the cyclist's cause, recently retired. He has attended several dinners of the Road Records Association.

Cycle "Tax"

BRIDGWATER traders recently suggested that the N.C.U. should advocate that cyclists taxed themselves by contributing half a crown to "Spitfire" funds! Bridgwater traders should concentrate on trade in their own area.

N.C.U. Move

THE N.C.U. has taken up temporary accommodation away from the heart of London and is now centred at 35 Balliol Avenue, Highams Park. London, E.4.

Tricyclists, Please Note

ALL racing tricyclists, whether members of the Tricycle Association or otherwise, having performances to their credit at 50 and 100 miles and 12-hours in Open of T.A. events, should send particulars of these to G. E. Lawrie, 132 Henley Avenue, Ilford, Essex, so that the winner of the "Major Liles" Memorial trophy (for the Best All Round Tricyclist) can be adjudged.

Broken Glass

WITH so much broken glass about in many streets, stouter tyres seem advisable. Yet the average tyre seems to stand up well: when did you last puncture? We've heard of at least one cyclist puncturing on a shell splinter!

"Cycle-Widow"

MUCH has been written, and spoken, about the "golf-widow," but little about the "cycle-widow." But because her husband went cycling on Sundays without her, a Glasgow wife deflated the tyres of her husband's machine! Words followed and there was a sequel when the wife summoned her husband for assault in a Glasgow court. The Baillie (a former Clarion rider) advised the pair to make it up and said: "Cycling is the cleanest thing a man can do. I wish more men would go out riding on Sundays."

Immobilising Cycles

THERE is no regulation demanding that cycles must be immobilised, yet in some areas the police are acting in a high-handed manner and cases have been reported when cyclists' machines have been tampered with and the tyres deflated. A war reserve constable, in the North London area, was found by the owner tampering with the valves of his machine. The cyclist asked the policeman what he was doing and the officer answered that he was "teaching the owner a lesson." The cyclist asked under what section of the Act the constable acted and added that unless some reasonable statement was made he would report the matter to a higher authority. Despite his blustering the constable was cornered and at the invitation of the wheelman pumped up both tyres to the amusement of a crowd which had gathered!

Black-out

LOOK to your lamps—especially your front lamp after black-out. The top half of the glass should be blacked out and the lower part of the reflector rendered ineffective. Many police prosecutions have been made regarding ineffective lights of late and, in one court, a fine of £2 in each case inflicted.

NOTES OF A HIGHWAYMAN

By L. ELLIS

A Market Woman's Philanthropy

IT is not often that a memorial is of so extensive a nature that its position occupies a considerable area on the map. Maud Heath's Causeway, however, will be found on most maps of the Chippenham district. The lady is said to have been a market woman of Langley Burrell who died in 1474. The story goes that she had had a hard life and had great sympathy with those who, like herself, were compelled to trudge through swampy country to take their market produce to Chippenham. She therefore left money and property not only to provide, but to maintain for ever, a footway from Wick Hill to Chippenham Cliff, a distance of about four miles. Her wishes have been carried out, and to-day the Causeway stands in excellent condition and serves as a footpath alongside the more modern road. A monument to Maud Heath's memory stands on a hill at Wick overlooking the Wiltshire plain. A statue, showing her with staff and basket, crowns the pillar, and the inscription, which is not remarkable for its good spelling, reads: "Erected at the joint expence by Henry, Marquis of Lansdowne, Lord of the Manor, and Wm. L. Bowles, Vicar of the Parish of Brimhill, trustees 1838." Where the causeway begins on Wick Hill there is a stone with the inscription: "From this Wick Hill begins the praise of Maud Heath's gift to these highways." At Kellaways there is a pillar with a sundial, and

Maud Heath's Causeway, near Chippenham

another inscribed stone is to be found at the Chippenham end of the path. At the foot of Wick Hill the path is carried over a stretch of marshy ground by means of a succession of small stone arches, about sixty in number.

A Highwayman's Retreat

DICK TURPIN'S fame, or should it be notoriety, is generally associated with London and the York Road, and it comes like something of a shock to be reminded of his sinister figure in the placid beauty of Corve Dale. There, sure enough, at a place called locally Aston Munslow, although the map says Munslow Aston, is a delightful little inn claiming a one-time connection with the robber. I suppose, like everyone else, I am apt to subscribe to a halo for Turpin, Robin Hood and the other picturesque brigands. Whether I agree with their methods or not, as one Highwayman to another I certainly admire Turpin's choice of inns. This little place lies in the heart of one of the peaceful valleys of Shropshire, a wide valley reminiscent of the Scottish straths or Wensley Dale. The road runs roughly north-east to south-west and is flanked on the northern side by the parallel ridge of Wenlock Edge. On the south, more distant and more broken, are the slopes of the Brown Clee and the Titterstone Clee. The dale extends approximately from Ludlow to Much Wenlock and is charming throughout its length. Dick Turpin is said to have arrived in Corve Dale early one morning in a brewer's dray and the story goes that he called at the Swan Inn at Munslow Aston. It is a quaint old place dating back to the fourteenth century, and is in an excellent state of preservation; in fact it is rapidly becoming modernised. Twin black and white gables adorn the roof, and eight stone steps lead from the road to the bar parlour. Until quite recently there was an immense chimney up which the sweep's boy used to crawl. I was too late to see this old relic, as on my last visit I found a brand new fireplace of new and ugly design.

A scene in Brighstone village street—a reminder of past touring holidays in the Isle of Wight

AROUND THE WHEELWORLD—By Icarus

1941 Road Sport

I AM informed by the secretary of the Road Time Trials Council that the National Committee is to meet, probably in London, at the end of the year or in January, to discuss plans and prospects for the 1941 road season. As I see it, the prospects of road sport for 1941 do not seem too rosy. The services are calling up time trialists in greater numbers. However, there are other matters which the National Committee of the R.T.T.C. can discuss, as well as the future of sport during the war. The R.T.T.C. has been operating now sufficiently long for the experimental period to be considered as closed. One point which has been raised and which must be discussed is whether Press men should be allowed to serve on the committees.

Claude Hulbert's Skit

ATTENTION was recently drawn in these columns to the remarks made over the air in the course of a talk on bicycles. One of those remarks was that the bicycle is difficult to immobilise, and this journal pointed out that it was one of the easiest vehicles to immobilise. Claude Hulbert evidently thought so too, for in his radio turn which followed a few nights later, he lampooned the remarks of the previous talker in a most amusing way. He said (of course, facetiously) that he agreed with the speaker who said the bicycle was difficult to immobilise. Even if you removed the front wheel he understood the Germans had been training as unicyclists so that they could ride on the back wheel only. Moreover, he said, should you be ultra-cautious and remove both front and back wheels, he understood that they were being taught to ride on the chain wheel only.

Patents in War Time

THE war has naturally stimulated the production of inventions and the Government departments have a special organisation for dealing with them during the war. A note is taken of any patent application which, from its title, appears as though it might be of interest to one or otber of the Ministries. When this is the case, a formal letter is sent to the applicant, asking him to submit further particulars and explanation of the invention. Government departments have, of course, the power to prohibit the publication of the particulars of any invention which might be of benefit to the enemy and they also have the right to take over and to use an invention, or to make the invention secret; they may even delay acceptance of the application for the period of the war to avoid publication. These actions do not abrogate the inventor's rights to his invention, for although the Government is entitled to use it for the national benefit, and are not obliged by law to make any payment in respect of it, they do in practice make a suitable payment. If they are unable to agree with the inventor with regard to the amount of payment, this is settled by arbitration.

Enamelling a Bicycle

NOW that it is difficult to purchase new bicycles, many will be turning their attention to renovating the old ones.

Mr. W. T. Downes, Works Manager of the County Chemical Co., Ltd., has sent me some notes relating to the enamelling of cycle frames which I gladly pass on.

The present professional or commercial method of enamelling cycle frames is by dipping the frames or pouring the enamel on to them, over a surface which has previously been made rustproof by one of the many processes now in use.

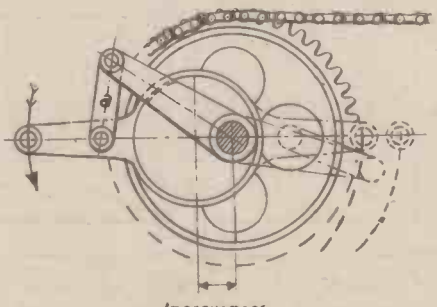
The enamel is afterwards allowed to drain off for a matter of 15 to 30 minutes according to the conditions, and stoved at various times and temperatures, according to the conditions in the particular factory in which the work is being carried out.

The enamel used for the first coating is called an undercoating or rubber coat, and the second coat is called the finishing or gloss coat. Here again it is allowed to drain for a similar time and afterwards put through the oven as in the case of the undercoating.

Of course, it is readily understood that the amateur could not enamel his frame under these conditions, but there are many types of air drying enamels now on the market by which he can get very good results. The process recommended is to thoroughly clean off the old enamel and rust, if any, with the aid of emery paper, and afterwards apply a coat of enamel. In the case of black, one coat is usually sufficient, but in colours you should give two coats of enamel—undercoating and finishing. The all important part is, of course, to see that the work is perfectly clean and free from rust or grit. Furthermore, many failures are due to the amateur buying a good quality enamel and yet a poor quality brush, the result being the bristles readily come out, which for some unknown reason always seem to be full of dirt.

Improved Power Crank

AN ingenious mechanism which is applicable to a bicycle, but is not so well known as it ought to be, is shown in the sketch. Its object is to utilise greater leverage during the working half of the stroke without increasing the length of the crank. In the application shown, two eccentric sheaves are keyed to the driven shaft on each side of a chain wheel. The cranks are extensions of the eccentric straps, each connected to a lever arm keyed to the shaft by a link *a*. Each crank is in advance of the arm in the direction of rotation. This device with ball bearings between all sliding parts, has been patented and one well-known bicycle manufacturer is interested in marketing a bicycle so fitted—not, I think, during the war, but rather as a part of his post-war programme.



Obtaining greater leverage on a crank during the working stroke.

The New Minister of Transport

MY sincere congratulations to Lt.-Colonel J. T. C. Moore-Brabazon, M.P., on his appointment as Minister of Transport. I have kuown him for very many years. I first met him when he was training to take his pilot's certificate of which he holds the first issued by the Royal Aero Club. I also know him as a keen motorist, and one who has been interested in road problems and transport all his life. There is no one in this country better able to fill the post, and I am certain that he will fulfil his duties with conspicuous ability and with benefit to the State and to all road users. He understands the cyclists' point of view, and will not allow motoring interests to outweigh his judgment. I am certain also that he will undo some of the messes created by Burgin and Belisha. Reith was not in the job sufficiently long to demonstrate his ability. I hope Moore-Brabazon remains Minister of Transport until all the multifarious road problems have been solved. It is not generally known that he is a keen model railway enthusinst, and owns a very complete model railway system, which I understand the editor will shortly describe elsewhere in this journal.

Beating the Hour

I SEE that W. J. Robinson returned 59 m. 58 s. for a "25." The event was promoted by the Herts C.C. and he is thus the fourth to beat the hour in Ireland. It was five years ago that Donegan created the 59 m. 5 s. record for the "25." Fleming, of course, got well inside this figure and although there was no doubt whatever concerning his time, he had not given the required notice to the officials, and so the record was not officially recognised. In this country Dougherty holds the "25" record with 59 m. 29 s. whilst Fleming returned 59 m. 38 s. and Nightingale 59 m. 37 s.

The N.C.U. Spitfire Fund

THE above fund has now reached very fair proportions and we understand a further £100 (approximately) has been subscribed. The Union has also received five Gold Championship Medals, one dated 1896, 1906, 1908, 1909 and 1912, from a well-known Catford member, Mr. W. Taylor. Mr. Taylor, with customary generosity, has asked the Union to sell these gold medals for the benefit of the N.C.U. Spitfire Fund.

But although the fund has been going for some considerable time, it is still a long way short of the £5,000 or £6,000 necessary to purchase a Spitfire. At the present rate of progression it will take over 18 months to collect the money.

N.C.U. Moves

THE N.C.U. has moved to temporary accommodation at 85 Balliol Avenue, Highams Park, London, E.4—telephone number Larkswood 2490.

Accidents

FURTHER confirmation for the arguments advanced by this journal against the speed limit are to be found in the return of road accidents issued by the Secretary of the Ministry of Transport for the month of August. If we take accidents to cyclists alone, we find that 55 were killed in August, 1939, on roads subject to a speed limit, whereas in August, 1940, this number had *increased* to 68. In August, 1939, there were 64 accidents on roads not subject to a speed limit, and 61 in August, 1940; thus for August, 1940, there was a total of 129 cyclists killed, as against 119 in August, 1939. The figures, however, apart from cyclists, show similar increases, and I am hopeful that Lt.-Col. Moore-Brabazon, with his mathematical mind, will be able to perceive the mistakes of the two Leslies, Belisha and Burgin, and abolish the speed limit and the pedestrian crossings, and the unwarranted liberties which are given to pedestrians, who in my view are far more responsible for accidents than any form of vehicle. As a fact, there were 618 people altogether killed in the roads during August, 1939, and no less than 729 in August, 1940.

"Shake" Earnshaw for R.A.F.

"SHAKE" EARNSHAW, famous professional cyclist, is likely to don Air Force blue in the near future. He was recently seen at a North of England depot of the R.A.F. where prospective flyers and groundmen undergo preliminary questioning prior to being called up within a few weeks.

Keep Your Head-Light On

I ADVISE all cyclists to ignore instructions from A.R.P. wardens and members of the Home Guard to put out their headlights during an air raid. The A.R.P. and the Home Guard are voluntary organisations which have no standing in law so far as lighting is concerned. The administration of the lighting laws remain in the hands of the police. A Chief Constable may instruct his officers to have cycle lamps extinguished, but a policeman may not order you to put your headlight out unless he has received such instructions.

WAYSIDE THOUGHTS

By F. J. URRY

IN mid-September I was lucky enough to obtain a few days' leave, and as usual spent it riding a bicycle, and escaping the charge of selfishness by joining my family at Bala, they having journeyed thither by car, a very small car used for the purpose of conserving petrol. My ride to Bala was a perfect journey, just an idle trail of miles through an ever-changing countryside which became more colourful as I neared the mountains and entered that superb Gate of Wales by way of the Vale of Llangollen. Lonely riding has its advantages inasmuch that you stop where you like and smoke, eat when you feel hungry, and as in this case, with no occasion to hurry, just meander amid the beauty and absorb that type of sanity which is always closely akin to nature. It was just glorious; the sense of freedom, the loveliness, the wind and the sun, and the personal power to collate those everyday things to the undiluted enjoyment of the moment. That is cycling in the best sense of the pastime, a conditioned achievement I would not change for any other form of travel. I was riding a six years old machine which had just been fitted with a Sturmey-Archer four-speed medium ratio hub giving ranges of approximately 69, 60, 52, 43, and this new plaything gave me an added interest in the going. To me the gear changes were most complementary, and I went the hilliest way to try out the various gears. Had you told me four gears on a bicycle were desirable a few months ago, I should have found it difficult to believe, but my recent experiences have made me a firm adherent to this new and delightful combination. The changes are so slickly easy—a flick of the finger—that you are encouraged to use just the gear most suitable to the grade or the wind, with the result that your riding is easier, and on the long slopes or the sharpish rises you are not conscious of tremendous effort.

Among The Welsh Hills

DURING this little release I rode nearly three hundred miles among the Welsh hills, with the little car frequently trailing me and carrying the picnic outfit; nor did I flinch at the little secondaries that rustle between the mountains and take you into remote spots, because I had the bicycle and the gear combination to make the going without strain, and well within my powers. Occasionally I walked a few hundred yards of the steepest pitches to stretch my legs and look around at ease with the world, but for the most part I could sit up and spin that 43 to the summit of the passes, slowly and enjoyably.

I had been lunching with the family about a mile on the Dolgelley side of Barmouth Bridge on a high plateau of ground completely hidden from the road, and had just started to amble back to Bala with the wind behind and the perfect vision of the Mawddach Valley in front of me, when a couple of riders passed me, making for Barmouth. We exchanged the usual greetings, but as these cyclists passed my unseen people on the bank, they overheard this conversation, "That was old Frank Urry; what a pity we did not stop and talk to him, he might have mentioned us in his notes." Such is the small reflection of fame; but I object to the qualifying adjective to my name, for though I have become a trifle bleached on top, I refuse to consider sixty-one summers as signifying a state of decay.

"Middle-Footing It"

HOWEVER, I do not want to bore you with my small adventures, and only recite them in the hope they may encourage a few folk to ride a bicycle more for the joy of wandering, than for the healthiness of the game or its undoubted convenience. There is such a lot to learn about cycling as I see the matter by observance of the multitudes who use a bicycle—wrongly I think in so many cases.

Take for instance the people who trundle along the road "middle-footing it." They look stodgy and they are stodgy, moving the wheels by the application of sheer brute force instead of that nimble pressure of power that comes of correct pedalling. What is correct pedalling? It is the full use of the flexibility of the knee and ankle joints, and the toggle of power that resides in the muscles controlling them. It is the use of the natural spring in the human make-up, and its application to crank revolution is the secret of easy riding. Our styles may differ as does our build, but the persuasion of the pedals over the dead centre "points" is one of the things the human can do better than any engine.

Club Riding

FROM my observations the men and lads are the worst offenders in this matter, for it seems as if the natural daintiness of the girls kept them from forming this bad cycling habit. Regular riders know what I mean, and with me most of them deplore the fact that this descent from perfection in the riding of a bicycle is so common. The club cyclist is seldom guilty of this error whatever else may be charged against him, and that is one very good reason why all folk who desire to make cycling a pastime of pleasure should give some adherence—however slight—to club riding. It is the best way to learn easily and comfortably the tips and hints that make riding a bicycle far more than the mere acts of balance and force. I stress this point because so much depends on correct pedalling; indeed it is the main link that makes cycling so delightful a travel method, and once it is acquired—and there is no difficulty about that—it is like swimming, you never forget it. Indeed proper pedalling is cycling, for all the rest of the game is centred round that nimble action.

In this connection I think it wise to stress, that which should be obvious to the novice but apparently is not, to walk before the effort of propulsion hurts. There is nothing clever in riding a hill for the sake of pride; in fact it is unwise, for strained muscles are not a pleasant trouble, and the aches that result sometimes prohibit sleep. How do I know? Well, I was once young and thought I could race without proper training, and naturally paid the penalty.

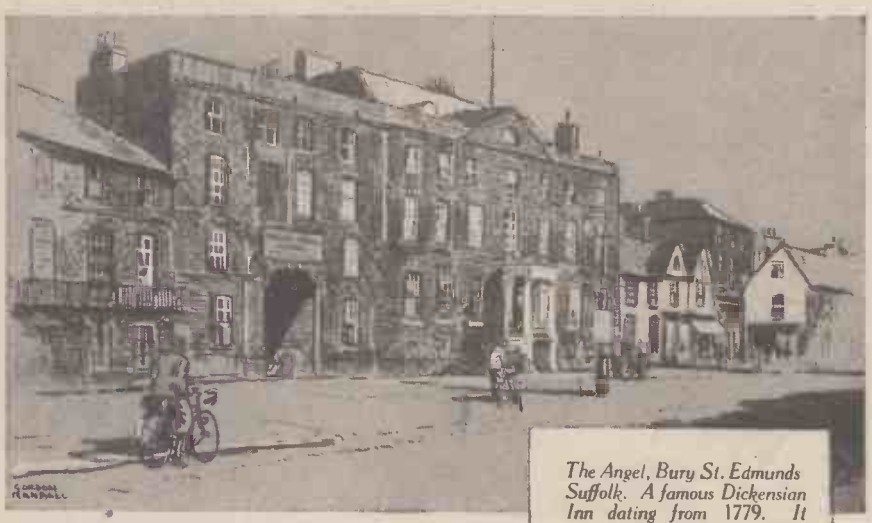
Change of Exercise

THERE is really no great need to do much walking, even in a hilly country, if one's machine is moderately geared; but I frequently tramp the length of a hill just for a change of exercise and the excuse for a smoke. Hills that are easy to ride in the summer or when the wind is favourable, often prove quite tough in other circumstances, so because you once rode a grade fairly comfortably, it is no reason why you should always be able to do so. And fitness counts tremendously in this matter. If you have been out of the saddle for some time, you will find lack of practice has its handicap, and most certainly you won't get fit again by the process of straining on the leash as it were. The golden rule for pleasure cycling is to take it easily always, and then in due time you will begin to realise the latent power of the human body to adapt itself to this "mechanical walking" and enjoyably cover anything up to a hundred miles in a day, if you want to, without feeling unduly fatigued.

I ride to business every day of the working week because I like cycling, the fresher air of the highway as opposed to train or bus or car, and the individual freedom from time tables or the price of petrol. "But," say my unconverted friends, "What about the bad weather; what about when it rains and blows, the nights are dark, and the black-out looks awesome?"

Mackintoshes

THIRTEEN miles every day is my business riding portion unless the snow is too deep for steering way, and I have never yet been more than dampened on the journey. Good mackintoshes are the answer, cape and leggings; not the flimsy things sold at a price, but a cape with plenty of room under it, and leggings that do not fit too tightly. It is waste of money to buy cheap waterproofs, yet the temptation to do so is very great, for most people excuse their bargaining on the grounds they will so seldom need to use them, so the cheap type will do. They expect to keep them in the bag as a kind of charm against wet weather; but when the moment comes, and the rain descends as it most surely will, then they know in less than half an hour the saving of pence has only brought them discomfort. Buy the best macks you can afford, and see that the cape is roomy, does not grip your shoulders, which means it will surely ride up your back when in service. Wet weather riding is an art in patience. Most people start to ride harder when it rains, which is absurd, for that means discomfort for the sake of saving five minutes. Go more slowly; just sit comfortably in the saddle, drape the cape over the bars at the front, and the bag at the rear, and keep as still as you can, except for your legs, ankles and feet. Use your lower gears to travel the slope or bore into the wind, and if the gradient is stiff, walk it.



The Angel, Bury St. Edmunds Suffolk. A famous Dickensian Inn dating from 1779. It occupies the site of three older inns. The Angel, The Castle and The White Bear

Driving Rain

I HAVE ridden all day in driving rain without getting wet through. The edges of my coat have been dampened, and so have the ends of my sleeves, while a change of stockings (which I always carry in the bag) has been grateful and comforting, because heavy rain on a long journey trickles down the leggings and percolates the lace holes of your shoes. When I have to face driven rain for a fair period of time I usually tie a light handkerchief round my neck to preserve what dignity my collar may command, and I always roll up my shirt sleeves to keep them free of the drift of moisture thrown up by the front wheel when coasting down hill.

That is all there is to it, but the greatest of these things is to ride easily and then you will ride enjoyably. Personally, I can and do enjoy a rainy ride, the air is usually so clean and the roads so very much your own. Besides it seldom rains all day in this country, and those immediate hours after the cessation present the wanderer with some of the loveliest visions in pastel shades of softness possible to imagine.

I remember some years ago persuading a friend of mine, who hated wet riding, to join me on a journey to Peterborough, an eighty miles trip, and though he was dubious at the start of that ride, he frankly admitted at its ending he had never enjoyed a day's cycling more. And it rained all that day, and far into the night until every lazy stream had become a torrent and the Soke of Peterboros' seemed well named. The pleasure of that ride was based solely on our easy journeying, which averaged rather less than eight miles an hour, including meal times, and finally brought us to Peterborough with only a change of stockings necessary for our comfort.

If Hitler Had Been a Cyclist

By Reginald C. Shaw

I AM sure that Hitler would have been a much happier man if somebody had given him a bicycle and taught him to ride it.

I have been everywhere that Hitler has been. In fact, I got there first—and I did it with much less fuss.

Take Czechoslovakia, for instance. When I crossed the frontier from Austria I had with me a mere handful of mounted men—C.T.C. members. We rode up to the frontier guards quite openly and produced twenty-five bits of paper (one for each of us), given to us by the Foreign Travel Department of the C.T.C.

Not a shot was fired. People were glad to see us; they wanted to give us presents, to show us this and that, and to make sure that we were really happy. We were.

Hitler, on the other hand, had quite a lot of difficulty in getting into the country. He talked about it for months before actually trying it. And then he needed more than twenty-five men on bicycles. He had to have hundreds of tanks. An awful expense, and a tremendous amount of trouble.

In Poland

It was the same in Poland. When my platoon swooped down on the frontier post in the Carpathians we met no opposition whatever. In fact the customs officials asked us to step into their office and make ourselves comfortable until the rain stopped. We couldn't stay as long as that, but we did hang around for an hour or two.

Later on, it is true, an old lady shouted out to us as we rode towards Cracow : "Are you going to start another war?" but she didn't bother to take cover, although I bet she did when Hitler and his gang came swaggering into the district.

When I visited Warsaw there was something to see. It was a beautiful city, a place I shall never forget. But when the Bavarian boor turned up to have a look round there was nothing to see but heaps of rubble and piles of scrap metal.

Poznan Memorial to the "Restored Poland"—one of the first things Hitler destroyed.

Rectifying Frontiers

Hitler has talked much and often about frontiers, and rectifying them, and liberating people and making unhappy folk rejoice, but the truth is he knows nothing about such things. When he's been cornered and confined—as he will be—the people of Germany must be shown what a fool he was, and what fools they themselves were, because at present they think he is the only wise man in Europe.

Somebody will have to buy them all bicycles and take them touring. They've never done that in Germany yet. Or course they do make some use of bicycles, but they don't use them for pleasure. Nor would you, if your machine was a German model. Great clumsy things they are, with two-inch tyres and prehistoric brakes. They are out of date, like German ideas of neighbourliness.

When this war is over there will be, I hope, a stream of British cycles flowing to the Continent, followed by a stream of British tourists to show the people what to do with them. Then they may learn sense. They may learn that the way to live at peace with your neighbour is to pay him a friendly call now and again, on a bicycle, and without your tommy-guns and screaming bombs. They may see in the end that frontiers are only front doors, and that they will be opened for you if you knock on them instead of trying to knock them down.

Staying At Home

Staying at home is not good for anybody. Those who never pay calls on their neighbours are the ones who cause the trouble—like Hitler. He had never been outside his own country until he started rampaging about Europe with his clockwork soldiers.

That's the trouble with most Germans : they think there is no need for them to go anywhere; they think they know all there is to know about the rest of the world without the trouble of looking at it.

We must take them in hand when the present spot of bother is over. We must take them by the hand and lead them gently over the countries they have smashed up, and make them realise what fools they've been.

My Point of View

By "WAYFARER"

The Foolish Cyclist

I WAS pedalling my way very serenely along the Thames Valley a few days ago when I discerned a brother cyclist who was grappling with the minor nuisance caused by an unauthorised perforation in one of his tyres. As one good cyclist should always say to another, in such circumstances, I called out : "Are you all right?"—and the reply proved that he was in anything but that desirable and happy condition. He answered my question with another : "Have you a pump?" *Had I a pump*, indeed? Would I venture to cross the road without one? So, with time to burn, a halt was called, and I set about assisting a fellow cyclist in slight distress. He proved to be a school-teacher, who was regularly doing a 20-mile ride each day to get to and from his job. Owing to the fact that one of the brazed-on pegs had broken off, he was not carrying a pump, and thus, with a puncture, he was well and truly "in the cart." His back wheel was divorced from the rest of his bicycle, and the tyre was dismantled. At the moment of our encounter, he was endeavouring to inflate the tube with the bellows God gave him, expecting thus to achieve sufficient distension to enable the puncture to be located. What a hopeless dawn !

Asking For It

MY pump—always a good one—made short work of the inflation job, and then, as the leak refused to show itself, I took the tube and set off in search of water, which was discovered in a horse-trough at a farm half a mile away. In less than no time I was back again, and it did not take long to make a repair, assemble the tyre, and replace the wheel. I allowed my friend to carry out the inflation act because a cursory examination of the cover revealed that it possessed two or three "sore places," and I preferred not to have the responsibility of bursting the tyre through what, in the circumstances, might be over-inflation. That was rightly his "funeral," not mine. Then, having a spot of good advice lying handy, I gave him some with regard to the folly of riding forth without a pump, and the further folly of using a tyre which was manifestly worn out. On the first point, it may be remarked that there is more than one way of carrying a pump : on the second point, I always feel that cyclists who take a chance with tyres are crying aloud for trouble. And, often enough, they get what they demand ! My friend saw the wisdom of my remarks, and I then went on my way, delighted to have been able to render a slight service to a brother of the wheel—and thankful that my schedule, such as it was, could afford a break of about 30 minutes.

Pump It Hard

THIS may be a good point at which to say a word or two on the subject of tyre inflation. How many of us fail to pump hard enough ! One might have to make allowances when using the boulder-strewn streets of, say, industrial Lancashire, but, in general terms, we should pump board-hard, thus gaining in personal comfort and prolonging the life of our tyres. To my way of thinking, a flabby tyre is distinctly uncomfortable, and it is always a joy to harden it. I find it a good plan, during the inflation process, to pump the tyre as hard as you think it should be, and then test it, pressing the two thumbs, close together, firmly into the thread of the tyre—remembering, the while, that the tyre has to carry your 10, 12, or 14 stones. Then, having decided that the pressure is just right, push some more air into the tyre, and that will be that ! A few evenings ago I encountered a perfect example of how not to use tyres. A parson came to my house to supper, and he travelled by bicycle. As I put his machine in a safe place—and I noticed that it weighed just about double one of my bicycles !—I observed that the tyres were as flabby as they could be, providing the rider with the peak of discomfort. I refrained from making any remark, because for one reason, you can't teach parsons anything, and, anyway, his tyres were in such condition that they might have rebelled at further pressure. But what "gets me" is the habit of some people in using tyres which are not in really reliable condition. Even at enhanced war-time prices, tyres are cheap enough, in all conscience, and, in my view, it is an excellent investment so to "shoe" your wheels that you purchase immunity from trouble. That way lies confidence in your bicycle and enjoyment in your pastime. And it may also prove to be the cheaper policy, as a man I met recently is now convinced.

Devoid of Wisdom

THIS merchant had a bit of bother with one of his tyres, and took it to a shop to be mended. The repairer, a wise old owl, whose word can be relied upon, pointed out that the tyre had seen its best days, and that a repair would not be a good investment. The customer knew better, or he was "economising," and declined to launch out into the expense of a new tyre. The very next day he was in trouble again. The tyre gave way as he was cycling to his work. He lost half a day's pay through being late—and he then had to face the expense of new "furniture" for his wheel. A distorted idea of "economy," to my mind !

Four-Wheel Cabs Galore

ON one of my recent evening jaunts into the glowing countryside, I came across a field which was veritably littered with four-wheel cabs of the horse-drawn class, the purpose being, of course, to prevent enemy aeroplane landings. It was a curious sight, and one could not help wondering where this collection of old-fashioned vehicles had been reposing since the motor car came along and pushed them off the road. I, personally, have something of a reputation as a hoarder, but—believe it or not—I have never gone in for hoarding four-wheel cabs !

Ann Briercliffe, West of Scotland Clarion, who broke the British W.R.R.A. 50 miles record on October 6th. Her time of 1h. 59m. 14s. is the first below two hours to be recorded by a woman.

Sportfolio

Racing News of the Month

Scott Still Winning

WILL SCOTT, the popular Scottish crack recently added one more "25" to his long list of successes, this being the Lancia "25" in which he clocked 1h. 1m. 41s. Some very fast times were returned in this race, and Scott only just managed to "pip" J. Armour of Auchterdon Wheelers, who was 16s. behind the Crawick rider. It is interesting to note that Mrs. Ann Briercliffe rode in this race and returned a time of 1h. 14m. 50s.

Fast 25 Milers

MOST of the Midlands' fastest 25-milers were included in the 75 entries for the East Midland Clarion "25" which was run off recently. The race was won by P. F. Possart, Solihull, who clocked 1h. 4m. 44s.

Glasgow Finals

THE final of the Scottish Track Cyclists' Association half-mile novice championship, held at the Westhorn track, Glasgow, was won by G. Edwards of the Nightingale C.C.

Irish Polo

THE Northern Ireland Bicycle Polo Association recently held their annual general meeting to elect officers for the forthcoming year. The following were elected: I. Carton, chairman; I. Paddington, vice-chairman; W. I. Mullan, hon. secretary; W. Nelson, treasurer; A. Smith, press secretary; S. Harkness and I. Thompson, referees' representatives.

The winners of the Northern Ireland Summer League were the Rangers, with the Wrens as runners-up.

Ann Briercliffe's "50" Record

ANN BRIERCLIFFE, Glasgow amateur, brought the British women's 50-mile record inside two hours on October 6th, when she clocked 1h. 59m. 14s. for the distance. This is eight minutes forty-five seconds better than the previous best, which was recorded by Marguerite Wilson, the Claud Butler and Sturmey-Archer professional, in July.

Mrs. Briercliffe used an East of Scotland course for her successful attempt. Good conditions prevailed, and she finished fit and undistressed. She used a variable gear, and Mr. G. R. Herd, official timekeeper of the Women's Road Records Association, followed throughout the ride by car.

She also broke her previous Scottish "50" record as well as the Scottish "25," "15" and "10" records, previously held by Eleanor Collins, of Edinburgh. The improvements in the three latter records were also substantial, and the new times are 53m. 30s., 31m. 56s., and 20m. 11s. All the new figures are subject to confirmation by the Women's Road Records Association and the Scottish Women's Cycling Association.

New Hill Climb Records

FIRST and second men in the classic Hamilton C.C. hill climb beat the previous fastest time for the hill. T. M'Nulty, Glasgow Wheelers, clocked 1m. 53 2/5s., and J. B. Jamieson, Bonawe C. & A.C., 1m. 53 4/5s. Jamieson held the previous record of 1m. 59s. put up last year. The hill has a gradient of 1-in-7 and a length of 600 yards.

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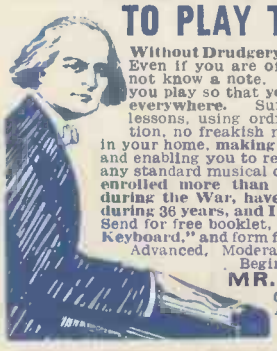

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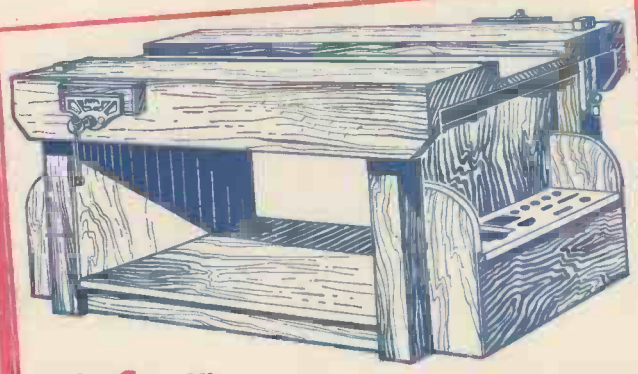


This Super

DOUBLE SIDED WORK BENCH

At Pounds Below To-day's Value

Exceptionally strong and very rigid. Fitted with **two "Record" 7-in. vices (one either side)**, 2 in. thick solid English beech top. Smooth, clean finish. Extra heavy deal underparts. Fitted two bench stops, two large tool racks (*one at each end*). All parts exceptionally heavy and bolted together. Bolt heads are sunk and pelleted. A bargain not to be missed.

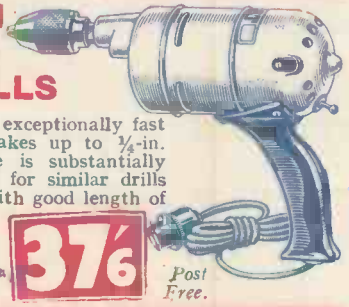
To-day's Value £10

4 ft. 6 in. long
2 ft. 6 in. high
2 ft. 3 in. wide

£6.17.6

Carriage forward outside our free delivery area

High-Speed ELECTRIC HAND-DRILLS



A high-grade tool with exceptionally fast penetrative power. Takes up to ¼-in. drill. Gamages' price is substantially lower than that asked for similar drills elsewhere. Complete with good length of flex.
For 200/240 volts A.C. or D.C..
Please state voltage when ordering.

37/6 *Post Free.*

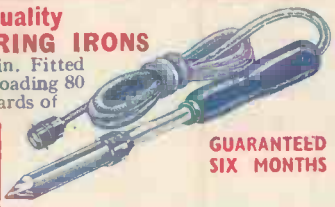
BOXES OF TWELVE ASSORTED FILES

The best and cheapest way to buy Files. British made and excellent quality. Sizes 6 to 12 in.

12 for 5/6 *Post 9d.*

Also sizes 4 to 8 in., 12 for **3/3**. *Post 7d.*

Super Quality ELECTRIC SOLDERING IRONS



British made. Length, 12 in. Fitted with a 6-oz. copper bit, loading 80 watts. Complete with 2 yards of power flex, and adaptor. Splendid value.

9/6 *Post 7d.*

GUARANTEED SIX MONTHS

Heavy Duty, Block Type CONDENSERS

1 MFD capacity. Suitable for voltages up to 1,000 A.C. or 2,000 D.C. Tested to 4,000 volts D.C. Dimensions approximately 4¾ in. wide 9in. overall height, ⅜ in. thick, bakelite case. To be cleared at an enormous reduction.

2/6 *Post 7d.*

Borden Tube Type PRESSURE GAUGES

Calibrated to 10 lb. per square inch, but can be calibrated to approximately double this pressure. Amazing value.

2/- *Post 5d.*

SET OF POCKET SOCKET SPANNERS

For ignition and household use. Smallest and most comprehensive eight-piece set on market. *Made in U.S.A.* Comprises seven sockets and handle. Sizes ¼, $\frac{5}{16}$, $\frac{11}{32}$, ⅜, and $\frac{7}{16}$ hexagon, ⅜ in. roundknurled, and ¼ in. square. Complete in steel rack. Length, 4½". *Post 7d.*

2/3

GEARED MINIATURE A.C. MOTORS (50 cycles)

Will work through any suitable transformer. Rating, 12 to 14 volts continuous, to two minutes at 24 volts. **Incorporating bi-metal thermal cut out and automatic clutch** to avoid breakage under sudden stoppage. Reversing switch. self-lubricating bearings. Rotor speed (no load) 2,000 r.p.m. Output spindle speed 38 r.p.m. All brand new and remarkable value.
Illustration is approx. one-third actual size. *Post 7d.*

7/6

POWERFUL 12 VOLT A.C./D.C. MOTORS

at a very keen price

Commutator type. Overall measurements (excluding shaft) 2¾ by 2¾ by 2¾ in. Weight 2 lb. Shunt wound, but can easily be altered to series, then machine operates on 30-40 volts. *Post 7d.*

6/6

INSULATED PLIERS

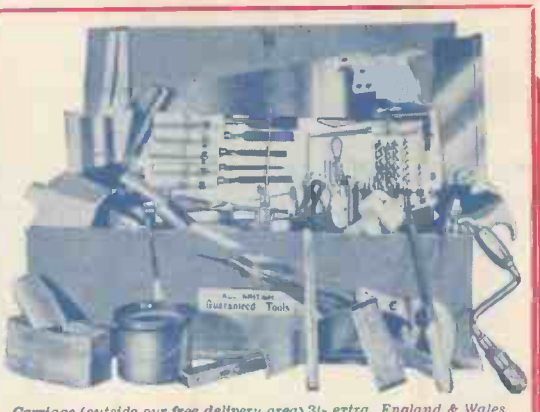
Tested to 12,000 volts
Insulated with thick rubber, in two sizes, 6 in. **2/-**
7 in., 2/6.
Post 5d.

Britain's Biggest Value in Tool Chests

61 SHEFFIELD MADE TOOLS IN CHEST FOR 97/6

Contains an exceptionally comprehensive range of fine quality tools—suitable for practically all woodworking jobs. Chest stained and polished walnut colour. Size : 27 in. by 11 in. by 7½ in. Fitted with fixed compartments for small articles, and movable tray with 24 spring clips to hold chisels, bits, etc.

Contents : 1 Skew-back Handsaw, 22 in.; 1 Tenon Saw, 12 in.; 1 Set 3-blade Compass Saws; 1 Pad Saw and Handle; 1 Smoothing Plane, 2 in. double iron; 1 Joiner's Hammer, No. 2; 1 Claw Hammer, No. 1; Joiner's Mallet, 5 in.; All-steel Hatchet, No. 1; 1 Cased Oilstone, 8 in.; 1 Joiner's Square, 6 in.; 1 Sliding Bevel; 1 Spirit Level, 6 in.; 1 Spokeshave, 2½ in.; 1 Marking Gauge; 1 Cabinet Turnscrew, each 4 in., 6 in.; 1 pair Pincers, 6 in.; 1 Handled Chisel, each ¼ in., ½ in., ¾ in., 1 in.; Handled Gouge, ½ in.; 1 Joiner's Plain Brace, 9 in.; 1 Centre Bit, each ¼ in., ½ in., ¾ in.; 1 Special Auger Bit, each ¼ in., ⅜ in., ½ in., ¾ in.; 1 Boxwood Rule, 2 ft.; a pair Combination Pliers; 1 Putty Knife; 1 Paint Scraper; 1 Mitre Block, 9 in.; 2 Gimlets; 2 Bradawls; 1 Glue Pot; 1 Cold Chisel, 6 in. by ½ in.; 1 Tack Hammer ; 1 6-in. Half-round File and Handle; 1 4-in. Saw File and Handle; 1 Centre Punch; 1 Nail Punch; 1 Packet of 12 Sheffield Twist Drills; 1 Pencil.



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