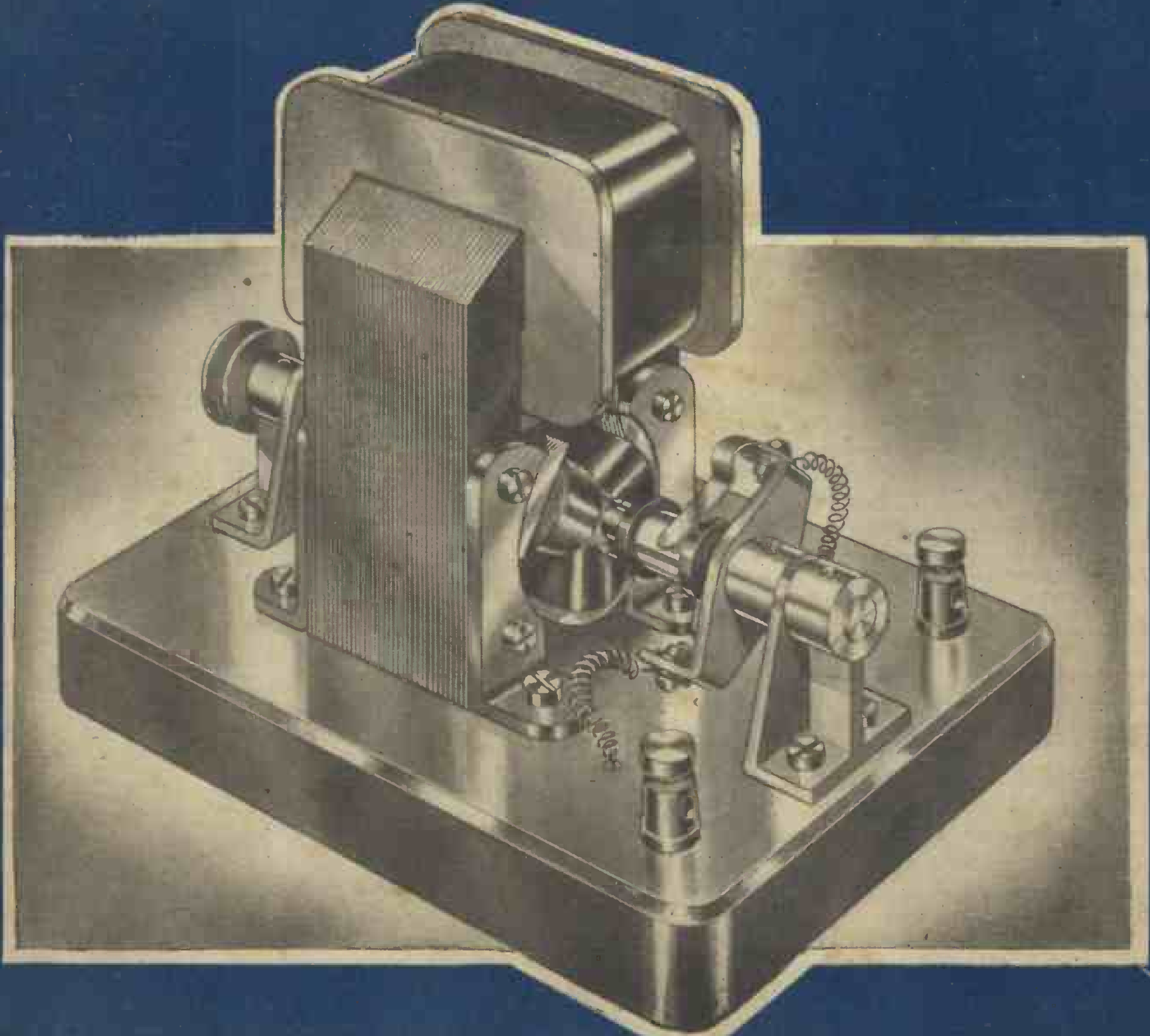
MAKING A 10-WATT MOTOR

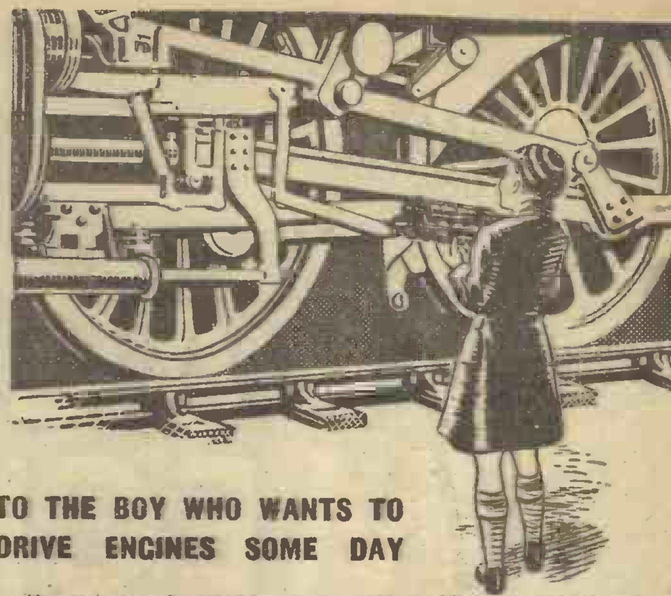
NEWNES

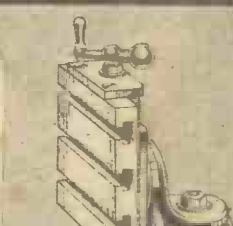
PRACTICAL MECHANICS

9D.

DECEMBER 1943







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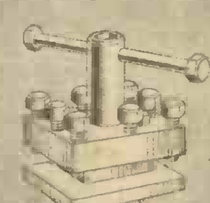

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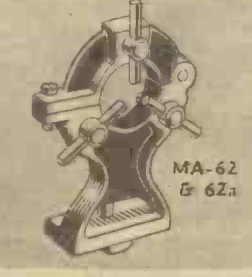

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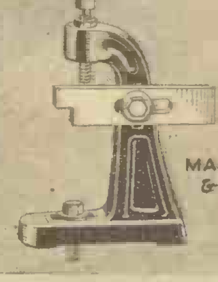

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Editor : F. J. CAMM

VOL. XI. DECEMBER, 1943 No. 123

FAIR COMMENT—BY THE EDITOR

Scientific Research in Post-war Britain

THE latest report issued by the Parliamentary and Scientific Committee, an unofficial group of members of both Houses of Parliament and representatives of certain scientific and technical institutions, is of great interest. It is entitled "Scientific Research and the Universities in Post-war Britain." Its main theme is that if we are to improve our standards of living after the war, and to maintain our position in the world, research in many categories will have to be undertaken on a scale not hitherto contemplated in peacetime. The resources upon which we depend for our scheme of reconstruction and social betterment will have to be used and developed with the maximum vision, intelligence and enterprise. Britain, says the report, cannot afford to fall behind other nations in this essential task of research, if only because of its density of population, and its position as the centre of a wide empire. If we are to maintain our position, we must take full advantage of the native abilities of our scientists and engineers, and the intelligence and craftsmanship of our workers. Science will have to be applied increasingly, to ensure the best use and maximum yield of our soil, animals, forests, fisheries and mines, and the development of our colonies and protectorates, as well as the maintenance of health, and the prevention and cure of disease.

In the period between the two world wars, we began to lose our pre-eminence in production to later entrants in the field. The work of our scientists and technologists since 1939, however, has demonstrated conclusively that this was not due to any diminution in our native talent. Modern creative scientific work is largely a matter of team-work, directed by first-class brains, but this has to be followed by practical application and testing, calling for large numbers of scientific and technical personnel. For these, the present strain on our provision of university and technical education is below that of either the U.S.A. and U.S.S.R. and calls for immediate steps to secure expansion, since the building up of research schools is a matter of years, and the training of the personnel cannot take place on an adequate scale until this has been done.

According to recent estimates, the university income of the U.S.A., with a population of 133,000,000, is more than 10 times greater than that of Great Britain, with a population of 46,000,000. The total research expenditure in the U.S.A. is £70,000,000 a year, whereas the total expenditure in the universities of Great Britain was less than £7,000,000 in 1938/39. The expenditure on research in the U.S.S.R. is comparable to America. Such comparisons are admittedly rough, and tend to neglect hidden assets and endowments in an old-established country like ours but they do provide a significant indication of pre-war trends, and hints of post-war possibilities. There are encouraging signs that we are beginning to appreciate the need to revise the scale of our efforts.

Search for Truth

APPLIED science cannot live on the fundamental discoveries of past generations, and unless fresh discoveries are made, it dies of inanition. The search for truth has always been an essential accompaniment of higher education, and teaching becomes ineffective if research aimed at and the extension of knowledge is allowed to languish. Such research, however, must not be confined to universities. Industrial and Government research organisations have also an essential part to play, and the Government of the future will have to give far greater financial assistance and encouragement. Lord Cherwell stated in the House of Lords that it is the policy and intention of the Government to increase their assistance to pure research, and he would welcome any developments in industry in a similar direction. Industrial research in Great Britain is mainly conducted by private firms in their own laboratories, but we have also the scheme of co-operative research associations for various branches of industry. The latter are aided by grants through the Department of Scientific and Industrial Research. The estimated expenditure of this department for 1942-3 is £678,596, which shows an increase over previous years. The Institution of Electrical Engineers has issued a report in which the outlines are sketched of a British Electrical Research Board, and the British Institution of Radio Engineers has made proposals on somewhat similar lines with regard to radio engineering. The recently established Gas Research Board is embarking on an ambitious programme. The Federation of British Industries has appointed a strong committee to report on the problems of scientific research in industry. Manchester University has appointed a committee which hopes to publish a report indicating how our scientific teaching and research should be expanded, and how our relations with industry may be developed. The Parliamentary and Scientific Committee in 1943 recommended an early and substantial expansion of the research work devoted to the utilisation of our unique natural resources of coal, and already the mine owners have indicated their intention of spending £500,000 for such purpose after the end of 1945. Many industries have similar plans. Mr. Oliver Lyttelton, in a recent speech about the future of British industry, stated: "It is towards the creation of demand and to the use of inventions that the economic thought of our specialists must be directed. Regarding the supply and training of research personnel, owing to the foresight of Lord Hankey and a Committee responsible for the preliminary training of the younger of these men, many of them have had substantial, though incomplete, university training in physics, chemistry, engineering and radio. For the training of research workers, this country, has looked, and must continue to look in the main, to the universities, for, with minor exceptions, there are at present no other institutions in this country providing the wide and accurate knowledge and the strict mental discipline essential for research workers.

War-time Output

WE have more than doubled the output of engineers and physicists during the war, but we must vastly increase this number in peace. Academic staff and buildings and equipment must be found. One of the war-time measures for ensuring the necessary flow of students through universities and higher technical institutes which must be continued and possibly developed is the system of State bursaries and engineering cadetships. Greater aid should also be available for young graduates who wish to continue studies for a higher degree. Direct Government assistance to universities now takes the form of an annual grant from the Treasury of £2,250,000. In addition, local authorities and other Government Departments provide just over another £1,000,000. More colleges will have to be converted into institutes of technology, on American lines. It is in such places, as well as in the universities, that the urgently needed Chairs of Aeronautics, Radio Engineering and so on might be founded.

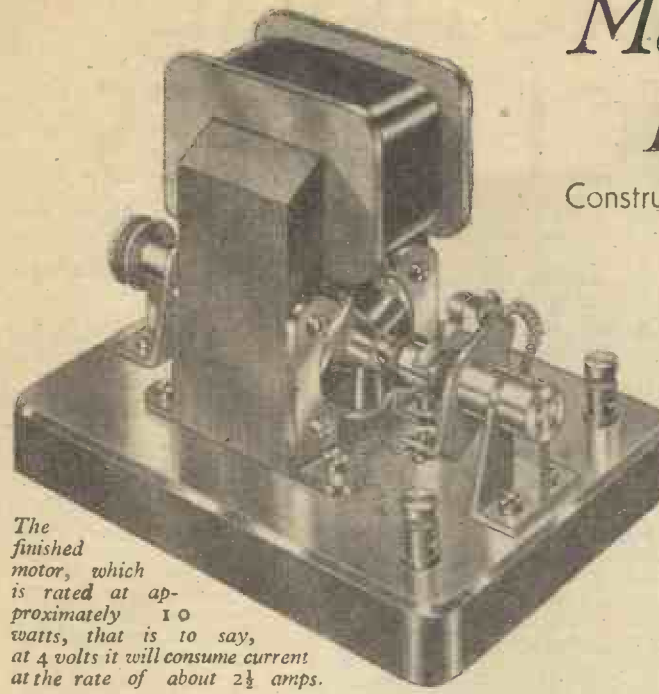
"Screw Thread Tables"

WE have just published a new 216-page, cloth-bound, vest-pocket book entitled *Screw Thread Tables*, at 5s., by post 5s. 3d. It is a companion work to our *Screw Thread Manual*, 6s., by post 6s. 6d. A great deal of practical information on screw cutting and calculations for change wheels are included. Other vest-pocket books in the series are: *Engineer's Vest-pocket Book*, 10s. 6d., by post 10s. 9d.; *Radio Engineer's Vest-pocket Book*, 3s. 6d., by post 3s. 9d.; *Mathematical Tables and Formulæ*, 3s. 6d., by post 3s. 9d.; and *Wire and Wire Gauges*, 3s. 6d., by post 3s. 9d. Orders and remittances should be sent to the publisher, George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2.

Making a 10-watt Electric Motor

Constructional Details of a Small but Efficient Machine

By "ELECTRICIAN"



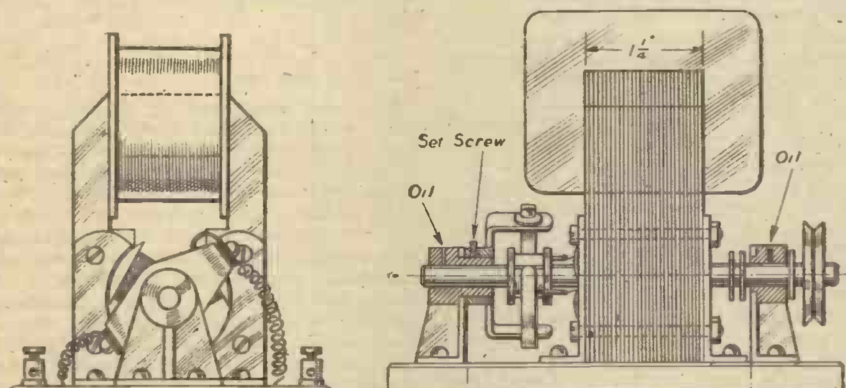
The finished motor, which is rated at approximately 10 watts, that is to say, at 4 volts it will consume current at the rate of about 2½ amps.

MODEL electric motors may be divided into two classes; those that merely go round, and those that are capable of doing some useful work! The one here illustrated I have endeavoured to bring into the second category, but at the same time, knowing the limitations of the average home mechanic's workshop, I have tried to keep the construction as simple as possible. No castings are required, and what little lathe work may be necessary the local garage may be able to do for a small outlay. The motor is rated at approximately 10 watts; that is to say that at 4 volts it will consume current at the rate of about 2½ amps. It can, however, be run at 6 volts, when the power used will be nearer 15 watts.

The Field Magnet

The order of construction does not really matter, but as the field magnet is perhaps the most difficult part, it is wise to get that made first. It is composed of laminations of ordinary soft sheet iron. This type is chosen because it is more efficient than a cast one, and can be made at home. Fig. 3 gives the dimensions of each lamination. You will want enough of these to build a magnet 1¼in. thick. The gauge of the iron is not important; the thicker it is, the harder it will be to cut, but at the same time you will need fewer laminations.

The procedure is as follows: First cut out sufficient "blanks." Then carefully mark out and drill a hole 1¼in. in diameter in each for the armature tunnel. This is best done with the aid of a good quality 1¼in. centre bit as shown in Fig. 3. It will probably ruin the bit, but will be found the easiest way to cut a clean circle if you have not the use of a tank cutter or panel cutter. If you use thick laminations, however, you will almost certainly have to use a cutter, as drilling small holes round the edge and removing the waste matter with a file is the only alternative and is very tedious. Punch a small hole for the centre of the bit to turn in, and rest the work on a block of hardwood. As soon as you have partially cut through the metal, reverse it. The "prong" of the bit may need sharpening after you have cut several holes.



Figs. 1 and 2.—End and side views of the electric motor.

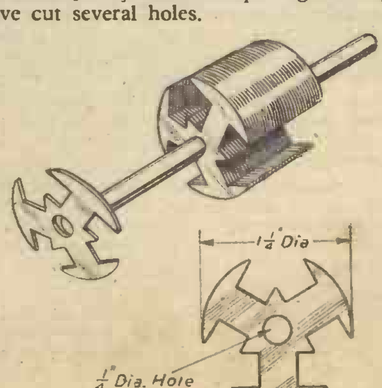


Fig. 4.—How the armature is built up.

Now drill four small holes in each lamination. The position of these must be exact, otherwise the magnet will not bolt up true.

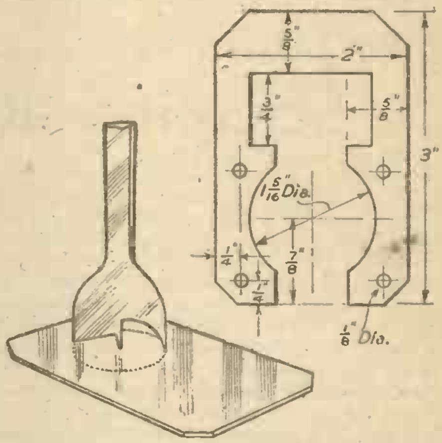


Fig. 3.—Details of the laminations for the field magnet.

A good idea is to drill the holes in one lamination and use it as a template to drill the others, each of which is in turn clamped in the vice with it. See that the armature tunnel holes coincide exactly each time. Now, before cutting away the rest of the middle part of each lamination, test the size of the armature tunnel hole in each. This is done with one of the armature stampings. It should pass through with about 1/32in. clearance. If it does not, the hole should be eased with a half-round file.

Test each lamination in this way, enlarging the hole if necessary. Now finish cutting away the remaining part of each lamination by means of the shears and file. It is best to give one side of each lamination a coat of shellac varnish before bolting the magnet together.

The Armature

Before going any farther with the magnet it is a good plan to build up the armature. This is made from stampings which can be obtained from Messrs. Economic Electric, 64, London Road, Twickenham. They are of the tri-polar type, 1¼in. diameter, and about 50 go to make up an inch. As your armature is to be 1¼in. long you should order six dozen to be on the safe side. Each

Fig. 5.—How to wind the armature.

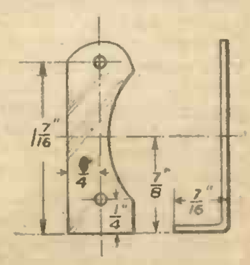


Fig. 7.—Details of the brass brackets, four of which are required.

stamping must now be shellacked one side, or may be separated from the next with a thin piece of waxed paper. Shellacking, however, is quite sufficient. Now thread them on to a steel spindle ¼in. in diameter and 4½ins. long, as in Fig. 4. Pack them together as tightly as possible. Before putting the two outside ones in place, clean them thoroughly, tin them round the spindle hole, and also emery the spindle. Then slide them on and tie the armature round tightly with string. A touch of solder will secure the end plates of the spindle, when the string may be removed and the armature core is complete. Before adding the windings

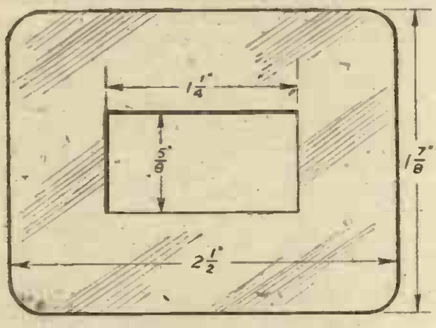


Fig. 6.—Dimensions for fibre end plates.

carefully insulate the core by winding on a layer of Empire tape in the slots. Do this properly, so that there is no chance of the wire anywhere touching bare metal. It is a good plan to use tape sufficiently wide to fill the sides and bottom of the slots, and to cut it narrow where it has to pass round the ends of the poles. It is the usual practice to fit a fibre washer of the same shape as the stampings at each end of the armature core before winding the Empire tape. This is an added precaution against the corners of the metal stampings cutting into the wire and causing a "short," and I strongly advise you to fit a pair if you wish your motor to give long service.

The complete core should be wound with 1¾oz. of 20 gauge double silk-covered wire, or just under two-thirds of an ounce for each pole. Fig. 5 shows how it is wound. Each coil must be wound in the same direction. Leave the ends twisted together ready for joining to the commutator. It is advisable, before tackling the commutator and bearings, to see if the armature fits nicely in its tunnel in the field magnet. With the bolts slacked off a little, any laminations that may be slightly out of place can be tapped in position. When you are satisfied that the armature will be able to revolve without touching, take out the bolts from the field magnet and slip on the two fibre end plates for the field coil. These are shown in Fig. 6. Before putting the bolt back again you should cut out four brass brackets of the dimensions given in Fig. 7, and then replace the bolts, passing them through the brackets. Once more check the clearance between the armature and the sides of the tunnel and bolt up tightly.

The Field Windings

Before commencing to wind on the wire, put on a layer or two of Empire tape to prevent the magnet chafing the wire. Then carefully wind on 3½ ounces of 20-gauge double silk-covered wire. Wind it tightly and evenly in layers, and finish off by winding some Empire tape round the outside. Here let me say that if you intend running the motor continuously from a 6-volt supply you will find 4 ounces of 22-gauge wire more suitable.

To complete the motor, there now remains the bearings and brush gear and the commutator. They are illustrated in Figs. 8, 9 and 10 respectively. The bearings are each composed of a bracket fitted with a brass bush to take the spindle. The bush is sweated in place, and a web is added to ensure rigidity. This also is soldered in position. Unless you happen to have something just the right size amongst your odds and ends, you will have to get the bushes turned up on a lathe. Fig. 8 gives their measurements. The brush rocker arm is of stout sheet brass and fitted with a brass bush, which is a stiff, sliding fit on the narrow part of the front bearing. The bush is tapped and fitted with a set screw, so that the rocker may be locked in any position. Fig. 9 (A) gives a general idea of the assembly, and B, C and D give the measurements of the rocker arm and its bush. The brushes are each made of springy brass, and are bolted to the rocker arm, but insulated from it by means of two fibre washers and a fibre bush (see Fig. 11).

The Commutator

Fig. 10 shows the various stages in the construction of the commutator. This is often a difficult part for the amateur to make owing to the need for having the hole in the bush perfectly concentric with the outside. If you have no lathe you will most

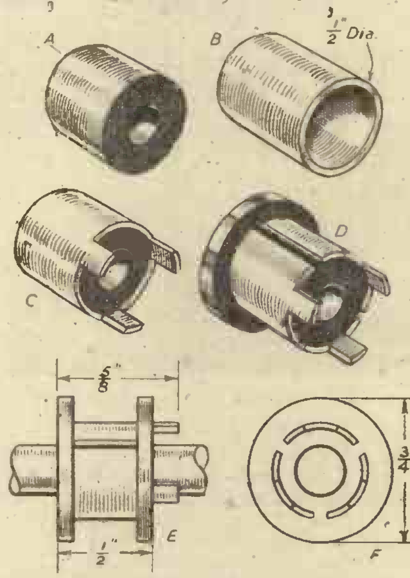


Fig. 10.—Component parts for making the commutator.

likely save time by getting the bush turned up for you. It should be a tight fit on the spindle, and also in the brass tube, which is to form the segments. It is forced into the tube as at Fig. 10 (C), and the end of the tube is then filled to the shape shown so as to form three soldering tags. Three evenly spaced saw cuts are extended to the other end by means of a small file, and a second fibre ring is forced on.

When you have made the commutator, drive it on the spindle and solder the armature wires to the tags. Do not worry about the position of the segments relative to the armature poles, as the rocker allows of the brushes being turned to the correct position.

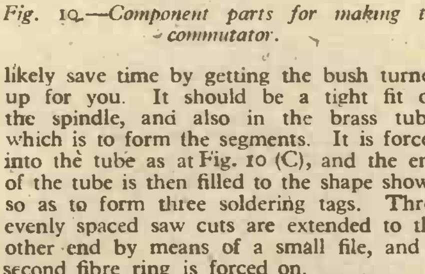
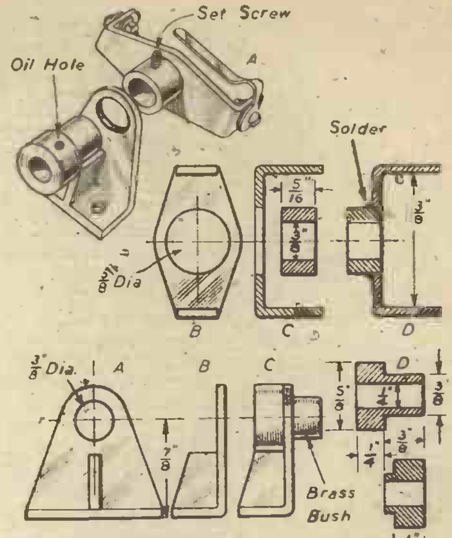


Fig. 11.—Details of the brushes.



Figs. 8 and 9.—Details of the brush gear and bearings.

Testing

When you have made all the parts, mount them very carefully on a hardwood base. See that the armature spins freely. The bearings should be quite free, but with no appreciable up and down play. Any irregularities in the construction of the field magnet brackets or the bearing brackets can be compensated for by placing thin washers under the brackets when screwing them down. Connect up the field magnet and brushes as in Fig. 12. You are now ready to put the machine through its paces! Oil the bearings with thin oil. See that the brushes are pressing fairly firmly on the commutator, and then switch on. If the brushes are in the right position the motor will zoom into life. However, if it does not, switch off immediately, or you will heat up the motor and exhaust the battery. Reset the rocker arm to a new position and try again. When you get it running, you can make the final adjustments. Set it at the position giving the greatest speed and the least sparking at the brushes. Just a final word. Small electric motors generally produce full power only at high revs. (3,000 is quite a usual figure), therefore they should be suitably geared. Do not attempt to make your motor pull a high gear like a steam engine, or it will most likely overheat. This is due to the fact that at low speeds a very large current passes through the machine, but as the speed increases so the motor commences to act as a dynamo and generates a "back E.M.F.," which opposes the current and so reduces the amount consumed. For this reason also a starting resistance is always useful. For the model described here, a heavy duty filament rheostat as used in wireless sets will be found quite suitable. It should be connected in one lead from the battery. As it gradually turns from zero to full-on, the motor will start smoothly and use less current.

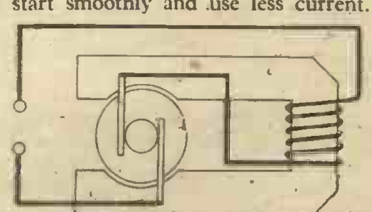


Fig. 12.—Diagram of connections for field magnet and brushes.

Rolling Over the Sea

A Description of Some Novel and Unconventional Sea-going Craft

By H. A. ROBINSON

WE have become so accustomed to vessels being built with floating hulls that are driven through the water by sail or engine power that any other method of construction would seem out of the question. Nevertheless, from time to time certain imaginative inventors have worked on a ship design which breaks away completely from the conventional shape.

These people have argued that if instead of forcing a floating body *through* water it was made to roll *over* the surface, much power would be saved and great speeds become possible. They have therefore mounted their craft on floating drums of one kind or another which it was hoped would be capable of rolling over the ocean much in the same way that an ordinary wheel rolls over a solid roadway.

The first boat of this kind—called *The Buoyant Propeller*—was invented and built by a Capt. Fryer, of America, in 1880. It was mounted on three watertight drums which, while carrying the weight of the upperworks, could also be revolved by an engine. Round the circumference of each drum short paddle blades were fitted, and as the drums rotated, these, digging into the water, sent the weird vessel along.

Another scheme was put forward seventeen years later by F. A. Knapp, a Canadian, who thought it would be much better if the whole ship consisted of one vast, rolling cylinder, with cargo, crew and passengers housed inside, in a body so arranged as to always remain upright, despite the rolling outer shell. The driving engine was also housed in the body, and revolved the shell by means of a massive cog track on its inner side.

A rolling vessel of this type was actually built under Knapp's direction and launched on the St. Lawrence River in 1897. One hundred and ten feet long and twenty-two feet in diameter, it was navigated from short bridges protruding from the ends, everything else being inside. Knapp had worked out that his vessel would skim over the water at 20 or 30 knots. But alas! with only calm river water to operate over, favourable winds and the engine going full out, no more than six knots could it be persuaded to do. Later he tried to get the Government to take up his idea, but they showed little interest, and for lack of funds his craft soon became a thing of the past.

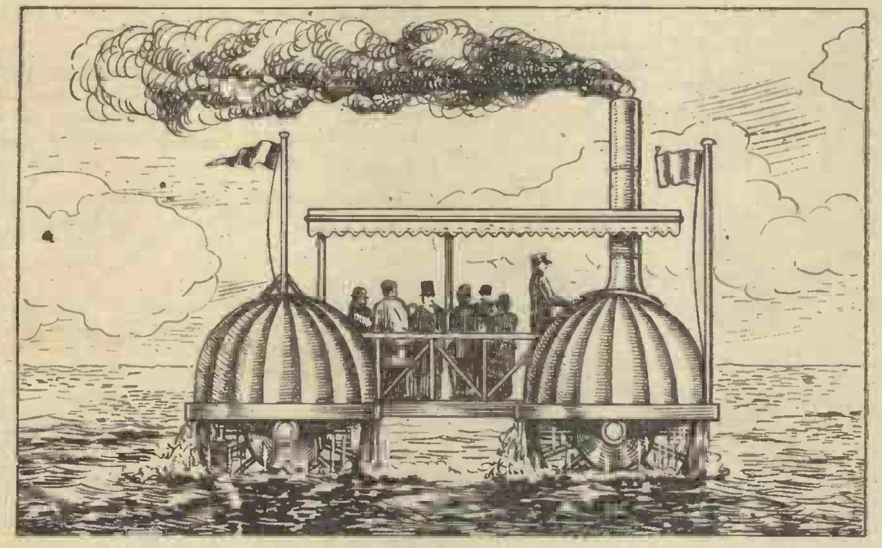


Fig. 1.—Capt. Fryer's "Buoyant Propeller" which was invented and built during 1880.

Bazin's Roller Ship

At the turn of the century a far more promising "roller ship" was designed and built on the Seine by M. Ernest Bazin, a Frenchman. This vessel was in a way quite successful, and proved that the idea of rolling over water was anything but an idle dream.

Bazin carried his craft on no less than six hollow "wheels," which even when fully loaded floated well out of the water, only about one-third of the diameter being below the surface. All six were revolved by an engine through suitable gearing, but full dependence for forward motion did not rest on the "rollers," for a second and independent engine was installed which operated an ordinary screw propeller astern.

Named the *Ernest Bazin* after its inventor, the vessel drew considerable attention, and her trials, which took place on the Seine, were watched by big numbers of technical experts. Much interest was raised among the general public also—perhaps because her appearance coincided with the Paris Exposition when people were in a frame of mind to study novel innovations—and the press took up the conception of a new form of sea travel with an ardour that was peculiar to the period.

As stated, this "roller ship" was by no means a complete failure. Although not nearly coming up to expectations, she demonstrated that she could move safely under her own power over the surface of the sea by negotiating the English Channel and making a quite successful voyage up the East Coast of England, during which trip she put into various ports and drew large throngs of sightseers.

Many Defects

Unfortunately, the same fundamental weakness soon made itself apparent. Apart from the saving of mechanical energy, Bazin had, like other inventors, considered that, relieved of the drag of a hull, even the comparatively small engines he had fitted should drive the craft at great speeds. Thirty and forty knots were again glibly quoted, and even higher rates of travel than this confidently hoped for.

Under the best conditions, however, of smooth water and no headwinds, she could only be made to do a little over seven knots. The failure was apparently caused by the tension created by water carried up at the back of the rollers, which produced as much retardation as the usual hull. This presumably being the reason for the Fryer and Knapp failures also.

Other defects which made themselves manifest were that the vessel made too much leeway even in the slightest wind, having no draft to speak of, and she did not accom-

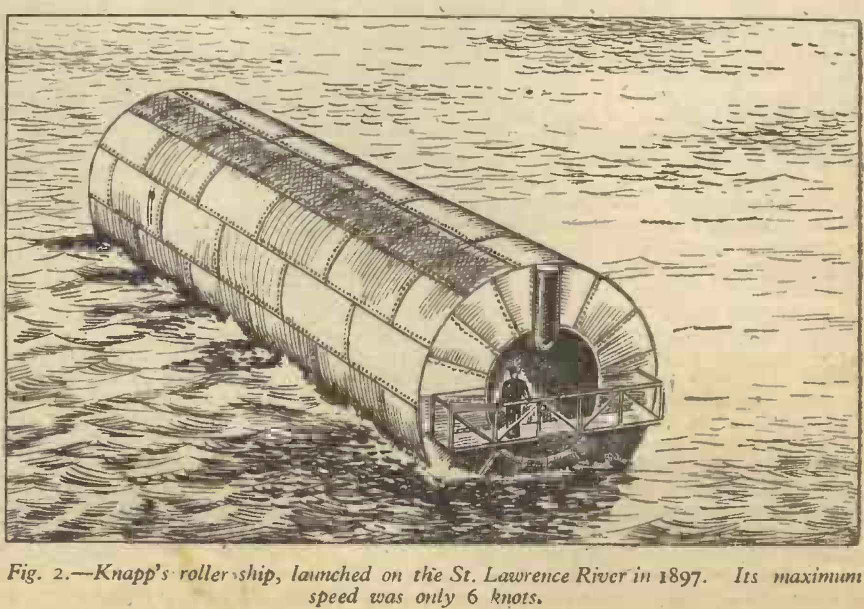


Fig. 2.—Knapp's roller ship, launched on the St. Lawrence River in 1897. Its maximum speed was only 6 knots.

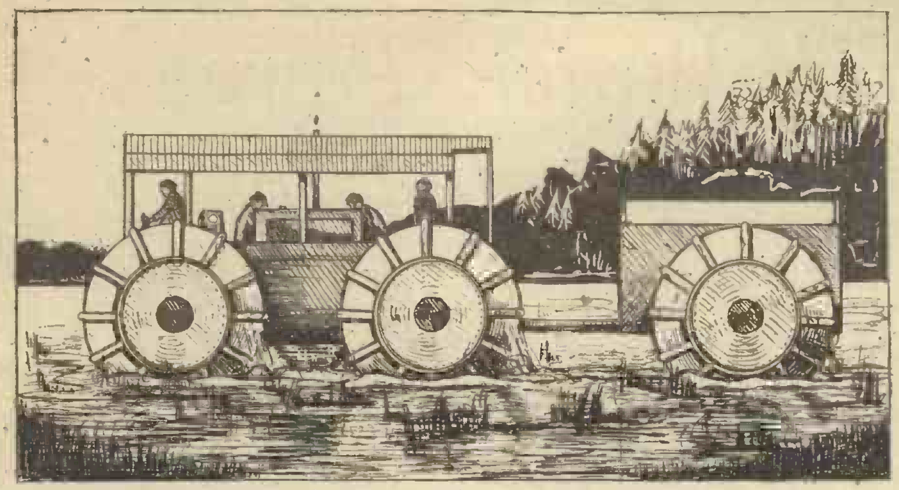


Fig. 4.—The "Marsh Buggy," a roller craft now in use on the swamps of Louisiana (U.S.A.) for oil-finding purposes.

modate herself to rough seas as well as had been anticipated. But it was the absence of the extraordinary speeds predicted that caused the greatest disappointment. Interest waned, and the *Ernest Bazin*, the craft that was going to revolutionise ship design, also faded into the limbo of things forgotten.

These failures, however, as might have been expected, did not kill the idea of rolling over water, for later there appeared the designs for a giant American roller ship after the Knapp principle, but immensely bigger. Once more there was to be the revolving shell round a stationary core, in which there was to be all the comforts of a modern luxury liner and engines of tremendous horse-power.

Great rates of travel were again prophesied, and to the numerous advantages of the roller principle the designer this time added the characteristic of "anti-tossing"—a ship property which is always receiving attention. This characteristic is not hard to appreciate, as the vessel would be one long cylinder and could only be subject to transverse oscillation, bow to stern tossing obviously being absent.

Then in 1930 a roller ship, complete to the last coat of paint, made its appearance on the River Danube, being constructed in the neighbourhood of Budapest. This craft, with modern equipment, reached a speed as great as 80 miles per hour. It was supported on two floating cylinders, ridged to give a grip on the water, and it was propelled by a 500 horse-power internal-combustion engine coupled to a twin-bladed air screw. The whole construction of the craft was light, and it does not seem to have been more than a novelty, at the best intended for smooth-surfaced lakes.

Marsh Buggies

Even regarding all these craft as more or less failures, it is good to know that the work of these early inventors has not been entirely without fruition, for recently there has appeared a really practical development of the roller ship principle in the Marsh Buggies of the Louisiana swamps. (Fig. 4).

Used by the Gulf Oil Company, a big oil producing concern, the Marsh Buggy is a strange amphibian craft, carried on four buoyant "wheels" of no less than 18 feet diameter. Monsieur Bazin's rollers were hollow and entirely made of metal, but those of the "buggy" are given the necessary buoyancy by massive air-inflated tyres of 3-feet cross-section. Each tyre is fitted with 12 cross strips of fibre, so that when the wheels are rotated by an inboard motor there is sufficient "grip" on the waters of the stagnant swamp pools and lakes to produce a forward motion of about five miles per hour.

Upon water the buggies float on the lower arc of the tyres, but, reaching a firmer part of the swamp, the revolving rollers begin to act as land wheels, thus continuing to carry the machine forward. And it is a weird sight to see the buggies splashing from land to water and traversing with ease otherwise impenetrable bog. On solid land a speed of 18 m.p.h. can be attained.

The vessels are used in the continual search for oil that takes place in the swamps bordering the Gulf of Mexico, a search which is becoming more intense as existing fields are drained and fall into disuse. Each unit is capable of towing a buoyant trailer coupled up much as is a land vehicle, the two being connected by a short deck. Dynamite is carried on board which, exploded depth-charge fashion, assists with the aid of seismographs and other oil-finding apparatus, the locating of fresh "pools" of the precious liquid.

During some recent destructive floods in the Mississippi valley a whole fleet of the Marsh Buggies were put to good service in rescuing marooned persons from locations that could not be reached by ordinary boat; and it has, not unreasonably, been suggested that under certain circumstances, adaptations of the buggy could well be made into a military unit for use when amphibian transport might solve some tactical problem.

Thus the visionary roller ship, which was originated to skim across oceans, has appeared in practical form in a sphere for which it was never intended; and who knows but from this sphere, in the course of development, it may find its way back eventually to the high seas.

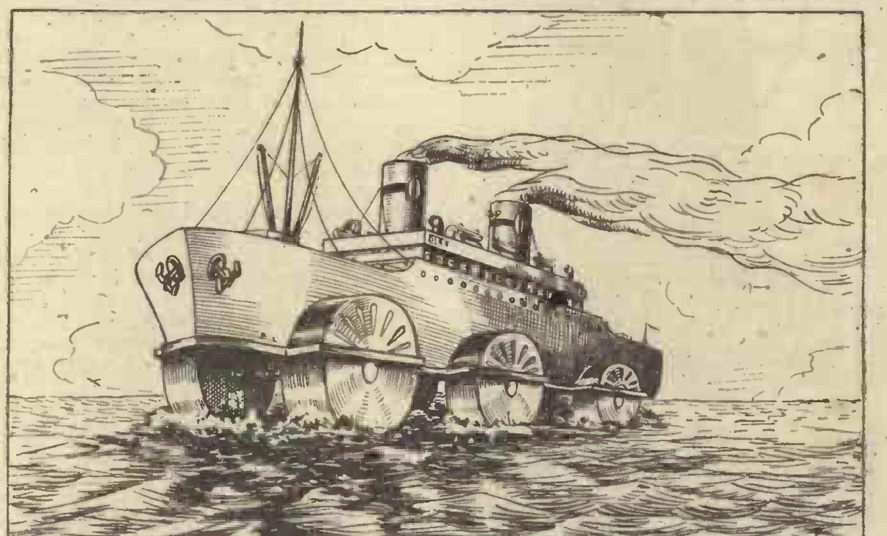


Fig. 3.—The writer's impression of a roller ship after the Bazin principle.

Notes and News

Long Life for Dustbins

THE inventor of a newly devised dustbin points out that, if this rubbish container is to attain longevity, its upper rim must be exceptionally strong. The rough handling to which the bin is subjected, for instance, when being emptied, is apt to distort the rim and prevent the cover fitting. It is also desirable that the rim should not have any projecting edges or beadings of metal or present edges and crevices which could collect moisture or interfere with the complete emptying of the bin. Such obstructions tend to cause corrosion.

The improved dustbin has a hoop to strengthen its mouth and a wall, both of which are corrugated. This enables the bin to offer increased resistance to deformity.

In manufacture the plain hoop is inserted into the mouth of the bin and the two are pressed together to produce corrugation.

Twin-light Torch

A NEW electric torch has come to light. The aim of its inventor has been to contrive a ready and convenient attachment for a hand torch which will give a white light in a forward, downward direction, and a red light in a rearward direction.

Over the bulb end of the torch is a cap-like push fit. The cap is shaped to accommodate within it a grip and two mirrors, set at an angle of 90 deg. to one another. A portion of one mirror near the junction of the two is unsilvered and transparent. Also contained by the cap is the forward end of a hollow tube which has a red-coloured glass within it, and extends backwardly along the torch

The forward illumination is effected through the unsilvered part of the mirror, while the rearward illumination is produced by reflection from mirror to mirror and down the hollow tube.

Wind and Water Power Installations

Their Operation and Uses Explained

By G. W. McARD

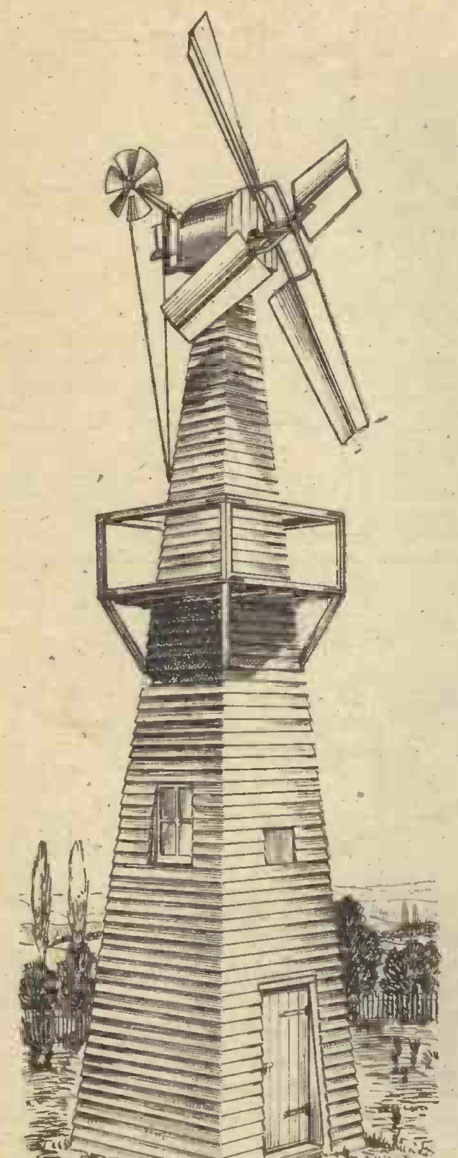


Fig. 1.—Design of Burne windmill for electric generation.

PROBABLY at no period in the history of power engineering has the question of fuel become so serious a factor as it is to-day, and although the position will ease when hostilities cease, those equipments which operate with power that is free from all cost will merit the fullest consideration. Such schemes fall into two classes, namely, those driven by wind power, and those operated hydraulically from dams and streams. In the earlier schemes the power wasted through high frictional losses formed a relatively high fraction of the total power absorbed largely due to the type of bearings employed To-day, however, by using ball or roller bearings, employing modern methods of lubrication, and designing the wind sails or turbine blades on scientific lines, these losses may be greatly reduced, and it will be remarked from the notes which follow that many opportunities definitely exist to-day of benefiting from the natural resources at our disposal.

Wind Power

Many areas may be found, in spite of the large territory served by the grid with electrical energy in bulk, where efficient wind-driven plants may still function with advantage to their owners, whether for pumping water to high altitude tanks for gravity supply where no water mains exist, generating electrical power for large private houses and blocks of cottages, driving farm machinery, or various other purposes. No fuel cost arises, nor is it necessary to have a man in charge for emergencies; the power unit operates under governor control, with a long-term lubricating outfit, a minimum of vibration, and an entire absence of fire risk and noise.

If employed to generate electricity it will do so at a cost which will generally compare favourably with other means, and in this connection it may be repeated that whilst the consumption and cost of all fuels ever tend upwards, the wind is still a free gift of nature.

In foreign countries a good deal has been done in the way of supplying villages, etc., by wind-driven plants in conjunction with storage batteries, sometimes with an oil-engine standby in order to keep down the size of the battery. Another application has been to supplement an engine generated public supply by feeding into the mains network.

In this country the matter has been left to private enterprise, and we illustrate in Fig. 1 an installation designed by Mr. E. Lancaster Burne, and in Fig. 2 an actual mill in operation. The hexagonal tower which carries the mill head and its gear at the peak is of specially creosoted timber, and completely encloses the dynamo, switchboard and battery, forming a self-contained installation from which only the mains have to be taken to the desired point.

Fig. 2.—Burne windmill in operation

Possibly the first feature to attract attention is the sail arrangement. These sails are designed upon strictly aerofoil principles combined with mechanical requirements, in that the front and rear surfaces form tension

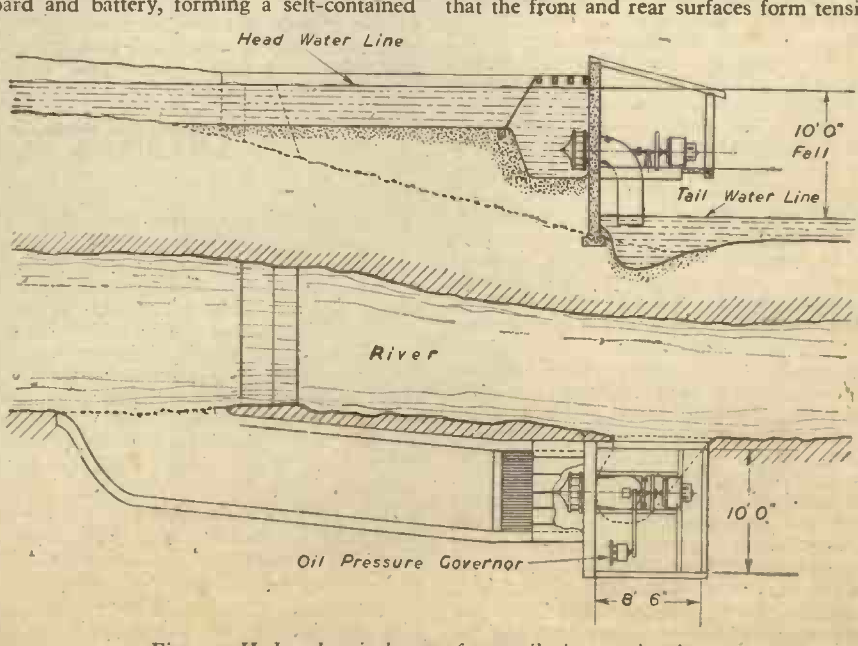


Fig. 4.—Hydro-electric layout for small river or brook.

and compression members respectively, thus affording extremely strong and rigid structures, yet light in weight. Their number (four) is in contrast to the familiar wind-wheel having 20 to 40 or more vanes. The latter design, however, is fully justified when employed to operate pumps, as the large surface and steep vane angle give high starting power, but at the expense of surface efficiency. This is an advantage when starting against a load such as that imposed by a pump, but it does not apply in the case of a dynamo ; moreover, the lower speed is detrimental in that it involves a higher gear ratio.

Large Wind-wheels

A few large wind-wheels have been built in this country measuring up to 40ft. or more, with as many as a hundred vanes, but a diameter of about 20ft. seems to be the economic limit. On the other hand, the old-fashioned four-armed windmill (whose obsolescence many people will regret) frequently had sweeps of 70 to 80ft. span, or, occasionally, even more.

As is well known, the sail surface of these mills is composed of canvas spread on a framework, or by shutters. Speed control in the first case could only be effected by stopping the mill and spreading more or less sailcloth. In the latter case the shutters are arranged to open automatically with excessive wind pressure, thus allowing it to pass through the sail. This last method gave good results, but the construction did not lend itself to aerofoil formation as developed by modern knowledge. It is only right to say, however, that this has been achieved to a limited extent in a few instances.

The usual method of controlling the speed of wind-wheels is to allow them to turn bodily more or less out of the wind. This rather crude system works quite well where no tendency exists for this to happen other than by that imposed by the wind ; but in a "power" mill, employing bevel gearing, a twisting effect on the mill head is introduced, tending to interfere with the normal governing action.

By reference to Fig. 1 it will be seen that the sails are faced to windward by a small back sail or "fantail" acting through gearing on the mill head, a well established practice which is free from the effect of the bevel gear, and quite prevents the hunting effect of a sudden and excessive swing round with a shift of wind.

It may also be pointed out that the sails shown are governed on a new and original principle, viz., each comprises two components which automatically fold back to the extent required by the conditions, and so alter the profile as to deflect excessive wind pressure Thus the speed and power of the mill may easily be altered without suspending its movement, and if it is desired to stop, the components are simply allowed to fold back and to present their edges only to the wind.

Few days exist in the year during which no wind occurs, and although it varies in intensity, it blows more constantly than is generally realised. Its power varies as the cube of its velocity, thus a wind of 20 m.p.h. has eight times the power of a 10-mile wind. A wind of 15 m.p.h. is considered a good working wind for power purposes, and this (and over) obtains in most places of good exposure in Great Britain for some 2,000 hours per annum. In places such as the coast these hours are likely to be exceeded.

Modern Windmills

With modern windmills even an eight-mile wind is not to be despised, and as is generally recognised, the softer the wind, the longer the period of its prevalence. For pumping purposes, where sustained performance is generally desired, calculations are, as a rule, based on using a breeze of 10 m.p.h., which velocity can usually be expected for about 4,000 hours per annum. A fortunate circumstance in connection with electric lighting is that the greater wind power available in the winter months coincides with the increased demands during that period.

The voltage to be adopted depends upon local conditions, chief of which are the distance of the mill site from the point of distribution, and the extent of the wiring. Obviously, a fewer number of large cells in a battery are slightly cheaper than a larger number of smaller capacity, and require less attention. On the other hand, low voltage means heavier wiring for the same energy transmission. In practice, voltage usually ranges from 50 to 100 except for very small plants, where it may be 25 or even less for a little bungalow.

A striking design of windmill for pumping purposes is shown in Fig. 3, and combines a high level tank of 1,000 gallon capacity in its structure. The wind-wheel is 15ft in diameter and stands at a height of approximately 35ft. above ground level. The mechanism at the head operates in an oil

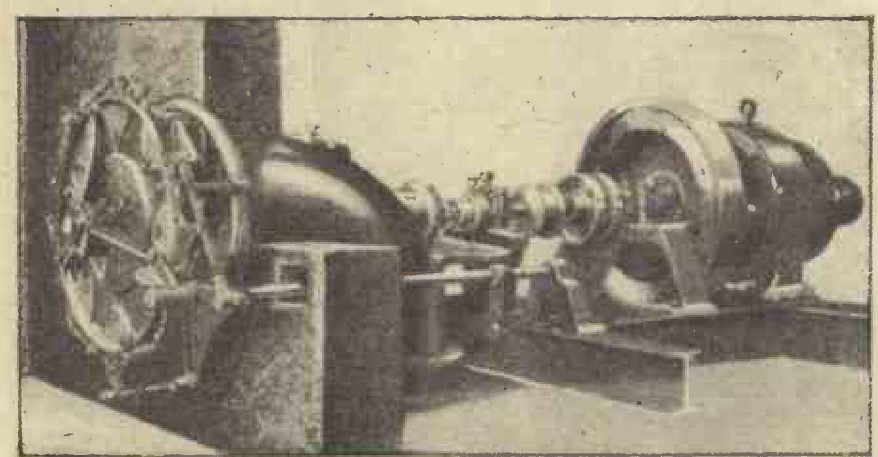


Fig. 5.—Turbo-generator as used in the system shown in Fig. 4.

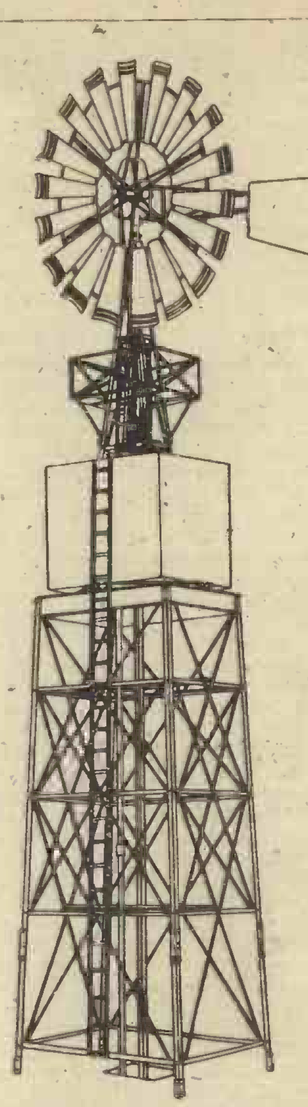


Fig. 3.—Pumping type of windmill, by Thomas and Sons.

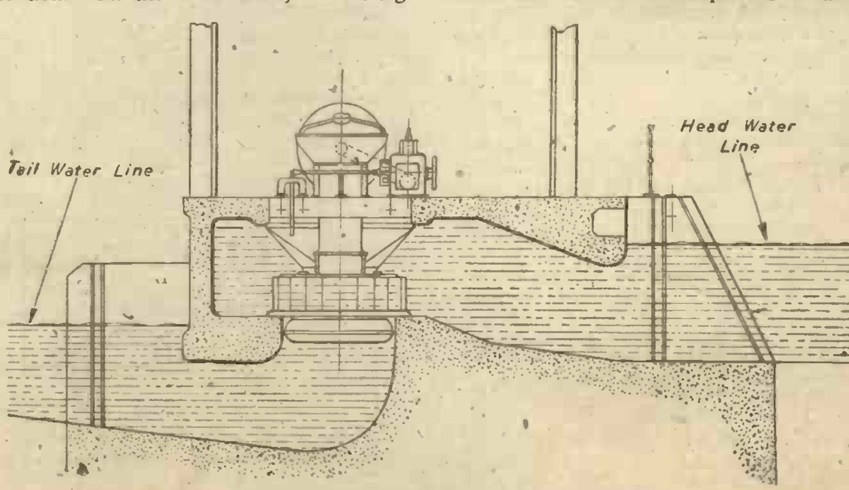


Fig. 6.—Hydro-electric layout for large river site.

bath which is replenished only once a year, and being fitted with ball bearings, in accordance with modern practice for these machines, it has a very good efficiency and functions in lighter breezes than was formerly possible.

A well constructed modern windmill plant carried out upon sound engineering lines should possess a long life and need a minimum of attention, at the same time affording a large measure of satisfaction to its owner, particularly if he happens to be an engineer.

Water Power

The opportunities of obtaining power on, of course, a relatively small scale from streams or other sources of water supply in Britain are numerous, and in many parts of this country streams and brooks can be found having water that flows more or less rapidly all the year round without any attempt being made to harness it. Every one of these is capable of generating power which, if converted into kilowatts, will heat, cook and light for a moderately large household in ample comfort all the year round, and do it at a comparatively trifling cost.

In the larger country houses and farm estates, many jobs can be done by these water power plants, such as the generation of electric current for heating, cooking and lighting; the pumping of water, where no mains exist, to high level tanks whence it falls by gravity to pre-selected points, providing also the water required for an electric heater which will maintain a generous supply of hot water day and night. The ubiquitous electric iron, vacuum cleaner, wireless, fans, radiator and fires can all be provided with the requisite current, thus affording an ideal illustration of the all-electric house which, for most folks, has been hitherto merely a dream. In many cases, the power can also be used to drive farm machinery, and a saw bench may be included for cutting up the logs which will be required for the lounge fire, most Britishers preferring to retain one open fire where the family and guests can foregather.

Water Flow

Where an ample supply of water can be relied upon day and night, the problem is a comparatively easy one, and a site adjacent to a river will usually meet the equipment engineer's requirements. Many houses, however, can only reckon on a good flow from adjacent hills, and where this fluctuates in volumes during the 24 hours, the method frequently adopted is to create a reservoir by damming the flow at a suitable point. From this the water can be led to wheel or turbine, and thence out to continue its journey to the sea.

One of the difficulties to be faced in earlier years concerned the question of storage for the current generated, and the introduction of batteries not only added somewhat to the capital cost, but also increased the annual charges, besides adding slightly to the work of maintenance. The modern layout dispenses entirely with batteries, and takes the current direct from the dynamo, through, of course, the usual switchboard. This has been rendered possible by the evolution of a governor which controls the speed of the dynamo with such accuracy and reliability that it is now normal practice to guarantee voltage fluctuation within 5 per cent. whatever the load variation, or however suddenly the change may occur. It is thus usual to allow the plant to run with no attention whatever other than what is necessary for lubrication and to ensure the proper functioning of the dynamo.

The question of initial cost is one which cannot be treated elaborately in an article of this nature, as every case must be considered separately, and the layout planned according to the water available. Most of the power units fitted are slow-running machines, and will operate for considerable periods with no maintenance or repairs whatever, given fair treatment, besides having a long life of useful work to their credit. As a matter of interest, however, we give below descriptions of two typical sets which are rendering good service in this country, together with the cost per unit of current generated from each set.

Fig. 4 is a layout showing the location of the power-house and inflow relative to a small river having fairly high banks, a fall of 10ft. occurring in the water level over a distance of approximately 100ft. A low concrete dam was thrown across the stream at the commencement of its fall, and the water led by a cutting 3ft. wide by 2ft. deep to a flume in which the turbine is situated. The tail water is discharged through a draft tube and short cutting back into the stream. The annual cost of operating the set, including also for depreciation and interest on the capital outlay, was 40 per cent. lower than that for the best alternative scheme taking current from the grid, and the cost per unit for the current generated worked out at 0.6d. The generating set is shown in Fig. 5.

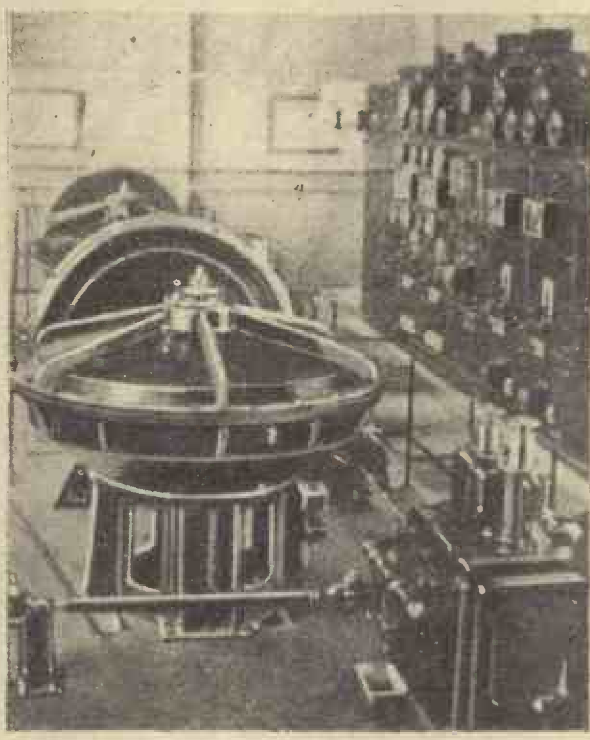


Fig. 7.—Turbo-generator as used in Fig. 6 scheme.

Hydro-electric Plant

The owner of a large country house, having a river with a slight fall passing through his estate, wished to install one of these equipments. In addition to a lighting scheme having 350 points, the following duties were specified:

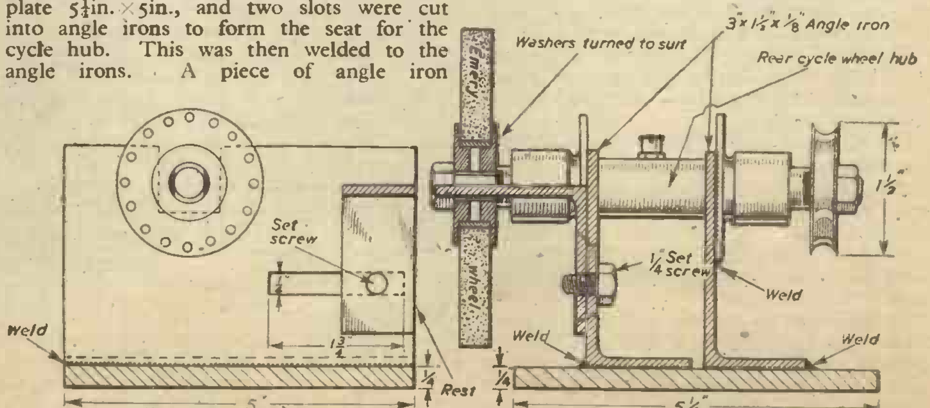
- Pumping—2,000 gallons per day.
- Sawing—Average of 25 B.H.P. required for 6 hours per day through 3 months of the year.
- Refrigerator — 2 B.H.P. for from 4 to 8 hours per day.
- Sundry motors for farm work averaging 2 B.H.P. for 8 hours per day.
- Cooking, central heating and hot water for domestic use, all by electricity.

In place of the two 30 H.P. suction gas engines originally fitted, a hydro-electric plant was installed comprising two 40 H.P. turbines each with governor and generator. The annual cost of operating the new plant proved to be appreciably less than 50 per cent. of that for the original power units, and the cost of electrical energy worked out at 0.57d. per unit. Fig. 6 shows a section through one turbine unit, and Fig. 7 is a view inside the power house.

Thanks are due to Mr. E. Lancaster Burne and Messrs. Gabriel, Wade and English, Ltd., of Wisbech, for particulars of the mills generating electrical energy, and to Messrs. Thomas and Son, of Worcester, for that shown in Fig. 3. Also to Messrs. J. J. Armfield and Co., of Ringwood, for particulars of the hydro-electric plants.

Grinder Made from Cycle Wheel Hub

I RECENTLY made a bench grinding machine out of an old cycle hub. This was made out of a piece of ¼ plate 5¼in. × 5in., two pieces of angle iron 3in. × 1½in. × ⅛in. and 5in. long. These were welded to ¼ base plate 5¼in. × 5in., and two slots were cut into angle irons to form the seat for the cycle hub. This was then welded to the angle irons. A piece of angle iron 2in. × 2in. × ⅛in. × 1in. was then tapped ¼in. Whitworth, and a slot cut into the base angle iron to form an adjustable rest. The machine is driven by a small motor, and has proved very successful.—R. C. BOLTON (Liverpool).

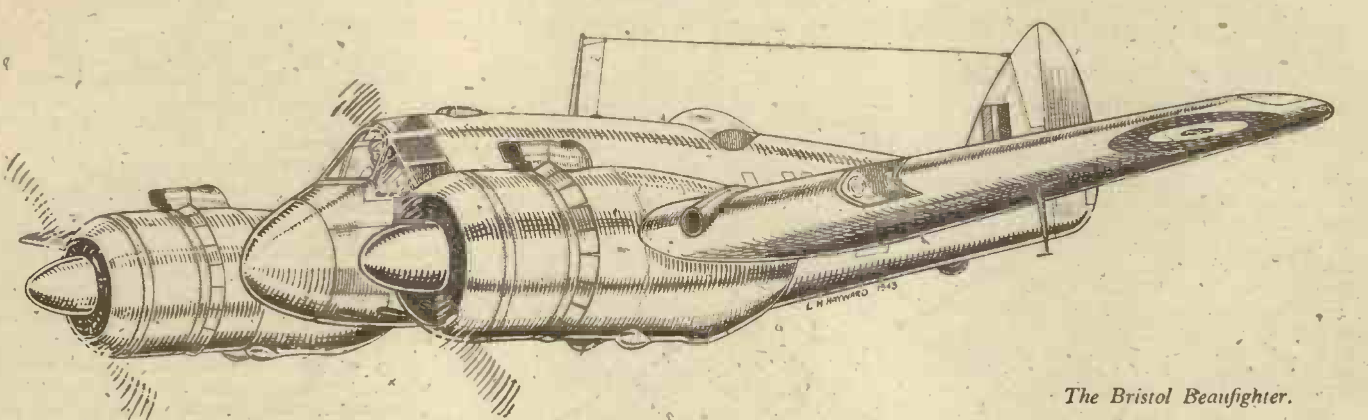


Grinder made from cycle wheel hub.—R. C. Bolton (Liverpool).

AIRCRAFT ON ACTIVE SERVICE

3.—The Bristol Beaufighter

By L. H. HAYWARD



The Bristol Beaufighter.

THE Bristol Beaufighter midwing monoplane is manufactured by the Bristol Aeroplane Co., Ltd., of Filton, Bristol, and at many "shadow" factories throughout Great Britain. The Beaufighter is one of the world's most versatile aircraft. Built originally as a long-range day fighter it has now been adapted as a night-fighter, fighter-bomber, torpedo-carrying fighter, intruder, tank buster, convoy escort, and coastal reconnaissance aircraft. Whatever the allotted duty may be the Beaufighter makes an extremely formidable opponent, its cannons firing approximately 550 rounds per minute and its six machine-guns 1,200 rounds per minute. Many types are now in service and the table below gives the leading particulars which may be published at the present time.

SPAN	LENGTH	HEIGHT	MAX. SPEED	RANGE	ARMAMENT	LANDING SPEED	MOTORS	MOTOR POWER
57′ 10″	41′ 4″	15′ 10″	330 m.p.h.	1,500 miles	6 .303 M guns & 4 20 mm. Cannons	80 m.p.h.	2 Bristol Hercules, 14 cyl. Radial	1,600 h.p.

Rolls-Royce, Merlin XX engines of 1,280 horse-power are installed in the Beaufighter II and give a slightly improved performance. Some of the torpedo-fighters have had their armament reduced to four cannons, while the fighter-bomber version may be seen with a Vickers gas-operated machine-gun in the blister half-way along the top of the fuselage.

Construction

The stub nose monocoque fuselage, which houses the four cannons, has a flush riveted all-metal stressed skin covering and is built up in three parts. Each part is built as a complete unit and allows extensive dispersal manufacture which is such a feature of the Beaufighter. Apart from the multi-plywood wing tips and the fabric-covered ailerons the wings are an all-metal structure built up on two spars covered with light alloy skin flush-riveted to the upper and lower surfaces. The wings are built in three sections, the centre section which passes through and is attached to the fuselage, houses the mountings for the Bristol Hercules 14 cylinder, two-bank radial, air-cooled, sleeve valve engines. Four machine-guns are housed in the right-hand wing and two in the left-hand wing.

Tailplanes and rudder are metal structures covered with an aluminium alloy stressed skin except on the movable surfaces, which are fabric covered. All Beaufighters have recently been fitted with the dihedral tailplane which helps to stabilise the aircraft and prevents swing during take-off.

Undercarriage

The two main wheels and the tail-wheel are retracted backwards and upwards by the engine-operated hydraulic system. Indicators on the main instrument panel in the cockpit show the position of each wheel unit, and if the engine revolutions fall below a specified figure while the undercarriage is still retracted an automatically-operated warning buzzer comes into operation. In the normal course of events it is impossible for the undercarriage to be retracted when the aircraft is on the ground as special safety locks automatically operate and prevent retraction.

Cockpit

Two doors in the underside of the fuselage provide entry for the pilot and observer/wireless-operator who comprise the entire crew. The compact cockpit houses an imposing array of special instruments and gauges necessitated by the radio location equipment installed for night fighting, heavy armament and the two engines.

As Beaufighter aircraft operate in all kinds of weather in many parts of the world a cabin heating system which can be turned on or off by the pilot is fitted. The pilot's seat is adjustable to individual needs and is collapsible in the event of an emergency exit having to be made. Bulletproof windscreens and direct vision windows allowing the best possible visibility in bad weather are provided.

Night Fighting

A very large amount of research has been carried out by the Bristol team of designers to ensure that flames from the exhaust and glowing exhaust pipes which would give away the position of the aircraft to enemy raiders do not occur, and special flame damping exhaust shrouds are fitted. Usually the night-fighting Beaufighters are painted all black, but so many different kinds of camouflage have been used that this is not always the case.

In Service

The first Beaufighters were in action during the latter part of 1940 and it is only natural that such a versatile aircraft will be found in operation all over the world. Operating from Malta, they played havoc with any enemy ships they found in the Mediterranean, and during the African campaign they were extensively used in Lybia and the Middle East.

As a close-to-shore convoy escort, bomb-carrying fighter and night-fighter, the Beaufighter is one of the most successful aircraft of its kind in the world and greatly adds to Britain's strength in the skies.

Improved Dust Collector

IN the shoe-repairing trade it is the practice to use machines with scouring, trimming and similar tools. When these are worked, the dust which naturally accumulates in the neighbourhood of the mechanisation, in the majority of cases, must continually be removed.

As many shoe-repairing shops have but a limited space, it is desirable that the machines should be as compact as possible. Therefore the dust collector should occupy as little room as is compatible with efficient operation Also it should not require a power beyond that which can readily be supplied in the shoe-repairing trade.

One of the various objects of an improved dust collector suitable for use in a shoe-repair machine is that it is so compact that it can fit within the frame of the machine.

The invention includes a casing with an inlet arranged to allow the introduction of a stream of dust-laden air to the interior of a flexible filter. There is also an outlet connected to a suction fan.

The filter is supported at its opposite ends on members slidably mounted in the casing And there is provided means independent of the aforementioned members, supported by the filter itself rather than by the casing, for shaking the filter when the latter is in the operative position, and during the time that a closure for the casing is in the closing position.

Engineer-built Houses of the Future—11

(Continued from page 50, November issue.)

Pre-built Upper Floors : Beam, Structural Plywood and Stressed Skin Construction—the Wiles of Jerry-builders

By R. V. BOUGHTON, A.I.Struct.E.

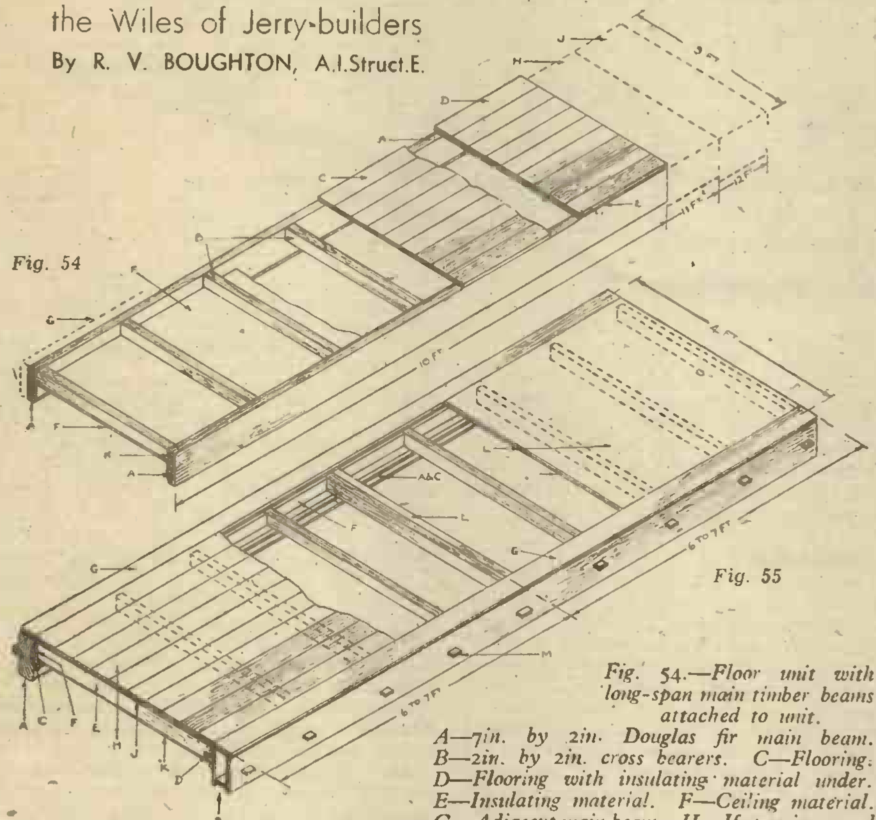


Fig. 54

Fig. 55

Fig. 54.—Floor unit with long-span main timber beams attached to unit. A—7in. by 2in. Douglas fir main beam. B—2in. by 2in. cross bearers. C—Flooring. D—Flooring with insulating material under. E—Insulating material. F—Ceiling material. G—Adjacent main beam. H—If span increased to 11ft., use 8in. by 2in. main beams. J—If span 12ft., use 9in. by 2in. main beams. K—Bevelled housed joint.

Fig. 55.—Floor unit with separate long-span main timber beams. A—Solid timber main beam. B—Built-up structural plywood beam. C—Small bearers housed into and screwed or nailed to main beam. D—Small bearer forming part of floor panels. E—2½in. by 2in. cross bearers. F—Board and bind ends of cross bearers together. G—Flooring board forming part of separate beam. H—Flooring of any suitable kind. J—Insulating material. K—Ceiling material. L—Plywood or other sheet flooring with insulating material under. M—2in. by ¼in. metal corbels extending through slots to other side of beam where they also form corbels.

Main Beam and Light Panel Construction

THIS method of construction may be considered under two sub-sections: (1) where the long span main beams which run in the direction of the length of the pre-built floor units are combined and pre-built with the subsidiary light transverse beams, as Fig. 54, and (2) where the construction is the same as (1) but with the important difference that the long-span main beams are separate to the transverse beams as Fig. 55.

Fig. 54 depicts long span floor units, 10ft. and upwards in length and about 3ft. wide, consisting of two main structural long span timber beams about 3ft. apart which support short span small size transverse beams or bearers at distances apart of about 18in. or to suit the type of flooring and ceiling covering which is used. The main beams are wrought, and the bottom of them project a few inches below ceiling, giving a good beamed effect. The small transverse members should not be only butted and nailed to the sides of the main beams—a sufficiently strong joint would not be attained by this manner of jointing. A good joint is the bevelled housed as shown, the housing at bottom need be only about ⅛in. The advantage of this joint is that it maintains practically the maximum amount of timber at the top of the beam, where it is required to resist compression and only cuts into the timber near to the neutral axis of the beam where the stresses are least. The flooring may be of any desired kind, such as ordinary softwood, hardwood, hardboard or plywood.

Fig. 55 shows a principle of construction where the main beams are separate to the light-weight floor panels; it is a principle which, in my opinion, has many advantages over that as Fig. 54. The main beams, even if of such span as 16ft., are not difficult to transport, handle and fix, and the separate floor panels can be of comparatively short length and may be 4ft. wide or even a little more. The main beams may be of steel (as Fig. 56), solid timber or built-up structural plywood; the latter material is now making rapid strides for constructional work. The solid timber beam, Fig. 55, complies in principle with good codes of structural practice; it can be of correct section to withstand bending stresses and to limit deflection, and the groovings for the small bearers to support the floor panels occur near the neutral axis of the beam, where a reasonable reduction in sectional area does not impair strength. Such small bearers should be housed as shown to ensure an adequate bearing on the beam; nailing only, unless the nails are

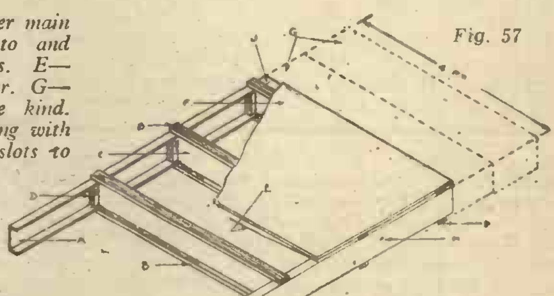
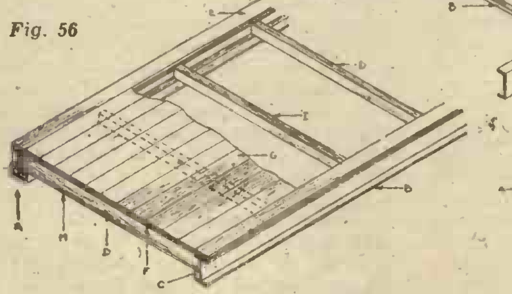


Fig. 57

Fig. 56



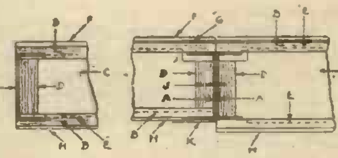


Fig. 58

Fig. 56.—Part of floor unit with separate long-span steel main beams. A—Steel beam with timber plates bolted to web. B—Steel beam. C—Timber plate and support floor panels. D—Cross bearers. E—Flooring board forming part of separate beam. F—Insulating material. G—Flooring. H—Ceiling material.

Fig. 57.—Floor unit with steel channel beams and cross ribs formed with timber splines and plywood web. A—Light section galvanised steel channel. B—Small timber splines to which flooring and ceiling material is nailed. C—$\frac{3}{16}$ in. plywood web. D—Hardwood blocks. E—Building or insulating material laid under flooring and allowed to sag to form air space. F—Flooring of plywood 12mm. thick. G—Extension in length from 12ft. (as detail) to 13ft. or 14ft. will necessitate increasing size of channels. H—Bolts connecting floor units. J—Channel to end of unit.

Fig. 58.—Alternative methods of designing cross ribs of floor unit as Fig. 57. A—Steel channels. B—Timber spline. C—Plywood web. D—Hardwood block. E—Groove in spline to receive plywood web. F—Flooring. G—Insulating material. H—Ceiling material. J—Bolt. K—Cover strip.

rather close together, cannot be relied upon to provide sufficient strength.

The wrought beam projects below ceiling level and may have small chamfers or mouldings as depicted, but in this respect too much timber should not be cut away otherwise the beam may be unduly weakened.

The built-up beam may consist of thick structural plywood, which has considerable strength in the vertical beam members and thinner plywood to the horizontal bottom and top parts. Alternatively, the top may be formed with the same material as used for the flooring. The floor panels, which consist of small size bearers spaced at distances apart to suit the type of flooring and ceiling covering used, may rest either on the small bearer, which is housed into the main beam, or metal corbels as shown. The corbels would be fitted into slots near the neutral axis of each vertical structural plywood member, this ensuring that the strength of the beam will not be adversely affected.

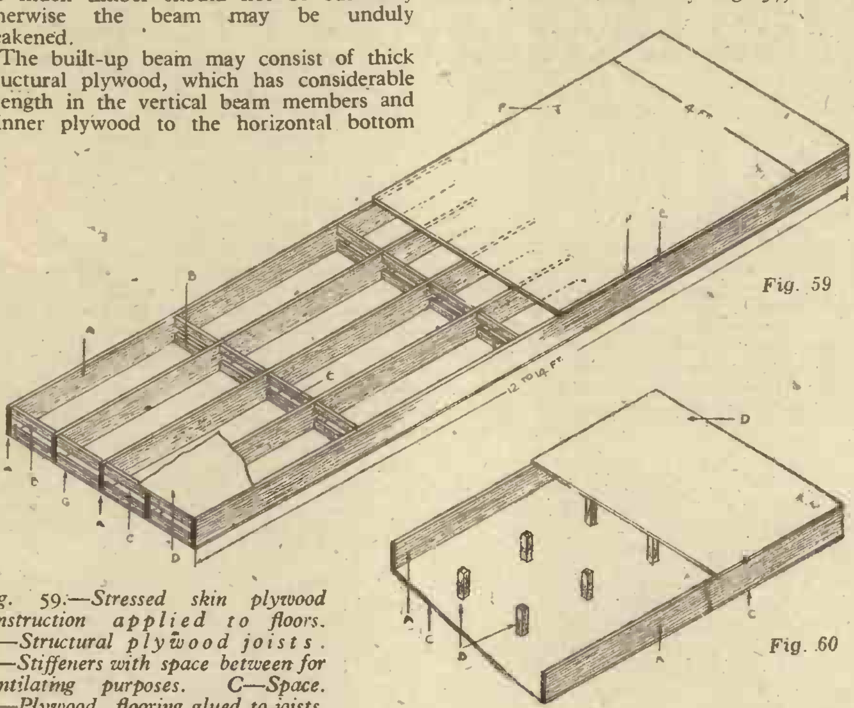


Fig. 59

Fig. 60

Fig. 59.—Stressed skin plywood construction applied to floors. A—Structural plywood joists. B—Stiffeners with space between for ventilating purposes. C—Space. D—Plywood flooring glued to joists. E—Insulating material if used would cause construction not to be on stressed skin principle. F—Flooring not glued to joists. G—Ceiling material of plywood glued to joists. Fig. 60.—Another system of stressed skin construction. A—Structural plywood. B—1¼in. by 1¼in. hardwood pegs. C—Plywood ceiling material glued to pegs members A. D—Plywood flooring glued to pegs, etc.

Steel Beams

Fig. 56 depicts the use of steel beams which, like the system shown by Fig. 55, are separate to the floor units. An advantage of using steel beams is that they may, as a rule, be of less depth than timber and structural plywood beams. It is, however, essential that steel beams be quite straight, as otherwise there may be difficulty in fitting the floor units; the same applies to all types of separate beams used in pre-built work; but timber is not so difficult as metal to align. Provided that care is taken in packing, transport and handling, there can be no serious objection in pre-building the steel beams complete with plates, flooring strip with insulating material and soffit casings.

Fig. 57 is interesting as it represents in general principle the Tarran system of floor construction, which consists of light pressed channel section galvanised steel main beams, with similar channels to the ends of the pre-built units (the channels forming a frame). The intermediate cross ribs are formed of 3/16in. resin bonded plywood and small section solid timber flanges or splines which fit into the sides of the channels. An insulating air space is formed by building paper laid on top of the cross ribs and allowed to sag in between them. The flooring or top decking is of 12 mm. resin bonded plywood nailed to the top flanges of the ribs. Adjacent floor panels are bolted together. In the Tarran system the cross ribs are shown at lesser centres than indicated by Fig. 57, and the ceiling covering (if the floor is not a ground floor) is of plaster boards fixed on site. The system of construction can be varied in detail, such as by making the cross ribs of correct strength to allow spacing them to suit any of the different flooring materials which may be desired; the ceiling covering, subject to the provision of access to bolts used for connecting the panels together, may be of any of various kinds applied at the factory and not at the site. Fig. 58 is an enlarged detail showing alternative methods of connecting the cross ribs to the steel channel. Such details, although following the Tarran system in general principle, which is very good, shows at the left-hand side a way in which the total thickness of the floor may be reduced by an inch or so if desired.

Structural Plywood Construction

Plywood for structural uses is now receiving much attention in this country, and particularly in America. If the material is properly chosen and used it has greater strength than ordinary redwood, and consequently structural plywood used on edge as joists may sometimes be of smaller sectional area than redwood. It is essential to bear in mind that the construction of plywood is such that the grain or fibres of some of the plies run in one direction, and others at right angles. This means that only those plies which have their grain running in the direction of the span of a beam or joist may be allowed as capable of resisting bending stresses; those which run in the other direction, that is, from the top to bottom of a beam, have comparatively little resistance to compression and tension, and therefore cannot be relied upon to provide much resistance to bending stresses. But, they do help to stiffen a beam and limit deflection.

Fig. 59 should first be studied as a construction not incorporating the stressed skin principle, and simply consisting of thin, structural plywood joists covered on the top surface with plywood or other kind of flooring material, and the underside with a suitable ceiling covering. The general framework is stiffened by nogging pieces, as shown, with a ventilating space between them. The complete floor units may be from 3ft. to 4ft. wide, and any convenient length.

Stressed Skin Construction

This type of construction is rapidly gaining favour, and Fig. 59 should now be studied again. Stressed skin construction, in brief, consists of a framework of joists (as in the case of floors, etc.), or studs (in walls and partitions), and to both faces of such framework a covering of plywood is glued, forming a rigid attachment between the frame and the covering. This attachment provides a resistance to shear between the framework members and the coverings, and, when a panel is under transverse loading, one covering is in compression and the other in tension. Fig. 59 shows structural plywood joists, and the flooring and ceiling coverings would be of reasonably thick plywood glued to the joists. When the floor is under load the flooring would be in compression and the ceiling in tension.

Fig. 60 depicts another type of stressed

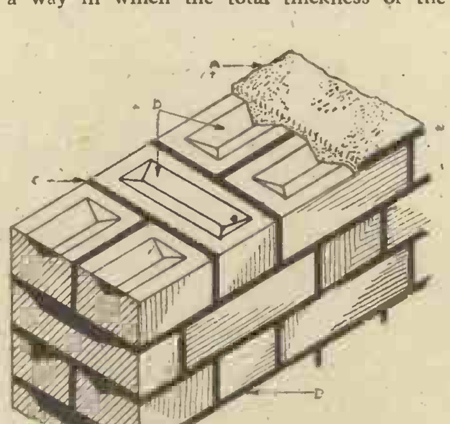


Fig. 61

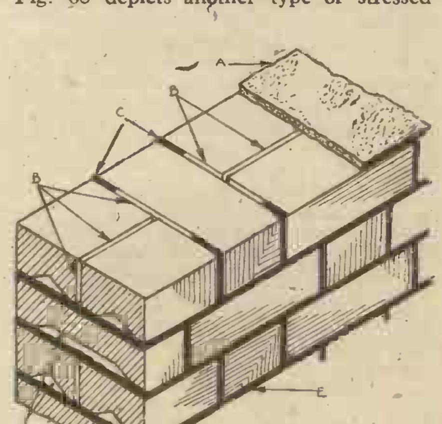


Fig. 62

Fig. 61.—Brickwork as it should be built. A—Mortar for bed joint. B—Frogs upwards filled with mortar. C—All vertical joints filled with mortar. D—Bed joint.

Fig. 62.—Brickwork which is jerried to save mortar and labour. A—Mortar for bed joint. B—Vertical joints not filled with mortar. C—Vertical joints on faces of work buttered with mortar. D—Frogs are placed downwards so that they are not filled with mortar. E—Bed joint.

skin construction where, instead of joists, hardwood pegs about 1¼in. by 1¼in., at 16in. or 18in. centres, are used, the coverings being glued to the ends of the pegs.

Supports for the Floor Units

All the types of upper floor units are supported by the main walls, and the beams ringing the house at floor level, by any floor beams; and by partitions and other main structural parts; all these structural supports are shown and described in the September, October, and November issues. All the floor units must be subject to their bearings on walls and beams, etc., being incapable of rotating; in other words, the units must have rigid connections to bind the walls, etc., to the floor.

There are various methods which will be described in a later article of insulating against sound and temperature the floor units, as well as other parts of the structure.

The Wiles of Jerry Builders

Brickwork should have all horizontal (bed) and vertical joints, and the "frogs," filled with mortar, and the frogs should be laid upwards. Correct brickwork is shown by Fig. 61.

The chief aim of jerry builders is to save money in materials and labour, and brickwork is one of the very many items in an ordinary house which can be subject to jerry principles. It does not matter to the jerry builder whether the brickwork is strong enough or not, or whether there are open joints which more easily permit the passage of rain, or not; the chief aim is to save money. Fig. 62 shows a very great difference between the correct work (as Fig. 61) and work which saves a considerable amount of mortar, including its materials and labour in mixing it, and bricklayers' time in laying the bricks.

Study Fig. 62, and it will be seen that the "frogs" are laid downwards, and are not filled with mortar; note how the vertical joints in the interior of the work are left hollow, and how by "buttering" the parts of the joints an appearance is given from the outside of perfectly filled joints.

Let us examine, fairly approximately, what this jerrying of brickwork saves. Each "frog" has a space of about 4½ cubic inches, and, as there are about 20,000 bricks in an ordinary small, semi-detached house, at least 2 cubic yards of mortar, about £3, is saved. The omission of mortar to some of the vertical joints usually saves at least half a cubic yard of mortar per rod, which consists of 4,350 bricks, and, as 20,000 bricks equals about 4½ rods, the saving is about 2¼ cubic yards of mortar, worth about £3 7s. 6d. Labour in bricklaying is reduced to the extent of, say, 10s. a rod, by bricklayers having a reduced quantity of mortar to use, therefore, another saving is effected of £2 5s.—a total of £8 12s. 6d.—and this does not take into account making mortar deficient in cement and by not conforming to other reasonable codes of brickwork practice.

Roof tiling, of the ordinary kind, gives scope to the jerry builder. This important work is usually done by sub-contractors, who supply the materials and labour, the latter often being done piecework. There are various qualities of tiles, and the cheapest are almost invariably used, and even these are good materials having chances of long life. Obviously, nails which are used to fix some of the tiles should be chosen with a view to them lasting as long as the tiles which they help to fix. It will be found that the cheapest are used, such as galvanised nails, which do not last very long, that the shortest and lightest nails are chosen, and nothing like sufficient of them are used in accordance with correct codes of practice. Fig. 63 depicts at "A" insufficient, and at "B" sufficient, nailing of ordinary roof tiling. Roof tiling with 10½in. x 6½in., or 11in. x 7in. nibbed tiles should be nailed every 4th, 5th, or 6th course, according to certain codes of practice, and every tile in the nailed course should have two nails.

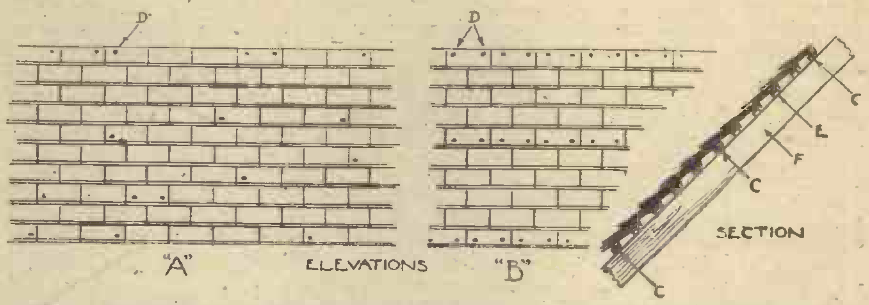


Fig. 63.—Roof tiling as it should be nailed and how it is jerried to save nails and labour. "A"—Jerried nailing. "B" Correct nailing. C—Correct nailing to every fourth, fifth or sixth course of tiling. D—Nails. E—Tiling battens. F—Rafter.

Tiles at abutments, valleys, hips, etc., should be nailed every course. The nails should be not less than 1¼in. long, and zinc nails, weighing 7½lb. per 1,000 or, better still, copper, 8lb. per 1,000, is proper practice. Tiles which are not nailed can be slided up the roof, or can be lifted upwards from the inside of the roof. I have tested the tiling of hundreds of roofs of jerry-built houses, and "A," Fig. 63, is by no means exaggerated. On one occasion I noticed tilers working on a roof (I was not connected with the job), and for half an hour ordinary tiles were simply laid over a considerable area and not a single nail was used! The tiles were laid almost as quickly as dealing cards.

Science Notes of the Month

"Flying Power Station"

NOW that multi-engined aircraft have become so large, that a special electric power plant is needed to start the engines, supply lighting and heating, and for operating undercarriages and gun turrets. Previously the power for these operations, whether by air, electric or hydraulic, has been provided by pumps and generators connected to the engines, driving the airscrews, but the limit of these auxiliaries has now been reached. Recently, Rotol Airscrews, Ltd., announced that at the request of the Air Ministry they have developed a "flying power station" for large aircraft. It consists of a six-cylinder petrol engine driving a generator providing both alternating and direct current. The whole unit is completely enclosed in a sound-proof metal box.

New Process for Making Aviation Fuel

WHAT is described as one of the great scientific discoveries of the war has been devised by an American firm, the Universal Oil Products Company, for the manufacture in large quantities of an aviation fuel called triptane. Although its precise characteristics are a military secret, it is claimed for it that engines which have been fitted with smaller and stronger cylinders can achieve on triptane a speed 50 per cent. greater than has yet been reached by any enemy aircraft, and that the best German 'planes would be reduced to tactical impotence against triptane-powered Allied 'planes.

Triptane itself is not new, but what is new is the fact that a method of producing it in quantity at common temperatures and pressures and on normal refinery equipment has at last been found.

The Boomerang

IT was reported from Canberra recently that the new Boomerang fighter 'planes, which were stated to have been in action for the first time during the Allied landing at Lae, have been secretly manufactured in Australia for nearly a year.

A single-seat, low-wing, all-metal monoplane, the Boomerang is equipped with a Pratt and Whitney engine, also made in Australia. Some R.A.F. squadrons have been equipped with the Boomerang, which was built as a high altitude interceptor.

Humber Armoured Car

THE Humber Car, Mark 4, which has done some fine work in France, North Africa, Sicily, and Italy, is a formidable-looking war machine, in appearance much like a small tank mounted on heavy rubber-tyred wheels, instead of the usual caterpillars. It is the first fighting vehicle made in this country on mass production lines to be fitted with American main armament. It carries a 37 mm. armour-piercing cannon, a 7.92 Besa machine-gun, a Bren gun for A.A. use, and a Thompson sub-machine-gun. In addition there are two smoke dischargers and a radio set.

The Mark 4, which weighs 7 tons 3 cwt. all up, has a maximum speed of 45 m.p.h., does an average of 35 m.p.h, and on rough cross-country work can maintain 13 m.p.h. It carries a crew of three men: driver, gunner and commander-leader.

U.S. Auto-Pilot

THE first official disclosure was recently made in New York of the method and performance of an auto-pilot, which is stated to have been partly responsible for the devastation wrought in raids by U.S. bombers. The auto-pilot is designed to take over completely the duties of a pilot on bombing raids, holding the 'plane on a designated course, and facilitating accurate bombing. The auto-pilot is electronically controlled, and can return an aircraft immediately to its course despite cross-currents of wind and variations in air blast from exploding A.A. shells.

Wind Tunnels

Their Uses in Testing Aircraft

By T. E. G. BOWDEN, Grad.R.Ae.S., M.I.E.T.

ALTHOUGH the science of aerodynamics has reached an extremely advanced stage, it is still desirable for the theoretical results to be checked by practical methods. There are still many problems to be settled as regards the reactions of bodies moving through fluids. The only way by which results may be obtained is by practical tests, as the theoretical side has not developed to a high enough standard at the present time. In aircraft design many inexplicable phenomena occur which, theoretically, should not happen, and consequently wind tunnels form an important part in the design of aircraft.

Basically, a wind tunnel, or wind channel, is a piece of apparatus which allows conditions of flight to be analysed in a laboratory. The model being tested remains stationary, and the air is forced past, thus enabling the forces of airflow acting on the model to be studied with comparative ease. There are various types of wind tunnels, each of which has its own particular function, and a description of these alternative designs follows.

Open-ended Tunnel

The most common type of tunnel is the open-ended design which is illustrated in Fig. 1. As will be seen, it consists of a long rectangular box-like structure through which the air is drawn by means of an airscrew. It is usual for the air to be drawn through the tunnel and not pushed through, as if the latter method is resorted to, extreme turbulence will occur.

The airflow must be as smooth as possible, and fittings known as honeycombs are fitted at the inlet and also in front of the airscrew. These honeycomb sections resemble a car radiator, and straighten the airflow which otherwise would travel in the form of a corkscrew, due to the twisting motion imparted to the air by the airscrew.

The velocity of the airflow is varied by altering the driving motor speed, and may be controlled to within extremely close limits.

A window is situated opposite to the point at which the model is being tested, and allows photographs to be taken which may be analysed at leisure after the test. The model is mounted on a system of balances which enable the forces acting upon it to be measured. A typical set of aerodynamical balances is illustrated diagrammatically in Fig. 2. The main forces of which measurements are required are the lift and the drag (for aerofoil sections). By using a wing which possesses a high lifting power, and at the same time does not have an excessive drag, an efficient aircraft may be designed. Should the drag be high, the horsepower required to propel the aircraft through the air will also be high, resulting in high running costs and other complications.

From Fig. 2 it will be noted that the model is mounted upside down, so that the lift force acts downwards, thus facilitating measurement. The two forward scales measure the lift force and the rear scale measures the drag. As the model tends to alter its position, weights are added to the balances to restore it to its original position. By simple calculations the actual forces may be calculated. These figures are worked out for varying angles of incidence (i.e., placing the model at different angles to the airflow) and graphs drawn, from which the suitability of the section may be deduced.

It is important that the airspeed be known accurately, and sensitive measuring gauges have been developed. An ordinary airspeed indicator working on the pitot tube principle is often used, although more accurate readings than normally obtained by the indicators fitted to aircraft are required. A device known as the Chattock Micromanometer is used, consisting of an adjustable U tube, in which the difference in level of the liquid

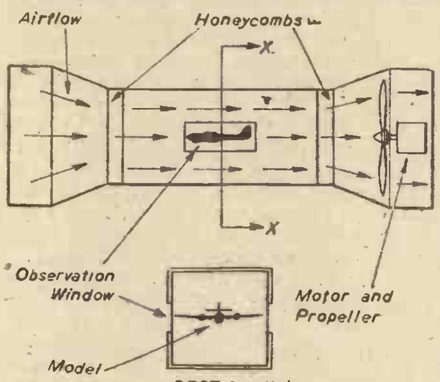


Fig. 1.—Open-end wind tunnel.

caused by the variation in pressure is measured by means of a microscope.

The speed obtained in this type of tunnel varies, but approximately 120 m.p.h. is normal, although far greater velocities are likely in the future. The cross section of the channel varies from 2ft. by 2ft. to 10ft. by 10ft., or, alternatively, circular sections are used.

Corrections to the results obtained have to be made according to the shape of section utilised.

Closed Return Tunnel

An improvement on the open-ended type of wind tunnel is illustrated in Fig. 3, and is known as a closed return tunnel. Instead of discharging the air which has passed through the working portion of the tunnel to the atmosphere, the tunnel is so shaped that the same air is re-used. The airscrew has therefore only to make up frictional losses, as the air retains its velocity.

The main problem in this type of tunnel

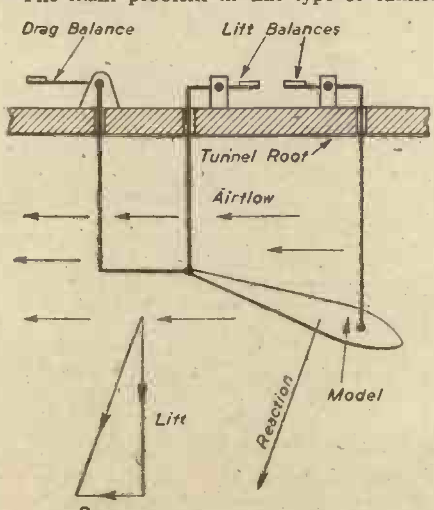


Fig. 2.—Aerodynamic balances.

is the guiding of the air round the tunnel without causing excessive turbulence. One method commonly adopted is to place guiding vanes known as cascades at each bend, and it has been found that the airflow resulting from the fitting of these guides is quite satisfactory.

A diameter at the working portion of 10 feet with an airspeed of 200 m.p.h. has been attained with this type of tunnel, which is extremely efficient in operation. By varying the diameter as shown, the velocity of the airflow past the model may be increased considerably. This increase in velocity also tends to maintain a smooth flow and to avoid turbulence.

Open Return Tunnel

For the testing of large models and even full scale aircraft, the open return type of tunnel has been developed. From Fig. 4 it will be seen that the airflow is guided round, as in the case of the closed return type. The main difference is that the working portion is open to the ordinary atmosphere.

The horsepower required to operate this type of tunnel is very high, e.g., 8,000 h.p. is required in an American tunnel with an oval cross section measuring 60ft. by 30ft., and possessing an air velocity of approximately 120 m.p.h. The cost of constructing such a wind tunnel is extremely high, and special buildings are needed to house them; in the case of the American tunnel, the space required is over 100 yards by 70 yards.

A crane is usually installed permanently for the lifting of aircraft on to the supports which are connected to the balances recording the forces acting on the aircraft. Aero-engines may be tested in the running condition, but precautions have to be taken against carbon monoxide from the exhausts.

In the future this type of tunnel is likely to be developed to even greater sizes, as the demand for more and more information increases.

Compressed Air Tunnel

An extremely interesting type of tunnel is that in which the air used is at a pressure greater than that of the normal atmosphere. Fig. 5 illustrates the outline of this tunnel, which is of the open return type. The whole of the system is enclosed in a steel shell similar to a boiler in shape. The steel walls are 2.5in. thick, to resist the pressure, which may be as high as 25 times the normal atmospheric figure. A maximum velocity of approximately 60 m.p.h. is attained at the working portion which has a circular cross section 6ft. in diameter. The strength of the tunnel has to be such that it can resist pressures of 24 tons per square foot.

The reason for this testing of models in compressed air is as follows. It has been found that if the Reynolds number for the model and the full scale aircraft are approximately the same, the results may be compared with confidence. Reynolds number is a ratio between velocity, length and the viscosity of the air. The reduction in length of the model as compared with the full scale machine may be cancelled out if the air density is increased. For example, if the wing chord of a proposed aircraft is 5ft. and the airspeed is 120 m.p.h., then a model with a chord of 1ft. tested in a tunnel with a velocity of 100 f.p.s. and a density of approximately nine times the normal density will give comparable results.

The models used in this type of tunnel must be extremely accurately made, otherwise incorrect results will be obtained. Wood or metal may be used for their construction and small electric motors are sometimes fitted inside the model to drive miniature propellers, so that the exact conditions of flight may be copied.

Due to the fact that the shell must be airtight, special balances have been developed and operate electrically. Devices enabling the position of the model to be altered are also worked by electrical means.

Vertical Tunnel

To enable the spinning of aircraft to be investigated, vertical wind tunnels have been developed. Spinning is an extremely difficult problem to treat theoretically, and a tunnel of this type enables experiments to be carried out without risking test pilots' lives or expensive aircraft.

A typical vertical tunnel is the one at Farnborough (England) which stands 30ft. high and is 12ft. in diameter. A current of air is forced upwards by means of an airscrew driven by an electric motor. By placing a model aircraft in an arm in the airflow and switching the motor, the model will spin freely without losing height. This enables accurate observations to be made or photographs to be taken.

The flying controls are operated by means of a clockwork motor fitted inside the model and which is set to operate them when desired. The recovery from a spin may thus be studied, together with the

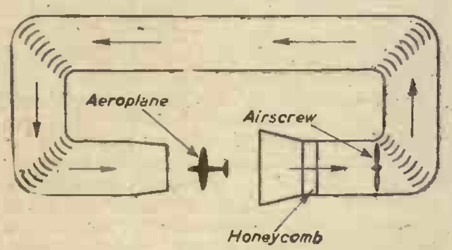


Fig. 4.—Open return tunnel.

amount of control required to pull out. Aircraft possessing bad spinning characteristics can be altered before any harm has been caused.

The vertical wind tunnel supersedes the old method of dropping models from a height and watching their behaviour. This method was obviously inefficient and only allowed a few seconds at the maximum for observation, whilst by using a wind tunnel the model may be kept spinning indefinitely. Slow-motion films enable the exact behaviour to be studied under ideal conditions.

High-speed Tunnel

At the present time the maximum airspeed of flying machines is increasing steadily, and is approaching the speed of sound. When this speed is gained, queer and sometimes inexplicable things occur, and it is essential that some form of testing be available if future designs are to be a success.

The speed of sound at sea level is approximately 750 m.p.h., and this speed has almost been attained when terminal velocity dives are carried out for test purposes. The airflow changes in character and becomes more solid. Wing and fuselage panels may be buckled and damaged as though hit with a sledge hammer. The wing is liable to stall at ordinary flying angles, and when this occurs it is known as a compressibility stall. Controls are also affected, and it is practically certain that the present-day systems will be superseded in the near future.

The manner in which the airspeed in high speed tunnels is attained is as follows.

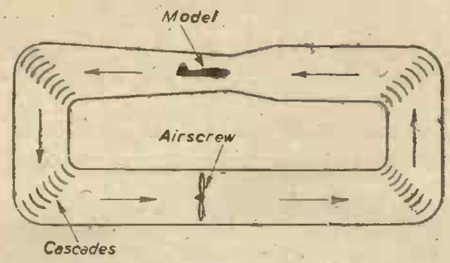


Fig. 3.—Closed return tunnel.

Air under pressure is released into the tunnel and draws a further volume of air through the working section. An air velocity of almost 1,000 f.p.s. may be gained by this method. These tunnels are only small as compared with those previously described, the working portion being approximately 1ft. diameter.

For speeds greater than that of sound, the working portion is reduced to only a few inches, and the same method as described in the previous paragraph used, i.e., high pressure air. Great heat is generated, and unless special cooling precautions are taken the time for which the tunnel may be run is limited. The models for this tunnel have to be constructed of steel. The velocity reached may be as high as 1,500 m.p.h.

Smoke Tunnels

To enable the airflow past wings, fuselages, etc., to be made visible, chemical smoke is often introduced into the tunnel. By doing this, any poor streamlining is immediately shown up, and other phenomena, such as trailing-edge vortices, may be studied. Titanium tetrachloride is a chemical which forms dense clouds of vapour and is frequently utilised.

Wood smoke is an alternative, and is generally passed to the model via small diameter pipes, and flows into the airflow from holes drilled in the skin. The effect of stalling an aerofoil is clearly shown, as the smoke flow becomes turbulent at the point, indicating loss of laminar flow.

Tunnels intended for visual tests only have been constructed, and consist of two sheets of glass placed close together. Smoke is allowed to enter in front of the model in the form of thin parallel lines. These smoke lines alter their course according to the shape of the model, and by this means extremely good results are obtained.

A tunnel constructed by Herr Lippisch had an air velocity varying from 20 to 60 m.p.h. with the glass plates 2ins. apart.

An electrical method of making the airflow visible is to heat the air passing over the model by means of electric sparks. If there is no disturbance, photographs show these heated portions of air as spots occurring at regular intervals. When the airflow is disturbed, the spots are no longer regular, and the flow may be estimated quite accurately by comparing with the regular spacing of the normal flow.

Another successful method in which the air is heated is as follows. By heating the air by electrical means the refractive index is changed. The lines of flow may be indicated on a screen if a beam of light is shone through the portion being tested. Photographs taken when using this method show the shadow pattern, the lines of flow being clearly visible.

In ordinary wind tunnels, i.e., not special smoke tunnels, the airflow is often indicated by means of tufts of cotton attached to the surface of the model being tested. In the case of a wing in normal flight, all these tufts lie flat along the direction of the airflow. When the stalling angle is approached, however, queer movements are noticed; in some cases the tufts point in the opposite direction to the line of flow, indicating extreme turbulence. Tests similar to this have been carried out on full-scale aircraft, and confirm the results obtained in the wind tunnels.

The variety of experiments that may be carried out in the various types of wind tunnels is endless, and a description of all of them would fill many volumes. Many interesting facts are shown, e.g., if two models, say, a wing and an undercarriage, are tested separately and their drag values found, when they are tested together the drag will not be the sum of the two separate drags. In some cases it may be more, and in other cases less.

A special form of tunnel which has been developed is the gust tunnel, in which the effect of gusts upon aircraft structures may be tested. Sudden up or down gusts cause heavy loads, and accordingly cause the structure weight to be made heavy. Any means of reducing the non-useful weight is welcomed by aircraft designers, and it is possible that experiments carried out in the gust tunnel may allow this to be accomplished.

An extremely interesting tunnel for the testing of stability and control is the free-flight tunnel. A model is allowed to remain stationary with the air flowing past without any supports. The tunnel may be tilted to alter the angle of the flow, so that the model is given the equivalent of varying angles of incidence, although remaining practically stationary. The controls are operated by means of electro-magnets connected to the control panel by very small diameter wires.

From the above description of the various

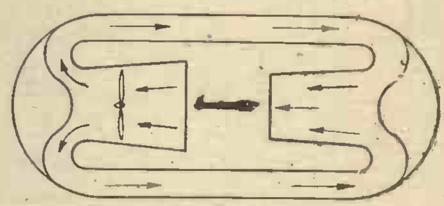


Fig. 5.—Compressed air tunnel.

types of tunnel that exist at the present time it will be seen that an immense amount of energy is being spent in order to increase our knowledge of aerodynamics. Startling and new ideas are being developed which could never have been tried out but for the use of wind tunnels.

Producer-gas Buses

At least 2,000,000 gallons of petrol will be saved by the conversion to producer-gas this year of 651 buses running in the Tilling group of companies throughout the country.

The estimate, a conservative one, is given in a survey of the Tilling group's pioneer work with producer-gas. The review points out that, although charcoal-burning producers had probably been used already on Continental buses, it was in the spring of 1938 that Tillings purchased the first producer to be used for buses in Great Britain.

Experience has shown that, by a strict observance of servicing routine, producer-gas buses can leave their stations, do their journeys, and return home in the evening as regularly as their predecessors, and that, in a give-and-take service over country which is not too difficult, an average speed of 15-18 miles an hour can be relied upon.

"The survival of producer-gas buses after the war," the survey states, "will be governed entirely by a fuel position of which to-day we know nothing."

"Picture" Signals of Compass Bearings

How Television Aids Navigation at Sea

UP to the present, interest in television has been mainly centred around its entertainment value. We are all waiting to know exactly when the new picture service is coming into operation, and how much it will cost us to bring it into the home.

Meanwhile, whilst these questions still remain unanswered, the discovery of television is making itself felt in other directions than broadcasting. We have, for the first time in history, found out how to transmit instantaneously a picture of events occurring at a point beyond the normal range of vision, and it would be strange indeed if this new discovery did not find some useful applications outside the field of mere entertainment.

The whole subject is, of course, still in its infancy, but as a line of approach to some of the possible "outside" developments in television it will be helpful to see, in the first place, what has already happened in the case of wireless. What can be done with one, can, or will be done—where it is advantageous—with the other.

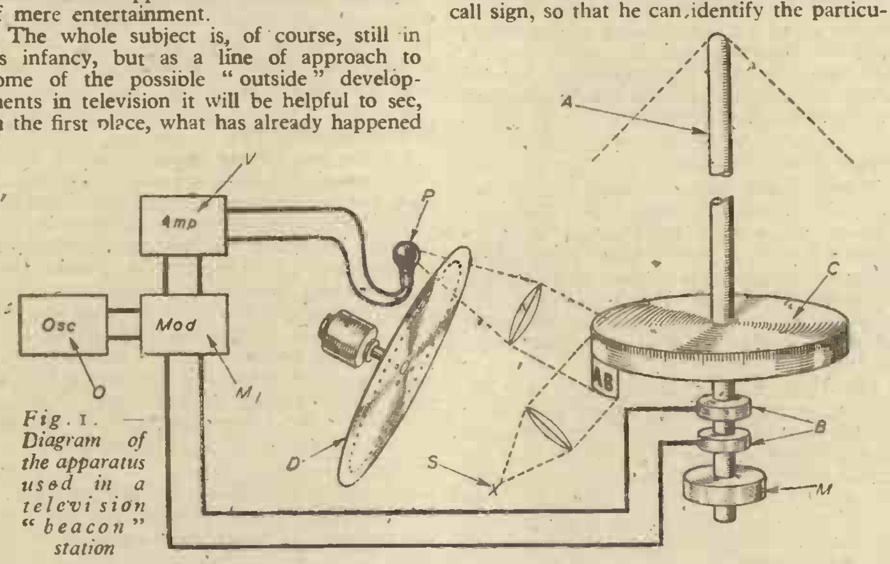


Fig. 1.—Diagram of the apparatus used in a television "beacon" station

Wireless first made its mark—long before the introduction of broadcasting—as a means of keeping in touch with those cut off from all ordinary means of communication, so that ships at sea, and aeroplanes in flight, for the first time lost their peculiar sense of isolation.

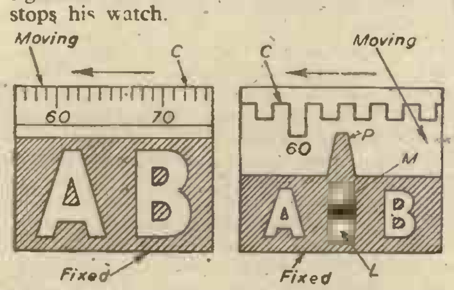
With the help of the radio direction-finder, a navigator can now come safely into port under conditions where all ordinary harbour lights and marks are completely blacked out. Similarly a course can be "marked out" in the air by overlapping wireless beams, so that an aviator can fly blindly along a given route, knowing that he will be automatically warned of any deviation to port or starboard by the radio instruments on his dashboard. Finally, when he reaches his destination, short-wave radio beams help him to come safely to ground, at the correct landing angle, even when fog completely blots out all sight of the aerodrome.

Aiding Navigation in Foggy Weather

Television is already following closely in the footsteps of directional wireless as a help to navigation in foggy weather. It has the definite advantage of giving a clear and unmistakable "picture" indication, which can be seen at a glance, so that the navigator does not require either a knowledge of the Morse code, or an ear sufficiently sensitive to judge when the received signals are at maximum or minimum strength in the midst of a confusion of other noises.

For instance, in one well-known method of assisting mariners to find their location during fog, a rotating beam of wireless is radiated from a beacon station, near the coast in much the same way as the ray of light from a lighthouse. In addition, a characteristic call signal—consisting of certain Morse letters which identify the station—is broadcast or transmitted in all directions, together with the Morse letter N at the precise moment when the beam is passing through the North point of the compass. The wireless beam makes one complete revolution every 30 or 60 seconds, or more, according to the particular transmitter concerned.

In order to find his bearings the navigator must first be able to recognise the Morse call sign, so that he can identify the particular transmitting beacon on his map. He next listens for the Morse letter N, which tells him that the beam is passing through true North on the compass, and immediately sets a stop-watch going. He then waits until the beam sweeps through his own position, where is produces a "maximum" signal in his receiver. At this moment he stops his watch.



Figs. 2 and 3.—The beam pictures as seen by the navigator at sea, and which indicate the exact bearings.

The number of seconds between hearing the "North" signal and the time the beam reaches him, then indicates his bearing relative to the land beacon. For instance, if the beam takes 60 seconds for a full revolution, and his stop-watch reads 30 seconds after hearing the North signal, he knows he must be lying due South of the transmitter. It will be seen that all this calls for a considerable amount of skill, as well as a competent knowledge of Morse.

The Television "Beacon"

By contrast it is possible to transmit comparatively simple television signals which show his bearings pictorially to a navigator, no matter where he is situated. The apparatus used at the beacon station is illustrated in simple form in Fig. 1.

The directive aerial A which radiates a clear-cut beam of wireless energy is constantly rotated at a uniform rate by a motor M. On the driving-shaft is a drum or disc C which is marked along its edges with a divided scale representing the points of the compass. At one particular point there is a card AB carrying the identification letters of the station. This card does not rotate with the drum and aerial, but remains fixed.

Light from a source S is focused upon the fixed card AB and upon the scale-markings of the disc C as the latter slowly swings past. The reflected light passes through the usual rotating disc D, and is thrown on to a photo-electric cell P, so that a television picture of the fixed card AB and of the scale markings on the disc D is fed first to the amplifier V, then to a modulator M_1 (which is supplied with a carrier wave from O), and finally back through brushes B to the aerial A, where it is radiated into space as part of the beam.

Simultaneously a second aerial (not shown) radiates synchronising signals, not as a beam, but in all directions, so as to keep any television receiver within range in step with the scanning disc D.

All that the fog-bound mariner now requires to do is to watch his television screen. As the beam sweeps past him, he will see a picture similar to that shown in Fig. 2, consisting of the stationary identification letters AB and a slowly moving image of the compass scale, which indicates his bearings relatively to the beacon station. Every suitably equipped ship within range will pick up a corresponding picture of its own bearings, since the rotating beam carries on its back, so to speak, a visible record of each point of the compass through which it is moving.

Although the system provides a picture signal which can be easily understood by a navigator ignorant of the Morse code, it is open to the objection that the scale markings are slightly "on the move" during the critical moment of observation. For this reason there may be some difficulty in taking an exact reading during the short period of time available.

In order to remove this uncertainty the procedure at the beacon station may be varied, by radiating the picture signals on a broadcast wave, which travels outwards in all directions, instead of putting them on the back of the rotating beam. The latter is, instead, used to transmit a tone signal which has the effect of producing at the receiver a "black bar," or distinguishing mark, under the exact scale-reading which represents the ship's bearings at any given time.

In this case, the picture seen by the navigator would be shown in Fig. 3, where C again represents the compass scale, and AB the stationary identification letters of the beacon station. As before, the letters AB remain "still" on the received picture, together with a special pointer P, and an aperture marked L, whilst the compass scale C continues slowly to move round. But at the precise moment when the rotating beam sweeps past his ship, a black bar M appears in the aperture L, and the navigator knows that the pointer P then marks his exact bearing.

Electric Motors and Dynamos—2

Their Selection. By H. SANDERS

ON large installations where a number of spare cells are used to boost up the main battery voltage as this falls owing to discharge, it is often found convenient to instal a small booster set to obtain the extra voltage required to charge the spare cells simultaneously with the main battery. A shunt regulator is essential, whether the load is constant or not, as there is usually an adjustment to be made to the field resistance of the dynamo as a result of alteration in working temperature.

Alternating Current Machines

The commonest form of industrial motor is the induction type, which may be of the squirrel cage or slip ring variety. Squirrel-cage motors are in most general use; are cheap, reliable, and will withstand a considerable amount of misuse, while being fairly efficient. There are no wearing parts, and under normal conditions their useful life is practically unlimited. Slip ring motors also have similar characteristics, but are not quite so simple in construction, and may require infrequent replacements and attention. The following points should be considered when choosing.

Squirrel Cage

The control gear is inexpensive and simple, and maintenance negligible. Starting torque varies with different types, but is roughly as follows. On three phase machines, with direct-on starting, from one to three times full load torque, depending on the size and speed of the motor.

With star delta starting, from one-third to full load torque or even more with some types.

All sizes may be safely switched direct on the line, but the starting current reaches a very high figure under such conditions, and if the current is taken direct from a supply company's mains, the consequent voltage drop may cause the rejection of the installation by the supply authority.

Star delta starting is usually employed for motors over 1 h.p. and gives fairly satisfactory results, as the starting current taken is limited to a reasonable figure, say 1½-2½ times full load current.

A further method of starting squirrel cage motors is by means of a transformer having tappings at various voltages. This is known commercially as an auto-transformer starter, the amount of starting torque and current available being proportional to the voltage obtainable at each tapping.

Slip Ring

Slip ring motors have nearly the same characteristics as a squirrel cage machine. They are, however, not quite so simple in construction, as the rotor is wound with insulated wire, connections from which are brought out to slip rings by means of which resistances may be inserted in the rotor circuit.

By this method the motor may be started up against load slowly, the starting current being limited by the resistances, which may be varied for special conditions. It is also possible to vary the running speed of slip ring motors by making provision for resistances of variable capacity to be inserted in the rotor circuit. The performance under these conditions, however, is similar to that of a d.c. series motor. Both motor and controller should be designed to suit the load, as the speed will be appreciably reduced by the controller unless the motor is fully loaded.

Starting gear for these motors is more expensive than for squirrel cage machines of equivalent size, but in view of the comparatively low starting current taken, the slip ring type of motor is usually preferred by the electric supply authority.

As an alternative to the variable speed slip ring motor, it may be found advantageous to instal squirrel cage motors of the pole changing type. These are ordinary squirrel cage motors with special windings, having connections brought out to external controllers. By means of this controller or switch, a range of constant speeds may be obtained with a maximum of four, depending upon the frequency and the motor winding. The motor will run continuously at any one speed, irrespective of the load, but fine variations are not possible.

Single Phase Motors

When single phase motors are to be considered, the position is somewhat altered. First, the starting torque of single phase induction motors is poor, in the worst instances being little more than enough to turn the motor round without any external load. This must be remembered when specifying the type of motor to be supplied.

For light starting loads, such as fans, shafting, or machines with loose pulleys or centrifugal clutches, a split phase squirrel cage machine may be used. This may be started by direct-on switching, in which case the starting torque may be anything from 40-150 per cent. with a very high current, sometimes as much as eight to ten times the full current load.

Alternatively a resistance starter may be used, but although the starting current will be less, the torque will be reduced to a very low figure (15-35 per cent. of f.l. torque).

Where a considerable starting torque is required, such as with pumps, compressors, presses and other machines which may start under load, it is advisable to use motors of the repulsion start induction types. This type has many advantages, such as high starting torque (sometimes as much as six to seven times full load torque); silence in operation; negligible brush wear; good overload capacity; etc. Such a machine, with properly designed brush gear, should give many years of trouble-free service.

It is important that the brush gear should be well designed. In the Higgs type S motor, the operating gear is totally enclosed and employs an entirely new principle. In this type it is impossible for the gear to get out of adjustment, as wear is automatically taken up by the mechanism itself. In addition there are other exclusive features in motors of this type.

Types of Starters

Standard squirrel cage motors up to and including 1 h.p. are often arranged for direct starting. This can be effected by means of a triple pole switch and fuses or alternative form of direct starting switch. If a switch fuse is used, a disadvantage is that the fuses have to be strong enough to withstand the heavy starting current, which may be 4-5 times the full load current. The fuses thus strengthened will not protect the motor against burn-out due to sustained overload of, for example, 25-30 per cent.

Direct starting switches can be supplied fitted with no-volt and overload releases of the thermal or time-lag type, and as these cost only a few shillings more than a fused switch, it is advisable to specify them. For machines of larger h.p., a star delta starter may be used, and this type limits both the starting current and torque. These starters may be fitted with no-volt and overload releases which, if properly adjusted, form complete protection against overloads on the motor.

Star delta or direct starting may be employed for large squirrel cage motors without damage to the windings, but owing to the large initial rush of current, this practice is usually prohibited by the electricity supply authority.

Slip Ring Motors

Starters for slip ring motors usually consist of a direct-on switch for the stator fitted with no-volt and overload protection, and a resistance type of starter or rheostat for the rotor. The two are usually interlocked mechanically or electrically to prevent the stator current from being switched on with all the resistance in the rotor being out of circuit. These starters may be alternatively air break or oil break, or a combination of both types. For frequent starting or heavy duty, the oil break type is more satisfactory, as the oil tends to prevent burning or pitting of the contacts.

When inquiring prices of slip ring motors, it is advisable to ask for particulars of rotor volts and ampères as these particulars naturally affect the starter prices. It is often found that although the motor price is low, the cost of the complete installation is more owing to the increased cost of control gear, cables, etc., due to the motor's having a heavy rotor current.

Single Phase Squirrel Cage Motors

Small squirrel cage motors up to 1½-2 h.p. may be fitted with an internal centrifugal switch, and can thus be started by means of an ordinary double pole switch, when the starting current will be approximately four to six times full load current with 40-60 per cent. starting torque. If it is desired to limit the starting current, a resistance starter may be used, when the current will be approximately twice full load current with a starting torque of 20-30 per cent. of full load torque. These machines cannot be supplied without either a centrifugal switch or a starter.

Single Phase Repulsion Start Motors

This type may be safely switched direct-on the line by means of a double pole switch fuse or direct starting switch with no-volt and overload features; the starting current will be as low as twice full load current, with a torque that may reach five or six times full load torque, but is usually about 3-3½ times full load torque. When it is desired to limit both starting current and torque, a resistance starter may be used that will give 1-1¼ times full load torque, with the normal full load current only on the first stud.

When ordering motors of this type, it is advisable to state which method of starting is to be used, in order that the brush rocker gear may be set for best results. Most machines are sent out with the rocker gear set for direct-starting and rotation "clockwise pulley end" unless otherwise specified.

The following tables give a list of the power for drives of various classes of machinery. Machines vary so greatly, however, while other factors, such as poor bearings, bolts, sprockets, etc., have so much bearing on the power absorbed, that the figures are only approximate. They have been collected, however, from the practical experience of outside engineers over many years, and should provide useful data. It should be borne in mind that the actual makers of the machine to be driven have designed their machine to take a calculated amount of power, and application should be made to them, if possible, in every instance The writer acknowledges the assistance given by Messrs. Higgs Motors, Ltd., Witton, for information supplied on which this article is based.

APPROXIMATE HORSE POWER REQUIRED TO DRIVE MACHINERY

Machine.	H.P.
Bottle Washers	1–3
Cement Machinery	
Roller Mills	10–20
Concrete Mixers (per cu. yd./hr.)	¼–⅞
Cranes	
Travelling Cranes 5–20 tons:	
Hoist	10
Travel	3–5
Traverse	1–3
Drilling, Boring, etc.	
Light Sensitive Drill	¼–½
Pillar Drill, 12 table	1–2
Radial 3 ft. swing	2
Portable Drills:	
up to 2 ins.	½–2½
Boring Mills, 3–5 ft. table ..	2–3
„ „ 9–10 ft. „ ..	8–12
Fans	
Exhaust, 1000–3000 c.ft./min.	⅛–½
Forge fans per fire	½
Farm Machinery	
Bone Mill	1–3
Cake Mills, small	1–2
„ „ heavy	5–10
Clover Huller	12–24
Chaff Cutter	2–5
Irrigation Pumps	10–20
Milking Machinery	
Separator, churn	½–1
Ploughs	30–60
Root Cutter	¼–1
Service Pumps	½–5
Threshers, light	5–10
„ heavy	20–40
Flour Mills	
Combination cleaning machine	1–3
Stone grinders, 2 ft. stone ..	5–10
„ „ 4 ft. „ ..	10–25
3 pr. roller mill 500–2000 lb. per hour	5–25
Dough Kneading per sack/hr.	2
Light Mixing Machines ..	½–1
Weighers and Cutters ..	1–3
Grinding Machinery	
Cup Wheel Tool Grinder ..	5
Emery, Carborundum, etc.	
up to 12 in.	½–1
ditto 12–30 ins.	1–3
Grindstones 2½–3½ ft. ..	1½–3
Guillotine Knife Grinder ..	3½
Polishing Lathe, light type	½–1
Double ended, 10 in. wheels	2
Saw-sharpening M/cs ..	½–1
Lifts	
30 ft./min. ½ ton	3–5
„ „ 1–2 tons	6–20
Express Passenger	25–35

Machine.	H.P.
Lathes	
Screw Cutting 6" centres ..	½
„ „ 12" „ ..	1–2
„ „ 24" „ ..	5
Engine	
2' swing, Carbon Steel ..	2
H.S. Tool Steel	7–10
4' swing, Carbon Steel ..	5
H.S. Tool Steel ..	15–20
6' swing, Carbon Steel ..	7
H.S. Tool Steel	25
Turret, allow roughly twice the power stated for S.C. lathe of same height of centres	
Wood Turning Lathe, 6–12" centres	1–2
Faceplate, 2½–5 ft.	2–4
„ 8–10 ft.	7–10
Metal Saws	
12" circular, cold	2
24–30" circular	4–6
Band (6" mild steel) ..	4–6
Milling Machines	
Light	½–1
Medium	2–3
Heavy	5–10
Organ Blowers	
Per 10 stops	1
Paint Mills	2–5
Planers	
Planers, 4–8' stroke	2½–5
10–15' „	7½–10
heavy	30–50
Shapers, light work up to 30" stroke	5–8
Slotters, 6–9" stroke	1–2
„ heavy	5–8
Printing & Paper M/cy.	
Letterpress and Lithographic — Impressions per hour	
Furnival Quad Demy 1600	5
Konig & Bauer Letterpress 1240	3
Double Demy Fieldhouse 1500	2
Double Royal 2-colour Payne .. 1400	3
Demy Furnival Litho 900	2
Large Alumer Press 1100	4
Five Bronzing M/cs	5
Wharfedale Cutter .. 5000	3
Baron Tube M/c .. 4500	3
Martin Folder .. 1200	2
40" Guillotine	3
Six creasing Pressing ..	9

Machine.	H.P.
Newspaper Printing Machinery	
Impressions per hour	
One 4p Hoe M/c .. 24000	20
„ 8p „ „ .. „	35
„ 16p „ „ .. „	60
„ 10p Webb Perfecting Press .. 12000	15
„ ditto .. 24000	30
„ 12p ditto .. 12000	20
„ ditto .. 24000	30
„ 32p ditto .. 12000	30
General Printing Machinery	
Demy 1500	¾
Double Crown .. 1350	1¼
Double Demy .. 1300	1½
Double Royal .. 1300	2
Quad Crown .. 1250	3
Quad Demy .. 1200	3–3½
Quad Royal 1200	3½–4
Double Demy Folder ..	½
Quad Crown and Double Demy Folder	1
Round Cornering	½
Punching & Eyeletting ..	¼
Bronzing & Dusting ..	¼–½
Envelope and Label punching	1–2
Cropper Platen	½
Guillotine Self Clamping	
26"	1
36"	2
42"	3
48"	4
Furnival centre driven high-speed machines:	
Double demy	3
Quad crown	3½
Quad demy	3½
Textile Machinery	
Bale breakers, openers ..	2–5
Beaters, Scutchers	3–8
Carding Engines, Doublers, silver lap, ribbon lap, combers, cloth pressers (each)	½–1
Calico loom 3–9'	⅓
Sailcloth loom, 5', 60–120 picks	1–1½
Lancashire loom, 40", 180–200 picks	⅓–½
Woodworking Machinery	
Circular saw, 8–16" ..	5/10
„ „ 17–24" ..	7½/15
„ „ 30–36" ..	10/30
Band Saws. Re-Saw	
Band Saw 28" wheels ..	3
38" „ ..	5
40" „ ..	7½
48" „ ..	15
54" „ ..	25
60" „ ..	30

Machine.	H.P.
Woodworking Machinery—Continued	
Rip Saws,	
40" wheels, hand fed ..	5
40" „ power „ ..	7½
42" „ hand „ ..	10
Plain Band Saws,	
30" wheels hand fed ..	2
34-42" „ „ „ ..	3
Planers for furniture surfacing, single—	
16×6	3
18×6	3
20×7	5
24×7	5
27×7	5
30×7	7½
36×7	7½
Moulders:	
Four 6", one side ..	2
„ „ two „	3
Four 6" three side ..	3
„ „ four „	3
Swing Saws:	
Dia. ins.:	
10–14	1
24–28	2
36–48	5
Planers & Matchers:	
9"×8", 14"×8", 19"×8"	15
21"×8", 24"×8", 26"×8", 30"×8"	20
30"×8" (twin)	20
9"×6", 15"×6"	15
24"×6", 30"×6"	20
Planers of Surfacing Machines:	
24"×6" to 24"×12" ..	10
30"×6" to 30"×14" ..	15
Borers:	
Post and Bench Borers ..	1–2
Horizontal and Radial Borers	1–2
Dowel Borers	3
Double Chair Borers ..	3
Multiple Borers	3
Miscellaneous	
Automatic knife grinder ..	2
Small emery wheel up to 12"	1
Ordinary sandpapering machine	2
Rabbeting and Jointing ..	2
Hollow chisel Mortiser ..	3
Heavy power Mortiser ..	3
Two spindle shaper ..	3
Reversible shaper	2

Steering Gear for Ships

An inventor has been cudgelling his brains to discover an improved way of steering ships. The orthodox method, by means of a rudder, he considers, has its drawbacks. He asserts that it is effective at speed, but its usefulness decreases with the reduced motion of the vessel.

To enable a craft rapidly to change its course when moving at full speed or at a very low rate, he points out that several inventors have proposed a device consisting of one or more transverse submerged propellers fitted to the bow or stern of the ship.

However, fitting the transverse propellers outside the hull, the inventor contends, would offer substantial resistance to the speed of the vessel. And fixing the transverse propellers within a duct or channel in a cross-tube in the bow would deprive the propeller of its full working capacity. Such a procedure would shield it from its full requirement of water supply, which might cause the propeller to "race" on depressed load transmission.

Bearing these circumstances in mind, the inventor has devised a plan which comprises a T-shaped duct situated at the bow of the ship below the water line. The longitudinal limb of this duct provides a complete bore supply of water to propellers placed inside the transverse limbs of the duct.

The main drive transmits the power to a transverse gearing, such as a worm drive or a bevel drive. On each side of this there may be a clutch to bring the left or right propeller into action. Alternatively, there can be a reversible drive or reversible propellers. Thus, the course of the ship may be rapidly changed, irrespective of its velocity. The influx of water is provided by the T-shaped duct, while the starboard or port propeller is put into operation as it is required to direct the bow of the hull to the left or the right of the course.

Geophysical Methods of Finding Oil

Science Saves Expense and Time in Oil Prospecting.

By EDWARD A. SMITH

OIL is one of the most important raw materials in this war, next to steel and coal. The fact is self-evident, but what may not be so apparent is that

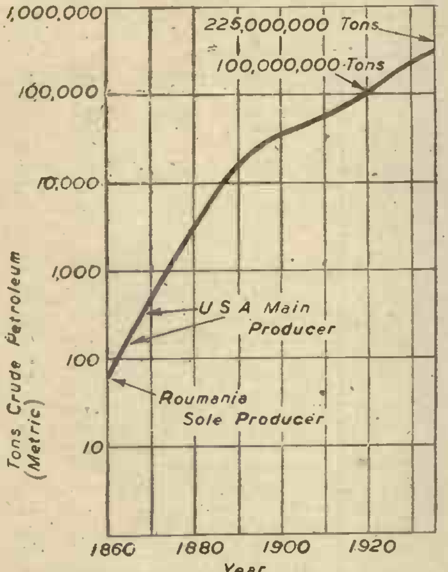


Fig. 1.—Graph indicating world production of crude petroleum. Note doubling of output between 1920 and 1930.

we are moving into an era which threatens to become completely dependent on oil. The time has passed when this important liquid could be considered as merely the key to transport on the ground and in the air. The progress of a nation is now bound up with oil, in all its phases, for the development of transport in all its forms has, in turn, speeded up intellectual and cultural progress in more remote places, has sent man here, there and everywhere, and, what is perhaps more significant than any other happening, has enabled him to wrest food from the ground more easily and more cheaply. Britain has undergone in the last four years a complete revolution in agriculture, this country being probably more highly mechanised in its farming than any other country in the world. All this depends on oil, for tractors are universally powered by the internal-combustion engine.

Oil Output

To appreciate the necessity for applying science to oil prospecting one should look at the prodigious progress made in the production of crude petroleum in the past thirty years. Before the 1914-18 war consumption was moderate, and the demands on the oilfields correspondingly low. With increasing consumption, prospecting and drilling had, perforce, to be speeded up. This meant more accurate methods had to be employed, which would not only locate oil-bearing strata more rapidly but indicate the potentialities of the deposit.

Fig. 1 indicates the rise in production of crude petroleum in the world in the past fifty years or so. It might be explained, for the benefit of those who are not acquainted with petroleum, that the fluid usually pumped up from the earth is a black, tarry, and evil-smelling mixture, bearing no resemblance whatsoever to the typical lubricating oil which we use in a motor-car. From this crude petroleum, as it is called, is distilled petrol, kerosene and other light fractions. Then follows the heavier oils in the petroleum, such as lubricating oils, and after the gelatinous greases are extracted, there is left a residue of black pitch.

Roumania was the first country in the world to tap her petroleum deposits, with a production in 1857 of 275 metric tons. Two years later the U.S.A. followed, with an output of about the same, after which Italy commenced boring, but yielding only a small output for many years. By the opening of the twentieth century most of the countries to-day producing petroleum were pumping up the stuff, or, to be more accurate, pumping it into storage tanks, for usually petroleum gushes up when an oil bed is tapped, the problem being to throttle down the flow. In recent years the presence of adequate oil deposits has been suspected, but no spectacular results have followed drilling, in Great Britain. Small wells, with low outputs of a rather poor-grade of oil, have been operated, but the results have proved somewhat uneconomic. Detailed explorations of various parts of the country have been made, with promise being offered in Sussex and some of the south and mid-southern counties.

Fig. 2.—Main areas of developed petroleum fields.

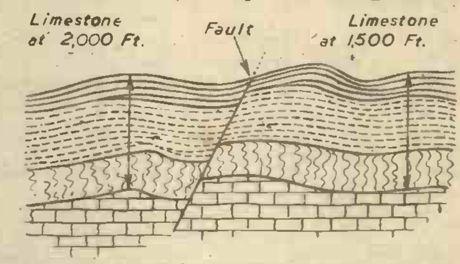


Fig. 4.—A simple faulting of strata, showing effect on the position of a bed.

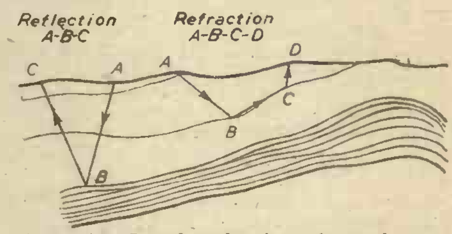


Fig. 5.—Reflected and refracted sound waves through strata.

In Fig. 2 is shown the approximate distribution of petroleum in the world to-day, although it should be added that there are many other fields ready for development when the war is over and when transportation methods render those fields more accessible economically. It will be apparent that oil is ubiquitous, and when one reads about so-and-so country's oilfields, one is apt to imagine that oil is the peculiar privilege of certain nations. Before long it is anticipated that most civilised countries will have found their own oil and will be developing their oilfields.

Geology of Oil Deposits

There is a popular misconception that oil usually occurs in vast underground lakes, which only have to be located and tapped to produce excellent quality oil. More often

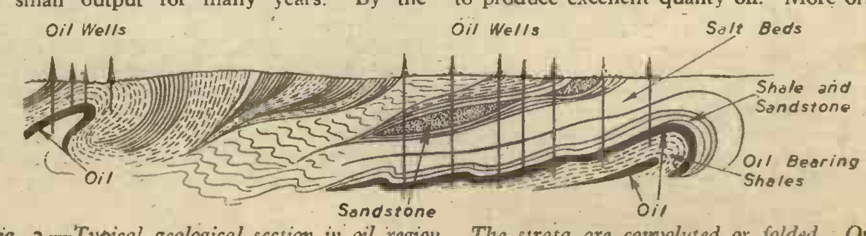


Fig. 3.—Typical geological section in oil region. The strata are convoluted or folded. On the extreme right is an overthrust.

than not it occurs as oil-bearing sand; that is to say, huge beds of sand occur, saturated with oil, and when these beds are penetrated, the oil which is compressed into them flows out from the sand, sometimes carrying water and other impurities with it. Geologists have learned sufficient about the earth's crust to be able to say that certain rock beds occur usually in association with others of a known type. Thus, limestone of a particular variety would indicate the presence of neighbouring coal seams. Furthermore, the geologist knows that the layers of rock and other deposits below the ground are seldom flat, but almost always convoluted. In Fig. 3 is illustrated some typical strata, and it is most important to appreciate this irregular configuration, for it is one of the reasons why oil accumulates in fairly well-defined deposits. Water is likewise trapped and tends to collect into underground reservoirs, saturating chalk or sand layers or lying in fissures, the water flowing to

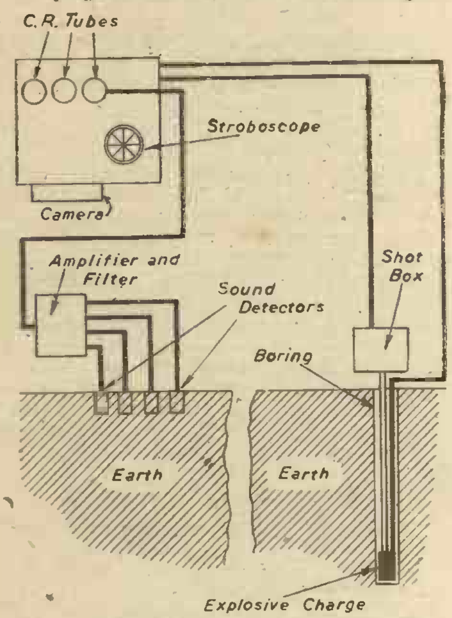


Fig. 6.—Layout for seismic projecting.

the collecting point by gravity, and being unable to leak away because of adjoining impermeable strata.

In the illustration of strata in Fig. 3 it will be seen that the oil, or it may be water, flows to the permeable sand by gravity, sometimes aided by underground pressure due to other causes, and will be stored there until tapped by man. A detailed knowledge of the geological formations of a particular area of country is required before prospecting can begin. If this information, or stratigraphy as it is called, is known, then it may be possible to predict the positions for detailed prospecting, without having to examine many miles of country. A good

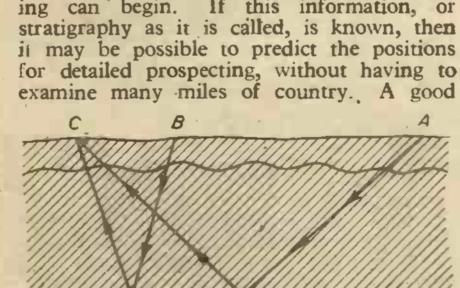


Fig. 7.—Two reflection waves received at a receiving station at different times.

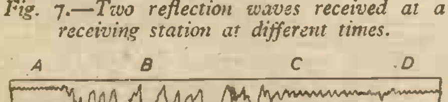


Fig. 8.—Seismographic record of reflection waves. A, initial wave (normal); B, shock wave; C, dying away wave; D, normal wave.

example of stratigraphy proving its worth was shown with the coal seams now being worked with success in Kent. The presence of these seams was predicted before the last war from a knowledge of the surrounding strata by a famous geologist of the day. Bores were sunk at the time, and no coal found, it being then assumed that the geologists' views were incorrect. But geology is an exact science, just as is chemistry, and some years later coal was actually traced, a few miles away from the predicted area. The slight error above was due to faulting in the strata, a common occurrence, a simple fault being illustrated in Fig. 4. Faulting of this kind, and more elaborate types, may upset calculations with oil prospecting, but the geologist and geophysicist are on their guard for such irregularities. The great value of geophysical methods of prospecting lies in the fact that they surmount many of the difficulties of stratigraphy, and sometimes reveal abnormalities which might pass unsuspected. It should be remembered that in this matter one is dealing with layers of rock which may be over ten thousand feet below ground level, and there is no way of "digging down to see for oneself." A bore may be sunk to find out the thickness and disposition of the layers at different depths, or core drilling, as it is called, but only a relatively small section of the strata can be covered in this way, and deductions have to take into account the possibilities of faulting or some abnormalities occurring a little way from the bore hole.

The Principles of Geophysical Methods

The older methods of finding oil depended on visual signs; that is to say, if oil gas was found emanating from the ground, or oil noticed on the surface, that particular area of country was deemed to have oil-bearing strata. Indeed, the method was as sure as it was simple, but it told the oil prospector little or nothing about the extent of the oil beneath. Then came core drilling, to find out if there was any likelihood of oil occurring in a certain area. By this means a tube of the strata was drawn up

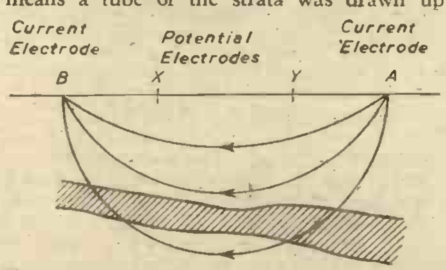


Fig. 10.—Path of current between two electrodes buried in the ground.

from below and the various layers in it examined. If the indications were good, a proper bore hole was sunk. But it happened frequently that a blank was drawn, and as drilling is an expensive matter, fruitless efforts in this connection might drain the capital of an enterprise formed to acquire oil.

Geophysics has changed the outlook on prospecting a great deal in the past 20 years.

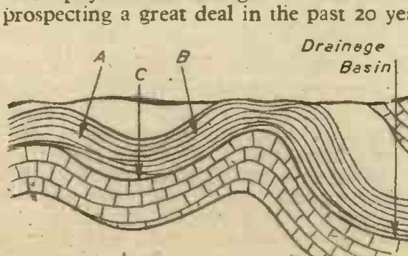


Fig. 9.—Folding of strata can mislead oil prospector.

As the words implies, it means the application of physics to the study of geology, or the strata in the earth. It is essentially a scientific method, and is virtually a specialised branch of physics, utilising, as it does, seismographs, electrical instruments,

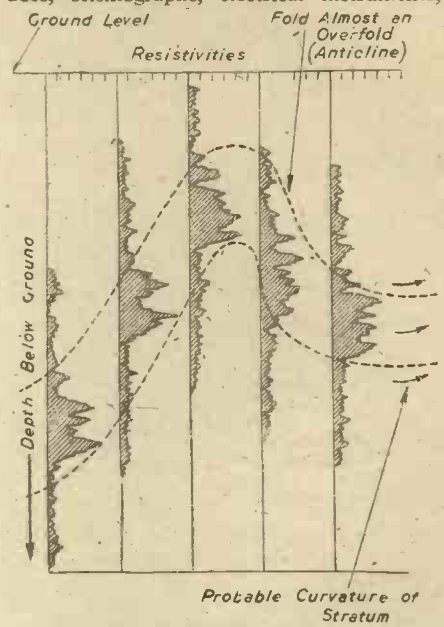


Fig. 12.—Showing resistivity measurements, reveal folds, etc.

highly sensitive galvanometers and magnetometers, not to mention the large amount of other apparatus which a geophysical exploring unit carries with it when looking for oil.

There are four main methods at present in use. Firstly, there is the seismic method, which relies on the observation of shock waves sent through the ground in the area

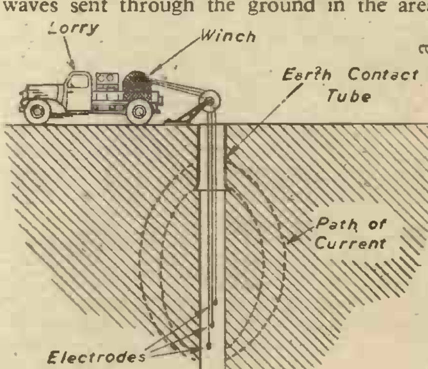


Fig. 11.—Set-up for electrical coring.

being prospected, the waves being timed on electrical apparatus. The second method relies on the different magnetic permeabilities of various types of strata. Thirdly, there is electrical technique, which measures the conductivity of strata, to find out their character, and the last method here considered is that depending on gravitational observations, calling for highly sensitive apparatus.

Seismic Method

It is well known that sound travels faster through solids than through air. The velocity through air is approximately 1,100ft./sec., and about five times that speed in liquid, and even high in solids, the velocities in the latter depending on the type of solid. It is thus evident that, as the strata beneath the ground will have widely different densities and hardness so will the velocity of sound differ in them.

Seismic prospecting is further divided into two sections: refraction and reflection methods. Sound, when it passes through a solid or liquid undergoes refraction in much the same manner as light in its passage through glass, or to put it in another way, the sound waves are diverted slightly from their true path. The reflection of sound, again following the light analogy, is too simply appreciated to need further explanation. The refraction and reflection of sound in strata is shown schematically in Fig. 5.

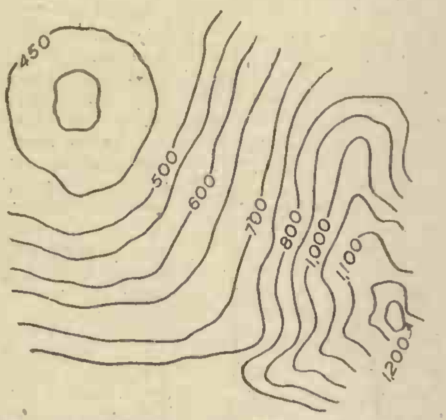


Fig. 13.—*Magnetic contours, each contour representing fifty gammas.*

In practice the geophysicist uses a large charge of explosive, such as gelignite, which is exploded near the surface of the ground. The recording stations, at which the sound equipment is located, will lie some distance from the source of the explosion, sometimes a matter of thousands of yards. This sound equipment, the main instrument being a sensitive seismograph, is linked by electrical means, such as a telephone line, to the seat of the explosion, so that the exact time of the explosion can be recorded. To make sure that the exact moment is logged of the commencement of the explosive wave on its travel through the ground, electrical wires are wrapped around the explosive charge. When the charge bursts, which is the beginning of the shock wave, the wires are broken and a circuit broken, this being recorded at the sound station some distance away.

The sound travels to the station in more than one path. There is first of all a shock wave which proceeds through the surface layers and through part of the lower layers. The set-up of a station for receiving these waves is shown in Fig. 6, which will help to understand the sequence better. How the waves are reflected is shown in Fig. 7, and from a correlation of time and distance with other factors, the depth of the stratum shown in the illustration can be calculated. The shock wave is followed by a succession of smaller sound waves of more regular frequency, and a typical seismographic record is reproduced in Fig. 8. The various types of waves are shown on the illustration, and the resemblance of the recording to an earthquake recording at an observatory will be evident. In the artifical production of miniature earthquakes in this way a matter of five or ten pounds of explosive only is used. Sometimes this is buried to a depth of 50ft. below the ground level, to eliminate surface effects as much as possible.

The reflection method is best suited to the examination of what the geologist calls sub-surface layers, or strata which do not lie more than a few hundred feet below ground level. When deeper examinations are required the refraction method is adopted. Except that the interpretation is theoretically different the practical set-up is much the same as for reflection work. Mathematical treatment of the practical results shows the relative depth and dip of certain strata, and consequently tells the oil prospector the configuration of the underground layers. And as has been already mentioned, he knows that particular types of strata indicate oil-bearing sands and shales, so that he can decide where to sink a bore. Consider, for example, the hypothetical case in Fig. 9, where the strata are shown convoluted. If the oil prospector assumed that because of the dip in the layers of rock at A and a corresponding or opposite dip at B, that there would be an accumulation of oil at C, he might risk an expensive well at that point to find nothing. The fold at B would have misled him, but geophysical observations would have warned him that there was such a fold, and would have led him farther along to the true drainage basin.

Electrical Technique

The electrical conductivity of rock layers will vary appreciably, and having determined the appropriate values for the various types in the laboratory, it is possible to send a current through the surface layers of the earth and interpret the results geologically. The idea is shown diagrammatically in Fig. 10, the path of the current being neither semi-circular nor truly elliptical, but a departure from both, which has been explained mathematically.

It will be seen from the diagram that there are three resistivities, two of which are given by the soil above the strata D, and one for the latter itself. In practice both current electrodes, that is to say, from which current flows, and two or more potential electrodes, are sunk into the soil. The last-named electrodes give the gradient or potential at their respective locations. Essentially this method enables the presence of beds of good electrical conductivity to be detected, as for example, a metalliferous stratum or a layer of salt water. If one can follow such underground deposits by moving the electrodes across the area being prospected, the dip, inclination, folding and other geological features can be mapped. This, in turn, enables oil to be predicted at some particular locality. Oil, it should be remembered, is a bad conductor of electricity, so this tends to operate in favour of the more conductive layers, but does not enable oil to be detected directly.

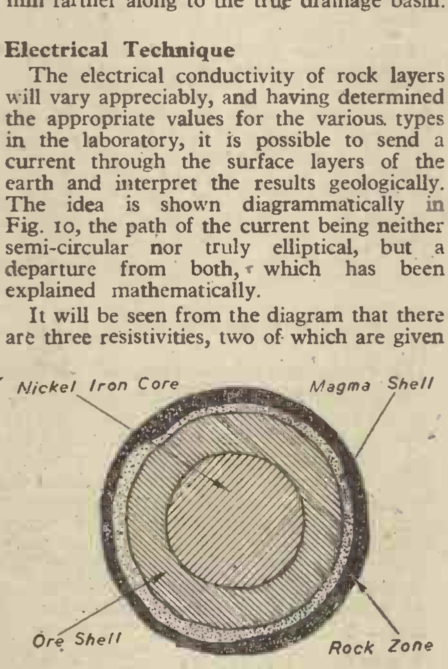


Fig. 14.—Reconstruction of composition of the earth from magnetic geophysical measurements.

Electrical Coring Method

In recent years there has been a tendency to employ another electrical method, namely, electrical coring. This core drilling, or the sinking of a bore to obtain a cross section of the strata below, is allied with electrodes, which are sunk down the bore hole and measure the resistivity of the strata. The set-up of the equipment for this technique is shown in Fig. 11. It will be observed that efficient contact between the soil and the recording apparatus is effected by a liner or casing in the top part of the bore hole. Three electrodes, lowered down the hole by means of a pulley on the lorry, represent the other end of the electrical circuit, and the paths of the current from two of them are shown by the dotted lines.

The resistivities are recorded on automatic equipment, and a continuous record made. In Fig. 12 is shown the sort of chart one obtains, and it will be seen that the position of maximum resistivity moves about, according to the position of the drilling. It is assumed that six bore holes have been sunk. The relative positions of the maximum resistivities indicate the folds of a stratum which may be a poor conductor. In Fig. 12 an anticline, or hump, in the stratum is revealed, and such information will prove of the utmost value in tracking down the oil-bearing sand or shale. In the same way, of course, synclines, which are hollows, and the opposite to anticlines, can be detected, indicating possible basins into which oil might drain.

From what has already been said, it will be appreciated that much reliance is placed on accurate instruments, and without such scientific devices geophysics would not be possible in oil prospecting.

Magnetic Method

Reference to instruments brings one to the last technique to be described in this article: magnetic prospecting. As the description implies, it depends on the characteristic magnetic permeability of different rocks, and from measurements, maps can be constructed, similar to that shown in Fig: 13. There is a resemblance between this technique and the electrical resistivity method, except that more importance is attached to the handling of the instruments, and the avoidance of interference. In Fig. 14 is shown a construction of the earth's crust, deduced from magnetic measurements, and it will be seen that the field is not so symmetrical as one imagines.

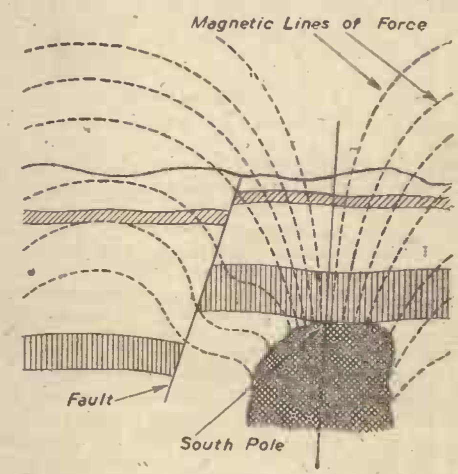


Fig. 15.—How a metal ore inclusion effects magnetization. Note also the influence of the fault.

There are three magnetic effects to be taken into consideration when using this method: The normal earth's field, local magnetic fields, due to local deposits of metalliferous ores, and thirdly, intra-local magnetic effects, which are due to the reaction of the local fields. These three must be separated, so that purely local effects can be isolated and suitable deductions made.

What happens to the local field in the presence of a metal inclusion in the strata and to faulting of the latter, is illustrated in Fig. 15. It is obvious that if sensitive instruments are moved along the surface, a complete magnetic map of the area can be plotted, and the faults of other underground features, unseen, of course, recorded.

Inventions of Interest

By "Dynamo"

A Shoe-repairing Tip

IN pre-war days there used to be boot-shops which made a speciality of repairs "while you wait." This is sadly true in these difficult days when one has to wait a month while one's shoes are soled and heeled.

To assist the unskilled to reinforce their heels with rubber is the aim of an invention for which a patent in this country has recently been applied. It consists of a form of tip which can easily be attached to a worn heel without the necessity of renovating any part of the leather.

In order to make the customary kind of tip fit effectively it has been imperative to cut away one or more layers of leather. This slicing is not an easy job for the amateur shoe repairer.

According to the invention in question, the rubber tip is practically of the usual shape; but it has a concave surface on that side which has to be applied to the heel. The curvature of this concave surface is such as to agree with that normally acquired by the heel during wear. And at its thickest edge it is of a thickness in excess of the amount of wear.

By means of this device it is maintained that an unskilled person can place the tip in position.

To Clean Fur

THE fur coat is one of the most effective shields against the frigid assaults of Jack Frost. If it be preserved from the ravages of its relentless enemy, the moth, it is undoubtedly a perennial sartorial investment.

I note that, among the applications accepted by the British Patent Office is one relating to a new process for cleaning fur coats. In the trade, I understand, the usual practice is first to clean the fur by rubbing it with hardwood sawdust saturated with naphtha. This process is carried out by hand or by means of what is known as a tumbling drum. The fur is then beaten to eliminate the sawdust.

The newly devised process supplements the above method by brushing the fur with a solution of carbon tetrachloride and water. This, it is affirmed, in conjunction with a covered warm iron, removes the surplus dirt remaining in the fur.

Magnetized Map

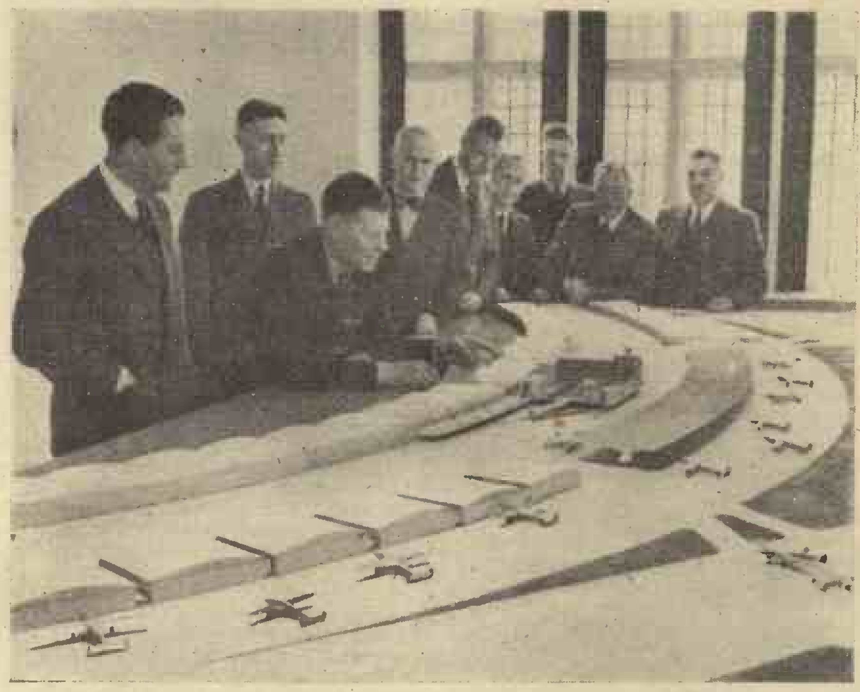
THE map invariably plays an important rôle in the theatre of war. Not only do the generals intently scan it, but it is the cynosure of a countless staff of amateur strategists. From many an armchair the movements of the contending hosts are eagerly traced on the map. And the relative positions of the belligerents are duly registered thereon, usually by pins with flags attached.

To prevent injury to a map by the use of marking means, it is sometimes laid in a horizontal position on a demonstration table. But this is disadvantageous, as considerable space is required. And, if many, observers round the table may be compelled to look over the shoulders of those in front. An additional inconvenience is the fact that some of the spectators have an upside-down view of the map.

It is certainly a desideratum for a map to be hung on a wall to enable observers to regard it in comfort. An inventor has now conceived an idea for marking, without damage, a map fixed in such a position. The map he has devised is provided with a magnetizable sheet backing, for example, of iron. Over this the map is hung loosely in order to be changeable.

The information on this page is specially supplied to "Practical Mechanics" by Messrs. Hughes & Young, Patent Agents, of 7, Stone Buildings, Lincoln's Inn, London, W.C.2, who will be pleased to send free to readers mentioning this paper a copy of their handbook, "How to Patent an Invention."

The carriers of the marking means are formed of magnetizable metal and will be held by magnetic force in position on the map. This force may be supplied either by the magnetization—for example, electrically—of the map backing, or by small, permanent magnets bearing the marking signs.



Mr. F. G. Miles, F.R.Ae.S., discussing a model of a proposed new airport with Mr. Guy Morgan (left.)

Gun Loader

FEEDING ammunition to machine guns is the subject of an application to the British Patent Office. It concerns guns, particularly those mounted in aircraft, which fire at a very rapid rate projectiles considerably heavier than bullets.

The inventor prefaces the description of his device with the remark that this kind of loading mechanism presents special problems.

If the cartridges are arranged in magazines or chargers clipped on to the top of the breech, there is the difficulty that a charger containing an adequate number of rounds is so heavy that it cannot conveniently be manipulated in the gun turret.

On the other hand, belt feed occasions difficulties not met with when rifle ammunition is used, owing to the weight and bulk of the individual rounds.

In the case of the new invention, the cartridges are held in a belt or chain from which they can be extracted sideways. The breech of the gun is designed to receive each cartridge from the side. And an arcuate guide, concentric, or approximately so, with gun trunnions, is arranged to co-operate with the base of each cartridge as it comes to the loading position. Consequently, it is forced to take up the same angle of elevation as the gun itself. Thus, when it is pushed out of the belt or chain, it is in the correct angular position to pass readily into the breech.

To Save Life at Sea

IN these dangerous days Mars at sea adds his quota of peril to that normally contributed by Neptune. Therefore, any invention which makes for the saving of life on the ocean is naturally welcome.

An improved lifeboat has hove in sight, and is cylindrical in shape. Secured to its bow and its stern are air tanks. And there are a number of longitudinally aligned hatchways, each having a pair of hatches hinged on their outer edges so that they can be folded inwards to close the hatchways.

If desired, the hatches can be folded outwards.

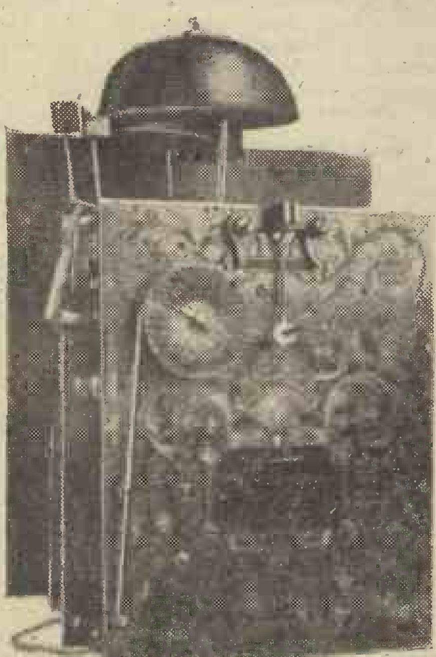
Masters of Mechanics.

George Graham—Watchmaker Pioneer

THEY called him "Honest George Graham," this curiously genial and inoffensive old Quaker watchmaker. He kept all his spare money in a brass-studded wooden strong-box which lay in a room above his Fleet Street shop, and although he frequently lent considerable sums to the needy, he would never take interest for his loans. For that reason, also, he would never invest any of the money which, in his mature years, flowed freely into his coffers from the Government funds of the day, for such official loans carried fair interest rates.

The civilised world acknowledged George Graham as one of its cleverest mechanicians and instrument makers. When a band of members of the far-famed French Academy of Sciences were sent North to make observations for accurately determining the curvature of the earth, it was George Graham, of London, who was considered to be the finest man in Europe to supply the necessary instruments for the expedition.

And yet this George Graham was, to all intents and purposes, a man whose earlier career had completely lacked that systematised (and nowadays compulsory) schooling which we are pleased to term "education." He was of very obscure origin, his parents being humble landspeople of the Cumberland heights. It was in the parish of Kirklington, Cumberland, that George Graham first saw the light in either 1673 or 1675, the exact year of his birth being uncertain. If he received any learning at all in his early years, it must only have been concerned with the elements of reading and writing, with, perhaps, a smattering of arithmetic. George Graham seems to have been one of those inborn geniuses to whom ability and practical knowledge come at the slightest endeavour. And, of course, in Graham's case, the subject of his genius was *mechanism*, the finer and the more delicate, it seemed, the better.



A rear view of the bracket clock shown in the opposite illustration. Note the highly ornamental back plate, which was a characteristic of clocks of this period.

George Graham shared the sturdy uprighteousness and independence of the Cumberland "Friends" in whose tenets and beliefs he was brought up. He must have been only about 16 years of age when he decided to tramp the hard, long road to London, the city which at that time was settling down to industry and affluence after the long unrest which it had passed through during the "protection" of Cromwell and his partisans.

George Graham.

Thomas Tompion

Perhaps, in his younger years up in Cumberland, young Graham had earned a name for himself as an amateur mechanic, a wheelwright, a repairer of this, that or the other and a general handy youth about the farm. We just do not know anything about this, however, so it is useless to proceed further with such speculations. What we do know is that shortly after Graham got to London he became (probably by influence of the Society of Friends) apprenticed for seven years to a certain Henry Aske, a noted clockmaker and a member of the old Clockmakers' Company. Graham seems to have acquitted himself more than usually well with Henry Aske, for, after the completion of his period of apprenticeship, he was admitted, in 1695, a Freeman of the Clockmakers' Company. Immediately afterwards, he entered the employ of the renowned Thomas Tompion, the "father of English Clockmakers."

The Tompion-Graham relationship was an extremely happy one. It was a case of one genius recognising another. In fact, a lasting friendship sprang up between the master, Tompion, and the assistant, Graham, a friendship which was only severed by the death of Tompion in 1713.

There is little doubt that the ultimate result of Graham's working day by day under the friendly ægis of the celebrated Tompion was his acquisition of a practical mechanical ability which far exceeded that of any of his contemporaries. The continual inspiration which he derived from the master-mechanic, Tompion, coupled with his own inborn mechanical genius stood George Graham in good stead throughout his life. After Tompion's decease, he took over the business of this king of clockmakers, and carried it on conscientiously and assiduously until his own death nearly forty years later.

The reputation which Graham made for himself as a watch and clockmaker resulted from the above two factors. Tompion's clocks were in great demand and were bought at the highest prices, but, after a time, Graham's timepieces obtained a similar reputation. The time came, however, when George Graham turned away from the exclusive making of clocks and watches. His was the mind which soon became surfeited with routine and repetition. His was the mentality which nourished itself on improvements and even on the introduction of new principles. That is why George Graham's name has descended to posterity not so much as that of a highly successful clock and watchmaker, but, rather, as that of a clock inventor, and an instrument designer.

Dead-beat Escapement

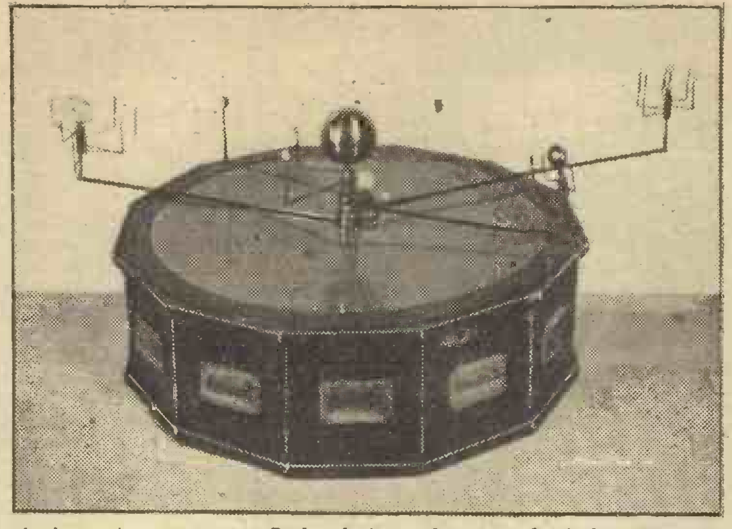
One of Graham's horological inventions comprised his creation of the dead-beat escapement. This type of escapement, which was introduced about the year 1715, afforded a better mode of timekeeping than had ever been previously possible. The older clock escapement, favoured by Tompion and others, had been of the "anchor" type which had originated in the ideas of that somewhat erratic genius, Dr. Robert Hooke, Secretary of the Royal Society, about 1675. Graham's dead-beat escapement did not subject the escape wheel of the clock mechanism to suffer any recoil movement. Hence its appellation, "dead beat." With the dead-beat escapement, the escape wheel advances through the

A British clock of Graham's day. This clock was made by John Topping, of London, c.1695. By pulling the small gut line shown on the right of the clock, it strikes the hour to the nearest number. It is thus termed a "repeating clock."

space of half a tooth at every impulse which is given to it. During the intervals, it remains absolutely stationary, being locked by one of the impulse pallets.

In 1720, Graham gave up Thomas Tompion's old premises, and moved to a new shop of his own choosing. The *London Gazette* of March 22nd, 1720, thus chronicles the removal:—

"George Graham, watchmaker, is removed from the corner of Water Lane, in Fleet Street, to the Dial and One Crown on the other side of the way, a little nearer Fleet Bridge, a new house next door to the Globe and Duke of Marlborough's Head tavern."



A planetarium or orrery. Such a device produces a mechanical representation of the motions of the heavenly bodies. The orrery here illustrated was constructed shortly after Graham's death.

It was in these "Dial and One Crown" premises that George Graham spent the rest of his life with his family and his apprentices and assistants. Here, in the little workshop behind the bow-windowed shop, he patiently worked out his clock, watch, and instrument inventions. And it was in the diminutive private sanctum above the shop that the scientists and, in particular, the astronomers of the day, were wont to consult with the now famous clockmaker over their own mechanical problems and perplexities.

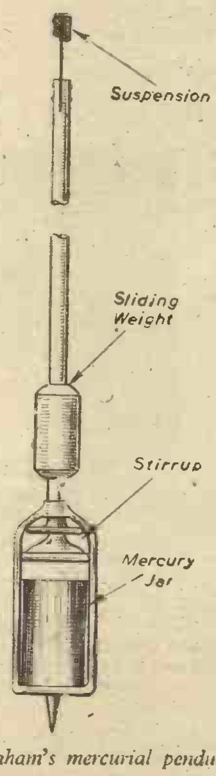
In 1720, Graham was elected a Fellow of the Royal Society. Two years later, he was made a member of the Council of that august body. All his discoveries were published by him in the Society's *Philosophical Transactions*, the volumes of this publication containing nearly two dozen papers by Graham on different mechanical subjects.

"Cylinder" Watches

It was in 1725 that Graham introduced his "cylinder" escapement for watch mechanisms. Essentially, this comprised an improved form of an earlier escapement originally due to Tompion. In Graham's cylinder escapement, the teeth of the escape wheel engaged with the surface of an incomplete cylinder upon which the balance of the watch was mounted. The necessary impulses were provided by the inclined face of the teeth which acted upon the edges of the miniature cylinder. By this means, the teeth were alternately locked and released. The impulse surfaces of the teeth were rounded to permit of accurate contact with the cylinder edges.

Graham's escape wheels which he used in his watches were made of brass, but his cylinders were often of ruby. The cylinder escapement demanded very careful construction, and, for this reason, although Graham himself discontinued the making of watches with the older "verge" escapements, many other makers did not, so that for many years after Graham's death "verge" watches were still being turned out by the commoner and less experienced makers.

Graham's policy was ever to put the best of workmanship into every creation of his. Many contemporary clockmakers relied upon a profusion of artistic ornament to cover up imperfections of mechanical workmanship. With Graham, however, superficial ornament came last. Mechanical quality, not artistic elaboration, was his aim, a reason which accounts for the peculiar plainness of Graham's clocks in contrast to the artistic elaboration of the horological creations of the majority of his contemporaries.



Graham's mercurial pendulum.

Perhaps Graham's chief clockmaking creation was his mercurial pendulum. This appeared in the year 1726, and was first announced by Graham in a paper which he contributed to the Royal Society entitled "A Contrivance to avoid irregularities in a Clock's Motion by the Action of Heat and Cold upon the Pendulum."

Mercury Pendulum

It was well known to Graham and other clockmakers that the expansion of a pendulum rod in response to varying temperatures seriously interfered with the accurate timekeeping of the movement. There is some evidence that Graham had been experimenting with mercury of quicksilver over a number of years. His ultimate idea, as embodied in his mercurial compensating pendulum, was to attach to the pendulum a vessel partly filled with mercury so that the mercury vessel acted as the pendulum bob. When the pendulum rod expands, the "stirrup" or frame containing the mercury vessel descends. But the mercury in the vessel expands upwards, thus tending to raise the centre of gravity of the pendulum. The upwards expansion of the mercury is considerably greater than the downwards expansion of the pendulum rod and stirrup, but by adjusting the actual volume of the mercury present, these two opposing expansions can be made to counteract each other.

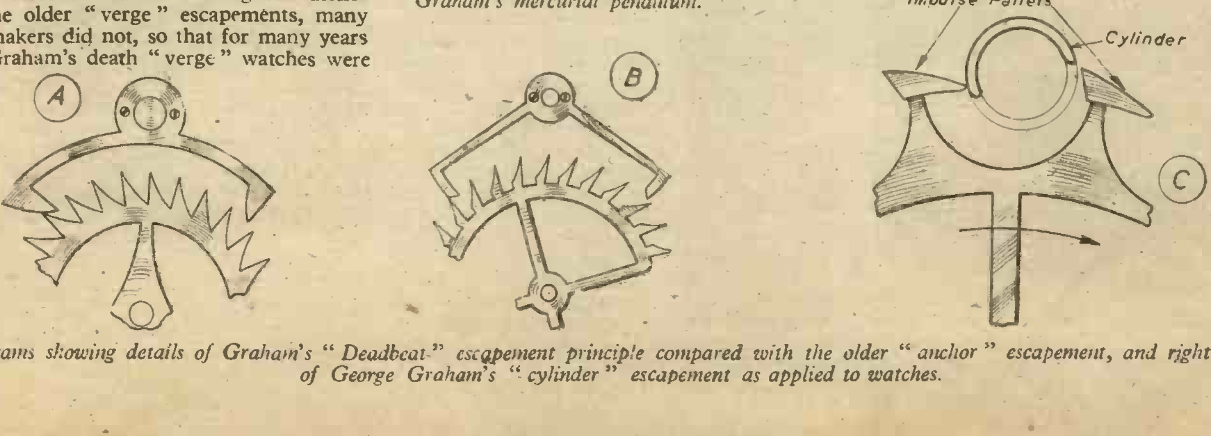
For first-class work, Graham's mercurial pendulum has been very much used, although for more ordinary horological construction. it was superseded not much later by John Harrison's "gridiron" pendulum in which the pendulum's expansion was controlled by a gridiron arrangement of vertical steel and brass rods comprising the bob of the pendulum. It has been suggested, and, probably, with much truth, that the gridiron pendulum was, in its essence, Graham's original idea, although Harrison himself actually worked it out in practice. Such a point has been much discussed, but it will never be decided conclusively.

George Graham had ever an inclination towards astronomical learning. As his clock, watch and instrument-making business became more and more successful he devoted more and more time to the pursuit of practical astronomy.

Divided Circles

After reliable timepieces of first-class workmanship, the next thing which the practical astronomer in his observatory requires is a well-divided circle for the measurement of his angles. It was for the making of such "quadrants" or portions of accurately-divided circles that George Graham became very famous.

(*To be continued.*)



Diagrams showing details of Graham's "Deadbeat" escapement principle compared with the older "anchor" escapement, and right, details of George Graham's "cylinder" escapement as applied to watches.

THE WORLD OF MODELS

A Variety of Models You can Make as Christmas Gifts

By "MOTILUS"

IN view of the latest Board of Trade regulations it would appear that there will be a very poor selection of Christmas presents for the young. Mechanical toys, apart from a few secondhand ones,

Fig. 1.—A simple model ship propelled by camphor.

are absolutely off the market, and no manufacturer of toys or models is allowed to use the necessary metal, even if the skilled labour was available. As regards wooden toys, the limit of retail price is now 24s. 6d., and these must not contain more than 10 per cent. metal, which sanctions just enough for a few screws and nails, and perhaps one or two corner plates.

So my article this month is devoted to a few ingenious model toys which those who are clever with their fingers can no doubt turn to good account as gifts for the "festive season," and as variety is still the spice of life, you will see I have chosen models from different spheres—model ships, model furniture, model trains and accessories for the model railway hobby.

Model Ships Propelled by Camphor

The first illustration shows you probably

Fig. 2.—The "camphor ship" of the skilled craftsman.

the simplest and most economically operated ship model in the world! All that is required to drive it is a small piece of camphor (obtainable from any chemist at 3d. a block). The illustration, Fig. 1, displays a model ship made of just a flat piece of balsa wood for the hull, a matchstick for the mast, and white paper for the sail. Could anything be neater or easier?

Actually, any type of ship may be modelled, provided it is not longer than three inches, as the propelling power of the camphor is limited. The hull should always be of a light wood—balsa is easily the best, or lime if this is not obtainable — and any details can be added according to skill and individual taste. It is advisable to paint the model in oil colours and gum it on to a piece of thin celluloid (see Fig. 2). This celluloid should be larger than the ship's hull and a "V" piece must be cut out at the stern, in which a piece of camphor, the size of a small pea, is wedged. The illustration shows this in detail. The ship—an exquisite little galleon model, the work of a skilled craftsman—is made stable on quite a large piece of celluloid, but being transparent it does not detract from the appearance of it when on the water.

Now for the launching. Fill a glass bowl or dish with water, and before "floating" the model draw a piece of paper across the surface of the water to remove any grease. Then lower the model gently on to the water by the mast, and it will cruise around for some considerable time, and will not stop until the water gets dusty or the power of the camphor is exhausted.

A Model Table

While on the subject of models in wood, a craftsman made for me recently a 1in. to the foot model of one of the best of the articles of furniture in the range of Utility furniture designed by the Board of Trade.

There is nothing new about this form of extension table (as shown in Fig. 3), but in my opinion it is one of the most satisfactory methods of increasing a table, as required, to nearly twice its length. This model is made in kauri pine and beautifully finished. The sliding extension leaves function with precision, and the illustration, I am afraid, does not do justice to the fine craftsmanship and detail which have gone into the making of this small piece of model furniture. Why not try your hand at something similar? It would make an excellent gift for a little girl for December 25th.

Fig. 3.—1 inch to the foot scale model of an extension table.

Fig. 4.—Waterline models of warships being constructed in large number for Government work.

Waterline Models in Presentation Cases

It is hardly possible to publish drawings in this feature, because of the very limited space available, but Bassett-Lowke, Ltd., of Northampton, and almost every other dealer in models and toys, keep in stock drawings with details of construction for many types of waterline models including battleships, aircraft carriers, cruisers, destroyers, submarines and merchant ships of various tonnages (Fig. 4).

These can be constructed from small pieces of wood, Bristol board, pins, or pieces of fine wire and seccotine. For the hull it is recommended to use a fine grain wood, like lime, free from knots, so that it will

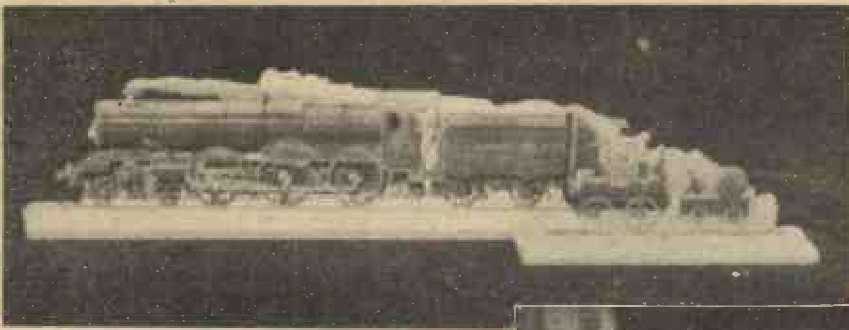


Fig. 6.—Cut-out locomotive models of the 4-6-0 G.W.R. "King George V" and Stephenson's "Locomotion No. 1." The smoke added by the artist avoids the necessity of cutting out the fine detail of the locomotive outline, and actually adds realism to the scene.

finish to a smooth surface. The decks and deck houses are of Bristol board and wood, the guns and turrets small pieces of wire, and the funnels of paper rolled round a wooden former to several thicknesses and then glued together. When it is quite dry the funnels can be cut off to the required lengths (Fig. 5).

Waterline models like these—a few inches long—make excellent gifts for someone who has a father, son or brother in the Royal Navy or the Merchant Navy, and as models get dusty, one can also make a little glass case to contain them. It is comparatively easy to obtain small pieces of glass—in fact, a photographer friend who has some old plate negatives would no doubt help you in this matter. Then, if you get some gummed binding strip in the colour required, you can construct a *passe-partout* case, and glue or fix this into a wooden base, with the grooves ready cut out. A most acceptable gift, and one with a touch of individual thought in it.

Locomotive Cut-outs

In a series of articles in PRACTICAL MECHANICS about a year ago, Mr. W. J. Bassett-Lowke dealt with the Progress of the British Steam Locomotive, complete with drawings, commencing with the "Pen-y-darren" of Richard Trevithick and concluding with the latest types of British and foreign locomotives. When he gave a lecture to the Leicester Youth Education Conference in August last, on the Fascination of the Model Railway, he had with him a complete series of cut-out models made from these drawings. All the students were keenly interested, and many of the railway fans have since started building up a similar series for themselves. This is quite an interesting and at the same time fairly simple job. Bassett-Lowke, Ltd., supply the full range of black line drawings (at 1s. 6d. a sheet post free). They are to the scale of 3½mm. to the foot (viz. "00" gauge). To make the cut-outs, the drawings should be firmly stuck on to thin plywood (there are plenty of scraps of this if you search around in these days). When thoroughly dry, cut out with a fine fretsaw, and to finish off attractively paint the model in its correct colours and varnish. To display to best advantage, make a small base about 1in. wide, with a slot down the centre in which the plywood shape can be fixed.

Fig. 5.—A 50ft. to 1in. model of the "Great Eastern"—Brunel's famous ship, built at Millwall, London, in 1858. It could carry 4,000 persons and was a wonderful achievement for its time. It was propelled both by paddles and screw.

Why not select the favourite locomotive of your railway-minded friend and present him with a coloured cut-out for Christmas? The photograph reproduced in Fig. 6 shows the famous 4-6-0 G.W.R. "King George V" (which went to America), and Stevenson's "Locomotion No. 1" (1825)—over 100 years of locomotive progress. You will notice the artist who painted these has added smoke and steam, which lends realism, and also avoids the necessity of cutting out the fine detail in the actual locomotive outline.

Education and Entertainment

The other day I came across a very ingenious constructional locomotive in wood, that a friend of mine had had built to his own ideas. The chief feature about it is that it can be put together by any intelligent lad between the ages of four and seven, and does not require any screws or nails, yet at the same time needs a certain amount of ingenuity to put the right things in the right place at the right time, so that it all fits together as a complete unit, making a reasonably correct model of a modern locomotive.

Fig. 7.—One way of absorbing the interest of a four-year-old. Making up an ingenious constructional locomotive in wood. The model contains no screws or nails, but fits together neatly as a complete unit, and when completed forms a model of one of our latest type locomotives.

Here is a young lad intent on this work (Fig. 7). In these days when it is impossible to give him a clockwork or electric locomotive, this is the next best thing, and of definite educational value.

Making a Success of Your Photography

Christmas Subjects.

By JOHN J. CURTIS, A.R.P.S.

WE British people will put up with many trials and troubles, difficulties and worries before we can be persuaded to give up our recognised and universal customs, and other items which are so typically British, and which have been handed down from past generations. Probably the most outstanding of these is Christmas, a time which is enjoyed by young and old everywhere from the poorest family to the wealthiest. Christmases of the past have left their memories and no doubt many of us are looking forward to the next, and perhaps some are wondering how we shall fare and whether the "rations" will enable us to have a "good time" and what the war news will be.

Amateur photographers have always used this time for obtaining results that are very definitely seasonal; they may have included snow scenes, but most certainly there have been several indoor shots which can only be taken at Christmas time, as, for instance, the Christmas tree, the making of the pudding, the kiddies opening their parcels of toys, the sending of greeting cards, the party on Boxing Day, and the many other incidents which go to make the time so happy for us all.

Various Subjects

Things may be rather more difficult this year; supplies of certain commodities may not be possible, but despite this we shall have our Christmas, and if it is not so good as we have had in the past, we must not forget it is 1943, the year when we began to feel that we were winning the war, and this thought should add a unique interest to all our photographic results.

I decided some time back to keep at least one spool of film in reserve, and I am hoping to get some really good subjects for my camera to record. I have already got a carton of Johnson's flashpowder in store for my indoor shots, and I suggest that you follow my example, for you will have many chances of using it.

Before getting on to the subject of what to take, I propose to give you one or two hints regarding the making of greeting cards. You have all got many prints from negatives of a variety of subjects and quite a number of these are very suitable, and especially so if you will take a little trouble with them. It is work of a particularly interesting character and you will be surprised how excellent results can be so easily obtained.

Colouring Prints

Those old prints can become much more charming by the addition of colour, and a box of phototints will enable you to do this without any previous experience. My method is to soak the prints in water for a few minutes; if they are very old or are on glossy paper then warm water must be used, the object being to soften the gelatine surface so that it readily takes the colour. The colours include nine tints sufficient for all needs. You must not use them in their concentrated form; dilute as much as you like with water and use sparingly. You will find that if the soaked print is laid on a piece of glass and the surface water blotted off, the colour will be quite easily absorbed. A little practice is needed to obtain good results.

Mounts, of course, are almost impossible to obtain, but here again I think I can help you. What have you done with the Christmas cards you received during the last two or three years? My family has always retained quite a number, and on opening a parcel of old ones I have had the good fortune to find that many were of the folded type, the last leaf being quite blank and being of a good class of card or thick paper. These, when properly cut or trimmed, proved to be most suitable as mounts for my prints. Another source of supply, which I have frequently used, are the fly leaves at the front or back of some of my novels and other books. These can be carefully extracted without destroying the appearance of the books.

Here, then, are the means by which you

A well-posed group.

can easily overcome the difficulties of getting supplies of printing paper and mounts, and if you are capable of good handwriting then get a bottle of white ink and also of Indian ink for filling in your greetings and mottoes, and perhaps a few lines or curves to form a suitable design.

With your film and flashpowder you should not be at a loss to find suitable subjects for your camera. I have already suggested several types, but, of course, there are many others, and your chief aim should be to introduce as many of your friends as possible, also to strive to get originality into your studies, and this can only be gained by giving some careful thought beforehand and consulting members of the family and your friends.

Keep the camera always ready, and there is no harm in having the contents of the tubes of flashpowder already mixed: it will keep quite well provided the tube containing the mixed powder is well corked and in a dry place. The little scoop holds 10 grains of the mixture, which is sufficient quantity for most indoor shots. If these preliminary arrangements are made you are then ready for any interesting happening, and many items are valuable because of the unrehearsed nature of them.

Groups

One of the subjects which you might find very enjoyable at a party of friends is during the performance of a charade. You know what fun can be got by the use of odd pieces of discarded clothing and the "larking about" which so often occurs when those who are "dressed up" for their parts appear in the room. You can get two shots, one of the party doing the charade, and another of the friends in the audience. It is just a matter of firing the charges of flashpowder and having the camera arranged in different positions of the room.

A "conversational piece" gives one an excellent opportunity for an interesting portrait group; let me give you an example: Say you have a party of five, six or even seven different individuals, three of these could be seated close together in an angle of the room with a small table in front, on which could be arranged drinking glasses, a fourth could be standing looking at and telling the three an interesting experience. About two yards to the left two others could be playing a game of chess at another small table, with the remaining member of the group intently watching the game and smoking his pipe or cigarette. Now, when taking such groups, the whole secret of success lies in the fact that not any of the members are the least interested in what you are doing; they certainly must not look at the camera when the flash takes place. It is therefore advisable to request them to concentrate their attention on what they are doing, or hearing.

On one occasion I was expecting a few friends to arrive for an evening's entertainment, and before the appointed time I had arranged camera and my flashlight apparatus—a piece of tin fastened to a tripod—ready for when they arrived, and were being received by the hostess. The result was quite good; the door was opened, and just as the flash took place one of the ladies was being greeted, and each of the others could be clearly recognised awaiting their turn. I am quite certain that if they had known what was about to happen I should not have been so satisfied with the result.

I am hoping to have a shot at the "waits" outside my house. I may be courting trouble with the A.R.P. officials if lighting restrictions are still in vogue, but should I find difficulty then I shall postpone my efforts.

You should make a point of making these "takings" one of the amusing items of the evening; you will be asked later on if they were successful and have you made prints from the negatives? I have generally refrained from showing the results, reserving them for use as Christmas cards when the season comes round again.

Films

With regard to the films for use with flashpowder, if you cannot get your usual make of "fast" films do not hesitate to ask for any other brand. All films are good, and you ought very easily to get hold of some "slow" ones which will answer your purpose very well. It will only mean the use of a larger stop or an increase in the quantity of powder for each shot; the light given is very powerful, and if the two powders are well mixed you need fear no danger from sparks. Keep your face and hands well away after igniting the touch paper.

Be careful to avoid any errors when developing "flash" negatives. I cannot offer any better advice than my old one, viz., use the time and temperature method with a developer known to yield "soft" negatives. As you know, I am a user of Azol for most of my films, and always prefer it for these indoor artificial light exposures, and for my prints I use an M.Q. developer and a soft grade of bromide paper.

Domestic Fires and Boilers

Notes on Their Efficient and Economical Use

By E. S. BROWN

WITH domestic fires, efficiency and economy are very closely allied. It is a fallacy to consider that a very small fire results in any appreciable saving in fuel. The feebly smouldering fire generates insufficient heat to consume the greater part of its own smoke, and other combustible matter, which results in a considerable loss in the heating value of the fuel used.

Domestic fires give heat mostly by radiation from the incandescent fuel, fire bricks, etc., and by convection, that is, heat given from the fire surround, and, to a lesser extent, from the brick chimney work. While the unavoidable heat losses through the chimney remain fairly constant, the gain by radiation and convection rise very rapidly with an adequate fire.

One of the first essentials towards the complete and efficient combustion of fuel is undoubtedly a good flue updraught. The chimney should be thoroughly swept twice during the year.

Chimney Sweeping

If you possess the necessary canes and broom to do the job yourself, the following precautions should be observed.

When making the cane connections, be sure to well tighten them, and at each thrust give a twist to ensure that they will not work loose. Very often, difficulty is experienced in negotiating the bends. When an obstruction is felt, easier and better results are obtained by short, swift strokes, rather than heavy lunges.

Another prevalent trouble is that caused by downdraught, this being often caused by the chimney stack not being high enough from the roof, or through higher adjacent houses causing the wind, when in certain directions, to be deflected on to the stack.

The probable cure for this is to have a special cowl or down-draught-preventing pot fitted. The average handyman is not likely to be in the position to effect this improvement himself, as, besides requiring the special ladders needed for the job, an assistant will also be required.

Frets or baskets that are very badly burned should, of course, be replaced, and any extensive cracks in the fire-place interior filled with a good fire cement, such as "Pyruma."

Except when a fair-sized lump of coal needs cracking, never use a poker. Far better results are obtained by gently raking any ash from beneath the fire. When burning coke to supplement coal, never put coke on anything but a bright fire. Place the coke at the rear of the fire where the maximum heat is, and bank up the front with preferably small coal. Do not use too much coke at a time, or the fire will burn "dead."

Domestic Boilers

Turning to domestic boilers. Undoubtedly the best fuels for these is anthracite singles, or Welsh nuts. Both of these fuels are, however, in very short supply, therefore coke nuts may have to be used.

Should a supply of this be obtained which is of inferior quality and refuses to remain alight, dissolve 1lb. of sodium nitrate in one gallon of boiling water, and sprinkle over the coke. This quantity is sufficient to treat 1 cwt. of coke. Upon being burnt, the oxygen liberated from the sodium materially assists combustion.

Defects that should be occasionally looked for are gaps or cracks between the flue pipe and wall, caused through the contraction of the plaster by heat.

Make good any such faults with a heat-resisting cement, as, if they are very extensive, the performance of the boiler will be greatly impared through the resulting air leaks.

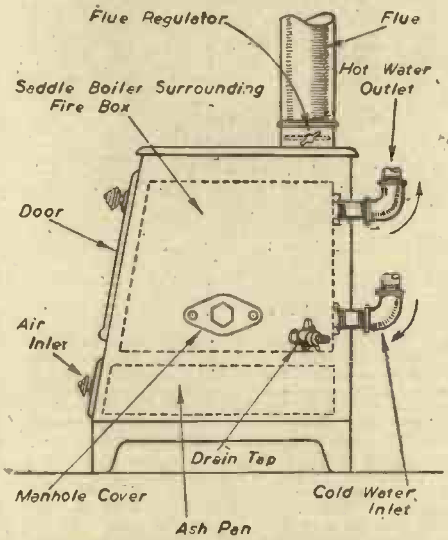
The formation of lime scale and sediment occurs in districts where the water is "hard." The rapidity of its formation depends, of course, upon the degree of hardness of the water, and the frequency with which the boiler is used.

It is a most effective heat insulator, and its presence can be suspected if the time and fuel required for heating a given quantity of water progressively takes longer.

Removing Scale

To remove the scale it is first necessary to turn the supply of water off from the cistern. If a tap is not fitted tie the ball-cock up, and drain the cistern through the cold water taps.

On most modern boilers, a drain tap is



A composite domestic hot-water boiler.

provided. Connect a hose to this, and drain the entire system. Where a drain tap is not fitted the hot-water taps will have to be opened; this drains the system, with the exception of the boiler.

When such procedure is adopted, be ready with a swab and pail (when opening the boiler manholes) as a certain amount of water which is left in the boiler will emerge.

On the side or rear of the boiler are situated the manhole covers, of which there are generally two. Remove these carefully, taking particular notice not to damage the washers which are fitted. With a suitable tool—a long screwdriver which is of no further use is excellent for this purpose—remove all the scale that can be reached.

A word of caution is necessary here. Do not use a hammer to facilitate the chipping process. The boiler, being cast iron, is quite easily fractured if excessive blows are resorted to.

The outlet pipe, that is the upper one, also collects its proportion of scale. By gently tapping this with a light hammer the scale will be dislodged, and can be removed easily from the manhole openings.

Make sure to remove all the loose scale, otherwise there is every probability of a large piece blocking up the system, and perhaps causing an explosion. When the de-scaling is completed, clean very carefully round the manhole covers to ensure that the washers bed correctly. The washers should be coated with boiled linseed oil, then replacing the covers, gently and securely tighten down the bolts.

When refilling the system with water, slightly open the hot-water taps. This will allow any trapped air to escape, thus avoiding air-locks.

Lagging

A surprising amount of fuel can be saved by lagging the pipes and tank. With most modern-built houses, however, the storage tank is combined in an airing cupboard, therefore the owner will have to weigh the pros and cons before deciding to lag this portion of the system.

Rolls of lagging material can be obtained quite cheaply from builders' merchants, and ironmongers. Before applying the lagging, cover all exposed pipes, storage tank, etc., with one layer of newspaper. This is best fixed in place by applying occasional applications of motor gasket cement. This is not only a strong, quick-drying adhesive, but equally important, it is also heat resisting. After two or three hours proceed to tightly and closely wind the lagging on, securing the free end with string.

For storage tanks, the lagging is sold in various-sized squares, which greatly facilitates the fixing.

Draught Regulation

Much fuel can be saved by giving careful attention to the draught regulation and stoking. When once the fire is well alight, it is regulated by means of the flue damper, and the ash-pan door. To enable the fire to draw up quickly, both of these should be wide open. To damp the fire, nearly close both regulators.

By careful adjustment of the regulators, the fire can be controlled so that it slowly and steadily burns through its mass, giving the greater part of its heat value to heating the water, together with a minimum flue loss.

To obtain the greatest heat effect, never completely fill the boiler with fuel, as far better results are to be obtained if the fire-box is maintained about half full. By doing so, the hot gases make contact with the water surfaces, instead of going straight up the flue.

Varley Motor-cycle Accumulators

THE new motor-cycle type dry accumulator produced by Varley Dry Accumulators, Ltd., By-pass Road, Barking, Essex, is made in 12-ampere capacity, at the 20-hour rate. The type number is MC7/12, and the list price is 27s. 6d. It is supplied either charged or uncharged.

The size is identical with the ordinary standard motor-cycle accumulator, the advantages of which have already been mentioned in these pages. One of the greatest advantages is their solid construction, which prevents the breaking of the plates. They have been in production for some time, and we understand from Varley Dry Accumulators, Ltd., that the demand has been so great that they cannot guarantee immediate delivery.

QUERIES and ENQUIRIES

A stamped addressed envelope, three-penny stamps, and the query coupon from the current issue, which appears on back 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.

Electrically-heated Gloves

FOR motor cycling this winter I wish to make a pair of electrically-heated gloves.

(1) What resistance wire is the most suitable for bending with the hands without breaking continually? The voltage is 6 at 3 or 4 amps.

(2) How much wire will be required for each glove, and should it be wired in parallel or series?

(3) Can such gloves be bought ready-made, and, if not, where can I obtain the necessary wire?—F. G. Ley (Eastleigh).

YOU cannot do better than use "Nichrome V" wire for the heating elements. This is exceedingly tough and will stand a lot of bending when run at low temperatures, such as you need for the purpose. To give added flexibility, coil the wire round a mandrel about ⅛in. diameter, and pull it out afterwards to a greater or lesser extent, according to length required. Try No. 20 s.w.g. for a start, with an overall length of 6ft. (before coiling) for each glove, and arrange for the two glove circuits to be in parallel. This should take about 4 amperes total on a 6-volt supply, that is 2 amperes per glove. The wire is obtainable from The Driver-Harris Co., Ltd., Gaythorn Mill, Albion Street, Manchester, but it is doubtful whether you will be able to purchase without an Authorisation on "Form M" from the Board of Trade.

Designs and Patents

I HAVE recently designed a variation of an ordinary component part of a bicycle and have obtained copies from the Patent Office of the following official publications:

"Instructions to Persons who wish to register Designs."

"Instructions to Applicants for Patents."

After studying these, I have decided that I can obtain sufficient protection for my idea by registering the design, as the whole advantage of it depends on the outside configuration as seen by the eye.

The questions that occur to me, and do not appear to be answered in the official pamphlets, are these:

1. Should any other person have anticipated my idea and already registered this design, will my application for registration of design be refused, with or without return of the registration fee of 10s.?

2. Should any other person have anticipated my idea and already filled an application for a patent, will my application for registration of design be returned, with or without return of the registration fee of 10s.?

3. Should I at any time wish to file a provisional patent of an invention, and it has been previously entirely or partly anticipated by a patent, registration of design or publication, will my application for provisional protection be refused, with or without return of the £1 stamp duty, or is the question of complete or part anticipation of the patent left over until filing the complete specification?—C. A. (Coventry).

PROVIDED the bicycle component is a complete article, does not embody any mechanical action, refers solely to the shape or configuration and is novel, it can be registered as a design, but it will be appreciated that protection is only given for the exact shape or configuration of the article as it appears to the eye.

In reply to the specific questions:

1. If the same or substantially the same article has been previously registered as a design or is already known, the application for registration will be refused and the registration fee will not be refunded.

2. The search made by the Patent Office in respect of designs does not extend to prior patents or patent applications. The Patent Office does not refund any fees paid on application either for designs or patents.

3. An application for patent must be filed before publication of the invention has taken place in any way. There is no such thing as a "Provisional Patent"; an application for patent must be accompanied with either a provisional specification or a complete specification. No official search is made on a patent application until after the complete specification has been filed and should the search disclose that the invention has been anticipated and the application is refused or abandoned, the Patent Office does not refund any fees already paid.

Gelatine for Mould Making

I AM making some plaster casts (dogs and plaques), and have tried using plaster of Paris for the moulds, but this is too brittle for the purpose. I am thinking of using moulding gelatine, but I am unable to obtain this. Could you give me the name and address of a firm where I could obtain a small quantity of this material?—W. Williams (East Ham).

GELATINE, in all its grades, is now stringently controlled by the Ministry of Supply. We believe, however, that ordinary "cooking gelatine" is still being rendered available. Hence, this material should be obtainable at large grocers and provision dealers, etc.

An excellent firm for gelatines of all qualities is Messrs. Oury, Millar & Co., Ltd., who are specialists in gelatine production. We would advise you, therefore, to get into touch with this firm, and to request that they supply you with, say, a 2lb. lot of a medium-quality powdered gelatine, which is not a very expensive commodity. There is no necessity for you to obtain the much more expensive highly-purified "leaf" gelatines for ordinary mould making.

Rewinding Induction Motor

I WOULD be grateful if you could give me stator winding details of an induction motor I have. It was "blitzed," and the windings burnt out. Used originally for 110v., I wish to rewind for 220v. single phase. Could you tell me the gauge and approximate weight of wire required to rewind the stator, and also the way the coils should be wound? Do I need a starting winding or can I use condensers? Speed required: about 1,400 r.p.m. H.P. was originally marked as ¼. If a special starting circuit is required I would be grateful for details.—L. Edwards (S.E.18).

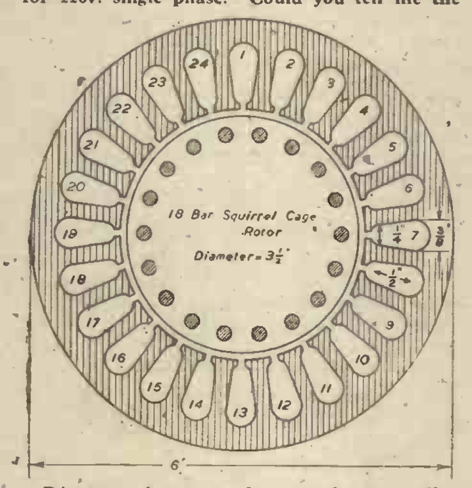


Diagram of rotor and stator for a small induction motor.

A MOTOR of the dimensions shown in your sketch should be capable of developing continuously ¼ h.p. at 1,450 r.p.m. on 220 volts 50 cycles single phase A.C. The rotor, previously used on a 110v. circuit will serve, as it is without alteration if of the squirrel-cage type. The stator winding should consist of 12 main coils and 12 starting coils. The main winding to consist of 54 turns per coil of No. 21 S.W.G., and the starting winding four coils of No. 27 S.W.G., about 160 turns per coil. The stator winding will be 4-pole concentric, the span being from slot 1 to 7 for the long coil, slot 2 to 6 for the middle coil, and 3 to 5 for the inner coil in each quadrant. This will leave one open slot in the centre of each pole group for the starting coils, one coil per pole. All the coils of each winding will be in series, and on starting up the two sets, main and starting, will be joined in parallel until speed is attained, when the starting winding is cut out either by an automatic centrifugal switch or by a "Twinob" hand-controlled switch. For diagrams please see A. H. Avery's "Small Alternating Current Motors," also "Electric Motor Management" (Percival Marshall & Co., Cordwallis Works, Maidenhead, Berks.

Making Liquid Soap

WILL you please inform me how to make a "liquid soap" with linseed oil and sodium hydroxide? I have tried experimenting with the formula given below, but I find that the oil separates from the water, and I should be greatly obliged if you can suggest a formula which would give a perfectly safe liquid soap, and where the linseed oil combines satisfactorily with the caustic soda.

The unsuccessful formula was as follows: Linseed oil, 24 parts; caustic soda, 3.5 parts; alcohol, 4.5 parts; water, 26 parts.

Also, could you please tell me what exactly is the chemical substance sodium lauryl sulphate?—E. Savidge (Blackpool).

A LIQUID soap is merely a strong solution of soap, in water and/or alcohol.

Soft soaps can only be made by the use of potash. And as potassium salts are very scarce these days, we do not think you will be able to produce the soap which you require. However, here is the method:

Take a known weight of raw linseed oil. Heat it in a vessel on a water bath, and add slowly to it with frequent stirring *exactly* 19.5 per cent. of its weight of solid caustic potash dissolved in a little water. After all the potash has been added, continue to heat the mixture for about two hours. Then allow it to cool. You will readily be able to separate the resulting soft soap from the accompanying "spend lye." The soap should be washed with a 30 per cent. solution of common salt (in which it is not soluble), and finally with a little water. It is then ready for use.

If, instead of caustic potash, you use caustic soda for saponifying the linseed oil you will get a hard soap. If you use caustic soda, only 14 per cent. of it will be required, and *not* 19.5 per cent. as in the case of caustic potash. You must see that you use pure linseed oil, since linseed oil is frequently adulterated with resin and other oils, many of which are not saponifiable at all.

The formula for soap making which you give is useless. Its proportions of oil and alkali are wrong, and it should not contain any alcohol.

Sodium lauryl sulphate is a synthetic detergent, and a "wetting agent." It is a derivative of lauric acid, $C_{11}H_{23}.COOH$, a fatty acid. You may, perhaps, be able to obtain a little of it from Messrs. A. Boake, Roberts & Co., Ltd., Stratford, London, E., or from some wholesale chemical supplier, such as Messrs. J. W. Towers & Co., Ltd., Victoria House, Widnes.

"Developing" Erased Metal Figures

SOME time ago I read in a book dealing with the American Bureau of Federal Investigation that it was possible to "bring up" and read figures and letters stamped into metal and subsequently filed out. This is apparently done by means of chemicals.

I would be much obliged if you could tell me the formula and method of use, as I presume it could be used on antique objects where names, dates, etc., have become so worn as to be unreadable.—Ian F. Clark (Aberdeen).

THE methods of "developing" erased figures in metal surfaces are both "mechanical" and chemical in nature. The best methods have never been published in detail, and they remain the "trade secrets" of various forensic laboratories.

"Mechanical" methods for the above purposes comprise the photographing of the metal surface (either in ordinary or in ultra-violet light), the metal surface being inclined at an oblique angle to the incident rays of the light. In this manner, quite a passable photograph of the required markings may be obtained.

The chemical methods of dealing with the problem vary with the metal under consideration. In the case of tin, lead, antimony and the various alloys of these metals, it is often sufficient to immerse the metal for a few hours in a very dilute solution of ammonium sulphide (say one part in 1,000 of water), whereupon a slight darkening or tarnishing takes place on the metal surface, often rendering the obliterated markings visible. In the case of iron, steel and ferrous alloys, the metal is "etched" by immersion in a warm 10 per cent. solution of ferric chloride, a method which very often renders visible markings which have been well-nigh obliterated.

Each case of "developing"-up such markings necessitates careful individual consideration, and it is quite impossible to lay down any rule or set of rules for accomplishing this work. Naturally, markings can only be recovered when merely the surface "skin" of the metal carrying them has been removed. When the metal has been filed away for a quarter of an inch or so below the bottommost depth of the former markings, their recovery is quite impossible. The whole principle of surface-marking recovery is based upon the fact that the stamping of the metal brings about a slight compression of the surface particles of metal, which compression results in a slight difference in the arrangement of molecules in those areas. The development of such markings after they have been filed away is a very difficult business, calling for expert scientific and chemical knowledge, and, often enough, even given this knowledge and experience, the various methods frequently fail.

So far as we are aware, such methods have never been used for the recovery of markings, dates, etc., on antique metal objects, but we certainly agree that, applied to such ends, the methods, if successful, would be of considerable value.

Electrical Polarity of Atmosphere

I UNDERSTAND that the electrical polarity of the atmosphere changes from positive, in strong sunlight, to negative during rain; and fluctuates during snow and thunderstorms.

Can you please tell me: (1) The potential value of this polarity, and what instrument is used to measure it? (2) Has it any bearing upon the growth of plants, or upon the nature of the spark at the plug point of an I.C. engine?—K. K. Thomson (Doncaster).

THE upper layers of the earth's atmosphere are always in a state of electrification. Their potential varies from day to day, but exactly how they attain their electrical conditions is not yet known with any certainty. In fine weather, the potential becomes higher the higher we ascend from the earth's surface, increasing at the rate of about 20 to 40 volts for each foot increase in height. This increase continues up to a height of about four miles, after which, so far as can be ascertained, it remains more or less constant.

The atmosphere's potential at any point is measured by placing an insulated conductor in that area and by allowing it to discharge its current into an electrometer or some similar electrical measuring device. In thundery weather the potential of the atmosphere increases to the order of several millions of volts.

So far as can be ascertained, the normal atmospheric potential has no practical influence upon plant growth, nor upon the size and character of a spark at the plug points of an I.C. engine or of any similar electrical device.

Making Glucose from Potatoes

WOULD you please let me know how to make glucose from potatoes? What amount of acid must be added per gallon of water used for boiling purposes, and the length of time it will take to convert the potatoes into glucose? Also, what is the amount of lime which must be added to neutralise the acid when conversion is complete? How can I make caustic soda, using washing soda and lime?—James McDonald (Dundalk).

IT is not easy to make glucose from potatoes. Many practical difficulties are liable to be met with, and, on a small scale, the yield of the process is not high. However, you may attempt the process in the following way.

Carefully clean and peel the potatoes. Then grate them finely into water. Heat the water to near boiling-point for half an hour. Then allow it to cool and settle. Decant off the clear liquid and allow it to cool. It will then deposit almost pure starch, or, if it does not, it will do so after further boiling.

We next make up a quantity of very dilute sulphuric acid. Only *pure* acid (arsenic free) must be used. Add one part of the acid to 99 parts of water. This is the strength of the dilute acid necessary.

Now take a quantity of the potato starch or of the starch liquor and add to it about five times the amount of the dilute sulphuric acid prepared as above. Warm (not boil) the resulting liquid for two or three hours. Then add powdered chalk to neutralise the excess of acid (lime can be used for this purpose, but chalk is better). The exact quantity of chalk is immaterial. After all effervescence has ceased, filter the liquid carefully from the excess lime or chalk, and then heat the filtered liquid to small volume. It will form a thick syrup, which consists of about 98 per cent. glucose and 2 per cent. unchanged starch. This syrup is very difficult to crystallise, but it will form crystals on long standing in contact with the air.

To make caustic soda from washing soda by means of lime (an inefficient process), take equal parts (by weight) of *slaked* lime and dry soda crystals. Dissolve the soda in about 30 times its weight of water so as to form a dilute solution. Raise this soda solution to the boiling-point, and, while it is boiling, scatter the slaked lime into it slowly. As a result of this process, insoluble calcium carbonate (chalk) will be formed in the solution, together with sodium hydroxide (caustic soda). Boil the solution for about 10 minutes after the addition of all the lime. Then allow it to cool and filter it off from the precipitated chalk. The clear liquid resulting will be a dilute solution of sodium hydroxide (caustic soda) which you can concentrate by heating to any degree of strength which you may require.

Converting Car Starter to A.C. Motor

I HAVE been trying to convert a starter-motor from a motor-car into an A.C. motor and have followed the instructions given in your journal (February, 1940, issue, page 203).

However, as I have not done any work of this kind before, I am unable to understand clearly the wiring diagram of this motor. Can you please help me on this matter? The motor is of the four pole, two brush type.

Also, I have a small universal motor from an electric cleaner; it is of the two-pole type. Can you please tell me how to wire up such a machine, assuming the field coils and armature are already wound correctly?—F. Peover (Macclesfield).

THERE are two methods by which this can be done. One is to connect up the motor as a "series-connected" commutator-type machine as Fig. 1 below, and the other is to convert it into a "repulsion" type motor, as Fig. 2. Since it is at present wound for low voltage, it would take a very heavy current from the ordinary 230 volt supply mains unless rewound, and

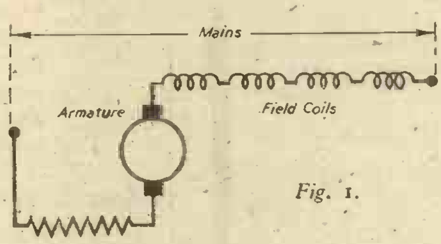


Fig. 1.

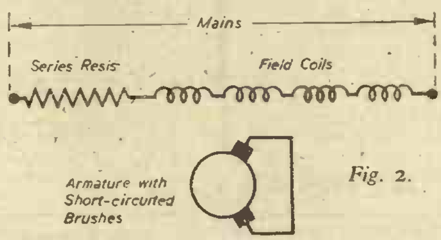


Fig. 2.

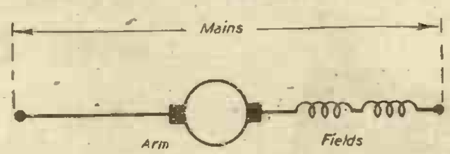


Fig. 3.

Showing method of converting a car-starter to an A.C. motor.

would require a large additional resistance in series with it, as shown, which would limit its power output and be very wasteful of current. As a repulsion motor the armature can be left as it is, but the fields would require to be rewound, or used in conjunction with added resistance, which is also wasteful. Unless the fields are laminated it would be hardly worth while spending much time over what would never prove a really satisfactory job. The connections of a "universal" motor are shown in Fig. 3.

Removing Stains from Prints

CAN you please tell me how to remove brown stains from old prints; something that will not injure the picture?

Also I have a tin of very old gold paint which has thickened. It is usable, but wants thinning down. How can I do this?—G. Bourne (Worthing).

YOU do not state whether your old prints are black and white engravings, etchings or colour prints; nor do you mention the extent and area of the brown stains which you wish to remove—all of which are important details.

We will assume, however, that your prints are of the ordinary black and white variety. In this case, you will require a large shallow tray or other vessel in which the print can be placed bodily. In this tray place the print in a perfectly flat position. Fill the tray with water, and then stir about three or four dessert-spoonfuls of chloride of lime into the water. Allow the print to soak for half an hour in this solution. Then pour off the solution, and, without rinsing the print, pour on to it a solution consisting of 12 parts of water and 2 parts acetic acid. Soak for 5 minutes, then pour off the solution. Finally, allow fresh tap water to flow through the tray containing the print for two to three hours in order to wash away every possible trace of the solutions used. This final washing is absolutely essential to the print, for if the least trace of the bleaching solutions are left in the paper the print will crumble within ten years.

After this bleaching treatment, the print will need re-sizing. This is done by soaking it in a hot 3 per cent. solution of gelatine for five or ten minutes, passing it through a roller-machine to squeeze out all superfluous gelatine and then by allowing it to dry slowly. Finally, the print is ironed on its back side. A print which has been treated carefully in this manner will be as good as new, and all damp spots will be removed completely.

For dealing only with very small damp spots, you might try painting these over with a camel's-hair brush dipped in "Milton."

It is almost impossible for us to give you precise information as to the nature of a suitable thinner for your gold paint, since we are not aware of the type of paint which you have. Such of these paints have a cellulose base; others are of the oil type. If your paint is of the cellulose type, it will require as a thinner a mixture of two parts amyl acetate to 1 part of acetone. If the paint is of the oil type, it will best be thinned by the use of equal parts of turpentine and raw linseed oil.

Softening Rubber

CAN you tell me how to soften a rubber mackintosh (fabric rubber fabric)? Also can you tell me how scrap rubber is reclaimed?—S. Warner (Hersham).

IT is virtually impossible to soften the rubber layer in a garment of the type you describe when once the rubber has hardened and perished. Any attempt to soften the rubber and to render it more pliable by means of applying linseed oil, naphtha and other solvents only results in both sides of the garment becoming dirty and tacky, so that it is rendered quite unfit for use. The hardening effect is due to the deterioration of the rubber, and when once this change has been effected, it cannot be altered.

Scrap rubber is reclaimed in two different ways, depending upon (a) the exact variety of rubber presented for reclaiming, and (b) the use for which the reclaiming rubber is intended.

In the first process of reclaiming, the rubber is soaked in naphtha for several days and then macerated and ground up with the solvent in a special type of grinding mill. A portion of new rubber and other softening ingredients are added, the whole then being most intimately ground up and mixed.

In the second process of reclaiming, the rubber material is treated with caustic soda or other strong alkali. A sort of pulp is gradually obtained, which pulp serves as an ingredient for mixing with untreated rubber. Frequently, the boiling with caustic soda solution is carried out under considerable pressure.

Making Paste

I WISH to make a thick white paste. A thin liquid paste is no good for my requirements. Can you please let me know of any formulas?—G. Walton (Faversham).

THE proprietary pastes of the type you mention are manufactured from dextrine, a starch commodity which was formerly very cheap but is now extremely scarce to the ordinary user, being entirely controlled by the Ministry of Supply. Hence, it is very difficult to obtain a supply of dextrine unless you can acquire a small amount from the existing stock of a local chemist.

To make a good "solid" white adhesive paste, merely boil gently for a few minutes a quantity of white dextrine with from three to four times its weight of water. Add a few drops of carbolic acid, methyl salicylate, clove oil or other antiseptic in order to prevent mouldy growths, and then pour the liquid into suitable containers. Within 24 hours, it will solidify to the white paste you require.

If you cannot procure dextrine, you might make up a thick starch paste by "creaming" starch with water (small quantity), and then by adding slowly boiling water (with constant stirring) until the liquid swells up into a gelatinous mass, but we fear that this will not give the cleanly, white paste-form of adhesive which you evidently require.

Heating Elements

I HAVE to repair some hair-curling "cookers" which are parts of a permanent hair-waving machine. The heater elements require renewal and I shall be grateful for information on the following points.

I have measured the diameter of the original wire, which is .003in. diameter. What is the resistance of this wire?

What is the temperature which these "cookers" attain, and what length of wire will be required to reach this temperature on a 230-volt supply?

Where can I obtain a supply of this wire?—J. F. Mitchell (Hadfield).

IF the measurements you have taken of the diameter can be relied on, and it is very difficult with ordinary appliances to be certain to three places of decimals on such small wires, your figures appear to indicate No. 40 B. and S. gauge, and the material of the wire is probably "Nichrome" 80/20. This has an approximate resistance of 70 ohms per foot. If coiled on a mandrel 1/16in. diameter and opened out to twice the close-coiled length a temperature of 200 deg. C. would be obtained with a current of 0.035 amperes, and a total resistance of 6,600 ohms would be necessary on a 230-volt circuit, equivalent to about 94ft. of wire. Apply to The British Driver-Harris Co., Ltd., Gaythorn Mill, Albion Street, Manchester, 15, for supplies.

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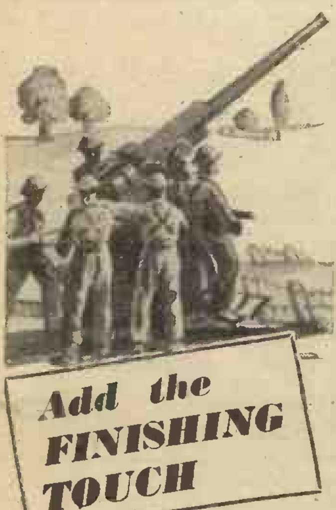

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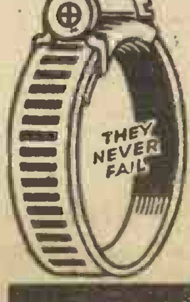

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Comments of the Month By F. J. C.

More About Massed Start Racing

THE latest move in the massed start controversy is a joint statement issued to the Press by the National Cyclists' Union and the Road Time Trials Council on November 3rd, 1943. Here is the statement:

"The National Cyclists' Union and Road Time Trials Council give notice that as from November 3rd, 1943, all persons suspended or precluded from affiliation to the National Cyclists' Union and/or the Road Time Trials Council by reason of their association with the British League of Racing Cyclists, or its constituents, are hereby granted a general amnesty.

"As and from that date, all such suspensions and prohibitions are, therefore, removed, subject to application for membership being made through the usual channels and to acceptance of the rules of the N.C.U. and R.T.T.C."

Now an amnesty is a general act of pardon for offences against a Government, and the use of this political term, which is only used in connection with war, revolution, civil riots and usurped power, is hardly a happy one. It suggests that the N.C.U. is the governing body for road sport, when massed start racing is not any concern of the N.C.U., which, as we have stated before, is merely concerned with racing on closed circuits, such as tracks. The Road Time Trials Council, itself a comparatively new body, formed by a number of rebels from the old Road Racing Council exists, as its name implies, merely to control time trials; that is to say, trials against the watch, where the riders are started at regular intervals of time. Therefore, the N.C.U. and the R.T.T.C., in talking of an amnesty, are arrogating unto themselves a power which they do not possess and therefore have no right to exercise. It is unlikely, from conversations we have had with various members of the B.L.R.C., that any of its members will re-enter the ranks of the two bodies concerned as a result of this statement, with its supercilious air and suggestion of usurped power.

The N.C.U. is evidently anxious to create the impression of profound forensic omniscience, for on previous occasions when they have banned races they have liked to use the term "proclaim," a term used centuries ago to mean to outlaw by public proclamation. The use of the words *amnesty* and *proclaim* suggests that those who indulge in massed start racing are criminals. Of course, the use of these archaic terms may impress youthful cyclists but they will not impress anyone else.

Questionnaire

THE N.C.U. and the R.T.T.C. have, of course, made this "generous" (*sic*) gesture after the statement by the Home Secretary that massed start racing is undesirable. We do not believe that the Home Secretary made this announcement without some promptings from outside sources, and this is a matter which we are investigating. Accordingly certain correspondence has taken place between us and the C.T.C., the R.T.T.C. and the N.C.U. We addressed the following questionnaire to the chairman of the council of the C.T.C.:

A statement recently appeared in the Press relating to massed start racing on the roads, and which purported to express the views of the C.T.C. on massed start racing. This statement included a reference to those running massed start racing as "a number of hot-headed youths." I should be grateful, therefore, if your council could give me an answer to the following questions:

1. Is the view expressed in the newspapers the official view of the C.T.C. towards massed start racing?

(*C.T.C. answer: The policy of the club towards massed start road racing is indicated by the Editorial, "A Dangerous Departure," on page 63 of the May, 1942, Gazette, which was written by direction of the finance committee confirmed by the council.*)

2. Has the C.T.C. taken a postal vote of its membership on the matter?

(*C.T.C answer: C.T.C. policy is determined by the council, and no postal vote has been taken, or is needed, on massed start racing.*)

3. If the answers to the first two questions are in the negative, will your council instruct the secretary to send a letter to the Press to this effect?

(*C.T.C answer: No statement to the Press is contemplated at present.*)

4. Can the statement that the C.T.C. promotes more massed cycling than any other club be justified? Surely the remarks in the first question apply equally to massed cycling as they do to massed start racing? (Our point here, of course, is that in massed cycling, the riders keep together more or less for the whole of their journey, whereas, in massed start racing, the riders soon thin out.)

(*C.T.C. answer: With some 200 sections carrying out regular fixtures the C.T.C. certainly promotes far more massed club cycling than any other cycling club.*)

5. Has the C.T.C. made representations to the Home Office on the subject of massed start racing, and expressing disapproval of it?

(*C.T.C. reply: No.*)

The C.T.C. claim that 200 sections promote massed cycling on the roads is, we think, a most dangerous policy, and the attention of the Home Secretary is drawn to it, in view of the statement he has issued to the Press on massed start racing.

The following questions were addressed to the N.C.U.:

1. Has the National Cyclists' Union made any representations to the Home Office on the subject of massed start racing?

2. If so, were those representations to the effect that the N.C.U. is opposed to massed start racing?

3. Has the National Cyclists' Union and Cyclists Touring Club jointly opposed massed start racing by representations to the Home Office?

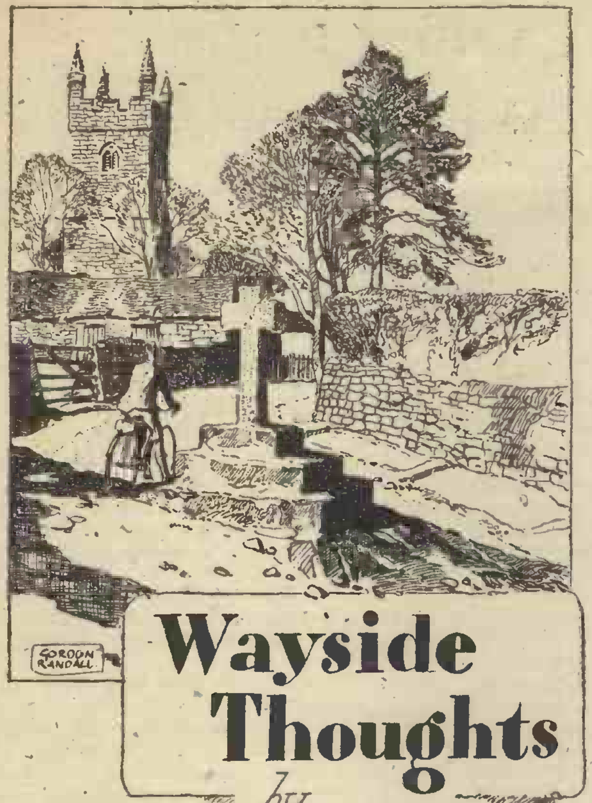
(*N.C.U. reply: I have now had an opportunity of placing your favour of the 20th ult. before my committee in which your opening paragraph is "I should be glad if you could answer the following questions for publication." They are not prepared to answer your questions for publication.*)

A somewhat similar letter has been addressed to the secretary of the Road Time Trials Council, but at the moment of going to press, their council has not had an opportunity of considering it.

As far as the national bodies are concerned that is where the matter reposes at the moment. We are not interested in the pros and cons of massed start racing *per se*, but we are concerned to see that the Home Office is properly informed on the matter, and that it hears all sides of the question. The attitude of both the N.C.U. and the C.T.C. has been: Here is a healthy baby, but we do not like it. Let's kill it! On the reasons at present advanced, it would be as sensible to ban pedestrians from the roads because thousands of them are killed on them.

Post-war Street Lighting

SIR CHARLES BRESSEY, who recently addressed the Roadfarers' Club on the subject of the post-war planning of London, has published some interesting facts concerning street lighting. In the two years, 1940 to 1942, the total death roll on roads during blackout hours exceeded 7,000, and out of every 10 deaths recorded on the roads during those two years, no fewer than four occurred during blackout, in spite of the very small volume of traffic moving at night, when so many roads are entirely deserted. It is for this reason that the Home Secretary is considering a modification of the blackout, and experiments are proceeding as we go to press. But, when the blackout is abolished, road users will still be imperilled by erratic street lighting, flashing signs, cats' eyes, misuse of red lights and white lights, roadside advertisements, multiplicity of road signs, and perhaps lack of adequate lighting altogether. The streets of London were first lit in 1685, when a lantern was placed in front of every 10th door, to be lighted on moonless nights. Yet, to-day, after a lapse of 258 years, unlighted highways are still extremely common outside our busy towns.



Wayside Thoughts

by

F. J. URRY

Sheepstor, Dartmoor village.

This Bad Riding

WHY don't the cycling organisations try to teach modern riders the art of pedalling? That question was put to me the other day by an old cyclist who said it hurt his sense of the fitness of things to see the sloppy way so many people propelled bicycles in these latter days. All of which is true enough; but I ask you how is it possible for the cycling organisations to reach and train the enormous army of unattached riders who never read a cycling paper or trouble to ask advice from an old rider? Club cyclists know the value of correct pedalling, that comfortable circularity of movement with every part of the leg and foot and ankle doing its fair share of the work; and it is largely the reason why they can ride all day without a sign of exhaustion, covering leagues that would be impossible of achievement by the "sloppy" rider except as a result of very conscious effort, and a weariness that makes the old criticism "cycling is hard work" seem true. I have always held that if a thing is worth doing it is worth doing well, and cycling is no exception to the sound rule, indeed, it is one of the simple things where "well doing" is the very foundation of its enjoyment. The middle-foot brigade are wrong in their carelessness of pedalling, so that it is safe to say that they will never become easy riding cyclists, which is a pity, because it is spoiling a fine game as far as they are concerned. But how are we to cure them of this bad habit? The only way I know is to catch them young, or when they are in the mood to buy a bicycle, and at the moment of purchase present them with an illustrated volume on the art of cycling, pointing to the fulfilment of a paradise of healthy travel, if a few simple and easily acquired rules are followed until they have been translated into habit.

Start to Sit Correctly

IN practice I find most people are apt to resent advice on the methods to get the best-out of cycling. So many ordinary riders just use a machine for convenience, and their manner of riding it apparently satisfies them. But how much more comfortable they would be if they sat right and learned to pedal freely and slickly, instead of relying on the sheer force of a hefty push. The only approach to the cure of this form of riding that I have found at all acceptable is the gentle art of persuasion. I always ask such folk if they think I have ridden a bicycle almost daily for more than 50 years without discovering the easiest method of propulsion, and, incidentally, the most graceful. That latter remark usually interests them to the point of asking questions, for most of us like to undertake activity of any kind with a certain amount of grace or style, and because such acquirement also means comfort and ease in riding, I, at least, gain a point. But it is difficult, particularly in regard to positioning, which is so important in its relationships to correct pedalling. Roughly one's poise on a bicycle should be an even distribution of weight between seat, bars and pedals, and from that attitude flows the comfort of easy riding, and the greatest aid of correct pedalling, with the ball of the foot firmly on the pedal, the knee just flexed at the lowest pedal point, and the whole of the leg free to make the crank circuit without stretch or conscious stiffness. Get this action right, and, in my opinion, the ankling motion, so freely talked about in our text books, will almost automatically follow; but it is useless to advise people to freely use their ankles unless the general poise is correct. Position is the great thing; the rest will follow in natural order, and habit so acquired will make the cyclist.

And Don't Hurry

I ALSO find the beginner at the real game of cycling—riding for the sheer pleasure of the exercise and the loveliness of the countryside—is often too impatient to "get on with the job." Enjoying the company of many such during a long life on the road, they have nearly all tried to bustle me into speed in the early hours of a long day, and when I have resisted, often told me: "You're a fine cyclist, you are, who doesn't want to ride at 15 an hour when the going is easy." Quite so; but if the going remains easy I am prepared to fall into that over average speed at the *end* of the day—but not at the beginning. No fear: I want to enjoy my day, all of it, nor use impatience to pile up the miles in the early hours, to make a tail of the afternoon and evening journey. You sit comfortably at work at 10 to 12 miles an hour in the early part of an easy day, and, if you desire to collect them, 100 miles can be gathered to your legs without any bad patches. If you want to gallop for the sake of exuberance reserve the outburst until after teatime, a period when I think cycling is at its best. If you have a hard journey to face—wind and rain, and an uneasy road—do not let the fact worry you; just drop the pace a couple of miles an hour, ride the hills slowly, walk occasionally, and refresh a little more frequently. And the finest pick-me-up I know is tea, which is the reason why club folk are so fond of it. The secret of easy riding is to match your speed and the daily miles to the conditions of road and weather, and, above all, don't worry, for that blunts your enjoyment before it has a chance to expand.

They Know Better

RECENTLY I had a long talk with a prominent cycle manufacturer, a man who rides his own wares and knows the difference between the best obtainable and the not quite so good; and he deplored the ignorance of his many friends who have lately taken to cycling because "it is the next best thing," and come to him for advice. And that advice is freely given, but as he says, how few among them take much notice of it. Tell them to gear moderately, to fit a flat handle-bar set level with the saddle height, to see that the saddle is a worthy specimen, and they just reply, "O! that is all very well for you, but I only want a bike to potter around on. I don't want to ride hundreds of miles a month." Well, one might just as well potter around comfortably as awkwardly, but no, they must sit dead upright and try to push round a gear of over 70. Yes, we do badly need a manual on how to ride and keep a bicycle in order, what a bicycle can mean to the average person in health and recreation, and particularly at that time in life when competitive games have trickled down the years with one's youth. I am convinced the pastime of cycling—apart from the sport—will not fully enter into its own until the full story of its joyousness is put into the hands of every buyer of a bicycle, not in praise of any particular make of machine, but just a bicycle. Ignorance of cycling has been enormously exemplified since so many folk have had to ride—or walk, and it is often a shock to me to discover that intelligent people know so little of this simple machine or how best to use it. There exists to-day a chance to make cycling, as a pastime, the major game of the land, a game that can be played with joyousness from seven to 70.

Glass On the Road

I AM glad the danger to tyres when broken glass is allowed to remain on the road in the track of vehicles has been raised by a Government spokesman, because it is about time some drastic action was taken. What is the use of all this propaganda on the care of tyres and the scare of the rubber shortage if the carelessness of their destruction—the worst feature of the war so far as tyres are concerned—goes unchecked. All my recent tyre troubles have been perforations by glass splinters, and once, now nearly a year ago, a rear cover was nearly cut in half by a broken bottle base which I did not see in the black-out. This broken glass plague seemed to develop immediately after the blitz. At first we road users said little about it because we naturally thought the bombing was the main cause; and we were probably right at the time. But the trouble has developed rapidly, and there is no doubt it is mainly due to broken milk bottles. The cure it seems to me to be to put a price on milk bottles and so make the community pay for their carelessness; but if this involves too much clerical labour—and one can conceive it may—then equip the milk roundsmen or women with a broom, and make them responsible in their districts for sweeping the remnants of wrecked bottles into the gutter out of the track of vehicles. In daylight the cyclist can do much to dodge this danger of damage, but now we have to grope our way about in the dark, the risks to our precious property are tremendously increased. And the motorist is really worse off, for he cannot do the dodging business in daylight. I find, too, it is the tiny spicules of glass, the almost invisible daggers, that do the main damage to my tyres. This is something we can cure, for it ought not to be beyond the power of the authorities to mend a situation that is so destructive of the very goods they ask us to specially preserve. Otherwise propaganda on this question is largely wasted, for it is futile to ask people to take care of rubber when destruction of it is spread abroad on all our roads and apparently no check imposed on the careless.

A Good Day

HERE lies contentment. That was the foremost thought in my mind at the end of a Sunday in October as I made my way home after a solitary day spent among the Midland lanes. I had started out with the intention of joining my club friends at the lunch rendezvous with food in my bag and a flask of coffee, but the weather was so quietly perfect, and the beauty so lovely in form and colour, that I felt I wanted to absorb it in a personal way, and the farther I went so that notion grew, until 20 miles from home I was still in solitary meditation and thoroughly enjoying the change. Not that I often practise introspection, for the prospect, and particularly the retrospect, may frighten me, being no better—and, I hope, no worse—than most men. I saw the woods at the turn of the season in their perfect quietude of beauty; the stubble bleaching under the mellow sunshine; heard the restless partridges "chi-vit" and the lordly cock pheasant crow; and ate my meal at the edge of a wood away from the road where a couple of rabbits popped out to look at me occasionally, evidently uncertain if I was really alive; and it was not until I struck a match to light my pipe that they determined I might be dangerous. I wandered on for a few miles along the colour-bordered lanes, and the ambient air seemed to half-promise a peace that may soon be coming, until among the fields of deep green roots I came to the farm where I felt I should be a welcome guest at the tea-table. And in the evening light I rode home and saw the sunset at rest to end a very lovely day that made me feel once again the full fortune of being a cyclist with that freedom of choice that so delightfully fits the moment to the mood.

Club Notes

Roberts in India

CHARLIE ROBERTS, of the Addiscombe C.C., is now serving with the R.A.F. in India.

Scott Wins

DAVID SCOTT, Crawick Whs., has won the 1943 championship of the Ayrshire and Dumfriesshire C.A. with an aggregate speed of 22.972 m.p.h., the fastest speed ever recorded in the competition.

Barclay Fastest

BILL BARCLAY, Gilbertfield Whs., won the annual West of Scotland T.T.A. hill climb, held this year at Logie Brae, near Stirling, with a time of 1m. 38⅗ secs.

Morrison Gains D.F.M.

DONALD MORRISON, pre-war massed-start star and 1939 champion of Glasgow Wheelers, has been awarded the D.F.M. He is serving in the R.A.F. as a Sgt. Flight-Engineer.

Farebrother's Success

C. FAREBROTHER, Altrincham Ravens C.V., has won the Oldham and District Cyclists' Union championship with an average speed of 20.13 m.p.h.

Clubman Lost

GAVIN ROUGH, former time trials secretary of Johnstone Wheelers, has lost his life while serving with the Fleet Air Arm.

Against Registration

THE West of Scotland Cyclists' Defence Committee has condemned both compulsory and "voluntary" registration of cyclists.

Full-Time

ERNEST SUGDEN, of Halifax, has been re-appointed as full-time secretary of the National Clarion C.C.

Cumnock in 1944

THE Cumnock rally will be held again in 1944, on the week-end of June 24th-25th.

Around the Wheelworld

By ICARUS

Bartleet's Collection

YOU will remember that a few months ago I challenged the accuracy of the dates and names appended to some of the machines in Bartleet's so-called museum of bicycles, which is now the property of the City of Coventry. I pointed out that both Hume and Dunlop stated that the machine which Hume rode in the famous race at the Queen's College Courts, Belfast, in 1889, was destroyed. Yet Bartleet claimed to possess it, and the machine, according to my information, still remains in the collection. It so happens that there was on the staff of this journal the son of one who was not only a famous cycling journalist, but who also undertook many famous Continental rides. This colleague is certainly a cycling historian, as distinct from a collector and consulter of old books and catalogues. He had an arrangement with Bartleet that anything in the way of books, prints, or old bicycles which he came across should be purchased for Bartleet's collection. I think, however, it is generally accepted by those who have made a study of cycling history that very many items in this collection of bicycles are wrongly described, and wrongly dated. I understand that Mr. Alf Bednall, who has had my views on the subject communicated to him, is investigating the matter. I merely raise the matter now in the interests of historical accuracy, for Coventry, the home of the bicycle, does not, I am sure, wish to be made to appear stupid in the eyes of the cycling world. After all, Coventry ought to be aware of the history of the industry it started. Another friend of mine, who owns an accurately labelled collection of bicycles, told Bartleet that many of his machines were wrongly labelled, but Bartleet asked my friend not to date them. If any of my readers are aware of inaccuracies, I should be glad if they will communicate with me. The book which Bartleet wrote on his collection repeats the errors. This is somewhat surprising when one bears in mind Bartleet's splenetic attitude, and the fierce letters of criticism tinged with acerbity which he would write to anyone having the temerity to write on cycling history or to mention a date. Bartleet made as many mistakes as any other writer on cycling history, and frequently he had to admit to those mistakes. I remember an incident in connection with the original Bath Road Cup. When this was re-presented by C. A. Smith, one of the vice-presidents of the club wrote to Bartleet and asked him to name the dates and the years when C. A. Smith made the winning rides. A typical Bartleet letter ensued, in which, with the air of one who cannot be wrong, he named the alleged dates, and concluded by saying that this information "was not for the benefit of his journalistic rivals." Now, unfortunately for the vice-president who had made the inquiry, the dates of the winning rides were engraved on the cup itself, and they differed considerably from those Bartleet gave. Later Bartleet admitted that he had made another mistake.

Noel Baker, M.P., a Roadfarer

MR. P. J. NOEL BAKER, M.P., who, as reported last month, gave such an interesting talk to members of the Roadfarers' Club, has accepted the invitation of the Council of that body to join its ranks, and he thus becomes a Fellow of the Roadfarers' Club.

Sir Charles Bressey at the Roadfarers' Club

SIR CHARLES BRESSEY, C.B., author of the famous Bressey Report on the replanning of London, gave an interesting address on his plan to members of the Roadfarers' Club at the Waldorf Hotel, on Friday, November 12th, with the president, Lord Brabazon of Tara, presiding. Over 70 members of the club were present. The meeting will be fully reported in our next issue.

That Typographical Error

OF course, owners of museums cannot blame it on the printer, and the slips to which I have referred cannot be termed typographical errors. In this connection I quote the following verse from the *Irish News*:

> The typographical error is a slippery thing and sly.
> You can hunt till you are dizzy, but it somehow will get by. . . .
> The boss, he stares with horror, then he grabs his hair and groans;
> The copy reader drops his head upon his hands and moans.
> The remainder of the issue may be clean as clean can be,
> But that typographical error is the only thing you see.

How true!

Road Accidents—September, 1943

ROAD accident figures for September contain a sharp reminder of the need for special care in the blackout. Deaths resulting from accidents during hours of darkness numbered 108, or 46 more than in August, and there was a proportionate increase in the number of injured during the blackout.

These facts underline the importance of pausing after leaving a well-lit building until the eyes become accustomed to the dark.

The total road casualties for the month were 455 killed and over 10,000 injured. Only one child—a cyclist—was killed during the blackout, but the total of 98 child deaths during all hours is slightly higher than that of either July or August.


Two well-known racing cyclists, A. W. Martin (left) and J. Simpson, both of Barnsley.

PARAGRAMS

R.T.T.C. Secretary

S. R. FORREST has taken over the secretaryship of the Road Time Trials Council which will meet, for the first time since 1939, in January.

Irish Record

UNBROKEN since 1939, the Northern Ireland 40-mile record has fallen to W. J. Dowds, Northern C.C., with a ride of 1 hr. 44 min. 23 sec.

Tricycling Sailor

SMITH PARKER, Cheshire Road Club and one time record holder, won the Northern T.A. 25 with 1hr. 14 min. 19 sec. He has been in the Royal Navy for three years.

Cycling M.P.

THE latest M.P. to cycle is Thomas Fraser, who represents the Hamilton Division of Lanarkshire, and who has joined the Royal Albert C.C. of Larkall as an honorary member.

Southend Wheelers

SERVING members of the Southend Wheelers include Pilot Officer A. G. Wright, R.A.F.V.R., and Pilot Officer L. G. Goss.

Fine Family Record

MEMBER of the C.T.C. (Northern Ireland D.A.), Sergeant Pilot A. Belshaw, R.A.F.V.R., is missing following an operational sortie over Germany. His brother is in Italian hands and his father, at home, is an enthusiastic cycling official.

Old Timer Passes

A F. ILSLEY, North Road C.C., and famed tricycle exponent, has died.

Yorkshire Rider Missing

FOLLOWING an operational sortie over enemy-occupied territory, Squadron Leader P. Dunclark, D.F.M., D.F.C., Stanley C.C. and C.T.C. member of Yorkshire, is reported missing.

Cycling in Ceylon

SOLDIER cyclists in Ceylon have formed the Jungle Roamers C.C.

End to End in Eight Days

A FINE ride was achieved by a Hitchin rider (Charles Reid) who claims to have toured from John O' Groats to Land's End in eight days: an average of over 100 miles a day.

Killed in Flying Accident

A NOTTINGHAM Wheeler member, Sergeant Pilot S. A. Richardson, lost his life in a flying accident in Scotland.

Addiscombe Man in India

C. ROBERTS, Addiscombe C.C., who put up a remarkable series of rides in the early part of the war, is now serving with the Forces in India.

Century Road Club Loss

FAMILIAR figure in North London—and on the Great North Road in particular—John Weir, Century R.C. member for 29 years, has died.

Dale Park Club Resuscitated

FOLLOWING an informal gathering of several pre-war members, the Dale Park C.C. has been resuscitated.

Morrison's Decoration

CHOSEN for the world's championship team in 1939 and prominent time-trialist before he joined the R.A.F. three years ago, Donald Morrison, Glasgow Wheelers, has been awarded the D.F.M. He is a flight engineer.

Lost With Fleet Air Arm

PRE-WAR time trial secretary of the Johnstone Wheelers, Garvin Rough lost his life while serving with the Fleet Air Arm.

Fate of W. G. Barnes

PILOT OFFICER W. G. BARNES, D.F.C., pioneer of massed start circuit racing in this country a decade ago, and virile member of the Charlotteville C.C., is now known to have been killed in action while on air operations over Germany. He was buried in Holland. Barnes represented this country in the World's Championship races in Germany in 1934 and in Belgium the following year.

Scotland's Stand

THE West of Scotland Cyclists' Defence Committee is solid against the growing practice of registration cycles with the police.

Coventry's Track

THE Butts cycle track at Coventry has been badly damaged by enemy action and by the weather, but local enthusiasts, headed by members of Coventry Godiva C.C., are trying to improve matters.

Local Record Beaten

THE Wisbech-King's Lynn record has been lowered by J. Gilbert and E. Cross, Wisbech Wheelers, with a fine ride of 1.4.56. On the afternoon before the ride Wright secured three firsts at a track meeting!

Finsbury Park Jubilee

FINSBURY Park C.C. celebrates its Diamond Jubilee with a special social in London during next month.

Club's Fine Record

MILDENHALL Wheelers have members serving in Malta, India, North Africa and the Far East. Gordon Webb, prominent pre-war stalwart, is in Japanese hands, and two other members, B. Ford and L. Morley, have just returned home after a long spell overseas.

Bernard McGrath Killed

IT has been ascertained that Pilot Officer Bernard McGrath, Cheshire Roads Club, who was previously reported missing following a R.A.F. raid over Germany, was killed in action.

Time-Trialists in Orkneys

CYCLING enthusiasts stationed in the Orkneys staged a seven-mile event among themselves. It was organised by Lieut. D. P. Morris, R.N.V.R., and pre-war stalwart of the Oval C.C., and won by G. Rough in 23 minutes 42 seconds.

Club Champion

WITH an average speed of 19.818 miles an hour over distances at 25, 50 and 100 miles, J. B. Stevens becomes champion of the Spelthorne C.C.

A Dual Award

C. W. MESSENGER, club champion of Hounslow and District Wheelers, has been awarded by his club with the "Dot Russell" meritorious trophy for services rendered.

Octogenarian's Achievement

CHARLES CAVE, 80-year-old member of the "Autumn Tints," celebrated his birthday by riding over 90 miles in a day.

Barnsley C.C. Record

BARNSLEY C.C. members have 12 fastest times to their credit this year. The club took 63 of the 229 awards offered in competition in the Midlands.

Cripple's Achievement

CHARLES POOLE, well-known Swindon rider, covered over 200 miles in 24 hours in his hand-propelled bath chair.

President's New Role

PRESIDENT of the Vagabood C.C., Stanley Sadler, who is also a member of the Barnesbury C.C., has been promoted to the rank of captain. He is serving with the R.A.S.C. in the Middle East.

Another Tyne Tunnel?

A FURTHER proposal for a Tyne tunnel, in addition to the one proposed at Jarrow, has been put forward.

New Hostel

A NEW youth hostel has been opened in South Wales, at Capel-y-ffin, near Abergavenny. Formerly the hostel was a monastery.

Park in Bowland?

A NATIONAL park covering the Bowland area, popular with cyclists from Lancashire and Yorkshire, has been proposed as a post-war measure.

"Sneaking Nuisance"

SHERIFF HAMILTON called an Army deserter who stole 23 bicycles at Paisley a "sneaking nuisance" and imposed a sentence of six months' imprisonment.

Hostel Reopens

LOCH Ossian youth hostel, on Rannoch Moor, has reopened for the winter.

Black Market

THE black market in cycle covers seems to be at its worst in Eire. Covers sold at 5s. 6d. in Britain are reported to be bringing over £1 each.

Modified

EDINBURGH'S street lighting plans has been modified. Until now wartime Edinburgh has been entirely without street lighting.

Charles King in London

CHARLIE KING, the Olympic sprinter and member of the Belle Vue C.C., is back in London again after working elsewhere in England and Scotland.

Scots Team Record

CRAWICK WHEELERS, through David Scott, James Scott, and Jack Tudhope, recently broke the Scottish team "30" record with a time of 3 hrs. 50 mins. 56 secs., better by 1 min. 6 secs. than the previous record.

The new record awaits confirmation by the Scottish Amateur C.A.

Fastest Wartime "100"

ALEX. HENDRY, Glasgow Wheelers, clocked the fastest "100" time of the war in the West of Scotland Clarion open. His time of 4 hrs. 25 mins. 7 secs. is the fifth best ever recorded in open competition.

Presentation of Scots Awards

THE Scottish Amateur C.A. will not be holding a prizegiving this season. Instead, officials of the Association will attend the prizegivings of clubs whose members figure in the awards lists of the S.A.C.A's three competitions, the wartime championship, the 50 miles invitation event, and the 25 miles invitation event.

Polo Recognised

THE British Polo Association of Great Britain has been constituted a member of the Central Council of Recreative Physical Training.

Still Active

BRITAIN'S most northerly cycling club, the Thurso Social C.C., is still active. J. B. Gair continues as secretary, and looks forward to the days when he can again help record-breakers at the far end of the Land's End-John o' Groats run.

For Fleet Air Arm

PERCY HUGGETT, Addiscombe C.C. official, has joined the Fleet Air Arm.

Club Member for 50 Years

PERCY BEARDWOOD celebrates his 50th year as a member of the Anfield Bicycle Club. He is also a member of the Bath Road Club, which he joined in 1919.

Glasgow Official on Leave

"FREDDY" CRAIG, former time trials secretary of the West of Scotland T.T.A. and also an official of the Glasgow United C.C., now in the R.A.F., was home on leave recently. He was then expecting to go abroad.

Newcastle Leads Clarion

NEWCASTLE and Gateshead section of the National Clarion C.C. leads the country in Clarion membership with 130 members on the books. Other sections with large memberships are: Bolton (116), Leicester (105) and Eastleigh (104).

Islands for Trust

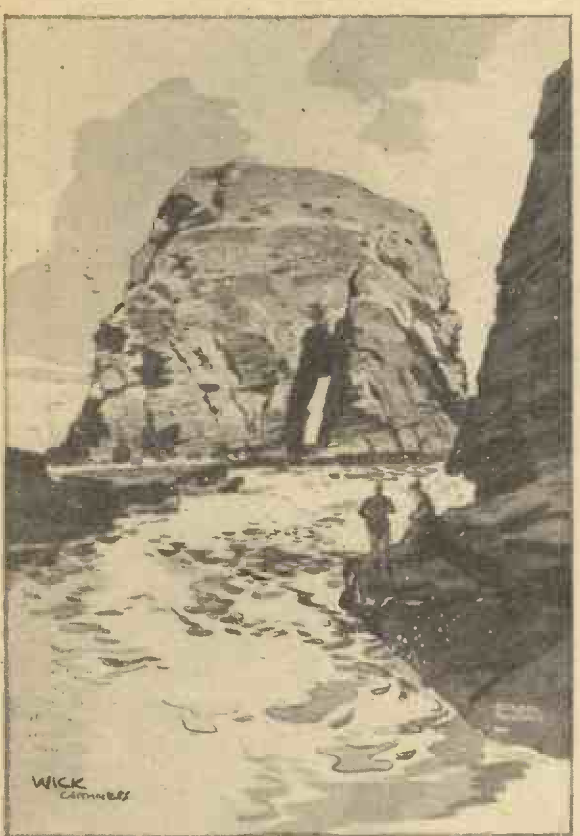
TWO small islands at the south-east corner of Loch Lomond have been given to the National Trust for Scotland.

Landmark for Nation

THE National Trust has been presented with land adjoining Peel Tower, a prominent landmark north of Bury, Lancashire. The donor is Colonel Austin T. Porritt, in memory of his son, Captain Richard W. Porritt, M.P., who was killed in Flanders in 1940.

CYCLORAMA

By H. W. ELEY


The Brough, Wick, Caithness, Scotland. The great tunnel right through the rock has been made by the sea. In stormy weather the waves dash through it with terrific force.

Retiring

I TALKED recently with a man who, after a lifetime of work in London, had reached his "retiring age" and cast off the dust of city streets for ever, and settled himself in the country . . . and he had chosen a tiny village wherein to spend the evening of his days. A pretty problem . . . this "retiring business," and all of us know men who have found that the longed-for leisure is not half so sweet in reality as in anticipation! But my friend was going to be happy; he loves a garden; he is going to keep fowls; he likes an hour at the village inn in the evenings; and . . . he told me that of all the essentials necessary for happiness in a village, the most important was . . . a bicycle! A fortnight in his cottage home had convinced him that he could not get along without a bike. Too far to walk to all the neighbouring beauty spots . . . but all were accessible on a cycle; the weekly jaunt into the nearby market town best undertaken on a cycle. So, if you are contemplating living in the country, don't forget that above all things you will need a bike!

December

AS I write, December looms ahead—and I suppose I ought to have visions of fogs, and drear, dull days, and dripping trees, and scenes of desolation when I look out of my window on to the flower-less garden. And yet . . . is December such a bad month, after all? It has been much maligned, and I think we forget that it has its own beauties. Not too late, in December, to see the woodlands at their most lovely and colourful . . . browns and golds and russets to delight the eye. And in the gardens and in the greenhouse there can be colour, too . . . is it not the month of the chrysanthemum? And if in December all else in your garden has faded, you may still have those gorgeous bronze chrysanthemums which are wondrous for cutting and give a grand splash of colour to any room. November has its interesting customs and associations, too . . . and if you love English history and the hoary legends which cling around the truth of our past, then you may, like I do, still find romance in Guy Fawkes and all the old-time fun of Bonfire Night. The war has made the manufacturers of Catherine wheels, and silver cascades, and rockets, and squibs turn their attention to more serious explosives . . . but I hope the days will return when we can, on the immemorial November the Fifth, have our celebrations with all the good novelties which used to rejoice us in our youth. And I shall not mind if, when the war is over, we again have to slip our pennies into the hands of small boys who are "collecting" for a "guy."

Interesting Ads.

HOW interesting are those Dunlop coloured advertisements which feature the "rankings" and badges in the Civil Defence services and other wartime organisations. I think the old company has done a good job in issuing these informative charts, which can be had on application (if you remember to observe the Paper Control Regulations and remit the necessary penny!) In these days there are so many uniforms, and such a multitude of badges and symbols, that one is apt to get a little confused. Anything which helps us to identify the ranks of our C.D. and N.F.S. stalwarts is all to the good.

The Roadfarers' Club

THAT keen and useful organisation, the Roadfarers' Club, staged a very interesting luncheon meeting the other week, and were fortunate enough to have Mr. Noel Baker, of the Ministry of War Transport, as the speaker. He gave an inspiring and hopeful address, and it is evident that the Ministry is thinking hard, and constantly, of the many great and urgent problems which will have to be solved when the days of peace return. I was much impressed by the stress which Mr. Noel Baker laid on the fact that we cannot ever again segregate our citizens into separate classes . . . motorists, cyclists and pedestrians; at times each of us is a motorist, at times we become pedestrians or cyclists . . . and it will help enormously if we rid ourselves of the foolish idea that a motorist is some extraordinary and distinct "species." We are all "roadfarers," and we must see to it that in future we make our roads fit for all to use—make them into highways of friendship between all classes of the community.

The "Prettiest" Village

NOT for the first time do I refer to the many arguments which go on, in inns and elsewhere, as to which is the prettiest English village. Well, the other day I had a variant of the old-time discussion . . . in a wayside tavern in Warwickshire I heard some cyclists talking about England's most interesting *towns*. And very many varied opinions were put forward. Some favoured Winchester, and as I listened to these cyclists chatting about the one-time capital of England my thoughts went racing back to good days I had spent in Winchester and the surrounding district. I saw again the glory of its cathedral; I wandered again, in spirit, down its ancient High Street . . . and I felt that it was right to regard old Winchester as one of our most interesting places. But Warwick had some "votes," too, and so did Shrewsbury and York. But such discussions are never final; England has so many towns and cities which are rich in beauty, steeped in history, and noble in architecture that it is really impossible to pick out any one place and say, "This is our most interesting town or city." But I love to hear cyclists talking in this way, because it shows that as they have ridden through England they have ridden with seeing eyes; the rolling road has brought them to places which have lived in their memories and which will live always . . . the grey stones of ancient churches, the monuments in market-squares, the timbered houses in narrow old streets, and the friendly inns which, built in more leisurely days, still have the power to beckon the traveller and bid him welcome.

Tyre Economy

"TYRE Economy" is still being preached by the officials at Tyre Control, and by the tyre manufacturers. We still have to be careful about rubber . . . and I am minded that one tyre manufacturer has a pungent phrase in an advertisement this week . . . "The War will be won on Rubber." Not much of an exaggeration, either! So, cyclists, take as your motto that sound advice, "Spare the pump, and spoil the tyre."

Harvest Time

NEVER in our country's history has a "Harvest Thanksgiving" service been fraught with so much meaning. And I love those Harvest Festivals held in our village churches. It is in the countryside that you get the real spirit of harvest . . . and when I think of all those acres of golden corn which I have watched—from my cycle, and from trains—I feel that I must ride out to some village during the next few weeks and take my part in rendering thanks for all the bounty of the fields. And what a wonderful job our farmers have done! "Speed the Plough" has been the slogan, and surely there has never been a more successful one! Never must we slip back into the bad old days when so much of our land was idle and neglected.

Broken Glass on the Roads

I AM glad to see that propaganda is being put out about the evil of broken glass on the roads. Here is a real menace to tyres, and something which does much to destroy all the good work which has been done by Tyre Control, and the Tyre Manufacturers' Conference, dealing with tyre care. Recently, in three separate roads, I saw quantities of broken glass . . . smashed milk bottles . . . and removed it from the paths of riders, to whom punctures are serious matters these days.

My Point of View

BY "WAYFARER"

St Mary the Virgin. Adderbury (Oxon) "For Strength"

Roundabout

A LIGHT-HEARTED leading article in *The Times* on the subject of rail travel concludes by expressing the hope that in the not too remote future we may be able to indulge our travelling eccentricities to the full, and, if we feel so inclined, book (from London) to Birmingham by way of Beachy Head. That is the sort of itinerary in which many cyclists like to indulge—without, of course, the formalities of "booking," for no tickets are necessary in our pastime. The thought of going from London to the Midlands via Beachy Head has quite a provocative aspect, and is just after the heart of one who once, on a cycle tour, came back from Killarney to Birmingham by way of Dublin, Belfast, Larne, Stranraer, Ayr, Dumfries, Carlisle, and Preston. I mind me that only a year or so ago I cycled from the Midland metropolis to Harrogate via Nottingham, Worksop, Doncaster, Selby and Ripon. Regularly I tourneyed "round the earth" to reach a destination less than 20 miles from home, finding recurring joy in the process. There is a saying that "all roads lead to Rome." This is also true concerning some of the places I infest. I invariably get to the Rome of my choice even if, at the outset, I start off in what would appear to be the wrong direction.

Pointer

AN experience which fell to my lot during a recent evening ride has acted as a pointer. My electric battery lamp failed me when I was a dozen miles from home, and new "innards" were secured only with considerable difficulty, and after I had cycled, lightless, for some distance. I obtained a new battery through the kindness of a man who had bought one for his own use, and had not yet fitted it. A few minutes later, as I was putting my best foot forward, as the saying is, the bulb died on me, and a spot of pedestrian exercise became necessary. I needed no further convincing of the wisdom of providing myself with spare batteries for both lamps, together with a couple of spare bulbs, the latter being carried in cotton-wool in a matchbox. And so now I do not care if it snows; I am armed to the teeth with replacements. Some of my cycling friends have adopted the plan of carrying a duplicate set of lamps, in the hope of defeating the machinations of the imp of mischief who plays tricks with batteries and bulbs, the idea being to obviate delay if overtaken by "trouble" along the road. For the time being, at any rate, I shall be content with the plan I have adopted, though occasionally I also carry a hand torch, which is distinctly useful if the front lamp goes out. In an emergency, too, it could be used—illegally!—as the head light.

By the way, the concession granted us some months ago by the powers-that-be constitute a great improvement in our lighting, so much so that my craze for cycling in the dark has returned almost to normal.

Catering

CASUALTIES amongst caterers are still being reported, and the ranks of those who provide us with eats and drinks are thinning. In view of the conditions under which catering is now carried on, it is not surprising that so many tradespeople in this class have thrown in their hand. Some will return when the happier days come back; others have given up the business "for keeps." One popular caterer told me a little time ago that she did not seem to be any worse off now that she was no longer feeding anything up to 100 cyclists every Sunday, in addition to others during the week. Possibly that was because her prices were too low; after all, a caterer is entitled to make a profit out of cyclists and others, and I never did think that this particular caterer charged enough, particularly having regard to the quality—and quantity—of the "grub" supplied.

Two specially good caterers within my acquaintance have recently withdrawn from the firing-line, to my great regret. One of the pair ran a pleasant riverside house in Shropshire, and you could always be sure of a good feed. I stayed a night there last Easter, and was confronted by a breakfast which was very much pre-war—to the extent of six rashers of bacon! This person has now taken on other commitments, and has decided to "pack" chance catering. The other case mentioned relates to an isolated farm in Buckinghamshire. The place took a bit of finding, especially in the dark, but when discovered, it always turned up trumps, with a sincere welcome, a bountiful supper, and a comfortable bed. You were right out of the world in that particular establishment, and, in pre-war days, not a sound reached you except the distant rumble of a train. It was a constant joy to me to visit that establishment. My first call there is a vivid memory, which competes for pride of place with the recollection of an Easter visit—a long, long ride on a bleak day during which I never got warm, to find the "house full" notices being displayed. But a bed was made up for me in a little passage which rejoiced in the name of "the office," and there I slept the sleep of the just, after a marvellous supper. The people inhabiting this delightful farmhouse have recently given up business and retired into private life. And thus the ranks of caterers are thinned.

It may be fitting at this juncture to express surprise that, in these difficult days, a national body should be contemplating the setting-up of a catering establishment somewhere in the Welsh Marches. When week-ending recently in that part of the world, I heard of two envoys from this body having passed through, intent on inspecting a house which it was suggested would be suitable for the purpose indicated. I know no more (for publication), but think this cycling club would be well advised to "stand from under" as regards catering, at least until the world is again at peace. The business is cram-full of complications, which would be accentuated with the control-point some 200 miles away.

Sovereign Remedy

IT needs no great gift of prophecy to suggest that, during the next few months, there will be many grey days—neutral, depressing days which amplify the call of the fireside. If the necessary leisure is available, turn your back on the chimney-corner and adopt the sovereign remedy which will endow such apparently hopeless days with joy. The bicycle is ever at your service. Get out on it. Discomfort may be your portion for the first hour or so, but pleasure awaits you round the next bend in the road. You will enjoy the impact of the wind on your face. You will enjoy the exercise. You will enjoy the changing scenes, dull though they may seem to the non-cyclist. How good it is to be abroad even on a bleak day! Stay out to tea if you can, and thus pile joy on joy. You will be sure of a welcome at that cottage along the lane. There will be a change of food and of environment. You can sit by the kitchen fire and make toast for your tea. And there is always the possibility of meeting two or three other hardy souls who also have their convictions concerning the sovereign remedy, and who will help you to pass a happy hour under that alien but friendly roof.

And so home, under the cover of darkness, along the deserted roads of this epoch. Delight resides in travel even on the dullest of days, and you now know more about the sovereign remedy for the mood induced by the neutral tints of the winter season.

Notes of a Highwayman

By LEONARD ELLIS

SOME of the most inspiring and romantic relics of earlier occupation of these islands are the old British and Roman roads. It is fairly easy in an old earthwork or castle to shut one's eyes and conjure up visions of 2,000 years ago and to people the spot with the figures of the ancient Britons or the Roman legions. It is much easier, however, on a road—a road that starts somewhere and goes somewhere. In other words, half the effort is saved by realising at once that a road had a purpose and that purpose is not far to seek. Many of these old trackways can be traced over the face of England mainly because the engineering work had been so well done centuries earlier that our engineers had a simple task merely to increase the width, deepen the foundations and improve the surface. One admits that where nothing has been done, the old tracks are merely faint marks or are often undiscoverable. It is very easy to forget that the Watling Street is a modern road, and to fall into the half-conscious error of imagining it still to be the Roman Road. It is easier still on the Fosse Way, where long stretches are not now used as a main road, but are grass-grown lanes, unfenced and running through fields, gated at frequent intervals.

Watling Street and Holyhead Road

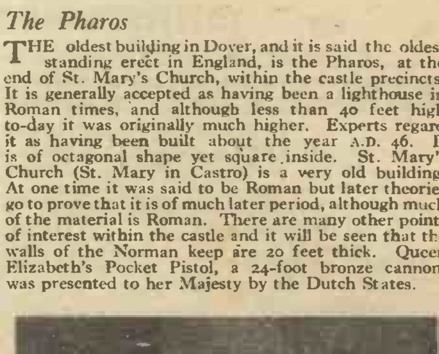
IT is so easy to forget just what the Watling Street is that it gets confused with A5, the Holyhead Road, the Road to Ireland and other titles that have been bestowed upon its various alternative routes. The Watling Street is generally accepted as the road that connected London with Uriconium, near Shrewsbury. Some say that an extension went south-eastward to Dover. Uriconium, now called Wroxeter, was a natural road centre and from here many roads radiated. It is possible that the original Watling Street continued into North Wales. It is certainly true that a road running south from here is also called Watling Street, and further roads ran to Chester and elsewhere. Thomas Telford, a great road engineer, used the line of the Watling Street to a great extent, but not wholly, in making his great Holyhead Road. Broadly speaking the two coincide from London to Weedon, near Daventry, where they divide. The Holyhead Road goes to Daventry, Coventry, Birmingham and Wolverhampton, and it is said that the steepest pitch is the Bull Ring in the centre of Birmingham. The old road goes more northward to High Cross, where it crosses the Fosse Way, and then on to Atherstone, Wall, Bridgetown and Gailey.

Curiosities en Route

IN Atherstone town there is a milestone that proudly states that it stands one hundred miles from London, Lincoln and Liverpool, but it is far from truthful. A few miles north of Weedon there is a three mile stretch where the old line disappears, but for the rest of its length this road is remarkable for its straightness. It is easy to understand, of course, that the early engineers had no intervening property or rights of way to consider. At Wall, near Lichfield, a rather curious break occurs where the old road coming from the south-east meets the Birmingham-Lichfield Road. The westering portion leaves the Lichfield Road nearly half a mile north of the point. The popular old story is that one party of road-makers started from Holyhead and the other started from London. In spite of their lack of surveying instruments, their work was so accurate that when they met they were only half a mile apart, as the Irishman must have expressed it. The Watling Street and the Holyhead meet again in a particularly squalid part of Shropshire surrounded by coal mine derricks and ironworks, but it will be noted that the newer road avoids the drop into and the climb out of Oakengates. It is a fascinating road to travel although it has its grubby moments.

The Pharos

THE oldest building in Dover, and it is said the oldest standing erect in England, is the Pharos, at the end of St. Mary's Church, within the castle precincts. It is generally accepted as having been a lighthouse in Roman times, and although less than 40 feet high to-day it was originally much higher. Experts regard it as having been built about the year A.D. 46. It is of octagonal shape yet square inside. St. Mary's Church (St. Mary in Castro) is a very old building. At one time it was said to be Roman but later theories go to prove that it is of much later period, although much of the material is Roman. There are many other points of interest within the castle and it will be seen that the walls of the Norman keep are 20 feet thick. Queen Elizabeth's Pocket Pistol, a 24-foot bronze cannon, was presented to her Majesty by the Dutch States.



The old milestone at Atherstone.

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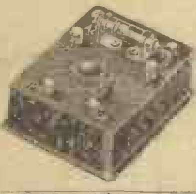

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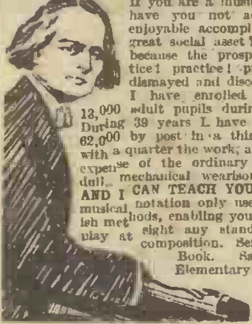

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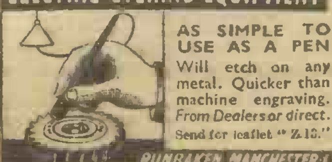

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