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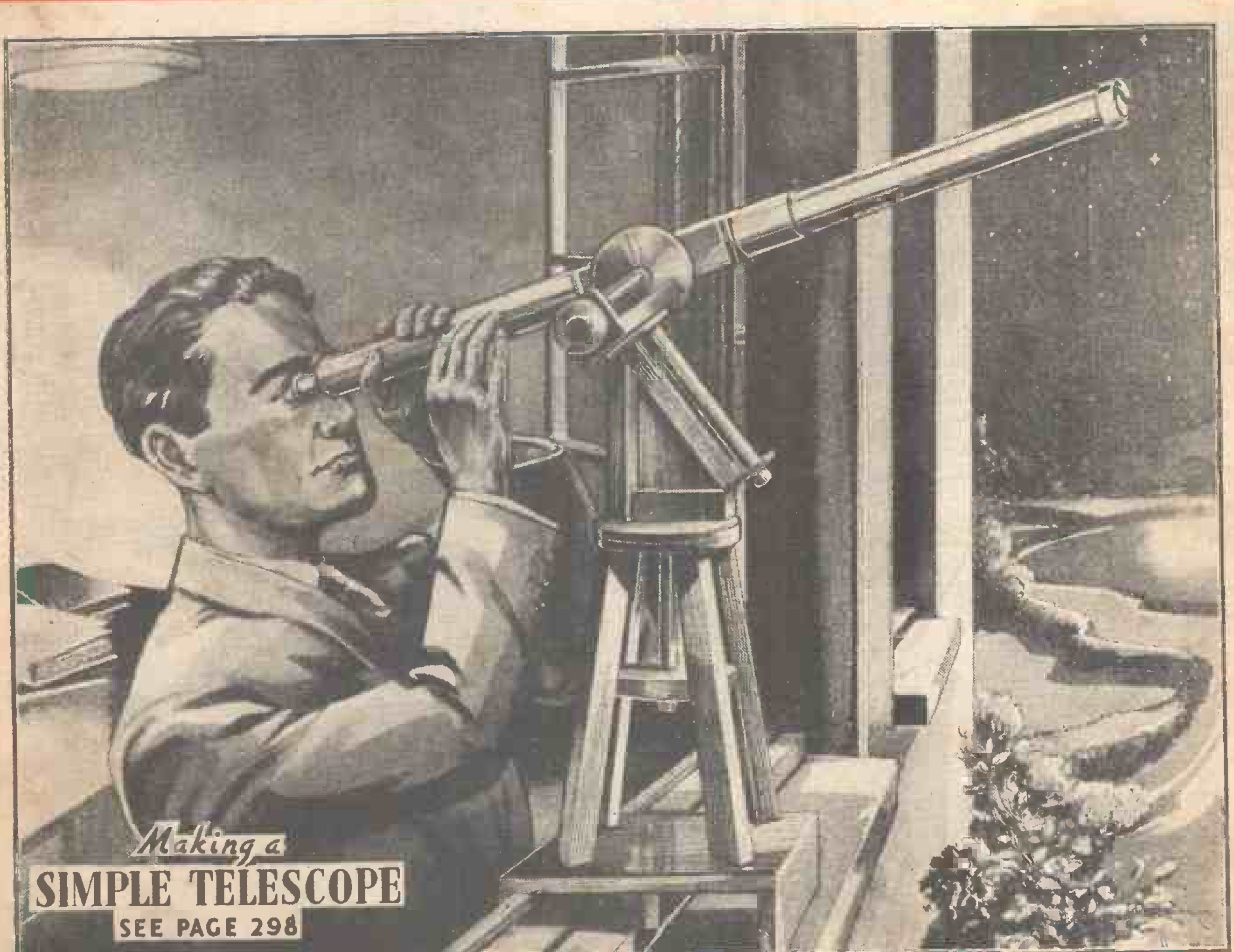
EDITOR : F. J. CAMM

JUNE 1952



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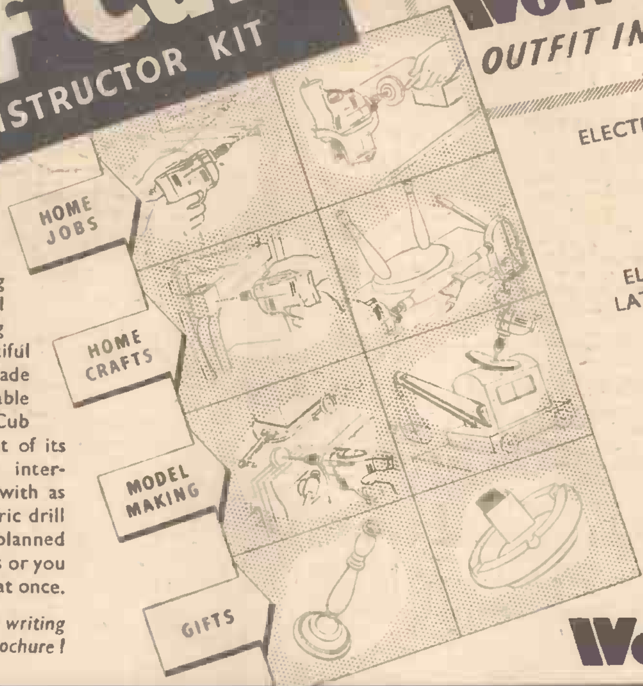

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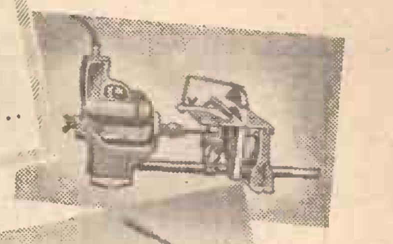

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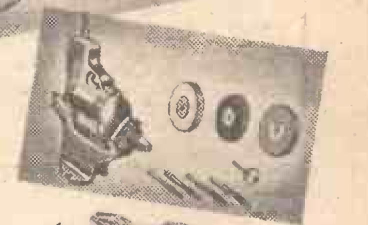

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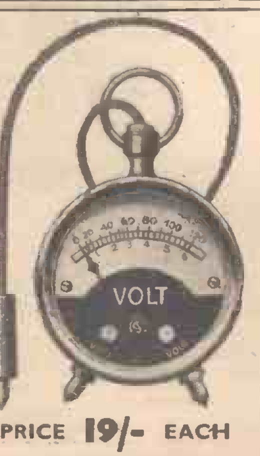

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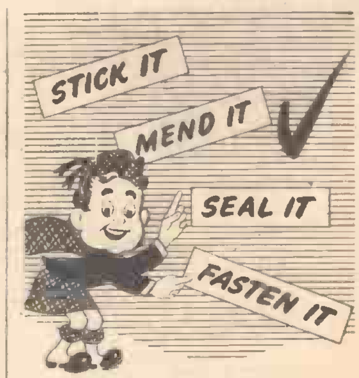

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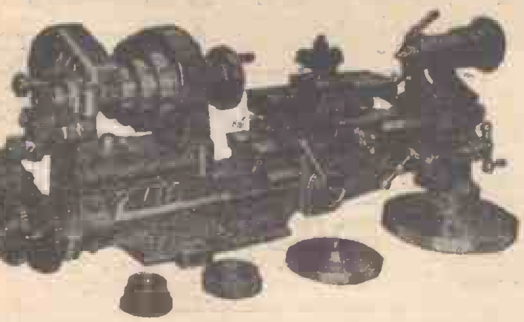

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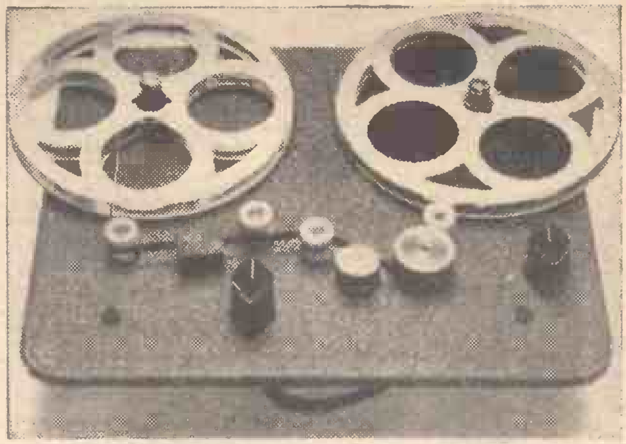

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JUNE, 1952
VOL. XIX
No. 222

PRACTICAL MECHANICS

EDITOR
F. J. CAMM

Owing to the paper shortage "The Cyclist," "Practical Motorist," and "Home Movies" are temporarily incorporated.

FAIR COMMENT

By The Editor

Scientific Signs of the Times

DURING April I gave a lecture, at the Birmingham Chamber of Commerce, organised in conjunction with Messrs. John Hudson, Ltd., the booksellers, also of Birmingham, taking as my topic "Scientific Signs of the Times." It was a pleasure for me to meet so many of our readers. I cannot afford the space to report my lecture in full, although I observed that the Press gave a fair summary of it. I did, however, make a plea for the formation of a Ministry of Inventions so that British inventors will be at least on a level with inventors in all other countries. In Russia to-day inventors are treated as demi-gods and they always have been in Germany. In America there is the Mellon Institute to help the poor inventor along. In this country quite often the Patent Office alone makes money out of inventions. The Inventors' Club feature of the television programmes has provided an enormous incentive to inventors and I am glad to note that as a result of the publicity given on the television screen, many inventions have reached production and are earning good rewards for their sponsors. The Ministry I have in mind would not replace the Patent Office. It would supplement it, and, once a patent has been granted, it would not be possible for it to be set aside in the Law Courts. This Ministry would also act as a clearing house for inventions and put inventors into touch with possible manufacturers. Such a Ministry would be of enormous benefit to the country.

I pointed out during the lecture that, whilst science had opened its Pandora's box during the past twenty years, and revealed many scientific secrets, development must inevitably be comparatively slow because of the financial limitations imposed by rearmament and our debt to America. Discoveries will crowd upon us and so will inventions, but until this country is able to pay its way and has fulfilled its rearmament programme we cannot expect any very rapid developments.

Atom power, undoubtedly, is here, but it will be many years before it is harnessed generally for peaceful purposes. The future of this country depends upon finding some substitute for coal. We are not short of it, but for reasons which are well known we are unable to get it out of the earth in sufficient quantities. If we did, many of our troubles, financial and otherwise, would vanish. If we could export adequate supplies of coal we should be able to import more goods and also pay our way. Why has coal never been converted into power at the coal face? Why cannot it be pulverised, mixed with water, pipelined to various centres throughout the country, dehydrated and made into coal bricks?

Although the jet engine has made rapid strides, it will be many years before the piston and crankshaft engine has been displaced. Our financial position is such that we shall be unable to afford the considerable outlay necessary for development of the new engines, and for the new plant which will be required.

OUR £200 COMPETITION

ENTRIES for our national competition announced in the two previous issues, for which we offered £200 in prizes, closed on June 1st and, as announced, the results will appear in our issue for August. We have received a large number of entries and the adjudicators have commenced their examination of the entries. A cursory examination shows that most of them are of high quality and display considerable ingenuity. Most competitors have captured the spirit of the competition and it is obvious that apart from the prize winners a large number of other competitors will see their efforts in print and receive cheques for them.

F. J. C.

Mr. F. J. Camm being introduced by the Marquis of Donegall at the Birmingham Chamber of Commerce, when he gave a lecture on "Scientific Signs of the Times."

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A Simple Telescope

Constructional Details of an Easy-to-make and Efficient Instrument

By E. W. TWINING

THE purpose of this article is to describe and give drawings of the construction of a telescope which, by the expenditure of quite a modest sum and the use of a few woodworking tools, will yield to its maker many very pleasant hours of observation of details which he has possibly never before seen. It will, on a clear night, show the oblate form of Jupiter, some of his satellites and possibly the belts. The rings of Saturn and the crescent form of Venus will be clearly visible, whilst the Moon, before or after the "full," will be a wonderful sight.

The Lenses

The primary facts about this telescope are that it is to have a simple non-achromatic object glass, having a diameter of 1½in. or a little over, and a focus of 40in., a cardboard tube for a barrel, an eyepiece of the Huygenian type, such as I have already described in PRACTICAL MECHANICS for September, 1951, and a stand with a head or top which will give equatorial movement to the instrument.

I stress this equatorial design for the head of the stand because it has very great advantages over what is known as the alt-azimuth mount and is just as easy to construct.

The first thing to do will be to acquire the object glass; this is a thin double convex lens which will be mounted in the tube in the same manner as are the lenses of the eyepiece in their focusing tube.

To obtain all the lenses an excellent plan would be to order from a reliable firm of lens makers who are themselves specialists in telescopes and other optical instruments.

Messrs. Broadhurst Clarkson & Co., Ltd., of 63, Farringdon Road, London, E.C.1, have arranged to supply to readers of PRACTICAL MECHANICS the three lenses required for this telescope: the object glass, 1½in. dia. by 40in. focus; the eyepiece Field lens, 2in. focus x ⅞in. dia., and the eye lens, .66in. focus x ½in. dia., all for the sum of £1 2s. 6d.

Making the Barrel

Having obtained the object glass, next find a strong cardboard tube, which is perfectly straight and with the ends cut dead square. Choose a tube which is made of whole sheets of cardboard, rolled and glued; not one of those in which strips are wound spirally; these latter have no great strength. If there is any difficulty in obtaining a tube in one length, the barrel can be made up of two 20in. tubes of the same diameter, butting them together and joining them by successive bands of thin card, or thick cartridge paper, 10in. long glued around the middle, thus making one long tube of 40in. Care must be taken to see that it is perfectly straight before the glue has set. In the drawings which follow I have assumed that the tube will have to be joined. In Fig. 1 the band is marked J.

Into one end of the tube the O.G. is to be fitted. It may be that the diameter of the glass will be a little greater than I have indicated, possibly up to as much as 1⅝in., and the nearest obtainable diameter of tube may have to be a trifle larger than this. The thing to do in that case will be to put a lining of thin card in the tube as many thicknesses as will be required to bring the internal diameter down so that the lens fits comfortably without forcing; the lining is shown at L in Fig. 1. Inside this lining a shoulder must be formed by a ⅜in. wide band of thicker cardboard (marked B^1) to form a rebate to support the lens.

Next black the inside of the tube. Artists' process black or poster black will do, since it is a water paint, but vegetable black in a thin lacquer or weak shellac solution is better. It must, whatever is used, dry with a dead black surface. When dry, insert two stops cut from thin cardboard fitting tightly in the tube, one S^1 at 13in. from the object glass, having a 1¼in. circular hole cut in its centre, and the other S^2 at 26in. from the O.G. with a 1in. hole. These stops must be blacked before being stuck in.

The Eyepiece End

Before we can deal with the other end of the telescope barrel the eyepiece must be made, using 1in. dia. brass tubing exactly in accordance with instructions given in my previous article, "Telescope Object Glasses and Eyepiece Lenses," in the September, 1951, issue. For this 1½in. telescope make eyepiece No. 1 of 1in. equivalent focus; this, with the 40in. O.G., will give a magnifying power of 40, which is possibly as much as the glass will stand. At some later date perhaps a little higher power can be tried.

The length of the brass tube for the eyepiece No. 1 is 4in. and this must have room to slide longitudinally for focusing. Wrap around this tube, quite tightly, a band of black velvet (V in Fig. 1), with the pile next to the brass; let this be 2in. wide; 2in. velvet ribbon would be ideal for the purpose because of the selvedges. Allow the cut edges to butt together longitudinally and secure them with a strip of glued paper. Then glue on to the velvet successive bands of thin cardboard, until a cardboard cylinder C is formed of about 1⅝in. outside dia. The glue must not be sufficiently liquid to soak through the velvet. Next cut three discs: D, D and D (Fig. 7), from either very thick card or from plywood, which will fit tightly into and be glued in the barrel tube. Each of these must have a truly circular hole cut in its exact centre, of such diameter as will just push over the cardboard cylinder around the eyepiece. The cylinder and the discs must be glued together, blacked and glued into the telescope barrel, as shown on the right hand end in Fig. 1.

When everything is dry and set slide the brass eyepiece out of the velvet. Insert the object glass and secure it with an outer band of cardboard, having a width of about ½in., the ends of which must butt neatly together and be glued into the barrel. This is B^2 in the drawing.

The Saddle

This completes the telescope barrel with the exception of a strengthening ring on the outside, at the O.G. end: R. in Fig. 1,

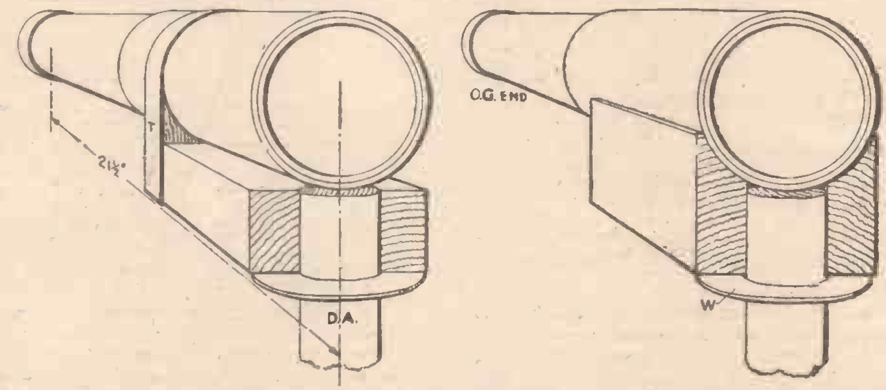


Fig. 2.—Cross sections of the telescope barrel showing alternative methods of making the declination axis attachment.

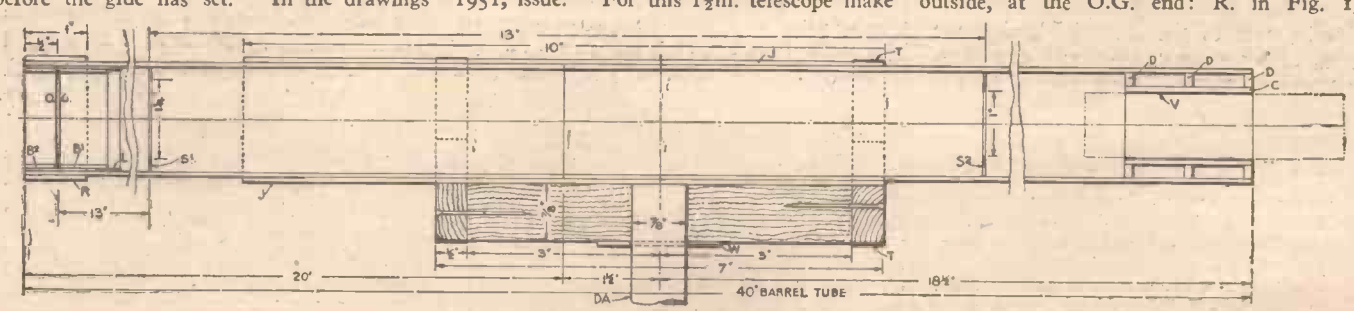


Fig. 1.—Section of the telescope barrel and cradle.

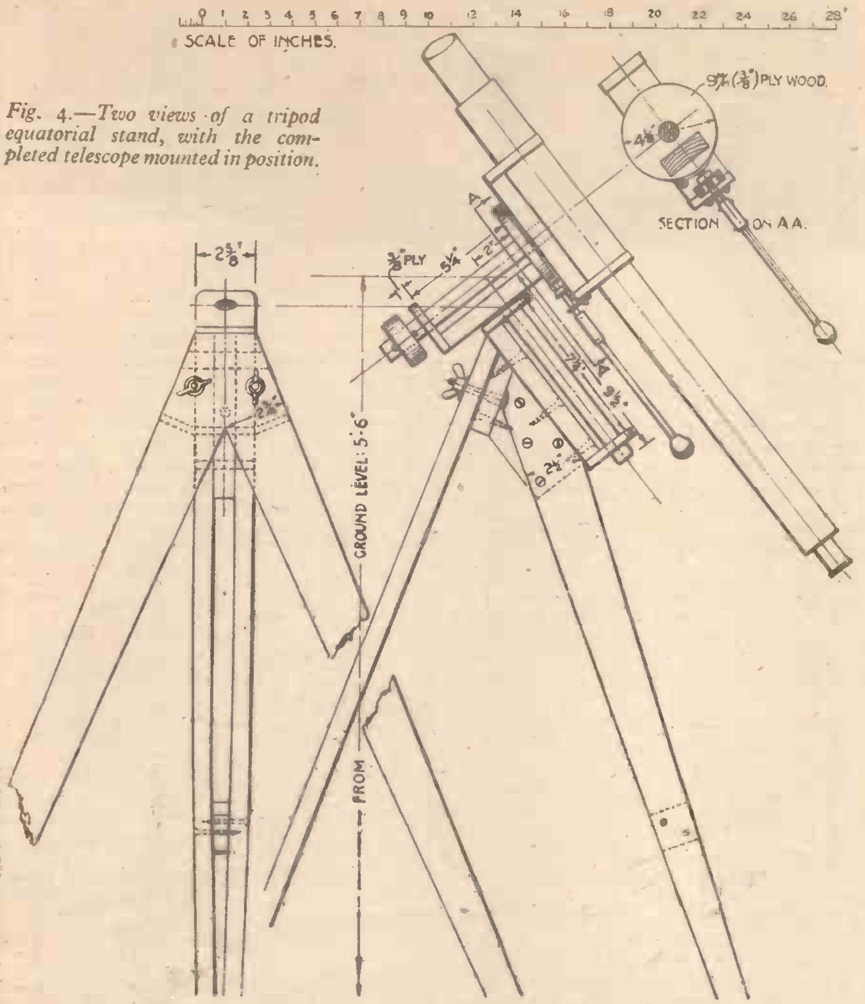


Fig. 4.—Two views of a tripod equatorial stand, with the completed telescope mounted in position.

and the attachment of the wooden saddle-piece with the declination axis: DA Fig. 2 is a cross section through the barrel, the jointing band J and the long piece of the saddle with the axis, DA, glued into it, all in accordance with Fig 1. This is not so much a saddle as a cradle, for the only pieces which are curved to fit the barrel are those of ½in. thickness, which are glued and bradded on at the ends. Shown also in Fig 2 is an alternative way of making the declination axis attachment. On the left it is shown built up of three pieces and on the right constructed by hollowing out, with gouges, one solid piece of wood, thus making a proper saddle. The reader can follow the method he prefers, but I think the three-piece construction is the more simple because the main piece into which the axis is glued can be cut, as can every other part of the equatorial head, from ⅞in. floorboard.

After the saddle is glued to the barrel I suggest, since the tube cannot be pinned to the wood from the inside, that the glued joint, on to the cardboard tube, be made more secure by wrapping a single band of ½in. linen tape (T in Figs. 1 and 2) soaked in glue around each end of the wood and around the tube, letting the ends meet, or overlap on the wood on the opposite side to the tube.

Declination and Polar Axes

Both the declination axis and the polar axis—to which I shall shortly refer—are made from ⅞in. dia. dowel wood which should be of straight grained birch. I have seen broomhandles of this wood and of this diameter, beautifully straight, true and smooth, and if one of these can be purchased there will be sufficient material for two or more axes.

For the declination axis a length of 9in. should be cut off the broomhandle and nicely rounded at the end opposite to the saddle; on this end a weight will be required to balance the telescope when the declination axis approximates to the horizontal. This weight, WT in Fig. 3, will be best cast as a ring in lead; it will be detachable and held, when in use, by two split pins, wooden pegs, or in some other suitable manner. If split pins are used, and they make the simplest fastening, they should be 1½in. long by ⅛in. dia. Any car repair garage will supply them.

Fig. 3 is a general view of the whole telescope barrel and declination axis, with eyepiece in position. Around the axis there should be a washer of very hard cardboard, glued to the saddle piece; this is lettered W in Figs. 1 and 2. Several thicknesses of Bristol board, as used in making the eyepiece, glued together, should be used for this.

The next thing to make will be the polar axis with the crosshead at the top. This axis is 9½in. long and the ⅞in. crosspiece, into which this axis is glued, will be 5¼in. long by 2⅜in. wide. The hole for receiving the axis must be bored dead at right angles in the crosspiece and 2in. from one end of it. At each end of the crosspiece are bearings, cut preferably from 9mm. (⅜in.) plywood, to carry the declination axis, as shown in Fig. 4. Both these bearings can be cut square but in the drawings I have shown the one nearest to the telescope truly circular in outline; this is done in order to provide for a simple clamp in declination. Such a clamp will be found of very great convenience in using the telescope because, when the heavenly body under observation is in the field of vision, the instrument is clamped in declination and cannot then be accidentally shifted. One rotative movement only about the polar axis, is then required in order to follow the apparent passage of the body across the heavens.

The polar axis and the crosspiece with the bearings make up the crosshead. The axis fits and rotates in bearings of plywood as shown in the drawings, which bearings are glued to a portion of the stand and, with the top of the stand, constitute the equatorial head.

Latitude Angle of Polar Axis

In Fig. 4 are two drawings of an equatorial tripod stand. I have shown the polar axis making an angle with the horizontal, or ground level, of 51½°, which corresponds with the latitude of the cities and towns named in the arc of that angle. For the beginner in matters telescopic and astronomical must understand that, with an equatorial mounting, the polar axis must be set up at such an angle that it is parallel with the true axis of the earth. From this fact he will realise that the angle which his polar axis must make with the ground will be controlled by the latitude of the place in which his telescope is to be used.

As, of course, not all of my readers live on the 51½° parallel of latitude I give below a brief list of some of the principal places in Great Britain, taken in order from south to north.

Plymouth	50⅜°	Darlington, Middlesbrough.. ..	54½°
Southampton	51°	Newcastle-on-Tyne	55°
London, Bristol, Cardiff	51½°	Ayr	55½°
Birmingham	52½°	Glasgow, Edinburgh	56°
Manchester.. ..	53½°	Dundee	56½°
Preston, Leeds, Hull	53¾°	Aberdeen ..	57¼°
York, Harrogate ..	54°	Inverness ..	57½°

Not all of the cities and towns are exactly on the latitudes stated but the angles given are sufficiently near for the setting up of any small equatorial which is not fitted with divided circles and clock driven. Furthermore, I may add, that the latitude angle of any place other than those I have named, can be obtained from good maps, particularly those of the Ordnance Survey Department.

Tripod Stand

Three alternative forms of stand will be described for the telescope and the first is a tripod (Fig. 4), all the parts of which can be made from lengths cut from ⅞in. red deal floor boards.

(*To be continued.*)

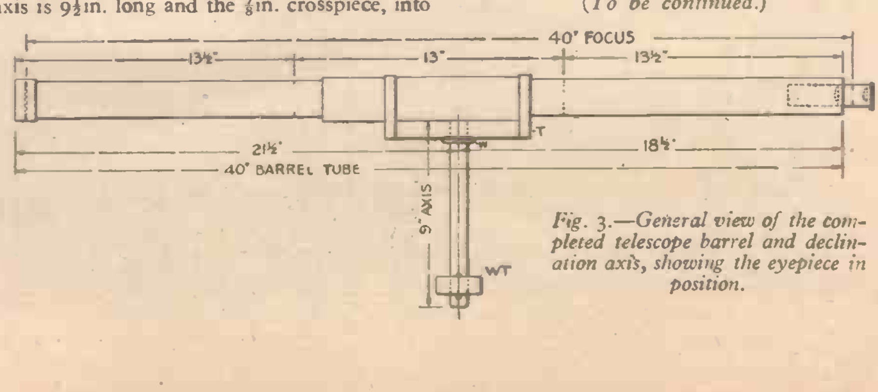
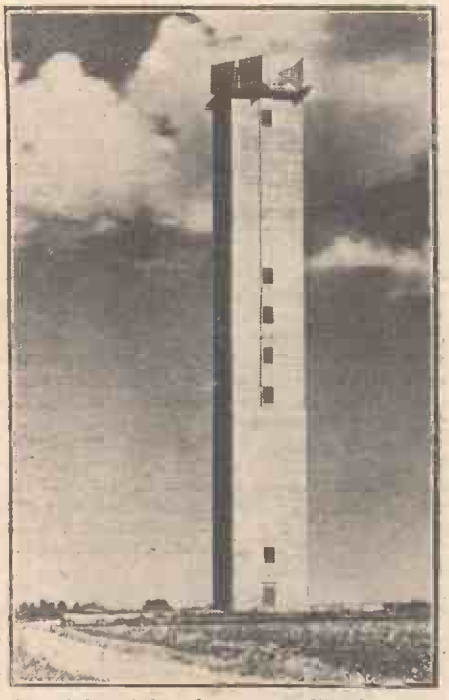


Fig. 3.—General view of the completed telescope barrel and declination axis, showing the eyepiece in position.

Trans-continental Radio-relay System

The New Coast-to-coast T.V. and Telephone Service in America



One of the reinforced concrete radio-relay towers

A NEW chapter in telephone history was opened last autumn when the first telephone call was speeded from coast to coast along the new microwave radio-relay skyway of the Long Lines Department of the American Telephone and Telegraph Company.

Supplying a new backbone telephone route, vital to the civilian and military needs of the United States, the project is the longest microwave system in the world. It is the product of years of engineering effort and close co-operation by the development, manufacturing and operating units of the Bell System.

The new facilities, which for the first time will send telephone conversations across the continent by radio rather than wire or cable, were opened in a ceremony in Long Lines headquarters.

Microwave Towers

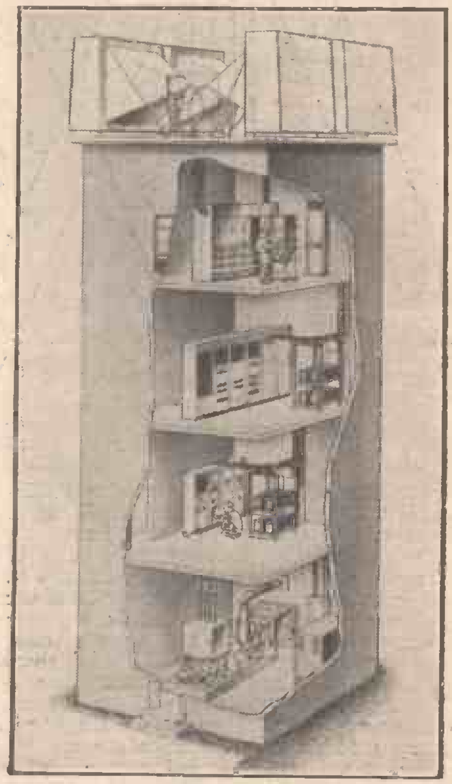
Built in about three years at a cost of 40,000,000 dollars, the system will relay calls along a chain of 107 microwave towers, spaced about 30 miles apart. The tremendous distances involved, together with the large number of radio channels required, posed a new set of problems for the Bell Telephone Laboratories. Three new developments provided the answers—first, a new electronic tube outstanding in performance at super high frequencies; second, a greatly improved metal lens which would handle thousands of simultaneous telephone calls; and third, a unique system of filters representing an entirely new contribution to the field of communications. This electronic equipment was made and installed by the Western Electric Company, manufacturing unit of the Bell System.

Messages will ride super high-frequency radio waves in the 4,000 megacycle range (4,000,000,000 cycles), compared to the ordinary radio broadcasting range of 550-1,600 kilocycles (550,000-1,600,000 cycles). Radio waves used in the relay system are about three inches in length as against wave lengths of about 1,000 feet for frequencies in the middle of the standard broadcast band. Amplifying equipment in each relay station boosts the power of the radio signals 10-millionfold, then they are focused in a narrow beam by the directional antenna, and sped to the next tower where the process is repeated.

TV and Telephone Messages

Designed to carry television as well as telephone messages, the system is already transmitting network TV shows as far west as Omaha, Nebraska, midway point in the 3,000-mile New York-San Francisco route. The western half of the route is expected to be equipped to handle coast-to-coast television by the end of next month. Initially, however, the system will provide one east to west channel for television. Another channel, west to east, will be ready for service later.

The radio-relay route will become the seventh telephone highway to cross the great western expanse of the country. Telephone engineers point out that the radio-relay system will not replace other types of communications, but will supplement those already in operation.



A cut-away view of a typical concrete station in the radio-relay system

The first trans-continental telephone system was an open wire line which was opened for service January 25, 1915. On that occasion, Alexander Graham Bell, in New York, spoke to his one-time assistant, Thomas Watson, who was in San Francisco. Since then, three other open wire lines, each capable of carrying dozens of calls simultaneously, and two cables, each containing hundreds of circuits, have spanned the continent over diverse routes.

The first trans-continental telephone cable followed a central route across the country and was placed in service December 22, 1942. The second cable, which was coaxial, followed a southern route and was completed November 15, 1947. Thus with different types of facility available—open wire, cable, and radio-relay along different routes—the American nation is assured of continuous communication from coast to coast.

An unusual view of a radio-relay station high up in the Sierra-Nevada mountains

Technical Blacks

Their Uses and Some Simple Methods of Producing Them

By J. F. STIRLING

THE "technical blacks," as they are sometimes called, play a surprisingly extensive part in modern arts, technologies and decorative processes. Their consumption in this country alone goes into many thousands of pounds annually. Yet, fundamentally, they are all (or, perhaps, more accurately, nearly all) based on amorphous carbon, that commonest of elements, in various degrees of purity.

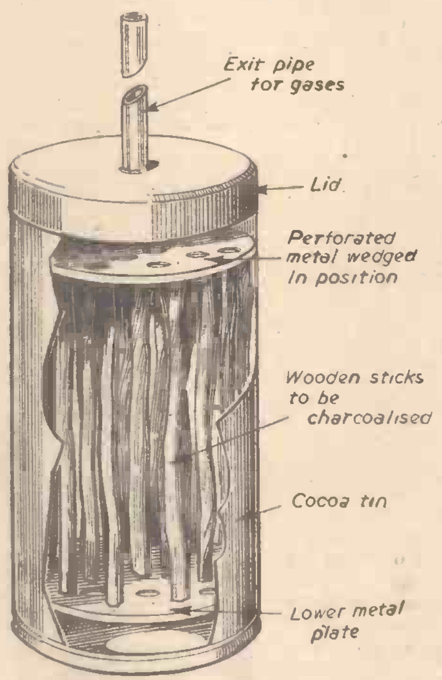
In one way or another we are all users of one or other of these "technical blacks." The amateur chemist makes great use of charcoal, animal charcoal and "bone black" for filtering and purifying his solutions. The gardener utilises charcoal in one or other of its forms. The enthusiastic aquarist or fish-keeper often pins his faith to certain varieties of prepared charcoal as an efficient absorber of deleterious gases in his aquarium waters. Even as a special fuel for domestic irons and other appliances, the use of ordinary charcoal is not quite obsolete even to-day. The artist and the water-colourist, of course, has his ivory blacks, his peach blacks and his lamp-blacks. So, also, has the more utilitarian painter and decorator. Without charcoal in one of its many forms, we could hardly have utilised the gas mask or respirator, and without the employment of one black or another in the printer's ink on this page you could hardly expect to be perusing this present article, and examining its illustrations.

Indeed, throughout the whole gamut of arts and industries there is usually a call, somewhere or other, for one of the many "technical blacks" which come to our notice so frequently but which we think so very little about.

Charcoal Making

Take for instance, ordinary charcoal—"wood charcoal," as it has been called for hundreds of years. This is a very useful material. Not only does it find many work-room and domestic uses, but it is also of great service to the amateur chemist and experimenter as a reducing and gas-absorbing agent and, also, as a very efficient filtering medium.

Much marking-out and sketching is done with the aid of charcoal sticks, and in technical photography, too, charcoal is useful, since the marks which it makes do not reflect light like those of a lead pencil and, consequently, they photograph dead black.



A simple type of carboniser necessary for the home production of the various charcoals and blacks.

Commercial charcoal in sticks is not exactly an inexpensive article to buy, yet it may be made easily and inexpensively enough in the very simple apparatus illustrated in the accompanying diagram. All that is required for home charcoal production is a fairly large-sized round "tin" of the coffee or cocoa type, together with a nice red kitchen fire.

The lid of the tin should fit tightly and it should be pierced with one or two holes to permit the escape of gases. It is better, in fact, if a six-inch length of iron tubing is attached to the tin lid so that the escaping gases can be led clear of the tin.

Two perforated plates are required for the interior of the tin, one fitting in place about half an inch from the tin bottom, the other about 1in. from the top of the tin.

Between these plates is loosely packed the wood which it is desired to "charcoalise." The best wood for this purpose is beech, for this gives a closely-grained highly-absorptive charcoal. However, any wood can be used for the purpose, but it is better, if possible, to avoid using woods containing a good deal of resin, such as pine and fir. Remember, also, that the prepared charcoal will have exactly the same shape as the original wood. Hence, if charcoal sticks and pencils are required, the wood must be thus shaped before being placed in the tin.

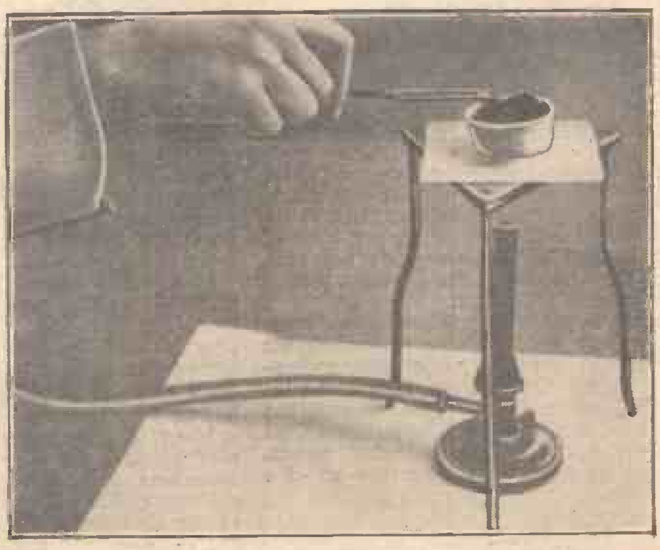
Having packed the wood in the tin and fitted the lid thereon, the entire assembly is placed in the middle of a red fire in a deep grate. The red coals or coke should entirely surround the tin, leaving only the exit pipe of the latter protruding above them.

Almost immediately, fumes will issue from the exit pipe of the tin, and presently they will be able to be ignited by holding a light to them. The wood inside the tin is now undergoing a process of what is termed "dry distillation," whereby it is being chemically broken up into gases, tars, water and other substances, all of which are driven off from the scene of action. When no further gas or fumes issue from the exit pipe of the tin continue the heating for ten minutes longer, and then remove the tin from the fire and allow it to cool.

On opening the tin, the wood will be found to be completely carbonised or "charcoalised" throughout, yet retaining its original form.

When finely powdered, the above wood charcoal will form the "charcoal black" of

Showing the method of sieving a black pigment in order to obtain a fine powder of uniform particle size.



The manufacture of genuine ivory black. Scrap pieces of ivory (old piano keys, etc.) are calcined at red heat in a porcelain crucible over a bunsen burner.

the artist. Its pigmenting properties are not as powerful as some of the other blacks, but it is most useful for mixing with whites to form delicate greys.

Nut Blacks

By treating nut shells, particularly coconut shells, in exactly the same way we can make a charcoal of exceedingly high gas-absorptive powers. These "nut blacks" or "nut charcoals" have been much used in the past for respirator making. A glance at the accompanying table will enable the reader to obtain a clear idea as to the enormous gas-absorptive properties of these nut charcoals.

There is another very useful variety of charcoal which is readily made. This is the well-known "animal charcoal." It is prepared by calcining bones in exactly the same manner as that employed for the making of wood charcoal. More gases are given off than in the case of wood charcoal manufacture, but the two processes are exactly the same. The animal charcoal, thus produced, is of a very porous texture, and it is dead black in colour. It is not used so much for absorbing gases but, rather, for absorbing and retaining impurities from solutions.

You may, for example, have a solution of, say, salicyclic acid or benzoic acid which, being impure, has a brown or yellow colour. Filter the hot solution through a bed of animal charcoal broken up into small pieces, and the solution will emerge colourless, the animal charcoal having taken up and retained the coloured impurity. Countless chemical processes, including large-scale ones, are based on this simple fact.

When powdered, animal charcoal is known as "bone black." It has been used as a pigment in this form, and, unfortunately, this "bone black" has been used for adulterating genuine ivory black, a material which we shall describe later. But, strictly speaking, bone black is hardly a true black at all, for it only contains about 10 per cent. of black carbon, the remaining 90 per cent. of the mass consisting, for the most part, of white calcium phosphate.

Indeed, by digesting powdered animal charcoal or bone black with warm hydrochloric acid for some time, the white calcium phosphate can be dissolved out, leaving the insoluble black carbon. This material has sometimes been sold as "ivory black," yet it is not a true product of that nature, although its pigmenting properties are of a high order.

Making Lampblack

Perhaps the most important of all the technical blacks is the well-known lampblack. On a large scale this is made by burning waste oils and other combustible materials in a very limited supply of air and by collecting the resulting "smoke" of carbon particles on special mats or "blankets" suspended in specially-designed collecting chambers.

On a small scale, ample supplies of this black can be obtained by the method illustrated herewith. The flame of an oil lamp burning paraffin oil is allowed to impinge on the surface of a glass flask through which a slow stream of cold water is allowed to pass. The lampblack is deposited continuously, and it is scraped off from time to time.

If, instead of an oil flame, we use a gas flame, the product is called "gas black." What is known as "acetylene black" is deposited in precisely the same manner, using an acetylene flame. Acetylene black is supposed to be exceptionally dense in blackness and, also, to have an extremely fine particle size. But, generally speaking, all these blacks consist of fine particles which will readily pass a 300 standard mesh, so that no special grinding process is required for them afterwards.

(Above) Making lampblack on a small scale. The flame of an oil-burning lamp is allowed to impinge on the under surface of a flask through which flows a stream of cold water.

Grinding up the calcined ivory black previous to "grading" or sieving.

One would expect lampblack, carefully made, to consist of pure carbon. Such, however, is not the case. It contains traces of hydrocarbons—compounds of hydrogen with carbon—traces of water and remnants of oil (in the case of lampblack made from an oil flame).

Many of these impurities can be got rid of by heating the lampblack to redness for some time, remembering, of course, that, at red heat, carbon will combine with the oxygen of the air forming the gas, carbon dioxide, and so burn away completely if the heating is too protracted. But to get pure carbon from lampblack, we must heat it to redness in a stream of dry, pure chlorine gas. The chlorine combines with the hydrogen of the hydrocarbon impurities, forming hydrochloric acid gas (which is driven off) and leaving the carbon behind.

"Sugar Black"

In passing, it may be interesting to note that the purest charcoal or carbon black is prepared by carbonising pure white sugar and by subsequently heating it to redness in a stream of chlorine gas. The product so obtained is denser than the other charcoals, having a specific gravity of 1.57 against that of 1.44 for ordinary charcoal.

When charcoal is thrown on water it usually floats. This is because it is buoyed up by the absorbed air which it contains. But if its contained air is sucked out by means of a vacuum pump, the charcoal will immediately sink.

"Ivory Black"

Coming, now, to the true ivory black. The genuine variety of this material is made by calcining ivory. For this reason it is expensive, and the genuine material is not easy to obtain. Yet, given a supply of ivory scrap, such as old piano keys, it can very readily be made by calcining the ivory material in a porcelain or silica crucible over a gas flame. A dense black product will be obtained. This will have to be finely powdered and passed through a fine sieve to reduce it to a more or less uniform particle size. A 200 mesh standard sieve is the most suitable for this purpose, although coarse muslin or other similar fabric can be used for the same purpose.

Ivory black does not consist of pure carbon. In fact, its carbon content is not as high as that of lampblack, since it contains mineral matter, a little tarry matter, some ammonia and other substances. Yet, as an artist's pigment, both for oil and watercolour work, it is very much admired, being perfectly fast to light and giving a softer black than lampblack, which latter pigment, when used for the same purposes, has a harder shade which, sometimes, has a slightly greenish cast.

Vine Black

Another black which is often sought after by artists is "vine black." This is manufactured on a small scale merely by calcining vine roots in the above manner. It contains more carbon than ivory black, and, in character, is about halfway between lampblack and ivory black. Still another artist's black is "peach black," made by calcining peach kernels.

When preparing pigments for any decorative use, ordinary soot should never be employed, because it is full of impurities and, again, it is never constant in properties. It is, therefore, quite impossible to match it in shade with any given depth of black.

The amateur pigment maker should also bear in mind the fact that it will always be possible for him to heighten and to increase the brilliancy of his black by grinding a small quantity of a blue pigment with it. For the finest and best blacks, genuine indigo or cobalt blue should be used for this purpose. For other types of blacks, ultramarine or lime blue can be employed. The "blueing" must not be overdone, otherwise a definite blue-black will be obtained.

There are many forms of "vegetable black." They are all made by calcining vegetable refuse. Another black which is known by the not very elegant title of "blood black," was at one time used by manufacturers of blacking pastes and polishes. It is, of course, made by the careful and controlled calcination of dried animal blood.

Many of the present-day "ink blacks" are not pigmentary blacks at all. They are merely aniline dyes, and, as such, although they may make excellent inks, their permanency is not to be compared with that of the true carbon blacks which we have enumerated above. Such "ink blacks" can all be destroyed by chloride of lime bleaches, whereas a carbon black is left quite untouched by such agencies.

Carbon Inks and Permanent

If any reader should desire to prepare a true carbon ink (a so-called "Indian ink") from any of the above-described carbon pigments, he will find this a simple task. Merely dissolve about 5 parts of gum arabic in 95 parts of water and grind sufficient of the black pigment into the liquid to pigment it to the required depth of blackness and, at the same time, without decreasing the liquid's flowing properties to any appreciable extent. Size, gelatine, or glue can be used in place of gum arabic, but the latter substance is usually the best. It is well to incorporate a little blue pigment into all such carbon inks in order to heighten their brilliance.

Metallic Black

For poster paints, the same procedure is adopted, but the medium can be made thicker, since the free-flowing qualities necessary for an ink have not to be conserved in this case.

In conclusion, and for the sake of completeness, it may be of interest to note some non-carbon blacks which are of absolute permanency. These are platinum black, palladium black and iridium black. In each case they consist of the respective metal in a very finely-divided condition, and they are prepared by gently warming a solution of the tetrachloride of the metal with any chemical reducing agent, as, for example, a little formalin. In such an instance, the metallic black is deposited as a dense black material.

Platinum and palladium blacks produced chemically on paper formed the working principle of the very beautiful but nowadays, alas, obsolete platinotype and palladiotype processes of photographic printing. Such images were absolutely unfadable.

Table showing the relative volumes of different gases which are absorbed by a given quantity of animal charcoal under normal pressures and at the temperature of freezing-point.

Gas	Volume of gas absorbed under normal pressure at 0° C.
Ammonia	170
Ethylene	75
Carbon dioxide	68
Carbon monoxide	21
Oxygen	18
Nitrogen	15

All these metallic blacks are very highly active. Palladium black, for example, possesses enormous absorptive powers. It will absorb at least 900 times its own volume of hydrogen gas, and the lower its temperature the more of this gas will it absorb. It is the least intense of these blacks. Platinum black is much denser and deeper, whilst iridium black is truly and unmistakably "jet." So active is iridium black that alcohol takes fire when poured on it.

It is only for specialised and highly scientific uses that these blacks can be employed, since they are exceedingly expensive. If they were cheaper, many applications would be made of them.

It is, therefore, fortunate that, since we are all users of "technical blacks" in one form or another, the carbon pigments of this type are so inexpensive and so readily prepared either in small or in large quantities. There is quite an attraction in preparing one's own blacks for some special technical, artistic or utilitarian purpose, and to any interested reader we commend any of the simple processes which have been outlined in this article.

Items of Interest

Duke of Edinburgh to Open The Model Engineer Exhibition

THE organisers have announced that His Royal Highness The Duke of Edinburgh has consented to open "The Model Engineer" Exhibition at the New Horticultural Hall, Westminster, on Monday, October 20th, 1952.

The opening of the exhibition by the Duke of Edinburgh emphasises the growing importance of model engineering in Great Britain, particularly in the protection of prototypes for scientific and industrial purposes.

British model engineers, moreover, are accepted as being without superiors, and acknowledgment of the fact is shown by the increasing number of foreign visitors to this annual exhibition.

The exhibition, which was to have been held in August, will be held from October 20th to October 29th inclusive.

Eliminating Windscreen Wipers

BRITISH scientists have discovered a new method of keeping car windscreens and shop windows free from snow, ice and mist. The secret lies in covering them with a film of pure gold.

It is not an expensive process. The gold film is stated to be only a quarter of a millionth of an inch thick, and is transparent. The discovery was made at the National Physical Laboratory at Teddington, Middlesex.

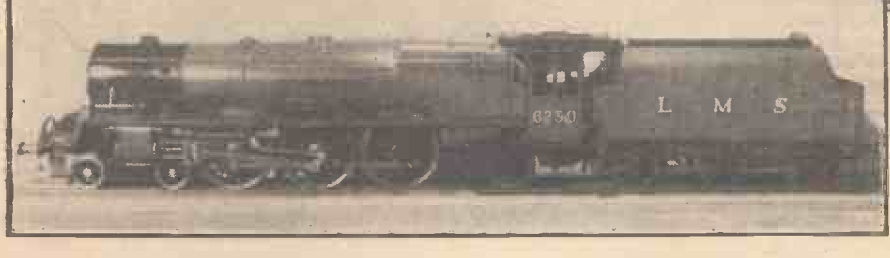
Large Gear Wheel

WHAT is probably the largest gear wheel ever made in South Africa has been produced in Beroni by Precision Equipment (Pty), Ltd., on a 16ft. hobbing machine recently installed by the company. Having a diameter of 15ft. this gear wheel is to be used as a girth ring for driving a cement mill. It is interesting to note that in the heavy shop equipment of this company are included two of the largest machines of their kind in the southern hemisphere—a 16ft. gear hobbing machine, and a 300-ton vertical boring machine of similar capacity.

Model Railway Exhibition

THE Model Railway Club held their annual exhibition in the Central Hall, Westminster, from April 15th to 19th inclusive. This year the number of models exceeded 3,000, and the exhibits included models of locomotives, coaches, wagons, stations, buildings and line-side gadgets. In fact, everything that goes to make an efficient model railway system. There were sections showing points and track layouts, free-lance models, and models under construction so that methods and craftsmanship could be studied. Many model steam locomotives built to large scales were on view, and visitors were able to have free rides behind some of these on the passenger-carrying track.

An innovation this year was a working model railway in a garden, and there was also a large working miniature railway layout displayed by British Railways, as seen in one of the accompanying illustrations.



Two exhibits at the Model Railway Exhibition. (Above) Miniature railway layout by British Railways. (Left) A ¾in. scale model of the L.M.S. locomotive "Duchess of Buccleuch," made by T. A. Bott, of Oxford.

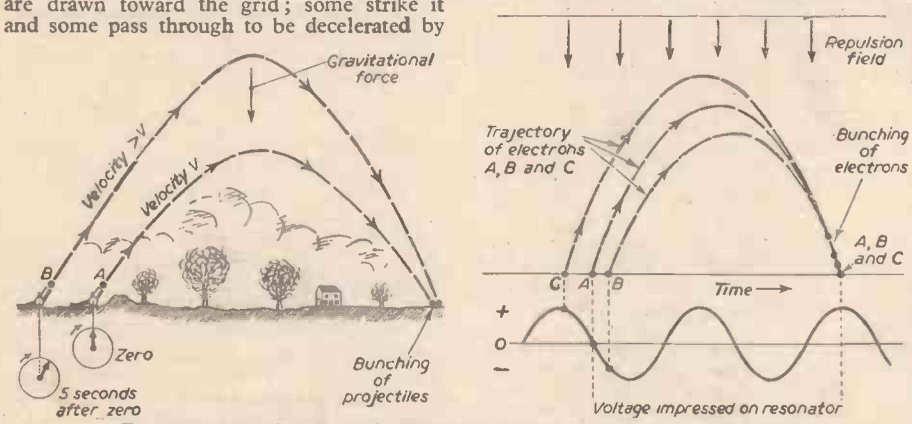
Generating Micro-waves for Radar

The Scientific Principles Simply Treated

By F. W. COUSINS, A.M.I.E.E.

(Concluded from Page 276, May issue)

THE first real attempt to use the transit time of the electrons, advantageously, was achieved by Barkhausen in what is now termed the Barkhausen-Kurtz Tube or oscillator. Such an oscillator is capable of generating ultra-high frequency oscillations above 10^8 cycles per second; its construction and action will now be explained. The oscillator comprises a triode in which the grid is positive with respect to the cathode, and the anode is slightly negative. An oscillatory circuit, consisting usually of lecher* wires, is connected across the grid anode circuit. In operation, electrons emitted from the cathode are drawn toward the grid; some strike it and some pass through to be decelerated by the negative plate and possibly redirected toward the grid, and in this manner certain electrons oscillate about the grid, finally coming to rest upon it. Electrons oscillating about the grid in this fashion induce A.C. voltages in the grid circuit, depending upon the transit time. Although part of the electron stream reaches the anode after one transit, that part of the stream which is free in the tube for several oscillations loses energy, and over a cycle the stream gives up more energy to the oscillatory circuit than is abstracted, consequently the transfer of energy can be used to build up the oscillations. It will be appreciated that the variation of the electron velocity is a radical departure from normal triode operation wherein the *intensity* of a constant velocity electron stream is the factor which is modulated, such operation being termed amplitude modulation. The variation of the velocity of the electrons in a constant current electron stream is termed velocity modulation.



Figs. 13a and 13b.—Ballistic analogy of velocity modulation and bunching.

Velocity Modulation

The phenomenon of velocity modulation which the electrons experience in velocity modulated oscillators is most simply described and explained by a ballistic analogy. Consider two projectiles A and B (Fig. 13a). Projectile A is ejected into space earlier than projectile B and at a lower initial velocity. Then projectiles A and B will follow parabolic paths, as depicted, under the influence of the Earth's gravitational force. Since B has a higher initial velocity than A, it will rise to a greater height against the gravitational field of force. If the interval of time between the ejection of A and B is so timed in relation to their different velocities it is possible for A and B to "bunch" together and arrive simultaneously, or approximately so, at the ground, the time of transit for B being less than that for A.

To complete the analogy, consider the graphical illustration Fig. 13b, which is partly due to Terman[3], wherein an alternating voltage is impressed across a resonator through which the electrons are passing towards the repulsion field as shown. Consider electron A passing when the voltage is zero, it will move as shown in the repulsion field; but electron B, passing earlier in time, has a voltage accelerating it which is more negative than that influencing electron A, consequently it is moving with a velocity lower than A, but since it was ejected earlier in time it reaches the end of its trajectory at the same time as A. Electron C leaves later in time and hence has a more positive voltage than A to accelerate it, and it moves faster than A; nevertheless its trajectory can be such as to cause it to arrive at the same time as A and B. Thus electron bunching is effected, and the velocity of the electrons modulated.

A simple oscillator producing a velocity modulated beam of electrons is shown diagrammatically in Fig. 14. Electrons emitted from the cathode are caused to enter a grid system across which an alternating voltage is applied, electrons entering with a velocity Vo are accelerated or decelerated according to the applied voltage, and in a drift space AB delimited by a reflector at a negative potential the electrons bunch together, the bunches having varying velocities.

* Lecher Wires. — Two parallel wires which are long compared to a wavelength and spaced from each other by a distance equivalent to a small fraction of a wavelength.

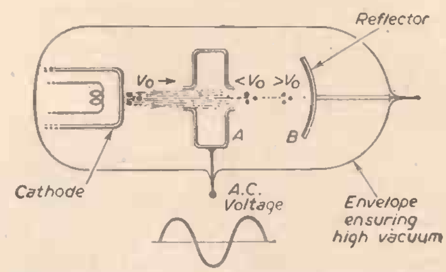


Fig. 14.—Schematic velocity modulation device.

Cavity Resonators

We have already seen that ordinary oscillators use "lumped" constants of inductance (L) and capacitance (C), that is to say, they use simple coils and condensers. The term "lumped" constant may generally be taken as referring to an electrical magnitude when its dimensions are small in comparison with the wavelength propagation of currents in it. However, as the frequency rises to a high order the coils and condensers have to be reduced to very small physical dimensions, since $f = \frac{1}{2\pi\sqrt{LC}}$. If the conventional circuits are used at wavelengths approaching their physical dimensions, radiation of energy is severe and the resistance of the wires becomes high due to skin effects.* These difficulties have been surmounted by using a "hollow box" type conductor which shields the radiation and confines the energy to the inside. These hollow box type conductors are called cavity resonators, and a consideration of Fig. 15 shows how the ordinary lumped circuit of L and C is transformed into the hollow box type arrangement—the cavity resonator. Careful thought will show that capacitance is reduced by moving the plates apart and reducing their area, while inductance

* Skin Effect.—The effect prominent at radio frequencies of the A.C. in a conductor which tends to concentrate near the surface, thus increasing the effective resistance.

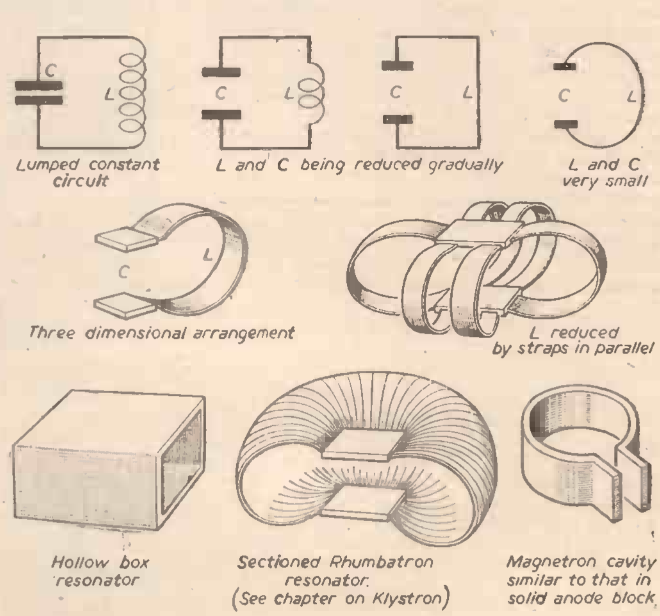


Fig. 15.—Diagrams illustrating the evolution of cavity resonator from lumped constant circuit.

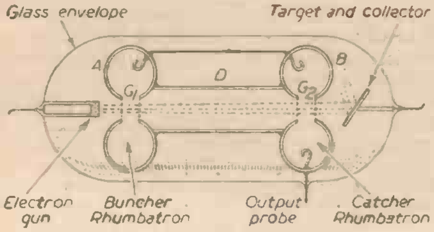


Fig. 16.—The klystron oscillator.

is reduced to a minimum by straight straps in place of multi-turn coils.

It is now possible to examine the most important velocity modulation oscillator invented by Varian [4] and known as the klystron oscillator, which is capable of generating oscillations of the order of 10,000 Mc/s. The klystron employs a cavity resonator termed a rhumbatron (Fig. 15), and a schematic diagram of an early klystron having two rhumbatrons; a "buncher rhumbatron" and a "catcher rhumbatron" is shown in Fig. 16. The operation is based upon the velocity modulation principle already referred to; electrons emitted from the cathode are accelerated by a positive potential applied to the resonator system, i.e., the rhumbatrons A and B connected electrically by the drift tube D. If no oscillations are present in rhumbatron A and B the electrons travel normally to the collector C at the velocity they enjoyed upon entering the resonator. Very different is the case when oscillations exist in A and B. Consider electrons arriving at the gap G_1 in rhumbatron A, oscillations existing therein. The electrons have a certain velocity, and depending upon the phase of the oscillations in A they are accelerated or decelerated in traversing the gap G_1. Upon entering the drift space of the drift tube D, the electrons travel at a constant velocity but at different velocities according to their treatment at gap G_1; in fact the electrons are velocity modulated and bunched. If gap G_2 in rhumbatron B is so spaced from rhumbatron A that the electrons reach G_2 when they have experienced maximum bunching, two main things may occur at gap G_2. (1) The bunch may be accelerated; (2) the bunch may be decelerated. If the first occurs then power is extracted from rhumbatron B and the oscillations therein will be damped. If the second case occurs, then power will be supplied to rhumbatron B, and this will sustain the oscillations. In actual operation, power is not supplied to rhumbatron B continuously, but the oscillator is arranged so that a net gain of power is effected over a complete cycle.

It should be appreciated that if the rhumbatron A (the buncher) is driven by an external source of power such as an antenna receiving radiations, and the electron beam is strong enough to give the rhumbatron B (the catcher) more power than the antenna gives to the buncher, the klystron acts as an amplifier. If, as already explained, the buncher is fed back with power from the catcher, the klystron is an oscillator. Should it be that the buncher is driven by power from both of the aforesaid sources at once, the klystron acts as a regenerative amplifier.

The Reflex Klystron

The reflex klystron shown diagrammatically in Fig. 17 has a single resonator which fulfils the dual role of buncher and catcher rhumbatrons, while a reflector electrode is arranged to return the electrons through the gap G_1 a second time. This type of klystron was developed largely by R. W. Sutton, of the Admiralty Signals Establishment, and it is a most useful form of oscillator. The electron beam is velocity modulated and electrons with the highest velocity penetrate farthest toward the reflector electrode, the field of which is exactly analogous to the gravitational field discussed under the heading of velocity modulation. The illustrations (Figs. 18a and 18b, May issue) show typical reflex klystrons manufactured by E.M.I. Research Laboratories, Ltd., of Hayes, Middx., who kindly supplied the photographs.

Before leaving the klystron it is of great interest to mention the water jet analogue of the reflection klystron, due to W. J. Scott [5], of the British Thomson-Houston Research Laboratories. This remarkable piece of apparatus

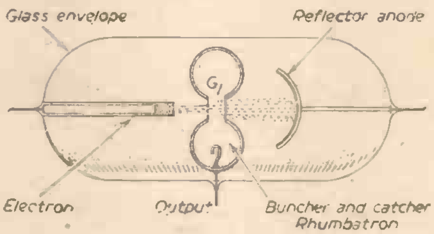


Fig. 17.—Reflex klystron.

was demonstrated at the Electron Jubilee Exhibition held at the Science Museum. For the benefit of those readers who were unable to see that exhibition, the apparatus is schematically represented in Fig. 19. The electron beam is replaced by a water jet issuing from a nozzle A mounted on a catcher grid C, which is attached to a horizontal arm H mounted on leaf-spring S, which acts as a resonator. According to the inventor, the action is as follows. Commencing from rest, the random motion of the water from the jet as it breaks into globules provides sufficient agitation to initiate oscillation of the arm, provided the jet velocity is correct. The jet is modulated by the vertical simple harmonic motion of the nozzle. The water is thereby alternately accelerated and retarded causing bunching, the bunches supplying power to the arm to sustain the oscillations.

The Magnetron Oscillator

The first magnetron oscillator was termed a split anode magnetron (Fig. 20). It comprises a divided anode structure with a filamentary cathode centrally disposed. The anode cathode assembly is situated in a magnetic field, the lines of force of which are parallel to the axis of the anode. A resonant circuit of either an orthodox pattern or lecher wires is placed across the divided anode. It will be observed that such an oscillator is fundamentally a diode with cylindrical electrodes situated in a magnetic field parallel to the electrode's axis.

Magnetrons of this type can be operated in two distinct ways:

1. Negative resistance magnetron.
2. Transit time magnetron.

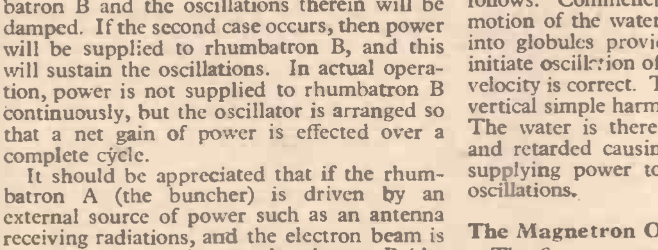


Fig. 19.—Schematic diagram of the water jet klystron.

1. The negative resistance magnetron has many of the disadvantages of the triode oscillator when used for high frequency operation in that it only operates efficiently at frequencies the oscillation period of which is lower than the transit time. If the two halves of the anode are at the same potential the anode behaves as though it were not split and electrons ejected from the cathode would, in the absence of an axial magnetic field, travel to the anode as shown in Fig. 21(a). When the magnetic field is present, however, the electron paths are as shown in Fig. 21(b), and 21(c). Fig. 21(b) shows the paths for a weak magnetic field and Fig. 21(c) for a more powerful magnetic field. If the potential of the anode halves are unequal the magnetic field tends to direct the electrons toward the anode half at the low potential. Thus the low potential results in an increase of electrons, i.e., current flow. If this current flow is plotted against the voltage across the anode

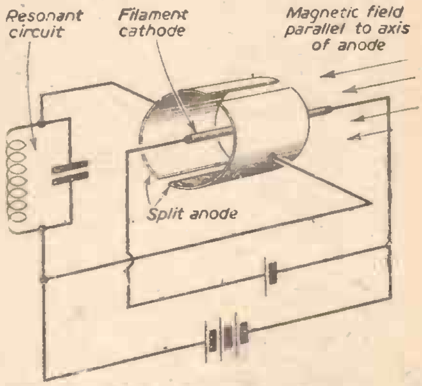


Fig. 20.—Split anode magnetron.

halves, the graph has what we term a negative resistance slope, because increased volts give a decrease in current. Oscillations are maintained by the negative resistance characteristic between the anode halves, and a typical electron path under operating conditions is shown in Fig. 21(d). For a more detailed description of this very complex phenomenon the reader is directed towards reference six in the bibliography.

2. The transit time magnetron is more suitable for the generation of micro-waves and the operation is characterised by the frequency being decided by the orbital period of an electron. The magnetic field intensity is adjusted so that under static conditions electrons ejected from the cathode move in paths which just fall short of the anode. Under varying anode voltage, on the two halves thereof, the operation is not dissimilar to that of the Barkhausen-Kurtz oscillator, the transfer of energy being achieved by the motion of the electrons in the anode cathode space inducing currents in the resonator. Some of the electrons gain energy and return to the cathode, while others lose energy to the electric field and cannot reach the cathode; these continue to move in the anode cathode space, and since their period within the space exceeds that of those electrons which gain energy from the electric field, the net result is a transfer of energy from electrons to the electric field and the oscillations are sustained in the resonator across the anode halves. This use of the electron transit time has resulted in oscillators of this type generating wavelengths of a very low order.

Both the negative resistance and transit time magnetrons have serious limitations for pulse radar operation: the filamentary cathode is not suitable for high peak currents, and the resonant circuits are not suitable for very high frequencies. These objections, however, have been overcome in the multi-resonator magnetron, which is probably one of the greatest inventions of the age, and certainly the most outstanding invention of the scientific apparatus which materially assisted the British war effort. The multi-resonator magnetron or cavity magnetron was due to Randall and Boot[7] and was a product of British skill. Dr. Randall has given an account of the early work in his lecture before the Physical Society.[7] He told of the great drive on centimetre wave work, initiated by Prof. Oliphant, at Birmingham University, and his part therein; his study of the Barkhausen-Kurtz Tube and the klystron of Varian, with a view to the production of a high-power centimetre wave. Eventually he chose a three-dimensional version of Herty's original loop wire resonator, and this gave a cylinder with a slot down one side. These resonators were symmetrically

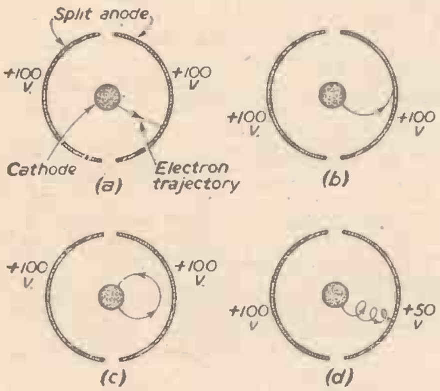


Fig. 21.—(a) No magnetic field; (b) Weak magnetic field; (c) Strong magnetic field; (d) Magnetic field and unequal voltage on anode halves.

spaced about a cathode, and in the prototype Randall used six resonators 1.2 cm. in diameter with slots 0.1 × 0.1 cm. and the resonator had a length of 4 cm.; this generated an electro-magnetic wave of length 9.8 cm.

A simplified view of a multi-resonator magnetron, which is shown in Fig. 22, comprises an anode block having eight resonant cavities or resonators (there may be arrangements having other than eight), the resonators being drilled out of the solid copper anode block and each communicating with a centrally disposed hole via a slot. A cathode structure passes through the centrally disposed hole and the entire anode cathode assembly is adapted to lie in a field of magnetic force produced by a large permanent magnet, the lines of magnetic force being parallel to the axis of the anode cathode assembly. A coupling loop is provided in one of the resonators and this collects energy from the magnetron when it is operating. The external appearance of a modern magnetron of the resonant cavity type with magnet removed is shown by the illustration Fig. 23. This magnetron produced by the General Electric Co., and styled MAG2, is capable of producing a frequency of 9475 ± 50 Mc/s.

Magnetron Operation

To explain the mechanism by which the direct input power is converted to ultra-high frequency power we must consider one of the resonators in the anode block. Each resonator is really a simple resonant circuit, having a pair of condenser plates and a single strap inductance (Fig. 15). Electrons ejected from the cathode structure move in cycloidal paths under the influence of the electric field between the anode and cathode and the magnetic field perpendicular thereto. If we consider a case when the magnetism is oscillating, the segments of the anode block will have alternate positive and negative values at any instant in the high frequency cycle. Electrons describing the cycloidal trajectories already referred to may be either accelerated or retarded by the electrostatic fields across the segments. The

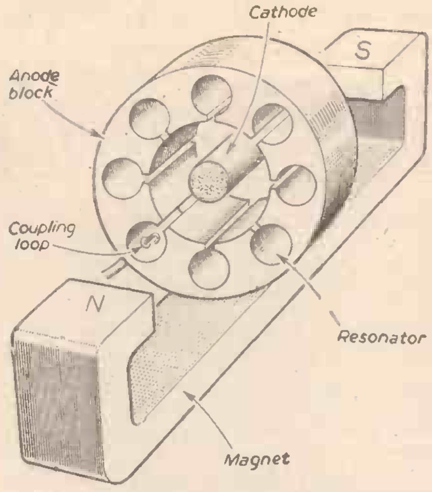


Fig. 22.—Schematic sketch of a multi-resonator magnetron.

accelerated electrons receive kinetic energy, and the retarded electrons give up kinetic energy to the electrostatic field, and this may, in the latter case, be extracted by the coupling

Fig. 23.—Magnetron (puke operated) 9475 ± 50 Mc/s.

loop. In the practical operation of the cavity magnetron the forces acting upon the electrons are so adjusted that more energy is given up to the field by the electrons than vice versa, and this ensures a positive efficiency.

The actual mechanism of energy transfer is by no means simple to explain in that it is of a most complex character. To conclude, and give a clearer picture of what occurs in the magnetron, so that younger readers may grasp the underlying principles, the diagram in Fig. 24 shows the result of a computation undertaken by workers at the University of Leeds. The shaded mass in the anode cathode space is the electron cloud bunched into a four-legged configuration which whirls round at many million revolutions per second, and in the lucid language of

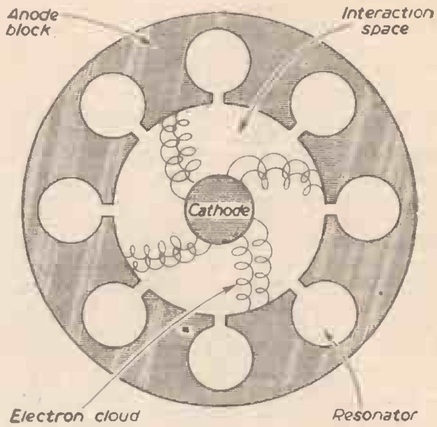


Fig. 24.—Diagram illustrating the principles of a multi-resonator magnetron.

Crowther and Whiddington[8], blowing a note on each cavity in turn operating in substantially siren fashion.

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PHOTOGRAPHY IN THREE DIMENSIONS

With Notes on the Telestereoscope, Polarised Light and Parallax Stereograms

By R. H. WARRING

STEREOSCOPIC photography which, for over a century, was regarded as little more than a scientific novelty, is now assuming major importance in both the military and commercial fields. Hyperstereoscopic photographs (that is, photographs where the stereoscopic effect is exaggerated) are, for example, of the utmost value to observers translating aerial photographs, whether these be for military purposes or ground surveys. Similar photographs have shown their value in astronomy where, for instance, it has been possible to throw stellar formations into relief for viewing, and "three-dimensional viewing" has, more recently, come into use in the sphere of radiography. Another vast field which is still the subject of much development work is cinematography in three-dimensional form and the formation of a similar "solid" image on the screen of a television tube.

There are several different methods whereby stereoscopic effects may be produced. Most of those have been brought into general use, and certainly the majority of the older methods rely on the use of suitable viewing apparatus which may be nothing more complicated than a pair of spectacles with coloured lenses, as far as viewing is concerned, at least. Stereoscopic effects can, however, be obtained without the use of such viewing aids, and it is undoubtedly in this field that the greatest advances will come, probably within the next decade. The most satisfactory form of stereoscopic cinema projection, for example, is obviously one which is self-contained, or "automatic," as it were.

The phenomenon of stereoscopic vision, as inherent with normal human sight, can be explained quite simply with reference to the convergence necessary with a pair of eyes to view or line up with a single object, as in Fig. 1. The lines of sight of the two eyes converge or incline inwards, and it is the mental perception of the muscular effort or control necessary to achieve this angle of convergence which resolves the mental image as a three-dimensional one, and not a simple picture in two dimensions, like a photograph. Allied to this is the fact that the images received by the separate eyes are not identical. Each eye views a slightly different aspect of the object.

When the object viewed is at an infinite distance there is no convergence of the two lines of sight, and thus the resulting image

Fig. 1.—Showing angle of convergence of normal human sight.

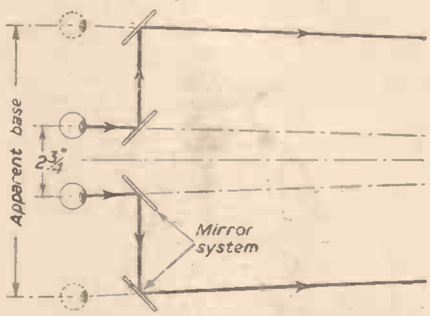


Fig. 2.—Diagram illustrating the principle of the simple telestereoscope.

is again "flat," or two-dimensional. The nearer the object the more marked the convergence, and hence the sense of depth, up to a point where the convergence called for is too great, i.e., the object is too near.

The Telestereoscope

For all practical purposes objects distant some two hundred feet or so require no convergence to view—hence there is little stereoscopic presentation of such images. The property of (human) stereoscopic vision is thus really related only to near and middle distant objects. The most obvious way to view more distant objects in relief would be to increase the distance between the eyes, known as the stereoscopic or parallactic base, by artificial means. This is the principle of the simple telestereoscope, as shown in Fig. 2, where the parallactic base is increased by a simple system of mirrors. Such views are said to be hyperstereoscopic since the (natural) stereoscopic effect is considerably increased. The more distant the object the greater the length of parallactic base required—an extreme example being the full horizontal displacement of the earth on its annual orbit, used as a parallactic base for the hyperstereoptical photography of certain stellar formations, so that these could be viewed in relief.

The Anaglyph

Probably the most popular type of stereoscopic picture has been the anaglyph—two-colour pictures in two dimensions which, when viewed through tinted lenses, appear in three dimensions. The two colours chosen are complementary and the two colour pictures are actually "right eye" and "left eye" images superimposed, one in each of the complementary colours. A simple anaglyph is shown in Fig. 3, where it can be appreciated that the left eye receives only the "left-eye image" (since the appropriate coloured filter or "lens" stops the colour in which the left-eye view is drawn, and thus the left-eye view appears in black lines; and the right eye only the corresponding right-eye view). The ultimate effect is, of course, similar to normal stereoscopic vision. The original "mixed" picture, usually in red and blue-green, appears as a three-dimensional view in black and white.

Anaglyphs are now almost one hundred years old, and during that period the process has been developed and improved. It is possible, for example, to duplicate the process in colour, instead of monochrome, and it can

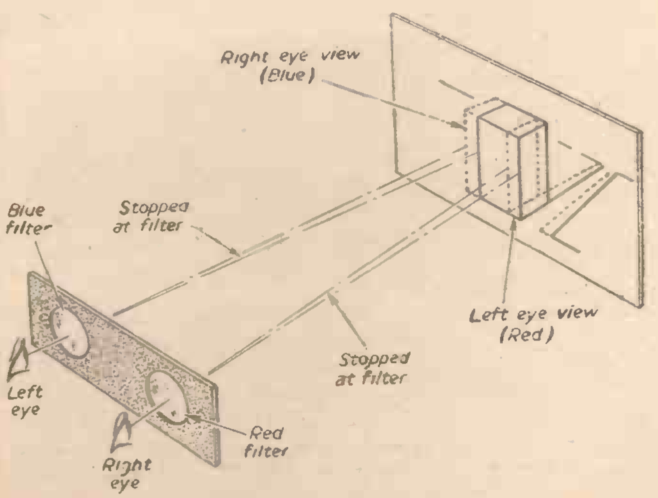


Fig. 3.—A simple anaglyph.

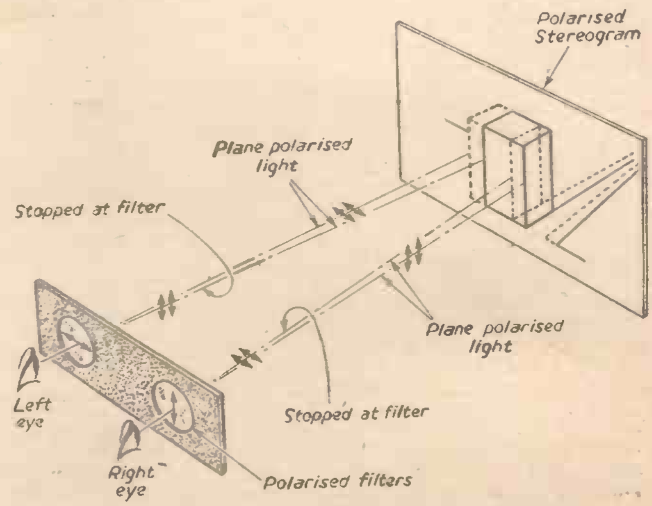


Fig. 4.—Applying polarised light to stereoscopic vision.

be applied readily to cinematography. Special cameras and projectors are, of course, needed, but apart from this, the only other complication is that each individual viewer must be provided with a pair of spectacles with the appropriate filters to "translate" the superimposed images thrown on to the screen by the projector. Naturally these filters result in a certain amount of loss of light or brilliance of the final picture, but that in itself is no serious problem. Much more important, if the question is reviewed from the commercial angle, is the initial cost of and depreciation of the tinted spectacles.

Polarised Light

This same objection can be raised against a further form of stereoscopic projection where the filters or spectacle "lenses" are transparent, not tinted, and polarised. In this case two images are superimposed, as before, one representing a right-eye view, and the other a left-eye view, but instead of being in complementary colours these images are formed by projected light plane-polarised at right angles to each other. The colourless transparent viewing filters are also plane-polarised at right angles so that the correct "eye" image is received by each eye. (Fig. 4.)

When this principle of applying polarised light to stereoscopic vision was first discovered at the end of the nineteenth century, the only suitable light polarising agents available were natural crystals of Iceland spar, which were both difficult to obtain and costly to re-work in the required form. Within the last 20 years, however, various synthetic polarising materials have been produced which has made stereoscopic work based on polarised light methods more widely available. The hyperstereoscopic aerial photographs mentioned earlier, and now almost invariably projected with the aid of polarised light, are viewed through "Polaroid" glasses. Polaroid being the trade name of the generally used polarising material. It is possible even to produce positive photographic prints, as opposed to film strip, in the form of a stereogram, by infusing minute polarising crystals with the emulsion. The image from these prints stands out in three-dimensional form when viewed through polarised glasses. The polarised stereogram does, in fact, offer many advantages over the anaglyph methods.

Parallax Stereograms

The other main methods of producing a stereoscopic image are based on direct presentation of that image, i.e., no separate viewing device is needed. These are quite numerous and rather difficult to collate under definite headings. The majority are known generally as parallax stereograms, and considerable work has been carried out in this field with a view to perfecting suitable "three-dimensional" projection for cinema showing. Fig. 5 indicates, in diagram form, the basic principle of a simplified system. The image projected is, as before, a double one (left-eye view and right-eye view), but in front of and fairly close up to the screen is a mesh or grid. This grid may consist of as many as 100 vertical and horizontal lines per inch, and its actual distance from the screen is a critical factor.

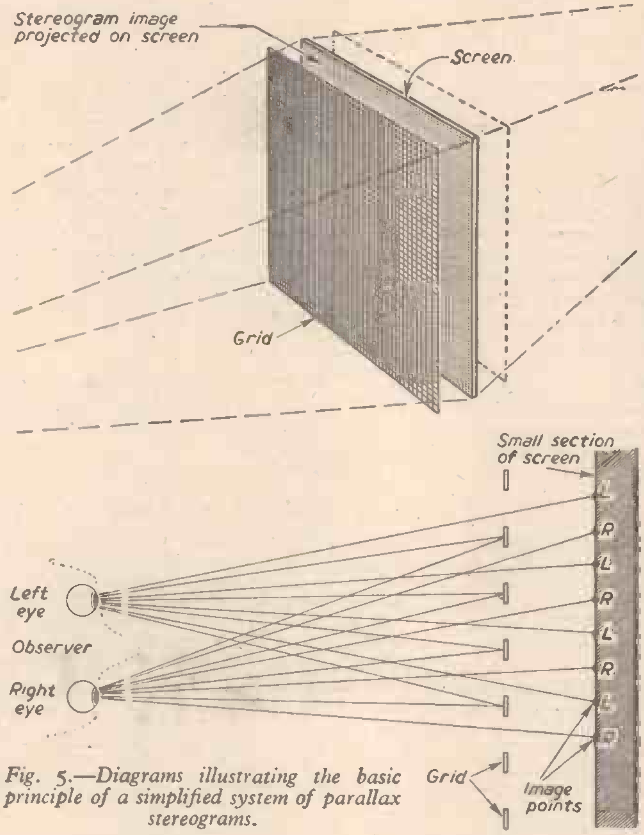


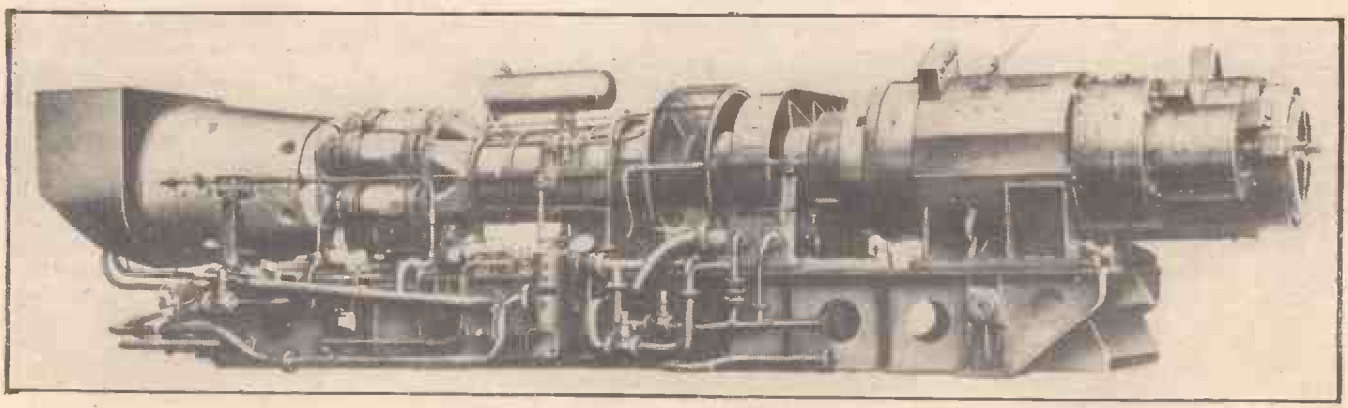
Fig. 5.—Diagrams illustrating the basic principle of a simplified system of parallax stereograms.

Projected on to the screen, either from the front or the back (and, if from the back, often through a second grid behind the screen), is the picture in the form of a parallax stereogram—right-eye and left-eye views mixed. If the observer is correctly positioned, however, the grid between his eyes and the screen will effectively blot out all the *right*-eye view images from his *left* eye; and all the *left*-eye view images from his *right* eye. In other words, each individual eye will receive the correct "eye-view" images, and the resulting picture will appear, to him, in three dimensions.

There is, however, one great disadvantage to this method. The actual position of the observer is critical. With a uniform grid—the open spaces equal in width and height to the opaque parts—there will be a number of positions where the observer will receive the correct images, and an equal number of positions where he will receive exactly the opposite. That is, his right eye will receive left-eye view images and his left eye right-eye view images. The resulting image will still be stereoscopic, but with reversed juxtapositioning. That is, "near" objects will recede into the distance, whilst "distant" objects will appear in the foreground. The perspective of the picture will still be preserved, however, but that will only add to the confusion, for objects will appear to get bigger as they recede into the background, and so on.

Pseudoscopic Viewing

The relative number of observer positions in which this reversed stereoscopic or pseudoscopic view is received can be reduced by amending the proportions of the grid so that the transparent areas are reduced. It is impossible, however, entirely to eliminate pseudoscopic viewing positions by this method, and in many cases the definition between the two can be quite sharp. A small sideways movement of the head, for example, may transform the image received from a true stereoscopic one into a pseudoscopic one. Nevertheless, methods like this have been used for practical three-dimensional projection.



A side view of the power unit for the new Metropolitan-Vickers gas turbine electric locomotive recently delivered to British Railways. The locomotive, No. 18100, has a maximum tractive effort of 60,000 lb.—sufficient to start the heaviest passenger train on the steepest gradient—a maximum speed of 90 m.p.h., and weighs 129 tons 10 cwt. It is 66ft. 9¼in. long, 9ft. wide and 12ft. 10in. in height above rail level. Whilst being suitable for use on any of the British Railways main lines, the new locomotive is primarily intended for work on the London to Plymouth route of the Western Region. The new locomotive is rated at 3,000 h.p.

PROGRESS IN SPEED

From 60 Miles an Hour to 700

By Professor A. M. LOW

WHEN the twentieth century was born, the world was a comparatively leisurely place. True some express trains in Britain travelled at speeds of sixty miles per hour, but they did it safely on fenced-in lines. A few horseless carriages, only recently freed from the Red Flag Act which kept their speed down to five miles per hour, chugged along the roads; but the horse was still the normal method of road transport.

In flying, a spectacular advance had not long been made. Santos Dumont had flown round the Eiffel Tower in his airship, winning a substantial prize by completing the journey of seven miles at a speed of 14 miles per hour. At Lake Constance, Count Zeppelin had constructed a gigantic airship on new principles which reached a speed of 20 miles per hour.

H. G. Wells Was Wrong

A handful of enthusiasts—cranks, many people called them—had been experimenting with gliders and even strange winged-machines powered by steam engines. No one really took them very seriously.

You can judge the attitude of the average person by comparing it with that of H. G. Wells, who was no average man, but a trained scientist with a vivid imagination and a gift of foretelling the future which had made him world famous. He wrote: "I do not think it at all probable that aeronautics will ever come into play as a serious modification of transport and communication. . . ." this was in the first year of the century.

While young Mr. Wells was writing his book "Anticipations," from which the above quotation was taken, two young men in America called Wright, who had read the obituary of Lillienthal, killed while gliding, were producing a glider which was the first to be fitted with elevators.

It is now familiar history that this was the prelude to the construction of the first powered aeroplane in 1903. They covered 852ft. in 59 seconds—a speed of very few miles per hour. To-day there are aircraft capable of travelling 852ft. in one second.

At the dawn of the century the mere fact of flight at all was sufficiently fantastic without worrying about miles an hour. Six years later flights were still being measured in yards rather than speed, and it was not until World War I that flying as a means of communication began to make real progress. The aeroplane entered the war a fragile baby and emerged a sturdy adolescent. That was only 30 years ago. It is still within the memory of millions of us that flying the Channel was considered so difficult that a prize of many thousands of pounds was offered.

Between the wars speed increased. The 100 m.p.h. that had seemed spectacular became 300 m.p.h. in 1929 and 400 m.p.h. in 1934. Always the target was set a little higher. If World War I was not notable for turning the aeroplane from an experimental device into an accepted means of travel, World War II was responsible for taking it to every part of the world. To-day there are thousands of aeroplanes capable of travelling round the world in as many days as Drake took years. Almost any part of the civilised world is less than 30 hours' journey from any other part.

That is some measure of the revolution that flying has made in transport, and yet we are only at the very beginning. Commercial aviation to-day is in about the same state as railway travel in 1870. Most of the routes have been pioneered, but consolidation has hardly begun.

The second half of the century will see nothing as epoch-making as that first flight of the Wright brothers, and perhaps there will be no multiplying of average speeds by ten and twenty, but there will be a spectacular increase in transport by air, comparable to the increase in transport by road in the first fifty years of the century.

Before the century ends, perhaps the person who remembers travelling to Paris by train may be as unusual as the man who remembers horse buses is to-day. A new generation will be growing up who accept air transport as the usual method of travelling long distances.

Motor Transport

When the century dawned motor transport was sufficiently advanced for thinking people to accept it as a permanent new feature of civilisation. In 1900 no fewer than 5,000 cars were registered in the U.S.A., bringing the total up to 8,000, but I doubt if even the pioneering owners of those 8,000 imagined that by 1916 the annual production would be 1,000,000 cars and that that figure would be doubled and then trebled in little more than a decade.

The real revolution in motoring has not been the increase in record speeds, or even of average factory model speeds, so much as the development of manufacturing methods to the point where it is possible to consider the motor-car as a normal possession of the ordinary man.

The second half of the century will obviously see a tapering off in road speeds, because of the limitations imposed by roads themselves. The man who motors to his office in the last year of the century will be content with a car that can travel at no higher speed than the cars of to-day, although he will demand much greater economy, comfort and simplicity of control.

The Railways

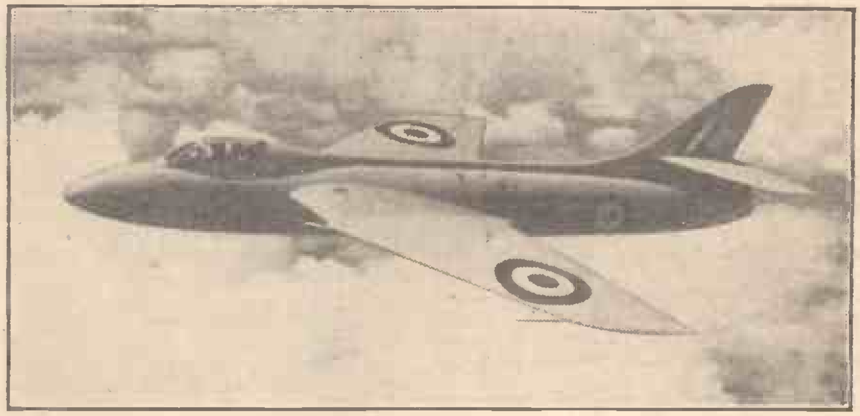
In the early years of this century the railway train was the accepted method of speedy and safe travel on land. In the last 50 years rail transport has matured, rather than developed. The feverish construction of new lines has ended, although the world would be richer for many thousands of miles more in Asia, Central Africa and South America.

Speeds have not increased notably—the journey from London to Aberdeen could be accomplished, in fact, a little quicker at the turn of the century than to-day. The emphasis has been on comfort, economy and the construction of great networks of railways to handle the ever-increasing traffic of the world's capitals.

The developments in transport by road and air have not destroyed the need for railways, but have rather limited their sphere. For the carriage of heavy goods overland, railways will probably remain supreme for many years. They will be aided by far more efficient power units and may hold their own in the handling of heavy suburban traffic because of their great carrying capacity and speed in congested areas. Long distance trains will increasingly lose their passengers to air liners, but by great economy they should be able to secure sufficient traffic to continue operation.

The Next 50 Years!

We have taken a bird's eye view of the astonishing development of transport in the first half of the 20th century with its far-reaching economic and social results, but what about the next 50 years?



The new Hawker P.1067, Britain's fastest fighter aircraft, on a test flight.

From the beginning, the urge with the aeroplane has been faster and higher—the two are not unconnected. Behind this urge has come that to travel further. Those trends will continue. The 700 m.p.h. which is the maximum to-day, may well be 7,000 m.p.h. by 2,000 A.D. in aircraft driven by "ramjets" or "rocket motors," the next stage after the jet engines of to-day.

Soon 1,000 miles per hour or more will be commonplace. The jump may be even bigger on long distance travel, since once the problems of take-off and alighting are solved, the stratosphere will offer almost "free passage" to ramjet 'planes of great efficiency.

The second half of the century can contain nothing so revolutionary in transport as that first flight of the Wright brothers, but the first flight into space may come near to it. The great difference will be that the average man and woman will be prepared. The Wrights' success was a "bolt from the blue."

To-day the average man is already convinced that a flight to the moon is held up only for lack of money. That is not strictly true. The technical problems, although perhaps solved in principle, remain very great.

The new electronic timepiece looks like a conventional watch but carries its own source of power and will run initially more than a year before the tiny energy capsule needs replacing.

Battery-operated Wrist-watch

Particulars of the Microscopic Cell, Coil and Motor

By THE MARQUIS OF DONEGALL

ON March 19th of this year the Elgin Watch Company of Chicago made public a project which, if their hopes are fulfilled, will go down to history as one of the landmarks of horology.

Mr. J. G. Shennan, Elgin's president, announced the birth of the electronic wrist-watch and unveiled the prototype, the result of many years experimenting by the Elgin company. He also made public the fact that during the company's research on the electronic watch they learned that the Lip Watch Company of Besançon, France, was also working on similar lines. In order to improve overall knowledge of the field of research the companies exchanged information but each continued working on its own research. As a result the Lip Company simultaneously announced in Paris that they had constructed an electronic watch differing in many mechanical and electrical respects from the Elgin version.

Technical and diagrammatic details are not yet available as the watch is still in the experimental stage. But it is possible to give a preliminary picture of what may prove to be as revolutionary a discovery as that of the mainspring in 1505 by Peter Henlein, of Nuremberg, the Harrison chronometer in the eighteenth century, or Breguet's over-coil hair-spring.

Early Electrical Timekeeping

The Elgin electronic watch embodies in miniature form several horological and electrical principles known for a good many years. The idea of electrical timekeeping was first realised when it was discovered that a magnet is created when electric current is led round a piece of iron. This was the basis of the electric telegraph and Sir Charles Wheatstone, pioneer of telegraphy, also worked on electric clocks. It was in 1840 that Alexander Bain, a journeyman clockmaker whom Wheatstone assisted, filed the first patent application for an electronic timepiece.

Then, nearly 50 years ago, the Bulle clock was introduced. The pendulum bob takes the form of a cylindrical solenoid which encircles and swings free round an arc-shaped permanent magnet. It is now possible, owing to Elgin's battery development, to run a Bulle clock on an energy capsule with only one-thousandth of the cubic volume of the battery originally designed for it.

Another form of electrical clock was a self-wound mechanism made by Chester H. Pond, of Brooklyn, in about 1880. In this timepiece a motor attached to the frame wound the spring of a conventional mechanical clock once an hour. The motor was started by an arm which, carried round by the train of gears in the clock movement, completed the electrical circuit on arriving at a certain point. When the spring was re-wound a projection on the mainspring barrel struck the arm away, breaking the contact and stopping the motor.

The idea of using alternating current from the electric light supply to operate clocks was first proposed in 1895 but was not introduced universally until 1918 by H. E. Warren. The result of Warren's work was that, if set in exact synchronisation with the time signals now carried on all standard frequency radio stations, the synchronous motor clock will retain its accuracy indefinitely or until an interruption in the power system breaks its rate.

The first watch was the Nuremberg "Egg," in 1550. This portable clock was carried by the night-watchmen of Nuremberg, and its comparatively smooth functioning was aided by brass plates and wheels which had been introduced 20 years earlier. Since then the bulk of watch-making progress has been in the nature of improvements and refinements, developing more precise parts so that greater compactness and better timekeeping might result.

Notable Developments

Four notable advancements in horology have come since the beginning of the twentieth century. One of these was the development of highly successful wrist-watches, made possible by strides in compression of the watch movement into an ever-dwindling space.

The second was the almost universal adoption of a system of interchangeable watch parts.

The third was the automatic self-winding watch whose mainspring is kept wound by a rotor activated through the motion of the watch on the wearer's wrist.

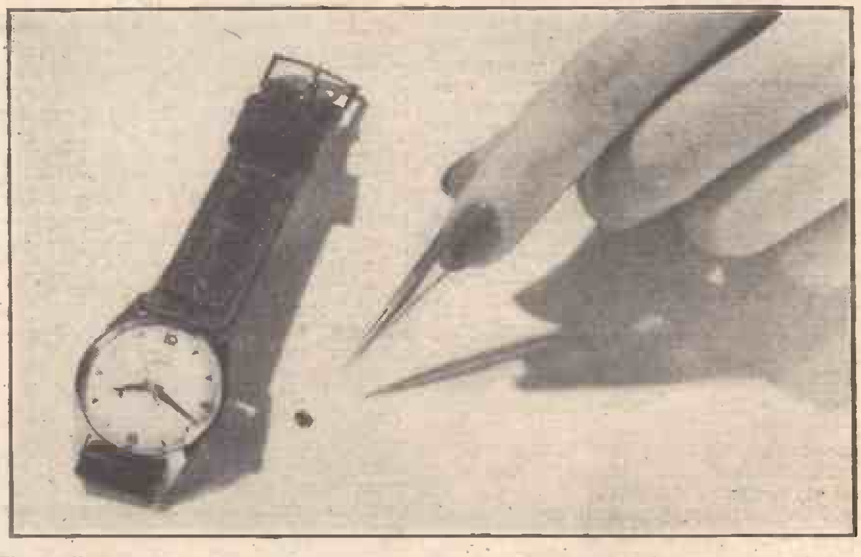
Finally, there was the "Durapower" mainspring, a recent development which almost eliminated the chief cause of watch failure by providing a non-magnetic, non-corrosive spring guaranteed against breakage. Theoretically, of course, no spring-driven watch can hope to measure up to an electronic watch for the reason that an energy capsule delivers power at an absolutely constant rate; not just for a few hours, but for months until a short time before it expires.

The electronic watch project started in Elgin's laboratories long before World War II. Not much was done during the war, but the appearance of new magnetic alloys for use in radio transmitters and receivers, for example, reduced the size of electronic equipment as much as 75 per cent. These new alloys naturally proved a blessing to those whose problem with the electronic wrist-watch was largely one of miniaturisation.

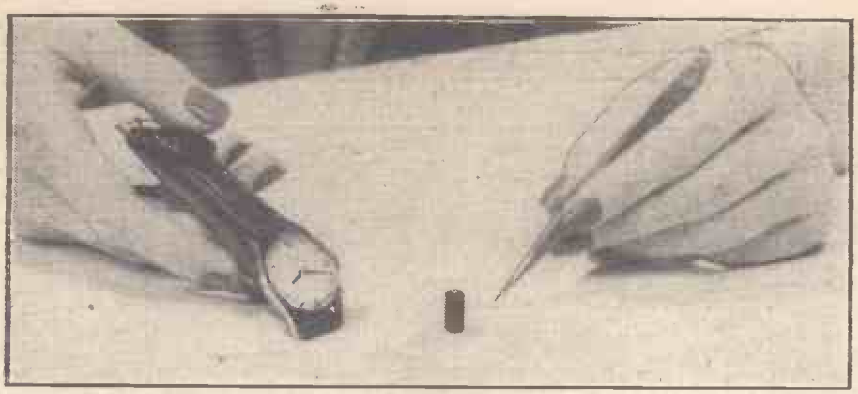
George G. Ensign, Elgin's research director, could long ago have perfected a pocket model watch on electronic principles. But he decided to do the job the hard way and produce the wrist-watch first on the principle that if an electronic wrist-watch could be constructed the principles could always be expanded into pocket watch size, whereas the converse was not necessarily true.

Difficult Problems

At first it appeared that an electronic watch would be just a small edition of an electric clock. It is fairly easy to design and make an electromagnet for a clock-size motor when the field coil may be more than an inch long and three-quarters of an inch in



The smallest practical coil ever built is used in the motor of the electronic watch. Experimental coil shown here is slightly more than ⅛in. in diameter and only 1/32in. long, yet it is wound with 3,000 turns of insulated copper wire, one-sixth the thickness of human hair.



The tiny battery which powers the electronic watch. Smaller in volume than a penny, the battery stores enough power to run motor of timepiece more than a year before a new battery is needed.

diameter; but to reduce the electromagnet to watch scale is quite a problem. The working force of an electromagnet decreases practically as the square of the dimensions; hence magnetic forces available in a watch-size motor become infinitesimal.

Besides the actual design of the stator and rotor of the motor there were other very difficult relative problems. First a means was needed for controlling the flow of electrical energy to the motor and, second, a power take-off was needed to drive the hands. Yet another problem was the energy capsule which has to meet a list of requirements. It has to be hermetically sealed but provide the very maximum stored energy capacity, be completely free from gassing and have a long shelf life. It must provide sufficiently high voltage to operate the watch, must maintain that high voltage at a constant value throughout its life and must have a high current-producing capacity. Its elements must be priced within reason and it must be readily manufacturable. Lastly, the problem in connection with the last-named specification was that of developing a satisfactory case material for the capsule.

The device that energises Elgin's electronic watch can properly be called a battery; yet it possesses many unique characteristics and is so small that it ushers in an entirely new era in the concentration of electrical energy into capsule form. It is the most recent and compact application of principles first demonstrated in practical form by the Italian scientist, Alexander Volta, in 1799. Its volume is less than that of a sixpence.

During World War II the Ruben-type cell was used widely in military instrumentation. A battery of 72 series-connected cells powered the "handie-talkie" radio field set, and a somewhat larger group of cells powered the "walkie-talkie." To-day one of the most important civilian uses of these cells is in deaf-aids.

It looked at first as though Elgin could use this type of cell in the electronic watch. But this proved incorrect for the powering of a watch.

Microscopic Cell and Motor

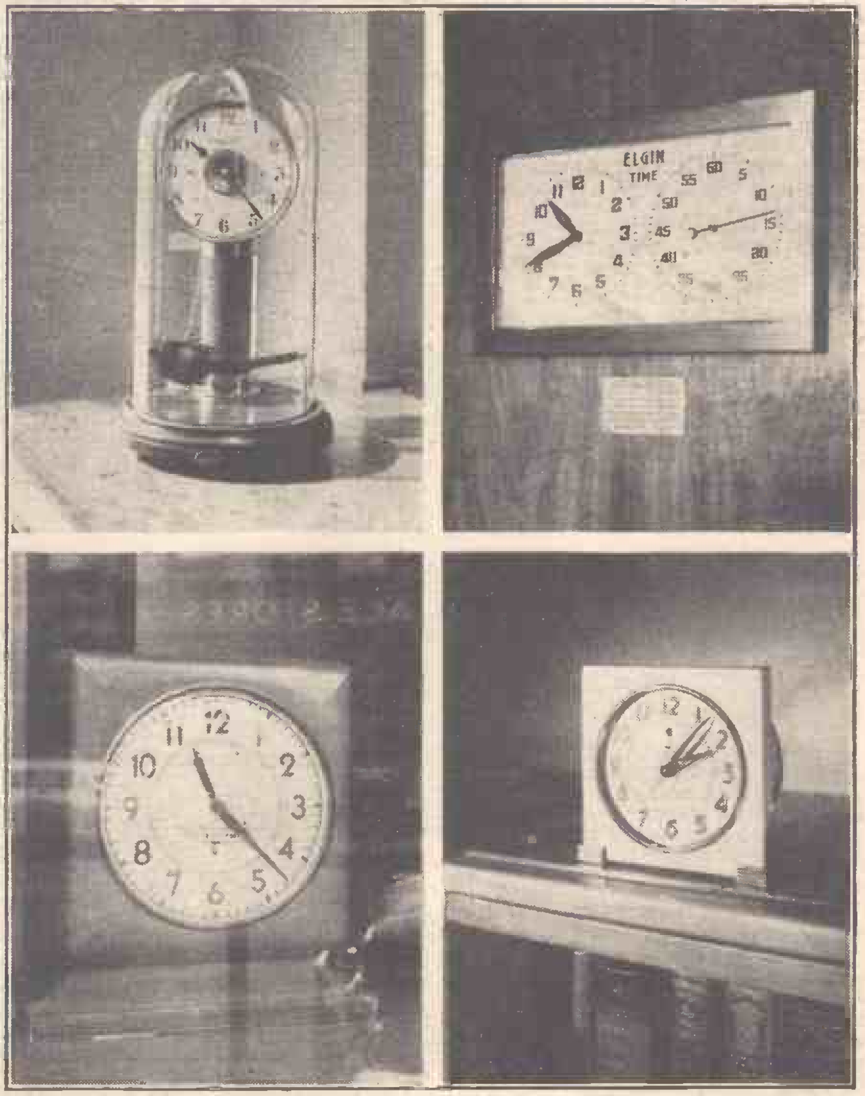
It thus became necessary to undertake a research programme specifically to solve the battery problem and produce the smallest practical power-producing cell ever made.

Then there was the problem of the motor. Most clock motors are very small, but they are giants compared with the motor used in the electronic watch No fewer than 10,000,000 motors as used in the electronic watch could be operated from the power consumed by a single 100-watt light bulb—if it were possible to distribute that power among 10,000,000 watches. The developed motor requires only a few micro-watts of power, and a micro-watt, as we know, is one-millionth of a watt. It is smaller than any of the so-called curiosity motors and yet, unlike them, it serves a very practical purpose.

We now come to the question of coils. Coils range in size from giant units used in the motors powering machines two or more stories high, down to the microscopically small size as built for the electronic watch—probably the smallest practical coil ever built. Preferably, coils should be wound with silver, which has very low electrical resistance, and silver was actually used in large generators on a loan basis during World War II when copper was in very short supply. Silver might have been used for winding the Elgin coil except that the extreme softness of the metal made it impracticable for this application. Experimental sub-miniature coils built for the watch were slightly more than one-eighth of an inch in diameter and one-thirty-second of an inch long: wound with 3,000 turns of insulated copper wire one-sixth the thickness of a human hair. This is surely the finest insulated wire ever wound as a magnetising coil, and is so silky and filmy that it cannot be seen with the naked eye except if it catches a reflection of light. A pound of wire, if unwound, would reach 240 miles.

As to the motor, all the information avail-

(*Continued on page* 318.)



The electronic watch embodies in miniature form several horological and electrical principles known for many years. Four basic types of electrical clocks, shown above, are:

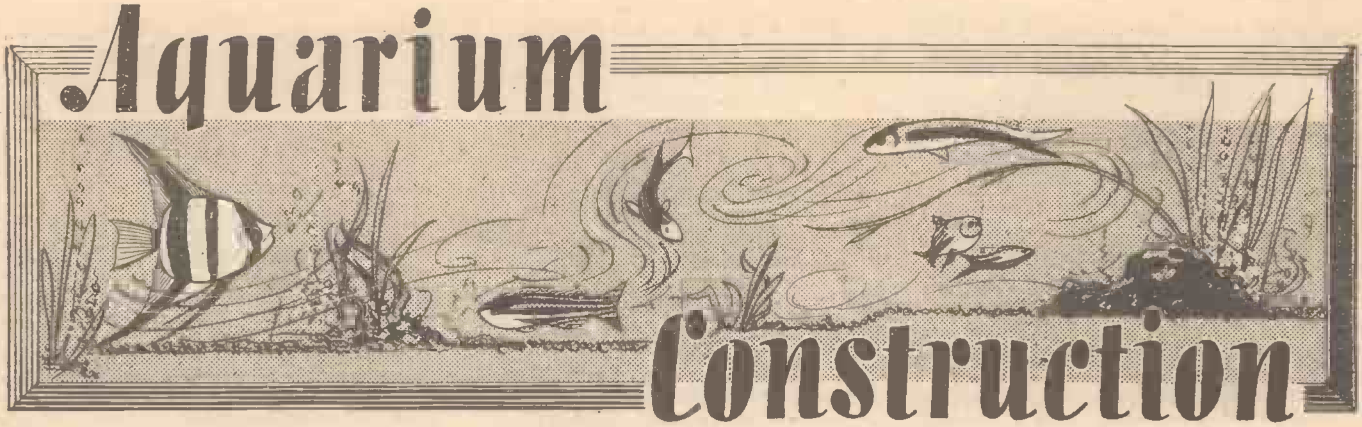
Upper left: Example of independent, self-contained timepiece, the Bulle clock, which operates from its own battery. With an Elgin-type energy capsule this clock now runs from a battery one-thousandth the size of its original battery.

Upper right: Example of "slave" clock; actually only a dial whose hands are moved by impulses from a master mechanical clock.

Lower left: Example of synchronising or error-correcting clock, a Western Union timepiece which has its own clock works but whose hands are corrected electrically to those of a master clock at regular intervals.

Lower right: The plug-in type synchronous motor clock used commonly in the home, which runs off a 60-cycle-per-second alternating current.

Aquarium Construction



Notes on Proportions, Making the Metal Framework and Glazing

By DOUGLAS GOHM, F.Z.S.

THE first consideration in the construction of an aquarium is its shape. Whilst odd shapes may look attractive from their owner's viewpoint, they generally have shortcomings which the fish do not appreciate, namely, a small surface area.

The most popular size is 24in. x 12in. x 12in. because it gives a reasonable surface area and good visibility combined. The following table will serve as a guide to suitable proportions, all the figures refer to inches:—

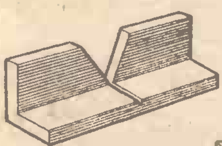


Fig. 1.—(Left) A V-notch block.

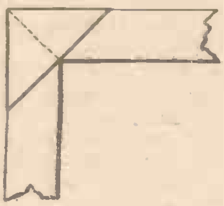


Fig. 2.—(Right) Strengthening the corner of the framework with a corner bracket.

PROPORTIONS FOR VARIOUS SIZES OF TANK

Length	Breadth	Height	Angle	Thickness
16	8	12	¾	3/32
18	10	10	¾	3/32
24	12	12	1	⅛
24	12	15	1	⅛
30	12	12	1	⅛
36	12	15	1¼	⅛
48	12	15	1½	3/16

The best aquariums are made from angle (brass or iron). They are robust and withstand the considerable pressure exerted by the water, but angle made from sheet steel can be used for aquariums up to 18 inches in length.

Brass Angle

Having decided upon the proportions, cut two lengths of angle to correspond to the total perimeter, allowing about ⅜in. for the bends at the corners. Now mark off the angle to correspond with the lengths of the two sides and two ends. Work from the centre when marking out so that some material will be left at each end for final sizing after bending. Use a hacksaw and a small V-block, Fig. 1, to cut a "V" at 45 deg. both sides of the vertical line that marks the lengths, leaving a small amount to be cleaned up with a file.

The angle is now ready for bending, this should be executed carefully to ensure a clean bend and to prevent cracking.

After bending, cut the two free ends to the correct length of side and end, mitre the corners at an angle of 45 deg. and the frame should be a nicely formed rectangle. Repeat with the other length. The two frames thus formed will be the base and the top of the aquarium.

The four vertical posts can now be cut to length and filed at each end to make them uniform.

Assembly

The base and top frames should be completed first. Thoroughly clean the mating joints and braze. If inconvenient to braze a hard solder can be used, providing the aquarium is not too large. It is important that the edges contact each other naturally and that no force is required to hold them together during the brazing or soldering operation.

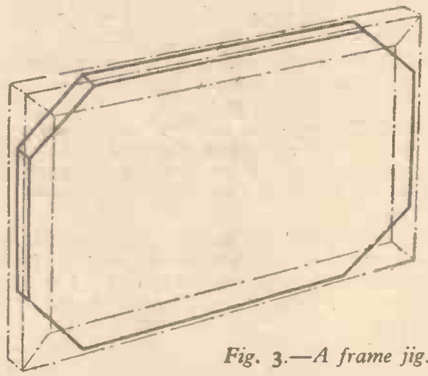


Fig. 3.—A frame jig.

Additional strength can be obtained if corner brackets are brazed at each corner, Fig. 2.

It is worth while making a jig to ensure squareness. This need only be a piece of wood cut to the internal dimensions of the frame, Fig. 3, or blocks of wood screwed to the bench top to hold the frame whilst the corners are brazed, Fig. 4. *Do not try to press the frame into shape after brazing.*

Brazing

The four uprights can now be brazed into the corners to complete the aquarium frame as at a, Fig. 5. Again a wooden frame can be used to ensure squareness and a C clamp to hold the frame in position during the brazing operation.

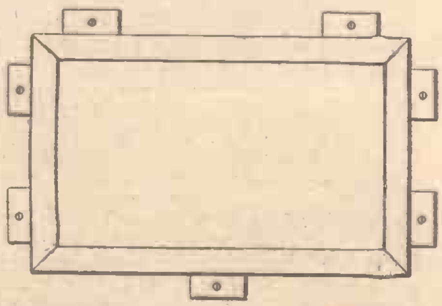


Fig. 4.—Jig made with wood blocks screwed to bench.

Iron Angle

If the frame is made with angle iron the joints can be made much smoother.

This should be cut to equal the four lengths, the four ends, and the four uprights and each end mitred to an angle of 45 deg. as shown at b, Fig. 6. If this is done carefully all ends will fit snugly together ready for welding.

After the joints have been welded they can be filed to provide a smooth finish.

If welding equipment is not available the local garage can usually be prevailed upon to do it at quite a reasonable charge.

Painting

The completed frame can now be painted in any suitable colour. It is preferable to use a good oil bound paint rather than a synthetic enamel as enamel tends to dry brittle and chip, the chips eventually finding their way into the aquarium at some later date.

Iron frames should be given an undercoat of red lead paint to prevent rust forcing itself through the finishing coat.

Glazing

It is not necesary to glass the whole of the aquarium with the best quality glass. The front, for obvious reasons, must be of good quality, otherwise the interior will appear distorted when filled.

The base can be made from slate or a sheet of fully compressed stipple glazed asbestos (not to be confused with ordinary builder's asbestos).

The following table will act as a guide in glass selection:—

TABLE OF SIZES AND WEIGHTS OF GLASS

Length	Front	Back and Ends	Bottom
Up to 18in.	24oz. clear	24oz. Hort	¼in. plate or
„ „ 24in.	32oz. „	¼in. rough cast	¼in. rough cast or
„ „ 30in.	32oz. „	¼in. „ „	slate or
„ „ 48in.	¼in. plate	¼in. plate	F.C.S.G. Asbestos

Cut the glass to the required dimensions,

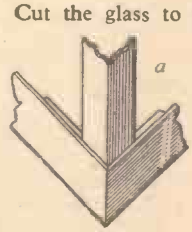


Fig. 5.—Corner of brass frame ready for brazing.

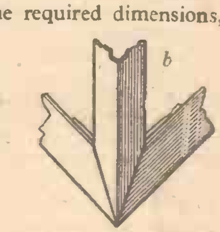


Fig. 6.—Corner of iron frame ready for welding.

bearing in mind the order in which they are to be assembled—first the bottom, then the sides and finally the ends.

It is advisable to leave a 1/16in. clearance between the glass edge and frame to allow for any radius or unevenness of the frame.

Cements

A proprietary brand of cement can now be purchased specifically for aquarium construction but, if you prefer to make up your own, the following cements can be made quite cheaply:—

Cement No. 1 (medium drying).
2 parts red lead
2 parts white lead
1 part linseed putty
Minimum quantity of gold-size.

Cement No. 2 (quick drying).
16 parts whiting
4 parts litharge
2 parts powdered red lead
2 parts powdered resin
Minimum quantity of gold-size.

Mix to consistency of stiff dough.

These cements will produce an excellent seal if mixed thoroughly. Cement No. 2 should only be made in small quantities so as to prevent the unused cement becoming too hard to work. Cement No. 1 should only have enough gold-size added to unite the mass.

Paint the inside of the frame with a thin smear of gold-size, this will help to bond the cement to the frame. Then spread the cement liberally into the bottom edge of the frame to a thickness of approximately $\frac{1}{4}$in., making sure it is well covered, lay the bottom slate or glass in and press gently and evenly downward until the cement is about $\frac{1}{8}$in. thick.

It will considerably assist the bonding if the glass also is smeared with goldsize along the face that will be presented to the cement. Clean off the surplus with an old knife.

Next treat the two sides, and then the ends in the same manner. Do not be tempted to wedge any of the glass panels with sticks inside the tank in the mistaken idea that it will hold them in position until the cement hardens. The glass will only revert to its natural position when the sticks are removed and so cause an early leak.

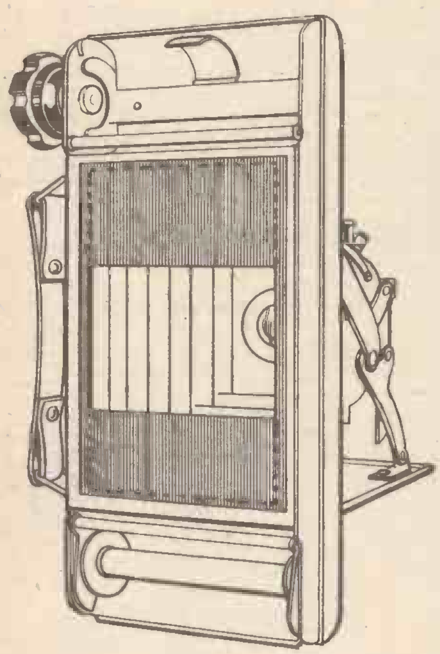
Thoroughly clean the interior of the now completed aquarium and disinfect with a methylated spirit soaked cloth, leave for a week to allow the cement to harden, and the tank is ready to receive its future occupants.

Sixteen Exposures on a 120 Film

How This Can be Done Without Camera Alteration

By W. HOUGHTON

IT would seem to be a straightforward job to convert a camera taking eight exposures on a 120 film to take 16



on the same film. Masking presents no difficulties, but the snag is making a new film inspection window in another part of the camera back. A good camera has a first-class finish, and only if the workmanship of the modification is up to this standard would the job be satisfactory. Unless you possess a high degree of skill, to attempt to knock holes in the back of the camera to line up with the 16-exposure numbering on the backing paper is asking for trouble.

Making the Mask

Sixteen exposures on a 120 film is quite a simple matter, without drastic camera modifications, by using the following method:—

1. A mask of suitable black card or sheet metal is fixed in the camera. Sellotape is suitable for this purpose. The $2\frac{1}{4}$in. by $1\frac{5}{8}$in. aperture should be cut accurately and the outside dimensions must fit the camera exactly. The mask must lay clear of the film, and in most Kodak cameras it can be fixed next to the bellows. (See Figs. 1 and 2.)

2. The viewfinder must be suitably masked, and this may be achieved either by making a box-type mask to fit over the existing finder (Fig. 3A) or alternatively made from black paper and fixed inside the finder. The top can be removed quite easily in most types. (See Fig. 3B.)

The box type of mask is made from thin card covered with black passe-partout. It has a one-position opening and has to be placed over the finder to suit vertical or horizontal "takes."

The size of the mask is worked out in proportion to the size of the existing mask on the finder, and remember that the camera must be held upright for horizontal shots and turned on to its side for vertical ones.

Fig. 1. — (Left) Sketch of a $3\frac{1}{4}$ x $2\frac{1}{4}$ folding camera with removable back detached, and showing the mask (shaded) in position.

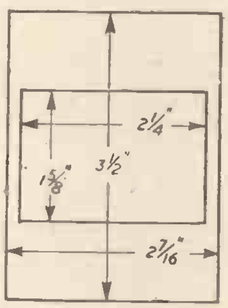


Fig. 2.—(Right) Details of the mask, cut from black card.

3. The film is rewound on to another spool so that "No. 1" is now the last and not the first to appear.

4. The loose end of the film is fastened to the backing paper with Sellotape. The trailing edge now becomes the leading edge, and unless fastened to the backing paper it will not find its way around the take-up spool.

Daylight Loading

Films prepared in this way in the dark-room can be daylight loaded in the usual manner. The numbering for 16 exposures will now appear in the existing window for eight exposures, and although it will appear backwards —16, 15, 14, etc., this is no disadvantage. The important thing is that you can now make 16 exposures instead of eight.

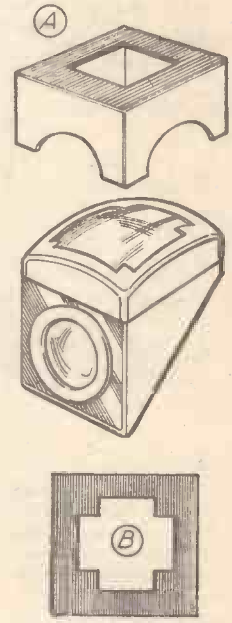
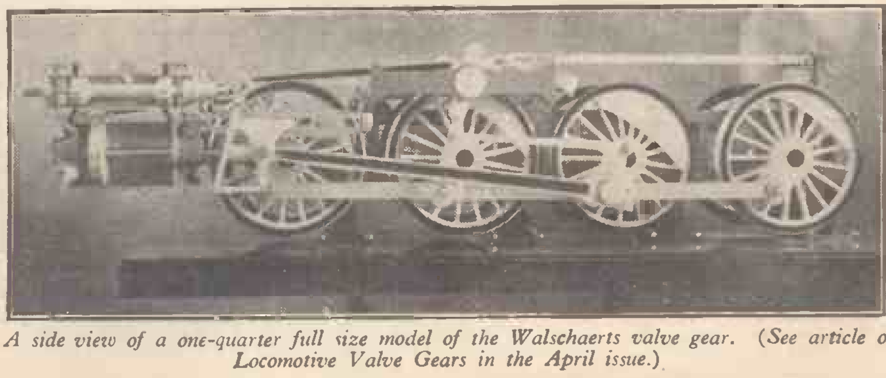


Fig. 3.—Shapes of masks for view finders.

Precision Model Making



A side view of a one-quarter full size model of the Walschaerts valve gear. (See article on Locomotive Valve Gears in the April issue.)

An Electric Thermostat

A Sensitive and Easily Constructed Appliance

By M. SOLEY

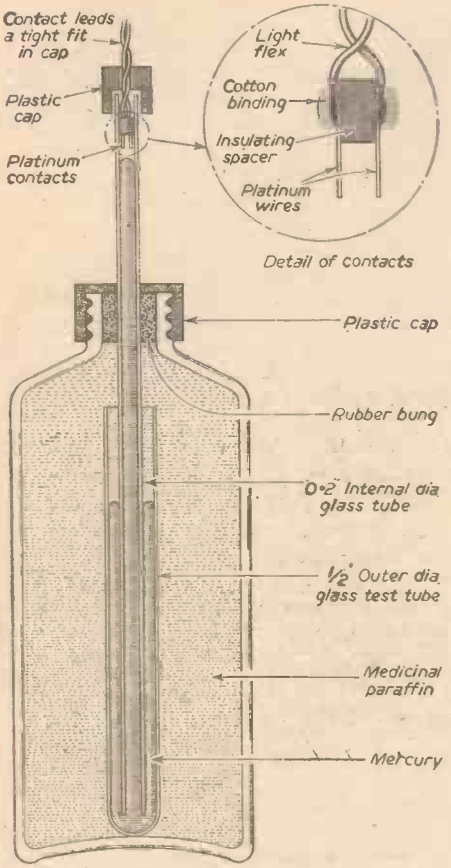


Fig. 1.—Sectional view of the completed thermostat.

A THERMOSTAT may be defined as a temperature-operated switch or valve; its operation may depend on the variation with temperature, of the curvature of a bi-metallic strip, the resistance of a wire, the E.M.F. of the thermo-couple or the volume of a liquid.

The thermostat to be described uses the last mentioned method, which has the advantage that it is relatively easy to construct in a highly sensitive form.

The liquid employed is preferably medicinal paraffin, which, as shown in Fig. 1, is contained in a glass bottle, and is in contact with a mercury column. The latter moves when the paraffin expands or contracts and makes and breaks an electric contact which, operating a relay, will switch the main heating current on and off.

Sensitivity Factors

Consideration of Fig. 1 will show that the sensitivity of the thermostat depends on (a) the coefficient of expansion (cubic) of the paraffin, (b) the volume of the paraffin, (c) the cross-sectional area of the bore of the mercury tube, and (d) the amount of movement required to make and break the circuit operating the relay. This is of the order of $\frac{1}{16}$in.

The temperature range (room temperature to operating temperature) and sensitivity of the thermostat may be calculated as follows:

If V is the volume in cubic inches of the liquid paraffin it will expand by $V\alpha$ for 1 deg. Fahrenheit rise in temperature, where α is the apparent coefficient of expansion of paraffin in glass (about -0.00040 deg. F.). $V\alpha t$ is the volume of mercury forced into the tube and the movement of the meniscus will be $\frac{V\alpha t}{A}$ inches, where A is the cross-sectional area of the tube in square inches and t the change in temperature causing the movement.

The thermostat described was used for an aquarium, the temperature maintained being 75 deg. F. Ten cubic inches (about 6 fluid ounces) of paraffin are used, the internal diameter of the tube being 0.2in. The movement per degree F. is therefore:

$$\frac{10\times 0.00040}{0.1^2\times 3.14}=0.127\text{in. (say 0.13in.)}$$

The sensitivity is thus rather better than ½ deg. F. and the range of movement from room temperature, say 50 deg. F. to the working temperature (75 deg. F.), is $0.13\times 25=3.25$in. The test tube containing mercury must hold more than sufficient mercury between the outside of the glass tube and the test tube wall to fill the column up to its height at the working temperature.

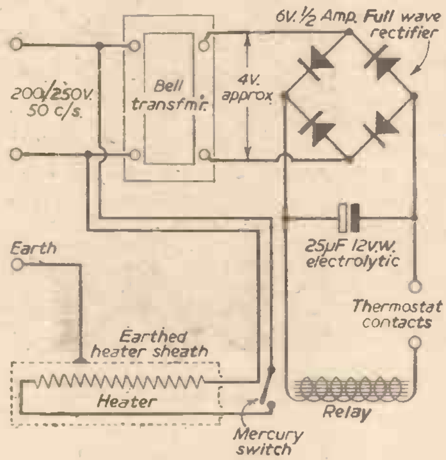


Fig. 3.—Circuit diagram.

Constructional Details

A 6oz. glass bottle, with a plastic screw top and rubber bung, should be filled with medicinal paraffin, taking care to exclude any air bubbles. The test tube, previously filled with paraffin, is then dropped in (the inside diameter of the bottle neck must be greater than ½in., the outside diameter of the test tube). The glass tube is next passed through a tightly-fitting hole in the rubber bung until, when in position, the end will be ¼in. from the bottom of the bottle. The tube is placed in the bottle, its end inside the test tube, and the bung resting on the edge of the bottle neck. The mercury is poured into the top of the tube to fill the test tube to a height of about 3¼in., displacing the paraffin from the bottle. The rubber bung is then slipped into place and the plastic cap (drilled to accommodate the glass tube) screwed into position. At this stage the range of movement of the mercury may be measured by immersing the bottle in water warmed to the working temperature, and noting the rise in level.

The contacts are made from two ⅝in. long pieces of 25 gauge platinum wire (not very expensive as the weight of platinum involved is only about 0.003 oz.); these are soft-soldered to the ends of the light gauge flex and bound together on either side of a small wooden separator. The temperature fixed by the thermostat may be adjusted by sliding the contacts up or down the tube.

Relay and Mercury Switch

A vacuum or inert gas-filled mercury switch is mounted on a cradle, as shown in Fig. 2, and is connected with thread to a light extension arm soldered to the relay armature. The assembly is counterbalanced to keep the mercury switch on when current is not flowing in the relay coil. The relay contacts and springs should be removed.

The electrical circuit is shown in Fig. 3. The parts used are: a bell transformer with a 4-volt tapping, a full-wave rectifier (6 volt, ½ amp.), and an electrolytic condenser, 25 mfd., 12-volt working. It is necessary to use a low current through the relay to minimise sparking at the thermostat contacts, and it will be found that if the relay and mercury switch are carefully set up and counterbalanced, 4 volts will be quite adequate (the current will then be $4/200=20$ mA).

Sufficient information has been given to enable the reader to design his own thermostat for any sensitivity or range, but it should be realised that the combination of great sensitivity and long range will result in a very long glass tube. There is no reason why metal parts should not be used for the thermostat, but it is more difficult to eliminate air bubbles from the system.

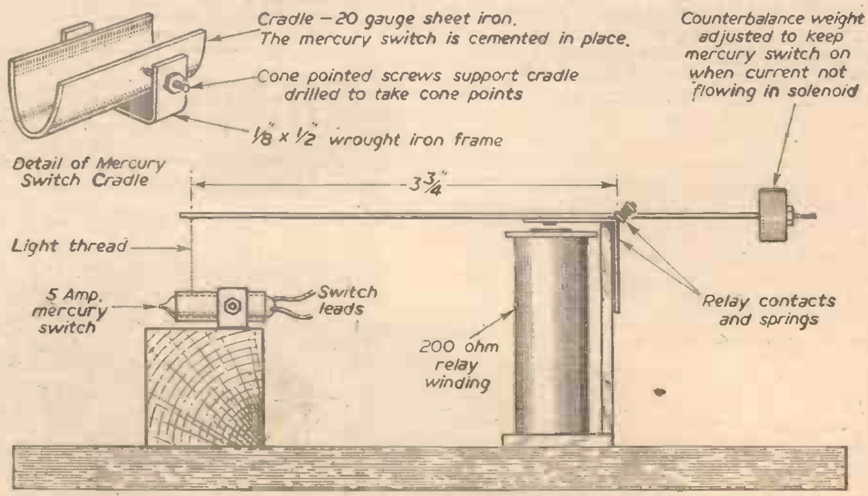
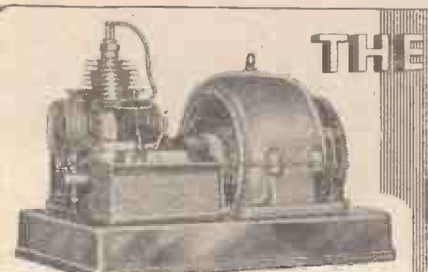


Fig. 2.—Details of the relay and mercury switch.



THE WORLD OF MODELS

By "MOTILUS"

Some Fine Examples of Modelmaking at the Northern Models Exhibition

THE Northern Models Exhibition is now a well-established annual event that is much looked forward to in modelmaking circles. The fourth exhibition was held in March this year at the Manchester Corn Exchange, with a greater number of models on display than ever before: nor did an increase in numbers mean a decline in standards of workmanship. On the contrary, standards were on the whole high among the large variety of exhibits.

I considered that improvement was especially notable in the locomotive models entered for competition. Some of the incomplete models especially showed excellent work. One I would mention for qualities of efficient model engineering and fine finish was a 5in. gauge 0-6-0 L.M.S. tank locomotive chassis, under construction by Mr. E. Younghusband, of Swinton. The model was to a design by Mr. Austen-Walton, well-known model locomotive amateur enthusiast. The chassis featured lubricators on all cranks, double springs on all bearings, working steam brakes and sanding gear, so that it was unusual in having a large amount of detail for this size.

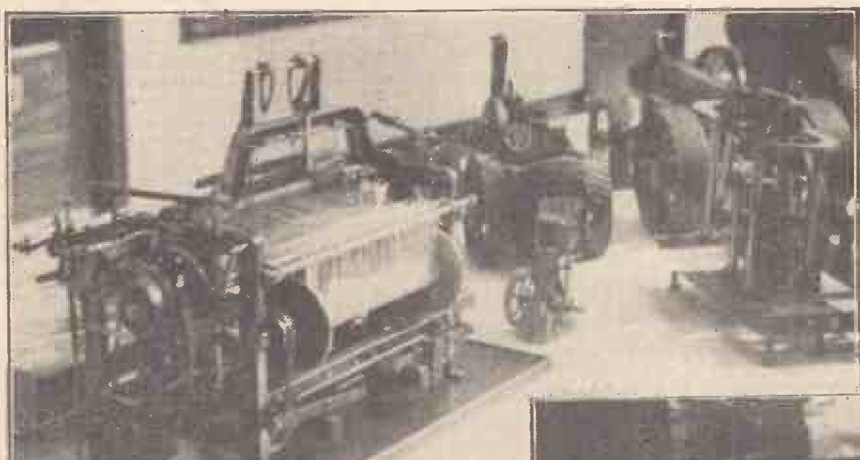


Fig. 2 (Above).—Model of a Lancashire weaving loom built to a scale of one-quarter full size by Mr. T. Jolly, of Whitefield.

Fig. 3 (Right).—Part of the general engineering section at the Northern Models Exhibition. A very high standard of workmanship was evident throughout this section.

Working Model Roundabout

Working model roundabouts are now frequently seen at model exhibitions and they do add a note of gaiety with their brilliant colours, polished brasses and mirrors and rows of traditional wooden steeds, all in whirling motion. The roundabout exhibited at the Manchester Exhibition by Mr. H. Slack, of Chapel-en-le-Frith, lacked none of these, and was indeed a first-class model, with three rows of horses. The model, shown in Fig. 1, drew many admirers.

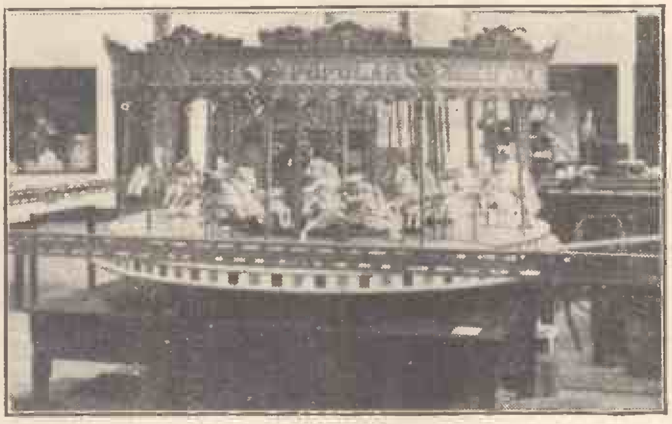


Fig. 1.—The gay working model roundabout exhibited by Mr. H. Slack at the Northern Models Exhibition in Manchester.

A large proportion of the ship models were non-working and ships of many different periods were represented. I especially liked Flt.-Lt. E. T. Ferry's model of Captain Cook's ship, *Endeavour*, which was well executed ; also Mr. C. L. Heworth's schooner yacht, to a scale of ⅛in. to 1ft. Mr. D. S. Anthes exhibited his neat and convincing waterline model of S.S. *Beaconstreet*, built to a scale of 1in. to 16ft. and which won prizes at the Third Northern Models Exhibition in 1951.

In the working steam and power boat class there were not so many entries. A ½in. scale electrically-driven twin screw motor cruiser by Mr. C. Taylor, of Oldham, was well made and of good appearance, which is so often overlooked in working model boats. I was also very interested to see the working model of R.M.S. *Caronia,* entered by Mr. W. E. Barnes, of Wilmslow, and I presume this model was the product of Mr. Barnes's model dockyard, about which I have written on previous occasions.

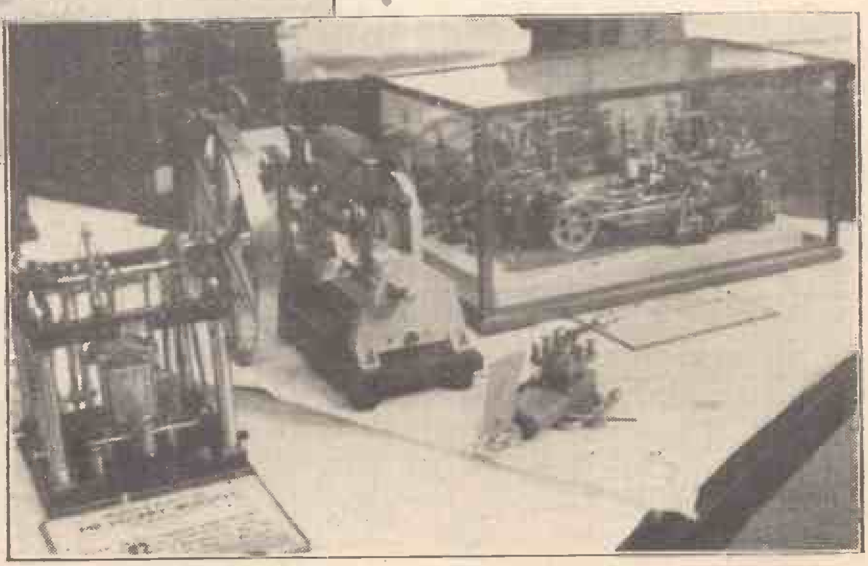
An interesting and unusual exhibit was provided by a series of fire engine models made by Mr. Victor Sutton, depicting "The Fire Engine Through the Ages." The series contained over fifty models of engines, from 1666 to the present day, including models of recent type engines in use in Manchester.

General Engineering Models

Some excellent models were to be found in the general engineering groups (Figs. 2 and 3), traction engines, tramcars, petrol engines and various other types of model engines made a good array, along with a selection of tools and workshop appliances. Mr. F. J. Haynes's 1in. scale working model of a "Massey" steam hammer was unusual and was a well-built model.

Model cars were not well represented, but there was a large number of model aircraft of all kinds. These included a good proportion of scale models for flying and for control line working, but very few static scale models. There were also several radio-con-

(*Continued on page* 317)



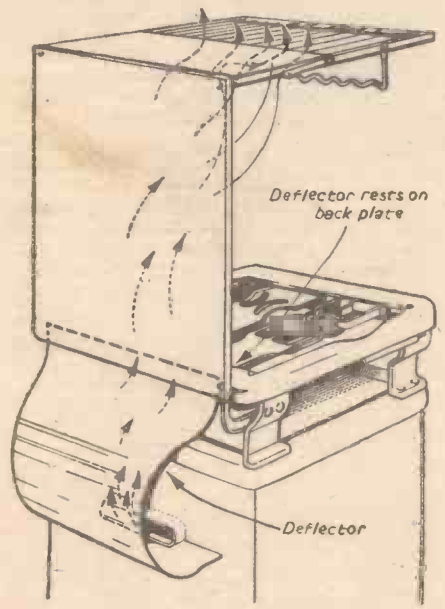
Vapour Deflector for Gas Cooker

SIR,—The accompanying sketch illustrates an idea I have developed to prevent plastered kitchen walls being spoilt by hot, greasy vapour issuing from the oven of a gas cooker.

This takes the form of a deflector fitted on to the outlet nozzle by a metal strip (not shown in sketch).

Most people know what a greasy, unsightly state the plaster gets into behind this outlet vent in the stove, and when decorating the kitchen invariably the plaster has to be cut out for quite an area and replastered.

After having had to do this job again before painting the walls of my own kitchen,



I was determined to try to find some method of prevention.

I could not think of any cure at the moment other than having to let in a square of tiles, and was on my way to purchase them when it occurred to me that some sort of a deflector would be easier and cheaper to make. Before purchasing the tiles I decided to see what could be made in this direction and finally decided on the device shown in the sketch, which is quite a success.

I think any handyman would be able to make one. I made mine from 20 gauge mild steel sheet, but I should think that aluminium would do just as well for anyone who had not the means of bending the metal to the form required for their particular stove.

With the deflector fitted, the greasy vapour from the outlet now passes up in front of the enamel back-plate of the stove, where it is easily wiped off.

I have also fitted a metal plate on top of the plate rack on which more of the greasy vapours condense before reaching the ceiling.—H. W. BRIDGE (Stockport).

Drilling Holes in Glass

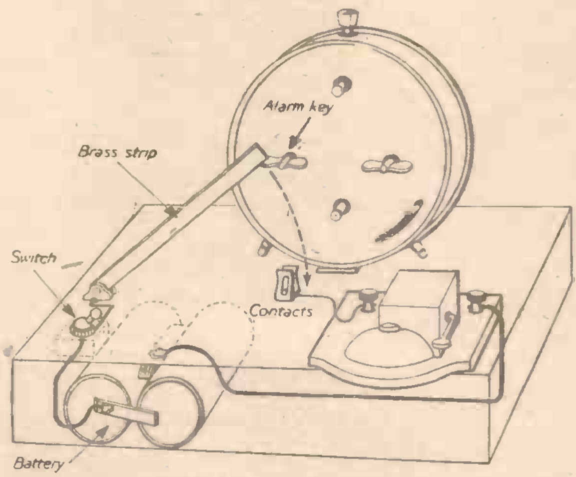
SIR,—Your correspondent, T. L. Green, will save a lot of time drilling holes in glass if he uses one of the carbide-tipped drills marketed by John M. Perkins and Smith Ltd. (who frequently advertise). I am not sure if they make a 1/16in. size of their "Glazemaster" drills, but there are various sizes, and they are quite cheap (about 5/-).

It takes me about two minutes to drill a ¼in. hole through the bottom of a brandy bottle. The drills must be run rather slowly and should be lubricated.—P. H. BLANCHARD (Sanderstead).

An Electric Alarm

SIR,—In the March issue I notice particularly the electric alarm unit by C. Heyes. It is similar to one I have used for the past ten years except that mine is portable, it being a complete unit.

The accompanying diagram may be of interest to other readers. The contact is out of an old switch, and the strip of metal is brass. When the alarm goes off and the key turns, the strip falls into the groove of the contact, thus completing the circuit.



A rear view of the electric alarm, showing general principles of operation.

The clock is not attached to the base in any permanent way. To set the alarm, simply wind the key to a horizontal position and lift the end of the brass strip on to the key, as shown in the sketch. I find the device very successful in operation.—G. BRAILSFORD (Worksop).

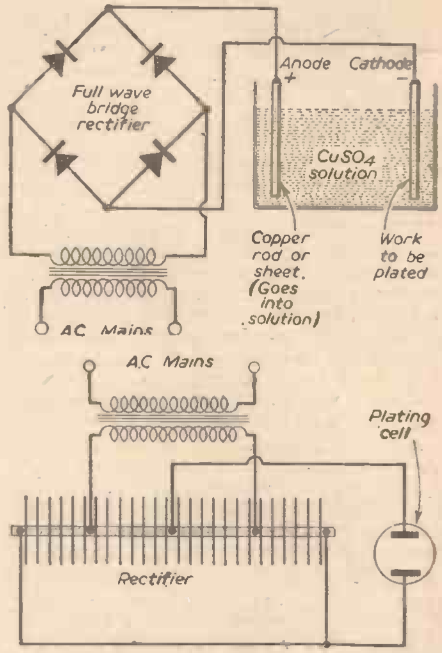
Electro-depositing Copper

SIR,—With reference to the answer given to the inquiry concerning "Electro-depositing Copper," appearing in the April, 1952, issue of PRACTICAL MECHANICS, may I point out an error with regard to the electrodes.

The reply states that the negative pole (cathode) of the rectifier is connected to a copper rod or sheet immersed in the copper sulphate bath, while the positive pole (anode) is connected to the article to be plated.

The result of this would merely be to cause deposition of copper on the copper rod, and the article to be plated would itself dissolve!

This is due to the fact that during electrolysis, the cations (positively charged ions),



Circuit diagram and rectifier connections for the electro-deposition of copper.

which are present in the solution, travel in the direction of positive current to the cathode (negative electrode), while the anions (negatively charged ions) travel to the anode (positive electrode).

In the present case, the cation is the Cu^{++} ion which will plate out on the cathode, while the anion will be the $SO_4^{=}$ ion which will travel to the anode. The overall chemical reaction may be represented by:

At cathode (−ve electrode)
$Cu^{++} + 2 \text{ electrons} \longrightarrow Cu$ (plates out).

At anode (+ve electrode)
$Cu - 2 \text{ electrons} \longrightarrow Cu^{++}$ (Cu goes into solu. as +ve ions constantly replenishing the solu. with Cu).

Assuming that a full-wave bridge rectifier is used, the circuit diagram will be as shown in the accompanying diagram.—B. C. HIBBIN (Dartford).

*[Thank you for calling our attention to what is an obvious error of polarity in the reply on the electro-deposition of copper, published on page 250 of our April, 1952, issue. Here, of course, the word "negative" should read "positive." This is evident, and, we think, must have been so to the original inquirer, for in all plating systems the metal to be plated is always released on the cathode or negative electrode, whilst it is the anode or negative electrode which completes the circuit in the bath or electrolyte.—*EDITOR.*]*

"Perpetual Motion"

SIR,—With reference to the recent correspondence on perpetual motion, it is surprising that those who have made various suggestions should not have tried them first. The proof of the pudding is in the eating. In view of the success of Cmdr. Arffyreus, referred to in PRACTICAL MECHANICS some time ago, I do not think such people should be called cranks. There is a way of doing it, and apparently Cmdr. Arffyreus discovered it. His source of motive power was gravity.

Sir Oliver Lodge raised the question many years ago of a permanent magnet being a source of power.

Apparently Mr. Philip Mount has made an accidental discovery of something of this kind and publication of some greater detail would be most interesting.—E. W. CHAMBERS (Heidelberg, Victoria, Australia).

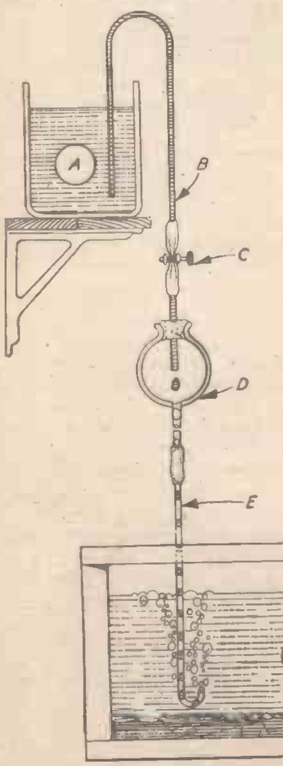
Aquarium Aerator

SIR,—May I be permitted to make certain observations about Mr. E. S. Brown's "Aquarium Aerator" as illustrated in the February issue of PRACTICAL MECHANICS?

I consider the aerator would be both unwieldy and unsightly, the base of the water container being at least 15in. above the water level. Furthermore, the method of mounting the apparatus is hardly suitable either from the practical point of view (as illustrated, it would be difficult to fit a cover-glass) or from the aesthetic point of view (aeration should be unobtrusive).

Might I suggest that if an aerator of such a type is required a far simpler device can be easily constructed, as illustrated in Fig. 1. For smooth working, the delivery-tube should be as long as possible with a minimum length of twice the head of water to be overcome.

As to the desirability of aeration as such, I believe it is generally accepted that the solution of oxygen from the rising bubbles is negligible, even when using a diffuser, and that any oxygenation that does take place is brought about by the promoted circulation of water at the surface. In my opinion, this increased circulation can be more efficiently achieved by using a water lift (Fig. 2), with a filtration stage, if desired, powered by a "water aerator" as illustrated in Fig. 3. The design of the latter apparatus can be suitably modified to meet the needs of the person unable to carry out the necessary glass working.—J. E. PROCTOR, B.Sc. (Eltham Park).



Key.

A.—Water container.
B.—Syphon-tube.
C.—Screw-clip on rubber connection.
D.—Thistle funnel with slotted cork.
E.—Delivery tube extension.
F.—Aquarium.

Fig. 1.—Simplified water-aerator.

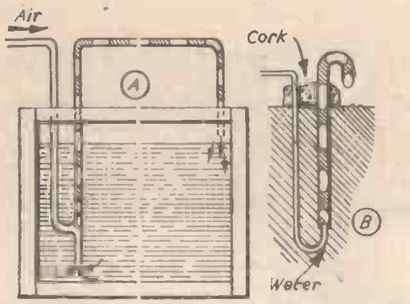
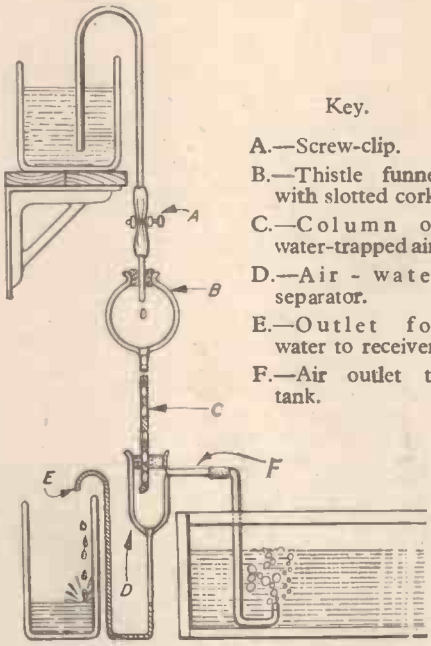


Fig. 2.—An air-operated water lift. A.—Water lift transfers water from one end of a tank to the other, filtration being included if required. B.—Easily constructed lift made from two pieces of glass tube of different bore.



Key.

A.—Screw-clip.
B.—Thistle funnel with slotted cork.
C.—Column of water-trapped air.
D.—Air - water separator.
E.—Outlet for water to receiver.
F.—Air outlet to tank.

Fig. 3.—A water-powered aerator.

Small Water-power Plants

SIR,—I was interested to note the letter from Mr. Steen, of Oslo, in the April issue of PRACTICAL MECHANICS, and would like to thank him for pointing out an error in my formula.

This should, of course, have read :—

$$\frac{76.4\sqrt{H}}{D} \text{ r.p.m.}$$

It should be noted that the wheel speed is proportional to jet velocity which varies as the square root of the head, and not directly as the head, as Mr. Steen suggests.—J. H. RAPLEY (Ystrad Meurig).

Centripetal Force

SIR,—In reply to your correspondent F. O. Brownson, who refutes "Grocock's" centripetal force, I should like to point out that this is the only force acting on a body travelling in a circular horizontal path and that centrifugal force does not, in fact, exist.

By Newton's "First Law of Dynamics," any moving body, not acted upon by external forces, will continue to move in a straight line: this defines the property of inertia.

Hence when a body rotates in a circular path there will be a continuous tendency, due to inertia, for the body to "fly off at a tangent," thus apparently so, due to the effect of a centrifugal force, whereas in fact there is none.

To keep the body in its circular path a centripetal force, of magnitude $m.r.w.^2$ and producing an acceleration $r.w.^2$ of the body towards the centre of rotation, is brought into play; where m is the mass of the body, r the radius of the circular path and w the angular velocity about the centre.

The existence of this centripetal force is clearly demonstrated by rotating a mass on the end of a string. An inward tension in the string immediately results.—R. HINE (Cardiff).

Earth-satellite Vehicles

SIR,—With reference to my article on the above subject in the May issue I would like to draw your attention to an error—not in the article, but in a current volume on the subject. I write because it may, a little later on, cause you some embarrassment.

You doubtless have at hand the admittedly fine book by Bonestell and Ley ("The Conquest of Space"). Now this book could be in the hands of many of your readers, and it gives on page 15 a period of 0.42 days for Phobos around Mars. This is quite wrong; it is 0.32 approximately.

If you will use *their* quotation for D of orbit (11,600 miles) and my constant in the article you get 0.318 days. Astronomical journals, e.g., The British Astronomical Association's Handbook (page 52), give 0.318 days.

My reason for writing is that in the article I invited readers "to deduce for themselves the figures for Mars." If they try it out on Mars' two satellites, using my constant, they will get 0.318 and 1.26 days, which are correct. This would happen even when they used B. and L.'s values for the orbital diameter D. The 0.42 is a typographical slip for an obvious 0.32. As the error is large (being nearly 33 per cent.) a possessor of B. and L.'s book would almost certainly write to you "pointing out *your* mistake"! for such a book is authoritative.—P. BOWN (Northampton).

THE WORLD OF MODELS.

By "Motilus."

(*Continued from page 315*)

trolled craft, sailplanes, power models and control line models not built to scale.

Entries in the junior section were not, on the whole, original, but some showed promise. A favourite choice was to model the tugboat *Turmoil*, and the Emmett Festival Railway was another topical prototype.

Radio-controlled Models

Radio-controlled models certainly hold a fascination for many people nowadays, and this branch of modelmaking was well represented on the stand of the International Radio-controlled Models Society. A working models arena in the centre of the hall allowed for demonstrations of these and other working models from time to time during the exhibition.

The British Model Soldiers Society is a group I have not been aware of previously, but members of their Manchester Branch had assisted with a display of model British soldiers. Many of the model figures were hand-made.

Once more I was pleased to see models from other countries in an international display. These included several Swedish models, and also a fine selection of work done by pupils of the Hobart Technical School, Hobart, Tasmania.

The tireless organisers of the Northern Models Exhibition are to be congratulated on another fascinating and successful event.

Trade Notes

A Review of the Latest Appliances, Tools and Accessories

Catalure Synthetic Resin

KNOWN as Catalure 344/2F, this synthetic resin, marketed by Catalin, Ltd., has the property of strengthening plaster castings very substantially by incorporating it in the plaster mix. Whether plaster is used for figures, moulds, artistic studies, or for souvenir emblems, Catalure ensures many real advantages to the user. This synthetic resin was specially developed for the purposes of reinforcing plaster. It is entirely compatible with plaster in both the wet and hardened states, and gives extremely effective results in a simple and straightforward manner without the necessity for any material alteration of standard methods of casting technique. It is conveniently available in the liquid state, and is, moreover, particularly economic in use. For ordinary grades of plaster of Paris, the addition of 20 per cent. by weight of Catalure 344/2F, calculated on the weight of dry plaster, will double the strength of the casting. Even stronger results can be obtained with the addition of increased quantities of the Catalure synthetic resin; the addition of about 40 per cent. by weight of resin will approximately treble the strength of the resulting casting.

Further particulars can be obtained from Catalin Ltd., Waltham Abbey, Essex.

"Mighty Midget" Electric Motor

THIS motor is considered to be the most efficient motor for its size in the world and, in addition to its use in models of all kinds, it is supplied by its makers, Messrs. Victory Industries (Surrey), Ltd., Barfax Works, Worplesdon Road, Guildford, to various Government Departments, Scientific Instrument Manufacturers, Hospitals, R.A.E. Farnborough, National Coal Board, Chemical, Photographic, Electrical and Radio concerns; so many trades have shown interest, in fact, that the makers have decided to produce a new Micro Motor of much more robust design especially for industry.

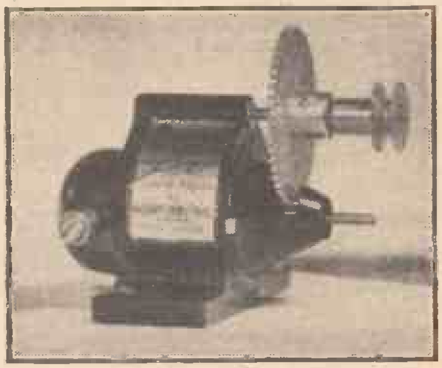
The "Mighty Midget," approximately 1⅛in. high and with a volume of about 1 cu. in., has a speed of 10,000 r.p.m. on a 4½ v. battery and a normal current consumption of less than a small flashlight bulb. The motor is supplied complete with accessories, comprising countershaft, 6¼ to 1 reduction gearing, pulleys and terminals. It is suitable for use on 3-6 v. and can be supplied to order for any voltage from 1½ to 24.

The new industrial type Micro Motor, the prototype of which has been constructed, when tested for performance at 6 v., gave the following results: Starting torque, 17.5 Gm. Cm.; torque at 6,000 r.p.m., 10 Gm. Cm.; torque at 7,800 r.p.m., 7.5 Gm. Cm.; consumption, .6 amp.; output, .6 watt—26.4 ft. lb. per min.

Electric scale model replicas of the products of the Nuffield Organisation and Vauxhall Motors, Ltd., of Luton, are produced and, powered by the "Mighty Midget" electric motor, these models are far above the ordinary standard of toys. They are true to scale, battery-driven and fitted with reversing gear. Fitted with right- or left-hand steering, they will run for miles on each battery at a scale speed of 75 miles per hour; and the batteries are obtainable throughout the world. They are fitted with detachable wheels and rubber tyres and are beautifully finished in all official colours.

The major part of these products is for export, but a small proportion is for the home market and the following are their retail prices, including purchase tax:

	£	s.	d.
Morris "Minor"	1	19	9
Vauxhall "Velox"	2	1	6
"Mighty Midget" electric motor		14	3



The "Mighty Midget" electric motor. This motor is approximately 1⅛in. high.

One of the scale model replicas produced by Victory Industries (Surrey), Ltd., in co-operation with the motor manufacturers concerned, the Vauxhall.

Club Reports

Harrow and Wembley Society of Model Engineers

THE club must be congratulated on the number of awards their members gained at the Kodak Society of Experimental Engineers and Craftsmen Bi-annual Exhibition. No fewer than 10 awards were "collected."

The 1st award went to Mr. C. H. Cosmelli, with his completed ¾ scale model L.M.S. Princess Royal loco. Mr. A. E. Tyler received a Very Highly Commended for his 5in. gauge Aveling and Porter 220 T.G. loco.

In the General Mechanical Models Section, Mr. E. G. Uphill gained a Highly Commended for his model steam driven electric generating set.

A 1st award went to Mr. E. V. Elderkin in the Workshop Appliances Section for small tools and surface plate (machine vices, toolmakers clamps and V-blocks, etc.).

In the Marine Section, again Mr. Elderkin gained a 1st award for five small marine engines and a weir pump. Mr. T. Howard a Very Highly Commended for his unfinished 7ft. working Model of H.M.S. *Hood*.

BATTERY-OPERATED WRIST-WATCH

(*Continued from page* 311)

able is that it is a synchronously controlled motor, powered by the capsule, replacing the mainspring and its associated parts. The winding mechanism is, of course, also eliminated.

It is, however, known that a disturbing problem was the fact that a new understanding and interpretation of established physical and chemical laws was required. Conventional calculations, it was found, scaled down from the familiar fields of engineering design, were utterly valueless in this hitherto unexplored field of micro-electronics. For example, it was found that the principles of conventional motor design theory no longer applied in a motor capable of producing only one-seventy-five millionth of a horse-power.

Future Prospects

The Elgin Watch Company refuses to speculate on the price of the watch when it is eventually marketed. That will certainly not take place for at least two years, and it will be some years before the watch can be sold at a price comparable to that of the average conventional watch of to-day.

Meantime, the present programme of testing and evaluating production models is being continued for an extended period to ensure that, once the watch is marketed in quantity, it will be a thoroughly tested and proven timepiece. Research still remains to be done in the handling of certain difficult materials used in the electronic wrist-watch.

Although the Elgin Watch Company is justifiably proud of its achievement, it cautiously points out that, although the electronic wrist-watch should prove a more accurate timekeeper than any spring-driven watch, it will be many years before the conventional timepiece is outdated.

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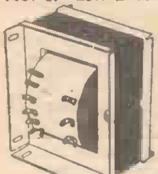
No. 2. As No. 1, but 350-0-350v., 17/-.
No. 3. 26v. 2.5a. tapped to give almost any voltage up to 26v. Ideal for chargers, models, W.D. motors, etc., 16/6.



No. 4. 4v.-9v.-20v. 4 amp. For 2, 6 and 12 volt chargers, 16/-.
No. 5. Auto wound, 10-0-110-200-230-250v. 150 watts. For general voltage changing, up or down, 16/6.
No. 6. 250-0-250v. 100 ma. 6.3v. 3.5a. 5v. 2a., 22/-.
No. 7. Television Auto with Overwind. 0-200-230-250-290v. 500 ma. 6.3v. 7 a. 0-2-6.3v. 2 a., 38/6.
All types upright or drop through. No others available. Primaries on 1, 2, 4 and 6 tapped 200-230-250v Interleaved, Impregnated, Screened, Guaranteed.
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IF YOU are interested in making any of the above and WANT FIRST CLASS RESULTS AT SMALL COST then you are badly in need of our booklet.

HOW TO USE EX-GOVERNMENT LENSES AND PRISMS. Price 2/6 ea. (Illustrated).

The popularity of this booklet over the past two years has quite frankly amazed us and still SALES CONTINUE TO INCREASE, mainly as a result of recommendations from one amateur to another. In addition to a mass of general information, it contains details concerning the general construction and optical layouts of all the above, except stereoscopes.

HOW TO USE LENSES AND PRISMS — No. 2. Price 2/6 ea. (Illustrated).

This was written as a follow up to the above in response to many requests. In addition to further information of a slightly more technical nature, concerning the use of lens, etc., readily obtainable on the surplus market of which we also held large stocks of all the types mentioned, it also deals fully with the construction of four types of film strip projectors from 8 mm. to 35 mm., a 35 mm. or 2¼ enlarger or projector, 3 types of stereoscopes and a 35X and 40X terrestrial telescope.

The above booklets are written in a style easily understood by the novice and expert alike. If our instructions are followed carefully best quality results are obtainable and at a very low cost.

From M. T., Leamington Spa:

Many thanks for sending me the two booklets. I congratulate you on them. I have been recently reading an expensive American publication on the same subject, and I find that your wording is more clear and easier for an amateur to understand.

K. I., London, writes:

Having read your very interesting No. 1, I am now anxious to read No. 2.

VERTICAL ENLARGER FOR 2¼ or 35 mm. All parts complete with all lens, 94/-. Plans and construction details, 3/6.

G. W., of Nottingham, writes:

I purchased from you lenses for a 2¼ x 2¼ enlarger and I can say that the results I have had are well worthy of an enlarger at £30 not 30/-, as I paid.

M. E., of Cornwall, writes:

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QUERIES and ENQUIRIES

A stamped, addressed envelope, three penny stamps, and the query coupon from the current issue, which appears on page 72 (THE CYCLIST), 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.

Waterproof Drawing Ink

I WISH to obtain a waterproof drawing ink in a signal red colour: red inks offered for sale either tend towards an orange or bluish tint. I have found a red writing ink which approaches the colour I require. Can you please tell me the ingredients which are added which render drawing inks waterproof once dry, and whether it is possible to so treat ordinary writing inks?—R. F. Storey (Palmers Green).

YOU can make a waterproof drawing ink by dissolving about 2 per cent. of gum arabic in the ink and by dissolving in the same ink about 1 per cent. of potassium dichromate. This ink, after being exposed to light on the paper, will become quite waterproof within a few hours. Its waterproof qualities can be increased still further if the ink, after drying, is sprayed with a mixture of equal volumes of formalin and water.

It is possible to treat any ordinary aniline ink in this manner, but it is necessary for such ink to be stored in amber glass bottles and in a dark place, so that the ink, under light influence, does not slowly become insoluble before it is used for writing purposes.

The very bright "Post Office red" colour, to which we think you refer, is produced in paints and in enamels rather than in soluble inks. The brilliantly scarlet pigment consisting of a "lake" is produced by the absorption of a red aniline dye on precipitated aluminium oxide. This could not be used as an ink. You require for your purpose a yellow-shade red dye, such as one of the permanent reds, of which there are several grades and shades. These are manufactured by Enico Dyestuffs, Ltd., Salcoates, Hull. Alternatively, you could use one of the Rhodamines. These are fairly cheap dyes which can be obtained from any dealer in chemicals, such as Messrs. Griffin and Tatlock, Ltd., Kemble Street, Kingsway, London, W.C.2, the price being about 2s. an ounce. Most of the Rhodamines give a blue-red shade which would quite possibly suit your purpose. There is, however, another dye known as "Fast Acid Scarlet" which, we think, would meet your requirements better. The average solution-strength of these coloured inks is equivalent to one part of dye dissolved in 60 parts of water. It is seldom necessary or desirable to increase this strength.

Dyeing Veneer

WHAT is the best method of dyeing veneer various colours? Also, how is grey sycamore obtained?—G. Evans (Nottingham).

WE assume that you are starting from whitewood strips and pieces. These should be placed in a shallow dish and the dye solution poured on them, the strips being weighted down in the solution for about 24 hours. It is best to use oil-soluble dyes dissolved in white spirit or paraffin. Of such dyes, use about 10 parts of the dye powder dissolved in 90 parts of the liquid. You can also use spirit stains, which are more easily procured. Of these, dissolve about 6 parts of the dye powder dissolved in 92 parts of methylated spirit. If the wood is thin, full impregnation (the wood being previously well dried) will occur in about 24 hours, so that there is no need for you to make the dye solutions any stronger. The veneers should be turned over or moved about from time to time in order to ensure equal penetration of the dye. After withdrawal from the dyebath, the strips should be hung up in cool air for the liquid to evaporate, and, when perfectly dry, each strip should be rubbed over gently with a soft cloth impregnated with raw linseed oil. Spirit and oil dyes can be had from most firms of laboratory suppliers, such as Messrs. Vicsons, Ltd., 148, Pinner Road, Harrow, Middlesex. These dyes cost, on an average, about 2s. 6d. per oz., but, for your work, as we assume it to be, you will not want more than about 1/3rd oz. of each dye. In some cases, these dye powders may be obtained locally from large paint and decorators' shops.

Purifying Gold

PLEASE give me full information regarding the methods, chemicals and apparatus employed in removing alloys such as copper, silver and brass from gold, e.g., 15 carat, 17 carat, etc. Also, where can I get these chemicals, apparatus, etc.?

The method I am using now is to heat the gold with nitric and sulphuric acids several times. This method is very slow and wasteful and the fumes are very pungent.—Chin Chin Cheang (Kedah, Malaya).

IN order to obtain pure gold from its various alloys, proceed in the following manner:

Mix together in a shallow basin 3 parts of strong hydrochloric acid and 1 part of strong nitric acid. Place the gold articles in this liquid and warm it slightly by resting the basin on the open top of a pan containing boiling water so that the contents of the basin are heated by the steam. The gold articles will dissolve slowly in these mixed acids (known as "Aqua regia") and a golden-yellow solution will be obtained. This should be filtered off through filter paper, returned to the basin and then heated again in the same manner until all the acid vapour has been driven off. The yellow crystals remaining in the basin will consist of impure gold chloride. The crystals are redissolved in a small quantity of pure water (preferably distilled water).

Next, make up a saturated solution of ferrous sulphate (iron sulphate). This is made by dissolving as much ferrous sulphate as possible in a given quantity of water. The solution is allowed to cool and is then filtered.

Now, add the saturated solution of ferrous sulphate to the solution of gold chloride which you have prepared as above. Allow the mixture, after stirring well, to stand overnight. After this time, all the gold present in the gold chloride solution will have been precipitated as a dark brown mass by the ferrous sulphate solution. The precipitated gold is then merely filtered off and then washed on the filter paper by pouring water through it. The washing process should be thorough for, otherwise, the precipitated gold will contain traces of iron sulphate and other impurities. After thorough washing in this manner the gold "mud" is spread out on a dish and allowed to dry. It will appear as a dark brown powder containing 100 per cent. gold. This powder can be used for melting up, or, if you wish to prepare pure gold chloride the brown powder is simply dissolved in a fresh portion of aqua regia, prepared as above.

We note in your letter that you say that you have been endeavouring to dissolve the gold alloy in nitric and sulphuric acids and that you find very pungent fumes are given off. Please note that gold is not soluble in either of these acids or in any mixture of them. It is only soluble in the aqua regia prepared as above. This liquid, being a mixture of hydrochloric and nitric acid, also evolves pungent fumes. It is, therefore, always advisable to carry out this experiment out of doors.

You will be able to obtain all the above materials and apparatus from any of the following firms:

Messrs. Baird and Tatlock (London), Ltd., 14/17, St. Cross St., Hatton Garden, London, E.C.1; Messrs. A. Gallenkamp and Co., Ltd., 17-29, Sun St., Finsbury Square, London, E.C.2; Messrs. W. and J. George and Becker, Ltd., Alperton, Wembley, Middlesex.

You will realise, of course, that these strong acids and chemical apparatus will need special packing so that the cost of their despatch to your address is likely to be high.

Readers are asked to note that we have discontinued our electrical query service. Replies that appear in these pages from time to time are old ones and are published as being of general interest. Will readers requiring information on other subjects please be as brief as possible with their enquiries.

Making Black Crayons

CAN you supply a suitable formula for making black pencils or crayons, for writing on polished metal and glass?—H. Buckley (Barking).

CRAYONS for writing on glass or polished metal surfaces can be made fairly readily. Melt gently together 4 parts of stearic acid, 3 parts of ordinary fat or suet and 2 parts (approximately) of beeswax. When melted, stir in 6 parts of red lead. This mixture is then poured into suitable moulds or into glass tubes. The mixture within the tubes can only be released by breaking the tubes, but glass tubing, as obtained from any laboratory dealers (as, for instance, Messrs. Vicsons, Ltd., 148, Pinner Road, Harrow, Middlesex) is still a relatively cheap commodity.

Note above that we put the word "approximately" in connection with the proportion of the beeswax ingredient of the pencils. This is because the consistency and the hardness of the pencil can be varied by altering the proportion of beeswax. The more beeswax, the harder the pencil. By using carnauba wax in place of beeswax, you can obtain extremely hard pencils.

Fluorescent Paint

CAN you supply the formula for a paint which gives off a phosphorescent glow when used in conjunction with an ultra-violet light? Also, where can the chemicals be obtained?—C. F. Bruin (Kingsbury).

ORDINARY yellow Vaseline is strongly luminescent in ultra-violet rays, and if you dissolve a little of this material in benzene and incorporate the resulting solution in the paint which you propose to use, you will get the luminous effect which you desire. Another substance which can be used similarly in benzene solution is anthracene. These materials are NOT suitable for water-paints. For the latter, you can use a solution of quinine sulphate in weak ammonia or a solution of salicylic acid in the same medium. These materials may be obtained from Messrs. Griffin and Tatlock, Ltd., Kemble Street, Kingsway, London, W.C.2. If you wish to obtain ordinary poster paints of the slightly-luminous or fluorescent type apply to Cheknian Silks, Ltd., 46, Poland Street, Manchester. There is, however, no luminescent agent which is suitable universally for all types of paint.

Cold Optical Cement; Cleaning Bloomed Lenses

DURING the war Ross and other optical firms were using a cold cement in place of Canada balsam for cementing lenses and prisms. It appears to contain an acetate base. Could you give me the formula, if known, and the address of any firm who would supply it?

I would also like to know if there is a method of cleaning bloomed lenses without scratching the bloom, or if there is a reliable solvent for the blooming?—L. Smith (Middlesbrough).

THE material which you are thinking of as a substitute for Canada balsam for the cementing of lenses and other optical devices is a toluene solution of polybutyl methacrylate. This is prepared by Vinol Products, Ltd., Butter Hill, Carshalton, Surrey, from which firm you will be able to obtain all particulars.

Bloomed lenses can be cleaned by ordinary methods without any danger of removing the fine fluoride coating which constitutes the blooming. To remove the blooming entirely, the lens must be immersed in hot concentrated sulphuric acid, which is, of course, a rather drastic treatment and one which is liable to have a deleterious influence on the soft optical glass of the lens.

Simple Wood Transfers

I DESIRE to make transfers, i.e., alphabetical letters in various colours. What "paint" pigments and materials are needed and what are the simplest processes for making transfers in small quantities? These letters are to be transferred on to wood—not dress materials.—R. Loftus (Auckland, New Zealand).

EFFECTIVE transfers are not easy to make. Most of them are now based on synthetic resin films and materials, the exact nature of which depends on the type of transfer desired and the surface to which it is to be applied.

Since you specify a simple process, we note the following composition which can be applied warm by printing, brushing or wood-block methods even to the thinnest paper:

Light-yellow resin	..	100 parts (by weight).
Beeswax	.. ..	30
Pigment	.. ..	30

The above ingredients are gently melted down with continuous stirring. Any mineral colour, finely ground, may be used as the pigment, including the modern metallic bronze "gold" powders. If the mixture is too stiff, it may be advisable to add a few drops of turpentine to it, but great care must be taken not to add too much turpentine lest the mixture be converted into a slowly-drying, sticky mass. For ordinary simple wood transfers, those made on the above lines are quite satisfactory, besides being very inexpensive. The transfer medium should be applied to the paper as thinly as possible, and preferably by rolling in the warm state. A photographic squeegee makes a good roller for the purpose.

Grease Solvents: Removing Scum from Bath

I REQUIRE a solvent for lubricating grease. I have a shaft running in a solid bearing which is lubricated by a screw-down grease cup. Owing to fine coal dust, the grease channels occasionally get clogged up. Is there anything, such as paraffin or turps substitute, that would destroy the hardened grease without injuring the shaft or bearing that I could use before using fresh grease? I have some trichlorethylene; would this help, and would you recommend this for cleaning scum marks from a porcelain enamelled bath?—E. Cheesman (Shoeburyness).

FOR mineral greases, hot paraffin or white spirit is as good as any. For dealing with greases containing vegetable oils, benzene, acetone, or a well-shaken 50-50 mixture of the two will give better results. None of these solvent liquids will injure shaftings or delicate machine parts. Trichlorethylene, although somewhat expensive, would also be an excellent solvent for getting rid of all kinds of grease. It also has the advantage of being non-inflammable. This latter substance is excellent for removing grease and soap scum from enamelled bath surfaces, but it will NOT deal with hard-water scums. For this you must use a soft cloth moistened with dilute hydrochloric acid (1 part in 4 parts of water), finally rinsing down with plenty of water to get rid of traces of acid.

Hardening Plaster of Paris: Glazing Plaster Figures

I WOULD be glad to have the formula for the hardest possible plaster of paris. I am aware of a plastic which is mixed with an accelerator into the plaster solution, which adds greatly to the strength.

I also wish to cover small plaster figures with a glaze which will be transparent, permanent and heat- and damp-proof, i.e., having the same nature as a glass glaze.

Is there any plastic solution into which the models could be dipped which would fulfil these conditions?—"Sculptor" (Waterford, Eire).

THERE are no really satisfactory means of hardening gypsum plasters or plaster of paris. The best way is to dissolve about 15 per cent. of common alum in the water used for slaking the plaster. This will by no means accelerate the setting of the plaster. On the contrary, it will delay the setting. The plaster, when set, will be hardened, so much so, indeed, that it may actually become brittle and powdery. If this happens, use less alum in the slaking water.

There is no connection between the hardening of gypsum plasters such as ordinary plaster of paris and the methods of "accelerating" the setting of plastic resin syrups. Conditions which apply to the one cannot be applied to the other. If you want anything substantially harder than plaster of paris as a modelling material you could employ calcined magnesite, this being slaked with a solution made by dissolving 40 parts of magnesium chloride in 60 parts of water. This material sets in 30 hours and, because it expands very slightly to a hard mass when setting, it produces casts which are particularly sharp. Ordinary plaster of paris can be made tougher (not harder) by slaking it with water containing about 3 per cent. of dissolved glue or gelatine. In this case, the setting-time of the plaster is greatly delayed.

There is no plaster glaze which has all the properties which you mention. The nearest glaze material to your specification would be a toluene solution of either poly-butyl methacrylate or one of poly-methyl methacrylate. Both of these are water-white syrupy liquids which set rapidly into clear films. They are obtainable from Vinyl Products, Ltd., Butter Hill, Carshalton, Surrey. The poly-butyl methacrylate film is softer than the poly-methyl methacrylate one, and is less liable to craze and to crack. Before brushing on either of these media, the plaster surface should be adequately sized by brushing over it a solution of 10 parts of gelatine in 90 parts of hot water. The plaster surface so treated should be quite dry (and preferably very slightly warm) before applying the synthetic resin glaze. Both these glazes will withstand temperatures up to that of boiling water (100 deg. C. or 212 deg. F.). They are damp-resistant and they do not yellow or become discoloured with age. The plaster models could readily be dipped into either of the above media, but for good results it is very necessary that the models should be adequately sized beforehand.

Another glaze can be made by dissolving 10 parts of poly-vinyl acetate resin ("Gelva" Resin, No. 7) in 90 parts of warm methylated spirit. This glaze can be applied by dipping, spraying or brushing, but it is not quite so water-resistant as the former ones. The "Gelva" resin, No. 7, is obtainable from Shawinigan, Ltd., Marlow House, Lloyd's Avenue, London, E.C.3, price about 6s. per pound.

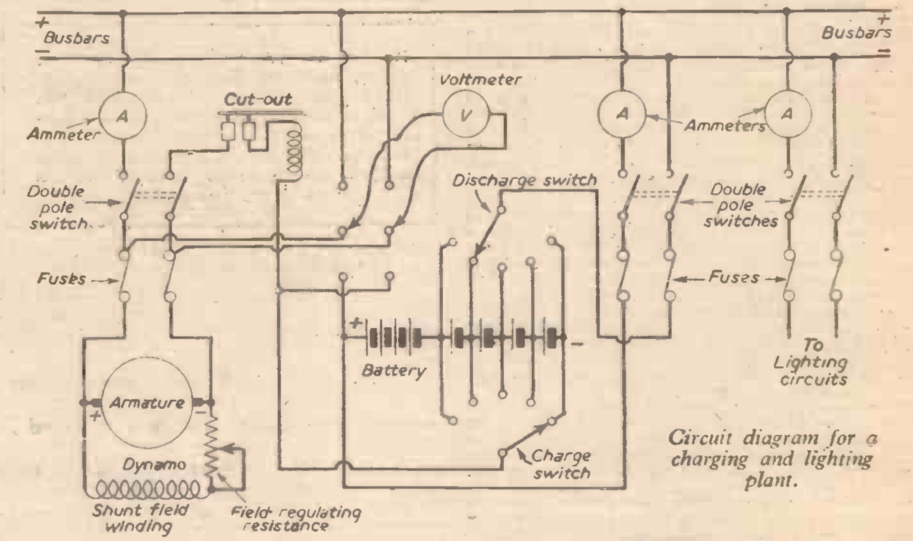
Charging and Lighting Circuit

I HAVE recently purchased a generator the rating of which is 35 volts 36 amps 1,260 watts. Can you tell me how to tell whether it is D.C. or A.C.?

It has three wires leading from it which are A+, L—, F. If it should be D.C., how can I wire it up to charge batteries, or direct for lighting?—N. Burkle (Watford).

FROM the information given the dynamo is evidently a direct current machine. The terminal F should be connected through a variable shunt field regulating resistance to the A+ terminal or the terminal L—, probably the A+ will be the correct terminal. The variable resistance may be used for control of the voltage or control of charging current. If the machine is run with correct rotation and correct shunt field coil connections so that the A+ terminal is the positive, this terminal should be connected to the positive terminal of the battery through a switch, fuse, ammeter and battery cut-out. The negative or L terminal should then be connected through a switch and fuse to the negative terminal of the battery. A voltmeter should be used with plugs or switch so that it can be connected across either the dynamo or the battery. If used solely for lighting the voltmeter can be connected across the dynamo, the cut-out will not be required, and the A+ and the L— terminals connected to the lighting circuit through the switch, fuses and ammeter.

If it is required to supply lighting at the same time as charging the battery, or to supply load circuits from the battery and dynamo together, a more complex circuit should be used as given in the accompanying diagram. A charge and discharge switch should be connected to four of the end cells so that the charge switch can be used to adjust the charging current, or the discharge current from the battery, whilst the discharge switch can be used to control the voltage which the battery applies to the lighting circuit.



Circuit diagram for a charging and lighting plant.

Waterproof Glue

I require for boat-building a small quantity of waterproof glue of the type in which a "syrup" is used on one piece of wood and an acid on the mating piece.

Can you tell me where I can obtain this acid setting type of glue? I believe one brand is called "Beetle" glue.—K. H. Clarke (Bradford-on-Avon).

YOU refer, we think, to a type of bakelite cement in which the bakelite "syrup" is spread over one surface and a dilute solution of acetic or hydrochloric acid is spread over the other surface, the two then being brought together.

These cements are obtainable from Bakelite, Ltd., 18, Grosvenor Gardens, S.W.1, or from Catalin, Ltd., Waltham Abbey, Essex.

The "Beetle" cement which you mention is a product of Beetle Products Co., Ltd., Oldbury, Worcs. You might also be able to obtain an even better adhesive for your purpose from Dunlop Special Products, Ltd., Fort Dunlop, Erdington, Birmingham, 14.

Treating Ply-faced Doors

I HAVE a bungalow in course of erection and the interior doors are flush ply-faced, with very nice graining. Can you advise me on the best way to treat the doors so as to retain the graining, if possible? Could they be treated with linseed oil, then wax polished? I would prefer a rich gold finish, the architraves to be black. The furniture in the house is mostly medium oak, the finish I want to aim at.—L. S. Eggington (Ibstock).

WE assume that the plywood panels which you wish to treat have not been varnished or stained in any way, the wood being entirely untreated. In this case, make up a very dilute solution of brilliant green dye in methylated spirit, and swab it fairly liberally over the plywood surface with a wad of cotton wool. This will considerably augment the grain of the wood, bringing out the contrast. The solution must be very weak—about one pin-head of brilliant green to the eggcupful of methylated spirit. Any solution of greater strength will ruin the work.

If the wood has to be golden finished, it should be stained with a spirit solution of a yellow dye of the required shade (say, a satinwood stain dye). Go over the panel with a soft cloth moistened with raw linseed oil, and leave to stand for three days, finally polishing with any household wax polish. A better sheen will be given if, after the treatment with linseed soil, the wood is lightly rubbed over with a shellac solution (1 part shellac dissolved in 2 parts of warm methylated spirit). As a final treatment, the entire surface is then wax polished. Repeated applications of the wax polish will be required.

The architraves should not be painted. They should be brushed very carefully with a strong solution of an ebony wood stain in methylated spirit, two or three brushings being given, then brushed sparingly with linseed oil, shellac-treated and finally wax polished on the lines above mentioned. This will give the parts a dull finish matching the remainder of the door. If you prefer a black, glossy enamel, use a black cellulose paint.

Transferring a Drawing on to Linen

HOW can I transfer a drawing I have of a galleon on to some fine linen for the purpose of embroidering same? I have tried tracing it on with carbon paper, but this does not seem to bring out the fine detail. The drawing was made with a 4H drawing pencil on semi-gloss drawing paper.—R. F. Lane (Mottingham).

YOUR task is rather a tedious one but it can be effected in the following manner: Trace the drawing or design on to a sheet of tracing paper, using a sheet of transfer paper, which is laid over the drawing paper on which the design has been made. Next, using a sharp needle, prick a series of holes along the outline of the design on the tracing paper. Now lay the pricked transfer paper firmly down on the embroidery cloth, securing it in position by means of heavy weights. Place a small quantity of a fine, coloured powder, such as umber or ultramarine (obtainable from any paint shop) in a saucer or dish and, using dry toothbrush for the purpose, pick up a little of the powder and dab it smartly along the line of holes pricked in the transfer paper. The fine powder will penetrate the holes and will mark the embroidery cloth underneath. Then, very carefully lift the transfer paper off the embroidery cloth and, without disturbing the latter, paint along the coloured line so marked on the cloth, using a very finely-pointed brush and any type of poster paint or washable water colour. This painted treatment will render quite permanent the highly impermanent lines of powder previously forced through the holes in the tracing paper so that you will then be able to handle and treat the embroidery cloth in any convenient manner.

The alternative to the above lengthy process is to trace directly on the embroidery cloth with the aid of a soft, ultra-soft carbon paper but, usually, this method produces a smudgy result.

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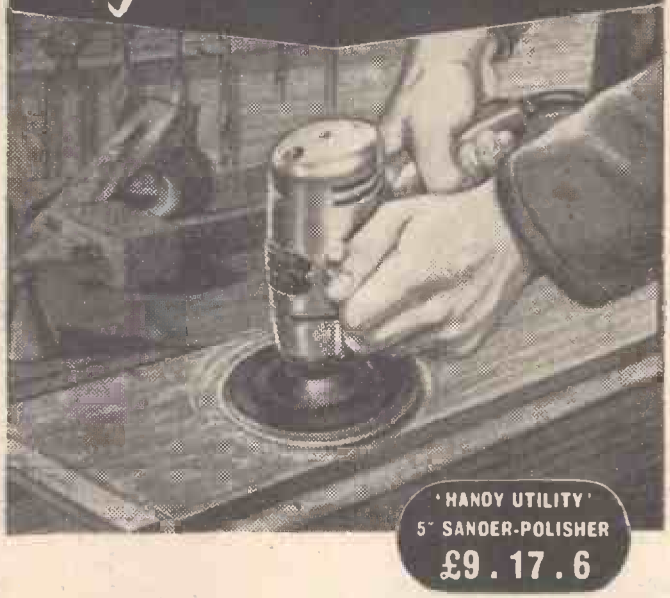

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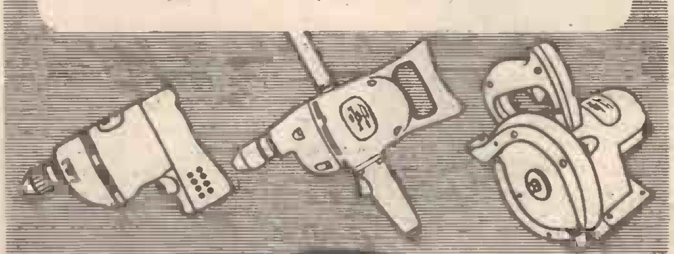

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Phone: Temple Bar 4363
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Comments of the Month

By F. J. C.

Highway Code Report

THE Committee on Road Safety in a recently published report to the Ministry of Transport have made recommendations for improving the Highway Code. Mr. Edward Terrall, the Recorder of Newbury, had submitted a plan to the Committee for consideration and the plan provided for giving selected precepts of the Highway Code the force of law. Needless to say, the Committee has not recommended the adoption of the plan, although they are in accord with the author's objective, which is to make the Highway Code more effective as an instrument for the prevention of accidents.

The Committee criticises the existing Highway Code and makes the recommendation that it should consist of simple rules of behaviour and an appendix illustrating the traffic signs and signals referred to in the rules. These rules should not deal with matters which are specific statutory requirements and with which the law is already adequate to deal. The Committee thinks that the summary in the existing Code which gives exhortations on safe walking, driving and cycling and the braking distance chart is useful to road users, but it should be segregated from the Highway Code and incorporated in a separate manual on the proper use of the roads. They also say that if this manual included "sound advice" on driving technique they think it would be popular and would sell at a reasonable price.

The Committee recommends that the Police should be encouraged to emphasise breaches of the Highway Code in presenting evidence in support of charges for offences of careless or dangerous driving, and that certain sections of the Road Traffic Act, 1930, should be revised so that the courts may have greater regard for the Highway Code. The report contains a reservation by the representatives of the motoring organisations, the T.U.C. and the National Road Transport Federation, who take the view that greater respect can be secured for the Highway Code without any alteration of its status in law.

Personally, we do not feel that the Highway Code is in need of alteration. If anything, it could be considerably reduced for many of its recommendations are a plain waste of space, as they merely express the obvious and entirely overlook the important fact that self-preservation is the first law of nature. It is many years since Mr. Hore-Belisha introduced the Highway Code, and, in view of the statistics published by the Ministry of Transport, it is obvious that the Highway Code has done little to solve the problem it sets out to do. It has, of course, added a considerable burden to the taxpayer. Every motorist applying for a driving licence is given a copy of the Highway Code and has to sign a declaration that he has read it and understands its provisions. If anything is necessary it is a Highway Code for pedestrians only, and the laws relating to the highway should be made to apply to pedestrians as well as to cyclists and to the drivers of vehicles. As we have said, and we again repeat, anything or anybody moving along the highway must be considered as a vehicle. Where footpaths are provided their use should be made compulsory, as should the use of pedestrian crossings. If the matter were left to the discretion of the Police, we have no doubt that the use of pedestrian crossings would be made compulsory. Accidents still occur, and the pedestrian crossings have only converted road travel into a wondrous game of hopscotch. Unfortunately, there is not a body which adequately represents the views of pedestrians. The only organisation of which we are aware has, we believe, a membership of less than two thousand.

No Sign of Peace

DURING a general discussion the other day among a group of people representative of all sections of cycling it became abundantly clear that the possibility of the various bodies composing their differences are extremely remote. The wounds inflicted in the past are deep and not easily healed by suave talk. Indeed, those who pay lip service to the need for the breach to be healed are those who in their public utterances seem most anxious to enlarge the fissure. There is an extraordinary amount of northern pugnacity behind the scenes, and if a few of them would retire from the fray or submerge their county characteristics, preferably the former, we have no doubt that reconciliation would be effected. Breakaway movements, as we have pointed out before, are nothing new. They take place in almost every branch of human activity. Even dance-band leaders suffer from it, when members of their orchestras break away and form their own bands. The N.C.U. has positively encouraged it by endeavouring to impose its will against the wishes of an important section of its membership. Thus, did the R.R.A., the Road Racing Council (now the R.T.T.C.) and the B.L.R.C. come into existence. To suggest that the B.L.R.C. should now come under the ægus of the N.C.U. because the latter has now decided to support mass start (the B.L.R.C. having turned the tables on the N.C.U. and imposed its will on the latter, instead of vice versa) is altogether unacceptable. Why has not the N.C.U. insisted on absorbing the R.R.A. and the R.T.T.C.? After all, the R.T.T.C. is not too friendly towards the N.C.U. Each body feels that the other is likely to put it out of business. That is the real reason for the opposition. But on the lines that people use words to conceal thoughts, their public utterances are that mass-start racing is "dangerous," "contrary to the interests of the public," etc. Those very same phrases were used by the N.C.U. when it acted the Judas more than half a century ago and jettisoned road racing and road records.

It may be that the N.C.U. has given rise to the formation of bodies which may be considered as children and grandchildren, but there is certainly no family spirit amongst them, and it is a truism that relatives are best apart anyway.

SELBY, YORKSHIRE.

The great Abbey founded by William the Conqueror in 1069. The first in the north after the Conquest

Herne Hill—No Women's Races

IT was recently announced that the Herne Hill promotions this year will not include Saturday afternoon racing for women. This has been severely criticised, and the N.C.U. has received a number of protests on the matter. We are of the opinion that previous experience does not warrant such promotions. Less than two dozen women have taken out licences for the 1952 season, and last year there were fewer than six Saturday afternoon meetings catering for them. Even those could hardly be termed successful. They were very poorly attended and supported, and in at least two cases, were a fiasco.

Model of Macmillan's Bicycle

THE $\frac{1}{8}$in. scale model of Macmillan's bicycle which was recently constructed and described in this journal, will be the subject of a function at the forthcoming Cycle Show at Earls Court this year. We have presented it to the Centenary Road Club, and the presentation will be made at Earls Court during the run of the Show.

Cycle Racing Gossip

A Monthly Summary

By W. J. MILLS

"ONE man, one job" is the National Cyclists' Union edict for the Olympic Games cycling selections, and I sincerely hope that this time they will stick to it, despite the obvious temptation to put the new Olympic hope, Cyril Peacock, of the Tooting B.C., in both the 1,000 metres sprint and, paired with Sid Maidment, of the Belle Vue (London), in the 2,000 metres tandem sprint.

Remember 1948 and the Olympic storm over Reg Harris? From an early announcement of "one man, one job," Manchester enthusiasts over-rode the Olympic Training Committee and tried to force Harris's selection for *three* Olympic events—sprint, tandem and 1,000 metres time trial. In protest Bill Bailey, team manager, resigned, Manchester succeeded in getting Harris entered for the sprint and tandem . . . and we did not gain a single Olympic cycling title.

Peacock looks like being the Harris of the 1952 Olympics (incidentally, he closely resembles Harris, not only in appearance but in racing style and position). He has shown that he is the number one choice as a sprinter and, with Maidment, he is terrifically fast on a tandem. But, if the N.C.U. want him to bring back an Olympic gold medal from Helsinki, they would be wise to keep him for sprint, and let Alan Bannister and Les Wilson concentrate on the tandem race.

* * *

For the Olympic road race, the N.C.U. certainly have far more information to draw upon than they did in 1948, thanks to a greatly augmented massed start programme in this country. The Route de France 14 days' race in May will have given a good indication of how our boys compare with the best of the younger continentals, but remember, the Route de France is confined to riders under 25 years old, and there are plenty of over 25 amateurs abroad still to be reckoned on.

The three key events in June, from an Olympic viewpoint, will be the *Daily Express* international 50 miles road race at Scarborough on Whit Monday, the N.C.U.'s national road championship at Birkenhead Park on June 21st, and the Isle of Man international (113 miles) on June 26th.

The Scarborough and Manx events are both expected to have French, Belgian and Dutch teams competing, and the *Daily Express* have invited G. Ghidini, of Italy, winner of last year's World Amateur Road Championship to ride, together with a full team, at Scarborough. But the Italians are usually chary of sending their Olympic riders abroad prior to the Games.

On known form, at the moment of writing, the best Britishers seem to be Pete Proctor (Bradford and Army), the National Road Champion; Les Wilmot (Birmingham and Army), the 100 miles record holder; and Brian Robinson (Huddersfield and Army). The Army riders are certainly in form, thanks to the War Office's encouragement of cycling as an officially recognised sport. In last month's Army 25 Miles Championship there were no less than 102 entries, with ranks ranging from private up to captain. Army influence on the start card: starting point ("secret" information under Road Time Trial rules) was quoted by Army map reference number, Q551892.

South Africa is building up a strong team of roadmen for the Olympic Games, and some of them are already in this country, training and racing. It is hoped to field a full team in the Isle of Man race, consisting of D. North and C. Voller (who are already here), plus J. Guzzwell and T. Richardson. Canada has similar plans, and hopes to get her Olympic team over to Europe in time for the Manx race, but no names are yet available.

Australian Olympic hopes are centred on the track, with Russell Mockridge as a highly possible winner of the Olympic 1,000 metres sprint. Mockridge, originally destined to be a preacher, was second to E. Sacchi, of Italy, in last year's world championships, and has been racing in Europe since Easter opened the season. Tall and bespectacled, Mockridge has improved, in my opinion, enormously since last year, and I cannot see Sacchi getting the better of him this year.

* * *

Although the N.C.U. have now at last recognised road racing they still have shown no signs of making peace with the British League of Racing Cyclists, for ten years the "rebel" body. An amalgamation of some sort is the obvious step, but when I talked to Doug. Peakall, who runs the major B.L.R.C. events, about the August "Tour of Great Britain," he assured me that it would be run under B.L.R.C. and not N.C.U. rules. The League, he added, had made approaches to the N.C.U., for a combined effort on this event, now the biggest road cycle race in the country, but with a negative result.

Until the race is run with N.C.U. blessing, naturally the big names abroad are banned from riding, so don't expect to see Fausto Coppi, Hugo Koblet and Ferdie Kubler riding this year.

* * *

French Olympic selections for the road race will be finalised on July 5th. Twenty-five riders will be picked from the various regions of France, to race together on June 9th and July 2nd and 5th. Selection will be made on a basis of points for places in these races.

* * *

The 25 Miles Road Time Trial Championship of England will be run off in June, riders, date and course being secret, naturally; but it is not difficult to speculate on the probable result. Last year's winner was R. Inman, of the Mercury R.C., in 57min. 17sec. But Stan Higginson, one of the Halesowen cycling twins (his brother Bernard is almost as fast), second last year, seems likely to be this year's champion. He started the year off with a rush, beating the "even hour" three weeks running, regardless of course or weather conditions.

Dave Keeler, the Vegetarian, who holds the national 25 miles record for 1951, with 57min. 11sec., also started the year well, with 59min. 19sec. in a Welsh event (which gave him the Welsh competition record), but he has not been so consistent as Stan Higginson.

Entrance to SYON HOUSE MIDDX.
The lovely grounds and the present house built by the Adam brothers are open to the public during the summer.

An artist's impression of historic Worcester Cathedral.

Presentation to Geoff

QUITE apart from the pleasant social occasion at the Savoy Hotel in April when the *Sporting Record's* "Sportsman of the Year" trophy was presented to Geoff Duke, world motor cycling champion, it was a pleasant gathering in many other respects. Journalists representative of the daily and periodical Press were present to witness the presentation, and I suppose it was the largest gathering of its kind of the year. The presentation was made by Lord Aberdare, with Mr. H. C. Drayton, chairman of *Sporting Record*, presiding.

Famous sporting personalities from every branch of sport attended, including Reg Harris, Stirling Moss, Johnny Leach, Jeannette Altwegg, Johnny Williams, Eileen Sheridan, Macdonald Baily, Arthur Wint, Doug Insole, Tom Whittaker, Roger Bannister, June Foulds, Denis Compton, Jack Solomons, John Savidge, Dorothy Tyler, Valda Osborn, the Bedser Twins, Goldie Gardner, Syd Patterson—over a hundred in all!

Representatives of the Press, national provincial and trade, were well to the fore: T. Blackburn, E. J. Robertson, Sir John Grotrian, Charles Ead, Bill McGowran, Frank Butler, Bernard Joy, George Casey, Roy McKelvie, Bernard McElwaine, Tom Phillips, Sylvester Bolam, John Gordon, Charles Buchan, Alan Hoby, Sir Harry Brittain, F. R. Lewis and W. Redpath.

An artist's impression of Hereford Cathedral.

AROUND THE WHEELWORLD

By ICARUS

Well-known figures in the wholesale and distributing trades were well represented.

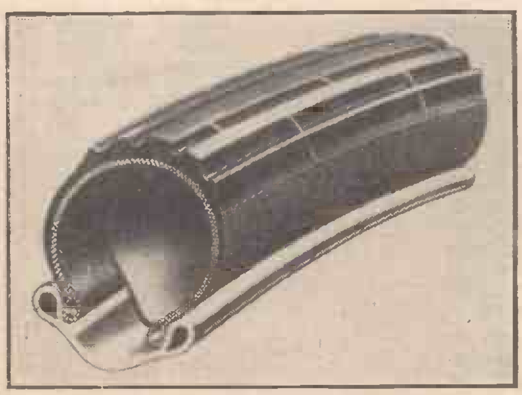
The ceremony was broadcast by the B.B.C. in the Light Programme for half an hour, with commentators Raymond Glendenning and Raymond Baxter interviewing many of the celebrities there.

Gaumont-British, British Movietone, British Paramount and Pathe newsreels filmed the presentation, as well as Television Newsreels.

Other personalities present included: the High Commissioner for Australia, the Hon. Sir Thomas White, Sir Sidney Abrahams, Admiral Sir Geoffrey Layton, Sir Ronald Ross, Lord Brabazon, Viscount Scarsdale, Earl Howe, R. M. Howe, Miss Joan Rice, Miss Elizabeth Allen, Eamonn Andrews, Kenneth Adam and S. J. de Lotbinier.

The N.C.U. Opening Meeting

THE first N.C.U. promotion under its new racing venture at Herne Hill took place at Herne Hill on May 10th. This was the first of a series of 17 regular Saturday programmes and I suppose is the largest season of racing ever staged in this country. The twenty riders based at Herne Hill raced at this first N.C.U. race meeting of the year. There was Dave Bedwell, Derek Buttell, Alec Taylor (second in the Tour of Britain in 1951), Stan Saunders, Jack McKellow, and two Scottish combinations, Alex and Andrew Hendry and Jack Proctor with Tommy McNulty. They competed against the exiled British pro's Dave Rickets and Len Jackson, who have been wintering on the Continent. The amateur races saw the second stage in the battle between the Australian and Empire champion Russell Mockrage and Cyril Peacock. I hope these Herne Hill meetings will do something to put Herne Hill back where it was.



The new Michelin tyre for power-assisted bicycles.

Future of the B.L.R.C.

AT the moment of going to press no fresh developments have taken place in the efforts to bring the disputing cycling organisations together. As a result of the meeting which took place at the end of May under the aegis of the Manufacturers' Union, there is hope that some formula will be found where one all-embracing cycling organisation will control cycling sport without loss of identity or loss of face to either. The N.C.U. is the oldest body, and naturally feels that it has prior right to take younger bodies under its wing. The two other bodies—the R.T.T.C. and the B.L.R.C. —both formed as a result of a breakaway from the N.C.U., still feel some apprehension that any agreement reached might be set aside in a year or so, thus leaving the N.C.U. in complete control of the sport, as they were in the early years of its foundation. There is really, however, no need for such a fear if an agreement is reached on a *vis-à-vis* basis, such agreement to be permanent for, say, ten years, when the subject can come up for revision. I think everyone in cycledom devoutly hopes that such unification can take place soon, for so much time is being wasted on talk and vitriolic recriminations that the sport itself is likely to be neglected. After all, it is cycling sport which matters, and not so much the people and the personal opinions behind it. All bodies here have a golden opportunity, it may be a last chance, to settle their differences, if each constituent can enter a committee room in a spirit of amity and not armed with ammunition for the Parthian shot.

New Tyre for Power-assisted Bicycle

THE new Michelin "Y" 26in. by 1⅜in. tyre has been specially designed for the extra duty imposed by the attachment of a power unit to a pedal cycle. It is shown in the illustration below. The tread is made of a very tough rubber compound which is specially resistant to abrasion and the tread pattern is unbroken, so that when rollers provide the driving force they travel along a continuous path and transmit the power without interruption. They also reduce tractive resistance. It is claimed that the walls are supple but extremely strong. It is fitted with twin bead wires, but does not need any special tube. It has a normal section and, therefore, there is no loss of lateral or radial clearance. It is also fitted with a dynamo track. It costs 14s. 7d.

Palco Shock Absorbers

MORE and more people are fitting Palco shock absorbers to bicycles. They damp out the shock before it reaches the rider. Tyres can thus be ridden at a higher pressure, thus lengthening their life and rendering them less liable to puncture; with harder tyres less energy is required to attain a given speed. Shock absorbers also prevent frame fracture, broken wheel spokes and head-lamp bulbs. Moreover, it reduces steering wobble and braking is more powerful.

B.R.C., Ltd., Jubilee 50

THE Jubilee Unpaced Scratch 50, organised by the B.R.C., Ltd., was held on April 20th over the usual hilly course. Last year the fastest time was 2 h. 12 m. 34 s. This year that was lowered to 2 h. 5 m. 33 s. by D. J. Keeler of the Vegetarian C. and A.C. H. J. Edwards, of the Eagle R.C., was second at 2 h. 8 m. 54 s. and G. J. Vines third at 2 h. 10 m. 6 s. There were seventy-one finishers. The winner receives the Bath Road Jubilee Cup.

The Medina River at Newport, Isle of Wight. Many visitors miss the charm of the Quay, with its old warehouses and interesting river craft. It lies a little way behind the High Street and is well worth seeking.

The team race was won by the Vegetarian C. and A.C. (D. J. Keeler, J. A. Hanning and T. F. Cooper) at 6 h. 48 m. 11 s. The Eagle R.C. were second at 6 h. 57 m. 11 s. and the B.R.C., Ltd., third, at 6 h. 57 m. 44 s. Perhaps one day the B.R.C., Ltd., will be able to win some of its own events and recapture some of the glory and fame of its past days.

Are Tricycles Out of Date?

AN item on the agenda of the February meeting of the R.R.A. proposing that the tandem tricycle records be abolished must have caused some surprise among those who still use this noble-looking, if antiquated, vehicle. Many famous R.R.A. records were accomplished on tandem tricycles and members of the Tricycling Association must have arched their furrowed brows in surprise that a body which has done much to encourage tricycling should now wish to set its face against one form of it. It is hardly necessary to recall that the proposition failed, although it had a very full hearing. Whether the chairman should have permitted such a lengthy discussion is now another matter.

There are very few tricycles in use in this country and, within 20 years, it is possible that specimens will be sold for cycling museums; for to modern eyes it is a comic sight to witness an elderly gent pedalling one of these stupid three-track contraptions at a high pedal rate but low road speed along our roads to-day. Like bowls, tricycling is a sign of age in many cases. The tricycle was produced towards the latter end of the last century at the time when cycling schools were making handsome profits teaching people to ride safety bicycles. It was thought that it would find a market amongst those inapt pupils who could not learn the comparatively simple art of balancing on two wheels. The fact is, that if you learn to ride a bicycle you will find it extremely difficult to ride a tricycle. You certainly won't be able to ride it straight away. It is a difficult machine. I must say, however, that it is much harder work than riding a two-wheeler. It is heavier, has three tracks instead of one, has greater transmission friction and, therefore, for ordinary riders, needs a correspondingly lower gear. It has the advantage, however, that equipment and parcels can be carried much more conveniently, but it is more affected by side winds than the two-wheeler. I witnessed an old gent riding one of these along the Bath road the other day. The wheels were out of truth in two planes, but he was praffling along quite merrily. Inquiries among manufacturers show that if they sell one tricycle a year they are doing good business! Of course, records on tricycles do not attain the same spectacular speed as the solo machines, but if people enjoy breaking records on them, I see no reason why the R.R.A. should set its face aginst the tricycle. If they did do so there would probably be a break-away from the R.R.A. as there has been on many occasions from the N.C.U. Perhaps we shall have a T.R.R.A.!

"The George" at Colnbrook

IF you visit "The George" at Colnbrook you may obtain a booklet from them which purports to tell its history. This booklet informs you that it was founded in 1066, but I can assure that it was not. Both its style of architecture and its name suggest that it is not more than 300 years old, if that. There is no reference to it in any of the authoritative works on old inns. It is not marked as a coaching inn on any of the early maps, nor does Thomas Burke in his well-known history of the ancient inn give it any date at all. In the copy I have he does not even mention it. The oldest inn, according to records which can be checked, is the "Fighting Cocks" at St. Albans (795) and the fourth oldest is beyond all doubt the Old Ostrich Inn at Colnbrook, opposite the seventeenth milestone from London and only a few yards from "The George." I notice that the booklet relating to the latter refers to it as having been founded by Milio Crispion. The latter, whose name by the way was Milo Crispen, had nothing to do with "The George"; but he certainly founded the "Ostrich" and left it to the Abbot of Abbingdon "For the benefit of travellers in this world and the peace of their soul in the next." Of course, all inns which are not modern claim to reach back into the mists of history, but few of them could substantiate their claim and no one tries to. In the course of years these obvious and amusing mis-statements get handed down and, because of lack of challenge, become accepted as fact.

A Cycle Stop-light Switch

By D. BARRY

THIS light switch is fitted to and actuated by the brake mechanism, and the type of brake used is that having a lock bolt at the bottom to adjust the cable, besides the usual screw for fine adjustments.

Construction

Take two pieces of tubing 1½in. in length, one to be a sliding fit inside the other. The piston and spring are fitted inside the smaller of these, the spring being attached to the base of the piston with a screw. The piston should be approximately ¾in. long and when the spring is relaxed should project about ¼in. above the upper end of the tube. It is shaped to a point to make good contact. To hold the spring in position the base of the tube should, of course, be sealed.

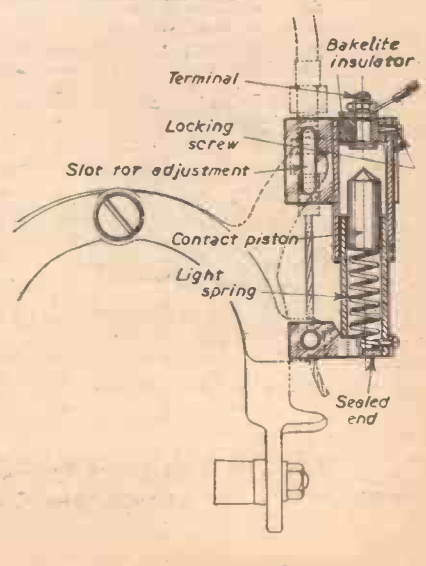
One end of the outer tube is sealed with a piece of bakelite about ⅛in. to ¼in. thick, and a bolt passed through the centre and locked on the outside with a nut. This acts as the terminal.

Two small pieces of metal plate were then obtained, one of which was just under 1in. wide: a slot was cut in this so that the switch could be adjusted on the brake. After bending the other end round the top of the outside tube, the plate and tube were drilled and tapped and a bolt passed through, which also locked the bakelite insulator in the tube.

The other piece of metal plate should be smaller and this is fitted to the bottom of the inner tube: a screw is also passed through this into the bottom of the tube in order to stop the spring jumping up with the piston. It is drilled at the other end so that it may be fitted to the lock nut at the bottom of the brake cable. Both pieces of metal are soldered in position.

Operation

When the switch is fitted to the brake and the brake lever is pulled up, the piston comes into contact with the terminal, thus completing the circuit (see Figure). The current flows through the switch to the battery, on to the lamp and back through the frame and brake to the switch.



TANNERS HATCH, SURREY
The lane to the Youth Hostel at the foot of Blagdon Hill on the picturesque Box Hill-Bookham road

Wayside Thoughts

By F. J. URRY

Worse For Us

THE threat of the cancellation of price control on priority articles now dispelled owing to the change of Government, if carried into law would have been a serious matter for the cycle trade and the cyclist, or so I think. I am concerned with the matter as a buyer of goods, the varying brands of which I know will give me reasonable satisfaction; think of them, tyres, outfits, saddles, chains, brakes and parts, indeed all the things a rider needs from time to time, not excluding the complete bicycle. Now, if the trade had not developed a price stabilisation it is a certainty that quality would have suffered, and not only should we pay more in the long run but have gathered a lot of trouble to ourselves along the road. Take but one commodity as an example of what I mean, tyres. To-day you can buy cheap tyres if you want to, and still have to learn that in this particular accessory you are probably buying trouble, and will need additional energy to move along the machine so fitted. Tyres, indeed, are a very good example where price maintenance has given us just the quality we are seeking at a price to suit everyone, for tyres are not a monopoly because of the very wide choice offered in quality and price. But if the makers of the well-known and well-tried brands could not govern the retailed price, then competition between dealers would finally bring the manufacturer to the point of cutting quality to meet a new retail figure, and that I submit would be a handicap to the user. If there are to be no standards on price then there cannot be standards in quality; and in their degree similar things would occur to every other cycling requirement, right up to the bicycle itself. I am a great believer in giving the ultimate user of any article a square deal, but as far as I can see the new notion of open competition in the retail prices of cycling equipment would do the very opposite. In saying that I remember the days of cut-throat prices before the industry had grown up, as it were, and also the utter rubbish that was foisted on a public just beginning to realise what a bicycle could mean to them in travel terms.

Spring Preparations

SPRING is in its heyday, and you can visualize me (if you want to) making the best and most of it. The evenings linger a little longer giving me enough daylight to go twenty miles on the way home, past the hives of industry, yea even Fort Dunlop, into the country, the clean air, and the fresh beauty of unfolding leaves. There are lots of things to do besides the daily ride and the week-end journeys, and I'm trying to do them, going carefully over the tyres to see if replacement is necessary, doing the little adjustment here and there, and quite a lot of lubricating, an item often neglected. I'm afraid my bicycles do not get the cleaning and polishing attention in the winter months they deserve, so one by one they are going down to the works for a thorough spring clean, and will soon emerge little the worse for wear and winter storms.

Such is the prelude to thoughts on cycling, and I sometimes wonder what the story will bring. We old cyclists nearly always make these resolutions when first we see the almond blossom, but I'm fairly certain most of use fail to carry them out in entirety, and perhaps that is one of the reasons why we do not write them down, for if we did and referred to them when the loud October skies are shouting we may be ashamed of our back-slidings. Yet it is good to have intentions, some of them will be sure to fructify, and the more that do the more will follow, for cycling is like that to the regular rider, its perfection grows with the miles you cover or the time you spend along the road, a fact always worth remembering.

A Little Timely Advice

I MUST consider myself lucky in possessing eight beautiful bicycles for it may be that good bicycles will not be too easily obtained this year or next, if there is any truth in the "cuts" of raw materials everybody is talking about. That there is more than mere rumour of shortage is proven by the fact that numerous firms depending on steel are now working a short week at a time when there is no lack of orders. This is bound to affect the cycle trade and particularly the home market, for in present circumstances it automatically follows if supplies of steel to the industry are curtailed most, if not all of it, will be absorbed in the export side. Therefore, if you know of a good bicycle and you need one, buy it, and if you have one or more care for it or them by making needful replacements quickly while the goods are still to be obtained. We are rather careless about these matters because we have been used to finding the things we need at the moment we need them. The best lesson I had on this subject was soon after the late war started, when I called in at my usual dealer to have a Sprite tyre fitted. He told me that I would be lucky if such supplies lasted a year, so then and there I bought and paid for ten covers, he to keep them in store for me. Some time before the end of the trouble and before the Sprite returned to the market, all those covers had gone, and I was reduced to patching and changing-over to keep in being the pleasure of easy running. It may not be as bad as that, but it may be difficult to buy what you want, so get the goods now while you have the chance. That is what I am going to do and I shall also take a little better care of my property, for an idle bicycle is waste of capital, and I hate to see good machinery rusting away waiting for spare parts which neglect had imposed—after warnings of shortages.

The Cold War

TO keep out the cold of mid-February was a problem, and as far as bodily comfort is concerned I think I have the answer to it. During that bitter winter of '47 I had made a kind of old-fashioned reefer jacket in Grenfell cloth to keep the wind out. It has been a real comfort, light in weight, short in the tail, and quite impervious to the knife-edged breezes. It may not be handsome and it wrinkles easily, but it does a brave job for me and that is the chief thing.

My main trouble in winter riding, however, still persists—cold feet. However warm I sally forth, in five miles I want to stamp my feet to restore a modicum of warm blood to them, and even that exercise has no lasting quality. I have tried everything from spats to oily anointment, but nothing seems to work the desired cure. I suppose I am one of those cold-footed beings and therefore must suffer the slight handicap, but because on occasion it can be painful I bought a pair of those wool-lined shoes, but find them so clumsy for pedalling that the cure—if it be one—is worse than the complaint. However, it is a small thing about which to complain. The rest of me can be kept warm easily, even my finger tips, for under wool-lined gauntlets I slip on a pair of thin silk gloves—like the flyers use—and this combination keeps my hands aglow all day. Then, during my journeys at the week-ends, I meet boys and girls wearing shorts and ankle socks! They make me shudder with envy for their warm young blood, and I wonder how they keep warm when they are off their bicycles, or at feeding times. To me it seems a mystery.

Good Reasons

SOMETIMES we are inclined to wonder why the American continent has lost much of its savour for cycling. The answer comes in a letter from a Canadian friend: "Canada is for cars, I think; the size of the country demands them and the roads must be given over to them." That is a fact we folk in these garden-like islands are apt to forget. After all, a man in a hurry rides from Land's End to John o' Groats in two and a quarter days, and any of us who possess touring pretensions can make the journey in a fairly leisurely manner during our annual holiday. This friend is in the Dominion for a spell of years and to-day is longing to be back among the lanes of his native land, for he says cycling over ruler-straight roads for endless miles, without a rideable side turning, loses its charm and the beauty of the pastime departs. Much the same impression was collected by my brother who, a year ago, spent six months' holiday in Vancouver B.C., a lovely land, as tame or as savage as you wish, but without the peculiar intimacy of our British countryside. When all the modern worship of foreign travel has been offered, this is still left to us. This is the ideal land for cycling, for beauty is always just around the corner, even outside our biggest cities, and the roads we ride over, because they were made to serve our ancient needs, hold all the fascination of their age as well as the best surfaces in the world. It may be as well to remember this when deciding where to tour this year.

CYCLORAMA

By H. W. ELEY

Approach to one of the loveliest of the lakes BUTTERMERE...

Liar's Cross

IT is in front of the Bear Hotel at Devizes, in Wiltshire, a curious Gothic memorial which was erected on account of the prevarication of a market-woman named Ruth Pierce. This unhappy soul told a lie, called upon God as her witness that she was speaking the truth, and immediately fell dead. There seems to be no record as to when this sudden visitation took place, but anyway, to-day, in this pleasant Wiltshire town, we may see this odd memorial and be reminded of the virtue and expediency of telling the truth! I like Devizes, a pleasant agricultural town, and it was here that Roger of Sarum built his great fortress in the twelfth century. All that remains to-day of this great structure is the ditch and castle mound. But Devizes can show us a fine old church, St. John's, with a twelfth-century tower, and in St. Mary's there is a fifteenth-century nave.

The Month of Roses

JUNE is, traditionally, the month of roses, but it does not always live up to its name, and often I have found that my roses bloom more freely and more beautifully much later in the year. Song-writers and poets have sung of the glory of the English rose, and surely no flower is as lovely! In my village there are one or two gardens where roses bloom in rich profusion, and it is my delight, on a June evening, to stroll round to the mellow old house by the mill and admire the grace and beauty of "Ena Harkness" and "Madame Butterfly," and "Betty Uprichard" and "Shot Silk" and "Covent Garden," and many other named varieties of roses. They are cared for with love and skill, these fine blooms which grace the old garden where, when the sultry days come, the bees will drone in the borders and green and blue dragonflies will flit across the pool where the goldfish swim among the reeds. A June evening . . . and an English garden! It is Paradise enough!

Jack-of-all-trades

HE exists in most small villages, the sort of man who can mend a farm-cart, repair a tyre puncture, deal with frozen pipes, "lay" a hedge, dose a sick pig or cow, and do many other jobs with a skill which seems inborn. Our "Jack" may not be an absolute master of all jobs he so cheerfully tackles, but he is wonderfully handy and an asset to the village. The weather has tanned his lined face to the colour of a walnut; his hand is as tough as gnarled oak; his old clay pipe as black as ebony. And he can talk on every farming topic with the wisdom of one born and bred to the land and its ways. On Saturday night he sits by the log fire in the tap-room of the inn and drinks his ale from a tankard given to him years ago by "the old squire" when "The Hall" was a piece of splendour and life moved on with stately, leisured pace.

Escape from Town

HOW I love to see those young fellows and girls, all riding bright, colourful bikes, slipping into our village early on a Sunday morning . . . "escapists" from neighbouring towns, anxious to revel in the green countryside, keen to sample the joys of winding, leafy lanes, of ancient grey churches, or little inns. Cycling binds them together in happy bonds of comradeship. Cycling gives them the exercise they need after a week of hard work at office desk or factory bench. And the magic carpet of England lies before them as they ride. Hedges starred with the pink and white dog-rose. Lush meadows where the black and white cattle graze in full contentment. Cottages where the little gardens almost proclaim the truth of the prophecies in florists' catalogues . . . "riots of bloom." Yes! there is much wisdom in these Sunday trips by town cyclists. I always greet them, chat to them about their machines, their touring experiences, and, sometimes, am able to show them some wayside curiosity or some strange feature of a church or inn.

"The Silent Salesman"

THAT is the name which, in my advertising days, we used to apply to the shop windows, and it is an apt name, for the window of a shop is truly a "salesman." It is often due to that first glance in a shop window that a sale is made. and that is why it is so important to "dress" the window as attractively as possible. The other day, strolling down the main street of a small provincial town, I was struck by the bright and colourful display of cycles and cycle accessories in a dealer's window. Festoons of "crêpe" paper, manufacturers' show-cards, brightly coloured tube-boxes and one or two gleaming new bikes which made me pause, examine, and long to possess. I asked the dealer about sales and business, and he was cheerful and happy. We may be living in difficult times, but young cyclists *will* have the best, and this dealer had no difficulty in selling the machines he received from the makers. "Quality first" seems to be the motto of our young riders, as it is, fortunately, the motto of the British cycle manufacturer!

Our Smallest County

THE latest correspondent to write to me about these notes, and my frequent mention of England's counties, writes from Rutland and tells me that he was born at Oakham, the county town. Do I know Rutland? Have I toured in the fertile and lovely vale of Catmose? Did I know that at little Braunston, in Rutlandshire, the genuine Stilton cheese was first made? Well, I have replied to my good Rutland friend and answered his several queries. I *did* know of the "cheese fame" of Braunston, and was aware that the original cheese was sent to an inn at Stilton, on the Great North Road, where it became famous. I mentioned, in my reply, that I had been in the twelfth-century castle at ancient Oakham and seen those walls covered with horse-shoes—they are connected with a very ancient manorial right originating with the Ferrers family. The Ferrers are descendants of the "ferrariius," or chief of the shoe-smiths in the army of William the Conqueror. and these shoesmiths used to claim toll of every horseman who rode through the town of Oakham! I also referred to the quiet little town of Uppingham and its famous school, founded in 1584 by Robert Johnson, Archdeacon of Leicester. Pleasant, homely little Rutland, with its sheep-raising and its wheat-growing, and its famous Cottesmore Hunt; I am glad to be reminded of it!

"The Wandering Voice"

YOU remember the poet's description of our friend the cuckoo? He is still with us, haunting coppice and woodland, and in June "he changes tune." How rarely one actually sees the cuckoo! His monotonous call comes from every direction, but it is not often that he shows himself. When he does, he turns out to be quite a large and handsome bird. He is not popular with the smaller birds, and everyone knows his curious habit of laying eggs (or, I should say, the *female's* curious habit of laying eggs) in other birds' nests. I have found a cuckoo's egg in the tiny, exquisite nest of a tree-pipit. But the cuckoo seems a very part of the English spring and early summer, and I for one would hate to miss that oft-repeated note from tree and copse.

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