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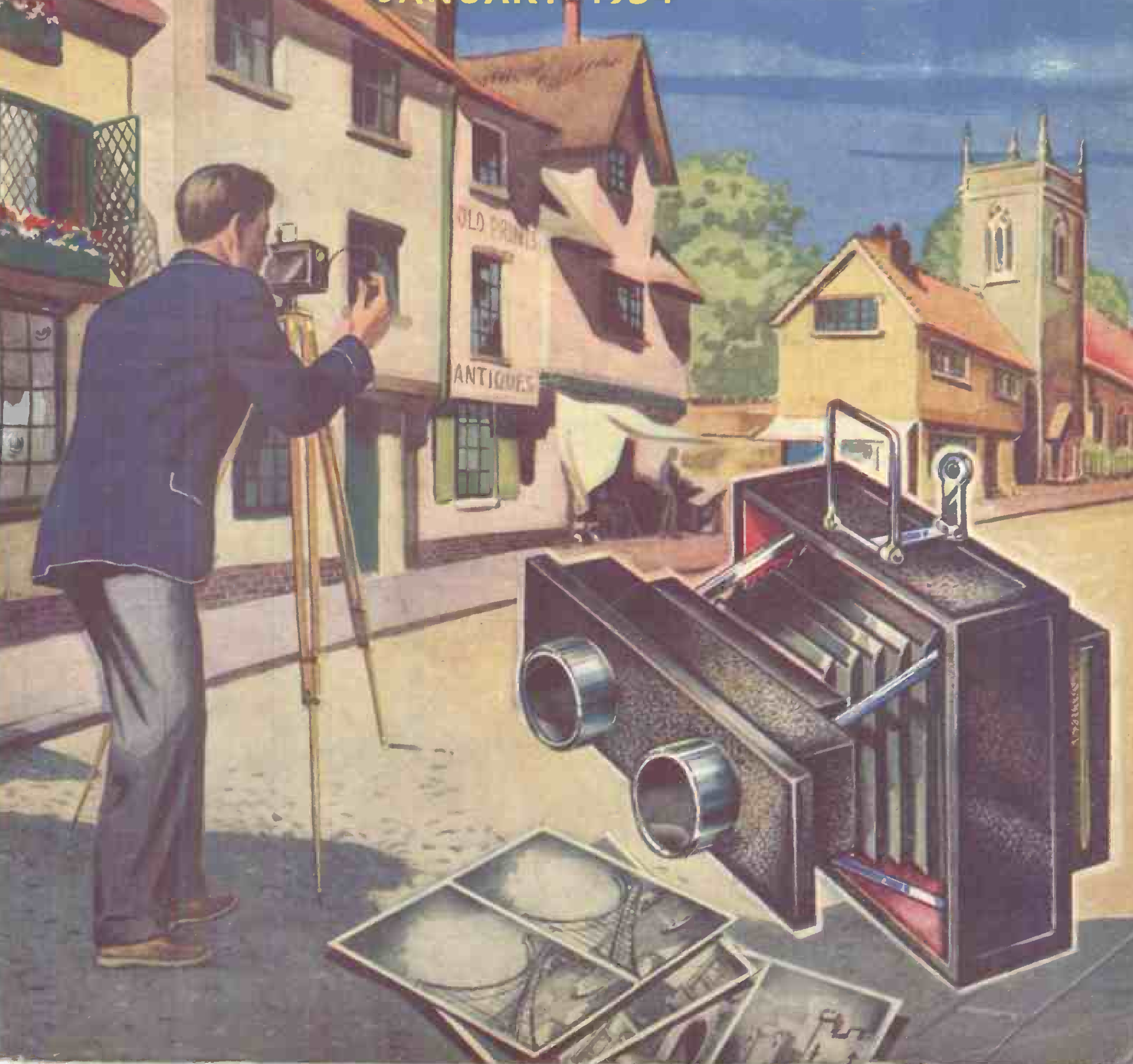
EDITOR : F. J. CAMM

JANUARY 1954



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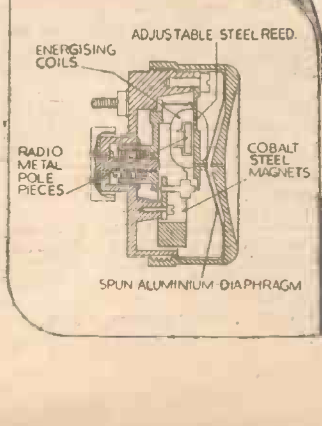

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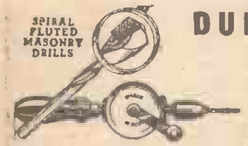

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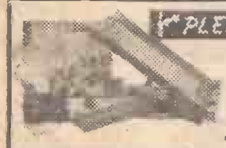

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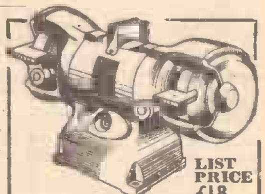

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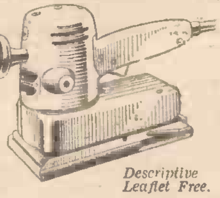

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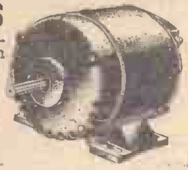

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JANUARY, 1954
VOL. XXI
No. 241

PRACTICAL MECHANICS

EDITOR
F. J. CAMM

The "Cyclist," "Practical Motorist," and "Home Movies" are temporarily incorporated.

FAIR COMMENT

By The Editor

"Life in 2000 A.D."

THE Royal Society of Arts will reach its bi-centenary in March of this year, and with this in mind its Council has arranged, in addition to various other celebrations to commemorate the Society's past achievements, a competition which will focus attention upon the future. It was announced at the inaugural meeting of the two hundredth session of the Society, when H.R.H. the Duke of Edinburgh, as President, was in the chair.

The Society offers prizes totalling £500, the largest being £250, for conceptions of life on this planet in the year 2000 and forecasts (in visual or written form), are invited of the future developments which may be looked for in some particular aspect of life related to Arts, Manufactures and Commerce, the field of the Society as defined in its full and original title. For example, a competitor might give his ideas of what transport, housing, food or clothing may be like in 2000. The chief criterion in assessing the entries will be originality.

Full terms and conditions relating to the competition, together with registration forms, may be obtained from the Secretary, Royal Society of Arts, John Adam Street, London, W.C.2. Registration forms must be completed and returned together with an entry fee of 1/-, by February 15th, 1954, and the actual competitive material submitted by June 30th, 1954.

Entries may be in written or visual form (drawings or models, with any necessary explanation in writing). In the former case they must be typewritten and in English and must not exceed 3,000 words.

The quality which will be most looked for in the entries is originality, but the judges will bear in mind, particularly, the degree to which the forecasts are concerned with practical matters. The year 2000 has been chosen by the Society as a focus for speculation because, while a period of 46 years would allow for the origination and development of entirely new features in life, it is short enough to enable competitors to envisage the world as they or their sons or daughters would like to see it.

Here are the general conditions. No competitor may submit more than one entry; the competition is open to (a) persons of British nationality and (b) Fellows and Associates of the Royal Society of Arts, whatever nationality; entries will be judged anonymously and must not, therefore, bear the competitor's name. The name and address (in block capitals) must be forwarded with the entry but on a separate card or sheet of paper; the Council of the Society reserves the right to exhibit or publish any entries (the copyright being retained by the competitor); the Council does not accept any responsibility for the safety and ultimate disposal of any material submitted to it for the purposes of this competition and will only return entries if specially requested to do so on the registration form. Return postage or carriage must be prepaid; the Council of the Society reserves the right to divide or withhold all or any part of the above prizes should the quality of the entries, in the opinion of the judges, justify such a course; the Council's decision regarding all matters connected with the competition will be final and correspondence cannot be entered into regarding the reasons for any decisions it may take.

There is plenty of scope in this competition for those having reasonable technical ability as well as for those whose skill takes a more practical form.

Flying TV

WHILST this country is torn between the two opposing forces on the subject of commercial TV., the Americans are tempering the wind to the shorn lamb by commencing experiments with flying TV. stations. These are 'planes which circle five miles over France and send programmes into Britain. As with all other important TV. inventions, this one was British also. The object of the experiment is to ascertain how far into Britain flying TV. can penetrate. It is expected that programmes will reach the Midlands. If this plan proves successful, British manufacturers will get orders to make special sets for the public.

The system would operate on these lines: At first sponsored U.S. programmes recorded on film will be relayed from 'planes flying over France. The programmes would give the British public a chance of judging American TV. programmes. Later on, when commercial stations planned for France are completed, the programmes will be televised from one of them and then be relayed by the 'planes. This would not be an expensive process for there is a very large library of tele-film ready in New York.

Immediately after the war, this country experimented on these lines, but it has been left to America to develop it.

According to Sir Robert Renwick, President of the Television Society and war-time Communications Controller at the Ministry of Aircraft Production, within a few years there could be a ring of commercial TV. stations on the other side of the Channel, transmitting their own programmes, or boosting others into millions of British homes. American plans on these lines are well advanced. Whilst this country, therefore, is arguing on the ethics of commercial TV., we shall have a television counterpart of Radio Luxembourg, which will involve British money going into foreign pockets.

As far as I have been able to trace there has been no great public demand in this country for commercial TV.—although criticisms of the B.B.C.'s programmes have been general. It is possible that the B.B.C. itself will provide the alternative programmes called for by selling programme time to advertisers who submit approved scripts. It is unlikely that we shall have any programmes from British sources on the American lines.—F. J. C.

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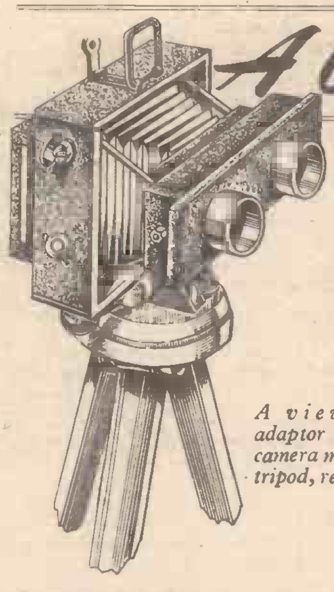


A view of the adaptor fitted to a camera mounted on a tripod, ready for use.

A Camera 3-D ADAPTOR

An Inexpensive Appliance for Converting Quarter-plate Cameras for Taking Stereoscopic Pairs on One Quarter-plate

By M. S. FORD

STEREOSCOPIC photography has, of course, been known and practised for many years, although the system of projecting the result as a single picture, on large screens, has only of recent years been solved. These systems, of which there are several, are those under the new guise of "third dimension," or to be up-to-date in these modern times, "3-D." These projection type, third dimension cinematograph films, although not all giving strictly stereoscopic results, are a step in the right direction, and "perfection" on a finally proved system will come in due course. Then we shall have colour, movement, and stereoscopic relief and, of course, sound, all combined to form another scientific achievement.

However, there is still much charm in viewing a pair of stereoscopic still photographs in the old-fashioned "scope," and the advent of the stereoscopic projection films, has again popularised the stereoscopic still photography. Indeed, one well-known manufacturer has already marketed a very moderately-priced stereoscopic box-type camera. There are other makes of the folding type, and much more expensive ones using 35mm. film.

However, not everyone can afford the more expensive instruments, neither does the writer advise owners of perfectly good modern cameras to sell or exchange these in one sudden urge to go all "3-D." He or she should work in gradual stages, and this can be done with little or no further outlay.

Principle of Stereoscopic Relief

Perhaps it will be appropriate at this stage to explain to readers how stereoscopic relief is reproduced photographically.

We have two eyes, so that each can view objects in different planes, from slightly spaced viewpoints. This is combined by the brain into one image, plus an effect of relief. We get so used to this, however, that, even if we close one eye, we will often refuse to admit that we are now only seeing a flat image, which, of course, actually is the case.

Now, all that is necessary, therefore, to reproduce this sensation photographically, provided, of course, that we have two perfect eyes, is to take two exactly similar photographs from very slightly different viewpoints and then view these at approximately the same distance as the focus of the lens through which they were taken. There is a simple procedure known as "transposition of prints," which will, however, be explained later. Also, in general, the viewing must take place through two fairly short focus lenses, an instrument known, in fact, as a "stereoscope."

We can, therefore, with care, take stereoscopic photographs by means of our ordinary single-shot camera. The views taken must be exactly identical except only in the slightly different viewpoint. In other words, there must be no movement whatsoever in any part of the subject, between the exposures of our two shots. As it will be discovered, quite a lot of movement in apparently the quietest of landscapes is always possible, even with the lightest of breezes, causing movement of grass and trees and clouds. Then there are animals and human beings to be reckoned with, and in those few seconds necessary to change position and turn the film the scene can change sufficiently to quite ruin the pair of photographs so far as stereoscopic viewing is concerned.

It will be realised, therefore, that both photographs in a stereoscopic pair must be taken at one and the same time, and this is exactly what a stereoscopic camera does, both shutters being mechanically connected to operate simultaneously. The moving objects will then be in their true relation as regards position in each picture area. Excessive movement can still be troublesome, of course, producing an identical blur in each picture, but this is merely a question of shutter speed.

The use of two identical cameras fixed side by side is quite a practicable proposition, and this method is very often adopted. The cameras used must, however, have exactly matched lenses, for the slightest variation of focal length in these would be useless for stereo pairs. Again, it should be possible to get the two cameras close enough together to give a distance between lenses of approximately 3in. and to be able to operate both shutters easily and together.

Whilst the two-camera method is quite a practicable one, the purchase of another identical model is not, especially if the owner's existing camera is an expensive one, and has been in use for some years. The chances of procuring an "original model," either from the manufacturer or on the second-hand market, are extremely remote, and certainly a series of tests would have to be carried out between the existing and second-hand camera to prove that the two lenses matched. Some of the more elaborate focusing model cameras would also need a most complicated mounting arrangement.

Using a Single Lens Camera

Various adaptors have been designed to actually use a single lens camera as a stereo-camera. By means of a system of prisms or mirrors, two spaced views are passed through the single lens, which, by the way, is usually of quite large aperture and are reputed to give two pictures of approximately half the original size as obtained when using the particular camera normally. This particular optical instrument is quite an expensive one, as, naturally, it must be designed individually for the model camera with which it is to be used, and there are obviously many snags possible in trying to pass two separate beams of light through one lens and obtaining two undistorted pictures therefrom.

Various other systems, using merely two mirrors, have been used with single lens cameras, but these usually require somewhat bulky fixtures, necessitate taking the photograph from an angle of 90 deg., and so on.

In the writer's opinion, and this of course will be confirmed by all serious stereo

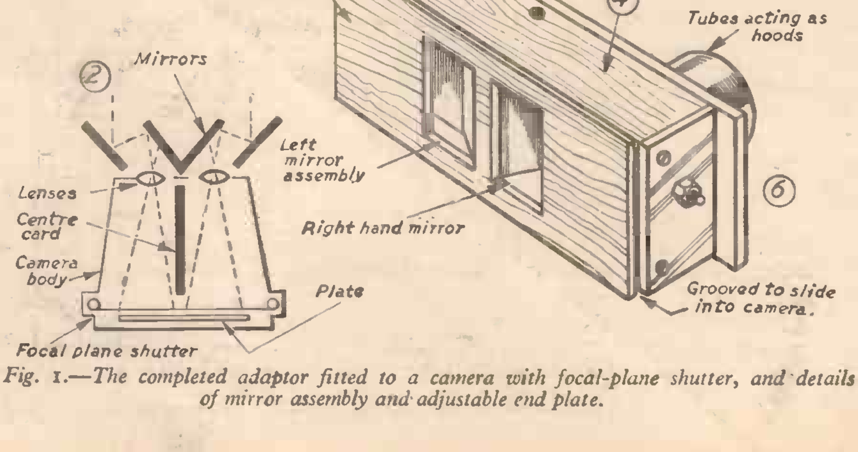


Fig. 1.—The completed adaptor fitted to a camera with focal-plane shutter, and details of mirror assembly and adjustable end plate.

workers, there is no efficient substitute for the two lens stereo camera. It is, therefore, rather "with his tongue in his cheek" that the writer admits the following departure from the conventional system of stereoscopic photographic equipment, but one certainly which has been tried and found to give quite excellent results.

Now, there must be many thousands of the old type plate cameras lying about idle, which could with a slight amount of modification be successfully employed to take stereographic photograph, as pairs of views on the one plate. One of the most popular sizes of the plate cameras was, and still is for that matter, the quarter-plate. This size, 4¼in. by 3¼in., is a useful one and plates of most makes are always available. Many of these cameras, too, have focal-plane shutters operating immediately in front of the plate.

It was with this in mind that the writer thought around the possibility of converting such a camera for taking stereo-pairs, yet to keep strictly to the stereo principle of a two-lens system.

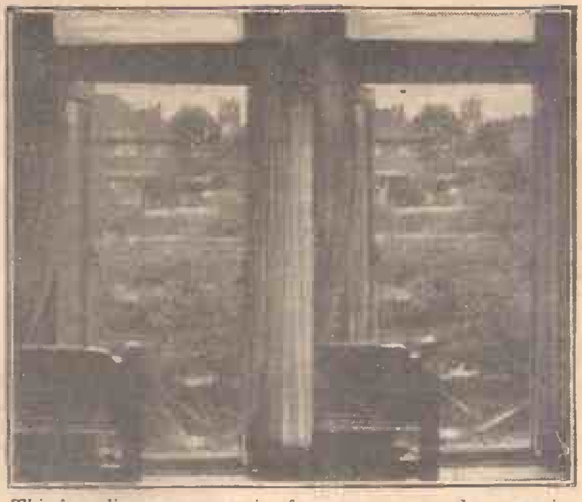
The result, and the general principle and constructive details, are illustrated, for those readers who may like to experiment on the same lines with similar cameras. It will be readily understood, however, that cameras vary in such a degree that those dimensions given in the drawings cannot be expected to be suitable for other than the camera for which it was designed.

It is for this reason that the finished adaptor (Fig. 1) has been shown fitted to a rather diagrammatic camera. The camera for which the sizes will apply is the Ensign quarter-plate Folding Reflex. For any other camera it is recommended that the appliance be made in stout cardboard first, before the final adaptor is made up in three-ply.

How the System Works

A brief explanation of the system and how it works will be appropriate here. The adaptor takes the form of a two-compartment rectangular box with an opening at the front and an opening at the back, for each compartment. In each of the latter are fitted a pair of optical mirrors set parallel to each other, but at 45 deg. angle to both the camera and view to be photographed. In the back two openings are fitted two simple meniscus lenses with a small aperture for each, but equal for each lens. The small aperture is necessary because no focusing device is fitted and all planes must be sharp in a stereographic pair. Two tubes are fitted at the front and act as hoods. These are essential. One mirror has been made slightly adjustable, so that the field of view for each image can be made to agree by a turn of a nut at the end of the box. The original lens, and shutter, is removed from the camera and the adaptor substituted. A specially cut black card screen is then carefully fitted inside the camera body, or bellows, to screen any overlap of one image on to the other. The original ground glass screen can be used in composing the picture if the camera is set up on a tripod or support, but a simple direct viewfinder can be easily made up from stout wire, to agree with the smaller half size view. The writer made such a viewfinder, as with the black card screen inside the camera body the mirror of the Ensign Reflex camera had to remain in the "released" position. By the way, no alteration was made to any part of the camera at all, and this can be used as a normal camera at any time by replacement of the original lens panel. It is a good policy to remember this before tools begin their work, which might well be regretted later. So the procedure is to do as little as possible to the camera except for some method of easily fixing the adaptor to the front of the instrument. The reflex camera mentioned has a sliding front lens panel which is easily removed, leaving an opening measuring 3in. by 2in., and this was very convenient as the two lenses could be given the exact centres of 2¼in. which for a length of plate of 4¼in. (quarter plate) will be found about correct, bringing each lens exactly at centre point of each half.

This rather small lens separation of 2¼in. explains the reason for the mirror system in front of them. For the benefit of those readers who may query the need for the latter, and ask "Why not take straight through the lenses?" the writer will explain. As mentioned earlier, the spacing of the human eyes gives us a stereoscopic effect, but this distance apart is rarely much under 3in. Therefore, our spacing of 2¼in. would give us very little stereo effect, except for very near objects, such as for table-top photography. For this reason the mirror system was incorporated in order to increase this small separation.



This is a direct contact print from one quarter-plate negative and would require cutting down the centre to change over the views for giving the correct right and left pictures. This necessary procedure is known as transposing.

Some of the most modern stereoscopic cameras manufactured to-day, using, as they do 35 mm. cinematograph film, overcome this separation problem by spacing the lenses correctly to approximately 3in. or 3½in. and then interlace the pairs. Thus we would get on our strip of film the following: first right-hand picture—second right-hand picture—first left-hand picture—second left-hand picture and so on. The space of about one frame is, of course, masked between the taking lenses.

However, the mirror system adopted here for increasing distance between viewpoints will be found quite practicable for plate cameras.

The diagram in sketch 2, Fig. 1, shows the general arrangement of the system. It will be noted from this that the writer's camera has a focal-plane blind shutter immediately in front of the plate holder or slide. Without this, some form of shutter would have to be arranged and a simple one will be described later.

It must again be pointed out that the dimensions given in the drawings will have to be modified in most cases, but the general design and construction should be adhered to, as a good stout job is required, with the mirrors rigidly fixed, with a vernier adjustment of one outside mirror only.

As has been mentioned two exactly similar meniscus lenses were obtained of focal equal to the distance from the front panel of the camera to the plate itself, and this was found to measure exactly 5½in. In finding this measurement, the reader is advised to ignore the focal length of the old lens which, with its mounting, may quite possibly be more than the measured distance. Try out the proposed lenses, attached temporarily to a piece of black card, and prove that each comes to focus for "infinity" on the ground glass screen. Almost the full diameter of the lens should be tested thus first, and then various smaller holes gradually reducing these until the image is quite sharp along each margin. Do not be discouraged if the image does not fully cover the ground glass, as only half coverage is essential, and the picture heights can be trimmed off, with advantage, to give a more square pair of pictures. As a matter of fact, the writer tried out a pair

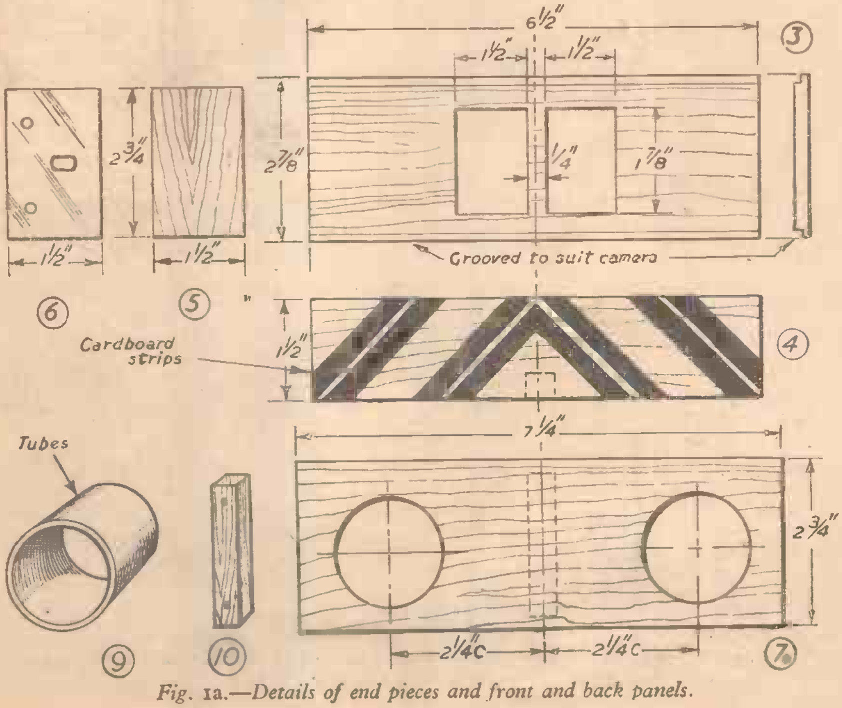


Fig. 1a.—Details of end pieces and front and back panels.

of lenses from a pair of magnifying reading spectacles, purchased from a well-known retail stores. As these start from a focal length of about 10in., two pairs of lenses used together are necessary for focal lengths of most quarter-plate cameras. As, however, these spectacles can be had in quite an extensive range of focal lengths, and are really quite cheap, a pair of suitable long focus can be used with existing meniscus lenses to reduce the focus of the latter, much in fact as used on some cameras under the title "supplementary lens." It will be explained later how the lenses and their diaphragms are fitted.

Constructional Details

Fig. 1 gives a very clear idea of the appearance of the adaptor, and the few simple parts to be made for it. All that is required in materials for the final adaptor is the following:—

A small sheet of good quality 3/16in. plywood.

Short length of planed ¼in. square hardwood.

Small sheet of good stout cardboard 1/16in. thick.

Small sheet of flat ⅛in. thick aluminium or brass. (Most of these materials can be purchased from the local "hobby stores.")

About 6in. length of 1½in. brass tubing for the front hoods.

Some plain (unbevelled) mirrors. These should be of first-class quality, and if they can be obtained of thin glass so much the better. These small thin mirrors are very easily cut with a good glass cutter to the final size required.

A few countersunk brass screws, some fretwork brads, a short length of 2B.A. screwed rod with nut, a light compression spring, and two or three 2 B.A. washers. Some black matt paint and a tube of croid glue about completes the list.

The various parts have been numbered in the drawings so that they can be readily recognised throughout the illustrations.

1.—This is a diagrammatic view of the adaptor fitted to a camera with focal-plane shutter.

2.—Shows the arrangement diagrammatically, and, of course, is the complete scheme or system, and includes recommended camera arrangement. The central black card partition is most essential, and will need very careful cutting out for the camera used.

The completed adaptor is shown, and at the lower extremity will be seen the mirror adjusting nut. Owing to its importance, a cut-away sketch of the arrangement is shown just above the complete adaptor. Also in the exploded view, in Fig. 2, the several small parts can clearly be seen in order of assembly.

Referring now to Fig. 1a. Depending on the sizes, the front panel 7, and back panel 3 of the box are cut out of 3/16in. plywood, together with the top and bottom pieces 4. The black strips shown are cardboard strips glued on, and are set at 45 deg. with the front. These strips must, of course, be glued to form a right- and left-hand duplicate. In other words, the slots for the mirrors which these card strips form, are inside the adaptor. This will be clearly seen in Fig. 2. The slots should be clearly marked on the top and bottom plywood pieces in clear pencil lines, using a 45 deg. set square, and be sure that the distances apart for each pair of mirrors is the same, otherwise a difference in image size will occur. The outer pair of strips, top and bottom, should be very slightly more spaced to allow the very minute vernier adjustment by the 2 B.A. nut.

View Separation

With stereoscopic cameras it is usual, of course, to refer to lens separation, a most important point too, by the way, as on this depends the degree of stereoscopic effect in the final slide. As before mentioned, however, our lenses are likely to be very much less distance apart than the normal human eye spacings of about 2¾in. to 3in., and little stereo effect would be experienced by taking straight through the lenses, which are about 2⅜in. centres. The mirror system, therefore, reflects through our lenses viewpoints more to the right and more to the left respectively, and thus we get good stereoscopic effect. It will be observed that in the adaptor the centres of the outside mirrors are increased to 4½in., which is, of course, in excess of the human eyesight centres. The reason for this is that this adaptor was primarily made for outside landscape work. Even with a separation of 3⅜in. to 3½in. it will be found that objects more than about a quarter of a mile away in a landscape will show little difference than those, say, at a half mile away. The 4½in. separation was found to give very good stereo effect, but of course restricted the use to more distant views. If portraits were taken with this separation, rather an exaggerated effect of relief may be obtained. Therefore, if the reader desires to concentrate on near close-ups, portraits, etc., slight reduction of the separation is advised. So once again the writer advises the rough assembly model first.

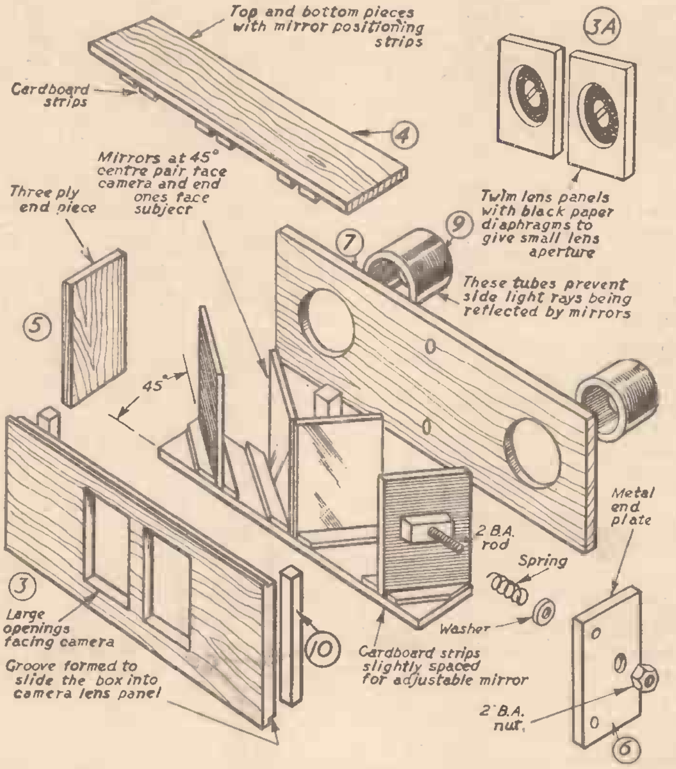


Fig. 2.—Exploded view of the adaptor, showing the various parts in order of assembly.

Parts 5 and 6 are the end pieces, one being plain three-ply, whilst the other part is of stout metal. This latter should be of 1/16in. to ⅛in. sheet aluminium or brass. It has a small elongated hole cut at the centre, this being for the mirror adjusting fitment. This arrangement is clearly shown in the partly cut-away view, at top right of the illustration, Fig. 1.

As previously mentioned, the back panel of the adaptor has been shown grooved (part 3) to slide into the camera. Other cameras will require a little experiment to arrive at the best method of fixture to the front, bearing in mind, of course, that the adaptor when fitted must be exactly parallel and rigid with the plate. In other words, it must not be possible to twist the adaptor when once fitted. The three vertical strips of 1¼in. hardwood (10) are for strengthening and screwing purposes, and should be fixed first to the top and bottom parts (4) to form a skeleton framework. The panel (3) is screwed on, and also the end piece (5).

Blacken all inside surfaces with a good matt black paint. Black spirit stain (used for leather) will be found quite good for the wooden parts, and the only metal parts needing blacking; the hoods can be done with flat paint, or may be covered inside with black paper glued on.

The Mirrors

These must be plain, *not* bevelled, mirrors, of thin glass if possible, and unmarked in any way. It may be possible to purchase these of exact depth of the inside of box, but a good glass-cutter will be found useful here.

When the box of the adaptor is dry, the mirrors can be pushed into their appropriate slots. These mirrors must be the correct way round, of course, and reference to Fig. 2 will clear up any doubts on this point. Leave just one mirror out for the moment.

A small wood block is next drilled part way through to take a short length of 2 B.A. screwed rod. This rod should be a very tight fit, and a spot of glue in the hole will make sure of the fixture. Put a little croid glue on the back of the block and attach it to approximately the centre of the back of the mirror. Then slide the mirror in its grooves and place the end plate (6) over it, passing the 2 B.A. rod through the elongated hole. Position the plate correctly, sliding the block on the mirror, if need be, and fix the plate temporarily and allow glue to set. The plate can later be removed, the spring and washer added, and the plate finally fixed into position. The spring gives the necessary pressure forward to the mirror. When the nut is screwed in, the mirror will swivel part of a degree, but sufficient to alter the image passed through to the lens quite considerably. In this way the two images can be made to agree as to the amount of view included.

Fitting the Lenses

It will be seen from Fig. 2 that each lens is fitted to a small plywood panel, as shown at 3a. It may be preferred to cut out the centre strip of the separate panel openings in (3) and make one panel suffice. In any case the two lenses must be fitted with their centres exactly parallel, and the holes in the paper diaphragms cut out together, so that these holes are identical in diameter. If the adaptor is made as shown to slide in to the camera front, then the panels, when fitted, must not protrude. A simple turn-button fixture arrangement may be fitted for easy removal of the lens panels, but these, too, may have to be recessed. If the panels

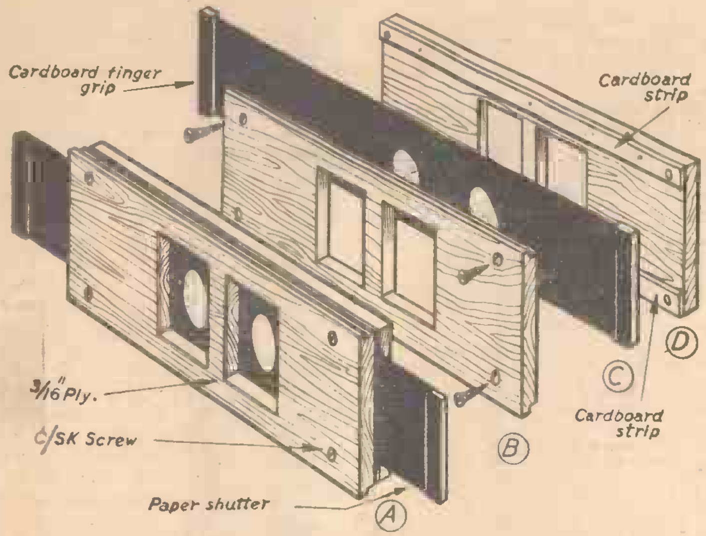


Fig. 3.—Details of lens panel and shutter.

fit fairly tightly, however, two small brass countersunk screws driven home carefully between panel edge and opening, will fix rigidly. Some time should be spent in getting the lenses correctly fixed, and the diaphragms should be small enough to give a nice sharp picture to the margins of the plate.

Tubular Hoods

The hoods are essential, as without them trouble with side reflections will be experienced. They can, however, be substituted by an extension of the front of the adaptor—in other words, another open-ended box surround, having also a central division. Experiment again is necessary to avoid cut-off of image.

A Simple Pull Shutter

As many cameras do not have the focal plane shutter fitted, some form of simple shutter will be a necessity in many cases. The writer tried out a simple form of pull shutter for slow speeds and found it quite efficient with practice. It is advisable, however, to fix the camera on a stand or solid support when using such a simple arrangement, which is clearly shown in Fig. 3.

The finished shutter is shown at A, and this should be fixed immediately between the lens panel of the adaptor itself. The shutter is merely a strip of film backing paper, with two holes, cut larger than the lens aperture, but at their exact centres. The strip is pulled steadily to one side, the holes allowing a momentary opening before each lens at the same moment. The sketch shows the position of the shutter at the moment of exposure. As the pull is completed, one hole is just behind the central point of the rectangular panel openings, whilst the other is behind the sandwich of the two three-ply boards, the lenses being covered. For the next exposure the strip is pulled across to the opposite side. In each instance, the strip is prevented from complete removal by the cardboard finger grips at each end.

One panel of the sandwich (B) slides into the camera as before mentioned for the adaptor. The strip shutter of backing paper with finger-grip ends, is shown at C. The second panel is shown at D, and also the cardboard strips to allow for the thickness of the paper shutter—about postcard thickness is right. In smoothing the panels the inner edges of the openings should be chamfered to avoid any possibility of the paper shutter catching and tearing, as the holes pass across.

View Finder

If the stereo adaptor is to be used for a variety of moving subjects, when a tripod will be inconvenient, then some simple form of view finder will be essential. A simple arrangement is shown in Fig. 4 and is not difficult to make. It is, however, necessary to experiment until the correct sizes of wire frame, height of spy-hole and distance between frame and hole is correct to give a picture area equalling the half size of the ¼ plate. The finder should preferably be secured in a position immediately between the two lenses, or in other words central.

Central Card Screen

This must be cut out carefully so that it fits snugly inside the camera and remains firmly in position. Take care, however, that the focal-plane shutter is just clear of the card and can operate freely. Also remember to remove the card before closing the camera. The card must be blacked on both sides.

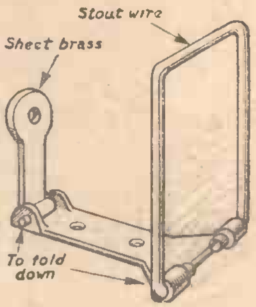


Fig. 4 (Left).—Suggested direct vision finder, sizes for which must be found by trial.

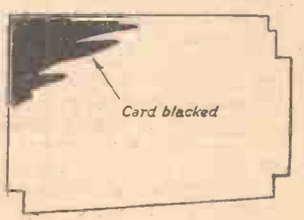


Fig. 5 (Right).—A special shape will be required for the interior central card screen.

Testing

This should be carried out with the focal-plane shutter opened at "time," or if using the simple shutter above described with the holes exactly in front of the lenses.

The division or screening card should be carefully fixed exactly central in the interior of the camera—a simple fixing clip might be devised to fix it rigidly in place yet allow the screen card to be removed when the camera is required to be closed after use. With the camera resting on a table, or stand, two clear and sharp images should be seen on the ground glass and by means of the adjustable control nut these images should be made to agree as near as possible. The goal to aim at is to see that all of the image included in one is duplicated in the other image. This is rarely possible to completely achieve, especially in the immediate foreground, but the adjustment helps to eliminate too much after trimming of the prints. Make sure, too, that no extraneous light is filtering through the fixture point between adaptor and the camera, as this, of course, would cause fogging. With the simple shutter, try covering your head with a focusing cloth and pull the shutter strip to one extremity. No light should be seen. Try pulling shutter strip across, for test of exposure timing and ease of operating. When satisfied a trial exposure can be made. No guidance can be given as to exposure, as there are so many factors to be considered. Approximate, aperture and focal length, speed number of plate, shutter used and, of course, lighting conditions, all govern this, so again personal trials are necessary.

Transposing

The results obtained with this two-lensed adaptor will, of course, be two images on one quarter plate, each measuring approximately 3in. high by 2in. wide, side by side. In the normal way the print obtained will have to be cut in half and the two reversed as to right and left. Also the distance between each print should be increased to about 2⅞in. from centre to centre. By the way, make sure the base of each print is level when fixing to the stereo mount. A stereoscope is, of course, necessary for viewing the slides produced.

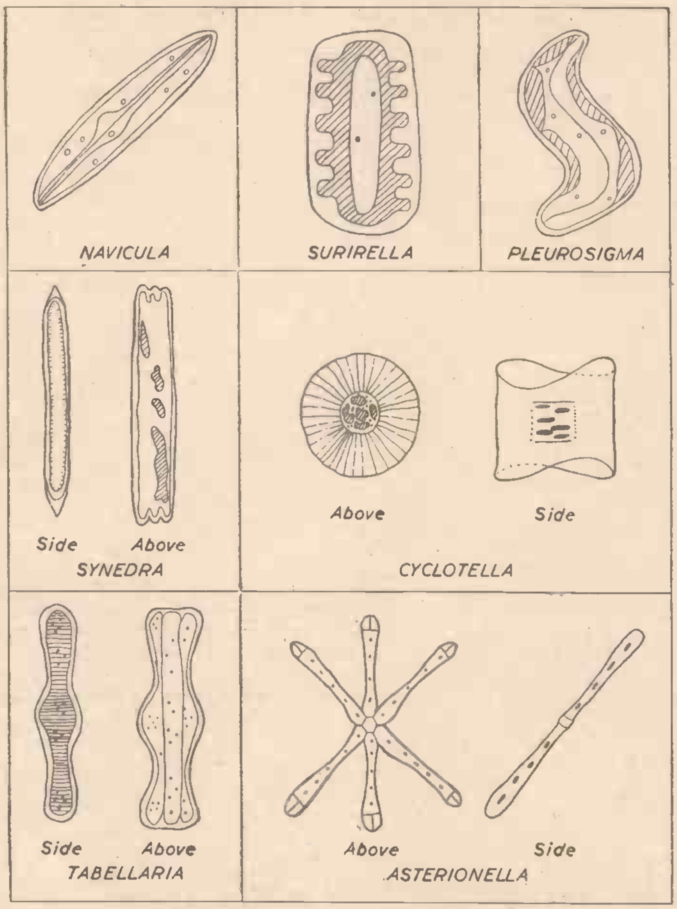
Whilst the instrument just described is perhaps rather bulky, even though light in weight, it has quite interesting possibilities, for providing the two lenses used are matched ones and the mirror assembly is carefully made and adjusted, there is no reason at all why results equal to a stereo-camera should not be obtained. The fortunate possessors of focal-plane shutter cameras, plus a pair of moderately good lenses, could with the help of the latest ultra speedy plate emulsions, try out some speed shots in stereo relief.

One final piece of advice. If the reader thinks of the modification of fitting the lenses in front of the mirror system, the writer has found that this produces an unpleasant double reflection to each picture. The system illustrated is, however, quite free from this.

Mounting Diatoms for the Microscope

With Hints on the Preparation of Specimens

By S. M. CHARLETT



Various types of diatom common in England. All approx. ×400 magnification.

IF one dredges up mud from the bottom of a stream or pond, and examines it under the microscope, one will find amongst the dirt and mud tiny, very distinct structures of all shapes and with very beautiful markings. These are the skeletons of the vast group of minute organisms that live in water known as the diatoms, and the skeletons are known to microscopists as "frustules." This skeleton is formed on the outside of the organism from the calcium salts in the water, and for the purpose of simplicity is known by the name of the group, a diatom.

A vast amount of literature has been written on the diatoms, and much of it can be obtained through any public library on application to the librarian in charge. The study of these tiny structures is a fascinating hobby, and a few hints are given below on the methods of preparing and mounting them in the most suitable manner.

A few of the forms that one will almost certainly meet are illustrated here, but the numbers of different types that will be met is very great, and reference will have to be made to standard works as the range of classification is too great to be covered in this article.

Cleaning the Specimens

In order to study these minute skeletons microscopically, they must be mounted on glass slides, by one of several methods, and they lend themselves very well to the preparation of permanent mounts. Before they can be mounted, however, the skeletons or "frustules" must be freed from all dirt and organic matter; this is done as follows:—

The sample of mud is thoroughly stirred up in clean water and then allowed to stand until all the heavy sand particles have settled to the bottom — the water above now contains the diatoms together with a fair amount of organic matter, and this is now decanted into a clean container and the diatoms allowed to settle to the bottom. The water is now removed by gently pouring off most of it, and then removing the rest with an eye dropper in such a way as to leave the residue undisturbed. This residue is now heated in strong nitric acid, taking great care not to splash or spill any, for 10 minutes or a little more to remove the excess organic matter. The diatoms are now thoroughly washed with clean water and then boiled up in strong hydrochloric acid for a few minutes and then again washed with clean water. A word of warning may be given here: when dealing with acids always remember that you should never add water to the acid but always the acid to water, thus when washing the acid treated diatoms always allow them to cool down, tip off as much acid as possible without disturbing the diatoms, and then *tip the remaining acid containing the diatoms into clean water*; never add water to the boiled diatoms. Always take this small precaution, as if acid is added to water then it becomes quickly dilute and no further action takes place, but if water is added to acid it is possible that a violent reaction may take place and you may get burnt by acid splashes.

Having prepared the diatoms as above the microscope slides and cover slips to be used are now thoroughly cleaned, and one is now ready to proceed with the actual mounting.

The "Wet" Method

As I mentioned earlier in this article there are several ways of mounting diatoms, and the first of these is the "wet" method. In this method, the diatoms are shaken up in a small quantity of clean, preferably but not necessarily distilled, water. A drop of this is then placed in the centre of a clean cover slip and placed in a dust-free place to dry; when all visible moisture has gone the slip may be dried for a short while in an oven to remove all traces of moisture that may have adhered to the diatom itself. After the slip has cooled the dried spot is covered with a drop of thin Canada balsam in Xylene and inverted; it is then gently lowered on to a slide, using a needle to prevent the formation of air bubbles, and the mount is placed in a warm dust-free place to dry.

The "Dry" Method

The second method of mounting is known as the "dry" method, and in this a clean cover slip is given a very thin coat of a one per cent. solution of gum arabic and placed out of the dust to dry. A drop of the suspension of diatoms is now placed on a clean slide and viewed under the 2/3in. objective of the microscope until a desirable specimen is seen; this specimen is now picked up on a bristle—a camel hair brush bristle glued to a dissecting needle-holder will suffice, but the author prefers a cat whisker. The slide is now removed and the prepared cover slip is placed under the objective, the diatom is lowered on to it and arranged as desired. This procedure can be repeated until one has a number of selected specimens on the cover slip arranged in a symmetrical pattern. If one now breathes very gently on the cover slip the gum layer will become sufficiently tacky to make the diatoms adhere, and the slip can now be placed to one side to harden up again. When set the slip can be inverted on a clean slide, and cemented in place by ringing with a suitable cement.

To give a final touch the cover slips in both cases should be ringed with a black lacquer and, in addition, do not forget to label and catalogue the individual slides.

The first mount is known as a "strewn mount" because the diatoms are distributed anyhow in the mountant, and the second mount is a "selected mount"; this information should be placed on the label.

Further methods of mounting may be found in the many works on microtechnique that have been published.

The mounting and subsequent study of the diatoms, or as the scientist calls them the Bacillariophyceæa, can be a really fascinating and absorbing hobby.

ONE HUNDRED M.P.H. WIND TUNNEL

BRITISH Railways recently brought into use, at Derby, a new 100 m.p.h. wind tunnel testing plant, designed to help railway scientists and designers in their research work. This includes the dispersal of smoke and steam, improvement of ventilation of trains and buildings, cooling of diesel locomotives, wind resistance of fast freight trains and design of draught-proof signal lamps.

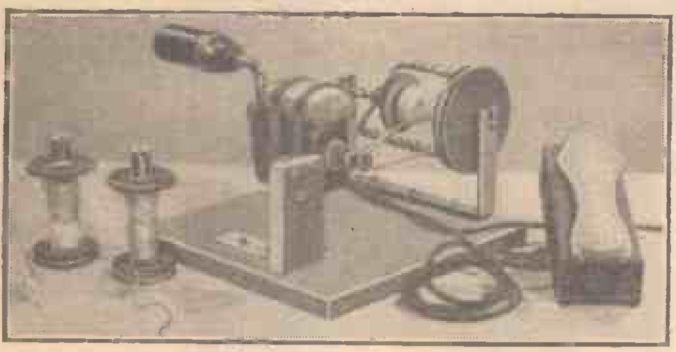
The tunnel, which will also be available for investigations for other undertakings of the British Transport Commission, is 65ft. long, is operated by an air-screw driven by a 50 h.p. motor which will create air speeds of over 100 m.p.h., and is of the return flow type which enables use to be made of the velocity of the air as it returns through a rectangular duct.

Scale models will be used in the tests and altered in detail during experiments so that results obtained with variations in design can be compared.

A Simple Spinning Machine

Constructional Details of an Inexpensive and Efficient Appliance for Domestic Use

By G. W. FILLINGHAM



General view of the completed spinning machine and motor-control pedal.

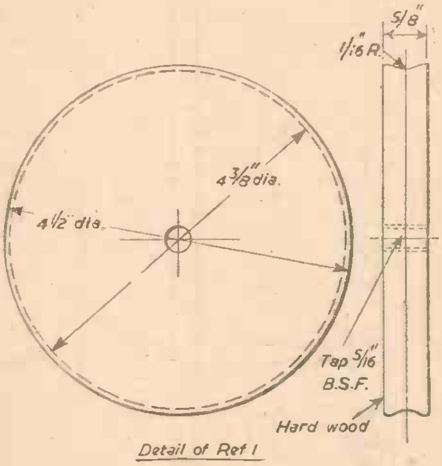


Fig. 2.—Front and side elevations of the fly pulley.

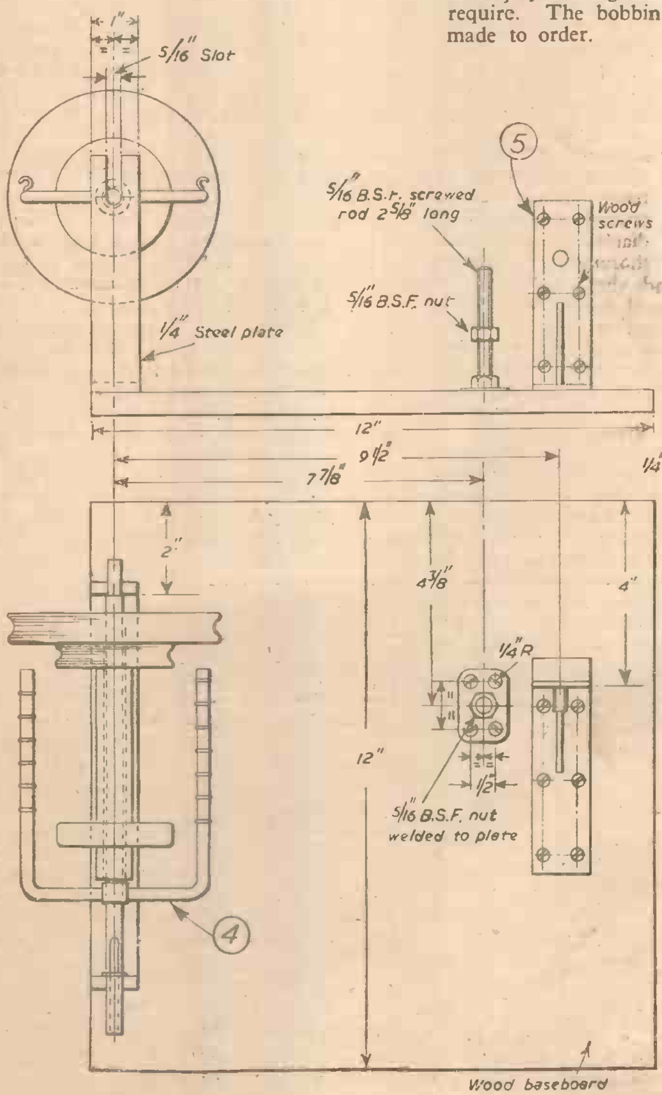
THE spinning machine shown in the accompanying illustrations is not only simple to construct, but is very efficient for spinning both ordinary wool and dog wool.

The idea came to me just after the last war, when things were in short supply and I was unable to purchase a spinning wheel.

Baseboard and U-bracket

The first parts I obtained were a baseboard, 12in. square and ¾in. thick, and a piece of ¼in. steel plate 1in. wide. This was bent to form a U, 8 1/16in. inside, 5in. high, a ¼in. hole being drilled in one end and a 5/16in. hole in the other, each 4⅛in. from the corner bend. Each upright part is then slotted, as in Fig. 1, so that it is a simple matter to lift out and change the bobbin. Three holes, ¼in. dia., equally spaced, are drilled through the bottom of the U-plate for bolting on to the edge of the baseboard.

The fly pulley, shown in Fig. 2, is made of hardwood, ⅝in. thick, and is 4½in. dia. The groove is ⅛in. deep. The central hole is drilled and tapped 5/16in. B.S.F. If you are unable to make this, it can be purchased from General Woodwork Supplies, 78, Stoke Newington High Street, London, N. 16, by sending a rough sketch of what you require. The bobbin, Fig. 3, can also be made to order.



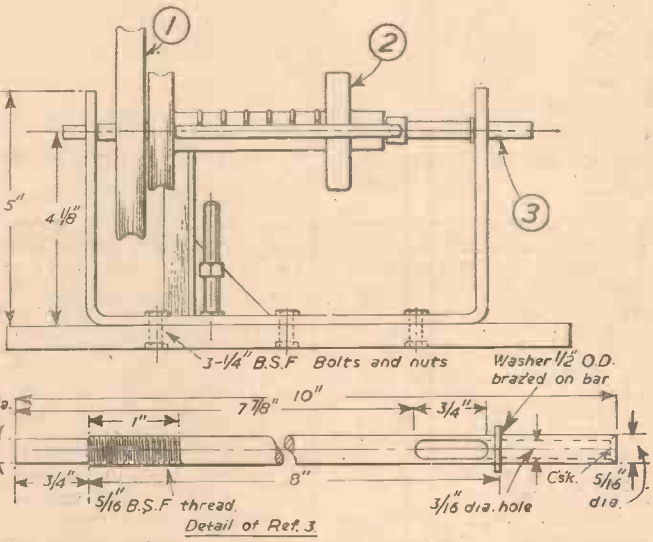


Fig. 1.—Front and side elevations and plan, showing the general layout of the machine, and detail of the steel spindle.

The groove in both fly pulley and bobbin pulley must be perfectly smooth to allow the string belt to slip while holding the wool for the twist.

The dimensions of the steel spindle are given in Fig. 1, and this part can also be made to order from the Caledonia Model

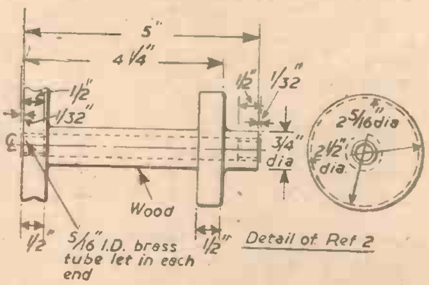


Fig. 3.—Side and end views of the bobbin, showing the brass bushes.

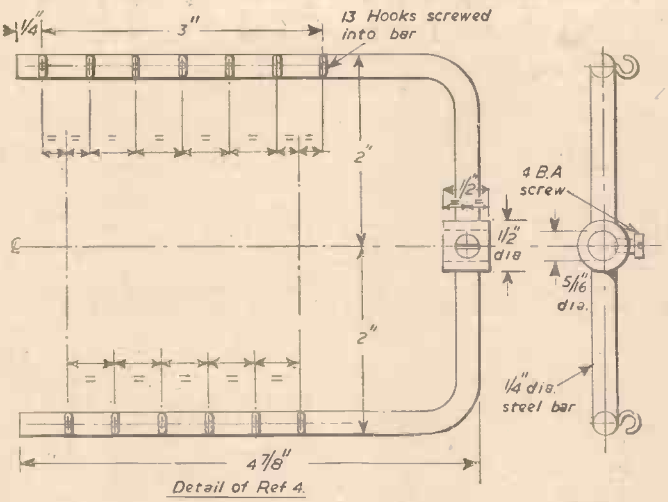
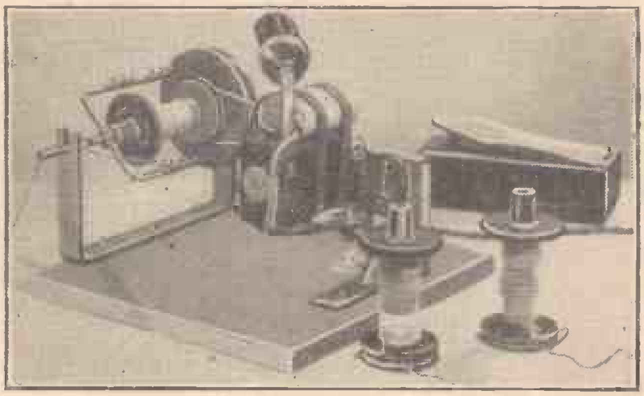


Fig. 4 (*Above*).—Plan and end view of the fly.

Company, 5, Pitt Street, Glasgow, C.2, or one can be obtained ready-made with bobbin from Douglas Andrew, Ltd., Summer Hill, Canterbury. The spindle may need a slight modification.

The Fly

This is made from ¼in. steel bar, bent at right angles (Fig. 4). The hub can be made from an ordinary nut, drilled out 5/16in. clear, then drilled to take the two fly arms and brazed round. A hole is drilled and tapped for the 4 B.A. grub screw so that it can be adjusted to give the bobbin a little play.



Another view of the completed machine.

The hooks are made from screw eyes, the type used for curtains, and these are threaded and the fly arms are drilled and tapped to receive them.

The bracket, Fig. 5, is made from 16-gauge plate bent at right angles, with a stiffening piece brazed in the corner. The wood upright is screwed to the bracket which is bolted to the baseboard. The rod which the motor fits on can either be drilled through the wood and bracket or brazed to the bracket.

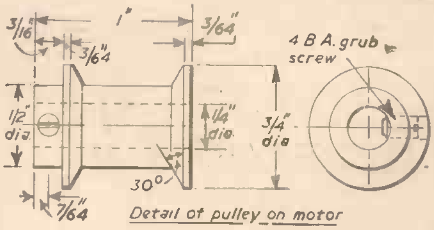
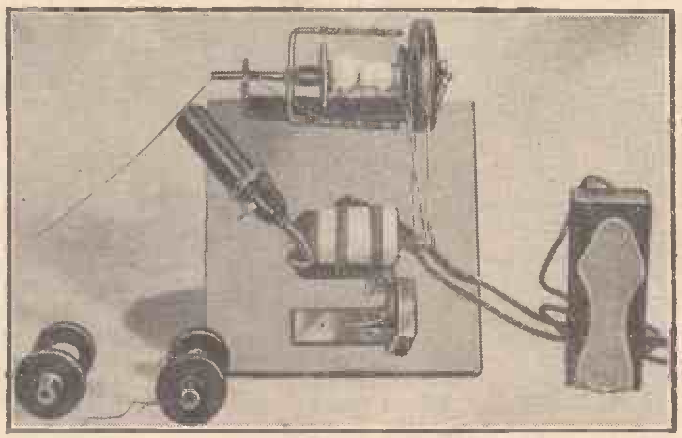


Fig. 6.—Details of the motor driving pulley.

A 5/16in. nut is brazed to a small plate which is screwed to the baseboard, and a 5/16in. rod with a nut brazed in the centre is screwed into this bracket, to allow for adjustment of the belt on the motor. The belt is made from a piece of white string, each end being unraffled for approximately ½in.; the two unraffled ends are then interlaced, bound round with cotton and sewn through to make a smooth finish.

The belt is taken round the bobbin pulley, round the pulley of the motor, back over the fly pulley and back to the pulley of the motor. It is essential to get the belt coming off the fly pulley underneath the part which crosses to the bobbin pulley.



This plan view of the finished spinning machine gives a good idea of the general layout.

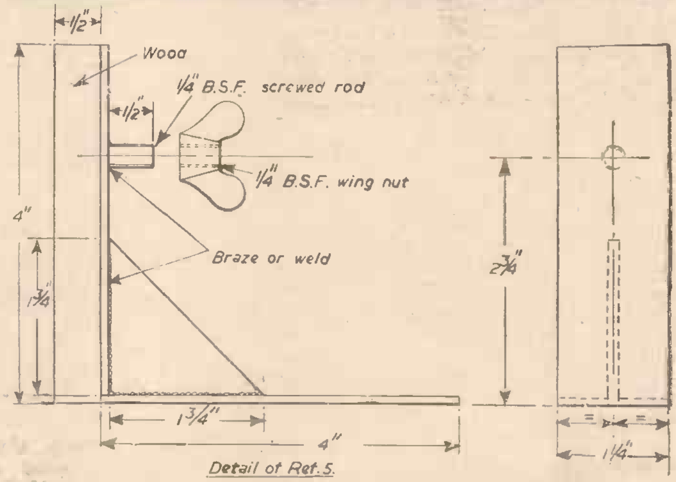


Fig. 5 (Right).—Side and end elevation of the motor-supporting bracket.

Motor

The motor is a sewing machine motor with foot control, which makes it easier to spin the wool, as the motor can be worked at a very low speed or high speed as desired.

The cost of the machine is lower, and it is not so cumbersome as the old-fashioned spinning wheel. The sewing machine motor can be obtained from Rain Industries, Leigh-on-Sea, Essex, price 56s.

Club Reports

Aylesbury and District Society of Model Engineers

THE last meeting of this society was held as usual at Hampden Buildings, Aylesbury, on the 21st of October. It was devoted to models, and amongst members' work on show was a 4-6-2 L.M.S. City class loco by Mr. Hasberry, the tender frames to Mr. Gill's "Pamela," and a chassis by Mr. Wright, showing excellent progress. Aylesbury was very glad to welcome a contingent of their friends from Luton, who came with their models. Mr. Lutley brought over his hot-air engine, and enthralled us with a demonstration of its powers. Amongst the models from Luton were several in the 5in. category.—Hon Sec., E. H. SMITH, Mulberry Tree Cottage, Devonshire Avenue, Amersham, Bucks.

Ramsgate and District Model Club

THE annual general meeting of the above club having taken place and the newly-elected officers and council members installed, the club looks forward to still greater progress during the ensuing year.

An attractive programme of future events has been arranged for the next six months and every member has received a folder card of these events in detail with his Monthly News Letter. The club's premises at Princes Street, off Queen Street, Ramsgate, are open every Wednesday and Friday evening from 7 p.m. to 9 p.m. and all who are interested in modelling or handicrafts are specially welcome.

A cordial invitation is also extended to members of fellow clubs should they care to pay us a visit.—E. CHURCH, Hon. Sec., 14, St. Mildred's Avenue, Ramsgate, Kent.

AN ELECTRIC CONVECTION HEATER

Constructional Details of an Efficient Heating Unit for a Small House

By R. R. HUTCHISON

The completed heater in use.

THE chief idea in designing this heater was (1) to keep a small house above freezing point while the occupier is out all day during severe weather. (2) To bring a small living or bedroom to a comfortable heat to sit in. (3) To be absolutely safe regarding fire and burning. Readers are asked to note, however, that this is a convection or air heater and not a radiant heater, and consequently the effect is not felt for half an hour or so, and lasts for a considerable time after switching off.

The Body

First, a suitably strong tin must be obtained approximately 9in. x 5in. x 12in. high. The writer found a two gallon "Dettol" tin excellent for the purpose. This should be thoroughly cleaned and all enamelling removed with caustic soda or paint remover. The top should be carefully cut out inside the rim. The bottom should be cut along the black lines (Fig. 5), and bent neatly inwards along the dotted lines so that the upturned edges appear as in Fig. 4. Rectangular holes ½in. x ⅛in. should be cut or punched near each corner to allow legs to pass through.

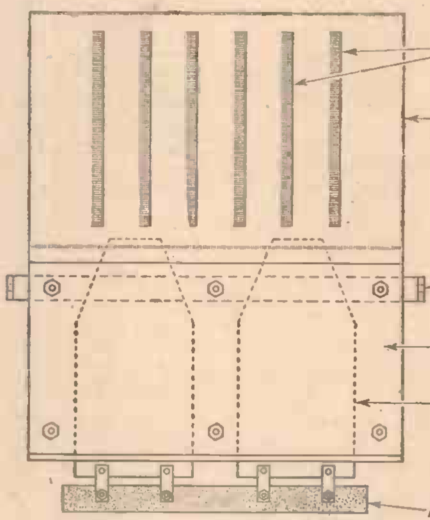


Fig. 2.—Interior assembly.

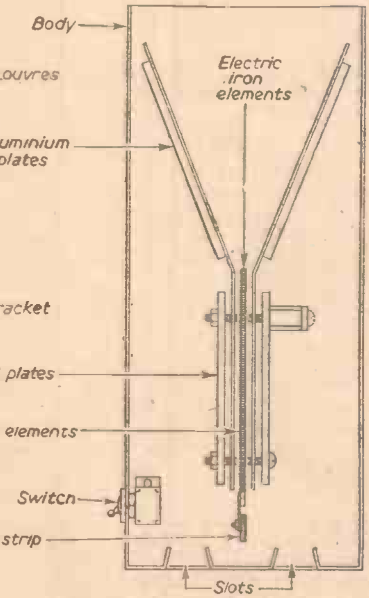


Fig. 4.—Cross-section.

The Legs

The legs are made from ½in. x ⅛in. mild steel in pairs (Fig. 3). The length should allow for approximately 1in. above the top rim of the body to approximately 5in. below the base. The width between the outside surface of the legs to be equal to the inside width of the body. They should be drilled and tapped 4 B.A., as indicated, for screwing to the body and lid.

The Heater Elements

These are composed of two universal type 450 watt electric iron elements between two sheets of aluminium (18 gauge) all being tightly clamped between two pieces of mild steel plate ⅛in. thick by six 3/16in. steel bolts (see Figs. 2, 4, 6). The aluminium

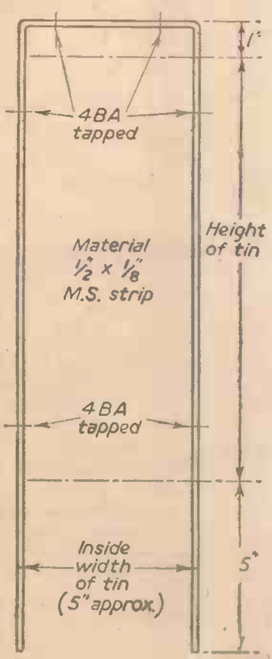


Fig. 3.—Details of legs.

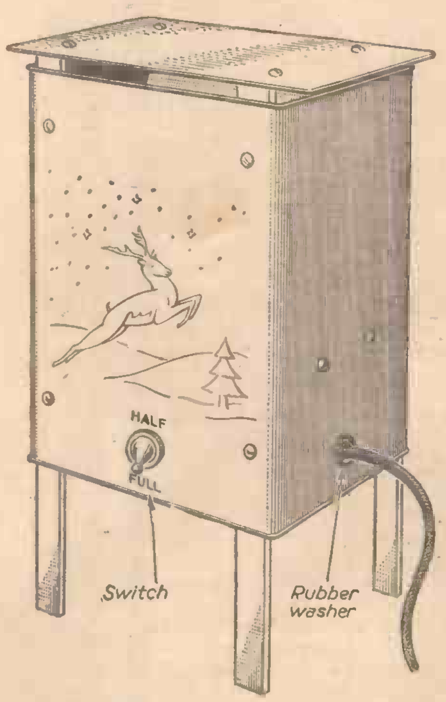


Fig. 1.—Perspective view of the completed heater.

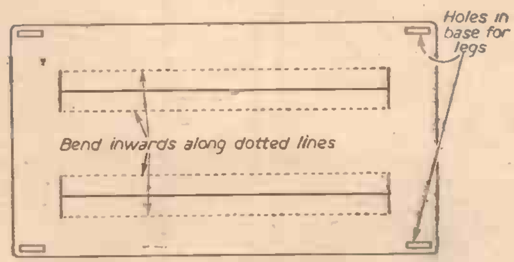


Fig. 5.—Bottom part of casing.

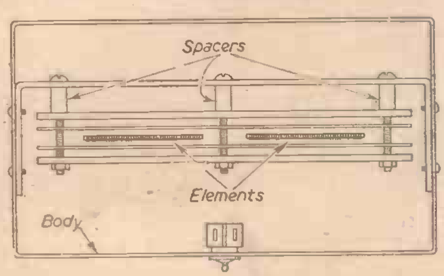


Fig. 6.—Plan of heater with top removed.

should be about 2in. shorter than the height of the body to allow for element connections, etc., and about 1in. narrower than the breadth of the body. The steel plates should be the same width as the aluminium but their depth should be a little less than the elements so as to clear the small element rivets (Fig. 2). Drill one of the steel plates with 3/16in. holes spaced to clear the elements, as shown and, using this plate as a template, clamp the aluminium and steel plates together and drill these six holes through all the plates. The top section of the aluminium plates should be slotted vertically at every inch with a fret saw and the strips given a slight twist to form louvres (Fig. 2). The element bracket is made from ½in. x ⅛in. mild steel bent to the breadth of the body, with end pieces at right angles and about half the width of the body.

The end pieces are drilled and tapped 4 B.A. to screw to the body. The centre piece is drilled with three 3/16in. holes to correspond with the top three holes in the steel plates (Fig. 6).

Using 1½in. long 3/16in. steel bolts the element parts can be clamped together as shown in Figs. 2, 4 and 6, note being taken that either extra nuts or small pieces of tubing are used as spacers between the steel plate and the bracket to prevent excessive heat being conducted to the bracket and body.

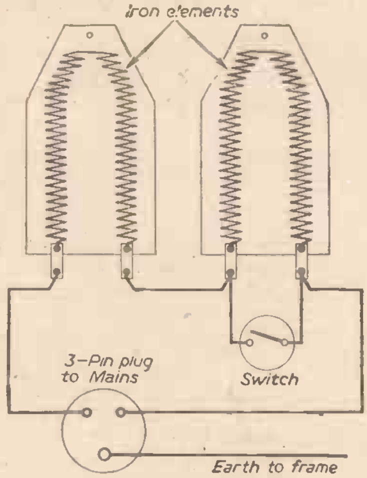


Fig. 7.—The heater elements and connections.

At this point the aluminium plates should be bent outwards from each other to form a Y, a little narrower than the width of the body.

The element connections being of very thin strip metal were all bolted with 8 B.A. brass nuts and bolts to a strip of stiff red fibre to give additional strength and rigidity.

A switch of the countersunk type is fitted at the lower middle of one side, and the three-core cable enters the body low on one of the narrow sides via a rubber washer or grommet to prevent the cable being frayed.

Connections

The connections are shown in Fig 7. It will be noted that the elements are in series, using only 225 watts. One can be shorted out by the switch when the full 450 watts of one element will be in use.

The writer does not advise readers to connect the elements in parallel. This was tried and proved far too hot to be practical for the design or purpose for which it was intended.

The lid is a piece of stout tin plate 1½in. larger than the width and breadth of the body. The edges are bent round a length of thick wire and the completed lid screwed to the top of the legs (Fig. 1).

The completed heater can be painted with a good heatproof enamel and a design stencilled on the sides if desired.

The writer has had great satisfaction from this heater for the past 18 months.

Converting a Petrol Engine to Run on Paraffin

Details in Reply to Recent Queries

By M. F. LEVETT

I ASSUME that by paraffin is meant vaporising oil, as used by farm tractors, etc. The main requirement of a paraffin-burning engine is adequate heat to ensure the complete vaporization of the fuel. It is usual practice to obtain the heat for the initial vaporization of the fuel from the waste heat in the exhaust, but in this case, with the manifolds disposed on opposite sides of the engine, the problem is slightly more difficult.

Make up a muff to surround the down pipe of the exhaust system, allowing about ¼in. radial clearance. Thin sheet steel is most suitable. The muff should extend over about 18in. of the down pipe, if possible. Fixing can be by tapped holes and screws, or welding, using suitable spacing pieces to maintain the radial clearance. Cut a hole in the centre of the muff of the same diameter or slightly larger than the carburetter intake. Connect the hole and the carburetter intake by means of a length of pipe—flexible exhaust pipe is very suitable. Care should be taken to keep the length of this pipe as short as possible, whilst the fixings must be very secure. The actual diameter is not critical, provided it is greater than that of the carburetter intake pipe.

Usually, the carburetter will require little in the way of adjustment, the slow running adjustment may require slight alteration, and possibly some increase in the size of the main jet might be required. As main jets are apt to be expensive, and sometimes unobtainable, careful use of a drill some few thousandths of an inch larger than the existing hole in the main jet may provide the answer. This point can only be cleared up by trial and error. A drain tap fitted to the bottom of the float chamber will also be most useful. Messrs. Zenith Carburetters make a carburetter that is very suited to vaporising oil engines (type 24T-2), and it may be helpful to get in touch with them.

The supply of fuel to the carburetter can present some tricky problems, but with reasonable foresight a simple and direct path for the pipes can be found.

An additional tank will be required to contain the supply of petrol for starting and warming up—its capacity can be about a gallon or two. A two-way petrol tap, suitable for the size of pipe employed, should next be fixed in a substantial manner in a suitable place, away from the engine, as vaporising oil seems to leak through even the tightest fitting tap and a few spots of paraffin on a hot exhaust pipe can soon cause a fire. A length of pipe should be fitted between the outlet end of the two-way tap and the carburetter union. It is also advisable to fit a filter into this line—vaporising oil always seems to carry a great deal of sediment along with it. The glass bowl type of filter is more suitable—it affords a visual check on the dirt level. One of the inlet connections of the tap is joined to the new petrol tank, while the other is connected to the vaporising tank (formerly the main petrol tank).

The ignition system as a rule requires little attention, provided it is already in fairly good condition. A slight variation in the timing can be tried; usually a few degrees retarding of the spark will prove satisfactory. The spark plugs at present in use may show a tendency to "soot-up"—in this case try fitting a slightly hotter running set; any large garage will have a list of the heat factors of various plugs, and if approached, will, I am sure, assist in this matter. It may also help to increase the present plug points gap by a small amount; experiment will prove if this is helpful or not—the increase can be about .010in.

The most suitable operating temperature for a paraffin engine is around 170 deg. F. and a suitable thermometer (ex-W.D.) is a wise fitting. The usual place for it is in the cooling water outlet pipe, as near to the cylinder head as is possible. Control of the water temperature may be by means of a "blanking off" sheet fixed across the bottom of the radiator, if a radiator is fitted. Where sea-water cooling in conjunction with a pump is used, care must be taken to avoid over-cooling. A screw down type of valve, mounted in a suitable position, will take care of this point. Once the correct position of the valve or radiator blind is found it can be left in this position and the engine will take care of its own temperature.

As far as the mechanical details are concerned, it may be necessary to alter the compression ratio to prevent detonation, although with an engine of 1926 vintage this will not prove of any importance.

Should detonation be apparent under load, however, the quickest compression reducer is another cylinder head gasket added between head and block. Owing to the greater amount of oil dilution that takes place when using paraffin as a fuel, it is advisable to change the lubricating oil rather more frequently than is the case with a petrol motor. A reduction in the change period of about ten to twenty hours is usually satisfactory. Over-cooling is the most common cause of excessive sump oil dilution —take care to keep the operating temperature high.

Starting should present no more difficulties than in the case of a petrol engine, provided that the engine is turned over to run on petrol a few minutes before stopping, in order that petrol will be available in the float chamber for the next start. The drain tap can be used if the engine is inadvertently stopped while running on vaporising oil.

After starting the engine on petrol, allow to warm up to about 120-130 deg. F. before turning over on to paraffin. When properly warm, adjust the main jet for the most even running—assuming a variable main jet is fitted. It is important to remember that a paraffin engine does not like overmuch slow running—the harder it is worked the better the performance. When under load and at the correct temperature, the exhaust should be colourless: detonation (pinking) will result in a pungent smell, with traces of black smoke; over-cooling, over-oiling, or faulty rings or pistons will give blue smoke, as also will an excessive supply of fuel to the engine. White smoke is nearly always due to faulty vaporisation.

Back to First Principles

11—Measuring Speed

By W. J. WESTON

SPEED is the rate at which a body changes its position ; speed has a distance factor and a time factor. The rate of change may be the same over a period (*constant*) ; it may be growing greater (*accelerating*) ; or it may be becoming less (*retarding*). Moreover, the acceleration or the retardation may be occurring steadily (*uniform*), or by fits and starts. It is interesting to study some problems of speed without reference to the forces bringing about the motion, or the change of position.

The Problem : A train approaching a station does two successive quarters of a mile in 16 and 20 seconds respectively. Assuming the retardation to be uniform, what further distance will the train run before it stops ?

The Comment

We need to know the velocity of the train at the beginning of the first quarter mile : represent this for the moment at x feet per second. We need to know also the rate at which this velocity is lost : represent this as y feet per second.

Velocity at the end of the first quarter is, therefore : $x-16y$

Velocity at the end of the second quarter is, therefore : $x-36y$

Average velocity for the first quarter is : $\frac{(x)+(x-16y)}{2}$

Average velocity for the second quarter is : $\frac{(x-16y)+(x-36y)}{2}$

Average velocity for the distance required is : $\frac{(x-36y)+0}{2}$

These average velocities in x and y are equated with average velocities in numbers.

The Answer

(1) $\frac{2x-16y}{2} = \frac{1320}{16}$ (since 1,320 feet = ¼ mile)

(2) $\frac{2x-52y}{2} = \frac{1320}{20}$

Therefore : (1) $x-8y = \frac{165}{2}$

(2) $x-26y = 66$

Therefore : $18y = \frac{33}{2}$ (taking (2) from (1))

Retardation is, therefore, at the rate of $\frac{11}{12}$ feet per second per second.

And $x = \frac{165}{2} + 8 \times \frac{11}{12} = \frac{539}{6}$ feet per second.

To lose this velocity at the rate of $\frac{11}{12}$ feet per second per second will need

$\left(\frac{539}{6} \div \frac{11}{12}\right)$ seconds = 98 seconds.

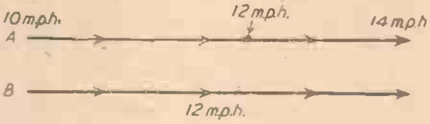
The distance required is, therefore, covered in (98−16−20), that is 62 seconds : and since $(x-36y) = \left(\frac{539}{6} - 33\right)$ the distance is $\left(\frac{539}{6} - 33\right) \times \frac{1}{2} \times 62 =$ 1,761 feet 10 inches

The Problem

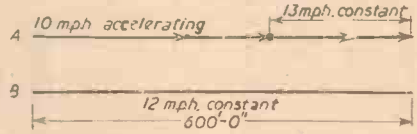
A cyclist A riding at 10 m.p.h. is overtaken and passed by B riding at 12 m.p.h. If A at once increases his speed with uniform acceleration, at what rate will he be riding when he catches B ? If, when he has increased his speed to 13 m.p.h., he continues at this speed and catches B in 200 yards, what is his acceleration ?

The Comment

The first question calls for no calculation but only a little thoughtful reasoning. B keeps to his steady 12 m.p.h. A begins his overtaking at 10 m.p.h. When he does overtake, he too must have covered the distance of the chase at an average speed of 12 m.p.h. His speed on reaching B must therefore be 14 m.p.h. ; for 10 at the beginning of the chase needs 14 at the end to obtain an average of 12. Thus :



The solution of the second problem comes from a consideration of the riding of A and B over the 200 yards. Thus :



The Answer

(1) Since B rides uniformly at 12 m.p.h., A must during the overtaking achieve an average of 12 m.p.h. Since, therefore, his initial speed is 10 m.p.h., his final speed must be 14 m.p.h.

(2) Let x = number of seconds during which A accelerated to 13 m.p.h.

Let y = number of seconds during which A rides at 13 m.p.h.

A's acceleration must therefore be

$\frac{13 \text{ m.p.h.} - 10 \text{ m.p.h.}}{x} = \frac{3 \times 1760 \times 3}{60 \times 60 \times x} = \frac{22}{5x}$ feet per second per second.

First equation (B's riding) :

$(x + y)\frac{88}{5} = 600$ [since $\frac{88}{5}$ per sec. is 12 m.p.h.]

Second equation (A's riding) :

$\left[\left(\frac{44}{3} + \frac{44}{3} + \frac{22}{5x} \times x\right) \div 2 \times x\right] + \frac{44 \times 13}{30}y = 600$

That is : (1) $11x + 11y = 375$

(2) $253x + 286y = 9000$

(Multiplying (1) by 26) : (3) $286x + 286y = 9750$

(Taking (2) from (3)) : $33x = 750$

Therefore $x = \frac{750}{33} = \frac{250}{11}$

Therefore : $\frac{22}{5x} = \frac{22}{5} \times \frac{11}{250} =$

$\frac{121}{625}$ feet per sec. per second.

The Problem

A train is uniformly accelerated and passes successive milestones at 10 m.p.h. and 20 m.p.h. respectively. Calculate the velocity when it passes the next milestone and the time taken over the second mile.

The Comment

The reasoning here is not unlike that in the preceding problem. The average velocity over the first mile is (10 + 20) ÷ 2, that is, 15 m.p.h. The mile, therefore, is covered in 4 minutes. And, since in that 4 minutes the velocity increases by 10 m.p.h., the acceleration is $\frac{10}{4}$ m.p.h. each minute. The velocity on reaching the third milestone is, therefore, $20 + \frac{10}{4}$ multiplied by the number of minutes taken.

The Answer

Let x = the number of minutes taken for the second mile.

Then, since the acceleration is $\frac{10}{4}$ m.p.h. each minute, the velocity at the end of the second mile is $\left(20 + \frac{10x}{4}\right)$ m.p.h.

The average velocity over the second mile is, therefore,

$\left(20 + 20 + \frac{10x}{4}\right) \div 2 = \left(20 + \frac{5x}{4}\right)$ m.p.h.

This velocity $\times \frac{x}{60} = 1$ mile.

The equation, therefore, is

$\left(20 + \frac{5x}{4}\right) \times \frac{x}{60} = 1$

That is : $\left(4 + \frac{x}{4}\right) x = 12$

Or : $x^2 + 16x = 48$

Or : $x^2 + 16x + 64 = 48 + 64$

Or : $(x + 8) = \sqrt{112} = 4\sqrt{7} = 10.58$

The number of minutes taken is, therefore, 10.58 − 8 = 2.58

And the velocity is $20 + \frac{10}{4} \times \left(\sqrt{112} - 8\right) =$

$20 + \left(10\sqrt{7} - 20\right) =$

$10\sqrt{7}$ miles per hour.

New Forge for Railway Axles

OPERATIONS have recently commenced at the new hammer forge which Messrs. Steel, Peech and Tozer have built at their Ickles works. This forge is specially designed for work on the manufacture of railway axles.

The new building consists of two bays, one 320ft. long by 70ft. wide and the other 240ft. long by 55ft. wide. Each bay is served by a 5-ton E.O.T. crane, fitted with a magnetic attachment. The principal items of equipment are a continuous gas-fired furnace, a 7-ton steam-operated hammer, an electrically-operated mechanical manipulator, a second furnace and oil tank for heat treatment purposes, a straightener and cold sawing equipment.

A 5-ton hammer and two batch-type furnaces are also included for general forging purposes.

Continuous Flow Principle

The layout of the equipment has been designed on continuous flow principles and permits an output exceeding 100 axles per shift to be achieved. The sequence of operations is briefly as follows :

The axle blooms are transported in wagons from the Templeborough Mills and are unloaded and stacked by an overhead crane. Each bloom is charged as required into the continuous heating furnace, through which it is pushed, being gradually heated to a temperature of 1,250 deg. C.

Auxiliary Motor Units

A Review of Some of the New Models Shown at the Recent Cycle Show at Earls Court

By R. L. JEFFERSON

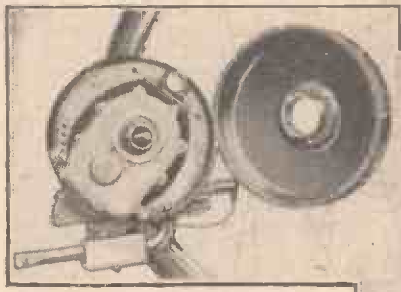
The motor unit of the B.S.A. Winged Wheel.

THE introduction of new models is always of interest to the public, and doubly so at show time.

B.S.A. Winged Wheel

On Stands Nos. 8 and 59 the eagerly awaited B.S.A. Winged Wheel was displayed for the first time, and it attracted a great deal of interest. The two-stroke engine has a bore and stroke of 36 mm. x 34 mm; 35 c.c. capacity, twin transfer parts, roller bearing big end and detachable alloy cylinder head. Amal carburettor with incorporated air cleaner/strangler, mainshaft on roller bearings with spring-loaded compression seals are provided.

The transmission is very robust and of the built-in type; it comprises a gear drive to the rear wheel with two stage reduction, first stage, from engine shaft to clutch mounted on a separate shaft, second stage, from clutch shaft to gear pinion on rear wheel hub. The clutch is of the three-plate type with cock inserts and runs in oil. There is a very efficient brake of the internal expanding type with a drum diameter of 9½in. The tyre is a Dunlop Carrier 26in. x 1½in., ignition is by Wico-Pacy flywheel unit. The petrol tank is attached to a neat parcel carrier and is of ½-gallon capacity. The pedalling gear free-wheel is of the Eadie Coaster type. The weight of this complete unit including tyre is 27lb. and the finish is gunmetal grey and aluminium. Price £25. There was a sectional working model on the stand which drew an interested throng. B.S.A. are stepping up production to meet an already brisk demand.



A feature of the B.S.A. Winged Wheel is the 9½in. dia. internal expanding brake which is an integral part of the design.

The clutch fitted to the B.S.A. Winged Wheel is of unusually sturdy design and operates under ideal conditions. Having three friction plates, it has been designed for long life, with the minimum of maintenance.

The "Cyclaid"

The well-established "Cyclaid" unit, which was displayed on Stand No. 158, has the unique feature of a belt drive from the engine pulley to a vee rim attached to the rear wheel spokes. This little unit has a continuous output of 0.7 h.p. at 3,500 r.p.h. Made by British Salmson Aero Engines, Ltd., the unit sells at £24.

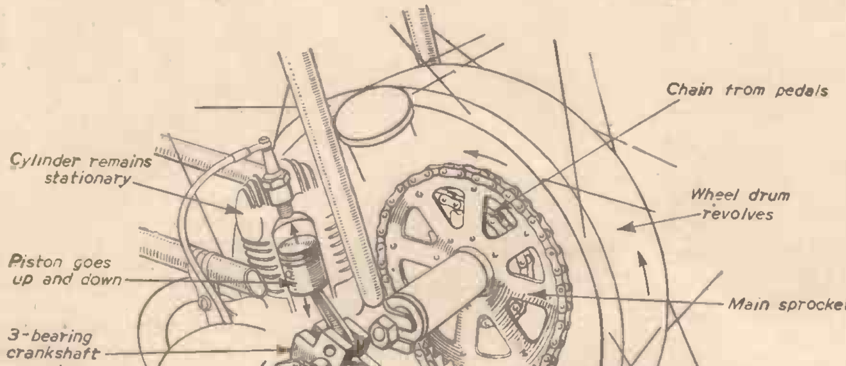
Once again the Cucciolo four-stroke unit of Italian origin was exhibited by Britax (London) Ltd. This unit fits below the bottom bracket and drive is by friction roller. On this stand, No. 124, Britax had a bicycle made especially for the unit by the Enfield Cycle Co. This machine has a reinforced frame, large section tyres and a front fork assembly suspended on rubber cords. The price is £18/18/-.

"Cyclemaster"

Stand No. 60 carried the display of the well-known "Cyclemaster," of 32 c.c. This little unit can be seen daily doing its job wherever there is a road. This year there were three complete machines on the stand designed for specific purposes. These were the Cyclemaster Mercury pillion bicycle; the Cyclemaster Roundsman for tradesmen's delivery use with a weight capacity of 1cwt.; and the Cyclemaster-Norman which is an export model.

There is no change in the price of this complete power wheel, which is £27/10/-. The pillion model complete with unit sells for £45/16/3 taxed. The Roundsman model is tax free at £47/5/-.

The neat petrol tank, which is mounted in a light tubular carrier for attachment to the chainstays, has a capacity of a little over half a gallon, enabling the rider to refill with half a gallon of petrol, plus oil, while there still remains sufficient fuel in the tank for several miles travelling. Combined with the filler cap is a measure which enables the owner of the B.S.A. Winged Wheel to add the correct quantity of oil to the petrol.



Diagrammatic sketch of the Cyclemaster, explaining the functions of the various components.

The "Mini-Motor"

The pioneer firm of Trojan Ltd. were displaying the well-known "Mini-Motor" on Stand No. 136. Model No. 3 has been discontinued and Model No. 5 takes its place; the capacity remains unchanged at

49 c.c., in this improved model and the engine unit and petrol tank are separated. The finish on these new models is gold. On this stand one of the three Mini-Motors which finished in the A.C.V. motor-cycle rally to Weston-super-Mare could be seen.

"Power-Pak"

The good news concerning Stand No. 116 was a price reduction to £19/19/- of the popular Power-Pak unit. This applies to the new standard model, a development of the already established standard model of which 20,000 are in daily use. Both the new standard model and the Synchromatic-Drive model have a new twist grip control which gives finger tip adjustment for tick-over. The tyre used on both these models has a guaranteed life of twelve months.

Vincent "Firefly"

On Stand No. 5 the Vincent "Firefly" made its Earls Court bow; it was introduced earlier in the year and has proved very popular. The unit fits below the bottom bracket and drives the rear wheel by serrated roller. The Amal carburettor No. 308 has a redesigned choke. An extra tank is provided for those bicycles on which it is not feasible to fit the tank on the front engine mounting clip. The unit of 48 c.c. retails for £25. The makers are Vincent Engineers (Stevenage) Ltd., Herts.

The Cyclaid belt-driven unit.

Much ingenuity has gone into the manufacture of these little units and it is indeed a far cry to the old auto-wheel and the even earlier Singer motor wheels.

I was glad to see so many manufacturers producing models on robust lines to take these little units. They have come to stay without question to fill a definite want. It is nonsense to suggest that the motorised bicycle will push the ordinary bicycle off the road; that will never come about.

A "Roll-a-coin" Game

An Easy-to-make Family Amusement

THIS game affords considerable amusement in that it requires careful strategy on the part of the contestants. The rules are at the discretion of the players. The main object is based on the usual principle of attaining the highest score, the points in this case being registered by the indicator and electric bell or buzzer.

The Electrical Circuit

As shown in the accompanying sketch, a wire is attached to a thin tin strip at (a), and wire (b) is attached to the framework of the coin indicator panel (see small theoretical circuit inset). The bell or buzzer should be connected between these two wires and fitted inside the "box" at a suitable position. The addition of a buzzer is a sample of the various methods which may be adopted by the constructor to make the game more interesting. The measurements should be: width 8in., length 18-20in.; this should provide a suitable pitch of coin, i.e., the distance from the runway to the coin reception cloth at the rear of the board. This cloth is fitted in a manner which serves two purposes: (a) to receive the coins, and (b) act as a dust cover for the indicators when the game is over.

The Coin Panel

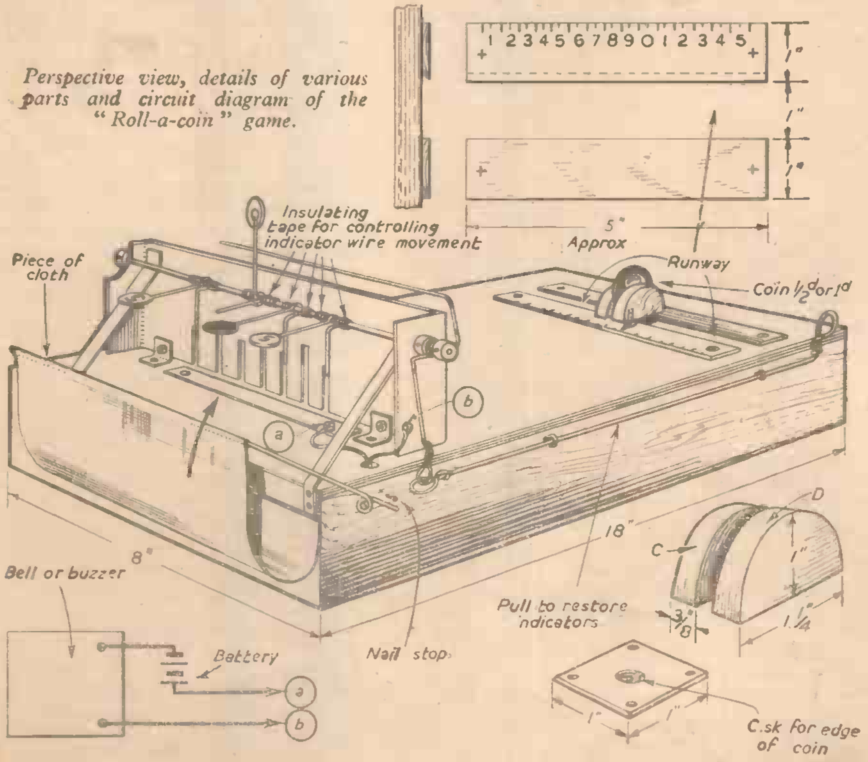
The aluminium or tin coin panel should measure approximately 6in. long by 3in. deep, with the flanges about 1in. in width, this measurement being adaptable to the size of game being employed.

The coin slots should be 3/16in. wide, and the 1d. slot should be 1¼in. high and the ½d. 1 1/16in. high. The sketch shows three 1d. slots and four ½d. slots, with the indicator arranged, reading from left to right, ½d. score 5; 1d. (no indicators) must ring bell to score 20, otherwise nothing to record; ½d. score 10; 1d. no score, must ring bell to gain a further 20 points; ½d. score 10; 1d. must ring bell to score 20; ½d. score 5. These rules are adjustable to requirements, but indicate one method of playing. The number of indicators used is, of course, left to the designer.

Slots	Points without bell	Bell rung	Bell not rung but coin resting in slot
½d.	5	—	2½ points
1d.	None	Add 20	10 "
½d.	10	—	5 "
1d.	None	Add 20	10 "
½d.	10	—	5 "
1d.	None	Add 20	10 "
½d.	5	—	2½ "

The coin panel is secured by brass angle brackets which, in turn, are fixed with countersunk wood screws to the baseboard. See that the contact strip of tin does not foul the framework or brackets in any way, otherwise the bell or buzzer will keep ringing due to this short circuit. The method of fixing an indicator release wire is apparent on referring to the drawing. This is a simple additional construction, but is not absolutely necessary.

Perspective view, details of various parts and circuit diagram of the "Roll-a-coin" game.



Coin Launching Platform and Runway

All the measurements for the coin launching arrangements can be seen on the drawing. The runway is formed from two strips of aluminium, one of which is graduated and has its rear edge bevelled. The actual launching platform, which slides up and down the runway, consists of two ⅜in. thick hardwood cheeks mounted on a 1in. square of aluminium. This square is drilled in each corner to take six B.A. countersunk screws which clamp the coin-holders to it, these latter being drilled and tapped 6 B.A. One edge of the square is bevelled to coincide with the bevel on the graduated strip of the runway, and it should lay between the two strips and be free enough to slide up and down the runway. The exact centre of the aluminium underplate should be countersunk with a fairly large bit so that the edge of the coin will rest lightly in it.

Propelling the Coin

The method of propelling the coin is to place it between the cheeks of the coin-holder, then press downwards on the rear edge of the coin so that it is shot forward with a rotating motion along the board. Very little practice is needed to become skilled at this.

Peaceful Uses of Atomic Energy

The Nature of Radio-activity, and the Applications of Various Radio-active Materials

By "PHYSICIST"

THE use of atomic energy for warlike purposes has overshadowed the less spectacular, but equally important, developments which have been made in the peaceful uses of atomic energy.

Admittedly, the substances which are used in these applications are, for the most part, by-products from the atomic piles, whose chief function is to produce atomic explosives, and the quantity produced is not very large, but their usefulness is out of all proportion to their weight.

Perhaps the main non-destructive use to which atomic energy will be put is its effective utilisation to provide industrial power, and it is comforting to know that the latest developments suggest that this may become a practical proposition in the near future. That this is so, is now well known, and it is not proposed to enlarge upon it here, but rather to discuss the more unusual research and industrial applications of atomic energy.

Both the warlike and the industrial power applications of atomic energy make use of the enormous amount of energy which is liberated when atomic fission occurs. There is, however, a further characteristic of atomic fission, i.e., atomic radiations, which can be usefully employed. In fact, it is precisely these radiations which were first detected by physicists in the late 19th century and which led to studies culminating in the discovery of atomic fission.

The few naturally occuring elements which give off these radiations are referred to as "radio-active" elements. They are invariably heavy elements, such as radium, uranium and thorium and, unfortunately, they are not plentiful and are exceedingly difficult to isolate.

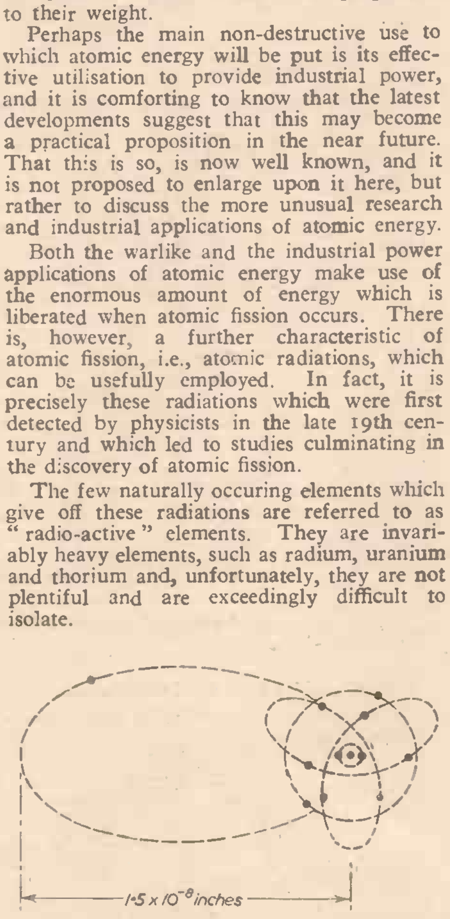


Fig. 1a.—Diagram of a sodium atom showing paths in which the electrons travel. The small central dot represents the nucleus. The large dots on the orbits represent electrons. The "diameter" of the atom is approximately 3 hundredth-millionths (3.0×10^{-8}) *inches.*

Everyone is aware of the patience and fortitude with which the Curies laboured to isolate the first specimen of radium from pitchblende and the terrible effects which were ultimately produced on the experimenters who, unknowingly, exposed themselves to its harmful radiations.

Because of their high cost, the industrial applications of naturally occurring radio-active materials have been very limited and confined to uses for which they were absolutely indispensable, such as the use of radium in the treatment of body tumours. It was only in 1946, when the first uranium pile was brought into operation in this country and it became possible to induce radio-activity cheaply in most elements, that their use in research and industry was developed.

The Nature of Radio-activity

Matter is made up of tiny particles called atoms and each atom comprises a small core or nucleus, which accounts for most of its mass and carries a positive electrical charge. A number of light, negatively charged particles, known as electrons, revolve in space around the nucleus (Fig. 1a). The charge on the nucleus and that of the electrons are equal, so the atom is electrically neutral.

The chemical properties of the atom are determined solely by the number and configuration of the electrons.

The exact composition of the nucleus is still uncertain, but it is believed to be made

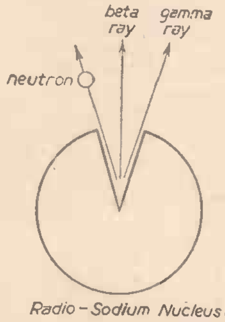


Fig. 2.—Schematic diagram of the breakdown of a radio-sodium atom (24 units of mass). One neutron is emitted, together with beta and gamma rays, leaving a normal sodium atom (23 units of mass).

up of particles of unit mass and unit positive charge called protons, and electrically neutral particles of unit mass, known as neutrons (Fig. 1b). There are various opinions as to whether these are the fundamental particles of matter, or whether the neutron is merely a proton combined with an electron, but this is rather academic and need not concern us here. Suffice it to say that by ejecting or

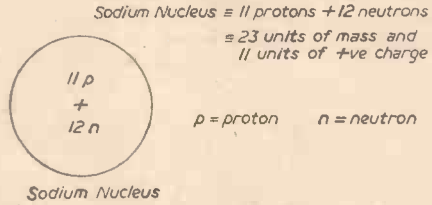


Fig. 1b.—Composition of the nucleus of an atom of sodium. Approximate diameter of the nucleus is roughly one billionth of an inch.

absorbing protons or neutrons, the mass of the nucleus is altered and transmutation of the elements can take place.

Particle capture or emission by the nucleus invariably results in the release or absorbing of energy, either as heat, light or radiation of a much shorter wavelength than visible light, known as X- or gamma rays. Electrons travelling at high speed are also emitted and these are referred to as beta rays (Fig. 2).

By placing elements in the atomic pile, where very high concentrations of primary particles exist, particle capture by the nuclei is enhanced, giving rise to artificially radio-active isotopes, and almost invariably the captured particle is later ejected from the nucleus, together with beta and gamma radiations. The rate at which the activated atoms break down differs from isotope to isotope, but it is always the same for each isotope, and is unaffected by extremes of temperature, or other climatic conditions.

Of course, with radio-active materials, whether naturally occurring or artificially prepared, precautions have to be taken to safeguard the health of the operator. But there is now such a variety of artificially prepared isotopes that a selection can be made which will obviate any health hazard. In cases where this is impracticable, the utmost is done to screen the operator from the radiations, and frequent health checks, together with the use of detection equipment, ensure that he is running no risk of over-exposure.

The emitted radiations can be detected fairly easily and with an accuracy which staggers credulity, using specially developed apparatus such as the Geiger-Müller counter, the ionisation chamber, or special photographic plates. The first two mentioned apparatuses make use of the characteristic which both beta and gamma rays have of ionising gas molecules and thus producing an electrical discharge between charged plates. In the ionisation chamber, the ionisation current which is produced is a measure of the intensity of the radiation, whereas the Geiger-Müller counter can be made to detect the presence of a single electron.

Applications of Radio-active Isotopes

The applications of radio-active materials may be classified as follows:

(1) Tracer techniques.
(2) Absorption and scattering techniques.
(3) Ionisation techniques,

and they will be dealt with under these headings.

Tracer Techniques

Radio-active isotopes have been used as tracers in almost every field of scientific endeavour. Essentially, the method depends upon the detection of the radiations from the radio-active substance, usually with a Geiger-Müller counter. Because of the extreme sensitivity of the apparatus, an exceedingly small amount of radio-active material can be used, and there is no health hazard.

The technique has been widely used in medical and biological studies. Since the chemical properties of the element depend solely upon the number of orbital electrons, a biological organism is unable to distinguish between a radio-active and a non-radio-active isotope of the same element. A small quantity of the radio-active isotope is, therefore, mixed with the naturally occurring material, and both follow exactly the same path within the body.

Thus, radio-sodium has been used to study the rate of blood flow in the arteries, and has proved helpful in locating constrictions in thrombosis. Radio-phosphorus has

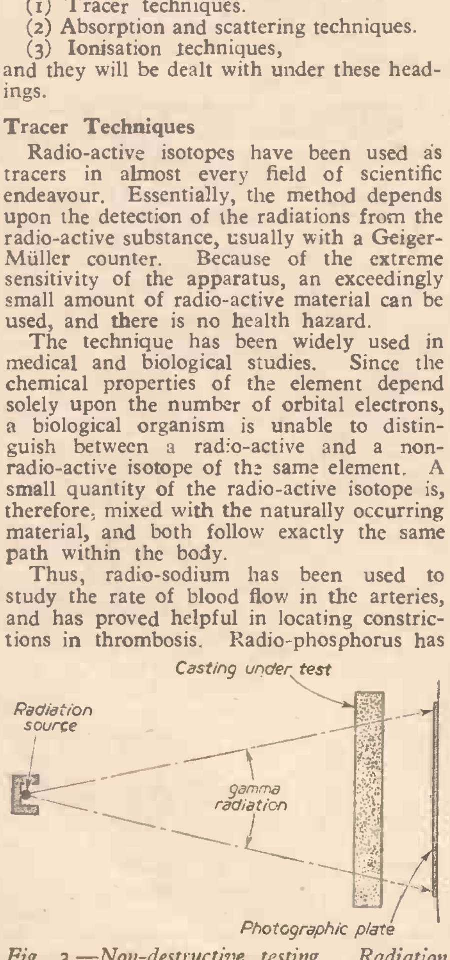


Fig. 3.—Non-destructive testing. Radiation source is usually radio-cobalt.

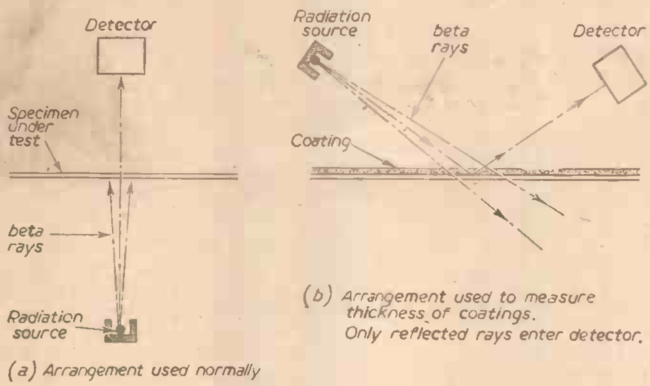


Fig. 4.—Thickness gauge (beta rays).

similarly been employed to study bone marrow formation, and radio-iodine has proved of great value in elucidating the functions of the thyroid gland.

Radio-active isotopes, used as tracers, have also proved of value in the research laboratory. Studies on metallic diffusion have been facilitated by their use, and they have found extensive application in determining the mechanism of wear on sliding surfaces.

The thickness of very thin oil films on textile fibres has been measured by mixing with the oil a minute quantity of a compound containing radio-bromine atoms.

The technique has also been extended to locate leaks in underground cables containing gas under pressure and to locate scrapers in underground pipelines.

Water soluble tracers have been employed to follow the courses of underground streams, and radio-argon and radio-xenon have found application in ventilation tests in buildings.

For the most part, in tracer techniques, the beta ray component of the radiation is used, but in the techniques described in the next section the far more penetrating gamma radiation is usually preferred.

Absorption and Scattering Techniques

Much progress has been made in the application of gamma-emitting isotopes in medicine and biology.

The use of radium for the treatment of malignant cell growth is well known, as is also the use of X-rays generated by electrical methods. Both techniques are costly and complicated. Highly satisfactory substitutes for radium have been prepared in the atomic pile. Radio-cobalt has given striking results, and has the advantage that it is very cheap and can be easily machined and worked before irradiation. When the radio-activity has decayed it can be returned to the pile for reactivation. Two radio-cobalt units have been made in Canada which give off gamma radiations similar to those obtained from a 2,000,000-volt X-ray generator.

Progress has been made in the treatment of deep-seated lesions which could not be satisfactorily irradiated from outside the body with radium sources, by prefabricating and shaping the gamma-ray source before irradiating it in the pile. In this way, it has proved possible to concentrate the rays within the body at the site where treatment is needed.

Further advances have come from the use of radio-gold and radio-phosphorus, which can be administered internally, and which collect in various glands and organs in the body, enabling diseased glands, etc., to be treated in a manner never before possible.

Changing Colours of Plants

Some attempts have also been made to alter the characteristics of various plants by irradiating seeds with gamma rays and neutrons in the atomic pile, and interesting changes in the shape and colours of the resulting plants were observed.

By far the biggest use of gamma rays is in the non-destructive testing of welds and castings. The principle underlying this application depends on the attenuation of the radiation by scattering, due to collision with the molecules of the material through which the radiation is passing. Atoms of heavier elements (larger nuclei) scatter the radiation more effectively than atoms of lighter elements.

Small sources of suitable isotopes are used and the specimen under test is placed between the source and a photographic plate (Fig. 3). A shadowgraph of the object under test is obtained, after development of the plate, on which the internal flaws are clearly revealed. For thin castings in steel, up to 2in. thick, radio-indium is used, but for thicker casting radio-cobalt is preferred.

Thickness gauges have been developed which depend upon the fact that beta and gamma rays are absorbed in passing through materials, and the degree of absorption in a given material is related to the thickness of the layer through which the radiation has passed. For light thin materials beta rays are most suitable and radio-active isotopes, such as sulphur and thalium, which exclusively radiate beta rays, are often used as sources.

The source is mounted on one side of the material under test and the detector (usually a Geiger-Müller counter) is mounted on the other (Fig. 4(a)). After calibration of the instrument the determination of the thickness of the material is instantaneous, enabling the material under test to be passed through continuously and allowing variations to be observed.

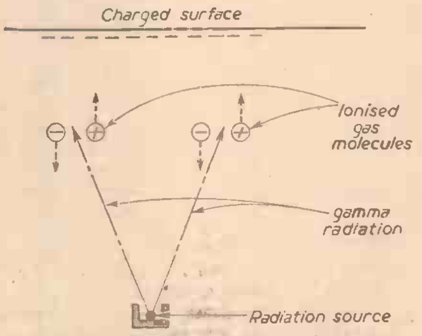


Fig. 5.—Static eliminator. Beta or gamma rays ionise gas molecules. Ions are attracted towards the charged surface and neutralise the charge on it.

The apparatus can be adapted as a controller for the thickness of materials in certain continuous manufacturing processes. It is of very wide application and is being used in the steel plate, paper and textile industries.

A rather novel application of the thickness gauge is its use to control the thickness of the tin coat on tin plate, by measuring the amount of radiation which is scattered back from this layer of metal (Fig. 4(b)).

A similar technique has been used to measure the height of liquids in opaque containers by moving the source and the detector simultaneously, on opposite sides of the vessel, to detect the point at which there is a sudden change in the intensity of the radiation picked up by the detector. In a further modification the apparatus is used as a control valve to maintain a constant head of liquid in the container.

Ionisation Techniques

In these techniques advantage is taken of the effect which is produced when beta and gamma radiations collide with gas molecules and electrons are liberated from the gas molecules.

Typical of this class of application is the static eliminator (Fig. 5), which is fitted to looms to eliminate the electric charges that are produced in the non-conducting yarns during their passage through the loom, as the cloth is woven. One such eliminator, developed by the Shirley Institute, uses a pure beta ray emitter, radio-thalium, and has successfully overcome the unsightly "fog marking" which was produced when the charged yarns accumulated dust by electrostatic attraction overnight.

Similar eliminators have found application in the printing and packaging industries, and also in the explosives industry, to reduce the risk of explosions due to sparks generated from charged surfaces.

Radio-active sources have also been used to initiate and stabilise the discharge in gas discharge devices, such as thyrotrons and voltage limiters.

Accelerating Chemical Reactions

With a view to utilising the waste product radio-active material from the atomic piles, much work has been pursued on its use in initiating and accelerating chemical reactions by ionisation. Studies have also been made on the irradiation of plastics by high intensity gamma and neutron beams, and some interesting changes in their properties have recently been reported.

The applications described in this article are but a representative few of the many which research laboratories and industry have found for these, as yet, almost unknown products of atomic fission. New uses are being found continually and industry is quickly appreciating that they can be cheap and versatile aids to production.

PICTURE FRAMING

Making the Necessary Fixtures, and

AT some time or other most of us have had to make a picture frame and have found it a difficult and exasperating job. Compared to a professionally made frame our mitres are frequently imperfect and it is disappointing to have to fill with plastic wood and touch up to camouflage the imperfections. A modern narrow moulding usually gives more trouble than the heavy old-fashioned kind and, since we all wish to turn out a job of which we can be proud, it is desirable to have proper appliances to control the operations. To buy these costs almost as much as to have the frame made professionally. The amateur can, however, make fixtures which will do the necessary work, quite quickly, and at little or no expense, and the purpose of this article is to describe a modified mitre block, a shooting-board and a simple form of corner cramp with the aid of which first-class results can be obtained.

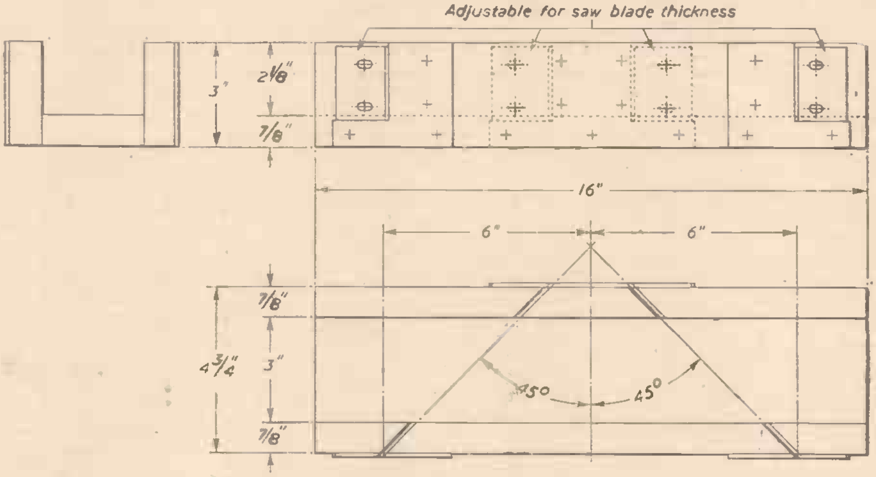


Fig. 1.—Front and end elevations and plan of a mitre block with adjustable metal fences.

Mitre Block

For cutting the mouldings a mitre block is required, and this is an item many people already possess. It is a thing that is very quickly made, however, when there is any suitable wood at hand in the workshop and, if reinforced with metal in the manner to be described, will prove most satisfactory, enabling perfectly clean and accurate cuts to be made which will require very little in the way of dressing afterwards. The addition of adjustable metal fences to an existing mitre block is well worth the trouble.

To make your own mitre block, select some clean, straight board, say, 1in. stuff (finished planed ⅞in. thick), and make up a channel section about 16in. long, and to the dimensions given in Fig. 1. Screw the sides to the base with some 1¼in. by No. 6 wood-screws.

The next step is fairly obvious, but is described because of the extreme importance of accuracy in marking off the angle of the saw-cut guide slots. Make a right-angled triangle on some cardboard as shown in Fig. 2. Point O lies in the middle of a line A B, the two points A and B being struck with trammels so that they are equidistant from O and as far away as the size of cardboard permits, as also is point C, which is marked by arcs from A and B respectively. A line joining C to O then makes a reference line on the cardboard which is absolutely at right angles to the base of the triangle. This reference line will be used later on. A 6in. radius from O determines the three corners of the triangle, which is then carefully cut out. On one side glue some strips of card, or a strip of three-ply, ⅞in. from the base, as shown in the end view on Fig. 2.

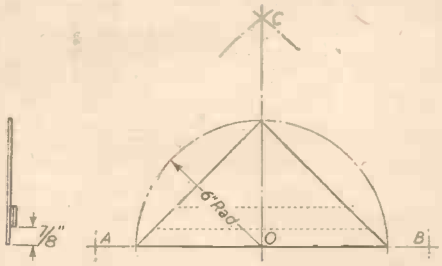


Fig. 2.—Cardboard template for marking angles.

Lay the triangle on the wood channel with the strip bearing on the inner face of one wall and with the point O midway. Then draw a pencil along the edges to mark the position of the saw guide slots on top of the channel. Now turn the channel on its side and, using a try-square resting against the underside, draw verticals to join up with the top lines. With these precautions the saw-cut guide slots will be exactly at 45 degrees and at right-angles respectively, which is most important, for if they are but a fraction of a degree out a perfect job will not be possible and the finished frame will be distorted.

Sheet-metal Fences

It is recommended that the slots in the channel be protected by metal; otherwise the act of sawing will very quickly spoil the mitre block, which will thereafter fail to produce accurate cuts. Prepare some sheet-metal fences, 16 s.w.g. or heavier, as shown in Fig. 3. One edge at least should be filed quite straight so that, using the try-square, the lines which form the indication for sawing the slots in them may be scribed truly at right-angles to the side which will form the bottom edge of each fence. Drill as shown in Fig. 3a for the "apex" fence, and as shown in Fig. 3b for each "base" fence, saw most carefully at an angle of 45 degrees down the vertical lines and part off by a horizontal cut along the chain-dotted lines, to separate the portion in which the fixing holes have been shown slotted in the figures. Now the saw cuts can be dressed up and hardened. Assemble the fences to the mitre block with ⅜in. by No. 6 round-headed woodscrews, using washers under the screws in the slotted holes, and adjust the gap to suit the saw it is intended to use to cut the mouldings.

Cutting the Mitres

Use a very fine saw for making mitres: a nice clean cut can be obtained by cutting with a "fine" hacksaw blade which already has been worn smooth. With such a blade stretched tightly in its frame, adjust the fences if necessary to eliminate side-play, and in making the cut apply only the slightest pressure. Let the saw descend almost under its own weight, so that the cut, especially on the "show" side of the moulding, may be quite clean. The "show" side should be on top so that the saw enters it first.

It is necessary to take some pains to grip the moulding firmly in the mitre block.

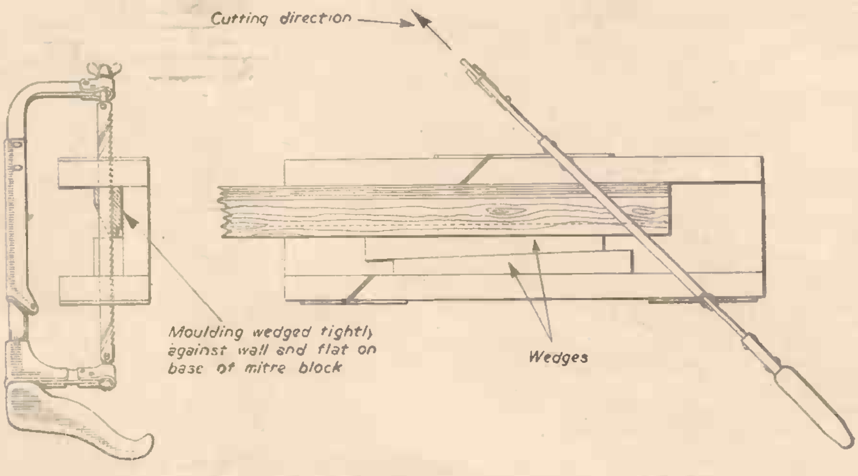


Fig. 4.—Showing the method of using wedges for holding the moulding firmly in place in the mitre block.

FOR AMATEURS

How to Use Them Efficiently

By C. W. TINSON

Fig. 4 shows one method—a pair of long wedges—to keep it tightly in place. The moulding should be placed against the far side wall, so that the cutting thrust pushes it on to its abutment, and before starting the cut check that the back of the moulding is firmly in contact with the base of the mitre block. All these precautions are necessary if a really first-class job is to result, in which the angles are correctly 45 degrees in plan and 90 degrees in end view, and the actual cut quite clean.

Shooting-board

A certain amount of dressing is usually called for and this requires a control, otherwise the accuracy of cut may be spoilt. Fig. 5 shows a shooting-board for doing the right-hand ends on one side, and the left-hand ends by turning the board upside-down. The cardboard triangle is again used to mark this out. To prevent warping, three-ply is best for the three middle laminations. In the figure a piece of moulding is shown in position, wedged firmly by means of the wedges used when cutting the mitre. Provided the cutting operation has turned out successfully—as it will if the precautions described have been taken—it will suffice to use fine glass-paper for dressing the end of the cut. An ordinary glass-paper block will do, but it is much better to make a special one about a foot long, so that there is plenty of length in contact with the shooting-board. This checks the tendency for the wrist to swing.

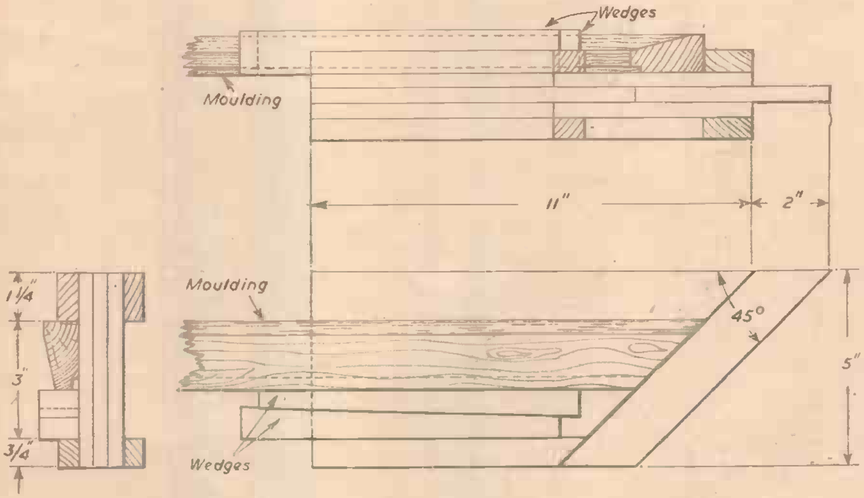


Fig. 5.—Details of a shooting-board for dressing the ends of the moulding.

Gluing Cramp

Finally, we want a cramp to hold the pieces firmly for gluing. Fig. 6 shows a simple and effective type, made from material which will cost very little—if it is not already available in the workshop. The first requirement is a baseboard of such a size that a fair length of the moulding can be supported by it on each side of the joint. This is to ensure that the back faces of the two pieces will lie in a common plane: otherwise, the picture frame may finish up with a certain amount of distortion and its glass will not bed all round the rebate.

For the base of the cramp choose a board at least 12in. by 8in., and since flatness is important a piece of three-ply, about $\frac{3}{8}$in. thick, can be used. Again with the aid of the cardboard triangle, draw a pencil along the sides of the triangle and also mark off or prick through on to the board the extremities of the perpendicular line, so that all three lines will appear on the baseboard. Drill and slot along the perpendicular line. Making use of the mitre block, cut some pieces of wood, about $\frac{7}{8}$in. wide by about $\frac{1}{2}$in. thick, for the outer stops. These should be strictly rectilinear in cross-section. Screw them down to the baseboard with their edges coinciding precisely with the lines marked on it, to produce a true right-angle in plan. Now make the inner block, using the mitre block again, drill, and bolt it through the slot. Fit washers under the bolt head and also under the nut.

Drilling and Gluing

Drill for panel pins through the outside of the moulding before gluing up, apply the glue and push the ends together into the corner formed by the outer stops. Attention must now be paid to two points: obviously the pieces of moulding must marry up correctly in the corner, and to do this they must meet properly in both elevations. It is necessary to check that the backs of the mouldings lie down absolutely flat on the baseboard. When satisfied that this is so, move the inner block to clamp the mouldings comparatively loosely and then push them into the corner to squeeze the glue; now the inner block may be pushed home firmly and bolted tightly.

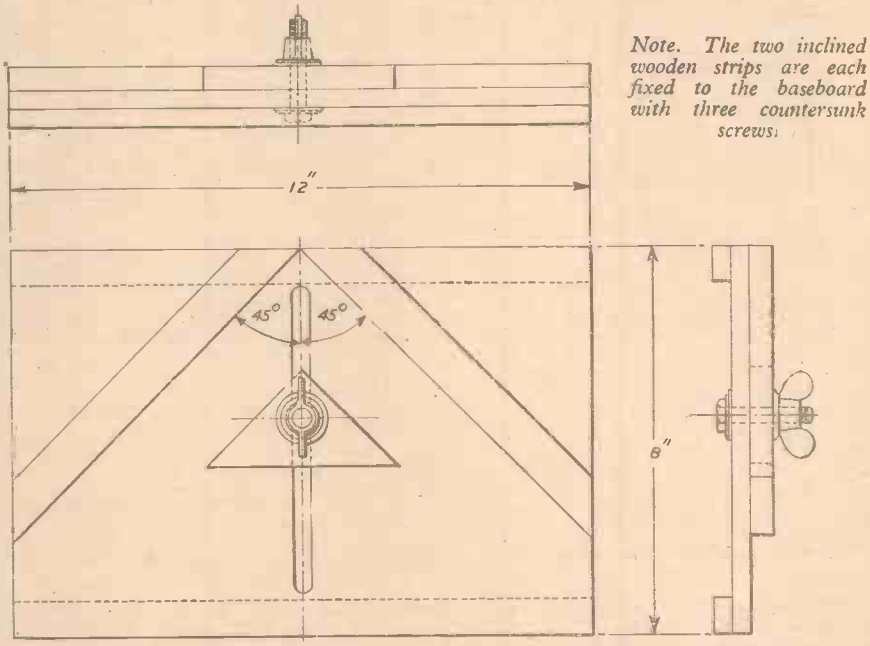


Fig. 6.—Plan and elevations of a cramp for holding the pieces of moulding while gluing.

Pinning the Joint

When the glue has set thoroughly, remove the work from the cramp and lock the joint by driving in two panel pins, one at right angles to the other.

If the processes described are followed carefully, a perfectly satisfactory picture frame will result; not only will the corners be neat and the frame be square in front elevation, but it will also be quite free from distortion, the glass resting evenly all round the rebate.

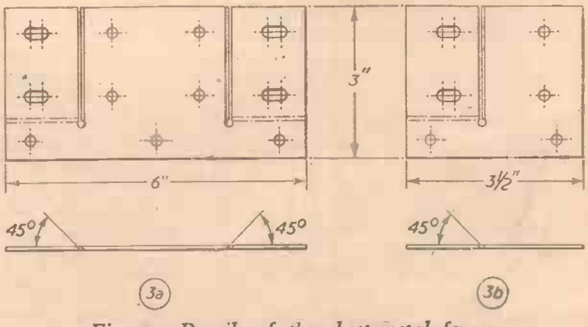


Fig. 3.—Details of the sheet-metal fences.

A Review of the Latest Book on This Intriguing Subject

By F. J. CAMM

FLYING SAUCERS OVER NEW YORK.—Observer George Conger sighted a round orange light hovering motionless directly east of the observation post at 00.11, July 27th, 1952, and pointed it out to Observers August Roberts and James Leyden. They noted that it moved slightly south-east. This was reported to Air Defence Filter Centre. Roberts was able to take a picture of this object while it hung motionless for a minute. Upon developing the film there was proof that there was something in the sky besides a conventional aircraft.

FOR nearly three hundred and fifty years well-authenticated reports have been received of strange objects flying through the air. These reports have come from many countries, including Switzerland, Italy, England, Scotland and Portugal.

The reports started in the year 1619 and have continued at sporadic intervals until three years ago, when a large number of reports were received, particularly in America, of unidentifiable objects seen flying at great speed and to which the name "flying saucers" has been given. Most of these reports can be dismissed as doubtful or explainable under the headings of Secret Weapons or Radiosondes.

Aeroplanes with circular wings were amongst the first aircraft to be flown. All of these reports, however, cannot be dismissed so lightly. They are too persistent to be regarded as a stunt and they have been seen by qualified observers in so many different countries to be regarded as phantasmagoria. Thus we are left with the ineluctable fact that strange flying objects are in existence and the only doubt is as to their source.

In considering the matter, therefore, we must accept that this is not the only inhabited planet in the Universe, nor should we consider that the inhabitants of other planets are less scientific than we are. We are at present interested in travelling to the Moon or to Venus and we must assume that the inhabitants of other planets are equally interested in visiting the Earth. If we are to believe that space ships from Venus have landed on the earth, and that one of the occupants has been interviewed, it is obvious that the inhabitants of Venus are more highly developed scientifically than we are.

But whereas hitherto the reports of flying saucers have merely been conjectures, the author of the volume under review,* as is obvious from its title, positively asserts that space ships *have* landed, that he has interviewed one of the occupants, that he has photographed the ship, is in possession of some hieroglyphics written by the space man he interviewed and that the landing was witnessed by several others who have sworn affidavits to that effect and which are reproduced in this most fascinating book. We are therefore entitled to examine his claims, although it is obvious he is convinced himself.

In a recent book published by Dr. Donald Menzel, of Harvard University, he states that flying saucers are simple natural phenomena. He explains how car headlights reflected upwards to a layer of cold air could cause the appearance of a moving disc in the sky. This, however, could not explain the appearance in the sky of these mysterious objects during daytime. It is well known that many of the so-called flying saucers have merely been meteorological devices which do somewhat resemble the saucer.

Messrs. Leslie and Adamski's book very fairly reviews all of the reports up to date of publication and from that point of view alone forms a valuable bibliography on the subject. Indeed, in America there is a magazine called *The Flying Saucer Review* which regularly catalogues all such reports.

The interest in this book, which is divided into two sections, is not only that it is a complete record of flying saucers to date, but that it gives very complete details of the landing and the conversation witnessed by Mr. George Adamski, who with Desmond Leslie as collaborator has written this book.

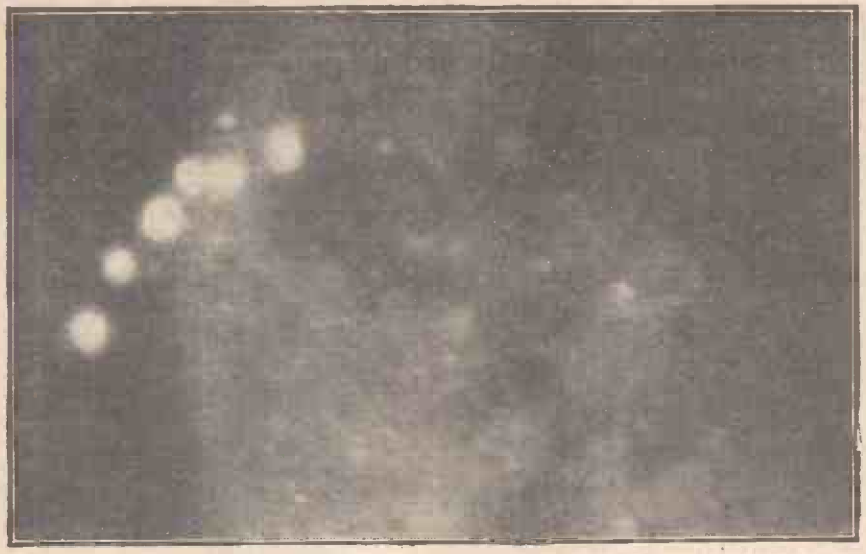
The first section explains what flying saucers are not; details of the flying saucer museum; the phenomena of Dr. Menzel; *The Flying Saucer Review;* flying saucers and politics; flying saucers and sound; the Vimanas; flying saucers before the Flood; saucers in Sanskrit; saucers for a song; saucers in Atlantis; the Solar System; the findings of Dr. Mead Layne; the saucer that came down; saucers in Celtic pre-history; power and the great pyramid, and the first spaceship on record, in which it is stated "from Venus in the year BC.18,617,841 came the first vehicle out of space to alight on our planet."

The first part of the book, therefore, is largely historical and deals with incidents which are well known. It is the second part which has aroused world-wide interest, controversy and doubt.

The first part of this deals autobiographically with George Adamski, who claims to be philosopher, student, teacher and saucer researcher. He owns two telescopes of the Newtonian reflector type. He expresses the belief, held by most to-day, that some of the other planets are inhabited, and through telescopes he has seen and photographed flying saucers. Many of the photographs are reproduced in the book. He states without equivocation that it was at 12.30 in the

The "Venusian" flying saucer or "Scout Ship" photographed at 9.10 a.m., December 13th, 1952, at Palomar Gardens, California, by George Adamski through his six-inch telescope. About 35ft. in diameter, this little spacecraft was made of a translucent metal. Notice the portholes, spherical landing gear and the lens or light on top of the cabin. The white line round the base of the dome appeared to be some form of power coil.

* "Flying Saucers Have Landed," by Desmond Leslie and George Adamski; published by Werner Laurie, 12s. 6d.



The flight of spacecraft shown above was one of several which passed over Texas in rapid succession on the night of August 30th, 1951. These giant saucers were estimated to be about 1,000ft. in diameter.

afternoon of Thursday, November 20th, 1952, that he made personal contact with a man from another world, who came to earth in his spacecraft, a flying saucer, which he called a scout ship. This took place on the California desert 10.2 miles from the desert centre towards Parker, Arizona. He was accompanied on this particular expedition by a number of people, including his secretary.

"At first glance it looked like a fuselage of a very large ship with the sun's rays reflecting brightly from its unpainted sides, at an altitude and angle where wings might not be noticeable. . . . Excitement filled the air as the truth was quickly realised and everybody began talking at once. Alice wanted me to get my telescope out of the car and take a picture of this beautiful ship so close by. Al Bailey wanted his Betty to take a movie of it while it was hovering, but she was so excited that she could not set the camera correctly. By the time she got herself calmed, the ship was already moving again.

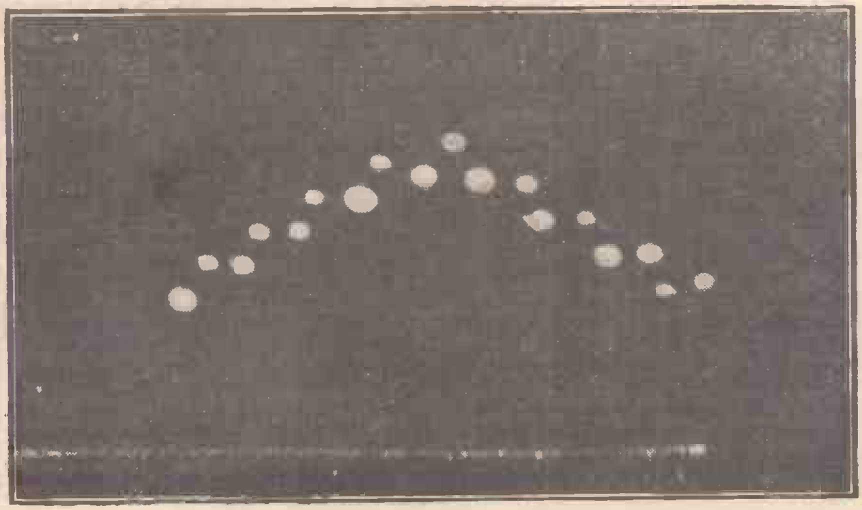
"Two pairs of binoculars which had been brought along were being passed rapidly from one to the other so all could get a good look. And it was with the binoculars that George noted a black or dark marking on the side as though an insignia of some kind was there. A member of the Air Force during the last war, Dr. George Williamson is well acquainted with the insignias of planes of other nations as well as our own. . . . I said 'Someone take me down the road—quick! That ship has come looking for me and I don't want to keep them waiting. Maybe the saucer is already up there somewhere—afraid to come down here where too many people would see them.'

"Don't ask me why I said this or how I knew, I have already said that I have a habit of following my feelings and that is the way I felt. . . . Lucy quickly got into our car and started the motor. Al asked if he might go too and climbed in beside her. Telling the others to stay where they were and to watch closely all that took place, I got into the back seat of the car. . . . We decided to try driving in closer and succeeded in making it safely, stopping within about 200 feet of my chosen spot. Here the large ship appeared to be almost directly over the car and as the car stopped, it also stopped ! . . .

"Al helped me unload my equipment, set up the tripod and fasten the telescope on it as firmly as possible. . . . But I did not want to waste too much time with these preparations because I did not know how much time I was being given. I felt a definite need for haste, but as I think back over my experiences I am not sure whether this feeling was coming from those in the big ship, or being created by my own excitement. . . . Not more than five minutes had elapsed after the car had left me when my attention was attracted by a flash in the sky and almost instantly a beautiful small craft appeared to be drifting through a saddle between two of the mountain peaks and settling silently into one of the coves about half a mile from me. It did not lower itself entirely below the crest of the mountain. Only the lower portion settled below the crest, while the upper, or dome section, remained above the crest and in full sight of the rest of my party who were back there watching. . . . Quickly I spotted it in the finder on my telescope and as rapidly as possible I snapped the seven loaded films, without asking time to focus through the ground glass in the back of the camera. But I was hoping and praying that Lady Luck was with me and that the pictures would turn out well. . . . Suddenly my reverie was broken as my attention was called to a man standing at the entrance of a ravine between two low hills, about a quarter of a mile away. He was motioning me to come to him and I wondered who he was and where he had come from. . . . As I

(*Continued on page 179*)

DETAILS OF LANDING GEAR.—This, the third of the telescopic series of pictures made on December 13th, 1952, gives a detailed view of one of the three landing spheres by means of which the saucer can apparently land in any direction. This ingenious arrangement would also facilitate manhandling on the ground.



TWO AMAZING FORMATIONS OF SPACECRAFT:—Compare this formation with the one at the top of the page. This was photographed against the Moon by George Adamski on May 29th, 1950, who says: "As I was observing the Moon through my six-inch telescope I noticed a number of very small pin-points of light apparently rising from the Moon's surface. I have observed this body endless times during the last twenty years, but I had never before seen anything like them. I quickly attached my camera and took this photo. Whether they were on the Moon's surface or hovering far out in space I cannot say. I only know that natural celestial bodies do not stop, start and change direction at will. I do believe that interplanetary travellers may use our satellite as a base from time to time." Many other astronomers have observed similar formations. The giant saucers shown above were estimated to be about 1,000ft. in diameter.

The Braking of Aircraft

The Hawker Hunter, which is fitted with an unusual braking equipment.

The Testing and Operation of Modern Aircraft Brakes

By MAURICE F. ALLWARD

FEW readers who visited the great air show at Farnborough will fail to have been impressed by the tremendous power of the thunderous jet engines that accelerated sleek fighters and big bombers to speeds of over 100 m.p.h. in a few seconds.

But how many gave thought to the relatively diminutive brakes which, at the end of each performance, quietly and effectively undid the noisy work of the engines and brought the aircraft to rest? Probably not many. Yet the performance of the modern aircraft wheel brake is just as impressive as that of the engines.

For example, the average family car has four brakes each of about 12in. diameter. The Percival Prince, weighing seven or eight times as much and landing at over 75 m.p.h., has only two brakes, 9in. diameter. The comparison is not strictly fair as the brakes are designed to cater for different requirements, but it does help to bring home the task now confronting aircraft brake specialists.

The higher landing weights and speeds of modern aircraft, jet engines and the reduction in aerodynamic drag owing to the use of nosewheel undercarriage, means that requirements have increased tremendously over the past few years. The rate of conversion of energy to heat has risen five-fold to over 1,000 B.Th.Us. per second, and torque requirements to 300,000lb./in.

The momentum of an aircraft about to land is stored as kenetic energy and for even moderate aircraft is measured in millions of ft. lb. Most of this is dissipated by conversion into heat within the brakes during the landing run. The relatively short stopping time means that little heat is lost by radiation or conduction during the actual run, so that the brakes have to absorb nearly all the heat generated without suffering damage. The brakes are, in effect, heat *reservoirs*, and the amount of heat that can be stored for a particular temperature is directly proportional to the weight of the brake and the specific heat of its elements.

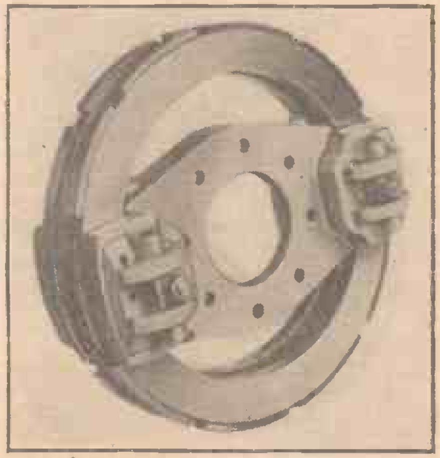
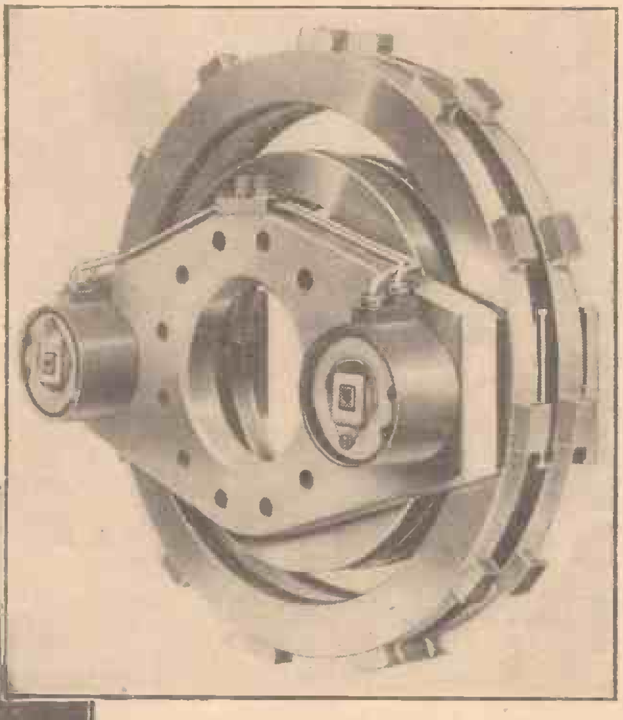


Fig. 2 (Left).—Palmer Disc Brake. The heat storing discs weigh 15lb. each and comprise 70 per cent. of the total weight of the brake.

Fig. 3 (Right).—Dunlop Plate Brake. This brake is used in many of the latest aircraft of all types. The operating rod passes through the gap between the discs and pulls them up against the torque flange. By working in tension it makes the fullest use of the strength of the material.



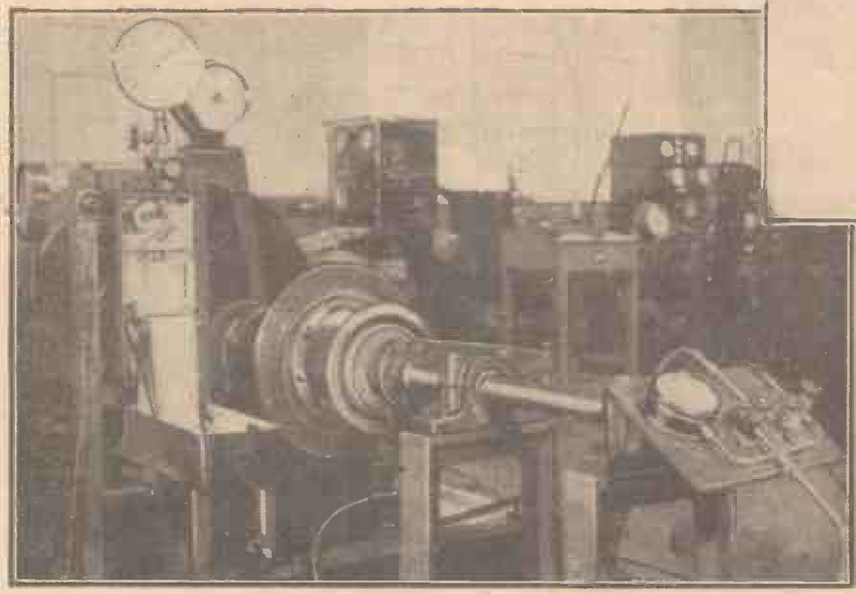


Fig. 1.—Brake Test Machine. The brake is in position in the wheel mounted on the end of the flywheel shaft. In the right foreground is the control panel for applying pressure to the brake. To the left is the time-torque recorder, behind which the massive flywheels are just visible.

Increasing Operating Temperature

Thus, if a brake can safely absorb a certain amount of heat, its capacity can be increased by increasing its weight and thus its heat storage capacity. And so, as might be assumed, designers have not found it easy to meet present-day requirements without a proportionate weight increase.

An obvious step to save weight is to increase the operating temperature, but when this remedy is applied to drum brakes—that is to brakes on which the actual heat *reservoir* is in the shape of a drum—many difficulties become apparent. These are such that it is generally thought that the solution is disc brakes. As the name implies, these are brakes in which the heat reservoir is in the form of a disc instead of a drum. The main advantage of this form of reservoir is that a disc, unlike a drum which dissipates heat from the wall opposite to the one on which it is generated and is thus prone to distortion, is heated on both sides and so has more even heating and cooling which reduces distortion. Also, instead of being rigidly bolted to the wheel like a drum, the brake disc floats freely and is isolated thermally from the wheel; thus the heat transfer by conduction between the two is kept low. The "open" design of the modern disc brake means that it is well ventilated and so cools rapidly after use, thus reducing the risk of tyre deterioration through excessive heat. A disc brake, therefore, in theory can be more readily operated at a higher temperature.

There may be some who although familiar with drum-type brakes are mystified by the term "disc brake," and a few words of explanation may help them to understand this type of brake which is now fitted to nearly all bombers, fighters and airliners.

The principle of the disc brake is quite simple. The disc is keyed to and rotates with the wheel. Astride the disc and fixed to the axle is a U-shaped frame housing the friction pads and operating piston. Normally the disc runs freely between the pads, but when the brake is applied, however, the disc is clamped between them, thus tending to arrest the motion of the wheel. The ordinary bicycle caliper brake is a form of disc brake, with the rim of the wheel acting as the disc.

Laboratory Testing

In view of the serious consequences that could arise from their failure, a comprehensive test programme for brakes designed for use of civil aircraft is required by the Air Registration Board. Another test schedule has been prepared for brakes intended for use on military aircraft, where the operating conditions can be quite different.

These laboratory tests are conducted on what the specialists call inertia machines. These usually consist of a motor-driven shaft to which various flywheels can be keyed and the weight and speed so adjusted to simulate the kinetic energy to be absorbed by the brake under test. The wheel, to which is secured the drum or disc, is fixed to the end of the shaft. The brake is mounted on a separate shaft concentric with the wheel, and this shaft is carried on a sliding saddle permitting the brake to be readily inserted and withdrawn for inspection (Fig. 1). An automatic recorder is connected to the brake and records the torque and stopping time for each run.

On the latest type of test machine the brake is tested more realistically and efficiently together with its wheel and tyre. This is effected by ramming the complete assembly against a rotating drum. These machines can reproduce the severe and intermittent loads often experienced during a bouncy landing.

Most of the inertia machines used for testing aircraft brakes incorporate air ducts which can supply a blast of air on to the brake similar to that which is experienced when the brake is actually on an aircraft.

For a "stop," as each individual brake application is termed, the flywheels are run up to the required speed, the motor is then disengaged and the brake applied. The flywheels are brought to rest in a matter of seconds. The temperature of the drum and other parts of the brake required is recorded and then, after a period to allow the brake to cool, the process is repeated until the series of tests has been successfully completed—or the brake has failed.

The programme for brakes for civil aircraft cleverly simulate the worst conditions likely to be met in service, and is divided into seven separate tests:

Fig. 6.—Aircraft Drum Brake. Drum brakes are still used on many of the smaller types of aircraft. On this high duty unit the friction lining is riveted in strips transversely across the supporting steel shoes.

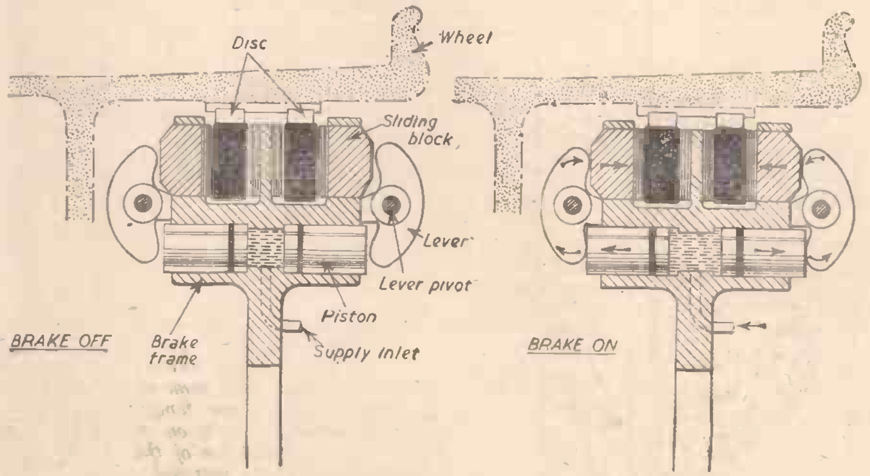


Fig. 5.—The principle of operation of the Palmer aircraft disc brake. With the brake off, the discs are free to rotate between the friction pads. When the brake is applied the pistons move apart and press the levers against the sliding blocks which move inwards and so clamp the discs against the centre friction pads attached to the brake frame.

The first requires that the static torque shall be measured at varying pressures or loads and is made to determine whether the torque varies with and is proportional to the operating pressure or load.

The second test is to ascertain the static torque developed in reverse, which must be sufficient to hold the aircraft on a slope of one in 10. More than one aircraft has suffered damage through coming to rest on an incline and the brakes then failing to hold! This test may be omitted in the case of brakes acting equally well in either direction, and as the normal drum and disc types of brake do so, it is thus usually only necessary in the case of brakes incorporating a servo action.

Several stops at reduced speeds are required for Test 3. These check the action of the brakes when applied fully at low speeds and bring to light any tendency of the brake to "grab" or "snatch" at such speeds.

General Performance and Wear Test

This entails making a series of "full K.E." stops and, as the title indicates, determines the general characteristics and reliability of the brake. Various observations are made including the time taken to bring the flywheel to rest, the temperature reached by the brake drum, or disc, various parts of the brake, and of the wear of the friction pads.

During this series the *Elapsed Time for Repeat Stop Test* is made. This entails making an ordinary stop and then waiting until the brake has cooled sufficiently to allow another stop to be safely made. The brake drum or disc (the heat reservoir), of

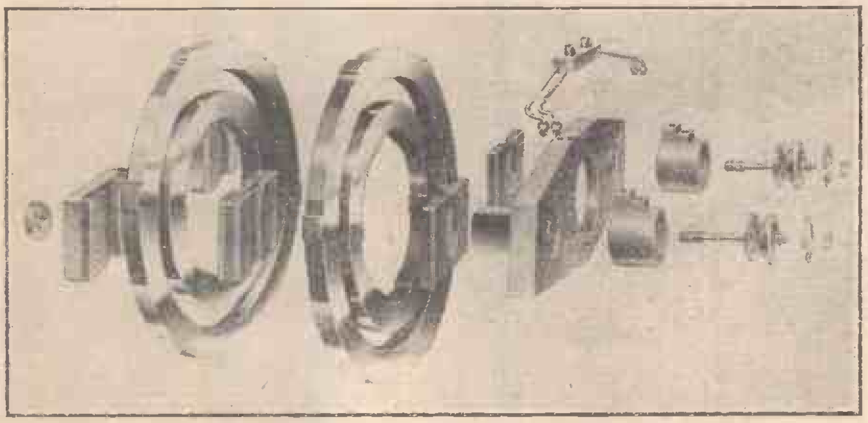


Fig. 4.—Exploded view of the Dunlop Plate brake.

course, cools steadily, but there is heat radiation to the remainder of the brake and wheel, the temperatures of which rise until a peak is reached. The time taken for the brake assembly to cool sufficiently to allow the brake to be used safely is noted and this time is later given in the pilot's notes. The figure is usually around 15 minutes. Imagine having to wait 15 minutes in your car after being halted by traffic lights before being able to start again!

Test No. 6 is termed the *Overload case*. As the title implies this ensures that the brake can be overloaded without failing. In service brakes can be overloaded if they are applied too early during a landing run and the speed of the aircraft is higher than normal, or in the event of engine failure during take-off when they might have to be applied with almost a full fuel load on board. For this test the inertia machine is adjusted to give 1.5 times the normal kinetic energy. The test is a severe one and often results in temperatures around the 1,500 deg. F. mark—with the brake a cheerful cherry red.

Over-use Test

The last of the series is the *Over-use Test*, and calls for two stops within five minutes of each other with no intermediate cooling. The second stop is thus made with the brake nowhere near cooled from the first and again is a very severe test and high temperatures are reached. This test reproduces a heavy application during a landing with immediate and intensive use during taxying. Damage to the brake is permitted so long as both stops are accomplished.

Much of the credit for the high performance of modern aircraft brakes should go to the friction lining manufacturers for the success of a promising design is often largely determined by the way the lining stands up to the extremely arduous conditions under which it operates.

It appears incredible that friction pads could be developed to withstand the repeated roastings experienced when acting against red-hot surfaces. But special high-duty materials have been developed that do not "fade" (lose their friction) at high temperatures and have reasonable wear characteristics. It is quite an experience witnessing a friction pad doing its duty during an "overload" test!

In their efforts to produce the lightest possible brakes consistent with safe operation, designers have been concentrating their efforts on reducing the weight of that portion of the brake not absorbing or storing heat, thus leaving the biggest proportion available for the disc or for "useful" weight. The result is that on some of the latest Dunlop plate brakes as much as 77 per cent. of the total weight is taken up by the heat-storing discs.

"Caliper" Disc Brake

Another light-framed brake is the Palmer "Caliper" disc brake (Fig. 2), on which a high proportion of the weight is also in the discs. The secret of these two brakes is that they both ingeniously eliminate the high bending loads inherent in some early designs, which necessitated heavy-jawed frames. The Dunlop plate brake (Fig. 3) does this by incorporating four discs, two inner and two outer, between the circumferential gap of which passes the operating rod working under *tension*. On the Palmer brake each disc is clamped individually and pushed towards a central friction member by a simple lever-operated hydraulic clamp (Fig. 4).

An unusual development is the arrangement used on the Hawker Hunter. On this aircraft the brake operating pistons are housed in bosses which are integral with the undercarriage leg itself. The weight of the frame is thus clearly negligible; virtually all the weight of the brake being "useful" in the discs.

But operators of aircraft are rarely satisfied for long. In spite of their efficiency, brakes are heavy items of equipment and on long distance aircraft such as the Comet and Britannia represent valuable lost payload. Looking for further ways by which to reduce weight, with the frame and operating mechanism already a low proportion of the total, thoughts are being turned to the disc operating temperature.

High Temperature Problem

If discs can be developed to operate safely at higher temepratures, then their weight can be reduced for a given capacity and a further saving made. In connection with this a representative on one stand of brake specialists at Farnborough, whilst commenting on this possibility, was heard to mention "temperatures of 2,000 deg. F."

Many difficulties will have to be overcome before temperatures of this order become possible. New friction linings will be required, although for this particular problem the answer may already be with us. A new lining material has been developed recently in America claimed to have remarkable properties. It contains no resin or other organic substance, but is a ceramic-based compound made of fired clay, with other ingredients added to give the necessary friction, long wear and non-abrasive qualities. The material is called Ceremetallic, and has been tested satisfactorily up to temperatures of 2,000 deg. F. In addition to not "fading" at such temperatures, the new lining lasts about five times longer than previous linings, and because of its low abrasive quality, brake discs may be expected to last up to *ten* times longer before replacement. Yet another advantage claimed is a higher thermal conductivity than conventional linings, important because heat will be transmitted more rapidly to the brake frame, thus adding the metallic mass of this for the storage and dissipation of heat.

When such a lining becomes available over here the performance of British brakes, already second to none, should be capable of further improvement.

Items of Interest

A Giant Gear Shaving Machine

CLAIMED to be the largest machine of its kind in the world, a turbine-gear shaving machine, designed and built by David Brown Machine Tools, of Manchester, has successfully completed its first test run at a Clydebank shipbuilding works.

Weighing 130 tons, the machine is 33ft. long and 16ft. high and can deal with marine main propulsion gears weighing 100 tons.

Gear shaving is a comparatively new finishing process which reduces minute errors in gear teeth. This gives quieter running and longer life to the gears.

A New Steel

A NEW steel, which has been named "fortiweld," has been announced by a Sheffield firm, the United Steel Companies, Ltd. It was found that when a little-used element, baron, was used with molybdenum, the yielding point of a low-carbon steel was doubled, without heat treatment. An ounce of baron added to a ton of steel containing 4 per cent. of molybdenum was sufficient to produce the improvement. Capable of withstanding two or three times the stress of mild steel, "fortiweld" is being used in aircraft engines and bridges.

New Diesel-driven Railcar

A "CINDERELLA" existence is being enjoyed by the 17-miles-long branch line between Gravesend and All Hallows (Kent), where a new diesel-driven railcar—a prototype—is being tested. Although the travellers on this line will soon be back to normal with their 50-years-old "push and pull" steam engine and ancient coaches, the "shape of things to come" has made a big impression. The new railcar resembles a cross between a train and a single-decker bus; passengers sit in double seats facing forward as in a coach. The train, practically noiseless in operation, is lightweight in construction and incorporates many new ideas.

The new diesel-driven railcar seen running into Gravesend Station during one of its test runs between All Hallows and Gravesend.

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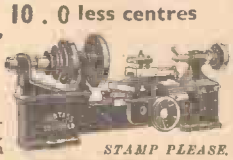

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Mr. Clive Wayne, of Thorpe Bay, gives his radio-controlled model of H.M.S. "Southampton" a trial run at Southchurch Park, Southend.

A GREAT deal of interest can be obtained from the radio control of models and other mechanisms, and the equipment need not be of a very complex nature. It is accordingly proposed to set out the methods which may be employed and to indicate suitable circuits. Such equipment is most usually employed to control model boats or aircraft, but mobile runabout models are equally suitable, and in some cases more convenient. The same methods can be used to control fixed mechanisms, broadcast-band receivers, or any other equipment.

The simplest type of model-control system is of the "On-off" type, and is shown in Fig 1. Almost all forms of control are elaborations or improvements of this method.

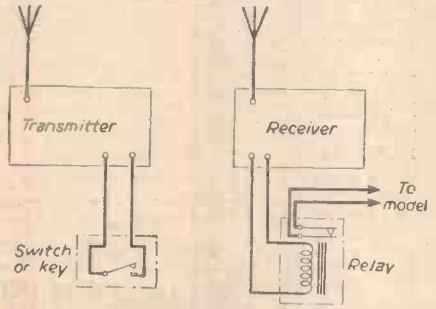


Fig. 1.—Basic method of operation.

Here the transmitter may be assumed to be of the "carrier wave only" type, and this radiates an unmodulated radio wave of the required frequency, when switched on. Switching is usually of the push-button type, or a Morse key or any similar means may be employed, if desired, for keying the transmitter. Such a transmitter may have one or more valves, according to the power required, and may be mains or battery operated. In the interests of portability, battery operation is most usual, especially as the power of the transmitter may not be increased beyond a limit fixed for such equipment.

The receiver may contain one or more valves, or may in some cases be of the valveless type. When the carrier wave radiated by the transmitter is picked up, the relay is caused to open or close, according to the manner in which it is wired. Operation of the key or switch at the transmitter therefore results in a circuit at the receiver being opened or closed, thereby controlling the model.

Rudder Control

Actual control of rudder or other mechanisms is achieved by using an actuator. This may be a small electric motor, which turns the rudder or other mechanism through reduction gearing. Or an electro-magnetic mechanism may be used, or a spring or elastic mechanism controlled by a magnetic catch. Such actuators may readily be made up, or can be purchased ready for use, and it is not proposed to cover their construction in detail at the present.

In a very simple model or apparatus, the relay could serve as the means of control. A motor might thereby be started or stopped, or a lamp or other receiver could be switched on or off. In more complicated models, other relays and mechanisms may be added so that other units may be controlled. In a boat, for example, it may be necessary to start, stop and reverse the propulsion motor, and control the rudder, for steering.

Transmitter Regulations

No special licence is required for the operation of a M.C. (Model Control) transmitter, provided the equipment is used in such a way as to minimise interference. To achieve this end, the transmitter must operate within the band between 464 Mc/s and 465 Mc/s, or in the band between 26.96 Mc/s and 27.28 Mc/s. For most purposes, the 27 Mc/s band, with a wavelength of approximately 11.11 metres, is most convenient. The higher frequency band requires radio circuits of a somewhat specialised nature—a disadvantage which does not arise with the 27 Mc/s frequency.

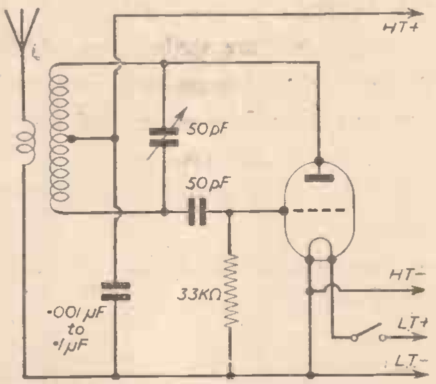


Fig. 2.—Self-excited one-valve transmitter.

The power output of the transmitter is also limited and the D.C. power input to the anode circuit of the valve or valves energising the aerial must not exceed 5 watts. With small 1 or 2 valve transmitters, there is normally little danger of exceeding this maximum. If there is any doubt, however, the actual figure may readily be calculated. To do this, any heater or filament currents are disregarded. So is the anode current of any crystal-controlled stage, driver stage, or other stage not energising the aerial. The anode current of the valve or valves energising the aerial should then be measured, and expressed in amps. (1,000 milliamps equal 1 amp.) This figure is multiplied by the high tension, or anode, voltage. The resultant figure expresses the wattage, and should not exceed 5. An example will make the calculation clear, and it should always be applied in cases of doubt. Assume that a 100v. H.T. supply is used, and the valve energising the aerial draws 25mA. 25mA = 0.025 A. 0.025 x 100 = 2.5. The transmitter would therefore be rated at 2½ watts.

In order that the transmitter may be kept within the permitted band, it may be crystal-controlled, or may be tuned to the desired frequency by means of a frequency-meter. The tunable type of transmitter enables maximum output to be obtained with minimum circuit complication, while the crystal-controlled transmitter has the advantage of frequency stability. In each case the receiver is tuned to the transmitter wavelength so as to obtain maximum sensitivity.

Self-excited Transmitter

This is the simplest form, and shown in Fig. 2. Any mains or battery-operated pentode, screen-grid, or triode valve can be used, including "all-dry" 1.4 V. types. The output obtained will depend largely upon the type of valve and H.T. voltage. Small detector or L.F. type valves, with low H.T. voltages, can be used for experimental purposes when the receiver is situated near the transmitter. But to obtain a reasonably satisfactory output for controlling the model at range, a power type valve is required, with a H.T. voltage of 100 to 150. Sufficient output can then be obtained for controlling the receiver up to ¼ mile or more, according to the sensitivity of the receiver and type of aerials used.

Such a transmitter, if battery-operated, will not give the full permitted output. The output of the transmitter may be increased by adding further valves, or an additional valve used in push-pull with that shown.

Self-supporting Coils

Self-supporting coils are suitable for both transmitter and receiver, and a coil for the 27 Mc/s band is shown in Fig. 3. It must be emphasised that exact coil-winding details for the band cannot be given because stray capacities in valve, holder and wiring can be sufficient to place the frequency of operation outside the band. It is therefore neces-

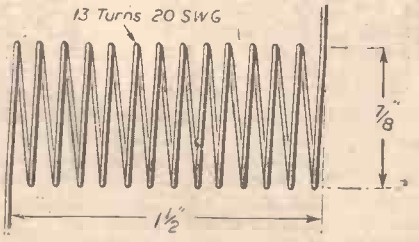


Fig. 3.—Details of a coil for a transmitter or receiver.

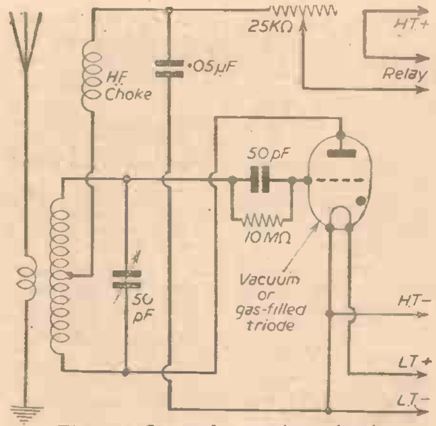


Fig. 4.—One-valve receiver circuit.

sary to use a frequency meter to tune the transmitter to the correct frequency. If the inductance of the coil is a trifle too large, the coil can be pulled out slightly; if too small, the turns may be compressed so that the coil is slightly shorter. The coil should be rigidly supported by short leads and centre-tap soldered in position.

Coils may also be wound on formers and this reduces the chance of wavelength changes due to rough handling. If a ribbed former is used, approximately 2 turns should be removed (e.g., an eleven turn winding employed). With a plain former stray capacity will be further increased, and 8 to 10 turns may be sufficient.

Transmitter and receiver will usually work at maximum efficiency when stray capacity is at a minimum, and the actual strength of the signal radiated will vary according to the design of the coil, as can be found by checking with a signal-strength meter. With power-type valves, the leak in Fig. 2 may be reduced to 15K if maximum output is required.

The transmitter can be switched on and off by breaking the filament circuit as shown. Rapid keying, for control of the model, can be achieved by using a switch or key in the H.T. circuit.

Quenching Receiver

A receiver circuit suitable for use with the transmitter in Fig. 2 is shown in Fig. 4. This is a popular circuit. It can be built in a very small space and only requires very small batteries, as the current consumption is low (about .05 amp at 1.4 v. for the filament, and 2mA or so for H.T.). In addition, it can be sufficiently sensitive to permit control of up to ½ a mile or more when a reasonably powerful transmitter is used.

The circuit is tuned to the same frequency as the transmitter, and is in a state of continuous oscillation. When the transmitter radiates, the signal is picked up at the receiver, changing the amplitude of oscillation and causing a change in anode current. This change in current operates the relay, the armature contacts of which control the actuator or model.

Either a vacuum or gas-filled valve may be used, the former being most suitable for short-range experimental work, when normal life will be obtained from it. The gas-filled valve permits of much increased range, since the change in anode current is very much greater. It has a rather limited working life, however, though this need not be a very severe disadvantage in the case of an actual model. The Hivac XFG1 valve is of this type, and has a maximum anode voltage of 45, with a maximum recommended anode current of 1.4A. As would be expected, the life of the valve may be increased by operating at reduced anode currents, when maximum range is not wanted.

The variable resistor may be about 25K to 50K, according to H.T. voltage and the resistance of the relay winding. It serves to control the violence of oscillation, in conjunction with aerial coupling, which influences the damping imposed on the tuned circuit.

When setting up such a receiver, a meter should be included in the H.T. circuit, and the tuning condenser adjusted until the deflection is at a minimum, when the transmitter is switched on. This shows that tuning is correct. If the correct tuning position cannot be found, it may be necessary to extend or compress the coil slightly. The receiver should then be moved to some distance (say 25 yds.) and the variable resistance and aerial coupling adjusted until the maximum dip in anode current arises when the transmitter is switched on. As the distance between transmitter and receiver is

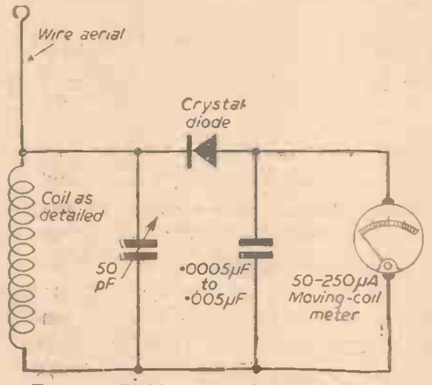


Fig. 5.—Field or signal-strength meter.

increased, adjustments will become progressively more critical. For operation at maximum range, accurate tuning and adjustment of the regeneration control become essential.

Types of Aerial

In order that the circuits given may be used to best advantage, the influence of the aerials must be kept in mind. The transmitter should always be tuned to the correct frequency with the actual aerial which will be used, and the receiver should similarly be adjusted with its proper aerial, since changing aerials may affect frequency and damping.

For short range experimental work, self-supporting wire aerials may be used on both transmitter and receiver. Aerials 9in. to 18in. long can be used, and may be connected directly to the coils, no aerial coupling winding being required. In the case of the transmitter, the wire may be connected to the anode of the valve; with the receiver, a tapping a few turns down the coil can be used.

When experimenting with transmitter and receiver in close proximity, it may be necessary to remove the aerial from the transmitter, to avoid a powerful signal which makes accurate receiver adjustment impossible.

Range will be greatly increased by using longer aerials, though there is seldom much necessity to employ more than 8ft. or so at the transmitter, and 4ft. or so at the receiver. In some models, the receiver aerial may be very short. Such aerials can readily be built up by using the 1ft. long interlocking sections available from many sources. The lower section may be fitted vertically in a suitable mount, and other sections added as required. If maximum range is required (which is rarely the case) the transmitter aerial may be adjusted to exact resonant length. This is best done by setting up a signal-strength meter at 50 to 100 yds. range, with a second person in attendance, and then modifying the transmitter aerial a little at a time until maximum radiation is secured. Such longer aerials should be energised by an aerial coupling winding. The free end of this may be wired to H.T. negative, or to a metal spike inserted in the ground, or taken to a counterpoise earth. Alternatively, the winding can energise a di-pole. If a signal strength meter is used, such as shown in the circuit in Fig. 5, the change in radiated power with various aerials will be immediately apparent. If the meter in the signal strength unit is of sensitive type (say 100 microamps down, full-scale deflection) it should not be brought near the transmitter, with full aerials attached, or damage may result, unless the transmitter is of exceedingly low power.

After transporting the equipment, it is always wise to test the transmitter for correct frequency and maximum obtainable output, and the receiver for maximum sensitivity, at fair range.

Floodlighting for Sports Ground

A NEW floodlighting installation at the Molineux Ground of Wolverhampton Wanderers Football Club was recently inaugurated. The efficiency of the lighting system enables the play to be followed with ease and the ball can be followed without difficulty both on the ground and in the air.

Four pylons approximately 110ft. high have been erected, one at each corner of the ground, and mounted on each is a battery of 15 special Holophane projector units. These units have been developed to enable high peak beam intensities of 85,000 candelas to be provided by using 1,500-watt standard

general service lamps for the main illumination for central play. Higher intensities of 110,000 candelas with 1,000-watt Class B.2 projector lamps are used for the long range lighting of the goal areas.

The installation was designed and carried out by Frances Electric Ltd., of Darlaston, Staffs, in conjunction with Holophane Ltd., Elverton Street, Westminster.

LETTERS TO THE EDITOR

The Editor does not necessarily agree with the views of his correspondents.

The Theory of Unity

SIR,—May I congratulate your excellent magazine on publishing the article by Mr. Avenel. There is no doubt that your open-minded readers, interested in astrophysics, read the article with considerable interest—anyway it made one think. I do not agree with all that Mr. Avenel has to say, but he is capable of original thought, a rare quality, and usually condemned by authority.

Then, I ask myself if Avenel's ideas are any more extraordinary than Hoyle's theory of the origin of matter by the spontaneous creation of hydrogen. This summer I had the privilege of listening to an address given by Hubble (whose recent death is a great loss to the U.S.A. and the world at large) at an R.A.S. meeting; he showed us the magnitude of error in our previous ideas of time and distance. From time immemorial new principles have been replacing old ones that had even been proved—but albeit fallaciously.

Let us have more articles about new ideas on all subjects that your magazine covers. The times when men were put away by authority for maintaining that the earth was spherical have now gone—I believe that Darwin had difficulty in finding a publisher for his "Origin of the Species," so thank you for sparing the space for such controversial subject matter. I shall try to keep an open mind and will enjoy reading constructive criticism from abler persons.—JOHN D. KING (Purley, Surrey).

SIR,—Congratulations to Antony Avenel and the editor for the Unity theory.

To me it seems that the value of the theory is in rationalisation and reconciliation, for it enables these puzzling things to be explained by the same means—the negative result of the M and M experiment, gravity, electricity and magnetism, and the lengthening and shortening of time and space owing to motion, as calculated by Einstein; it also enables time and space themselves to be explained by the same means.

It really is a brilliant piece of work which opens up an entirely new approach to these puzzles, but the theory is for the man wishing to take a broad view, not for the person with the painstaking mind who *must* search for an error of a halfpenny in ten thousand pounds.

One complaint I have is the reference to flying saucers—surely this is sheer speculation and out of place in the practical and logical reasoning of the article?—J. DIXON (Driffield).

SIR,—Mr. Antony Avenel's article on the "Unity of Creation Theory" interests me, since it comes nearer to my own ideas on the subject than any other theory known to me.

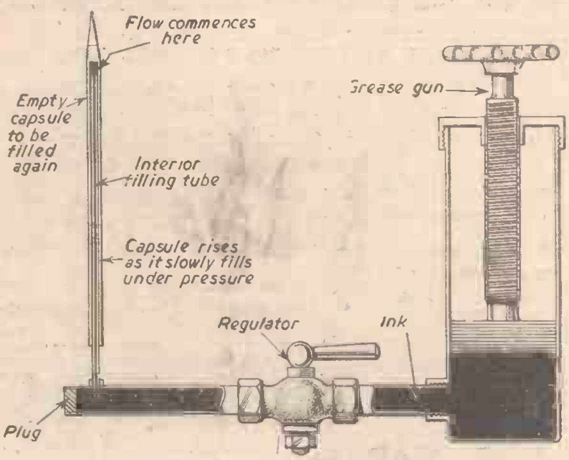
I am, however, not in agreement with him on some of the details one of which affects our conception of the aether. The description of the action of gravity which, with minor differences, is, I believe, substantially correct, indicates that this force is produced by the interception of a "carrier" wave by matter. There is little difference in effect between intercepting a wave and intercepting a general motion as can be seen when one examines a sea wall which has been destroyed. The obstruction not only feels the effect of the wave, but also affects the wave motion. Thus the obstruction obstructs a wave motion in much the same way as it obstructs the motion of a stream.

You thus cannot have a drag on the obstructing matter without a corresponding drag on the aether and this contradicts the statement that you cannot have an aether drag. I suggest, therefore, that this statement is incorrect.

This leads to a more material aether which will be dragged along by bodies such as the earth. This explains the negative results of the Michelson-Morley Experiment without any need for the Lorentz contraction.—R. LESLIE (Kent).

Filling A Ball-point Pen

SIR,—In reply to a reader who recently asked for information on how to fill a ball-point pen, this can be done in the following manner: A motor-cycle grease gun is fitted with a short length of brass tubing and a regulator tap, as shown in the accompanying sketch. Near the end of this tube, which is plugged, a hole is drilled to take a length of small diam. tubing which fits inside the ball-point capsule. The ink for the refill is placed in the grease-gun container, and on screwing down the plunger the ink is forced up the narrow tubing and slowly raises the capsule until it is filled.—T. SALMAN (East Ham).



Arrangement for filling ball-point pens.

Oil-burning Unit for Stoves

SIR,—Re the query from Mr. R. J. G. Outing (Essex) in PRACTICAL MECHANICS for October, I converted three ordinary slow combustion stoves and had the same trouble experienced by Mr. Outing. I tried a larger vaporiser tube; I also put a thick covering of fireclay round the tube, but had to clean out repeatedly. I almost gave the idea up altogether when I thought of a modification which was a great success.

I discarded the idea of the tube running through the body of the stove and made the tube to run alongside the stove and enter the side of the burner box and run through just long enough for a socket and plug to facilitate cleaning. The tube running through the burner has four ¼in. holes drilled through. The scheme gives me no trouble apart from cleaning out with a strong wire before I light up in the morning. It is also a simple matter to clean the tube while the stove is burning if you wish, although I have never found this necessary. I am sure if Mr. Outing adopts this idea he will have no further trouble.

I have also a large filter fitted over the pipe in each supply tank, and these I take out once a week to wash them in paraffin. I find these filters keep back sediment which clogs the taps and stops the oil flow.—R. ROODHOUSE (Doncaster).

Interplanetary Space Travel

SIR,—Interplanetary travel is impossible! We all know that our solar system exists by virtue of a balance between natural forces, i.e., the earth rotates around the sun at a distance determined by the balance between the centrifugal force exerted by the earth in its rotation and the sun's gravitational field. Also the moon is held in its path around the earth by a balance between the earth's gravitational field and the centrifugal force exerted by the moon in its rotation around the earth.

These paths are in fact eliptical, due to the influences of other forces and combinations of forces.

However, to get to the moon is quite possible and comparatively simple, but when would-be space travellers talk about "free space" I am afraid they are in error. There is no such thing as "free space"! Once outside the earth's gravitational field a space ship would be irresistibly attracted by the sun and would proceed in that direction at ever-increasing speed.—A. D. MUXLOW (Middlesbrough).

Microscope Lamp

SIR,—I feel sure that Mr. Charlett will not mind a few comments on the simple microscope lamp described in your October issue, because it so happens that I have been using a somewhat similar arrangement for some time now, and believe that I can suggest one or two improvements.

First, regarding the power of the lamp. I have substituted a 60-watt pearl, and feed this from a supply of 40 volts higher than the marked voltage of the lamp.

If the user is on 240-volt supply, then it is easy to get a lamp of 200 volts and no other alteration is necessary, but, in other cases, it is necessary to boost the mains with a 40-volt transformer in series with the lamp.

This is rather a good idea because, when the primary is switched off, the lamp runs on the lower rating, only taking the higher voltage when desired.

Regarding the housing, I found it better to use a double jacket, the inner one only just a fraction larger than the bulb, with plenty of ventilation top and bottom, and the outer one about ½in. larger all round. This ensures that the outer casing keeps far cooler, a factor of importance where the lamp is used for several hours at a time.

A piece of daylight glass filter is fixed permanently in position, and this, combined with the overrun lamp, gives a very intense light, which approaches daylight far more than any other that I have tried.

The final change is in the size of the aperture, which I have found must be fully 2in. in diameter if a low-power objective is in use, otherwise the field is not completely filled.

I therefore use this size, and have fitted a condenser in front of it so as to completely even up the illumination.

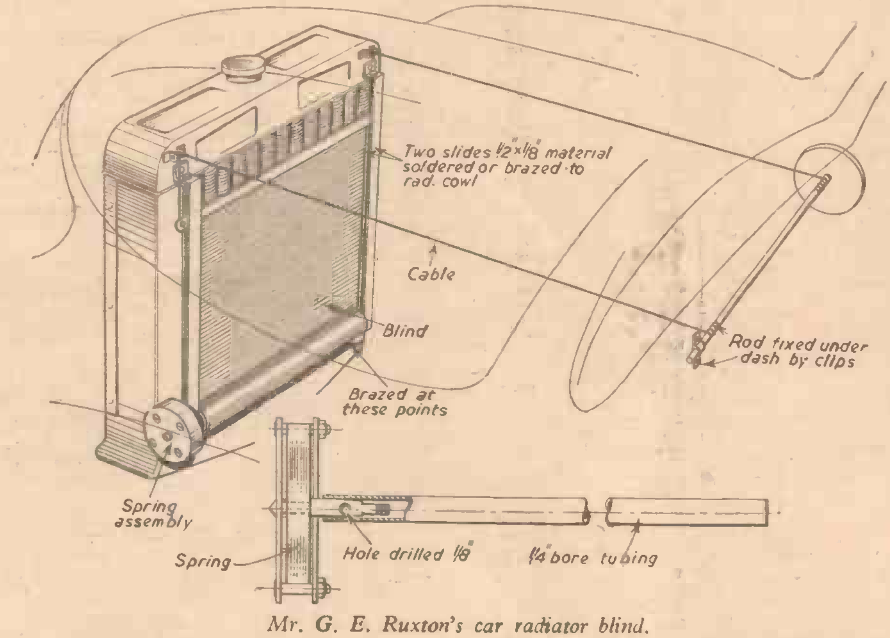
When using a high-power objective, the aperture is reduced to ½in. or even ¼in., according to the accuracy of the correction of the substage condenser.

An extra point worth mentioning is concerning the use of Cellophane for filters. As Cellophane is optically active (pleochroic), it interferes with the accuracy of some observations made with polarised light, and should be avoided if possible.

In conclusion, may I say that I use my lamp for all routine observations and due to the excellent daylight effect, I find it far superior to natural daylight, which is always varying.—S. PATRICK (New Eltham, S.E.9).

Car Radiator Blind

SIR,—In reply to the letter by Mr. D. T. Dickinson in the "Information Sought" column in the August issue in which he asked for details of a radiator blind for an Austin A40, I offer the following design. The sketch and details, however, are for a radiator blind not specifically designed for an A40, but the necessary alterations will probably be slight.



Mr. G. E. Ruxton's car radiator blind.

The materials required for the spring assembly are as follows: two 1/16in. thick circular plates, as in sketch; four ⅛in. csk. metal screws and nuts; four small sleeves, 5/16in. long with 3/16in. bore; spindle from the gear of an old alarm clock and spring.

The spindle should be drilled ⅛in. and then a suitable length of ¼in. bore tube obtained and drilled the same. The tube is then pushed over the spindle end and they are riveted together. When assembling the spring, first place the inside disc, then the spring, fitted to wind in an anti-clockwise direction. Next place the spacers and put the spindle in position, making sure that the small lip on the spindle is in the right direction for catching spring. All these details are shown in the sketch. A small plate is brazed to the inner disc and the other end bolted to the radiator cowl to hold the spring assembly firm.

The purpose of the spring is to keep the blind taut, and this is very important because the distance between the radiator cone and impeller boss is not great. The suction of the fan would tend to draw the blind if it were not held firmly and the spring just gives the necessary degree of tightness.

The top edge of the blind, which is made of canvas, is attached all along its length to a strip of metal which overlaps the blind at each edge. Two small holes are drilled, one at each end, to take the Bowden cable. This strip with the blind attached runs up and down between two guides made of ½in. x ⅛in. material brazed or soldered to the radiator cowl. Each slide consists of two pieces and two slides are fitted, one each side of the blind. The Bowden cables actuating the blind are taken to the dashboard via miniature pulleys similar to those used for the 3-speed cable of a pedal cycle.

The driver actuates the blind by means of a rod fixed to the dashboard by clips and a turnwheel, by means of which he winds up the Bowden cables, thus raising the blind.—G. E. RUXTON (Rainham).

Cleaning Plastic Cups and Saucers

SIR,—In reply to Mr. E. W. Collins' question (November, 1953), may I suggest the following treatment for the plastic saucers. Prepare ¾ bucketful of water (hot or cold) and add ½ cupful of Parazone. Leave for ½ hour, then remove saucers and wash with hot water, rinse and dry, thus removing tea stains and odour of Parazone.

The above method has proved excellent even with very dark stains. I have not tried it with plastic cups for we do not use them, but it should be effective.—EDISON P. MORRIS (Llanelly).

Stereoscopy

SIR,—Regarding the article on stereoscopy in the December issue, "Physicist's" article is interesting as far as it goes, but is rather weak on history and on direct-viewing systems.

The anaglyph method was used long before the 1920s, even for motion pictures. Invented by the German physicists, Dove and Rullmann, in 1856, it was re-invented by d'Almeida and (as usual) by Ducos du Hauron. Anaglyphic motion pictures were shown in Paris round about 1903, and have been made on or off ever since. As a method of viewing still stereograms it was well established before 1914, and has been in widespread use ever since. Many middle-aged and older readers will recall anaglyphs in books and periodicals of their childhood, and I cannot recall any time in which some anaglyphic publications have not been on sale in my lifetime. The anaglyph is, of course, a long-established concomitant of topographical survey.

Even polarised-light stereo motion pictures had been demonstrated before 1910, polarisation and analysis being achieved by piles of thin glass plates, as was usual up to the commercialisation of "Polaroid." This had been invented by Merapath about a century earlier, but the invention was overlooked.

Polarised stereo films in colour were very successfully displayed at both the New York World Fair and San Francisco Exposition of 1940. Current American stereo production is based on the experience gained there, and theoretical investigations commissioned from Dr. Rule, then of the M.I.T.

"Physicist" omits the "Vectograph" form of polarised print, familiar to many during the war, when it was applied to lantern slides and opaque prints from aerial photographs. Here the two stereo components are printed by imbition on polarised material and superimposed to form a single composite image in which the components are polarised at right-angles. Thus, stereo films can be projected by an unmodified single standard projector.

The Russian direct-viewing system does not use lenticular screens, but a fan-shaped grid of wires masking unwanted strip components by parallax. The basic idea is old, widespread, and well developed throughout the world, including Britain. It has not been used commercially so far outside one theatre in Russia because, *inter alia*, of the cost of the screen.

A recent, and very successful, form of this uses a rotating basket-shaped grid. It is most efficient from any part of the auditorium, but so far has been made only for screens of "home-cine" size. Naturally, the rotating basket must be as large as the projected picture.

Lenticular auto-stereograms as stills have been made for many decades. Since 1945 they can be seen almost anywhere in Britain, mainly as advertisements, and the whole process is on an ordinary commercial footing. The plastic lenticular screens (for still pictures) are remarkably cheap. The taking and printing equipment is not. The difficulty with projected images is that of registration aggravated by slight dimensional instabilities.—R. A. FAIRTHORNE (Hants).

Flying Saucers

SIR,—The subject of your "Fair Comment" (November issue, 1953), appears to need very close investigation. Many observers of these "flying saucers" have reported that they *have* seen something tangible and solid, and it is noticed that the shape and character of the object is the same in almost every case. Besides—and I am allowing for illusion—the integrity of several of the observers is beyond doubt.

Myself, I say without hesitation, the "flying saucer" is fact; the Venusian part of the story, however, is not even fiction in the true sense, but is actually a cloak to the devilish immediate use of this otherwise wonderful machine.

Sooner or later we shall know the wonderful features of this aircraft and then I think it will be understood why the secrecy of it was so complete. It becomes comparatively simple for an aircraft which can travel at 10 or 20 times faster than the speed of sound to hide its whereabouts.

It is obvious that extremely revolutionary ideas have gone into the construction of the "flying saucer," and it is these ideas, rather

(*Continued on page 179*)

READERS' SALES AND WANTS

The pre-paid charge for small advertisements is 6d. per word, with box number 1/6 extra (minimum order 6/-). Advertisements, together with remittance, should be sent to the Advertisement Director, PRACTICAL MECHANICS, Tower House, Southampton Street, London, W.C.2, for insertion in the next available issue.

FOR SALE

70,000 8 B.A. BRASS C.H. SCREWS, ⅛in. long, ⅛ dia. head, 1/6 per gross, or offer for lot. C. H. T. Calver, 32, Berkeley Ave., Romford, Essex.

THE "E.W." 2½in. x 10in. Convertible Lathe, unrivalled in its class; prices from £13/4/-, or no fuss credit terms; s.a.e. for brochure and details. Wanstead Supply Co., 48, High Street, London, E.11.

TWIST DRILL BARGAINS, 16 Chrome Vanadium, 1/64in. to ¼in. x 1/16in., 12/6; 8 C/V Drills, 1/32in. to ¼in. x 1/32in., 6/9; 8 Carbon Steel, 1/16in. to 3/16in., in plastic case, 4/6; all 3 offers 22/6; post free. H. Lockwood, 44, Disraeli Street, Burnley, Lancs.

DRAUGHTY FLOORS MAKE A COLD HOUSE. Cover your concrete and wood floors with ¼in. thick Hardwood Ply Parquet; choice of 6 patterns from 11/- sq. yard, delivered. Send 1/- for sample and booklet (refunded on first order). New-Een (PM), 101, Kings Cross Road, London, W.C.1.

HIGH-SPEED LATHE TOOLS, set of 12, ⅜in. square 40/-, ½in. square 65/-; 24 high-speed Drills, up to ⅜in., 17/6; 5-pint Brazing Lamp, list £7/15/-, our price 70/-; Surface Plates, 12in. x 8in., 40/-; carriage 4/-. Stamp for lists of tool bargains. Mibro Equipments, 65, Knaresborough Rd., Harrogate.

PERSPEX Pieces, Fittings, etc., lowest prices. Hardy Plastics, Bishop Street, Stockton/Tees.

YOUR WORKSHOP, OFFICE OR HOME; switch on to Fluorescent Lighting; more light, less money; first-class fittings at a price you can afford; 5ft. 80-watt Trough, £1 down and 4 payments of 12/6; 4ft. 40-watt Batten, 15/- deposit and 4 payments of 9/-; fittings less tube; carriage 5ft. 6/6, 4ft. 4/6. S.A.E. details. Wanstead Supply Co., 48, High Street, London, E.11.

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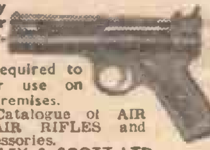

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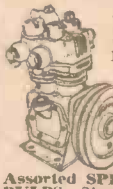

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LETTERS TO THE EDITOR

(*Continued from page* 176.)

than the power plant, that gives tremendous speed.

Several of these revolutionary ideas have become apparent to me since I began to search for reasons for its fantastic speed, which has been reported by competent observers as being " like a shooting star."

It is well known that pressure set up by high-speed flying tends to immobilise the human body, yet this is not so with the " flying saucer."

One of the most wonderful ideas used by the " saucer" is a means by which the machine can isolate itself from air resistance to its passage of flight, and yet another idea is employed which allows the saucer to tap the isolated pressure when it is required that the machine should travel from one point to another.

A unique feature of this wonderful machine is its ability to " re-use " the exhaust pressure after it has left the machine. This unique feature is actually responsible for very high, effortless, comfortable and pressure-less. speed; in other words, unlike the conventional type of aircraft, the " flying saucer " *uses* air resistance and does not battle against it.

On the initial "take-off" this wonderful machine begins to isolate itself from air resistance to all directions of forward flight. Thus, the movement necessary for " take-off " gives vertical rise only, and at a required height in vertical rise a method is employed which allows the machine to tap the isolated air resistance to any forward direction of flight and a point of air resistance corresponding to any point on the compass can be selected, which means, of course, that while the " saucer " is revolving at one point in the air, it can select any direction in which to travel. The conventional type of aircraft must, at " take-off," travel in the direction which its nose points.

What has made me so eager to search for these revolutionary ideas is the fact that newspaper reports have stated that, although our experts have been investigating " flying saucers " since 1947, they remain baffled. Seeing that we must remain second to none in the air, these ideas which I am confident have gone into the " flying saucer " are available under the usual conditions to any aircraft company who wishes to bring them to reality. —V. A. MILBURN (Kent).

SIR,—Your comment on the book, " Flying Saucers Have Landed," in the November issue, does not appear to be entirely fair.

You state: " One wonders how the Venusian knew that we had named his planet ' Venus ' and how he knew of our atomic experiments." Mr. Adamski, the co-author, explains clearly how he elicited this information by a series of plain gestures and repetitive words: the space visitor only repeated the word Venus after Adamski had said it three times with his illustrative gestures. Also, atomic experiments are not mentioned as such, but purely radiations due to large explosions. If we are being as constantly watched by superior beings in " saucers " as the widespread reports suggest, evidence of atomic explosions and radioactivity could hardly be missed. Your concluding remark that " the whole of the book savours of science fiction " is meaningless as any factual space craft landing or story would do so; this type of subject is the very essence of science fiction. However, there is good and bad science fiction, and while maintaining an open mind on this book I would submit that even if it is not true it is very good science fiction.—A. CARLTON SMITH (Stevenage).

Restoring Hardened Boot Blacking

SIR,—With reference to Mr. G. Lovegrove's query on the restoration of hardened boot blacking on page 90 of the November issue, it should be pointed out that cold solvents will not convert the hardened mass into a paste. Modern paste boot polishes are made by forming a hot solution of the waxes and dye. The general rule with all solvents is that they will hold more solids in solution hot than cold. On cooling, solids are deposited, and we are left with a mixture of a saturated solution plus solid. This is what happens with boot polish, the solid being so evenly distributed in the saturated solution that a paste results. This principle must, therefore. be followed in the reincorporation of the evaporated solvent.

The proportion of solids to solvent is generally in the neighbourhood of 25-75. White spirit (turpentine substitute) is the usual solvent now employed. Mr. Lovegrove should therefore proceed as follows: Weigh the hardened blacking and for each gram allow 3ml. of white spirit. Heat the white spirit in a water bath which has been boiled and the flame removed. Melt the hardened blacking in another water bath, remove the flame and stir in the hot white spirit. Stir till the whole forms a homogeneous solution, remove from the bath and continue stirring until thickening commences. Then pour into the blacking tin.—LAWRENCE A. FANTOZZI (Cheshire).

HAVE SPACESHIPS LANDED?

(*Continued from page* 165)

approached him a strange feeling came upon me and I became cautious. At the same time I looked round to reassure myself that we were not in full sight of my companions. . . . I could see he was somewhat smaller than I and considerably younger. . . . His trousers were not like mine. They were much like ski trousers. . . His hair reached to his shoulders. . . . Now for the first time I fully realised that I was in the presence of a human being from another world! . . . He extended his hand in a gesture toward shaking hands."

After a much fuller description of the height, weight, appearance and general demeanour of this space man, Mr. Adamski proceeds to the interview. " I asked him where he came from, but he did not seem to understand my words. His only response was a slight shake of the head and an apologetic expression. I am a firm believer that people who desire to convey messages to one another can do so, even though they neither speak nor understand the other's language. This can be done through feelings, signs and, above all, by means of telepathy. . . . So to convey the meaning of my first question to him I began forming to the best of my ability a picture of a planet in my mind. At the same time I pointed to the sun. He understood this. . . . Then I circled the sun with my finger, indicating the orbit of the planet closest to the sun and said ' Mercury.' I circled it again for the second orbit and said ' Venus.' The third circle I spoke ' Earth ' and indicated the earth upon which we were standing. . . . He indicated that he came from Venus. This was the third time I had spoken the word ' Venus ' in relation to the second planet and he nodded his head in the affirmative. Then he too spoke the word ' Venus.' "

Mr. Adamski asked why he was visiting the Earth and the visitor indicated that their coming was friendly and that they were concerned with radiations going out from Earth. He asked if this concern was due to the explosion of our bombs. He understood this readily and nodded in the affirmative.

Readers may think that this Venusian must have had the bump of precocity well developed to so quickly have been able to follow a strange language.

In reply to the question as to whether he had come from Venus to Earth in the space ship which had been photographed, Mr. Adamski was informed that this craft had been brought into earth's atmosphere by a larger ship. " I could tell by his expression that he was receiving my mental pictures." There is much more of this on similar lines.

Sketches are included of the foot impressions left by the visitor in the sand. As the visitor departed in his ship he borrowed one of the photographic films, which some days later he returned when his space ship flew close to Mr. Adamski's home. The date is given as December 13th, 1952. " As I watched steadily I was able to observe it gliding noiselessly in my direction. . . . It was as if the pilot of this craft knew I was there and was waiting! A warm glow of hope filled my being and I thought ' That's my friend. I'm going to see him again! Maybe he will land here.' . . . But it was too much to hope for. As it came over the near-by valley, about 2,000 to 3,000 feet from me and approximately 300 to 500 feet above the valley, it seemed to stop and hover motionlessly. . . . As it approached probably within 100 feet of me and to one side, one of the portholes was opened slightly, a hand was extended and the selfsame holder which my space-man friend had carried away with him on November 20th was dropped to the ground. As the holder was released, the hand appeared to wave slightly just before the craft passed beyond me. I watched the holder drop. Picking it up I wrapped it in my handkerchief in case there were fingerprints." Having developed the film " there were indications of the original photo being washed off; and this was replaced by a strange photograph and a symbolic message; which to this day has not been fully deciphered." Several scientists are working on it.

Here is one of the affidavits, which are all in similar terms:—

" We, the undersigned, do solemly state that we have read the account herein of the personal contact between George Adamski and a man from another world, brought here in his Flying Saucer ' Scout ' Ship and that we were a party to and witnesses to the event as herein recounted."

These statements evoke a number of important questions. Should not a visitor from another planet be regarded as an invader and arrested? Why was it necessary to interview the space visitor alone? Why was he and the footprints not photographed? Why . . . but I have given the reader a sufficient number of extracts for him to propound his own questions and supply his own answers. There can be no doubt, however, that this is a most fascinating book and it should be read by all interested in this modern scientific topic.

QUERIES and ENQUIRIES

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

Moulding Glass

I WISH to make some small glass mouldings similar in shape to a 1in. dia. lens. Please advise me as to what I should use to make the moulds and about the method of casting the mouldings.—S. Baker (Surrey).

GLASS is not cast like metals, but pressed whilst in a thick, treacly state. Any available press can be utilised, as the applied pressure need not be great. You need two cast iron blocks each machined to one-half of the required form, and these should be coated with soot or carbon black.

The glass can be melted in a fire-brick trough with a brazing lamp; gobbets of the molten material are picked up on the end of an iron rod and transferred to the lower mould, and the upper mould is brought immediately, and steadily, down to squeeze out the surplus.

Optical lenses are not made in this way, but are ground from blocks or discs.

Coal Gas Detection

PLEASE tell me of any substance, solid, liquid or gas, which reacts to small quantities of ordinary coal gas. I intend to do some experimenting with a safety device.—J. K. Kinlay (Fife).

IT is necessary to select one of the common ingredients of coal gas, which is always present, and which will give a reaction even in minute quantities. Carbon monoxide is the one selected.

This substance decomposes iodine pentoxide into free iodine when passed through a tube of iodine pentoxide. In series with this tube you need another U-tube containing potassium iodide paper, which should be maintained moist.

As soon as carbon monoxide or coal gas passes over the first tube it is converted into free iodine. The iodine vapour then passes on to the second tube containing the potassium iodide paper and gives a brown tint to the paper.

Dispersing Fog Indoors

WE often suffer from fog here and I am seeking a method of clearing this from the air of a living-room or bedroom.

Basically a silent-running electric fan drawing air through a suitable filter would suit and I shall be grateful for any suggestions.—W. M. Hunter (Glasgow, W.2).

VOKES, LTD., Upper Richmond Road, Surrey, supply replaceable filters and the fans you have in mind. A simple and effective way to disperse fog in a room is to have one or two lighted candles in action in the room.

Making an Olympic Torch

I AM organising a sports meeting and am considering the idea of a runner, or runners, arriving with the traditional Olympic torch. Could you suggest a suitable composition for a torch which would burn well in the open when held by a runner, but would not in any way endanger him ?—A. M. Stainer (Oxford).

THE "professional" torches of the type you mention are usually fuelled by butane gas which is stored in compressed form within a small cylinder built under the torch. This type of fuelling renders the torch, more or less, unextinguishable in heavy winds and inclement weather. You should be able to obtain particulars of butane gas for torch uses from Shell Chemicals, Ltd., 112, Strand, London, W.C.2, or from Messrs. Griffin and Tatlock, Ltd., Kemble Street, Kingsway, London, W.C.2. The well-known Calor gas can be used in place of the butane fuel but the cylinders in which it is supplied are, usually, of too large dimensions for convenient handling.

As an alternative to these gaseous fuels you can use a light liquid fuel consisting mainly of a mixture of aviation petrol, white spirit, acetone and benzene. The precise proportions of the ingredients will have to be determined by yourself. The more benzene present the more luminous and smoky the flame of the torch will be, whilst the more acetone admixed, the more opposite these characteristics will be. It is a good plan to provide a cylinder loosely packed with asbestos wool and to saturate the latter with the mixed liquid. This will provide a convenient storage space for the fuel together with a suitable "wick." Such a torch will be relatively cool-burning and the products of its combustion will not be toxic.

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.

Removing Gilt and Silver

PLEASE could you tell me the best method of removing the gilt and silver backing from imitation jewellery ?—A. G. New (Southsea).

AS no doubt you are aware you cannot do the job by using the appropriate acid solvents, aqua regia for gold and muriatic acid for silver. You must do it by an anodic process, which is the reverse, of course, of the normal anodic deposition principle.

Use a 6-volt current of low amperage and make the object the anode in your circuit. Place your work in a solution of sodium cyanide, 16oz. to the gallon plus caustic soda of strength 8oz. to the gallon. Both these chemicals must be as pure as possible. Then set up your circuit in the normal way but make the "work" the anode instead of the cathode as you would if you were gold plating.

Removing Plastic Discoloration from Car Bonnet

I PUT a grey transparent plastic coat over the bonnet of my car, just after it had been raining. Approximately six hours later I removed the coat and found that the bonnet was discoloured in parts where the coat had adhered to it.

Can you suggest a remedy that will restore the colour of the car without ruining its surface, and also, can you tell me the reason for this discoloration?—Jas. Macfarlane (Glasgow, W.4).

THERE is, unfortunately, no certain remedy for your trouble. The discharge of the grey colour of the plastic raincoat into the plastic surfacing of the bonnet of your car is due to an intermingling of the two plastic layers, and the extent to which the matter can be rectified depends entirely on how far and how deep this intermingling of surfacings has taken place. Apparently, from what you say, the discolorations are mainly on the bonnet of the car. The best and, indeed, the only way to deal with this matter, is to rub the bonnet down, very gently, with a soft cloth charged with acetone. This will have a solvent effect on the surfacing resin of the bonnet and it will tend to remove both resin and discoloration.

You will, of course, have to carry out this work very delicately and evenly, lest, otherwise, the discolorations on the bonnet are converted into bared patches. With very great care, however, it will be possible to treat large areas of the bonnet so that the existing discoloration and patchiness is fairly satisfactorily evened up so as to become hardly noticeable. Before commencing such operations, of course, the bonnet surface must be adequately degreased by washing down with hot soda and soap.

Rotary Blower for an Organ

I AM building a chamber-pipe organ, to be supplied by wind from a reservoir measuring 3ft. x 1ft. 6in. with four folds, the ribs being 4in. wide. To fill the reservoir I want to make a single stage rotary blower direct-coupled to a ⅓ h.p. motor. My motor runs at 1,750 r.p.m. The wind-pressure throughout the organ will be 2½in. by organ-builder's

(*Continued on page 182*)

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MAINS TRANSFORMERS, 200-250 volts input, output 400/0/400 volts, 280 m/amps, 6.3 v. 8 a., 2 v. 3 a., 5 v. 3 a., 4 v. 2 a., 4 v. 2 a., the last two heaters insulated at 8,000 volts, **85/-** each; another 200/230 volts input, output tapped 0, 9, 18 volts at 4 amps, **25/-** each, post 1/-.

D.C. MOTORS, 230 volts, ·3 h.p., 3,000 r.p.m., in good condition, **£3/5/-** each; ditto Fan Motors, 230 volts D.C., **20/-** each; 110 volts D.C., **17/6** each.

MAINS TRANSFORMERS, input 200/250 volts, output 45/50 volts, 70 amps, suitable for arc welding, **£15** each; another 70 volts, 50 amps, **£15** each.

anemometer gauge. Please inform me as to sizes of inlet and outlet diameter of rotor, shape and number of blades, speed, etc.—F. W. Lane (Sussex).

WHAT is needed in this case is a rotary compressor or blower commonly known as the "crescent" type. In this, the compression action is positive by gradually reducing the volume of the chamber into which the air is aspired. This gradual reduction of volume is effected by positioning a rotor eccentrically within a cylindrical casing so that there is a minimum clearance at the lowest point of the casing and a maximum clearance at the highest. The chamber thus formed between the top of the rotor and the casing is crescent shaped and is divided into spaces of varying area by blades which are free to slide in slots cut radially in the rotor. The rotation of the rotor causes the blades to be thrown out by centrifugal force and to sweep through the crescent-shaped compression chamber. The suction port is located where the space between any adjacent blade is a maximum, the space gradually diminishing as the rotor turns towards the discharge port, opposite to which it is a maximum.

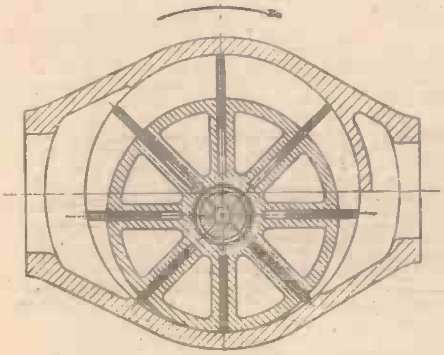


Diagram of crescent type compressor.

As will be understood, design will be based upon pressure and volume required. Basic design requirements are that the free air delivered is a function of speed (r.p.m.) and the volume of air taken into the compression chamber, i.e., the volume of each space between adjacent blades measured at the point of maximum clearance between rotor and casing, multiplied by the number of such spaces; usually eight, as shown in the accompanying diagram. The pressure generated is proportional to the reduction in volume of each compression space, whilst inlets and outlets should, of course, be designed in accordance with the volume of air entering and leaving the machine.

Microscope Lamp for Photomicrography

I NOTICE in the October issue of PRACTICAL MECHANICS an article dealing with the construction of a microscope lamp.

Could you please inform me if this lamp is suitable for photomicrography ?

In the commercial type of apparatus an iris diaphragm is incorporated ; this I believe is expensive and, as an alternative, I propose to construct a "wheel diaphragm" which consists of a thin disc of metal with a number of various-sized holes around its periphery. Can you please give details of the diameter and thickness of the disc, the number of holes and their size ?

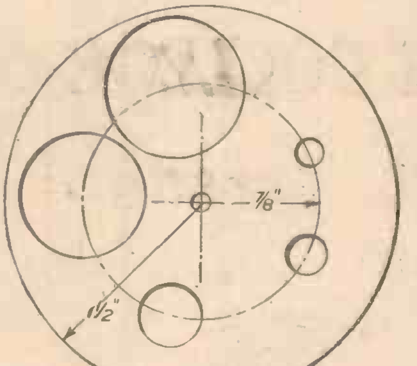
Will the 100-watt lamp as specified in the article be suitable for photomicrography ; if not, what wattage would you recommend ?

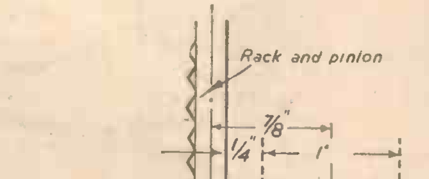
Is it possible to build the whole of the above apparatus in one unit, allowing for the moving parts to be adjusted by rack and pinion ?—M. Haigh (Essex.)

WITH regard to a "Wheel Diaphragm," many of the details tie up with each other. The diameter must, of course, depend on the space available in the substage of the microscope used and on the number of holes required, which in turn depends on the number of objectives to be used. However, certain details can be taken arbitrarily and then modified as required, and a diaphragm constructed to the following specifications will be found very versatile and can easily be modified.

A 3in. circular disc is cut from ⅛in. aluminium and holes of the following diameters made in it : 1in., ¾in., ½in., ¼in., 3/16in. A spindle hole is made at the centre to enable the disc to be mounted on the substage.

It will be found that these holes are able to fill the back lenses of the majority of the more common objectives with light, thus enabling fairly critical illumination to be obtained. Remember that the higher the power of the objective, the smaller should be the light aperture used, e.g., with a 2/3in. use the 1in. hole, and with a 1/6in. use the ½in. hole. Really critical illumination can only be obtained by using a condenser lens between the diaphragm and the objectives. This should be of about 1in. focal length and 1½in. in diameter. It will be found quite simple to mount this on a rack and pinion movement and to mount the diaphragm beneath it in such a way as to allow the centres of the holes to correspond in turn with the centre of the lens. The drawings show how this may be done in a convenient manner. With the above modifications the lamp in question will provide illumination as good as most commercial models. A 100-watt lamp will suffice for time-exposures, but it may be found necessary to use a 150-watt lamp for fast film or plate.





The wheel diaphragm and condensing lens for a microscope lamp.

Information Sought

Readers are invited to supply the required information to answer the following queries.

F. J. Rawlinson's letter asks : "Could you please give me details and measurements of the towing mechanism for a light trailer, suitable for carrying about 6 cwt. of camping gear ?

"I would require it to apply the brakes of the trailer automatically and also to provide for a hand control while it was stationary."

F. Aupiais, of Kimberley, South Africa, writes : "I wish to make a small diffuser, the type generally used for artificial aeration of aquaria.

"Could you please furnish me with details, using 220 volts with a 6-volt transformer (if a transformer is required).

"The capacity of the aquarium is approx. 12 gallons."

K. J. Hurd, of Peterborough, asks : "Please give me details of a moisture meter (or gauge). I am interested in soil-less culture of carnations and in a greenhouse have beds 4ft. by 2ft. by 10in. containing a mixture of vermiculite and silver sand. These beds are fed from the bottom with chemicals from a centre trough covered with glass wool. The chemicals get to the plant roots by capillary action of the vermiculite. I require a means of telling by the reading of a dial (or gauge) whether the vermiculite/sand requires feeding with solution."

From a reader in Ireland we received the following : "About forty years ago I made several globes from brass sheet.

"The whole globe was made out of *one* piece and after cutting the necessary lines on one side of the sheet, it was folded together and brazed. The surface of the globe showed diamond shapes all of the same dimensions, but I forgot the start and shape of the brass sheet. Can you help me out, please ?"

S/Ldr. K. Herring, of R.A.F. Northwood, writes : "I now wish to make a device which awakes one in the morning with the usual alarum, but which also switches on the light and makes the tea.

"I know these items can be bought but they are too expensive for me. Can you supply details, please ?"

P. Conway-Wallace writes from Farnham : "I wish to construct an electrical immersion heater for a tropical aquarium, the size of which is 25in. x 8in. x 8in. and holds approximately 6 galls. I would like the wattage to be as low as possible for that size of tank.

"I have made unsuccessful enquiries at one or two dealers about the element."

F. B. Cox, of Oxford, asks : "I have been given a very old cottage piano which is beyond repair and I am trying to use some of the parts to make up a dulcetone. Could you tell me what tubing would make the best bells, and the best way of fixing them to the sound-board ?

"How long would a tube have to be, to tune to C above middle C ?"

The following is an extract from a letter from J. Gilbert, of Hounslow : "I have tried to build a cycle-trainer, but, unfortunately, have run up against difficulties, especially in fixing the speedometer on to the rollers."

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THE Cyclist

Editor : F. J. CAMM

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COMMENTS OF THE MONTH By F. J. C.

Brakes on Cycles

THE Minister of Transport and Civil Aviation has submitted a copy of Draft Regulations which he proposes to make on the subject of brakes on cycles, to be known as "The Brakes on Pedal Cycles Regulations, 1953."

These regulations are made under Section 29 of the Road Traffic Act, 1930. It is proposed that the regulations shall come into force on the first day of September, 1954.

The regulations relate to cycles and pedal tricycles and do not, of course, relate to motor-assisted bicycles or motor-cycles. They will apply to every cycle used on the road, with the exception that they will not apply to any cycle so constructed that the pedals act directly upon any wheel or upon the axle of any wheel without the inter-position of any gearing, chain or other device ; nor to any cycle whilst it is being pushed by hand to premises where its braking system is to be repaired, nor to any cycle brought temporarily into Great Britain by a person registered abroad and intending to make only a temporary stay in Great Britain, provided that its brakes comply with the requirements of Article 26 of the International Convention on Road Traffic signed in Geneva on September 19th, 1949.

Every cycle, apart from these provisions, having any wheel of which the outside diameter, including the tyres when fully inflated, exceeds 18ins. shall, if it is so constructed that one or more of the wheels is incapable of rotating independently of the pedals, be equipped with a braking system operating on the front wheel or both the front wheels, if it has two front wheels ; or if it is not so constructed be equipped with two braking systems, one of which operates on the front wheel or both the front wheels if it has two front wheels, and the other of which operates on the rear wheel or one of the rear wheels if it has two rear wheels. Every other cycle shall be equipped with at least one braking system. All braking systems required by the regulations shall be efficient and shall be kept in proper working order. For the purpose of the regulations a braking system shall be deemed not to be efficient if the brake operates directly on the tyre of any wheel.

Leatherhead

A lovely 17th century Surrey cottage standing on the hilltop of the London road. This fine example of domestic architecture has been preserved under Trust for the town.

Any police officer in uniform will be authorised to test and inspect the brakes of any cycle on a road or, where a cycle has been involved in an accident, on any premises where the cycle is kept provided that the test and inspection are carried out with the consent of the owner of the premises and within 48 hours of the accident.

These regulations are not so onerous as might be supposed, and it is unlikely that they will meet with any opposition either from the Manufacturers Union or from the national bodies. They, in fact, merely regularise an existing state of affairs. Very few bicycles do not at present comply with the regulations, and the police under present law have power, in the case of an accident, to check the efficiency of the brakes.

It is in the interests of cyclists that good brakes should be fitted and maintained in good order. All bicycles when sold are equipped with brakes, with the exception, of course, of racing machines.

Fixed gear machines are in a slightly different category. It is true that the bicycle can be brought to a standstill by means of pedal pressure, but chains have been known to break, especially if they are old chains.

Road Safety Week

SPECIAL reports from the police show that during Road Safety Week, which covered a period of 10 days from October 17 to 26, casualties numbered 5,908, of which 158 were fatal. This excludes one Scottish county for which statistics were not available, but they may bring the total to 5,940.

In the corresponding 10 days of October, 1952, when no special effort was made, the total casualties were 5,882, of which 140 were fatal. Thus, in spite of all the special efforts which were made during Road Safety Week the number of fatal and non-fatal accidents increased.

The total casualties in October, 1953, showed an increase of 5¼ per cent. over October, 1952. This should be compared with the increase of 7¾ per cent. in the number of vehicles licensed at the end of August, 1953 (the last available figures), over the end of August, 1952. In Road Safety Week itself the total casualties were less than 1 per cent. above the figure for the corresponding 10 days of October, 1952, though it must be borne in mind that the traffic in the London area during the last few days of the week was less than usual owing to the petrol strike.

The Albert Hall Concert

A NOISY minority at the Albert Hall Concert organised by the R.T.T.C. marred what could have been a very pleasant evening. Letters of protest have been received from all over the country. One of those who interrupted the programme by sounding a motor horn said that the poor quality of the turns deserved this. If one does not like a particular turn in a programme one shows disapproval by refraining to applaud, not by slow clapping and the sounding of noisy instruments. This form of barracking has taken place on previous occasions and we are surprised that this year the R.T.T.C. had not taken steps to avoid a repetition of it. Rather belatedly they announce that next year they propose to take steps to do so, although how is difficult to discern. You cannot search every member of the audience, although adequate marshalling to eject any offender is a possible solution.

This conduct is bringing cycling and cyclists into disrepute. It is the sort of conduct which one expects from unintelligent hooligans. It was obvious that the affair was organised beforehand. No member of the audience could have known in advance of the quality of the turns, which in our view was excellent and, therefore, to be in possession of a motor horn and rattles and paper darts when they entered the hall is an indication that this contingent, mostly from the North, intended to rag the show.

We hope that those clubs responsible will take due warning.

The R.T.T.C. next year might ask clubs who apply for a block of tickets for their members to give an undertaking that they will appoint a marshal to keep these recalcitrants in order. The Albert Hall authorities, too, might take exception to a repetition of this disorderliness.

Wayside Thoughts

By F. J. URRY, M.B.E.

Hampton-on-Thames

The boats with their white and bright coloured sails seen against the grey tower of the old church.

What They Said

I SUPPOSE it is natural for the elders among us to suddenly discover that something in their muscular make-up is not working as of old, or as we would desire it. Yet when such a thing does happen to you it comes as a shock because it emphasises the run of the years and makes you realise that, for you, there will be an end to them. I went to a specialist and complained. "Why," said he, "you are a lucky man; you have merely failed to recognise it." That may have been complimentary, but it was not comforting: for how few of us really want to slow down or accept the pressure of the years with the grace we are so readily apt to suggest to the other fellow? It was not nearly so bad as it might have been, for I rather dreaded the verdict of this erudite medical gentleman, knowing that the majority of his tribe appear to have small regard for cycling. "Go on with it," he said, "for cycling is one of the finest exercises older people can do; but use it in moderation and don't be tempted to hurt yourself." That was good hearing, so I'm going on and the miles ahead of me seem more gracious because I am quite content to go easily—even slowly—so long as I can go. Only a day or so later I saw an old acquaintance—a medical professor—who asked me the result of the interview, and, astonishingly, told me he rode regularly, not only because he liked it, but that he found the exercise of the utmost value. "And now go and tell your friends," he said, "that not all medicine men are adverse to the pastime, that some have discovered how valuable it is, and how much more valuable it could be if better known, as a preservation to activity for older people." Such recommendations are good when they come spontaneously from the professors.

So Keep On

I HAVE always felt that the value of cycling as a health and activity preserver was high, but to have it confirmed by eminent medical folk is a great compliment to the pastime which ought to be widely publicised. The medical profession, however, do not give testimonials, and we only obtain this direct knowledge by paying for it through the ordinary professional channels; it can, therefore, only be passed on in a second-hand way. What an excellent reason why the young cyclist of to-day should remain a member of the pastime until the years run out for him. He—like all of us when young—thinks nothing can upset his working parts, no matter how violently he uses their superb energies: but it naturally follows the years will take their toll and the day come when the triumphant yesterday seems a long way off. Then is the time to keep on cycling to exchange speed for ease, allowing that speed to decline within the orbit of comfort as the years increase. It is a pleasant process of growing old, and I am enjoying it for its own sake and because its activity is far greater than it would be without a bicycle. To give up cycling if you can enjoy it—and most of us can if we want to—is to loose the reins of personal freedom of mind and body, and become mechanised. That may be the next best thing to cycling, but I should hate it to be my only means of contact with the land I love. Anyhow, I am going on riding and, because I shall do so with expert advice, it makes the prospect seem extra cheerful.

These Late Autumn Days

THIS autumn gave us some happy days, though, unfortunately, most of them happened in mid-week when we were at work, but there were some hours along the road which were a benediction in beauty. I have ridden under canopies of yellow and amber, with here and there a fiery flame still waving in the woods, and this is a fragrant remembrance when I wander these ways again under the pang of winter. Winter riding, I confess, is not a happy prospect, yet when it comes, as come it surely will, it is not nearly so uncomfortable as seemed likely, provided we prowl around warmly clad and the distance between one roaring fire and another is not too great.

I go out most week-ends with an old friend to get a lung-full of fresh air and a little cheerful exercise, and our 20 to 30 miles of Sunday morning riding makes a delightful trip to round off the week, and is of times a running commentary on the fortune of health which favours us, usually attributed to the fact that we have "kept on keeping on." These are not rush jobs; just a prowl round familiar ways which change so marvellously with the swing of the seasons, but they keep us fit and fresh, and perhaps above all, thankful for our luck in life. It doesn't take much to make a cyclist happy, just a decent bicycle and a good companion, the road before them, and, somewhere in the not too great distance, a fire to warm their toes and a drink to warm their insides. These simple excellencies could be the acquisition of the million, who would be all the better for them; they deposit a sense of contentment and well-being in any man's make-up. True the scampering days are past, but the gentle journey is still very good and very satisfying.

The "Old Adam"

I FIND that going quietly makes cycling very easy, but the habit of it is not simple to acquire. Naturally my cycling speed has slowed considerably since I touched the seventy mark, and will probably drop a degree or so further but, though it sounds simple enough to practise, the old attitude towards travel somewhat persists. Someone passes me on the way home using splayed feet and a rolling gait to make progress, and, like the weak human I am, the desire to show him a better way of making ground more or less gracefully overcomes my mental balance and I go after him. Very soon I am reminded of the little disability the years have sown in my left leg, and I am thereby reminded of my foolishness, but still persist in being a fool. Do not dismiss this admission with an airy wave of the hand, for the "Old Adam" resides in all of us and breaks out in many curious forms. Gradually I am learning to go slowly, and trying to content myself with the delightful fact that I can go at all, for I should seriously miss the joy of my daily ride and the little wanderings I make at the week-ends, which may not be so far as of yore, but bring to me the same satisfaction as of old. I could not go walking, and I do not want to render myself inactive by making a car my means of travel, so here is the compromise to pleasantly gild the years of my older age.

Why the Youngster?

WHY do the would-be doctrinaires on road safety aim their shafts of criticism at the juvenile cyclist? Do these people ever remember they too were once young and sought the first means within their muscular power to ride a tricycle or bicycle? Road-sense is an important factor in road safety, and I do not know a better method of acquiring that rather negative trick of the mind than introducing the very young to juvenile cycling. Fortunately, authorities, and especially police people, have shut kindly eyes to the footpath rides by our young folk in suburbia, with the result that the toddlers grow expert at the handling and control of their vehicles long before they venture on the highway. Parents have become, according to my observation, very conscious of the modern road risks and take considerable pains to train their progeny to obey the Highway Code; indeed I see many of these youngsters "doing their stuff" in a manner to shame our more casual adult attitude to the rules of the road. The fact is, of course, that if every road user exercised care and tolerance, both for his own safety and that of the other traveller, more than half the tragedies would promptly disappear. Instead of that simple method of cure we are all apt to try to impress the blame for wrong conduct and ill manners on the other fellow, and because the young cyclist is an easy target and can only be defended by proxy, he naturally has far more than his share of criticism. Another point frequently overlooked is that the barbed shafts are often wrapped round with the soft wool of care for the young, whereas in many cases such concern is just a ready means leading to the hope that finally the use of the road will be debarred to the young folk: there is such subtlety in some of this criticism that we, who love what is left of the freedom of the road, must beware our inheritance is not further invaded.

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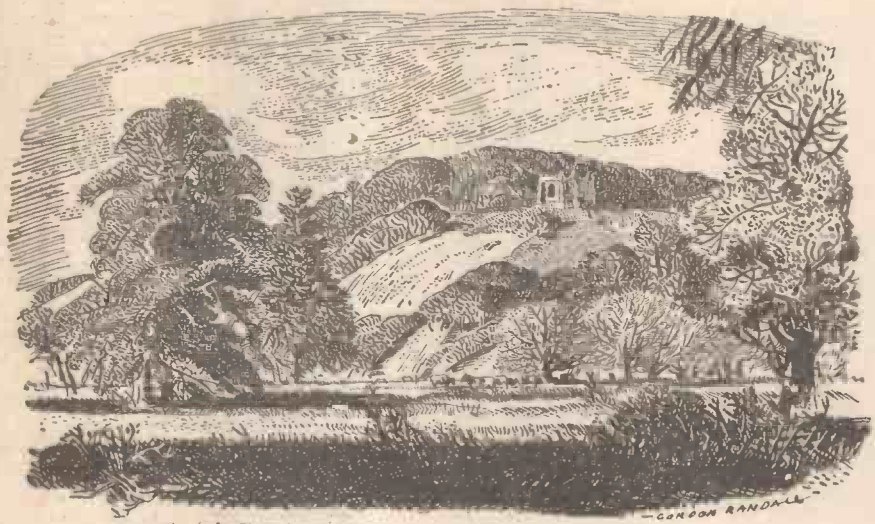
By ICARUS



St. Catherine's Chapel, Guildford.
The ruins of the old Chapel on the Pilgrims Way. The old track leads down the hill, across the ford over the Wey, and then climbs the hill to St. Martha's.

Bulbs and Batteries

CORRESPONDENTS continue to support my view that bulb failure is more frequent than it used to be. One correspondent, Mr. D. A. Branch, of Egham, also criticises the poor quality of batteries.

Dealing with twin-cell batteries, he recalls buying one of these in 1935, and he used it every week-end for at least three hours, with additional occasional use as a torch. It lasted until October, 1936. That must have been truly exceptional. Of course, the shortage of zinc has been responsible to some extent for the drop in battery life.

Sportsman of the Year

SPORTING RECORD is now conducting its annual national ballot to elect the Sportsman of the Year. Specimen ballot forms are obtainable from them at 184, Fleet Street, London, E.C.4. Votes can, of course, be sent in on plain paper provided the name and address of the voter is given.

The first nation-wide ballot to find the Sportsman of the Year was organised by *Sporting Record* in 1946. Since then this ballot has become a national institution. Ever-growing public interest in the ballot is proved by the annual increase in the number of votes received.

In the first ballot Bruce Woodcock was elected "Sportsman of the Year." Public choice in 1947 was Denis Compton, who again headed the poll in 1948; for the next two years, 1949 and 1950, the elected sportsman was Reg. Harris; in 1951 Geoff Duke, double world champion motor-cyclist, received the trophy, while Britain's No. 1 sportsman in 1952 was Len Hutton.

Coronation year was, of course, exceptional in the field of sport, so voters have plenty of names from which to choose their favourite. Gordon Pirie, for example, established a new world record over six miles and was in the world record-breaking 4 x 1,500 metres team; Jim Peters, too, the world's fastest-ever marathon runner, winner of international races, unbeaten in marathon events this year. Roger Bannister ran a magnificent mile in 4 mins. 2 secs., and is regarded as the most likely athlete to attain the four-minute mile. Consider as well Bill Nankeville, another member of Britain's world record-breaking 4 x 1,500 metres, and 4 x 1 mile teams.

Jean Desforges, Great Britain's women's international team captain, has broken the British record for the long jump, is Britain's best woman hurdler and ranks as one of our fastest sprinters; while Anne Pashley, British 100 yds. sprint champion, scored many successes over German and French sprinters.

Other big names in sport are soccer's Stanley Matthews, one of the greatest players of all time; his tremendous Cup Final performance will never be forgotten. Sir Gordon Richards, champion jockey for the twenty-sixth time; Geoff Duke, Eric Oliver and Fergus Anderson, all world champions in motor cycling; Don Cockell, for his challenge to American boxing on its own ground. Reg. Harris, still the greatest cyclist in the world, and Eileen Sheridan, modest record breaker; all these come to mind.

Then cricket; it may be Len Hutton, captain of the team which won the "Ashes," or the great Alec Bedser or Trevor Bailey, Freddie Trueman or Denis Compton.

Any survey of the year's sport picks out Pat Smythe, Britain's greatest woman show jumper and her tremendous successes in many countries. Harry Llewellyn, too, has consistently achieved victories in the equestrian field.

A special silver trophy is also presented to the sportswoman receiving most votes in the ballot.

'Ooliganism at the Albert 'All

EXCUSE my dropping of the aspirates in the title of this paragraph, but it seems appropriate to do so when dealing with the general conduct of the audience at the Cycle Concert at the Albert Hall last year. I have commented before upon the rowdiness of some of the crowds which attend and which gives the impression that cyclists are a gang of guttersnipes. The noise seemed to come from Northern contingents—Lancashire and Yorkshire and Scotland. It seems to me that the organisers should appoint marshals to eject those who refuse to be restrained in their too vociferous enthusiasm. Cat-calls and wolf whistles, offensive remarks and constant interruptions on a large scale such as this do the pastime great harm.

Some of the larger clubs are responsible for developing the belief that to be a good member of a cycle club you must play questionable practical jokes, tell risque stories and generally conduct yourself as a noisy hooligan. Anyone who wishes to go to one of these concerts should expect to be able to enjoy the artistes and the speeches. How different is this concert to what it was before the R.T.T.C. took it over!

Slow hand-clapping is an insult to professional artistes. I am, therefore, glad to know that the National Committee of the Road Time Trials Council will take strict measures next year. It is scandalous that steps should have to be taken at a concert of this nature to restrain the use of paper darts, rattles and other noise-making instruments. It is not an advertisement for organised cycling and a direct invitation to newcomers to remain outside the club movement.

One Accident Every Two Minutes

REPORTS received by the Ministry of Transport and Civil Aviation up to the end of October show that road casualties in September totalled 20,415—nearly 2,300 more than in September, 1952. There were 436 deaths, an increase of 15, and 4,991 were seriously injured, an increase of over 600. These figures give an average of one casualty every two minutes, and one person killed or seriously injured every eight minutes.

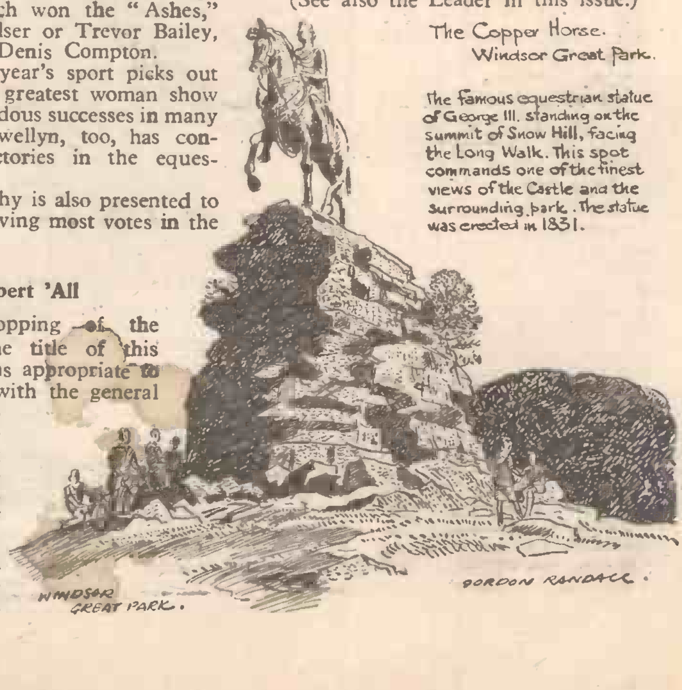
The increase in the total is the largest so far recorded in any month this year. In the previous eight months the average increase, compared with the corresponding months of 1952, was under 1,400.

In August, the peak month for holiday traffic, casualties totalled 22,103, or 858 more than in August, 1952. There were 457 deaths, an increase of 19; and 5,408 were seriously injured, an increase of 206.

Details issued show that the increase in the August total occurred mainly among drivers, motor cyclists and passengers.

Casualties during the Bank Holiday week-end, from Saturday to Tuesday inclusive, numbered 3,305. This was only three more than in the corresponding period of 1952.

(See also the Leader in this issue.)



The Copper Horse. Windsor Great Park.
The famous equestrian statue of George III. standing on the summit of Snow Hill, facing the Long Walk. This spot commands one of the finest views of the Castle and the surrounding park. The statue was erected in 1831.

CYCLORAMA

By H. W. ELEY

Hambledon.
The Old Bat and Ball Inn.
An historic corner of England that will always be associated with the game of cricket
Hampshire

"Chill Janiveer"

A COLD month, this first month of the year can be, and yet it often gives us fine clear days, when it is a rare delight to cycle down the hard roads and catch the beauty of the bare countryside. Beauty there is, even on a chill January day, when the frost is all silvery on the hedges and all Nature seems locked in an icy grip. Those tall trees on Tannard Ridge look really beautiful in their starkness, and the furrows of early-ploughed earth are good to the eye. There is some bird-song, too, early though the season is; a missel-thrush sings lustily from a bare hawthorn tree, and occasionally, when the sun peeps through, the sweet song of the robin is heard. Bird-life is not all gone, and overhead a kestrel hovers, sending the small birds into the shelter of the bare hedges. Yes, it is good to ride out on a January day and feel the nip in the air, and dream of sunnier days to come! One steadfast flower greets us as we ride, for the golden gorse, blooming throughout the year, is aflame on the heath in brave defiance of all that winter may do or bring.

Letter From Lancashire

I RECENTLY received a friendly little letter from Wigan; Wigan — the immemorial butt of music-hall comedians and as much a stock subject for their jokes as the maligned mother-in-law! My correspondent is a "mill lass" and an ardent cyclist. She loves her native Lancashire and writes with pride of the beauties of Pendle Hill, that wild and alluring Lancashire district where witches rode their broom-sticks and where there is still romance. My "lass from Lancashire" is acquainted with that wonderful book of Harrison Ainsworth's, "Lancashire Witches," and asks if I have read it. Most certainly I have, and I have always told folk who fondly believe that all Lancashire is composed of murky towns and dingy streets to capture the romance of the county by reading this book. What magnificent views one may get from Pendle Hill! One may see the ruins of ancient Clitheroe Castle perched on a crag near the old town of Clitheroe, and looking so different from the popular conception of Lancashire as just "Cottonopolis." To the cyclist browsing over his maps, and wondering where to go, I would say, "Try Lancashire, and it will take you to its heart."

New Year Resolutions

THESE vows are so optimistically made and so swiftly broken! We all tend to jot down, when the Old Year ticks away in its last hours and minutes, some good resolutions which we are going to keep throughout the New Year, heralded in by those happy pealing bells. Quite a few good and useful resolutions could be made by the cyclist—a little more frequent use of the oil-can; a little more attention to tyre pressures; the prompt renewal of worn brake-blocks, and greater care of the saddle. These, I fancy, are subjects for New Year resolutions for many a cyclist, and, if kept, what a world of difference they would make to one's riding! I had occasion to borrow a friend's bike the other day to ride on urgent business down to the village, and could not help but notice that the tyres were woefully under-inflated, and the saddle ought to have been "pensioned-off" long since!

Three Cheshire Inns

EVERY English county can boast of some famous inn or inns, and wherever we may tour we may find some ancient hostel where history has been spun. In Cheshire, at Sandbach, I am reminded that there is the "Black Bear"—an inn ancient indeed, for it dates back to the year 1634. It stands opposite the famous Sandbach crosses, and its upper part has some fine timber-and-plaster work. And, in Cheshire, too, there is the "Cock" at Great Budworth, where Drunken Barnaby quaffed ale until he could not stand. For our third Cheshire inn we will slip along to Chester itself and find, in Watergate Street, that "Yacht Inn" where Dean Swift stayed for a night before embarking for Ireland. Yes! Cheshire is not only famous for its cheese!

Night Ride in January

HOW alluring is the silent countryside on a fine January night, when the air is crisp and the moon shining, and the road dry and hard! Good, on such a night, to ride out into the real country, through the tiny hamlets, along the narrow lanes and see the mysterious aura which night-time throws around the familiar daytime scenes. The barn at Fradwell Corner takes on a new and eerie shape in the darkness; that old haystack at Broad Acres Farm looks different too; and in the gleam of our bright headlight the very road seems bewitched with romance. A rabbit darts across our path, a cat slips stealthily up the hedge-bank, and the silence is only broken by the hooting of the owls in Hazel Spinney. There's a thrill in a night ride, and a sweet solitude and a sense of freedom which can be captured in no other way.

Chesterfield's Crooked Spire

EVERYONE knows of it, but not everyone has seen it, or the noble church of which it is a part. I suppose it is Chesterfield's chief claim to fame—this curiously twisted spire, the twist generally being considered due to some peculiar action of the sun's rays on the sides. Whatever the reason for the twisting, it has certainly added to the fame of Chesterfield, which is an ancient town, somewhat grimy from the lordship of King Coal, but having quite a charm. Those who enter the fine parish church should note, in the Foljambe Chapel, the whale's jawbone, which is popularly supposed to be a rib of that mythical cow slain by Guy of Warwick.

"A Guid New Year!"

THE wish comes to me from an old Scottish cycling friend, gone back to his native land to celebrate, in true and proper fashion, the passing of the Old Year, and the birth of the New. With the wish comes a parcel which contains a genuine, traditional haggis and a "wee" bottle of whisky. A "Guid New Year" to cyclists everywhere!

Keswick.
The famous High Street with its quaint Moot Hall, known to thousands of cyclists touring the Lakes.

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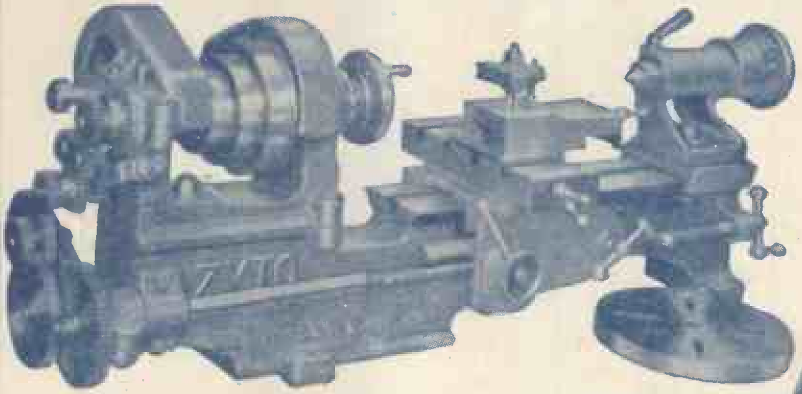

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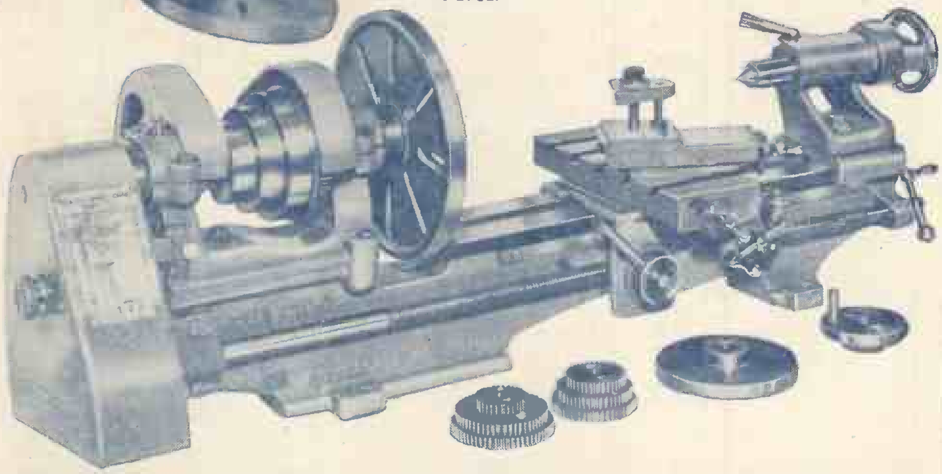

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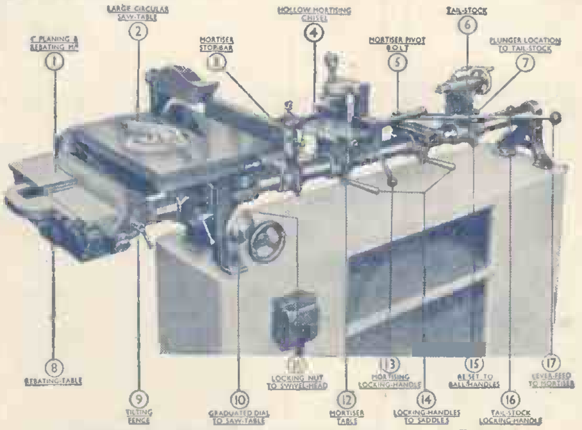

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