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PRACTICAL MECHANICS

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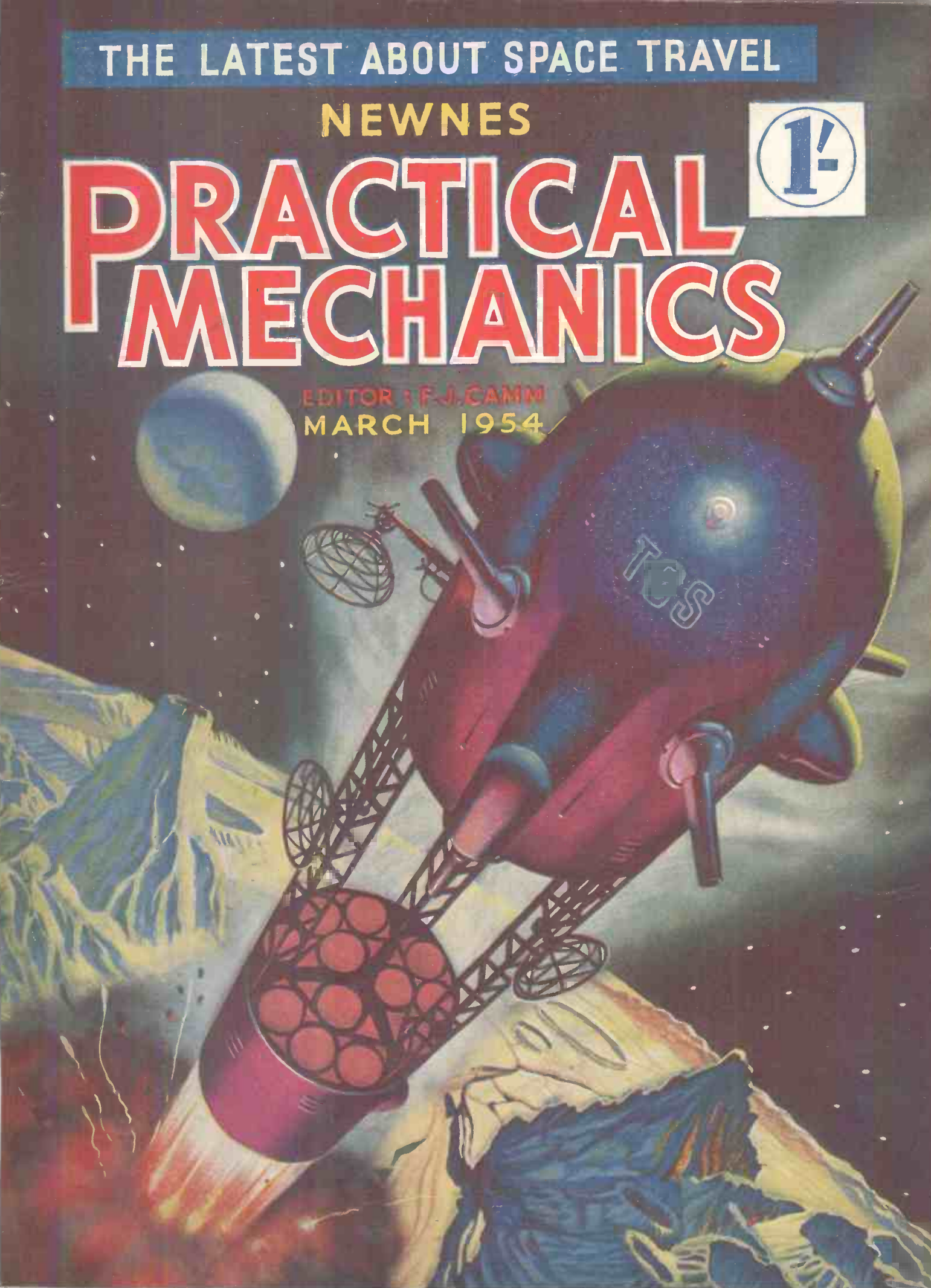
EDITOR : F. J. CAMM

MARCH 1954



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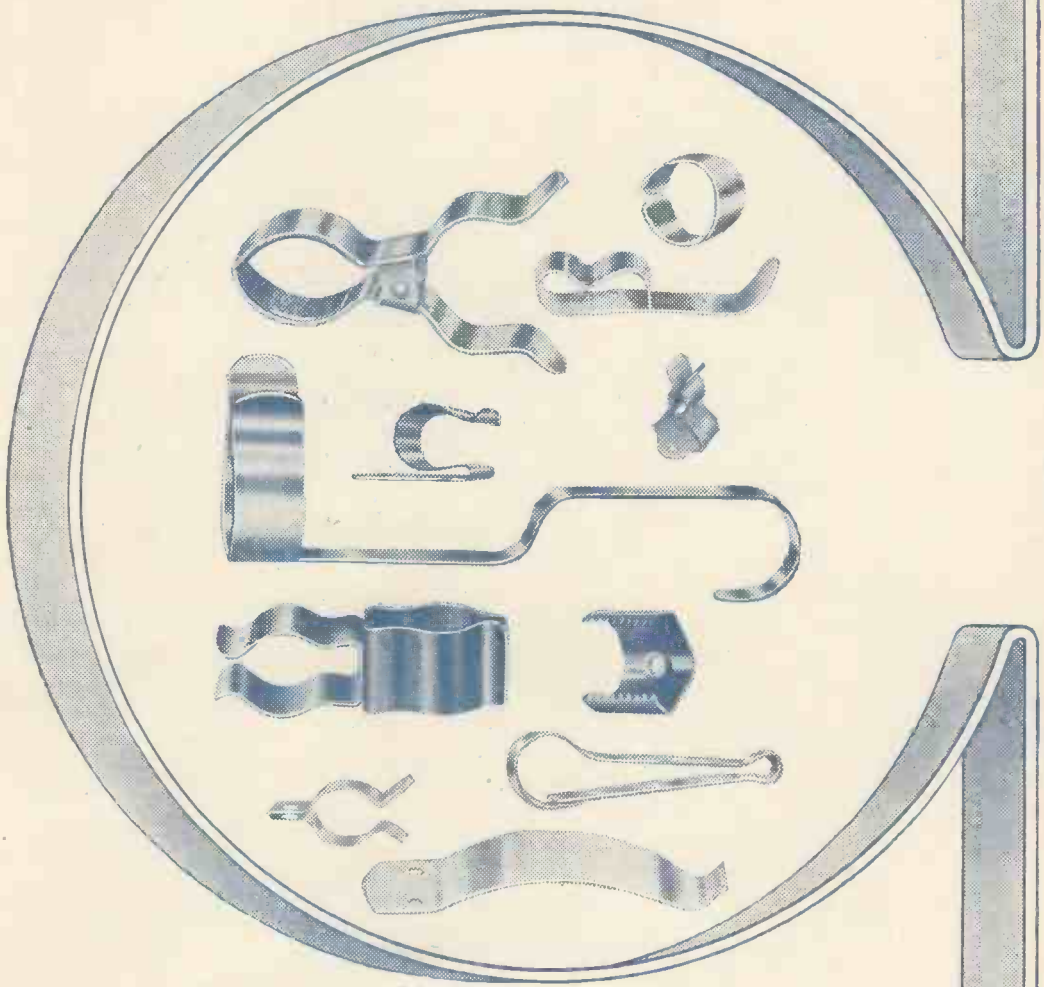

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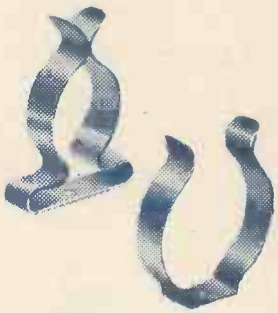

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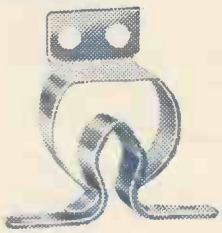

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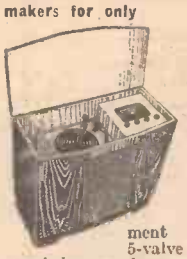

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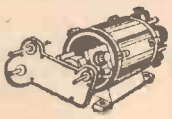

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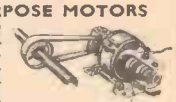

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MARCH, 1954
VOL. XXI
No. 243

PRACTICAL MECHANICS

EDITOR
F. J. CAMM

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

FAIR COMMENT

By The Editor

The Flying Saucer Controversy

Some Questions Answered

THE publication of my article entitled "Have Space Ships Landed?" in the January issue has evoked an enormous amount of correspondence. Most readers, whilst believing in the possibilities of space travel, do not accept the statements which have been made in various books and newspapers that space ships of other planets have landed here and that, indeed, some of the Venusians are here in captivity. Seldom has a topic discussed in this journal produced so much criticism and correspondence. I am asked whether I really believe that a space ship has landed, whether I believe in the existence of flying saucers, whether I believe that space travel will take place this year, whether, indeed, there *are* such things as flying saucers and dozens of questions in similar strain.

I do not hesitate to give my opinion, but ask readers to remember that it is only my opinion, and that I am open to be convinced. Elsewhere in this issue I have endeavoured to state the scientific facts of the case concerning space travel. On the question of flying saucers I am only prepared to concede that strange objects have been seen in the sky. I do not accept that they are space ships from other planets, and nothing which has been said or written on the subject, and I have heard and read most of it, will convince me otherwise. All manner of explanations have been given for the existence, assumed, of these objects in the sky. They have come from reliable people and accredited scientists and it would be absurd to presume that they are all suffering from hallucinations. We must not overlook the fact that interest in science fiction to-day is on the increase and that those without scientific knowledge are likely to associate some strange phenomena with something they have read as science fiction, and to believe that some writer with Wellsian imagination has forecast something which has since taken place. One can understand such beliefs. The scientific forecasts of H. G. Wells, most of which have come true, justify people in having such credulity. He not only forecast radar, almost to the month, but the form of flying machines and aerial warfare. We must remember, however, that Wells was not a science fiction writer as such. His writing on scientific subjects, which admittedly took the form of fiction, were based upon scientific knowledge. He was a Bachelor of Science and he used his scientific knowledge to write scientific novels based upon scientific facts and scientific trends. Any science fiction writer, by presuming the impossible, can write an interesting scientific story and the difficulty is to convince people that the basis upon which the novel is written, such, for example, as a paint which renders people invisible, *is* impossible.

The matter is further complicated because so many impossible things have come to pass. Who would have thought, for example, 50 years ago, that it would have been possible for people sitting in remote villages to witness on a small screen a play being performed in a studio, the Coronation ceremony or the Cup Final at Wembley? Who would have thought, indeed, that it would be possible to hear in one's home a concert in a studio or to record the human voice and to be able to hear it long after the person is dead or that vision could be recorded on tape?

When the telephone was invented by Alexander Graham Bell, it was considered to be the ultimate in scientific achievement.

Now we are recording vision on tape. If we believe certain theories it should be possible to construct an apparatus so that we can still hear the Battle of Waterloo. The public, therefore, is justified in refusing to accept that anything is impossible, as so many things hitherto thought to be impossible things have come to pass.

I believe that space travel is possible and that it will take place within the next 20 years. I believe that the first space ship will be unmanned. Beyond that firm conviction I am not prepared to go.

In spite of this I would warn readers against over-credulity and sensational journalism. It is noteworthy that no one of high scientific attainment has yet supported the opinion that space ships have landed from other planets. It is pure conjecture, although one must not doubt the sincerity of those who hold such beliefs.

A Radio Watch

ACCORDING to an American periodical we shall soon have miniature radio watches, about 2in. in diameter and ½in. thick. The dial of the watch will be calibrated for all broadcast stations. The owner will tune by pulling out the usual winding stem and rotating it. The watch will be placed to the ear, perforations on the other side of the watch permitting sound from the speaker to reach the ear.

This will be made possible by transistors, which have already been dealt with in this paper. A transistor is about the size of a match head, and, in the course of a few years, will replace the present unwieldy vacuum tube. It requires so little electric current that a minute dry cell, about the size of an overcoat button, will power the entire receiver.

Already electronic watches, where the main spring is replaced by a small dry cell no larger than the usual watch main spring barrel, has been successfully made and demonstrated by an American watch company.—F. J. C.

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WHEN—HOW—HOW MUCH?

By F. J. CAMM

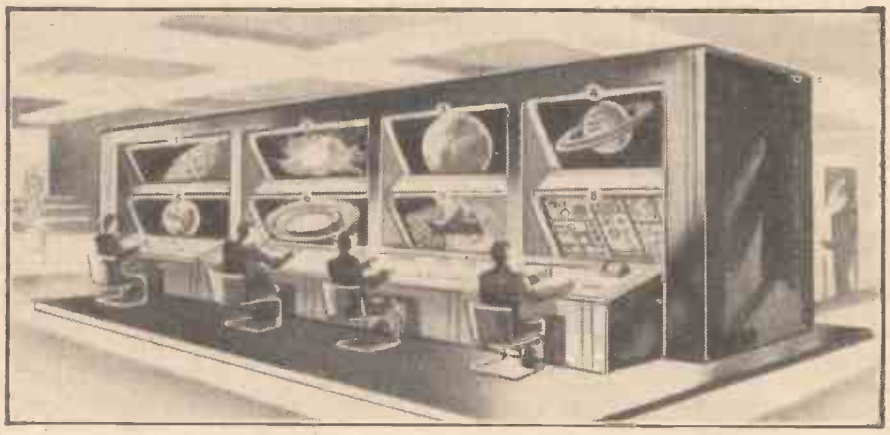
SO much is being written and spoken about the possibilities of space travel at the present time that it is wise to take stock of the position and to analyse the facts. To-day those best qualified to write and talk about space travel are beset not by incredulity, but the over-incredulity of the public, based on the volumes of nonsense which have been written about Flying Saucers during the past two years, supported by several recently published statements that space ships have landed, and that Venusians have actually been captured. It is somewhat surprising, therefore, that no agreement or denial with this statement has been issued, and it is therefore one which should be accepted with the greatest reserve. Since I wrote my article in the January issue I have been inundated with letters stating that the photograph of the space ship was that of an electric lamp standard, which could be found in most lamp-fitting manufacturers' catalogues and generally expressing doubt about the claims made by the author. Some suggest, in spite of the affidavits which have been sworn and which are reproduced in the book, that it is a piece of science fiction. Those affidavits, of course, need to be read very carefully. They do not, in so many words, say that they actually saw the Venusian, who, the author alleges, was interviewed by himself alone. I am glad to learn, however, from the publishers of his book that we shall be confronted with a number of astonishing developments in the flying saucer story during the course of this year that will make Mr. Adamski's account look old fashioned and commonplace. I am also glad to learn that Mr. Adamski plans to visit this country in June and that any sceptic will have the opportunity of asking him questions direct. I hope to be present at that meeting and to receive convincing answers to some of the questions which I have already propounded. After all, I can fairly claim to have been associated with the science of aeronautics for a long period of years, and with all those responsible for the creation of the aircraft industry. No one would suggest that I am unacquainted with aeronautical theory, nor with the problems involved in space travel. Indeed, this journal has published more about that subject than any other in the world. From this you will concede that my opinions are not those of a sceptic, but those of one able to discriminate between science fiction and fact.

When I questioned the photographs of the alleged Venusian ship and stated categorically that it looked like an electric light fitting with the suspending ring at the top, the mechanically knurled edges of the metal work and the lamp bulbs clearly showing beneath, I was told that according to experts the lamp shade must have been thirty-five feet across! I pointed out that one could drop a lamp shade from the top of a high building or from an aeroplane and photograph its descent, but was informed that two independent photographic experts had examined the photographs and they adhered to their opinion that the photograph was genuine.

Those, however, who think that this is some sort of a hoax, must bear in mind that if it was intended as such the author would have been a little more subtle and would have gone to the trouble of constructing an object more in accord with the popular idea of what a space ship would be. Some have written to say that the object resembles a child's humming top, others a bath plug or the lid of an electric kettle. The author insists that it is a photograph of a space ship, and we must leave it at that.

Now my friend Hugo Gernsback, a well-known science editor of American publications, makes the unequivocable statement that the first atom-powered space ship will take off for the moon in 1970. He forecasts a television-guided space ship which will be unmanned. I think everyone will agree that the very first flight to the moon will be by means of an unmanned space craft equipped with scientific recording apparatus. Gurnsback goes further when he says that it will be fitted with a unique television transmitter which will relay to the earth all the sights, sounds and experiences which humans might undergo on that epic flight which will be the forerunner of the manned ships of the future.

The illustration on the cover of this issue shows his conception of an Earth-Moon space ship in flight with the atomic plant in the rear. The funnel-like object on the atom section is a rocket which, when fired, steers the space ship to the right. Other rockets are out of sight on the opposite side. The disc-shaped circular objects are six "search" radar units and the six long tubes are television telescopes which can be pointed in any direction. The telescopes are inside the tube, so that they may be more easily telescoped. The illustration reproduced above shows a section through the observer station on Earth from whence the rocket is guided electronically. Everything the space ship sees is instantly transmitted by television to the sight screens simultaneously. A close-up of the moon is shown above by 1; the Sun Corona by 2; the half Earth by 3; Saturn by 4, Mars by 5; the Andromeda nebula by 6; the test animal on the space ship, now weightless, by 7, and the instrument board on the space ship by 8.



Section through the earth observation station as conceived by Gernsback.

Mr. Gernsback thinks that such a ship will commence its flight in the year 1970, a date supported by a number of scientists over here and in America.

Such a journey at the speeds contemplated will take 250 hours, or about eleven days.

We know nothing at the present time about the behaviour and the survival of animal life during space flight. There are the hazards of extreme heat and cold ranging from almost absolute zero to hundreds of degrees of heat. The traveller must also contend with cosmic rays, ultra violet radiation, the weightlessness of the internal organs of the human being for days on end, space sickness, damage to the space ship caused by meteorite collisions, to mention but a few of the hazards. It is obvious, therefore, that much more information must be garnered by unmanned flights before human beings attempt such an interesting but perilous task. It is simpler, in any case, to undertake an unmanned flight. Air conditioning and air purefying a space ship for at least six men would entail extremely heavy apparatus, and weight saving on space craft at this stage is of prime importance. Human beings must be provided with facilities for water and food and sleeping accommodation, all occupying space and increasing the weight. I, therefore, am inclined to the view that unmanned flights will take place in this century round about the year 1970 and that the space for the weighty equipment mentioned will be occupied by light-weight scientific recording and transmitting apparatus. After all, scientific apparatus does not need feeding, nor does it need sleep. It is not likely to die without disclosing what it has found out. Even if it stops working and is not damaged in descent, it records something of the conditions through which it has passed. So many instruments to-day are able to record human functions and act as mechanical brains that it is hardly necessary for the human being to do more than write on a sheet of paper what the dials record, or to analyse the photographic records.

We know a great deal to-day about guided missiles and unmanned craft, which can be sent to their destination without a pilot, do a particular job of work, such as dropping a bomb or a parachute to which scientific apparatus is attached, like a radiosonde. Technically, therefore, there seems nothing in the way of an unmanned flight to the moon, and the only questions which arise are how, when, and how much will it cost? No competent scientist doubts that space flight is now technically possible if we are prepared to put enough money and effort into it, for progress in rocket research during the last ten years has put us firmly on the road to the stars.

Speeds of 2,000 miles per hour with rockets have already been achieved and the speeds of manned rockets will achieve 5,000 miles an hour at an altitude of 250 miles.

The artificial satellite is, of course, the first consideration for purposes of refuelling. When the flight will take place and how much it will cost are problems which are tied together. According to Cleaver, who has done so much research work in this subject, a manned satellite would cost in the year 1975 £250,000,000, and a manned moon flight £1,000,000,000 by the year 2,000. These sums of money, of course, seem enormous, but we must relate them to others.

Take the largest sum mentioned, about £1,000,000,000. Most of this would be spent in non-recurring research, and that is the amount the United States spends each year on atomic energy and it is the amount it spends every two years on rockets. It is a quarter of the amount spent every year on aviation, and one hundreth of the amount spent so far on flying. It compares favourably with the sum we spent on World War II. At present, therefore, the military budget of a single nation could easily absorb in a few years the cost of the first steps into space. The earth satellite, of course, has several military applications, apart from those of space exploration.

It is obvious that true space flight, such as expeditions to the moon and planets, will not take place until there is a strong and influential body of opinion believing it to be worth while. It is a depressing thought that it will only be considered worth while when the great powers believe that space travel has military and warlike significance.

It must be remembered, however, that scientific research always pays dividends in the long run. It may take centuries It is hopeless to expect that those dividends will be quickly attained. It took centuries to develop the aeroplane and the internal combustion engine. It has taken thousands of years for Hero's demonstration of the reaction turbine principle to be put into practice. We must not consider cost in such a vast and important project. The recent successful surmounting of Mount Everest, for example, has no practical value, but it stimulated the world. How much greater would that stimulation be if Great Britain became the first nation to conquer space?

The spirit of curiosity and wonder has been the driving force behind all of man's achievements. Man will still want to conquer space, even if he finds that there is nothing at the other end. The search for the end of the rainbow will go on. The moon is not the only target for those interested in interplanetary travel. After all, the moon is only about the size of Africa, but it is important as a base—the first stepping stone to the planets. The other planets have their moons, too, with at least ten times the surface area of the earth waiting to be explored. It is almost certain that there is life on one of the planets, probably Mars. How fascinating it will be to discover what sort of people they are, how they live and whether they have made the same scientific discoveries as we.

Certain it is, however, that this century should see the circumnavigation of the nearer planets and perhaps landings on them. There is little practical difference between flights to Mars and Venus, although a little more difficult than a flight to the moon. In fact, the only real difference is the time factor.

Interplanetary travel may arrive sooner if atomic propulsion is evolved in the next few decades, for power in the atom makes the power requirements of space flight trivial. A small number of tons of the atomic power used in the first atomic bomb would be required to propel a space ship to the moon, and certainly by the 21st century space flight will be in full swing and the greatest age of exploration will be under way.

To-day we are like the people of mediæval Europe who lived in their tiny closed world around the Mediterranean before the great voyages of the Elizabethan age opened up the globe and destroyed the theory that the earth was flat. People of that period could never have imagined the ultimate consequences of those voyages—the unheard of civilisations to be found in lands then unknown.

That same sequence of events is beginning again on a far larger scale, and it is most appropriate that we should see it start when there is a second Elizabeth on the throne.

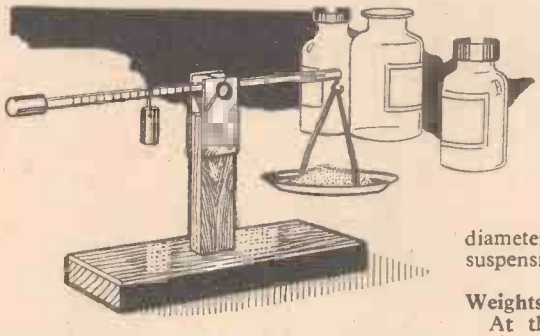
Once our atomic powered space ship has been launched it will be in constant and uninterrupted communication with the earth, but due to the earth's rotation on its axis and the moon's rotation round the earth, it will be necessary to have from four to six observation points at widely separated stations on the earth, located somewhere near the equator. By means of radar we shall be able to keep track of the space ship, except for a few hours when it circumnavigates the moon. The observation points around the earth will probably be linked by short wave radio, so that they may operate as a single unit.

The Interplanetary Society, founded in this country, has done a vast amount of work on this subject. Its members are all men of scientific achievement and they believe in the possibilities. The public interest is there. It seems, therefore, that the solution to the problem is only a matter of money.

The present financial burdens of rearmament make it impossible for at least 10 years for any of the large powers likely to be interested in space travel to divert comparatively large sums of money for the purpose.

As has been the case with every important scientific development the pioneers must continue to plod along slowly, supported by the meagre sums they can obtain from membership fees and private gifts.

An impression of a lunar ship approaching a crater area of the moon showing reverse blasts for safe landing.



A Simple Beam Balance

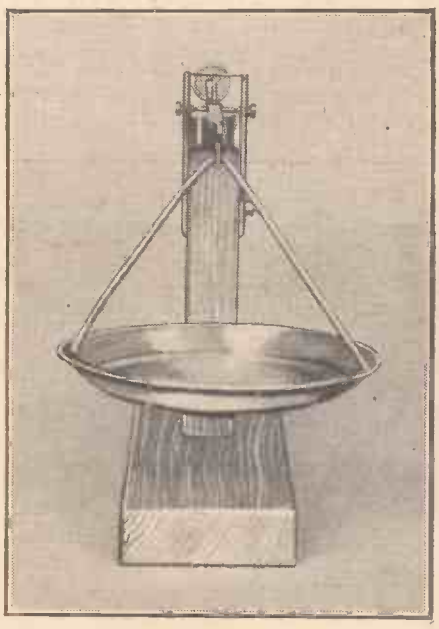
A Handy Appliance for the Workshop or Darkroom

By J. D. M.

THE balance was originally designed for weighing photographic chemicals, but it can no doubt be used for other purposes. It is small, accurate to a reasonable degree and, what is an asset to non-technical minds, it is extremely simple to make. The balance weighs small quantities up to 25 grams in stages of 1 gram, or up to 1oz. in ¼oz. If higher values are required then multiples of values up to 25 grams, or 1oz., are easily obtained.

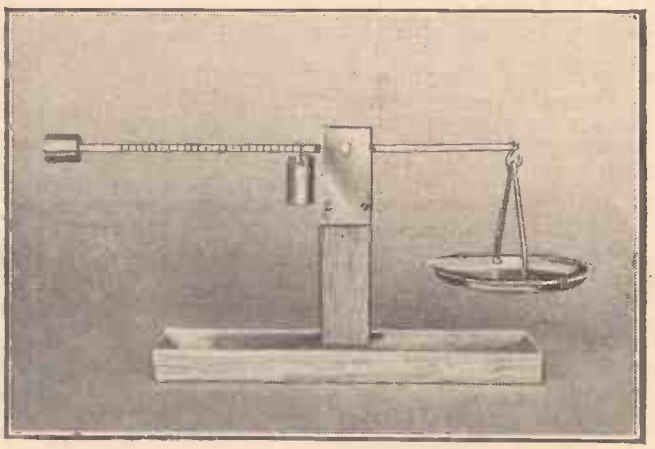
The Fulcrum

The fulcrum is the most important part of any balance and, to overcome the difficulty of friction, the balance staff and pivots of an old alarm clock were used. The clock balance staff was mounted between end plates on a vertical wooden column. The thickness of the column depends on the distance between the original clock end plates. In fact, the original clock end plates



(Left) End view showing the side bearing plates and pan.

(Right) A view of the completed balance showing the simple stand and mountings.



can be used if so desired. The clock pivots can either be screwed into the balance end plates or soldered into holes drilled in them (see Fig. 1).

The Beam

The beam is 8½in. long of ⅛in. sq. silver steel. A hole is drilled through it 3in. from one end to take the balance staff, and another at right angles to take the pointer, which is made from part of an old gramophone needle. Fig. 2 shows the pointer and balance staff soldered in position.

One end of the beam has a hole drilled through it to take a ⅛in. diameter steel hook which supports a copper or an aluminium pan. The pan is 3in. in diameter and its supporting wire is 2in. above the rim of the pan. The pan, of course, can be of any size or shape, and if it is made smaller in diameter the distance between the point of suspension and fulcrum can be decreased.

Weights

At the other end of the beam a brass counterweight is forced on. The adjustable weight is of the same material and diameter. The exact weight of the balance weights depends on the weight of the pan. The counterweight is about three-fifths the weight of the adjustable one. The moving weight is held on to the beam by a wire which fits into slots in the beam top.

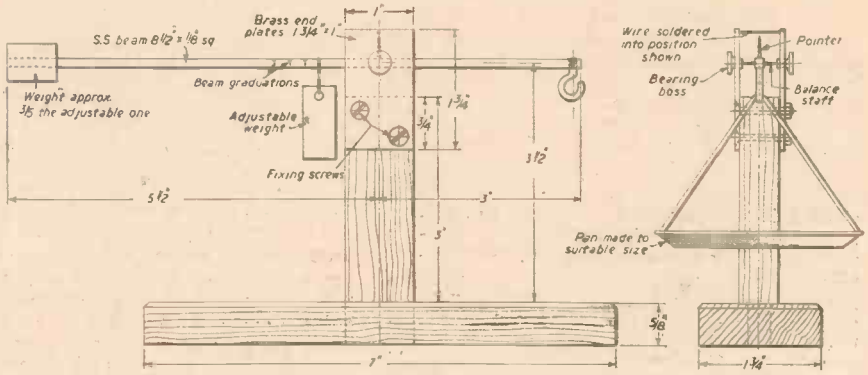


Fig. 1.—Side and end elevations.

Balance Support

The base and column are made of wood. The 3in. high column is screwed into a base 1½in. x 7in. The brass end plates are 1¾in. x 1in. and can either be bolted through or screwed into the wood.

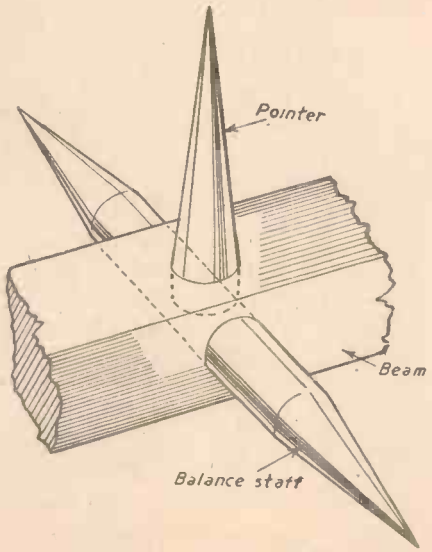


Fig. 2.—Details of the balance staff and pointer.

Calibration

With the balance assembled bring the moving weight near to the control column. When the beam is in a horizontal position cut a slot in the top of the bar to take the suspension wire of the adjustable weight. Also, solder in a wire across the top of the end plates in line with the pointer needle. On the two left-hand vertical faces of the beam, stick white paper for the scale and mark off the zero point already obtained. The scale is graduated by putting appropriate weights on the pan and then marking off the scale. The scale shown gives the 5 grams in red marks, and 1 gram values in blue. On the other side of the beam the scale is marked off in ¼oz. If difficulty is experienced in obtaining weights for calibration, then the use of coins will facilitate matters:

1 halfcrown = ½oz.
1 halfpenny = 5.5 grams } mean values of
1 penny = 9.3 grams } several coins.

A Power-driven Wringer

Constructional Details for Converting an Ordinary Hand-operated Wringer to Electric-motor Drive

By R. J. HUNT

THIS wringer was constructed for use in connection with the washing machine described in the August, 1953, issue of PRACTICAL MECHANICS. The washing machine was completed three years ago and the wringer six months later; both have been used for the weekly wash of a family of three ever since and have given complete satisfaction, subject to a few minor adjustments and repairs from time to time. The combined machine provides a very useful adjunct to the kitchen in a neat and compact form which fits conveniently along the kitchen sink.

The object was to adapt an ordinary hand-operated rubber roller wringer to be driven by a similar power unit to that used in the washing machine, with power provided through the same transformer. The wringer was purchased second-hand, and at the time of purchase these machines must have been in short supply for the only one which was obtainable was a 16in. pre-war type. On inspection after purchase it was discovered that the bearings were of hardwood and these had to be renewed in brass before the machine was suitable for conversion. Wringers of the modern type, which are more pleasing in appearance, are now fairly common in second-hand shops at reasonable prices, but whatever type is used the intending constructor should see that the bearings are of metal and work freely up and down in their slots, otherwise much labour will be necessary in converting them.

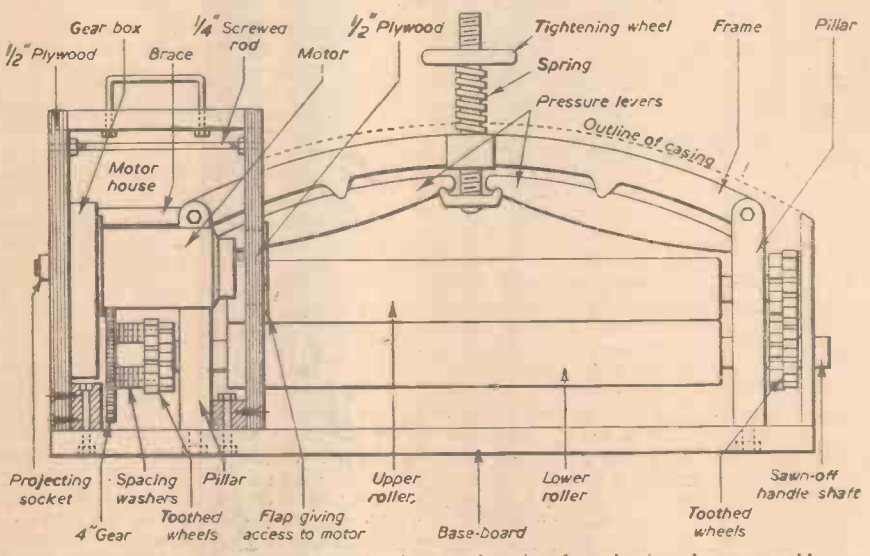


Fig. 1.—Combined front elevation of wringer and section through motor house assembly.

Baseboard

A sketch showing the general arrangement of the wringer in conjunction with the power unit is given in Fig. 1, and a more detailed drawing of the motor housing in Fig. 2. It will be seen that the lugs for fixing the wringer to the sink or table have been removed and that the wringer is bolted to a ¾in. plank which serves as the base for the whole assembly. The handle of the wringer has also been removed and the projecting shaft to which the handle is attached sawn off. This, of course, is not essential and, if desired, the shaft may be left so that the handle may be used in an emergency. In this particular case the limitation of space made the removal of the projecting shaft essential.

The Power Unit

It will have been noted that the power unit is the same type of Bendix hand generator and gearbox which was used for the washing machine, but there are two important departures from the adaptation used in that case. The first is in relation to the brush gear, where, as before, a seating is provided for another brush at right angles to the existing brushes on the L.T. side. In this case, however, both the existing brushes are retained and another brush is required in the centre seating. One of the H.T. brushes which has been removed will be quite suitable for this purpose. With three brushes arranged as described, the middle one being common and the current switched alternately from one to the other of the outside ones, it will be found that the motor will reverse. A simple three-stud switch will therefore enable the direction of the rotation of the rollers to be reversed, and this enables articles to be wrung first in one direction and then the other, as well as helping to free any jams which may occur owing to the varying thicknesses of material being wrung.

Fig. 3.—The completed power-driven wringer ready to be swung out into service.

The second variation is the alteration of the outlet of the power drive from the gearbox. In the case of the washing machine, it will be remembered that this outlet was the handle socket on the side of the gearbox opposite the generator. If this arrangement were retained the length of the wringer would be too greatly increased. With a 16in. wringer being used, it was necessary to reduce the space occupied at the end to a minimum and the gearbox was altered so as to enable the power outlet to be on the same side as the motor.

Gearbox Details

On the gearbox being dismantled it was found that the shaft of the large gear was sufficiently large to take a ¼in. tapping hole, and this was drilled very carefully so as not to go out of centre (no lathe being available) and tapped to take a ¼in. silver steel shaft screwed to the necessary length. The shaft projects on the motor side sufficiently to take the driving pinion. On the other side it projects through the driving handle socket, which is first filled by inserting the square shank of the driving handle sawn off flush and with its centre hole drilled out to ¼in. A ¼in. nut is then screwed tightly on to the projecting end and made secure by a pin

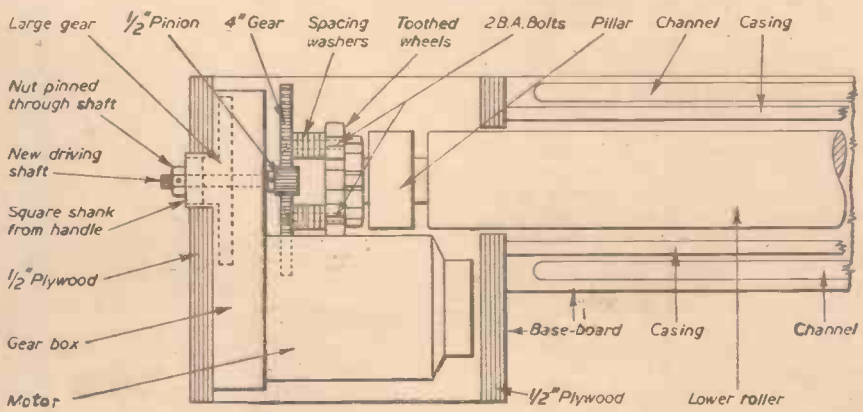


Fig. 2.—Enlarged plan view of motor unit and part of wringer.

inserted in a 1/16in. hole drilled through nut and spindle.

It will be seen that the transmission of the drive from the gearbox to the wringer is by means of a small pinion attached to the new driving shaft of the gearbox meshing with a large gear wheel attached to the shaft of the lower roller. These gears were obtained from a disposal stores and the gears used were a pinion of ½in. diameter meshing with a gear wheel of 4in. diameter. The relative sizes of these gears are, of course, very important, because if the reduction is not sufficient there will not be enough power to drive the rollers against the very heavy resistance offered by wet articles. The above sizes have been found satisfactory in practice to drive the wringer at a moderate speed with a minimum number of stoppages to reduce pressure in order to free a jam.

Gear Wheel Fixing

The fixture of the large gear wheel to the roller shaft may present some difficulty. In this particular case the shaft diameter was ⅜in., whilst the diameter of the hole in the gear was 1in. and no suitable material for bushing was available. In these circumstances the expedient was adopted of bolting the gear direct to the toothed wheel on the roller shaft. The wheel on this type of wringer was secured to the shaft by a bolt, on removal of which the wheel could be slipped off the shaft. At the base of each of the six teeth on the wheel there was sufficient space to take a 2 B.A. tapped hole. These holes were first drilled and then the toothed wheel replaced on the shaft. The thickness of the adjoining portion of the shaft was then built up by winding carefully round it a strip of paper (a strip from one of the reels of adhesive brown paper in common use was used) until the diameter was sufficiently increased to provide a snug fit for the gear wheel. Using the holes drilled in the toothed wheel as a template the positions of the corresponding holes required in the gear wheel were then carefully marked and the holes drilled. If these operations are carried out very carefully the gear when bolted to the toothed wheel should be quite true. The distance between the gear and the toothed wheel can be adjusted by means of spacer washers on the bolts.

It will be realised that the utmost rigidity must be obtained in the fixing of the gearbox so as to keep the pinion tightly in mesh with the large gear and prevent any risk of slipping and stripping the teeth of the gears.

Motor Housing

The assembly adopted for the purpose will be fairly clear from Fig. 1. The gearbox itself is bolted, by means of the lugs provided, to a piece of ½in. plywood, forming the rear of the motor housing. This is secured at the base by being screwed to a piece of 1½in. x 1in. batten which is bolted to the baseboard. At the top it is secured by two pieces of ¼in. steel screwed rod by which it is connected to a similar piece of plywood forming the front of the motor house. An additional brace is provided at the top by means of a right-angled bracket with base bolted to the rear board of the motor house and the end securely bolted to the top of the side pillar of the wringer.

Whatever type of wringer is used it will be advisable for the sides and top of the motor housing to be cased in, with the sides easily detachable to facilitate access to the motor. It was also found necessary to provide an opening covered by a flap in the front of the motor house so as to permit the insertion of a long screwdriver to reach the bolts fixing the motor to the gearbox, so that the motor could easily be removed for any necessary attention.

The covering of the remainder of the wringer will depend on the type of machine used. If of the modern type with an attractive enamel finish it may be better to leave it as it is, but where the machine is of the old-fashioned type with the unattractive cast-iron frame exposed it would be preferable to encase it with plywood, finished with enamel paint, which looks quite attractive and can be kept clean easily. The final arrangement of wringer and washing machine is shown in the photographs. Fig. 3 shows both out of use, with the wringer pushed back to the wall and the draining board in its ordinary position in front of it.

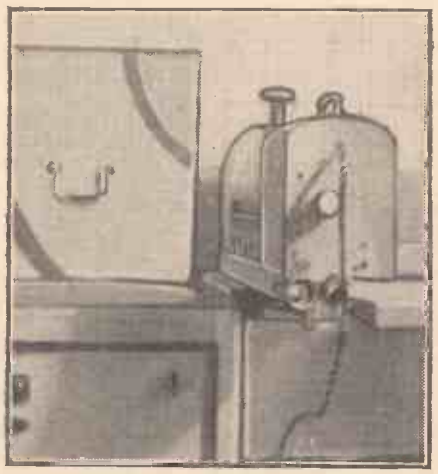


Fig. 4.—Another view of the completed wringer in position over a kitchen sink.

The illustration also shows the wringer ready to be swung out into service. It will be seen that the baseboard is attached to a pivot over the sink so that the other end can travel over the lid of the wash-tub to enable the wringer to take up its position for wringing. The arm which can be seen at the right-hand side of the washing machine normally supports the side of the draining board, but a portion of it is hinged near the end so that that portion can be turned to rest on the front edge of the sink and support the wringer in its wringing position.

This becomes clearer in Fig. 4, which shows the wringer in position for wringing. The lid of the wash-tub is here shown removed and standing at the back, the draining board has been placed in position across the sink to receive the wrung articles which are led through the wringer after removal from the tub. Note that two small wheels have been fixed to the rear of the wringer. These avoid the necessity of lifting the heavy weight of the wringer in order to swing it backwards and forwards into position. The handle on the motor house also facilitates this movement. The curved strip appearing on the left of the lid of the washing machine is a piece of aluminium sheet which acts as a track for the wheels and prevents damage to the enamel surface. The lips to the apertures in the casing giving access to the rollers are also faced with aluminium so as to prevent wear by contact with the wet articles.

The left-hand switch in the front panel of the cabinet is the on/off switch for the washing machine. The right-hand switch controls the wringer. In its upright position it is neutral and the rollers are motionless; turned to the right, articles are wrung in the direction of the sink, to the left the rollers reverse and return the articles towards the wash-tub. The cable shown in the illustration, Fig. 4, is three-core and conveys the current to the wringer after control by the switch. One lead of the two from the transformer passing the current is taken direct to the centre brush of the motor, the other is taken to the centre of the control switch. Leads from the forward and reverse studs of the latter are taken to the other two brushes. Thus there are three leads to be taken to the motor of the wringer and, as the latter has to be moved backwards and forwards, they are first taken to a three-pin plug screwed at the side of the cabinet and thence, on the insertion of the plug, to the wringer. When the latter is swung back against the wall the plug is removed and the cable dropped at the back of the wringer out of sight.

Discharge Vents

It will be noted that there are vents cut into the panels covering the front and back of the wringer. These discharge the water from the wringer into channels cut into the baseboard. At the centres of these channels holes have been drilled into which have been driven two short lengths of copper tube, which project slightly below the bottom of the baseboard. These ensure that the water ejected by wringing discharges either into the sink or back into the wash-tub and none is spilled on to the floor.

The Editor judging the models at the Powers-Samas Exhibition.

MACROPHOTOGRAPHY

Notes on Photographing Small Objects and Making an Adjustable Stage

By A. F. BAGSHAW

Fig. 5.—Head of a small fly, about 3 mm. diameter. Macrophotograph approx. 36 diameters. Leica f 12.5. 3 minutes.

WHEN photographing very small objects, or small areas of objects, with the camera lens only about 2in. away, critical focusing is essential. The depth of focus, even at minimum lens aperture, permits a tolerance not of feet or inches, but of millimetres. This sphere of photography—the technique of photographing small objects and reproducing at natural or larger than natural size without the aid of a microscope—is termed "macrophotography."

Fig. 2.—Method of taking macrophotographs with a Leica camera fixed to a sliding arm mounted on a column.

The correct range for taking macrophotographs can be found in two ways: (1) by visual focusing; (2) by measurement. The former method can be used with cameras embodying a ground glass focusing screen, such as plate cameras, with reflex cameras and with cameras to which a focusing screen can be attached. In other cases it is necessary to measure the distance from the object to the camera lens. Visual focusing is the more satisfactory of these alternatives, because apart from obtaining correct focusing the operator can actually observe the composition of the image before he records it on film.

Generally speaking, macrophotography demands long exposures; long, that is, compared with the outdoor "snapshot." Exposure depends on several factors, including film speed rating, distance from lens to film, intensity of illumination, the light-reflecting characteristics of the object and, of course, the stop used. For this type of work the smallest stop gives optimum results. The exposure time will vary from a few seconds to several minutes. A rigid support for the camera is thus essential in order to avoid movement during exposure. The kind of support will depend, to some extent, on the type of camera, but most cameras can be attached to a sliding arm on an enlarger column. The camera is secured to the arm by a screw threaded to accommodate the tripod bush.

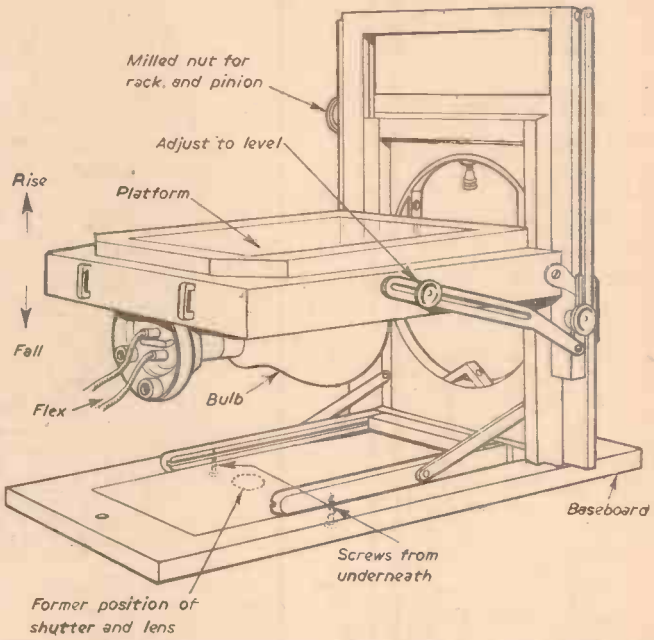


Fig. 1.—The rise-and-fall platform made from a modified half-plate camera.

Rise-and-fall Platform

Once the camera has been locked in the position which is most convenient it is desirable to move the object rather than disturb the camera. It is more difficult to raise and lower the camera through a few millimetres when focusing than to move the object. The easily made rise-and-fall platform, illustrated in Figs. 1 and 4, achieves that end.

Fig. 6.—Part of the final grooves of a gramophone record. 20X. 4 minutes at f. 12.5.

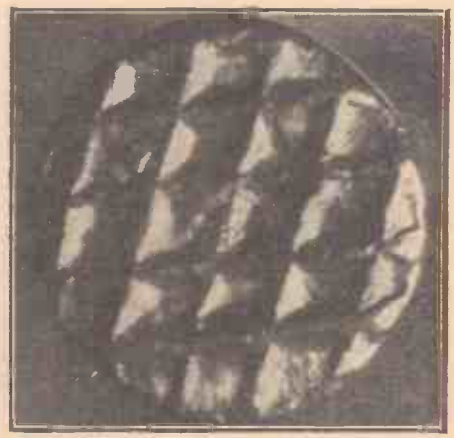


Fig. 7.—Head of a 2in. nail. 2 minutes at f. 12.5.

It is essentially a slightly modified half-plate camera; it may be possible to obtain a cheap secondhand one.

To adapt the plate-camera, remove the lens, the shutter and the bellows and secure it to a baseboard of well-seasoned wood (in this case oak) about 12in. by 7in. by ½in. so that the ground glass formerly used for focusing forms a horizontal stage. Four holes should be drilled in the baseboard to take the brass screws which are inserted from underneath and driven into the maho-

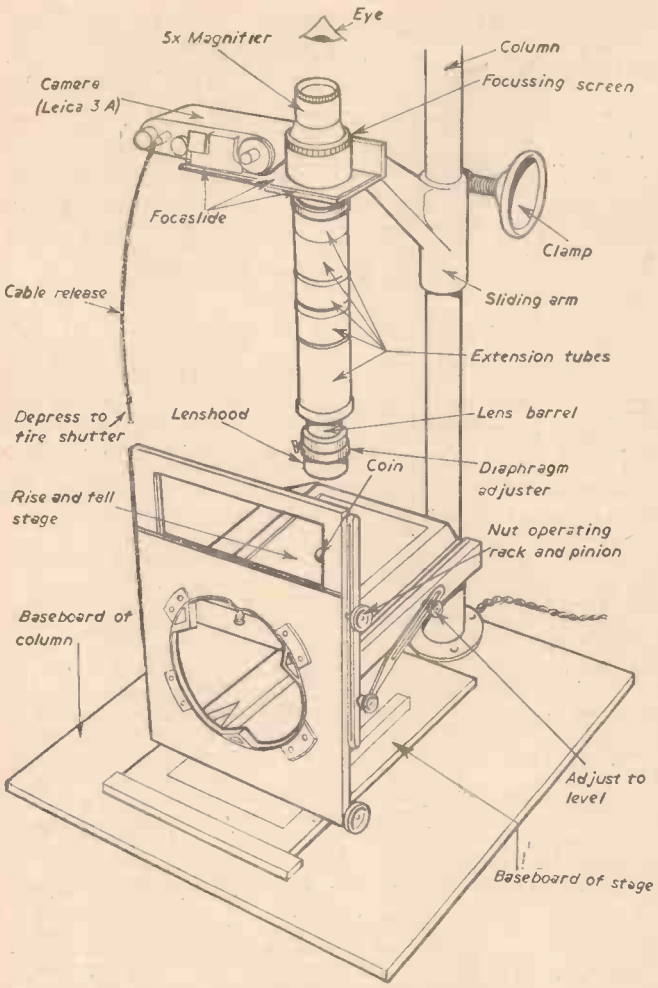


Fig. 3.—Details of the focusing arrangements for taking macro-photographs.

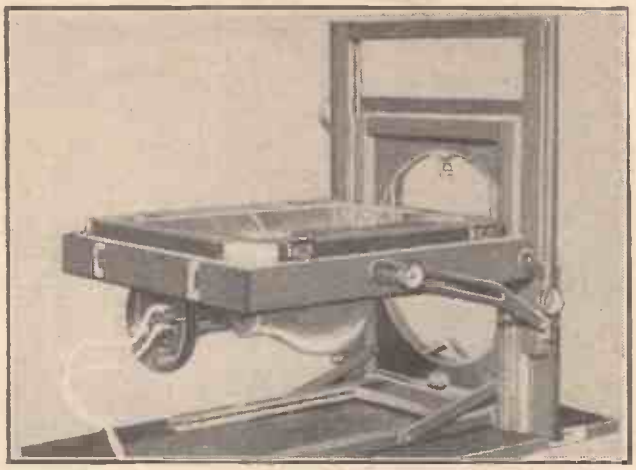


Fig. 4.—A photograph of the completed rise-and-fall platform.

Fig. 9.—Eye of a small sewing needle. 90 secs. at f. 12.5, using Leica. 20X.

gany frame of the plate-camera. These can be at any convenient point and will roughly form the corners of a square. It is important to drill the mahogany for about half the distance that the screws will penetrate to avoid splitting the frame.

With a spirit level on the glass, adjust the brass strips located on either side of the frame until the platform is level. The baseboard is fitted with four rubber feet.

There is a milled brass nut on the frame which operates a rack and pinion, raising or lowering the stage as desired. A total movement of 6in. is possible and, although a few millimetres will suffice in the case of small objects, it is useful to be able to lower the platform to enable larger surfaces to be included in the negative without moving the camera—for copying prints or photographs 8in. by 6in., for example.

For illuminating transparent objects, such as colour transparencies, an opal 75 watt bulb is provided beneath the platform. The bulb rises and falls with the platform thus keeping the intensity of light even. A condenser is not necessary as the glass of both the bulb and the platform is frosted. For opaque subjects the light is extinguished and alternative lighting from above is employed.

Visual Focusing

Figs. 2 and 3 show a Leica camera fixed to a sliding arm mounted on a column. Visual focusing is achieved by means of an accessory called the Focaslide which consists of two metal plates, one for attaching to the camera and the other for holding the lens and extension tubes. On one plate there is a ground glass screen with a masked-out area equal to the size of the negative, and in exactly the same plane as the film. When the image of the object to be photographed is in sharp focus on the glass it will also be in focus when the camera is slid into the same position directly over the lens.

The metal cylinder above the focusing screen next to the camera is a 5X magnifier to assist in accurate focusing. A cable release is used to obviate camera shake, and it will be seen that a lenshood is employed. The latter is important to prevent stray light falling upon the lens. The rise-and-fall platform can be seen under the lens. It is in an exactly parallel plane to the film, thus ensuring perfect all-over focus. The extension tubes were made by a local garage mechanic and the combination shown gives a magnification on the negative of four diameters which can subsequently be increased by ordinary enlarging.

The main problem in actually taking these macrophotographs is calculating exposure time. To begin with, the way to ensure good results is to make test exposures, keep a record and then compare these with later attempts. After a time, however, experience will generally provide what the average exposure meter, at small distances, cannot.

Examples of some macrophotographs are given in Figs. 5, 6, 7, 8 and 9.

Fig. 8.—Reverse of fountain-pen nib. Leica. 2 minutes at f. 12.5.

Fig. 11.—Wind-borne unit with cover removed.

A New Radar Meteorological System

Particulars of the World's First Fully Automatic Radar System for Weather Observations in the Upper Air

(Continued from February issue.)

The Aerial Unit.—The transmitting and receiving aerials are mounted on a common pedestal on the roof of the ground station. The transmitter radiates through a pair of vertically polarised Yagi arrays. These are mounted on either side of a 5ft. diameter receiving paraboloid and nutating dipole which provides a conical scan. Misalignment of the aerial causes amplitude modulation of the incoming signal at the coning frequency. An error signal is thus produced and is fed to a servo system which re-aligns the aerial.

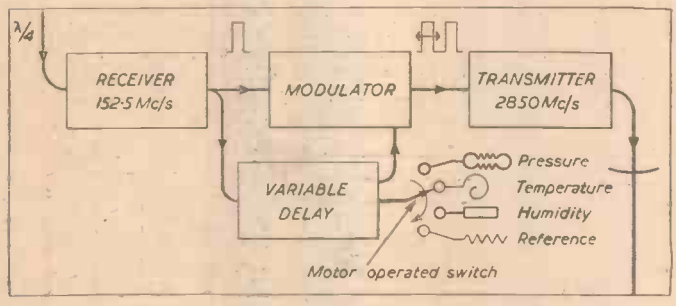


Fig. 13.—Block schematic of the air-borne radar wind unit.

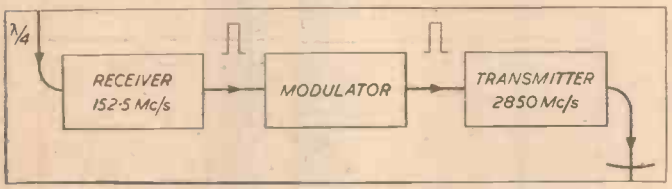


Fig. 14.—Block schematic of the air-borne radar sonde unit.

Transmitter/Receiver Unit.—In the operations room, the equipment may be broadly divided into two sections, namely, the radar equipment and the computing and recording equipment. The radar equipment comprises a V.H.F. transmitter; a microwave receiver; a display unit and a control column.

The transmitter and receiver are built into 6ft. consoles and form the left- and right-hand sections, respectively, of a 4-unit console. The display unit is located between them and houses the range display oscilloscope and aerial azimuth and elevation repeater magslips. The control column extends from the top of the display unit to the ceiling and carries the controls and indicator lamps for the main power supplies.

Wind Computer.—The computing and recording equipment includes a wind computer and a 3-unit console comprising a wind recorder, a telemetering unit and a sonde recorder.

The wind computer is a separate unit and is built around a 4ft. diameter rotable table. Wind direction is computed and recorded on a polar chart fixed to the table.

Recording and Telemetering Unit.—This is a 3-unit console at the left-hand of which is the wind recorder. This unit houses the wind-speed and true-height pen recorders and the main controls for the complete console. In a radar wind theodolite the wind recorder is mounted separately. The telemetering unit is the centre desk unit of the console and houses a teleprinter and telemetering circuits. The sonde recorder forms the right-hand unit of the console and houses the pressure, humidity and calibration recorders. The latter monitors the operation of the sonde airborne unit.

Power Supplies.—Power supplies for the ground station are derived from a central power supply unit, remotely controlled from the control column. This unit may be located in any convenient position in the station. It requires a supply of 415v. ±. 15 per cent., 3-phase, 45-65 c/s and has a total power consumption of 15kVA.

Airborne Units

These have been designed for economic mass production to enable costs to be kept to a minimum since in normal operation two of these expendable units may be released every day. Two types are available, a radar wind unit for radar wind operation and a sonde unit for radar sonde operation.

The radar wind unit comprises a receiver which triggers a transmitter. The sonde unit contains, in addition, three meteorological elements for measuring pressure, temperature and humidity, which are switched in sequence by a motor-driven switch, and a precision pulse delay circuit which provides the necessary pulse-time modulation for telemetering. The temperature element is a coiled wire resistance thermometer of small time constant and low radiation constant. Pressure is measured by a conventional aneroid capsule operating a movable core in a coil, and, similarly, the electrical signal for humidity is obtained from a goldbeater's skin element. The complete meterological unit is newly designed and represents an advance in technique.

Power for both units is obtained from 6.5 volt, 2.5 amp batteries, the h.t. supplies being furnished by a vibrator. Both units employ miniaturised equipment mounted in a light, thermally-insulating container, and are suspended from the balloon by means of the quarter wavelength receiving aerial. The transmitting aerial projects from the bottom of the container. The balloon is the usual type of size determined by the extreme height to which it will be needed to ascend. No radar reflector is needed with this equipment so that the balloon and airborne unit is more compact and appreciably easier to launch than the usual balloon, reflector and radio sonde assembly.

Meteorological Specification

Maximum Range :—Exceeds 100 nautical miles (185 km.).

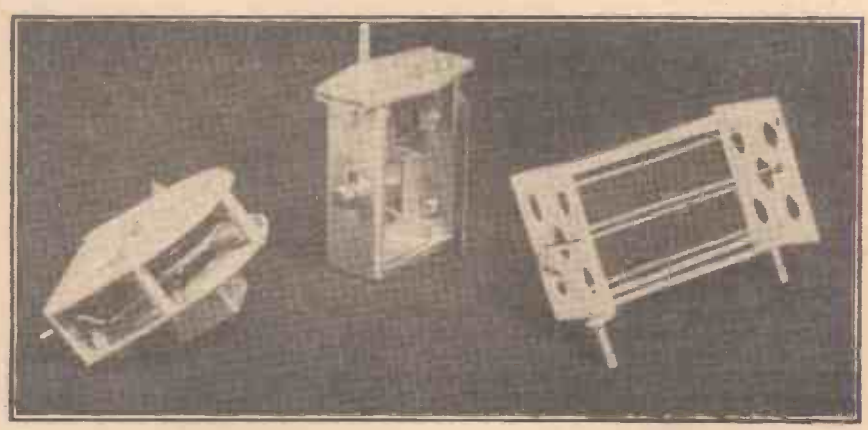


Fig. 12.—Temperature, humidity and pressure elements of the air-borne radar sonde unit.

Height :—At least 100,000ft. (30.5 km.).
Information :—Radar Wind: wind speed; wind direction; balloon bearing; balloon height and balloon range. Radar Sonde: Covers additionally temperature, pressure and humidity.

PERMANENT RECORDS—OBTAINED AUTOMATICALLY

Presentation of Results :—Wind speed, strip recorder; wind direction, polar chart covering 100 mins. flight; height, strip recorder; temperature, pressure, humidity, strip recorder for profile observation and 4 digit numbers on teleprinter tape.

Visual Readings :—Bearing, fine and coarse magslip indicators; range, pulse display on c.r.t. (A-scope).

MEASUREMENT RANGE AND ACCURACY

Speed and Direction :—Range, 0-300 knots; accuracy, 3 knots vector.

Height :—Range, 100,000ft. (30.5 km.); accuracy, 200ft. (61 m.) or 0.5 per cent. whichever is greater.

Temperature :—Range, 110° to −150°F. (43.5° to − 65°C.); accuracy, 0.5°F. (0.28°C.).

Pressure :—Range, 30-300 mb 300-1050 mb; accuracy, 1 mb 2 mb.

Humidity : — Range, 0-100° r.h.; accuracy, 1 per cent.

The last three measurements represent an accuracy of 0.1 per cent. of full scale on the telemetering channel and are the accuracies of the electronic system. Overall system accuracy is limited by that of the meteorological elements, which in the case of temperature approaches the figures quoted whilst pressure and humidity are lower. The overall equipment is designed to accommodate meteorological units of an accuracy greater than those currently available.

BASIC OPERATING DATA (ELECTRICAL)

	Transmit	Receive
Frequency: Ground Station	152.5 Mc/s	2,850 Mc/s
Frequency: Radar Sonde Unit...	2,850 Mc/s	152.5 Mc/s
Power Output: Ground Station	50kW peak	
Power Output: Radar Sonde Unit...	30kW peak	

Modulation :—Pulse at 404 c/s repetition, 2μs duration. Variable pulse spacing from sonde unit to convey data.

(Reprinted by courtesy of Mullard, Ltd.)

A Masking Frame for Enlarging

A Cheap and Easily Made Photographic Accessory

By W. KETTLE

ALL amateur photographers, and especially those who do their own enlarging, will appreciate that to place a white border round their prints and enlargements is a costly business. Even the cheapest adjustable metal masks cost in the region of £3 10s., and although they will last a lifetime they are not really as necessary as they would appear.

I made my own enlarger for practically the cost of the lens, and I have now made a universal masking frame that only cost a few shillings, plus one evening spent at the work bench. The idea is comparatively simple, and all that is required is a sheet of 6-ply measuring 12in. by 10in. approximately; a small tin of matt white paint; 5½ft. of plain picture framing; and four or five small knobs which can be bought at any of the cheap stores. It is assumed that the type of framing you decide to buy is appropriately sectioned as shown in Fig. 1.

Cutting the Picture Framing

First clean up the 12in. by 10in. piece of 6-ply and make sure that at least two adjacent sides are at 90 deg. angle; sandpaper well, and give two coats of matt white paint on one side only. Next, cut off two lengths of picture framing, one piece 12in. long and another piece 13in. long. Then plane face A until the ¼in. dimension is reduced to ⅛in. Next plane face B until the ¼in. dimension is reduced to a dimension whereas it is possible to place it on its face and slip a doubleweight postcard right up to the back end. Repeat this operation on both pieces then mitre the ends, using a protractor and a small saw. Carefully clean the edges and glue into position, as shown in Fig. 2, and trim the overhanging ends to suit. It will be understood that if this part of the unit is placed in position underneath the enlarger lens, and a piece of photographic paper is exposed in the usual way, we find on development that there is a plain white border down two adjacent edges of the postcard or whatever size of material that was used. The white base on the unit has also acted as a suitable screen upon which to focus the negatives. So far, so good, but now to obtain borders on any size of print we care to enlarge.

TABLE OF SIZES

Size of enlargement	Length C	Length D
3½in. by 2½in.	2½in.	3½in.
5½in. by 3½in.	3½in.	5½in.
6½in. by 4¼in.	4in.	6½in.
8½in. by 6½in.	6½in.	8½in.

Assuming that prints of the following sizes will be required (3½in. by 2½in.), (5½in. by 3½in.), (6½in. by 4¼in.), (8½in. by 6½in.), cut eight pieces of picture framing various lengths so that when each set is mitred and glued together they are of the dimension indicated in Fig. 3, and the table of sizes. It is essential before mitreing to perform the same planing operation on faces A and B as shown previously in Fig. 1. When these are completed, we have a set of four half masks as shown in Fig. 4, which will provide us with a cheap and easy method of obtaining the white border on most of the enlargements. Also a change can be made from one size to another, without the bother of sliding strips, etc., into position.

Fixing the Knobs

For easier handling of these angles, small knobs of the type used on small cabinet drawers can be screwed into position near, but not too near, the mitre joint. I have used one of these masking frames for a number of years now and have found them to be light, speedy to use, and will produce a perfect white border.

Using the Masking Frame

The actual enlarging procedure is very simple. Assuming it is desired to make enlargements half-plate size with a ⅛in. white border, first use the half-plate "angle" and place it into position as shown in Fig. 4. Place negative in the carrier and switch on. Move masking unit into position until the picture is correctly placed, higher or lower, enlarging head for size, and, finally, focus sharp. Switch off, remove angle, place sheet of sensitised paper in position, then replace the angle, and expose in the usual way. For different size enlargements, the same procedure applies, but a suitable size "angle" is substituted. It is a good idea to have the ends of the angles cut at a slight taper so that when they are pushed into position (Fig. 5) no light from the enlarger can pass through the joint, which would, perhaps, show a black line on the finished print. I would also add that if one does not wish to paint the base, a suitable sheet of thin white cardboard glued well down will do just as well. But this must always be kept clean, for its sole purpose is to act as a screen on which to focus the negative.

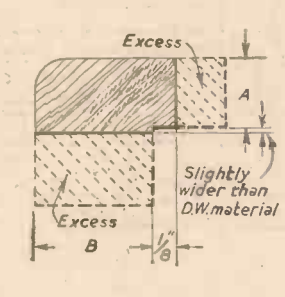


Fig. 1.

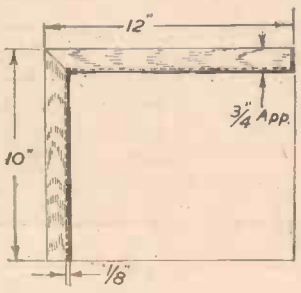


Fig. 2.

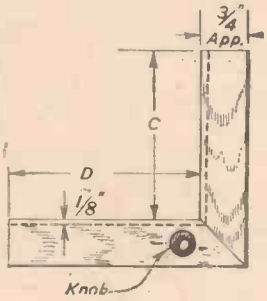
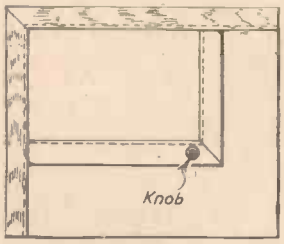
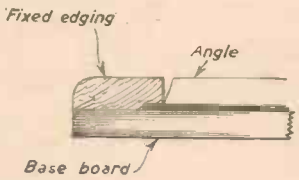


Fig. 3.



(*Left*) Fig. 4.



(*Above*) Fig. 5.

Figs. 1 to 5.—Constructional details for making the simple masking frame.

The Importance of Paper

Its Applications and Possibilities in the Modern World

By Prof. A. M. LOW

PAPER to most people, implies a material used for stationery, newspapers, magazines and books. But it is probable that little more than half the paper produced in the world is used for this purpose. In 1948 about 75,000,000,000 pounds of paper of all kinds were made ; about one-third of this amount was used for wrapping and one-twentieth for an extraordinary variety of purposes, from covering walls to insulating electric wires.

The world's appetite for paper has grown year by year and appears to be insatiable. Production of paper has more than doubled in the present century and if present trends continue it may soon double itself again. In the United States 5½ million tons of paper were used for printing newspapers last year, and the amount has increased by about 7 per cent. a year for some time. Other countries have not been able to increase their consumption of newsprint to the same degree, not altogether because there was less demand, but because there was no money. There are still hundreds of millions of people in the world who can neither read nor write. As they learn, they too will demand newspapers, magazines and books. It seems that, for any foreseeable time in the future, the production of paper for printing and writing will always lag behind.

At the same time the demand for paper for these purposes is increasing. Take the next biggest use of paper, boards and wrapping. Every year we ask for more wrapping paper, and we like the wrapping to be more elaborate. In any large city thousands of tons of paper a year are used for paper bags to hold purchases, sheets of paper to wrap cheese, butter and meat before they go into the shopping basket, paper containers to hold sugar, soap flakes and other things generally sold ready packed. For an increasing number of articles the paper cover serves not only to wrap the article for cleanliness but to make it more attractive to the eye or to carry information about its use.

Paper Containers and "Sacks"

Paper is now being used for wrapping articles that previously needed sacks. Heavy Kraft paper sacks are used for holding all kinds of goods for transport, from cement to flour. Now that the technique of making these containers immensely strong has been mastered they have the advantages that fine powders cannot seep through to cause dust. The estimated consumption of 700,000 tons of paper for use in "sacks" in the United States in 1948 shows how this application of paper has leapt ahead.

A large grinding stone used for disintegrating waste paper at the mills on the River Esk, in Scotland.

One look round shows how paper is tending to take the place of other materials. The chances are that the towel you use in a public wash-place will be paper. You may even use paper towels in your own kitchen to save the trouble of laundering. If you have a cold you can use paper handkerchiefs. When you go to the hairdresser he probably puts some special paper into your neckband instead of cotton wool. If you travel on the railway you may use a paper pillow, specially made to be used once and thrown away. Restaurants provide paper napkins instead of the linen of our youth ; it is cheaper to use paper and throw it away than to wash a linen napkin. In the United States paper curtains are coming into service for the same reason. The cost of a complete new set of paper curtains is only about four-fifths the cost of laundering a pair of cloth curtains. Even string, by a new process, is being made from ordinary paper waste, not to mention such familiar things as filter paper, blotting pads and unfortunately less familiar, the ordinary bank notes.

The Port Alfred Pulp and Paper Mills at Ha Ha Bay, in Quebec.

Paper, specially gummed, is replacing string for tying parcels and compressed paper in various forms, often treated with special plastics, is replacing wood and other materials for constructional purposes. Paper is light, has good qualities of insulation for sound, heat and electricity and, when specially prepared, can be as strong as other building materials of equal thickness or weight. Paperboard, largely made from waste, becomes daily of increasing importance for constructional, boxing and allied purposes. The chances are that the "art leather" binding of your book, looking so exactly like leather, is just paper. Your "fibre suitcase" perhaps not quite so hard wearing as leather, but strong enough, is largely paper. Plates and drinking cups of compressed paper as well as containers for milk, oil and other liquids, are becoming increasingly popular. The advantages are lightness in comparison with glass or metal, the fact that paper cannot break and, above all in this labour saving world, that these new containers are so cheap that they can be thrown away after use instead of needing to be washed for use again. The time may not be far distant when really attractive paper "crockery" can be made so cheaply that "washing-up" after meals will become a thing of the past. The

housewife will just sweep the table into the garbage bin. Not, we hope, into the street!

Hand-made Paper

Paper used to be very precious material. It was laboriously made by hand, sheet by sheet, from any fibres found suitable. It is still made in this way over great areas of China and in other parts of the world. Naturally, in such cases paper is a very precious commodity and never thrown away, but used again and again. Until the Japanese invasion surprisingly enough, China was the biggest importer of paper in the world—not for printing, but waste paper, mostly out-of-date newspapers which were used for purposes never dreamed of by those who first read these journals. Applications included preparing the interior of houses to insulate them, making toys and wrapping anything and everything. In Chokiang alone it was estimated 200,000 people lived on selling articles made from waste paper. About the only paper burned was in the form of "mock money" at funeral services to ensure that the deceased would be able to purchase anything he required in the next world.

We in Britain are not so careful of our waste. During the war we made a great effort to collect it, but now the amount being burned and spoiled is increasing as we return to our old pre-war wasteful ways when we throw away about 1,500,000 tons of paper and cardboard each year worth about £3½ millions at the time and twice as much or more to-day.

Indestructible Fibres

The astonishing thing about paper is that it contains fibres which are virtually indestructible. You can tear the paper up into small pieces, wet it so that it tears at a touch, but treat the fibres, pulp the spoiled paper, and roll it out again and we have an almost new material that can be used again. The fibres that make paper possible remain. It may not be practical or profitable to remake the paper into its precise original form. This would mean sorting all the waste according to its type, and the use of manufacturing processes even more elaborate than those required for making paper from woodpulp. But the paper can be re-made into wrapping, cardboard, fibre-board, and all types of articles which we have need. Remade paper is perfectly satisfactory for most purposes, and its use helps to save the more expensive raw materials which can then be applied to newsprint or writing paper.

Re-using paper means far more than saving money, although that is a consideration. It means that valuable fibres are conserved. The fibres come from many plants, mostly softwoods, but there is only a limited supply in the world. The chemist with all his success in synthesis has not yet been able to make artificial paper. The fibres which become paper owe their shape and strength to the fact that they are of very large and complex molecules which cling together, and these are not easy to build up from simple substances like the chalk, air and water so often used for synthesis in the laboratory. Our paper supply depends upon plants, and is likely to do so for a great many years to come.

Limited Raw Materials

The natural substances in demand for making paper, particularly wood pulp, are also in demand as the raw materials for other industries. All textiles depend upon fibres and rayon uses as its raw material much the same main material as paper—wood pulp. Because of the limited amounts of such fibres as wool, cotton, hemp, flax and jute, available for textiles, the demand for synthetic textiles has risen every year and with it the demand on the raw materials which are also needed for paper. In many ways paper and textiles are competing industries; they not only compete in the finished products, as in the instance of string and gummed paper, but for the basic raw materials. Other raw materials used in paper-making are esparto grass, straw or cotton, linen, hemp and jute fibres. Each has its special purpose for special types of paper.

With the constantly increasing need for both paper and textiles the difficulties of limited raw materials will become greater. It is true that far more wood is used for fuel and furniture making or housebuilding than for making paper or textiles, and that we can effect great savings by using other more economical fuels and by developing metal alloys in place of timber. It is also true that new and more efficient methods of pulping are giving a greater amount of paper or textile from a given amount of wood, although there are limits beyond which we cannot go in this direction at present.

But there are few limits to the extent to which we can re-use paper. Every scrap of paper from the solitary bus ticket to the soiled parcel wrapping can be used again after treatment, perhaps appearing as a cardboard box or the heel of a woman's shoe, in artificial leather. The time is coming when we shall have to give much more attention to saving paper, not only as a matter of financial economy, but because paper burned or ground into the mud of the street means fibres lost for ever, and these are the precious fibres which cannot be grown fast enough to replace the world's very urgent requirements. Life without modern paper would lose immeasurably in amusement, comfort, safety and health.

Items of Interest

New Plastic Piping

A NEW form of plastic piping has been developed by Bardex Engineering, Ltd., of Chertsey, which may, during the next few years, entirely supersede the use of rubber as a tubing medium, and is now being manufactured at the rate of thousands of feet per week in an all-out, day-and-night production drive. It is known as Bardex Patent Flexible Fuel Pipe.

Rod-chain Conveyor

IT is essential in a modern factory to have up-to-date methods of transport of goods, and this is obtained at the new Rolls-Royce factory by the installation of the Pantin patent rod-chain "in floor" type conveyor. Stated to be the largest single unit of its type in Britain, the conveyor extends for almost 5,000ft. It conveys trucks up to two tons in weight at a slow walking pace, and has a maximum pulling load of 60 tons. The conveyor services several factory blocks, and moves in a continuous trench under the floor, only a three-quarter inch slot being visible.

New Swift Jet Aircraft

A DEVELOPMENT of the Swift in which Lt.-Commander Lithgow set up a new world speed record, the Vickers-Armstrongs Supermarine Swift FR5, has been removed from the Air Ministry's secret list to the part-publication list.

The latest Swift is a fighter reconnaissance aircraft and is powered by a Rolls-Royce Avon jet engine.

An 80-ton Load

THE accompanying illustration shows the Norwegian ship S.S. *Beljeanne* loading a 112ft. (80 tons) motor launch aboard at Charlton Buoys. This launch is to be used in connection with a "Shell" petroleum project in the Persian Gulf.

Forced Draughts in London's Tubes

A TEN-FEET diameter fan weighing five tons, and revolving at 200 revolutions a minute, is being installed on the Northern tube line between Kennington and Oval stations, and will "push" something like 100,000 cubic ft. of air a minute out of an "upcast" shaft disguised as a park shelter in Kennington Park. This is only one of the many ventilating fans and draught-shafts being installed to reduce the temperature in the complex system of underground tunnels riddling the earth below London.

Large Generating Station at Uskmouth

THE large £20 million Uskmouth generating station, first planned by Newport Corporation in 1946, has been declared officially opened.

Operation of the boiler plant at the station is fully automatic, and the speeds of the fans which provide the draught in the furnaces are automatically varied to suit the quality of coal and the steam demand on the boilers.

Electrical Repairs at Home

Further Hints on the Upkeep and Repair of Domestic Electrical Appliances, and How to Avoid the Many Pitfalls That May be Encountered by the Home Electrician

By "HOME MECHANIC"

(*Concluded from page 209 February issue.*)

ELECTRIC fires, toasters, etc., are the easiest to repair, because the elements are exposed and very accessible. In the bowl type of fire the element is protected by a small wire guard clipped over the edge of the bowl and easily removed. Unscrew the element and former. This is a fire-brick former fitted with a G.E.S. cup. It often happens that the centre contact of the holder becomes weak through over-heating. Arcing occurs here, with a result that the fire burns intermittently and finally goes out altogether. The contact can be replaced by a strip cut from the longer pole of a flash-lamp battery. Make this exactly the same size as the original or it may touch the edges and cause a short. If the element has burnt out this is obvious because the spiral will be slack and broken. Each spiral is wound for a definite voltage. Do not cut the spiral, but pull it out to the required length by trial. One connector is made first and the wire pulled out to fill the grooves and then joined to the other screw. Slight tension only should be felt in the spiral when both ends are connected. To make a connection double over one end of the wire and hoist it up tightly, then pass this round the screw between the two washers and tighten up. If a contact becomes loose the wire will arc here and finally burn through, and once an element has broken after being in use it cannot be rejoined. The wire becomes brittle and breaks when bent. Screw back the former tightly before switching on.

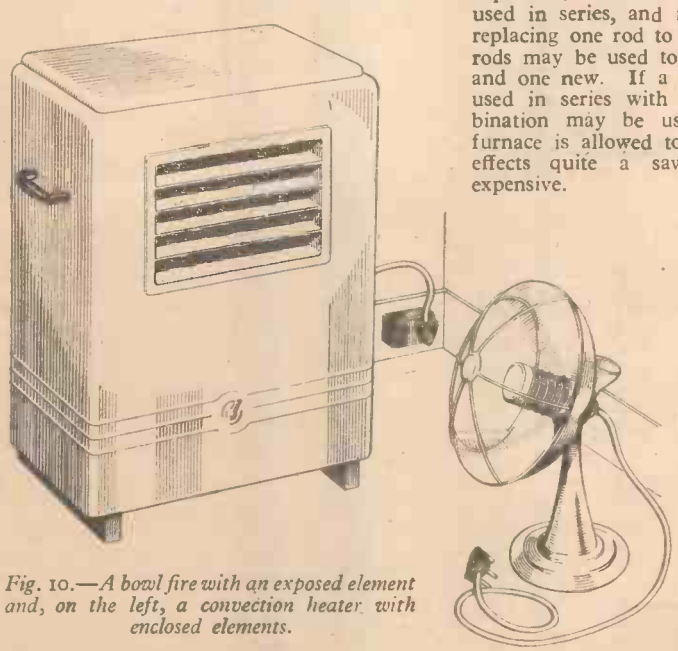


Fig. 10.—A bowl fire with an exposed element and, on the left, a convection heater with enclosed elements.

Elements

A similar small spiral element is found in toasters, but here the spiral is arranged in rows vertically. Attachments and replacements are made as before. In the hair dryer the element is wound on a light former of mica. It is of single wire. To examine the element remove the cap at the end of the air tube and then pull the element out. The former is plugged into a holder in the base. An element easily burns out when the fan fails, so before replacing the element in a dryer in which the fan has failed repair the fan first, then the element.

The bowl fire is rarely found with loadings over 1,000 watts. (See Fig. 10.)

When replacing broken elements in larger fires remove the old former and wire by disconnecting at each end and replace with a new one. When ordering spares quote the fire make and type, the loading in kilowatts, and the line voltage. There is a type of fire with two spiral elements wound on flat fire-brick formers, each of a loading of 750 watts. Either one or both may be used, depending on the switching arrangements. A further type has for the element a carborundum rod of special manufacture. Replacements are very easy but fairly expensive. In furnaces two rods are generally used in series, and it is advised that when replacing one rod to replace both. Two old rods may be used together, but not one old and one new. If a controlling resistance is used in series with the furnace any combination may be used, providing that the furnace is allowed to heat up slowly. This effects quite a saving as the rods are expensive.

Fire "Glow" Fans

Most modern fires (see Fig. 11) have a supplementary lamp to cause the "glow," and the flicker is caused by a small fan revolving above the lamp. This fan is really a two-bladed shutter that revolves in the hot air rising from the lamp. If the fire receives a blow the fan may jam or come off its pivot, but it is easily replaced. Do not lubricate the fan, but a little blacklead on the pivot will be found effective.

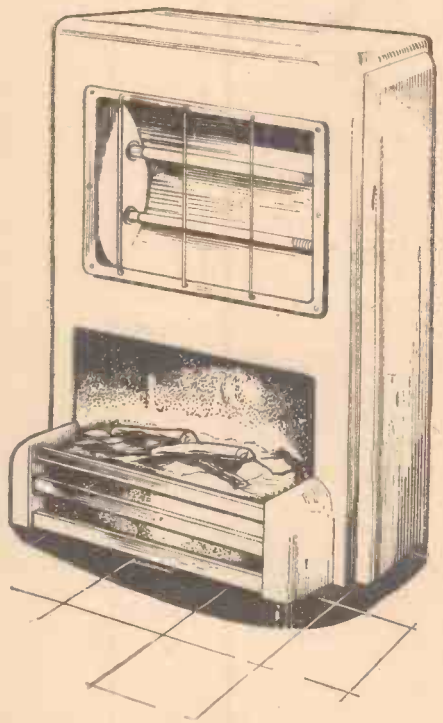


Fig. 11.—A flickering "coal" fire with two heater elements.

Hotplates are rewound in the same way as toasters and bowl fires. Some hotplates have a concealed and embedded winding (Fig. 12), but these cannot be repaired at home and must be returned to the maker.

The domestic cooker falls into the same class of fire, but here there are several points that may go wrong. Elements can burn out, but replacements may be obtained easily and fitted just as a fire element. A cooker is a piece of high-load apparatus, and as a result the switches are quite large and, due to the arrangement of the elements, complicated. (Figs. 13 and 14.)

These switches are of the rotary type, generally having either two or three positions and "off." Switch failure is usually due to burning of the contacts, with consequent arcing and, finally, open circuit on some points. The contact blades cannot be replaced, so a new switch is required. Disconnect the leads, but do not disturb their relative positions; there may be four, five or six terminals on the switch, with as many as 12 leads connected to them, hence care is necessary. If you are in doubt, before removing any collection of leads tie together

and label. Take care to avoid crossing the leads.

Fire Hum

Some fires and heaters have a very nasty habit of humming, like a transformer, but with a noise that is louder and more penetrating. If an old fire starts this then it is generally due to a loose connection, or even a loose bolt on the fire case. Tighten up all nuts and bolts and connections. If a new fire does it, look for the possible loose connection or bolt, but failing to find one you are advised to change the fire.

So far we have only mentioned the all-important question of earthing and not given it the importance it deserves. We cannot over-estimate the importance of a good earth on all portable appliances, especially those near water pipes, etc. Some appliances are not provided with an earth connection, but one can easily be made. If a fire is required to be earthed, drill a ¼in. hole in the case, push through it a 3/16in. bolt, put on two large washers and clamp the earth wire tightly between. An iron may be earthed by passing a lead under one of the cover securing nuts. A hair dryer, if made of bakelite, need not be earthed, but must have a metal sleeve or other heater, and the earth wire may be passed under one of the screws securing it. All fixed apparatus, such as cookers, fires, etc., will be earthed, but periodically examine them. The earth must be capable of carrying the maximum load of the appliance. It is possible for a few strands of an earth to corrode through and yet the appliance be earthed, but it is not safe, because the cable could fuse at the weak spot and leave the cooker "live." The same can apply to fires. The earth wire is often regarded by the layman as being quite unnecessary and put on for fun. The regulations say that the earth wire must be protected if necessary. This may not be necessary when the appliance is first installed, but later the need for an earth becomes apparent.

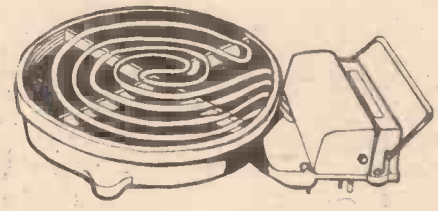


Fig. 12 (Above).—A hot plate. (Left) A four-heat boiling plate.

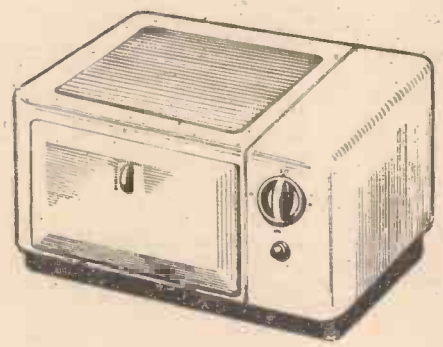


Fig. 13 (Right).—A small electric cooker, showing the rotary switch.

Domestic Motors

Domestic motors are generally of one main type—*series commutator*. Others in use are *repulsion-induction* and *squirrel cage*; but fortunately repairs in these are rarely if ever necessary because there are no electrical moving parts to wear.

Running repairs consist of oiling and greasing and cleaning the commutator. This work is easy and does not need the dismantling of the machine.

With commutator machines, and especially those small ones that are frequently overloaded, the brushes require constant care and attention. Sparking is always present; it is not necessarily a bad sign, but when the sparks extend right round the commutator, stop the machine and examine. New brushes are fitted by lifting the tension springs and extracting the old ones. Fit brushes of exactly the same type. Never be tempted to file up any scrap carbon and use this as a brush. It will damage the commutator and cause excessive sparking. We have used this method in cases of emergency, but have replaced the makeshift brush by a proper one as soon as possible. The brush position in some machines is often obscure, and sometimes it is necessary to dismantle the covers and cases on vacuum cleaners and hair dryers, etc. The replacing of a brush spring is quite easy. First draw out the brush and then make a new spring from stiff brass wire of a similar gauge.

Commutators must be cleaned with soft rags. Do not try to smooth down with sand-paper or emery cloth. If a commutator is badly fitted and worn, it must be repaired by an expert. If a machine is over-oiled and oil gets on the commutator, this must be cleaned and dried. It may be necessary to separate the bars and remove carbon. Do this with a pin or needle, and smooth down the rough edges with a steel burnisher. Too much grease is as bad as too much oil, and if this gets on to the winding may cause, like oil, a short or a fire.

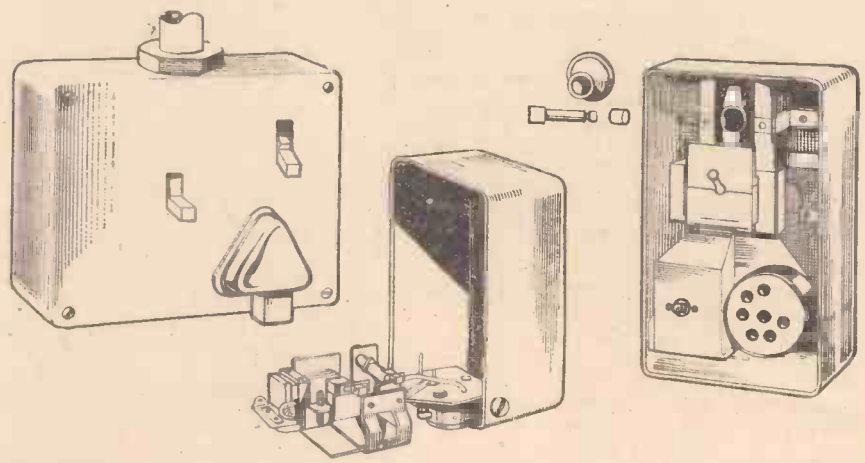


Fig. 14 (Left).—A modern cooker control switch. (Centre) The mechanism is hinged to give access to the terminals. (Right) The switch open showing the construction and connections.

A "Burn-out"

In the case of a burn-out of either armature or field carefully dismantle and inspect all connections. Examine and test both armatures and field to discover in which the connection has gone. It will probably be the field, so carefully remove one coil and strip off the insulation tape. Now take a sample of the wire and find out its gauge. If you do not possess a micrometer, take a sample with you to the shop when you get the new supply. Count the number of turns; there will be the same amount of wire on each pole, but as an additional check examine the other pole as well. Weigh the total amount of wire and obtain slightly more than this from the suppliers. Rewinding is now a simple matter. Take the usual care with insulation and other problems.

If the trouble lies in the armature it is not so easily remedied. You will be able to tell, as a burnt-out armature is always obvious. Strip one coil and very carefully note the connections. Draw these on paper and pin the paper on the wall over your bench. If you pick a coil that will not unwind, leave it and examine the armature closely until you find the coil that was put on last, then start from this and count the number of turns. Weigh the total amount of wire. When dismantling keep count of the turns on each coil, as they should be the same. Observe the relation of the slot to the commutator segment and the brush line to the inter-pole line. Find the gauge of wire on the armature and obtain new as before.

New Insulations

New insulations must be used on both the armature and field, and these must be identical with those removed. If the insulation is thicker, the correct number of turns cannot be put in each slot. It is essential that exactly the same amount of wire is put on each coil in order to balance the armature both electrically and mechanically. Unevenly wound coils cause excessive sparking and noisy running. Great care must be exercised in soldering the connections to the commutator bars, and a non-corrosive flux must be used. This method of rewinding by counting the original turns is superior to a purely theoretical one based on calculations, etc. We advise readers to use the above, even when the windings are charred and burnt quite badly. Most insulation is double cotton, and if this is used in all cases it will suffice.

Rewinding Heater Elements

Readers may wonder why we have given no details for rewinding heater elements and fires, etc. The chief reason is that manufacturers will not supply small quantities of these wires. A pound reel is generally the smallest, and this is too expensive for the average reader. Secondly, elements are all standard now, and can be obtained at such reasonable prices that it is not worth while making them. Thirdly, mica of sufficient size and quality is difficult to obtain. When one considers the above, it is obviously not worth while to consider rewinding an element.

HOME-MADE BURGLAR ALARMS

Some Simple, Economical and Effective Alarms Which Afford Ample Protection Against Burglars

ONE often hears the subject of burglar alarms discussed in terms of mystery. Actually, they are nearly as simple as the household bell system.

There is one decision to make. Shall the burglar alarm be obvious, so that its presence scares off intending intruders (which might also have the effect of drawing attention to valuables), or shall it be hidden and the householder rely solely on the effectiveness of the system? If you intend to take the first alternative, fix the alarm bell in such a position outside the house that no one, not even at night, can fail to see it, but at the same time make absolutely certain that it cannot be reached, thus giving anyone the opportunity to prevent it ringing. The alarm bell should, however, be the only thing which is noticeable, all other devices, wires, etc., being well hidden or protected to prevent tampering.

A Simple System

The simplest system is one in which move-

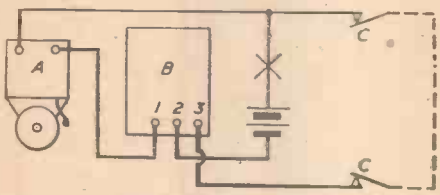


Fig. 1.—Theoretical circuit of the series-relay system.

ments of a door or window cause contacts to close, thus completing the circuit and ringing the bell. There is, however, one serious disadvantage in this system, for it is only necessary to cut or break the wires to stop the bell from operating. Should the intruder notice wires and contacts attached to a window it would be quite a simple matter for him to take a piece of glass out and then cut the wire, so that the window could be fully opened without operating the alarms. The next best system, and one which will be advised for ordinary conditions, is an arrangement of contacts in series with each other, continuously closed, and in which the alarms only operate once the circuit is broken. Immediately this happens the alarm bell rings, and even if the series circuit is made again the bell will still keep on ringing until such time as it is purposely and deliberately stopped.

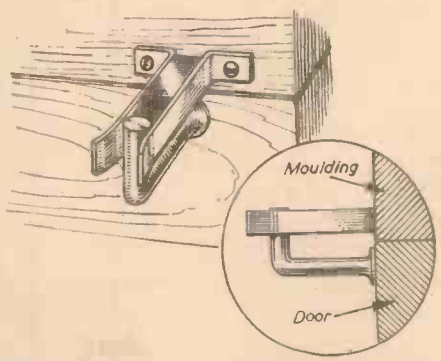
A third system, which works on the Wheatstone Bridge principle, is generally considered the most effective, even against the expert housebreaker. This system is "set" with the resistance of the alarm circuit balanced against that of an adjustable "arm" and any alteration in the resistance of the alarm circuit is sufficient to operate the system. If the intruder cuts the wire or tries to be clever and short circuits the contacts, which he hopes later to separate safely, the balance is upset, and as these systems are generally balanced very closely no method can be devised which gives any hope of seeing the system balanced for even the shortest space of time. However, this system requires continual attention and is not advised for ordinary household work.

A Series-relay System

Fig. 1 shows the main details of the series-relay system which is advised. "A" is the alarm bell, "B" the mechanically reset relay, and "C" the contacts arranged in series throughout the house. The bell is just an ordinary electric bell, which can be obtained quite cheaply. If it is intended to put the bell outside the house, then a more expensive waterproof type should be used. The relay, shown in detail in Fig. 2, can be purchased, but without the variable resistance, which is included purely to reduce the amount of current passing to the most economical value. "A" is a pair of coils taken from an electric bell and mounted firmly in the top of a wooden box. The faces of the cores are covered with a thin disc of paper, "B." to make sure that the armature, "C," will come "unstuck" when current in "A" fails. The armature is riveted to

Fig. 6.—A suitable arrangement for safeguarding a skylight by means of a thin insulated wire passed through bars made of split conduit, and connected as shown.

the brass arm, "D," which is pivoted at "E." This pivot should be quite free and must allow the arm to fall easily into the two contacts, "F" and F1," which are made of thin but very springy brass. "G" is a standard 400-ohm potentiometer used for radio purposes. Beyond these details little more need be said, except that a cover should be spread over the top of the box, leaving only the resetting knob "H," and the resistance visible. The box should be fixed in a place as remote as possible from any point where an entry might be made, probably an upstairs room is best of all. The alarm bell should be fitted in a position where it can be easily heard both inside and outside the



Figs. 3 and 4.—The type of contact which covers most positions where the door moulding juts out over the door; an ordinary cupboard hook provides a satisfactory key.

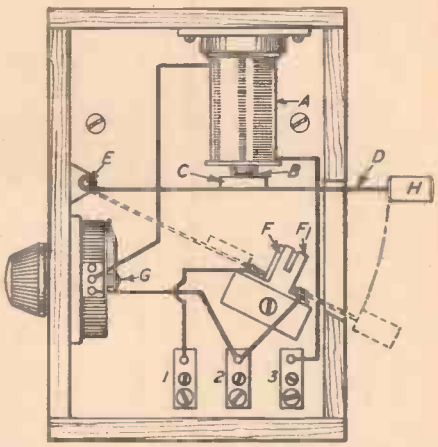


Fig. 2.—The relay shown can be purchased, but without the variable resistance, which is included to reduce the current passing to the most economical value.

house, but out of the way of possible interference. When the rest of the system has been completed and all contacts closed lift the arm, "H," against the pole pieces and adjust the knob of the resistance so that the arm just holds up. Some allowance might be made for vibration dislodging the arm. Further economy in current can be effected by rewinding the coil bobbins with 36 or 38 s.w.g. d.s.c. wire.

Usually two 1½-volt bell cells will be ample to operate the system nightly for many months. A switch should be inserted into the battery lead at "X" (Fig. 1) to render the gear inoperative when not required. In testing the system at night, when the ringing of the alarm bell might unnecessarily disturb others, an ordinary flash-lamp bulb can be inserted across the bell contacts and the bell disconnected while the tests are made.

Effective Contacts

The contacts, described later, should be placed in every conceivable place where an entry might be effected.

Every possible point should be covered, even roof traps and skylights and pantry windows. The various types of contacts which are required are very numerous, and only a few are described here. The main thing to avoid in these contacts is flexible wires or wires attached to moving parts which may be a cause of non-operation later. Fig. 3 shows the type of contact which can be used in most positions. One of the

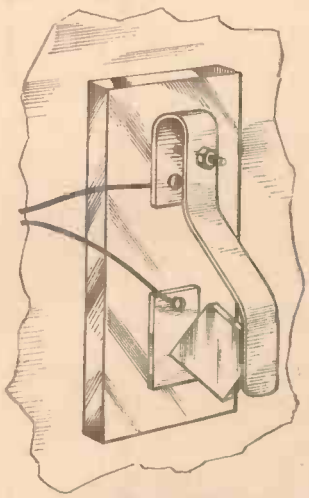


Fig. 5.—Large windows which do not open, but provide an excellent opportunity for total removal as a means of ingress, can be safeguarded by a contact of the type shown here.

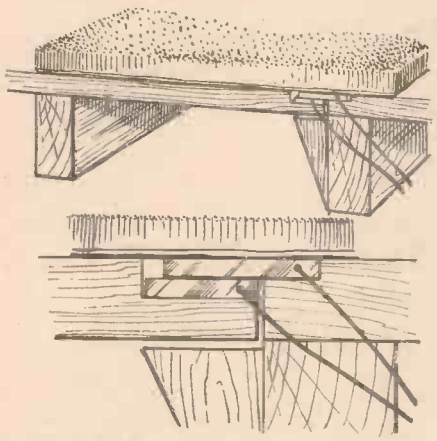


Fig. 7.—Suitable and effective contacts that can be arranged under a mat.

contacts has a piece of fibre or ebonite fixed to it to prevent the contacts closing together, connection between the two parts only being made when the key-piece is inserted. The contacts are screwed to the top of the door or window surround and the key, which can be a stout brass screw with the head cut off, is driven into the door itself. The connecting wires are best soldered to the foot of the contacts. Where the door moulding juts out over the door an ordinary cupboard hook provides a satisfactory key and is shown in operation in Fig. 4. The coloured lacquer must be cleaned off the brass before such hooks are used, because it is an insulator.

Contacts for metal windows must be mounted on ebonite blocks, which are then secured to the iron frames with metal thread screws, it being necessary to drill and tap in these cases. It might be found that the metal windows are insulated from one another in some cases, but it is always advisable to insulate the key-piece as well.

Large windows which do not open, but provide an excellent opportunity for total removal as a means of ingress, can be covered by a contact of the type illustrated in Fig. 5. The base should be a thin slip of ebonite and the lower contact of ⅛in. strip brass.

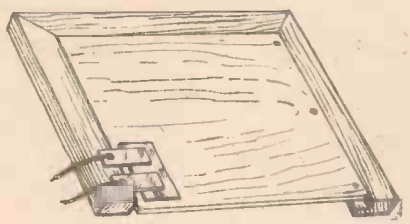


Fig. 8.—Another under-the-mat type of contact which is very effective.

The upper contact is of thin springy brass and just sufficiently strong to hold the solid brass key up in position. The complete contact can be secured to the glass with sealing wax or Page's glue. The best position is in the centre of the window, but the device is effective even at the edges. The device operates by the inertia of the key. When vibration shakes the window, the device shakes with it, but the key tends to remain steady, and pushes the thin spring outwards, and relieves the pressure on the solid contact, with the result that the key drops out and breaks the circuit. Precautions and care in making and adjusting the thin spring must be taken to ensure that wind or traffic vibration will not cause the key to fall out.

Where a window or a skylight can be barred ½in. split conduit can be used through each bar of which a thin insulated wire is passed and connected, as shown in Fig. 6. Ordinary pipe saddles can be used to secure the bars. The effectiveness does not lie in the strength of the tube but in its weakness. No. 36 s.w.g. d.s.c. wire is suitable for use.

"Under the Mat" Contacts

These can be arranged as shown in Figs. 7 and 8, the first being suitable for wooden floors, and the second on stone or tiled floors. Outside gates can also be contacted, a satisfactory form being shown in Fig. 9. The two contact plates are screwed to the gate post and the key-piece made from springy

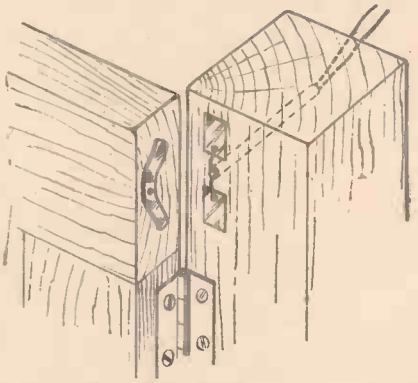


Fig. 9.—A satisfactory method of fitting contacts to an outside gate.

brass to the gate itself. Used in such a position the contacts are invisible and also protected from the weather. The wires are passed right through holes drilled in the gate post, as shown in Fig. 9. All outside wires should be lead covered and hidden wherever possible, whilst those inside can be of 26 s.w.g. d.c.c.

Fig. 10 shows the essentials of a piece of apparatus which is necessary under the following conditions. If a contact is fitted to the front door, the last person out will trip the main relay, merely in the act of opening the door to pass through, and it is impossible for the main relay to stay "up" if the door is left open. To overcome this a special out relay is required which makes the door contacts inoperative until they are closed. "A" in Fig. 10 represents the door contacts which must be open before the system can be "set." The lever, "B," is then raised so that the armature, "C," is against the core of the magnet, "D." The point of the trigger, "E," will keep it in position mechanically until such time as the main relay (Fig. 2) is closed. When this happens the coil, "F," attracts the armature, "C," and releases the trigger, "E," which, however, does not fall owing to the line current traversing the coil, "D." However, when the door is shut and the contacts, "A," close, the coil, "D," is short circuited and the armature, "C," drops clear, the armature, "G," still being held against "F," and the contact, "H," broken. This leaves the door contacts, "A," in charge, and should these be opened then the alarm bell will ring in the normal way.

Commercial Burglar Alarm

Readers may also be interested to know that there are a considerable number of burglar alarms obtainable on the market for quite a small outlay. These alarms take various forms and are generally of the make-and-break contact type. One consisting of a divided sphere, one-half of which acts as a bell and the other half containing the mechanism, is an interesting example. The half containing the mechanism is also fitted with three legs, and when wound up by twisting the two halves in opposite directions, is placed on the floor legs downwards. The

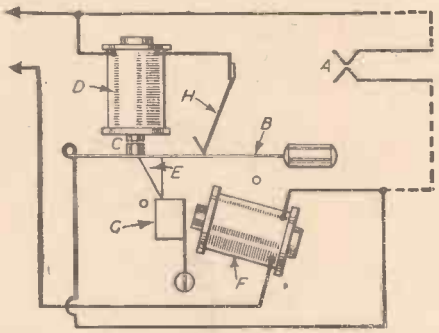


Fig. 10.—A circuit diagram of a special relay which makes the door contacts inoperative until they are closed.

weight of the device causes the legs to recede into the body and act as a check. When placed behind a door, window, etc., opening them will cause the ball to roll, thus freeing the legs and causing the bell to ring for several minutes.

Door contacts suitable for operating burglar alarms can also be obtained very cheaply and consist of continuous and trigger types. As a further safeguard against

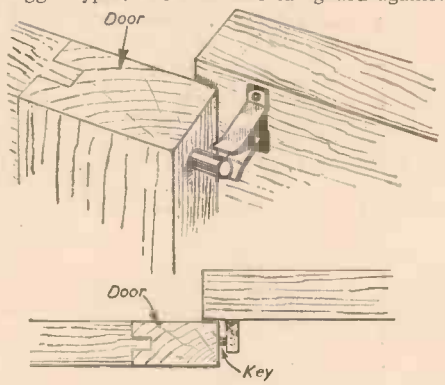


Fig. 11.—A pictorial sketch showing the contact suitable for the circuit shown in Fig. 10.

burglars, it is also possible to obtain special locking devices for locks which make them practically burglar-proof.

New Plastic Window Folds With the Hood

A TRANSPARENT plastic material with a number of important new advantages is already being used for several well-known makes of sports cars. In the past the rear window in car hoods had to be kept small to prevent it from being bent and cracked when folded back. Vybak Clear Flexible Sheet (VB215), made by Bakelite, Ltd., overcomes this problem and makes it possible to have a much larger rear window with the obvious benefits of better visibility and more light. A further important advantage of a larger rear window is that more effective use can be made of the interior driving mirror, and this means safer driving.

Vybak Flexible Sheet *folds* with the hood. It will not crack or craze however much it is bent or rolled, neither will it "yellow" with age, but retains its clarity throughout its life. An exhibition model hood has already been opened and shut many thousands of times in demonstrations and shows no sign of wear or tear. The highly polished surface of the sheet is easily cleaned with soap and water.

Making a Dissecting Microscope

A Handy Accessory for the Microscope Enthusiast

By S. M. CHARLETT, F.R.M.S.

THE normal microscope enables us to examine, in detail, very small objects, or we can use it to examine the structure of a fairly large object, for instance, the structure of an insect wing or eye. In the latter case the object, wing or eye or other organ, must first be removed from the insect, and this can prove extremely tricky if the right method is not used. The only way we can be sure of removing these parts without damaging them is to use a very simple device called a "dissecting microscope."

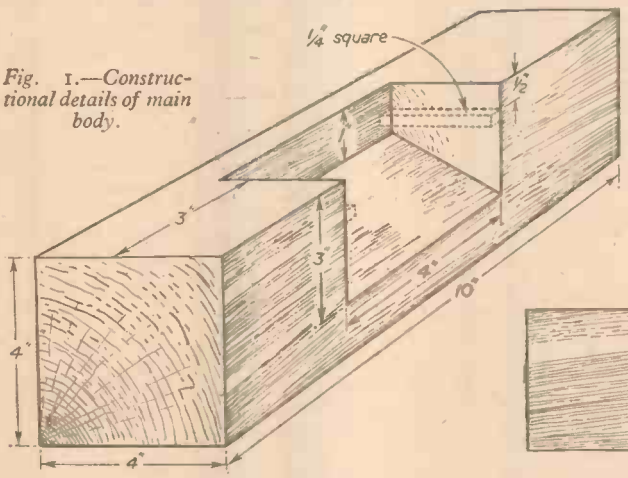


Fig. 1.—Constructional details of main body.

This consists of a single lens, which magnifies about 10 or 15 times, mounted over an illuminated glass plate, thus enabling one to place an insect or some other specimen on the plate, and to remove parts of it with needles or small sharp knives. A lens as described usually has a focal length of about 1½in.-2in. with a fairly large field of view, and small objects can be handled quite easily when being viewed through it.

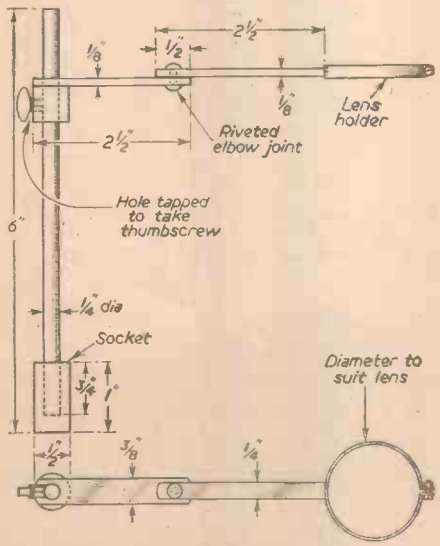


Fig. 3.—Details of lens support and holder.

Constructional Details

The instrument that is described here has been constructed and found very efficient, not to say very useful. The body (Fig. 1) was constructed from a piece of 4in. x 4in. soft wood, the recessed portion being chiselled out and sandpapered. This recess was to take a mirror for lighting the dissecting stage, but it was found that a small piece of aluminium, polished to a good surface and screwed on to the sloping surface, gave a satisfactory light and avoided any possible inconvenience due to breakage. At the top of the recess are two pairs of ledges. The lower set takes a ground glass plate which provides a diffuse light for the dissecting table, this being a rectangle of clear ⅛in. plate glass which rests on the upper set of ledges.

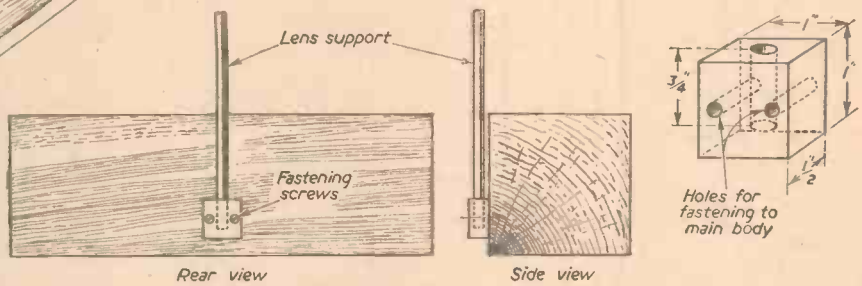


Fig. 2.—Rear and side views of the lens holder in position and details of lens support socket.

The lens support (Fig. 2) is made of ¼in. round steel rod, the lower end fitting into a holder attached to the bottom rear of the main body of the instrument. The lens holder consists of an adjustable collar to take the selected lens at the end of an arm, made of ⅛in. x ¼in. and ⅛in. x ⅜in. brass strip, provided with an elbow joint, and soldered to another small brass collar which slides up and down the support. A locking screw is fitted in the latter collar enabling the holder to be fixed at any desired height above the dissecting table. The up and down movement can be used for focusing any chosen lens, and the elbow joint, combined with the movement about the support, enables the whole area of the table to be swept by the lens. (Fig. 3.)

Using the Device

When in use the instrument should be located so that a good light falls on the mirror; this ensures that any object placed on the stage is well illuminated by a diffuse and steady light through the ground glass screen.

An object can now be placed on the dissecting table and focused under the lens. Then, resting the wrists on the flat portions either side of the table and observing the object through the lens, the necessary dissections may be performed with ease and accuracy.

The instrument may also be used to observe such things as water from a pond in order to detect any of the larger forms of life, or samples of dust in which may be concealed mites or weevils. In fact, the instrument is so versatile that its uses are almost innumerable and it can, with the proper care and use, provide hours of interesting observation.

Adjustable Wing Research Aircraft

BRITAIN'S unorthodox adjustable wing aircraft—the Short SB5—which is investigating the characteristics of delta wings, has entered a new phase in its flying research. It was recently flown for the first time with the tail plane beneath the fuselage, whereas in early flights the tail plane has been fixed to the top of the rear fin. It had already completed a series of tests with 50 deg. and 60 deg. sweep-back of the wings. The present programme is aimed at investigating tail design of swept-back wing aircraft, and results of all the tests are being passed on to the aircraft industry. Many new facts about the behaviour of supersonic shapes at low speed have been gathered from the SB5. It will shortly commence a fourth series of tests with its wings swept back to 69 deg.—the greatest amount of sweep-back of any aircraft wing in the world.

The Short SB5 with tail plane positioned below the fuselage.

All flying is carried out at the Ministry of Supply experimental aerodrome at Boscombe Down, Wilts.

Making a Potter's Wheel

Constructional Details of an Inexpensive but Efficient Appliance

By R. E. A. PALMER

THE ancient craft of pottery has in recent times claimed the attention of many people who, fascinated by the medium and its possibilities, find the opportunity to try their hand.

Art schools and training colleges have produced enthusiasts who have introduced the craft throughout the country to many modern schools, and it is not long before the acquisition of a potter's wheel seems imperative.

It was under such conditions that the machine, described and illustrated here, was brought into being by a group of boys in a modern school metalcraft room.

Nothing very original is claimed for it in design, but if any merits other than for looks and working qualities can be accorded it they must be for its cheapness.

Catalogue prices for similar articles range upwards from £32, but at a cost of £4 approximately this one was made by a team of nine boys in one term.

It must be stated that the bought parts consisted of main bearing castings, thrust-race, throwing-wheel, main shaft, aluminium sheet and some nuts and bolts. Other parts were selected from that carefully hoarded stock of odd-looking bits "which may come in useful one day."

An old treadle lathe provided the fly-wheel. Its weight and diameter were the dominant features on which the design of the chassis was based. A heavy wheel is slow to get moving, but its speed, once attained, is easier to maintain than a quick-starting light one, and the size of work may also be influenced.

Complete detailed measurements are not given here as the materials at hand would settle most of them for anyone wishing to construct a machine. Some sizes are given as a guide, such as the base dimentions and height of the throwing-wheel, but apart from these considerations the principal features to watch are rigidity, reasonable weight and free running.

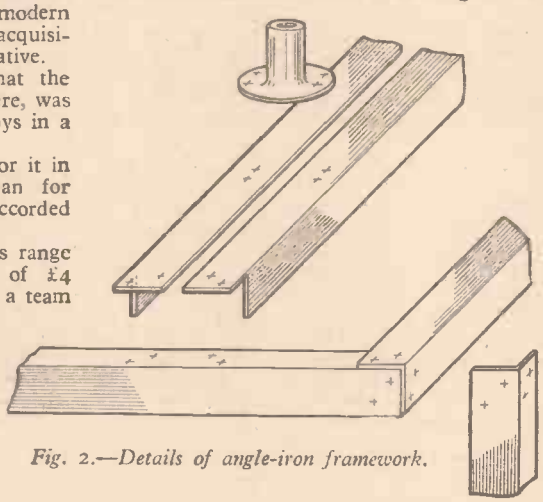


Fig. 2.—Details of angle-iron framework.

The completed potter's wheel ready for use.

Construction

It was found best to begin work on the phosphor-bronze bearings. These were, with the cast-iron throwing-wheel, obtained from Messrs. Western Foundries Ltd., Southall, Middlesex.

Holding the boss of the top bearing in the three-jaw chuck the base was faced and diameter turned to size. It was then reversed in the chuck, turned all over and the hole bored a running fit for the main-shaft. Some small relief was turned inside the bore, as shown on Fig. 1, owing to the length of the bearing, and an oil well on the edge of the hole.

The bottom bearing was held by the plate in the four-jaw chuck and the long boss faced and cleaned up. It was then reversed in the three-jaw chuck, faced up, the hole bored and relieved as in the top casting. The shallow boss on this side was recessed to take the bottom ring of the thrust-race, the inside diameter being made 1/1,000in. under size for a press fit. Bolt hole drilling completed the phosphor-bronze castings.

Angle-iron Framework

The table framework was built up from old bed angle-irons, except for the two cross rails which bear the whole weight of fly-wheel, shaft and throwing wheel. These rails were 1⅛in. by ⅛in. angle-iron.

Accurately sawn-off lengths of bed-iron were drilled ¼in. and bolted up to form the top frame, the long sides being just lapped over the short ones, as shown in Fig. 2.

Leg lengths were then sawn off and bent to an angle of 175 degs. 6in. from the tops (Fig. 9); the method used was to prepare a sheet-iron template to the angle stated, make the irons red hot at the bending point and, by holding the 6in. length in a vice, pull the metal to conform with the pattern. Any side bulge or twist was eased out on the anvil.

It is necessary here to mention that bed angle-iron is rarely found with its sides at right angles, and it is therefore essential to correct faulty pieces before incorporating them in any bolted-up framework. This may easily be done by squeezing opposite edges in the vice to reduce the angle, or by pressing a round bar into the angle to increase it.

The legs having been re-checked for uniformity of splay were then drilled and bolted

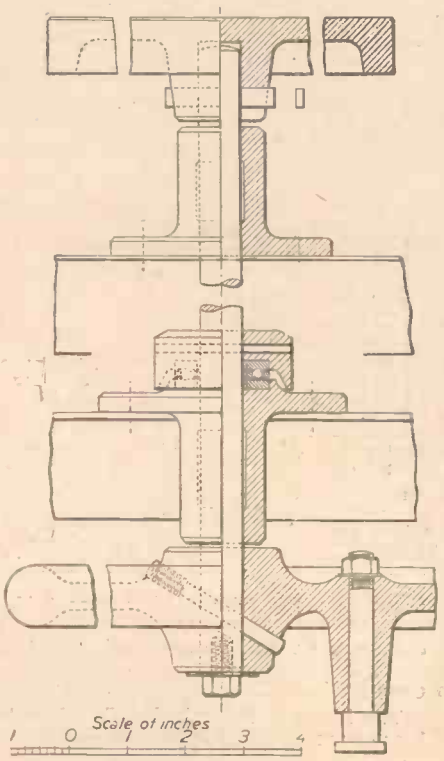
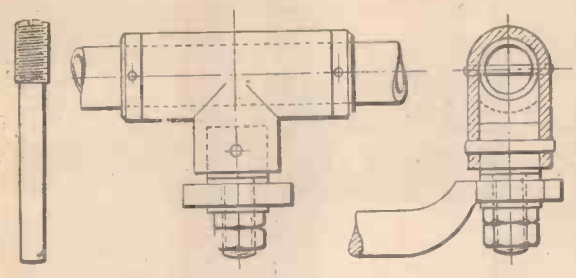


Fig. 1.—Half section of main bearings.



Figs. 3 and 4.—Details of flywheel fixing peg and treadle swivel fitting.

to the top frame. They were next firmly braced with wooden blocks in their correct position at ground level in order to facilitate the marking out, drilling and fitting of the bottom bearer unit. This member was constructed as clearly shown in the photograph, and consists of two side-rails supporting cross-bearers, spacers and the main bearing, with thrust-race ring fitted. Its height above floor level, and therefore the length of the side-rails, is determined by the necessary clearance of fly-wheel and treadle-bar from the floor.

The full-scale drawings (Fig. 2a) gave this height, and the unit was temporarily held in position with sash cramps. Before drilling the bolt holes the main shaft was placed in the bearing and carefully checked for vertical. Adjustment for this was made by gently tapping the side rails at appropriate ends with a hammer.

The top bearer rails having been prepared were then easy to locate in relation to the main shaft and the phosphor-bronze bearing. They were bolted in position, but the casting was not fitted at this stage.

Cross-stays

Four equal lengths of $\frac{5}{8}$in. conduit were cut off, flattened at red heat on all ends for a length of $2\frac{3}{4}$in. and at lapping points for $1\frac{3}{4}$in., the exact position for these latter being taken from the side elevation drawings as the bays are not rectangles.

The lapping flats are on opposite sides of each pair, and all ends were radiused before assembly.

Having loosely bolted each

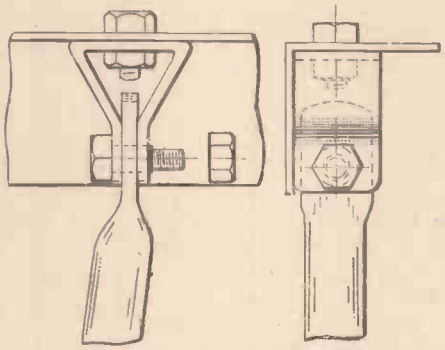


Fig. 5.—Details of treadle-arm bracket.

pair at the lap they were laid on the frame, holes marked through on the legs and finally all tightened up. It might be mentioned that only one stay on each side is really necessary.

Back stays of 1in. by 3/16in. M.S. strip were next fitted to complete the framework, and wooden block feet, rounded at the bottom, were screwed inside the legs for floor protection.

The Main Shaft and Thrust-race

In Fig. 1 is shown the fixture on the shaft which acts as housing for the top ring of the thrust-race, and also a shield against dirt and wet. It was turned from a solid piece of mild steel bar $2\frac{1}{2}$in. in diameter faced on both sides to a thickness of $1\frac{1}{8}$in., and a bevel made on the top edge before reversing in the chuck for the boring and recessing operations.

First, a $\frac{1}{2}$in. drill-hole was bored to .002in. under shaft size. The big recess was bored out and then the top ring housing recess to correct depth, but several thousandths of an inch under diameter. An oil way was drilled and a 4 B.A. tapped hole prepared for its cover plate.

The actual position of this piece was marked on the shaft which was then held horizontally in the vice. The fitting was made dull red hot, slid along the shaft and cooled. As a further precaution against moving a hole was drilled right through, reamed 3/16in. and a silver steel pin lightly riveted in (see Fig. 1).

Lastly, the main shaft was held in the three-jaw chuck and the ring housing opened out to make a fairly tight fit for the ring, which was then pressed in.

Shaft and race were next inserted into the main bearing and attention given to the top bearing.

The top bearing was dropped down the shaft to rest on the bearer rails, and the holes marked through and drilled. It was not bolted on, as this was the appropriate time to cut the shaft to its correct lengths above and below the bearings.

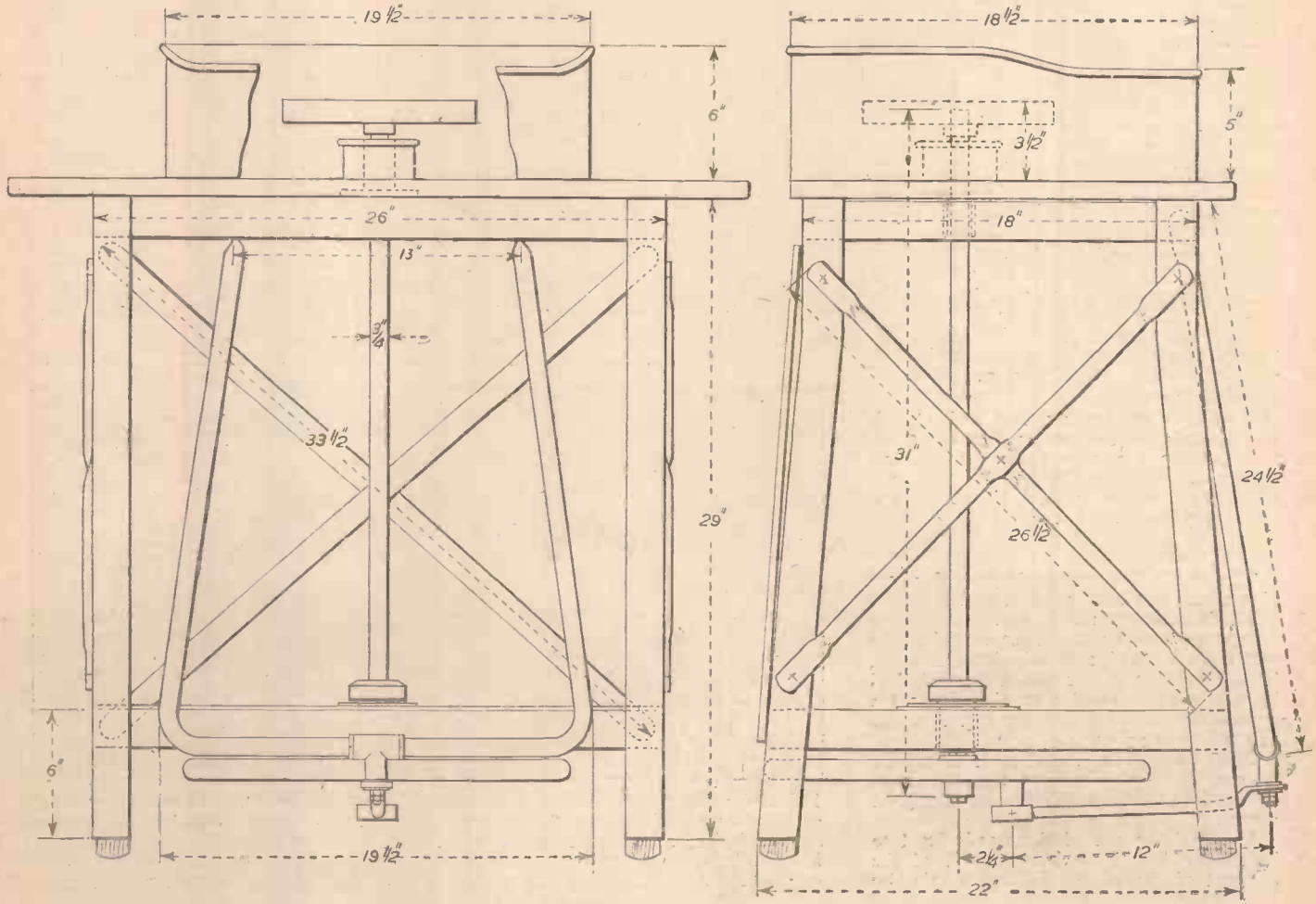


Fig. 2a.—Front and side elevations of the complete machine.

The machine was laid on its side, the fly-wheel pushed on and a mark made on the shaft, allowing a clearance of about 1/16in. At the same time the amount of shaft required to project above the top casting was marked off.

Withdrawing the shaft it was then cut to marks, both ends faced in the lathe, and the bottom end drilled and tapped to take for free movement when the nuts were fully tightened.

Universal Joints

As the treadle swings through an arc the outer end of the connecting-rod rises and falls simultaneously with its lateral swing. Since the fly-wheel revolves only in a horizontal plane some form of universal joint is

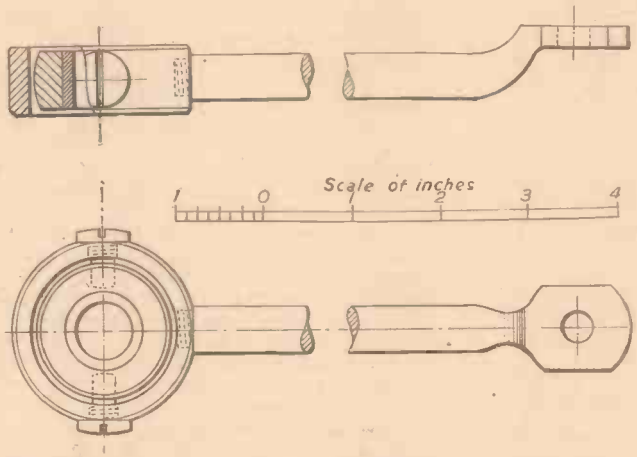


Fig. 6.—Part-sectional elevation and plan of the gimbal fitting.

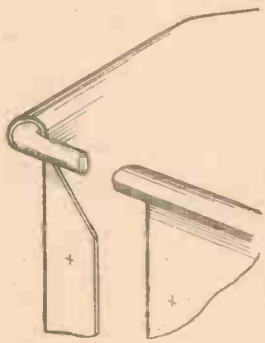


Fig. 7.—Details of the outer shield.

a 5/16in. by ⅜in. Whitworth set screw with large washer. This washer takes the weight of the fly-wheel which was finally fixed to the shaft by pegging diagonally through the shaft, as shown in Fig. 1.

The hole was drilled ¼in. and tapped 5/16in. for ½in. on the top side of the boss. A piece of 5/16in. silver steel was turned to ¼in., as shown, parted off ½in. beyond the shoulder and screwed at this end. It was then slotted for the screwdriver (Fig. 3).

Driving-dog

At the top end of the shaft a 3/16in. wide slot was cut to take a driving-dog for the throwing-wheel, the boss of which was later slotted to accommodate the dog (Fig. 1). The plate can thus be removed easily for tray clearing, oiling the top bearing or the fitting of other types of wheel.

Race (grease packed), shaft and fly-wheel were then finally fitted and the top bearing bolted down. Owing to variations in the frame and surface irregularities the top bearing was then found to be binding slightly, but after packing one end of the top bearers with shim-stock this fault was overcome and the shaft ran sweetly.

The throwing-wheel was faced, edge trued, and the hole and slot prepared for the shaft.

Everything was now ready for checking against the drawings for the sizes and positions of the connecting rod, treadle-bar and their respective fittings.

Treadle-bar

The treadle-bar was made from ½in. gas pipe which was bent, red hot, to a full-scale chalk drawing on the forge floor. Before the second bend was made the central swivel was slid on the pipe with its locating rings. This piece was a cast tee-joint which had been previously bored a running fit on the pipe. The sectional drawing Fig. 4 shows this fitting complete.

After cutting the rising arms of the treadle to correct length the tops were flattened, radiused and drilled 5/16in. for the pivot screws.

Fig. 5 shows one of these ends fitted to its bracket bolted to the underside of the top rail of the table. Mild steel 1in. by ⅛in. was used for the brackets, and the pivot bolts were 5/16in. reduced and threaded ¼in. necessary at each end of the connecting-rod if smooth and quiet running is aimed at.

The construction of the gimbal fitting at the big end is clearly shown in the part-sectional drawing, Fig. 6. Simpler and

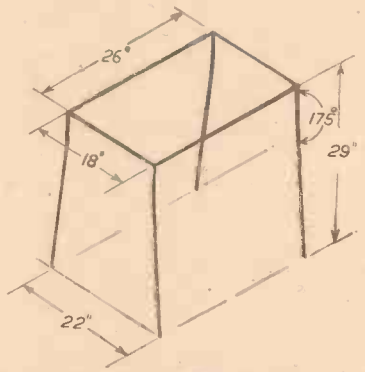


Fig. 9.—Diagram of angle-iron framework.

equally efficient fittings could be made, but the one used proves quite successful.

Connecting-rod length was fixed so that when the treadle-bar arrived at the "in" position it missed the wheel by ½in., the operating foot coming well above the wheel.

This completed the mechanical parts, and the table top was next fitted.

Table Top

A wooden top ¾in. thick, battened at each end with slotted-screw fixings, was suitably holed to allow the top bearing to come through. Blind holes ¾in. in diameter were bored to accomodate the frame bolt-heads and the top was buttoned to the frame, cabinet-maker fashion.

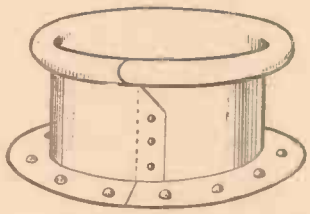


Fig. 8.—Circular central shield.

Aluminium sheet, 18 s.w.g., was used for cover and shield, the whole assembly completed as a unit, dropped into place, and the edges flanged down and under.

The outer shield (two pieces riveted at the lapped corners) has a rolled top edge with a ¼in. annealed copper wire insert (Fig. 7). After bending the front to its correct shape the bottom edge was flanged ½in., and ¼in. holes carefully spaced and drilled for rivets.

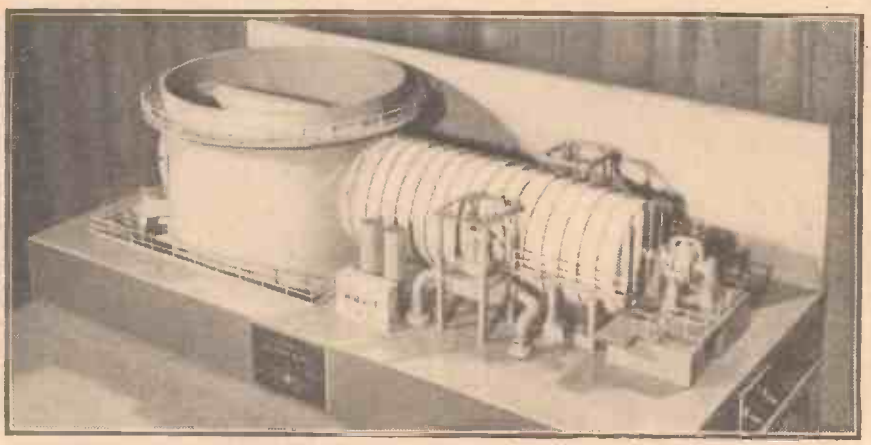
The back piece being ¾in. wider and with no bottom flange was drilled for No. 6 wood screws for fixing to the back edge of the table.

Circular Shield

To prevent water from running through the central hole a small circular shield was made in similar fashion and tightly riveted down. (Fig. 8.) The four pieces were thoroughly rubbed down with wire wool before assembly, and the unit was then fitted to the table as described above.

All nuts were fully tightened up, the framework was given an undercoat of aluminium enamel and a finishing coat of Robbialac synthetic green.

The joint between shield and top can be made watertight with "Loy" plastic metal.



This scale model of a submarine hull section and giant "sea tank" shows how engineers have provided an artificial "ocean" for the world's first atomic submarine engine. The engine has been built by the Atomic Energy Commission's Bettis plant operated by the Westinghouse Electric Corporation, working in co-operation with the AEC's Argonne National Laboratory and installed in the "life-size" counterpart of this model. The capacity of the "sea tank" is 385,000 gallons, and it surrounds a portion of the hull of the land-locked atomic submarine. The full-size tank is 50ft. diameter and 40ft. deep.

COOL LIGHT

Some Notes About Light and the Use of Phosphors in its Production

By "PHYSICIST"

ABOVE all other physical phenomena light has been by far the most important key to man's progress throughout the ages. Whilst fire may have been necessary for his survival it is not difficult to imagine how slow his progress would have been had he lived in perpetual darkness. It is, therefore, little wonder that the production and control of light has for long been a dominant feature in man's pattern of existence.

The Nature of Light

Light is but one of several forms of energy. The idea of energy existing in several forms, viz. heat, light, sound and electricity, and being capable of transformation from one form to another, is now so well established that there is little need to dwell upon it here.

Energy is transmitted across empty space as electromagnetic vibrations of varying wavelength, and visible light constitutes but a small part of the total range of wavelength which extends from wireless waves and infra-red rays through the visible spectrum to ultra-violet rays, X-rays, and cosmic rays, see Fig. 1.

What we know as white light is a blend of visible light of all colours, and that this is so can easily be demonstrated by passing a beam of white light through a glass prism, whereupon it is split up, forming a band of coloured light on a screen, see Fig. 2. A natural manifestation of this effect is the rainbow, where sunlight falling upon raindrops is split up into its constituent colours before being reflected to the observer.

Experiments show that the fundamental difference between the various colours is one of wavelength, red light having a longer wavelength than blue light.

Scientists have established that light is emitted by the individual atoms of which matter is composed. Energy supplied to the atom in one form such as heat or electromagnetic vibrations outside the visible spectrum is stored within the atom and given out again later as visible light, Fig. 3. Heat is by far the most frequent natural source of energy for transformation into light. Thus the atoms of matter on the sun are at an extremely high temperature and the heat energy associated with this high temperature is transformed in part into sunlight by the atoms on the surface of the sun.

It has long been established that the wavelength of the emitted light is related to the temperature of the emitter. We are all familiar with the fact that as the temperature of a body is raised it starts to glow dull red, then bright red, before becoming white hot; from which observations it is not difficult to appreciate that high temperature is an essention prerequisite for the production of white light from a heated body.

It can be shown by fairly simple means that the light which is emitted from a hot body covers a range of wavelength, and the peak wavelength is correlated to the temperature of the body, Fig. 4a. In fact, temperature indicating instruments (optical pyrometers) have been devised in which this distribution of wavelength is measured and used to calculate the temperature of the emitter.

Because the whiteness of the light is related to the temperature of the body, whenever light is produced by heating a body a considerable amount of the heat energy which is supplied is used up (a) in maintaining the temperature of the body, and (b) in the production of invisible radiations (e.g., infra-red and ultra-violet rays); see Fig. 4a. Under the most favourable conditions less than 4 per cent. of the energy supplied is emitted as light from a heated body.

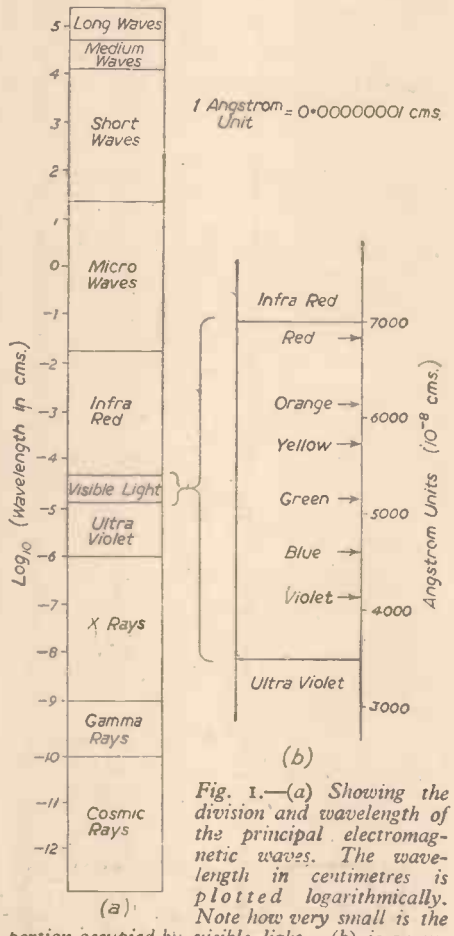


Fig. 1.—(a) Showing the division and wavelength of the principal electromagnetic waves. The wavelength in centimetres is plotted logarithmically. Note how very small is the portion occupied by visible light. (b) is an expanded part of (a) covering the visible spectrum. Here the wavelength is expressed in Angstrom Units (10⁻⁸ cms.) and plotted linearly.

Because light thus produced is associated with high temperature it should not be assumed that the two phenomena are inseparable, for even ancient man had before him, in the glow-worm, a light source in which high temperatures were plainly impossible. It is little wonder, then, that the dream of "cool light," that is light produced without heat from sources at normal temperature, should have been a long-sought-after goal. But, although some little progress was made, it is only recently that the mechanism of cool light production has been scientifically investigated and put to commercial use.

In 1603 a shoemaker of Bologna heated together some charcoal and barytes (barium sulphate) and produced a substance which, after exposure to sunlight, continued to glow in the dark. It is less than a hundred years ago that the principle underlying this emission of light, unaccompanied by the evolution of heat, was recognised, and it was shown that the luminescence was brought about by the absorption of light of short wavelength followed by the emission of light of longer wavelength, sometimes long after the original energy source had been extinguished. The substances which possessed this unique property were called phosphors.

Unknowingly use was made of this phenomenon in the latter half of the last century, when small pieces of limestone were held in high temperature flames and found to emit considerably more white light than most other bodies at that temperature. This white light, known as limelight, was used as the principal illuminant in theatres before electric light became available.

Certain rare earth oxides, notably cerium and thorium, also showed this effect, and they found application in the Welsbach incandescent mantle, which is still in use as an illuminant for gas-supplied street lighting.

The precise mechanism by which these substances produce light is still largely unknown, particularly since it only occurs at high temperature, and though the energy transformed into visible light is greater than for most other bodies at that temperature it can hardly be quoted as an example of cool light production.

Recent work has shown that there are two types of luminescence (a) *fluorescence*, in which light emission only occurs when the specimen is exposed to the incident radiation, and (b) *phosphorescence*, where the light emission continues some time afterwards. Furthermore, there are two types of phosphors: (a) pure substances such as dyestuffs and other organic compounds, and (b) inorganic crystalline materials containing small amounts of impurity.

Organic Materials

In this first group, fluorescein and eosin are two well-known examples, and more recently a group of dyestuffs have been discovered which are used in fluorescent paints, giving rise to striking, richly coloured, effects on posters, etc.

A unique material in this class has the long sounding name of methyl umbelliferone, but is more commonly referred to as "optical bleach." This is being more and more used

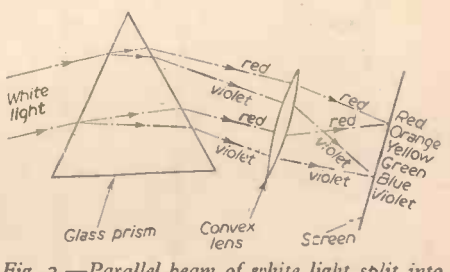


Fig. 2.—Parallel beam of white light split into its constituent colours by a glass prism and focused by a convex lens to give a spectrum on a screen.

in soapless washing powders, where, because it absorbs ultra-violet light which it re-emits as white light, and because it is retained on the clothes after rinsing, they look whiter than they actually are, particularly by com-

parison with normally washed clothes under identical conditions.

Use is also made of organic liquids which fluoresce in ultra-violet light for crack detection on metal surfaces. The liquid is made to flow over the surface, which is then wiped clean. The oil which remains in the cracks glows in ultra-violet light, thus revealing cracks which might easily pass unnoticed under normal visual inspection.

Inorganic Materials

In the second group the amount of "impurity" is so critical that the term is almost a misnomer. The materials are first prepared in a high state of purity, and then a minute quantity, sometimes as little as one part in a million, of the impurity is added and the mixture fused together. The techniques involved in this process are both rigorous and highly skilled, necessitating very careful control during all stages of manufacture.

A detailed explanation of the mechanism of light emission in this particular type of substance is too involved to be dealt with here, but broadly the effect can be ascribed to energy absorption and emission by the molecules in the crystals, rather than to the individual atoms themselves, and this is greatly influenced by the "impurity," which distorts the regular molecular arrangement within the crystals.

Typical phosphors which are affected by ultra-violet light are zinc and cadmium sulphides, in which copper is used as an activator, and these usually show a pronounced phosphorescence. More recent types which have been developed for specific purposes are zinc orthosilicate, calcium tungstate, zinc beryllium silicate and magnesium silicate. All these have been used in fluorescent lamps.

Fluorescent Lighting

The luminous efficiency and colour of the light emitted by the incandescent electric lamp have been limited by the highest temperatures at which the filament could be operated, consistent with a satisfactory life. Under the best possible conditions, using a coiled coil filament with an inert gas in the lamp, only 4 per cent. of the electrical energy that is supplied is given out as light; the rest being lost as heat and invisible light. Inevitably, therefore, alternative means of light production have been sought.

It has long been known that the passage of electricity through a gas under reduced pressure resulted in the emission of light from the gas atoms without the evolution of a large quantity of heat, but, unlike light

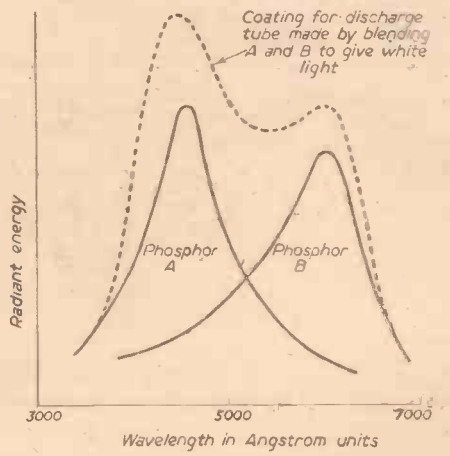


Fig. 5.—Energy-wavelength plots for a blue emitting phosphor, A and a yellow emitting phosphor, B. A blend of the two would have an energy-wavelength plot shown by the dotted line and would give a bluish-white light.

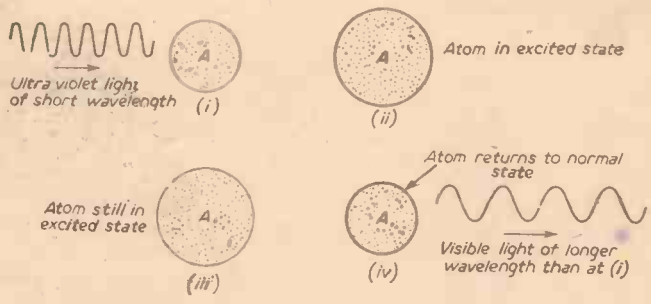


Fig. 3.—Diagrammatic representation of light absorption and emission by atoms. (i) Atom in normal state is illuminated by ultra-violet light. (ii) Atom absorbs energy from incident light. (iii) This energy can be held by the atom for some time. (iv) Atom returns to normal state after emitting energy as visible light of a longer wavelength than incident light.

emission from heated bodies, the spectrum was not continuous; the energy being given out as light of several fixed wavelengths, some of which were unfortunately outside the visible spectrum, Fig. 4b. The light thus obtained was, therefore, of a distinctive colour, for example the red colour of the neon discharge tube.

The first big step forward was made when the idea of marrying the gas discharge tube and the phosphors was suggested, and

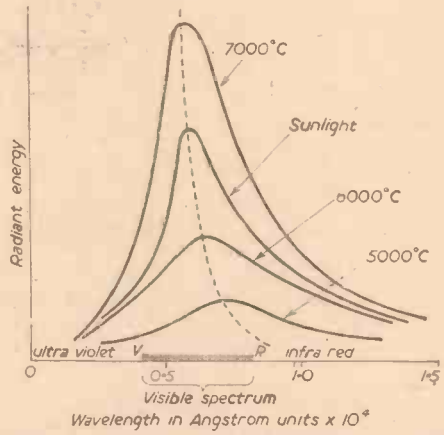


Fig. 4a.—Typical energy-wavelength plot for heated body and for sunlight. Note how little energy lies in visible spectrum. Dotted curve joins peak wavelength at different temperatures.

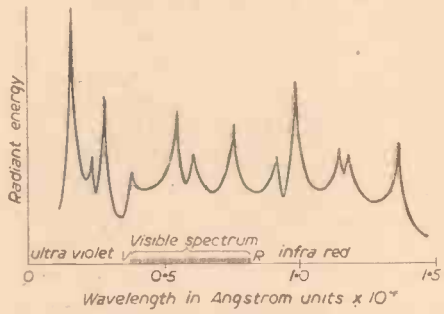


Fig. 4b.—Typical energy-wavelength plot for gas discharge. Note how the energy is largely confined to light waves of single wavelength, unlike energy-wavelength distribution in Fig. 4a.

such rapid progress has been made that it is now a serious rival of the incandescent electric lamp.

Basically, the idea was to convert the non-visible component of the gas discharge tube, largely that in the ultra-violet region of the spectrum, into visible light by allowing it to fall upon a suitable phosphor.

Originally, neon was used in the discharge tube, and phosphors such as zinc orthosilicate which fluoresces green, and calcium tungstate which fluoresces blue, were coated on the inside of the tube. The resulting light from the tube, being a combination of that from the neon discharge (i.e. red) and that of the phosphor, was therefore yellow or pink respectively.

More efficient tubes containing mercury vapour were devised later, this gas giving an intense radiation in the ultra-violet region of the spectrum. When zinc beryllium silicate activated with manganese is used as the phosphor in this tube, a yellow-white to pink colour is obtained, and when this phosphor is mixed with magnesium tungstate (which used alone gives a pale blue fluorescence), the resulting light is similar to daylight.

Most recent of all phosphors for "daylight" fluorescent lamps is calcium halophosphate activated with antimony and manganese.

Fluorescent lamps are constructed so as to have a large surface area over which the phosphor is spread. Usually they are long narrow glass tubes, the inner wall of which is uniformly coated with a thin layer of phosphor. In this tube, about 16-20 per cent. of the energy is converted to light, without the lamp reaching anything like the temperature of the normal electric lamp.

By blending various phosphors the colour of the light can be varied over a wide range of shades, see Fig. 5, and the stroboscopic effects sometimes observed on A.C. mains supply with ordinary electric lamps, which can be so dangerous when these are used to illuminate moving machinery, can be minimised by using a combination of fluorescent and phosphorescent materials, thus enabling the coating of the tube to continue emitting light in the parts of the cycle when the tube is not conducting.

Fluorescent and Intensifying Screens for X-Rays

Although X-rays are invisible to the human eye they produce an intense fluorescence on several phosphors. Thus a thin uniform coating of a phosphor on a screen makes the X-ray beam visible, enabling X-ray shadow-graphs to be viewed instantly without resort to photography. The idea has also been adapted to X-ray photography, where a phosphor coated screen placed in contact with photographic plates, which alone are but slowly affected by X-rays, enables the exposure time to be considerably reduced. This technique has proved invaluable for the examination of materials which are affected by exposure to X-rays.

Cathode Ray Tube Screens

Perhaps the most important use to which phosphors will ever be put is for screen materials for cathode ray tubes in television and radar. In these applications they are indeed key materials, for without them these valuable discoveries would be impossible.

In both radar and television the picture is displayed on the screen of a cathode ray tube upon which a modulated electron beam moves in some regular manner.

The phosphors have, therefore, to be sensitive to electron bombardment, and whilst the selection of suitable phosphors for image producing screens is, of course, correlated to the effectiveness with which the phosphor converts the incident energy into visible light, other considerations such as particle size and

(*Continued on page 263*).

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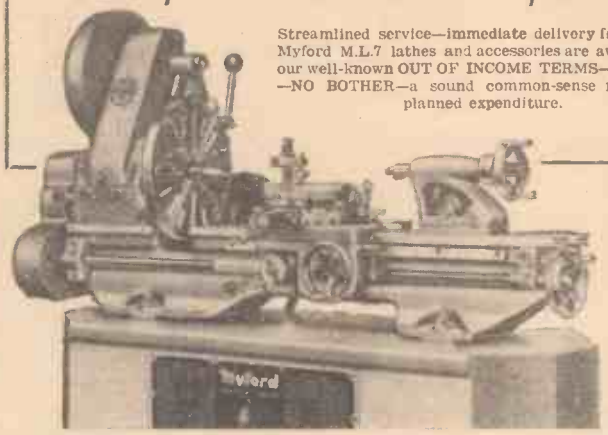

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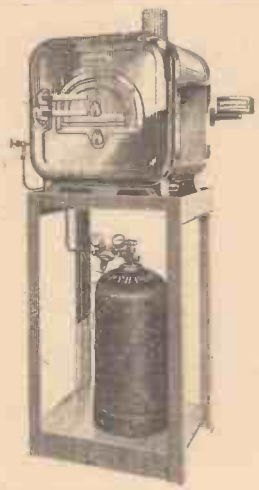

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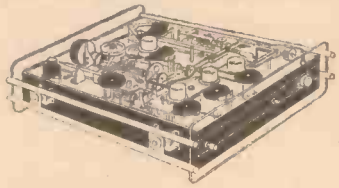

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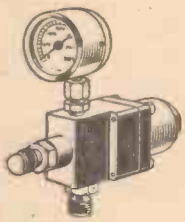

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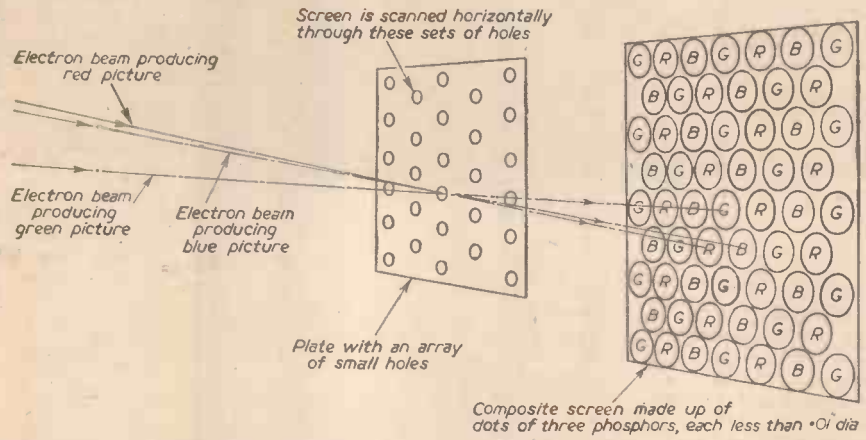


Fig. 7.—Diagrammatic representation of the R.C.A. single screen system of television. The screen is built up from a mosaic of dots of three phosphors, viz. (1) zinc orthophosphate activated with manganese ($\beta Zn_3(PO_4)_2 : Mn$) which gives a red colour. (2) Zinc sulphide activated with silver ($ZnS:Ag$), which gives a blue colour. (3) Zinc orthosilicate activated with manganese ($Zn_2SiO_4 : Mn$), which gives a green colour, are assembled in such a manner that the beam from each falls only on the dots of one phosphor throughout each complete scan.

stability under electron bombardment have to be taken into account. Again, when rapidly moving events are being observed the screen materials must have virtually no phosphorescence.

Nowadays screen materials can be made to have any desired colour and phosphorescence. A selection of some of the more widely used ones are shown in Fig. 6.

For white screen television a two-component phosphor is used, and this is usually of the sulphide or silicate type; in each case one component of the phosphor has its peak emission in the blue region of the spectrum and the other has its peak component in the yellow region of the spectrum. The two phosphors are blended together in such quantities that white light results. Of the two blends the silicate type has a slightly wider spectral distribution and finds considerable application in projection televisors.

Colour Television

Before the knowledge of luminescent materials had reached its present state it was widely believed that colour television would only be achieved by using a single white screen, in front of which a disc carrying primary coloured filters was rotated in synchronisation with a similar scanning disc in the television studio. There was little hope of this system ever proving feasible, due to the inherent difficulty in achieving synchronisation between the two discs.

However, as the knowledge of phosphors grew materials were found with widely differing spectral distribution, so that by careful selection the screen colour (i.e., the colour of the emitted light) could be adjusted to cover any portion of the visible spectrum. Consequently it proved possible to dispense with the rotating disc and have three cathode ray tubes, each having a screen selected to give light of one primary colour.

Systems using this tri-screen arrangement have been satisfactorily demonstrated, but the equipment is cumbersome and the optical set up is such that perfect superimposition of the three coloured images is only obtained when the viewer is in one fixed position with respect to the set.

This disadvantage can be overcome, using a projection method, but since this would entail triplication of the projection apparatus it is hardly an economic proposition.

Latest of all applications of phosphors in colour television is the R.C.A. colour system, which uses but one screen. This is built up from a regular array of dots of different phosphors, each less than 0.01 inches in diameter, which are selected to give the three primary colours (viz., blue, green, red). A flat plate, containing a regular series of holes, interposed between the screen and the three electron guns (one for each primary colour), enables the electron beam from each gun to fall only on one particular type of phosphor, Fig. 7. In this way the three primary coloured pictures are built up to give a composite picture in full colour.

Cool Light Emission from Crystals

It has recently been discovered that crystals of certain substances known as semiconductors can be induced to emit cool light by the passage of electricity through them. Few crystals show the effect, which was first described by two Hungarian scientists a few years ago. They found that small crystals of the man-made abrasive, silicon carbide (carborundum), could be induced to emit an intense white light when held between two copper gauzes with from 20-50 volts potential difference across them. Although glowing accounts were made of this discovery at the time, it has still not been exploited commercially. Apparently the effect is again dependent on "impurities" in the material, and the commercially available variety of silicon carbide is much too impure to give any light whatsoever.

Without doubt the recent developments in this new field of science have shown how valuable a material phosphors can be, and as the applications of electronics, especially radar and television, continue to grow they are sure to prove of increasing usefulness.

But above all else in this world of dwindling fuel supplies any advance which represents an increased efficiency in the use of fuel is of the greatest importance. Fluorescent lamps give four times more light for the same energy imput as the electric lamp. This fact alone ensures that they will be more and more used as a general illuminant.

Name	Activator	Formula	Colour	Uses
Zinc Sulphide ...	Copper	ZnS : Cu	Yellow	Radar Screens, long phosphorescence
Zinc Sulphide ...	Silver	ZnS : Ag	Blue	T.V., Radar, short phosphorescence
Zinc Sulphide ...	Manganese	ZnS : Mn	Red	Colour T.V., short phosphorescence
Zinc Cadmium Sulphide	Copper	(ZnCd)S : Cu	Yellow / White	T.V., Radar, variable phosphorescence
Zinc Cadmium Sulphide	Silver	(ZnCd)S : Ag	Yellow	T.V., Radar, short phosphorescence
Zinc Ortho-Silicate	Manganese	Zn_2SiO_4 : Mn	Green	T.V., Radar, short phosphorescence / Fluorescent Lamps
Calcium Tungstate	—	$CaWO_4$	Blue	T.V., X-ray / Fluorescent Lamps
Calcium Halo-Phosphate	Antimony and Manganese	$Ca_5(PO_4)_3F$: Sb / $Ca_5(PO_4)_3F$:Mn	White	Best Phosphor for Daylight / Fluorescent Lamps
Zinc Beryllium Silicate	Manganese	(ZnBe)SiO_2:Mn	Yellow to Red	Formerly much used in Fluorescent Lamps
Zinc Ortho-Phosphate	Manganese	$\beta Zn_3(PO_4)_2$:Mn	Red	Colour T.V.
Magnesium Tungstate	—	$MgWO_4$	Pale Blue	Formerly used in Fluorescent Lamps
Barium & Lead Sulphate	—	(BaPb)SO_4	Yellow to Green	X-ray Intensifying Screens
Barium Pyrophosphate	Titanium	$Ba_2P_2O_7$: Ti	Blue	Fluorescent Lamps

Fig. 6.—Table listing the characteristics and the uses of several phosphors.

LETTERS TO THE EDITOR

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

Stencil Cutting

SIR,—I feel that E. J. Rabe's reference to the latest development in duplicator stencil cutting by an electronic stencil-cutting instrument is a bit misleading in respect to the finished results. I have proved without doubt in my business that the straight photographic process of stencil cutting, whether line or half-tone as invented by the late David Gestetner, is still far in advance of any other method yet conceived. Furthermore, I can make them myself, and after use the stencils can be stored indefinitely and re-used as often as required, without having to return them to the manufacturers for reconditioning.

The "electric eye" scanning process as invented for sending pictures by wire, and now adopted by Messrs. Roneo to transform copy to stencils, is all very novel and interesting, but those of us in the photographic world who have a keen sense of quality cannot agree that results are in any way comparable with the finished picture as obtained by the orthodox methods of photography, and thereafter transferring to paper, film, canvas, printing blocks, stereos or duplicating stencils.

I am most alive and keen at all times for improved methods in attaining the end in view, but the results must be at least consistent with what we know to-day. For Mr. Rabe to say that the method he refers to "gives results not possible by the photographic method" makes me wonder just why he mistakes this very obvious mis-statement. —A. HOOD (Dundee).

Electronic Flash Construction Kits

SIR,—*Re* the query by A. M. Cooper in PRACTICAL MECHANICS for November about an electronic flash construction kit, the following firms supply home-constructor kits: General Electronics, Portobello Road, London, W.11; Clive Courtenay and Co., Ltd., Horsham Road, Dorking, Surrey; also Glanvill Engineers, 48, Cotswold Road, Westcliff-on-Sea, Essex, who supply parts for construction of 2.5 kV units exactly as described in the book *The Electronic Photographic Speedlamp*, published by Bernards at 3s. 6d. I personally have made up one of these 100J outfits with complete success.—J. G. MCWILLIAMS (Newcastle-on-Tyne).

Mounting Maps

SIR,—In answer to G. Lovegrove's query *re* mounting maps, in the November issue, stretch the linen (open or close mesh) on a sheet of polished zinc or glass a trifle smaller than linen, pin linen down with drawing pins and carry on as he suggests.

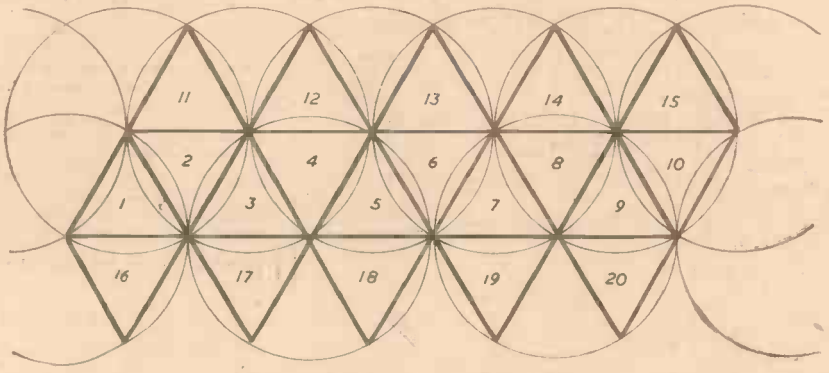
When whole is dry it will peel off the zinc or glass quite easily.—A. WARNE (Newcastle-on-Tyne).

Forming a Globe

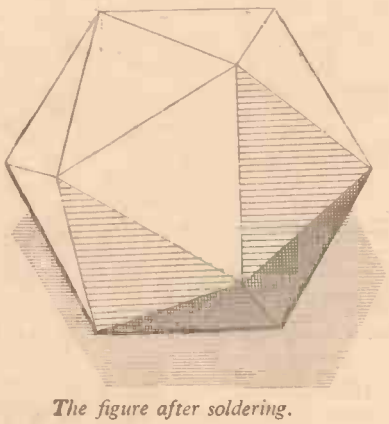
SIR,—*Re* information sought in January PRACTICAL MECHANICS, I hope the following drawings will supply information for your Ireland reader seeking the setting out of a Icosahedron (a 20-sided object). Being a plumber by trade I had occasion to make a ball for a ball-valve. All the joints were soldered from inside, the last three from the outside.—F. W. PAGE (Enfield).

Interplanetary Space Travel

SIR,—A. D. Muxlow is quite wrong in stating that interplanetary travel is impossible (PRACTICAL MECHANICS, January) —at least for the reasons given.



The method of setting out a Icosahedron.



The figure after soldering.

Even if a space ship were attracted towards the sun as suggested, it could—assuming sufficient power was available—accelerate away from it. However, present-day knowledge indicates that the following is the case: A body which has "escaped" from the earth will still share the earth's motion round the sun. This motion will generate a centrifugal force that will counterbalance the gravitational pull of the sun in just the same manner that the moon's speed around us balances the earth's gravitational pull. To escape from the sun, after escaping from the earth, requires a further increase of velocity of about 27,000 m.p.h., making 52,000 m.p.h. in all. Now, if an escape velocity of 25,000 m.p.h. is required to leave a planet, then it should be realised that this 25,000 m.p.h. will have to be lost—and this will require the expenditure of just as much energy as was needed for the initial acceleration—before the return landing can be made. It is because of this fact that one hears so much about "aerodynamic-braking"—a scheme whereby speed is reduced by using the friction of the atmosphere—in connection with space flight. This holds promise of making possible a big reduction in the fuel supply.

The velocity of escape of the sun at its surface is some 1,400,000 m.p.h. and is still over 1,000,000 m.p.h. at the distance of the earth from the sun, and so it is obvious that not only will a space ship *not* tend to fall into the sun, but a colossal expenditure of fuel and a very high speed would be required before it could do so.

A. D. Muxlow is also wrong in inferring that planetary motions are elliptical "due to the influence of other forces and combinations of forces." The orbits are elliptical because of the initial velocity imparted to the planets when they were created, plus centrifugal and gravitational forces. The other forces referred to are, in fact, the very ones which prevent the orbits from being truly elliptical!—MAURICE F. ALLWARD and FRANK E. BEHENNAH (British Interplanetary Society).

SIR,—Since you published my letter on "Interplanetary Space Travel" in the April issue under the name of W. J. Land there have been letters published answering my theories, all more or less in the same strain, from a variety of different people. I would like to say that they all alike have missed the point of my ideas.

I compared the passage of heat in a vacuum to electricity since both obey the same laws. What is a good conductor of heat is equally a good conductor of electricity and the reverse holds true. In a vacuum no electricity can flow till the space is rendered conductive by heating the filament. Then a cloud of free electrons is formed and acts as a conducting path—which, however, has a high resistance to the passage of electricity. The resistance of this increases with distance between the electrodes.

The electricity can, however, pass in a spark discharge if the electrodes are close enough together and the pressure of volts high enough, in the absence of the cloud of free electrodes. I should like to know to what extent heat obeys those laws. To assert loosely, as all four contributors have done, "that heat can pass through a vacuum by radiation" is certainly not good enough.

Can heat be freely radiated through a vacuum irrespective of the length of the vacuum's path or intensity of heat? In space we would not be dealing with ¼in. or so, but thousands of miles.

As it is generally agreed that no heat can be lost by conduction or convection, it is all-important to know fully the capabilities or limitations of radiation, since by radiation alone could the heat continually generated by human bodies, motors, jets, and also the heat of the sun, untempered by atmosphere, be got rid of.

In a racing motor engine all three—

(*Continued on page* 267)

conduction, convection and radiation—are employed to the fullest possible extent to cool the engine. In a rocket ship there would be, perhaps, a thousand times more heat to get rid of—by radiation alone ?

It is important to obtain exact information on this matter as many lives and much treasure would depend on knowing the answers.—W. J. LAW (Ealing, W.5).

SIR,—Reader Muxlow, when stating that as soon as a spaceship left the earth's field it would be irresistibly attracted to the sun, forgot that it would still have the same rotation about the sun as had the earth. Also, as the spaceship approached the sun it could use its reaction motors to increase its orbital speed, thus keeping its centrifugal force and the gravity balanced. Assuming this mode of space travel is used, the next obstacle would be to land on the chosen planet. The ship would have to destroy its orbital velocity, either partly or completely, to adopt that of the planet. Another obstacle which to my knowledge has not been overcome is the calculation involved. It will be like a beginner at chess trying to play the 3-dimensional version of the game ; there are so many new things to be taken into consideration. I am, however, completely confident that space travel *will* be successfully attempted in the future, but I fear that at first, as in flying, the unsuccessful attempts will far outweigh the successful ones.—M. C. MILLS (Wembley).

SIR,—I read with intense interest the many articles and letters concerning space travel, flying saucers and kindred subjects, which from time to time appear in PRACTICAL MECHANICS.

Many of these contain much that is of value, but I was amazed to read the views of Mr. V. A. Millburn, who sets forth his "theories" concerning the principles of operation of the flying saucer as though they were established by wind-tunnel and flight tests ! The phrasing of his letter indicates that Mr. Millburn knows nothing about the principles of aerodynamics or the effects of high speed flight upon the human body, and confuses air resistance with acceleration. The former cannot, of course, have any effect upon a pilot in an enclosed cabin ; whereas the latter can "immobilise" him (as Mr. Millburn quaintly puts it) and is the principal reason why flying saucers, if their manœuvrability is as high as many witnesses have reported, cannot be manned by human crews.

As an aircraft engineer, therefore, I say that the only aerodynamic *fact* contained in Mr. Millburn's letter is that a conventional aircraft, when taking off, must travel in the direction in which its nose is pointing ; and I can only liken his "revolutionary ideas" to those of the man who stood in a bucket and tried to raise himself by lifting on the handle !

And now, as a member of the British Interplanetary Society, I must take up arms against Mr. A. D. Muxlow, who asserts with conviction that interplanetary travel is impossible ! Perhaps a short explanation of the interplanetary voyage will clear up the confusion.

In the first place the motion of any body in space, be it a pea-sized meteorite, a spaceship, or a planet, is ordered by the same laws. The spaceship, before it starts its journey, will possess the same intrinsic velocity as the earth, i.e., about 18.5 miles per second relative to the sun. The thrust of the rocket motors will be used to modify that velocity, but the greater part of the spaceship's velocity during the inter-orbital journey will be due to the movement of the earth around the sun.

To reach an outer planet, such as Mars, the spaceship must leave the earth in the same direction as the earth's motion around the sun. Thus the velocity imparted by the motors will be added to the original 18.5 miles per second, and the spaceship will therefore move on a widening orbit. Consider the way in which a centrifugal governor weight widens its orbit when its speed of rotation is increased ; the analogy is accurate enough.

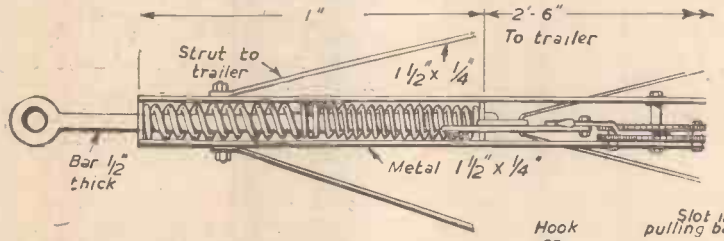
Similarly, if it is desired to reach an inner planet, such as Venus, the spaceship must depart *against* the direction of the earth's motion around the sun. In this case, although it will be travelling away from the earth with the velocity imparted by its motors, the spaceship will in fact be moving in the same direction as the earth at reduced velocity. (An observer on the sun would say that it was moving tail first with its rockets acting as a brake.)

I need hardly stress the fact that the 18.5 miles per second happens to be the orbital speed required to balance a body against the sun's gravitational attraction at a distance of 93,000,000 miles ; and in the case of the voyage inwards, if the motors were powerful enough to push the ship's speed up to 18.5 miles per second it would lose all its radial velocity and fall straight into the sun, as Mr. Muxlow gloomily predicted.

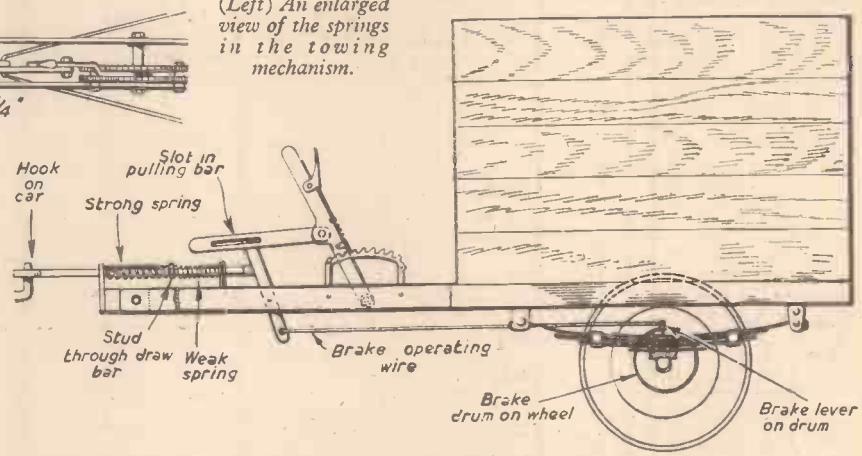
I am aware that the foregoing is a gross over-simplification, but I do not think it contains any basic inaccuracies.—C. JACKSON (Senior Technician, R.A.F. St. Athan).

Towing Mechanism for Light Trailer

SIR,—In answer to Mr. F. J. Rawlinson's letter asking for details of towing mechanism for a light trailer, the following may help him. The measurements I have given need only be taken as approximate and he can be guided by his own requirements as to the actual shape of the trailer. The action is very simple. When the car is pulling the trailer the strong spring is very slightly compressed, absorbing jerks caused by bumpy roads, which would be transmitted to the car if a rigid fixture were employed. On slowing the car down the trailer tries to override the car, this causes the drawbar to be pushed back, compressing the weak spring and pushing on to the short lever. This lever swivels on its bearing (a bolt will do) and by pulling on the brake operating wire applies the brake. For parking the trailer the hand lever is pulled back, thereby setting the brake.—C. EMMS (Ipswich).



(Left) An enlarged view of the springs in the towing mechanism.



A side view of the towing mechanism, including details of the hand brake.

"Have Spaceships Landed ?"

SIR,—In the January issue of PRACTICAL MECHANICS my attention was drawn to Mr. F. J. Camm's article "Have Spaceships Landed ?" reviewing Mr. George Adamski's book "Flying Saucers Have Landed."

I have read excerpts from the newspapers on his book and have put the idea down to clever science fiction, but reading carefully through Mr. F. J. Camm's article I have changed my mind. I refer to the short paragraph—"Two Amazing Formations of Spacecraft"—wherein is stated: "As I was observing the moon through my 6in. telescope I noticed a number of very small pinpoints of light apparently rising from the moon's surface. I have observed this body endless times during the last 20 years, but I had never before seen anything like them."

During the summer of 1953 I was experimenting with a home-made telescope and had it focused on the moon, when I suddenly saw these tiny pinpoints of light rising from the top of the north-west quarter of the moon ; they seemed to rise a short distance and then disappear ; there must have been 30 or 40 of them. Needless to say it startled me for the moment, but on reflection I thought they may have been "liver spots."

But now reflecting on the matter, after having read Adamski's article, I believe that they may have been spaceships.

Adamski saw them in 1950, I saw them in the summer of 1953, so these things may have been going on for some considerable time.

If these spacecraft do not come from outer space they may come from the other side of the moon, which may present a different appearance than does the earth side.

After all, who has seen the other side of the moon ?—E. S. H. (Romford).

SIR,—Having read with great interest your review entitled "Have Spaceships Landed ?", I must say that the close-up photographs of the "Venusian Scout Ships" are most unconvincing.

The object shown is easily recognised as being a model mock-up made from an old vitreous enamel lamp shade of a type much

used in the past for outdoor lighting; the unglazed port holes served the original purpose of ventilation.

The seeming appearance of a "power coil" would be due to flaking the outer enamel finish to reveal the lighter undercoat beneath it.

A car bulb or glass marble mounted on top of the shade and three billiard balls fastened beneath it complete the illusion—almost.

If then photographed with the camera slightly out of focus the subsequent pictures would have that nebulous appearance so often associated with astral photographs.

Regarding the "ingenious" landing gear, I submit that the arrangement of spheres as shown could not possibly fulfil the function claimed, nor indeed could it serve any practical purpose whatever; this suggests that its designer has little or no mechanical knowledge.

Furthermore, if the craft can rise and fall vertically, hover or move in any direction in relation to itself as claimed, why the need for any landing gear at all?

If "Flying Saucers" do exist then they must be of earthly origin and are probably experimental craft still on the Secrets List.

May I conclude by offering my reply to the query "Have Spaceships Landed?"—the answer is no, they have not nor are they ever likely to, unless they are our own ships returning from an expedition into space, sometime in the distant future.—W. KOHL (London, W.1.).

SIR,—I was much amused by the article "Have Spaceships Landed?" in your January issue and assume this review was included with the tongue in your editorial cheek as otherwise I cannot understand its inclusion at such length in your usually very authoritative magazine.

The photograph reproduced at the foot of page 165 of "an amazing formation of spaceships" and which Mr. George Adamski claims to have taken on May 29th, 1950, is the same photograph (but inverted and reversed from left to right) which appears as Fig. 6 in the book "Flying Saucers," by Donald H. Menzel, Professor of Astrophysics at Harvard University.

The caption in that volume refers to the objects as the "Lubbock Lights" and attributes the photograph to a Carl Hart, Junior, who took the photograph at Lubbock, Texas, on August 30th, 1951.

The "Venusian Flying Saucer" also reproduced in your article is obviously a rather poor photograph of an industrial-type lamp shade.

However, as I am all in favour of good clean fun, I enjoyed reading this review.—R. J. NORMAN (Belfast).

SIR,—As I feel sure you will be interested I take the opportunity to draw to your attention a useful item of electrical equipment.

The illustrations are not up to the standard to which you are accustomed and I ask you to overlook their "muzziness." I think, however, that they do show the article quite clearly.

Illustration A (PRACTICAL MECHANICS, January, page 164, bottom) shows how the electric bulbs, spaced round the inside of the reflector, are carefully protected by being flush with, or even slightly lower than, the surrounding "skirt." No damage can, therefore, come to them should the reflector be placed on a flat surface, or slid along a flat surface. You will note that the heat which must be generated around the tops of the bulbs can be dispersed by way of the holes perforated around the narrowed waist portion. Above this you can see the ring that is provided for affixing the chain or other means of suspending the fitting from the ceiling. The ring of light is, of course, the reflection of the light used to make the exposure.

Illustration B (page 165, centre) is taken from below the fitting and shows how it has been arranged, in accordance with accepted practice, so that the bulbs are reflected from a position near their spherical centres. A small gadget recently again put on the market and advertised widely adopts a similar principle. The centre portion of the shade is the housing for a high-wattage bulb (not shown in illustration).

A suggested trade name for the fitting might be "The Venusian"!—WILLIAM RODWELL (Suffolk).

Club Reports

Model Railway Club

IN connection with the forthcoming Model Railway Exhibition, which is held annually during Easter Week at the Central Hall, Westminster, The Model Railway Club have arranged to devote their next meeting to the Press Photography of models which will be displayed at the Exhibition. The facilities available for photographing will include studio lights and trackwork for posing models.

The club meetings take place at Waterloo Station in the Ambulance Room, access to which is down the subway opposite the entrance to No. 12 Platform, through the second door on the right in the subway, and down the stairs again.—G. E. BIGMORE, Press Officer, 15, Forestdale, Southgate, N.14.

Aylesbury and District Society of Model Engineers

ON January 20th the society met at Hampden Buildings for its seventh annual general meeting. As usual, the A.G.M. is the time for electing officials. Our president, Mr. E. D. Eborn, was re-elected, as were our vice presidents, Mr. F. R. Forest and Mr. H. East. Unfortunately, Mr. A. Cleaver, who this time last year was in hospital, has since passed away, and all friends and members will mourn with Mrs. Cleaver the loss of a dear friend. Mr. Cleaver's place among our vice presidents is to be offered to Mr. H. D. Bond, of the Luton S.M.E. Mr. Forest we re-elected to the chairman's seat, although he thought somebody else should take over the post. Mr. E. Smith was again proposed to fill the secretary's chair, and with it will go the offices of treasurer and scribe. Among the committee this year we will see that familiar figure of Mr. E. Bide, who was elected to replace Mr. C. Darton by eight votes to six. The rest of the committee being the same as last year, namely Mr. C. Gill, Mr. N. Gower, Mr. C. Horwood and Mr. E. Burch.

Mr. Forest was again elected to put the club interests at meetings of the Aylesbury Association, while Mr. H. Mortimer was also again elected club auditor.—Hon. Sec., E. H. SMITH, Mulberry Tree Cottage, Devonshire Avenue, Amersham, Bucks.

West Hants Aeromodellers' Association

OF great interest to all R.C. fans is a trophy which has been presented to the Southern Area Committee of the Society of Model Aeronautical Engineers by the West Hants Aeromodellers Association for a radio-controlled glider event, the trophy to be known as the "West Hants Radio Controlled Glider Trophy."

This event will be open to all the *country* and will not be restricted to members of Southern Area clubs. Full information is not yet available but, briefly, rules will be as follows: Trophy to be held for one year, no restriction on model except that it must be a model glider or sailplane and radio controlled; contest to be in two parts, an "out and return" course flight and a duration event. Models to be launched by means of a hundred metre tow line.

Contest organisation will be in the hands of the Southern Area Committee of the S.M.A.E., and the event will be held in conjunction with the Southern Area Rally on July 4th, at a venue to be announced in the near future.

The event will be open to members of the W.H.A.A.

For further information send a S.A.E. marked "R/C Comp" in the top left-hand corner to H. E. WHEATLEY, 5, Alum Chine Road, Westbourne, Bournemouth, and you will then be kept posted with further information as and when it becomes available.

Poole Model Yacht and Power Boat Club

THE 1954 "Marblehead" National Championship Races will be held on the water of the Poole Model Yacht and Power Boat Club, in Poole Park, during the Whitsuntide, June 5th, 6th and 7th, 1954.

The Poole Club have decided to make this practically a week of regatta, as they have arranged to stage their radio-controlled regatta the following week-end on June 12th and 13th. It is hoped the radio-control competitors will come down for the national races and be able to put in some practice on the days between the races.

A souvenir programme is being compiled, covering the two separate events, and a brochure of the town of Poole will be sent to all competitors, which will show the position of the water in relation to the hotels and boarding houses in the town.

The O.O.D. for the "M" Class National will be Mr. A. R. Litton, of Exeter. The assistant O.O.D. will be Mr. M. Fairbrother, the racing secretary of the M.Y.A. Entry forms can be obtained from Mr. Fairbrother, and his address is 122I, Pershore Road, Stirchley, Birmingham 30. Each club will be allowed to enter three boats.

Particulars of the radio-controlled events and entry forms can be obtained from the Hon. Sec., Mr. W. L. PERRETT, 46, Cranbrook Road, Parkstone, Dorset. An early application is strongly advised owing to the large amount of organisation necessary for these events.

Topsham Model Engineering Society

THIS small club, which was formed two years ago, now has upwards of 14 active members. Meetings are held on Tuesdays and Fridays at 7 p.m. The club is equipped with a small and large lathe, grinder, compressor and drill, etc., and members are at liberty to use any of these tools on meeting nights. Our first annual dinner was held last December and proved very successful. Model loco construction is one of the chief activities of the club, and a 5in. gauge 0-4-0 tank loco, now partly finished, is to be used at fêtes, etc. Other models include stationary engines, power tools and electrical apparatus. Further particulars are available from the Hon. Sec., G. BELL, Pinehurst, Exton, Topsham, nr. Exeter.

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

TWIST DRILL BARGAINS. 16 Chrome Vanadium, 1/64in. to ½in. 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.

TYLER SPIRAL HACKSAW BLADES are "all-ways" sharp; cut intricate shapes in steel, wood, plastics; 12 Blades and Adaptors to fit Standard Hacksaw 5/6 from your local dealer, or 6/-, post free, from Spiral-Saws Limited, Trading Estate, Slough.

SHELBY TOOL & ENGINEERING CO., LTD., have made a purchase of a large assortment of new tools for the woodworker, engineer, builder, etc., mostly in original wrappings; bargain prices to clear; send 6d. for lists. Shelby Tool & Engineering Co., Ltd., Annesley Woodhouse, Notts.

COMPRESSOR EQUIPMENT. Miscellaneous Items; catalogue, 1½d. Pryce, 157, Malden Road, Cheam.

TRANSFORMERS, Rectifiers, Volt and Ammeters, Controllers, Cut-outs, Battery Chargers, Power Units; lists; s.a.e. Harry Gilpin, Manufacturer, Portobello Works, Walton-on-Naze, Essex.

PERSPEX for all purposes, clear or coloured, dials, discs, engraving. Denny, 15, Netherwood Road, W.14. (SHE. 1426, 5152.)

HOUSE SERVICE METERS, credit and prepayment; available from stock. Universal Electrical, 221, City Road, London, E.C.1.

ELECTRIC BLANKET; make your own in 5 minutes; we supply the interior element complete, 6ft. long, 2ft. 6in. wide, and 9ft. of flex attached; tested and guaranteed; 35/-. Dept. E.L., Brace, Dairy Green, Thaxted, Essex.

PLATED Nuts, Screws, Washers, Bolts, Soldering Tags, Hank-bushes, Self-tapping Screws, Grub-screws, Socket-screws, Wood-screws; large quantities or gross cartons. List sent post free. Sinden Components Ltd., Dept. E., 117, Churchfield Road, Acton, W.3. (ACOrn 8126.)

LIQUID BROMIDE EMULSION for photographing on paper, cloth, cellophane, metals, 8/6 bottle; c.w.o.; enquiries, s.a.e. M. Dept., O. Bill, 17, Greenhill Rd., Birmingham, 13.

HIGH-SPEED LATHE TOOLS, set of 12, ¼in. square, 40/-, p. and p., 1/-; 24 High-speed Drills up to ½in., 17/6, p. and p., 9d.; 5 pint Brazing Lamp, list £7/15/-, our price, 70/-, p. and p., 3/6; Surface Plates, 12in. x 8in., 40/-, p. and p., 4/-. Send 6d. for list of tool bargains. Mibro Equipments, 65, Knaresborough Rd., Harrogate.

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COMPRESSORS for sale, 2½ CFM, 180lbs. sq. in., on metal base, with driving wheel and receiver, price £3; ½h.p. Heavy Duty Motors, price £3; carriage forward. Wheelhouse, 1, The Grove, Isleworth. (Phone Hounslow 7558.)

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NUTS, BOLTS, SCREWS, Rivets. Washers, and hundreds of other items for model engineers and handymen; s.a.e. for list. Whiston (Dept. PMS), New Mills, Stockport.

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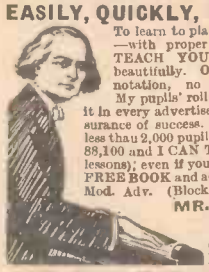

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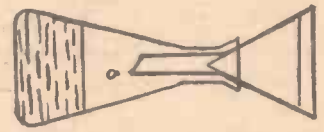

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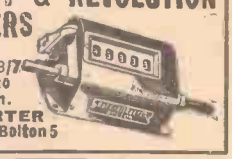

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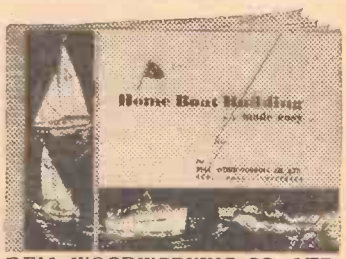

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Trade Notes

Fluorescent Lighting Kits

SINCE the war many offices, homes and factories have turned over to fluorescent lighting and many more would do so if it were not for the high cost of the initial installation, which is from £6 to £20. This type of lighting has many advantages; fluorescent tubes give over three times the light of an ordinary bulb and last five times as long, surface brightness is low, giving reduced eyestrain, shadows are eliminated and the heat radiation is about a quarter that of ordinary lamps. A wide range of colours is now available, from "daylight" and "white" for workshop and office use to "peach" and "mellow" for domestic interiors. The complete unit comprises the tube, the control gear (essential to operate the tube) and a steel, wood or plastic fitting to hold everything together.

Dynalite fluorescent lighting kit.

Messrs. Dynalite Electrical, 38, Stevedale Road, Welling, Kent, have sent us details of the fluorescent lighting kits which they supply. Owing to the risk of breakage in transit the tubes are not supplied, but these are available from any electrical store. The mounting-plate can be made by the handyman for a few shillings.

In their price list Dynalite Electrical offer control gear kits from £1 7s. 6d. to £3 3s. in many different forms and for many different purposes. The £1 7s. 6d. kit, for instance, operates a 24in. 20-watt 1½in.-diameter tube and is useful for illuminating a showcase, as a bed-lamp, a desk-lamp or a simple bench-lamp for localised lighting. It is used in place of a 60-watt bulb.

Individual components are also supplied. Free technical advice is available on application to Dynalite Electrical if a 2½d. stamp is enclosed.

The "Longdon" Projector

THE Educational Visual Aids Ltd. (Dept. P.D.), 26, Charing Cross Road, London, W.1, have issued a booklet giving full constructional details of the "Longdon" 36 mm. strip and slide projector. This projector is a small efficient machine of unit construction and uses a 3in. lens and a 200- or 250-watt lamp. With an average density Kodachrome transparency an excellent picture about 4ft. by 3ft. is obtained across the average size lounge. Included with the booklet are six scale instructional sheets of working drawings. Priced at 4s. 6d. the booklet is obtainable from the address given.

Power Control Units

THE Lawrence Frankel Mail-Order House, of 134, Cranley Gardens, London, N.10, have just issued their new list for 1954 covering super power controls for small motors and models including model railways. The power units operate from A.C. mains, and there is a converter for D.C. mains, which can operate a 20v. A.C. loco. Other components listed include moving-coil voltmeters, transformers, and battery chargers.

This list is obtainable from the above address free of charge to applicants enclosing a stamped, addressed envelope.

Two Electric Tools

MESSRS BLACK AND DECKER have sent us their latest leaflets giving details of two handy electric tools — the ¼in. electric drill and the 5in. sander-polisher. With these tools may be obtained a large range of accessories, by the use of which any amount of variegated odd jobs may be accomplished, and many different types of operation performed, including drilling, buffing, sanding, burnishing, polishing, waxing, sharpening tools, cutlery, etc.

The chief accessories available are: a ¼in. bench stand which enables either tool to be set up as a drill press for extra leverage, accuracy and control and costs 67s. 6d.; a horizontal stand which screws to the bench and is used for stationary grinding, buffing, etc., the price is 17s. 6d.; a sanding table attachment which fits on to the horizontal stand and comprises a 5in. metal sanding plate, clamp-on table, three sanding discs, mitre gauge and tube of disc cement is available for 32s. 6d. This firm also supply a buffing and polishing kit, an abrasive kit and mops, sanding discs, wire brushes, etc. The electric drill, with its pistol grip, has been designed primarily for drilling in wood, plastics, pottery, brick, tile, steel, cast iron, aluminium, etc., and is handy for reaching inaccessible spots. The higher speed of the sander-polisher, plus its specially designed switch and side handles, makes it suitable for a variety of polishing and sanding jobs.

The latest modification to these tools is the fitting of G.P.O.-approved TV suppression. The price of the ¼in. electric drill is £5 19s. 6d. and the 5in. sander-polisher costs £8 7s. 6d.

Black and Decker ¼in. electric drill kit.

Books Received

New Home Photography. 2nd Edition. By A. R. Pippard, B.Sc., and K. P. Macdonnell. Published by Johnsons of Hendon Ltd. 103 pages. Price 2s. 6d. net.

THIS compact, informative book is designed especially to appeal to the amateur photographer. It contains everything the enthusiastic amateur needs to know about his subject, including taking the picture, both from the technical and artistic points of view, processing negatives and prints, with notes on tank and dish developing, contact printing and enlarging, and a section which deals with all the things which may have gone wrong. The booklet is beautifully illustrated throughout with photographs, both as examples and illustrations of actual processes. This, the 2nd edition, has been revised and brought fully up to date.

Model Motor Boats. By Norman G. Taylor. Published by Cassell and Co., Ltd. 65 pages. Price 4s. 6d.

THIS work is No. 3 in the New Model Maker Series of practical handbooks. After a general discussion about types of model, general requirements, and models for a particular purpose, the author details the equipment which will be found most useful in the modelmaker's simple workshop. A chapter entitled "Motive Power" deals with the installation and operation of steam, diesel, glowplug, spark ignition and jet motors and there is another on practical construction. Four chapters deal individually with the construction of four separate models and at the end of the handbook detailed scale drawings are given. Illustrations throughout take the form of line drawings.

Machine Shop Practice. By W. C. Durney. Published by Sir Isaac Pitman and Sons, Ltd. 196 pages. Price 12s. 6d. net.

THE object of this textbook is to outline the fundamental operations for processing fairly standard light-weight work pieces, the operations being given in a practical sequence. The book has been brought up to date with the latest practice and adequately meets the requirements of students and apprentices taking an Ordinary National Certificate Course in Production Engineering, as well as those studying for the City and Guilds of London Intermediate Examination in Machine Shop Engineering. The book is divided into five chapters dealing respectively with Machine Tools; Cutting Tools and Materials; Simple Machining Exercises; Fitting Exercises; Gauge and Tool Making; Advanced Machining Exercises. The book is profusely illustrated with line drawings, and there is also an appendix of useful tables.

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.

Polishing Old Brass Candlesticks

I HAVE some brass candlesticks which have not been cleaned for the past 40 years, with the result they are heavily tarnished. Could you advise me in the choice of a suitable chemical or method to clean them ?—Hans George.

HOLD the old brass candlesticks, one by one, over a hot fire so that any wax accumulations are melted away and, at the same time, rub the wax away with a soft rag. Then make up a solution of 1 part of caustic soda in about 8 parts of water. Pour this solution in a tall glass vessel and stand each candlestick therein for about a day, subsequently washing the solution away thoroughly with hot soap and water. The candlestick thus treated should be allowed to dry thoroughly. It should then be rubbed over with very fine glass paper, after which a light rubbing over with fine steel wool, followed by a concluding treatment with any ordinary metal polish, will bring the article up to its original brilliancy.

A suitable lacquer for polished brass and other bright metalwork can be prepared by dissolving 20 parts of polyvinyl acetate in 80 parts of warm methylated spirit. The lacquer is cheap and effective, and it can be applied quite readily by means of a brush or spray. Polyvinyl acetate, under the name of "Gelva Resin No. 7," is obtainable from Shawinigan Ltd., Marlow House, Lloyd's Avenue, London, E.C.3.

Removing "Sugar Soap" Stain

I HAVE recently had some internal decorations done and the painters in cleaning off the old paint have used a strong solution of what is known in the trade as "Sugar Soap." Unfortunately, when putting on the new paint the remnants of this soap solution were not properly cleaned off with the result that a stain is coming through the varnish, and although this can be wiped off it reappears, giving a very unsightly appearance. Short of burning off and repainting, is there any way in which this trouble can be overcome? Your assistance would be appreciated.—A. E. Pennell (Southport).

FROM your description of the circumstances, it would appear that the paint medium or the overlying varnish has been destroyed in patches so that what you call the "stain," although it can be wiped away temporarily, is never entirely obliterated. To make a really good and permanent job of the matter would necessitate burning off the paint and varnish down to the wood and, consequently, repainting and revarnishing, but it is quite possible that you may be able to patch up the work satisfactorily if you can manage to remove the upper varnish only with the aid of a light solvent and gentle rubbing. For the solvent you could try hot methylated spirit or cold acetone. The "strength" of the methylated spirit solvent could be increased by adding a few drops of ammonia to it. The procedure would be to wipe the varnish over as evenly as possible with a soft cloth impregnated with the solvent. This will, of course, have the effect of removing some of the underlying paint, but if the task is done carefully quite a passable result will be obtained and revarnishing will improve the appearance and almost (but not quite) even up any residual patchiness which may occur. At any rate, such a method is well worth trying since it is practically the only alternative to burning off and repainting.

Another very simple method, which may or may not be satisfactory, is to scrub the existing varnish surface with a solution of soda and soap. Give it a good wiping down whilst in the wet state and allow it to dry out perfectly. Then wipe the dried surface with a cloth soaked in raw linseed oil. Allow a week or so for the oil to seep into the paint and varnish layer on the surface. The result may be quite pleasing and it may eliminate all the patchiness which has given rise to the present trouble. We cannot, however, guarantee the efficacy of this method. It all depends on the precise nature of the paint and of the varnish which has been used.

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.

Spirit-fixing Transfers

CAN you please give me any details concerning the making of "spirit-fixing" transfers ?—J. L. Haynes (Notts).

THE term "spirit fixing" which you quote applies ordinarily to the use of methylated spirit, rectified spirit or to any other form of alcohol, but on economic grounds alone methylated spirit will always be used.

Spirit-fixing transfers are mostly based on shellac which forms the adhesive agent of the transfers. The precise method of making them depends upon the exact nature of the transfers. Generally, such transfers may be made quite simply by combining with the transfer material about 20 per cent. of any good spirit varnish. A suitable spirit varnish for the purpose may be prepared by dissolving about 25 parts of orange shellac in about 75 parts of warm methylated spirit. Another method is to brush such a varnish over the existing transfer in one or two coats so that a thin, uniform layer of varnish is spread. In either of these cases the transfer is immersed for a few minutes in a bath of methylated spirit. It is then withdrawn, hung up to drain and, after "testing" with the bare knuckles, it is applied to the wood or other surface with a rubbing pressure, and, finally stripped therefrom when the methylated spirit solvent has had time to evaporate.

Quite a new type of spirit adhesive which has considerable promise is polyvinyl acetate, which is a clear resin completely soluble in methylated spirit. A good spirit varnish could be made by dissolving 30 parts of this material in 70 parts of warm methylated spirit. If this varnish proved too thick it could readily be diluted by the addition of more spirit. Under the name of "Gelva Resin No. 7," this material may be obtained, at relatively low cost, from Shawinigan Ltd., Marlow House, Lloyd's Avenue, London, E.C.3.

Gas Kiln for Firing Stained Glass

I WISH to construct a gas kiln for firing stained glass and would be very grateful if you could suggest a plan. I require a chamber to take trays approximately 24in. by 16in. and believe that I should have to maintain equal temperatures up to 800 deg. C.—Anthony Griffin (Bucks).

THE temperature at which painted glass is fired is, as you surmise, about 800 deg. C. maximum, but much depends upon the flux in the colour and more upon the hardness or softness of the glass. Silver stain requires a comparatively low temperature, especially on soft glass, i.e., a glass with a low melting point. We do not think it is necessary to measure the temperature of the kiln, but it is absolutely necessary to work on a "time of firing" basis and this applies to all kilns, both large and small.

The size of tray you mention is, for a repeating kiln, just a little on the large margin for weight and comfort in handling, although they *are* made as big as that.

Full working drawings for building a kiln were given in a folding plate in "The Art and Craft of Stained Glass," by E. W. Twining (Pitman), 1928. This work is now out of print, but doubtless a copy can be obtained from Foyles, Booksellers, 111, Charing Cross Road, London, W.C.2.

Transferring Printed Matter

PLEASE give me the formula for a liquid in which cuttings from newspapers, magazines, etc., can be soaked, and the printed matter can then be transferred to plain paper or fabrics

(Continued on page 274)

by simple pressure.—H. J. Grenfell (Plymouth).

MAKE up a mixture of candle grease and turps 1 : 2. Soak printed sheet in this solution and drain well. Place paper on plate glass surface and rub print on paper with hand-smooth knob.

"P.M." Telescope Axes

I HAVE made the PRACTICAL MECHANICS astronomical telescope from your blueprints but have had difficulty with the wooden bearings for the polar and declination axes. I have made these exactly as described, but after I get them a nice, easy fit they keep tightening up. I have put paraffin wax on them, but this seems to make them worse. Please tell me how to overcome this difficulty.—B. J. Sidwell (Kenilworth).

THE trouble you are having with bearings and polar and declination axes, which work in the bearings, is undoubtedly due to the use of wood which is not thoroughly dry and seasoned. In all probability you would find, with callipers, that the holes of the bearings and perhaps the journals of the shafts are gradually becoming more and more elliptical. Putting wax on the surfaces will do no good. The parts ought to be totally immersed in beeswax at a high temperature for an hour or so to drive out all air and moisture and let the wax fill the grain right through. Then, when cold, blacklead all the rubbing surfaces. An alternative to this would be to make new bearing pieces from several thicknesses of 9 mm. plywood glued together and shellac-varnished before being painted.

Straightening Circular Saws

PLEASE tell me how to straighten circular saws which have become bent or dished (saucer shape).—A. E. Clegg (Huddersfield).

IF these saws are not too large, a hand press is an ideal tool for this work; with care a close degree of accuracy is possible. Alternatively, they can be placed on a slab and hammered flat, a sheet metal worker being the most suitable craftsman for this process.

Attention to the segments at this stage is no doubt necessary, and we suggest it will be advantageous to take the opportunity to replace any parts with broken teeth.

We believe the saw makers undertake to renovate their products as they become worn; you may find that this service, if resorted to, will give a more efficient tool, particularly if you do not have facilities for a subsequent sharpening operation.

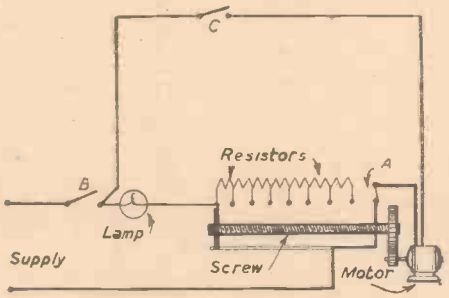
Light-dimmer for Bird House

I WISH to fit my bird room with a variable lighting system, which will vary slowly from a 100-watt bulb at full brightness to complete darkness over a period of an hour.

The object is to have a "sunset" effect for the birds. The mains supply is 240 volts at 50 cycles.—I. Grewar (Dundee).

ONE method would be to use a small motor-driven variable resistor in series with the 100-watt lamp. The motor could drive, through reduction gearing, a screw which slides a moving contact along the fixed contact studs of the variable resistor. The speed of the motor, gear ratio and pitch of the screw could be such that the full travel of the contacts occupied one hour, or such other time as may be required. At the end of its travel the moving contact could be arranged to interrupt the lamp circuit and thus to switch off the lamp completely, afterwards pushing over the knob of a tumbler switch connected in series with the motor.

In order to allow of the device being reset by hand the screw could be driven through a ratchet or clutch so that the motor could be disconnected from the drive whilst turning the screw back to the starting position by hand. With the device thus reset and switch A closed the lamp would then be lit when the switch B



System for gradual lighting dimmer.

was closed. To start the dimming action the switch C could be closed to start the motor; or this could be a time-switch set to commence dimming at any pre-set time. The motor would then start up to insert resistance in the lamp circuit, finally opening the lamp circuit at the last contact stud and then opening the switch A.

Assuming the supply is at 230 volts, the resistor could consist of about 30ft. of 38 s.w.g. nickel-chrome resistance wire wound round a mica strip and connected to as many contact studs as practicable.

Making Jig-saw Puzzles

I WISH to undertake the manufacture of jig-saw puzzles, and intend to cut them from 3/16in. thick plywood. I have a power-driven jig-saw machine, but I believe there must be another method for making production puzzles.

What is this system, please, and where can I obtain suitable bright-coloured pictures ?—John Busuttil (Malta).

VERY few jig-saw puzzles are now produced on "jig-saw" machines; most commercial puzzles are cut with power-presses in one single stroke. These are, of course, made from cardboard or millboard.

However, if you wish to make wood jig-saw puzzles, and can obtain a higher price for them than for the cardboard ones, there is no real difficulty. You will understand, nevertheless, that this requires considerable practice before proficiency is attained.

You will be well advised to cut a stack of six puzzles together in order to cut down production time. The pictures should be pasted on the plywood first, and when dry should be placed in pairs with the picture sides inwards, three pairs to a stack. This prevents the paper edges from getting ragged when cut.

You can probably obtain brightly coloured lithographs suitable for your purpose from Messrs. McCorquodale & Co., Ltd., Printers, Newton-le-Willows, Lancashire, England. Other possible sources are: Messrs. Taylowe, Ltd., Slough, Bucks; Messrs. Cary, 60, Newport Street, Bolton, Lancs. If you require only small quantities in the first place the last-named firm will doubtless be the best to get in touch with.

Boiler for Model Steam Engine

WOULD you please advise me on the construction of a horizontal boiler to supply a model horizontal mill engine?

The engine has a bore of 1¼in. and a stroke of 2¼in. and, as I should not require it to develop any great power, I should imagine that a working pressure of 25-30lb. would be sufficient. I intend using ordinary coal gas, through a suitable burner, as a means of heating.

Naturally, I should want the boiler to be of adequate strength as to be absolutely safe in use, assuming good workmanship.—S. Hadden (Nottingham).

FROM the fact that you wish to fire your model boiler with coal gas—and for this a large ordinary gas-ring would be most convenient—we think that a vertical type boiler would be best. It should have an external diameter of about 13¾in. and height about 2ft. 2in.; thickness of copper plate ¼in. to 5/32in. with double-riveted lapped joint. The inner firebox, 12in. diameter of same thickness plate, can have a height of 10in. Between the crown of the firebox and the top tubeplate of the boiler shell 25 copper tubes can be got in, all with a diameter of 1¼in. The smoke-box plate can be of, say, 3/16in. sheet iron, either flanged to fit into the boiler shell and also to take the flue, or fitted with angle irons. The foundation ring will be a casting in gunmetal. Rivets should be of copper ¼in. diameter; working pressure, 25-30lb. There is a small handbook, "Model Boiler Making," published by Percival Marshall & Co., 19-20, Noel Street, London, W.1, but we are not sure that this is still in print. If you could see or obtain a copy you would find it most useful.

Cadmium Testing Lead-acid Cells

I SHOULD be grateful for any advice you can give me with regard to cadmium testing of lead-acid cells. I am an auto electrician.

The testing equipment for lead-acid cells consists, at most garages, of (1) hydrometer and (2) heavy discharge tester. This may be adequate for the obvious defect, but for the not so obvious—loss of capacity, etc.—I take the view that a cadmium test at the termination of S.G. rise is essential. I intend advocating the purchase of same, but the problem is that my theory of the cadmium test is rather hazy.—C. E. West (Manchester).

THE cadmium test enables an estimate to be made of the condition of the positive and negative elements of the battery. An auxiliary electrode consisting of a thin stick of cadmium may be placed in the acid and the voltage between this electrode and the positive and negative elements or terminals measured, preferably by means of a centre-zero voltmeter. The electrode may have a perforated rubber sheath to avoid it making contact with the plates.

If the cell is tested on normal discharge rate and is almost discharged there should be about 0.3 volt between the electrode and the negative terminal, with about 2 volts between the electrode and the positive terminal; the voltage of the cell then being $2-0.2=1.8$ volts. If the voltage between the electrode and the negative terminal is greater than 0.2 volts under the conditions stated this indicates that the negative plates are defective.

When tested at the end of a charge, with charging current flowing, a normal cell should show about 2.45 volts between the electrode and the positive terminal, with about 0.25 volt between the electrode and the negative terminal; in this case the cell voltage will be $2.45+0.25=2.7$ volts. If, under these conditions, the voltage between the electrode and the positive terminal is less than 2.45 volts, this indicates that the positive plates are not fully charged; if the voltage between the electrode and the negative terminal is less than 0.25 volts this indicates that the negative plates are not fully charged. Each cell should be tested both on charge and discharge in order to obtain an estimate of the condition of the plates, and considerable experience may be necessary in estimating the results, since these will depend on the type of plates, the position of the electrode in the acid, and the specific gravity of the acid.

THE Cyclist
Editor: F. J. CAMM

VOL. XXII MARCH, 1954 No. 382

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COMMENTS OF THE MONTH By F. J. C.

General Meeting of the R.T.T.C.

THE R.T.T.C. continues to devote, after all these years of experience of time trialing, the major part of its Annual General Meeting to the discussion of rules—more rules and amendments to rules. We have suggested on a number of occasions that a small sub-committee should be appointed to go through the present rules with the idea of reducing them to simple proportions. No time trialist can be expected to memorise the present cumbrous list, mostly based on the belief that racing cyclists are potential cheats. Of course, in all well regulated sports rules are necessary.

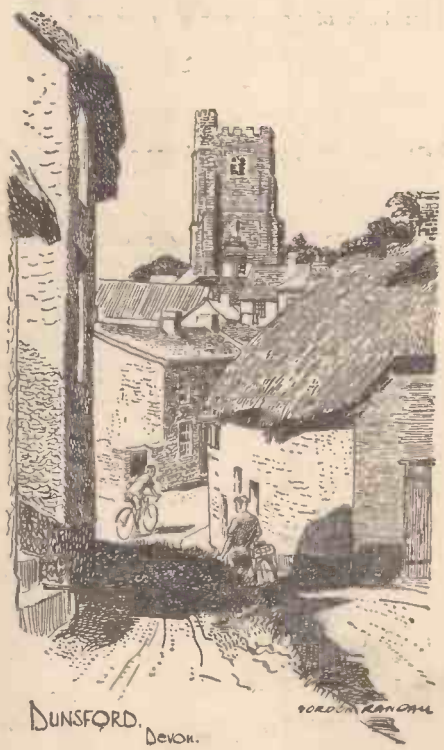
At this year's A.G.M. it was decided that time trialists are to be *permitted* to carry numbers this year, and it has been hailed as a "major decision." It should have been introduced years ago to reduce the possibility of error under the previous method of the rider shouting his number at the turn and finish. Time trials are held early in the morning and it is implicit that there should be no noise. The ticket system should have been the major part of that well intentioned policy. Yet last year when the same proposal was made it was defeated. Even now it is not *compulsory* for a rider to carry a number. The decision as to whether a rider should or should not is to be at the discretion of district councils and the promoters and competitors must still shout out their numbers if they are requested to do so.

Another surprising decision is that the R.T.T.C. is still opposed to prior publicity of time trials, notwithstanding the fact that such events may include professional and independents. In view of the fact that the police are no longer interested in time trials and, indeed, co-operate with promoters on some of the larger events, and are even apprised beforehand of them, we are unable to understand why this stupid opposition continues. In our view this opposition comes mainly from northerners who are determined to impose their will upon the rest of the cycling world with typical northern pugnacity. There can be no other reason for it. There is not one valid argument which can be adduced in favour of no prior publicity. Many arguments can be produced in favour of it. It cannot be denied that B.L.R.C. events have caused great changes in road sport and a different outlook on the part of time trialists, who hitherto had been led to beleive that they were taking part in some furtive and illegal game, which must not be noised abroad in Gath. The police were bogymen, lurking behind trees waiting to grab any cyclist suspected of taking part in a time trial. All those myths have been blown sky high—police opposition—road racing illegal—M.O.T. may stop road racing—and all of the other mumbo jumbo of that diminishing band of diehards whose main claim to fame is that they rode bicycles in the latter part of the last century, and never fail to tell you so at every club function which they attend.

All this raises the question as to whether the control of cycling sport has become overstaffed and unwieldy. It would be interesting to compile statistics showing how many people are actively engaged in cycle racing and to relate them to the number of non-cyclists engaged on committees, and in other ways controlling their rides. It is not true that in a multitude of councillors there is wisdom. Too many cooks spoil the broth!

Now let us turn to another aspect of the problem. We have for over fourteen years been keen supporters of the B.L.R.C. We framed the famous Memorandum for them, we attended, with Mr. J. Kain and Mr. W. J. Mills, a meeting at the Ministry of Transport to discuss massed start racing and we played a large part in achieving recognition for what we proclaim to be the most important aspect of cycle racing to-day. By the written and the spoken word we have supported the League and helped to defeat its antagonists. We were largely responsible for the B.L.R.C. securing international recognition. That does not mean to say, however, that we support everything in its policy, and we wonder whether too much time is not being given to policy and personalities and too little to the riders. It was presumed when the tripartite agreement was reached between the three bodies that an honourable working agreement had been reached and that it would be given a fair trial. The R.T.T.C. has made concessions and the N.C.U. has been relegated as far as massed start racing is concerned to a secondary position. At the A.G.M. of the R.T.T.C. it ratified its agreement with the B.L.R.C. and the N.C.U. While this ratification was taking place the League was in solemn conclave on the subject of what further action should be taken in the event of a complete breakdown of negotiations with the R.T.T.C. and the N.C.U. Such a possibility seems to us remote for it is in the interests of the three bodies, in view of U.C.I. recognition, to reach agreement. The N.C.U., indeed, has approved the agreement. The League now becomes the only body which is unhappy about the present arrangements. The very agreement between those bodies which it sought to bring about has been made and races have been run for a few months under it. It is particularly unfortunate that those members of the League who fought so hard and sincerely to bring the agreement about have been dismissed from office. The League, indeed, in some cases is divided against itself, and we are wondering where it is all leading. If long continued it will mean that the decision taken at the last U.C.I. conference will be reversed. Just at the very time when it was necessary to demonstrate that, having achieved its object, the B.L.R.C. was a united body speaking with one voice through its accredited representatives, it is advertised to the world that there is dissention in its ranks. We appeal to the League to re-adjust its attitude in accord with the amity which was established by the three party agreement and not to provide the two other bodies with a powerful bargaining weapon when the matter is next discussed on an international basis. We also appeal to the League to remove from its ranks the well-known firebrands who are not working in the interests of the League, but in personal interest and climb to power.

In view of our past support we hope that they will attach some weight to these words and act accordingly.



A Dartmoor village of great charm and antiquity standing on the slopes above the lovely River Teign.

Direction Indicators

CYCLISTS must learn to recognise the new flashing signs fitted to motor cars, now made legal by new regulations which came into force on January 1st. Three types of illuminated direction indicators are now permitted on motor vehicles. The first is the semaphore type now in use, consisting of a moving arm illuminated in amber, fitted to the side of the vehicle; in future these may be illuminated by a steady light or a flashing light. The second is a flashing light showing to front and rear and fitted to the side of the vehicle, illumination being amber in both directions, and the third is flashing light indicators placed in pairs at the front and rear of the vehicle.

Wayside Thoughts

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

Looking Forward

I HAVE not eased from daily pedalling, or nearly daily pedalling, for many years, and hope to go on for many more, but somehow when March blows into the calendar you begin to think of holidays, of all the delightful places you have seen that it is time to revisit, and of the few—for me—that are yet to come within my ken. It is the "spring feeling," when everything wakes up, stretches, and prepares to go out into the warmer winds and gather the fragrance of sunshine and all the growing things. The birds know all about it and have done for a week or two now; they, as tribes, have felt the call of spring since time immemorial, so why not mankind, and especially if it owns a bicycle and can go silently into the slanting sunshine of early morning to wonder and worship once more at the shrine of the awakening. Of course, I shall see some racing, the old competitive spirit of the game still moves me to those busy scenes, but for the most part my wandering will be to places where quiet reigns amid the greening land, or the wild breezes of March shake the branches and stir the sap in the old forest trees.

It is a happy thought as I sit here writing a kind of introduction to a season I hope will see me riding some thousands of miles over a land I love, and one which gives so full a mead of satisfaction. I know none better for the pursuit of the pastime of cycling no matter what the many Continental wanderers may say, most of whom have so little knowledge of their native land.

The Simple Way

IT is not for me to dictate the terms of your travel. All I say is travel, and if possible go by bicycle, because you are then a live roamer, near to the earth and the people, literally and spiritually and, because of that, your natural self. This makes such a difference to enjoyment, and I know, having tried both ways, the bicycle and the car. When you go motoring you take the town with you, and the folk you meet—the country folk—are either suspicious or shy; you never quite get down to their point of view, to their thoughts or the way of life; but when you are cycling you are readily accepted as one of them, for they also are riders, even though their journeys may be purely utilitarian. This makes a difference to the atmosphere of a holiday and it also cheapens it in the matter of costs, which together add a subtle something to the enthusiasm for cycling.

How difficult it is to convey the feeling of this delightful independence, this sense of perfect freedom pervading the individual from the moment he starts a cycling holiday until he returns home. Years ago, when I rode tandem with my good lady, this is how we felt, but we could not explain it, nor can I now. Then followed the long years when riding was denied to her and she went with a car, but always averred right to the end that the cycling adventures were the high-lights of holidaying. No doubt it was that reasoning which gave to me so much wheeling freedom, and now I sometimes wonder if I was a trifle too selfish in my regard for the pastime. Yet I do not think so, on reflection, for we joined up on many a journey after days of separate wandering, for the old car had a couple of cycle racks at the rear. The delectable lands were there for both of us to wander over at will. It was a happy unity, two on the car and two on bicycles, with meeting points every three or four days.

A Good Line

SOME years ago I fitted one of my machines with a pair of New Service cycle tyres made by the John Bull Rubber Co., of Leicester. To date I have used them for over 4,000 miles, mainly riding to work, which includes over four miles of granite setts in a fourteen miles journey, and, as far as I can see, they are good enough for a similar distance without giving up the ghost. To date I have had one puncture, caused by a gargantuan drawing pin which clicked itself into notice on the way to work, but allowed me to get there before repair. Now that seems to me a good record and worthy of mention. This tyre is not supposed to be among the top-flight speed peripheries, but it is lively, and to be candid I was agreeably surprised to find it so responsive to effort, without any "feel" of sluggishness. I never have believed in saying kindly agreeable things about a product I use without giving it a fair test under normal riding conditions, and I think nearly 5,000 miles of rough going and in all weathers is quite a reasonable distance to arrive at a conclusion. This cover is very reasonably priced and seems to me ideal for the knock-about journey. It stands upright too when the road conditions are inclined to be slippery, its well moulded tread giving the rider confidence with its grip, and it is not "dirtier" than any other tyre I use. It was about 2½ years ago that this New Service cover was marketed, when that Arctic Circle journey of some 4,000 miles by three professional riders launched it firmly. I read that little adventure, and wondered at the time if my specimens would make the miles without trouble. They have, and are good for many more.

An Old Subject

THE question of gearing came to my notice in an abrupt manner. An old acquaintance followed my advice and bought a bicycle, a very good bicycle, and after a fortnight's use he came home one Sunday morning full of complaints that he found the going hard. I hopped on the machine and rode it up the slight slope near home and immediately knew what the trouble was. It had four gear changes, and the normal ratio was 72in., in my opinion 12in. too high for a man of sixty. When will it be generally realised that gearing for the average cyclist, and especially for the elderly rider, is very closely related to the ease of riding? Over-gearing has lost many a rider from the ranks of the pastime.

It is very easy to say that the rider should know better and correct the fault, but the fact is that this simple lesson appears to want a lot of learning. Outside the ranks of the racing cyclist and the clubman, I doubt if ten per cent. of riders know the gear ratios of their bicycles. If you need confirmation of this statement make inquiries of the daily riders at any big works, and you will be amazed at the ignorance displayed on this question. Why will people make riding a very conscious muscular effort, not, mark you, for the purpose of achieving speed, but just to amble along at eight to twelve m.p.h., which is all they desire, and which can be attained so very much more easily on a modest normal gear in the early sixties? It is a mystery to me, and one needing solution, for I believe the retention of interest in cycling largely depends upon the ease with which the pastime can be played, and that is almost wholly a matter of gearing.

All Days are Good

A FRIEND asked me the other day if I went cycling on those days when the weather conditions were depressing and a comfortable room and fire seemed the appropriate place for an ancient individual. When it snows or the roads are icy, no; the risk of tumbles is too great, but rain or cold or wind are just a challenge to do something to help the old body enjoy a modicum of activity, and the mind rise a little above the state of the weather. Now if I did not make a journey on such days, if only for a modest number of miles, I should find the idleness persuasive and possibly slump into inactivity, which is not good for any man, particularly the elderly. With good macs you can be secure against the rain, and with low gears at call keep moving without undue exertion; but more than anything else counts the value of the habit of not to be beaten by any kind of ordinary weather. Having started, the rest is easy, for as the miles slip by the very rhythm of movement is pleasant and is enhanced by a kind of human egotism dormant in all of us who do things we needn't.

A lot of people give up cycling in the winter, or only go riding on the season's jolly days; but they make a mistake I think, because the easy swing of cycling is part of the enjoyment of the pastime resulting from regularity. It is to me a pleasant thing to visit friends on such days, and as many of mine are farmers, gamekeepers and country folk, I seldom return without being able to add a trifle to the larder. I shall feel sorry if the time ever comes when rain and wind keep me out of the saddle, for I enjoy cycling, and that aftermath of evening comfort with a friend or a good book.

Around the Wheelworld

By ICARUS

The Uncreative 18-year-olds

IN a recently published report issued by a physician and a phsychiatrist as a result of the study of the leisure habits of 18-year-youths, it is stated that "hopes were centred on free time activities and often elaborated into unrealistic dreams of becoming champion cyclists, football stars, or dance band leaders." This was given as the reason for modern youth failing to study subjects which would be of use to them in their careers. As far as cycling is concerned, no doubt the R.T.T.C. and the B.L.R.C., as well as the N.C.U. could wish that this was so, in view of our very poor showing in international sport. Only a very few keen cyclists, however, have ambitions to be a Southall or an Eileen Sheridan. Everyone knows that the "life" of a champion cyclist is, with minor exceptions, at the most five years, and their best performances do not extend beyond that period. Some tail off much earlier. Certainly it would be difficult to make a fortune out of professional cycling. There is little gate money in it, as is proved by attendances at Herne Hill, for example. With the exception of massed start racing, cycling in this country as a public spectacle has passed, never to return, and the sooner that fact is realised the better it will be.

Speeds

ROAD-RACING speeds get higher and higher, but the short-distance track expert is no faster now than his grandfather of the early 1900's.

Why is this? Road time trials have picked up from twenty miles an hour to twenty-five miles an hour, but Bill Bailey's half-mile flying start amateur record of 1908 remains unbeaten to this day.

Bill Bailey clocked 54.4 seconds at Shepherd's Bush track nearly fifty years ago, and he still holds the flying start quarter-mile with 24.8 seconds (Herne Hill, 1911), and the half-mile standing start, 57.6 secs. (Shepherd's Bush, 1908).

Every amateur track record on a single bicycle at a distance of under five miles dates back to before the war. The only "modern" records start at Charlie Marriner's five miles time of 11m. 4.2s. in 1950, up to his one-hour record of 1947, 26 miles 1,020 yards.

This suggests that cyclists have long since reached the limit for short, all out, bursts of speed, but are still learning how to build up their stamina to sustain speed over longer distances and times ranging up to twenty-four hours, or is it just that road surfaces are so improved that riders can use lighter machines, lighter tyres, and thus achieve new records ?

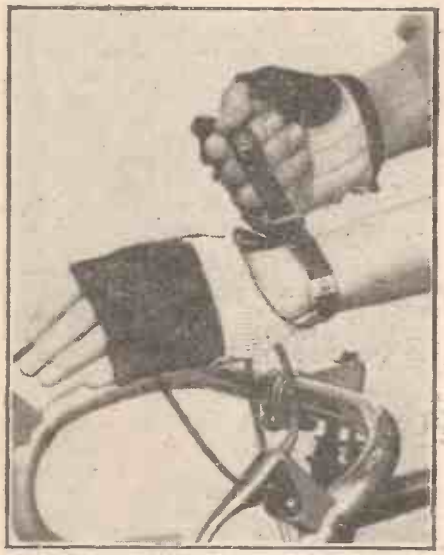
Who Initiated Time Trials?

A READER asks me who was the first to initiate time trials and the answer, as every cyclist of a few years' experience of racing knows, is that it was F. G. Bidlake. The first time trial took place on October 5th, 1895, and this system of racing was introduced by Bidlake after the N.C.U. sided with the police, who were opposed to road racing on bicycles, and abandoned its connection with road record breaking and two years later banned road sport entirely. The larger clubs, such as the North Road C.C., then but a few years old, resented this attitude on the part of the N.C.U. and in 1895 two fifties, a hundred, twelve and twenty-four were forced on to the path because of police activity. They were a financial loss and Bidlake, closely associated with the North Road Club, evolved time trials, the first of which was a fifty, run on the date mentioned. Each man went off separately and there were 22 starters, of whom six finished. It is interesting to compare the times of the first three with those of to-day. Gordon Minns was first at 2h. 54m. 26s., the second, William Ward, 2h. 56m. 29s., and the third, A. E. Marsh, 2h. 57m. 25s.

Although our *Every Cyclist's Pocket Book* records most of the important dates in cycling history this particular fact was not included and possessors of that handbook may like to add this note which may be pasted in at the back.

New Track Mitt

G. WADDINGTON & SON, LTD., glove manufacturers, Hull, have recently produced a new track mitt design—



The new track mitt, made by Waddingtons.

the "Continental." These mitts are in yellow and black horsehide, and special features are their extreme flexibility, reinforced no-slip palm and special "stay-on" wrist band. A specially fashioned mesh back is provided for coolness in wear. The new mitt has already been enthusiastically received by cyclists all over the country.

"The Times" on Bicycles

ACCORDING to *The Times*, slightly more cyclists than walkers are now using youth hostels in England and Wales. The article says "that the cycle came into its own during the war as a holiday vehicle and has never looked back." It is true that the petrol shortage forced many to abandon their cars and take to the two-wheeler for week-end jaunts, but I suspect that most of those have forsaken their wartime bicycles and returned to motoring. The bicycle came into its own as a holiday vehicle over 50 years ago, and it has been steadily growing in popularity ever since. Estimates tell us that there are between 10 and 12 million cyclists in this country, although we shall never know the real figure unless, unhappily, cyclists are compelled to register or are taxed. I do not think, however, that the estimates are far wrong.

Tea Bags

MESSRS. JOSEPH TETLEY & CO., LTD., of Worship Street, London, E.C.2, have recently marketed for the special convenience of cyclists as well as motorists, cartons of tea bags. They have a particular interest for cyclists who picnic and for cycle campers, for they are convenient for making tea in thermos flasks. They are particularly useful for those going on caravan holidays.

Each tea bag will make two good cups of tea and they eliminate all loose tea leaves. They retail at 1s. 3d. per carton, containing 16 bags.

Sportsman of the Year

CYCLISTS did not rank high in the *Sporting Record* contest this year for the best Sportsman of the Year. Gordon Pirie won the coveted award in the national ballot. The second was Stanley Matthews, the footballer, the third Len Hutton, and the fourth Pat Smythe, the woman horse-jumper. Others in the leading 12 were Alec Bedser, Sir Gordon Richards, Trevor Bailey, Billy Wright, Lieut.-Col. Harry Llewellyn, Geoff. Duke, Randolph Turpin and finally, our own Reg. Harris. Over 194,000 votes were received from all over the world. One might think that this was rather a small number of votes upon which to decide such an important question.

Hub Brakes and Spoke Breakage

WHEN I first commenced to use hub brakes, I found spoke breakage was frequent and finally had to increase the weight of the wheel by having it respoked with spokes of stouter gauge. Possibly I was unlucky. Perhaps these early hub brakes were not so efficient as they are to-day. It is, however, beyond all argument that a rim brake must bring a bicycle to a stop quicker than a hub brake, because of the greater diameter on which the braking effort is applied.

New member of The Roadfarers' Club—The Hon. Gerald Lascelles.

CYCLORAMA

By H. W. ELEY

"Mad March"

THIS third month of the year may "come in like a lion and go out like a lamb" or, as like as not, its moods may be reversed and with the first days of March we may get genial sunshine to greet the first of the spring flowers. One of the very first of these which we shall see on our cycle ride in March is the yellow coltsfoot, prolific on clay ground, and curious because its flowers appear before the leaves. As a March companion it has the common dandelion . . . a weed to be sure but, glistening in the springtime sun, a showy and beautiful plant. Time was when the countrywoman prized the humble dandelion, gathered the blooms and made good dandelion wine, and how succulent that wine can be on a cold and bitter night. A glass of matured dandelion wine has no superior for keeping out the cold, and making one glow with friendly warmth! I like my rides in March, with the blackthorn or sloe a-bloom in the hedges and, in the dell, the dainty wood anemone bespangling the ground. As I ride down the lane a lark sings joyously overhead, lambs frisk in the fields, and I feel that at long last King Winter has been dethroned and green spring has ascended in his place.

The Charm of the County Town

MOST of our "county towns" have a subtle and singular charm which is not possessed by other towns, possibly larger in size and of more economic importance. The true county town is the repository of a shire's history. Within it is enshrined the county's story. It is usually an ancient place; its stones are hallowed by time and events of the long ago. Choose whichever English county you will and generally the county town is the place which lures the tourist, the place for exploration, the place to linger in.

I think of ancient Warwick, with that matchless view from the bridge over the placid Avon, with the ancient Leycester Hospital by the old West Gate. I think of Shrewsbury, with its black-and-white timbered houses, which have given it the nickname of "Magpie Town." Whenever I remember Shrewsbury I think of steep Wyle Cop, and the quaint and alluring street names — Shoplatch, and Murivance, and Mardol. How lovable are such names and how unique! The famous Wyle Cop was the thoroughfare up which the celebrated coaching "whip" Sam Hayward used to drive his team with a flourish, up the steep street and into the spacious yard of the Lion Hotel—a hostel still remaining to us and in which we may weave our fancies of the great days of old.

There is Lincoln, too, with ancient history in almost every stone. The Romans called the place Lindum Colonia and it is easy to trace the modern name from that title. What glories this particular county town has to show us: the noble cathedral, the building of which began as far back as 1072; its famous Angels Choir, its magnificent central tower rising to 271ft.; the Saxon tower of the old church of St. Peter-at-Gowts. Yes! Lincoln is one of the county towns I love and in which it is good to wander and muse upon the past. If, on your tours, you would find romance and ancient history, then go to the county town of the shire in which you find yourself, for there you may be sure you will find all that you wish.

Mapping the Holiday Tour

TIME now to be thinking about that summer holiday tour; mapping it out, making notes of the places to visit and linger in, looking up the curiosities of the road, and making sure that—whether the tour is to be in Devon or Durham, Cumberland or Cornwall—nothing worth while in the scenic sense will be missed. I have made a road map my constant companion during the long winter nights, when the cosy fireside has been a stronger lure than the out-of-doors, and I have made copious notes of the route I shall take into quiet Suffolk, where I have decided to tour this year. No rocky gorges, no towering peaks, no shimmering waterfalls in this quiet East Anglian shire, but much beauty nevertheless! I plan to explore again "Constable land" and see Flatford Mill and Willie Lott's cottage, and all the peaceful beauty of the valley of the Stour. Suffolk is "homely" and suits my mood. Possibly next year my mood will have changed, and I shall go a-wheeling in wild Westmorland or seek the rugged charms of Exmoor.

In Superstition Land

MY recent notes on old superstitions, and the quaint surviving beliefs of the remoter countryside districts of England, have brought me one or two very interesting letters from cyclists who have also met with strange superstitions on their travels. One rider from Staffordshire tells me of some weird superstitions he has met with in the "Staffordshire Highlands"—the quite wild country beyond Leek. He tells me that he met an old woman in a remote village who had given minced mice to all her numerous children in order to keep away the Evil One! And this same old crone was in the habit of advising all young mothers to give the juice of crushed snails to any child suffering from whooping cough! One may imagine that in this modern and scientific age the old superstitions and beliefs have died out, and in the towns probably they are dead; but journey far into the remote countryside, talk with old dames who, in by-gone days would have been regarded as witches, and it is amazing how many weird beliefs still linger on. They are handed down from one generation to another, and whilst some are merely picturesque, some (particularly those dealing with cures for the myriad ills of the flesh) are revolting. A "cure" for asthma and consumption which I met with in a Wiltshire hamlet many years ago was the eating of raw cat's flesh when the moon was at the full! "Superstition Land" is a fascinating place, and I am indebted to my good correspondent for adding to my list of mystic cures and remedies.

Tribute to Tyres

IT is ages since I had a puncture in the tyres of the bike I ride in this hilly and somewhat grey countryside, but last week I was unlucky and my tyre deflated. Of course it was at a most inconvenient time, and in a most awkward place! The rain was beating down so heavily that the hills beyond the road were almost hidden. The wind was blowing and I spent a very uncomfortable quarter of an hour—but I do not grumble, for it is my experience that the modern cycle tyre deserves all our warmest praise. I had had miles and miles of puncture-free travel, over all kinds of roads and tracks; I had almost forgotten what the inside of a "puncture outfit" looked like! To my mind, as a cyclist, no product of to-day gives better service than the tyre. I salute the tyre manufacturers!

The Oldest Inn?

MANY a time I have listened to arguments about the old inns of England, and heard opinions expressed as to which can claim to be the oldest of them all. Often, the palm has been awarded to that admittedly ancient inn at St. Albans the "Fighting Cocks," but I am not by any means sure that this inn *is* the oldest in our land of inns—there are reputed to be some 70,000 of them throughout England! The old "Fighting Cocks" has rivals and I have heard more than once that there is no inn in England which can boast a longer lineage than the "Dog and Partridge" in Tutbury, in Staffordshire. And what of the "Trip to Jerusalem" in the castle rock of Nottingham? No! I fancy that there is no certainty about the question, and I am well content to recognise the fact that we have many an ancient inn with a long and proud history, and that all our inns, new and old, give the age-old welcome to the traveller, whether he be cyclist, hiker, motorist, or horseman!

The inn which, perhaps, has the most fascinating history of all is "The Ostrich Inn" at Colnbrook. The murder here of a rich clothier from Reading provided material for the first novel in the English language. It also claims to be the fourth oldest inn in England, being built in 1106.

Published about the 30th of each month by GEORGE NEWNES, LIMITED, Tower House, Southampton Street, Strand, London, W.C.2, and Printed in England by W. Speaight & Sons, Exmoor Street, London, W.10. Sole Agents for Australia and New Zealand—Gordon & Gotch (A/sia), Ltd. Sole Agents for South Africa—Central News Agency, Ltd. Subscription Rate (including postage): For one year, Inland and Abroad 14s.

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