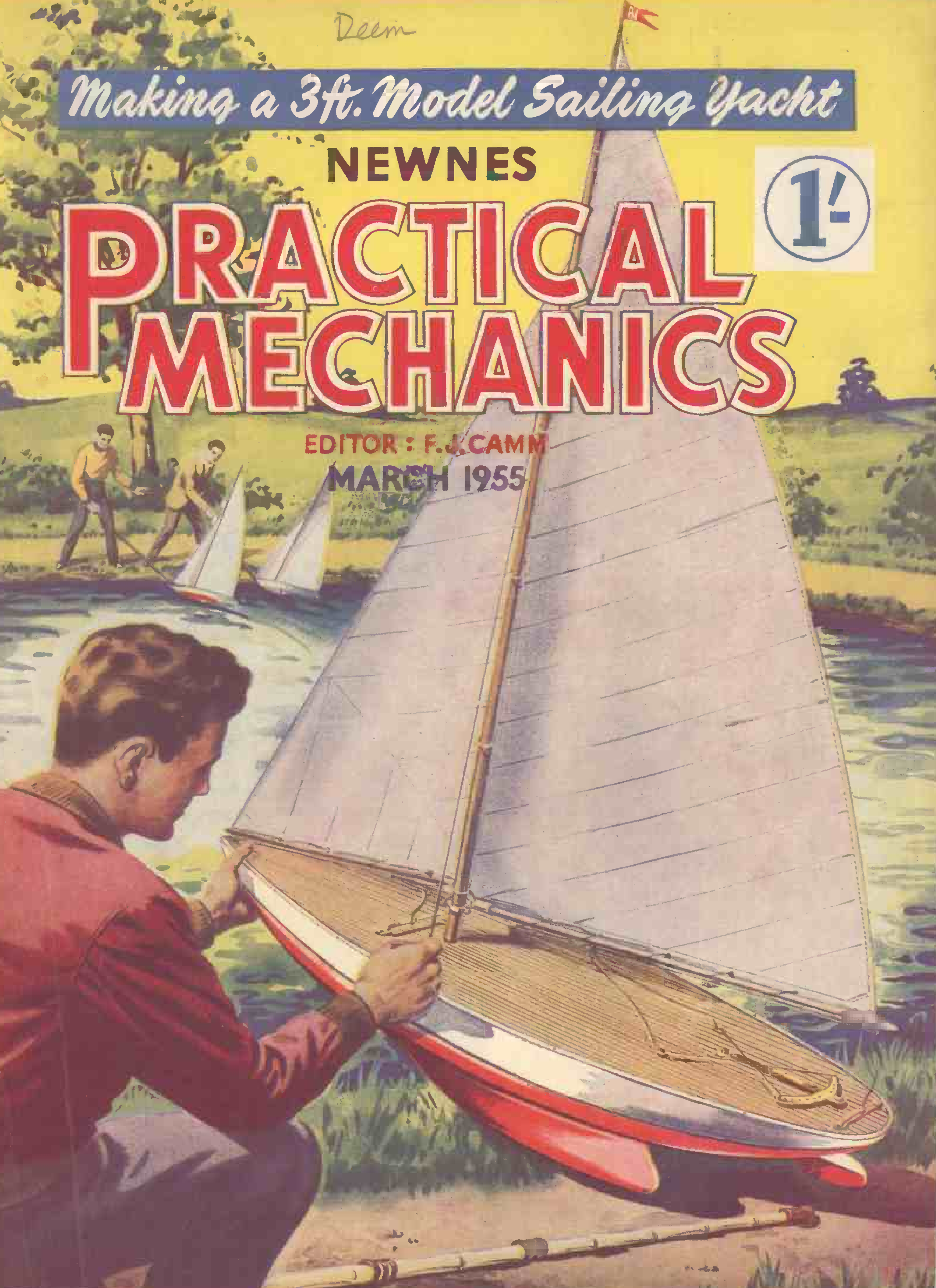
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MARCH 1955

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Editor: F. J. CAMM

MARCH, 1955

FAIR COMMENT

By

The Editor

There has been during the past 20 years a tendency on the part of industry to make more use of the roads for the transport of goods and less use of the railways. It is too late now for the railways to retrieve the business they have lost to road transport. Indeed, industry itself cannot wait 15 years for that state of affairs to be brought about. The railways have been allowed to lapse into a state of almost archaic desuetude. In fact, there has been very little real development, apart from electrification, since the early part of the present century. Carriages are still uncomfortable, time schedules seem to mean nothing, few long distance trains arrive on time, it takes an inordinate amount of time for goods to be transported for a comparatively short distance and the speed of trains is almost exactly what it was 55 years ago. I am referring here, of course, to long distance train journeys. A comparison of the time tables of the early part of the century with those of to-day will prove that this is so. The only difference is that then the trains did run to time. To-day if one is expecting a visitor from the North one arrives at the London terminus and immediately examines the notice board to see how late the train will be. No one expects it to arrive on time!

The railways for the best part of 80 years enjoyed a monopoly, and because they lacked competition, did nothing to improve their services. They saw the competition of the internal combustion engine, the development of goods vehicles for road transport, but they heeded not the signs.

Road transport has gone too far now for the railways to be able to compete on an economic basis. Instead of developing its own road services to act in unison with the railways so that passengers alighting were picked up and transported by road to their destinations, they allowed private companies to perform a service which should have been their concern.

If atomic power is developed within the next 15 years, diesel and diesel-electric vehicles will be rendered out of date. It is almost impossible at this stage of scientific development to adopt a long-term policy in rail transport.

The Government has been compelled to modify its long-term policy on armaments, because of the rapid changes in scientific and technical development, and the reasons for this apply with greater force to transport. It will be difficult for the railways to modify the policy if improved forms of power are developed.

Notwithstanding all this, the passing of the steam locomotive will be regretted by thousands of train lovers and particularly by a large band of model railway enthusiasts. Shall we have model diesel-electric locomotives in the year 1970, or will the hobby of operating model railways pass with the steam locomotive? Model electric railways today are a serious competitor to the steam counterpart, and model diesel engines of tiny cubic capacity are already available. Will helicopters compete with road transport and the railways of the future? As towns and cities cannot build outwards, will they build upwards, and provide landing grounds for helicopters, so that business people may take off from their business premises and land close to their destination? It is an intriguing thought. It takes as long to get from London to London Airport, a distance of only 15 miles, as it does to travel 200 miles by air!

It is possible that by the year 1970 the railways will have ceased to function as passenger carriers and will be entirely devoted to the transport of heavy goods.

The steam engine is a wasteful source of power and its passing, sad though it may be, is inevitable.—F. J. C.

The Passing of the Steam Locomotive

ALL lovers of the iron horse and the iron road will regret the announcement that by 1970 all steam locomotives will have vanished from the railroads of this country, for there is over a century of romance behind the development of steam transport since George Stevenson died in 1848.

George Stevenson was born at Wylam, near Newcastle in 1781, and this great improver of the locomotive engine was one of six children whose father earned twelve shillings a week. In his early years George worked as fireman to a colliery-engine, and spent his evenings in learning to read, write and calculate. Meanwhile, he made a minute study of his engine. His first great step in life was gaining, in 1821, the post of engineer at the Killingworth Colliery. His first engine, "My Lord," was used to draw the coal from that colliery to the sea. He was next appointed engineer on the Stockton and Darlington Railway, opened in 1825, the first to carry passengers as well as goods by steam traction. He gained the prize offered by the directors of the Liverpool and Manchester Railway for the best locomotive, his "Rocket" making the trial trip at the rate of 29 miles per hour. His life henceforward was spent in advising on the numerous railway schemes which soon covered the country with a network. His "safety lamp," the "Geordie" for mines, which some preferred to the "Davy Lamp," should also be mentioned.

Diesel and diesel-electric engines are to replace steam as a source of power. But who can say with any certainty that these modern power units will not be rendered out of date in the course of the next 15 years? Atomic power is on the way, as we have seen from the announcement that America already has a submarine in being powered by atomic energy. Is it wise in these days when almost overnight discoveries of world-wide importance are announced, to plan 15 years ahead? The Minister of Transport has announced his plan for the development of the first major motor road between London and Birmingham, and there can be no doubt that as the economic position improves other roads will complete a network which will result in rapid development of our road transport system.

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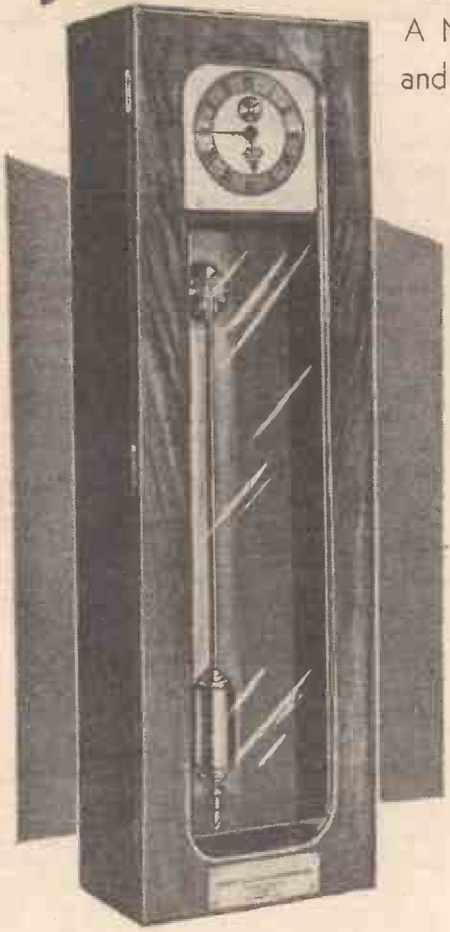
Making a FREE PENDULUM ELECTRIC CLOCK

A New Pendulum Design Which is an Alternative to the Hipp Clock and One in Which the Only Interference to Pendulum Swing is Magnetic

By J. A. ROBERTS *(Concluded from the February issue)*



The completed clock

THE escapement assembly is arranged on an ebonite panel 4in. by 4in. by ¼in. thick (approx.) and secured to the backboard by a bolt which passes through the hole shown. This bolt provides the pivot upon which the whole escapement can be canted to the right to counteract any tendency on the part of the armature carrying the contact screw to bounce more than once against its opposite contact, carried on a spring. The armature is a circular soft iron blank 1in. in diameter, ⅛in. thick, and is held by a short 6 B.A. countersunk screw to the brass piece which carries at its opposite end a platinum contact screw.

This piece is drilled ⅛in. clearance to slide up and down the escapement arm, a 2in. length of ⅛in. brass rod, and is locked in position by a screw. This escapement arm is really a miniature pendulum and, therefore, its speed will be determined by the position up and down the rod of this brass piece, which acts as a pendulum bob. Upon the speed of this miniature pendulum depends the position the main pendulum will be in when it receives its impulse from the motor coil, as the escapement arm must travel from its extreme left hand position to its extreme right during the time the pendulum has travelled from its left-hand position to the point where it has entered the field of flux of the motor coil, and the Hipp law observed.

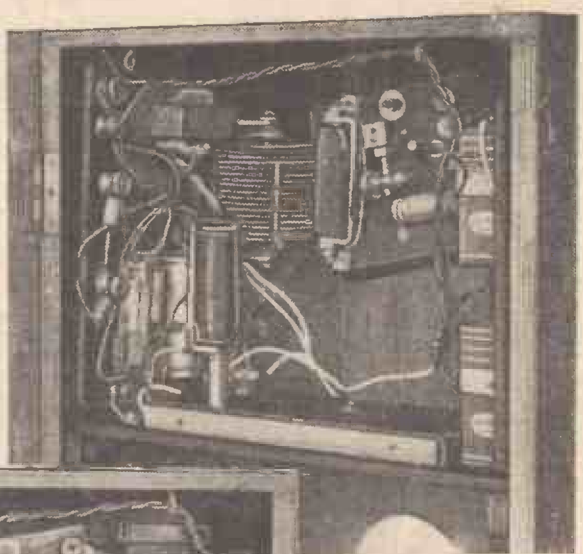
This state of affairs is not so tricky as it sounds and is further dealt with under the heading of Assembly.

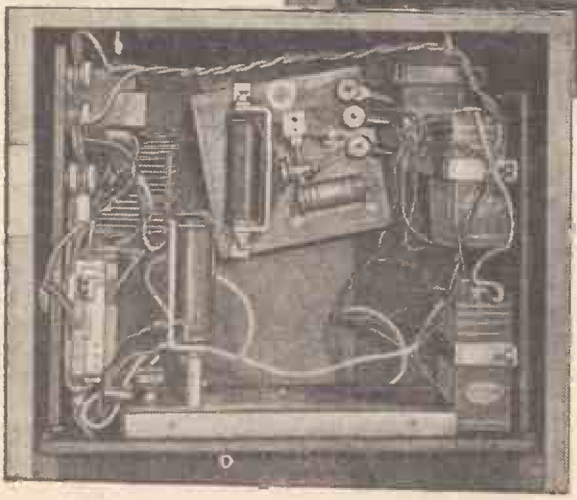
Upon the length and therefore the speed of the main pendulum will depend the speed required of the escapement arm and the position up and down this of the contact piece. Some builders may use ¾-second pendulums, others 1 second, and some, converting old clocks, pendulums of nondescript lengths; thus it is impossible to give exact measurements and positions, but these are not difficult to arrive at.

Once the position of the escapement piece is found, the coil can be bolted down to the panel and the contact soldered to the spring in the correct position, the centres of all these lying along the same arc as shown by the dotted lines in A.

In B is shown how the escapement arm is fitted into the small piece of square section brass bar which also carries a steel pin, secured in position by a screw. This pin forms the bearing upon which the escapement arm swings and is seated in two holes drilled into two opposite sides of a piece of square brass channel, which, by means of the short length of ¼in. brass rod, is secured to the escapement panel as shown.

As will be seen at C, the centres of the coil, escapement piece and contact spring must all be of equal distance from the panel; the coil supporting brackets, the post which supports the escapement arm bearing, and the length of contact spring support must all be arranged to conform with this.





Two views, with the clock face removed, showing escapement assembly and batteries.

Advance and Retard Switch

As mentioned earlier, the hands of the primary movement and slaves are advanced and retarded by the action of a simple single-pole double-throw change-over switch. When the switch arm is in the right-hand position, *normal* working is provided by connecting all slave coils across the escapement coil in parallel. When the arm is mid-way between the two positions and not touching either, all slaves are disconnected, and the pendulum circuit not being effected thereby, the pendulum continues to swing. Finally when the arm is over to the left and is depressed, the slave coils are shorted across the power supply and, all coils thus being energised, their slaves advance forward 2 or 1½ seconds for each depression, depending upon whether the pendulum is of 1 or ¾ seconds length.

Therefore, all that is required in order to slow up the slaves is to move the switch arm off the *normal* contact and leave it there until time indication is again required, then slip it back. Conversely, if advancement of the hands is required, then the arm is moved to the extreme left and rapidly depressed, throwing the arm back to normal when the hands have reached the required position.

In Fig. 7, "A" shows an end-on view of this switch, the method of securing same to the motor panel, and the three positions of the switch.

Only two poles are required, and these are filed out of ½in. lengths of ¼in. square brass bar to the shape shown at C, the contact surface of the left hand (advancing) pole being filed to a lower level than that of the right-hand (normal) pole.

The switch arm, a simple brass strip pivoted to the switch panel, swings over and slides comfortably on to the contact surface of the right-hand pole, and remains there during normal working. Any position between the two gives *slow*, and depressing the arm downwards on to the contact surface of the advance pole will, as stated, advance the slaves to the extent of two swings of the pendulum for each depression.

A stop pin is provided to prevent the switch arm going far enough over to the advance position to " make " on the left-hand

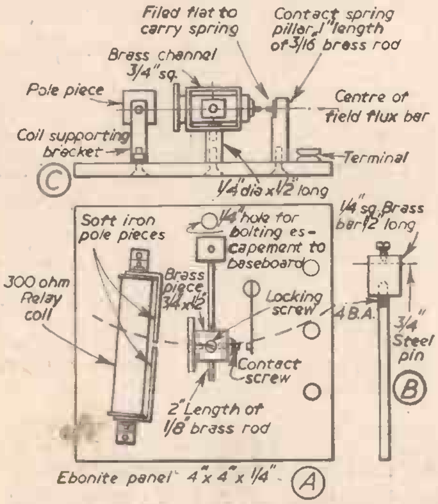


Fig. 6.—Escapement assembly.

edge of the pole and is simply a 6 B.A. screw let into the switch panel and bolted.

Primary Movement

This is the movement associated with, and in the same case as, the master transmitter, and is usually referred to as the primary; all slaves follow the same design mechanically, and where slaves are not used, the primary becomes simply the face of the clock.

The writer had a small 60 by 1 movement with a 40-tooth count wheel made to order, though few builders will go to this trouble and expense, as the gears of any clock having a pendulum of not much less than ¾ seconds length will suit the purpose, and in most cases the original escape wheel, suitably masked, will serve as the count wheel. Here, as indeed throughout the article, the dimensions given are only approximate, and may have to be modified to suit individual requirements.

In the orthodox type of spring or weight driven pendulum clock, the escape wheel moves round one tooth at a time for every swing of the pendulum in one direction, and this is precisely the effect of the pendulum in this case.

In some clocks the escape wheel turns in the opposite direction to others through variations in the gear arrangements, and in this system it will naturally have to turn in the same direction as in the old, so that it may be necessary to feed it from the opposite side to that shown in the sketch, so that this point will have to be settled before work is commenced.

Where an old clock is converted to this new system, and the same gearing and escape wheel used, the effective length of the new pendulum will have to be the same as the one discarded, as also, to some extent, will the cabinet.

Primary Movement Construction

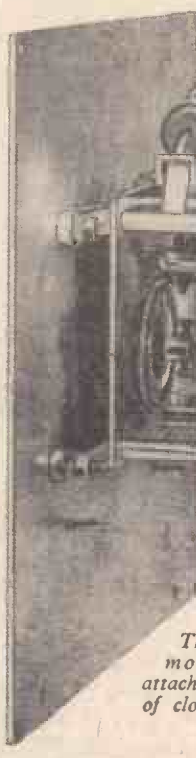
A number of feeding arrangements can, and probably will, be devised to work under this system, but the one suggested here will be found to be as simple and efficacious as any (see Fig. 8). It consists simply of a rod or bar, pivoted about its centre, and one end of which is drawn down by the pull of an electric magnet, the other end being raised, and in the process of rising selecting a tooth on the count wheel, falling under its own weight and thus propelling this tooth forward when the current to the coil is switched off. The degree of weight and distance of fall is sufficient to do this and no more. One of the four plate supporting bars of the movement is drilled ⅛in. clearance as at A to admit the 2in. length of ⅛in. brass rod, threaded 4 B.A., which is screwed centrally into the bottom of a 1in. length of ¾in. channel.

The sides of this channel are drilled to admit a steel pin which is carried and locked in a ¼in. length of ¼in. bar, this latter being drilled transversely ⅛in. clearance to admit the fulcrum bar, a length of brass rod bent to the shape shown, the degree of bend and length of rod depending upon the size of the movement used.

This bar carries the two pieces shown at C which work against the two 6 B.A. adjusting screws let into the bottom of the brass channel and locked by nuts, the position of these screws deciding the degree of rock and therefore the amount of feed.

These two pieces, or " shock stops," as they might be termed, are ¾in. lengths of 3/16in. rod, drilled transversely to admit the fulcrum bar, tapped 6 B.A. at one end for the locking screw, and drilled 5/32in. at the other, small pieces of rubber or leather being rammed into this hole.

These two cushions play against the ends of the two screws, and, as before mentioned, provide, silently, the two limits of the feed. B shows the coupling at the rear end of the fulcrum bar and though not strictly necessary, does allow the armature to come down flat upon the poles of the coil.



The primary movement, attached to rear of clock face.

Mounting the Movement

The movement is mounted by means of strips to the rear of a rectangular face plate, the heads of the countersunk screws holding it being hidden by the hour ring, which itself is held to the other side of the plate by four 10 B.A. screws at the cardinal points, this side of the plate being the face of the movement and is finely ground and lacquered. The size of this face-plate will vary with the size of the movement and cabine tused, but should be slightly larger than the vignette space and the edges therefore hidden when the door is closed. The face-plate is screwed to a hardwood base, which also supports the coil in a manner similar to that used in the case of the motor coil. This base allows the movement to stand unsupported anywhere and when in the cabinet is bolted in position to the movement shelf.

Light damping of the escapement wheel is provided by a friction detent spring supported by a small bracket on the movement plate at one end, the other pressing either on the boss of the escapement wheel, or a small bush on its shaft.

Some form of detent action is, of course, necessary, and many builders will prefer to use the more orthodox type, namely a click engaging in the teeth of a ratchet wheel on the escapement shaft, or on the teeth of the escapement wheel itself, but the method described can be recommended as it works very well, leaving the wheel exactly where it is put, is simple to arrange, and gives a good " dead beat " effect without the back lash common in either of the other methods. Trouble was anticipated when the boss became smooth in wear, but this has not so far appeared.

The pressure of the detent, the inertia of the hands and gears, and any friction developing in the latter, all represent a load moved by the fall of the fulcrum bar, which must be correctly adjusted. The arrangement shown gives every possible facility for this and once set, the settings should never alter.

The Power Unit

A great fault in this system is the fact that, even when a primary movement only is being driven, three coils have to be energised every 2 or 1½ seconds as the case may be, making a heavy drain on current; this would still be the case if a more economical value of coils than given here were used. It was, therefore, decided to run the clock from the usual A.C. 220-240 volts mains supply, using batteries only as a stand-by in the case of the supply failing through a fuse blowing or any other reason.

Although this clock would not run very long on the type of batteries used (the Ever Ready U80) they are useful in keeping the clock running during the short time it takes to repair a fuse.

The circuit is very simple and consists of a small mains transformer, giving 6 volts 1 amp. output, the secondary of which goes to the input terminals of a full-wave rectifier. The output from here energises the coil of an ex-W.D. relay, the contacts of which have been modified to give S.P.D.T. action. From Fig. 9 it will be seen that the output from the rectifier, in addition to going through the coil, also goes, on one side, directly to one of the output terminals of the unit, and on the other side, to the opposite terminal via the relay arm and one of the contact points. Thus the terminals to the clock are in parallel with the relay coil and will be alive as long as the mains are operative.

Should these become dead, the magnetism of the coil ceases and the arm, under its own

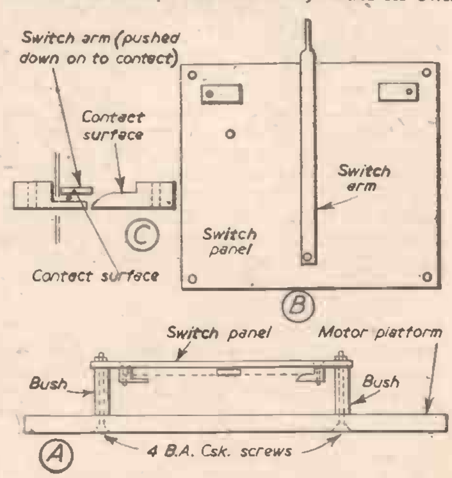


Fig. 7.—Advance and retard switch.

spring action, falls back on to the other contact and closes the battery circuit. Thus, providing, of course, the batteries are alive, there is always power available for the clock of one sort or another.

Components and Mounting

When selecting components for the power

unit it must be remembered that the current provided by the mains must be of the same order as that provided by the batteries. With the values of transformer, rectifier, and relay coil given, it was found that this was less than given by the batteries and there was a greater tendency towards noise when these were in use, but this is a good fault as there will be a decrease in current during the shelf life of the batteries.

It is not a bad idea to disconnect the clock from the mains periodically, say, for a few minutes once a month to test the device.

The components of the mains unit are assembled on a ¼in. plywood panel, secured to the side of the case by a bolt and wing-nut for easy removal and housed in the same compartment as the primary movement and battery panel, which latter is of similar size and secured in the same way, metal strips holding the batteries in position.

The 300 uF electrolytic condenser is a refinement and if found difficult to obtain, can be dispensed with; but it is advised where possible, as by this means the last trace of ripple left after rectification is eliminated. Without it, a distinct " burr " is noticeable during operation when the contacts close.

Assembly

After the suspension plate with its two supporting arms and the backboard have been bolted to the rear of the cabinet as in Fig. 3 B, hang the pendulum in position, there should then be a space of about 3in. between the bottom of the armature and the bottom of the cabinet. This is to accommodate the motor platform, which, complete with its components mounted, should be slid into position, the motor coil being immediately under the pendulum armature with the latter at rest. The motor platform will later be screwed down to the bottom of the cabinet but do not do this until the pendulum has really started working, as a slight adjustment to right or left of the motor coil may be necessary.

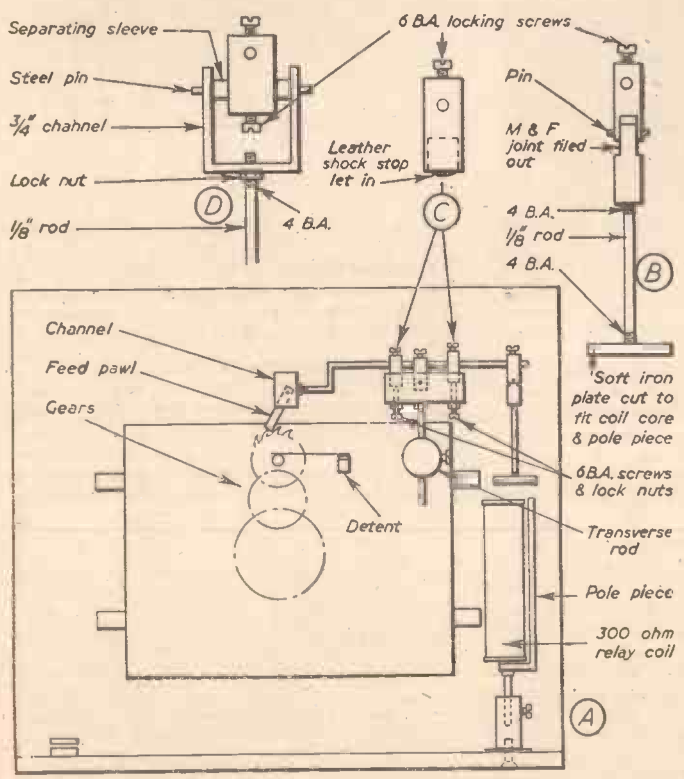


Fig. 8.—The primary movement.

The tricky job of setting the pins into the side of the cabinet to support the motor cover may then be attempted. This is best done by hanging the pendulum with the armature screwed up about ½in. higher than it would normally be in running, and the magnetic switch ½in. lower. Holding the cover between the two and perfectly level with the left hand, and with a pair of inside calipers in the right, open these under the cover until they touch and with this setting mark for the pins. There should be one on each side of the cabinet and one in the centre of the backboard. They should be driven in hard after removing the pendulum.

Replace the pendulum and bring the armature down until it just skims the cover and lock it in position with the nut; bring up the magnetic switch to a position where, when the pot magnet rises, it just stops a few thou. short of the cover. The motor coil should then be brought up to within about ¼in. of the cover and, all connections being in position, and everything in readiness, the pendulum can be given its initial push to the left and the sequence of events described earlier should begin.

As this pendulum has no work to do apart from dragging itself out of the influence of the permanent magnet, and the coil pulling it is switched on with every alternate swing, the degree of pull required from the coil is very small, and the gap between coil and armature will therefore be much wider than might be expected, or than will be found in the Hipp system.

The pendulum must swing exactly to its correct position over the magnet (*not* more or less) and so some experiment in the positioning of the coil must be expected.

As described in Fig. 2A, four leads, which should be of different colours, pass through a hole in the backboard beneath the motor cover and these should be connected to the terminals on the motor platform with spade tags, these leads pass behind the backboard and out of the hole above the movement shelf, and are connected as shown.

It is assumed, of course, that the mains unit and battery panel have been bolted into position on each side of the cabinet in the movement compartment and the escapement assembly in position at the upper end of the backboard, before the test, and for this purpose the escapement panel may be in a more or less perpendicular position.

Adjusting the Escapement

It may be found that in this position the escapement arm will tend to bounce more than once against its contact before settling down to rest prior to being actuated again at the next swing of the main pendulum, and this, though it will not prevent the pendulum from swinging, is not desirable and can easily be rectified by canting the whole escapement panel to the right until only one bounce is produced, the one which switches on the motor coil.

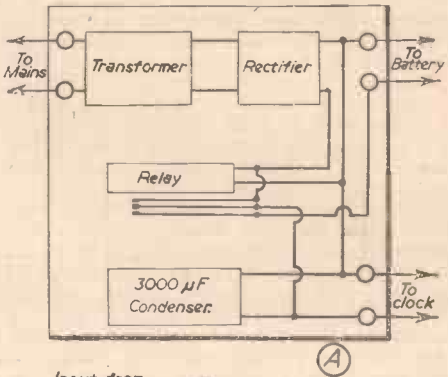
Once the pendulum is going satisfactorily the primary movement can be placed in position on its shelf, connected up, and bolted down, a felt pad or small rubber pieces being placed between the base of the movement and the shelf, or rubber rings or bands being stretched round the base as a further silencing aid.

The timekeeping is adjusted in the usual way by moving the pendulum bob up and down the rod by means of the lower (tapped) supporting blank (Fig. 4). The grading nut is used for fine correction though in the writer's clock an error of six seconds a week has been achieved in only three alterations of the bob after assembly, and without recourse to the grading nut.

Length of Swing

Another requirement of the perfect pendulum in addition to the one already mentioned is that it should swing over a very short arc, or not more than 1in. from side to side of zero.

This factor was aimed at and achieved by the old French clockmakers and examples of their success in this direction can be seen in the priceless timepieces in the British and



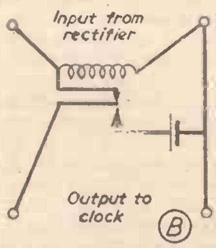


Fig. 9.—Power unit.

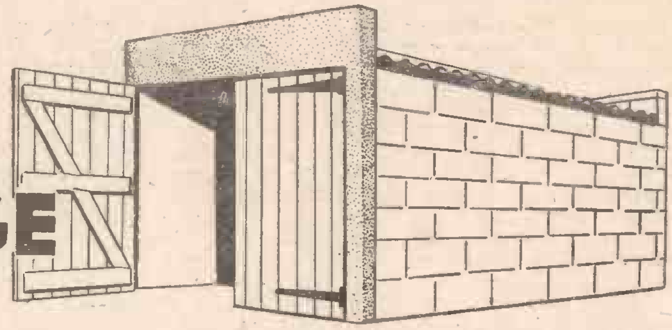
other museums. Unfortunately, in none of the pendulums of electric commercial clocks, whatever the system of propulsion, does this factor seem to be achieved to any marked degree, and though phenomenal timekeeping is claimed by all, and is not here disputed, this might be reached more easily if this small arc of swing could be achieved. The very nature of the principle used in most commercial systems prevents this very short swing, and as far as experiments have shown the new system is no better in this respect, as much has to happen between the pendulum starting the return journey from the extremity of its left-hand swing to zero.

Though, in theory, the time taken for a swing of 1in. is the same as for 4in., it was found that when this very short swing was created, by bringing the magnetic switch nearer to the motor coil, the escapement arm did not have time to complete its swing and the impulse to the motor coil came too late. This, in theory, should not happen, but it does, and an explanation would be long and difficult.

This and other finer points of pendulum performance have long been acknowledged, and much has been written about them, and it may well be that if perfect timekeeping is to be achieved we cannot afford to ignore them.

Though the purpose of this article is to show how the mechanical troubles of the Hipp can be avoided and an almost free pendulum built, and not to compare the timekeeping of the two methods, it does seem from early tests that this new system is a better timekeeper, and though as not yet perfect to " one second a year limits," this point of the very short arc of swing is worth working on by prospective builders of this clock.

Building a CONCRETE BLOCK GARAGE



By W. J. HARRIS

Full Constructional Details, Including Details of the Doors. Notes on Siting and Submitting Plans to the Local Authority

THERE are three important considerations to be borne in mind when arriving at a decision on the acquisition of a garage. The first consideration is naturally that of cost. The cost of erection, by a builder, of a garage of a permanent nature to the plans shown, is in the region of £100. Sectional garages of a similar size, range from about £40 for wood and/or asbestos, to about £65 for prefabricated concrete and in both cases the cost of a suitable floor (concrete recommended) is, of course, additional.

The second consideration is that of suitability and durability, and it is clear that prefabricated or permanent structures are the most satisfactory from these standpoints. A permanent structure is the more suitable of the two because it can be built and rendered in a similar style to any adjacent building, such as a house, and, as a result, the value of such property is increased. The third consideration is that of compliance with bye-laws applying to the district in which erection is to be made. In urban districts, the bye-laws relating to fire-risk require that a wooden garage should stand a stipulated distance from all other buildings and all dividing fences, and a serious limitation is thereby placed upon the choice of a suitable site for erection.

From these considerations it is clear that a garage of permanent structure is the most desirable apart from the cost. However, it is well within the capabilities of any handyman to build such a garage and the cost is then in the neighbourhood of £40.

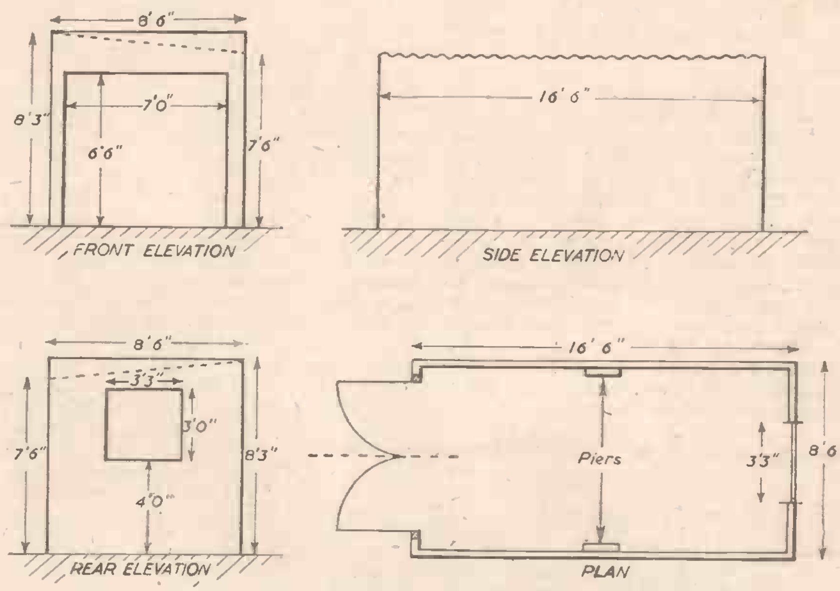


Fig. 1.—Side, front and rear elevations and plan view, giving chief dimensions.

Siting

In the case of urban areas, the problem of siting is not very great, as the "property plot" will be controlled by a "building line," behind which the garage must stand. Also a long drive up to the garage will not only be more costly, but will use up precious land that could be devoted to other purposes. Generally speaking, a lean-to garage against the side of a house, must allow unrestricted access of a given minimum width to the rear of the house.

In rural areas where there may be considerably more choice of a site, three points should be borne in mind—first, the site should not be subject to seasonal flooding; secondly, the sub-soil should not be likely to become waterlogged and thirdly, it should afford a reliable foundation for the structure proposed.

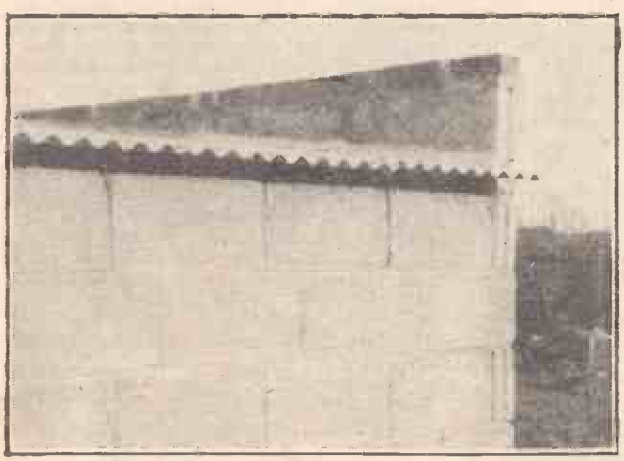


Fig. 2.—View looking to rear of garage and showing method of block construction.

Whether the property be urban or rural, it is essential to make certain that there are no restrictive covenants on the use of the land, concerning the erection of a garage.

Submission of Plans to Local Authority

Fortunately the plans required for the erection of a garage need not be very detailed, and the type of sketch shown in Fig. 1 is adequate, providing that it enables the local authority to assess that the proposed building will conform to the existing planning regulations and bye-laws and also be structurally sound. In addition to the constructional plans, a site plan will be required. This must show the proposed location of the garage with respect to other buildings on the property plot, dividing fences and buildings on adjacent properties, and the street or highway and means of access thereto. Details must be given (usually on an official form) of the materials to be used for the walls and roof and of the type of rendering and roof construction. Full details of what is required (often together with much useful advice) are, of course, obtainable at the local council offices, and should be sought at the beginning of the project.

Materials and Tools Required

The materials required are shown below. The concrete blocks are 18in. × 9in. × 4in. (3in. thick blocks are not recommended). These, although heavier to handle than bricks have the advantage that a

MATERIALS REQUIRED

4in.-thick concrete blocks, 42 sq. yd.

Building sand, 2 cu. yd.

Mixed aggregate (sand and pebbles 3/8in. down), 1½ cu. yd.

Cement, 9 cwt.

Corrugated Asbestos sheets (9ft. long), seven (3in. corrugations) or eight (6in. corrugations).

Timber, two lengths 17ft. × 4in. × 2in. (sawn); one length 9ft. × 4in. × 2in. (sawn); one length 7ft. × 3in. × 3in. (prepared); two lengths 6ft. 6in. × 3in. × 3in. (prepared); eight lengths 13ft. × 5½in. × 1in. (tongued and grooved); two lengths 10ft. × 6in. × 1in. (prepared); two lengths 7ft. × 4in. × 1in. (prepared).

Angle iron, one length 17ft. × 1½in. × 1/8in. thick.

One metal framed window, with glass and putty.

Damp course, two rolls 25 yd. long 4½in. wide.

Pebbles for rough-casting, 3 cwt.

Sundries, nails, screws, hinges, reinforcing rods, metal ties, waterproofing agent, guttering, etc., as necessary, special nails and hooks for fixing asbestos sheets.

given area can be erected more quickly and also more correctly and accurately by the novice. The use of corrugated asbestos sheets permits the simple lean-to method of roof construction, but it will necessitate the squaring-up of the front of the garage (as shown in the plan) so that the lean-to roof is not visible from the road. (This may not be a country-wide regulation, but it does, in any case, give a much better appearance, as also does the squared-up rear.)

Few tools are needed for the wall construction. They are a trowel, a board for holding the mortar, a plumb rule, a square, a long level and pins and line. Beside these, of course, normal wood-working tools will be required for the roof and door construction.

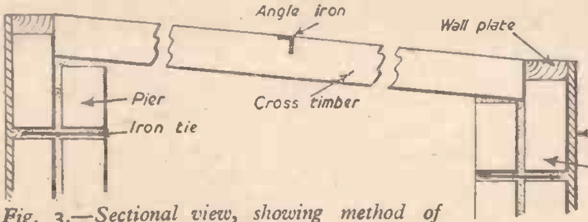


Fig. 3.—Sectional view, showing method of tying piers, and roof construction.

Method of Mixing Mortar and Concrete

Mixing should be carried out on either a clean platform of boards or on a cement-paved surface. The concrete mix for the foundations and floor, and door and window lintels, is six parts of the pre-mixed ballast and sand to one part of Portland cement. The mixture for the cement mortar for the wall construction and rendering is three parts of sand to one part of cement. In both cases the materials should be measured out into a heap and thoroughly mixed dry. Water should be added slowly to the materials and a quickly acquired experience will determine when the right consistency for the mixture has been reached. It is essential that the mixtures should be sufficiently wet for "dry" concrete wears badly and "dry" mortar has little strength because of its rapid "set."

When deciding upon the quantities of materials to be mixed at a time, it should be borne in mind that for best results, concrete and mortar should be used within about one hour of mixing. It is also advisable not to attempt to mix too large a quantity of concrete at a time, for when water has been added to the dry materials, mixing can be quite strenuous. If help in mixing is available, small regular supplies of fresh mix are ideal. Since the cost to do so is very reasonable, it is worth considering the hire of a small petrol-driven mixer when laying the foundations and floor, particularly if a concrete approach or paths have to be laid as well.

Foundations and Floor

The shape of the garage should be roughly marked out on the site extending for a couple of feet or so in each direction outside the actual outline, and the top soil within the area removed. The area should then be roughly levelled and the exact position of the walls and their foundation trenches should be carefully set out, the marking pegs being well clear so that they need not be disturbed. Lines should be stretched between the pegs so as to clearly define the outline of the trenches and the walls. The trenches should be about 1ft. wide by 1ft. deep and the walls should stand centrally on them. The floor thickness should be about 4in. A considerable saving in the amount of concrete required, and increased strength in the mixture, is obtained by incorporating stone or brick rubble with the composition recommended. It is recommended that boards, say, 6in. wide and 1in. thick, be levelled up around the outer limits of the area so as to be flush with the floor surface for this will facilitate the process of levelling the concrete when laid.

Construction of the Walls

The first thing to do is to set the corners and particular care must be taken to ensure squareness. The method for laying the blocks (working from the corners) is as follows. The mortar in which the block will be set is placed in position. The end of the block with the depression is spread with mortar and smoothed from each side so that the thickness of mortar tapers off from about 1½in. immediately above the depression to nothing at the edges. The block is then placed against the end bearing the ridge or key of the adjacent block, and allowed to rest in the embedding mortar. It is then tapped until the joint is well filled with a thickness of mortar of ½in. to ¾in. and trued vertically and horizontally. The joints on the inner side of the wall should be smoothed flush with the surface of the blocks, but the mortar in the joint on the outer side should be recessed with the point of the trowel. These recesses will help with the keying of the mortar layer to be used later when the walls are rendered.

It will be necessary to cut some of the blocks in half in order to get correct bonding. This is the procedure for strengthening the walls by ensuring that vertical joints do not come directly above each other and is illustrated in Fig. 2. Before attempting to cut a block it is advisable to mark the parting line in pencil. Then with a hammer and cold chisel (preferably one with a 4in. wide blade), mark lightly all the way around the line and the block will break cleanly.

When the first row of blocks has been laid, the damp course which prevents dampness creeping up the walls must be set. A very convenient form of material to use is the bitumastic hessian strip, 4½in. wide, sold especially for the purpose. A layer of mortar should be spread over the upper edge of the blocks and the damp course material laid in position with another layer of mortar spread on top of it. The second and subsequent rows of blocks may then be laid. Generally speaking, it is not advisable to lay more than two rows of blocks at a time so as to ensure that the blocks will remain true vertically and not lean over. The piers shown in the middle of each long wall (Fig. 1) are for strengthening and consist simply of a vertical row of blocks, each block being tied to its adjacent row with metal ties set in the mortar (Fig. 3). Since the blocks are very absorbent, it is advisable to keep them dampened so that they do not take up water from the mortar in the joints and thereby weaken the latter.

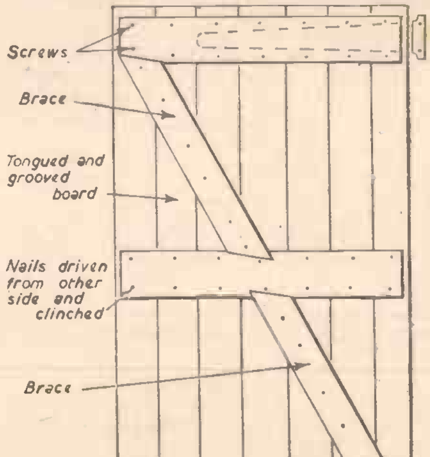


Fig. 4.—Constructional details of the doors.

It is normal practice to support the door frame and window frame and bring the blocks flush against them as the walls are built. The frames are anchored to the walls by means of metal hooks or ties set in the mortar. Alternatively there is no reason why spaces should not be left for the door and window, and the frames fixed in by plugging and screwing into the walls when finished. If a metal-framed window is used, there is no need to surround it with a wooden frame as it can be directly cemented in position.

There should be no difficulty in casting the lintels for the doorway and window. That for the window can be satisfactorily cast in position, but unless substantial timber is available to form and support the casting mould, that for the doorway is better cast on the ground and lifted into position. Both lintels should be reinforced with iron rods and be about 1ft. longer than the gap that they will span. It is essential to "tamp" the concrete mixture sufficiently to ensure that there are no air bubbles to create weakness in the lintels. Both lintels, after casting, should be kept damp for at least 48 hours, and if that for the doorway is cast on the ground no attempt should be made to lift it into position for at least a fortnight. The boards of the casting moulds should be removed after about 48 hours so as to allow drying to proceed and for the same reason, a lintel cast on the ground should be raised and supported to expose the underside. For both lintels a suitable thickness is 6in., whilst the width should of course be 4in., the same as the blocks.

Roof

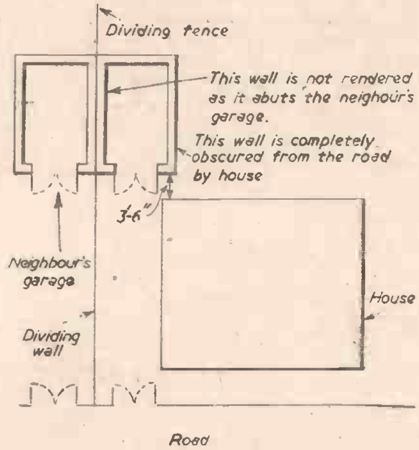
The supports for the corrugated asbestos roof consists of two timber wall plates 4in. wide and 2in. thick running the length of the side walls and fixed thereto by plugging and screwing, and a cross timber (4in. × 2in.) supported in the piers as shown in Fig. 3. Also running centrally down the length of the roof is a piece of 1½in. angle iron ⅛in. thick which is let into the cross timber (Fig. 3) and cemented into the front and rear walls. All the timber should be creosoted. The corrugated asbestos sheets are fixed to the wall plates by means of special nails and are anchored in the centre to the angle iron by means of special hooks. Holes will be required to be drilled in the sheets for both the hooks and the nails and all holes and fixing must be made through the crests of the corrugations. To ensure no leakage the sheets should overlap by two corrugations. Where the end sheets abut against the squared-up front and rear walls, a good seal must be made by first cementing and then covering with a lead or bitumastic strip. Although they need to be handled with greater care, the asbestos sheets are preferable to galvanised iron sheets as they may be drilled and cut more easily and they need no treatment or attention once in position.

Circumstances will determine how the roof overlap and guttering are to be obscured. If they are not visible from the road because of being hidden by the side of the house for example, the appearance of the garage may be as shown in the plan (Fig. 1). If they are not so obscured, however, an additional half-block width should be bonded into the garage front on each side.

Rendering

The chief reason for rendering the walls is to make them damp-proof, but at the same time rendering improves the appearance of the structure. There are three rendering finishes available: (1) commercial waterproofing cement wash ; (2) fine-casting ; and (3) rough-casting. If the garage is in close proximity to the house it is desirable to render it in a similar manner to the latter. Rendering is carried out in two stages. A well-smoothed coating of waterproofed cement mortar from ¼in. to ½in. thick is applied to the walls from the bottom upwards, and after a few hours, when partially hardened, is criss-crossed with the point of the trowel or some other means. The grooves so formed are necessary to key a second similar coating, put on when the first has sufficiently hardened. If a rough-casting is required, the moist surface of this second coating is dashed with fine pebbles or chippings which require to be dry for best results. In order to prevent wastage, a piece of sacking should be spread out beneath the portion of wall being dashed so as to catch the pebbles that do not stick, for these can, of course, be used again. If a fine-casting is required, the moist surface of the second coating is roughened by brushing or other means. The second coating is allowed to set before a cement wash is applied. Of the three types of finish, rough-casting is generally considered to be the most satisfactory in preventing weather attack.

The mortar used for the rendering is waterproofed by simply adding to the standard mix a waterproofing agent either as a powder or liquid.



This is an additional sketch showing the position of the author's own garage. The garage site, of course, depends upon individual circumstances.

Construction of the Doors

A simply constructed but robust type of door is the ledged and braced door (Fig. 4). This is made of tongued and grooved boards (1in. thick) with 6in. wide 1in. thick ledges and 4in. wide 1in. thick braces. The ledges should be slightly shorter than the door width, and after being squared up they are screwed to the outside tongued and grooved board which should, of course, have had the tongue or groove on its outer edge planed away. If the structure is now reversed, the remaining boards can be nailed on, each board being tightly pulled against its neighbour. The nails may be either dovetailed or allowed to project and clenched on the back. In either case the nailheads should be punched in and the holes filled with plastic wood. The braces should be let into the ledges as shown and the heel of the brace should always be at the hanging edge of the door. Ledged doors require hanging on strap hinges and the cross-garnet type is quite satisfactory. These should extend to at least half the width of the door and should be screwed on the ledges.

The framework for the door should be made of 3in. square timber.

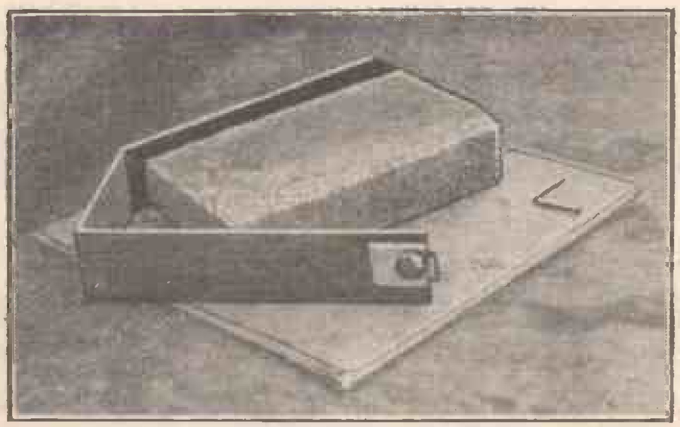
Recommendation

If it is possible to do so, it is well worth while getting quotations for the materials from several builders' merchants as prices are by no means standard, and the author found a variation of as much as 25 per cent. on some of the major items.

Concrete Block Making

These Blocks are Suitable for Building the Garage in the Preceding Article

By J. W. STANNAGE



The casting frame and a completed block.

THE concrete block is perhaps the most useful building material from the point of view of the handyman. Because of its size the rate of building is very rapid and the blocks can be made quite easily at home. The saving by making them is quite considerable—approximately £2 per 100; if bought, they cost £4 10s. per 100.

One hundred blocks 18in. × 9in. will build 112½ sq. ft., representing a wall approx. 28ft. long and 4ft. high. Using these figures as a rough guide it is possible to work out the cost of a workshop, garage, garden walls, etc.

When estimating the cost of a workshop or garage the cost of such items as window frames, glass and putty, doors and roofing material must be borne in mind. Incidentally, if a building is roofed with asbestos or corrugated iron sheets it must also have a ceiling of wood, plaster board or some such material if condensation is to be avoided. Also 4in. concrete blocks built on their edges should be plastered both inside and out to prevent damp, and also to give greater strength to the structure.

Making the Mould

Flat iron, ⅛in. × 4in., was used, but experience has shown that with this light material the mould is inclined to sag slightly when the mixture is compressed in it and, therefore, a heavier material is suggested. Cut to the size shown in the drawing and weld at two corners. The two half sections of the mould are joined by two 3in. back-flap hinges, secured with ¼in. Whitworth countersunk screws of a suitable length. The holes for the screws are countersunk on the inside of the mould. To facilitate handling, a plastic knob was fitted to one of the hinge retaining screws. The fixing hole in the knob was drilled and tapped ¼in. Whitworth and screwed on. See Fig. 1 and photograph.

To enable the mould to be opened and closed, the pin of one of the hingest must be removed and replaced with a short length of round mild steel rod. It was found that a 6in. nail suited this purpose admirably, and it was bent to the shape of the letter "L" to provide a grip for easy removal.

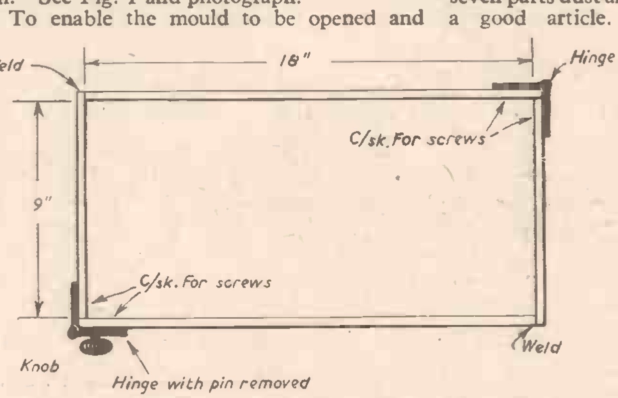


Fig. 1.—Constructional details of the casting frame.

When in use, the two parts of the mould are brought together and secured by the pin. It is then filled with the concrete mixture which should be firmly pressed down and the top skimmed off. The pin is then removed and the mould swung open, separating it from the block which will set without the mould.

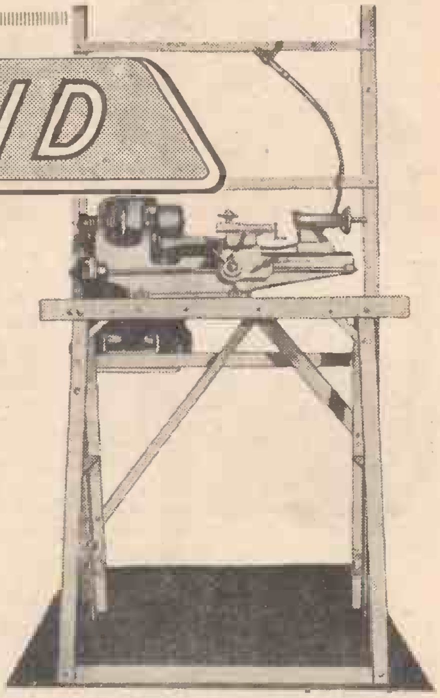
Mixture

A good mixture for block making is: five parts stone chippings, two parts sand and one part cement. If quarry dust is available then seven parts dust and one part cement will make a good article. Care should be taken when adding the water, as the finished mixture should be damp and not wet. A wet mixture will collapse as soon as the mould is removed.

Blocks can be made under cover or outside, provided a level surface is available. A garage floor or a concrete yard or path is ideal. The blocks should be made on a palette of some kind : odd pieces of wood, hardboard, plasterboard, pieces of felt and even old newspapers may be used—in fact, anything to prevent the damp block adhering to the concrete floor or path. Each block should be made on a separate palette, and no attempt should be made to make two or more blocks on a large piece of wood, etc.

When the blocks are firm they can be removed from the palettes and stacked on their edges in an open place to cure.

MAKING A LATHE STAND


A front view of the lathe stand.

Construct this Angle Iron Unit, to Receive Your Lathe

By W. E. RICKARDS

THIS stand was designed to carry a small lathe (3in. to 3½in.), an electric motor, flexible shaft, and spot light.

The flexible shaft greatly increases the usefulness and scope of the lathe. With the addition of a division plate, ornamental turning and other work can be undertaken without the elaborate overhead gear otherwise required.

The small frame which carries the motor has provision for belt tension adjustment and for the interchange or replacement of pulleys both on motor and countershaft. (The countershaft will be referred to as the c/s.) The provision of a method of interchanging pulleys allows almost any gear ratio to be set up by the use of different diameter pulleys and belts. The flexible shaft drive is taken from the c/s. The c/s.-to-lathe belt is adjustable from "no drive" to "full tension," without affecting the motor-to-c/s. belt. The pulleys are for endless belt of ½in. Vee section.

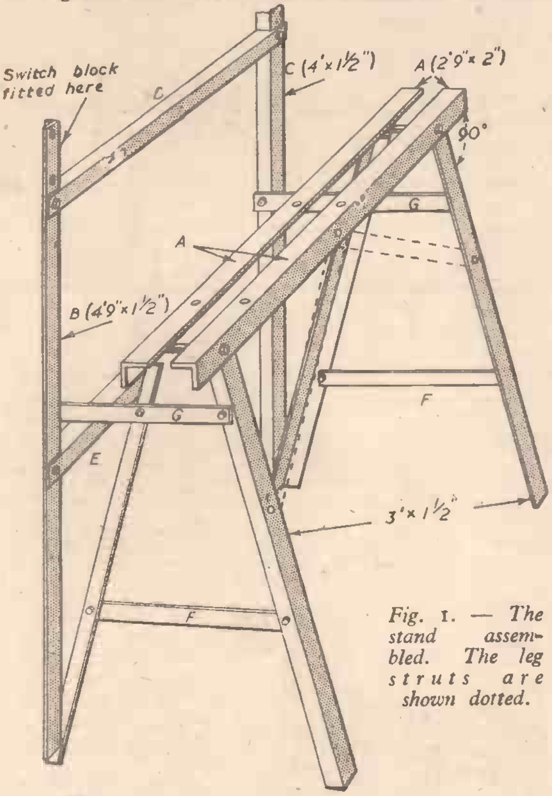


Fig. 1. — The stand assembled. The leg struts are shown dotted.

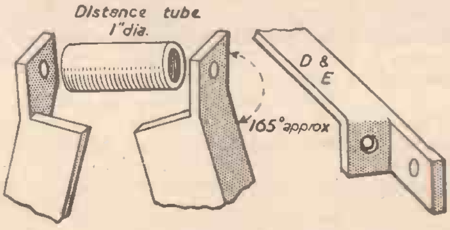


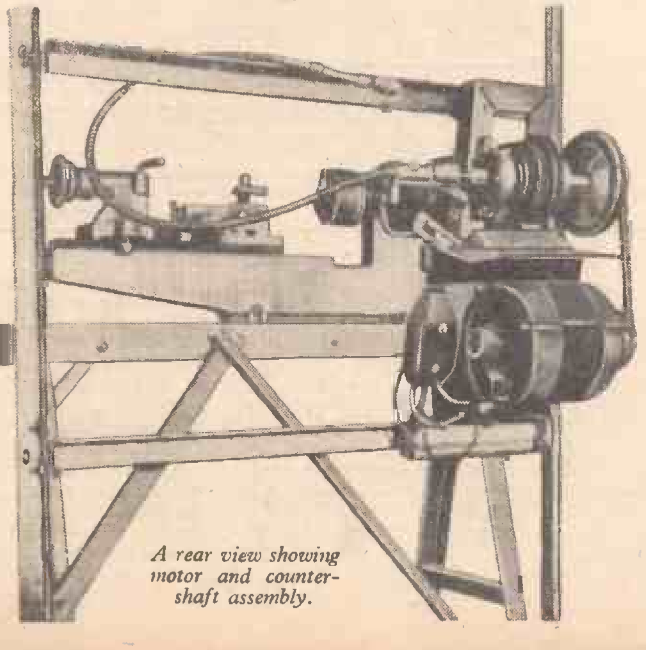
Fig. 2 (left).—Tops of legs and spacer.
Fig. 4 (right).—The ends of the crosspieces (D and E).

The stand is constructed almost entirely of angle and flat mild steel or iron. The bed, marked A in Figs. 1 and 3, consists of two lengths of angle iron, supported on four legs suitably braced; the motor and c/s. frames are supported and adjusted on two cross members between the two uprights.

The belt adjustments are as follow :—Motor to c/s. by two slotted guides, locked into position by wing nuts. From c/s. to lathe by ½in. Whit. bolt and two hand lock-nuts.

The three-pin socket and the two switches are located on the top of the left-hand upright.

The dimensions and sizes given are intended as a guide; they can be modified to suit individual requirements, type of lathe, etc. Bolt hole positions are, in most cases, obvious and, unless otherwise stated, 5/16in. bolts are used throughout.


A rear view showing motor and countershaft assembly.

The Stand

The bed (A, Fig. 1) is made from 2in. angle iron. The legs, the uprights (B and C) and the cross members (D and E) are of 1½in. angle iron. The struts and leg stretchers are of flat mild steel of suitable strength.

Cut A to the length required, and prepare the two distance tubes, making sure that the ends are square, see Fig. 2. The distance between the two parts of A will depend on the width between the fixing holes on the lathe being used.

Cut and bend the two pairs of legs

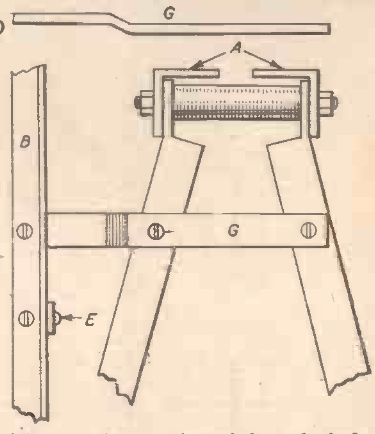


Fig. 3.—An end view of the lathe bed (A) and the supports (G).

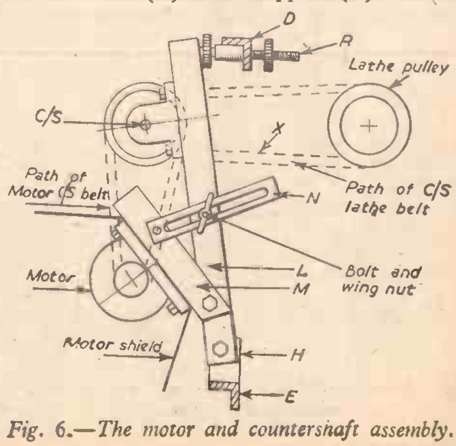
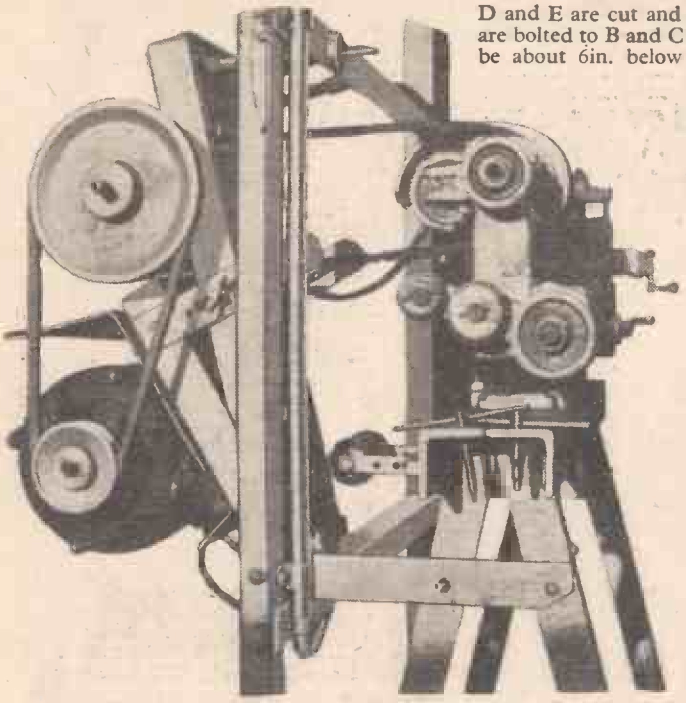


Fig. 6.—The motor and countershaft assembly.



A view from the left of the lathe stand. Note shield round motor.

as shown in Fig. 2 and bolt the bed and legs into position, using one bolt at each end. Prepare and fit (with ¼in. bolts) the leg struts, shown in Fig. 1. The two stretchers are next fixed in place (using ¼in. bolts) and these are shown at F.

The uprights B and C are added next, being bolted to the bottom of the rear legs, and held in a vertical position by the 1¼in. x ¼in. flat strips, bent as in Fig. 3, G. It will be noted that one of the uprights, B in this case, is about 9in. to 12in. longer than C; this is to carry the switch block. The cross pieces D and E are cut and bent as in Fig. 4; they are bolted to B and C on both faces. E should be about 6in. below the bed, and D about 14in. above it. The lathe itself should be fitted into place next, with the centre step of the pulley about 7in. to the right of upright B.

Before finally bolting the frame into position the electrical wiring should be considered so that fixing holes can be drilled; first, the type of wiring to be used, conduit, armoured cable, etc.; secondly, the path it will take, which would normally be down B and along E to the motor position. Details will be given later.

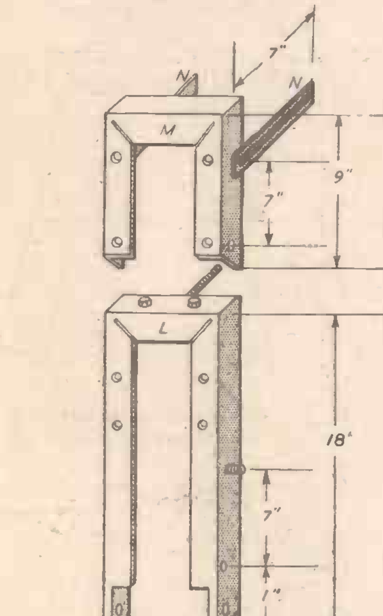


Fig. 5.—General assembly of motor and countershaft frames.

The Motor and Countershaft Assembly

The frames for both motor and c/s. are constructed from 1½in. angle iron. The assembly of the various parts as shown in Figs. 5 and 6 is as follows:

The c/s. frame L fits inside the bracket H, and is hinged by a bolt which passes through the holes in L and H and also through the distance tube K. The bolt is secured by lock nuts or a split pin.

The motor frame M fits outside L and is hinged by two bolts fitted with lock nuts. The slotted members N are hinged in a similar manner. The adjusting bolt R (Fig. 10) passes through a hole in D, Fig. 1. When the whole assembly is bolted into position on E the top of L should be level with the top of D.

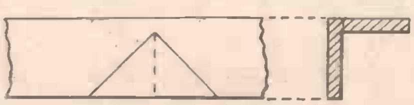


Fig. 7.—Making right angle bend in angle iron.

Fig. 8.—The countershaft frame before bending.

Make L first; this should be wide enough to allow the three-step c/s. pulley, and loose pulley, if one is used, to run freely without touching the frame. When the dimensions have been settled, mark out the two bends with lines at right angles, as shown by dotted line Fig. 7. With this line as a base, draw two more lines, one on each side at an angle of 45 deg. Cut out the triangle thus formed and this will leave the angle iron before bending as in Fig. 8. Heat and bend, taking care to keep the top faces P (Fig. 8) in the same plane. Prepare the adjusting bolt and bracket, as in Fig. 10. It should be about 8in. long with about 6in. of thread. Two hand nuts and a distance tube (about 1½in. long) are also required. The bracket is made from ½in. x ⅛in. flat mild steel. The bolt should be loose enough in its retaining bracket to allow vertical movement, but not enough to allow the bolt to turn. Use ¼in. bolts.

The c/s. line-up is shown in Fig. 9, and consists of a ½in. diameter shaft (or same diameter as motor shaft) fitted with a ½in. or ¼in. chuck at one end and two plummer blocks, with the pulleys running between them. The three-step c/s. pulley should match the three-step lathe pulley. If a bushed pulley of any diameter is available it could, with advantage, be incorporated in the assembly as in Fig. 10. As an alternative to the chuck, the c/s. end can be bored to take the flexible shaft drive, being secured by a grub screw.

The motor frame should be made next.

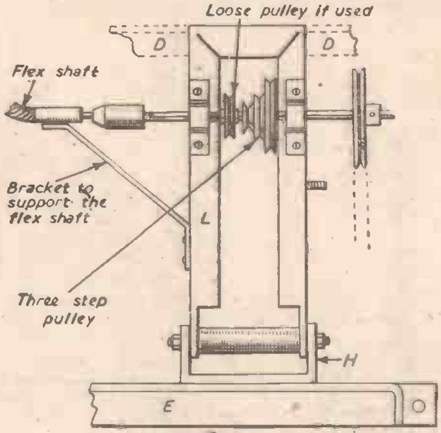


Fig. 9 (above).—The countershaft line-up

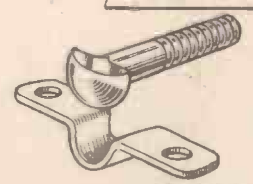
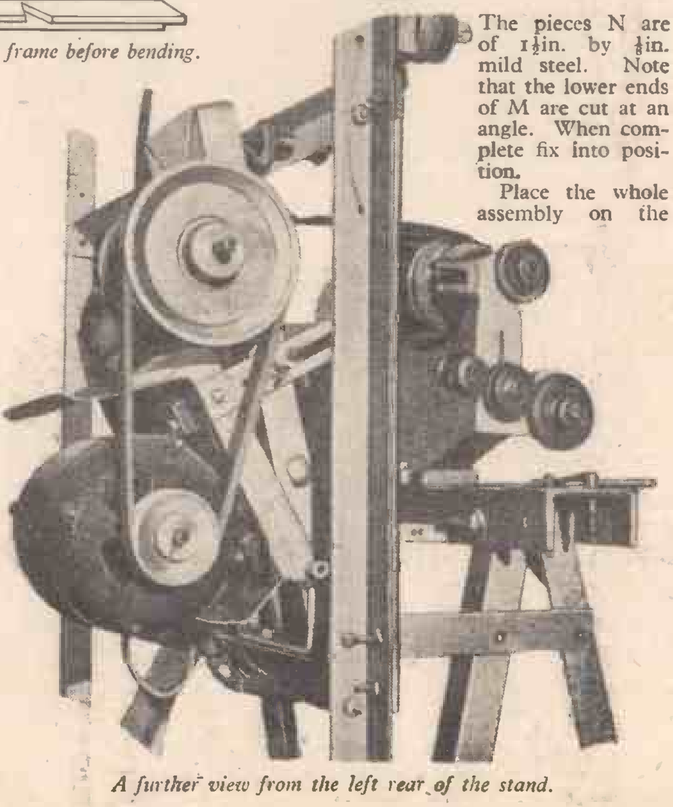


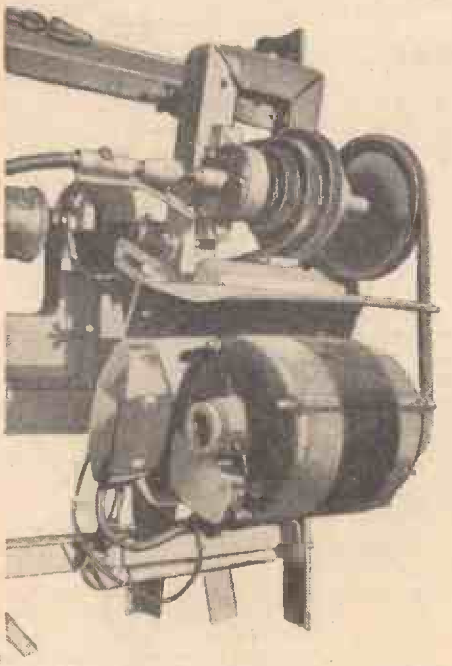
Fig. 10 (left).—The adjusting bolt.

The pieces N are of 1½in. by ⅛in. mild steel. Note that the lower ends of M are cut at an angle. When complete fix into position.

Place the whole assembly on the



A further view from the left rear of the stand.



A close-up view of the motor and countershaft assembly.

cross piece E, line up the c/s. pulley with those of the lathe, mark position on E, drill holes and bolt H into place. Mark and drill hole for adjusting bolt in D and when this is done, run one hand nut and distance tube on to the bolt, thread through the hole and lock with the other hand nut. The motor is fitted next, the motor and c/s. pulleys lined up, grub screws tightened, and belt added.

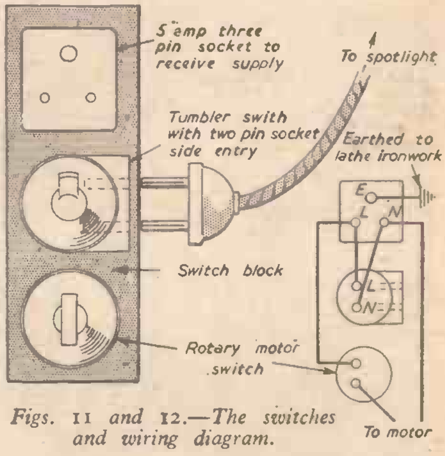
If an endless belt is used between c/s. and lathe, the mandrel will have to be removed to admit the belt. The belt should be long enough to allow plenty of slack when L is pulled up to D, Fig. 6.

The Flexible Shaft

This should be at least 3ft. long, and fitted with a ¼in. chuck. It is advisable to support the driven end of the shaft by a suitable bracket bolted to the c/s. frame L, Fig. 9. The chuck end can be clamped in the tool post when required to work on any job held in the lathe chuck. When it is desired to use the flexible shaft, draw the frame L up close to D by means of the adjusting screw R, this will slacken the belt X, Fig. 6, which can then be disengaged from the pulleys and hooked safely out of the way, or run on to the loose pulley if one has been fitted. The flexible shaft should always be disconnected when not in use.

Wiring

The mains feed is brought in via a three-pin plug to the socket shown in Fig. 11. The spot lamp is fed through a combined switch and



Figs. 11 and 12.—The switches and wiring diagram.

two-pin socket. The motor switch is of the rotary type to avoid confusion. The lamp can be mounted on D and can be of any adjustable type. A wiring diagram is given in Fig. 12. Make sure that the switches are connected in the "live" side. If in any doubt do not run any risks, call in an expert. A radio and TV suppressor should be fitted to the motor.

A guard should be provided to cover the belts, and a thin metal shield to protect the motor from turnings and bits of metal. The shield is shown in Fig. 6.

A Pan and Tilt Head

By J. H. WILLIS

Another Use for the A.M. Astro Compass Mk. 2

Fig. 1.—The Astro Compass as purchased.

THE A.M. Astro Compass Mk. 2 is very easily adapted to a first-rate pan and tilt head for use on a tripod. I understand this instrument was originally designed for use in aircraft to navigate by means of the stars. The instrument is shown in Fig. 1.

A sight is pivoted on a bracket at the top of the instrument by means of a large headed screw. By turning a knurled knob on the left-hand side, the bracket can be revolved horizontally via a drum marked L.H.A.↑ N. Lat. The drum can be revolved vertically by turning a knurled knob on the right-hand side of the instrument. This knob can be disengaged by depressing a lever above the knob, allowing the drum to be set instantly in any horizontal plane. When the lever is released the gear drive is restored and final adjustment can be made by the knob.

The entire mechanism so far described is screwed to a circular plate which will rotate horizontally over a circular baseplate.

Screwed to the baseplate is a little alloy casting engraved True Course which contains two very useful spirit levels set at 90 deg. The instrument can thus be set up dead level by adjustment of two knurled knobs tucked under the baseplate, similar to the mounting of a theodolite (see Fig. 3).

To support this piece of precision engineering a light alloy casting is attached to the underside having a large circular hole and locking screw for fixing to the head of a tripod. Since tripods vary considerably it is difficult to give any universal method of attachment, but little difficulty will be experienced as the casting is substantial and simple.

If the sight is replaced by a mounting to carry the camera we will have all the movements mentioned available for the positioning of the camera. A screw mounting is easily provided by removing the sight and fitting in its place a small block of metal, into which is screwed a short bolt of the same size and thread as the camera bush. Two nuts and bolts must be fitted through the bracket and

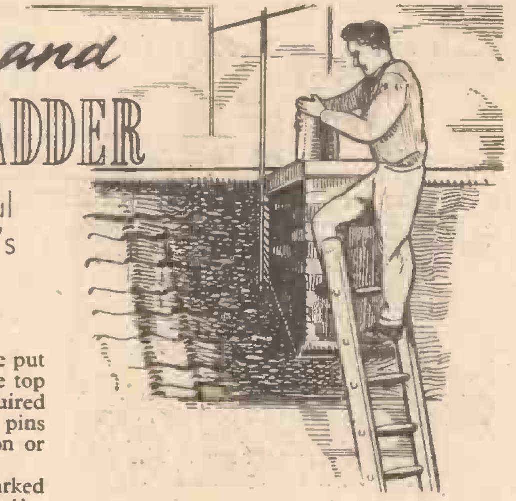
Fig. 2.—The metal block and screw to receive camera.

Fig. 3.—The camera in position.

block of metal to prevent the rotation of the latter about the pivot screw of the sight, see Fig. 2.

This pan and tilt head will be found smooth and accurate in use and is shown with camera in place in Fig. 3.

FOLDING STEPS and an EXTENDING LADDER



How to Make Two Useful Additions to the Handyman's Equipment

By "HOME HANDYMAN"

THE folding steps shown in Figs. 1 and 2 are light and easily made and are preferably constructed in hardwood such as birch. If made from yellow deal or other softwood, the dimensions for the finished wood thickness should be slightly increased.

The four pieces of wood marked (A) in Fig. 2 are planed and finished 1½in. wide by ⅝in. thick by 61in. long. These are laid side by side and the positions of the tread bearer pin holes are marked.

The Hinge Pin Holes

The top hinge pin hole is positioned 1in. from the end of the wood and this allows ¼in. to be removed afterwards when putting the ¾in. radius on the end of the wood. Both ends of each piece have this radius. The other bearer pin holes are spaced out at 10in. intervals thus giving the steps six treads. The last pin hole in the bottom of each piece is marked 1in. from the end of the timber.

The pin holes are now carefully drilled 3/16in. diameter.

The tread bearers can next be prepared. Ten of these measure 6in. × 1in. × ⅝in. The top pair measure 6in. × 1½in. × ⅝in. and the two centre tread bearers to which the back struts (C) Fig. 2 are pinned measure 7¼in. × 1½in. × ⅝in. The pin holes are marked out at 4¾in. centres and the two additional holes in the centre tread bearers are spaced at 1in. centres.

The bearers and side pieces can now be put together and all the pin joints except the top front two riveted. Three washers are required for each joint as shown in Fig. 3. The pins should be cut from 3/16in. diameter iron or mild steel rod.

The top and bottom cross pieces marked (D) and (E) in Fig. 1 are cut 9½in. and 15½in. long respectively, ½in. thick and 2in. wide. These pieces are next screwed on to get the width of the steps. The width at the front should then be 12in. at the top and 18in. at the bottom.

The treads can now be prepared and these should be made from 4¾in. wide by 7/16in. thick hardwood free from knots. If soft wood is used, the timber will need to be slightly thicker. The front edges of the treads are rounded or chamfered and all except the top tread can now be screwed to the bearers.

The two back pieces marked (B) in Fig. 2 measure 1½in. × ⅝in. × 58in. long. The top hinge pin holes in these pieces can next be drilled and they can then be riveted with the top tread bearer to the outside of the front pieces (A). The two struts (C) in Fig. 2 are 1in. × ⅝in. × 25in. long with 24in. pin centre distance. These are riveted to the projecting ends of the centre tread bearers.

The steps are next folded flat and the length of the rail (F) is determined. It can then be screwed to the back pieces (B).

The position for the strut pins (C) on the pieces (B) is approximately 9in. from the bottom but it is advisable to ascertain the exact position by temporarily screwing on the strut and correcting by trial. The top tread can now be screwed on.

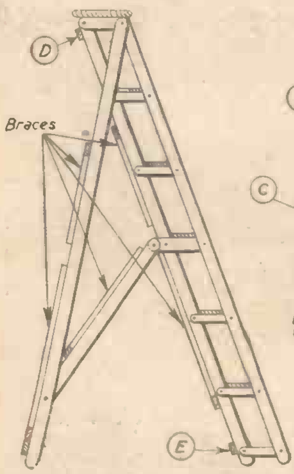


Fig. 1.—A side view of the completed steps.

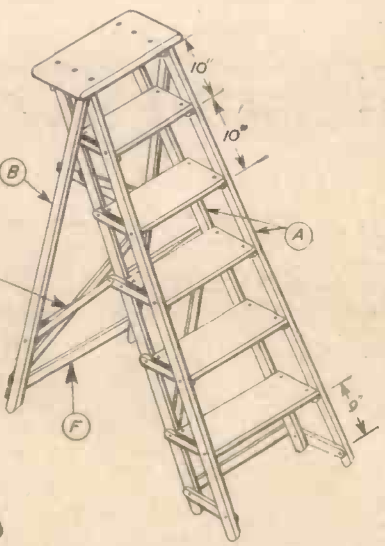


Fig. 2.—A perspective view giving some of the dimensions.

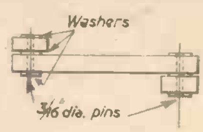


Fig. 3.—How the pin joints are made.

The Braces

There are five light braces which should now be made from 1in. × ⅝in. wood. Two of these are screwed to the back of the main steps, one is fixed to the struts (C) and the remaining two are positioned on the back frame.

With the steps folded flat all five braces can be suitably placed and screwed on, allowing sufficient clearance between each.

The additional bearers at the bottom of pieces (A) serve to strengthen the ends and are pinned in the same way as the other tread bearers.

An Extending Ladder

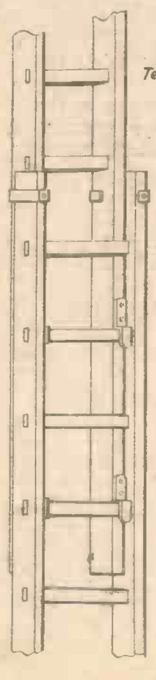
The old type of ladder in which the sides were made from a pole sawn down the centre and which was fitted with round staves, was made with little regard or no knowledge of stress distribution. As a result the timber used in this kind of ladder was not used to advantage.

The extending ladder to be described here has sides and staves which are of rectangular section, and advantage is taken of the fact that timber is generally stronger in compression than tension.

It can be seen, by referring to Fig. 5, that by setting over the stave mortises to one side of the centre line of the sides, that is to say into the compression side, regard is paid to the strength of the material, at least to some extent. There is also the additional advantage that the sides of the top and bottom ladders are brought closer or more in line with each other.

Selecting the Timber

The chief object in selecting the timber for ladder making, apart from choosing good quality seasoned wood, is to get as far as



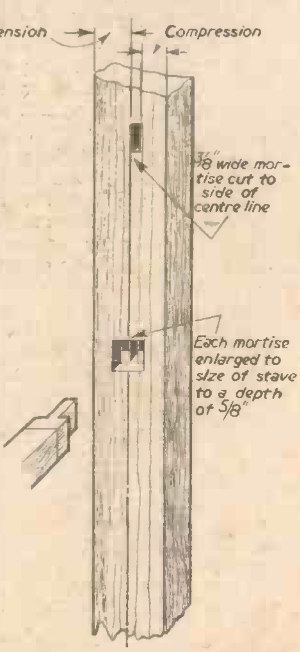


Fig. 4 (Left).—A perspective view of the completed ladder.

Fig. 5 (Right).—Details of the stave mortises.

possible all the parts cut out parallel with the grain for strength. The timber used must not contain knots or other defects directly affecting the breaking strength.

The safest policy, undoubtedly, is to cleave out the staves approximately to size and then plane them up, but of course the best method is not always the easiest, nor is it always possible.

The Sides of the Ladder

The sizes given here are adequate for a ladder 28ft. long when fully extended. A somewhat shorter ladder is, however, chosen for this article. The top ladder is 12ft. long and the bottom ladder 14ft. long. The sides are made from 3in. × 1½in. yellow deal.

The stave mortises are marked out ⅜in. wide by 1¼in. long, and these are afterwards enlarged to the size of the staves, namely 1¼in. by 1⅜in., to a depth of ⅝in. Details of the mortises are shown in Fig. 5, which also shows how the ⅜in. wide slots which are cut right through the timber are positioned to one side of the centre line for the reason stated above. The mortises are spaced out so that the distance from one mortise to the corresponding point on the next one is 11in.

Having cut all the mortises and enlarged them on the inside of each of the side pieces, the four corners of each side can be chamfered.

The Staves

These are made from oak and are finished 1¼in. × 1⅜in. on both ladders, both of which are, of course, parallel.

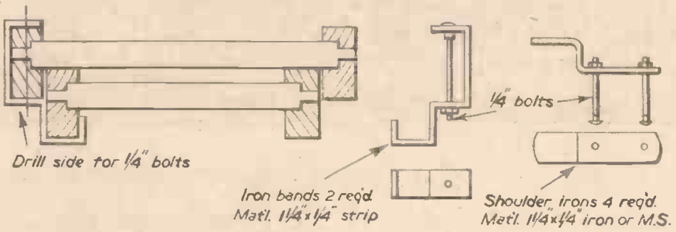


Fig. 6.—Details of the various irons required.

The staves should be cut and the tenons sawn on each end so that the width on the inside of the bottom ladder is 12in. The staves for the top ladder should then be finished so that the width on the outside of this ladder is 11¾in.

The Shoulder and Strap Irons

The various irons required for this ladder and the method of fixing them is shown in Fig. 6. They are all made from 1¼in. × ¼in. iron or mild steel and the shapes should be accurately drawn on a board if they are to be made by a blacksmith.

Assembling the Ladder

The stave mortises on the outside of each side should be slightly pared away as each receives two wedges.

The tenons at one end of the staves are now coated with glue, and it is recommended here that for this work a waterproof resin glue such as "Cascamite" is used. All the staves are then driven in one side and having tested for squareness, the wedges are driven in firmly.

The tenons at the other end of the staves are next coated with glue, and the mortises in the second side are just entered on the tenons one by one. The side can then be driven home, a piece of wood being used to prevent damage to the side from hammering or the side can be squeezed on by the use of cramps and finally wedged.

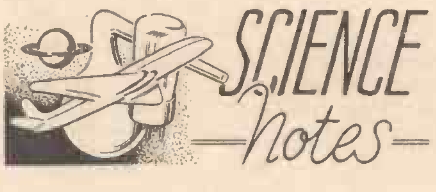
Fitting the Bands and Shoulder Irons

Having completed both top and bottom ladders the various irons can now be fitted.

The two end bands are bolted to the lower ladder about 3½in. from the ends. The other four irons must be positioned so that the staves of both ladders are level with each other. All the irons are secured with ¼in. diameter bolts as shown in Fig. 6.

In conclusion, it will not be out of place to remind the ladder builder that having made his extending ladder, its good condition should be carefully maintained. His own, or another person's life may well depend on this being observed. Ladders which are left in the open and exposed to all weathers can very soon become invaded with rot and should then be considered unsafe.

The ladder should be finished by applying two or three coats of good quality lead paint. In addition, the ladder should be hung on suitable brackets or hooks secured to a fence or wall, a small sloping roof being provided to keep off rain.



Fire-fighting Appliances on Show at Science Museum

THE collection of fire-fighting appliances, which has been in store since the outbreak of war, was reopened to the public recently.

An original model manual engine dating from 1680 is the first of a series of exhibits illustrating the development of the fire engine up to the modern appliance.

Model Steelworks

A WORKING model of a complete steelworks is also now on view. On a floor area of 60ft. by 24ft. it portrays a steelworks covering a site of over a quarter of a square mile in area, with a weekly capacity of 10,000 tons.

It shows how the various pieces of steelmaking plant are arranged in process sequence from the iron ore to the finished product. Raw materials are unloaded at the docks by transporter crane and, together with coke from the coke ovens, charged into the blast furnaces. There follow in sequence: steelmaking furnaces, ingot-casting bays, soaking pits and rolling mills.

Ancillary services, such as a power station, repair shops, stockyards, 20 miniature locomotives and 1,500 pieces of rolling stock running on half a mile of track, complete the scene.

A New Use for Plastic

A MOSCOW firm of printers are now printing from plastic type instead of the usual type metal alloy.

Award to American Engineer

THE Council of The Institution of Mechanical Engineers have awarded the 1955 James Watt International Medal to Dr. Igor Ivan Sikorsky, of the United States, in recognition of his life's work in applying science to the progress of mechanical engineering through pioneering development of aircraft of various types: multi-engined, amphibians, and particularly helicopters.

The James Watt International Medal was founded to commemorate the bi-centenary of the birth of James Watt, which took place on January 19th, 1736.

A Powerful Pump

A TINY pump, 5in. high and weighing only 20lb., which is capable of raising water to a height of 200ft., is expected to be on show at the British Industries Fair (Birmingham section) in May. It is of the hydraulic ram type and works on the principle that a stream of water falling from a small height can lift some of the water to a greater height.

New Helicopter Rescue Apparatus

NEW apparatus to improve the means of rescue by helicopter has been developed by the Royal Navy in the form of a scoop net. The previous method of lifting persons from the sea has been by means of a strap which is lowered and then secured round the waist, either by the persons themselves or by aircrewman lowered to assist them, but this method has disadvantages. People struggling in the sea often cannot help themselves, and suspension in mid-air can be terrifying; also a badly injured person, lifted by a strap, may suffer further injury during the lift.

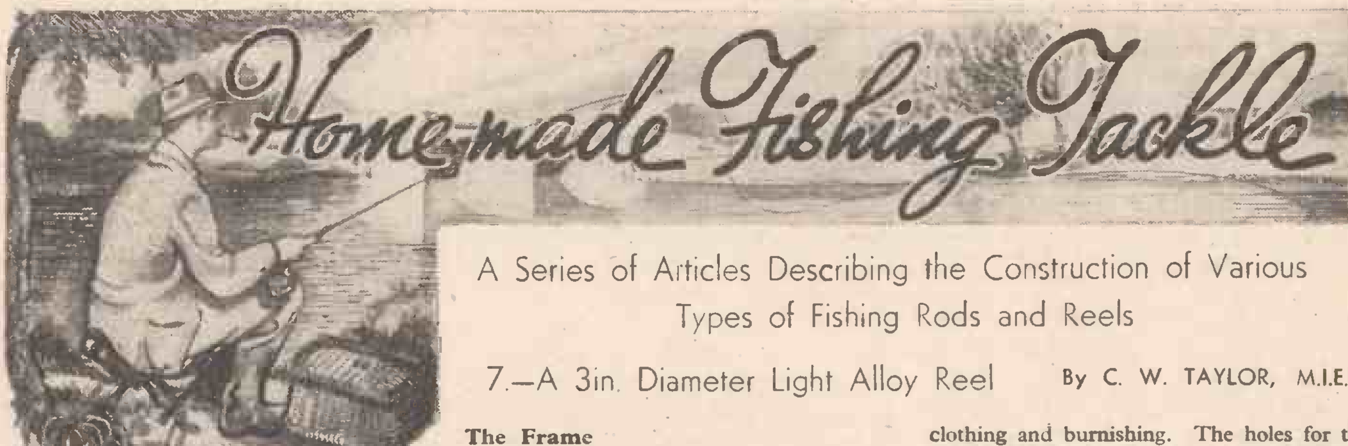
To overcome some of these disadvantages the Search and Rescue Unit at the R.N. Air Station, Ford, in Sussex, designed the scoop net, which is capable of scooping a person out of the sea as a helicopter moves overhead at walking pace.

The scoop net is extremely simple: a rope net is attached to a tubular frame which is in the form of a D. The D frame is lowered face downwards into the water and is stabilised by a drogue. When in position for a pick-up the face of the D is submerged, the arc of the letter remaining above water. It is then trawled through the water until the person is drawn into the net and then hoisted alongside the cabin of the helicopter so that the person can either be assisted into the aircraft, or, if badly injured, allowed to remain undisturbed in the net until the helicopter returns to base.

A Mechanical Mathematician

A NEW differential analyser—the largest in the world—is now in operation at the National Physical Laboratory. It has taken over five years to build and will be of invaluable assistance to physicists, mathematicians and engineers. Its prime function is to solve differential equations, and it may be used to find the solution to any problem which can be expressed in this form, including many in diffusion and heat transfer, ballistics, electron optics, statistics, ultrasonics, aircraft design (which involves exceptionally complicated mathematics, especially in connection with supersonic flight), mechanical analysis, and a wide range of applications in electronics and atomic physics.

In the past, when a mathematical analysis has given a differential equation, engineers have often had to resort to trial and error for a working solution to their problems; by making use of the new differential analyser they can now obtain an exact evaluation. Results are given to an accuracy of three figures.



Home-made Fishing Tackle

A Series of Articles Describing the Construction of Various Types of Fishing Rods and Reels

7.—A 3in. Diameter Light Alloy Reel

By C. W. TAYLOR, M.I.E.T.

THIS article is directed to those readers who have a centre lathe.

My original reel was machined from a block of 3in. diameter solid duralumin, and although a good deal of metal must be removed as waste, there is no alternative method of making this type of reel in the absence of suitable castings. The main components could perhaps be fabricated, but it is doubtful if any alternative method would have a real advantage. It is therefore suggested that a piece of 3in. diameter solid duralumin bar is used to make the drum and the frame. In addition, a short piece of ⅜in. diameter duralumin rod is required for the handles. Some odd pieces of brass, mild steel, cast steel, a piece of strip spring steel, and various B.A. brass screws complete the list of the required materials.

In using duralumin for the reel, it must, of course, be remembered that this metal is not resistant to salt water corrosion, and if the reel is likely to be used for light sea fishing it will be necessary to use one of the corrosion resistant aluminium alloys such as "Birmabright."

The Frame

This consists of a stationary back plate made integral with a line guide for right- and left-hand use. The work is mainly plain turning, and boring or facing away the interior metal; see Fig. 1.

One end of the block of metal should be faced up and polished. A light skimming cut can also be taken half-way along the block which is then reversed in the chuck ready for boring.

The inside corner of the metal should be bored or faced out sharp; any small radius will rub against the inner flange of the drum. The 1/16in. deep recess is then machined for the centre pin flange, and the ¼in. diameter hole is drilled to take the spigot of the centre pin. The outside diameter of the metal can then be finish turned and polished.

With the turning and boring completed, the outside diameter of the frame should be marked out for drilling. Eight ½in. diameter holes are drilled, and for this the frame should be clamped to an angle plate. Having drilled the holes, the metal should be carefully sawn through to form the guide apertures. The apertures must be carefully finished and all sharp corners must be rounded by filing and scraping and finally smoothed by emery clothing and burnishing. The holes for the two B.A. screws and the slot for the check button are left until later.

The Drum

The work on this component is also mainly plain turning and boring. It is advisable first to rough-turn the drum and drill the 5/16in. diameter hole for the centre pin bush. The rough drum is then mounted on a 5/16in. mandrel between centres, or driven on to a piece of steel running true in a three-jaw chuck. The drum is then finish turned true with the hole.

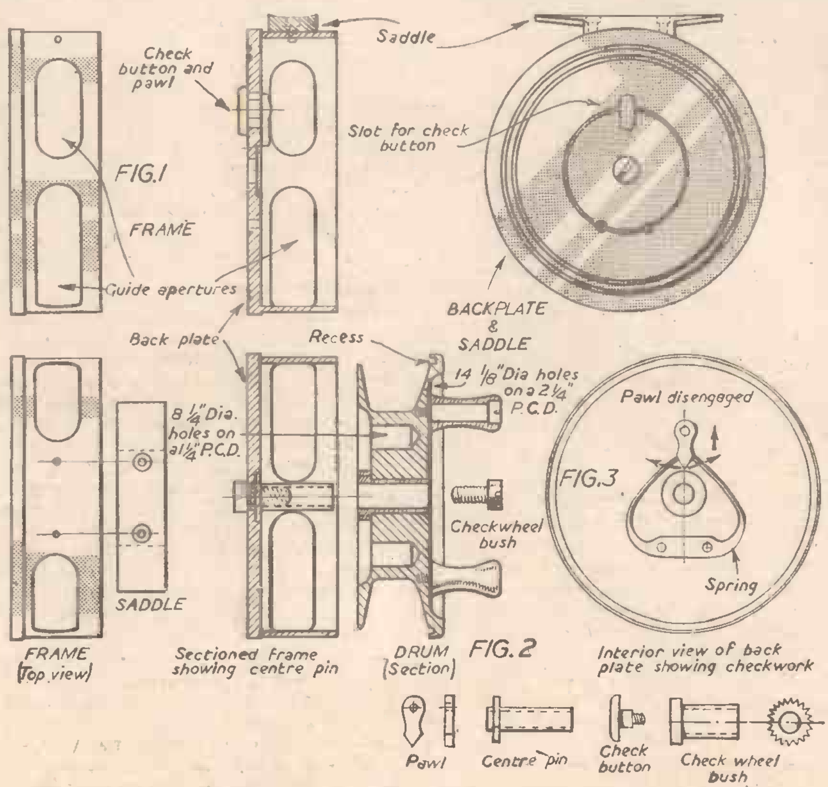
The inner or smaller flange should be

Photograph of a reel of the author's own make

turned to clear the inside of the frame; about .015in. clearance is sufficient. Excessive clearance will allow fine fishing line to become wedged between the two components.

A recess is cut in the inside of the larger flange of the drum to accommodate the frame ring as shown in Fig. 2; the clearance between the recess and the frame ring should also be about .015in.

The back of the drum is recessed to houes the checkwork, and metal is also removed from the front of the large flange to decrease the weight. A ring of ⅛in. diameter holes is also drilled in the large flange partly for appearance and partly to allow air to circulate round the line when the drum is full. The holes for the handle pins can also be drilled and tapped.



Figs. 1, 2 and 3.—Details and dimensions of the component parts of the reel.

The Checkwheel Bush

This is a combined checkwheel and centre pin bush, and can be made from a piece of

½in. diameter carbon tool steel, or from a similar piece of mild steel. If made from tool steel the component will be hardened after it is made by heating to a bright red and quenching in oil or water, which is followed by tempering at pale straw colour. If mild steel is used the bush must be case-hardened by enclosing in a small tin full of Kasenit compound so that the bush is completely buried. The tin and contents are then kept at a bright red heat in a fire or by means of a blowlamp for half an hour or longer. The bush is then removed from the tin, cleaned, reheated to a bright red and quenched in water.

When machining the bush the outside diameter is turned to a press or a light driving fit in the drum and is drilled ¼in. diameter.

The checkwheel is turned ⅛in. wide and the teeth are carefully spaced out and filed 1/16in. deep. A triangular saw file can be used for this. The bush is best pressed into the drum using a mandrel press or some similar means to avoid the possibility of breaking the bush.

The Centre Pin

This is made from a piece of ½in. diameter mild steel. The pin is turned ¼in. diameter to a good running fit in the checkwheel bush. The flange is 1/16in. thick and the spigot is turned ¼in. diameter by means of which the pin is accurately located in the hole drilled in the frame back plate. The pin is drilled right through and is tapped No. 2 B.A.

The length of the pin should be made about .004in. longer than the bush so that the drum revolves freely.

The Handles

These are turned from ⅜in. diameter duralumin rod. The handles are drilled 3/16in. diameter and are counterbored to receive the heads of the special turned pins which screw into the drum flange.

The pins are turned 3/16in. diameter to a running fit in the handles; the ends are screwed No. 4 B.A., and the plain turned portions should be made about .004in. longer than the handles so that the latter revolve freely on the pins. Brass can be used for making the pins.

The Saddle

This is made from any suitable piece of brass; a piece of 9/16in. diameter solid bar can be sawn longitudinally to make this component. The top surface is curved, looking at the end view, to fit the rod handle and rings, and this curve or hollow is easily made using a half round file.

The bottom surface must also be filed to the correct arc which will accurately bed down to the top of the frame.

The saddle is drilled and counterbored to receive two No. 4 B.A. screws by which it is secured to the frame.

The Checkwork

Three components in addition to the checkwheel form the mechanism for the check. These are an operating button, a pawl, and a special spring.

The operating button is turned from a short piece of ½in. diameter brass. The shank is turned 3/16in. diameter and the end is screwed No. 4 B.A. for just about three or four threads. When the reel is assembled this portion is screwed into the pawl and riveted over.

The button shank must be made so that when it is pushed through the slot in the back plate and screwed up tight in the pawl both the button and the pawl are able to rotate freely in the slot without end movement. That is to say, the button and the pawl should form a good fit to the outer and inner sides of the back plate without being tight.

The pawl is made from a small piece of carbon tool steel and is hardened by heating to a bright red and quenching in oil or water. The pawl is left in the "dead hard" condition. The hole in the pawl is tapped No. 4 B.A. and into this is screwed the end of the button shank.

The Special Spring

Making the special spring can prove somewhat tricky. It is made from a strip of spring steel; ¼in. × .048in. strip is suitable but other size steel will do if it is reduced by filing.

The strip is filed or ground at each end to the thickness shown in Fig. 3. The actual finishing thickness of the ends will depend on the amount of check action required; some anglers prefer more than others. It will be found, however, that a taper of 1/32in. to slightly less than 1/16in. is about correct. The spring can easily have a little ground off after it is made if the check is too heavy.

Having filed the strip, it should be bent carefully to shape as a gradual curve. (See Fig. 3.) The holes for the No. 6 B.A. screws can then be drilled and tapped.

The Hardening and Tempering

The spring can next be hardened and tempered. If it is unevenly heated for hardening, the gap between the ends may close in a little and this must be carefully watched when heating the spring. It is advisable to make a slight allowance in the gap for change of shape so that the ends of the spring do not clamp too tightly in the neck of the pawl. If this happens it may be difficult to operate the check. With the spring at a uniform bright red heat it should be quenched in warm water or oil; cold water will usually cause considerable distortion.

The spring is next brightened by emery cloth. Care must be taken when emery clothing as the spring will be very brittle and will easily snap.

Tempering consists of reheating the spring to a uniform blue colour, and in the absence of a tempering bath great care must be taken to ensure that a rapid change of temperature does not occur. The spring should be held some distance away from the source of heat and kept on the move to avoid local overheating.

It should of course be remembered that it is better to overheat the spring to a soft condition than allow it to remain brittle and suffer breakage.

Assembling the Reel

The slot for the check button should now be cut in the back plate by drilling two 3/16in. dia. holes and filing away the unwanted metal.

The exact position for the slot should be determined by positioning the pawl as it would be in the engaged position. The check button shank will now be at the bottom of the slot when it is cut, and knowing this, the centre of the first 3/16in. hole to be drilled is easily determined. The pawl is next moved to the disengaged position and a clear indication will be obtained of the centre of the other 3/16in. hole. Both positions of the centres of the holes can also, of course, be obtained by direct measurement.

With both 3/16in. holes drilled in the back plate the slot is filed out.

The saddle can next be positioned on the frame and the centres of the two holes for the No. 4 B.A. screws can be marked. The two holes are then drilled and tapped in the frame and the saddle can be screwed down.

Fixing the Checkwork

To obtain the position of the holes in the back plate for the screws which hold the spring, the ends of the spring are first placed in the neck of the pawl and the latter is again positioned as if engaged. The position is now marked for the holes by transferring from the tapped holes in the spring, using a scriber. Two No. 6 B.A. clearance holes are then drilled in the back plate.

All the check components and the centre pin can now be screwed in position, having cut the various fixing screws to the exact required lengths.

The handle pins should be greased and these also can now be screwed with the handles to the drum flange.

A few spots of a thin grade oil should be placed on the centre pin and checkwheel.

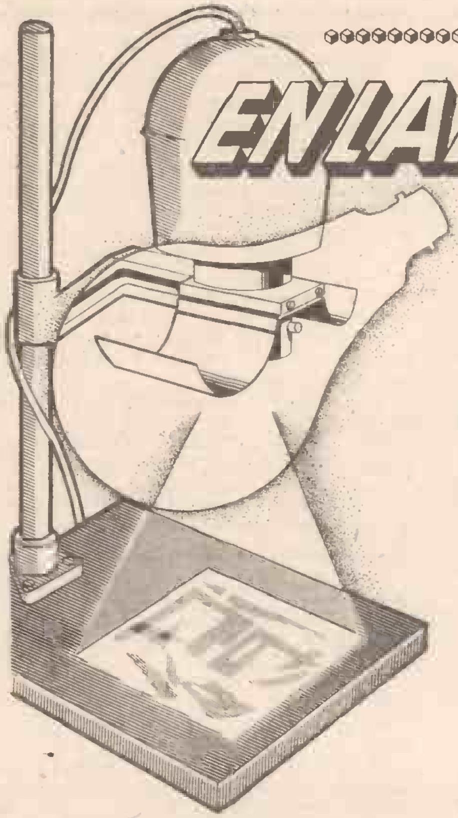
The check button is finally screwed up tight in the pawl and the check button shank should be riveted over. Obviously these two components cannot afterwards be separated so the riveting should be left until everything is working satisfactorily. It is also obvious that clearance must be maintained during the construction of the reel between the various check components and the recess in the drum which houses these components.

A Luxury Design Autocycle

The N.S.U. "Quickly"

Those who require something more streamlined and comfortable than the motor-assisted bicycle should be interested in the N.S.U. Quickly autocycle. The machine has powerful motor-cycle brakes, sprung front forks, "silenced air" carburation, a two-speed twist-grip operated gearbox and a clutch which enables the machine to be used as a motor cycle. The standard specification includes full lighting set, electric horn, swinging saddle (adjustable for height), luggage carrier, safety lock, central stand and balloon tyres. The Quickly is assembled by Vincent Engineers (Stevenage), Ltd., Stevenage, Herts, and retails at £59 18s.

ENLARGER ILLUMINATION



Various Lamps : Optical Systems : Light Measurement : Enlarger Copying

By F. G. RAYER

SEVERAL different systems of illumination are used in photographic enlargers, and a knowledge of them should prove helpful to anyone constructing an enlarger or wishing to modify an enlarger already in use. With winter there is usually more time for operations of this nature, and in some cases it should be possible to increase the scope of an existing enlarger, or to obtain better results from it. For best results and ease of manipulation, the image projected should be bright and evenly illuminated.

The Standard Arrangement

Fig. 1 shows the general arrangement of components in a standard enlarger of simple type, and this can be a model for home-made apparatus. Provided each part can fulfil its purpose, its actual shape or form is not important. For example, though some lamphouses are spherical, many are cylindrical. Square lamphouses are also seen. For home-construction, the cylindrical type is probably the simplest to devise. The spherical type, or types with cooling " fins," grow less hot, but for all normal purposes with average lamps this consideration is not important. As the bulb is usually switched on for short periods only, no ventilation is required, unless a very powerful lamp is used.

Diffused Illumination

Illumination of the negative is by opal lamp and opal glass. This system is found in many instruments in the £10 to £15 class, and is cheap and trouble-free. To achieve reasonably even illumination the lamp should be several inches from the glass. About 6in. to 8in. is a good figure. With greater distances the illumination obtained is somewhat weak. The lamp itself may be of 40 to 150 watts. It can, of course, be operated directly from A.C. or D.C. mains, a pendant or other switch being included in one lead.

The negative is situated immediately below the opal glass. It may be in a " glassless " carrier, which consists of a thin metal frame of suitable size, or may be sandwiched between two sheets of clean glass. The latter method is the easiest from the home-construction viewpoint. Some types of negative carriers have curved " wings," as shown in Fig. 1, so that a film need not be cut up into separate negatives.

Negative Lens Adjustment

Some form of bellows is necessary to allow the distance between negative and lens to be adjusted. The bellows may resemble that in Fig. 1, or consist of a threaded tube with multi-start thread, or be merely two tubes which are a sliding fit in each other. With bellows like that in Fig. 1, a rack and pinion or similar means will be present to hold the lens in its correct position and enable adjustment of distance between lens and negative. The lens itself may be a simple doublet or a larger lens with adjustable iris.

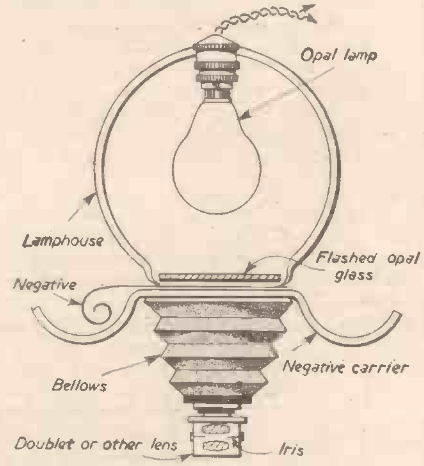


Fig. 1.—Diffused light illumination.

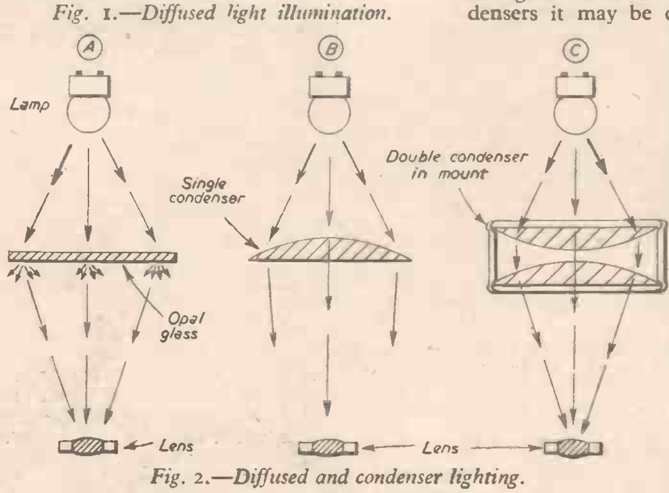


Fig. 2.—Diffused and condenser lighting.

Systems Compared

Fig. 1 may be considered as a basic arrangement, to which improvements may be made. Though it can give excellent results, illumination is not very strong, even with a large lamp. This means that the exposure for dense negatives is long, especially if a simple doublet lens with maximum aperture of $f8$ is used. In addition, the dim image is difficult to focus and compose on the enlarger baseboard.

The manner in which diffused lighting is obtained may be seen from reference to " A " in Fig. 2. Of all the light emitted by the lamp only a portion will reach the opal glass. Here the light is evenly distributed in all directions, as shown by the small arrows. Only some rays reach the lens. The projected image is therefore lacking in brightness, especially as the opal glass itself further reduces the light.

These limitations may be overcome by using condenser illumination. A single condenser is shown at " B." In many enlargers it is only necessary to lift out the opal glass and place the condenser in its position. The increase in brightness of the projected image is very noticeable, allowing shorter exposures, smaller apertures, and greater ease of focusing. With some enlargers (especially those for 35 mm. negatives) only a single condenser is required ; but from " B " it will be seen that not all the light rays are directed to the lens. This can be overcome by using two condensers, as at " C." When the distance between lamp, condensers, and lens is correct all the light falling upon the condenser is focused upon the lens. It thus passes through to the baseboard, giving maximum brightness of illumination. Single or double condensers may easily cut the exposure time to one-tenth, compared with that required when opal glass is employed.

The Opal Glass Method

With opal glass, the distance between lamp and glass is not important. But with condensers it may be quite critical, if a clear-glass bulb giving a " point " source of light is used. For this reason it is best to retain the opal type of lamp if possible. Condensers are obtainable in moulded and optically-worked types. The latter are best since the danger of uneven lighting due to blemishes is absent. With opal lamps, moulded condensers can be perfectly satisfactory, however.

The condenser should be large enough fully to cover the negative. As a rule, a condenser about 2¼in. in diameter is suitable for 35 mm.

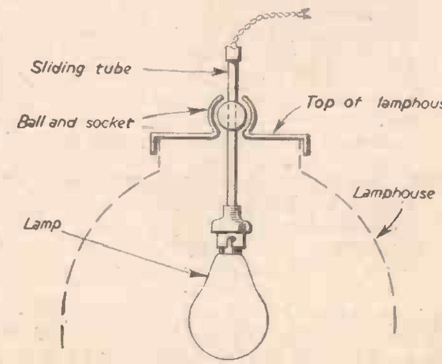


Fig. 3.—Adjustable lamp fitment,

and other small negatives. For 2¼in. square negatives, 3¾in. diameter condensers are usual, with 4½in. diameter condensers for 2¼in. by 3¼in. negatives. Where two condensers are used, a simple metal ring or other mount holds them with their curved sides adjacent, as illustrated.

Point Light Sources

These are generally encountered when using low-voltage lamps, either worked from a transformer, or from an accumulator because mains are not available. With accumulator operation the bulb will usually be rated at 36 to 60 watts. These ratings cannot be much exceeded because of the relatively large current drain. With opal glass and such a lamp, the projected image will be inconveniently dim. Condenser illumination thus becomes almost essential when low-voltage operation is required.

As bulbs of this kind have a small point source of light, wrong spacing between lamp and condensers may result in very uneven illumination. The negative may be brightly illuminated in the centre, with dark edges, or there may be a dark circle of reduced illumination in the centre of the image. To overcome difficulties of this nature, some enlargers have an adjustable lamp similar to that shown in Fig. 3. The lamp may be moved sideways to counteract any inaccuracy in its shape or filament. It may also be moved up and down until its distance from the condenser is suitable for the focal-length of the latter.

Where such a bulb must be used, for the reasons given above, it should certainly be adjustable, so that its position may be found by trial. If possible, such bulbs are best avoided, in the interests of even illumination. With a large, mains-type opal lamp, even illumination can usually be achieved without much difficulty.

The focal-length of the condensers best employed depends upon the focal-length of the enlarger lens, and spacing of components. However, photographic condensers of the diameters mentioned will have suitable focal-lengths for average lenses, and can be used with success. Should illumination prove to be uneven, adjustment of the distance between lamp and condenser will remedy this. The ideal situation is that shown in Fig. 2c, with the lamp brought to focus on the lens, but this is seldom achieved (and must invariably be lost to some extent as the lens is adjusted for focusing).

In addition to the increase in brightness of the image, the use of a condenser slightly increases contrast in the projected image, thus resulting in increased brilliance in the finished enlargement, especially where fine detail is concerned. This is due to the direction of light-rays through the negative, instead of their diffusion, as with opal glass. The improvement in this direction is not, however, a very important one, especially compared with the increased brightness. As a result of the latter, smaller lens apertures can be used.

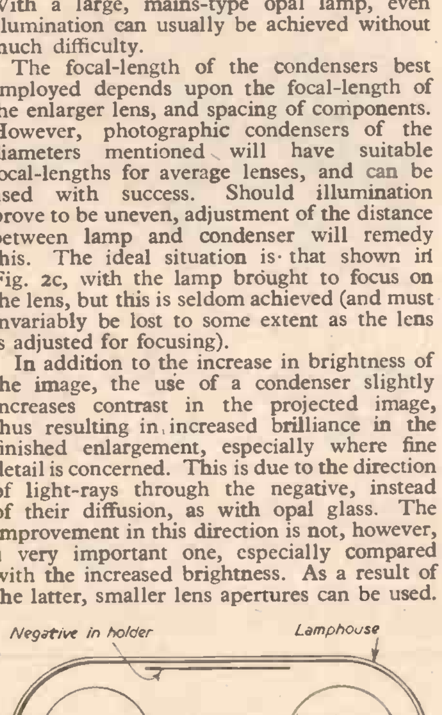


Fig. 4.—Paper negative illumination system.

Errors in the lens, or in focusing or alignment, are thus made less important, giving improved definition, especially with lenses of other than the highest quality.

A further method of illumination is also employed, but is found only in expensive and large commercial enlargers. This is the "cold cathode" system, which uses a kind of flat lighting panel of fluorescent type. Its advantages are lack of heating and even illumination over large areas, such as would be required when dealing with large-sized negatives.

Indirect Illumination

This is used for the cheap type of film in which the emulsion is upon paper instead of celluloid. Such paper negatives cannot be projected by transferred light, and a system such as that shown in Fig. 4 is employed. The lamps require to be of fairly high power—60 to 150 watts each. The lamphouse is so shaped that direct light from them cannot fall upon the lens; or this can be achieved by internal screens or baffles.

It will be seen that this method of illumination is that used in episcope projectors. Ready-made lamphouses of this kind are only available for expensive enlargers, but construction is not particularly difficult. Apart from the use of bromide paper or other paper negatives, such a lamphouse permits the enlarger to be used as a projector, any photograph, picture, or other positive (including printed matter) being thrown upon a screen. A mirror requires to be mounted at 45 deg. below the lens, with the usual type of vertical enlarger, to throw the picture horizontally upon the screen, and to present printed matter the right way round. For brightest results a $f3.5$ or $f4.5$ enlarging lens is required, with powerful lamps. The enlarger may then be used as a projector without difficulty.

Illumination Measurement

Very obvious unevenness in the illumination may be seen with the naked eye, as explained. But

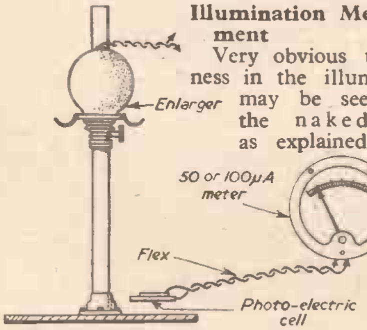


Fig. 5.—Measuring strength and evenness of illumination.

for a more exact determination of strength and evenness of illumination a photo-electric meter is preferable. This may most easily be set up as shown in Fig. 5. The meter should be as sensitive as possible, unless the enlarger gives exceptional illumination. As it need not be calibrated in actual current figures, ex-service movements of various kinds are satisfactory. For a photo-cell of the usual small type (e.g., about 16 by 22 mm.) a 50 or 100 microamp movement is best. If the meter is less sensitive, a larger cell will be required, or the pointer indications will be too small for accurate reading.

The enlarger should be tried set at various heights, the lens being set in such a position as to throw a sharp image on the baseboard, if a negative is inserted. The cell may then be moved about the baseboard, and areas of uneven illumination will then be apparent. Usually, some slight falling off in the strength of illumination, towards the extreme edges of the area, will be found. Even good enlargers may suffer from this defect, which may be emphasised by the use of wrong lamps, condensers, or unsuitable spacing between lamp and condenser. With diffused lighting, even illumination is usually present. If the meter indication at any edge of the area is less than one-half of the reading at the centre of the area, the illumination system should be improved. Variations smaller than this will not in general be visible to the naked eye.

It will in some cases be found that any unevenness of illumination grows less, or disappears, upon stopping down the lens.

With condenser illumination, the strength of the light cast upon the baseboard may not be much decreased when the lens is stopped down. This indicates that spacing between

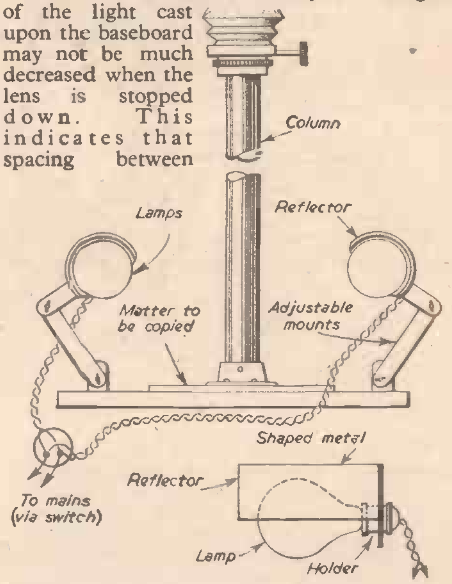


Fig. 6.—Illumination for copying.

lamps and condenser unit is correct, so that nearly all the light is being directed to a focus, and passes through the centre of the lens only. It is for this reason that exposure times do not always require to be increased mathematically, when stopping down, as they would have to be increased with a camera. The illumination will, however, begin to fall with very small apertures ($f8$ to $f16$), however good the condenser system.

It is necessary to make the tests with the enlarger head at different distances from the baseboard, because the angle of the cone of light-rays passing through the lens will change as the distance between lens and negative is modified in focusing.

Enlarger Copying

With two or more lamps to illuminate matter placed on the enlarger baseboard, copying with a high degree of definition is possible, especially with a good enlarging lens. Such an arrangement is shown in Fig. 6, and it may be used to copy old photographs, diagrams, printed matter, drawings, etc.

The lamps should be shielded so that direct light from them cannot fall upon the lens. Two lamps are best to secure even lighting.

A usual method of working is to insert a negative in the negative carrier, switch the baseboard lamps off and focus the image of the negative upon the matter to be copied, the enlarger lamp being switched on. When focus is correct all lamps except the darkroom safelight should be switched off, and the negative upon which the copy is to be made should be inserted in the negative carrier, emulsion side down. If there is any danger of light reaching this negative the carrier should be shielded by a dark cloth. The baseboard lamps are then switched on to make the exposure. The negative is afterwards removed, developed and fixed in the usual way.

With a standard enlarging lens a whole sheet of newspaper-size print may be photographed upon a 2¼in. sq. negative with sufficient sharpness to permit of all print being read with a projector or strong magnifier.

As a guide to exposure black and white matter may be copied with an exposure of eight seconds, two 60-watt lamps being situated about 1ft. 6in. from the baseboard, and a 30 deg. Sch. film being used with an aperture of $f22$.

ROTARY-VALVE STEAM ENGINES

Original Designs for a 3-cylinder Radial Engine and a 4-cylinder V Engine for Air or Steam Operation

By A. H. TOMS

OWING to lack of a lathe and other tools really needed for the satisfactory making of model steam engines having piston or slide valves, all my early ones were based on single or double acting oscillating cylinders.

Fig. 3.—The three-cylinder radial engine.

The next stage was to construct a single-cylinder double-acting engine employing a piston valve of my own design which was made from a simple cylindrical rod, with flats filed on it, passing through a hole in a brass block, holes at right angles in the block serving as inlet and exhaust ports.

While making this piston valve it occurred to me that if, instead of making it to oscillate to and fro, I could redesign the arrangement of flats on it so that inlet and exhaust could be effected by rotation of the rod, then I might be able to dispense with a valve altogether and achieve the same result by filing the flats on the engine crank shaft and converting an elongated bearing into the equivalent of the valve chamber.

This I succeeded in doing as shown in Fig. 1, which represents one cylinder only of the roughly assembled three-cylinder radial engine which I made and is illustrated in the photographs Figs. 2 and 3.

It will be seen that two flats have been filed on the shaft so that, as it rotates in the brass bearing sleeve, the port linked by a tube with the cylinder head is connected alternately with the inlet or exhaust chambers which surround their corresponding rings of holes passing through the bearing sleeve.

This design may not be original, but without searching the Patent Office files to check up, I have not found its replica.

The design is extremely simple in conception and needs high accuracy in fabrication in two things only, namely that the shaft should be a first class fit in its bearing and the flats should be formed accurately on it so that the width of shaft left between them is just sufficient, when opposite the cylinder port, to cover it completely and thus prevent steam from passing directly to exhaust from the inlet without doing useful work in the cylinder.

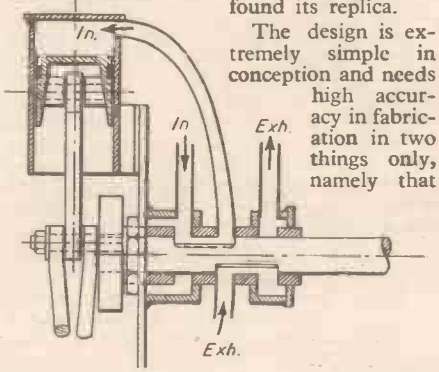


Fig. 1.—One cylinder of the three-cylinder radial engine.

There is, of course, no means of varying the "valve setting" when once the flats on the shaft have been filed and the crank and sleeve bearing have been assembled.

How Many Cylinders ?

It will be seen at once that, theoretically, any number of cylinders can be operated off this one rotary valve. In practice the number is limited by the constructional problems of getting their inlet pipes and ports spaced round the bearing sleeve, and also of accommodating all the connecting rods on the one crank pin. The latter problem could, no doubt, be overcome, if for any reason it was desired to use a large number of cylinders, by employing one master connecting rod, as is done in aero engine practice. The bigger difficulties, in trying to use more than three or four cylinders radially, are those of accommodating reasonable sized ports round the periphery of a shaft whose diameter is not too large in relation to the crank pin circle. The three-cylinder model illustrated has shown that marked strangling of the steam in the ports and friction in the rather long and narrow pipes to them from the cylinders causes a large drop in torque as the speed rises. At slow speeds the engine is more free running than any of my others.

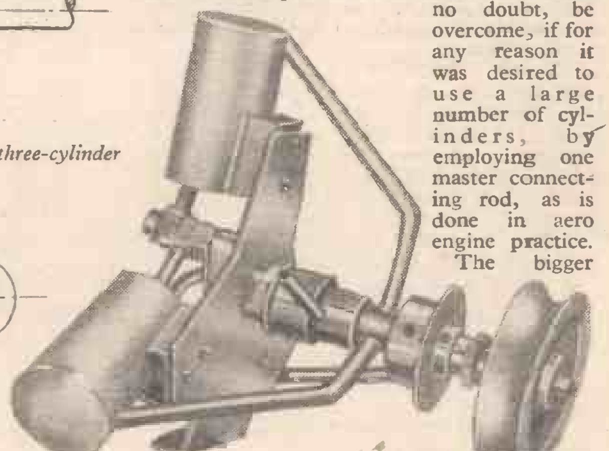
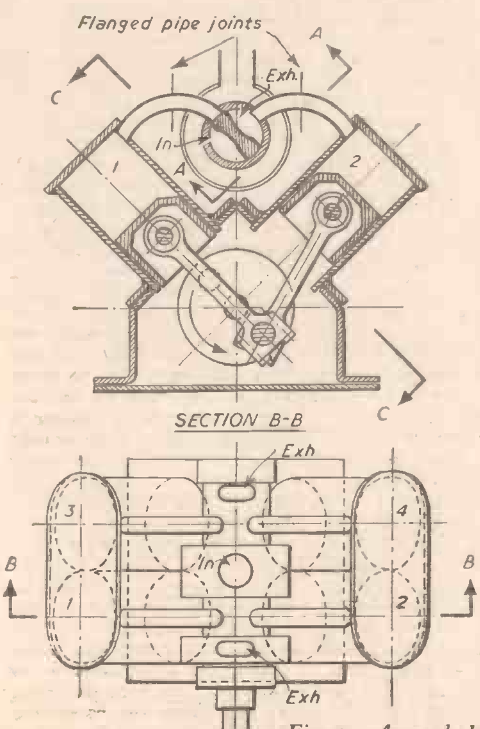


Fig. 2.—The three-cylinder radial engine.

For the above-mentioned reasons, I turned my attention to the problems of design of a more compact and efficient engine.

A Suggested Design

Fig. 4 is a rough design prepared for a four-cylinder V engine in which the valve diameter could be as large as the compromise between friction and port area would permit, and with interconnecting pipes which would be very much shorter. The valve would have to be driven by simple gearing at the same speed and in the same sense as the crankshaft. No model has yet been made.



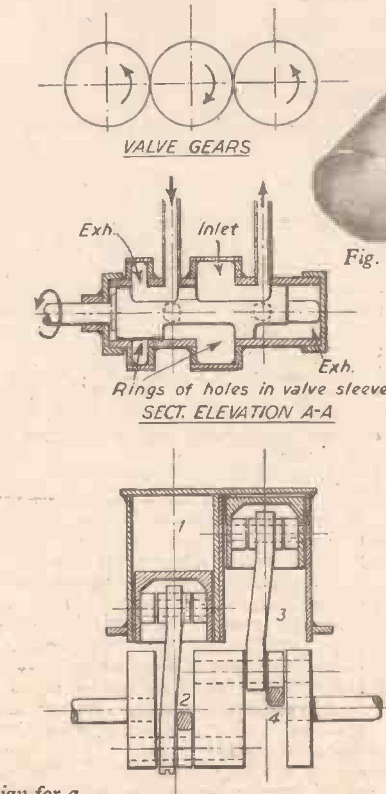


Fig. 4.—A rough design for a four-cylinder V engine.

Making A THREE FOOT MODEL

Full Constructional Details of a 36in. Class Model Suitable for Racing

By E. W. TW

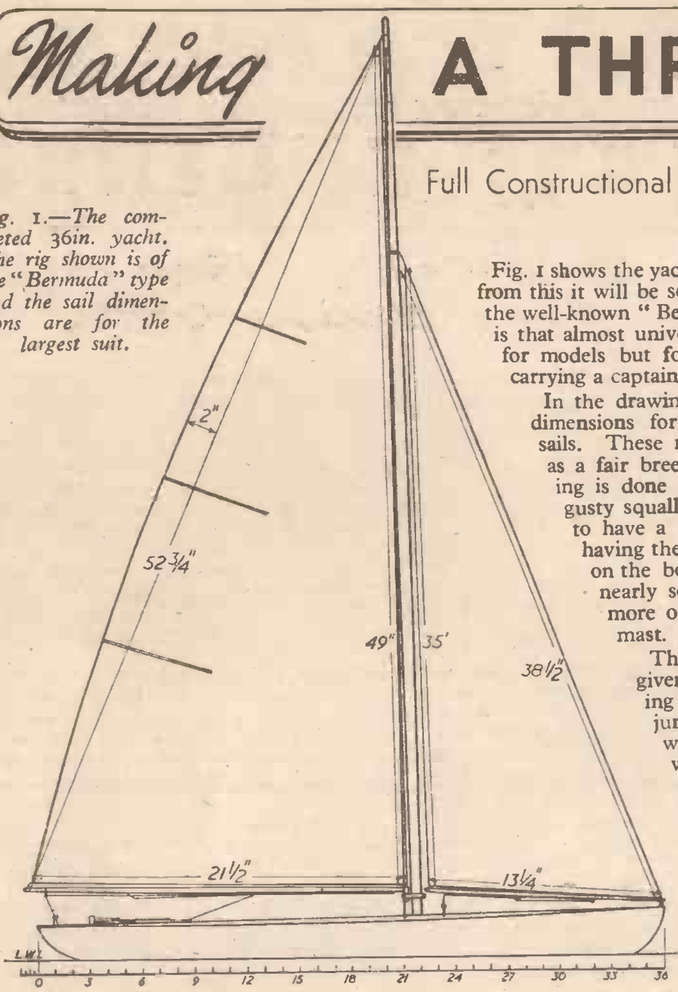


Fig. 1.—The completed 36in. yacht. The rig shown is of the "Bermuda" type and the sail dimensions are for the largest suit.

THE model is of the smallest class recognised for entering for races by the Model Yachting Association, which is the British National Authority on what has become a very popular sport. There are five sizes of yacht adopted as standard and most of these are very much restricted as regards every dimension. So much so that in each class all yachts are much alike and the winning of a race depends largely on the skill of the person sailing her. The five classes are :—

The A class, length overall 74in. to 80in. Weight 45lb. to 56lb.

The 10 Rater, length overall 60in. to 72in. Weight 23lb. to 32lb.

The 6 Metre, length overall 56in. to 60in. Weight 22lb. to 30lb.

The M Class, length overall 50in. Weight 16lb. to 23lb.

The 36in., length overall 36in. Weight 12lb.

Not every model yacht club caters for all five of these classes. Some do not include the 36in., but it is popular with clubs whose regattas are held on inland lakes and small ponds. Furthermore, its lightness is a great consideration when carrying. Although it is one of the restricted classes the ruling only controls the limits for the hull dimensions and weight. These limits are : Extreme length overall 36in. Beam, maximum, 9in. Depth, maximum, 11in. Weight, everything on, 12lb.

There is no restriction on height of mast nor on sail area, so provided it is possible to keep down the weight in the hull and spars that saving can be added to the keel and so enable more sail area to be carried, but it must be remembered that the weight of sails and fittings are all included in the 12lb.

Fig. 1 shows the yacht in sheer elevation; from this it will be seen that the rig is of the well-known "Bermuda" type, which is that almost universally used not only for models but for quite large yachts carrying a captain and crew.

In the drawing I have given the dimensions for the largest suit of sails. These may be looked upon as a fair breeze type. If any sailing is done in high winds with gusty squalls it would be as well to have a second smaller suit, having the same spread, or less, on the booms but not being nearly so tall and making a more obtuse angle with the mast.

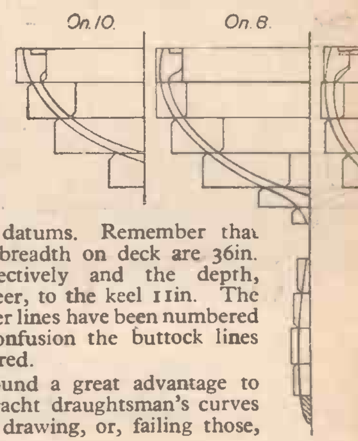
The lines of the hull are given in Fig. 2 and reading this drawing in conjunction with Fig. 3 it will be seen that all water lines are the glued joints between the planks, of which the hull is built in the bread - and - butter fashion, the planks being 1in. thick. The buttock lines are also 1in. apart though these are only drawn lines and not joins. The stations for the body lines, the shapes of which appear only in the end views, are spaced at 3in. intervals through the length of the hull.

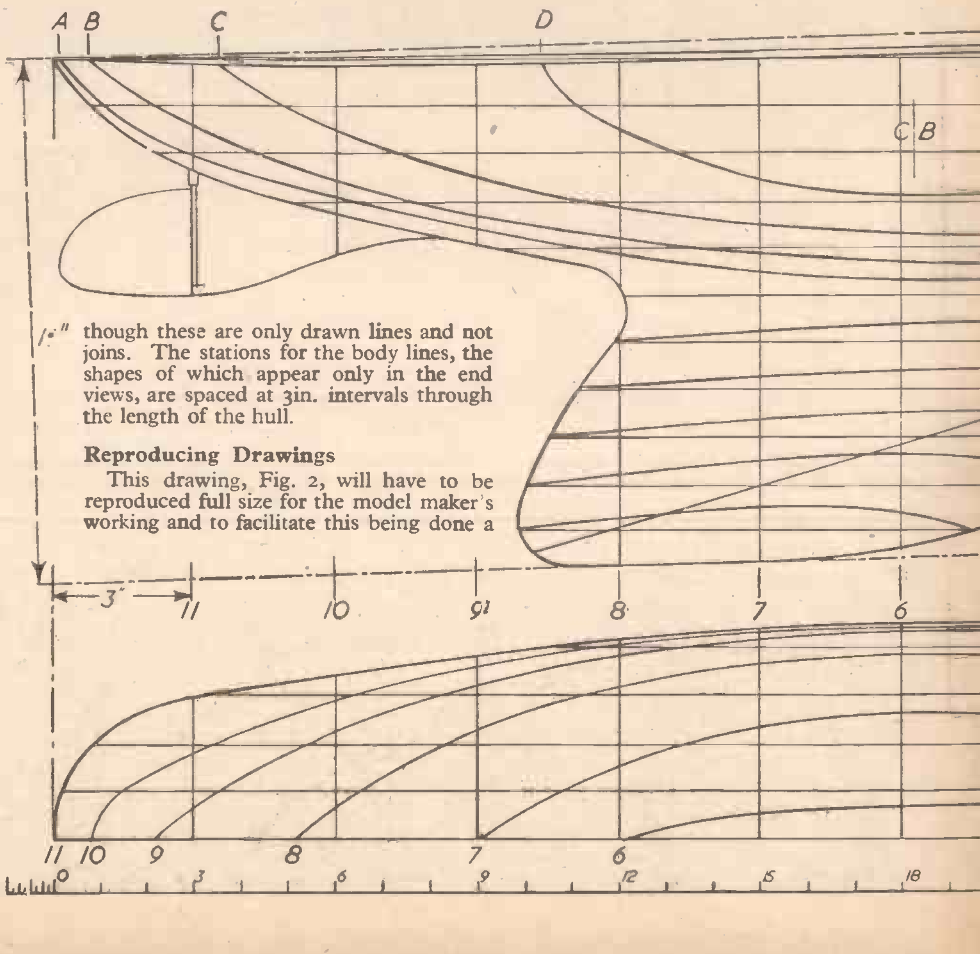
Reproducing Drawings

This drawing, Fig. 2, will have to be reproduced full size for the model maker's working and to facilitate this being done a scale of inches has been added. It must be made full size because tracings will have to be made from it for all the water lines for transferring the inside and outside outlines of each water line to the wooden planks. A double-elephant size drawing board and the same size sheet of cartridge paper will therefore be required.

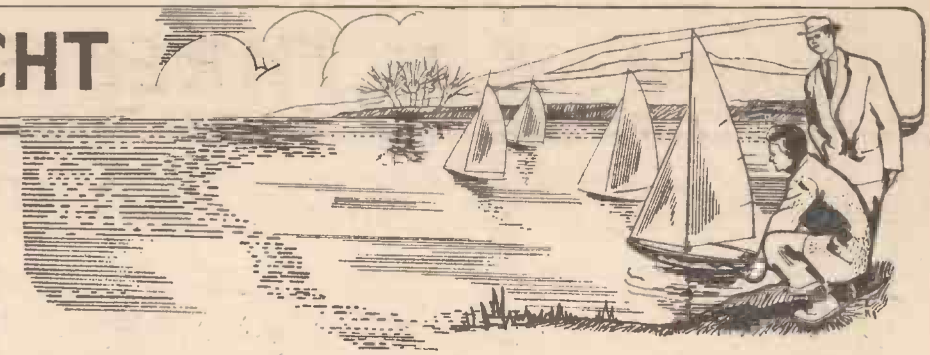
The body plan need not be drawn where I have placed it, there will not be sufficient room on the paper—it can be placed below the buttock lines or between the sheer and the buttock plans at one end. First draw the load water line (L.W.L.) and the centre line of the body plan and construct all the other lines from these as datums. Remember that the length and breadth on deck are 36in. and 9in. respectively and the depth, ignoring the sheer, to the keel 11in. The stations and water lines have been numbered and to avoid confusion the buttock lines have been lettered.

It will be found a great advantage to obtain a set of yacht draughtsman's curves in making this drawing, or, failing those,





SAILING YACHT



Jnder Model Yachting Association Rules

INING

splines of thin flexible wood may be used. Adjustable curves may be tried but I have found them of very little use; they do not give, however you manipulate them, exactly the sweeping, free-from-kinks curve that is necessary.

Selecting the Timber

Having completed the drawing the next thing will be to select the timber. If you can get it buy first quality yellow pine: it must be prime, well-seasoned wood free from shakes

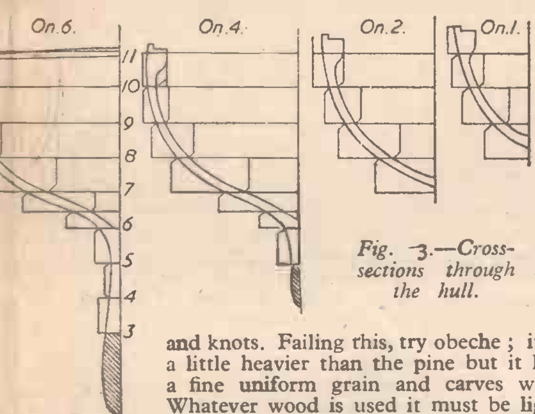


Fig. 3.—Cross-sections through the hull.

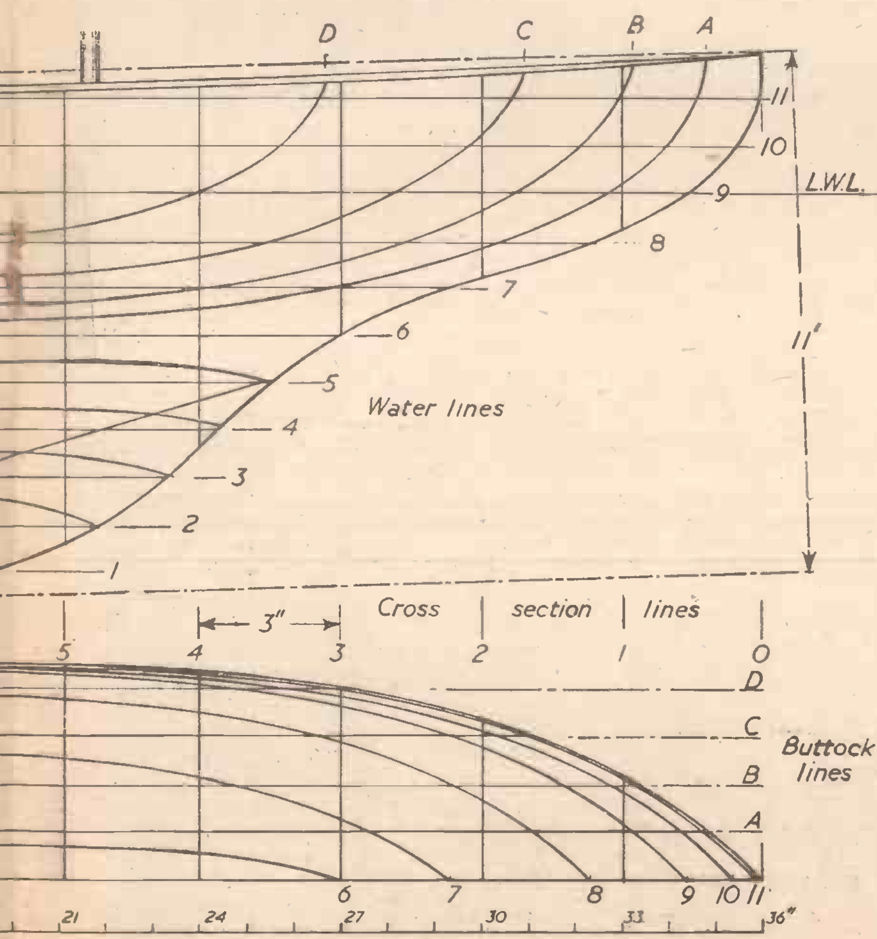
and knots. Failing this, try obeche; it is a little heavier than the pine but it has a fine uniform grain and carves well. Whatever wood is used it must be light in weight and fulfil all the conditions named. Have all the planks cut, thicknessed and surface planed so that they are all, except two, a uniform thickness of exactly 1in. Any discrepancy will result either in the model being above its regulation depth or it will have a smaller displacement.

Marking and Cutting the Planks

Next make the tracings for all the water lines, but it is recommended that, in addition to these, a full size copy by made of Fig. 3, with all the cross-sections at every station drawn in. Six stations only are shown, but it would be as well to draw all the other four, Nos. 3, 5, 7 and 11, then you will have the widths of wood which are to be left for carving and these widths can be added to each tracing and plank. The object of the tracings is to enable the outlines to be transferred, by means of carbon paper, to each plank. Four lines will be drawn on each tracing, two inner lines representing the carving lines and outer the sawing lines. Each plank must have drawn upon it a centre line and this must, by means of a square applied at each end, be repeated on the other side, so that you have centre lines on both sides of every plank. Each tracing must, of course, bear a centre line.

Lay a tracing on a plank. Suppose we are dealing with the plank between water lines 7 and 8 the tracing No. 8 is laid with its centre line coinciding exactly with that on the plank; lay carbon transfer paper—typewriter carbon will do—between the wood and the tracing and transfer the four lines; then turn the plank over and from tracing No. 7 transfer four lines. Now if you could see the wood in cross-section it would be clear that the two inner lines of each four provide for carving the thickness of the hull and the outer lines, the bottom in one case and the top in the other are the sawing lines.

The amount of wood which is to be left for the thickness of this hull is not large because the yacht must be light and buoyant and weight must be concentrated in the lead keel. The thickness must not be more than a full 3/16in. or 7/32in. at the most; consequently it is not safe to saw-cut right up to the finished outline either inside or outside, hence the reason for drawing and transferring four lines. For sawing, a fine-toothed jig saw is the best. Such a saw will have a flat table so that the cut automatically comes square with the plank. A power fretsaw will have the same and can be used if the gap clearance is deep enough. Failing either of these, a fine hacksaw will suffice, but care must be taken to keep it square with the plank all the way around the cut. Having completed the cuts in a plank both inside and out, take a paring chisel and put a chamfer on the cuts on both sides, letting the chamfers come up to the inner lines. When the hull is glued up it will be to the limits of these chamfers that the carving will be carried. Obviously, after glueing the transferred lines will not be visible and their places will be taken by the chamfers, therefore, the chamfers should be deep and make an angle of at least 45 deg. On all the planks station lines 1 to 11 should be drawn to ensure a check on the gluing up. These station lines should register on all the planks when they are assembled.



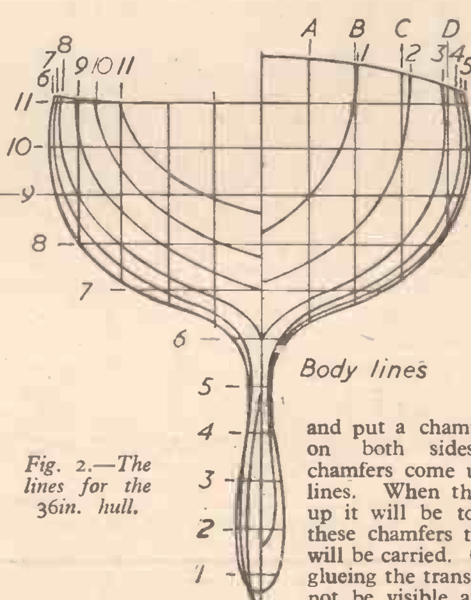


Fig. 2.—The lines for the 36in. hull.

It will be noticed that in Fig. 3, between water lines 6 and 7, are shown two planks of half the thickness of all the others. These ½in. planks are introduced to avoid the large amounts of wood which would have to be hand-carved away were one 1in. plank used. Particularly on the inside would this amount be difficult and awkward to deal with, the difficulty being chiefly in gauging the thickness of material to be left. Of course it would be possible to use ½in. planks throughout, but although this would reduce the amount of carving somewhat it would entail twice the amount of tracing, transferring and sawing.

Gluing up the Hull

This is the next operation and for it a cold glue is to be preferred, such as Casein. Although it is not quite impervious to moisture

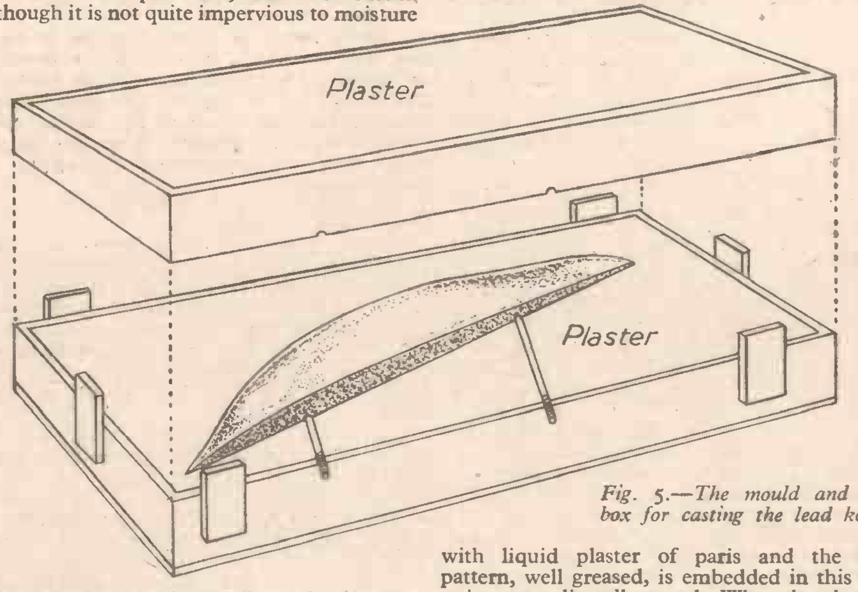


Fig. 5.—The mould and its box for casting the lead keel.

it is much more so than ordinary Scotch glue and far stronger.

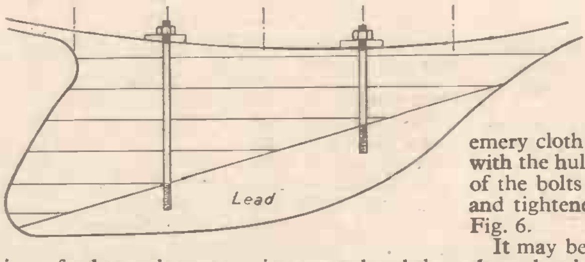
The work of gluing should be done in stages, one plank being added at a time and ample time allowed for drying, according to the time of year and the amount of humidity in the atmosphere; anything from 12 to 24 hours may be required for each joint. Cramps will be required to be applied and these will each have to be formed by two pieces of hardwood having round-headed black bolts, fitted with butterfly nuts, passing through them. Fig. 4 shows the method of applying them to the hull under construction. When the uppermost planks are being glued at least five clamps will be needed, so it would be as well to make five or more so as to distribute the pressure as evenly as possible all over the joint being glued. Gluing should be commenced at the top of the keel, working upward. In Fig. 4 joints A, A and A have been made and are dried. B is the last joint made and this is drying. C, C are packing pieces to put the pressure of the clamp directly on the wet joint.

When all the planks, now open rings, are glued up, including the topmost piece of the keel, the carving can be commenced. As the hull will ultimately be so thin, I think it will be best to work on the inside first and remove the wood which involves the heaviest cutting; then work in the same way on the outside; do this alternately until only the finest paring is needed to bring the model to its final shape. Everywhere the cutting with paring chisels and gauges will be carried on until the chamfers have just, and only just, disappeared. For the shaping of the outside it would be advisable to make gauges of thick cardboard or thin plywood from the body plan, one gauge for each of the stations 1 to 11 and finish with the chisel and glasspaper to these.

Casting the Lead Keel

The fin keel is cut, glued up and carved separately and should be made in full, including the part which will later be of lead. A depth equal to the thickness of the saw-cut must be added where I have drawn a diagonal line across the keel in the sheer plan Fig. 2. When the shaping of the fin is finished make this saw-cut and plane both surfaces dead square with the vertical centre line. The portion which has been cut off will be shellac-varnished and used as a pattern for casting the lead. To enable this to be done a wooden box must be made, sawn through the centre longitudinally and have small pieces of board added to the lower half at the sides and ends to enable the two portions to register again, see Fig. 5.

The bottom half of the box is then filled with liquid plaster of paris and the fin pattern, well greased, is embedded in this up to its centre line all around. When the plaster



is perfectly set the pattern is removed and the mould very thoroughly dried. The surface of the plaster is then given a coat of thin shellac, the pattern is replaced and the top half of the box put on. Now fill this top half with liquid plaster and, when set, lift it, remove the pattern and dry as before.

You now have a mould but in this provision must be made for securing the lead to the hull. The fastening may be done with two brass rods having a diameter of 5/32in. screwed at each end. These are to be laid in the mould, channels being cut in the plaster for them to lie in, and the lead poured around the threads. A few fine vents will have to be cut radiating from the pattern for the escape of air and also a pouring hole or runner for the lead. The temperature of the molten lead should not be too high and, before pouring, any dross which may have formed should be skimmed off or prevented, by means of a gate, from entering the mould. Sufficient lead should be melted to enable pouring to be continuous until the mould is full. Figs. 5 and 6 show respectively the mould with the casting in the lower box and the assembly of the lead keel, the bolts and the hull.

Very little filing of the lead will be needed: the runner must be sawn off, the part from which it has been removed finished to shape and the vents trimmed away; the rest of the finishing of the casting should be done with

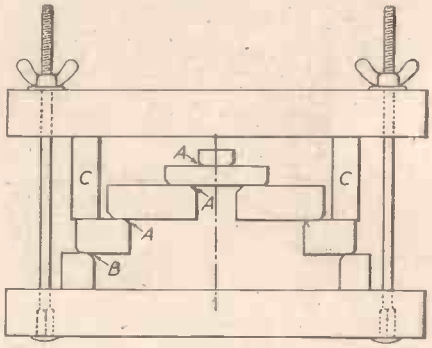


Fig. 4 (Above).—Method of clamping the glued joints. Fig. 6 (Left).—The attachment of the lead keel to the hull.

emery cloth or glasspaper. The fin can, along with the hull, now be drilled to suit the angle of the bolts and the fin can then be glued on and tightened up by nuts on the bolts as in Fig. 6.

It may be noticed that in Fig. 5 the runner through which the molten lead is poured is not shown. It does not matter very much where this is placed, but really the best position for getting a sharply defined casting will be at one end, holding the box vertically when pouring. The runner could be put on the flat top between the bolts and this would be most convenient for sawing off, but there is the chance that the metal would not flow perfectly to the extreme ends. Of course the runner must be cut through the box and the plaster; it should be circular with a diameter of about ½in.

(To be concluded)

Lectures by Sir Frank Whittle

THE first of his series of Christmas juvenile lectures was delivered at the Royal Institution, on December 28th, by the famous pioneer in jet propulsion, Sir Frank Whittle, K.B.E. The theme of the six lectures is "The Story of Petroleum."

The picture shows an inspection of one of the working models prior to the lecture. Left to right: Sir Frank Whittle, Mr. Stanley Robson, Secretary of the Royal Institution, and Lord Brabazon of Tara.

THE CAMERA OBSCURA

Its Operation and Uses. Details of the Camera Lucida

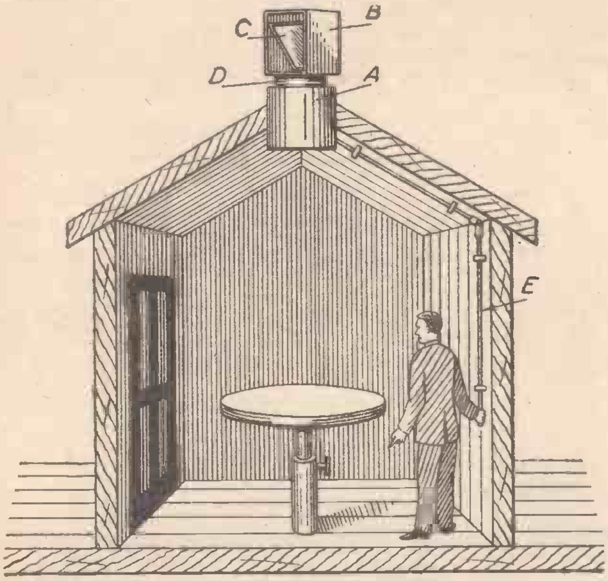


Fig. 1.— The interior of a camera obscura.

ACCORDING to one or two authorities this interesting and useful contrivance was invented as long ago as 1589 by Baptista Porta.

A century ago the camera obscura appears to have been a popular form of entertainment, the apparatus being erected in various parts of the country on suitably elevated spots in the grounds of well-to-do individuals. In later years the instrument was chiefly used for purposes of amusement at seaside resorts and other places.

Fig. 1 gives details of the interior of a camera obscura. A darkened room is used for the purpose, no windows being provided, because when the apparatus is shown at work the only light that should be allowed to enter the room is that which passes through the lens seen in Fig. 2. This lens, which is a double convex one of about 6 or 8ft. focus and 5in. in diameter, is mounted in a round cell, A, fixed in the roof of the chamber or room.

Adjustable Mirror

Immediately above the lens cell is arranged a square box, B, with the bottom and one side open, in which is placed a mirror, C, mounted on a pivot bearing at each side, so that it can be turned at different angles. The box B, usually about 6in. to 8in. square, has a circular projecting part, D, fitted to the bottom to allow it to turn round within the upper part of the cell, A.

By an arrangement of rods, E, which are connected to the bottom of the circular part, D, by means of suitable gearing, the operator in the room can turn the box, B, so that the mirror can face in any direction.

On the floor of the room, directly below the lens, is arranged a table with a circular top, about 3ft. in diameter, the centre leg of which is made telescopic, so that the height can be carefully adjusted to suit the focus of the lens. The top of the table is smooth and white, and in order to correct the indistinct images formed near the edges owing to the spherical aberration of the lens, it is usual to make the surface of the table top slightly concave.

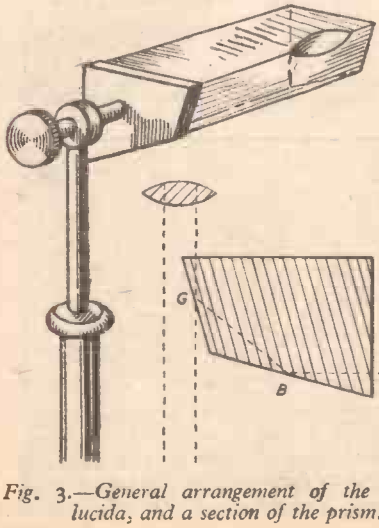


Fig. 3.—General arrangement of the camera lucida, and a section of the prism.

Operation

The action of the apparatus is as follows: rays of light from distant objects facing the mirror are reflected downwards, as depicted in Fig. 2, through the lens, which projects the rays on to the surface of the table. Images of the objects reflected are thus formed in their natural colours on the white surface of the table top, and the effect is much the same as if one were looking at the focusing screen of a large camera, the screen in this case being circular instead of rectangular. By means of the rod, E, the operator can turn the box, B, completely round, as before mentioned, so that objects in the near vicinity, in any direction, may be viewed according to which way the mirror faces. The mirror, being arranged on a pivot, can be turned at different angles from the horizontal for reflecting objects at varying distances from it. The greater the angle, the farther off will be the objects reflected.

Another use to which the camera obscura is sometimes put is for sketching purposes out-of-doors. A form of tent of opaque material is erected, in the top of which the lens fitting is mounted, and below this is arranged a small table carrying a sheet of white paper. The artist has simply to turn the mirror to reflect the required object on to the paper and then trace the image with a pencil.

The Periscope

It is interesting to note that the modern development of the camera obscura is found in the periscope used in the trenches, and in the submarine. The same principle is also used in the ordinary camera. When viewing the subject to be photographed on the ground glass screen of a camera, the instrument virtually becomes a miniature camera obscura. The same principle is applied when using the small viewfinder attached to a pocket camera.

The Camera Lucida

Another instrument sometimes used to facilitate the sketching of objects from nature is known as the camera lucida. It relies for its action on the property of total reflection of a particular form of prism, a section of which is given in Fig. 3. A common form of instrument, introduced by Dr. W. H. Wollaston in 1807, is also shown in the sketch.

The prism used has four angles, one of which is 90 deg., the opposite one 135 deg. and the other two each 67 deg. 30 sec. One of the two faces which contain the right-angle is turned towards the objects to be sketched. Rays of light falling normally on this face, as from A, are totally reflected at B, to the next face at C, whence they are again totally reflected to emerge normally at right-angles to the fourth face, as indicated in Fig. 3. If an eye is placed above the corner of the prism so as to receive the reflected rays, the observer will see the reflected image projected on a sheet of paper arranged below the prism for this purpose. The image can then be traced with pen or pencil.

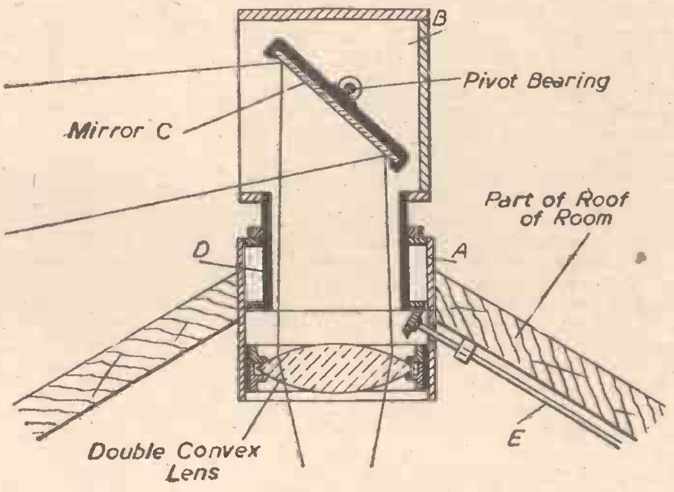


Fig. 2.—Section through the lens and reflecting mirror.

For convenience of drawing the paper is usually fixed at a distance of about 1ft. from the prism, a small concave lens, having a focal length slightly less than 1ft., is fixed above the corner of the prism when drawing distant objects. By raising or lowering the prism on its stand (Fig. 3), the image to be sketched can be focused clearly on to the surface of the paper.

The prism is mounted so that it can be adjusted vertically or rotated in a horizontal direction, and the prism is usually covered with a movable blackened metal casing, having a suitable aperture near one end for the observer to look through.

Television Film Recording

General view of one of the 35 mm. suppressed frame television recording assemblies showing part of the picture display tube and the monitoring oscilloscope. In front of the main display tube can be seen the pistol grip photometer used for measuring the screen brightness of the display tube. See final paragraph.

The Solving of the Problems Involved in Recording TV and Present-day Methods

By PERCIVAL J. GUY, Assoc.I.E.E.

ON the subject of television film recording, it is often true to say that *it is all done by mirrors* !

Many difficulties had to be overcome before the picture part of the television signal could be successfully recorded and the story of the problems involved and the ingenious ways in which these have been solved is both interesting and instructive. It is not generally realised how important a part recording plays in maintaining the television programme. One vital purpose is to enable a given programme to be repeated without tying up valuable studio space that could otherwise be more usefully employed for rehearsals. Another is to enable topical events to be re-televised at peak viewing hours.

Both these uses are fairly obvious, but recording has other important functions to perform—one of the most intriguing being for film inserts in live dramatic performances. If, for instance, an actor appears in one scene in outdoor clothes and a second later has to be shown in pyjamas in bed, one scene or the other must be pre-recorded.

Before the difficulties that were encountered in making a television film can be appreciated, the way an ordinary motion picture is made must be understood.

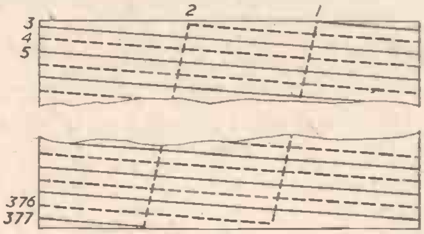


Fig. 2.—Method of interlacing ; showing path of flying spot. Line fly-back lines are not shown.

Standard Film Technique

If a strip of cinematograph film is looked at it will be seen to be made up of a series of still photographs or transparencies, each separated from the next by a black bar. If the photographs are of a moving scene, the moving objects are in a slightly different position in each succeeding picture (Fig. 1). Down the side of the picture strip a continuous track records the accompanying sound.

Fig. 1.—A strip of commercial 35 mm. cinema film, showing sound track at side.

The sensitised film negative is exposed in a special camera that unrolls the film in jerks. Each picture-sized strip of film is brought into position before the shutter and held there for the short time in which the film is exposed. Then the shutter closes and the next piece of film is pulled into position ready for exposure. The normal picture repetition rate is 24 film frames per second, so that the total time available to pull down the film and expose each picture is 1/24 second. About half this time (1/48 sec.) is required to pull down the film and register it in position ; this leaves the balance of 1/48 sec. for the film to be exposed. As the sound track is a continuous one, the film motion has to be smoothed out before the film reaches the " sound gate "—the position in the camera in which the sound is recorded.

When a sound passes through the air, variations in pressure in the atmosphere are produced along the path of the sound. These variations in pressure cause the diaphragm of the microphone to vibrate. The vibrations of the diaphragm cause electric currents to be generated varying in amplitude and frequency with the sound pressures.

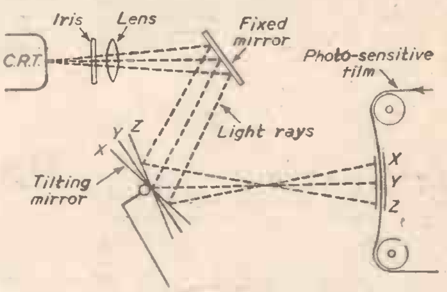


Fig. 3.—A simplified picture showing the arrangement of fixed and tilting mirrors in the Mechau camera.

These varying currents are recorded by one of two methods :

In the first, they are used to control the brightness of a glow lamp—the film, as it passes by, being exposed to the varying light of the lamp. This produces a track of varying transparency. In the second method, the varying currents control the movement of a shutter between an " exciter " lamp and the film. This produces a sound track of varying area. Both kinds of track are, on reproduction, passed between a narrow beam of light and a photo-electric cell—a kind of electric eye finely sensitive to changes in strength or quantity of light. The output of the photo-electric cell is a current which varies with the changes in light falling upon the cell. This current is amplified and passed to the loudspeaker which thereupon reproduces a good copy.

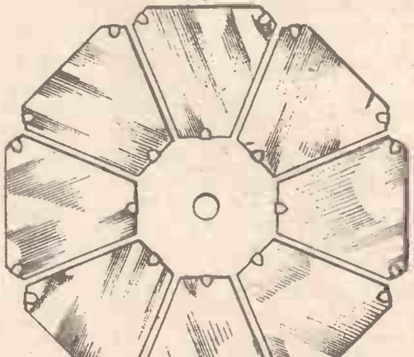


Fig. 4.—Camera mirror arrangement.

(*Continued on page* 263)

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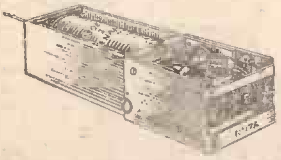

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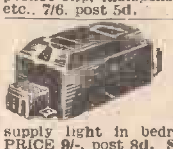

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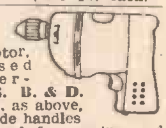

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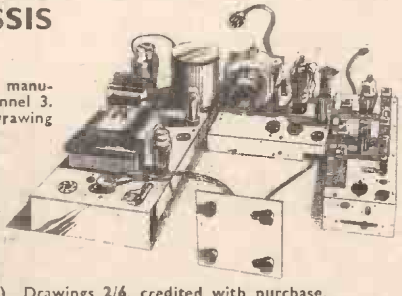

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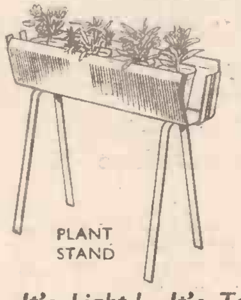

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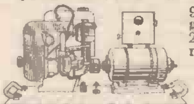

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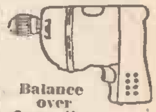

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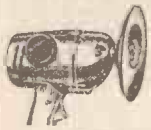

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Television Filming

When the filming of television pictures was first attempted, difficulties were encountered because the standard television picture repetition rate is different from that in the cine-camera.

In a television receiver the picture is formed by a moving ray of varying strength which scans the fluorescent coating of the screen of the cathode ray tube, causing the screen to glow more or less brightly according to the strength of the ray at each instant as it strikes the screen, the brightness at each spot depending upon the light intensity at each corresponding spot in the original scene. The ray moves across the screen from left to right in straight lines, flying back to the left on the completion of each line. The ray then moves across again but this time a fraction lower down the screen. In this way the whole screen is explored. In the BBC system the ray moves down two lines distance each time until it comes to the bottom of the screen, then it pops up to the top and starts to re-scan the screen along the lines it missed the first time—this is called interlaced scanning (see Fig. 2). It takes about 1/50 sec. to do the "odd" lines and the same time to do the "even" ones. Though the picture repetition rate is nominally 25 per second, it will be realised

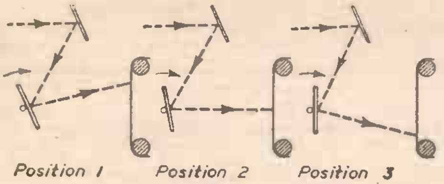


Fig. 5.—The mode of tilt to offset downward movement of film.

that each complete picture is actually made up of two separate scans each lasting 1/50 of a second.

So instead of 24 frames per second as in the case of standard 35mm. film, there are 50, each frame being separated from the next by 1.4 thousandths of a second. The shortness of the time between frames is the cause of the difficulty. Even if machinery could be devised to accelerate a film sufficiently fast to pull it down one picture space in so short a time as 1.4 milli-seconds, the strength of the film would be insufficient to prevent it tearing at the sprocket holes and in any case a non-standard film (with 50 pictures a second instead of 24) would be produced.

The first moderately successful solution was to use 1/50 of a second to pull the film down and to expose it during the next 1/50 sec. In this way, providing the film camera motor was carefully made to run in synchronism

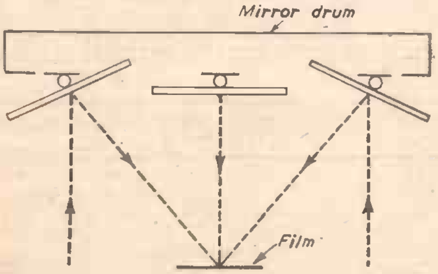
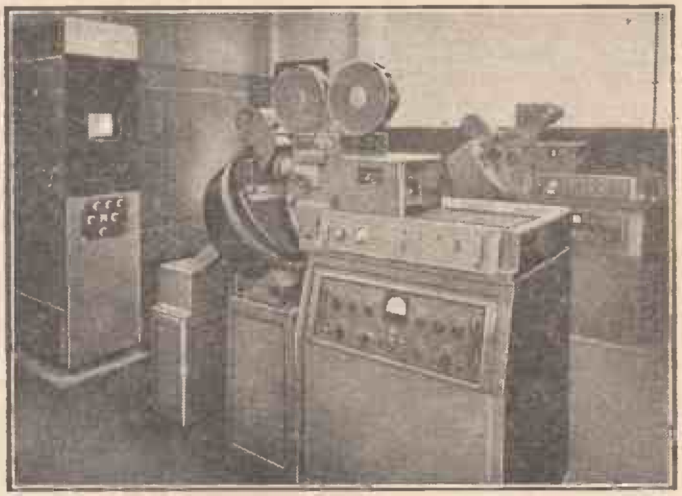


Fig. 6.—The mode of tilt to offset rotational movement of mirror drum.

with the television picture, a film with 25 frames a second resulted. (The slight difference in running rate (4 per cent.), being within the usual tolerance of cinema projectors.) But by this system only half the full television image information could be recorded, because during the exposure period of 1/50 sec. the film was exposed to only half the total number of television lines, i.e., one "odd" line scan or one "even" line scan. In the nominal 405 line system used in this country each television picture is made up of two interlaced sets of lines each consisting of 188½ lines—the complete interlaced picture therefore having 377 lines. The balance of 28 lines time has to be used for television frame pulses—the pulses which tell the scanning ray to go back and commence another scan. In this early system—exposure period 1/50 sec.—the film was exposed to only 188½ lines and, because the other normally interlaced 188½ lines were missing, the reproduced picture showed a clear line structure. Moreover, because of film judder, etc., there was severe moire patterning at times.

The next method suggested was better, but too costly. Briefly the film was exposed during a complete odd and even line scan period of 1/25 sec. and then pulled down and registered during the next 1/50 sec.

This produced a 377-line film picture, but the repetition rate was only 16⅔ pictures



General view of one of the 35 mm. inverted Mechau continuous motion telerecording assemblies installed at Lime Grove Studios. The picture display unit is on the left and behind it are the vision amplifier and supply cabinets.

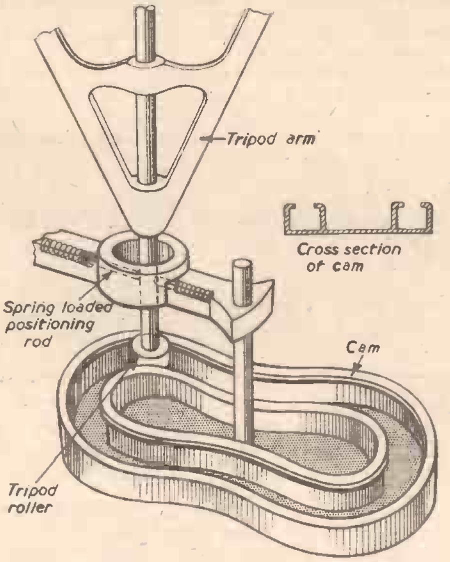


Fig. 7a.—The tripod roller in the kidney-shaped cam. The spring loading enables the centre pole of tripod to float around the hole in the main casting—its position being decided by the position of the roller in the cam.

per second and in order to get 25 film frames per second, "step printing" (each second film negative frame being twice printed when the positive was made) was resorted to. This pushed up the cost, which was still further increased because the sound track had to be re-recorded (25 film frames a second resulting in a longer film than the original 16⅔ frames/sec. film as recorded).

In 1948 a better solution was thought of, and as that is a method still employed I shall describe it in some detail.

The "Mechau" System

In Germany, before the war, many cinemas used a most ingenious form of film projector, designed to cut out flicker. In this projector, called the "Mechau," the film was unrolled at a continuous rate (not in the usual jerks), and the light image of each film picture was kept in a constant position on the screen by a system of tilting mirrors. After 1/25 sec. the image was faded out, but just before this happened another image from the next film frame was faded in by means of another tilting mirror. In this way the screen remained lighted continuously to the full extent and flicker was greatly minimised.

An adaptation of this ingenious device was linked up with a cine camera modified to make the film run at a continuous rate.

The light from the flying spot on a television receiver screen was reflected on to the sensitised coating of the moving film negative, and the tilting mirrors were used to keep the spot in the correct relative position with respect to the film, despite the continuous movement of the latter (see Fig. 3).

In this way each film frame of the negative was exposed to a complete 377 line interlaced scan and flicker was avoided.

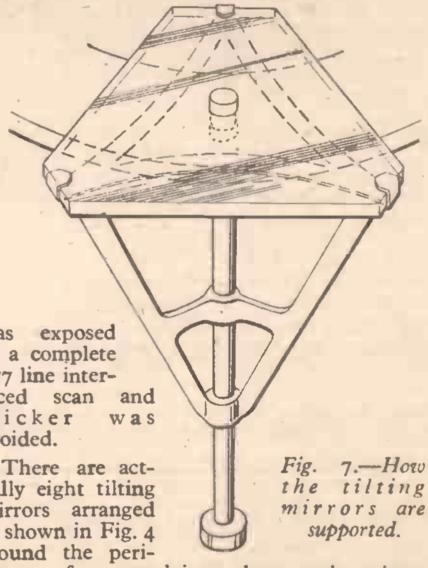


Fig. 7.—How the tilting mirrors are supported.

There are actually eight tilting mirrors arranged as shown in Fig. 4 around the periphery of a revolving plate—each mirror being responsible for one film frame in each sequence of eight. Because the mirrors are rotating with the mirror plate they have to be made to tilt in two different ways—one tipping forward to take care of the downward movement of the film, the other swinging round to take care of the rotation of the plate.

Looking along the side edge of each tilting mirror, the tipping forward movement would be as shown in Fig. 5, and looking down at the top edge the swinging round movement would be seen as shown in Fig. 6. To achieve all this each mirror is pivoted on a ball bearing and held in position by the three arms of an inverted tripod, at the bottom of which is a roller; the method of mounting the mirror is shown in Figs. 7 and 7a. The roller runs round a kidney-shaped rail as the mirror plate rotates and thus imparts the required tilts to the mirror.

The kidney-shaped rails or cams as they are called—one for each mirror tripod—are mounted on a circular plate beneath the mirror drum, as shown in Figs. 8 and 9. It will be seen that the cam plate is eccentric with respect to the mirror drum. When the mirror drum is rotated, the tripod rollers push the cam plate round and in so doing each tripod roller is forced to make a complete excursion of its individual cam once per revolution of the mirror drum. The effect is similar to that which would be obtained if the cams were rotated beneath the tripod—the mirrors tilting first one way and then the other.

Just as mirror number one is fading out

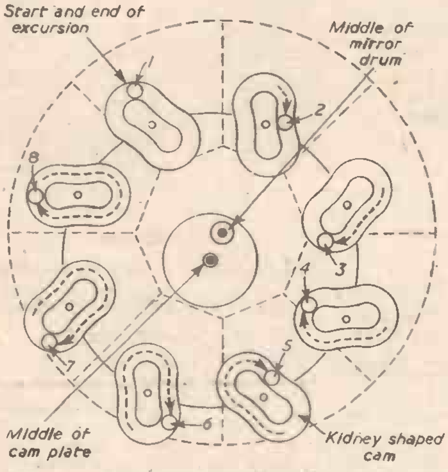


Fig. 8.—The position of the tripod roller at successive instants.

the image of television picture one on the film, mirror number two is beginning to fade in the start of television picture two exactly one film frame's distance above the photograph of number one, so that as the film passes

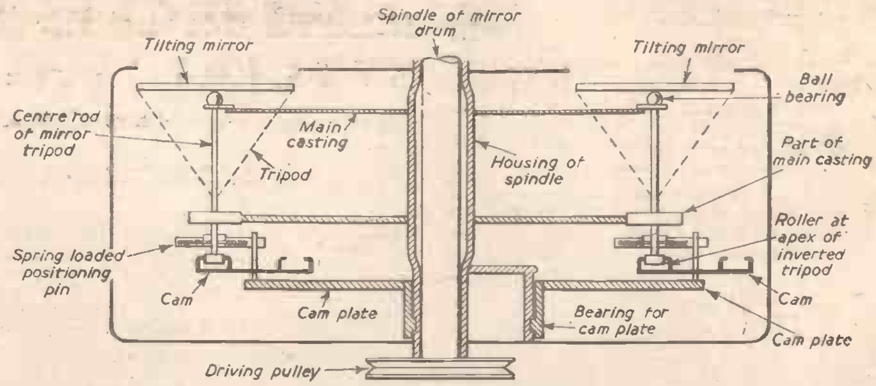


Fig. 9.—The mirror drum.

downwards it is exposed to a series of complete television pictures (each consisting of the full number of lines) each picture being the correct distance apart from the next.

The receiver tubes used are very similar to the normal home receiver, though somewhat brighter. The high lights in the picture are specially over-emphasised to offset certain light losses inseparable from the recording process. Spot-wobbling is used to prevent any line structure being noticeable on the screen. This simply means that the spot instead of flying straight across like this ————, is made to go across like this ~~~~~~, thus effectively decreasing the apparent separation between the lines.

The results obtained are often surprisingly good—the television film at its best being indistinguishable from a normal cine-film. Sometimes results are not so good—it depends a great deal on the sort of television camera being used, and, of course, upon the amount of light on the scene.

It may be wondered why an ordinary cinematograph film could not be made instead. The answer is, of course, that only one camera can view a given object from a given place at a given time, and the cine-film could therefore never be a true copy of a "live" televised show.

Moreover, lighting and make-up suitable for television may not be suitable for cine filming. Cine filming is also a great deal more costly, because a producer must shoot his picture from many angles at once—afterwards editing and discarding unwanted portions, whereas in the television record the editing is done by the producer looking at his preview screens at the time the show is televised.

The Suppressed Frame System

A few months before the Coronation, it was decided to try out a new system. This new "suppressed frame system," as it is called, was really a reversion to the earlier one of having the film in intermittent motion and using a whole frame period to pull down and re-register the film. With improved methods of synchronisaton and with spot wobbling on the monitors, it gives better definition in a horizontal direction than the Mechau Camera. The definition in the vertical direction is reduced, but the results achieved are memorable enough—it was this system, for instance, that was used to make the film flown overseas and used in the Coronation evening newsreel.

Better methods still of making television films will no doubt one day be evolved—indeed, the BBC is continually experimenting to this end. In one of the latest methods which is the subject of experiment both in this country and the United States, the vision signal is not recorded in the form of a series of photographs, but by varying the magnetism along the length of a plastic tape coated with iron oxide, very much in the same way that magnetic sound recordings are made.

A Question of WEIGHT

IF you put you hand on a spring scale and press hard, the scale shows your hand as "weighing" eight or ten pounds; and so it does, for weight is simply the pressure exercised by a body. The fraudulent shopkeeper who leans his elbow on the scale is not faking. He is simply weighing his elbow with the goods. He perpetrates his fraud when he fails to deliver the goods—or all the goods—he has weighed. A Shylock customer might insist on his "pound of flesh."

Weight is due to the fact that everything attracts every other thing. A scientist might find it difficult to calculate, psychologically how much you attract a girl, but not mechanically. All he wants is your weight and her weight and the distance between you. He knows that every pound of matter, whether it is chalk or cheese, attracts every other pound at a distance of one foot by 1/440,000th part of a grain.

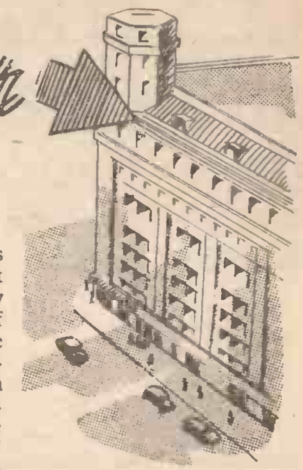
Because of the shape of the earth and the constitution of the matter underneath it, a pound is not the same weight in different places. Of course, it will show the same on the scales, if they are not the spring balance type, because the same change takes place in the scales; but a pound of sugar on the Equator is not always such a good bargain as a pound of sugar in England or the U.S.A. This difference in weight, or gravity, can be measured by delicate instruments and is very useful. For one thing it enables geologists to determine what is underneath the earth's surface.

The pressure of wind is trifling compared with the pressure of water, because water is so much denser; the effect of a jet of water under pressure is much more devastating than a jet of air under the same pressure. The pressure (or weight) of water in the sea increases about 115lb. for every 30ft. The pressure at the deepest place in the ocean must be about seven tons to the square inch.

An interesting point, illustrating what this pressure means, is that if we could lower a gun far enough into the sea and pull the trigger, it might not go off—even if we took care that it did not get wet. The reason is that the pressure outside the barrel would be greater than the pressure of the explosion inside. The barrel, incidentally, would not burst, because of the external pressure. What would happen is that as we withdrew the gun slowly it would reach a position where the pressure was just equal to that behind the bullet, which would be very gently released.

We should see equally strange effects if we had "air oceans." For instance, if we ever dug a mine about 30 miles deep, we should not be able to have a wooden chair in it. The chair would float! The pressure of the air naturally increases as we descend a mine, and, at this depth, its weight would be greater than that of wood, so that the wood would float. Of course, human beings could not withstand this pressure.

Letters to the Editor



The Editor Does not Necessarily Agree with the Views of his Correspondents

Modelling the Human Face

SIR,—*Re* the letter from Mr. J. Turner in "Your Queries Answered," January issue, I can assure you that to a person with the necessary experience and skill making a mould from the human face in one operation is by no means difficut; but it does come very close to the term "trade secrets."

The main difficulty is not, as you suppose, the breathing; that is done through goose quills inserted in the nostrils and suitably packed. The eyes are the main trouble. Owing to the heat of the body most greases melt and become oil. This finds its way between the lids and eyeball. The face must be absolutely still and relaxed, and this is very hard for a person with oil on and in the eye. In setting, the plaster becomes quite warm, which does not improve matters. The secret consists in keeping the oil and plaster out of the eye. Most people have their own methods of doing this.

Another difficulty is eyelashes that curl. It is obvious that if the eyelashes are in the plaster it is going to be an ordeal for the model. Goldbeater's skin is one way to hold them down.

I think I can say the results, if well done, are much superior to a clay modelling. But before Mr. Turner attempts a face let him try a part of the chest or arm to get some kind of experience. I certainly would not like to be the model for any inexperienced person. It is amazing how one's face will itch when covered with plaster and to keep it perfectly still is quite a job.

There is another point: the weight of the plaster will very often push the cheeks in, so a good likeness is by no means certain.

Re Mr. Phillips' letter on a plaster gloss, Vinyl Products (Carshalton) sell a very good glaze called Vinalac. Unfortunately, I do not think they supply small quantities. F. W. Nuthall, 69, St. Marks Road, Hanwell, sells small quantities of a similar glaze. The best method I know is to give several coats of size to close pores thoroughly and then a coat of Valspar, but any oil varnish on plaster will stain it, so it must be protected.—C. V. THOMPSON (W.14).

SIR,—Reference Mr. J. Turner's query, "Modelling the Human Face," I notice that you recommend plaster of paris for taking the impression of the face in sections—a rather uncomfortable procedure.

There is an easier way of doing this whereby the impression can be removed from the face in one piece. Two rubber tubes must be placed up the nostrils while the material is setting for breathing purposes.

The material to use is *Zelex*, obtainable from Claudius Ash, Sons and Co., Ltd., 26-40, Broadwick Street, London, W.1. The material is rather expensive and quite a lot would be required for an impression of a face, but the result would be worth the expense.

Zelex is an elastic impression material and sets in about three minutes rather like a stiff jelly and can, therefore, be removed from the undercuts in one piece. I suggest the above firm be contacted for their suggestions.—J. C. ROBERTSON, P.D.S. (Chicago), L.D.S., R.C.S.(Eng.).

Septic Tank Construction

SIR,—I would like to reply to Mr. E. G. Smith's letter in the January issue of PRACTICAL MECHANICS, in which he passed various comments on the designs of the Septic Tanks which were submitted in response to a request by Mr. Ottaway.

First, a cesspool and, in its simplest form, a septic tank are very much alike in appearance, but there is one essential difference in design—whereas a cesspool is designed to hold a certain amount of sewage for a short period, a septic tank is designed to store *sludge* for a comparatively long time. The formula which I used to calculate the capacity of the septic tank appears to be unknown to Mr. Smith. How, then, did he arrive at the particular dimensions for his own design?

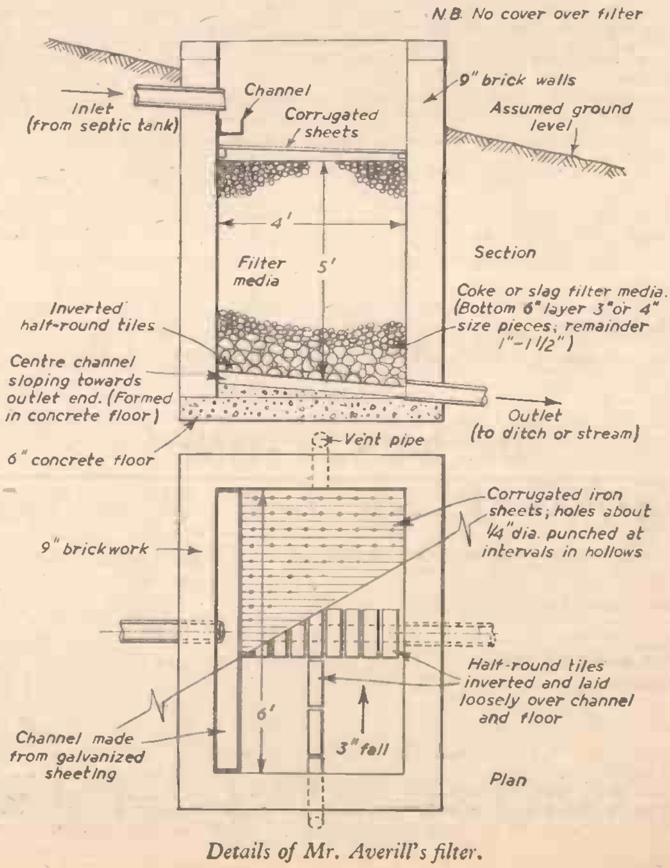
Secondly, with regard to ventilation of septic tanks, Mr. Smith states that "on no account would it be permissible to leave gaps in the covering for ventilation." I would like to refer him to the Memorandum written by the Ministry of Housing and Local Government on the subject of Small Sewage Works design, which states that adequate means of ventilation *should* be provided in the covering of a septic tank in order to free gases which might otherwise cause an explosion. The Memorandum also states that the smell arising from this procedure is not sufficient to be objectionable. In fact, the covering is really only necessary to prevent adventurous children from falling in!

Thirdly, Mr. Smith makes this statement: "Presuming the filter is underground, which it should be. . . ." Apparently Mr. Smith's knowledge of filters is even less than that of septic tanks. The best possible condition that could exist for perfect filtration is that where the filter is entirely *above* the surface of the ground. Unfortunately, this is not always possible, since for it to exist it is usually necessary to have a sloping site. It is essential that air can circulate through the media of a filter, and in Mr. Smith's design I fail to see how this is to be achieved.

Fourthly, intercepting chambers are considered by modern authorities to be obsolete as the Ark, and in this area in particular are undesirable. It was assumed that Mr. Ottaway was aware of the existence of Local Byelaws, which would necessitate the submission of details of his project to the local authority.

The sketch shows a "suitable filter," which I trust may be of use to Mr. Smith, as well as to Mr. Ottaway.

J. M. F. AVERILL (Caerphilly).



Details of Mr. Averill's filter.

Visitors from Space

SIR,—I should like to comment on the letter from K. E. Nicholls, in the December PRACTICAL MECHANICS. This reader does not question George Adamski's sincerity in recounting his meeting with a space visitor, yet he himself cannot accept it because he does not believe that telepathy between minds exists. Surely he has heard of the work of Professor J. B. Rhine, of Duke University, and his associates, who, after literally thousands of tedious and painstaking experiments, succeeded in bringing the study of telepathy to a point where most psychologists regard it as a proven fact. I cannot imagine all these people, including our own Professor Soal, devoting so much time to something that does not exist.

Mr. Nicholls makes the startling suggestion that if telepathy existed we should be able to commune with ants; it should be pointed out that, as a prerequisite to telepathic communication, the minds concerned should share a certain association of ideas and similar mental symbols. Assuming that ants have minds and not only an instinctive reasoning faculty, it is difficult to imagine on what common ground the ideas of a man and an ant could match each other.

In your article " A Visitor from Mars " you make the point that these visitors should be arrested or apprehended as foreigners. A little later you complain that they seem to prefer isolated localities to land in. Adamski's Venusian also gave this as one of the reasons for their present tentative contact with us. Leaving the moral aspect aside, I should certainly have considerable qualms about tackling a space-visitor in this manner.

You also refer to " open-minded scientists." As a generality I am not too sure of this. I would draw your attention to an article that appeared in the London *Evening Standard* some months ago under the title " Let Us Bury These ' Flying Saucers,' " by no less a person than the Astronomer Royal. It contained these statements :

" I can say quite definitely and with absolute assurance that none of the flying saucers can have come from another planet.

" Sufficient is known about conditions on Venus to be able to say that life of any sort on that planet is out of the question.

" . . . there can certainly not be any of the higher forms of animal life . . . on Mars."

How can Sir Harold know ? Has he been even within a million miles of either ? How about the perpetual cloud or vapour blanket which shrouds Venus and precludes any but the most cursory examination ? Surely it is well known that all our measurements and speculations about the heavenly bodies are conducted from the bottom of a sea of air which, according to a recent statement, may well be over 600 miles in depth, and of whose constituents and particular properties we are largely in ignorance.

It would seem that science, too, has its dogma !

Incidentally, I wonder how many people know that Adamski has had at least four subsequent meetings with the Venusians (including women), has been taken up for a short trip in a " Saucer " and has had ample opportunity to verify every single statement given in his account in " Flying Saucers Have Landed " ?

Finally, I have just read the very latest book on the subject—" Space Gravity and the Flying Saucer," by Leonard G. Cramp, M.S.I.A, and I look forward with interest to your eventual review of it.—S. E. FRIEST (Southall).

Flying Saucers

SIR,—I have been following the correspondence concerning flying saucers for some time and I should like to present a thought which I have never yet seen in print. We are told by those people who imagine every flash in the sky to be a space ship that flying saucers have been observed for many hundreds of years. If this is true, and if these objects are indeed space ships, how is it that their crews have made no attempt to communicate with responsible leaders of the world ? Why have they confined their landings to remote parts of the globe and spoken only to people of questionable intelligence who cannot even handle a camera with any degree of skill ?

If the position had been reversed and we on earth had conquered the problems of space travel 300 years ago, can anyone seriously believe that we would have wasted time flitting around the upper regions of the various planets ? Of course not ! Some way or another contact would have been established with the inhabitants of those planets, even if only by hovering over a large city and flashing a beacon or something similar.

It has been said that the space travellers do not land because of the war-like nature of earthmen, but in all fairness there is not a war being fought continuously in every part of the world !

I cannot believe for one second that there is a race of super-intelligent beings somewhere out in space who have the skill (and money) to build incredibly complicated aircraft and then waste their time in organising " trips round the lighthouse "—these things in the sky can only be weird cloud formations, or some other natural phenomenon, and I will stick to this view until a saucer lands in a town and the crew actually emerges and makes itself known to us.—F. WILLIAMSON (Chingford).

Lighting Control Panel

SIR,—With reference to the enquiry by C. E. Fox (Roxburghshire) in the January, 1955, issue of P.M., I think that your answer to his problem of how to build a switchboard for an amateur dramatic group is good, but does not go quite far enough. I enclose a plan which I use myself (with modifications to suit circumstances).

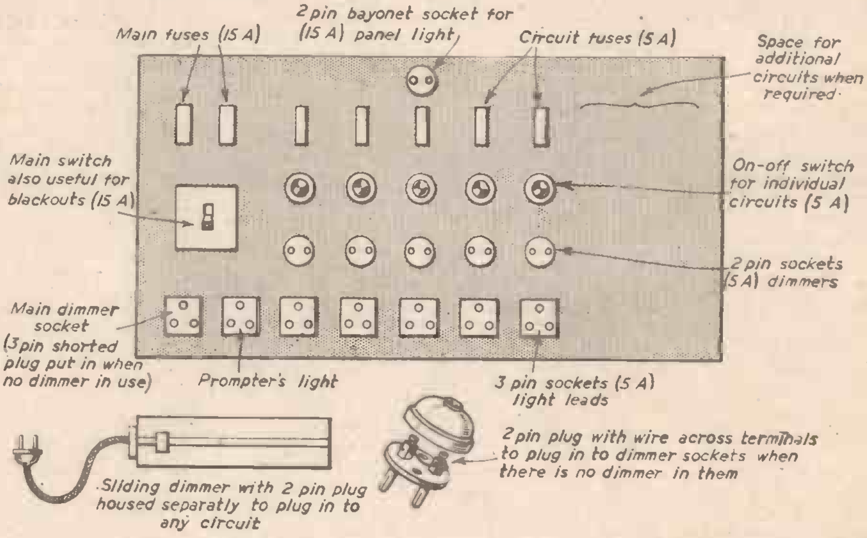
It is a very flexible switchboard as it can be extended to suit all requirements and by using shorting plugs, which, for convenience, may be hung from the board by strings to prevent loss; the dimmer(s) may be used on the circuits where they are needed. A heavier rating dimmer is necessary for the main plug. I suggest the whole thing be mounted in a case with a lockable lid to prevent unauthorised meddling when not in use. The board and dimmers being mounted on asbestos sheet. Remember that dimmers get hot so must preferably be separate and ventilated.

Dimmers are obtainable from Strand Electrical Engineering Co., of London, but unfortunately they are prohibitively expensive, the cheapest being in the region of £10. It is possible to hire them, however, for a very moderate fee. Alternatively the local cinema may have some old ones stored away which might be bought cheaply and renovated.

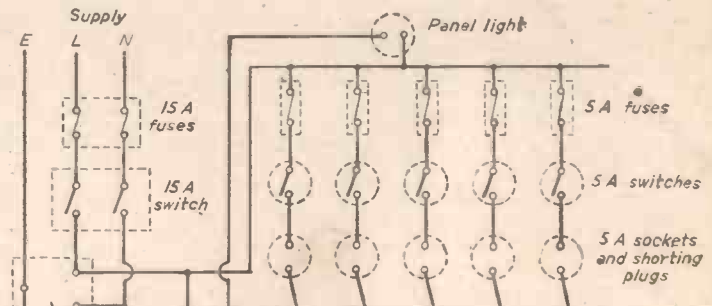
The suggested lighting system seems rather inadequate and perhaps Mr. Fox might consider scrapping his footlights and substituting one or two overhead battens as well as his " headlights " which I take to be some species of spot or floodlight.

The best outfit for a small stage is two overhead battens, two or three " biscuit tin " floodlights, and some " front of house " spotlights which can all be home-made. The objection to footlights being that on a small stage they light the lower halves and feet of the players and, without adequate top lighting to balance, leave nasty shadows on the face. I would refer Mr. Fox to any book on " Stage Lighting for Amateurs," a good selection of which are often found in the nearest public library.

In conclusion may I wish him every success and no (unintentional) blackouts.—L. CORDEAUX (Middlesex).



Lighting control panel suggested by Mr. Cordeaux.



Lighting control circuit.

Curing Condensation

SIR,—In answer to Mr. A. T. Thompson's query (Information Sought, January issue) it is very likely that moisture arising from the books and stationery is the cause of the window steaming.

The heating appliances mentioned would only warm the paper and drive out the moisture.

The best way to cure this is to have a fan or some method of ventilation. It could possibly be open to the shop.—A. M. BAILEY (Yorks).

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(Continued on next page)

(Continued from previous page)

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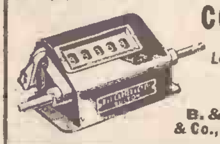

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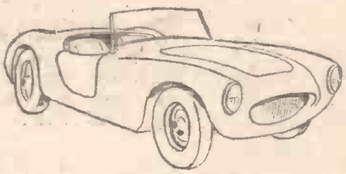

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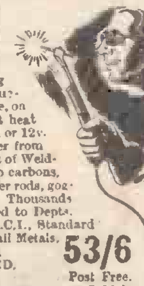

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LANDING LAMP MOTORS exactly as described for SELF-OPENING GARAGE DOORS—"Practical Motorist," Aug., '54 (copy of article sent with motor). 12/24v. D.C., also 30 v. A.C., drive via gear and quadrant giving lateral movement of about 2in. and reverse. Each 25/-, post 1/9. **HAND GENERATORS.** Complete with handle and 72/1 gearbox. Output 28 volts and 300 volts. As described for WASHING MACHINE in "Practical Mechanics" Aug. '53 and WRINGER Mar. '54. Each 25/-, post 1/9. **EPICYCLIC GEAR MOTORS.** (Aircraft cowl gill motors) operate through 4-stage 625/1 gear (5-25-125-625 one or more stages easily locked to give any of these ratios) 24 v. D.C., 5 amps., 12 v. D.C., app. 4 amps. also also operate 16/30 v. A.C., app. 5/7 amps. Each 25/-, post 1/9. **ELECTRIC FANS.** New in maker's boxes. 230-250 v. A.C. 7½in. Blades. Suitable extraction or circulation. Bargain at 50/-, post 2/-. **BAKELITE LAMP HOLDERS,** chrome reflector, screw rim, clear glass 5in. dia. Suit window display, etc. etc. S.B.C. double contact. Each 4/9, post 9d. **PRESSURE TANKS** (R.A.F. Oil Reservoirs). Each 5/-, post 1/6.
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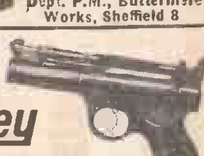

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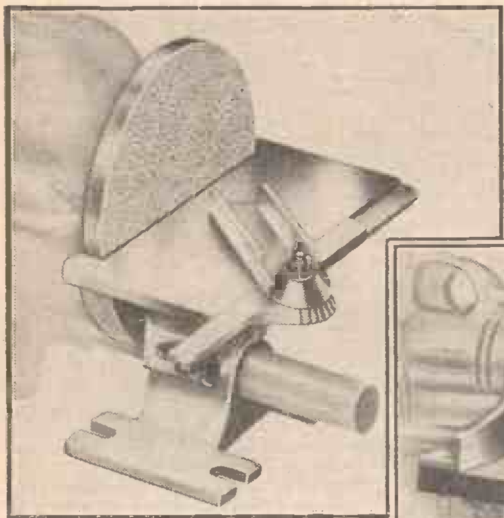
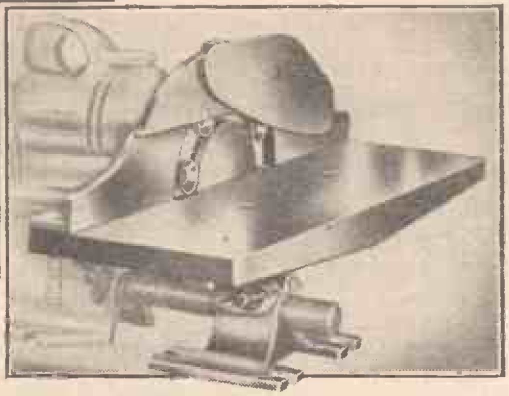
Trade Notes

New Wolf Cub Units

WOLF ELECTRIC TOOLS LTD. have recently added to their "home handyman" equipment an electric bench planer. It is powered by the Cub Drill and fitted with a cleverly designed planing head. Continuous cutting action by means of patent conical high speed cutters eliminates difficulties of planing against the grain. Owners of the Cub Drill can add this Set to their equipment for the cost of £3 9s. 6d., whilst the complete Bench Planer, including the Wolf Cub Drill, Bench Clamp, Pillar and No. 10 Planer Set, costs £10 13s. 3d.





Two additions to the Wolf Cub range, the electric bench planer (right) and the bench sander (above).

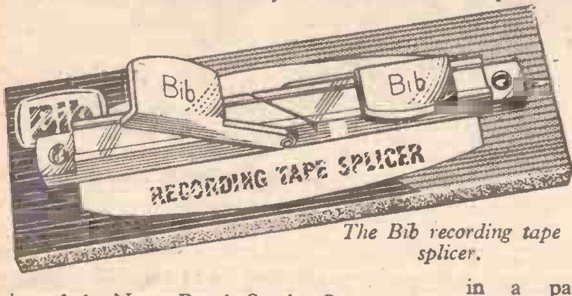
Announced simultaneously is the introduction of the No. 9 Bench Sander Set at a cost of £1 18s. 6d., or, for those who do not possess the Cub Drill, the complete Bench Sander, comprising the No. 9 Sander Set, Bench Clamp, Pillar and Wolf Cub Drill, can be had for £9 2s. 3d. Fine accurate finishing may be obtained at high speed on wood, metal, plastics and similar materials to a depth of 2¼in. Self-adhesive sanding discs are provided in assorted grades to suit different work, and these can be easily fixed to, or removed from, the faceplate as desired. The set includes a bevel attachment which enables mitres and other angles to be sanded with accuracy and speed. Conversion packs to convert planers to sanders and vice versa are also available.

The range now embraces facilities for bench sawing, wood turning, portable and bench drilling, grinding, bench planing, polishing, portable and bench sanding, fretsawing, etc. Fully descriptive literature of the above Sets can be obtained from Wolf Electric Tools, Ltd., Hanger Lane, London, W.5.

Tape Splicer

MANY people to-day own and use a tape recorder, for musical recordings, and when editing the tape—either removing announcements, or joining together a number of items—the question of cutting and joining the tape arises. This can be not only awkward, but can give rise to trouble if done carelessly. An aid to accurate splicing is, however, to be found in the Multicore product, the Bib Tape Splicer.

This is similar in construction to a normal film splicer, two clamps at either side holding the tape rigidly in a guide-way the width of the tape. A diagonal slot across the centre of the device enables the ends of the tape to be cut with the aid of a razor blade, and if the broken or roughly-cut ends are first overlapped very slightly over the diagonal, the two edges may be cut simultaneously and will butt perfectly. A short piece of cellulose tape is then pressed over the joint, and the edges of this are trimmed, again making use of slots running along the top and bottom of the guide-way, thus producing an almost undetectable joint, which will pass the guides, pressure pads, and heads on any tape recorder. If a length of tape is inadvertently torn and cutting cannot be resorted to (due to it being in a particularly good recording for instance), the torn edges may be held accurately together by means of the clamps whilst the adhesive tape is placed over the break.



The Bib recording tape splicer.

The price of this handy device is 18s. 6d., from Multicore Solders, Ltd., Maylands Avenue, Hemel Hempstead, Hertfordshire.

A New Continuous Burning Fire

A NEW continuous burning fire, called the Kozi-Toes, is announced by the Cradley Foundry and Engineering Company, Staffs. The fire, which retails at 62s. 6d. (including trivet) has been approved by the Ministry of Fuel as an all-night fire and as suitable for smokeless fuels.

A simple device known as the summer converter is also being manufactured by the firm so that when the fire is not in use as a solid fuel appliance, the draught plate can be replaced by a plate carrying a one kilowatt electric fire. Price of the converter, including tax, is 39s. 3d.

Provided with the Kozi-Toes is a multiple tool for removing the ashpit door, ashpan and extension plate. This has been specially designed so that the extension plate can be handled in any position without danger of burning the hand. The fire will fit all 16-inch B.S.S. 1251 and Milner firebrick openings. Installation is remarkably simple, metal rawlplugs being provided to help hold the fire in position.

The Kozi-Toes is available in copper lustre, pewter lustre, marble and cream enamel finishes. It has a simple draught control plate to ensure maximum efficiency, and is claimed to be the lowest-priced Ministry-approved fire on the market. It is available from hardware stores and is intended to anticipate the introduction of compulsory smokeless zones.

The Rolla-Bench

THE latest product of the Shandon Scientific Company, 6, Cromwell Place, S.W.7, is the Rolla-Bench shown herewith, which tackles one of the biggest problems encountered in every laboratory and workshop, namely, the shortage of bench space.

Within seconds the Rolla-Bench adds 5 sq. ft. to the existing bench when and where extra working space is required. It is moved easily and rapidly to any position along benches of all heights, and by the turn of a lever is securely locked to provide a firm and level platform capable of carrying heavy loads.

An attractive feature of the bench is the ease with which it brings the additional working room to precisely that part of the bench which is overcrowded without in any way interfering with access to drawers and cupboards underneath.

The Rolla-Bench.

CLUB REPORT

Guildford Model Engineering Society

THE president, Mr. E. W. Gearey, held the chair for the first club A.G.M. held at Hut 6, Woking Road. He remarked on the satisfactory year, with Exhibition and engagements for the portable Live Steam Railway, and progress on the club 4mm. layout.

Visitors are very welcome; 4mm. Tuesdays, and Live Steam Wednesdays 7.30 p.m. Hon. Sec. Mr. V. H. Selley, 42, Raymond Crescent, Guildford.

Your Queries Answered

Drilling Lamp Standards

I INTEND making a number of standard lamps in wood, and would like to know of a method of drilling down the length of the standard, say, about ⅜in. diameter, for the flex. I understand there is an old craftsman's way of doing this without the use of a drilling machine.—John F. Margereson (Thornton Heath).

UNFORTUNATELY we cannot recollect seeing this operation performed and we therefore cannot help you in this respect. However, we suggest that you make up a simple machine from bright bar material with a carriage similar to a lathe saddle to carry the standard. An equally simple drive from a ¼ h.p. motor will rotate the drill as you will need only one speed. Attach a drill to a length of tube and run these in steadies to provide support. Though this " machine " is rather long the construction is not difficult and should not cost a great deal.

The above method is, of course, only applicable if a fair number of these parts require drilling, but if handwork is anticipated, then perhaps a simple jig rigged up on the workbench to hold the piece and an engineer's hand brace rigidly held will solve the problem. Feed is supplied by pushing the jig along a slideway, and again the drills are run in steadies. To lessen the degree of error arising adopt the same procedure as that practised in the machine shops—drill half-way, reverse and drill the opposite end. Use flat drills and not the twist variety.

Straw Hat Stiffening

I HAVE washed an imitation panama hat, which has become soft. Can you tell me how to treat it to make it stiff and keep the same shape as before?—W. Hill (Cheshire).

THE following is a typical formula for a straw hat stiffening " varnish " :—

Gum elami, 5 parts ; resin, 4.5 parts ; gum sandaræ, 3 parts ; shellac, 5 parts ; methylated spirit, 86 parts ; castor oil, 12 parts.

Dissolve the castor oil in the methylated spirits ; then dissolve the remainder of the ingredients, warming the methylated spirits if necessary.

In our opinion, however, you would get a much better, simpler, cleaner, less messy and quicker drying product by dissolving about 15 parts of poly-vinyl acetate in 85 parts of warm methylated spirit. Poly-vinyl acetate (under the name of " Gelva " resin, Grade 7) is sold by Shawinigan, Ltd., Marlow House, Lloyd's Avenue, London, E.C.3, price about 6s. lb. About ¼lb., we think, would amply fulfil your needs and leave you with some material over for future occasions.

" Blown " Fruit

WHAT is meant when preserved fruit is stated to be " blown "? Is this caused by chemical reaction or is it due to defective sterilising?—A. Inkpen (S.E.1).

THE technical term " blown " is usually employed to designate sealed tins of preserved material which, under internal gas pressure, are bulging at their ends. This is due to defective sterilising. It means that some process of fermentation or chemical activity consequent upon putrefaction or chemical change in the composition of the preserved material is proceeding within the container. We cannot tell you precisely what this chemical reaction may be since it is dependent entirely on the nature of the material. These blown or bulging cans and their contents cannot (or should not) be remedied. If the can is pierced to allow the escape of the gas the contents will still be partly decomposed. There is no remedy for a blown can. The only thing to do with it is to open the can and destroy the contents immediately. The trouble is always due to defective sterilising, the remedy for which is obvious.

Wastepipe Connection

WHAT is the best method of fixing the wastepipe connection to a porcelain wash-basin?

I have already tried " Adament," but this seems to wash out gradually.—R. Salisbury (Birmingham, 28).

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.

THE wastepipe connection of an ordinary domestic porcelain wash-basin is attached to the downpipe by means of the usual plumber's soldered joint. The metal flange inside the basin is made to rest on a bed of putty, which is quite sufficient to render it quite watertight. Any threads on the pipe unions are wiped over with white or red lead paste before being screwed up. A trap should be positioned under the basin in order to prevent the upwards rising of drain gases into the basin. One of the modern shallow brass taps is quite sufficient for the purpose. The ordinary heavy lead U-bends are ugly and unnecessary.

Highest Melting-Points

COULD you please tell me the metal with the highest melting point, and similarly the highest melting point of any substance—like carbon or firebrick? I assume that it is not possible to determine the melting point of everything, because the instruments would melt.—B. C. Bateman (Glamorgan).

TUNGSTEN has the highest melting-point of any pure metal, its melting-point being 3,267 (plus or minus about 30 deg. C.). Tungsten is the metal of the ordinary electric filament lamp. After this, comes tantalum with a melting-point of 2,850 deg. C.

Of non-metallic substances carbon has the highest known (or rather highest determined) melting-point of approximately 3,600 deg. C. Some of the newly-discovered " refractory " metallic carbides, such as tantalum carbide, have apparently higher melting-points still, for they have never been melted in the mass.

These ultra-high melting-points are usually determined on small amounts of the material heavily surrounded by inert refractory layers. The temperatures are assessed, not by direct thermometers but by those of the radiation type which collect and measure the intensity of a portion of the heat energy radiated from the experimental material. Hence the actual thermometer may be situated several yards away from the material under test.

Painting Iron Window Frames

MY house is fitted with iron window frames and I am troubled with paint peeling off due to rust.

Can you advise me how to treat the iron and what kind of paint to use to prevent this trouble in future?—W Brook (Shipley).

(Continued on page 274.)

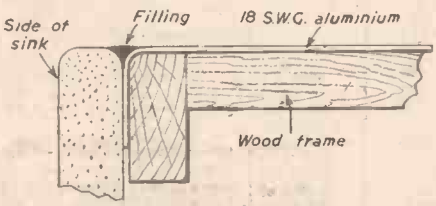
YOUR trouble seems to be due either to the use of a very poor quality paint or to the painting over of badly rusted metal frames. It is clear that the rust is proceeding actively underneath the paint layer.

There is only one way to stop the trouble. Remove all the paint by scraping, and remove all the underlying rust also. This will have to be done by patient sandpapering. Having exposed the bare, clean metal, give the latter a coat of priming paint—a red oxide paint will do, but better still would be a coat of a metallic lead paint, which you should be able to obtain from any good paint stores. The metallic lead has a powerful inhibitory effect on the rusting of the iron.

Having given a coat of the priming paint, allow it to set hard, and then repeat the coat. Finally, apply two separate coats of the finishing paint of your choice. All coats of paint should be put on thinly, since, in all probability, the window frames will not close properly if the paint coats add too great a thickness.

Sink—Table Filling

I HAVE built my kitchen sink into a self-contained unit with a table top on the same level as the top of the sink. I have covered this table top with 18 s.w.g. aluminium as below :—



J. W. E's sink unit

Is there any filling for the joint which will dry with a white glazed appearance ? I have tried plaster of paris, alabaster and adamant, but all these are soft, soon become dirty and rub away on cleaning. —J. W. E. (Birmingham 20).

THE most serviceable type of filling for your purpose is one of asphalt, which can be procured from any local asphalting firm.

First of all, fill the sink with very hot water so that it becomes thoroughly warmed. Melt the asphalt in a small ladle, and pour it into the joint, until its level reaches two-thirds of the way to the top. You can, of course, take the asphalt level right up to the top, but this would give a black joint, which, we observe, you do not want. After the asphalt has cooled and hardened, fill the remainder of the joint with a paste made by slaking with water, a 50 : 50 mixture of Portland cement and whiting. This paste should be fairly stiff and packed firmly into the joint, being smoothed off at the top. It should be given 25 hours in which to set. After this, its surface should be made as smooth as possible with fine sandpaper, and then given two or three coats of paint.

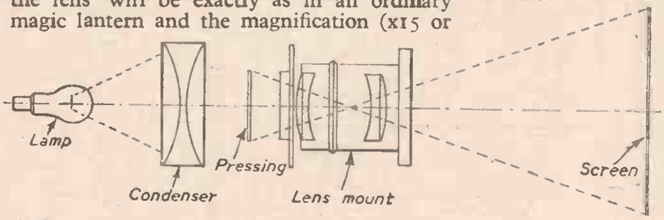
The cement composition is fairly well waterproof. The asphalt underlayer and foundation is totally waterproof. It is desirable to have the sink thoroughly warmed up before applying the molten bitumen or asphalt in order to eliminate any tendency of the cold sink to crack locally by sudden contact with hot asphalt.

Note that you cannot apply a white or other paint directly over asphalt, since the bitumen in the latter will merely come through and thus completely discolour the paint.

A Special Projector

I WISH to construct a projector for accurately measuring pressings. The magnification to be x15 to x10. Can you please tell me the best combination of lens and illumination and also the most compact arrangement ?— H. W. Brain (Leics).

YOU do not state the maximum size of the pressings, of which you wish to project the images, for the purpose of measurement ; this is important because the lens must be large enough to include the whole of any, pressing, unless it is only of portions, say, one portion at a time that you wish to determine a diameter. Actually the arrangement of the light, a condenser, the pressing and the lens will be exactly as in an ordinary magic lantern and the magnification (x15 or x10) will depend upon the distance which the screen is from the lens. The distance of the pressing behind the lens and the screen in front of the lens will depend upon the focus of the lens. This can be a photographic lens of as large as possible. It must be of the Rectilinear type. That is to say it must be a double lens, achromatic and with an iris diaphragm in between the lenses.



Projection arrangement for pressings

The lamp is, say, 100 watts. The amount of enlargement will depend wholly upon the relative distances of the pressing from the lens and the screen from the lens, which can be got by adjustment. Write to one of our advertisers re an ex-Govt. lens.

Plant Preservation in Plastic

IF flowers, leaves, foliage, etc., are covered in a cold-setting plastic, completely cutting off air, for how long would they retain their colour and freshness before it becomes noticeable that they are decaying ?—F. S. Allen (South Harrow).

IT is, unfortunately, not practicable to embed flowers, leaves, stems, etc., in a cold-setting plastic material or even to varnish them with such material so that the shape, form, appearance and colour of the plants or flowers are preserved. This is a chemico-physical problem which has *not* yet been adequately solved.

The trouble is that plant tissues contain water and other fluid ingredients. After the stem of the plant has been severed from the root, the tissues begin to decay—chemically and physically. Surrounding the tissue with an inert substance does not wholly arrest this decay. Chemical interactions still go on within the tissues of the plant. The result is that the tissues shrink and tend to lose their form. The green substance, chlorophyl, is destroyed by internal reactions. The colouring matters of the flowers (even when preserved in darkness) undergo a soft of automatic chemical breakdown, which reactions are speeded up enormously by exposure to light, especially ultra-violet light.

By surrounding the flowers with plastic, you might slow down these reactions for a week or so, but you would do little more than that.

However, if you wish to try out the resin treatment, we suggest that you use " Catacast," a synthetic cold-setting resin manufactured by Catalin, Ltd., Waltham Abbey, Essex.

Non-slip Mat Solution

I WISH to purchase or make a solution which can be painted on the back of mats to prevent them from slipping. Can you help me please ?—C. D. Greenland (Wilts).

MOST of the preparations for non-slipping mats which you describe are merely rubber solutions, or rather " suspensions " of rubber latex. They are not very successful because they are not durable and are difficult to process and to pack.

Plasticised solutions of synthetic resins have been tried for this purpose also, and they give more promise. Such " friction solutions " may be made by dissolving pale coumarone resin in paraffin and adding to it about 1 per cent. of dibutylphthalate. These materials are rather expensive and are obtainable only from chemical supply firms, such as Messrs. Griffen & Tatlock, Ltd., Kemble Street, Kingsway, London, W.C.2. In our opinion it would be better if you dissolved powdered resin in warm paraffin or naphtha and then painted the solution on to the back of the mat, allowing it to dry thereon. It would give rise to a light film of resin on the back of the mat, and this would be sufficient to prevent any ordinary slipping of the mat. The solution strength should not be too great, otherwise a thick film of resin will be deposited on the mat, and this will tend to dust off and cover the floor with resin powder.

In the above preparation you need only use common resin—the ordinary hard, light amber-coloured type.

Information Sought

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

From Scotland, Mr. P. Balnave asks : " Have you any information concerning the simple workshop production of inflatable rubber latex articles ?

" I know that toy balloons, etc., are made by dipping a former into latex, but I doubt if this method would be suitable.

" As a hobby I wish to make large figures such as animals modelled by myself. Could this be done by pouring latex into a plaster-cast mould of the figure, then pouring out, repeating until thickness is reached ? Is this workable ? If so, how would I go about a simple vulcanising process ?

" Where can I obtain a small quantity of latex, and what is the price ? "

Mr. F. Gregory's query reads : " I am making my garage doors so they will open electrically, and understand that on the market is a device to operate such doors from a remote spot. This consists of an electro-magnet under the front of the car, which is energised by a push-button on the dashboard of the car from the battery. This operates a magnetic switch buried just below the surface of the ground in front of the garage.

" Could you please let me know how to construct such a switch (which, I suppose, will open the doors through a relay switch) and also what winding will be required on the magnet (12 volt) ? I have all the tools required, including a lathe."

Mr. J. Doyle (Co. Dublin) asks : " Can you give me any information on the making of moulds for plaster casts, using gelatine, also beeswax ? What is the best type of beeswax to use ? I believe there is white and yellow. What is the correct percentage of gelatine to water ? Is there a book on this subject ? "

Mr. F. J. Mack, of Surrey, writes as follows : " Could you supply me with constructional details for a three-octave xylophone ? "

THE Cyclist

Editor : F. J. CAMM

VOL. XXIII MARCH, 1955 No. 394

All letters should be addressed to the Editor, "THE CYCLIST," George Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2.

Phone : Temple Bar 4363

Telegrams : Newnes, Rand, London

COMMENTS OF THE MONTH By F. J. C.

The Bicycle Industry

SOME staggering statistics showing the continued progress and expansion of the bicycle industry were recently released by the British Cycle and Motor Cycle Manufacturers' and Traders' Union Ltd.

Production for 1953 was just short of the 3m. mark (actually 2,996,000), but there has been a marked increase in 1954 and the total production for the year is expected to exceed 3,150,000 bicycles. Bicycle exports have also shown an encouraging rise and their value in the first nine months of 1954 exceeded that for the first nine months of 1953 by more than £1,300,000. The number of bicycles exported in 1953 just topped the 2m. mark (2,019,685). The figure for 1954 will show an improvement even on this figure and is estimated at 2,100,000 machines.

As far as the home market is concerned, after a dull period in 1952 and 1953 there has been a substantial improvement this year. This has been due to the removal of hire-purchase restrictions, for which the industry has been clamouring for some time. The home market absorbed just short of one million machines in 1953 (977,000), but by the end of 1954 the figures are expected to pass the one million mark.

As far as production is concerned there has been a steady increase in motor-cycles and the total for the calendar year 1953 was 152,935, which will be substantially exceeded in 1954 as will be seen when the figures are released. It is expected that the 1954 production figures will be about 190,000—a record for the industry, exceeding the previous highest figure of 171,730 achieved in 1951.

As was reported a year ago, motor-cycle exports fell in 1952 from the record figure achieved in 1951 (91,699) to 70,266, and a further fall was experienced in 1953 (63,135). This tendency has been stopped and, in fact, exports are on the up grade. The total for 1954 is likely to be about 76,000 machines—the second highest export figure in the history of the industry. In the home market sales for 1954 are likely to exceed 100,000 machines, compared with 89,800 in 1953 and 82,700 in 1952.

Two of the most significant developments during the year have been the Tariff Commission enquiries on bicycles in India and the United States. The director, Mr. H. M. Palin, M.B.E., was present in Bombay in November-December, 1953, for the former and in Washington in September, 1954, for the latter. The results will clearly have far-reaching effects on the bicycle industry's exports to these most important markets.

In the case of India the result has now been made known. The commission recommended a reduction in the *ad valorem* rate of duty on bicycles from 63 per cent. to 45 per cent., but the Indian Government did not wholly accept this recommendation and has imposed an alternative specific duty to protect the Indian industry against the import of cheaper machines.

The old Plough at Speen. A delightful country inn, tucked away in a fold of the Chiltern Hills near High Wycombe

The net result, however, has been a slight improvement in our position, added to which there has been an indication of a more liberal official attitude towards import quotas. Anxiety is felt, however, at the tendency to refuse to admit completely equipped bicycles. The latest development—a decision not to allow saddles to be supplied with imported cycles has received a vigorous protest from the industry.

Notwithstanding the many difficulties encountered through import restrictions and other obstacles in many parts of the world, the twin industries continue to earn substantial sums in foreign currency in the national interest. In 1953, the total earned was £36.2m., and the 1954 figure should exceed this by £1m.

It is interesting also to record that 18 per cent. of the twin industries' exports at present go to the U.S.A. and Canada, compared with an average of 12 per cent. for all other exporting industries.

There has been a very steady increase in interest in the smaller capacity lightweight motor-cycle and in the motorised bicycle. In the case of the latter it is satisfactory to report on the growing popularity of the specially designed machine, which should do much to remove the anxiety originally created in the industry at the very real prospect of engines being fitted to bicycles not designed for such use, and quite unsuited thereto.

It is worth noting that at present motor-assisted cycles (with engines under 50 c.c.) are included in the official bicycle production figures issued by the Board of Trade. It is estimated that there are now more than 200,000 of these machines on our roads, and it is hoped that Her Majesty's Government will give earnest consideration to proposals being submitted by the industry for the relief of these small machines from the unnecessary burden of driving tests.

The increased home sales of bicycles is convincing evidence of the healthy state of the bicycle trade and of the fact that the interest in motorised machines has not been created at the expense of the pedal cycle.

It has already been announced, however, that motorised bicycles are to be subject to a 25 per cent. purchase tax. This tax, of course, relates to the clip-on power unit, which is thus brought into the same category as the complete bicycle and motor-cycle. Hitherto, motor attachments for bicycles, provided they were not in-built with the machine, carried no purchase tax, being regarded as accessories.

Road Casualties

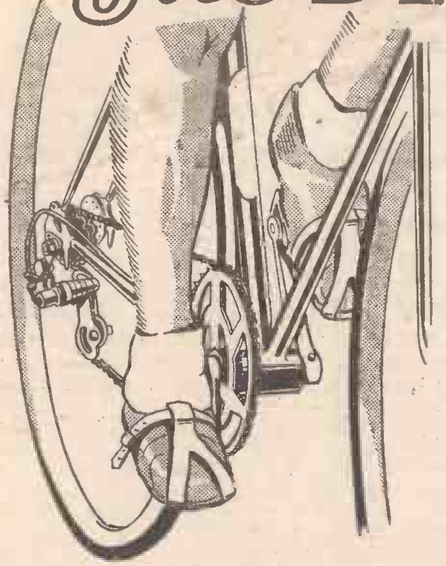
PROVISIONAL road accident figures for December show that 632 persons were killed, 5,696 seriously injured and 16,180 slightly injured.

The total of 22,508 is 1,286 more than in December, 1953. Fatal casualties increased by 30, serious injuries by 206, and slight injuries by 1,050. But the increase in the total was less marked than in October and November, when the figures went to about 3,000 above the 1953 level.

December's casualty figures bring the provisional total for the year to 238,318. This is the second highest total ever recorded; being only 628 less than in the peak year, 1934. Since 1934 the population of Great Britain has increased by four millions and the number of motor vehicles on the roads by three millions and a quarter.

The DERAILLEUR GEAR

The Correct Fitting Procedure and How to Align it Accurately



DUE to the infinite variety of ratios obtainable the derailleur gear is used almost universally by the cycling enthusiast, both in the fields of touring and racing; indeed, for the mass start rider it is an indispensable accessory.

There are several different makes of

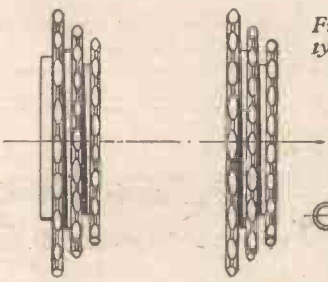


Fig. 1.—Two types of freewheel.

derailleur on the market, but most of them work on the same basic principle and the procedure to be followed when fitting and aligning them is in all cases similar.

Fitting the Multiple Freewheel

The freewheel block may have three, four or five sprockets; if a ½in. by ⅛in. chain is employed a choice of three or four speeds is available; if a ½in. by 3/32in. chain is used there is a choice of four or five speeds. The block may be one of two types—a *flush back* freewheel or a *boss* type (see Fig. 1). If the former is used packing will probably have to be inserted between the inner edge of the hub and the freewheel, so that the chain, when it is running in bottom gear, will not touch the spokes. Special shims are available for packing, but if a considerable amount is required a bottom bracket locking ring may be used. This is merely screwed on to the hub, the thread being the same.

Unless an overlength spindle is already in use it will be found necessary to fit a special gear spindle, which is considerably longer than the standard type. A multiple freewheel block should not be fitted to a hub designed for a " fixed " sprocket, as the short right-hand thread available may " strip " under the uneven strain which would be applied to it. The thread on the " gear sided " hub should be greased before the freewheel block is screwed on; this will facilitate its removal if and when required.

Aligning Chain-ring and Sprockets

As the chain has to be changed from one sprocket to another across the width of the block it is obvious that it will not be in line with the chain-ring in every gear. It is not possible to avoid running the chain out of line, but the misalignment should be reduced to a minimum. To do this the chain-ring must be exactly in line with the centre

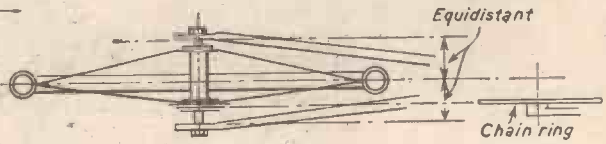


Fig. 2.—Correct chain alignment and the properly dished wheel.

sprocket on the freewheel, except in the case of a four-speed block, when it should be in line with a central point between the two middle sprockets.

The chain-ring should be trued-up first and this is done by inserting a lever through the cutaway part of the chain-ring and twisting out any buckles which may be present. Any deviation from truth may be spotted by rotating the cranks and watching for any variation in the clearance between the rim of the chain-ring and the chain-stay.

When this has been done, the chain-ring and the freewheel block may be tested for alignment by means of a long straight-edge (see Fig. 2). If they are not in line the rear wheel should be moved to whichever side is necessary by packing the spindle with spacing washers.

Dishing the Wheel

When the correct number of washers has been ascertained the next step is to bring the rim of the rear wheel into the centre of the rear forks. This operation, known as " dishing " the wheel, is accomplished by loosening the spoke nipples on the side away from the freewheel block and then tightening those on the freewheel side. The right amount of dishing usually results if the plain-side spokes are loosened about one and a half turns and the sprocket-side spokes tightened one turn, but this will vary a little according to the type of freewheel used. The final adjustments should be made with the wheel mounted in the rear forks. The wheel is shown correctly dished in Fig. 2.

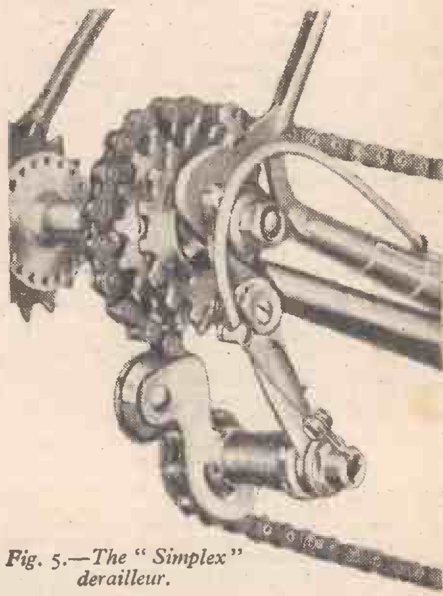


Fig. 5.—The " Simplex " derailleur.

Fitting the Mechanism

The method of gear attachment will vary according to the type of mechanism and whether special lugs are available brazed-on on the chain-stay or the rear end; most gears are supplied ready

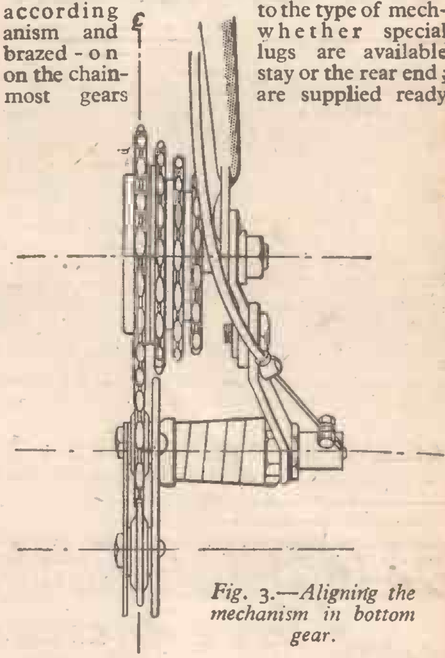


Fig. 3.—Aligning the mechanism in bottom gear.

to fit on to the rear hub spindle. When the mechanism has been attached the tension pulley and jockey sprocket should be adjusted laterally until they are immediately below and in line with the low gear sprocket (see Fig. 3). This is done by means of a bell nut and adjusting screw. Make sure also that the cage carrying the tension pulley and jockey sprocket or pulley is vertical and that the shaft carrying the spring is at right angles to it.

The gear lever is fitted next and the cable carried down and attached to the toggle chain. Before locking the draw bolt all slackness should be taken out of the cable,

(*Continued on page* 35)

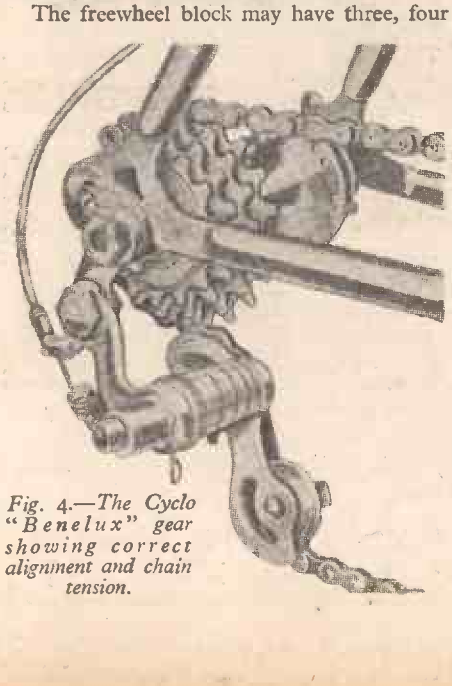


Fig. 4.—The Cyclo " Benelux " gear showing correct alignment and chain tension.

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2013	**SCREW AND NUT** Square Thread 5/16" x 10 T.P.I. Length of Thread 2⅞". Total length 3⅜". Steel. ½" Thick Brass Nut with lots of metal for fitting to Slides, Vices, Clamps, etc., very useful, 2/6.
2014	**SCREW AND NUT** Similar to 2013, Nut travel 2¼" but total length 8½", 3/-.
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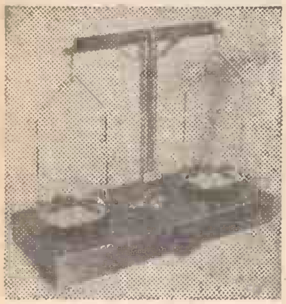

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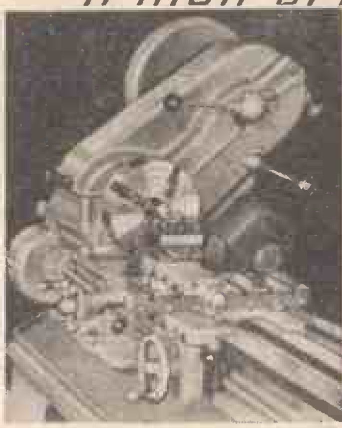

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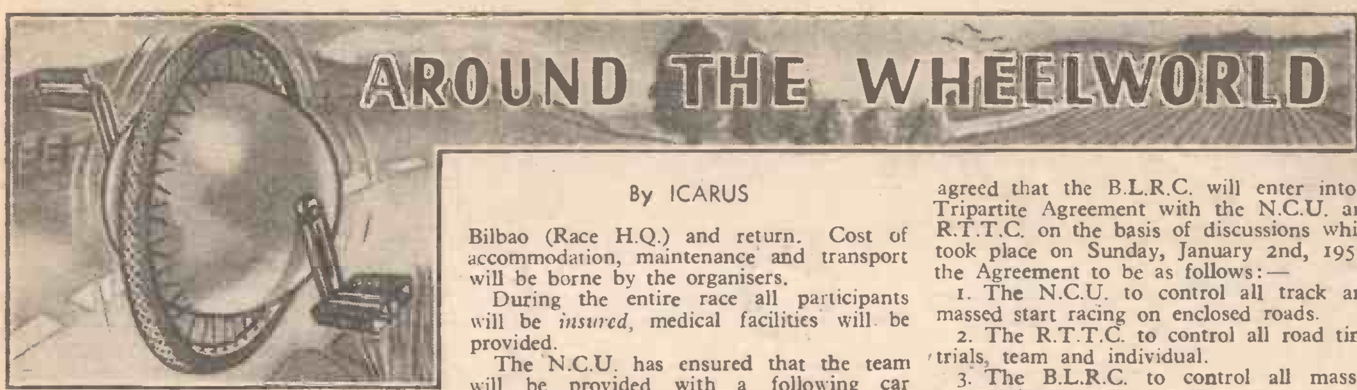


AROUND THE WHEELWORLD

By ICARUS

Award of the Dunlop Cup

DESPITE a crash during his racing season the National Cycling Union has awarded the Dunlop Cup for 1954 to John Brian Ashmore, of the Brodsworth Road Cycling Club, Doncaster, Yorkshire. The cup is given to the rider who starts the season as a novice and shows the greatest improvement. It has been awarded each year since 1935.

Ashmore, who is 21 and lives at Earlston Drive, Bentley Road, Doncaster, had his crash at the Mexborough Sports in July. At the sports he won five first prizes and two seconds.

During the season he has competed in two second class handicaps and won both. In two open handicaps he won one and was second in the other.

New President of Manufacturers' Union

D. H. EVAN-PRICE, the new president of the British Cycle and Motor Cycle Manufacturers' and Traders' Union, is still the user of a bicycle. Local director at Fort Dunlop of original equipment supplies to manufacturers, Mr. Price was born at Newton Abbot, Devon, 50 years ago. Educated at Newton College, where he trained in the Officers' Training Corps, he went to Wolseley Motors Ltd. at the age of 18. After four years there he joined the staff of Dunlop's technical advisory manager, and during the war he was manager of their aviation division when he did a lot of flying in service planes. He is a member of the board of the Dunlop Rim and Wheel Company, Coventry.

The Tour of Spain

THE National Cyclists' Union has further news to report on an invitation to send a British team of racing cyclists to take part in the Tour of Spain, from April 23rd to May 8th.

A team of six professional riders will be invited to compete.

The race will be run over main roads, reported to be in good condition. Roads will be closed to all other traffic while the race is in progress.

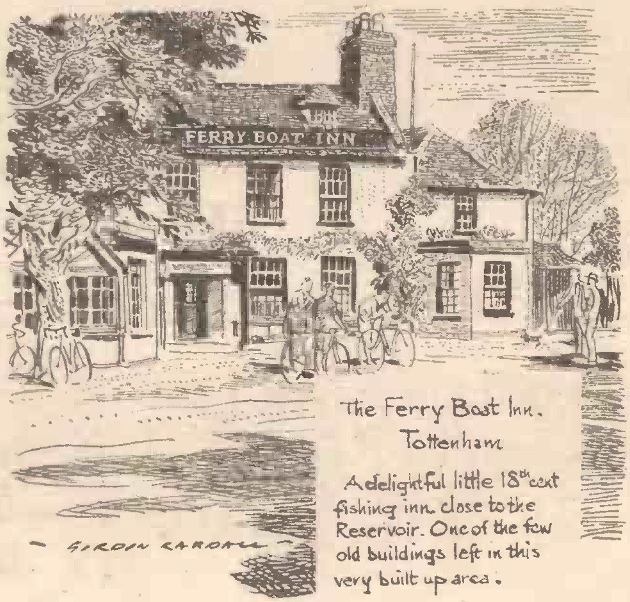
A guarantee is offered to the British team, as follows, by the organisers: That the team will receive 36,000 pesetas if the total amount of prizes won throughout the race by the team does not reach this figure.

Second class rail fare will be offered to all members of the team from London to Bilbao (Race H.Q.) and return. Cost of accommodation, maintenance and transport will be borne by the organisers.

During the entire race all participants will be *insured*, medical facilities will be provided.

The N.C.U. has ensured that the team will be provided with a following car throughout the race.

The prizes are as follow: Overall race winner will receive 100,000 pesetas (prizes to go down to 21st placing); Best National team, 40,000 pesetas (prizes to sixth place); Best mountaineer, 40,000 pesetas (prizes to sixth place); Stage prizes will be 40,000 pesetas, 25,000 pesetas, 15,000 pesetas, 10,000 pesetas, 5,000 pesetas and 2,500 pesetas each stage. In addition prizes will be given to leading riders on various mountain summits and the race leader will receive a daily award.



The Ferry Boat Inn. Tottenham

A delightful little 18th cent fishing inn close to the Reservoir. One of the few old buildings left in this very built up area.

Tripartite Agreement

AT an emergency meeting of the Management Committee of the League, it was agreed that the B.L.R.C. will enter into a Tripartite Agreement with the N.C.U. and R.T.T.C. on the basis of discussions which took place on Sunday, January 2nd, 1955; the Agreement to be as follows:—

1. The N.C.U. to control all track and massed start racing on enclosed roads.
2. The R.T.T.C. to control all road time trials, team and individual.
3. The B.L.R.C. to control all massed start racing on open roads.
4. A single agreed International Licence shall be prepared forthwith and shall be issuable at will by any party.
5. The B.L.R.C. will agree not to provide general benefits to its members, e.g., Legal Defence, Third-Party Insurance, Touring Information, Cycle Insurance.
6. The B.L.R.C. will agree that the N.C.U. shall retain its sole International recognition until December 31st, 1956, and that an overall body—combining the three bodies—for International purposes shall be set up between October 31st and December 31st, 1956, to take over British International Recognition from January 1st, 1957.

In addition to the above:—

1. The B.L.R.C., however, requires that no party shall be able to withdraw from the Agreement unless the membership of that body, by prior consultation, through constitutional procedure, shall have agreed to such a step being taken.

N.B.—This requirement is to avoid any possibility of the sport and its participants being plunged into chaos at a future date because of disagreement between a few people.

2. That the B.L.R.C. definition of an Independent shall continue to operate until such time as the Union Cycliste Internationale rules otherwise. The B.L.R.C. undertakes to alter its definition of an Independent to conform absolutely with any U.C.I. decision on this matter and will accept in full the U.C.I. ruling on the subject.

N.B.—The B.L.R.C. definition is in strict conformity with the present U.C.I. definition of an Independent.

The B.L.R.C. is prepared to accept a two-year limitation on Independents but the R.T.T.C. is not prepared to allow Amateurs to compete against Independents.

The N.C.U. has assured the B.L.R.C. that it is quite prepared to accept Point 1 of the additional requirements.

The Derailleur Gear

(*Continued from page 32*)

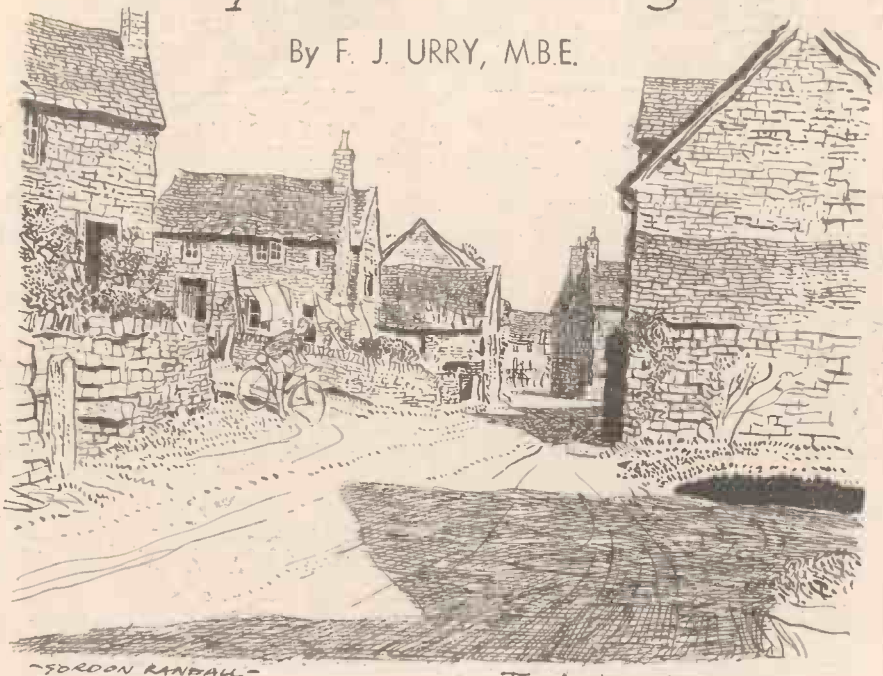
but it should not be pulled tight. This will ensure that the gear does not change past bottom position and into the spokes. The gear must be in low gear position while the cable is attached. Finally the chain is fitted; if ½in. by ⅛in. chain is used a normal spring link may be employed for joining, but with a ½in. by 3/32in. chain riveting must be used for connection. Before finally riveting the chain make sure it is of the correct length. In bottom gear (i.e., the largest sprocket) the chain should be as tight as possible, but still free running. This means that the cage carrying the jockey and tension pulley will be approximately 45 deg. to the vertical (see Fig. 4). The chain should not now sag unduly in top gear. If the chain is too tight it will jam when changing on or off the largest sprocket; if it is too long, there will not be sufficient tension in top gear.

Once they are fitted and correctly aligned derailleur gears should be trouble free, except for slight adjustments from time to time. Trouble may be experienced when a new chain is fitted and run over old sprockets, but this usually disappears as the chain wears in. Sometimes a gear starts slipping for no apparent reason—the chain may be well worn in and the change mechanism in line—the trouble is usually in the gear lever. The centre bolt of the change lever is apt to shake loose and consequently the gear will not hold in position; a screwdriver applied to this bolt will completely cure the trouble.

The derailleur should be kept clean and the bearings oiled with a good lubricating oil; grease should be avoided. When laying the machine down it is always advisable to place it gear side uppermost to avoid damage through contact with the ground.

Wayside Thoughts

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



Tissington – Derbyshire.

Some of the fine stone cottages to be seen in this village, which is also famous for its wells. These are dressed at Ascension time with flowers woven into lovely patterns, representing stories from the Bible—this custom dates from 1349.

Winter Riding

THERE are those who say cycling is uncomfortable during the winter months, and on many days there is good reason for holding that opinion. It is astonishing, though, how many "good" days occur from November to the end of March; the trouble is they do not always fall at the week-ends when we want them. But I should be sorry if I did not have a ride sometime during the weekly holiday, take my quota of fresh air, and, occasionally, rain and wind. The fresh scenes under their winter brevity, and the real delight of scampering over main roads which few folk seem to use at these times, revive memories of those long ago days when there was no motor traffic and we cyclists were indeed the only swift vehicles on the prowl.

In these days, when the sun shines, many of us eschew the main roads and claim the secondaries and the little lanes as our passing property, as it were; so it is to me a refreshment to traverse the hard highways when winter weather hangs out its veils of rain. From the interior of a warm room such hours look dismal, but once you are out, the old joy of movement returns, and you recapture the hardihood, or something of the hardihood, of youth.

To-day, we can keep out the weather, and do it comfortably, if we are wise enough to slip a mile or so an hour from our normal speeds, especially the downhill glides, which, if the machine is given a free run, are the wettest part of any rainy journey. It is part of the philosophy of happy riding to temper speed to the weather, forget the miles and so enjoy the exercise and the changing scene of your own area under the impact of storm or the blurred dampness of winter.

The Urge to Go

I MADE such a journey on a recent Sunday morning, alone, for none of my old friends considered the suggestion of joining me was wise. Maybe they were right; but when I have spent the greater part of six days at work I think I need the change of the open spaces, even if the weather is unkind. A hesitancy did enter my mind on the question of going, but the urge to "do something" won, and before 10 o'clock the rain was running off my mack as I bore quietly into a sou'wester with the intention of calling on an old friend living nearly fifteen miles away. The wind moaned and the rain slanted into my lap; the prospect was not bright, but, strange as it may seem to some folk, I thoroughly enjoyed the ride—and the tea and biscuits that rewarded it when I reached shelter. I was warm, but comfortable, and the slight dampness on the arms was mainly the result of condensation. My friends wanted me to stay for lunch, but I was promised at home for 1.30, and besides, was looking forward to the storm-assisted return as payment for the pressure of the outward journey. I was not disappointed and had a real sailing ride, checked only on the long down slopes to keep the beat of the rain from penetration. On the way out and home I saw seven cars and four cyclists; eleven other wheeled road users in nearly 30 miles, which shows the measure of loneliness still to be enjoyed in this teeming land on wet days. True the route was mainly a lane journey, but even so it is sometimes pleasant to feel you are the passing owner of so many wide areas.

Hope Deferred

THE organisations of the industry are trying to arrange meetings with the Government with a view to the elimination, or the reduction, of purchase tax on bicycles. By the time this is in print it is possible that news on the subject will be public property. I do not think there will be any change of tax, for while it is easy enough to say "away with the impost," no one seems capable of suggesting what should be put in its place. For it is certain the Government wants the money resulting from purchase tax, and it is equally certain its method of collection is, to them, delightfully easy. Obviously, nothing in the cycle buying sense would give me greater pleasure than the complete elimination of the tax, for I do not like to see an invoice with some £4 added to the cost of a new bicycle.

The thing I cannot understand is why the trade organisations publicise their intentions to seek some redress of this burden. By all means let them try—indeed, it is their duty to take every favourable opportunity offered; but, naturally, when they give such intentions Press space, dealers and buyers hold off, hoping for the best, and thereby trade is reduced to hesitancy. It seems to me absurd to undermine confidence without any very definite reason, for this purchase tax reduction subject is at best only based on hope, and I think a very feeble hope at that. Still, I suppose the powers that be know what they are doing by this endeavour to enlist public sympathy, but if that is the object it is no use them complaining of trade in the same breath: they are asking for a hold-up in demand until Budget day.

The Only Hope

PURCHASE tax is a nuisance, it has made the cost of a good bicycle rather more than twice the price of a similar pre-war article. Take the tax away and bicycles would be cheap reckoned on the modern standard of values, and, since we all have got to pay the tax if we want the goods, I think we can consider bicycles as cheap as any taxed commodity. Purchase tax brings in £290 millions to the Exchequer, Income tax £1,400 millions, Tobacco £620 millions, and Beer £325 millions. Thus, P.T. is a valuable asset to the Chancellor, and would give him a problem in replacement if he listened to our complaints. It is on that fact that I place my opinion that P.T. will not be cancelled; it may be reduced, and then only if Parliament is prepared to cancel the Budget surplus.

That, of course, may occur because high finance says a big surplus is for the purpose of checking inflation, and possibly the need for it has now departed. In any case, do not be afraid to buy; the risk of paying too much tax is very slight, and, in any case, you can console yourself that it is in a good cause. I have just bought a new bicycle, and the tax on it is well over £4 10s. 0d., but, if fate is kind to me, I shall get my value out of it.

I am looking forward to the longer days, the gathering warmth of the sunshine, the fragrance of spring, and the prospect of a holiday. Some people love new raiment, new cars, new decorations, and get a lot of quiet satisfaction from them. I like new bicycles, and some of the elderly ones, too, for, to me, they represent freedom, a lessening of all ties with work and domesticity, a sheer joy in looking and listening to the beauty of the world as the quiet furlongs flow under me. I marvel that there are so few of us who really use the values of cycling, and forget all about P.T.!

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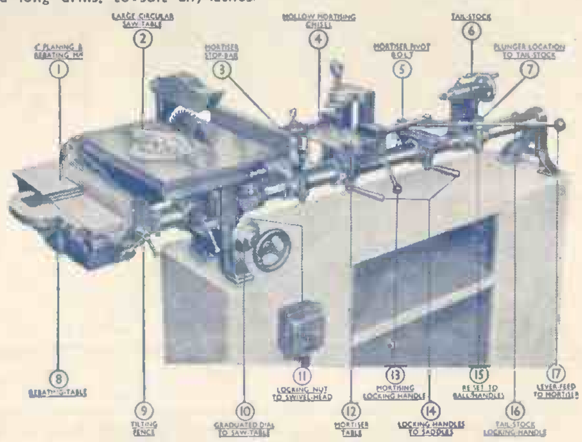

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