MAKING A MODEL UNIFLOW ENGINE

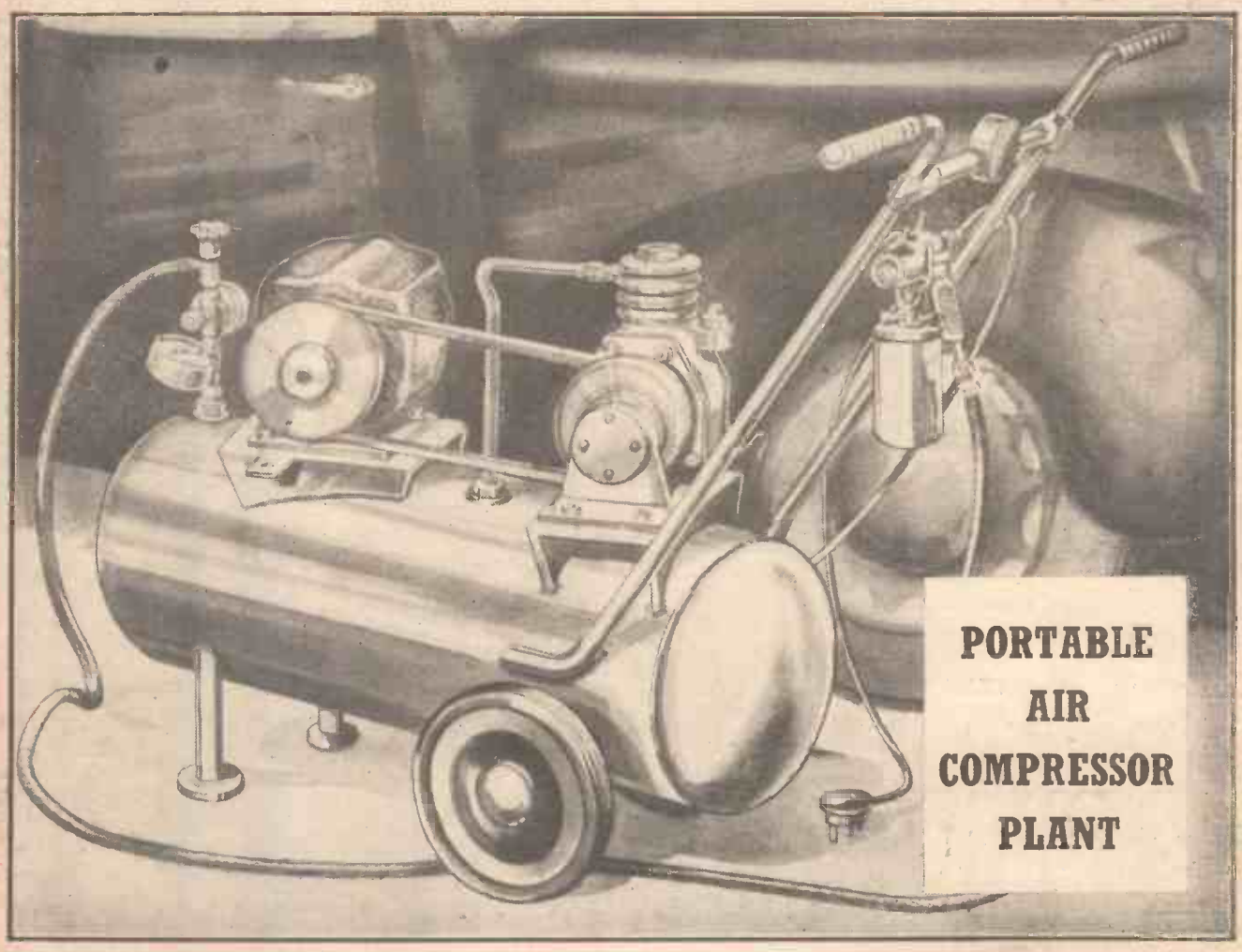
NEWNES

PRACTICAL MECHANICS

9d

EDITOR : F. J. CAMM

JANUARY 1950



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PRACTICAL MECHANICS

EDITOR F. J. CAMM

JANUARY 1950
VOL. XVII. No. 195

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

FAIR COMMENT

By THE EDITOR

COMPETITION FOR MODEL MAKERS

FOLLOWING on our lathe competition I now offer a first prize of £20, second prize of £10, third prize of £5, for the best design and description of a working model made and designed by the competitor. Here are the conditions:

1. The design must be the original work of the competitor. The model must not be the constructed version of a published design.
2. Drawings should be to scale and accompanied by a photograph or photographs, and a 1,000-word description, which should include a list of components and sources of supply.
3. Models made round ex-Government surplus or scrap parts are not permitted. It must be possible for anyone to be able to make the model from readily obtainable parts.
4. Models may be of locomotives, aeroplanes, steam engines, machine tools; in fact, of anything which works.
5. Readers may submit the actual model if they so desire. It will be returned when the judging is complete.
6. Competitors should state whether they are professionals or amateurs, as this will be taken into account in the judgment.
7. Models which have already received awards in open competition are expressly excluded, and it is a condition of entry that the model has not previously been described in any periodical, book or newspaper.
8. Entries should be received not later than March 1st, 1950, and be addressed to The Editor, PRACTICAL MECHANICS, George Newnes Limited, Tower House, Southampton Street, Strand, London, W.C.2.
9. The Editor does not accept any responsibility for the loss of models, nor damage to them, but every care will be taken to see that they are returned in good condition.
10. Stamps for return by registered parcel post must be enclosed.

RECORDING OF TELEVISION

WITH the advent of television recording, or "telefilm" as it is called, a new tool has been placed in the hands of the television programme builders. Until now television pictures have been ephemeral: however notable the event, however great the labour devoted to planning and rehearsal, the picture flashes on the screen and is gone. Now, thanks to this new system, the pictures are captured in an enduring photographic record on ordinary cinema film.

After several months' work, during which many difficulties have been overcome, the system has been developed to the stage at which it is possible to telefilm a broadcast and reproduce it again in the programme days or weeks afterwards, with little loss of the original picture quality. The method was proposed by H. W. Baker, engineer-in-charge, Alexandra Palace; H. G. Whiting, now engineer-in-charge of the new Sutton Coldfield station, in collaboration with D. R. Campbell, one of the senior engineers at Alexandria Palace, and perfected by W. D. Kemp, of the planning and installation department of the B.B.C. It is covered by a patent application and is one of several that have been, and, indeed, still are being, investigated.

This result has been achieved by a detailed study of the deterioration of picture quality that must inevitably take place in any process, such as recording, that combines complex electronic, optical and photographic methods. The B.B.C. engineers have assessed these losses and have introduced into the process accurately judged degrees of electrical over-compensation which almost exactly counterbalance the degradation in picture quality that accompanies the recording process.

The recording system uses a continuous-motion camera—actually, of course, two are provided to enable continuous recordings to be made—in which the movement of the film is chased by an optical image of the television picture reflected from a rotating mirror drum. By this means all the 405 interlaced lines of the picture are recorded on the film, and the difficulties of relating the television frame frequency to the picture repetition frequency on the film are overcome.

The new recording equipment came into service at the beginning of November in a small way, and the intention is to broaden the scope of its use as time goes on. The Service of Remembrance on November 6 and the Lord Mayor's Show on November 9 were two of the first important Outside Broadcasts to be telefilmed in order that they could be shown in the evening to viewers who had been unable to see them during the day.

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"PRACTICAL ENGINEERING" DATA SHEETS

A REMINDER to readers of this journal that our companion journal, *Practical Engineering* (published at 4d. every Friday) includes eight valuable data sheets every week, and these will continue until at least one hundred and sixty have been completed. A special binder is available for 2s., and back issues, limited in number, of course, have been specially reserved for those who miss the commencement of this series of valuable engineering data sheets. If you are engaged in engineering or are likely to be you should not miss this opportunity of acquiring, at a tithe of its real price, this unique collection of tables, formulæ, data and memoranda which are needed every day in the drawing offices and workshops.

SOLDERING ALUMINIUM

THE soldering of aluminium because of its rapid oxidation has always been a difficult problem. A British firm has now solved the problem by means of what is termed an ultrasonic soldering iron. This device consists essentially of a removable copper soldering bit and a magneto-striction transducer. The soldering bit which is heated by means of a conventional resistance winding, is secured to a brass block held in firm contact with the nickel core of the transducer. The ultrasonic power necessary to drive the transducer is supplied by an electronic amplifier comprising the power supply unit.

In this new soldering iron the problem of temporarily destroying the refractory oxide film, which forms on most light metal and alloys, is solved by ultrasonic stimulation. This provides a clean surface and greatly facilitates the soldering of aluminum and other metals which form refractory oxides.

The soldering iron is simple to use, and has the advantage that no flux is required, and that standard soft solders may be employed. To avoid electrolytic action, however, it is advisable to use a solder with a tin-zinc base instead of the usual tin-lead alloy.

In application the soldering bit is allowed to heat to the usual operating temperature. The transducer is then energised, and the bit is tinned by applying a soft solder. After this, soldering is carried out in the normal way, care being taken to maintain a good liquid contact between the bit and the work. This ensures the maximum acoustic efficiency, and enables positive and uniform joints to be obtained.

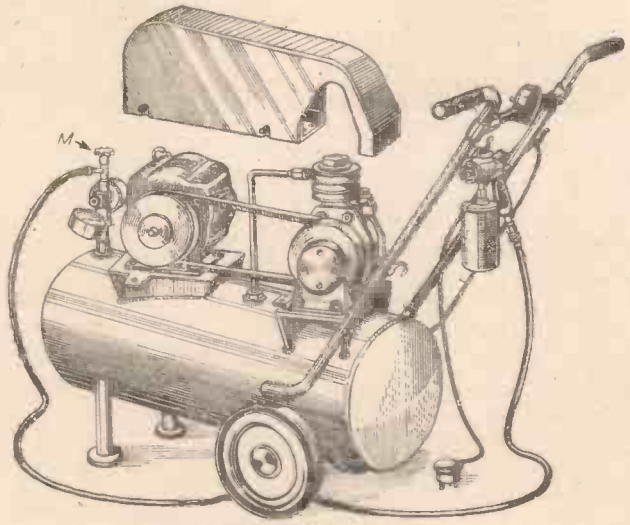
The ultrasonic frequency chosen to operate the bit is well above the normal audible range, so that no discomfort is experienced by the operator.

This new ultrasonic soldering iron, which is the first commercial model of its kind in the world, should prove of particular value in the aircraft, civil engineering, shipbuilding and hardware industries—and, in fact, all manufacturing industries where the successful soldering of aluminium and its alloys has for so long been a pressing problem.—F. J. C.

A Portable Air Compressor

An Adaptation for an Air Compressor Unit for Paint Spraying

By C. W. DEAN



The completed spray plant with belt guard removed.

THIS useful plant described in the present article is within the scope of the average mechanic, and can be constructed in a small engineers' shop equipped with a small electric welding plant.

Air compressors of the type shown in the accompanying illustrtations are still obtainable from the Air Ministry surplus supply stores. They are of high quality workmanship and are made by leading British manufacturers.

The compressor is of the reciprocating type and the official data states that they are capable of giving a pressure of 200 lb. per sq. in. in 10 minutes at 1,200 r.p.m. It must only be run in a vertical position, and depends on the outside air for cooling. The cylinder head must not heat up above 122 deg. F. or it will affect lubrication.

The piston is operated by a cross-head, and the cylinder has a phosphor bronze sleeve with a transfer port in the lower half of the cylinder wall.

Cycle of Operation

The cycle of operation is similar to a two-stroke internal combustion engine (see Fig. 2). When the piston ascends, the air pressure decreases and a partial vacuum is created in the crank-case. Air at 14.7 lb. per sq. in. is drawn in through the inlet valve A into the crank case and at the same time the air already in the cylinder is being compressed by the piston and forced through the ball valve B.

The descending piston compresses the air in the crank-case, and when nearing the bottom of its stroke the transfer port C in the cylinder is uncovered. Air now under pressure passes from the crank-case into the cylinder ready for further compression on the next ascending stroke when air is again forced through B and out to the air receiver.

The main delivery valve unit D consists of the non-return valve B and a spring loaded relief valve E. This is normally set for 200 lb. per sq. in. pressure and it should automatically cut out when this pressure is reached, or it could be reset to a lower predetermined pressure by slackening back and repinning the adjusting nut, or by inserting a weaker spring. An excess of air or back pressure from the receiver will force E off its conical seating and the air is then by-passed through passages L which lead from the valve unit D through a passage in the compressor body and back to the crank-case. The compressor cannot then generate further pressure until the receiver pressure falls below the setting of valve E, thus allowing the compresor to idle after the total pressure in the receiver has been reached.

A non-return valve is not necessary between the compressor and the air receiver. It will prevent the compressor from cutting out, even if you do regulate valve E. This also applies when you use a regulator M at the outlet of the receiver. However, seeing that the re-setting of the valve E is a delicate job it is advisable not to disturb valve E for lower pressures than 200 lb. per sq. in. but use a standard regulator at M. Paint can be sprayed at between 30 and 50 lb. per sq. in. and M can be regulated accordingly.

When adjusting or overhauling the valve unit D, the following information might be useful. First release the air out of the receiver, unscrew the top hexagon cap, and remove sealing washer, then, with a special spanner, remove the steel locking sleeve F. Remove the split-pin and unscrew the ball valve stem G. A special valve extractor is then screwed into valve E and the valve assembly can then be withdrawn from the top of the compressor. Notice and mark the position of the spring retaining nut H, because you will require to know this position when reassembling, especially if you want the same cut-out pressure.

Remove nut H and spring. If the ball valve B is pitted this should be replaced after cleaning the seating and sliding parts with petrol. Lap the by-pass valve E to its seating if necessary.

On reassembling the valve, smear all working parts with oil. Nut H must be carefully positioned and the ball stem G adjusted. The procedure for this is to screw G down on to the ball, then unscrew a full sixth of a turn back to bring the slot in the top of the screw of G in line with the slot in the nut H, then replace the split-pin. The copper washer J under the valve should be clean; also be careful to replace all washers, because these determine the clearance between the piston and the valve unit. This clearance when the piston is on the top dead centre is .002 to .004in. The locking sleeve F must be screwed down very tightly. Turn the compressor by hand to check that the piston does not foul the valve. If it does, use extra washers to make up a total clearance of .007in.

Defects in pumping air can be caused by: the piston leaking due to lack of oil, or the non-return valve leaking due to lack of sealing oil. (Check the oil level in the crank case for either fault.) Or defects by internal leak at the cylinder head when the locking sleeve F requires tightening, or leaks in the pipe line, which can be detected by smearing all joints with thin oil or soapy water and watching for bubbles.

Lubrication

Lubrication is provided by a small quantity of castor oil being poured in and afterwards topped up through the inlet valve A every 10 hours' running time. The inlet valve cover should be taken off, the valve stem depressed and oil poured in. Castor oil will keep a good viscosity when heated up. The oil seeps to the botom of the crank-case and moving parts dip and are splash lubricated. Use plunger K for testing the oil level and stop filling when oil emerges. The level must not be exceeded. It might be useful to note that the hexagon cap gets fairly hot when 50 lb. per sq. in. is registering on the regulator dial at M.

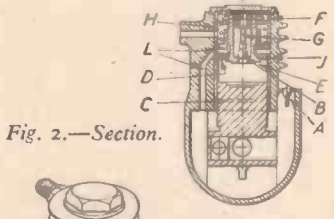


Fig. 2.—Section.

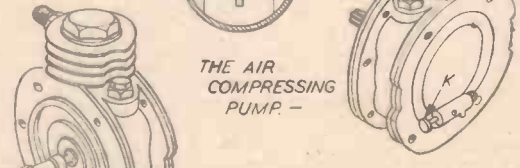


Fig. 3.

Fig. 1.—General view showing the splined shaft.

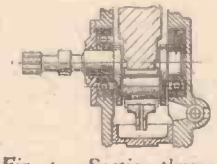


Fig. 4.—Section through the crankshaft.

Sectional views and details of the pump and flywheel.

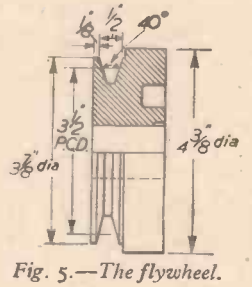


Fig. 5.—The flywheel.

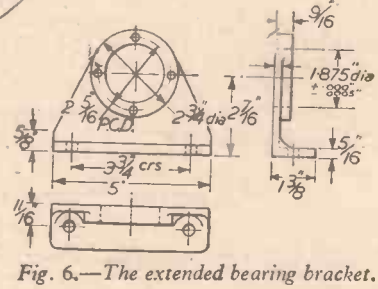


Fig. 6.—The extended bearing bracket.

Fig. 4 shows a section of the crankshaft supported on ball bearings. The overhung shaft extension has six splines, and also a reduced neck 5/16in. diameter. The shaft is made of a good quality steel.

The strength of this reduced neck was checked and assumed to be 40 tons per sq. in. tensile, or 32 tons shear steel, and with a safety factor of 10 the shaft should be capable of transmitting .84 h.p. at 1,200 r.p.m. calculated for pure twisting only. Many tests and experiments were carried out with the aim of obtaining two cu. feet of air at 50lb. per sq. in. pressure at the spray gun, and it was found that a direct coupling to a motor would not give the desired result.

Air Compression Factors

The compressor bore is 25 mm. and the stroke 30 mm. The factors and formulæ governing the supply of compressed air are: That according to Boyles Law, $p \times v$ is constant, where p=pressure per sq. inch.
v=volume in cubic inches.
1 cu. ft.=1,728 cu. in. 25 mm.=.984in. 30 mm.=1.18in. 25 mm. dia.=.7584 sq. in. area.

$$h.p. = \frac{pLAN}{33{,}000}$$

Where h.p.=horse power.
p=pressure per sq. in.
L=stroke in feet.
A=area of piston in sq. in.
N=No. of working strokes per minute.

8in. dia.=50.26 sq. in. × 24in.=1,210 cu. in. volume of receiver.

Pressure of atmosphere=14.7 lb. per sq. in.

From previous information these compressors will deliver when running at 1,200 r.p.m.:—

400 cu. in. of air compressed at 200 lb. per sq. in. in 10 minutes.

or 400 cu. in. at 20 lb. per sq. in. per min. $\therefore p \times v = 8{,}000$ constant.

or 160 cu. in. at 50 lb. per sq. in. per min. $\therefore p \times v = 8{,}000$ constant.

or 106.5 cu. in. at 75 lb. per sq. in. per min. $\therefore p \times v = 8{,}000$ constant.

From compressor: Bore × stroke × r.p.m.=cu. in. per min.

.7584 × 1.18=.9 cu. in.=vol. of displacement.

.9 × 1,200=1,080 cu. in. vol. delivered per min.

For 75 lb. per sq. in.=75+14.7=89.7 lb. per sq. in.

Theoretical vol. per min.=

$$\frac{1{,}080 \times 14.7}{89.7} = 179 \text{ cu. in.}$$

From the above the compressor actually delivers 106.5 cu. in. at 75 lb. per sq. in.

$\therefore \frac{106.5 \times 100}{179} = 60$ per cent. efficiency of compressor. The speed of the compressor was increased 50 per cent. to give 1,800 r.p.m.

$\therefore \frac{106.5 \times 1{,}800}{1{,}200} = 160$ *cu. in.* at 75 *lb. per sq. in.* at 1,800 r.p.m.

or 240 *cu. in.* at 50 *lb. per sq. in.* at 1,800 r.p.m.

The h.p. required to drive the compressor when it is pushing air into the receiver against a mean effective pressure of 75 lb. per sq. in. is: $h.p. = \frac{pLAN}{33{,}000}$

$$\therefore h.p. = \frac{75 \times 1.18 \times .7584 \times 1{,}800}{12 \times 33{,}000} = .305 \text{ h.p.}$$

and at 60 per cent. efficiency=.51. h.p.

Volume in receiver=1,210 cu. in. The compressor pumps into receiver 160 cu. in. at 75 lb. per sq. in. per min.

$\therefore \frac{1{,}210}{160} = 7\frac{1}{2}$ mins. to fill up to 75 lb. per sq. in. or 5 mins. to fill up to 50 lb. per sq. in.

Also $v \times p$=constant $\therefore$ 1,210 × 75=91,000. If we require 50 lb. per sq. in. and 1 cu. ft. per min. delivery 50 × 1,728 = 86,500 and $\frac{91{,}000}{86{,}500} = 1.055$ mins. to empty, but you are still pumping in 240 cu. in. × 50=12,000 at the same time, which will increase the time of emptying. At first I used a one-third h.p. motor and was content with 25 lb. per sq. in. and about 1 cu. ft. per min. delivery and found that the compressor held this pressure very well with only a very gradual falling off in pressure. I also built up to 100 lb. per sq. in. with this one-third h.p. motor, but it began to heat up to the detriment of the motor. However, it was found from tests that a one-third h.p. electric motor will drive the compressor and deliver 50 lb. per sq. in. pressure. A ½ h.p. motor is a better proposition, and if you set the regulator to blow off at 90 lb. per sq. in. you should get a delivery of 75 lb. per sq. in. from the actual storage pressure in the receiver.

As a final proposition, if you work to the original specification and used the compressor for 200 lb. per sq. in., the h.p. required

$$= \frac{200 \times 1.18 \times .7584 \times 1{,}200}{12 \times 33{,}000} = .565 \text{ theoretical}$$

h.p. There is an increase in efficiency: $\frac{1{,}080 \text{ cu. in.} \times 14.7}{214.7} = 74$ per cent. $\therefore$ the h.p. required $= \frac{.565 \times 100}{74} = .77$ h.p. = approximately ¾ h.p. motor. It is advisable to keep to the 1,200 r.p.m. for the compressor and the delivery of 40 cu. in. at 200lb. per sq. in. per minute as it was originally built, and as this latter example shows. The receiver will be filled at this pressure in 30 minutes., e.g., $\frac{1{,}210 \text{ cu. in.}}{40 \text{ cu. in.}} = 30$. $p \times v = 242{,}000$ and at 50 lb. per sq. in. used at the rate of 1 cu. ft. per min.=2.8 mins. to empty the receiver, but you still have 160 cu. in. at 50 lb. per sq. in. being pumped in all the time after your pressure has dropped to 50 lb. per sq. in. in the receiver.

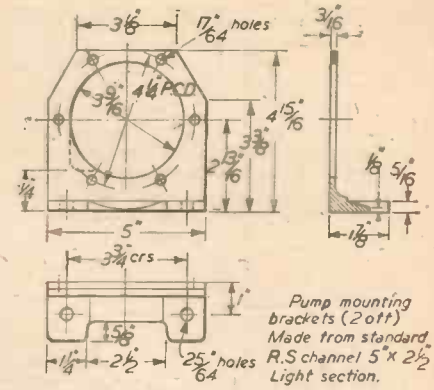


Fig. 8.—Elevations and plan of the pump mounting brackets.

Oil-free Air

Regarding any oil vapour, from the actual running it was found that there is no trace of this in the air from the receiver, and considering that the transfer port in the cylinder is fairly small there is very little oil getting to the ball outlet valve. In some installations it is the practice to place an oil container between the compressor and the receiver and air is pumped through this oil, which is also controlled by baffle plates in the container. Back pressure, which is always present then acts on the oil and seals the ball valve B. The oil level in the container should be below the compressor and oil can then drain back into it. When the relief valve E comes into operation the back pressure of the air from the receiver forces oil from the container back into the main valve of the compressor, and it then causes an effective seal on the top of the ball valve whilst air is then being pumped through the open relief valve and through the passages back into the crank-case.

Constructional Details

Coming to the practical and manufacturing part of the design, the tests for speeds, pressures and temperatures were carried out by first trying several diameters of pulleys on the ⅓ h.p. motor, which runs at 1,425 r.p.m. A speed of 1,800 r.p.m. was decided on for the compressor, but it was

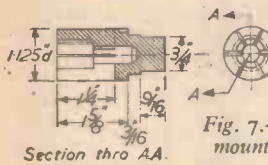


Fig. 7.—Flywheel mounting sleeve.

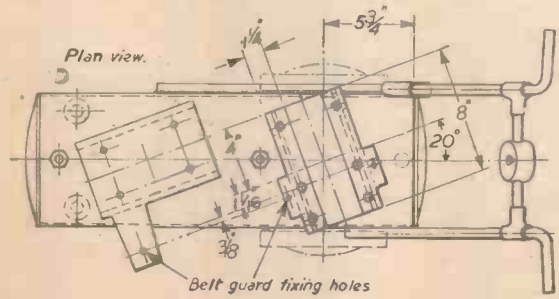


Fig. 9.—Side elevation, end view and plan of the air receiver showing the arrangement of the handles and the general layout of all the welded parts. Note the position of switch and cable entrance.

found that the motor would not drive the compressor at a higher speed. A flywheel is necessary on the compressor and the dimensions for this are given in Fig. 5. An extended bearing, as Fig. 6, had to be incorporated in the design for avoiding any bending on the compressor shaft. Fixing the flywheel on to the splined shaft was a problem because I had no broaching machine in my small workshop, but I had a machine with the standard indexing equipment and found it was more practical to mount the flywheel on a sleeve (Fig. 7). This was bored to suit the bottom diameter of the splines and also counterbored to fit the collar on the shaft. The six sawcuts were milled to suit the width of the splines and go right through to the outside of the sleeve. The sleeve is a tight fit in the flywheel pulley and is fixed by three grub screws half and half in the wheel and sleeve. The inner race of the ball bearing is a tight fit on the end of the sleeve. A standard ½in. to 40 deg. vee-belt is used and the pitch diameter of the pulley on the motor is 4 7/16in. and 3½in. p.c.d. on the flywheel pulley, at approximately 10in. centres This belt will transmit about one h.p., so this should be trouble free.

The bright steel packing piece which is loose under the bracket (Fig. 6) is easily removed; set screws are necessary for fixing the bracket and sleeve so that the packing piece can be withdrawn if the belt ever does require replacing.

The bracket, Fig. 6, and also the two side brackets (Fig. 8), are made from standard R.S. channel 5in. x 2½in. light section. A piece 15¼in. long was machined smooth and square on the bottom flange and on the outside of the web. The top flange was cut down to leave the full depth of the web thickness, and the brackets were then sawn to length and the two, as in Fig. 8, were bored and drilled together to suit the spigot on the side of the compressor, then finished to shape. Part of the inside bottom flange is shaped for belt clearance. The left-hand bracket is filed out to accommodate the plunger on the compressor. The bracket, Fig. 6, is formed by welding a disc to the inside of the channel web after it has been shaped; it is then bored a push fit to take the outer race of the ball-bearing. The cover plates and bracket are then drilled together. The depth through the bore of the bracket is 1/32in. more than the ball-bearing and this will allow the outer race to line up with the inner race. The self-aligning type bearing is the most satisfactory as it will allow for a slight mis-alignment. No. 14 gauge electrodes were used for the welding.

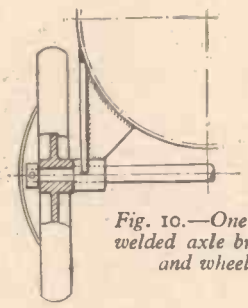


Fig. 10.—One of the welded axle brackets and wheels.

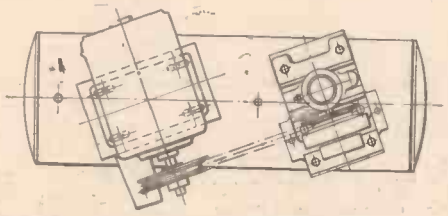


Fig. 11.—General plan showing ½ h.p. motor in position.

Welding Details

The base channel N (Fig. 9) has two ¼in. x 8in. strips welded on the top, and these are then machined to take the compressor feet and to eliminate distortion due to welding. These strips also give extra tapping thickness for the set screws, and the projecting faces are for supporting the belt guard. The channel for the motor is machined on top, holes tapped and studs fitted with locknuts underneath. The 20 deg. angle setting makes a more compact and balanced assembly. Also the centres of both channels correspond with the centre line of the receiver, which makes for more symmetrical cutting of the arcs in the channel flanges and easier for setting and welding to the receiver.

A steel tube 8¼in. outside diameter was obtained, and the end discs were then turned and dished. By chamfering the tube ends outwards I was able to set a "butt vee" weld for these end discs. The inside of the receiver was painted with copal varnish. A satisfactory receiver could be made with a foam extinguisher of the required diameter; these are usually made to stand 200 lb. per sq. in. pressure, or more. The three views of Fig. 9 show all the welded parts on the receiver. Fig. 10 shows one of the welded axle brackets and wheels. The three-core electric cable for the motor runs through one handle to a metal-clad switch mounted between the handles, the cable entering at O (Fig. 9).

Standard electric conduit and tee pieces make the handles, etc. The general plan (Fig. 11), shows a ½ h.p. motor in position. As the dimensions of motors vary, the fixing and position of this can only be decided by the actual motor; the fixing studs are in the middle of the slots in the motor base in order to get the belt on and to provide for further tightening of the belt.

Three views of the assembled compressor unit are given in Fig. 12.

The belt guard is made of 18 to 20 gauge sheet metal, and the small bottom channel for this has four ¼in. x ⅜in. Whit. studs, welded in the sides; this channel is bolted across the projecting faces of the base channels The guard drops down over the entire belt drive.

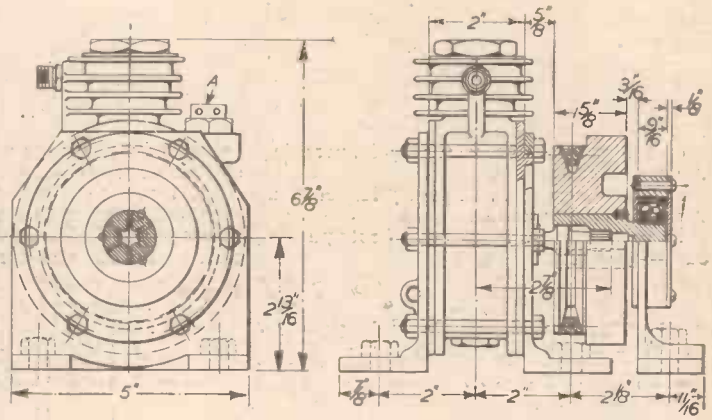


Fig. 12.—End view, part sectional, side elevation and plan of the assembled compressor unit.

The stronger disc type pram wheels, heavy type, make suitable wheels.

A reduction in the diameter of the receiver is not recommended as the size given has been found to be best for proportion and balance.

LIST OF COMPONENT PARTS

Ref.	Description	No. Off	Mat. Reqd.	Remarks
1	Compressor	1	—	Bought complete.
2	Electric Motor	„	—	Fractional h.p., 1,425 r.p.m.
3	Vee Rope	„	Stk.	Std. ½in., 31½in. approx. inside circumference.
4	Flywheel Pulley	„	C.I	3½in. pitch cir. dia. (see detail, Fig. 5).
5	Motor Pulley	„	„	4 7/16in. P.C.D., 1½in. thro. bore. keyed on.
6	Sleeve	„	M.S.	See detail, Fig. 7.
7	Grub Screws	3	„	3/16in. dia. × ¼in.
8	Ball Bearing	1	Stk.	¾in. L.T. type, self-aligning, 1⅞in. o/d.
9	Bracket	„	M.S.	See detail, Fig. 6.
10	Disc Cover Plate	„	„	2¾in. dia. x ¼in. thick, 1/32in. recess. Drilled.
11	Disc Cover Plate	„	„	2¾ dia.x ¼in. thick, 1/32in. recess bore 25/32in.
12	Bolts	4	„	No. 1 B.A. × ⅝in., round head.
13	Angle Bracket	2	„	(Fig.8) Ls from 5in. × 2½in. x 15¼in. channel.
14	Bolts and Nuts	6	„	¼in. × 2¾in. hexagonal head.
15	Set Screws	4	„	⅜in. × ⅝in. hexagonal head.
16	Loose Packing Piece	1	„	5in. × 1¼in. × ⅜in. drilled from bracket 6.
17	Set Screws	2	„	⅜in. × 1¼in. hexagonal.
18	Packing Strips	„	„	MS. plate from 8in. × 1¾in. × ¼in. welded on.
19	Base Channels	„	„	5in. × 2½in. × 8in., flanges shaped, welded on.
20	Studs and Locknuts	4	„	Approx. 5/16in. for motor.
21	Air Receiver	1	„	8¼in. outside diameter × 2ft. 0in. long.
22	Axle Brackets	2	„	3/16in. plate (see detail, Fig. 10).
23	Axle	1	„	From ½in. diameter × 12in., reduced cnds.
24	Collars and Split-pin	2	„	⅜in. for axle ends.
25	Wheels and Covers	„	„	Steel, rubber-tyred, 8in. o/d.
26	Legs	„	„	⅜in. o/d. × 6½in. electric conduit welded on.
27	Disc Feet	„	„	1½in. × ¼in. thick, welded on.
28	Handles	„	„	¾in. conduit × 6ft. 0in. total length.
29	Tee-pieces	3	„	For electric conduit.
30	Tumbler Switch	1	„	Ironclad case.
31	Drain Plug	„	„	⅜in. std. gas.
32	Airhole Pads	2	„	For inlet and outlet, hexagon nuts welded.
33	Rubber Hose	1	—	¼in. bore, ⅝in. o/d × 8in. long, h.p.
34	Connectors	2 Sets	Brass	Stems, nuts, clips.
35	Regulator	1	„	With dial and pressure marks.

CORRECTION

In the article on Model Internal Combustion Engines (December issue, page 95) the first line in the first column should read, ". . . from a 1½-volt dry battery . . ." and not "from a 2-volt accumulator." In the same page, eight lines below Fig. 6, the word "which" should read "when."

Invisible Slaves of To-morrow

The Electron Will Run Our Factories and Homes

By Prof. A. M. LOW.

THINK of the smallest thing we used to know—an atom of hydrogen—so small as to be far beyond the reach of even the new super-microscope magnifying 50,000 times. Then try to think of something which weighs only one 1,840th part of this atom. It is impossible to "imagine" such a minute thing, and yet it is one of the most useful known to man. It is providing us daily with entertainment. New developments suggest that in the very near future it will almost entirely run our factories and homes. It is the servant of the future, never complaining of overwork, wanting no "afternoons off."

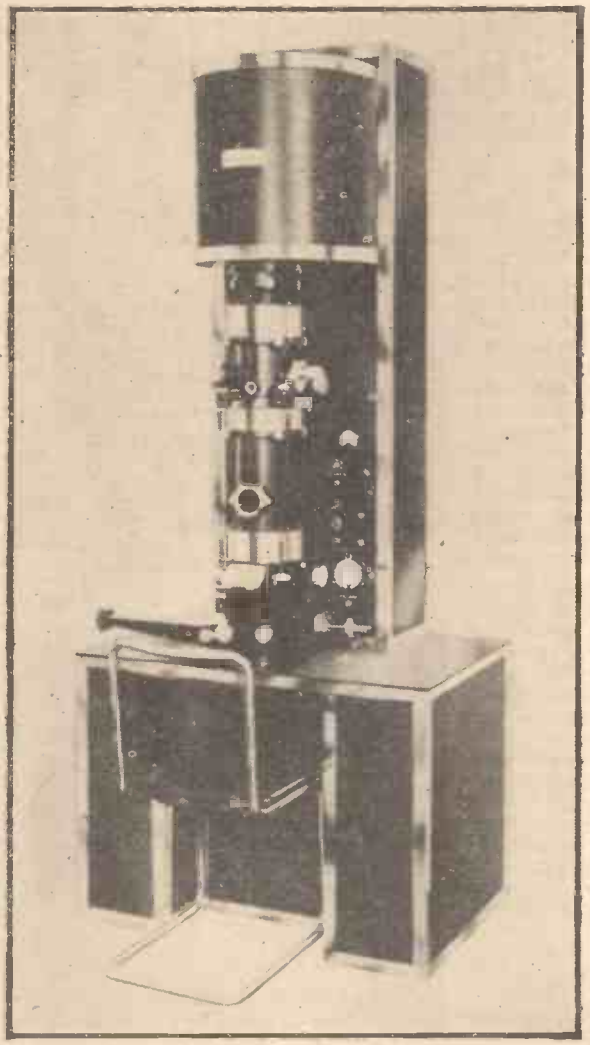
This "thing" is an electron. Its employment in a wide diversity of tasks is making a new science of electronics, a word that will be common to-morrow. Billions of them are produced whenever an electric current passes between two electrodes in a tube from which the air has been exhausted. They are, of course, the servants that perform the "miracles" on our wireless set. We cannot see them, but it is their impact on the screen which makes the "pictures" in television. To-morrow they will be lighting our homes, collecting the dust from our rooms, removing the soot from our chimneys and cooking our meals, to mention only a few applications. There is no "perhaps" about this. All these things are being done by these invisible servants to-day and it is only the hangover of war that prevents a vast extension of electronic usefulness.

"Electronic" Lighting

"Electronic" lighting is already installed in many factories and offices. It was invented about 20 years ago and lamps that would work from the ordinary mains were perfected in 1939. Briefly, how electrons give us light that is three times as cheap and far better for our eyes than the electric lamp we have known so long, is as follows: When millions of electrons strike certain chemicals these chemicals give off light or fluoresce. The energy of the electrons excites the chemicals, and by carefully selecting the proportions of zinc silicate, calcium tungstate, "codiam" borate and other substances we can produce a light of almost any colour we want. The most useful is one that has all the different colours in the exact proportion of daylight because this makes everything appear in its "natural" colours.

In the ordinary lamp there is far too much red and not enough blue, with the result that colours look different by artificial light. Fluorescent lighting can almost exactly match daylight and women will no longer have to worry about changing their make-up when the sun goes down or find it difficult to match threads at night. The electrons go to work in lamps about five feet long in narrow tubes sometimes containing mercury vapour at low pressure or in small bulbs of almost any shape, with electrons passing in a stream from the electrodes. In a few years time we shall no doubt see these lamps in every house with benefit to our bills and our eyes. There is one odd thing about this lighting. Since the electrodes usually have to be hot before they discharge electrons, there is a momentary pause after switching on before there is any light, like a wireless set warming up.

Dust collecting will be done by electrons produced by special "valves" or tubes. The principle is quite simple. We learned at school that oppositely charged particles attract each other. The electrons will convey charges to dust particles as they float in the air and they will be attracted to little metal plates carrying an opposite charge. There will not be any dusting to be done, because the process will go on continuously in every room. The device is quite small, requires only a trifle of electricity. In the same way, electrons will collect smoke particles in chimneys and funnels on to metal plates which will be periodically cleaned.



The Plessey Electron Microscope. A two-stage electro-magnetic instrument, giving direct visual magnification from 600 to 20,000 diameters.

(Photo by the Plessey Coy., Ltd., Ilford).

Cooking by H.F. Current

Cooking will be carried out in special ovens of which the vital part will be a vacuum tube generating a high-frequency current. Without going into technicalities, the food will be placed on a shelf so that it becomes the dielectric of a condenser. Food is a bad conductor and therefore the energy will have to be dispersed. It disperses itself as heat. Heating occurs in exactly the opposite way to a gas or electric oven, from inside the food outwards and it will be perfectly even. A complete meal can be cooked in five minutes and the toughest chicken will become tender at the hands of electronic agents. At the present time these ovens are being used for "cooking" plastic plywood and for other purposes. Incidantally, this method of cooking in combination with plastic glues may provide a method of "seaming" cloth without stitches.

But electrons are, perhaps, doing their most spectacular work in controlling intricate machines and carrying out delicate tests. Most television depends upon the fact that electrons can be bent out of the straight path by an electro-magnet and a condenser. The amount of bending depends on the strength of the current going into the attractor. On this fact are based instruments that will analyse steels in a quarter the time usually required, magnify invisible objects up to 100,000 times and tell you the chemical constituents of something that weighs only some millionth of a milligramme! Electrons are doing all these jobs in factories and laboratories to-day.

Steel Analysis

Steel analysis is effected by a variation of television. Instead of the current deciding the path of the electrons being varied by the light and shade of a "picture," it is varied by the resistance of the specimen and this will alter with the smallest change in its constituents. Suppose you have thousands of pieces of steel and want to know whether they come up to a certain standard. A sample found to be perfect by laborious tests is put in the tester. It produces a "picture" on the screen, the electrons striking it in a "pattern." Now you have only to put the other samples one by one in the machine and see whether they "fit the picture" to know whether they are the same or not. By coupling this device up with a photo-electric cell and relays, you can turn it into a calculator or a sorter, separating different pieces of metal in accordance with the electronic picture they make. In fact, thousands of rivets and screws have been sorted at high speed in this way in factories.

Electron Microscope

The high magnification of an electron microscope is secured by using a stream of electrons in place of the ray of light in an

ordinary microscope. Magnetic fields are the lenses, bending the stream of electrons in much the same way as glass lenses bend light. But the electron stream being much "finer" than the light waves is able to show up particles so small that they would be invisible under the most powerful light microscope, simply because the light would pass round the object instead of being reflected. Since electrons are invisible we cannot directly observe the "picture" they make as the result of striking the object. We make them impinge either upon a photographic plate or on a fluorescent screen when they make a visible picture as in television.

Combating Diseases

The latest development of this idea is even more remarkable. The electrons as they pass through the object collide with the electrons forming part of the atoms. Every normal atom consists of a neutron with a varying number of electrons round it. The more electrons the more collisions there will be with the invading stream of electrons and therefore the slower they will be on emerging. Arrange a magnetic field, therefore, so that the electrons are curved round in accordance with their speed as they emerge from the object, and a pattern will indicate with certainty the identity of the atoms in the object—whether they are of carbon, nitrogen or whatever it may be! This electron microscope analyser is still in its experimental stage, but it has shown that it can, for instance, indicate the chemical constituents of a little dark patch which is only part of a virus so small that it could never be seen with the most powerful microscope! It is likely to prove a tremendous weapon in the fight against the as yet unconquered diseases.

These are just some of the uses of our new servant the electron. It will season our timber in a quarter the time now required, kill insect pests, or make better ice-cream and mayonnaise by giving them a "shaking-up." It will produce better paints. And in the control of machinery there is no limit to what it will do, except our own ingenuity of setting it to work.

The Law About Patents—2

Letters Patent

By W. J. WESTON

"LETTERS patent" is the English dress of the Latin *litterae patentes* and the French *lettres patentes*. "Patent," which means open, is the descriptive word; but, in our economy with language, we make "patent" inclusive of letters. The descriptive word becomes a name, and the patentee is he to whom the King, "of our especial grace, certain knowledge, and mere motion," has given these letters that all may read. "Patents," we are told, "are not sealed up, but exposed to open view with the great seal pendant at the bottom, and are usually directed or addressed by the King to all his subjects at large." The seal of the Patent Office has since 1883 taken the place of the Great Seal.

Have you ever examined a form of letters patent? It is a curious and cumbrous document. A good many of its phrases have led to much litigation, much throwing about of brains in Court: and some of them, as we shall see, have received interpretations not at first sight obvious. The essence of the document is that the Kings grants a monopoly: "we give and grant unto the said patentee our special licence . . . that he shall have and enjoy the whole profit and advantage" of his invention. Moreover, "we strictly command all our subjects whatsoever" not to encroach upon the patentee's privilege of sole use. Let none, but with his leave and licence, presume to use the invention.

Statute of Monopolies

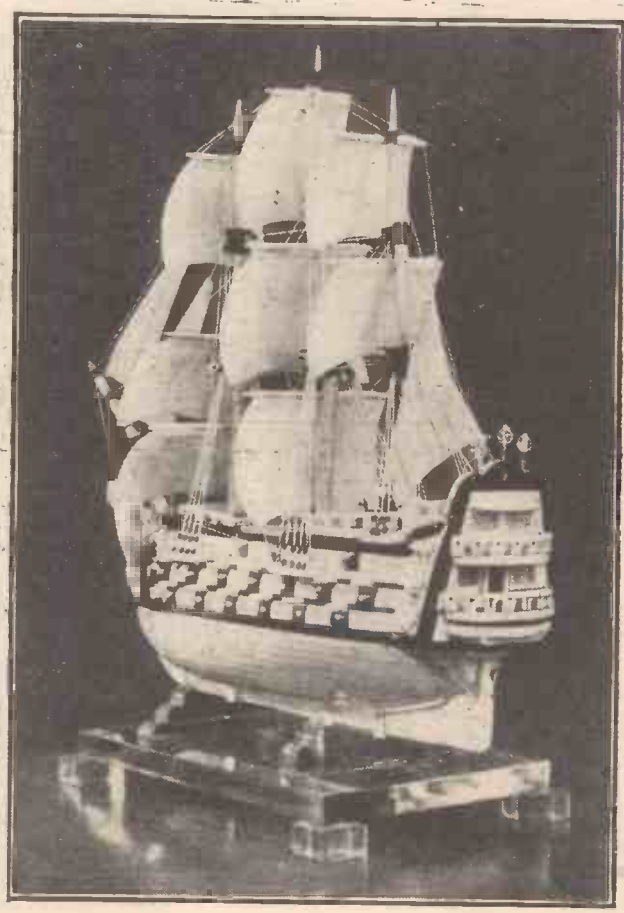
The actual grant of the privilege is ushered in by a number of *Whereases* explaining how it is that the King can, in this particular deserving instance, grant the privilege. For long ago—1624, in fact—Parliament passed the Statute of Monopolies preventing the Crown from granting trading monopolies in general. Such granting—a monopoly of salt, for instance, where nothing but the moderation of the monopolist kept price from soaring ever higher—had been an easy and cheap way of making gifts to those whom the King delighted to reward. But such granting was also a hardship to the community, and it was forbidden by Parliament. The exception in the Act was in favour of the grant of the privilege for sixteen years "of the sole working or making of any manner of new manufactures within this realm, to the true and first inventor of such manufactures." Parliament, well aware of the old abuses, added, however, that the privilege must not be granted if it should be mischievous to the public welfare by the raising of prices of commodities at home, or the hurt of trade, or the general inconvenience.

Whereas—

The *Whereases*, therefore, explain four things in order to justify the grant. First, that the inventor "hath by his solemn declaration represented unto us that he is in possession of an invention: and that, moreover, "he is the true and first inventor thereof." Second, that "the said inventor hath humbly prayed that we would be graciously pleased to grant unto him . . . our royal letters patent for the sole use and advantage of his said invention." Third, and this condition for obtaining a patent is rigorously enforced, "the said inventor hath by and in his complete specification particularly described the nature of his invention." He has made the disclosure that merits reward. Fourth, and last of the explanatory *Whereases*, "we, being willing to encourage all inventions which may be for the public good, are graciously pleased to condescend to his request."

Well, the inventor gets the monopoly he seeks; but then follow certain *Provideds*, warning the inventor of the possible cancelling of his privilege. It may be that the inventor's claim is not good; his is no new invention, nor is he the first and true inventor. It may be that the inventor fails to pay the requisite fees for his patent, the grant being not at all a free gift. Or it may be that the inventor has failed to supply a Government department with his goods on reasonable terms. In any such event "these our letters patent shall forthwith determine and become void."

Model Frigate in Perspex

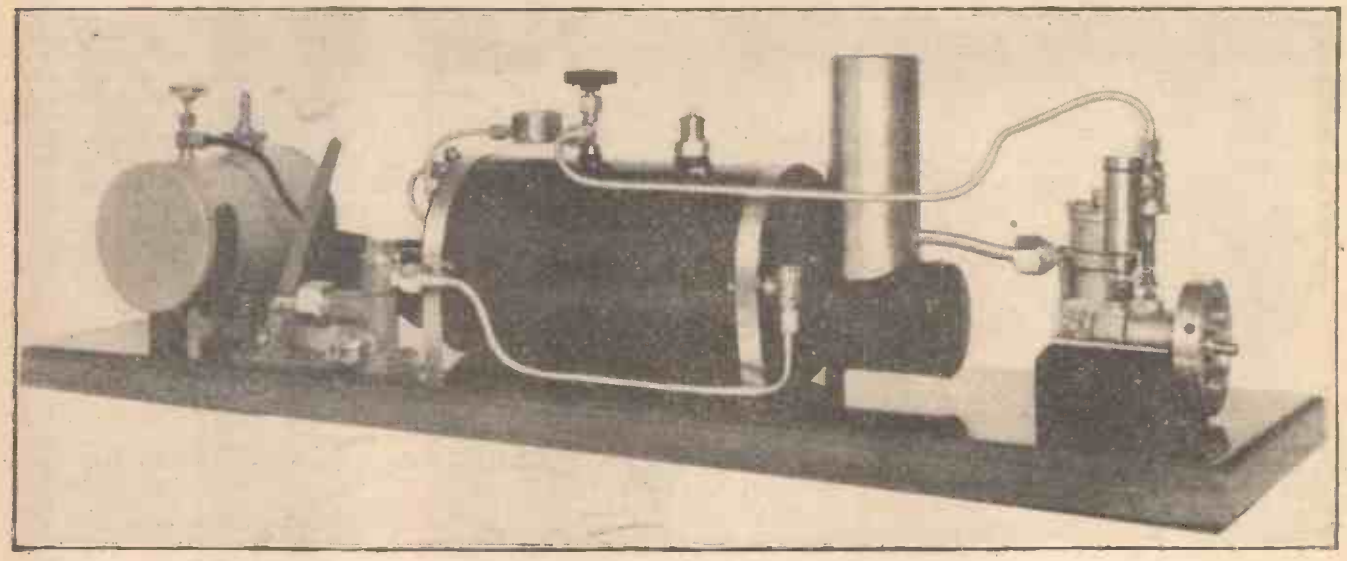


IT is not often that an ultra-modern material can be so successfully employed to exemplify period design as the model frigate in "Perspex," constructed by R. S. Chalmers, of Glasgow. The model is made entirely in "Perspex" acrylic plastic sheet, and the parts are joined with "Perspex" cement; even the sails are modelled in "Perspex," and they have been shaped realistically, to give the impression of graceful movement, by bending the thin sheet material after subjecting it to mild heat.

The wealth of detail indicates that many hours of patient work were spent in the modelling and construction of the model which rests on a stand also made in "Perspex." Full advantage has been taken of the properties of the material in construction and finish, and careful attention has been paid to the finer points of fabrication.

A rear three-quarter view of the model frigate made in Perspex.

The B.L. Model Uniflow Engine



The Complete Uniflow Plant.

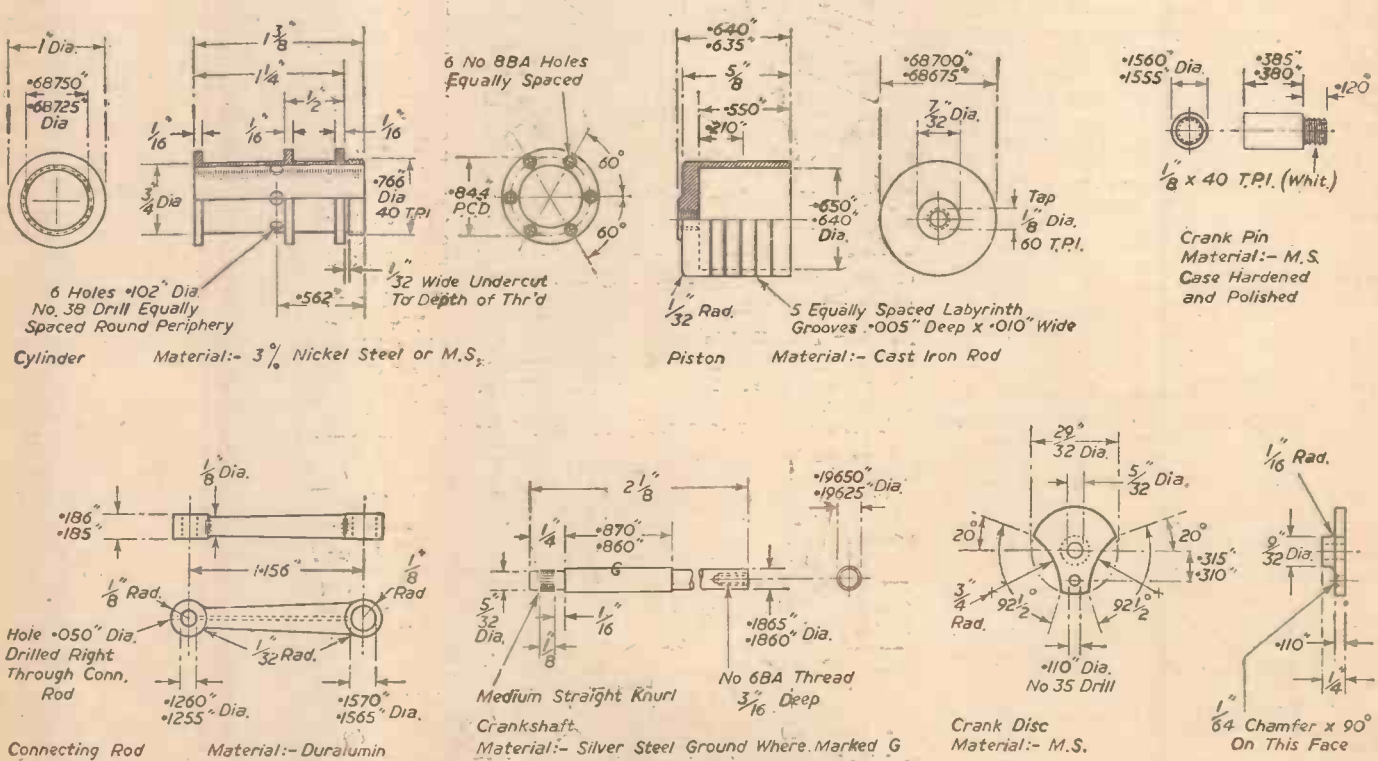
THE Uniflow engine designed by Bassett-Lowke, Limited (as announced in our May issue), is now available either as a complete power unit or as sets of castings. The photograph at the top of this pags shows the complete power plant, an easily constructed and powerful unit for model boats, etc. It is fitted with a centre flue tubular boiler, 6½in. by 3½in. fired by blow lamp and complete with cross water tubes, safety valve, steam valve, pressure gauge, water gauge, check valve, hand feed-water pump and funnel for exhaust and vapour. It is fitted with a displacement lubricator and solid fly wheel, and the base carrying the whole plant, as illustrated, measures 20in. by 8in.

Under test a working pressure of 90lbs. is reached in seven and a half minutes, and at this pressure the speed of the engine is 3,600 r.p.m. The pressure was raised to 120lbs. and the speed increased to 4,100 r.p.m. The pressures were maintained continuously during the entire run of eighteen and a half minutes, with the safety valve blowing the whole time. In this test the steam pipe from the boiler was carried through the casing, a 24in. length being coiled in the flame of the boiler to provide superheat and maximum expansion.

The price of the complete finished engine without displacement lubricator is £5 9s. 6d., whilst a complete set of finished machine parts is £4 15s. A set of castings materials and ball races costs £2 5s.

The engine has a single cylinder of 11/16th inch bore and ⅝in. stroke.

The drawings on this page show the dimensions to which some of the parts must be machined. A further set of drawings will appear next month. We have had one of these engines under continuous test since last March, and we can thoroughly recommend it.

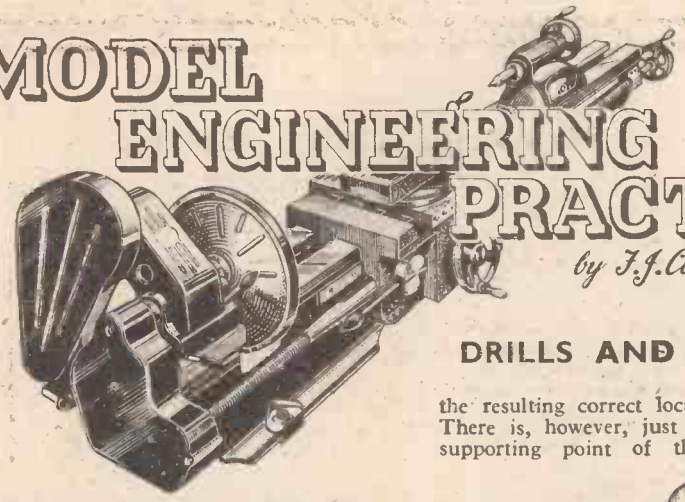


Details of Cylinder, Piston, Connecting rod and Crankshaft.

7th Article of a New Series

MODEL ENGINEERING PRACTICE

by J.J.Camm



DRILLS AND DRILLING

THE first essential in drilling practice is a correctly sharpened drill and, where possible, this should be done mechanically.

When sharpened mechanically, drills are usually ground on the side of the emery-wheel, so as to avoid a concave cutting edge. If done by hand—and this requires considerable skill—they should be held at about 60 deg. to the vertical or horizontal, according to the obstructions of the wheel guards, etc., and given a short spiral twist, at the same time taking a light cut equally on both cutting edges and quenching in water often. Care is necessary to avoid overdoing this twist, otherwise the cutting edge on the opposite side of the drill will be damaged.

The clearance or relief angle to be ground is approximately 10 deg., and the cutting angle 118 deg. If a gauge is not available it is difficult to estimate this 118 deg. when sharpening a drill but a good plan is to hold up the point of the drill so that the top cutting edge is parallel to a level surface and noting position of other edge. From this position it is easy to see a right-angle and, therefore, a right-angle plus almost a third of a right-angle.

In Fig. 70a is shown a badly-ground twist drill in which the cutting edge A is shorter than at B. As the drill is pivoted out of centre the drilled hole will be oversized to the extent of twice X, and this is shown at b, whilst the inevitable ridge c will add to your troubles. The explanation of this ridge in a drilled hole is that, in drilling through a steel plate the defective drill rotates out of centre and as soon as the drill point breaks through the metal the drill then rotates on.

At d is shown a drill with included angle of 118 deg., but not 59 deg. from the centre line, cutting on one lip only (e), and at f the pilot hole.

The pilot hole in ordinary drilling practice is much favoured by engineers because of the resulting correct location and diameter. There is, however, just one snag: as the supporting point of the drill has been removed it is necessary to reduce the speed of the drill to avoid chattering and out-of-round hole.

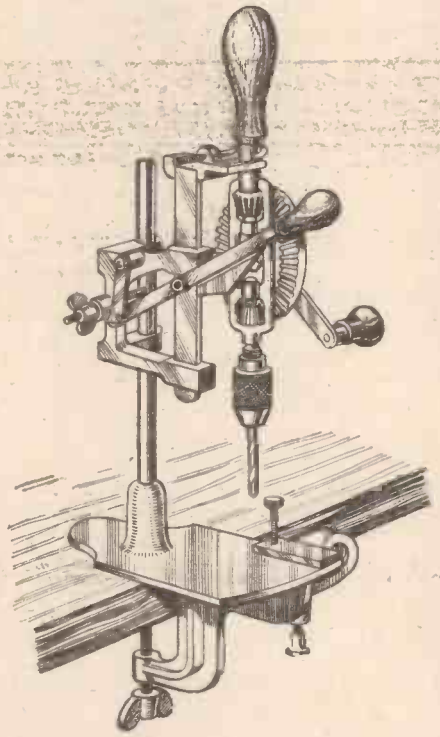


Fig. 69.—Useful lever-feed bench-drill adaptor for hand-drill.

Making Flat Drills

Flat drills have their uses, but are not to be recommended either for accuracy or efficiency.

These, however, can easily be made from a piece of cast steel, or, preferably, silver steel, and forged or just filled to shape. See that the metal is cast steel and not mild steel, and that it is straight. You cannot harden mild steel, but only case-harden it, and this process is of little value for cutting tools.

For use on steel it would be necessary to have a full diameter cutting-edge drill, as shown in Fig. 71b and c, but in the case of brass and other soft metals, especially for small thread tapping sizes, a reliance on the diameter without cutting edges, Fig. 71d, is an advantage. In any case, you will not get a poor thread due to oversize drill hole.

When you have made the drill it must be hardened and tempered, and this can be done in either of two methods:

(1) With large drills by heating 1in. of the cutting end to blood red and partly quenching in cold water. Whilst some heat is still retained, clean the cutting end with a piece of brick or stone then, when the tempering colour reaches a dark straw, quench out in cold water; or

(2) With small tools by heating to blood red and quenching right out in cold water. Tempering can then be done satisfactorily by polishing the drill with emery cloth and applying heat slowly until a dark straw colour reaches the cutting point.

The drill should then be quenched out.

Finally, it may be necessary to grind the drill to meet your requirements, and care should be taken to see that the point runs true. Fig. 71 shows, in comparison, the cutting angles of a twist drill and a flat drill, and accounts for the very heavy pressure that is required for the flat drill, which has a negative rake and whose cutting properties can only be described as scraping. To overcome this difficulty a small clearance groove is made and this is shown at e.

Morse Taper Drills and Sleeves

Most drilling machines are fitted with Morse taper spindles to take drill chucks and taper shank drills, and it is, therefore, essential that both the machine and drill tapers be kept scrupulously clean and free from damage. Clean, because the drill is held in position by friction only, and free from damage, otherwise the drill or chuck will not revolve truly.

As a further aid to these conditions, the interchangeable sleeves to fit taper shank drills and chucks should be removed by a drift supplied for this purpose, and not by any other means.

Don't use a steel-headed hammer either to knock off the sleeve, as shown in Fig. 74, or even to drive through the drift. Use a copperhead hammer, or lead or hide, or even a hard-wood mallet.

Drawing-over the Hole

The object here is to mark out the position of drill hole, and if the drill should wander at its commencement it can be drawn over by cutting grooves, as shown in Fig. 77, taking a light cut, and then to repeat the grooves until the drill hole is correctly

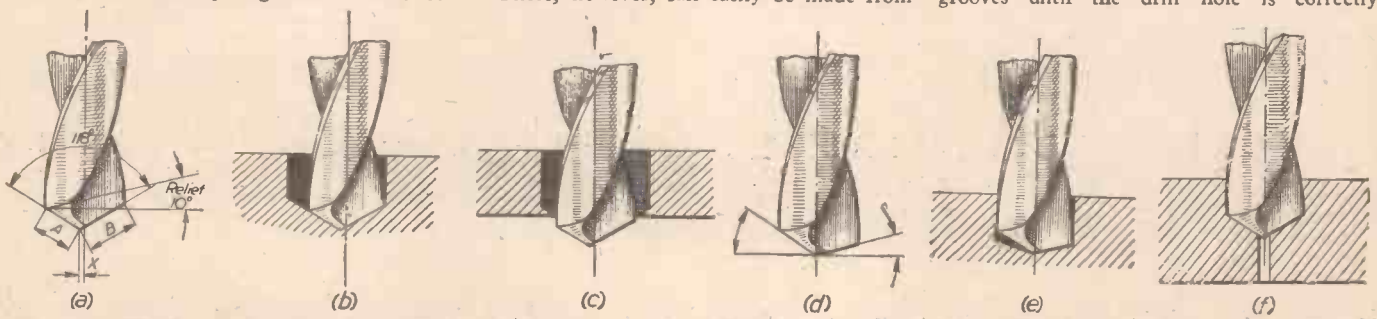


Fig. 70.—a. The unequal lip drill. b. The oversize drilled hole. c. The inevitable ridge. d. The unequal angle drill. e. The one-lip cutting drill. f. The not-too-good pilot.

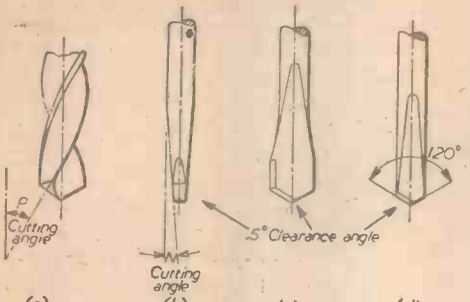


Fig. 71.—Drill efficiency.

positioned. You cannot draw-over the hole if a pilot hole has already been drilled.

The marking out should be done with sharp-pointed tools, and firm, clear lines are necessary if accurate work is to be done. As an aid to the clearness of the marking, steel with a black surface should be whitened (chalk will do) and bright steel darkened by rubbing over a solution of copper sulphate and water.

Lines scribed on non-ferrous metals—brass, copper, etc.—can be plainly seen.

Vice Jaw Characteristics

You may have noticed the work that always rises from its base when tightened in the vice, and that it fails to hold two parallel pieces of like dimensions set one upon the other. This, of course, is due in the former case to the lifting of the sliding jaw, and in the latter to the opening out of jaws when the vice screw is tightened. Vertical pressure on the workpiece is necessary when tightening the vice.

Supporting the Work

However true a drilling machine might be in its squareness to the work table, unless the work is properly supported faulty drilling is the result. To counteract the severe downward thrust of the drill special care is necessary to pack-up the workpiece solid with the base. This also applies to the rising of work in the vice jaws, as previously explained, and although this is not immediately visible, the pressure of the drill will force the work down and out-of-square with the drill proper.

The Cutting Speed

The speed at which you can run the drill will depend upon its quality and diameter and the nature of material drilled. If, for instance, the surface speed of steel is 30ft. per minute, then the revs. per minute of drill spindle for a carbon steel drill of ½in. diameter would be:

.5in. x 3.1416 = 1.57in. for one rev.

$$\therefore \frac{30 \times 12}{1.57} = \frac{360}{1.57} = 230 \text{ r.p.m. (approx.)}$$

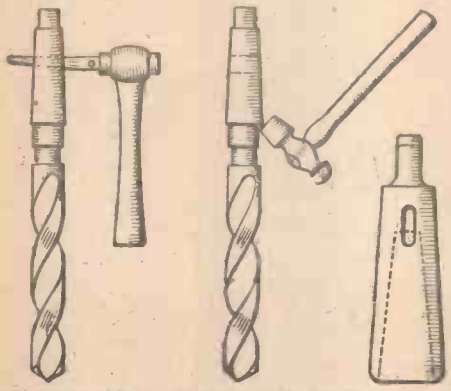


Fig. 74.—The right and wrong way to remove a taper drill sleeve.

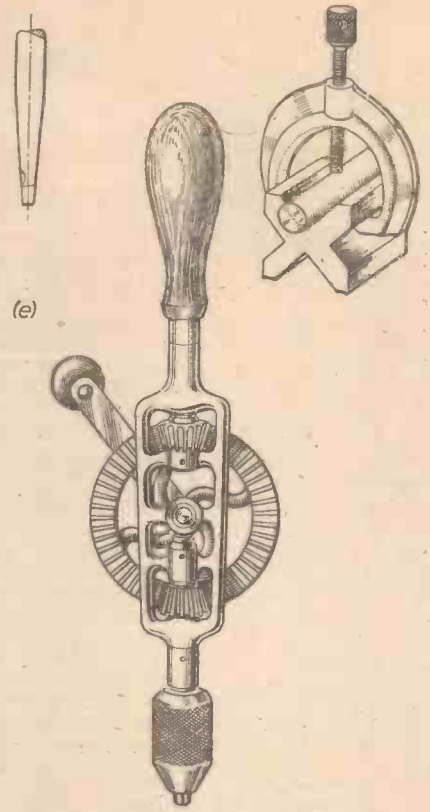


Fig. 72.—Small hand-drill or brace.

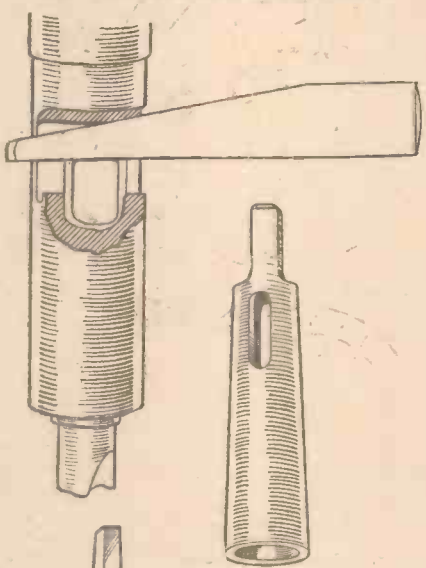


Fig. 73.—Drill for Morse taper socket, and Morse socket adaptor.

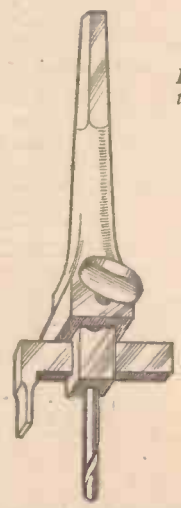


Fig. 75.—Expanding or trepanning cutter.

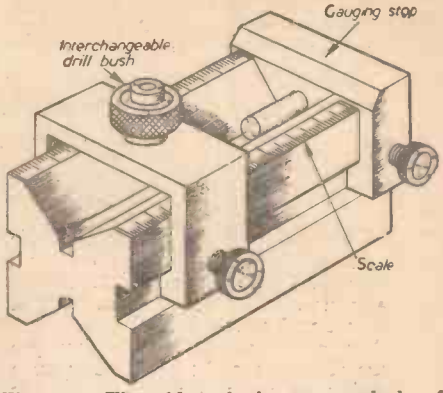


Fig. 76.—The old and the new methods of drilling holes in round bars.

Drilling Operation

See that the drill is held firmly in the chuck by the shank only.

You cannot commence drilling on metal until you have made a location point, or a guide is provided, and it is also very important that the work be securely held, otherwise personal injury is certain. The two most common dangers in this respect are:

(a) Holding down thin plates with your hand.

(b) At the time when drill breaks through the metal.

Lubricating the Drill

A cutting lubricant for the drill is necessary to prevent failure by over-heating at point, and this is usually a soluble oil, i.e., oil and water mixed. In the case of cast-iron and some non-ferrous metals, paraffin, turpentine and other similar fluids are used.

And in conclusion—

Don't leave key in chuck.

Don't leave machine running unattended.

Don't leave machine in a dirty condition.

Drilling for Production

Having gained experience in the art of drilling and drills one can speed up the process and become acquainted with the established practice in the use of drilling jigs and fixtures for accurate and mass-production purposes.

Fig. 76 shows a standard vee block and clamp used in most toolrooms for holding round bars whilst drilling, etc., and needs no description here.

Using Small Drills

The drilling of very small holes needs care. Use the shortest possible drills. All small drills are made far too long and thus are very flexible unless driven at very high speed. A good tip is to break off a piece of a drill and insert it in a hole of its own diameter drilled in a piece of, say, ⅛in. silver steel, soldering it in. The straight flute clockmakers' drills of Eureka pattern are the best type for small holes. Frequent removal of the drill to clear the swarf is necessary.

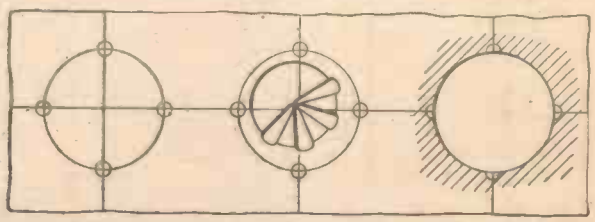


Fig. 77.—Grooved channels to aid correction. (Left to right) The marking. The wandering drill. The correctly positioned bore.

NEW SERIES

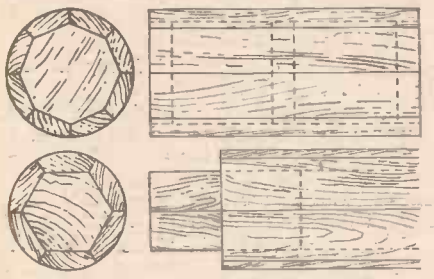
Wood Turning—5

Faceplate Work

By FREDERICK JACE

ONE method of turning a tool handle was shown in Fig. 32 last month, and this method is preferred if the handle is a long one. The hole for the tang of the tool is bored afterwards.

Wood is usually attached to the faceplate by means of screws, and there are few cases where screw holes can be avoided. Thus it is essential to give some thought to the



Figs. 35 and 36.—Methods of building up large diameter from smaller pieces.

mounting so that the screw holes are in the least conspicuous places. If this is not possible the holes should be plugged afterwards.

In the case of very thin pieces the work may be glued to the plate using resin, carpenter's glue or even sealing wax if the cut is to be right. The difficulty with these methods is in removing the piece, but if the glue is confined to the outer edge the final cut can part the disc clear of this. Where glue is used a piece of paper should first be glued to the plate and then the work glued to the paper as this makes removal easy. Wherever possible insert the screws so that there is no risk of the tool cutting into them, and so causing a gap in its cutting edge. Use the shortest possible screws in other words. It is not necessary to use pieces of paper of the same size as the work. Three or four patches of paper will do.

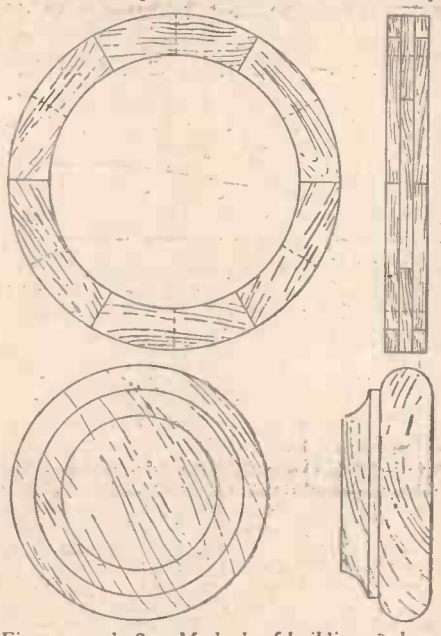
In segmental work which is often attached by glueing it is only necesary to use paper at the joints. It is necessary to use pressure on the work to squeeze out excess glue, and to make quite sure that the work lies flat against the plate. It will be found that when the turning is completed the piece may be prised off with the chisel quite easily. Examples of built-up work were in Figs. 33 and 34 last month, which also indicate how temporary faceplates may be made. The methods shown would apply if one were turning the lid of a copper. As much wood as possible should be removed by means of a fretsaw, bandsaw, etc., and it should be cut reasonably round to reduce the amount of turning to be done. It helps also if the surfaces are planed flat. An uneven surface gives rise to a juddering cut.

It should be noted that in all work turned between centres the length of the blank must be greater than the finished job, which should be turned almost to the point of separation and then the two end pieces containing the centre folds sawn or chiselled off.

When a number of articles are required of identical shape it is often convenient to turn them from one blank between centres, parting off almost to the centre, and completing the operation with a saw when they are all turned.

Built-up Work

The action of turning cuts away the dried and seasoned surface of the wood and exposes fresh and sappy grain which can shrink. Allowances often have to be made for this, especially when turning circular dowells. Also it is important to complete the work at the one setting rather than leaving it overnight. It will be found if work is left too long that circular discs become oval. Use only well-seasoned timber to prevent warping. Material which is built up from a number of pieces of timber is less likely



Figs. 37 and 38.—Methods of building up large diameter discs for faceplate work.

to shrink or warp than that which is cut from the solid. Fig. 35 shows a method of building up which is of advantage when a piece of timber of the required size is not available. Additionally, this method enables scrap pieces of timber to be used up. Fig. 36 indicates a hexagon core with the grain running unilaterally with the covering pieces. It is important when deciding to use this method to make sure that the turning does not cut into the core.

Building in Segments

Fig. 37 shows an example of segmental building suitable for faceplate work. Obviously the number of segments will depend upon the diameter and the timber available. It is seldom necessary to use more than eight, nor should less than six be used, otherwise there will be large areas of end grain showing. It will be noted from Fig. 37 that

Fig. 39 (left).—Locating pieces glued to faceplate for re-chucking.

Fig. 40.—Pattern makers' boss. To ensure concentricity this is chucked by the stud.

the joints of each ring do not coincide. This, of course, is for strength.

Re-Chucking

If it can possibly be avoided work should not removed from centres nor from chucks until turning is completed. Occasionally, however, this is unavoidable and steps must therefore be taken to see that when it is re-chucked it goes back in the same position in relation to the chucks as it was before it was removed. Making a pencil mark on the wood to coincide with another mark on the chuck or the centre is a help. Where it is necessary, for example, to turn both sides of a disc to ensure accurate re-chucking, a recess should be turned in a wooden faceplate of the finished diameter so that the disc can be turned and turned about and maintain concentricity. Fig. 38 is an example of work which is turned only near the edge. The surface adjacent to the plate is planed true before attachment and so that only a small amount of turning has to be done near the periphery a faceplate smaller than the diameter of the work should be chosen to permit the turning to be done in one operation. Fig. 39 shows another method of ensuring concentricity in re-chucking. Chucking blocks are mounted on the faceplate and this avoids recessing. Thus the faceplate would last longer since there is a limit to the number of times it can be recessed. Another method is to have a hole drilled in the centre of the faceplate, and a corresponding piece of dowelling fixed to the work to fit the hole.

A patternmaker's boss is an example of re-chucked work. These bosses are, of course, provided with studs or dowels for correct centreing on the pattern. Exact concentricity is required between stud and boss, so the boss should be chucked by its stud, as illustrated.

(To be continued.)

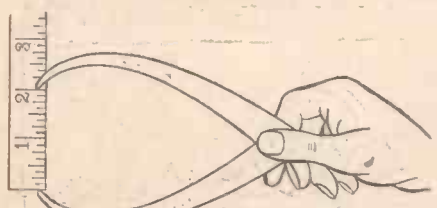


Fig. 42 (left).—Setting the calipers to measurement against the edge of a rule.

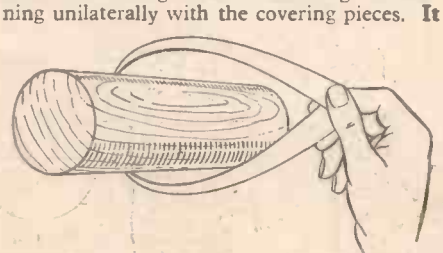


Fig. 41 (centre).—Method of using calipers on cylindrical work.

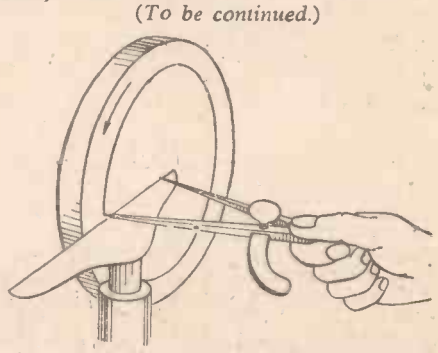


Fig. 43 (right).—Stepping off the diameters from the hand rest on faceplate work by means of dividers.

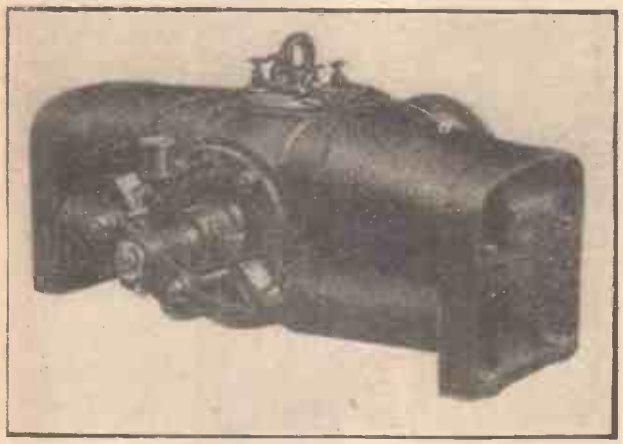
The Crompton Historic Collection

Unique Exhibits Demonstrating the Pioneer Work of Col. Crompton in the Electrical Industry

THE manufacture of electrical products is recognised as one of Britain's key industries, and as such it is assisting the recovery of national prosperity in two ways: first, by providing equipment for modernising industries for the purpose of increasing their outputs; and second, by supplying vast quantities of equipment for export. The development of the industry to its present position was brought about by a succession of men who believed in its future, but special recognition is due to the men responsible for the work of the pioneering period.

The pioneering period was one when, after the scientists had demonstrated in their laboratories the principles of such basic electrical apparatus as the generator, the motor, and the arc lamp, and contrived rough working models, the practical engineers came along and took over where the scientists left off to develop these things into forms that could be employed in the service of man.

One of the engineers who did much to achieve the practical realisation of electrical principles in the early days was the late Colonel R. E. B. Crompton. He founded in 1878 one of the first electrical manufacturing firms in this country, Crompton and Co., of Chelmsford, Essex. This company was in 1927 merged with F. and A. Parkinson, Ltd., to form Crompton Parkinson, Ltd., but it did not lose its identity. Now, as a permanent record of the early work of Crompton and his associates, Crompton Parkinson, Ltd., have completed a historic collection of machines, instruments, arc lamps and other apparatus, some of which are shown in the accompanying illustrations.



Crompton-Burgin Generator (1879).

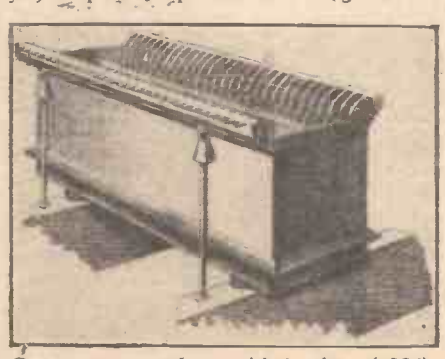
Early Years

Colonel Crompton was born on May 31st, 1845. He died in 1940 in his ninety-fifth year, having lived to see the full development of his early work and the realisation of many of the ideas that he propounded long before the time was right for their acceptance. Although he first chose the army as a career, even then his deep interest in engineering found an outlet in the development of steam-engine road vehicles in India. But in 1876 he resigned from the army, and back in England two years later, more or less by chance, he became interested in electric lighting.

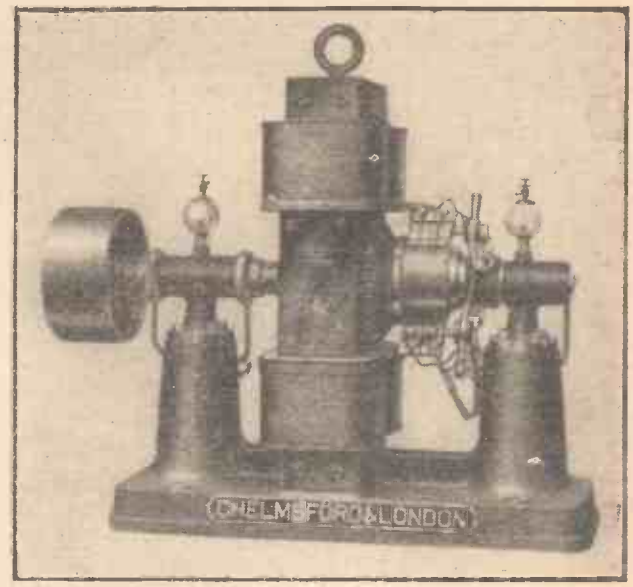
Crompton was associated with the Stanton Ironworks and had the job of designing a new foundry. Wanting to provide good lighting for night working he investigated the possibilities of electric arc lighting developed by Gramme in France, and obtained some of his apparatus. Using this he installed what was the first industrial lighting installation in this country, and as the result of experience with the dynamos and arc lights he became recognised as a leading authority on electrical engineering—at that time confined almost exclusively to the practice of arc lighting.

Development of the Generator

His next enterprise was to obtain and supply lighting installations of Gramme equipment, but after experimenting with various forms of arc lamps he decided to manufacture electric lighting plant embodying improvements he devised, and in consequence started Crompton and Co. at Chelmsford. With Burgin, a Swiss engineer, Crompton designed and eventually built a dynamo of superior performance and greater reliability. This used in conjunction with the new types of arc lamp produced resulted in contracts for the installation of electric lighting at some of the royal palaces, the principal railway stations, docks, and other public places. Then as the demand for electric lighting grew rapidly Crompton realised that some method would have to be devised to carry heavy currents for transmission. In 1881 he filed a patent for a solid system of underground mains with tubular copper conductors insulated with glass or vitreous enamel. Concerned with the continuity of electricity supply in emergencies, or when the main plant was shut down at night, or on light load, in the same year he took out a patent for accumulators, with a specially large active lead-plate surface in the electrolyte, to operate in parallel with the generators.



Crompton accumulator with 61 plates (1886).



Crompton generator with wrought iron magnets (1883).

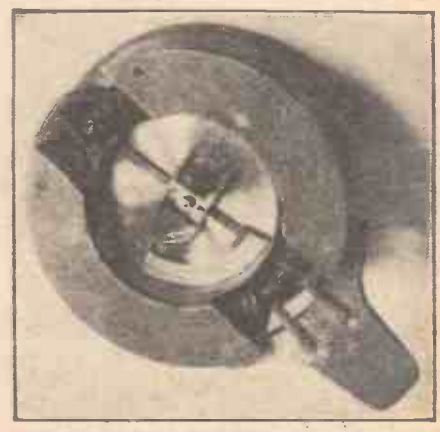
He also read a paper on "Electric Light Progress" before the United Service Institution, incidentally advocating the use of searchlight projectors for naval, military and mercantile marine purposes.

When Swan in this country and Edison in America evolved the incandescent filament lamp, Swan called at Crompton's London office in Mansion House Buildings and invited him to Newcastle for a demonstration of the new lamp. Crompton agreed about its vast possibilities and co-operated with Swan in the design of special dynamos for supplying a large number of these lamps in parallel—a system that involved many problems at that time.

The Chelmsford Works

The name of Crompton and Co. became more widely known through various exhibitions and demonstrations of their products. Crompton himself concentrated upon the development of the Chelmsford Works, and by his inspiring personality, combined with his great practical experience, attracted many well-known engineers to his staff.

With the introduction of the incandescent filament lamp the lighting of houses, shops, and small premises became a practical proposition and led to the idea of the distribution of electricity from one central generating station supplying a whole district. Crompton's



Crompton-Kapp electro-magnetic instrument (1883).

"Kensington Court Electric Light Co., Ltd.," was one of the pioneering supply companies. It became in 1888 the Kensington and Knightsbridge Electric Lighting Co., Ltd., and for very many years he was to be associated with it as chairman.

Electrification Schemes

Because of the high reputation built up by Crompton & Co. many requests were received to advise upon or to submit electrification schemes for power and lighting in all parts of the world. Several contracts were carried out in Africa. One of them was for the public supply power station at Pretoria, South Africa. Here, the special job of the electrification of an explosives factory was also undertaken. Other towns in South Africa equipped with electrical plant included Bloemfontein and Capetown, where the largest bipolar dynamo hitherto built was installed. In the north, Khartoum was equipped with three-phase alternators.

Crompton's knowledge of India enabled him to overcome national prejudices in that country against the use of electricity. He made a special journey to survey several towns with a view to electrification and industrial development. The first installations were at Karachi and included supply to the docks. A hydro-electric station was equipped at Darjeeling at an altitude of 7,000 feet. Other important towns—Calcutta, Madras, Cawnpore, Allahabad—were equipped with electricity stations and the name of Crompton became famous throughout India. Other supply installations were undertaken in Burma, the Malay States, Australia and New Zealand.

Measuring Instruments

Apart from his work on the development of lighting plant, Crompton was responsible for new forms of measuring instruments, which, in fact, he needed to carry out experiments on machines and so forth.

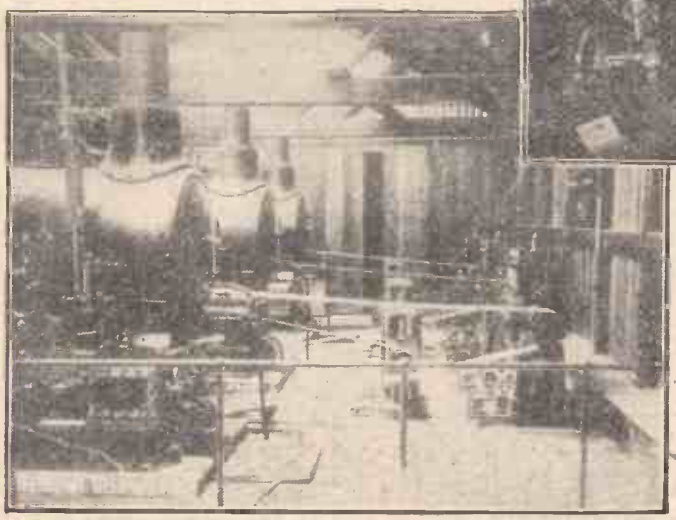
In co-operation with Professor J. A. Fleming (later Sir Ambrose Fleming) he devised accurate means of measuring electromotive forces, currents, resistances and power circuits, far superior to existing methods. The Crompton potentiometer came into general use for testing the efficiency of new generating machinery. He also designed suspended coil galvanometers of a very sensitive type.

During the first decade of Crompton & Co. electricity was used mostly for lighting so that the loading period was only a few hours a day. Crompton had for long emphasised the advantages of a day load to improve the economics and load factor of a supply undertaking, and to provide this he designed and manufactured heating and cooking appliances, both commercial and domestic. Associated with him in this effort were Messrs. H. Dowsing and E. J. Fox, well-known engineers of the period. Many patents were filed, and at a specially equipped centre in London electric cooking demonstrations were given to the public. To publicise electric cooking the City of London Electric Lighting Company held a banquet in 1895, where all the food was cooked by equipment designed and constructed by Crompton. Many large industrial establishments and restaurants, including Romano's and the canteen at the Bank of England, were equipped by Cromptons with electric cooking apparatus, and in 1894 the firm had the unique distinction of holding five diplomas and four gold medals for their success in this field. But in this activity Cromptons were ahead of their time by more than a generation.

In other applications of electricity Crompton made notable achievements—including the Southend Pier Electric Tramway in 1889, locomotives for the first tube railway in 1896; electric cranes, furnaces and welding for industry, together with individual motor drives for machine tools.

The historic collection at Chelmsford serves to commemorate Colonel Crompton and other early pioneers who laid the foundations of the vast electrical industry as we know it to-day.

Underground locomotive built for the City and South London Railway (1896).



(*Above*) *Part of the historic collection at the Chelmsford Works of Crompton Parkinson, Limited.*

(*Left*) *Tilbury Docks South Power Station* (1885).

He Shot a Bear

By A. M. L.

I DO not like conundrums unless they are suggestive in their implications. Mere twisting of the mind is neither clever nor a sign of intelligence. I have known many people who respond most poorly to psychological tests but in whom one could place the greatest confidence. I am credibly informed that Winston Churchill was not a good boy at school, but no one could deny his value or his brilliance.

But I want to put this problem to you. A man left his hut one morning, walked four miles south and shot a bear. Then he walked four miles east and four miles west. After that the man tramped four miles north and found himself at the place where he started. (This may be wrong, but it does not much matter.) What was the colour of the bear?

Let me give you the answer by reminding you that with ordinary time-keeping methods any clock and any window at the North Pole always face south. The story I have given could only take place at the North Pole, and I am sure that the bear was just plain white.

How Thermometers are Made

A Tour of the Works of H. J. Elliott, Ltd., of Glamorgan

By OUR SPECIAL CORRESPONDENT

IN our June issue we featured an article by the Marquis of Donegall describing a tour of factories in South Wales. He was unable, however, to visit all the industries in this part of the British Isles as his time was limited. I happened to be in South Wales recently and came upon a factory of such absorbing interest that I felt a few particulars of the visit would be of interest to readers.

The works in question is the home of Messrs. H. J. Elliott Limited, E-MIL Works, Treforest Trading Estate, Glamorgan, and the firm specialises in the production of scientific glassware and chemical thermometers of all kinds. Occupying 45,000 sq. ft. of space, it is, I understand, the largest of its kind in the British Commonwealth—a fitting reward for the efforts made by its founder over 35 years ago.

Thermometer Making

Owing to the limited time at my disposal I elected to be shown the basic principles of thermometer making and the making and graduating of volumetric cylinders. The works manager took me to the thermometer department, where I was amazed to witness the speed attained by various operators in cutting 5ft. lengths of thermometer tubing into suitable working pieces. The measuring of the bore (barely visible to the eye) was something to be remembered. This is done on a special microscope, and is essential for calculating the exact range.

This firm has gone to great pains to eliminate mental calculations and human errors by evolving a chart which is prominently displayed and calculated to cover all ranges and types of thermometer bores.

We passed from the gauging section and on to the "stick on" (which means the joining of the mercury bulb to the thermometer stem) and "sealing off" division. Here the first actual blowing stage is carried out, and the material used for the bulb was a special thermometric glass approved by the National Physical Laboratory—such glass does not shrink or contract with age as does ordinary glass, therefore the standard of accuracy is maintained throughout the normal life of the thermometer.

From this department all thermometers are taken and filled with mercury under vacuum at the rate of approximately 500 per hour.

Scaling and Ring Topping

Scaling is the next operation, and during this process the thermometers are subjected to various temperatures to ascertain the position of the range before being permanently marked. Having run off all surplus mercury, the tubes (as they are called here) are ready for sealing off and ringing. Each thermometer before ringing is filled with nitrogen so that no oxidisation can take place, and therefore the sensitivity of the mercury to heat is maintained. To do this a small splint is drawn on the end of each tube and then sealed off. Each splint is marked with a glass-cutting knife, and when sufficient are ready (approximately 50) they are put under a vessel filled with nitrogen and broken off against the inside of the container. Nitrogen immediately rushes in, as the bore above the mercury is vacuous. On filling all the tubes, they are withdrawn and immediately turned upside down to prevent the gas, which is lighter than air, escaping—in this position they are sealed off before being placed aside for ring topping (making the small ring at the top, by which a thermometer is hung).

Calibrating scientific glassware to N.P.L. standards.

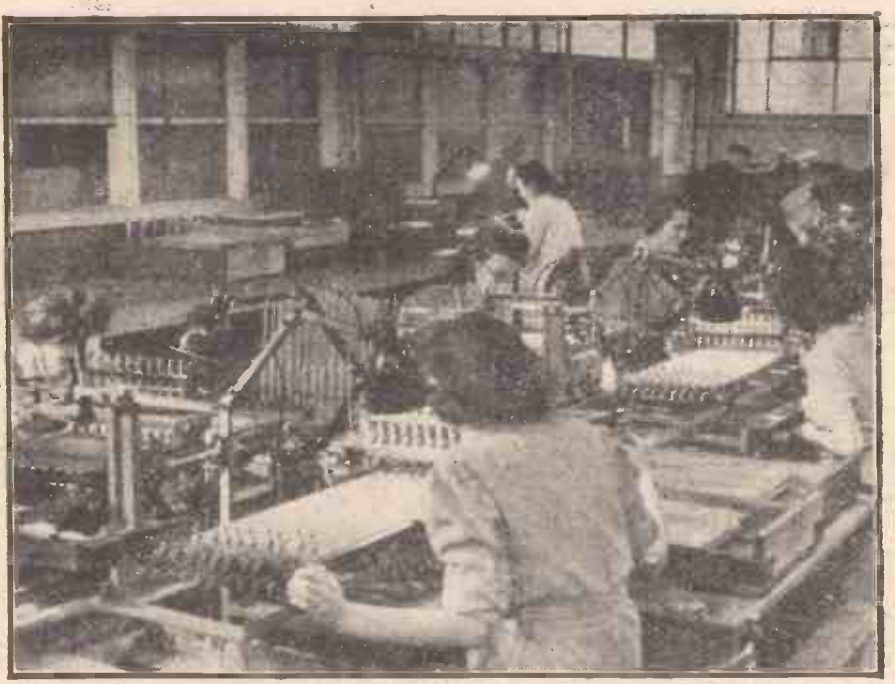
In ring topping, the remainder of the splint drawn for the previous operation is cleverly bent round until it can be sealed to the top part of the stem; after this has been done the thermometer is complete, with the exception of being correctly pointed. To describe this final operation accurately would be too involved, owing to the number of different ranges required by various customers and the many types of solutions the thermometers are required to be tested in.

Dividing or graduating burettes.

Glass-blowing

I was next shown the glass-blowing department, where glass is blown, pressed and rolled into a multitude of shapes and sizes. Here the making and graduating of stoppered cylinders is carried out.

Glass for the main body and the feet is carefully selected and cut into the required lengths by cutting wheels and diamonds. On one such machine I watched an experienced operator slicing 10in. pieces from a full-length cane at a rate in excess of 2,000 per hour. From here the tubes were taken to be manipulated on a glass-working bench lathe, which forms the necks to exact requirements before being ground. The next step in the manufacture of these cylinders is to join and spin out a foot by hand. This operation to a layman is amazing, the operator using only a brass-pointed tool (known as a reamer), and with which he can turn out a foot to any size required within 2mm. It is interesting to note that throughout the glass industry the metric



Photographing or inscribing figures on burettes.

system of measuring is used. After a suitable batch of feet had been joined and formed to the correct diameter they were taken to an annealing oven (in this case a long electric oven worked on an endless belt system) where all apparatus is subjected to varying temperatures to remove any strain which may have been created in the article during its making. The instruments controlling this oven are of the highest quality, being made by Messrs. Negretti & Zambra Limited, and with which it is possible to control the main temperature to within fine limits, and also at any time to be able to ascertain the heat in any one zone. After annealing, each article is tested under a polarised light, which shows clearly on a screen any strain that may still be in the glass. This is rarely found, but should the case arise the apparatus in question is repacked into a tray and drawn into the mouth of the oven for re-annealing.

Calibrating

The next stage in the sequence is calibrating. Here operators run known quantities of distilled water (from vessels made on the premises and certified by their quality control section as being to National Physical Laboratory standards) into the cylinders. As each quantity is added, the position of the meniscus is clearly marked by a very fine ink-line, which has to remain on the cylinders to assist in subsequent operations. To make this fine line a human hair (supplied by one of the operators) is used—cemented into a holder suitable for handling. I learned that so far no substitute had been found that would perform the job so well. From the calibrating section I watched the cylinders being dipped in wax in readiness for the dividing operation. On the dividing section machines are used which are capable of being set to any predetermined pattern or style. It was at this stage that I noticed how clearly the calibrating marks could be seen beneath the wax. The reason for requiring these marks became very apparent when the cylinder had been set up on the dividing machine and the operator had set the needle of the dividing head on the first two ink marks or points. The machines are calculated to make any number of divisions (in a sequence, giving long, short and medium length lines) equally spaced between any two points. Each capacity mark is treated in the same manner until the whole has been divided. The reason given for dividing in short sections, instead of one operation from bottom to top, was that if the latter method was adopted the accuracy of the capacity could not be maintained owing to the variation of the bore. From here the work moves on to the pantographing section, where numbers indicating the volume at various points are added and the usual capacity signs placed at the head of the dividing, together with any trade mark that may be required. The final operation covered by this section came with the etching of these cylinders. Here the work is immersed in concentrated hydrofluoric acid for periods varying from 30 seconds to three minutes according to the type of glass used or the depth of line required. After immersion the work is carefully washed in cold running water to remove surplus acid and placed in a metal basket for degreasing. This is done in a standard trichlorethylene vapour bath. Following this operation the glass is washed in a warm dilute acid solution, thence into warm, clean water for a final rinse—to remove all traces of dirt and water stains.

Colouring

After draining, the work is now ready for colouring (having the graduation marks filled in). It was at this stage that I learned that "twins had been born to the Elliott family," namely, proprietary brands known as "Gold and Green Line." Fundamentally, as the name suggests, Elliott's are using an unconventional filling for their graduations, of yellow and green, signifying apparatus guaranteed to be within the limits of the National Physical Laboratory test for Class "B" work, in the case of "Gold Line," while Class "A" or, alternatively, works certified Grade "A" apparatus, tested at five points, is defined by the green filling. This filling, unlike the usual type, is very durable and resistant to acids and alkalis.

Grinding

After watching the "filling in" of the cylinders I had been following around the factory (these were conventionally white) I went to the grinding department, where the last operation was to be performed before final inspection and packing. The grinding of glass is done in the main by diamond laps or carborundum powder. On this particular operation carborundum was the medium. The machines are of the usual grinding head type, controlled for speed by variable pulleys. Here the powder, mixed with water, was poured over a mandrel of a predetermined size and taper and the cylinder neck fed on to this spigot and ground to a given stop plate. By this method it is claimed that necks can be tooled to such fine limits that the stoppers used become interchangeable. I was shown a series of "plastic" stoppers, exclusively used by this firm, on the proprietary brands previously mentioned. The stoppers are of a material resistant to all acids, etc., non-absorbent, and which, while sealing the necks off perfectly, cannot under any circumstances become jammed. A registered design number has been issued for this stopper and a patent is pending. From here the finished articles, after cleaning to remove surplus grinding powder, are sent to the final inspection department, where all goods are thoroughly examined by competent operators before leaving to be packed. Each article has been allocated a special fitting carton which is supplied free of charge to the user.

Whilst in the packing department my guide showed me a finished product known as the "E-MIL" Pocket Companion, which consists of a small thermometer (4½in. long approximately) mounted in an attractive coloured plastic case, on each side of which is embossed useful temperature data. The thermometers, I understand, can be supplied in various types and ranges. As a point of interest I inquired as to the meaning of "E-MIL," and learned that this registered trade mark is in short an abbreviation of Elliott/Millilitre, and, as the works manager put it, "a hall mark of quality."

In conclusion, I was impressed by the clean layout of the various sections, particularly the obvious emphasis on quality control, which was stressed by the fact that every piece of apparatus is not only examined by the "final inspection" but is subjected to a very minute examination by inspectors after each and every operation.

The Elements of Mechanics and Mechanisms—27

Gear Tooth-forms (contd.)

THE motions of the profiles of two mating involute gear teeth at their point of contact are such that relative sliding takes place. (An exception to this statement occurs when the point of contact happens to be at the pitch point; at that instant purely rolling contact is made.) Sliding at a loaded point of contact means loss of power by reason of friction, and in the past it was regarded as important to reduce sliding to a minimum. In modern spur and helical gears, however, the power loss by friction at the tooth surfaces is only about one half of 1 per cent. of the

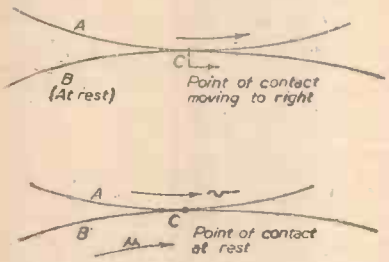


Fig. 43.—Illustrating contact conditions.

transmitted power, so that even if the power loss by friction is increased by, say, 50 per cent., it represents only a negligible fraction of the transmitted power. It is now recognised that a comparatively high sliding velocity is in itself no serious disadvantage; on the contrary, it may tend to assist lubrication. The effect of contact conditions on the endurance of the tooth surfaces is much more important than their influence on efficiency.

In the upper diagram of Fig. 43 C is the point of contact between profiles A and B. The latter is imagined to be at rest and A is moving to the right. The point of contact is also moving to the right.

The velocity of A is the sliding velocity of A relative to B, whilst the velocity of C is the rolling velocity of A over B.

Lubrication Conditions

Although this is the usual way of considering the relative velocities, it is most convenient for some reasons to think of the velocities of the profiles relatively to the point of contact which is imagined to be at rest.

Thus, in Fig. 43 the profiles A and B touch at C, which is at rest; the velocities of A and B are v and u respectively. The velocity of relative sliding of A and B is (v—u).

Now suppose that v and u are in the same direction and that v is greater than u. A point on B approaching C from the left is in contact with an oil film which eventually also makes contact with A. When it does so the film tends to be drawn forward to C because the velocity of A is greater than that of B and this makes for effective lubrication of each point on B.

On the contrary, a point on A approaching C from the left is in contact with an oil film which eventually touches B. Now B, although moving in the same direction as A, lags behind it because of B's lower velocity. Thus any point on A suffers inferior lubrication conditions because B tends to retard the approach of the oil film to the point of contact.

If v and u are equal, v—u=0 (zero) and there is no sliding at the point of contact. Lubrication conditions are satisfactory for both profiles, since neither lags behind the other.

If the velocities of A and B are opposite (i.e., v and u are of opposite sign) lubrication conditions are imperfect for both profiles. As any point on either of them approaches the point of contact it is close to the other profile moving away from the point of contact.

The position may be summarised thus:

(1) If the velocities at the point of contact are in the same direction, lubrication conditions for the faster-moving profile are inferior to those for the other profile.

(2) If the velocities at the point of contact are equal (and in the same direction) there is no sliding, and lubrication conditions are satisfactory.

(3) If the velocities at the point of contact are opposite, there is much sliding and lubrication conditions are poor for both profiles.

The velocities of sliding which occurs on involute gear teeth may be studied with the aid of Fig. 44. This represents the end view of the engagement zone of a pair of spur gears, the upper one driving the lower one. There are two points of contact, C and D. The line of pressure is the common tangent

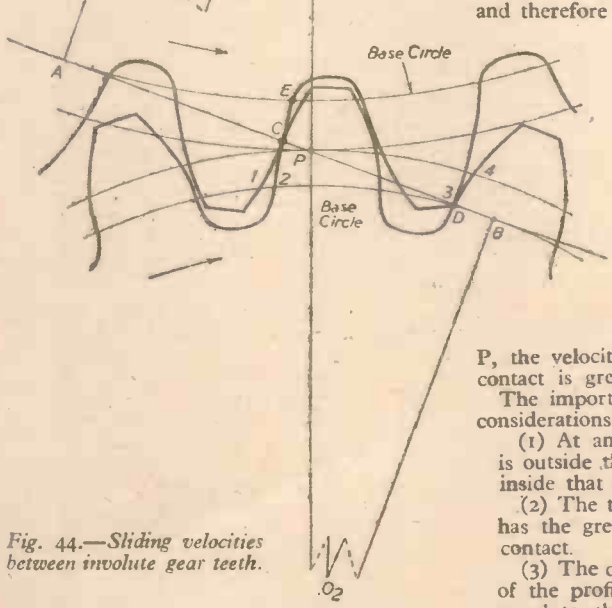


Fig. 44.—Sliding velocities between involute gear teeth.

AB to the base circles. It is desired to know the velocities with which the profiles at C are passing C. The profile 1 is moving away from the point A, and the velocity of the point E (where it meets the base circle of the upper gear) is the circumferential velocity of the base circle of the upper gear.

Now, because the profile 1 is involute, the distance from A to E measured round the base circle is the same as the length of the straight line AC. Hence the velocity of C along AB is the circumferential velocity of the base circle of the upper gear, and this, incidentally, is equal to the circumferential velocity of the base circle of the lower gear.

Since the length AC is increasing at the same rate as the circumference of the upper base circle is moving, the relative motion of the base circle and AB at any instant is the same as if the circle were rolling on AB. At any instant, therefore, the motion of the base circle relative to AB is a rotation about A. Since the profile 1 at C is perpendicular to AC, the velocity of the profile perpendicular to AB is simply AC multiplied by the angular velocity of the upper gear. Denoting the angular velocities of the two gears by ω_1 and ω_2 we have:

Velocity of profile 1 at C = $AC\omega_1$ upwards.
Velocity of profile 2 at C = $BC\omega_2$ upwards.
Velocity of profile 2 − Velocity of profile 1
$= BC\omega_2 - AC\omega_1$.
$= (PB + PC)\omega_2 - (PA - PC)\omega_1$.
$= (PB\omega_2 - PA\omega_1) + PC\,(\omega_1 + \omega_2)$.

Now the circumferential velocities of the pitch circles are ω_1 (O_1A) and ω_2 (O_2B) and these must be equal.

$$\text{Therefore } PB\omega_2 = \frac{PB}{O_2B}\omega_2 O_2B = \frac{PB}{O_2B}\omega_1 O_1A$$

Also, because the triangles PAO_1 and PBO_2 are similar,

$$\frac{PB}{O_2B} = \frac{PA}{O_1A}$$

$$\text{Therefore } PB\omega_2 = \frac{PA}{O_1A}\omega_1 O_1A = PA\omega_1$$

and therefore Velocity of profile 2 − Velocity of profile 1 = PC $(\omega_1 + \omega_2)$.

So long as C is to the left of P the velocity of profile 2 across AB (i.e., past the point of contact) is greater than that of profile 2, the difference being PC $(\omega_1 + \omega_2)$. When the point of contact is at P, then PC = O_1, there is no difference in velocities of profile at C, or in other words the contact at the pitch point is purely rolling. When the point of contact C has passed to the right of P, the velocity of profile 1 at the point of contact is greater than that of profile 2.

The important points arising out of these considerations are:

(1) At any instant, the point of contact is outside the pitch circle of one gear and inside that of the other.

(2) The tooth profile of the former gear has the greater velocity past the point of contact.

(3) The difference between the velocities of the profiles at the point of contact is equal to the distance of that point from the pitch point multiplied by the sum of the angular velocities of the two gears.

Taking this in conjunction with the remarks previously referred to, it will be seen that lubrication conditions are less favourable at points outside the pitch circle than at points inside them. At the pitch circle itself there is no sliding.

(To be continued)

Locomotives for Narrow Gauge Railways

Their Design and Construction

By E. W. TWINING

ALTHOUGH the motor omnibus, the luxurious motor coach and the road lorry has in this country almost killed the light railway, there are some narrow gauge lines still in operation catering for passenger and goods as well as mineral traffic. Abroad and all over the world there are many such railways. India alone finds a use for several, and wherever roads are poor or non-existent the light railway holds its own domain, for in flat country it is cheaper to lay a light railway track than to make a good modern type of road.

Then, beside the point-to-point narrow gauge railway, there are in Great Britain dozens of tracks in the yards of ironworks, factories, gravel pits, quarries and other industrial concerns all operated by locomotives, some driven by internal combustion motors but mostly by steam.

In the very narrow gauge of 15 inches there are many small public pleasure railways, and the writer has recently been preparing designs and drawings for two 15in. gauge engines now in course of construction.

Some 10 years ago drawings were made for the engine shown in Fig. 1, the general type of which the writer claims as his own. It is not, however, of this engine that the present articles are intended to deal, but of a much heavier locomotive for 27in. gauge, designed since the end of the last war. The general outline is much the same except for the fact that it is of the 0-6-2 type. A scale elevation is reproduced in Fig. 2 and cross-sections through firebox and smokebox in Fig. 3.

Before going into descriptive details of the design it may be as well to give a complete table of dimensions, weights, etc.; here then is the:—

Specification

Engine: Coupled wheels, diameter	24in.
Radial truck wheels, diameter	16in.
Cylinders (2) Stroke	10in.
" Diameter	7in.
Piston valves Diameter	3in.
" " Travel	1 5/8in.
" " Lap	7/16in.
" " Lead	3/64in.
Valve gear: Modified Joy.	
Boiler, Diameter outside	30in.
" C.L. above rails	4ft. 0in.

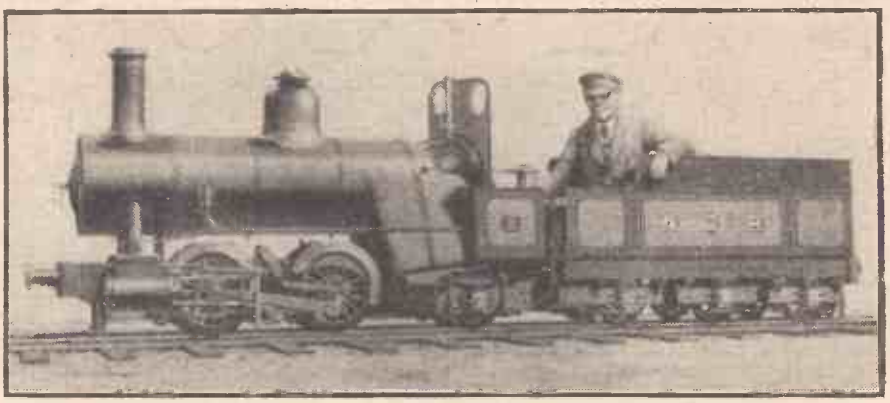


Fig. 1.—A locomotive of the 0-4-2 type for 15in. gauge.

Boiler heating surface: Tubes	207.25 sq. ft.
" " " Firebox	32.5 sq. ft.
" " " Total	239.75 sq. ft.
" " " Grate area	8.25 sq. ft.
Ratio: Grate area to heating surface	29
Boiler pressure	150lb. sq. in.
Tractive effort at 80% boiler pressure	2,450lb.
Wheelbase, coupled	5ft. 0in.
" total	8ft. 7in.
Weight in working order	9 tons 2 cwt.
" on leading wheels	1 ton 18 cwt.
" on driving wheels	2 tons 14 cwt.
" on rear coupled wheels	2 tons 12 cwt.
" on truck wheels	1 ton 18 cwt.
Curves, minimum radius	120ft.
Length, engine over frame plates	13ft. 0in.
Tender: Wheels, diameter	16in.
Wheelbase	6ft. 7in.
Tank capacity, water	400 gallons
Coal	1 ton 14 cwt.
Length over frames	9ft. 5in.
Weight, loaded with driver	5 tons 9 cwt.
Total weight, engine and tender	14 tons 13 cwt.
Total height of engine	7ft. 3in.

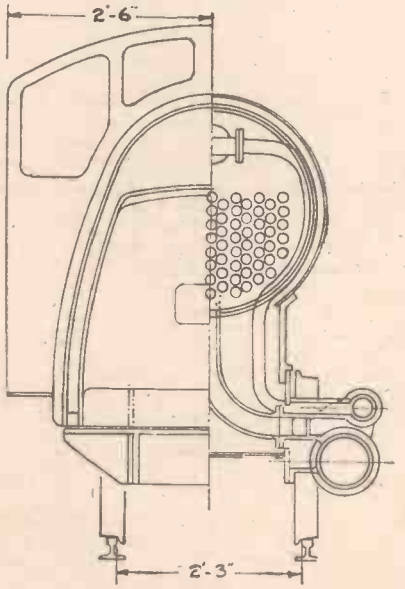


Fig. 3.—Half cross-sections of the engine.

It will be realised that although the engine is designed for 27in. track no great alteration would be called for to render it suitable for any other gauge from 24in. to 30in.; merely a shortening or lengthening of axles, frame stretchers and other cross members; the boiler would be unaffected.

Main Features of the Boiler Design

Despite the risk of restating what has almost become a platitude, it is pointed out that the secret of power in a locomotive lies in the boiler; that is to say, in its capacity to generate steam at a sufficiently rapid rate to fill the cylinders up to the maximum required speed, with maximum load, and that without having to resort to hard firing. Therefore it follows that the boiler must be as large as may be practicable: it must have a large area of heating surface and, above all, a big grate area.

With a grate having an area of 8¼ sq. ft. and heating surface of nearly 240 sq. ft. the ratio of one to the other is 29. The (late) L.M.S. big Pacific type engines have a ratio of about 50 and the (late) Great Western *King* class about 64. From these figures some idea may be gathered of the evaporative capacity of the boiler of the engine we are now considering. It may be argued that with such a low ratio as we have provided more steam will be generated than the engine can use; but this is not the case; it merely means that less fuel will need to be shovelled into the firebox and less clinker will form on the firebars. A big grate admits more

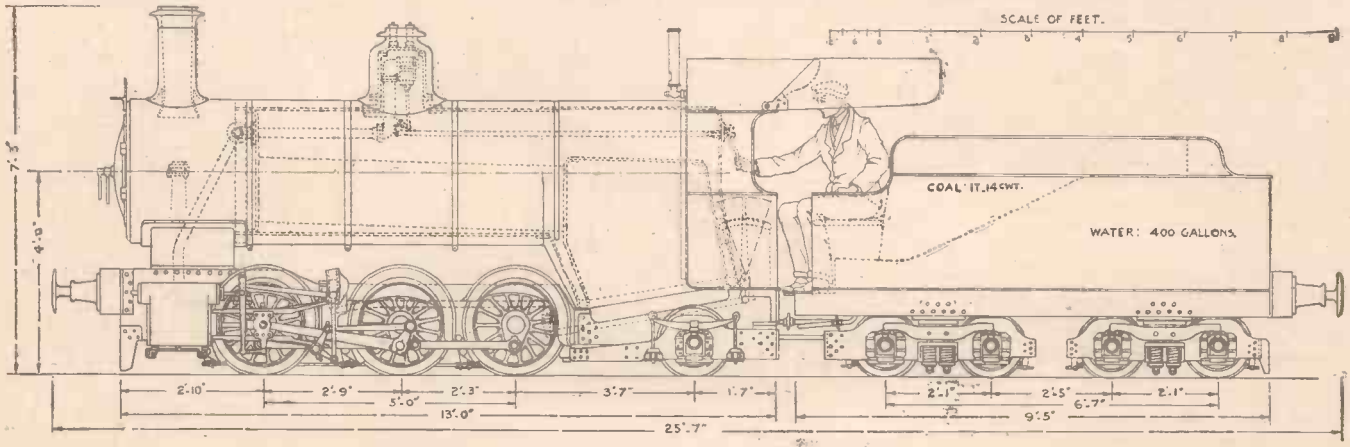


Fig. 2.—An 0-6-2 locomotive for 27in. to 30in. gauges.

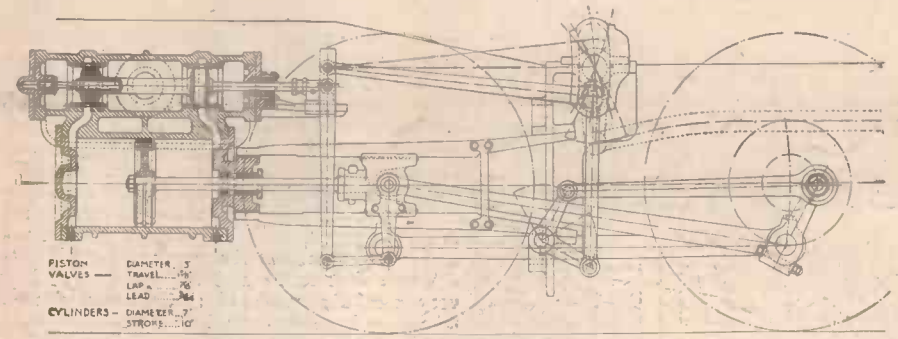


Fig. 4.—A radial gear for outside cylinders.

oxygen and the bars are kept at a lower temperature.

As will be seen from Fig. 3 the firebox is of the wide type and this, with its front tube-plate, back-plate, and especially with the throat-plate, makes for simplicity of flanging, staying and general construction.

The front tube-plate is of the drum-head type ; that is to say, it is flanged all round and recessed into the boiler barrel. There are no superheaters. The dome is in the middle of the boiler barrel with two direct-loaded safety valves on the top. The regulator is in the dome and the design of this will be dealt with later.

The chimney has a very short petticoat extension down into the smokebox because it has, of course, been possible to provide a fairly tall stack, and the exhaust pipe and blast orifice are kept well up nearly to the level of the uppermost row of flue tubes. This is as it should be, in order to equalise the suction, or draught, on all the tubes from top to bottom.

Valve Gears

Although the Walschaerts gear has come to be almost universally used in outside cylinder engines and, notwithstanding that he introduced it into the design for Fig. 1, the writer is not greatly in favour of this gear.

The Gooch radial gear, a better one than the Stephenson, employed four eccentrics, but, unlike the Stephenson, the expansion link was centrally pivoted and so fixed. Between the link and the valve spindle there was a radius rod which was moved by the reversing rod and lever from the top to the bottom of the expansion link and vice versa. It used to be argued that when in either forward or backward gear there was a definite angular drive to the valve. So there was, but exactly the same angular drive is to be found in Walschaerts's gear. Why, if it was a fault in the gear of Gooch, is it tolerated in Walschaerts's? Engineers are queer folk.

But it is not this angular drive that the writer objects to so much as the fact that it is more or less a compromise as regards the geometrical layout. On British railways, too, there is an unnecessary amount of slip of die-blocks ; in the expansion link when in forward gear and in the slotted end of the radius rod in both fore and back gear.

The gear invented by David Joy gives a very beautiful and almost perfect steam distribution, and as applied to marine engines it is ideal ; but for locomotive work there is a very serious objection to its use. The whole of the gear is operated and the motion taken from a point in the length of the connecting rod, the up-and-down vibration of the rod being the movement utilised to make the required change of motion through a right-angle to drive the valve. Through a system of links and levers his vertical vibration of the connecting rod is made to slide a pair of die-blocks in curved guides, the angle of which can be changed by the reversing lever. To the pin through the die, or quadrant blocks, a radius rod connects up to the valve spindle.

Now it will be seen that as the correct travel of the valve depends upon the angle of vibration of the connecting rod being equal on each side of a centre line passing through the centre of the driving axle, any vertical movement of the axle-box and axle from the normal will cause the die or quadrant blocks to follow portions of an arc which are unequal above and below the point where the curved guides are pivoted. It is obvious, of course, that an engine must "ride" on its springs, due to inequalities in the track, and this has the effect of upsetting the valve events. This riding with tender engines is not a very serious matter, but it does make a difference whether the water level in the boiler is full or low ; so does the amount of fuel in the firebox. When the Joy gear is fitted in tank engines the unequal steam distribution becomes serious because the difference in weight of the engine between full tanks and coal bunkers and the same empty is a large disturbing factor.

The Writer's Valve Gears

Having in mind the foregoing objections to both Walschaerts's and Joy's gears the writer was led to design two mechanisms which would retain the best features of the Joy gear, and in one of them features which are essential in the Walschaerts. It is this latter which was chosen to be embodied in the design for the 27in. gauge engine (Fig. 2).

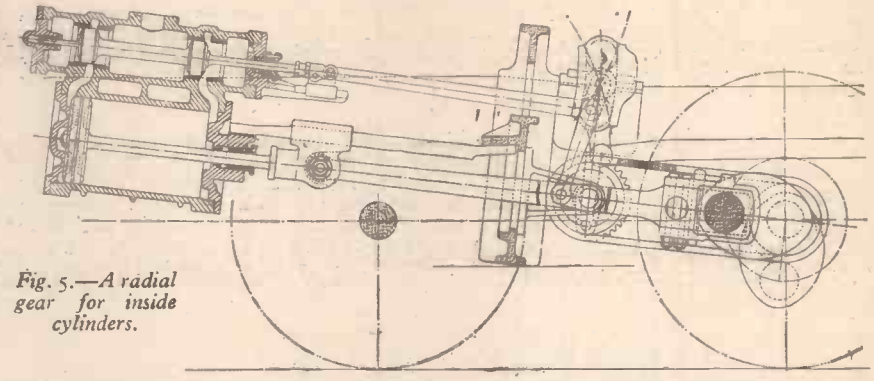


Fig. 5.—A radial gear for inside cylinders.

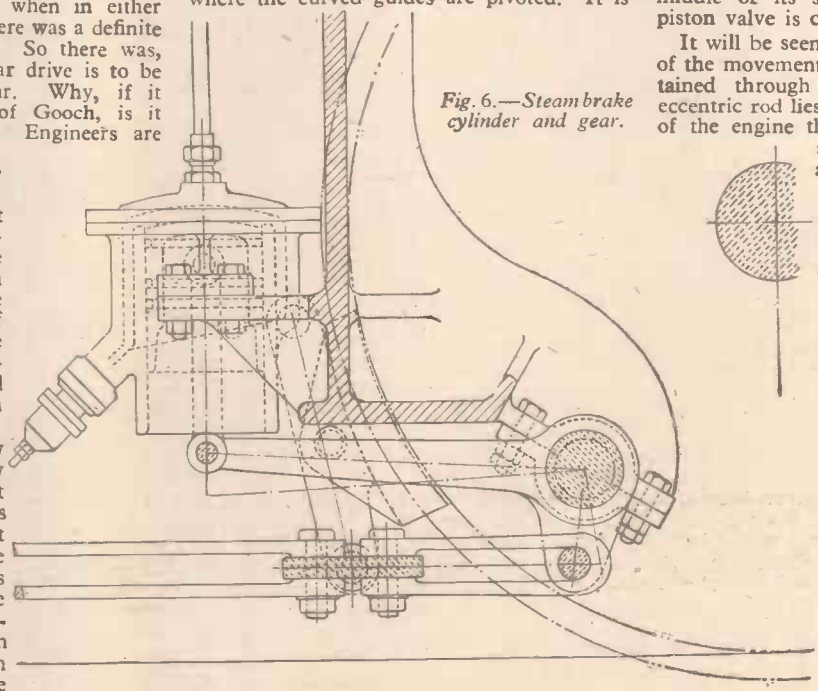


Fig. 6.—Steam brake cylinder and gear.

The drawing (Fig. 4) shows the complete gear. Here it will be seen that the Walschaerts return crank on the main crank pin is retained, as well as the combination lever and union link, taking motion from the main crosshead through which the lap and lead functions are given to the valve.

From Joy's gear the curved guides have been taken which, by inclination over to either of the chain-dotted lines, through movement of the reversing lever, give the valve travel. The engine is here drawn in mid-gear position so that, with the main crank pin on bottom centre and piston in the middle of its stroke, the inside-admission piston valve is covering the ports.

It will be seen that the vertical component of the movement in the curved guides is obtained through a bell-crank, and as the eccentric rod lies parallel with the centre-line of the engine there is no disturbance from sliding of the axle-box up and down in the horns.

There are no die-blocks in the curved guides, and, in fact, there are no sliding parts anywhere in the gear. The place of die-blocks is taken by a pair of light radial ball bearings which roll in the guides. The question as to whether the guide surfaces shall be hardened has not yet been decided.

The other gear, for which there is no immediate use, is intended for engines of small size having inside cylinders. It is illustrated in the drawing (Fig. 5). Here nothing is taken from the Walschaerts gear, but the curved Joy guides are retained with radial bearings in place of die-blocks. The vertical

movement of these, together with the radius rods, is obtained through a short crank-shaft carried in ball bearings. This shaft is chain-driven from the main crank-axle.

It will be noticed that the small valve-gear cranks are set in line with and on the same side of the centres as the main crank pins. From the small crank pins links are taken up to the radial bearings in the guides, and at a certain point in these links the radius rods are pinned; thus we obtain the necessary movement to provide for lap and lead of the valves. In the drawing the main crank is on the forward dead centre, the piston at the front end of the cylinder and the valve open to lead.

It will be obvious that the two small cranks must be set at right-angles one with the other, that one chain only is all that is really essential to drive the shaft and that the whole shaft must be sufficiently short to clear the two main connecting rods. The use of ball bearings should render it possible to fit two sets of sprockets and chains in order to provide against the failure of one of them. The chain or chains will be set in the centre between the bearings with the cranks on either side. A gear case would be advisable to enclose the chains, which can then run in an oil bath formed in the lower part of the case.

The advantages claimed for both of these

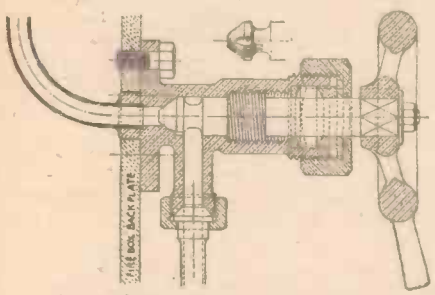


Fig. 8.—The driver's brake valve.

gears are that they are simple in construction, the dead weight of the whole is not so great as some other gears, that they are generally much more correct as regards steam distribution and that the cost of maintenance is low. The cut-off point is not limited by the throw of eccentrics, or by the length of expansion links, but depends upon the angle to which the quadrant guides are inclined; so that if the reversing lever is arranged to allow the guides to be carried over past the normal full-gear point of cut-off, say, of 75 per cent., a cut-off up to as much as 85 or 90 per cent. is possible, thus increasing for a short period the starting power of the engine.

Steam Brakes

In Fig. 2 only the brake blocks, hangers and parts of the brake rigging is shown. The power is applied by a single-acting steam cylinder, with an open lower end. There is nothing extraordinary about this, but the assembly of the cylinder with the crank lever and attachment to the third cross beam, together with the frame stretcher casting, may be of interest, and a drawing is therefore given in Fig. 6. The only novelty lies in the fitting shown on the forward (left-hand) side of the cylinder; this is a blow-through and drainage valve which is drawn in section, along with the cylinder, in Fig. 7.

In most cases in the past drainage has been provided for by fitting a small ball valve which falls off its seat directly steam is cut off after application of the brake, thus allowing the condensed steam to drain away. But as the ball runs in an almost horizontal track it closes again when steam is again turned on. There is no arrangement for blowing steam through the cylinder to warm

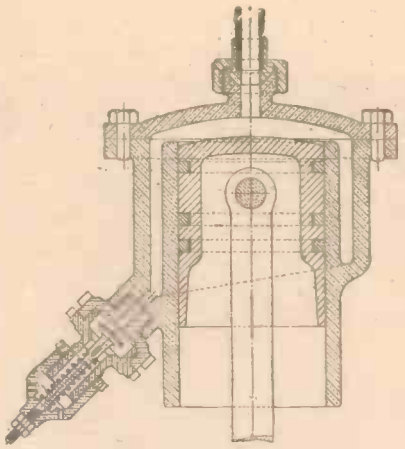


Fig. 7—Brake cylinder with warming and drainage valve.

it preparatory to braking. Consequently, the first rush of steam is condensed and full braking effect is not obtained until the cylinder has become sufficiently hot to allow condensation to cease.

The valve shown here is of the mitre type with three wings, spring loaded to hold it open. Through holes drilled in the lower case the condensate drains away. When the engine driver knows he is approaching a stopping place he opens his steam valve slightly; this allows a small trickle of steam to blow through the cylinder and through the valve without closing the latter. By the time that full brakes are required the cylinder and piston will be sufficiently warm to prevent loss of power by condensation. For partial or full brake power the driver's valve is opened accordingly when the drainage valve on the cylinder closes.

Any suitable type of driver's valve can be adopted, but that shown in longitudinal section in Fig. 8 is designed for the 0-6-2 engine. Here it will be seen that on the steam side of the large operating screw there are two cylindrical portions which make a good rotating fit in the bore of the valve body. Beyond the second cylindrical part is the valve cone which is ground to fit a conical seating. In the valve cone a channel or port is cut, through which, when the valve comes slightly off its seat, a small volume of steam passes to the cylinder. The small sketch drawn above the valve, in Fig 8, shows the channel referred to viewed from a different angle from that of the main drawing.

The Dome and Regulator

The regulator is the valve which, on being opened by the driver, admits steam to the cylinders and sets the engine in motion. This valve, with its seating, takes many forms, according to the ideas and practice of the designer. Some are flat, and work or slide on a flat seating. Others, still flat, are semi-rotary. Both types are perforated and uncover ports in the fixed regulator head. Yet other valves, and these are almost universally fitted in America, are of the double-beat mitre pattern, the upper member of which is a little larger in diameter than the lower. This valve is almost balanced against steam pressure and requires little power to move it, a very great advantage over the flat type.

For the two 15in. gauge engines previously referred to, as well as for the 27in. gauge which is the subject of Fig. 2, the writer has designed a sliding type valve which by reason of its form is always in perfect equilibrium.

As will be seen from Fig. 9 the valve is cylindrical, closed at the lower end, open at the top, and pierced at about the middle of its length with six ports, all in line circumferentially. These ports, when the regulator is fully opened, come into alignment with a cored-out opening in the regulator head.

When first made and fitted the valve is very carefully machined and finished dead true, the head is truly bored and ground, and finally the valve is lapped into the head. As the valve moves up and down vertically no effect of wear should be found for a long time, and the valve will remain steam tight. It is operated through the medium of a bell crank by a push-and-pull rod from the foot-plate. For the sake of stiffness the rod is made from a length of steel tubing. This is plugged at the end near the firebox back and into the plug a steel solid rod is screwed, which solid rod passes through the usual stuffing box to the driver's handle. The screw provides a means of adjustment for the valve.

The drawing (Fig. 9) shows a stop cast on the pipe below the regulator head. This is merely a safety device to guard against the possibility of the valve falling out of the head in the remote event of failure of any part of the bell-crank mechanism.

Relief and Blow-off Valves

These valves, fixed at both ends of the main engine cylinders, are necessary in order to get rid of water resulting from condensation. On standard gauge full-size engines the relief valves, heavily spring loaded, are automatic in action and open only when water is present and has accumulated without the knowledge of the engine driver. They are entirely separate from and independent of the blow-off valves and are usually mounted on the cylinder covers. They open

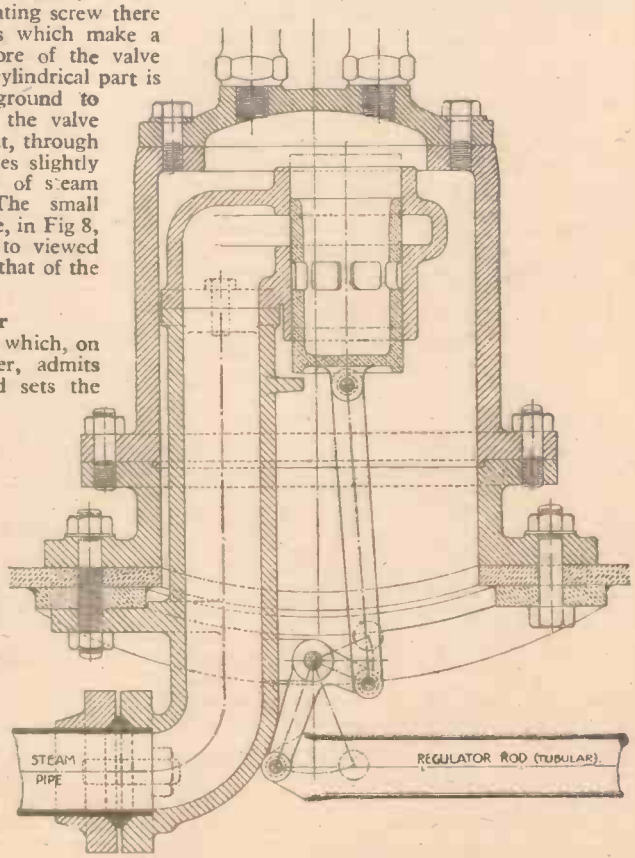


Fig. 9.—Sleeve valve regulator in steam dome.

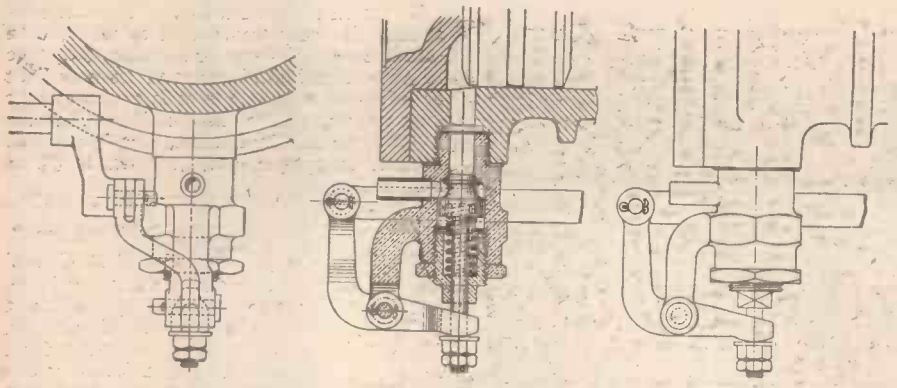


Fig. 10.—Cylinder combined relief and blow-off valve.

when the piston presses upon the water at the ends of its stroke.

Blow-off valves are not automatic but are opened through mechanism led from the footplate. The driver invariably uses these valves when the regulator is opened to admit steam to cold or cool cylinders.

It will be obvious that to give quick relief the automatic valves on big cylinders must be of large area and, as they have normally to carry the full steam pressure without opening, it would be impossible to open them manually. On small cylinders, where the areas of the valves need not be great, there is no reason why the relief and blow-off should not be combined in one valve at each cylinder end.

This is what the writer is doing in the narrow gauge engines which he is designing or has designed. Such a valve is shown in the drawing (Fig. 10). Here it will be seen that the combined valve is placed in the normal position on the cylinder, that is to say, that usually occupied by the blow-off valve or cock: the lowest point at which water will accumulate. The valve itself is of the mitre pattern and below it is a cylindrical part fitting the bore of the valve case. The spring must be of sufficient power to keep the valve from just opening under the maximum steam pressure. It will then be possible to give manual relief through the levers and rods or cable led from the cab. Stranded steel cable is usually found most convenient with spring-loaded blow-off valves.

The Tender

By way of conclusion a few words may be said regarding the tender shown on the drawing (Fig. 2). The size and capacity of the tender for such an engine as this will of course depend upon the nature of the work to be done and the distance to be travelled between the points where fuel and water can be taken in. For shunting in yards and hauling over short lengths of track a small four-wheeled tender, sufficiently large to carry three or four hundredweight of a mixture of coal and coke and, perhaps, 60 gallons of water, would probably meet the case. Longer journeys, extending for several miles, out and home, would call for, perhaps, something larger on six wheels, after the style of that attached to the engine in Fig. 1, the wheelbase of which is articulated.

But, returning to the large tender in Fig. 2, the chief points to which reference may be made are: the drawbar arrangement and the driver's seated position. Taking the two points in order, and dealing with the drawbar first, it may be explained that the bar is coupled to the radial truck on the engine and to the front of the leading bogie on the tender. A very little consideration will show that if the bar was attached to the engine main frames between the firebox back and the rear buffer beam a very heavy side pull would be put on the back of the engine when negotiating sharp curves, producing terrific flange friction at both the rear and front coupled wheels. Of course the radial truck pivot and the tender bogie pin have to be made capable of taking the full draw-bar pull.

Turning to the human question of the driver being seated whilst driving: is there any reason why he should not sit? With comparatively small boilers the firehole and all fittings on the firebox back are low down and are far more accessible from a seat. Likewise in firing: with a short-handled shovel and a shovelling plate on the top of the front end of the tender tank beside him the fuel is much more conveniently transferred from the tender to the firebox.

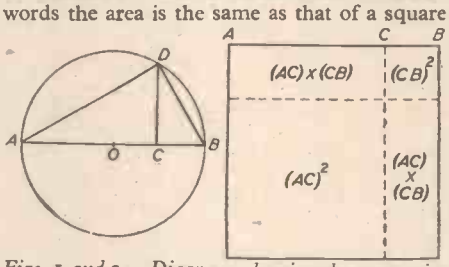
In Fig. 2 the driver is drawn to exactly the same scale as the engine. It will be seen that he is amply protected from bad weather by a large cab roof which is pivoted for ease of access to this seat, whilst in long continued fair weather the roof extension can be entirely removed.

(To be continued)

Mathematics as a Pastime

Problems With the Circle

DALLY a little while with that remarkable property of a circle, that the angle in a semi-circle is always a right-angle, and consider one of the many curious deductions from it. You know that a rectangle of length a and breadth b has an area of ab: in other words the area is the same as that of a square



Figs. 1 and 2.—Diagrams showing the properties of a circle and rectangle.

with a side of $\sqrt{ab}$. You can express this relation between a and b and $\sqrt{ab}$ as a proportion.

$$a : \sqrt{ab} :: \sqrt{ab} : b$$

or $\frac{a}{\sqrt{ab}} = \frac{\sqrt{ab}}{b}$. The three terms a, $\sqrt{ab}$, b are in progression: for a becomes $\sqrt{ab}$ if you multiply by $\sqrt{\frac{b}{a}}$ and $\sqrt{ab}$ becomes b if you multiply by the same $\sqrt{\frac{b}{a}} \cdot \sqrt{\frac{b}{a}}$ is, you say, the common ratio.

$\sqrt{ab}$ you call the geometric mean between a and b, and your circle enables you to get this mean geometrically. In other words, the circle provides you with an interesting way of making a square root emerge. You will not, indeed, use the method in practice, since you have more expeditious methods at your service. But as an engineer you welcome this playing with geometry; for you know that often a result can be reached more easily by a drawing, than in any other way.

Examine the matter. Make the diameter of your circle equal to the combined length and breadth of your rectangle, equal that is to $(a+b)$: suppose AC to equal a and CB to equal b.

Erect CD at right-angles at AB, and join D where the line cuts the circumference to A and B.

Consider the square on AB. You know that this is equal to the squares on the two parts (AC and CB), plus twice the rectangle contained by those parts.

That is:

$$(AB)^2 = (AC)^2 + (CB)^2 + 2(AC \times CB).$$

But, since ADB is a right-angle, $(AB)^2$ is also equal to $(AD)^2$ plus $(DB)^2$. Moreover, $(AD)^2$ equals $(AC)^2$ plus $(CD)^2$, and $(DB)^2$ equals $(CB)^2$ plus $(DC)^2$. Or

$$(AB)^2 = (AC)^2 + (CB)^2 + 2(CB)^2$$

The two rectangles $2(AC \times CB)$ are clearly equal to the two squares $2(CD)^2$. That is to say, (CD) is the geometric mean between (AC) and (CB); and (CD) is also the side of a square equal in area to $(AC \times CB)$. Therefore if (AC) were 4 and (CB) were 1, (CD) would be exactly 2. Try this.

Very well, apply the method to getting the square root of 2.75 and of .75: your diameters will be (1+2.75) and (1+.75).

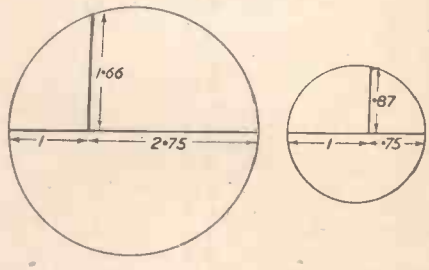


Fig. 3.—Method of obtaining square roots.

Chemical Resisting Cement

SIR,—I have just been reading the February issue of PRACTICAL MECHANICS, and in connection with a query raised by one of your readers on how to line a metal tank to resist sodium hypochlorite, I would take this opportunity of drawing your attention to a range of products made by the Morgan Crucible Company, Ltd.

For lining concrete, brick or metal tanks a Carblox Chemical Resisting Cement is used. These cements are supplied in two parts, one liquid and one powder, which are mixed together in definite proportions on site. The freshly-mixed cement is applied with a trowel to form a membrane ⅛in. thick. This is allowed to air-set for 24 hours, and then heat treated at a temperature of approximately 100°C for a further period of 12 hours. After this the tank can be put into service, provided the maximum operating temperature does not exceed 40°C. Should a higher operating temperature be required, or if the tank has also to resist mechanical abrasion, this can be achieved by a further lining of Carblox bricks or tiles. These bricks or tiles are jointed and backed with Carblox Chemical Resisting Mortar. After this has been completed a further period of air-setting is required as above, and again heat-treated as before.

The resulting structure can now be used at a maximum operating temperature of 170°C, and is completely resistant to most inorganic acids including hydrofluoric acid.—W. ALVA LLEWELLYN (Kingston-on-Thames).

Long Distance Telephones

SIR,—In an article in the November issue of PRACTICAL MECHANICS, the Marquis of Donegall attributes the development of long-distance trunk dialling to American free enterprise, and says that the British Post Office may have such a system "in a few years." Your contributor has been misinformed. The British 2-voiced-frequency trunk signalling and dialling system (known invariably as 2V-F) was put into service in the dark days of 1940, was developed and expanded in the face of great difficulties through the war years, and is now the standard system of trunk signalling between all the large towns in the country and many of the small ones. The system is identical with the vaunted U.S.A. system, in that the outgoing trunk operator completes connection with the called subscriber by direct dialling over a trunk junction, without the intervention of the distant operator.

In fairness to British engineers, may I suggest that the Marquis gets in touch with his local telephone manager and asks for information on 2V-F, and makes public his findings. I think he will be surprised, interested and, I hope, chastened! — F. E. WILLIAMS (Birmingham).

Catching a Cold

SIR,—The medical evidence hitherto is against the statement made by "Icarus" in your November issue (Cyclist Section): that colds are not caught, that is, transmitted from one person to another.

Kruse, in 1904, was first to demonstrate that a cold is infectious by causing the disease by the introduction of infective material into the nose of a healthy person. Later workers have confirmed this by infecting volunteers from a culture of the virus, isolated from cases of "colds." Any open-air exercise will reduce the risk of inhaling sufficient of the virus to cause infection. Similarly this risk is increased where ventilation is poor and a number of people, some of whom are probably in the infective stage, are present.

As a consequence, it will be apparent that to sneeze or cough without using anything to intercept the resultant spray of infective droplets is to fail in one's social duty; the more so in that secondary infection may set in, causing middle ear disease, pneumonia, etc.—PAULETTE O'DOWDA (Edinburgh).

Film-Strip Projector

SIR,—With reference to Mr. Markham's suggested improvements on the home-built film-strip projector in the November issue of PRACTICAL MECHANICS, the arrangement shown could possibly be dangerous.

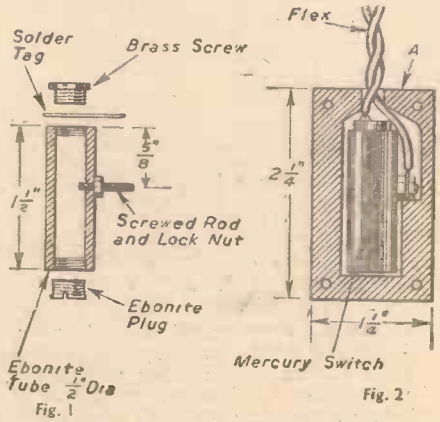
Mr. Kay used the bottle of water to prevent the radiated heat from the lamp, which is concentrated in the same way as the light waves by the condenser, from reaching the film strip, with the consequent risk of fire.

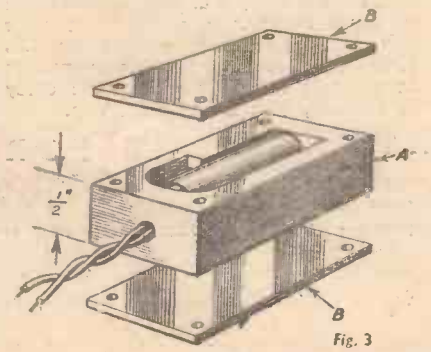
Water, in common with various other substances, is only transparent to waves of a certain length. Glass, for instance, is opaque to ultra-violet light, but not to ordinary light or infra-red waves. Water is transparent to light waves, but to infra-red, and waves beyond the infra-red range, that is radiated heat, it is opaque.—M. J. FORREST (West Hallam).

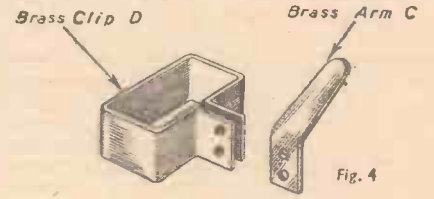
Mercury Switch for "Radio Awakener"

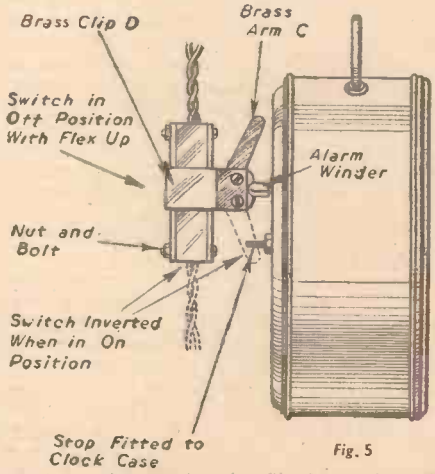
SIR,—I was very interested in B. R. Coates' "radio awakener" in the October issue, but I consider it to be too complicated and bulky compared with my own simple but efficient idea. Make the actual switch from a piece of aerial lead-in tube 1½in. long; this needs threading internally at each end for a distance of about ½in. (Fig. 1). Next fix a brass screw and solder tag at one end with a little shellac on the threads. Then drill and thread a hole ⅝in. from the same end and fit a piece of screwed rod to project into the tube, and tighten with a lock nut—a small screw with a soldering tag could be fitted instead. The next step is to pour enough mercury into the tube just to cover the screwed rod in the side of the tube, then make a small threaded plug of ebonite, shellac the threads, and screw in. For the casing (Fig. 2) use a piece of 2¼in. by 1¼in. by ½in. thick ebonite or hard wood and, with a fretsaw, cut the centre out, as shown, so that the switch fits snugly with room for the wires. Now make two cover pieces—BB—(Fig. 3) from paxolin or similar insulating material, clamp the three pieces together and drill a hole in each corner for the fixing bolts. From strip brass a clip D (Fig. 4) is made to fit tightly round the centre of the switch case. Next make a brass arm C, and drill to fit the holes in the clip. Place the clip in position, pass two screws through the brass arm, through the clip and bolt on to the alarm winder. At this point the alarm should be almost fully wound. Drill a hole under the alarm winder in the clock back to take a nut and bolt to act as a stop for the arm C, as shown in Fig. 5.

To operate, all that needs to be done is to set the alarm and turn the switch case with the flex upwards. It will be seen that when the alarm rings the switch will turn upside down and the brass arm will hit the stop.







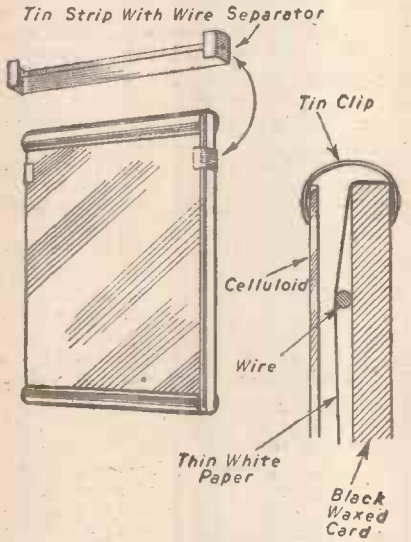


Details of the mercury switch for a "radio awakener"

At this juncture the mercury will be at the other end of the tube and making contact with both brass screws. To reset just turn switch back into original position. As the alarm winder only makes a half-turn each time it will be understood that the alarm never needs rewinding. This device is efficient, and has been in use a considerable time.—F. O. ATKINSON (Hull).

CELLULOID WRITING PAD

SIR,—In a recent issue of PRACTICAL MECHANICS, I noticed in the "Queries and Enquiries" pages, under the heading, "Writing Pad with Celluloid Front," the suggested construction of same, and I wish to offer an alternative method.



Details of a writing pad with a celluloid front.

I believe I am right in suggesting that the base consists of a black wax paper, or paper mounted on cardboard, with a thin white paper on this, and the Cellophane or thin celluloid on top. When the pointed stick is pressed on the celluloid it causes the white paper to adhere to the waxed paper and shows black at contact, a thin wire stretched across the pad is pulled down when the writing needs to be "washed out." I believe that with thin celluloid this type of pad gives very good service. The accompanying diagram shows the construction of the suggested pad. —H. J. HONEYBALL (Gosforth.)

BOOKS ON TELESCOPE MAKING

SIR,—Your querist, F. C. Coppen, of Reading, would probably find "Making Your Own Telescope," by Allyn J. Thompson, and published by the Sky Publishing Corporation, Harvard Observatory, Cambridge 38, Mass., and obtainable at quite a few book shops, most useful. There is also obtainable in London another American work. I think it is called "Telescope Making," and a second volume "Advanced Telescope Making." I can recommend any or all of these most instructive and excellent books.—G. E. WILLIAMSON (Bickley).

RHODIUM PLATING

SIR,—In reply to a query sent in by A. C. Large (Chichester) in the November issue, it is stated that it is necessary to copper-plate glass before depositing rhodium. This is not the case, as it is possible to deposit rhodium successfully, direct to glass. by high vacuum technique. Most metals can be deposited in this manner.

In my opinion, the suggestion to silver plate the copper then polish same, prior to rhodiumising, would lead to loss of definition. I suggest that the inquirer has his reflector aluminised. This will give a very durable film, with a minimum reflectivity of 84 per cent.

This is a method I can strongly recommend, as I am engaged daily on the evaporation of aluminium and other metals on to glass, in all types of optical instruments.—R. J. BUNTING (Glasgow, W.2.)

SIR,—We have had an inquiry from one of your readers regarding the rhodium surfacing of glass mirrors, following the mention of our name in your Queries and Enquiries columns as a source of supply in this direction.

We think it as well to make it clear that while we perform a considerable amount of rhodium plating upon metals and are suppliers of rhodium plating salts and anodes, our interest in the vacuum distillation process by which glass is coated with rhodium is confined to the supply of rhodium plated tungsten helices for the purposes.

We do not undertake the actual treatment of glass surfaces, however, and we would suggest that if you receive other enquiries of this nature you should refer your correspondents to one of those firms which handle such work. Messrs. Barr and Stroud, Anniesland, Glasgow, W.2, can be quoted as an example.—B. W. DAVIS (Johnson, Matthey and Co., London, E.C.1.)

Bassett-Lowke's Fiftieth Anniversary Dinner

THE famous firm of Bassett-Lowke Limited celebrated the attainment of 50 years of trading at a jubilee dinner given by the firm at the Savoy Hotel on November 15th, 1949, when over 60 members of the firm and guests were present. Mr. Cyril Derry, M.S.E., the chairman of Bassett-Lowke Limited, was chairman on this occasion, and the guests included Lord Brabazon of Tara, P.C., M.C.; Mr. C. E. Vivian Rowe, LL.B., town clerk of Northampton; Mr. Walter Lines, president, British Toy Manufacturers' Association; Mr. J. D. Kiley, J.P.; chairman of Trix Ltd.; Mr. George Dow, A.M.Inst.T., president of the Model Engineering Trade Association, and Mr. G. H. Lake, his secretary; Mr. J. C. Crebbin, the well-known model enthusiast; Mr. A. H. Redrup, of the Cunard White Star Line; Mr. D. Caird, Royal Mail Lines; Mr. T. A. Aggett, Blue Star Line; Mr. R. A. Raulin, French Line, and Mr. A. H. Robson, Union-Castle Mail Steamship Co., Ltd. Members of the firm present, including the chairman, were: Mr. W. J. Bassett-Lowke, M.I.Loco.E., F.R.S.A., Mr. H. F. R. Franklin, Mr. H. W. Franklin, Mr. R. H. Fuller and Mr. R. Bindon Blood, and Mr. F. Prior, of the Associated Company of Precision Models, Ltd., Mr. P. F. Claydon, of the subsidiary company, Ships Models, Ltd., Mr. W. H. Rowe, Mr. V. S. King, Mr. H. M. Sell, Mr. H. Foreman, Mr. C. B. Cox, Mr. E. H. Clifton. The Press was represented by Mr. J. N. Maskelyne, Mr. A. R. Peers, Mr. R. J. Raymond, Mr. J. R. Cox, Mr. B. W. C. Cook, Mr. A. Leach and Mr. F. J. Camm.

It was a memorable evening in many ways, notably for the uniform quality of the speeches, and the many tributes which were paid to Mr. W. J. Bassett-Lowke and his firm which have done so much to act as a shop window throughout the world for British products.

The toast of Mr. W. J. Bassett-Lowke and his company was proposed by Lord Brabazon of Tara, himself a model enthusiast and founder of the Standardisation Committee. Mr. W. J. Bassett-Lowke, in his reply, stated that some of the staff present had been with the company over 40 years. He reviewed his history from the age of 12, when he started work as a blacksmith's mate, proceeding to the machine shop and from there to making models as a business. Mr. William Rowe, now sales manager and chief buyer, was with him 50 years ago and must have been the first indentured apprentice to model engineering. He paid adequate tribute to the loyalty of his staff. The craft of model-making was proposed, of course, without response, by Mr. George Holland, the Northampton lecturer; the visitors were proposed by Mr. H. W. Sell, with response by Mr. George Dow, whilst the gentlemen of the Press were toasted by Mr. R. H. Fuller, with response by Mr. F. J. Camm.

Some of the guests at Bassett-Lowke's fiftieth anniversary dinner. Reading from left to right:—Mr. James Mackenzie (Hanwell Engineering Co., Ltd.), Mr. Walter Lines (president, British Toy Manufacturers' Association), Mr. W. J. Bassett-Lowke, M.I.Loco.E., F.R.S.A. (managing director, Bassett-Lowke, Ltd.), Mr. Cyril Derry, M.S.E. (chairman, Bassett-Lowke, Ltd.), Lord Brabazon of Tara, P.C., M.C. (guest of honour), Mr. F. J. Camm (editor, "Practical Mechanics"), Mr. George Dow, A.M.Inst.T. (president, Model Engineering Trade Association).

The WORLD of MODELS

New 3½in. Gauge Tank Loco : Trix Model American "Switcher" : Scale Model Church

By "MOTILUS"

WE cannot start the New Year better than by reviewing some of the newer items of interest to model enthusiasts which are either available at the time of writing or will be ready shortly. The selection is varied, touching many different phases and activities of model work. It is of general interest to note that there is now a much better selection of small tools on the market, as these have been scarce for some years, including lathes, drilling machines, etc., and a variety of hand or bench tools.

For the model steam engine enthusiast a full range of small diameter steam pressure gauges can now be purchased, and a complete range of engine and boiler fittings, including injectors in three sizes.

Fig. 1.—The first 3½in. gauge, 0-6-0 tank locomotive model built from the drawings, castings and parts now available.

New 3½ in. Guage Steam Loco

Messrs. Bassett-Lowke, Ltd., have introduced a most comprehensive and accurate set of drawings for a 3½in. gauge 0-6-0 tank locomotive (Fig. 1). As well as the drawings they can supply castings and finished fittings accordingly. The design is a most compact one, requiring an economical amount of labour and expense, yet it is so designed that it is suitable for hauling some 16 passengers on a 3½in. gauge running track. Already many model-makers interested in this gauge have commenced making this new introduction among steam locomotives.

Gauge 1 (scale 10 mm. to 1ft.) was at one time more popular than gauge 0 and it is now gaining favour again in the model railway world. A new scale chart of agreed dimensions has been published and various new drawings: also castings and parts are again available for this very suitable gauge for outdoor model railways. Laid permanent way and points can be obtained from stock, in steel or brass, for this gauge and also materials for model-makers to lay their own track.

For the gauge 0 fans, whether they favour electric, steam or clockwork propulsion, there is a new series of inexpensive scale model passenger coaches. These are being produced in the new British Railways livery, which incorporates a most attractive range of colours. Coaches such as these have not been available since manufacturers ceased making them in 1939.

Fig. 2.—The Gauge 0 "Flying Scotsman" in pre-war livery. Photographs of the post-war models were not available at the time of going to press but they are now available in new British Railways blue and L.N.E.R. green livery, complete with detailed lettering.

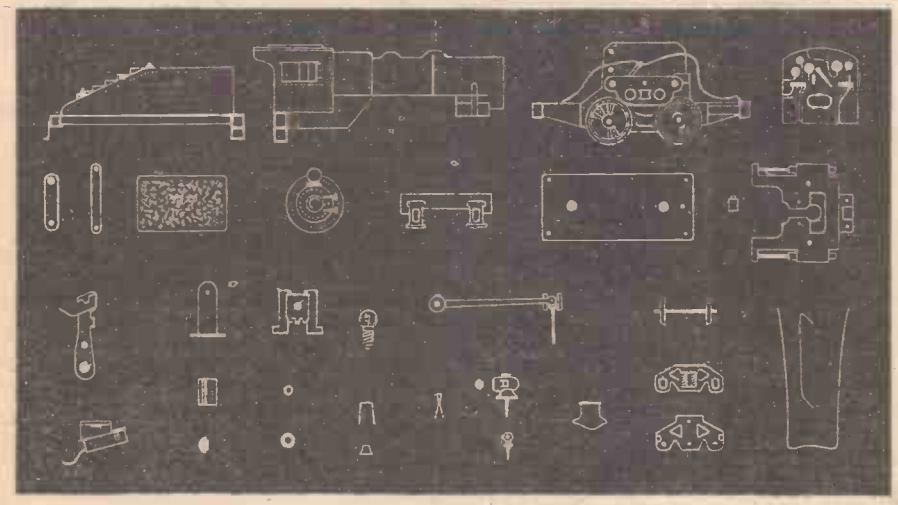


Fig. 3.—The complete set of finished parts that are supplied for building the Trix American "switcher" locomotive for scale track, two rail system.

Gauge 0 Steam Locomotives

For those who like building their locomotives from a finished set of parts, there is a new gauge 0 steam locomotive set which is less expensive and simpler in construction than the very popular "Mogul" locomotive set, although the newcomer is similar in design and workmanship to the old favourite. Readers may also remember a very popular Bassett-Lowke gauge 0 "Pacific" type locomotive, the "Flying Scotsman." This model (Fig. 2) is now available once more, with several improvements and in new British Railways blue or L.N.E.R. green colours. It is for clockwork or electric propulsion at the price of £10 6s. 0d., including purchase tax.

Those who use electric traction for their model railways up to size gauge 1 will be interested in the new types of rectifiers that

can now be purchased. They incorporate transformers to reduce current and rectifying elements to convert AC to DC, the latter being more and more widely used both in England and abroad.

Nor must we forget our model boat builders. I am sure they will be pleased to learn that there is now in production a series of inexpensive ship fittings, diecast to ensure accuracy. Well proportioned and well finished, they are admirable for working models and can be purchased with oxidised or nickel plate finish.

A new paraflame burner of the Venturi type has been introduced for firing both model locomotive and ship boilers. Its miniature form makes this burner adaptable for many other special purposes.

It may be many years before a full range of model goods is again available similar to pre-war days, but we must all agree that very good progress has been made during the past twelve months, not only in variety and quantity but also in the quality and workmanship.

Model American "Switcher"

Perhaps the most interesting good news for gauge oo (16½ mm.) modellers is the steadily improving supply of Trix trains and Hornby "Dublo" trains. Those who use Trix track may have taken advantage of the appearance in the Trix range of the model American "switcher," an 0-4-0 type locomotive so familiar in all American shunting yards. For a time this was produced solely for the American market but it is now available in small quantities at home.

These same oo gauge scale enthusiasts are also taking great interest in the Trix production of a complete set of finished parts for building this popular American locomotive and tender. One of this month's illustrations (Fig. 3) shows all the component parts making up this excellent locomotive model, whose manufacture incorporates many new features. The mechanism, for instance, is entirely new and for the first time a Trix locomotive has been fitted with a permanent magnet motor, which has a tri-polar armature wound for 12 v. DC. The driving mechanism offers exceptional hauling power and realistic slow running. The chassis is a well braced diecasting that preserves accurate alignment of gears, armature and driving wheels. The boiler body and cab have steam domes, boiler bands and a wealth of detail in rivet heads, window framing, etc. Last, but not least, there is a very realistic representation of the boiler fittings and other details in the cab itself. The tender is also a pressure diecasting with full detail in steps, imitation coal, rivet heads, back-up lights, axle guards, etc.

The complete locomotive (Fig. 4) is fitted at either end with the new Trix couplers, which ensure automatic coupling as soon as the locomotive touches a similarly fitted car and enables uncoupling to be performed by ramp rails at any desired point on the track.

Working on 12 volts, the locomotive will reach a speed of 102ft. per minute, without a load, this being a scale equivalent of 100 m.p.h. Alternatively, it will also do, unloaded, a minimum speed of 12ft. per minute on 3-4 volts, an equivalent of 12½ m.p.h. in scale speed. The hauling capacity, at 12 volts with load on one truck is 1½lb., which is equal in scale to 784,000lb., the gear reduction being 29: 1. The locomotive also operates on a maximum gradient of 1 in 10 without slipping. All these figures are taken on actual performance.

Fig. 4. (Right).—The finished oo gauge Trix American "switcher" locomotive, for running on scale track, that can be built up from the finished set of parts. It is driven by permanent magnet mechanism. (Photo: by courtesy of Trix, Ltd., London.)

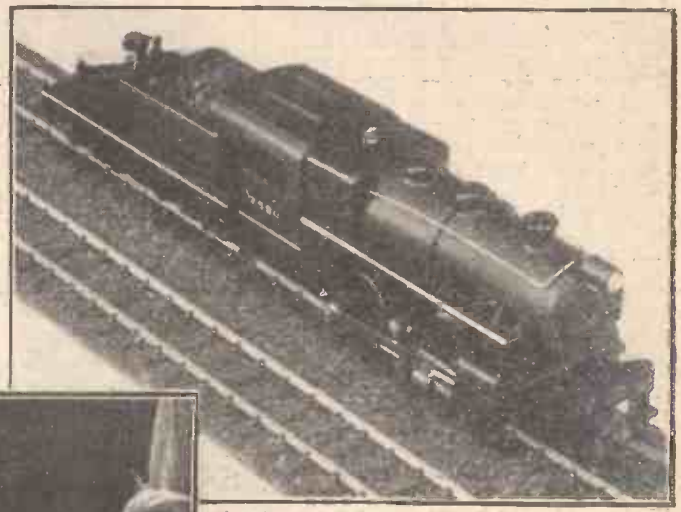


Fig. 5 (Below).—Early stages in the building of the model of St. Andrew's Parish Church, Plymouth.

Fig. 6 (Above).—Further progress on the model church, showing the roof removed to reveal interior construction.

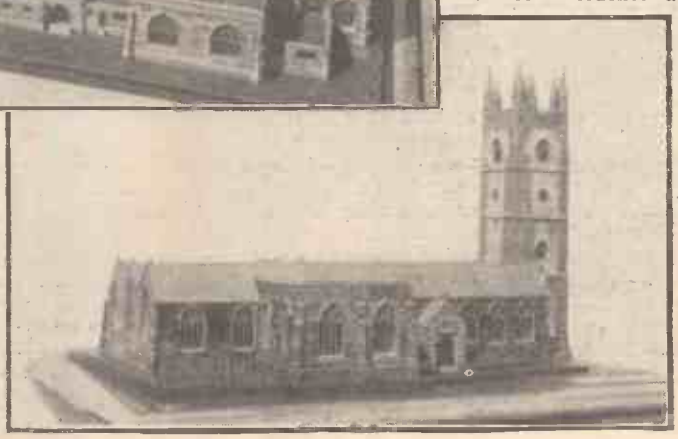


Fig. 7 (Right).—The complete model of St. Andrew's Parish Church, built to demonstrate the proposed restoration and enlargement of this church.

Scale Model Church

Through the courtesy of Miss J. E. Hughes and her staff, of Tavistock, Devon, who have been responsible for the making of a model of St. Andrew's Parish Church, Plymouth, I am able to give a complete description of the building of this outstanding model; an unusual opportunity that I am pleased to accept.

The model was ordered by the Reverend Canon N. Clarke in February, 1949, for the purpose of showing his parishioners the proposed restoration and enlargement of the Church which was partly destroyed through enemy action in March, 1941. As well as re-building the church, it is proposed to add a library and organ loft to the north side of the church, in the shape of a flat-roofed wing added to the transept. In the model, the tower of the church and also this additional portion have been made detachable. The pitched roofs are also removable, so as to reveal the interior of the church and allow re-planning of the interior by the use of movable pews, altar block, etc.

The model (Figs. 5, 6 and 7) is to a scale of 1in. to 8ft. (or 1/96th actual size). The drawings used for building the model were supplied by Mr. F. Etchells, the architect in charge of the church restoration. In addition to this, numerous photographs were available for details of the interior, and of the remains of the church still left standing.

The completed model is mounted on a base 2ft. 7in. by 2ft., made of birch plywood with a moulding of English cherry wood, polished in its natural colour.

The tower of the model is 1ft. 4½in. high and is made of well-seasoned English lime wood. It is built in four pieces of diminishing sizes, to obtain the necessary relief, the mouldings being added afterwards. A special feature of the model are the twelve octagonal pinnacles on the tower: these are made of lime wood, details being built up with Bristol board to give the correct shape, the extreme points being completed with the use of a safety razor blade.

Tiny Detail Work

The numerous tiles in the louvres of each window were fashioned with further dexterous use of Bristol board. The miniature clock faces, each only ⅛in. in diameter, were lathe-turned in holly wood, painted black with Roman figures painted in gold and Bristol board hands, also painted gold. The figure of Saint Andrew, a salient feature of the church over the north door of the tower, was carved in detail from lime wood and is only ¼in. high. The tiny figure stands, holding his symbolic fish, in a niche of fretted wood moulding that has been shaped in places with a mixture of seccotine and whitening.

The main walls of the model building are ⅛in. thick with window openings cut out with a bandsaw. The twenty interior pillars were cut to shape on a circular saw, using a fine, hollow ground saw and finished with sandpaper. For the windows ⅛in. thick Perspex sheet was used, a great asset in dealing with this difficult detail in a model of this scale.

The Gothic tracery on the windows presented quite a problem. It was overcome by building the tracery up from punched shapes of thin Bristol board. The shapes were laid on a sheet of glass over the architect's drawing for the windows and then stuck together with seccotine. When complete, the tracery was slipped off the glass, thickened up all over with a paste of glue and whitening and then given a coat of stone-coloured paint. When dry the tracery pieces were stuck on to the Perspex windows and the whole securely fixed into the respective window openings in the walls.

Painting and Finishing

Much detail work was necessary on the church roofs. The barrel roofs were built from lime wood and the external slates were represented by lines cut longitudinally to the scale width of the slates and then marked out vertically with an X-Acto knife tool. Approximately 29,000 slates were marked out in this way, and then painted grey-green, the interior of the roofs being painted white.

The exterior of the model was given one coat of gold size and then a coat of light stone-coloured matt enamel. To complete the effect of the different types of stone used to build the prototype, cut potato was impregnated with matt paint and applied with excellent effect. All the painting was done by hand.

The time taken for the building of this lovely model was over four months and Miss Hughes, who is a well-known craftswoman, especially in wood work, is to be congratulated on this masterpiece of its kind. Those who have seen Miss Hughes' work when displayed by the Arts and Crafts Exhibition Society in London will realise and appreciate the detail that has been put into the work on this model.

This model of St. Andrew's Church will be exhibited to assist restoration funds. Some readers will remember that H.R.H. Princess Elizabeth visited Plymouth during last October and laid the first stone for the restoration building of this ancient church.

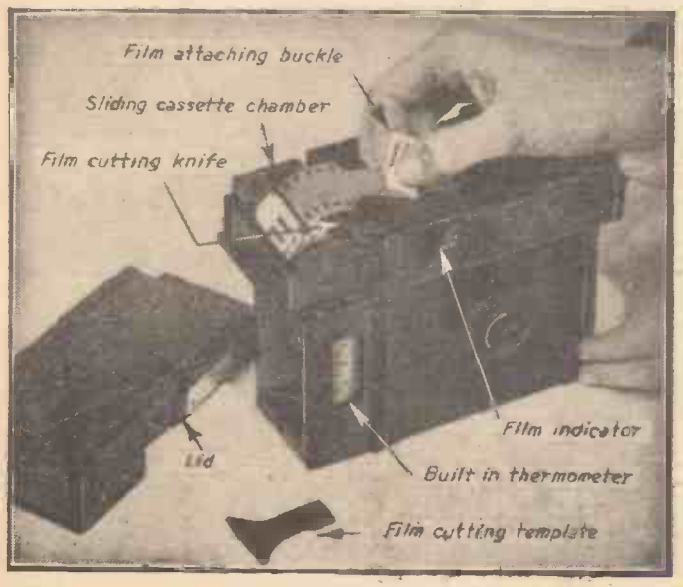
Trade Notes

Johnson "Wellcome" Photographic Year Book

MESSRS. JOHNSONS, of Hendon, have just issued their Photographic Year Book for 1950. This is the first edition for which this firm have been solely responsible. All the technical information has been revised and brought up to date, and many helpful suggestions have been incorporated. The principle of the Wellcome Exposure Calculator has been retained, but it has been amended to conform with the British Standard Photographic exposure tables. The price of this book is 4s., plus 1s. purchase tax, and it can be obtained from photographic dealers.

The Essex 35mm. Daylight Developing Tank.

THIS compact developing tank, which is simple to use, takes 36 frames, 36 x 24 mm. of all makes of 35 mm. film. The whole operation of loading the film into the tank and developing can be carried out in daylight. Whilst the tank should naturally not be exposed to bright sunlight or strong artificial light, ordinary room lighting is perfectly safe, and no darkroom is required at any stage. With the Essex tank it is not necessary to expose and develop the whole 36 exposures of 35 mm. film. For example, only 12 or 24 frames need be exposed, if desired, the camera then being rewound, and the cassette placed in the tank. After winding off the exposed frames they are then developed, leaving the unexposed balance of the film in the cassette, which can then be put back in the camera and exposed at a later date. The tank is provided with a built-in thermometer which ensures that the exact temperature of the developer in contact with the film is known throughout development. An illustrated booklet giving full operational details of the tank is obtainable from Messrs. Johnsons, of Hendon, and Neville Brown and Company, Ltd., Newman Yard, Newman Street, London W.1., who are distributors to the trade.



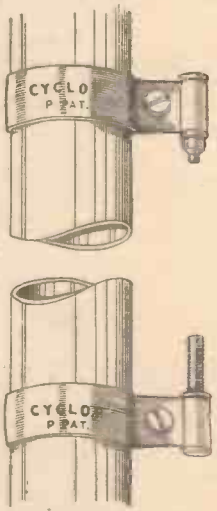
The Essex daylight developing tank with cover removed.

Fabroseál No. 7 Solution

A SPECIAL solution known as Fabroseal No. 7, which eliminates the "dusting" of concrete floor surfaces, is marketed by Carrick, Howat and Lindsay, Lister Road, Hillington, Glasgow, S.W.2. This solution, which is non-oily, does not discolour the floor, and does not make the surface slippery. When applied according to the directions for use the diluted solution penetrates and combines with the concrete, filling every pore with a hard crystalline deposit, increasing the abrasive resistance by approximately 100 per cent., and providing a dense, durable and hygienic surface. The treatment prevents absorption of dirt and foreign matter, and ensures easy cleaning. Further particulars are obtainable from the manufacturers at the address given.

Cyclop "Stop-thief" Pump Clips

THESE new self-locking pump clips effectively prevent thieves from snatching cycle pumps, and stop them from dropping off on bumpy roads. There are no extra gadgets or padlocks to carry, no keys to use, and there is no dependence on springs in the pump handle. In fixing the clips in position, the threaded clip is placed at the bottom end of the cycle frame tube with the threaded part pointing upwards. The pump is then taken and the bottom end screwed down clockwise on this thread, as far as it will go. The other pump clip is fitted at the top of the frame tube with the point downwards. The pump handle is then pressed down and the upper clip adjusted so that the joint just clears the pump handle and the connector which is held in it. After moving the pump handle away from the point, the clip is fixed firmly in position. To lock the pump in place, the pump handle is moved to engage the point of the upper clip, and the pump is then turned anti-clockwise so that it moves up on the thread of the lower clip, causing the pump handle to screw up tightly against the upper clip. These clips, which are marketed by Kowing, Ltd., 21, Duke Street, Piccadilly, London, S.W.1., are priced at 1s. 3d. per pair (nickel plated), or 2s. per pair in chrome.



The Cyclop self-locking pump clips.

QUERIES and ENQUIRIES

A stamped addressed envelope, three penny stamps, and the query coupon from the current issue, which appears on page 32 (THE CYCLIST), must be enclosed with every letter containing a query. Every query and drawing which is sent must bear the name and address of the reader. Send your queries to the Editor, PRACTICAL MECHANICS, Geo. Newnes, Ltd., Tower House, Southampton Street, Strand, London, W.C.2.

Wax Polish for Car Exteriors

I HAVE a few pounds of beeswax which I am desirous of using for polishing my car. Could you tell me what solvent I must use to thin out this wax, so that I can put it through a spray-gun, to put an even layer on the car, which will easily polish with a cloth?

I am using an ex-R.A.F. compressor and a 500 cub. in. air bottle for my spraying outfit. I wish to fit a second bottle of small capacity between the gun and the large bottle. What chemical must I fill this small bottle with, in order to dry the air and not restrict the flow? Who manufactures such a chemical?—E. Taylor (Barrow-in-Furness).

LIQUID polish solutions are never very satisfactory for spraying purposes because the wax solution tends to agglomerate into large drops which form solid "blobs" on the polished surface and are only removed by vigorous hand polishing.

However, beeswax itself would hardly be suitable in any form for polishing a car exterior. The wax is not hard enough for the purpose. You would find that it would "print" or finger-mark badly. An excellent polish may be made by hardening-up the beeswax with carnauba wax, the latter being the hardest of all the natural waxes. Gently melt together 3 parts of beeswax and 1 part of fatty grey carnauba wax. Then dissolve 3 parts of the mixed waxes (parts by weight) in 7 parts of warm white spirit. This will give you an excellent paste polish, which is very economical in use. If you require a true liquid solution you will have to dilute the paste polish with more warm white spirit until you obtain a liquid of the character you desire. However, as we have mentioned, these wax solutions do not give the rapid results which one might expect on spraying. In practice, it is better and quicker to use the paste polish with a soft rag, and then to polish up in the usual manner.

For the rapid drying of air, you can use a bottle filled with granulated calcium chloride or with silica gel, both of which absorb moisture from the atmosphere. But since the air current passing through such materials would be a rapid one, a fairly large volume, say 1 quart, of material would be necessary to get a reasonably dry air. A small bottle would be useless for the purpose.

The above materials may be obtained from Messrs. J. W. Towers, Ltd., Victoria House, Widnes.

As good a practical way as any of getting a fairly dry compressed air current free from "wetting" moisture is to have a large copper cylinder as a compressed air reservoir. The compressor feeds this cylinder and any air moisture tends to be condensed in it. The surplus moisture can, from time to time, be run off from a tap fitted to the bottom of the cylinder. For average spraying purposes, this air "drying" method is usually effective.

Gold-plating Bath

I WISH to gold-plate some small metallic articles and I would appreciate advice for the best method of preparation of the gold salt used in the process. I have some scraps of 9ct. gold for making the salt.

Is the article to be coated made the negative electrode the same way as in the process described for copper on page 34 of the October issue?—F. Hennelly (Navan).

NINE ct. gold is an alloy of 9 parts of pure gold and 15 parts of base metal (copper and zinc).

To obtain the pure gold, the gold material must be dissolved in *aqua regia*, which is a mixture of 3 volumes of strong hydrochloric acid and 1 volume of strong nitric acid. To aid solution, the *aqua regia* should be warmed and when all the metal has dissolved, a greenish solution will result. This acid solution must be gently boiled to dryness and immediately the last drop of acid has evaporated, turn off the heat and redissolve the residue in a little water. To the resulting solution, when cold, add a cold saturated solution of iron sulphate which has been made slightly acid by adding a few drops of sulphuric acid to it.

The addition of the iron sulphate solution precipitates the pure gold as a dark-brown powder. Allow the mixed solutions to stand overnight. The precipitated gold will have sunk to the bottom of the vessel. Pour off the supernatant solution, wash the gold powder with water, and then preserve it for further use: it is pure gold in finely-divided form.

To make the gold-plating bath, first of all dissolve your gold powder in *aqua regia*. Then the excess acid must be expelled by gently boiling down the *aqua regia* solution to dryness, as before. This will give you solid gold chloride, which is yellow in colour.

All electro-gilding solutions are of the cyanide type, being based on potassium cyanide, which, as you will realise, is excessively poisonous, and which will only be supplied to you by a pharmacist to whom you are personally known.

Dissolve about 1½oz. of pure potassium cyanide in ½ gallon of water, and then add to it a solution of gold chloride. The colour of the gold chloride solution will disappear, giving a colourless solution of gold potassium cyanide in free potassium cyanide. The actual amount of gold chloride solution added to the potassium cyanide solution is more or less immaterial as long as sufficient gold is present to deposit electrolytically. The gold chloride solution must be quite free from acid, or when it is added to the potassium cyanide solution, the highly dangerous hydrocyanic acid gas will be evolved. *Please note this. It is very important.*

Before plating, it is best to heat the gold solution to nearly boiling-point, and then to let it cool again.

Particulars of gold plating are to be obtained from any textbook of practical plating, such as, for example, S. Field and A. D. Weill: "Electro-plating" (Pitman). In general, the article to be plated forms the cathode or negative electrode of the cell, whilst the anode or positive electrode must be a strip of *pure* gold or pure platinum. If a platinum anode is used, the gold taken from the bath owing to deposition will have to be made up for by periodical additions of fresh gold chloride.

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.

If a gold anode is used, it will be dissolved away slowly by the solution. Hence, do not keep the gold anode in the bath when not in use. A voltage not exceeding 2 should be used. The bath should be worked at a temperature around 40 deg. C. if a pleasing shade of gold deposition is desired.

Remember at all times that the plating bath is very highly poisonous.

Silvering Small Mirrors

CAN you assist me with following problem? I am building a colour camera which will incorporate two mirrors of microscope cover-glass thickness. The mirrors are to be silvered in such a way that a portion of the light will be reflected and the remainder transmitted, i.e., so that two images may be obtained from each mirror, as indicated in the diagram.

In the professional models these pellicles, I believe, are made by electrical means, but I am told that such an effect is possible by chemical means as well. Possibly, something on the lines of the mirrors one can see through would work.

I should also be glad if you could tell me where the glass can be obtained.—R. Baggott (Clapham).

Diagram of a double-image mirror for a colour camera. (R. Baggott)

ORDINARY chemical silvering will effect the result you want provided that it is not carried out to finality. Unfortunately, the process is not an easy one for a beginner. It demands some skill and experience, and if you could get it done for you by some firm of glass silverers you might well save the extra cost in time and trouble—and, perhaps, disappointment.

Any type of glass can be used for silvering, but if you want special glass of microscope cover-glass thickness, this can be obtained from a firm of opticians and microscopists, such as Messrs. C. Baker, High Holborn, W.C.2, or Messrs. Watson and Co., Ltd., Barnet.

The glass is cleaned by immersion in a 2 per cent. solution of caustic soda, followed by rinsing, followed by immersion in 2 per cent. nitric acid solution. After this, it is advisable to immerse the glass in a 2 per cent. solution of stannous chloride until it is ready for silvering.

The silvering solutions are the following:

Solution A

Dissolve 60 grains silver nitrate in 1oz. of water and pour this solution into a hot—almost boiling—solution containing 48 grains Rochelle salt in 1oz. water. Filter the liquid and make up to 12oz. with water.

Solution B

Dissolve 60 grains silver nitrate in 1oz. water and add ammonia to it *drop by drop* with frequent shaking of the liquid until the precipitate almost forms—and then redissolves, leaving a faint turbidity. Then make up this solution to 12oz. with water.

For silvering, mix equal volumes of solution A and B and pour on to the glass to be silvered. Since you only require half silvering, the glass should be withdrawn from the liquid within about half a minute, or within a few seconds of silvering commencing.

In making up the above solutions, it is preferable, but not essential, to use distilled water. The glass should be handled by tweezers so that no grease or oil from the skin of the fingers is allowed to make contact with it.

Dial Hygrometers

CAN you suggest a device that will give an indication of excessive humidity in my workshop situated in a top room of my house—preferably by signal or a bell circuit?—G. W. Wilson (Sheffield).

THE relative humidity of air is usually estimated by a device known as the Mason's "Wet and Dry Bulb" hygrometer, a detailed description of which may be referred to in any textbook of physics. For an alarm device such as you mention, you require one of the dial hygrometers in which the extension and contraction of a specially-mounted thread under the influence of humidity causes a needle to move across a dial. If you can obtain one of these instruments, you would probably be able to arrange for the needle to effect a metallic contact after it has passed any particular mark on the dial, this contact thereby energising a relay or a bell circuit.

Unfortunately, dial hygrometers are not easy to obtain at the present day. We suggest, however, that you make inquiries of the following suppliers: Messrs. Philip Harris and Co., Ltd., Birmingham; Messrs. Townson and Mercer, Ltd., Croydon, Surrey; Messrs. Baird and Tatlock (London), Ltd., 14-17, St. Cross Street, Hatton Garden, London, E.C.1; Messrs. J. W. Towers and Co., Ltd., Victoria House, Widnes, Lancs.

Repolishing Furniture

I HAVE several pieces of furniture suffering from general wear and tear and the polish is in a very scratched condition. I have spraying equipment and would like to spray polish them. Could you please give me a formula for a polish which will give a French polished appearance?—W. A. Parker (Cottingham).

NO spraying method will impart a good French polished appearance to furniture. Such methods give a hard, glassy, cheap appearance which, to many people, is objectionable.

However, you can make a cellulose spray by dissolving scrap celluloid in a mixture of equal parts of amyl acetate and acetone, or, alternatively, you can purchase a ready-made cellulose varnish from any good paint shop, or from Messrs. Nobles and Hoare, Ltd., 3, Cromwell Road, London, S.E.1, or Messrs. James Beard, Ltd., 16, Great Ancoats Street, Manchester.

A much better method of renovating your furniture,

we think, would be to go over it by hand using an ordinary shellac "white polish," which can be obtained from Messrs. James Beard, Ltd., address as above. This should also be obtainable from any good paint shop in your area.

Again, you could use for the same purpose a good "button polish," which is merely a solution of shellac in methylated spirit. This can give quite good results if it is carefully applied with a smooth, fluffless cloth.

Preparing Metal Surfaces for Painting

COULD you advise me regarding the following? What preparation can I use on an aluminium sign-board (aluminium being used in place of wood) before painting to prevent peeling of paint?

(a) Preparation before oil paint;

(b) Preparation before cellulose.

Also, what is the necessary procedure for a sign-board of zinc sheeting?—M. I. Newman (Shanklin).

DISSOLVE 1 part of caustic soda (or soda ash) in 3 parts of hot water. Using a rag tied to the end of a stick, mop the *hot* solution over the aluminium surface. Alternatively, immerse the whole of the metal surface in the caustic solution. The solution will rapidly attack the metal, so that within about 20 seconds the solution must be rapidly rinsed off the metal with plenty of water, and the metal then allowed to dry. It will be found to have a dull, matted or slightly rough surface.

To the metal, thus matted, apply a thin coat of a grey priming paint. When this has dried thoroughly (after a week or 10 days) apply two thin coats of the surface paint that you wish to use. The paint will now adhere to the metal for a long time. If possible, use a cellulose-base paint in preference to an ordinary oil paint.

Your zinc sheets should be treated in exactly the same manner, but, in this case, the caustic treatment will have to be a little longer in duration.

If you do not wish to use a caustic solution as a matting agent, you may employ diluted sulphuric or hydrochloric acid—1 part of acid to 3 parts of water, this acid mixture being used cold.

"Crackle" Finish for Lampshades

I SHOULD be grateful for some information regarding the "crackle" finish that appears on some lampshades.

I am aware that the paper is sized, then varnished, and prior to the varnish drying an astringent is applied to obtain the "crackle." I wish to know the *exact* procedure, the actual astringent, the best paper, and the best varnish to use.—R. S. Gordon (Broadstairs).

FOR lampshade-making you need a fine-grained "toned" paper of tough texture and make-up. You can obtain such material from either Messrs. G. W. Russell & Sons, Ltd., Hitchin, Herts, or from Dryad, Ltd., Saint Nicholas Street, Leicester. From the latter firm, we believe, you can now obtain suitable varnish for producing the "crackle" effect.

There are several types of these varnishes. They are all based on synthetic resins, and the "astringent" employed for developing out the "crackle" is either a strong solution of tannic acid or formalin. The varnished paper is air-dried in a slightly warm oven (or without an oven). Afterwards, the astringent is wiped over the surface, and the paper is then placed in an oven at about 75 deg. F. for 40 minutes. Sometimes a sort of coarse-mesh cloth, immersed in formalin or tannic-acid solution, is wrung out and then placed flat on the varnish surface, being pressed down with an iron. In this manner, the astringent medium is only made to contact the varnished surface in confined areas. The fabric mesh is then removed and the paper is heated as before. At other times the fabric is kept in position on the paper surface during the whole of the heating. The effect is the same, the varnish so treated becoming unduly brittle and crackling in the embrittled areas.

The trouble with such papers is that the cracks do not always remain stationary. Under the heat of the lamp within the lampshade, the cracks sometimes tend to extend so that the whole surface "burns," that is to say, becomes brown and powdery and, in time generally disintegrates.

Bronzing Solution

I HAVE three "Mene" bronzes which have been well cleaned. Can you inform me how to oxidize them so as to obtain a dark brown polished surface somewhat similar to that of bronze name-plates?—B. Taylor (Ramsgate).

THE pleasant dark brown colour of nameplates is not usually a chemical colouration of the metal. Normally, it is an applied surface-lacquer. You can, however, obtain a warm-brown colouration on a bronze surface by immersing the cleaned bronze article in a diluted solution of sodium sulphide, say, one part of the latter in 30-40 parts of water. Sodium sulphide can be obtained from any photographic supply shop. Ammonium sulphide used in the above proportion will give a warmer tone still, but this material is a liquid which is not very stable, and which is, therefore, not easily obtained.

Another bronzing solution can be made by gently boiling for 15 minutes equal parts of lime and powdered sulphur in about 30 times their bulk of water. A yellow liquid results. This should be filtered off from the lime-sulphur residue and diluted about 15 times with water. Bronze-immersed in this turns warm dark brown and eventually brown-black. Having coloured the metal to your satisfaction, rinse it well with water, allow it to dry, and then lacquer it with any of the proprietary clear lacquers which are nowadays obtainable. Some sort of surface lacquering is essential in order to protect the chemical colouration.

Insulative Materials: Bituminous Paint

I AM interested in huts made of corrugated steel sheets, and desire to insulate the insides previous to lining with hardboard in order to reduce heat in summer and cold in winter. I have in mind a mixture I have seen applied to steam pipes leading from boilers to plant some distance away.

Could you recommend any such insulation, giving its composition, and where it could be purchased?

Would bituminous paint applied to the sheet surfaces before the insulation was put on prevent corrosion?—J. G. Brims (Stirling).

THERE are two excellent and cleanly insulative materials which are suitable for your purpose. They are both good insulators, are fireproof, sound-proof, vermin-proof, and well-nigh indestructible.

The first is asbestos fibre, which is obtainable from Turner Brothers Asbestos Co., Ltd., Rochdale, Lancs., or from Messrs. Jas. Milne Cooper & Co., Ltd., Kobar Works, Bradford, Yorks. The second is a newer product, a sort of spun glass which has been named "fibreglass." This is obtainable from Fibreglass, Ltd., St. Helens, Lancs.

A good bituminous paint applied to the sheet surfaces would definitely keep metallic corrosion at bay over a long period. Such a material is "Mariolene," which is supplied in black, brown or red colours by British Asphalt & Bitumen, Ltd., The Docks, Preston, Lancs. Similar paint is manufactured by Wailes, Dove Bitumastic Co., Ltd., Collingwood Buildings, Newcastle-on-Tyne.

Water-wheel Plant

I AM thinking of installing a small water-wheel to drive a 12-volt 10 amp. dynamo. The diagram explains the layout of the water supply. It consists of a 500-gallon water tank supplied by a six-gallon per minute flow. A pipeline of suitable size would have to be chosen to maintain the supply in tank constant. The diagram also shows the position of the desired pipeline, which must remain as shown owing to a viaduct which has been constructed over the river bed. The total height from the level of the tank orifice to the water-wheel is from 10-15ft.

Would these conditions enable the water-wheel to be properly driven, or would a water-wheel or a turbine be more satisfactory? Where could I obtain such a wheel or turbine?—A. O. Boyle (Portglenone).

YOUR projected scheme for operating a small dynamo by means of water power is quite satisfactory. A 1in. diameter pipe would be rather better than the ¾in. pipe which you propose. At any rate, the wider pipe should run as far as point B on the diagram in order to keep the flow-resistance to a low figure.

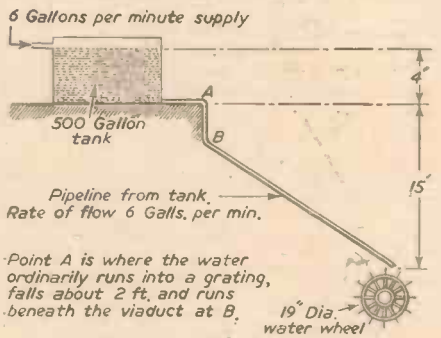


Diagram of a small water-wheel plant. (S. O. Boyle)

You could use an ordinary overshot waterwheel for the purpose, but this would have to be lightly balanced and very free-running. On the whole, however, we are inclined to think that you would find a smaller water-turbine to be a better although, perhaps, a rather more initially expensive proposition.

The following firms specialise in the manufacture of such turbines, and we suggest that you send them a copy of your plans and request a quotation for a suitable turbine to meet your needs:

Messrs. Carrick & Ritchie, Ltd., Waverley Engineering Works, Norton Park, Edinburgh; Messrs. Gikes, Gilbert & Co., Ltd., Canal Iron Works, Kendal; Messrs. Warburton & Co., Ltd., Bedford Street, North, Halifax, Yorks; Messrs. W. Gunther & Sons, Ltd., Central Works, Havelock Street, Oldham, Lancs.; Messrs. Joseph John Armfield & Co., Ltd., Vale of Avon Iron Works, Ringwood, Hants.

Colourless Linoleum Lacquer

PLEASE inform me of any formula you may have for a colourless linoleum paint. I recently purchased some linoleum and wish to paint it with some very hard setting liquid. I believe there is one with a resin base,—D. J. Ayton (Richmond).

A HARD, colourless, transparent synthetic resin lacquer of the type you mention may be prepared according to the following formula:—

Gelva resin (grade 7) (Polyvinyl acetate resin)	28.5 per cent.
Amyl phthalate	1.5 per cent.
Xylol	21.0 per cent.
Amyl acetate	21.0 per cent.
Toluene	14.0 per cent.
Ethyl acetate	7.0 per cent.
White spirit	7.0 per cent.

The Gelva (polyvinyl acetate resins) may be obtained from Messrs. Shawinigan, Ltd., Marlow House, Lloyd's Avenue, London, E.C.3. The other materials may be obtained from any general chemical merchant and laboratory supplier, such as Messrs. Griffin & Tatlock, Ltd., Kemble Street, Kingsway, London, W.C.2, or Messrs. Vicsons Ltd., 148, Pinner Road, Harrow, Middlesex.

The above varnish is of a high-grade, durable type, having a good gloss. It can be pigmented with dry colours, if required. If you want a simpler varnish, try a plain (say, 20 per cent.) solution of Gelva 7 in acetone or methylated spirit. It is possible that this may be sufficiently durable for your purpose. It will certainly be easier to make and less expensive.

Developer for Panchromatic Film

COULD you inform me of the method and the chemical formula used for developing 16 m.m. safety film, either panchromatic perforated negative or panchromatic perforated positive film?—P. McGovern (Drogheda).

THE correct developer for panchromatic film depends to some extent on the nature and make of film in question. Since you do not give this information, we can only provide you with the formula for making a good "average" developer for this class of material. Such a formula is:—

Metol	1 gram.
Sod. sulphite. cryst.	75 grams.
Hydroquinone	4 grams.
Sod. carbonate	50 grams.
Potassium bromide	1 gram.
Water	500 ccs.

Dissolve ingredients in the order named. For use, dilute 1 part of the above solution with 5 parts of water.

At 65 deg. F. panchromatic film of average quality and correct exposure developed in the diluted developer will take exactly 7 minutes for proper development. With panchromatic material, development must take place in complete darkness, since the panchromatic material is sensitive to red light.

If the film is of short length, say up to 3ft., it can be developed "by hand" merely by passing the strip of film backwards and forwards through a bath of the developer. If the film is of considerable length it is best wound on a drum or stretched on a frame, the whole then being completely immersed in a vat of the developer.

After development, follow by well rinsing and then immersion in an ordinary fixing bath of hypo.

Food Storage Cabinet on Evaporation Principle

I AM in need of a good household food storage cabinet, and not being inclined to pay present-day prices for a refrigerator, I have decided to try and construct a suitable alternative.

I have read the claims of firms producing a cold cabinet which is non-mechanical and which works by simply filling with cold water daily.

I believe these work on a simple evaporation principle. Could you tell me if this is so, and give me a few general constructional details of same? Also, are any chemicals used to give better results? I am proposing to use sheet dural or zinc in the construction of the apparatus.—R. Watson (Rugby).

WHEN any liquid evaporates it requires a certain amount of energy to do so. It utilises the heat energy which is inherent in it for this purpose. Hence, an evaporating liquid always becomes colder. The quicker the liquid evaporates the colder it becomes. This is the "evaporation principle" to which you refer.

Now, if we make a hollow structure in any porous material, and saturate the material with water, the evaporating water will lower the temperature of the medium. Consequently, any article placed within the structure will become colder, because it will lose its heat to its colder surroundings.

No chemicals are needed in this kind of apparatus. You merely have a porous material, such a plaster, unglazed porcelain, porous brick, compressed fibre, etc., which can take up fair amounts of water. The structure is built up around an inner chamber which it is wanted to cool. Water is allowed to drop slowly on to the porous surface so as to keep it liquid-saturated. The hotter the day, the quicker the liquid evaporates, and the colder becomes the interior of the structure. A metal framework can be provided, but this does not take any intrinsic part in the operation of the cooling device. Hence, the metal part must not be an all-enclosing one, otherwise the water will not be able to evaporate from the porous material and the cooling action will stop. Provided that you allow for ready and free evaporation from the porous material, you will get fairly effective cooling.

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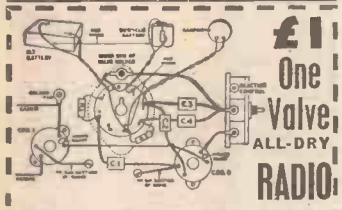

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By L. H. Sparey

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CONTENTS

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THE Cyclist
Editor: F. J. CAMM

VOL. XVIII JANUARY, 1950 No. 334

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

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Comments of the Month

By F. J. C.

THE N.C.U. CAVES IN

THE National Cyclists' Union has consistently opposed massed start racing. It has gone behind the scenes in official quarters to try to get it suppressed. It has launched tirades against the sport, and various members of the N.C.U. have written inspired letters to the Press in the hope that the gullible editors will print their fulminations. We have consistently supported this form of racing, without at the same time necessarily agreeing with all that the League has said and done. We do not think in the early days it had a square deal, either at the hands of the association or in the columns of the technical press. Some of the methods which have been adopted can only be described as underhand and dirty and they should find no place in a sport which claims to be clean. The opposition mainly came from those who have come to regard themselves as the proprietors of the movement, instead of servants of the sport, there to carry out the wishes of the majority. There can be little doubt that the majority of cyclists interested in cycling sport are in favour of massed start racing under B.L.R.C. conditions, for in spite of the continued opposition it continues to gain support and the League membership continues to increase. The opposition, in our view, came from those bodies such as the N.C.U. who feared that the new sport would oust older forms of sport and perhaps weaken their authority. For it must be remembered that the N.C.U. exists solely to control cycle racing on tracks and closed circuits. It does not speak for time trials, a form of sport which it endeavoured to throttle in the 'nineties, together with road record attempts. Its views then were that time trialling was dangerous and promptly threw it overboard and forbade its officials to have anything to do with it. Fifty years of time trialling have shown the N.C.U. how wrong its judgment was and how wrong it has been over record breaking on the roads, and there is no reason to suppose, therefore, that its judgment is any more accurate on massed start racing. The N.C.U. has been the apostle of lost causes for over fifty years. It has always done the wrong thing, as may easily be checked by consulting the files of the journals for that period. With minor exceptions it has been subject to justifiable criticism because of its proprietorial attitude, its wrong decisions and the inaccuracy of its judgment.

If it did not want massed start racing on the roads it went the worst possible way about getting it stopped. Members of the N.C.U. who are on certain committees were instructed to oppose it. The N.C.U. Ogpu extended its underground methods by visiting the Ministry of Transport and spitting its venom against M.S. It was fortunate indeed for massed start enthusiasts that we discovered this fact and prepared for the League the now famous memorandum on massed start which we, with W. J. Mills and J. Kain, presented to the Ministry of Transport.

Notwithstanding the announcements from the Ministry and from the Home Office stating that massed start racing was undesirable, and the veiled threats of dire penalties if it continued, it has continued safely and overtly and has introduced a breath of fresh air into a sport which was covert and conducted on hole-and-corner lines. It has brought a great deal of valuable publicity to cycling. It attracts crowds larger than any event the N.C.U. can stage at Herne Hill. Indeed, cycling sport of the time trial variety is designed to avoid publicity.

THE LEAGUE'S FIGHT

The League has put up a very gallant fight without much in the way of funds and without a friendly Press. The present position in which it finds itself must give it cause for extreme satisfaction. Astonishing though it may sound the N.C.U., faced with the fact that its campaign of calumny against the B.L.R.C. has failed, has made a virtue out of necessity and now wishes to temper the wind to the shorn lamb. It has gone to the Ministry of Transport and, in effect, said "we have been unable to stop road racing after a six years' campaign against it and we have very loyally adopted your requests to discourage it. We are now of the opinion that the new generation of cyclists wants this type of sport, and as a national body we are expected to meet that demand. What will you do to help us?" This is a complete *volte face*, and a complete victory for the League. We do not agree with one critic that the Union will be able to obtain for massed starters far more than has been obtained by the B.L.R.C. The B.L.R.C. merely wishes to be left alone. It is well able to control itself and the present change of heart on the part of the N.C.U. is merely an attempt to enlarge their membership and to absorb the League. No one has any confidence that the Union would be any more successful in running massed start than they have been in running track events. It must not be forgotten that they really exist merely to control a few hundred track riders and to issue licences to them. The bulk of their membership is merely an affiliated membership.

It is obvious that the Government does not want to introduce legislation to stop massed start racing. Indeed it could not do so without at the same time stopping time trials. Had the Government done so only one body would have been to blame—the N.C.U.

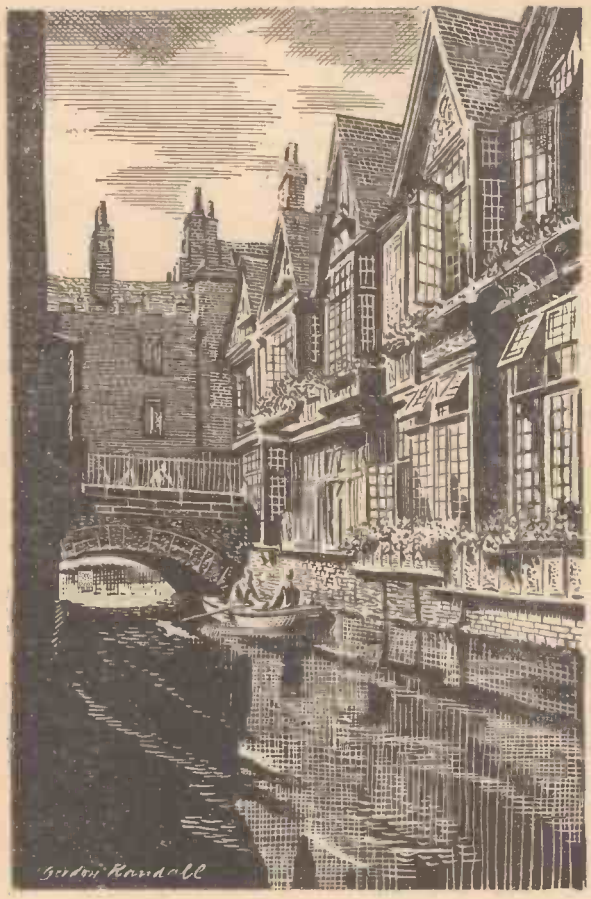
By its action the N.C.U. has exhibited a little wisdom, but too late. There are many smiles in cycling circles at this latest antic of the boneless wonder of the cycling movement—one of the three tailors of Tooley Street.

The Speedway Cyclists' Association was frowned upon by the N.C.U., but profiting from its experience with the League it has given provisional recognition to it and proposes to formulate a set of rules for cycle speedway events. This newest form of cycle sport is keenly followed by a large number of junior cyclists. It should prove a useful training ground for N.C.U. members.

We have on a number of occasions suggested that peace can descend in the realm of cycling sport only by the formation of a totally new body representative of all interests and run on democratic lines. The cycling organisations to-day are by no means democratic, although they go through the motions of democratic elections.

We threw ourselves energetically into the fight for massed start racing and we like to feel that some measure of the success is due to our efforts. We think that some of the critics soon changed their views when they saw League events hitting the headlines. One, indeed, was heard to say, "It looks as if we have backed the wrong horse!"

Paragrams



Canterbury. The river Stour and the Weavers' Houses. A lovely group of timbered houses which were long occupied by refugees who fled to Canterbury from the Netherlands and France at the time of religious persecution.

Most Popular Sportsman

BENNY FOSTER, a member of Welland Valley Wheelers' Cycling Club, Market Harborough, Leics, was voted the town's most popular sportsman in a contest arranged in connection with the local shopping week. The runner-up was the cricket club captain.

A Boy, a Girl and a Bike

WHEN the cycling film, *A Boy, a Girl and a Bike*, was screened at the Odeon at Hinckley, Leics, Mr. Fred Smith, a local cycle agent, arranged a little publicity connecting the sport with the film. There was a procession of cyclists through the town, led by the Odeon's assistant manager, Mr. Rex Reeve, riding a decorated tandem. Mr. Smith also arranged a competition for the best cycling holiday photograph and offered a prize of £2.

I Can See You!

THE time will soon be coming when the point-duty policeman, instead of standing in the middle of a busy street directing traffic, will fly above our heads, telling us where to go and pointing out our bad road manners. This was demonstrated to members of the Leicestershire and Nottinghamshire police forces at Rearsby aerodrome, Leics. An Auster Autocrat, with microphone and transmitter in the cabin and a loudspeaker under each wing, flew over the airfield at heights varying from 400 to 1,000 feet, and the instructions of the pilot to those on the ground were clearly audible. With its slow speed and manœuvrability, the Auster is a very suitable machine for traffic control, but a sudden bellow from the sky could be very nerve-shattering to a hesitant traveller.

Starts Racing at Fifty-nine

ARTHUR WYATT, 59-year-old president of Lincolnshire's Fenland Clarion Cycling Club, has just made his first appearance on the road in a competitive event. He was one of the eight entrants in the 12-hour time trial of the Fenland Road Riding Association, the last of the association's championship events for the season, and he covered 184 miles. The winner of the event was L. Fensome, of Spalding, who set up a new Fenland record with 241 miles and has won all four of the association's championships this year.

Beware of Second-hands!

AFTER sentencing a Peterborough man to one year's imprisonment for stealing 22 cycles within a few weeks, the chairman of the Bench suggested that anyone who bought a second-hand machine from a person not a reputable dealer or agent was asking for trouble. If people bought cycles from all and sundry, and the machines were later found to be stolen, they would lose their money and the machines as well, and they would have no one to blame but themselves. The chairman described the defendant as "a pest to the community" and said the magistrates were determined to do all they could to put an end to this stealing of cycles. The total value of the stolen machines was £276, but only four machines and a quantity of parts were recovered.

Kitchen Stove as Well?

SIXTY-FIVE-YEAR-OLD Richard Jefferys, who travels all over the country on his bicycle and, like the snail, carries his home with him, was the other day on his way through the Eastern Counties to Yarmouth. He seemed to have all his belongings with him, including the kitchen stove, for his machine was hardly visible beneath the bundles and packages that were festooned all over it. Over the top of the cycle, to keep off the hot sun, was a canopy supported on poles. A sudden squall of wind would mean an immediate capsize, as there seemed to be no rapid means of taking in the mainsail!

3,000-*mile Ride*

MR. ALEC J. SLATER, of Cleethorpes, a local schoolmaster, has undertaken a 3,000-miles trip across France and Italy to Rome and back again to England, accompanied by a 14-year-old Cleethorpes schoolboy. Their average daily mileage was about 70, but in order to reach their destination in the time they had decided upon, they put on a spurt on the last lap to Rome and covered 154 miles that day. Sometimes the weather was so furiously hot that the riders had to rest in the daytime and ride at night. Most of the time they camped out, but once they were caught in a terrific storm and had to spend the night in the nearest hotel.

The Things People Find!

DURING work in connection with the demolition of an old cottage in Bath Row, Stamford, Lincs, the builders opened up a cavity between the original building and a later edition and found inside an old boneshaker, some 80 years old. The machine, which has a rear wheel just over half the size of the front wheel and provides a most uncomfortable ride, was in perfect condition and with a clean up and a drop of oil could be taken on the road by anyone with sufficient energy to pedal it. From inquiries it appears that the machine belonged to the father of the present owner of the property and was bricked up many years ago "to get it out of the way."

Toil and Sweat!

MUCH energy was expended by Kettering Friendly C.C., Wellingborough C.C. and Fenland Clarion C.C. riders who took part in an "Old Crocks Race," at Wicksteed Park, Kettering. Wearing Victorian costumes, the riders were mounted on various types of early cycles, some of them 70 or 80 years old, and there was also a home-made double-decker machine built by a Kettering rider. The winner flashed home on a penny-farthing, closely followed, in a photo-finish for second place, by the double-decker and a boneshaker.

School Lessons While Cycling

THE geography master of Huntingtower-road Secondary Modern School, Grantham, and ten of his pupils, have just returned home after a six-day cycling tour in Derbyshire. They combined learning with an enjoyable holiday and studied the local rock formations, made notes for essays, carried out map-reading and generally applied in practice a good deal of what they had been taught in class. One young rider even had a lesson in physics and the behaviour of gases under certain conditions when the fizzy lemonade he was carrying in the bottle on his cycle blew the cork high in the air! The experiment was altogether so successful that the master plans to arrange another tour in the spring.

Keen Type!

WHEN a man was charged at Towcester (Northants) Magistrates' Court with driving a car without due care, it appeared that he had cycled the 60-odd miles from his home in Kensington to the Court because he had not sufficient money to pay his fare. He was fined £1 for the offence and was allowed one month in which to pay. Then off he went again on his cycle to cover the return journey.

In Glorious Technicolour?

RESEARCH workers have now developed asphalt for road surfaces, coloured red, green, blue, yellow and cream, and it is claimed that coloured roads would make for road safety. It is suggested that the roads shall be laid to match the country through which they pass, so we shall soon no doubt be seeing roads in the country that are green in spring and summer and change to red and brown in autumn and to cream in winter, to match the seasons. But whatever the colour of the roads there will still be motorists to whom cyclists are invisible, even in broad daylight.

Around the Wheelworld

By ICARUS

Simplified Racing Rules

IT seems to be the ambition of every racer, time trialist to turn up at the A.G.M. of his club and suggest some amendment to the existing rules or a new rule. The simple sport of time trials does not need complicated rules. There are now so many rules that every time trialist is bound to break one of them at some time or another. These breaches are often undiscovered because the judges and officials cannot be expected to remember the long list of rules. I would suggest that instead of expanding the rules, someone goes through them and cuts them by at least 50 per cent. Each year sees time trialing become more complicated. Why not abolish first of all the anti-publicity rules? And why not allow winners to select prizes which they require, whether engravable or not? Incidentally, why not abolish medals? They are old-fashioned, few people wear them, and they seem insignificant. You, I expect, have seen the proud winner of thirty years or so ago photographed by his sideboard overloaded with pots, rose bowls, biscuit barrels, canteens of cutlery, etc., and wearing a railway coupling watch chain festooned from end to end with medals proclaiming his many victories in local events. Possibly there was one for regular attendance at Sunday School.

Old Cycles

MY colleague Harold Eley, in a recent issue, wrote a paragraph suggesting that old cycles never die. This has brought me a letter from Mr. F. H. Fisher, D.C.M. and Bar, who tells me that he has had his cycle frame since 1909 and that all the other parts have been renewed several times. His machine was an Elswick, which was amongst the first to fit 26in. wheels, with a drop frame and short head. When the 1914-18 war broke out the War Office bought up many old cycles and issued a standard cycle made by Alldays and Onions. The number of Mr. Fisher's machine is 17672, but its original famous green finish is now black. This does indicate the high quality of British bicycles.

Raleigh to Make Cycles in India

IT is interesting news that Raleigh Industries, Ltd., have announced that they have decided to associate themselves with the flotation of a company in India with the object of manufacturing in that country the pedal cycles associated with their name. The Indian bicycle market is, of course, the largest in the world and even before Partition Raleigh had been considering the question of the future development of this market and had come to the conclusion that in order to conform with the policy of the Central Government the erection of a bicycle factory of a modern type in India was essential.

Perfection in Cycling

MY old friend Frank Urry has written a most interesting booklet entitled "Perfection in Cycling," for J. A. Phillips and Co., Ltd., Credenda Works, Smethwick, Birmingham, who will supply copies free to readers. It is a most valuable contribution to the literature of cycling and it deals in the well-known Frank Urry style with the intimacy of cycling, the marvel and magic of the bicycle, the joy of journeying, the difference between a bicycle and a real bicycle, how to ride and where to ride, the joy of touring, life attachment, and attention to the needs of a bicycle. The booklet is beautifully illustrated and contains a brief biography of the author.

B.R.A. Winner

THE British Best All Rounder Competition, promoted jointly by the Road Time Trials Council and the Scottish Amateur Cycle Association, announces the 1949 winner to be K. H. Joy, of the Medway Wheelers, with K. R. Whitmarsh, of the Southampton Wheelers and P. Beardsmore, of the Medway Wheelers, second and third respectively. The corresponding speeds were 22.808 m.p.h., 22.712 m.p.h. and 22.689 m.p.h. S. Haslam, of the Lancashire Road Club, was close runner-up for third place, with 22.686 m.p.h. No fewer than 28 riders beat 22 m.p.h., 140 beat 21 m.p.h., and all of the remainder beat, of course, 20 m.p.h. The rules of the competition are that the riders are placed on their mean average speed, which is the average of their best speeds at 50 miles, 100 miles and 12 hours for men, and 25 miles, 50 miles and 100 miles for women. The competitions, which run throughout the whole season, are promoted jointly by the Road Time Trials Council (England, Wales, and Northern Ireland) and the Scottish Amateur Cycling Association; and are open to all members of affiliated clubs.

This year's competitions have been a record, both in the number of riders and the quality of the performances. Approximately 14,500 individual rides were taken into account, and over 500 riders qualified for certificates by returning a mean average of 20 m.p.h. or more. The winner, K. H. Joy, of the Medway Wheelers, returned a mean average of nearly a quarter of a mile an hour better than the previous best.

In the Women's B.A.R. the average speed is calculated from rides at 25, 50 and 100 miles. The winner was Eileen Sheridan, of the Coventry C.C., at 21.827 m.p.h.; second Susie Denham, of Meersbrook C.C., at 21.522 m.p.h.; and Stella M. Farrell, of the Yiewsley Road Club, third at 21.418 m.p.h. Six of the women beat 21 m.p.h., and the remainder, 19, beat evens. It will be seen that the difference between Kenneth Joy's speed and Eileen Sheridan's is only .009 m.p.h. Team winners were as follow:

MEN.

	m.p.h.
Medway Wheelers: Joy, Beardsmore, Enfield	22.644
Norwood Paragon C.C.: Brown, Callanan, Kitchiner	22.425
Middlesex Road Club: Macdonald, Berry, Price	21.905
Nelson Wheelers: J. K. Riley, A. M. Riley, Hampson	21.895
Lancashire Road Club: Haslam, Coleman, Baxter	21.871
West of Scotland Clarion C. and A.C.: Shewan, Davie, J. H. Walker	21.688
Huddersfield Road Club: Robinson, Stake, Scholes	21.618
Southampton Wheelers: Whitmarsh, Brown, Armstrong	21.594
Law Wheelers: Murphy, A. Walker, MacDonald	21.488
Lomond Roads C.C.: Linden, Clark, Niit	21.452
Yorkshire Road Club: Heppleston, Hargreaves, A.D. Smith	21.441
Aberdeen Wheelers: Adams, Crombie, Brand	21.416
Westerley Road Club: Whythe, Griffiths, Morrell	21.374

WOMEN.

Rosslyn Ladies' C.C.: Seeger, Tregoning, Moulsdale	20.706
Pyramid Road Club: Greenhalgh, Mitchell, Buckley	20.319

Exeter.

A stop by the cathedral, slowly recovering from the scars of war. The view shows part of the fine Norman tower of St. Peter. This tower contains a remarkable clock dating from the days of Edward III.

Dynohub Automatic Switch

FOR the past few months I have been using the new Raleigh automatic switch which cuts in the battery automatically when the dynamo ceases to generate, such as at a traffic stop. The device is entirely automatic and the switch-over takes place without visible change in illumination. I like the Dyno Hub system, having had every make of lamp on the market for the past forty years. My old Lucas King of the Road and Silver King oil lamps still, however, retain an honoured place on the lamp brackets of two of my bicycles. One great advantage of oil, acetylene and battery headlamps is that you can remove them for inspection of tyres, chains, etc., on dark nights and this is not possible with lighting sets which are permanent fixtures, so to speak. For such purposes I carry a self-generating pocket torch of continental manufacture, which is not on the English market unfortunately owing to permit difficulties. But on many occasions I have been glad of this self-generating hand torch when headlamp bulbs have blown and I have been without spares. Incidentally, I am still using the same headlamp bulb with the Dyno Hub which does not suffer from voltage fluctuation of a type likely to destroy the filaments. I strongly advise all Dyno Hub users to fit this new switch, which is incorporated in the lid of the cylindrical battery container.

The White Hart, LAUNCESTON

The most interesting and rare feature of this famous hostelry is the fine carved Norman doorway to its main entrance. This doorway is said to have come from an ancient chapel in the Castle. The inn stands in the busy square of this well known Cornish hill-town

Wayside Thoughts

By F. J. URRY

Right Way?

I GO to work on a bicycle every morning, but I do not consciously think of my mental condition except when I am stopped by a friend in a car who desires a word with me, and nearly always says at the end of the exchange, "You do look well—and happy." I am—both. How much all this simple contentment with life is concerned with cycling I cannot tell, for the habit of that travel has been with me far too long for me to present it as the sole reason of my well-being. Certainly I think daily cycling can make the healthiness in the animal, and I suppose from that base flows the cheerfulness of spirit. In any case, it is a possession mainly appreciated when someone puts the thought into your mind; and then you are very thankful. On my daily journeys I pass folk walking and waiting for transport, and many people pass me in cars. All of them seem obsessed with the seriousness of life; they have begun to wear the frown of work before reaching the place of it, as if its propinquity needed the mask of severity. Maybe they are right to so order their minds that facial expression ponders the difficulties of the day before need; but I do not think so personally because it is just adding another period to working time unnecessarily. I have no intention of doing that when there is no need, so I enjoy my ride to work because it is the next best thing to going the other way leading to the open road and the quiet by-lanes; and, because of that fact, cycling and its exercise seems better than any other means of progression. Thus, in this activity I feel superior; probably no one else imagines that to be so, but the fact that I do makes its possession all the more positive.

My Truth, is it Yours?

I AM fully aware I shall never convert man to my common mode of work-travel. They must have their cars (if they can afford them), their season tickets, and their regular bus journeys, or they would lose caste. Would they? I wonder; or would they be hailed as wise men keeping an old body decently fit for work and play, as I frequently am? It is little use pondering the question, because a lone old wolf will not change a fashion—in many cases an expensive one—for a method of movement that possesses all the virtues that a virile man should acknowledge, but does not. I am told that "it just cannot be done," by people who should know, and when I ask them why, the replies are completely smothered in that indescribable state of mental outlook which the word swank suggests. "All very well for you," they say, "for people have got used to your idiosyncracies, and would be as shocked were you otherwise, as they would be if we followed your example." This is probably true, and incidentally goes to prove my contention that it is all a matter of habit. Actually it is more than that; it is too much trouble for millions of people to exercise their bodies at the lowest possible cost. They will do it on the golf course, or on tennis courts, the cricket, football and hockey field, go hacking, spend quite a lot of money, and fail to appreciate that all those things, good as they may be, are less than the health values of cycling, and infinitely less in variety. You can do all these things and still ride a bicycle, and probably do them better because of it. Sometimes an ignorant individual tells me cycling lacks the competitive element, when probably, as a sport pure and simple, it is the most strenuous of all games played.

The Strenuous Games

THE fact of the matter is that many cyclists, and practically all non-cyclists, know very little about the sport of cycling because such publicity is usually confined to the technical Press. They do not know in fact that an unpaced 100 miles has been ridden in 3h. 45m. 51s., and that 11 years ago by Bert James; or the "50" in 1h. 39m. 42s. ten years ago by Earnshaw; and that week-end following week-end many remarkable performances in cycling speed are made by the clubmen of Britain. These folk are the experts at the game, in youth, and often in mid-manhood and womanhood, they are riders who are wonderful examples of high-grade athleticism. Indeed, I suppose cycling is one of the few games extant which can be played throughout the whole run of life, from the infant pavement trike (beloved of every youngster) to the quiet pottering progress of the ancient. I mention these sporting matters now because I still find it easy and enjoyable to wander my way through the world with a performance approximating 25 per cent. of the highest competition effort, and that is a satisfaction which makes living enjoyable because it grants it a sense of freedom no other form of movement can give. For that reason alone I cannot understand why cycling is not more popular, and especially why so many old-timers on the sporting side seem to lose their erstwhile loyalty to the game when the years preclude active participation in competition. Looking back now to the days of my own racing efforts, I firmly believe that once the regret of lost vigour has past, then the best days of riding and touring arrive. You know how to ride, how to combat the weather and the contours, how to conserve energy over a given journey and above all how to enjoy the changing scene with an intensity of observant pleasure comparable only to that of the walker. It is a great game for those who play it rightly, and for those who can and do play it every day it possesses the inestimable values of healthful ease, minus time-tables, instant response to the desire to move without needing a single thought on the cost involved.

All Fit for a Journey

THESE things come home to you in joyousness at the week-ends; they may not be strenuous ones as far as I am concerned now, but they fill my leisure with sheer delight. To the people who are ignorant of cycling, or have cursorily tried it on the wrong type of bicycle and with a flabby muscular condition, that may seem an exaggeration. Indeed, I have know such, and they want a lot of convincing; for like every game played an individual must be reasonably fit to enjoy it. There is the trouble; people in the main will not take time to get reasonably cycling fit, and refuse to be advised on the type of bicycle to buy. When they see an individual moving easily along the road, it seems such a simple thing to them to emulate such action. So it is—if they will go the right way about it—since cycling in its finest form is a marriage of properly used muscular energy with the right choice in machinery. The right choice differs with all of us in some degree, but the machine is made and can be obtained if purchase is selective. All my machines are of a type, even though they bear different transfers, and they are dissimilar from my old riding mounts only in the matter of gears, saddles, tyre section and bars, for now I ride for joy not speed, and the sacrifice in weight is amply compensated by the addition to comfort. That is how it ought to be as a man grows older—content to be an onlooker at the speed game where once he was a participant, finding to his great joy that the tricks of racing have given him a certain degree of mastership in cycling that has made the pastime into an unending pleasure. My claim that cycling is the best of all games for the elderly participant is founded on these facts plus the important one that always you can play it at your own tempo, no matter what the conditions of weather, road, wind or time. Time is too often the cause of disappointment because the old habit of measuring the miles by it dies hard in the old competitor. Forget it if you want to enjoy the pleasures of cycling, whether you are on tour or just circling the home area in search of the ever changing variety provided by the seasons. It is the best advice I can give to any and every rider, for it is the spirit of cycling conceived in beauty and delight.

Better Values

THE change in outlook among the big manufacturers of bicycles is a sign of the times. Riders are becoming more discriminate in their choice of mount, which is a very good thing for the pastime, and the makers are responding. Recently I ordered a Phillips with the main notion of checking up on quality from the big factory. It was to my usual specification and minus the fancy finishes now so fashionable, but which in my opinion will not wear and look respectable after a few winters have gone over them. This machine has carried me well over 1,000 miles, and I like it; indeed, it is as good as any bicycle I have, which is a high compliment. I mention the matter because I have heard folk say the mass makers of bicycles cannot turn out a really high-grade mount. That is nonsense, and here is the machine to prove it, for I am not given to riding bicycles nearly as good as the best—I have grown too old for that. Quality in all types of bicycles has improved these last couple of years, and quality in the best of them is a hidden virtue for which you pay, but the dividend is conservation of your energy and a trouble-free journey whenever you go out.

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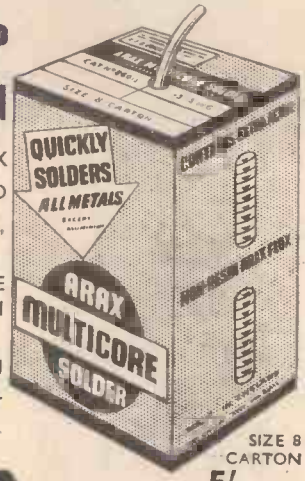

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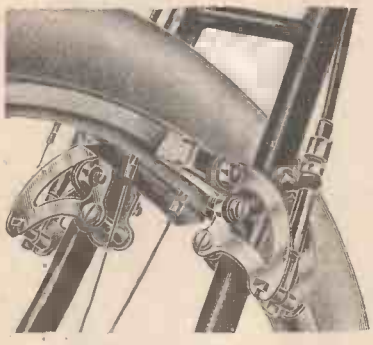

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CYCLORAMA

By H. W. ELEY

On the sunny beach at CLOVELLY the mecca of all Devon tourists.

A Recovered Thrill

I HAVE just discovered that it is possible to recapture an old-time thrill—a thrill of boyhood days! I have just bought a new bicycle, and as I visited cycle agents' shops and compared the merits and "gadgets" of various machines my mind went racing back to boyhood days when, with the price of the bike provided by a fond parent, I made my very first cycle purchase; and what a thrill it was! No three-speed gear in those days, so no problem as to whether to have it fitted with control on the handle-bars or on the cross-bar, and how colourful the machines are to-day compared with those faraway days when I was a schoolboy and the "Hyde" free-wheel still a novelty!

The winter is with us, and I am afraid that the pristine loveliness of my new mount will soon be besmirched, for I ride along muddy, rutted roads, but I have time to devote to oiling and cleaning, and it will be a rare delight to keep my new possession bright and gleaming.

The Charm of Hill-country

OFTEN have I written of the charm of the flat-lands, and East Anglia has always been one of my favourite touring grounds (not that it is all flat by any means!). Living, as I now do, in Derbyshire, I am rediscovering the glory of hill country, the splendour of views when one has climbed a "steep one," and there *are* some hills in Derbyshire. I can easily reach such beauty spots as Dovedale, the Manifold Valley, the Weaver Hills and such delectable places as Norbury, where there are reminders of George Eliot and "Adam Bede." Staffordshire and Derbyshire meet in this region, and only the other day I heard a true son of Staffordshire proclaiming with much emphasis that half of Dovedale was in *his* county and not in Derbyshire at all, and, on checking matters up, I found that he was right! Thorpe Cloud, which I can see on a clear day as I cycle into ancient Ashbourne, is quite an eminence and well worth climbing, and as for Kinder Scout, well, I have the greatest respect for that hill or mountain, which has brought many an amateur climbing party to grief on a wet and misty day.

That Cycle Show

IT is perhaps a little late in the day to be making any references to the Cycle Show (incidentally, I thought it had a most excellent Press), but one fact which was brought to my notice struck me as being of particular interest. Forty buyers of good British machines came from countries behind the "Iron Curtain"—these being Bulgaria, Czechoslovakia, Hungary, Poland, Rumania and Yugoslavia. How widespread is the fame of the British bicycle! I feel that the Cycle Show is one of the greatest of all tributes to the skill, ingenuity and enterprise of the British manufacturer and skilled craftsman. Customers were also welcomed at Earl's Court from Afghanistan, Iceland and Ethiopia. Cheering facts!

Parsons' Pleasure

YES, I know that the heading of this paragraph is the name of a popular tobacco, but what I have in mind is the enormous popularity of the bicycle among the clergy—particularly the country clergy. A bike is, of course, almost the ideal form of transport in the countryside, and the habit of cycling is growing. Petrol prices up again, a new realisation of the easiness of cycling and the inborn love which most country parsons have for the sights and sounds of the open country: these are, I fancy, the main reasons for the growth of cycling among those who administer the small country parishes. I often meet some of the country clerics when on my travels, and frequently we chat together, smoke our pipes and look out over the rolling landscape from the top of a five-barred gate, and such simple pleasures are good indeed!

The Tread and the Track

WHEN one's riding is generally along fairly rough country roads one appreciates the well-patterned, "knobbly" tread of a good roadster cover. Country mud can be very slimy and conducive to skidding, and I like to feel that I am riding on tyres with some road-gripping qualities. The average cyclist does not pay half enough attention to his tyres; he rides them until they are smooth and dangerous; he rarely inflates them hard enough; and, in consequence, he loses many miles "built into" the covers by the manufacturer. Now, this is not "manufacturers' propaganda," but just common sense. A little extra pumping, and . . . longer tyre life!

The Friendly Owl

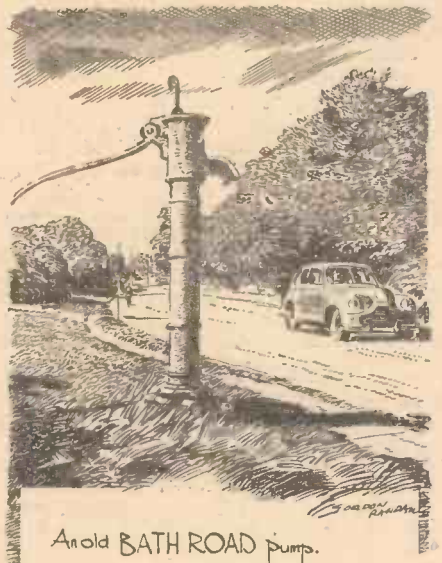
ONE of my feathered friends in this countryside which is so rich in bird life is the owl. Almost every night he takes up his position on the branch of an ilex tree, and from there hoots mournfully but not unpleasingly into the dusk. I have watched him, in the daytime, through a good pair of field-glasses, and he is a large and handsome creature. During the summer and autumn, directly he came to his tree, the smaller birds—and especially the blackbirds—gave vent to clamorous, shrill twittering, and I have seen a pair of blackbirds pursue the owl with obvious venom, swooping over him and "nose-diving" at him with anger and speed. He is not at all a favourite with the other birds, but he "belongs" to my country domain, and I would not miss his nightly hoot for worlds. And while on the subject of birds, I found enormous pleasure in the early summer in watching a pair of house-martins build their nest in the corner of an old outhouse, rear their brood and finally teach them to fly before departure. I could easily become a keen ornithologist!

All the Colours of the Rainbow!

THE window of a cycle shop in Derby . . . and what a colourful display! The window was stocked with a dozen or more machines, and the colours ranged from pale blue to olive green, and included bright red, brown, pastel grey, orange and mauve. Most were sporting bikes, of course, but even the roadsters were gay and glamorous. The "colour trend" has come to stay, and it grows upon you even if you were reared in the days when sombre black, with a faint "lining," was the accepted order of the day.

My Point of View

By "WAYFARER"



A old BATH ROAD pump.

An interesting relic of the coaching days. These old pumps were used to keep the road well watered and were placed at close intervals on the left hand side of the road travelling from London. The sketch shows one standing near Longford a few yards to the west of the junction of the old road and the Colnbrook-by-Pass.

If True

I RATHER care for that Sunday newspaper story of a Hertfordshire cyclist charged with "riding furiously." His lawyer quoted "transported with passion" as one of the dictionary meanings of the term, and, when the police witness returned a negative reply to the question: "Was my client riding passionately?" the case was dismissed. Evidently the authorities in one of the Home Counties are more unsophisticated than I thought. That is, if the yarn is true.

Return to Sanity

HOW very welcome it is to observe a departure from the eternal parrot-cry as to the need for cycle paths in connection with every new road! The Lancashire County Council suggests a reduction in the width of main roads to help farmers, who have been complaining about the amount of agricultural land which is being taken. The surveyor considers that, by keeping carriageways to the standard width of 22ft., but cutting out cycle paths and reducing the central reserve from 26ft. to 10ft., they could save 5½ acres of land on every mile of road they build. I seem to recall a saying about what Lancashire thinks to-day the country thinks to-morrow. May it be true in this respect! It would be very pleasant were the advocates of cycle paths to dry up.

The Way Out

IN the course of a gloomy letter to the Press (a letter which has nothing whatever to do with cycling), somebody who is alarmed at the continued growth of our existing towns suggests that "the greater part of the day will soon be spent in travelling to and from one's business, jostling people on the pavements. . . ." The remedy for that aspect of the problem under discussion is the greater use of the bicycle from the purely utilitarian point of view. Cycling remains a quick—sometimes the quickest—form of locomotion between home and office, or factory, or shop, and "jostling people on the pavements" is a thing unknown to the wise individual who relies on the two-wheeler for his daily journeys in search of the wherewithal to buy his bread and cheese. The bicycle is the way out for many more people, of both sexes, who will find in this handy instrument an easy, pleasant and inexpensive mode of travel to and from work.

Is There Monotony

AT this point I may fitly go on to refer to a point which was raised the other evening in a discussion group as to whether daily cycling to and from work did not tend to become monotonous. How could it? For the greater part of a long business career I cycled regularly to and from my job. I am not doing so now for good and sufficient reasons, the nature of my work making it inconvenient for me to be burdened with a bicycle at the office, to which I may go in the morning and then not return for several days. But, day by day, as I sit on or in buses, I chafe at the delays which the use of the bicycle would enable me to avoid, and I dislike the crowds and the elbowing which are often a condition precedent to my securing a place in the public transport vehicle. That is by the way, and I set out not to advertise the bicycle as the very best means of travelling between home and office, etc., but to combat the suggestion that this daily travel may become monotonous. I repeat: how can it

Of course, indulgence in the to-and-fro act may lead to complete boredom—if you let it. And, with proper care, regular travel by any other method may reduce you to tears, just as daily work, and even life itself, can drive you to distraction. As in the wartime slogan, it all depends on you! I would suggest, however, that cycling to and from work is the method of travel least likely to become monotonous. Why? Well, because of the variety which is imported into the job by reason of the weather, by virtue of the people you meet and the incidents which occur, and through your own ever-changing mood. The last spell of cycling to and from work in which I indulged lasted exactly six years and involved me in a journey of 2½ miles four times a day. I was never bored: I never found the least degree of monotony. Each day's ride was a thrill, and I obtained infinite pleasure from it. Moreover, many of those little journeys were profitable, and time after time I had to dash into my office or home and set down the details of some incident which had occurred, or some train of thought which had come to me during the ride. (These things have to be grabbed at once, or they fade out of the mind and do not return.) Monotony? Never! A procession of pleasures, with many a thrill.

Maps

HAS it ever been explained—if so, I somehow missed the news—why the leading firm of map-makers in this country made changes in the sectionalising of their products, with the result that the old cyclist (that's me), buying a replacement of a favourite map which has seen better days, finds himself "in the air" as regards certain strips of country? There may be perfectly good reasons—watertight reasons—for what would appear to be a harsh and arbitrary action. Frankly, however, I cannot imagine them. It may be "good for trade"—from the consumer's point of view that would be no justification—but the reverse is the case so far as I, personally, am concerned. A replacement of my most used (and, therefore, most dilapidated) map is overdue, but realising what is involved by the purchase of one map, I am indulging in a policy of "make do and mend"—especially the "make do" portion of that injunction.

Balloon Tyres

ONE occasionally hears the suggestion that balloon tyres should be popularised in this country. Whatever the experience on the continent of Europe, and however desirable fat tyres might be for special circumstances (for instance, for utilitarian purposes over the stone setts which "lag superfluous" on many roads in Lancashire), I really cannot discern the slightest need for balloon tyres. My own experience with such was short-lived and unsatisfactory. It must be at least 20 years since I was lent, for trials, a quality bicycle shod with balloon tyres. I used that mount not only without prejudice, but with enthusiasm and optimism. My disappointment was all the greater! I took the bicycle, which was provided with a free wheel, into Wales and looked forward, gleefully, to some fast running down certain of the long slopes of the Principality's banks. Alas! the tyres proved to be very sluggish, and the thrill of quick travel was missing. This was explained to me later by an expert who had no reason for condemning balloon tyres, and there seemed to be something in his view that the slowness arose from the fact that so much of the tyre was in contact with the ground. Be that as it may, I cannot see that there is any need for fat tyres, though it is possible that the tendency in the opposite direction may go too far. Everyone to his taste. I, personally, have settled down to 1⅜in., and do not anticipate any movement towards something smaller.

Obliging

A CATERER to whom I recently wrote in quest of two nights' accommodation replied that she would be glad to "oblige" me. That expression made me see a mild shade of red. It struck me that, if any obliging was being done, I was doing it, seeing that my promised visit would provide part of the caterer's living, enabling her to go on breathing for a while longer. But I claim nothing in that direction. The letting and taking of accommodation is a 50/50 arrangement, with no obliging on either side. It is a business transaction, just as is the purchase of a pound of bacon (if you can get it!), a bottle of ink, or a doormat. The case is different where, in a moment of stress, somebody who does not normally cater agrees to provide you with a night's board and lodging. She does "oblige" you.

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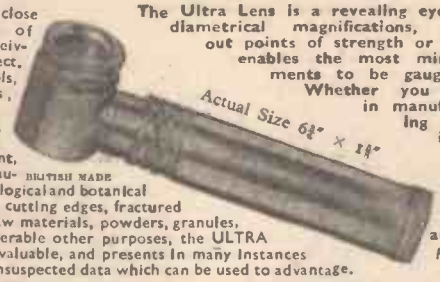

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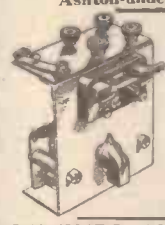

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